DCS550

Manual
DCS550 Drives (20 A to 1000 A)

ABB

DCS550 Manuals

		Language						
	Public. number	E	D	I	ES	F	CN	RU
Quick Guide	3ADW000395	x	x	x	x	x		
DCS550 Tools & Documentation CD	3ADW000377	x						
DCS550 Modules								
DCS550 Flyer	3ADW000374	x	x		x			x
DCS550 Technical Catalog	3ADW000378	x	x			x		
DCS550 Manual	3ADW000379	x	x		x	x		
DCS550 Service Manual	3ADW000399	x						
Installation according to EMC	3ADW000032	x						
Technical Guide	3ADW000163	x						
Extension Modules								
RAIO-01 Analog IO Extension	3AFE64484567	x						
RDIO-01 Digital IO Extension	3AFE64485733	x						
Serial Communication								
RPBA-01 PROFIBUS	3AFE64504215	x						
RCAN-01 CANopen	3AFE64504231	x						
RCNA-01 ControlNet	3AFE64506005	x						
RDNA-01 DeviceNet	3AFE64504223	x						
RMBA-01 MODBUS	3AFE64498851	x						
RETA-01 Ethernet	3AFE64539736	x						
Status 11.2013								

DCS550 Manuals list f.doc

Safety instructions

Chapter overview

This chapter contains the safety instructions you must follow when installing, operating and servicing the drive. If ignored, physical injury or death may follow, or damage may occur to the drive, the motor or driven equipment. Read the safety instructions before you work on the unit.

To which products this chapter applies

The information is valid for the whole range of the product DCS550.

Usage of warnings and notes

There are two types of safety instructions throughout this manual: warnings and notes. Warnings caution you about conditions, which can result in serious injury or death and/or damage to the equipment, and advice on how to avoid the danger. Notes draw attention to a particular condition or fact, or give information on a subject. The warning symbols are used as follows:

Dangerous voltage warning warns of high voltage, which can cause physical injury or death and/or damage to the equipment.

General danger warning warns about conditions, other than those caused by electricity, which can result in physical injury or death and/or damage to the equipment.

Electrostatic sensitive devices warning warn of electrostatic discharge, which can damage the equipment.

Installation and maintenance work

These warnings are intended for all who work on the drive, motor cable or motor. Ignoring the instructions can cause physical injury or death and/or damage to the equipment.

WARNING!

1. Only qualified electricians are allowed to install and maintain the drive!

- Never work on the drive, motor cable or motor when main power is applied. Always ensure by measuring with a multimeter (impedance at least 1 Mohm) that:
    1. Voltage between drive input phases U1, V1 and W1 and the frame is close to 0 V.
    2. Voltage between terminals C+ and D- and the frame is close to 0 V.
- Do not work on the control cables when power is applied to the drive or to the external control circuits. Externally supplied control circuits may cause dangerous voltages inside the drive even when the main power on the drive is switched off.
- Do not make any insulation resistance or voltage withstand tests on the drive or drive modules.
- Isolate the motor cables from the drive when testing the insulation resistance or voltage withstand of the cables or the motor.
- When reconnecting the motor cable, always check that the C+ and D- cables are connected with the proper terminal.

Note:

- The motor cable terminals on the drive are at a dangerously high voltage when the main power is on, regardless of whether the motor is running or not.
- Depending on the external wiring, dangerous voltages (115 V, 220 V or 230 V) may be present on the relay outputs of the drive system (e.g. RDIO).
- DCS550 with enclosure extension: Before working on the drive, isolate the whole drive system from the supply.

Grounding

These instructions are intended for all who are responsible for the grounding of the drive. Incorrect grounding can cause physical injury, death and/or equipment malfunction and increase electromagnetic interference.

WARNING!

- Ground the drive, motor and adjoining equipment to ensure personnel safety in all circumstances, and to reduce electromagnetic emission and pick-up.
- Make sure that grounding conductors are adequately sized and marked as required by safety regulations.
- In a multiple-drive installation, connect each drive separately to protective earth (PE).
- Minimize EMC emission and make a 360° high frequency grounding (e.g. conductive sleeves) of screened cable entries at the cabinet lead-through plate.

Note:

- Power cable shields are suitable as equipment grounding conductors only when adequately sized to meet safety regulations.
- As the normal leakage current of the drive is higher than 3.5 mA_{AC} or 10 mA_{DC} (stated by EN 50178, 5.2.11.1), a fixed protective earth connection is required.

Printed circuit boards and fiber optic cables

These instructions are intended for all who handle the circuit boards and fiber optic cables. Ignoring the following instructions can cause damage to the equipment.

WARNING!

The printed circuit boards contain components sensitive to electrostatic discharge. Wear a grounding wristband when handling the boards. Do not touch the boards unnecessarily.
Use grounding strip:

ABB order no.: 3ADV050035P0001

WARNING!

Handle the fiber optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibers with bare hands, as the fiber is extremely sensitive to dirt. The minimum allowed bend radius is 35 mm (1.38 in.).

Mechanical installation

These notes are intended for all who install the drive. Handle the unit carefully to avoid damage and injury.

WARNING!

- DCS550 size F4: The drive is heavy. Do not lift it alone. Do not lift the unit by the front cover. Place it only on its back.
- Make sure that dust from drilling does not enter the drive when installing. Electrically conductive dust inside the unit may cause damage or lead to malfunction.
- Ensure sufficient cooling.
- Do not fasten the drive by riveting or welding.

Operation

These warnings are intended for all who plan the operation of the drive or operate the drive. Ignoring the instructions can cause physical injury or death and/or damage to the equipment.

WARNING!

- Before adjusting the drive and putting it into service, make sure that the motor and all driven equipment are suitable for operation throughout the speed range provided by the drive. The drive can be adjusted to operate the motor at speeds above and below the base speed.
- Do not control the motor with the disconnecting device (disconnecting mains); instead, use the control panel keys and , or commands via the I/O board of the drive.
- Mains connection
  You can use a disconnect switch (with fuses) to disconnect the electrical components of the drive from the mains for installation and maintenance work. The type of disconnect switch used must be as per EN 60947-3, Class B, so as to comply with EU regulations, or a circuit-breaker type which switches off the load circuit by means of an auxiliary contact causing the breaker's main contacts to open. The mains disconnect must be locked in its "OPEN" position during any installation and maintenance work.
- EMERGENCY STOP buttons must be installed at each control desk and at all other control panels requiring an emergency stop function. Pressing the STOP button on the control panel of the drive will neither cause an emergency stop of the motor, nor will the drive be disconnected from any dangerous potential.
  To avoid unintentional operating states, or to shut the unit down in case of any imminent danger according to the standards in the safety instructions it is not sufficient to merely shut down the drive via signals "RUN", "drive OFF" or "Emergency Stop" respectively "control panel" or "PC tool".
- Intended use
  The operating instructions cannot take into consideration every possible case of configuration, operation or maintenance. Thus, they mainly give such advice only, which is required by qualified personnel for normal operation of the machines and devices in industrial installations.
  If in special cases the electrical machines and devices are intended for use in non-industrial installations - which may require stricter safety regulations (e.g. protection against contact by children or similar) - these additional safety measures for the installation must be provided by the customer during assembly.

Note:

- When the control location is not set to Local (L not shown in the status row of the display), the stop key on the control panel will not stop the drive. To stop the drive using the control panel, press the LOC/REM key and then the stop key .

Table of contents

Introduction

Chapter overview

This chapter describes the purpose, contents and the intended use of this manual.

Before You Start

The purpose of this manual is to provide you with the information necessary to control and program the drive. Study carefully the *Safety instructions* at the beginning of this manual before attempting any work on or with the drive. Read this manual before starting-up the drive.

Note:

This manual describes the **standard** DCS550 firmware.

What this manual contains

The *Safety instructions* are at the beginning of this manual.

Introduction, the chapter you are currently reading, introduces you to this manual.

The *DCS550*, this chapter describes the basic properties of the DCS550.

Mechanical installation, this chapter describes the mechanical installation of the DCS550.

Planning the electrical installation, this chapter describes how to plan the electrical installation of the DCS550.

Electrical installation, this chapter describes the electrical installation of the DCS550.

Electronic board details, this chapter describes the electronics of the DCS550.

Accessories, this chapter describes the accessories for the DCS550.

Start-up, this chapter describes the basic start-up procedure of the DCS550.

Firmware description, this chapter describes how to control the DCS550 with **standard** firmware.

Serial field bus communication, this chapter describes the communication capabilities of the DCS550.

AP (Adaptive Program), this chapter describes the basics of AP and instructs how to build an application.

Winder, this chapter describes the winder and instructs how to use the winder blocks of the DCS550.

Signal and parameter list, this chapter contains all signals and parameters.

DCS Control Panel, this chapter describes the handling of the DCS Control Panel.

Fault tracing, this chapter describes the protections and fault tracing of the drive.

Appendix A: Quick start-up diagrams

Appendix B: Firmware structure diagrams

Appendix C: Index of signal and parameters

The DCS550

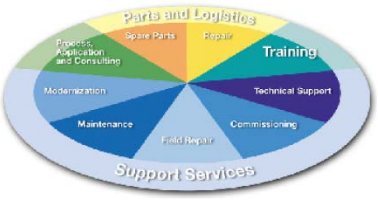
Chapter overview

This chapter describes the basic properties of the DCS550.

General

ABB Drive Service

In order to offer the same after sales service to our customer around the world, ABB has created the DRIVE SERVICE CONCEPT. ABB's after sales service is globally consistent due to common targets, rules and the way of operation. This means for our customers simply visit the ABB drive service homepage at www.abb.com/drivesservices.

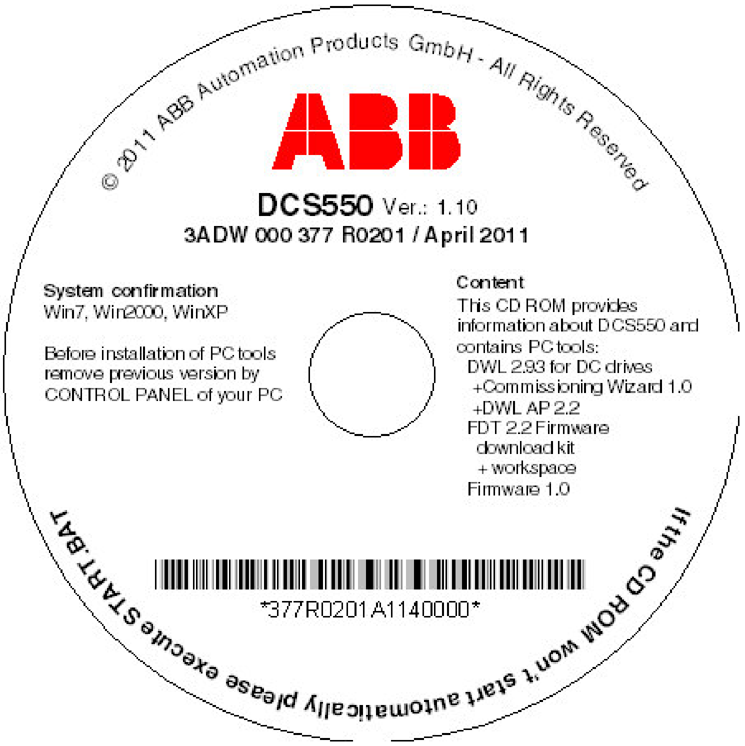


DC drives worldwide Service Network

Country	Local ABB Service	Town	Service Phone No.
Argentina	Asea Brown Boveri S.A.	BUENOS AIRES	+54 (0) 12 29 55 00
Australia	ABB	NOTTING HILL	+61 (0) 3 85 44 00 00
Austria	ABB AG	WIEN	+43 1 60 10 90
Belgium	ABB N.V.	ZAVENTEM	+32 27 18 64 86 +32 27 18 65 00 - 24h service
Brazil	ABB Ltda.	OSASCO	+55 (0) 11 70 84 91 11
Canada	ABB Inc.	SAINT-LAURENT	+1800 865 7628
China	ABB China Ltd	BEIJING	+86 40 08 10 88 85 - 24h service
Czech Republic	ABB S.R.O.	PRAHA	+42 02 34 32 23 60
Finland	ABB Oy Service	KUUSANKOSKI	+35 8 10 22 51 00
Finland	ABB Oy Product Service	HELSINKI	+35 8 10 22 20 00
Finland	ABB Oy Service	NOKIA	+35 8 10 22 51 40
France	ABB Automation ABB Process Industry	MONTLUEL from abroad France	+33 1 34 40 25 81 +0810 02 00 00
Germany	ABB Process Industries	MANNHEIM	+49 18 05 22 25 80
Greece	ABB SA	METAMORPHOSSIS	+30 69 36 58 45 74
Ireland	ABB Ireland Ltd.	TALLAGHT	+35 3 14 05 73 00
Italy	ABB	MILAN	+39 02 90 34 73 91
Korea, Republic	ABB Ltd., Korea	CHONAN	+82 (0) 4 15 29 22
Malaysia	ABB Malaysia Sdn. Bhd.	KUALA LUMPUR	+60 3 56 28 42 65
Mexico	ABB Sistemas S.A. DE C.V.	TLALNEPANTLA	+52 53 28 14 00
Netherlands	ABB B.V.	ROTTERDAM	+31 1 04 07 88 66
New Zealand	ABB Service ltd	AUCKLAND	+64 92 76 60 16
Poland	ABB Centrum IT Sp.zo.o	WROCLAW LODZ	+48 42 61 34 96 2 +48 42 29 93 91 39 5
Russia	ABB Automation LLC	MOSCOW	+74 95 96 0
Switzerland	ABB AG	DÄTTWIL	+41 5 85 86 87 86
Singapore	ABB Industry Pte Ltd	SINGAPORE	+65 67 76 57 11
Slovakia	ABB Elektro s.r.o.	BANSKA BYSTRICA	+42 19 05 58 12 78
South Africa	ABB South Africa (Pty) Lt	JOHANNESBURG	+27 1 16 17 20 00
Spain	ABB Automation Products	BARCELONA	+34 9 37 28 73 00
Taiwan	ABB Ltd.	TAIPEI 105	+88 62 25 77 60 90
Thailand	ABB Limited	SAMUTPRAKARN	+66 27 09 33 46
Turkey	ABB Elektrik Sanayi A.S	ISTANBUL	+90 2 16 36 52 90
USA	ABB Industrial Products	NEW BERLIN	+1 26 27 85 32 00 +1 262 435 7365
Venezuela	ABB S.A.	C□R□C□S	+58 (0) 22 38 24 11 / 12

DCS550 Tools CD

Every DCS550 comes together with a DCS550 Tools CD. This CD contains the documentation and PC tools for the DCS550.



Documentation

The structure of the documentation is according to the following system:

- The *DCS550 Technical Catalogue* contains information to engineer complete DC drive systems.
- The *DCS550 Manual* contains information about
  1. module dimensions, electronic boards, fans and auxiliary parts,
  2. mechanical and electrical installation,
  3. firmware and parameter settings
  4. start-up and maintenance of the entire drive
  5. fault, alarm codes and information for trouble shooting.
- The *DCS800 / DCS550 Service Manual* contains information for maintenance and repair of the converters.
- Additional information about technical accessories (e.g. hardware extension or fieldbus interfaces) are handled by separate manuals. See chapter *DCS550 Manuals*.

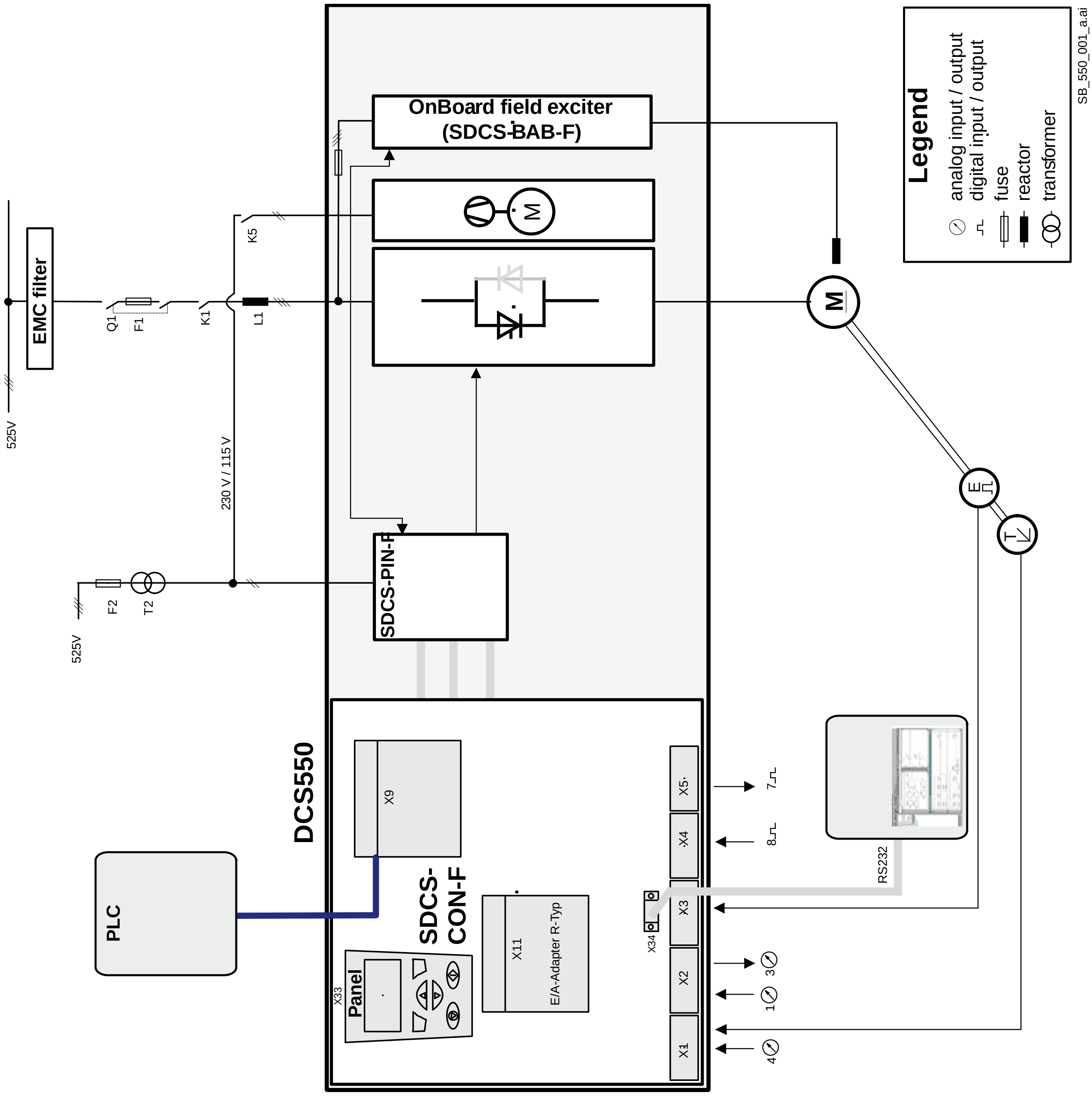
DCS550 PC tools

After inserting the *DCS550 CD* all programs and documentation necessary to work with the DCS550 can be installed. This includes:

- DCS550 documentation,
- DriveWindow Light for parameterization, commissioning and service,
- plug ins for DriveWindow Light (DWL AP and the commissioning wizard)
- Hitachi FDT 2.2 for firmware download and
- DCS550 firmware.

Overview Main circuit and control

DCS550 converter units F1 to F4 for 525 V with integrated field exciters.



Environmental Conditions

The technical data contain the technical specifications of the drive, e.g. the ratings, sizes and technical requirements, provisions for fulfilling the requirements for CE and other markings and warranty policy.

System connection

Voltage, 3-phase:	230 to 525 V acc. to IEC 60038
Voltage deviation:	±10 % continuous; ±15 % short-time (0.5 to 30 cycles)
Rated frequency:	50 Hz or 60 Hz
Static frequency deviation:	50 Hz ±2 %; 60 Hz ±2 %
Dynamic: frequency range:	50 Hz: ±5 Hz; 60 Hz: ± 5 Hz
df/dt:	17 % / s

Note:
Special consideration must be taken for voltage deviation in regenerative mode.

Degree of protection

Converter modules and options (line chokes, fuses, field exciters, etc.):	IP 00 / NEMA TYPE OPEN

Paint finish

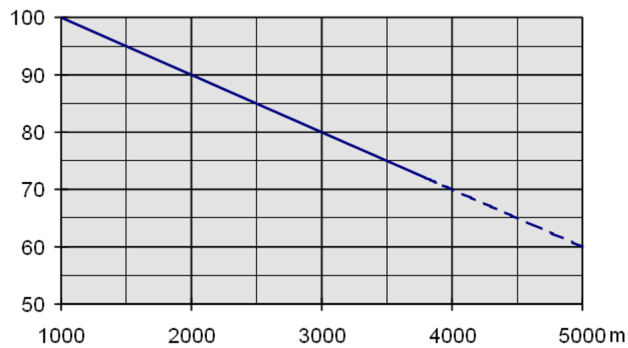
Converter modules:	Dark grey RAL 7012

Environmental limit values

Permissible cooling air temperature

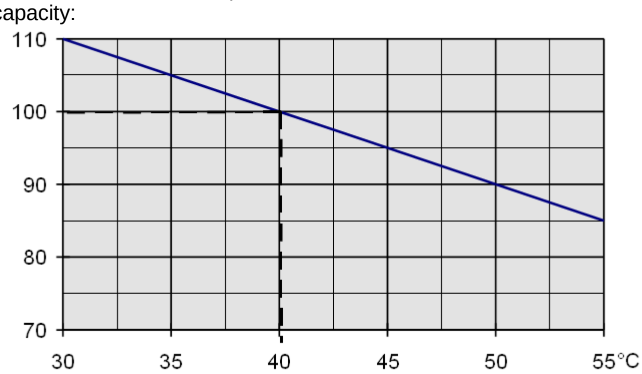
– with rated DC current (forced ventilation):	0 to +40°C
– with different DC current see figure below:	+30 to +55°C
– for options:	0 to +40°C
Relative humidity (at 5...+40°C):	5 to 95 %, no condensation
Relative humidity (at 0...+5°C):	5 to 50 %, no condensation
Change of the ambient temp.	< 0.5°C / minute
Storage temperature:	-40 to +55°C
Transport temperature:	-40 to +70°C
Pollution degree (IEC 60664-1, IEC 60439-1):	2
Vibration class:	3M3
Site elevation	
<1000 m above mean sea level:	100%, without current reduction
>1000 m above mean sea level:	with current reduction, see figure below

Effect of the site elevation above sea level on the converter's load capacity:



Current reduction to (%)

Effect of the ambient temperature on the converter module load capacity:



Current reduction to (%) for converter modules

Size	Sound pressure level LP (1 m distance)	Vibration	Shock	Transport in original Package	Short circuit withstand rating The DCS550 is suitable for use in a circuit capable of delivering not more than:
F1	55 dBA	1.5 mm, 2 - 9 Hz 0.5 g, 9 - 200 Hz	7 g / 22 ms	1.2 m	65 kA rms symmetrical ampere at a maximum of 600 V_{AC}
F2	55 dBA				
F3	60 dBA			1.0 m	
F4	66 - 70 dBA, depending on fan				

Regulatory Compliance

The converter modules are designed for use in industrial environments. In EEA countries, the components fulfill the requirements of the EU directives, see table below.

European Union Directive	Manufacturer's Assurance	Harmonized Standards
Machinery Directive		
98/37/EEC 93/68/EEC	Declaration of Incorporation	EN 60204-1 [IEC 60204-1]
Low Voltage Directive		
73/23/EEC 93/68/EEC	Declaration of Conformity	EN 61800-1 [IEC 61800-1] EN 60204-1 [IEC 60204-1]
EMC Directive		
89/336/EEC 93/68/EEC	Declaration of Conformity (If all installation instructions concerning cable selection, cabling and EMC filters or dedicated transformer are followed.)	EN 61800-3 [IEC 61800-3] in accordance with 3ADW000032

North American Standards

In North America, the system components fulfill the requirements of the table below.

Rated supply voltage	Standards
up to 525 V_{AC}	– See UL Listing www.ul.com / certificate no. E196914 – Approval: cULus The spacings in the modules were evaluated to table 36.1 of UL 508 C. Spacings also comply with table 6 and table 40 of C22.2 No. 14-05. – or on request

Type code

The type code contains information on the specifications and configuration of the drive. Description see below:

The drive's basic type code: DCS550-AAX-YYYY-ZZ-BB			
Product family:	DCS550		
Type:	AA	= S0	Standard converter modules IP00
Bridge type:	X	= 1	Single bridge (2-Q)
		= 2	2 anti parallel bridges (4-Q)
Module type:	YYYY	=	Rated DC current
Rated AC voltage:	ZZ	= 05	230 V_{AC} - 525 V_{AC}
Fan voltage:	BB	= 00	Standard F1: no fan 20 A / 25 A 24 V_{DC} internal 45 A - 100 A F2, F3: 115 V_{AC} / 230 V_{AC}; single phase F4: 230 V_{AC}; single phase
Additional information:	CC		

Voltage and current ratings

The maximum available armature voltages have been calculated using the following assumptions:

- U_{VN} = rated mains voltage, 3-phase,
- Voltage tolerance ±10 %,
- Internal voltage drop approximately 1 %

If a deviation or a voltage drop has to be taken into account in compliance with IEC and VDE standards, the output voltage and / or the output current must be reduced.

Mains voltage	Maximum DC voltage		Ideal DC voltage	DC voltage class
U_{VN} [V_{AC}]	$U_{d\ max\ 2\text{-}Q}$ [V_{DC}]	$U_{d\ max\ 4\text{-}Q}$ [V_{DC}]	U_{d0} [V_{DC}]	
230	265	240	310	05
380	440	395	510	05
400	465	415	540	05
415	480	430	560	05
440	510	455	590	05
460	530	480	620	05
480	555	500	640	05
500	580	520	670	05
525	610	545	700	05

The maximum available field voltage can be calculated using following formula:

$$U_F \leq 1.35 * U_{VN} * \left(\frac{100\ \% + TOL}{100\ \%} \right)$$, with:

U_F = field voltage,
U_{VN} = mains voltage and
TOL = tolerance of the mains voltage in %.

Size	I_A, 2-Q [A]	P_{out} [kW] ①	I_A, 4-Q [A]	P_{out} [kW] ①	Mains [V_{AC}]	I_F [A]	P_{loss} [kW]	Air flow [m^3/h]	Auxiliary voltage
F1	20	12	25	13	230 - 525 -15 % / +10 %	1 - 12	0.11	no fan	115 V_{AC}, 230 V_{AC}, 230 V_{DC} -15 % / +10 %
	45	26	50	26			0.17	150	
	65	38	75	39			0.22	150	
	90	52	100	52			0.28	150	
F2	135	79	150	78		1 - 18	0.38	300	
	180	104	200	104			0.56	300	
	225	131	250	131			0.73	300	
	270	157	300	157			0.88	300	
F3	315	183	350	182		2 - 25	0.91	300	
	405	235	450	234			1.12	300	
	470	280	520	276			1.32	500	
F4	610	354	680	354		2 - 35	1.76	950	
	740	429	820	426			2.14	950	
	900 ②	522	1000 ③	520			2.68	1900	

① Ratings for 500 V_{AC} -10 %
② 900 A_{DC} for 35°C and 850 A_{DC} for 40°C ambient temperature
③ 1000 A_{DC} for 35°C and 950 A_{DC} for 40°C ambient temperature

Current ratings - IEC non regenerative

See the current ratings including several standard duty cycles for the DCS550 with 50 Hz and 60 Hz supplies below. The current ratings are based on an ambient temperature of maximum 40°C and an elevation of maximum 1000 m above mean sea level:

Converter type (2-Q)	$I_{DC\,I}$	$I_{DC\,II}$		$I_{DC\,III}$		$I_{DC\,IV}$		Size	Internal field current
	continuous	100 % 15 min	150 % 60 s	100 % 15 min	150 % 120 s	100 % 15 min	200 % 10 s		
525 V	[A]	[A]		[A]		[A]			
DCS550-S01-0020-05	20	16	24	16	24	15	30	F1	1 - 12 A
DCS550-S01-0045-05	45	36	54	35	52	31	62		
DCS550-S01-0065-05	65	54	81	52	78	49	98		
DCS550-S01-0090-05	90	76	114	74	111	73	146		
DCS550-S01-0135-05	135	105	157	100	150	93	186	F2	1 - 18 A
DCS550-S01-0180-05	180	130	195	125	187	110	220		
DCS550-S01-0225-05	225	170	255	165	247	148	296		
DCS550-S01-0270-05	270	200	300	195	292	180	360		
DCS550-S01-0315-05	315	240	360	235	352	215	430	F3	2 - 25 A
DCS550-S01-0405-05	405	310	465	300	450	270	540		
DCS550-S01-0470-05	470	350	525	340	510	310	620		
DCS550-S01-0610-05	610	455	682	435	652	425	850	F4	2 - 35 A
DCS550-S01-0740-05	740	570	855	540	810	525	1050		
DCS550-S01-0900-05	900	680	1020	650	975	615	1230		

Note:

AC current $I_{AC} = 0.82 * I_{DC}$

Current ratings - IEC regenerative

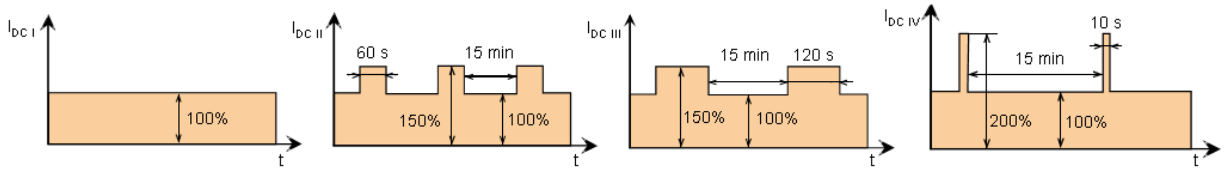
Converter type (4-Q)	$I_{DC\,I}$	$I_{DC\,II}$		$I_{DC\,III}$		$I_{DC\,IV}$		Size	Internal field current
	continuous	100 % 15 min	150 % 60 s	100 % 15 min	150 % 120 s	100 % 15 min	200 % 10 s		
525 V	[A]	[A]		[A]		[A]			
DCS550-S02-0025-05	25	22	33	21	31	20	40	F1	1 -12 A
DCS550-S02-0050-05	50	38	57	37	55	33	66		
DCS550-S02-0075-05	75	60	90	59	88	54	108		
DCS550-S02-0100-05	100	85	127	83	124	80	160		
DCS550-S02-0150-05	150	114	171	110	165	100	200	F2	1 - 18 A
DCS550-S02-0200-05	200	145	217	140	210	115	230		
DCS550-S02-0250-05	250	185	277	180	270	165	330		
DCS550-S02-0300-05	300	225	337	220	330	200	400		
DCS550-S02-0350-05	350	275	412	265	397	245	490	F3	2 - 25 A
DCS550-S02-0450-05	450	350	525	340	510	310	620		
DCS550-S02-0520-05	520	400	600	380	570	350	700		
DCS550-S02-0680-05	680	525	787	510	765	475	950	F4	2 - 35 A
DCS550-S02-0820-05	820	630	945	610	915	565	1130		
DCS550-S02-1000-05	1000	750	1125	725	1087	660	1320		

Note:

AC current $I_{AC} = 0.82 * I_{DC}$

Sizing and standard duty cycles:

The ratings apply at ambient temperature of 40 °C (104 °F).



Dimensions and weights

Size	h * w * d [mm]	h * w * d [inch]	weight [kg]	weight [lbs]
F1	370*270*208	14.57*10.63*8.19	11	24
F2	370*270*264	14.57*10.63*10.39	16	35
F3	459*270*310	18.07*10.63*12.21	25	55
F4	644*270*345	25.35*10.63*13.58	38	84

See the dimensional drawings of the DCS550 below. The dimensions are in millimeters.

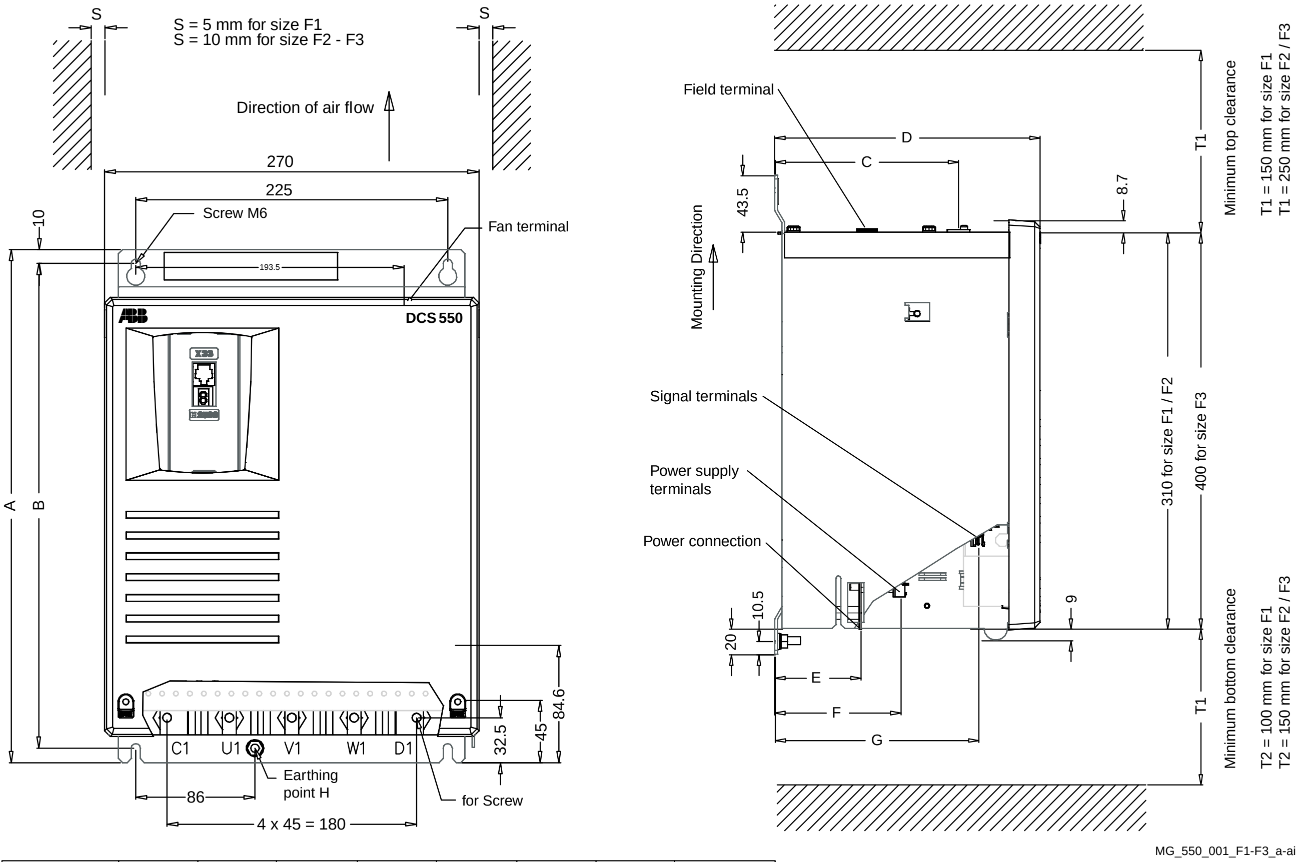
Size F1:
DCS550-S01-0020
DCS550-S01-0045
DCS550-S01-0065
DCS550-S01-0090
DCS550-S02-0025
DCS550-S02-0050
DCS550-S02-0075
DCS550-S02-0100

Size F2:
DCS550-S01-0135
DCS550-S01-0180
DCS550-S01-0225
DCS550-S01-0270
DCS550-S02-0150
DCS550-S02-0200
DCS550-S02-0250
DCS550-S02-0300

Size F3:
DCS550-S01-0315
DCS550-S01-0405
DCS550-S01-0470
DCS550-S02-0350
DCS550-S02-0450
DCS550-S02-0520

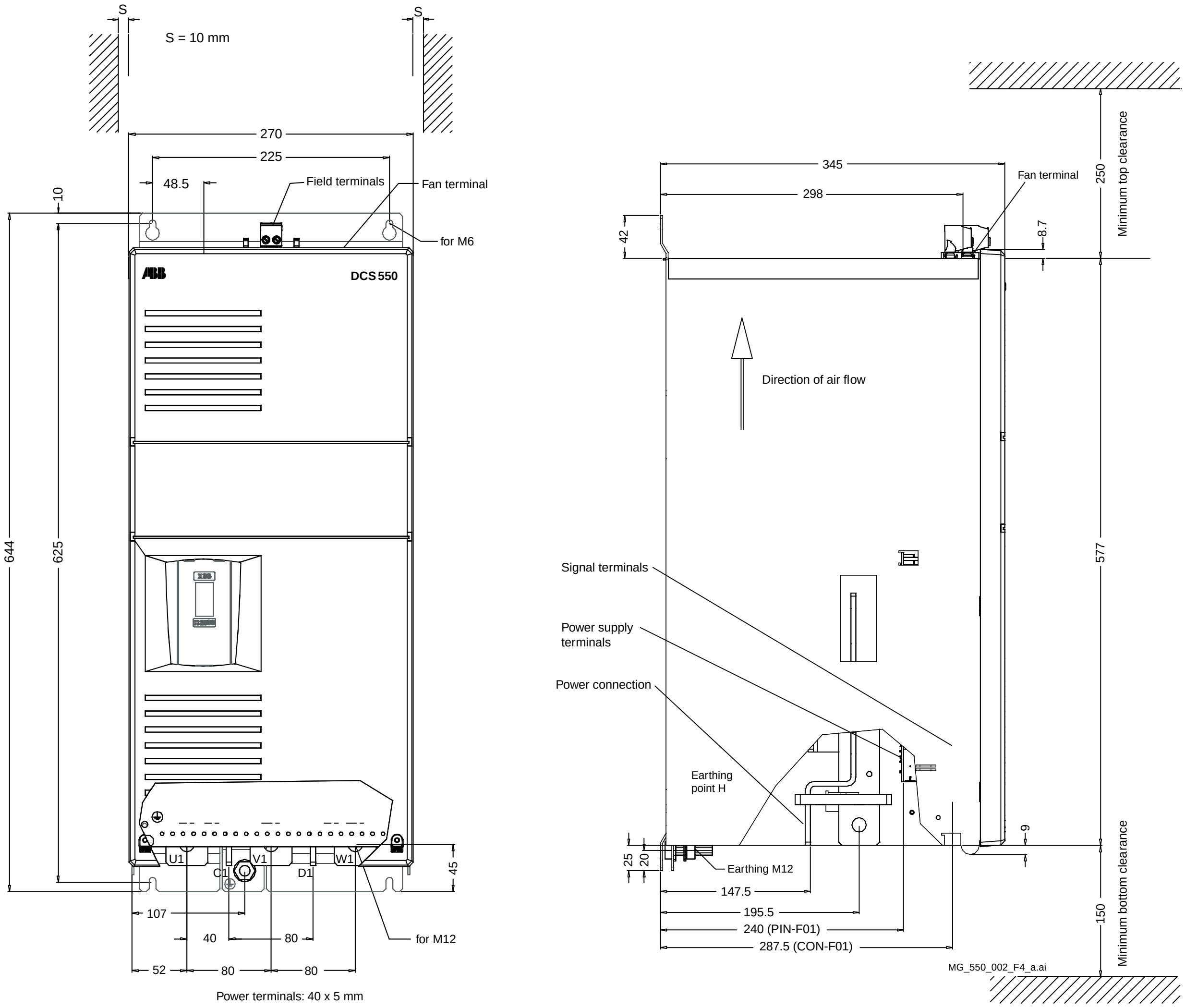
Size F4:
DCS550-S01-0610
DCS550-S01-0740
DCS550-S01-0900
DCS550-S02-0680
DCS550-S02-0820
DCS550-S02-1000

Size F1-F3:



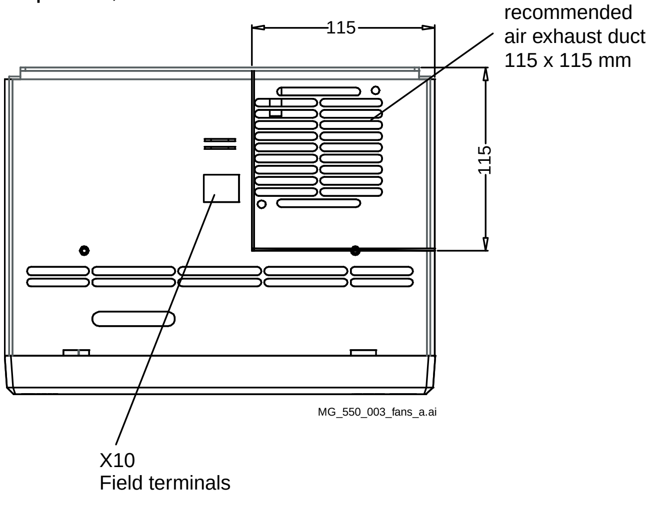
Size	A	B	C	D	E	F	G	H
F1	370	350	-	208	79	110	157	M6
F2	370	350	165	264	121.5	163.5	212	M10
F3	459	437.5	242	310	147.5	205	255	M10

Size F4:

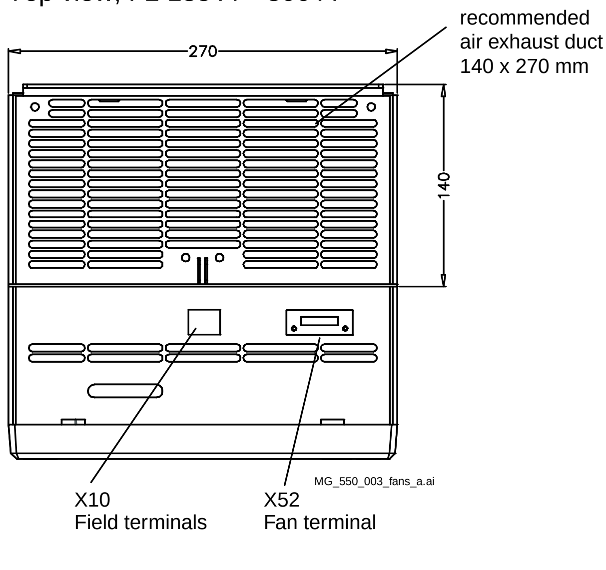


Field-, fan terminals and cooling air duct sizes

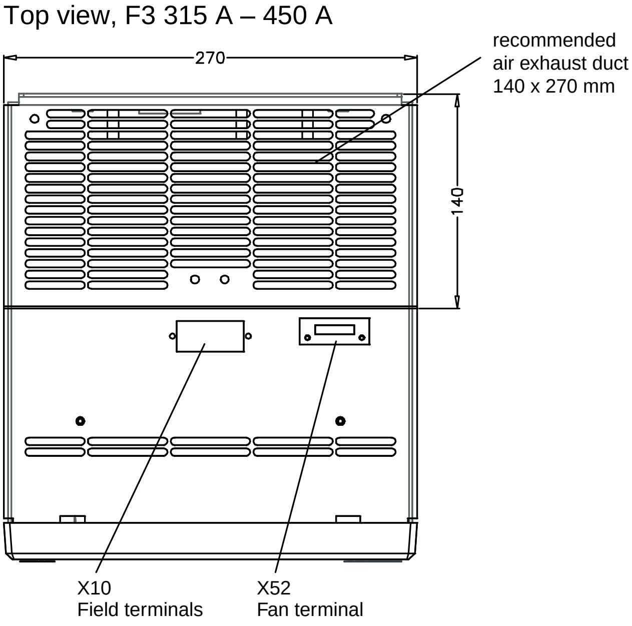
Top view, F1 45 A – 100 A



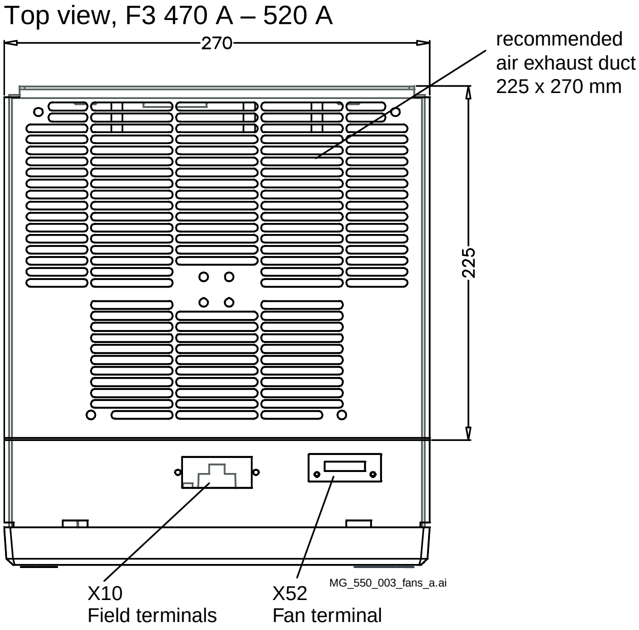
Top view, F2 135 A – 300 A



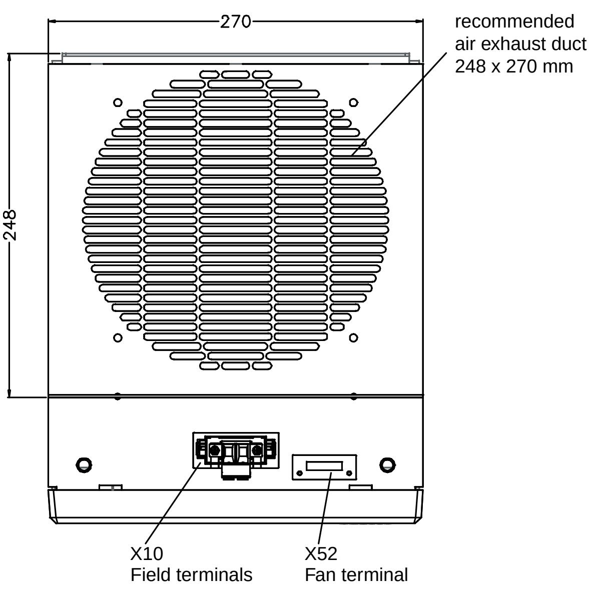
Top view, F3 315 A – 450 A



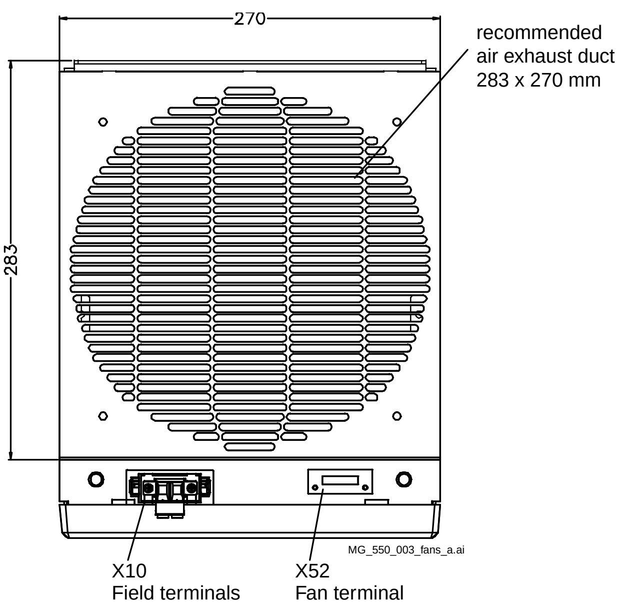
Top view, F3 470 A – 520 A



Top view, F4 610 A – 820 A



Top view, F4 900 A – 1000 A



Mechanical installation

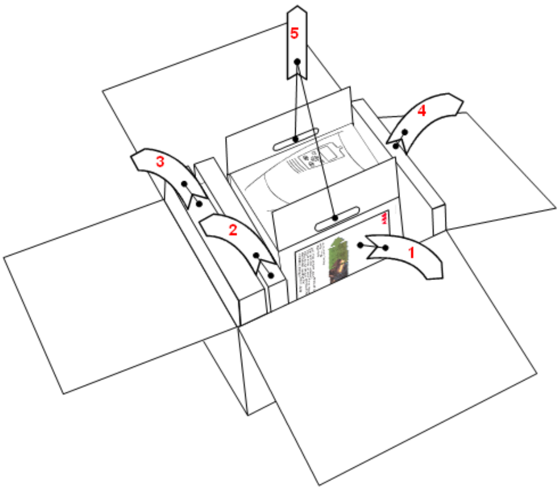
Chapter overview

This chapter describes the mechanical installation of the DCS550.

Unpacking the unit

- Open the box,
- take out shock dampers,
- separate manual and accessories.

Attention:
Do not lift the drive by the cover!



Delivery check

Check that there are no signs of damage. Before attempting installation and operation, check the information on the nameplate of the converter module to verify that the unit is of the correct type. The label includes an IEC rating, cULus, C-tick (N713) and CE markings, a type code and a serial number, which allow individual identification of each unit. The remaining digits complete the serial number so that there are no two units with the same serial number. See an example nameplate below.

CE N713	**ABB Automation Products GmbH**	U_1	3 ~ 525 V	U2	610 V	c UL us LISTED 78WN IND. CONT. EQ.	Made in Germany
	Type: DCS550-S02-0075-05-00-00	I1	62 A	I_2	75 A		
	Ser No: 0025421A10524264	f1	50/60 Hz	I_f	18 A		
		SCCR	65 kA	Fan	----		

Production year 2010 and week 52

Rated input voltage
Rated input current

Rated output current
Rated internal field exciter current
Rated fan voltage

Before installation

Install the drive in an upright position with the cooling section facing a wall. Check the installation site according to the requirements below. Refer to chapter *Dimensions* for frame details.

Requirements for the installation site

See chapter *Technical data* for the allowed operation conditions of the drive.

Wall
The wall should be as close to vertical as possible, of non-flammable material and strong enough to carry the weight of the unit. Check that there is nothing on the wall to inhibit the installation.

Floor
The floor or material below the installation must be non-flammable.

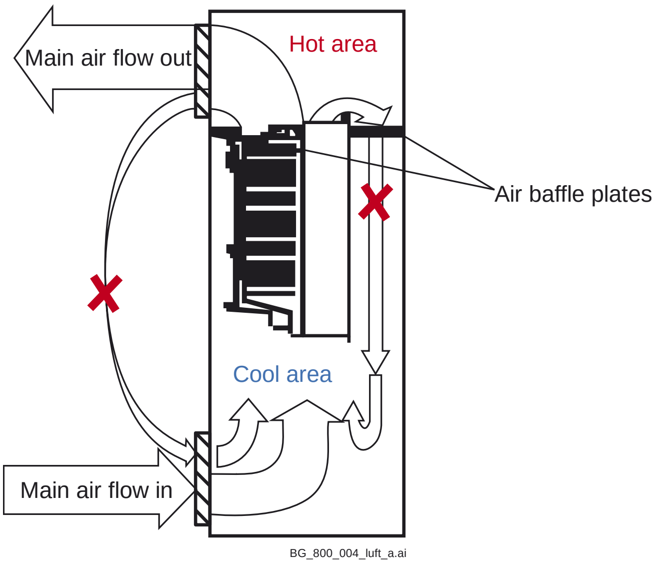
Free space around the unit
Around the unit free space is required to enable cooling airflow, service and maintenance see chapter *Dimensions*.

Cabinet installation

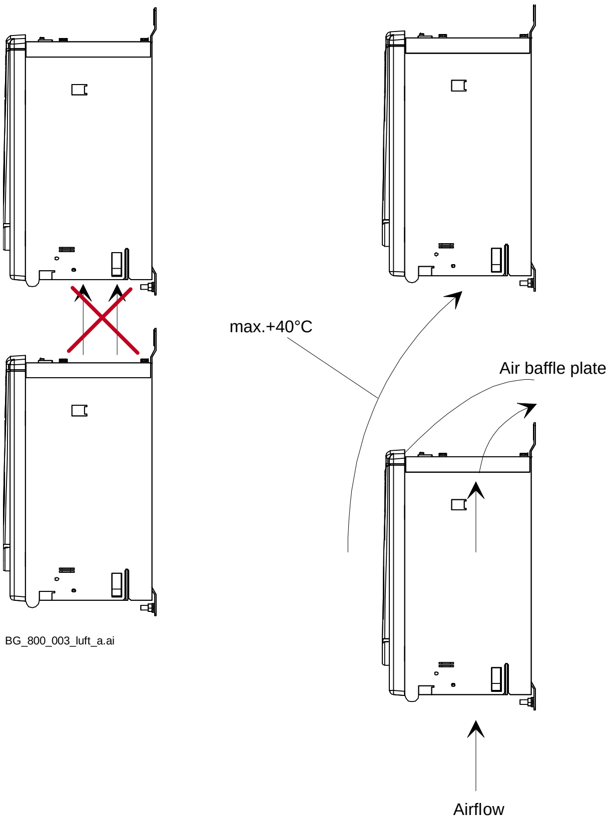
The required distance between parallel units is five millimeters (0.2 in.) in installations without front cover. The cooling air entering the unit must not exceed +40°C (+104°F).

Preventing cooling air recirculation

Prevent air recirculation inside and outside the cabinet



Unit above another



Lead the exhaust cooling air away from the unit above. Distances see chapter *Dimensions*.

Planning the electrical installation

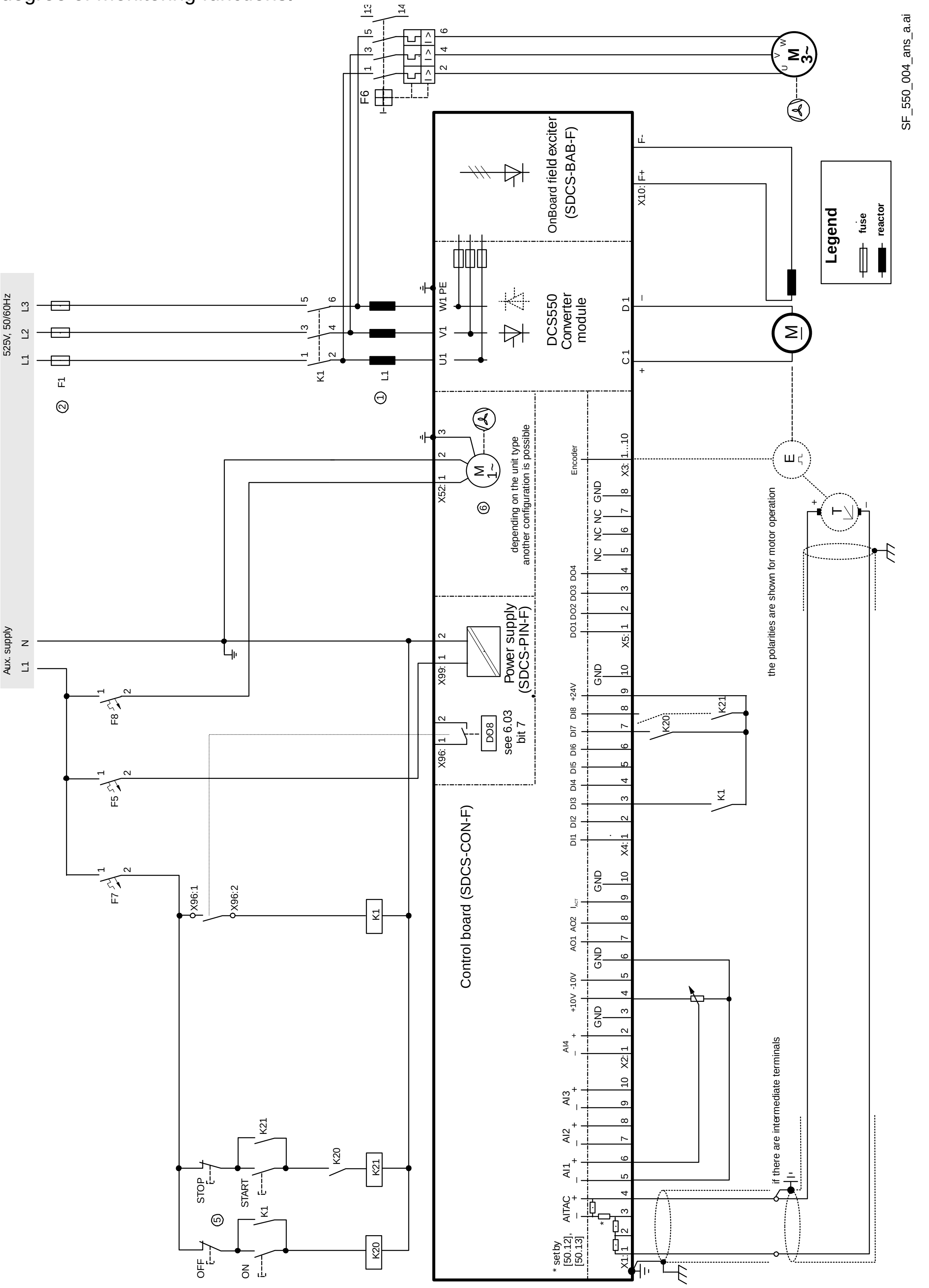
Chapter overview

This chapter contains the instructions that must be followed when selecting the motor, cables, protections, cable routing and way of operation for the drive system. Always follow local regulations. This chapter applies to all DCS550 converter modules.

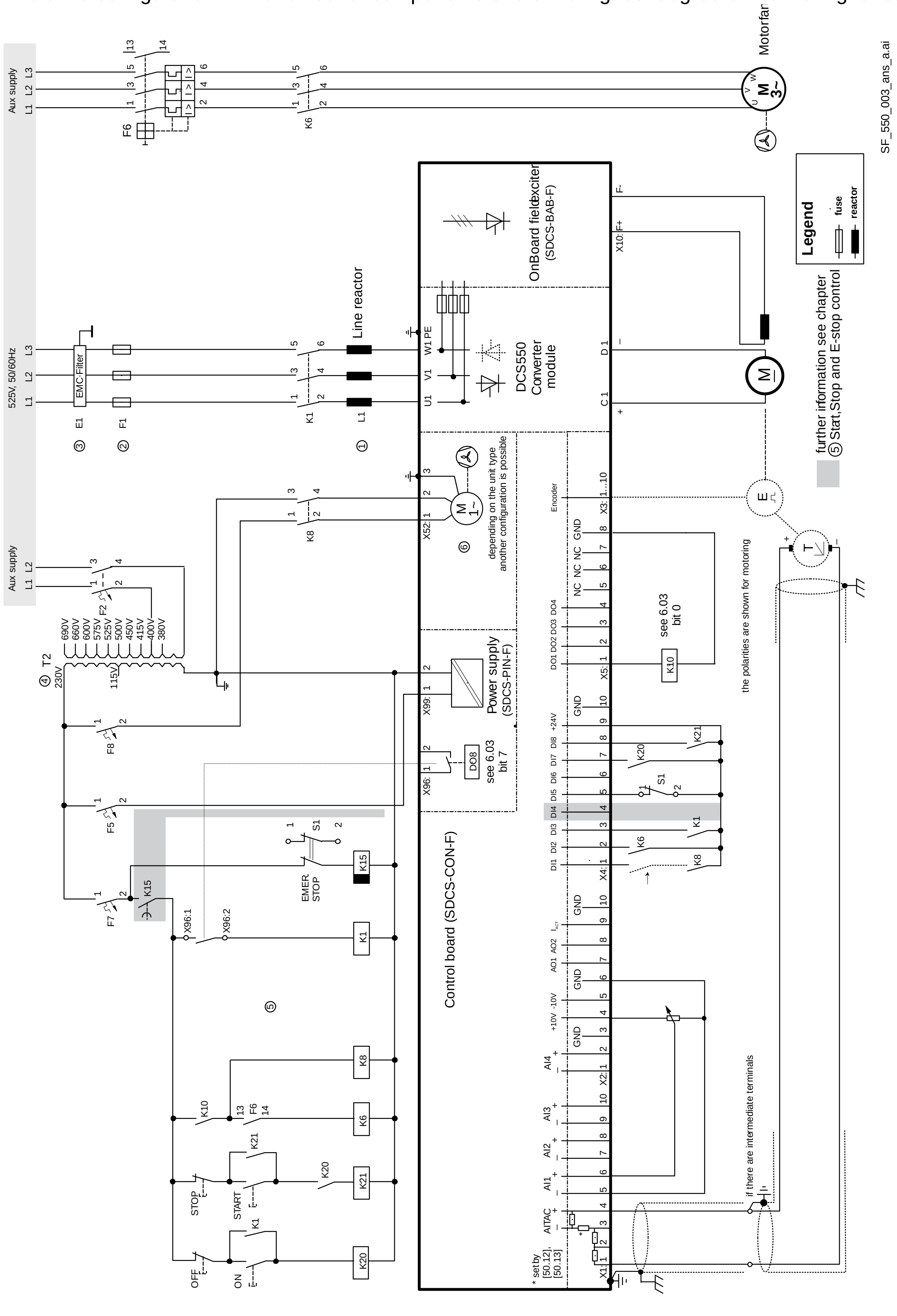
Attention:
If the recommendations given by ABB are not followed, the drive may experience problems that the warranty does not cover. See also *Technical Guide*.

Drive connection and wiring example

The drive configuration with a reduced set of components gives the same control performance, but a lower degree of monitoring functions.



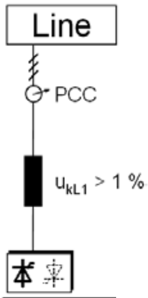
The drive configuration with a full set of components offers the highest degree of monitoring functions.



Installation components

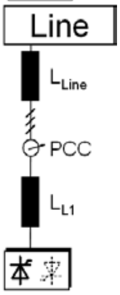
① Line reactors (L1)

When thyristor power converters operate, the line voltage is short-circuited during commutation from one thyristor to the next. This operation causes voltage dips in the mains PCC (point of common coupling). For the connection of a power converter system to the mains, one of the following configurations applies:



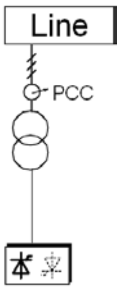
Configuration A

When using the power converter, a minimum of impedance is required to ensure proper performance of the snubber circuit. Use a line reactor to meet this minimum impedance requirement. The value must therefore not drop below 1 % u_k (relative impedance voltage). It should not exceed 10 % u_k, due to considerable voltage drops at the converter outputs.



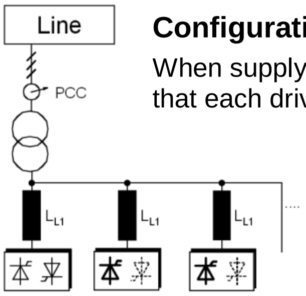
Configuration B

If special requirements have to be met at the PCC (standards like EN 61 800-3, DC and AC drives at the same line, etc), different criteria must be applied for selecting a line reactor. These requirements are often defined as a voltage dip in percent of the nominal supply voltage. The combined impedance of Z_{Line} and Z_{L1} constitute the total series impedance of the installation. The ratio between the line impedance and the line reactor impedance determines the voltage dip at the connecting point. In such cases, line chokes with an impedance around 4 % are often used.
Example calculation with u_kLine = 1 % and u_kL_1 = 4 %:
Voltage dip = Z_{Line} / (Z_{Line} + Z_{L1}) = 20 %. Detailed calculations see *Technical Guide*.



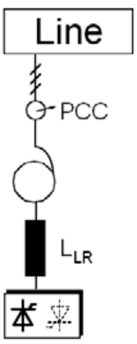
Configuration C

If an isolation transformer is used, it is possible to comply with certain connecting conditions per Configuration B without using an additional line reactor. The condition described in Configuration A will then likewise be satisfied, since the u_k is > 1 %.



Configuration C1

When supplying 2 or more converters by one transformer use configuration A or B. One can see that each drive needs its own line reactor.



Configuration D

In the case of high power converters, frequently a transformer is used for voltage matching. When using an autotransformer for this purpose, additionally install a commutating reactor, because the u_k of commonly used autotransformers is too small.

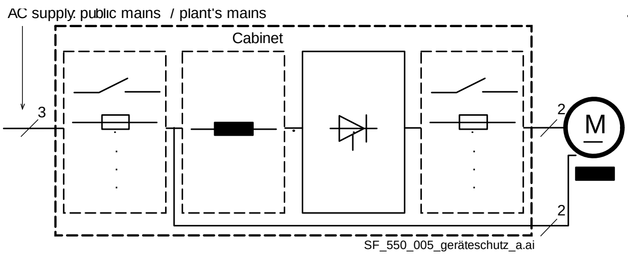
② Semiconductor fuses (F1)

Aspects of fusing for the armature circuit of DC drives

Unit configuration

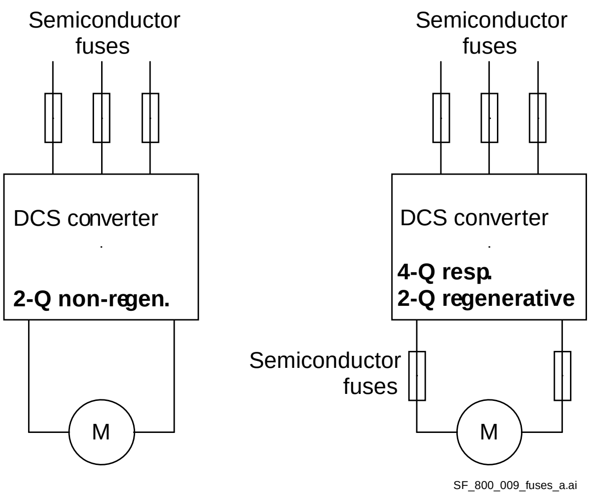
Protection elements such as fuses or overcurrent trip circuits are required in all cases to protect against further damage. In some configurations, this will entail the following questions:

1. Where to place which protective element?
2. In the event of what faults will the element in question provide protection against damage?



The figure shows the arrangement of the switch-off elements in the armature circuit. Further information is available in the *Technical Guide*.

Conclusion



Never use standard fusing instead of semi-conductor fusing in order to save money on the installation. In the event of a fault condition, the small amount of money saved can cause the semiconductors or other devices to explode and cause fires. Adequate protection against short circuit and earth fault, as depicted in the EN50178 standard, is possible only with appropriate semiconductor fuses.
Use DC fuses (2 of them) for all regenerative drives to protect the motor in case of a fault during regeneration. DC fuses must be rated for the same current and voltage as AC fuses, thus follows DC fuses = AC fuses.

③ EMC filters (E1)

Filter in a grounded line (earthed TN or TT network)

The filters are suitable for grounded lines only, for example in public European 400 V_{AC} lines. According to EN 61800-3 filters are not needed in insulated industrial networks with own supply transformers. Furthermore, they could cause safety risks in such floating lines (IT networks). According to EN 61800-3 filters are not needed in industrial zone (Second Environment) for DCS550 drives above 100 A_{DC} rated current. For rated currents below 100 A_{DC}, the filter requirement is identical to Light Industry (First Environment).

Three-phase filters

EMC filters are necessary to fulfill the standard for emitted interference if a converter shall be run at a public low voltage line, in Europe for example with 400 V_{AC}. Such lines have a grounded neutral conductor. ABB offers suitable three-phase filters for 400 V_{AC}. For 440 V_{AC} public low voltage lines outside Europe 500 V_{AC} filters are available. Optimize the filters for the real motor currents:

– $i_{Filter} = 0.8 * i_{Mot\ max}$; the factor 0.8 respects the current ripple.

Lines with 500 V_{AC} and higher are not public. They are local networks inside factories, and they do not supply sensitive electronics. Therefore, converters do not need EMC filters if they shall run with 500 V_{AC} and more.

EMC filters

Further information is available in the *Technical Guide*.

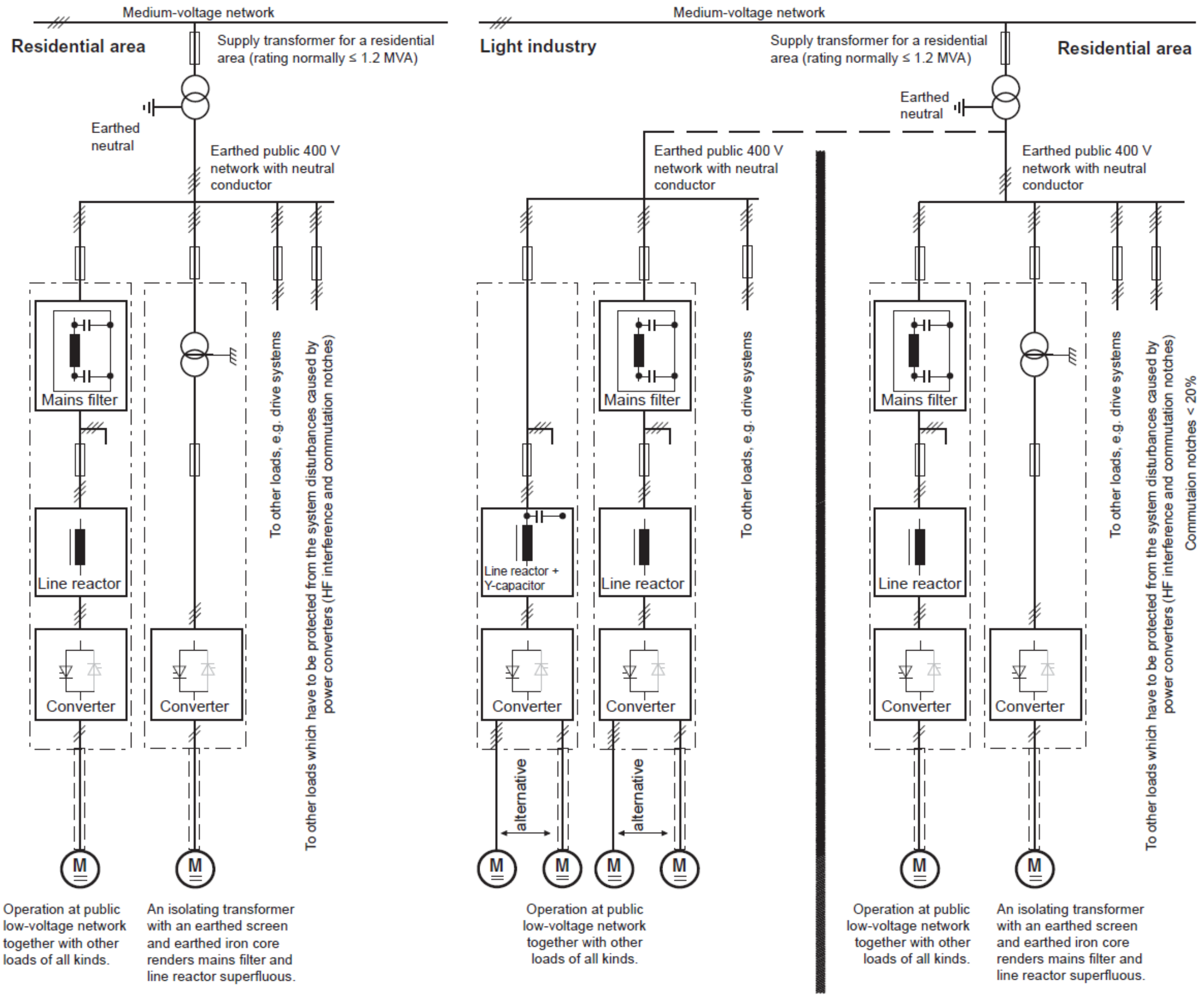
The paragraphs below describe selection of the electrical components in conformity with the EMC Guideline. The aim of the EMC Guideline is, as the name implies, to achieve electromagnetic compatibility with other products and systems. The guideline ensures that the emissions from the product concerned are so low that they do not impair another product's interference immunity.
In the context of the EMC Guideline, two aspects must be borne in mind:

- the product's interference immunity and
- the product's actual emissions.

The EMC Guideline expects EMC to be taken into account when developing a product; however, EMC cannot be designed in, it can only be quantitatively measured.

Notes on EMC conformity:
The conformity procedure is the responsibility of both the power converter's supplier and the manufacturer of the machine or system concerned, in proportion to their share in expanding the electrical equipment involved.

First environment (residential area with light industry) with PDS category C2		
Not applied, since category C1 (**general distribution** sales channel) excluded		
Not applicable		**satisfied**
satisfied		



For compliance with the protection objectives of the German EMC Act (EMVG) in systems and machines, the following EMC standards must be satisfied:
Product Standard EN 61800-3
EMC standard for drive systems (**P**ower**D**rive**S**ystem), interference immunity and emissions in residential areas, enterprise zones with light industry and in industrial facilities. This standard must be complied with in the EU for satisfying the EMC requirements for systems and machines!

For emitted interference, the following apply:

EN 61000-6-3 Specialized basic standard for emissions in **light industry** can be satisfied with special features (mains filters, screened power cables) in the lower rating range *(EN 50081-1).

EN 61000-6-4 Specialized basic standard for emissions in industry *(EN 50081-2)

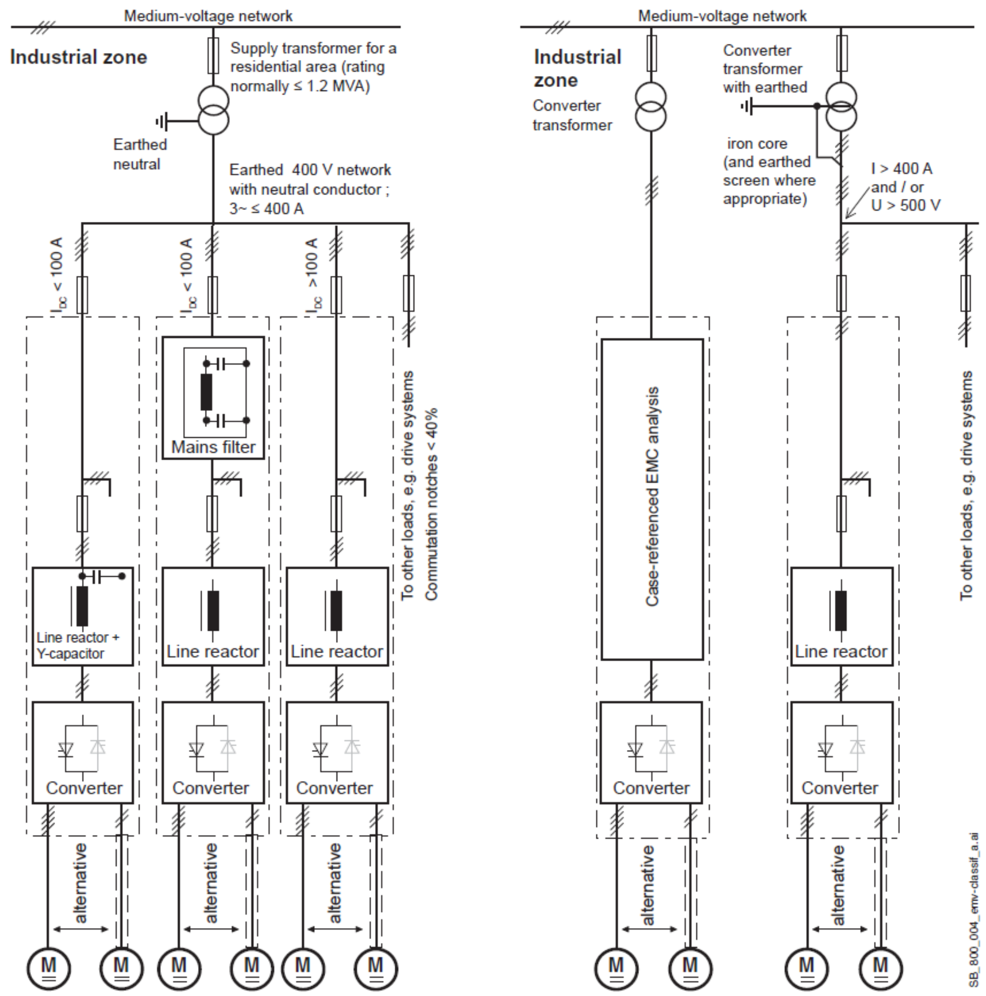
For interference immunity, the following apply:

EN 61000-6-1 Specialized basic standard for interference immunity in residential areas *(EN 50082-1)

EN 61000-6-2 Specialized basic standard for interference immunity in industry. If this standard is satisfied, then the EN 61000-6-1 standard is automatically satisfied as well *(EN 50082-2).

* The old generic standards are given in brackets

				Standards
Second environment (industry) with PDS categories C3, C4				**EN 61800-3**
Not applicable				**EN 61000-6-3**
satisfied		**on customer's request**	**satisfied**	**EN 61000-6-4**
satisfied				**EN 61000-6-2** **EN 61000-6-1**



Operation at low-voltage network together with other loads of all kinds, apart from some kinds of sensitive communication equipment.

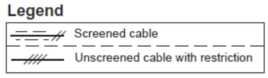
Operation with separate power converter transformer. If there are other loads at the same secondary winding, these must be able to cope with the commutation gaps caused by the power converter. In some cases, commutating reactors will be required.

Classification
The following overview utilizes the terminology and indicates the action required in accordance with Product Standard
EN 61800-3
For the DCS550 series, the limit values for emitted interference are complied with, provided the measure indicated is carried out. PDS of category C2 (formerly restricted distribution in first environment) is intended to be installed and commissioned only by a professional (person or organization with necessary skills in installing and/or commissioning PDS including their EMC aspects).

For power converters without additional components, the following warning applies:
This is a product of category C2 under IEC 61800-3:2004. In a domestic/residential environment, this product may cause radio interference in which case supplementary mitigation measures may be required.

The field supply is not depicted in this overview diagram. For the field current cables, the same rules apply as for the armature-circuit cables.

Legend



④ Auxiliary transformer (T2) for converter electronics and fan

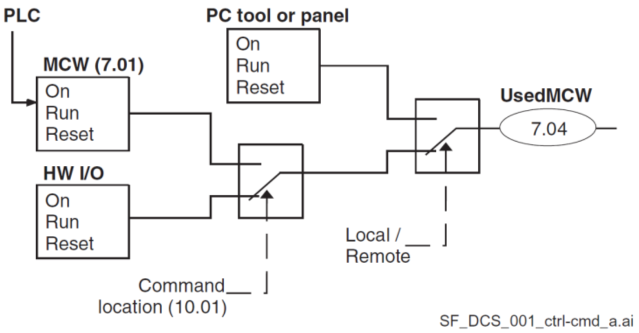
The converter module requires various auxiliary voltages, e.g. the module's electronics and cooling fans requires either a single-phase supply of 115 V_{AC} or 230 V_{AC}. The auxiliary transformer (T2) is designed to supply the module's electronics and cooling fans.

⑤ Start, Stop and E-stop control

The relay logic is splitted into three parts:

1. Generation of On / Off and Start / Stop commands:

The commands represented by K20 and K21 (latching interface relay) can also be generated by a PLC and transferred to the terminals of the converter either by relays, using galvanic isolation or directly via 24 V signals. There is no need to use hardwired signals. Transfer these commands via serial communication. Even a mixed solution can be realized by selecting different possibilities for the one or the other signal (see parameter group 11).



2. Generation of control and monitoring signals:

Control the main contactor K1 for the armature circuit by the dry contact of DO8 located on the SDCS-PIN-F. The status of motor (K6) and converter (K8) fans can be monitored by means of *MotFanAck (10.06)*.

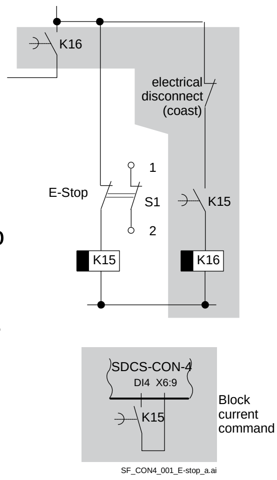
3. Off2 (Coast Stop) and Off3 (E-stop):

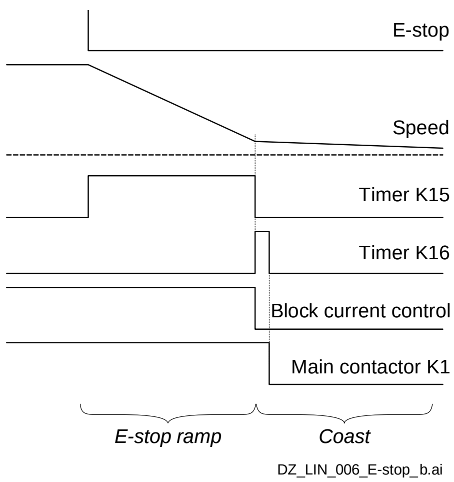
Beside **On** / **Off** and **Start** / **Stop** the drive is equipped with two additional stop functions **Off2** (Coast Stop) and **Off3** (E-stop) according to Profibus standard. **Off3** (E-stop) is scalable via *E StopMode (21.04)* to perform stop category 1. Connect this function to the E-stop push button without any time delay. In case of *E StopMode (21.04)* = **RampStop** the K15 timer relay must be set longer than *E StopRamp (22.04)*. For *E StopMode (21.04)* = **Coast** the drive opens the main contactor immediately.

Off2 (Coast Stop) switches the DC current off as fast as possible and prepares the drive to open the main contactor or drop the mains supply. For a normal DC motor load the time to force the DC current to zero is below 20 ms. This function should be connected to all signals and safety functions opening the main contactor. This function is important for 4-Q drives. Do not open main contactor during regenerative current. The correct sequence is:

1. switch off regenerative current,
2. then open the main contactor.

In case the E-stop push button is hit, the information is transferred to the converter via DI5. In case *E StopMode (21.04)* = **RampStop** or **TorqueLimit** the converter will decelerate the motor and then open the main contactor. If the drive has not finished the function within the K15 timer setting, the drive must get the command to switch off the current via K16. After the K16 timer has elapsed, the main contactor is opened immediately, independent of the drive's status.





⑥ Cooling fans

Fan assignment for DCS550:

Converter type	Size	Configuration	Fan type
DCS550-S01-0020, …, DCS550-S02-0025	F1	-	No fan, convection cooled
DCS550-S01-0045, …, DCS550-S02-0100		1	1 x 3110 KL-05W (internal 24 V_{DC})
DCS550-S01-0135, …, DCS550-S02-0300	F2	2	2 x 4715 MS-12T (115 V_{AC} / 230 V_{AC})
DCS550-S01-0315, …, DCS550-S02-0450	F3		
DCS550-S01-0470, …, DCS550-S02-0520		3	2 x 4715 MS-12T (115 V_{AC} / 230 V_{AC}) 2 x 3115 FS-12T (115 V_{AC} / 230 V_{AC})
DCS550-S01-0610, …, DCS550-S02-0820	F4	4	1 x W2E200 (230 V_{AC})
DCS550-S01-0900, …, DCS550-S02-1000			1 x W2E250 (230 V_{AC})

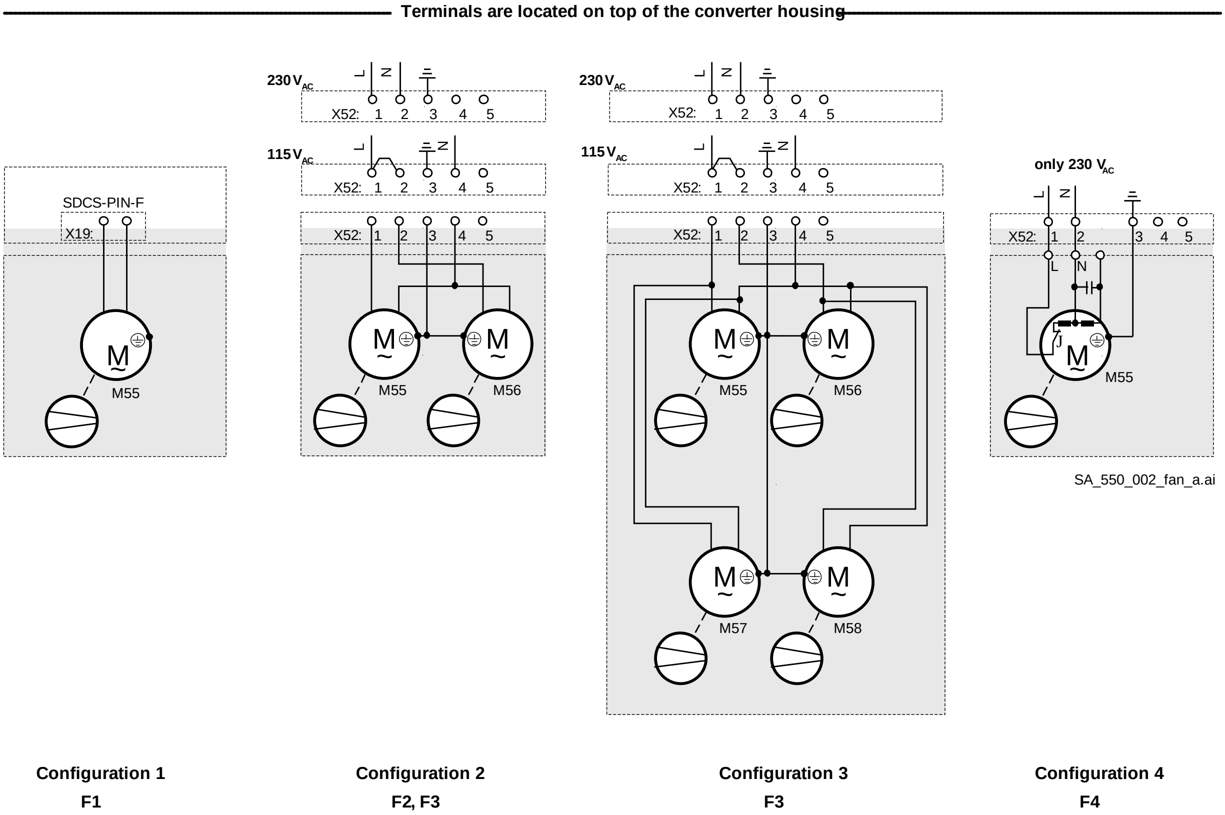
Fan data for DCS550:

Fan	3110 KL-05W	4715 MS-12T		3115 FS-12T		W2E200		W2E250	
Rated voltage [V_{AC}]	24 V_{DC} ①	115; 1~		115; 1~		230; 1~		230; 1~	
Tolerance [%]	+15 / -50	± 10		± 10		+6 / -10		+6 / -10	
Frequency [Hz]	-	50	60	50	60	50	60	50	60
Power consumption [W]	2.88	16	13	9.5	8.0	64	80	135	185
Current consumption [A]	0.12	0.2	0.17	0.075	0.060	0.29	0.35	0.59	0.82
Blocking current [A]	-	< 0.3	< 0.26	< 0.085	< 0.075	< 0.7	< 0.8	< 0.9	< 0.9
Air flow [m^3/h] freely blowing	66	156	180	47.5	55	925	1030	1860	1975
Max. ambient temp. [°C]	< 70	< 60		< 70		< 70		< 60	
Useful lifetime of grease	approximately 70,000 h / 25°	approximately 40,000 h / 60°		approximately 50,000 h / 20°		approximately 40,000 h / 60°			
Protection	DC	Impedance ②		Impedance		Internal temperature detector			

① Internally connected

② Increased losses due to increased current with a blocked rotor will not result in a winding temperature, higher than permissible for the insulation class being involved.

Fan connection for DCS550:



Cabling

Thermal overload and short-circuit protection

The drive protects itself and the input and motor cables against thermal overload when the cables are dimensioned according to the nominal current of the drive.

Power cables

Dimension the mains and motor cables according to local regulations. The cables must:

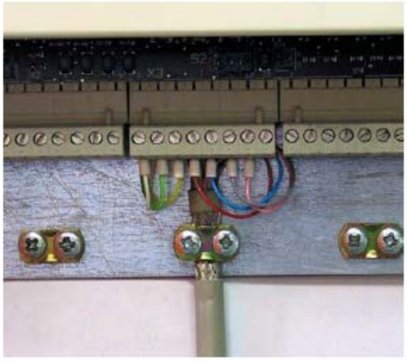
1. be able to carry the DCS550 load current,
2. be rated for at least 60°C (140°F),
3. fulfill short-circuit protection,
4. be rated according permissible touch voltage appearing under fault conditions (so that the fault point voltage will not rise too high when an earth fault occurs) and
5. be screened according to safety regulations.

Mains cable (AC line cable) short-circuit protection

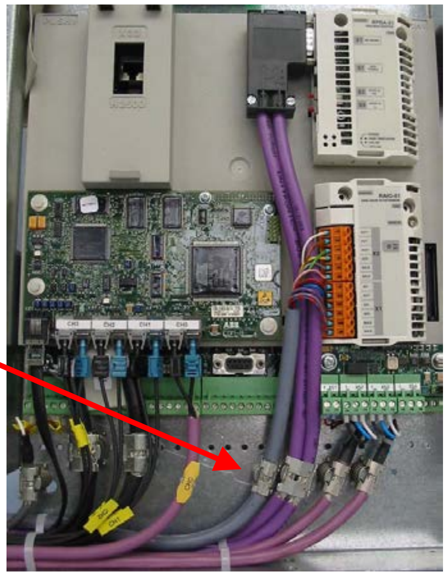
Always protect the input cable with fuses. Size the fuses according to local safety regulations, appropriate input voltage and the rated current of the drive, see chapter *Technical Data*.
High-speed semiconductor fuses provide short-circuit protection, but do not provide thermal overload protection.

Control / signal cables

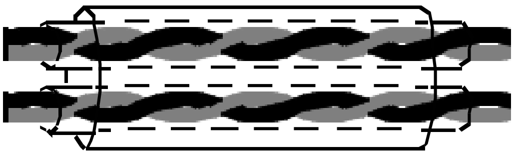
Used screened cables for digital signals, which are longer than 3 m and for all analog signals. Connect each screen at both ends by metal clamps or comparable means directly on clean metal surfaces, if both earthing points belong to the same earth line. Otherwise, connect a capacitor to earth on one end. In the converter cabinet this kind of connection must be made directly on the sheet metal close to the terminals and if the cable comes from outside also on the PE bar. At the other end of the cable, connect the screen well with the housing of the signal emitter or receiver.



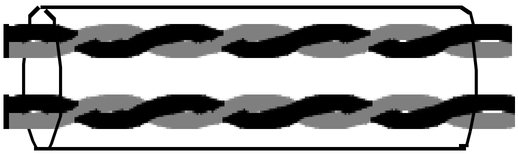
Connection of cable screens with metal clamps to the metal surface of the electronic tray.



A double shielded twisted pair cable, e.g. JAMAK by NK Cables, Finland, must be used for analog signals and the pulse encoder signals. Employ one individually shielded pair for each signal. Do not use common return for different analog signals.
A double shielded cable is the best alternative for low voltage digital signals but single shielded twisted multi pair cable is also usable.



Double shielded twisted pair cable



Single shielded twisted multi pair cable

- Pairs should be twisted as close to terminals as possible.
- Run analog and digital signals in separate, screened cables.
- Relay-controlled signals, providing their voltage does not exceed 48 V, can be run in the same cables as digital input signals. It is recommended that the relay-controlled signals be run as twisted pairs too.

Attention:
Never run 24 V_{DC} and 115 / 230 V_{AC} signals in the same cable!

Co-axial cables

Recommendations for use with DCS550:

– 75 © type,
– RG59 cable with diameter 7 mm or RG11 cable 11 mm and
– a maximum cable length of 300 m.

Relay cables

Cable types with braided metallic screens (e.g. ÖLFLEX, LAPPKABEL, Germany) has been tested and approved by ABB.

DCS Control Panel cable

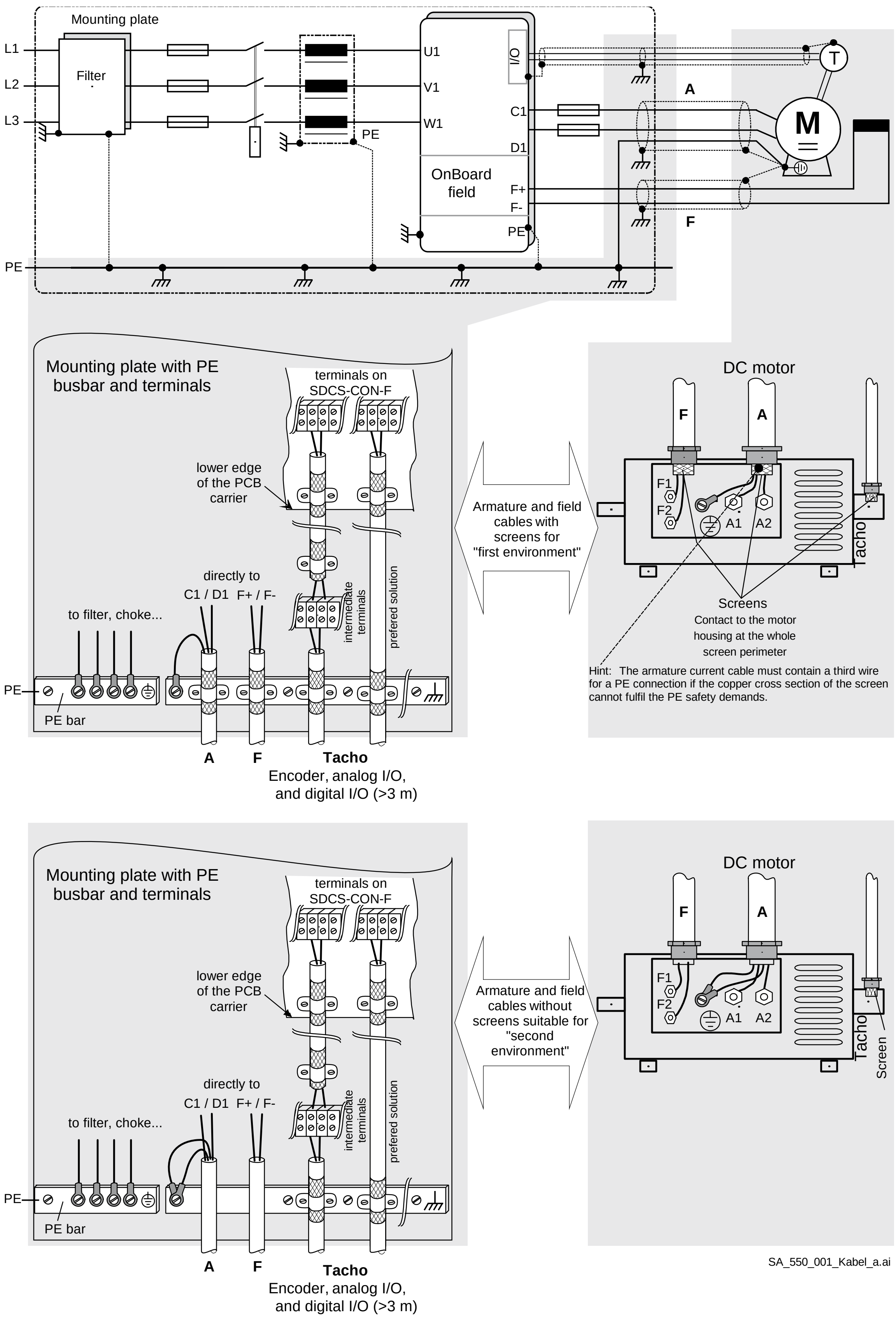
The cable connecting the DCS Control Panel to the DCS550 converter module must not exceed 3 meters (10 ft.). The cable type tested and approved by ABB is included in the DCS Control Panel option kits.

Fieldbus cables

Fieldbus cables can be quite different, depending on the fieldbus type. Please refer to control / signal cables and co-axial cables.

Connection example in accordance with EMC

The example shows the principle structure of a DC drive and its connections. It is not a binding recommendation, and it cannot respect all conditions of a plant. Therefore, consider each drive separately and with respect to the special application. Additionally take the general installation and safety rules into account:


Mounting plate
L1
L2
L3
Filter
PE
U1
V1
W1
I/O
C1
D1
OnBoard field
F+
F-
PE
T
M
A
F
Mounting plate with PE busbar and terminals
terminals on SDCS-CON-F
lower edge of the PCB carrier
directly to
C1 / D1 F+ / F-
to filter, choke...
intermediate terminals
prefered solution
PE bar
A
F
Tacho
Encoder, analog I/O, and digital I/O (>3 m)
Armature and field cables with screens for "first environment"
DC motor
F
A
F1
F2
A1
A2
Tacho
Screens
Contact to the motor housing at the whole screen perimeter
Hint: The armature current cable must contain a third wire for a PE connection if the copper cross section of the screen cannot fulfil the PE safety demands.
Mounting plate with PE busbar and terminals
terminals on SDCS-CON-F
lower edge of the PCB carrier
directly to
C1 / D1 F+ / F-
to filter, choke...
intermediate terminals
prefered solution
PE
PE bar
A
F
Tacho
Encoder, analog I/O, and digital I/O (>3 m)
Armature and field cables without screens suitable for "second environment"
DC motor
F
A
F1
F2
A1
A2
Tacho
Screen
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Electrical installation

Chapter overview

This chapter describes the electrical installation procedure of the DCS550.

WARNING!
A qualified electrician may only carry out the work described in this chapter. Follow the *Safety instructions* on the first pages of this manual. Ignoring the safety instructions can cause injury or death.
Make sure that the drive is disconnected from the mains (input power) during installation. If the drive was already connected to the mains, wait for 5 min. after disconnecting mains power.

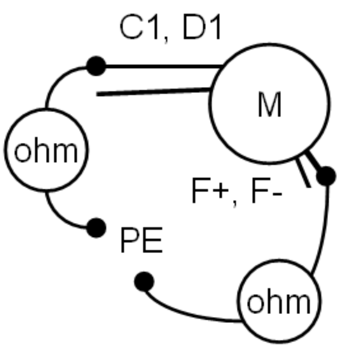
Further information is available in the *Technical Guide*.

Checking the insulation of the assembly

Every drive has been tested for insulation between the main circuit and the chassis (2500 V rms 50 Hz for 1 second) at the factory. Therefore, do not make any voltage tolerance or insulation resistance tests (e.g. hi-pot or megger) on any part of the drive. Check the insulation of the assembly as follows.

WARNING!
Check the insulation before connecting the drive to the mains. Make sure that the drive is disconnected from the mains (input power).

1. Check that the motor cable is disconnected from the drive output terminals C1, D1, F+ and F-.
2. Measure the insulation resistances of the motor cable and the motor between each circuit (C1, D1) / (F+, F-) and Protective Earth (PE) by using a measuring voltage of 1 kV DC. The insulation resistance must be higher than 1 M©.



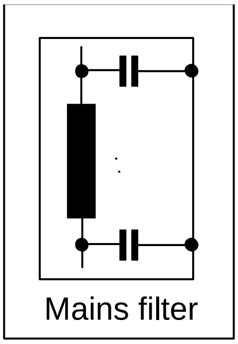
Connection of a motor temperature sensor to the drive I/O

WARNING!
IEC 60664 requires double or reinforced insulation between live parts and the surface of accessible parts of electrical equipment that are either nonconductive or conductive but not connected to the protective earth. To fulfill this requirement, the connection of a thermistor (or other similar components) to the inputs of the drive can be implemented by 3 alternate ways:
1. there is double or reinforced insulation between the thermistor and live parts of the motor,
2. circuits connected to all digital and analog inputs of the drive are protected against contact and insulated with basic insulation (the same voltage level as the drive main circuit) from other low voltage circuits or
3. an external thermistor relay is used. Rate the insulation of the relay for the same voltage level as the main circuit of the drive.

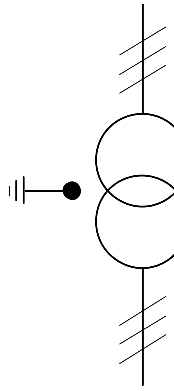
Power connections

IT (ungrounded) systems

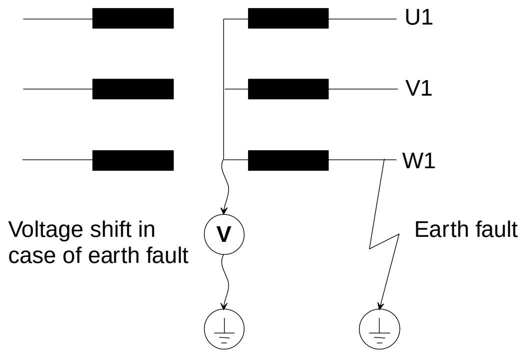
Don't use EMC filters in IT systems:



The screen winding of an existing dedicated transformers must be grounded:



For installations without low voltage switch (e.g. contactor, air-circuit-breaker) use an overvoltage protection on the secondary side of the mains transformer.
The voltage shift of the isolated supply must not be larger than the voltage shift in case on an earth fault:



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Supply voltage

Check voltage levels of:

– auxiliary voltage (X99 on SDCS-PIN-F),
– cooling fan terminals and
– mains voltage connected to U1, V1, W1.

Connecting the power cables

Check:

– Grounding and screening of power cables see chapter *Cabling*.
– Cross sectional areas and tightening torques of power cable, see chapter *Cross-sectional areas - Tightening torques*.

Cross-sectional areas - Tightening torques

Recommended cross-sectional area according to DINVDE 0276-1000 and DINVDE 0100-540 (PE) trefoil arrangement, up to 50°C ambient temperature. The necessary wire torque at 60°C wire temperature is the same as recommended in the following tables.

Excitation:

Size	F1	F2	F3	F4
DC output current	12 A	18 A	25 A	35 A
max. cross sectional area	6 mm²/ AWG 10	6 mm²/ AWG 10	6 mm²/ AWG 10	6 mm²/ AWG 10
min. cross sectional area	2.5 mm²/ AWG 16	4 mm²/ AWG 13	6 mm²/ AWG 11	6 mm²/ AWG 10
Tightening torque	1.5, ..., 1.7 Nm			

Armature:

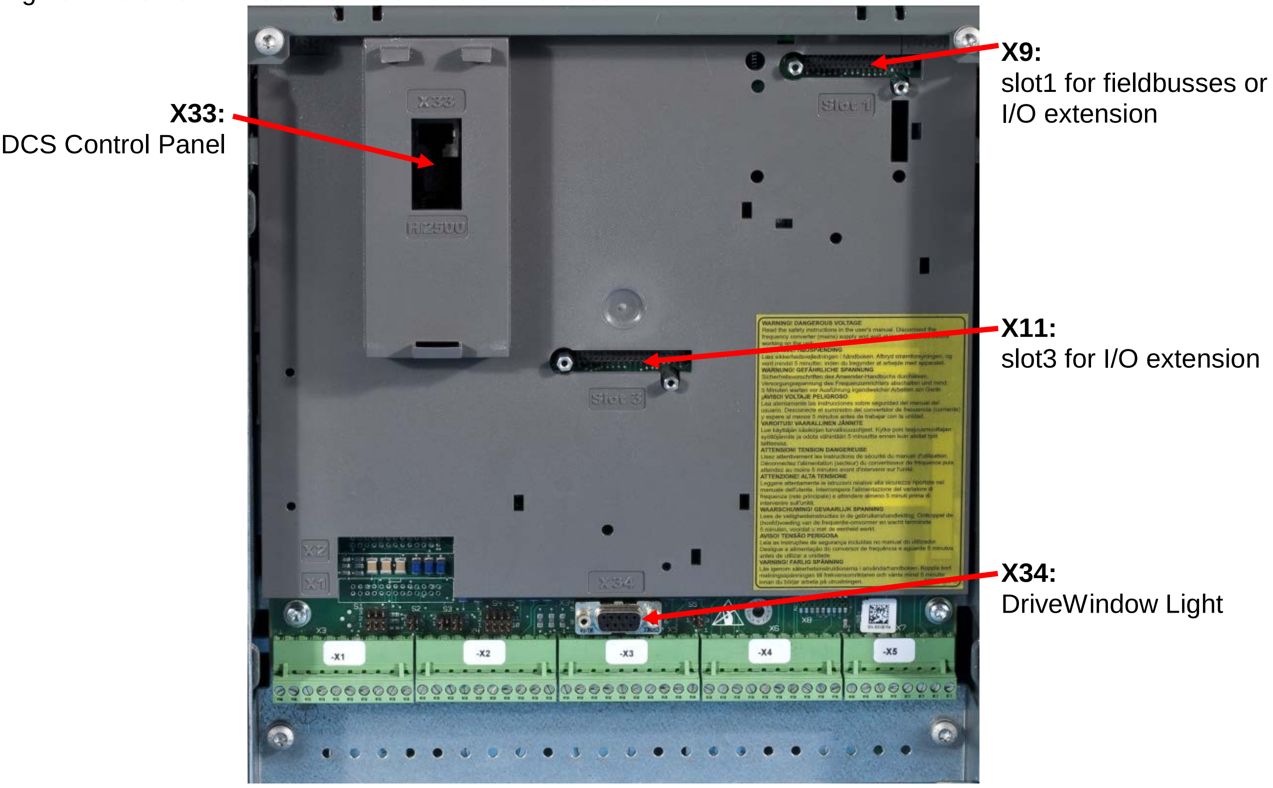
Converter type	C1, D1			U1, V1, W1			PE		
	IDC [A-]	1 [mm²]	(2.) [mm²]	Iv [A~]	1 [mm²]	(2.) [mm²]	[mm²]		[Nm]
DCS550-S01-0020, DCS550-S02-0025	25	1 x 6	-	41	1 x 4	-	1x 4	1 x M6	6
DCS550-S01-0045, DCS550-S02-0050	50	1 x 10	-	41	1 x 6	-	1x 6	1 x M6	6
DCS550-S01-0065, DCS550-S02-0075	75	1 x 25	-	61	1 x 25	-	1x 16	1 x M6	6
DCS550-S01-0090, DCS550-S02-0100	100	1 x 25	-	82	1 x 25	-	1x 16	1 x M6	6
DCS550-S01-0135, DCS550-S02-0150	150	1 x 35	-	114	1 x 35	-	1x 16	1 x M10	25
DCS550-S01-0180, DCS550-S02-0200	200	2 x 35	1 x 95	163	2 x 25	1 x 95	1x 25	1 x M10	25
DCS550-S01-0225, DCS550-S02-0250	250	2 x 35	1 x 95	204	2 x 25	1 x 95	1x 25	1 x M10	25
DCS550-S01-0270, DCS550-S01-0315	315	2 x 70	1 x 95	220	2 x 50	1 x 95	1x 50	1 x M10	25
DCS550-S02-0350	350	2 x 70	-	286	2 x 50		1x 50	1 x M10	25
DCS550-S01-0405, DCS550-S02-0450	450	2 x 95	-	367	2 x 95	-	1x 50	1 x M10	25
DCS550-S01-0470, DCS550-S02-0520	520	2 x 95	-	424	2 x 95	-	1x 50	1 x M10	25
DCS550-S01-0610	610	2 x 120	-	555	2 x 120	-	1x120	1 x M12	50
DCS550-S02-0680	680	2 x 120	-	555	2 x 120	-	1x120	1 x M12	50
DCS550-S01-0740, DCS550-S02-0820	820	2 x 150	-	669	2 x 120	-	1x120	1 x M12	50
DCS550-S01-0900, DCS550-S02-1000	1000	2 x 185	-	816	2 x 150	-	1x150	1 x M12	50

You will find instructions on how to calculate the PE conductor’s cross-sectional area in VDE 0100 or in equivalent national standards. We would remind you that power converters might have a current-limiting effect.

Drive interfaces

Location R-type options and interfaces

Tighten the screws to secure the extension modules.



Pulse encoder connection

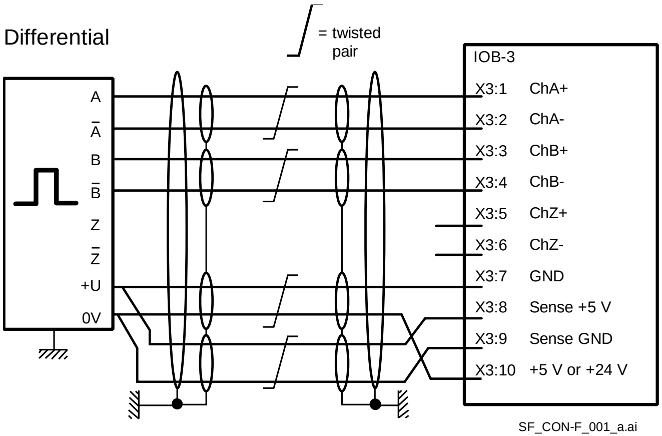
Power supply for pulse encoders

The SDCS-CON-F uses jumper S4 to select either the 5 V or 24 V supply voltage.

Encoder supply	Jumper S4 setting	Hardware configuration
5 V	10 - 11	sense controlled
24 V	11 - 12	no sense

Use the sense feedback when the power supply level of a differential pulse encoder is only 5 V.

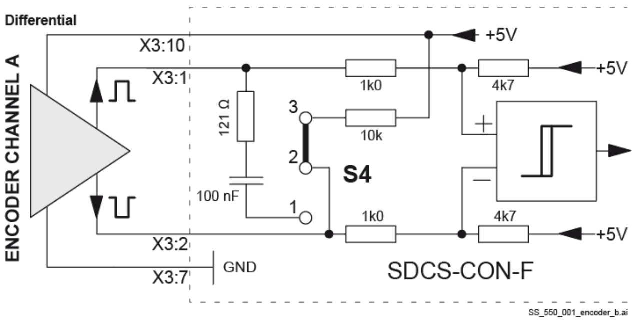
Commissioning hint:
If the drive's measured direction of rotation is wrong or does not correspond to the measured EMF speed, **F522 SpeedFb** may appear during start-up. If necessary correct it by exchanging the field connections F1 and F2 or exchange tracks A+ & A-.

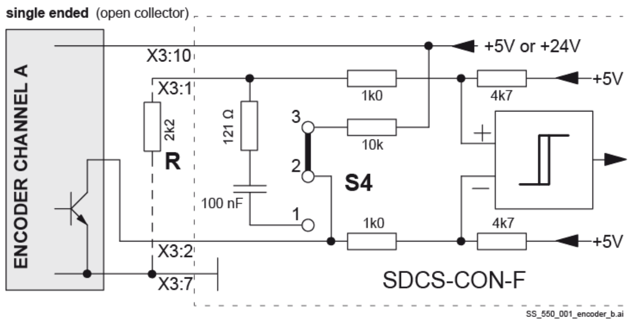


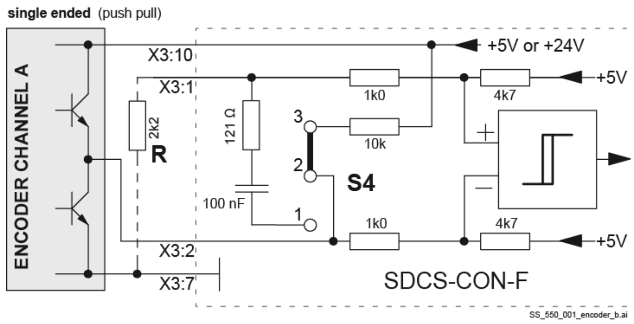
Pulse encoder connection principles

Two different incremental encoder connections are available:

1. differential connection; pulse encoders generating either voltage or current signals can be used,
2. single-ended (push pull) connection; only voltage signals can be used







In case of a single ended 5 V encoder the jumper S4 has be set to a neutral position. To get a threshold lower than 5 V each terminal X3:2, 4, 6 must be connected via a resistor R to GND.

Cable length

The maximum distance between pulse encoder and interface board dependents on the voltage drop of the connecting lines and on the output and input configuration of the used components. Use cables according to the table below. The voltage regulator can compensate the voltage drop caused by the cable. Use twisted pair cables with pair shielding plus overall shielding:

Cable length	Parallel wires for power source & GND	Cable used
0 to 50 m	1 * 0.25 mm²	12 * 0.25 mm²
50 to 100 m	2 * 0.25 mm²	12 * 0.25 mm²
100 to 150 m	3 * 0.25 mm²	14 * 0.25 mm²

Cable length	Parallel wires for power source & GND	Cable used
0 to 164 ft.	1 * 24 AWG	12 * 24 AWG
164 to 328 ft.	2 * 24 AWG	12 * 24 AWG
328 to 492 ft.	3 * 24 AWG	14 * 24 AWG

Installation checklist

Check the mechanical and electrical installation of the drive before start-up. Go through the checklist below together with another person. Read the *Safety instructions* on the first pages of this manual before you work on the unit.

MECHANICAL INSTALLATION

- ☐ The ambient operating conditions are allowed (see *Environmental conditions*, *Current ratings*)
- ☐ The unit is mounted properly on a vertical non-flammable wall (see *Mechanical installation*)
- ☐ Cooling air will flow freely (see *Mechanical installation*)
- ☐ The motor and the driven equipment is ready for start
- ☐ All screen terminals are checked for tightness (see *Cabling*)
- ☐ All cable connections are seated properly (see *Cabling*)

ELECTRICAL INSTALLATION (see *Planning the electrical installation*, *Electrical installation*)

- ☐ The converter modules are grounded properly
- ☐ The mains voltage matches the converter module's nominal input voltage
- ☐ The mains (input power) connections at U1, V1 and W1 (L1, L2 and L3) are OK
- ☐ The appropriate mains fuses and disconnector are installed
- ☐ The drive connections at C1, D1 and F+, F- and their tightening torques are OK
- ☐ Motor cable routing (armature and excitation) is OK
- ☐ Check that the screens are properly installed at the motor and in the drive cabinet
- ☐ The motor connections L+, L-, F+ and F- and their tightening torques are OK
- ☐ The control connections are OK
- ☐ If pulse encoder is used, check the encoder cables and correct direction of rotation
- ☐ PTC, Klixon cables: Check that the connections are appropriate for the type of sensor used in the motor
- ☐ Check the prevention of unexpected start-up (on inhibit, coast stop) circuit for proper function
- ☐ Proper function of E-stop circuit and relay
- ☐ Cooling fan power wiring connected
- ☐ The external control connections inside the drive are OK
- ☐ There are no tools, foreign objects or dust from drilling inside the drive
- ☐ Drive, motor connection box and other covers are in place

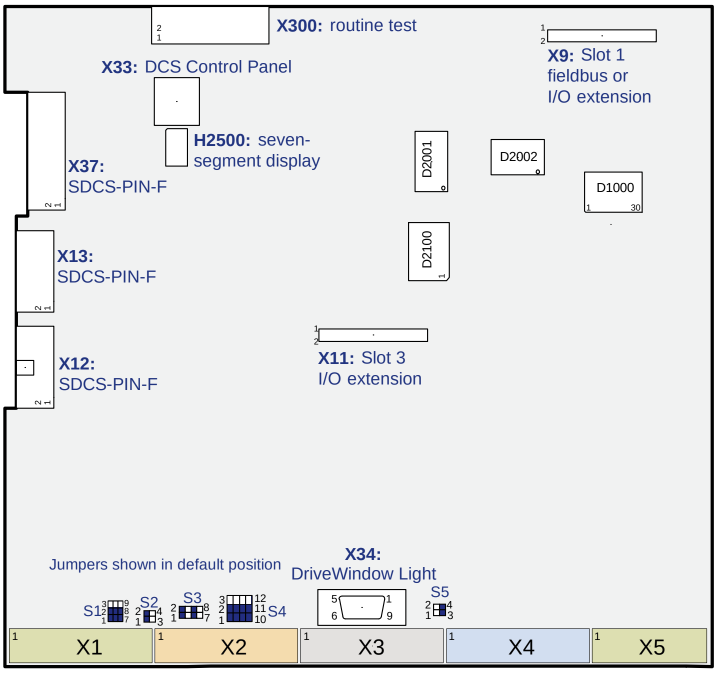
Electronic board details

Chapter overview

This chapter describes the electronics of the DCS550.

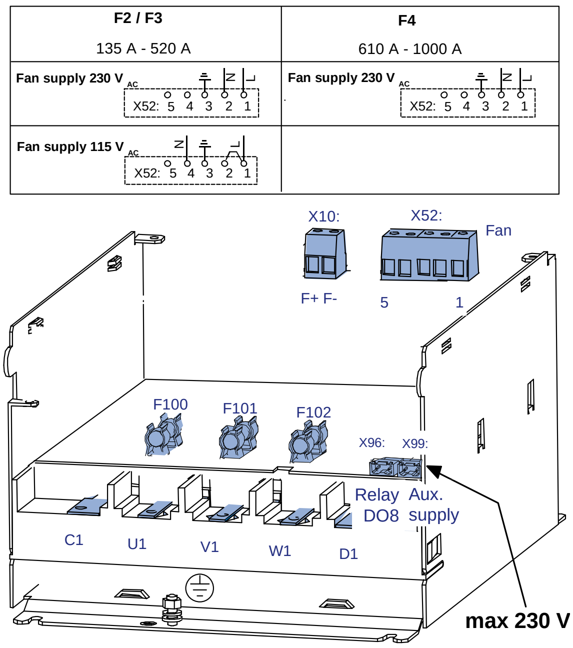
Terminal locations

SDCS-CON-F connector allocation

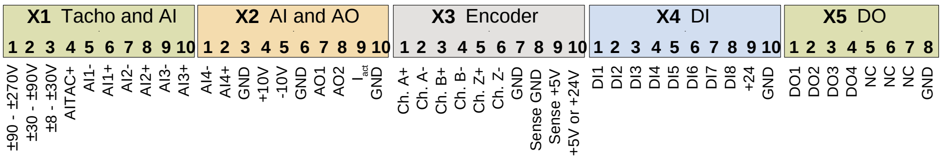


DCS550 module

Terminal allocation



SDCS-CON-F: Terminal allocation



F100, F101, F102	KTK 25
F401, F402, F403	KTK 30

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Table of used boards

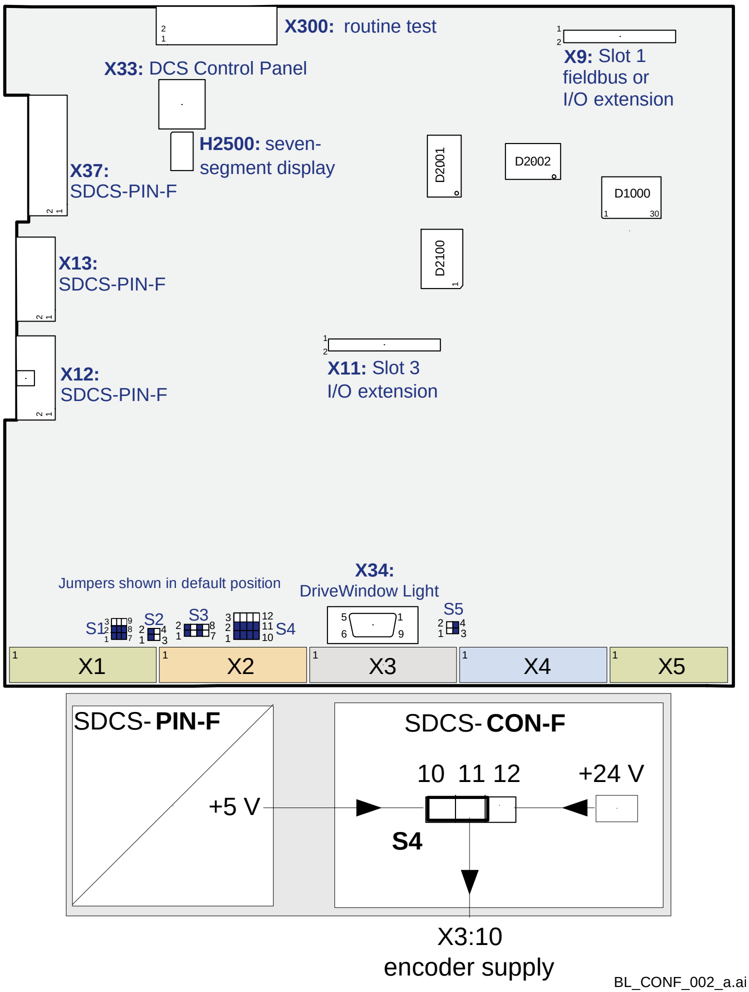
Size	Converter type	SDCS-CON-F	SDCS-PIN-F	SDCS-BAB-F01	SDCS-BAB-F02 Using fuses F100 to F102 on SDCS-PIN-F	SDCS-BAB-F02 Using external fuses F401 to F403
F1	DCS550-S01-0020	X	X	X		
	DCS550-S01-0045	X	X	X		
	DCS550-S01-0065	X	X	X		
	DCS550-S01-0090	X	X	X		
	DCS550-S02-0025	X	X	X		
	DCS550-S02-0050	X	X	X		
	DCS550-S02-0075	X	X	X		
	DCS550-S02-0100	X	X	X		
F2	DCS550-S01-0135	X	X	X		
	DCS550-S01-0180	X	X	X		
	DCS550-S01-0225	X	X	X		
	DCS550-S01-0270	X	X	X		
	DCS550-S02-0150	X	X	X		
	DCS550-S02-0200	X	X	X		
	DCS550-S02-0250	X	X	X		
	DCS550-S02-0300	X	X	X		
F3	DCS550-S01-0315	X	X		X	
	DCS550-S01-0405	X	X		X	
	DCS550-S01-0470	X	X		X	
	DCS550-S02-0350	X	X		X	
	DCS550-S02-0450	X	X		X	
	DCS550-S02-0520	X	X		X	
F4	DCS550-S01-0610	X	X			X
	DCS550-S01-0740	X	X			X
	DCS550-S01-0900	X	X			X
	DCS550-S02-0680	X	X			X
	DCS550-S02-0820	X	X			X
	DCS550-S02-1000	X	X			X

Control board SDCS-CON-F

Layout

Jumper coding	
S1	* Jumper parking position, normal DC tacho
	Reserved, do not use
	* AITAC1+ (X1:4) connected to GND
	Jumper parking position, AITAC1+ (X1:4) notgrounded
	* Jumper parking position, do not change
	Reserved, do not use
S2	* AI1 (X1:5-6): R_{in} = 200 kΩ; range ±10 V
	AI1 (X1:5-6): R_{in} = 250 Ω**; range ±20 mA
S3	* AI2 (X1:7-8): R_{in} = 200 kΩ; range ±10 V
	AI2 (X1:7-8): R_{in} = 250 Ω**; range ±20 mA
	* Jumper parking position, no PTC connected
	PTC connected at X1:7-8, 4.75 kΩ pull-up resistor activated
S4	* Encoder mode **differential**; RC loads activated with R = 121Ω and C = 100 nF
	Encoder mode: **single ended**; 10 kΩ pull-up resistor activated
	* Encoder supply +5V, sense at X3:8-9 is active
	Encoder supply +24V, no sense available
S5	Firmware download
	* Normal program execution or text download

* default value
** 250 Ω x 20 mA = 5 V == 100 %



Location

The SDCS-CON-F is mounted on an electronic tray. The electronic tray is put in the housing by means of four hinges and the SDCS-CON-F is connected with the SDCS-PIN-F through three flat cables.

Memory circuit

The SDCS-CON-F is equipped with a flash PROM that contains the firmware and the stored parameters. It is possible to handle the parameters by DCS Control Panel, DWL or overriding control. Changed parameters are stored immediately in the flash with the exception of parameters for cyclic communication via the dataset table in groups 90 to 92 and pointers in group 51.
In addition, the fault logger entries are stored in the flash during de-energizing the auxiliary power.

Watchdog function

The SDCS-CON-F has an internal watchdog. The watchdog controls the proper function of the SDCS-CON-F and the firmware. If the watchdog trips, it has the following effects:
- the thyristor firing control is reset and disabled,
- all DI’s are forced low (zero) and
- all programmable AO’s are reset to zero (0 V).

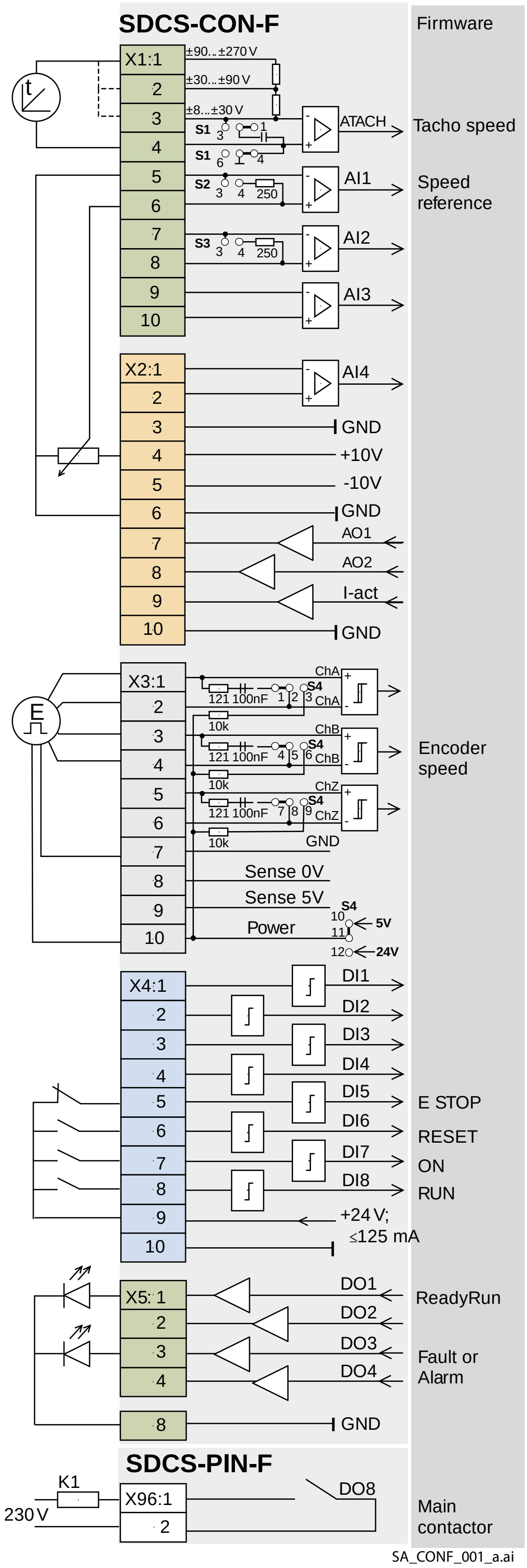
Terminal description

- Connectors X1 to X5 provide the standard digital and analog connection of the drive.
- Use connector X9 or slot1 for R-type extension I/O modules and R-type fieldbus adapters.
- Use connector X11 or slot3 only for R-type extension I/O modules.

	Connector X9 or slot1	Connector X11 or slot3
RAIO, RDIO	X	X
R-type fieldbus adapters	X	-

- Connectors X12 and X13 connect the SDCS-CON-F to the SDCS-PIN-F for voltage, current and temperature measurement. Additionally the firing pulses are sent to the thyristors trough the SDCS-PIN-F.
- Use connector X33 to connect the DCS Control Panel either directly via a 40 mm jack plug or via a CAT 1:1 cable with RJ45 plugs.
- Use connector X34 for firmware download, to connect DriveWindow Light, commissioning assistant and DriveAP tool. Usually use the RS232 interface for parameter setting and commissioning the drive via DriveWindow Light.
- Use connector X37 to connect the SDCS-CON-F to the power supply from the SDCS-PIN-F.
- A seven-segment display named H2500 is located on the control board SDCS-CON-F to show the state of drive. It displays for example fault- and alarm codes. A detailed description of the seven-segment display is available in chapter *Status messages*.

I/O connections



Resolution [bit]	In- / output values hardware	Scaling by	Common mode range	Remarks
15 + sign	±90 V, ..., 270 V ±30 V, ..., 90 V ±8 V, ..., 30 V	Firmware	±15 V	
15 + sign	±10	Firmware	±15 V	
15 + sign	±10	Firmware	±15 V	
15 + sign	±10	Firmware	±15 V	
15 + sign	±10	Firmware	±15V	

			Power	
	+10 V		d 5 mA	
	-10 V		d 5 mA	
11 + sign	±10	Firmware	d 5 mA	
11 + sign	±10	Firmware	d 5 mA	
	±10	Firmware, Hardware	d 5 mA	8 V ⇒ min. of 325% of (99.03) or 230% of (4.05)

Encoder supply		Remarks
		Inputs are not isolated Impedance = 120 ©, if selected maximum frequency d 300 kHz
5 V 24 V	≤ 250 mA ≤ 200 mA	Sense lines for GND and supply to correct voltage drops on cable (only available for 5 V encoders)

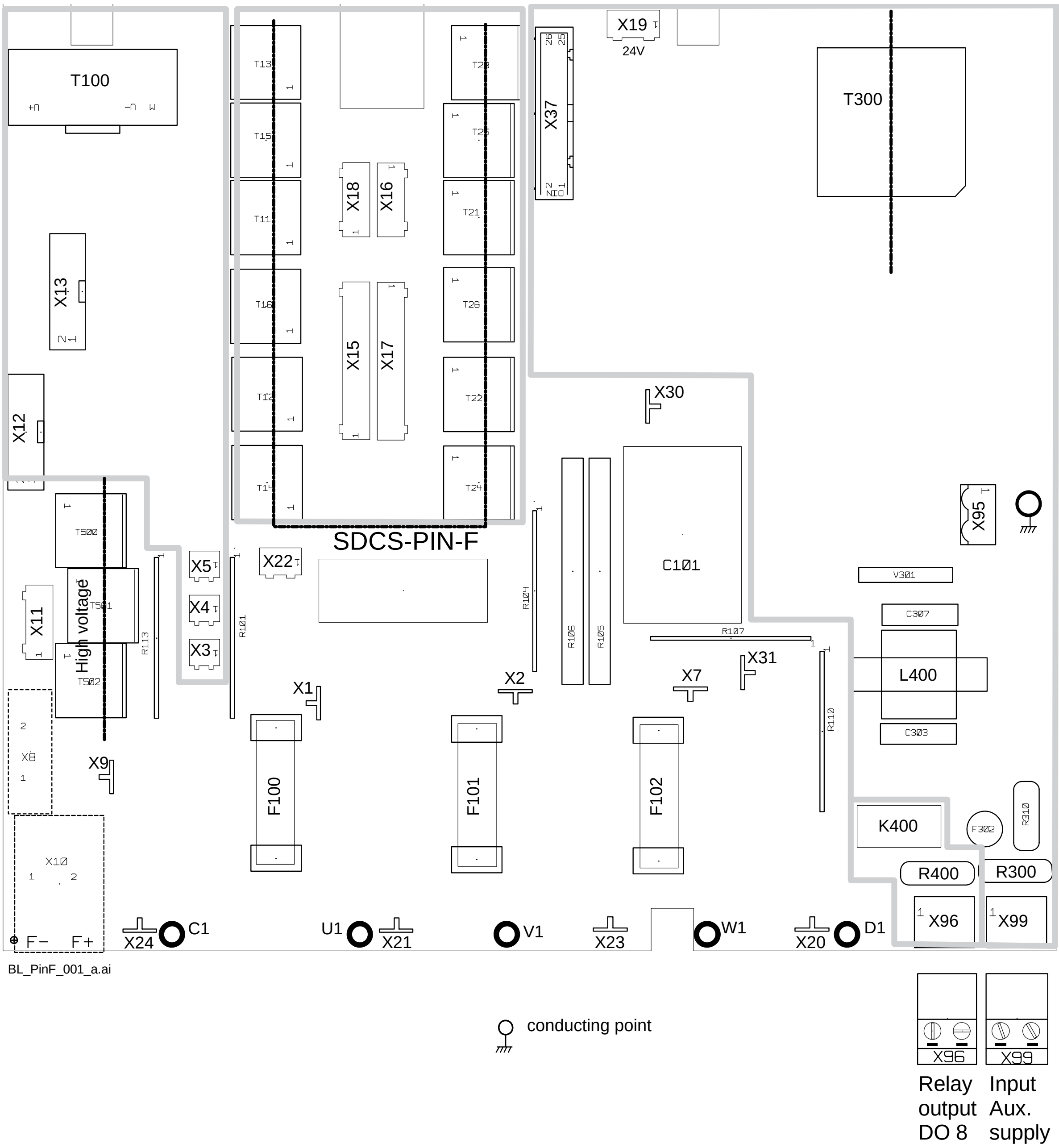
Input	Signal definition	Remarks
0 - 7.3 V 7.5 50 V	Firmware	⇒ “0“ status ⇒ “1“ status

Output	Signal definition	Remarks
50* mA; 22 V at no load	Firmware	Current limit for all 7 outputs together is maximum160 mA. Do not apply any reverse voltages!

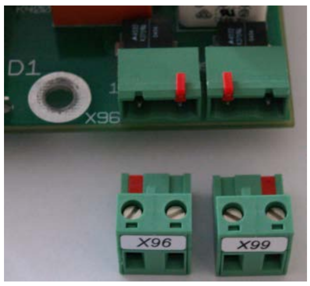
* short circuit protected

Power Interface board SDCS-PIN-F

Layout



To protect X96 and X99 from being swapped both plugs are coded:



Location

The SDCS-PIN-F is located between the power part and the control board SDCS-CON-F.

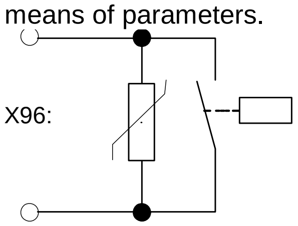
Functions

The DCS550 provides an automatic adjustment for current and voltage measurement, burden resistor settings and 2-Q or 4-Q operation by means of setting parameters in the firmware. The SDCS-PIN-F provides:

- the power supply for all the auxiliary voltages of the whole drive and the connected options,
- control of armature bridge including high ohmic measurement of DC- and AC voltage and an interface for the current transformer measuring the armature current,
- control of the integrated field exciter and field current measurement,
- an interface for the heatsink temperature measurement with a PTC resistor,
- a snubber circuit for thyristor protection together with the snubber resistor mounted on the heatsink.

Terminal description

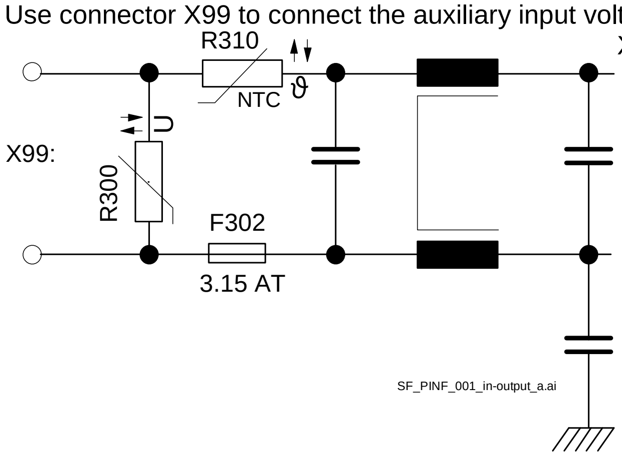
- The integrated field exciter with firing pulse transformers and field current measurement via transformer T100 is located on the SDCS-PIN-F. The power part is a three phase half-controlled bridge supplied from the mains U1, V1, W1 via fuses F100, F101, F102 and is located on the heat sink.
  The measurement of the field current is automatically scaled and selected by the firmware. Deselect a not needed integrated field exciter by means of the firmware.
- Connector X96 controls the main circuit breaker. To save an additional relay in the cabinet the DCS550 provides a normally open relay contact integrated on the SDCS-PIN-F. Digital output 8 controls the relay output at connector X96. The function or signal definition of digital output 8 is done in the firmware by means of parameters.



Isolated relay with a normally open contact
Contact ratings:
- 230 V~ / <3 A~
- 24 V- / <3 A- or 115 / 230 V- / <0.3 A-

- Use connector X99 to connect the auxiliary input voltages of 230 V_{AC}, 115 V_{AC} or 230 V_{DC}.

X99 features a hardware filter and a voltage limitation.

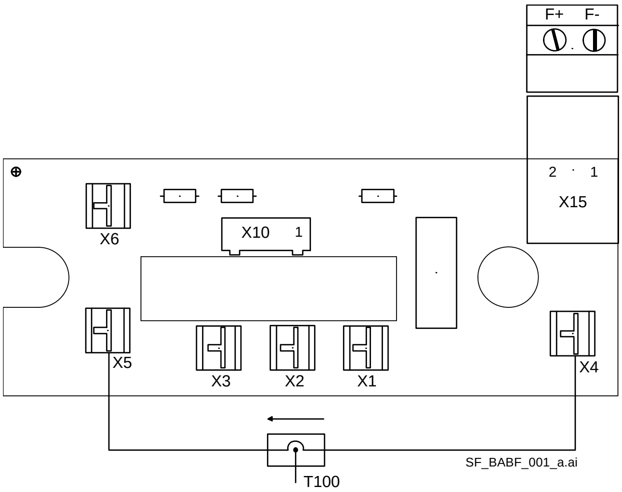


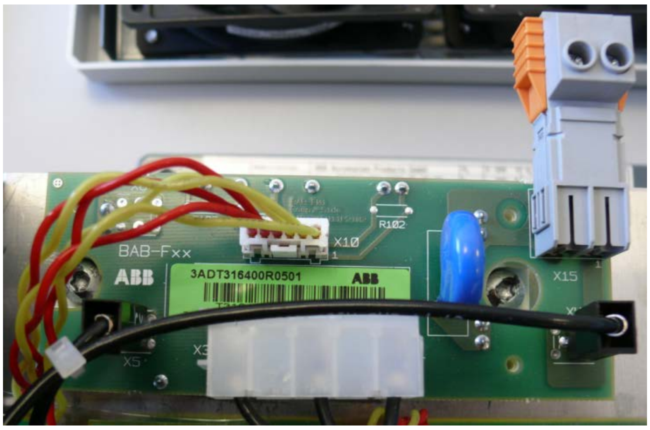
Auxiliary voltages	115 V_{AC}	230 V_{AC}	230 V_{DC}
Tolerance	-15 % / +10 %	-15 % / +10 %	-15 % / +10 %
Frequency	45 Hz to 65 Hz	45 Hz to 65 Hz	
Power consumption	120 VA	120 VA	
Power loss	d 60 W	d 60 W	d 60 W
Inrush current	*20 A / 20 ms	10 A / 20 ms	10 A / 20 ms
recommended fusing	6 AT	6 AT	6 AT
Mains buffering	min 30 ms	min 300 ms	150 ms
Power fail	< 95 V_{AC}	< 95 V_{AC}	< 140 V_{DC}

Integrated field exciters SDCS-BAB-F01 and SDCS-BAB-F02

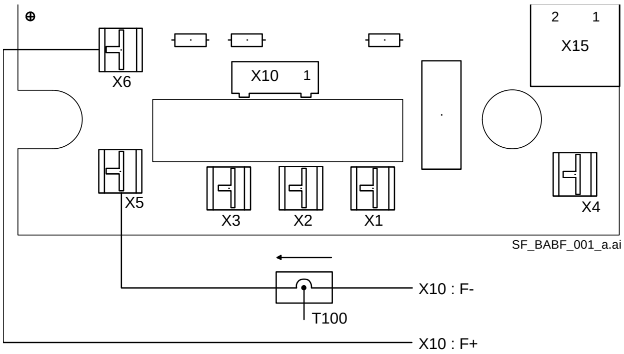
Layout

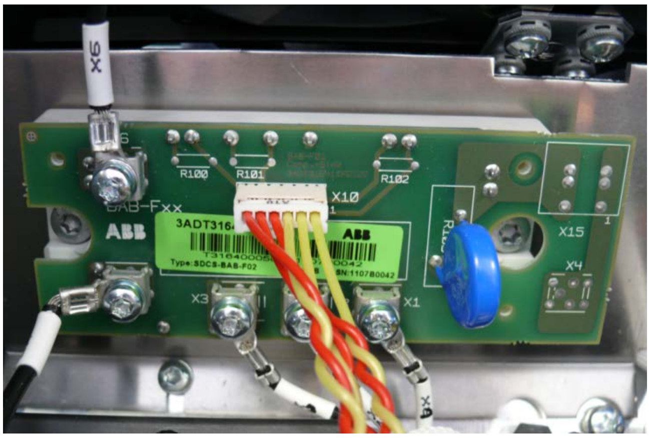
SDCS-BAB-F01 for module sizes F1 and F2:





Layout SDCS-BAB-F02 for module sizes F3 and F4:





Location

The SDCS-BAB-F is located between the power part and the control board SDCS-CON-F.

Functions

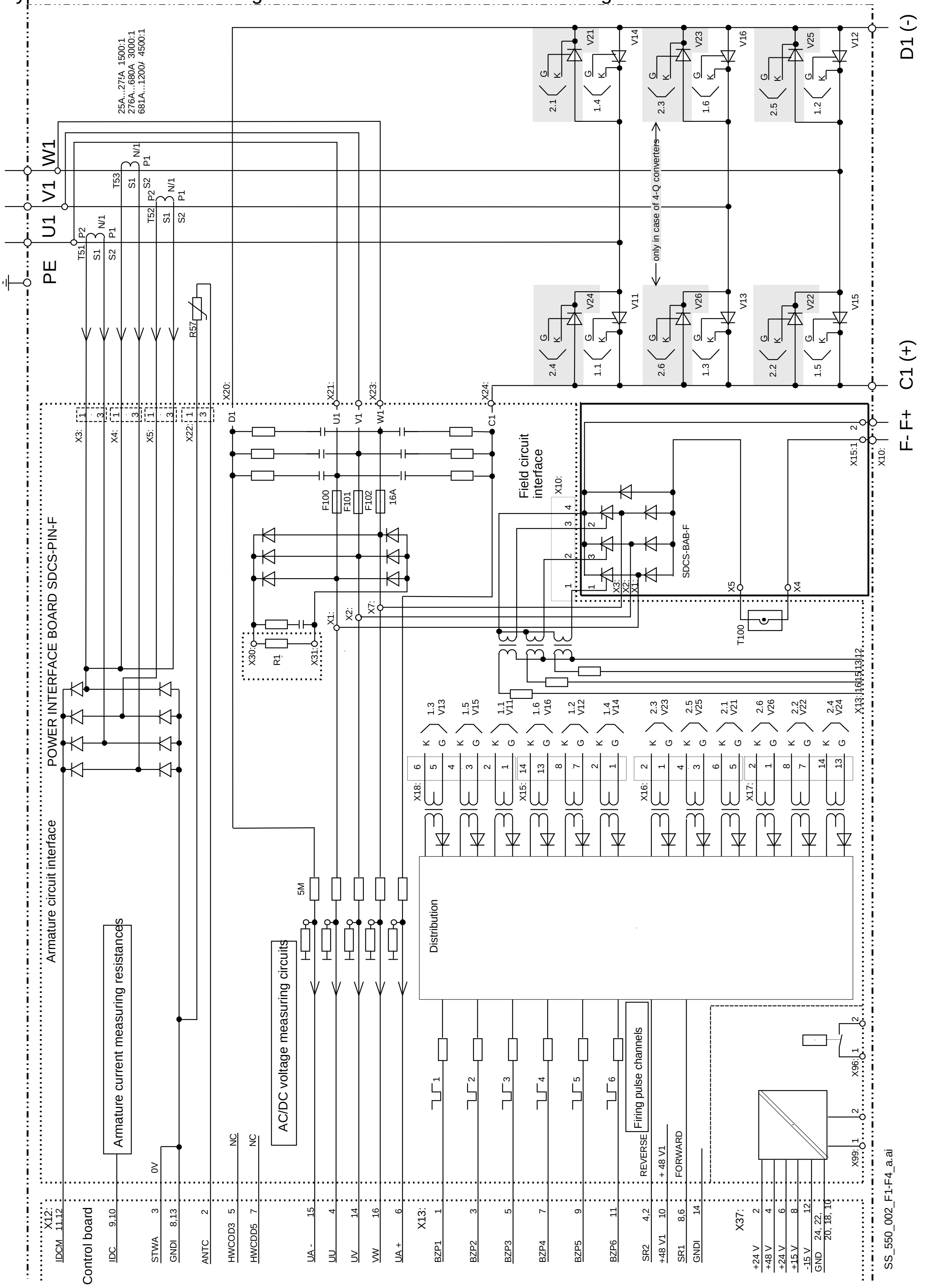
The SDCS-BAB-F is a three-phase half-controlled field exciter. The field exciter is directly supplied from the armature mains. Its firing pulses and snubbers are located on the SDCS-PIN-F. For connection details see next pages.

Size	Converter type	Used type	Used fuses	T100 threads	I_F [A]
F1	DCS550-S01-0020 - DCS550-S02-0100	SDCS-BAB-F01	F100 - F102 on SDCS-PIN-F KTK 25 = 25 A	3*	1 - 12
F2	DCS550-S01-0135 - DCS550-S02-0300	SDCS-BAB-F01	F100 - F102 on SDCS-PIN-F KTK 25 = 25 A	2*	1 - 18
F3	DCS550-S01-0315 - DCS550-S02-0520	SDCS-BAB-F02	F100 - F102 on SDCS-PIN-F KTK 25 = 25 A	1*	2 - 25
F4	DCS550-S01-0610 - DCS550-S02-1000	SDCS-BAB-F02	F401 - F403 in drive KTK 30 = 30 A	1*	2 - 35

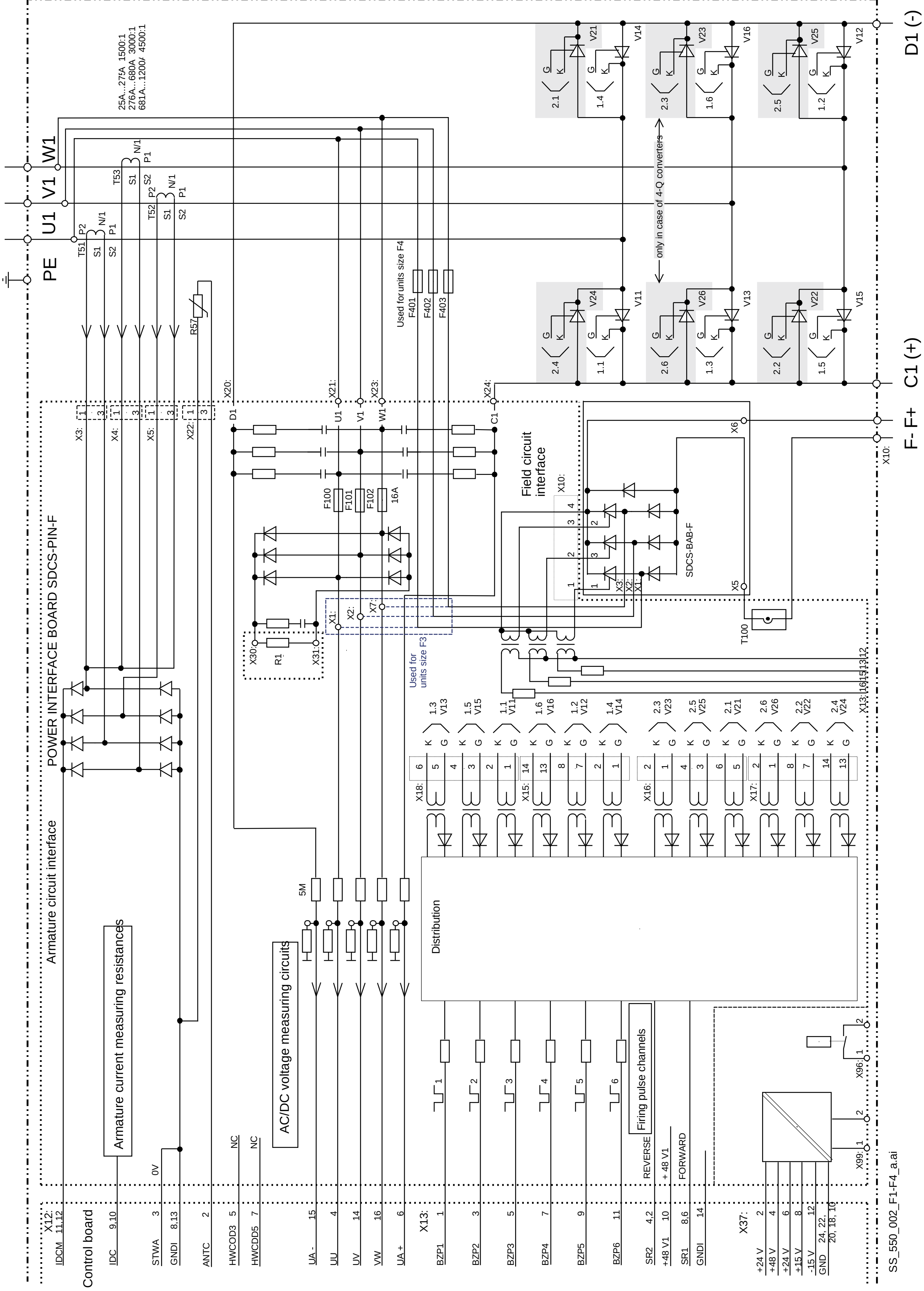
*Number of threads through the hole in the T100 (e.g. 3 threads equal 2 loops)

Circuit diagram

Typical armature circuit diagram for module sizes F1 and F2 using SDCS-PIN-F and SDCS-BAB-F01:



Typical armature circuit diagram for module sizes F3 and F4 using SDCS-PIN-F and SDCS-BAB-F02:



Accessories

Chapter overview

This chapter describes the accessories for the DCS550.

① Line reactors (L1)

Line reactor types ND01 to ND13 (u_k = 1 %)

Line reactors of types ND01 to ND13 are sized to the unit’s nominal current and frequency (50 / 60 Hz). These line reactors with a u_k of 1 are designed for use in industrial environment (minimum requirements). They have low inductive voltage drop, but deep commutation notches.
Line reactors ND01 to ND06 are equipped with cables. The larger ones ND07 to ND13 are equipped with busbars. When connecting them to other components, please consider relevant standards in case the busbar materials are different.

Attention:
Do not use the line reactor terminals as cable or busbar support!

Size	Converter type (2-Q)	Converter type (4-Q)	Line reactor (u_k = 1 %)	Design figure
F1	DCS550-S01-0020	DCS550-S02-0025	ND01	1
	DCS550-S01-0045	DCS550-S02-0050	ND02	
	DCS550-S01-0065	DCS550-S02-0075	ND04	
	DCS550-S01-0090	DCS550-S02-0100	ND06	
F2	DCS550-S01-0135	DCS550-S02-0150		
	DCS550-S01-0180	DCS550-S02-0200	ND07	2
	DCS550-S01-0225	DCS550-S02-0250		
	DCS550-S01-0270	DCS550-S02-0300	ND09	
F3	DCS550-S01-0315	DCS550-S02-0350		
	DCS550-S01-0405	DCS550-S02-0450	ND10	
	DCS550-S01-0470	DCS550-S02-0520		
F4	DCS550-S01-0610	DCS550-S02-0680	ND12	
	DCS550-S01-0740	DCS550-S02-0820	ND13	3
	DCS550-S01-0900	DCS550-S02-1000		

Fig. 1

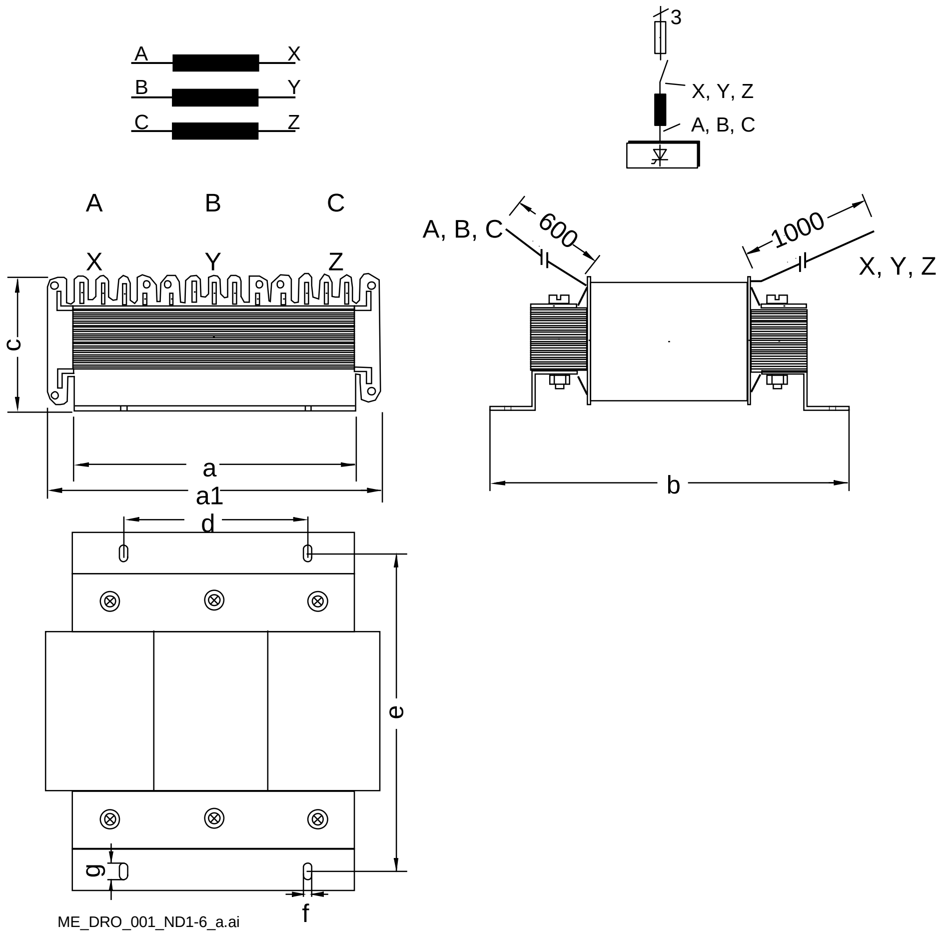
Fig. 2

Fig. 3

Line reactor (u_k = 1 %)	L [µH]	I_{RMS} [A]	i_{peak} [A]	Rated voltage [U_N]	Weight [kg]	Power losses Fe [W]	Power losses Cu [W]
ND01	512	18	27	500	2.0	5	16
ND02	250	37	68		3.0	7	22
ND04	168	55	82		5.8	10	33
ND06	90	102	153		7.6	7	41
ND07	50	184	275		12.6	45	90
ND09	37.5	245	367		16.0	50	140
ND10	25.0	367	551		22.2	80	185
ND12	18.8	490	734		36.0	95	290
ND13	18.2	698	1047	690	46.8	170	160

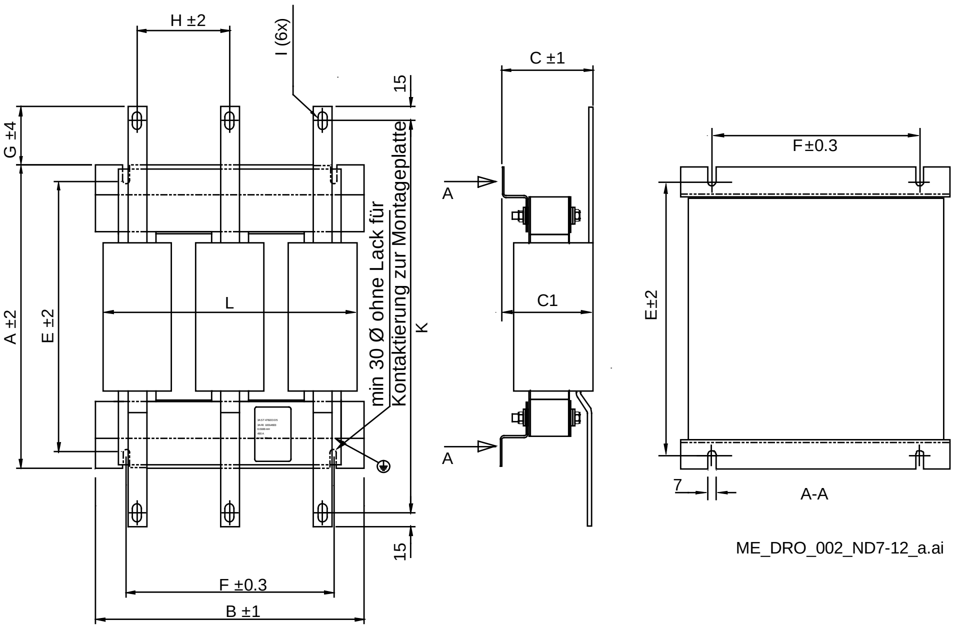
Line reactor types ND01 to ND06

Line reactor (u_k = 1 %)	a1 [mm]	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]	f [mm]	g [mm]	$[mm^2]$
ND01	120	100	130	48	65	116	4	8	6
ND02	120	100	130	58	65	116	4	8	10
ND04	148	125	157	78	80	143	5	10	16
ND06	178	150	180	72	90	170	5	10	35



Line reactor types ND07 to ND12

Line reactor (u_k = 1 %)	A [mm]	B [mm]	C [mm]	C1 [mm]	E [mm]	F [mm]	G [mm]	H [mm]	I [mm]	K [mm]	L [mm]	Busbar
ND07	285	230	86	100	250	176	65	80	9 * 18	385	232	20 * 4
ND09	327	250	99	100	292	224	63	100	9 * 18	423	280	30 * 5
ND10	408	250	99	100	374	224	63	100	11 * 18	504	280	60 * 6
ND12	458	250	112	113	424	224	63	100	13 * 18	554	280	40 * 6



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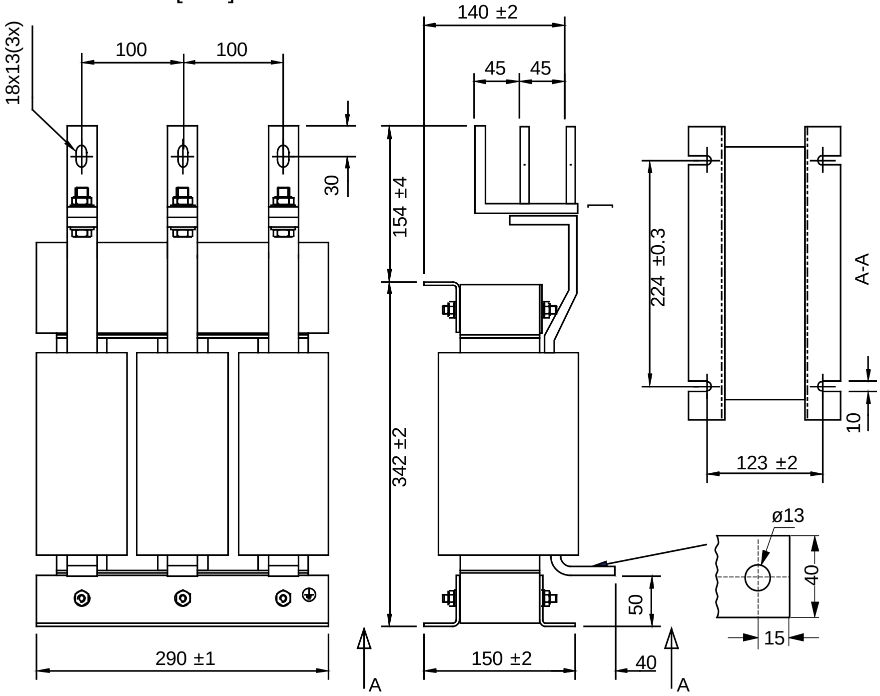
Line reactor type ND13 all busbars are 40 * 10

Dimensions in [mm]:



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Line reactor types ND401 to ND413 (u_k = 4 %)

Line reactors of types ND401 to ND413 are sized to the unit's nominal current and frequency (50 / 60 Hz). These line reactors with a u_k of 4 are designed for use in light industrial / residential environment. They have high inductive voltage drop, but reduced commutation notches. These reactors are designed for drives, which usually operate in speed control in 400 or 500 V_{AC} networks. The percentage taken into account for that duty cycle is different:

– for U_{supply} = 400 V_{AC} follows I_{DC1} = 90 % of nominal current,
– for U_{supply} = 500 V_{AC} follows I_{DC2} = 72 % of nominal current.

Line reactors ND401 to ND402 are equipped with terminals. The larger ones ND403 to ND413 are equipped with busbars. When connecting them to other components, please consider relevant standards in case the busbar materials are different.

Attention:
Do not use the line reactor terminals as cable or busbar support!

Size	Converter type (2-Q)	Converter type (4-Q)	Line reactor (u_k = 4 %)	Design figure
F1	DCS550-S01-0020	DCS550-S02-0025	ND401	4
	DCS550-S01-0045	DCS550-S02-0050	ND402	
	DCS550-S01-0065	DCS550-S02-0075	ND403	5
	DCS550-S01-0090	DCS550-S02-0100	ND404	
F2	DCS550-S01-0135	DCS550-S02-0150	ND405	
	DCS550-S01-0180	DCS550-S02-0200	ND406	
	DCS550-S01-0225	DCS550-S02-0250	ND407	
	DCS550-S01-0270	DCS550-S02-0300	ND408	
F3	DCS550-S01-0315	DCS550-S02-0350		
	DCS550-S01-0405	DCS550-S02-0450	ND409	
	DCS550-S01-0470	DCS550-S02-0520	ND410	
F4	DCS550-S01-0610	DCS550-S02-0680	ND411	
	DCS550-S01-0740	DCS550-S02-0820	ND412	
	DCS550-S01-0900	DCS550-S02-1000	ND413	

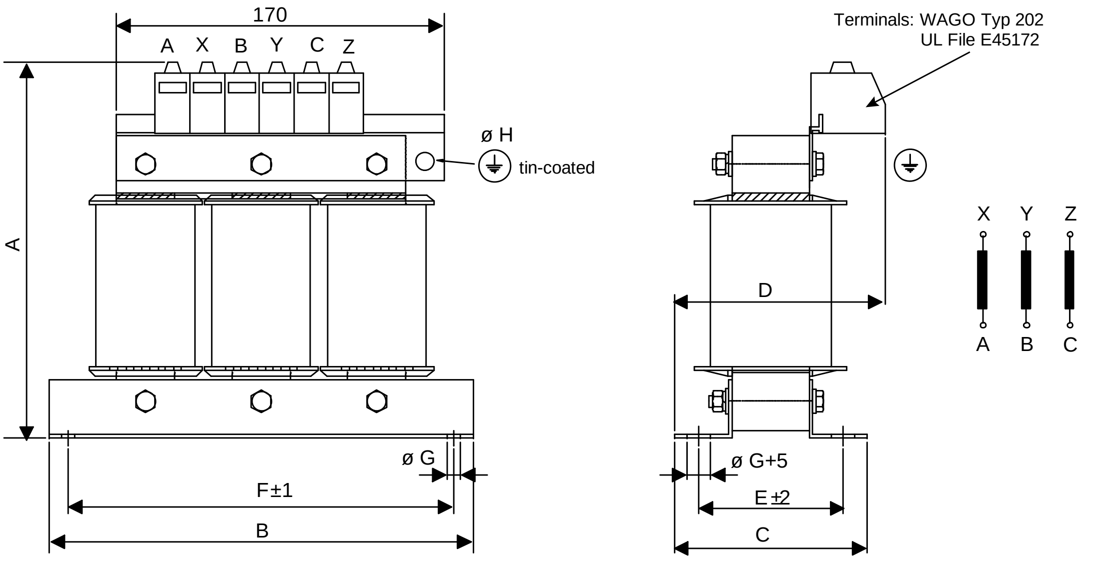
Fig. 4

Fig. 5

Line reactor (u_k = 4 %)	L [µH]	I_{RMS} [A]	i_{peak} [A]	Rated voltage [U_N]	Weight [kg]	Power losses Fe [W]	Power losses Cu [W]	DC current for U_{mains} = 400 V_{AC}	DC current for U_{mains} = 500 V_{AC}
ND401	1000	18.5	27	400	3.5	13	35	22.6	18
ND402	600	37	68		7.5	13	50	45	36
ND403	450	55	82		11	42	90	67	54
ND404	350	74	111		13	78	105	90	72
ND405	250	104	156		19	91	105	127	101
ND406	160	148	220		22	104	130	179	143
ND407	120	192	288		23	117	130	234	187
ND408	90	252	387		29	137	160	315	252
ND409	70	332	498		33	170	215	405	324
ND410	60	406	609		51	260	225	495	396
ND411	50	502	753		56	260	300	612	490
ND412	40	605	805		62	280	335	738	590
ND413	35	740	1105		75	312	410	900	720

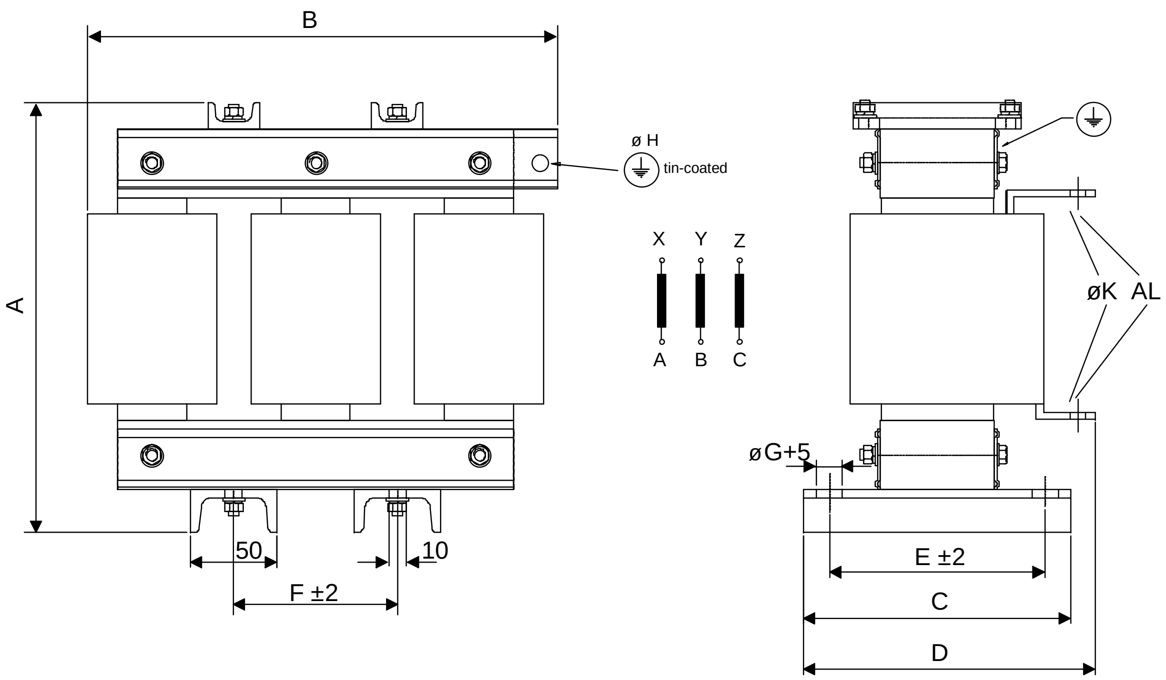
Line reactor types ND401 to ND402

Line reactor (u_k = 4 %)	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Ø G [mm]	Ø H [mm]
ND401	160	190	75	80	51	175	7	9
ND402	200	220	105	115	75	200	7	9



Line reactors type ND403 to ND408

Line reactor (u_k = 4 %)	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Ø G [mm]	Ø H [mm]	Ø K [mm]
ND403	220	230	120	135	100	77.5	7	9	6.6
ND404	220	225	120	140	100	77.5	7	9	6.6
ND405	235	250	155	170	125	85	10	9	6.6
ND406	255	275	155	175	125	95	10	9	9
ND407	255	275	155	175	125	95	10	9	11
ND408	285	285	180	210	150	95	10	9	11



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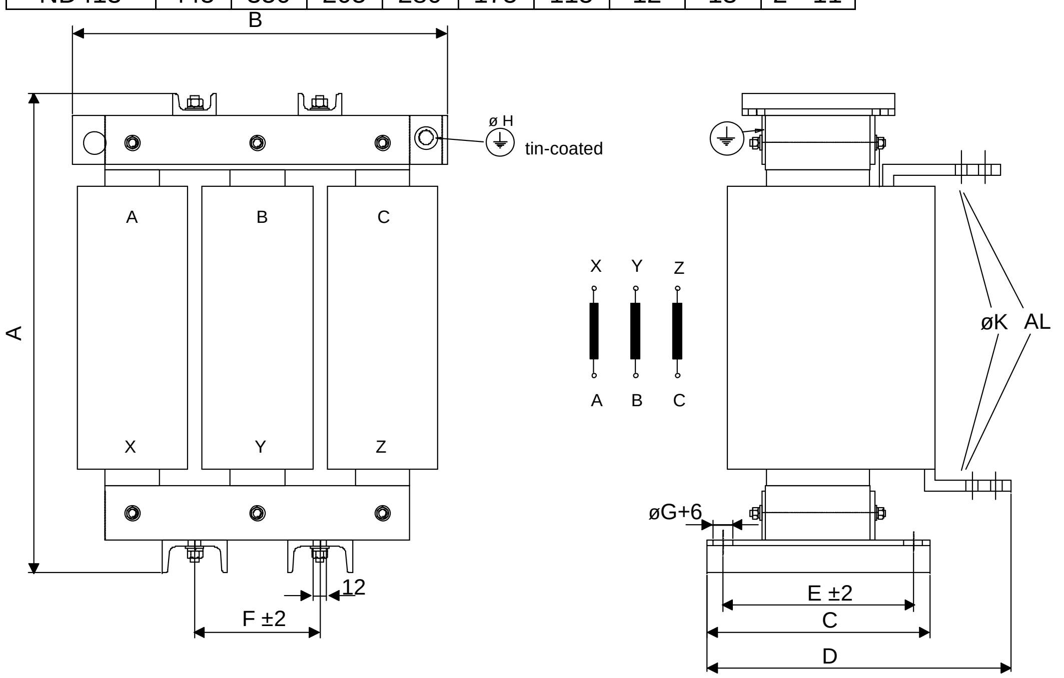
Line reactors type ND409 to ND413

Line reactor (u_k = 4 %)	A [mm]	B [mm]	C [mm]	D [mm]	E [mm]	F [mm]	Ø G [mm]	Ø H [mm]	Ø K [mm]
ND409	320	280	180	210	150	95	10	11	11
ND410	345	350	180	235	150	115	10	13	14
ND411	345	350	205	270	175	115	12	13	2 * 11
ND412	385	350	205	280	175	115	12	13	2 * 11
ND413	445	350	205	280	175	115	12	13	2 * 11



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② Semiconductor fuses (F1)

Semiconductor fuses and fuse holders for AC and DC power lines

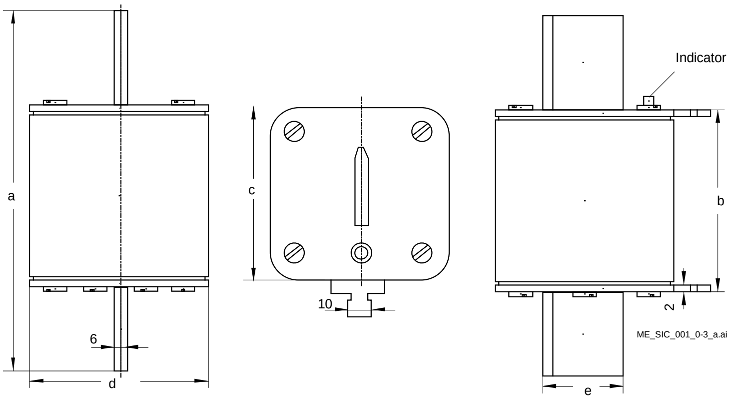
The DCS550 requires external mains fuses. For regenerative drives, DC fuses are recommended. The third column of the table below assigns the AC fuse to the unit. In case the unit should be equipped with DC fuses, use the same type of fuse as used on the AC side.

Size	Converter type (2-Q)	Converter type (4-Q)	Fuse type	Fuse holder	Fuse type	Fuse holder
					North America	
F1	DCS550-S01-0020	DCS550-S02-0025	50A 660V UR	OFAX 00 S3L Size 0	FWP-50B	1BS101
	DCS550-S01-0045	DCS550-S02-0050	63A 660V UR		FWP-60B	
	DCS550-S01-0065	DCS550-S02-0075	125A 660V UR		FWP-125A	1BS103
	DCS550-S01-0090	DCS550-S02-0100				
F2	DCS550-S01-0135	DCS550-S02-0150	200A 660V UR	OFAX 1 S3 Size 1	FWP-200A	
	DCS550-S01-0180	DCS550-S02-0200	250A 660V UR		FWP-250A	
	DCS550-S01-0225	DCS550-S02-0250	315A 660V UR	OFAX 2 S3 Size 2	FWP-300A	
	DCS550-S01-0270	DCS550-S02-0300	500A 660V UR	OFAX 3 S3 Size 3	FWP-500A	
F3	DCS550-S01-0315	DCS550-S02-0350				
	DCS550-S01-0405	DCS550-S02-0450	700A 660V UR		FWP-700A	See *
	DCS550-S01-0470	DCS550-S02-0520				
F4	DCS550-S01-0610	DCS550-S02-0680	900A 660V UR	3x 170H 3006 Size 4	FWP-900A	
	DCS550-S01-0740	DCS550-S02-0820				
	DCS550-S01-0900	DCS550-S02-1000	1250A 660V UR		FWP-1200A	

* No fuse holder is available; attach the fuses directly to the busbar.

Dimensions of fuses

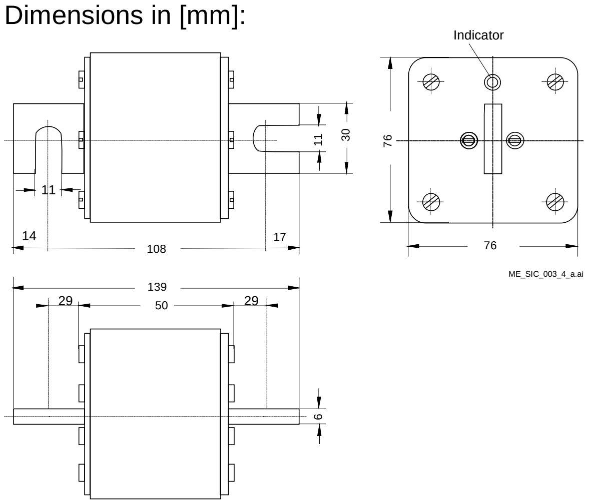
Size 0 to 3



Size	a [mm]	b [mm]	c [mm]	d [mm]	e [mm]
0	78.5	50	35	21	15
1	135	69	45	45	20
2	150	69	55	55	26
3	150	68	76	76	33

Size 4

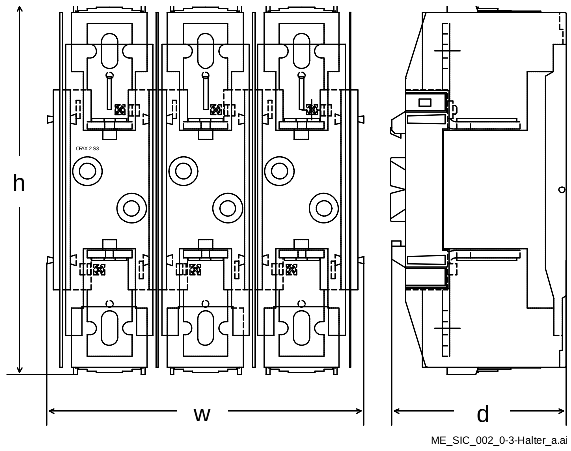
Dimensions in [mm]:



Dimensions of fuse holders

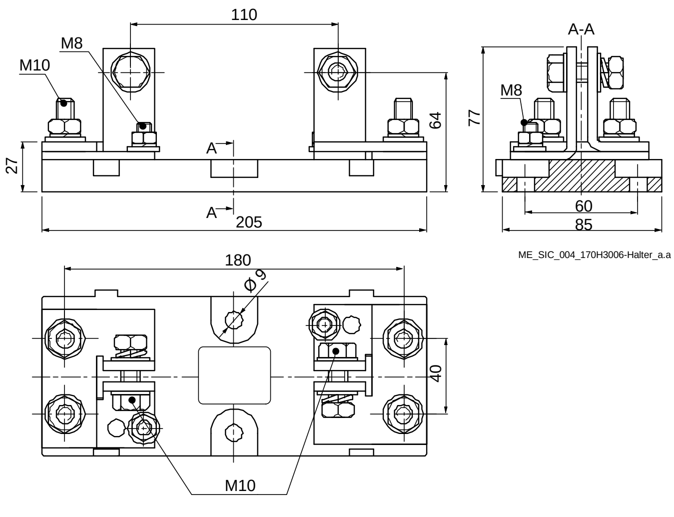
Size 0 to 3

OFAX xx xxx



Fuse holder	h * w * d [mm]	Protection
OFAX 00 S3L	148 * 112 * 111	IP20
OFAX 1 S3	250 * 174 * 123	IP20
OFAX 2 S3	250 * 214 * 133	IP20
OFAX 3 S3	265 * 246 * 160	IP20

170H 3006 (IP00)



③ EMC filters (E1)

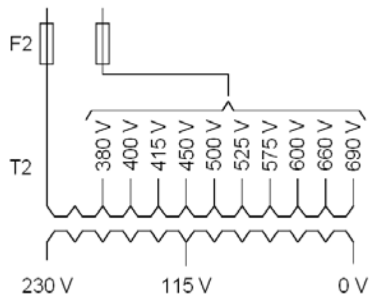
List of available EMC filters:

Size	Converter type (2-Q)	Converter type (4-Q)	Filter type for 440 V_{AC}	Filter type for 500 V_{AC}
F1	DCS550-S01-0020	DCS550-S02-0025	NF3-440-25	NF3-500-25
	DCS550-S01-0045	DCS550-S02-0050	NF3-440-50	NF3-500-50
	DCS550-S01-0065	DCS550-S02-0075	NF3-440-64	NF3-500-64
	DCS550-S01-0090	DCS550-S02-0100	NF3-440-80	NF3-500-80
F2	DCS550-S01-0135	DCS550-S02-0150	NF3-440-110	NF3-500-110
	DCS550-S01-0180	DCS550-S02-0200	NF3-500-320	
	DCS550-S01-0225	DCS550-S02-0250		
	DCS550-S01-0270	DCS550-S02-0300		
F3	DCS550-S01-0315	DCS550-S02-0350		
	DCS550-S01-0405	DCS550-S02-0450	NF3-500-600	
	DCS550-S01-0470	DCS550-S02-0520		
F4	DCS550-S01-0610	DCS550-S02-0680		
	DCS550-S01-0740	-		
	-	DCS550-S02-0820	NF3-690-1000 *	
	DCS550-S01-0900	DCS550-S02-1000		

* available on request

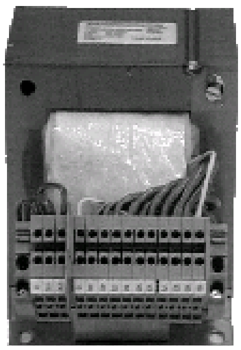
④ Auxiliary transformer (T2) for converter electronics and fans

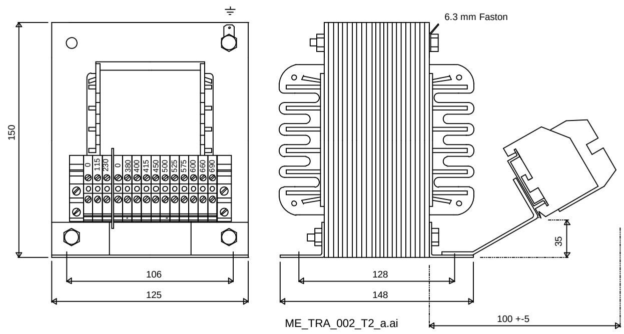
The auxiliary transformer (T2) is designed to supply the module's electronics and cooling fans.

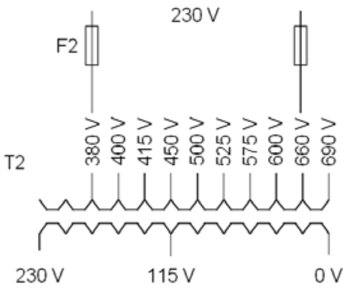


Input voltage: 230 / 380 to 690 V_{AC}, ± 10 %, single-phase
Input frequency: 50 to 60 Hz
Output voltage: 115 / 230 V_{AC} single-phase

Transformer (T2)	Power [VA]	Weight [kg]	Power losses [W]	Fuse F2 [A]	Secondary current [A]
T2	1400	15	100	16	6 @ 230 V 12 @ 115 V







Commissioning hint:

T2 is designed to work as a 115 V_{AC} to 230 V_{AC} isolation transformer to open or avoid ground loops. Connect the 230 V_{AC} at the 380 V_{AC} and 600 V_{AC} taping according to the drawing on the left hand side.

Start-up

Chapter overview

This chapter describes the basic start-up procedure of the drive. A more detailed description of the signals and parameters involved in the procedure is available in *section* Signal and parameter list.

General

Operate the drive:

– local, with DWL or DCS Control Panel
– remote, with local I/O or overriding control.

The following start-up procedure uses DWL (for further information about DWL, consult its online help). However, it is possible to change parameters with the DCS Control Panel. The start-up procedure includes actions that need only be taken when powering up the drive for the first time in a new installation (e.g. entering the motor data). After the start-up, the drive can be powered up without using these start-up functions again. Repeat the start-up procedure, if the start-up data need to be changed.
Refer to *section* Fault tracing in case problems should arise. In case of a major problem, disconnect mains and wait for 5 minutes before attempting any work on the drive, the motor, or the motor cables.

Commissioning

Start-up procedure

Observe the Safety Instructions at the beginning of this manual with extreme care during the start-up procedure! Only a qualified electrician should carry out the start-up procedure.

Tools

For drive commissioning following tools are mandatory:

– standard tools,
– an oscilloscope including memory function with either galvanically isolating transformer or isolating amplifier for safe measurements,
– a clamp on current probe (in case the scaling of the DC load current needs to be checked it must be a DC clamp on current probe),
– a voltmeter and
– DriveWindow Light including commissioning wizard and DWL AP.

Make sure that all equipment in use is suitable for the voltage level applied to the power part!

Checking with the power switched off

Check the settings of:

– the main breaker (e.g. overcurrent = 1.6 * I_n, short circuit current = 10 * I_n, time for thermal tripping = 10 s),
– time, overcurrent, thermal and voltage relays,
– the earth fault protection (e.g. Bender relay)

Check the insulation of the mains voltage cables between the secondary side of the supply transformer and the drive:

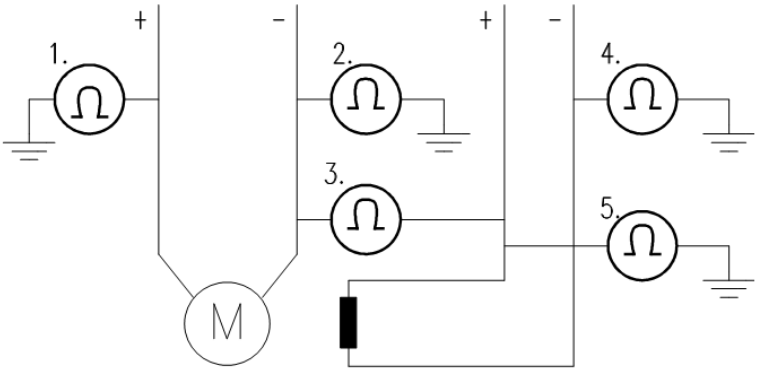
– disconnect the supply transformer from its incoming voltage,
– check that all circuits between the mains and the drive (e.g. control / auxiliary voltage) are disconnected,
– measure the insulation resistance between L1 - L2, L1 - L3, L2 - L3, L1 -PE, L2 - PE, L3 - PE,
– the result should be MΩs

Check the installation:

– crosscheck the wiring with the drawings,
– check the mechanical mounting of the motor and pulse encoder or analog tacho,
– make sure that the motor is connected in a correct way (armature, field, serial windings, cable shields),
– check the connections of the motor fan if existing,
– make sure that the converter fan is connected correctly,

- if a pulse encoder is used make sure that pulse encoder's auxiliary voltage connection corresponds to its voltage and that the channel connection corresponds to correct direction of rotation,
- check that the shielding of the pulse encoder's cable is connected to the TE bar of the DCS550,
- if an analog tacho is used make sure that it is connected to the proper voltage input at the SDCS-CON-F:
  X3:1 - X3:4 (90 - 270 V)
  X3:2 - X3:4 (30 - 90 V)
  X3:3 - X3:4 (8 - 30 V)
- for all other cables make sure that both ends of the cables are connected and they do not cause any damage or danger when power is being switched on

Measuring the insulation resistance of the motor cables and the motor:
isolate the motor cables from the drive before testing the insulation resistance or voltage withstand of the
- cables or the motor,



Instructions how to measure the insulation resistance
- measure the insulation resistance between:
  1. + cables and PE,
  2. - cables and PE,
  3. armature cables and field cables,
  4. field - cable and PE,
  5. field + cable and PE,
- the result should be MΩs

Setting of Jumpers:
- The boards of the DCS550 include jumpers to adapt the boards to different applications. Check the position of the jumpers before connecting voltage. For specific jumper settings, see chapter *Electronics*.

Check following items for each drive and mark the differences in the delivery documents:
- motor, analog tacho or pulse encoder and cooling fan rating plates data,
- direction of motor rotation,
- maximum and minimum speed and if fixed speeds are used,
- speed scaling factors:
- e.g. gear ratio, roll diameter,
- acceleration and deceleration times,
- operating modes:
- e.g. stop mode, E-stop mode,
- the amount of motors connected

Checking with the power switched on

There is dangerous voltage inside the cabinet!

Switching the power on:

- prior to connecting the voltage proceed as follows:
    1. ensure that all the cable connections are checked and that the connections can't cause any danger,
    2. close all doors of enclosed converter before switching power on,
    3. be ready to trip the supply transformer if anything abnormal occurs,
    4. switch the power on

Measurements made with power on:

- check the operation of the auxiliary equipment,
    1. check the circuits for external interfaces on site:
    2. E-stop circuit,
    3. remote control of the main breaker,
    4. signals connected to the control system,
    5. other signals which remain to be checked

Connecting voltage to the drive:

- check from the delivery diagrams the type of boards and converters which are used in the system,
- check all time relay and breaker settings,
- close the supply disconnecting device (check the connection from the delivery diagrams),

close all protection switches one at a time and measure for proper voltage

Checking the DCS550 firmware

Nominal values of the converter are available in group 4, check following signals:

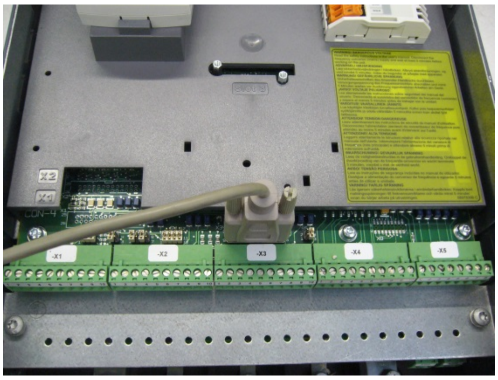
- *ConvNomVolt (4.04)*, nominal AC converter voltage in V read from *TypeCode (97.01)*,
- *ConvNomCur (4.05)*, nominal converter DC current in A read from *TypeCode (97.01)*,
- *ConvType (4.14)*, recognized converter type read from *TypeCode (97.01)*,
- *QuadrantType (4.15)*, recognized converter quadrant type read from *TypeCode (97.01)* or *S BlockBrdg2 (97.07)*,
- *MaxBridgeTemp (4.17)*, maximum bridge temperature in degree centigrade read from *TypeCode (97.01)* or *S MaxBrdgTemp (97.04)*

If signals are not correct adapt them, see group 97 in this manual.

Connect DCS550 to PC with DWL

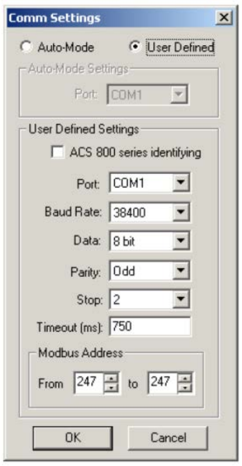
Connect a normal serial cable from the PC COM port to X34 on the drive:

Remove the DCS Control Panel, if present.
Depress the locks to remove the cover



Connect the DCS550 via X34 to the PC COM port

Start DWL and check the communication settings:

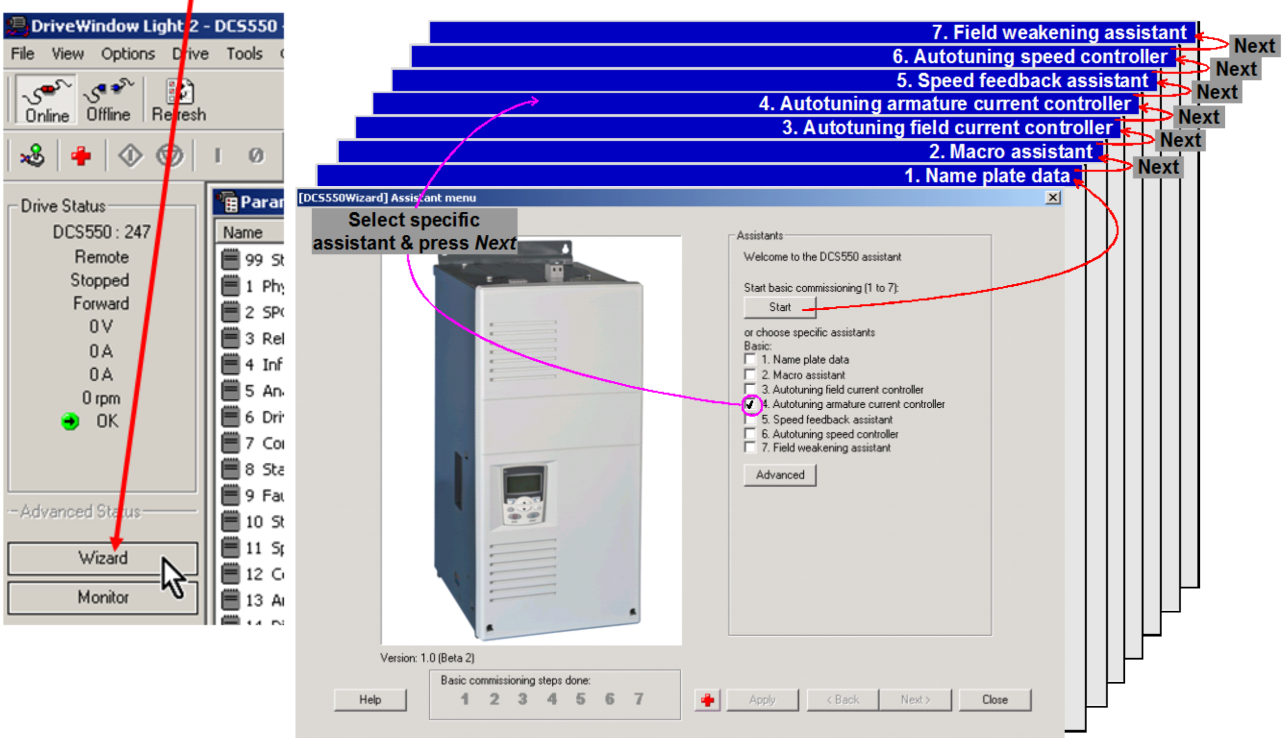


Example with COM1

Commissioning a DCS550 with the wizard

To launch the commissioning wizard start DWL and press the *Wizard* button:

Start the wizard in DWL: For basic commissioning press the *Start* button or select a specific assistant:



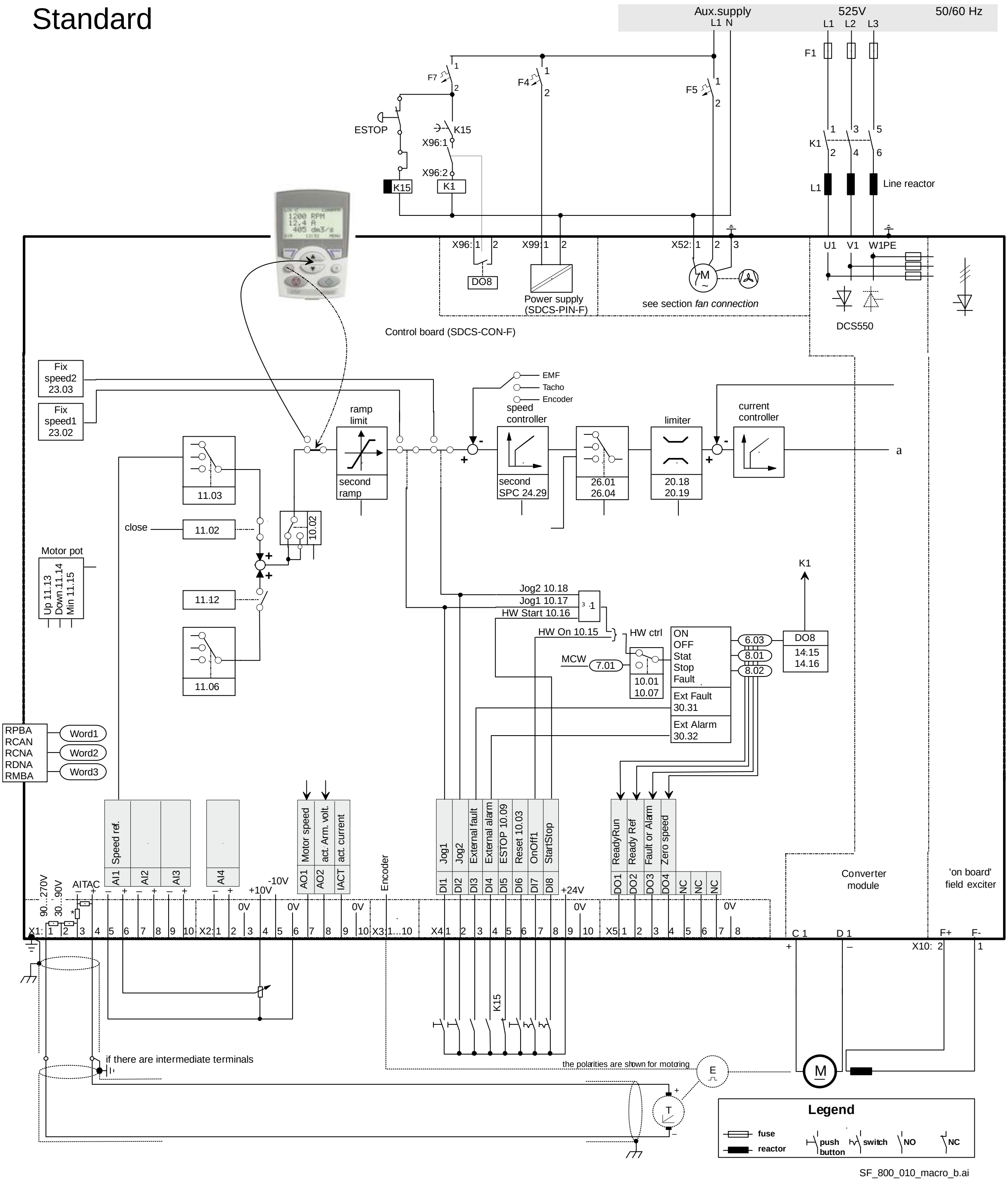
Fore more information about the wizard, parameters, faults and alarm press the *Help* button!

Macros

Macros are pre-programmed parameter sets. During start-up, configure the drive easily without changing individual parameters. The functions of inputs, outputs and control structure are macro dependent. Any macro can be adapted by changing parameters without restrictions. Select macros by means of *ApplRestore (99.07)* and *ApplMacro (99.08)* or the macro assistant in DWL. Check the result of the selection in *MacroSel (8.10)*. The following diagrams show the structure of the macros.

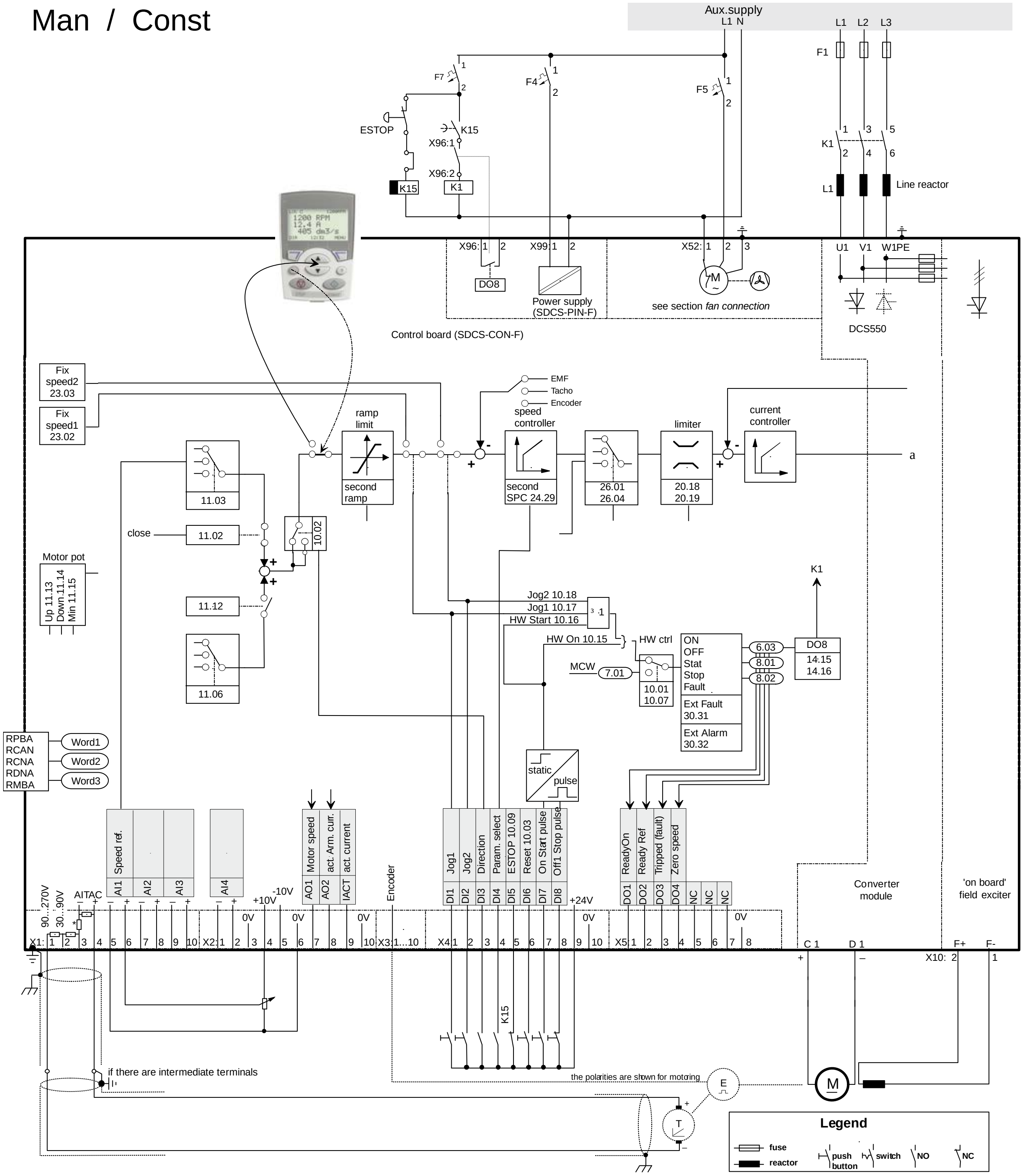
Macro name	**Main Contactor**	**ON / OFF Start/Stop**	**DI function**	**Comment**	**E-stop ⇒ DI5 Reset ⇒ DI6**
Standard	AC	Static	Jog1 ⇒ DI1 Jog2 ⇒ DI2 ExtFault ⇒ DI3 ExtAlarm ⇒ DI4	Hardware I/O control	x
Man/Const	AC	Pulse	Jog1 ⇒ DI1 Jog2 ⇒ DI2 Direction ⇒ DI3 SPC-KP, KI ⇒ DI4	Hardware I/O control; select gain (KpS ⇔ Kps2, TiS ⇔ TiS2)	x
Hand/Auto	AC	Static	Control ⇒ DI2 Speed reference ⇒ DI2 Direction ⇒ DI3	Hardware I/O or field bus control	x
Hand/MotPot	AC	Pulse	MotPotUp ⇒ DI1 MotPotDown ⇒ DI2 Direction ⇒ DI 3 Speed reference ⇒ DI4	Hardware I/O control; reference: hardware or MotPot	x
MotPot	AC	Static	Direction ⇒ DI1 MotPotUp ⇒ DI2 MotPotDown ⇒ DI3 MotPotMin ⇒ DI4	Hardware I/O control; reference: MotPot	x
TorqCtrl	AC	Static	OFF2 (Coast stop) ⇒ DI1 TorqSel ⇒ DI2 ExtFault ⇒ DI3	Hardware I/O control; speed control or torque reference	x
TorqLimit	AC	Static	Jog1 ⇒ DI1 Jog2 ⇒ DI2 ExtFault ⇒ DI3 ExtAlarm ⇒ DI4	Hardware I/O control; torque limit	x
2WreDCcontUS	DC	Static	Jog1 ⇒ DI1 Jog2 ⇒ DI2 ExtFault ⇒ DI3 MainContAck ⇒ DI4	Hardware I/O control	x
3WreDCcontUS	DC	Pulse	FixedSpeed1 ⇒ DI1 ExtFault ⇒ DI3 MainContAck ⇒ DI4	Hardware I/O control	x
3WreStandard	AC	Pulse	FixedSpeed1 ⇒ DI1 ExtFault ⇒ DI3 ExtAlarm ⇒ DI4	Hardware I/O control	x

Standard



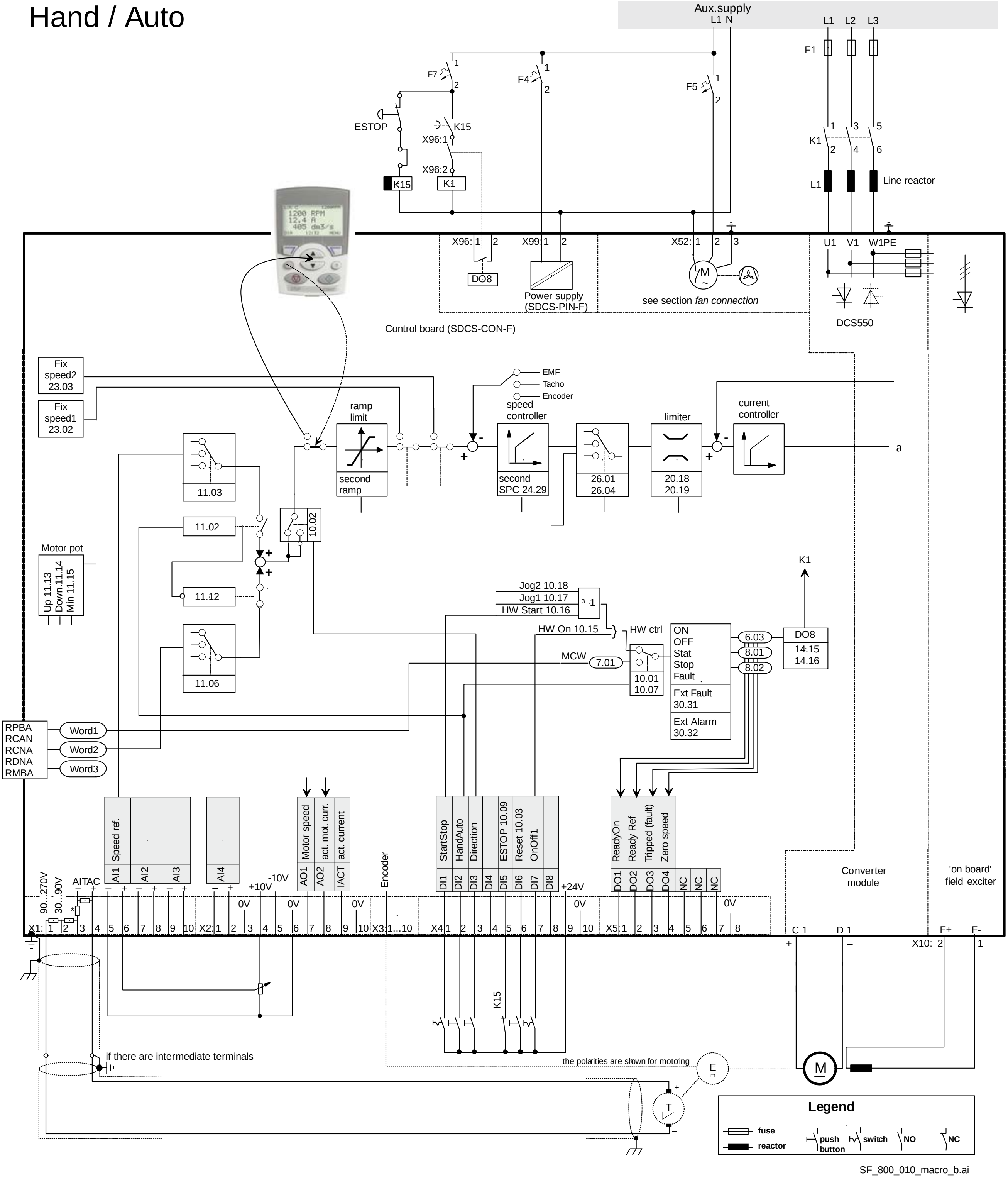
Aux.supply
L1 N
525V
L1 L2 L3
50/60 Hz
F1
F7
F4
F5
ESTOP
K15
X96:1
X96:2
K1
Line reactor
X96: 1 2
X99: 1 2
X52: 1 2 3
U1 V1 W1PE
DO8
Power supply (SDCS-PIN-F)
see section fan connection
DCS550
Control board (SDCS-CON-F)
Fix speed2 23.03
Fix speed1 23.02
EMF
Tacho
Encoder
ramp limit
speed controller
limiter
current controller
second ramp
second SPC 24.29
26.01 26.04
20.18 20.19
11.03
close
11.02
10.02
Motor pot
Up 11.13
Down 11.14
Min 11.15
11.12
11.06
Jog2 10.18
Jog1 10.17
HW Start 10.16
HW On 10.15
HW ctrl
MCW
7.01
10.01 10.07
ON OFF Stat Stop Fault
Ext Fault 30.31
Ext Alarm 30.32
6.03
8.01
8.02
DO8
14.15 14.16
K1
RPBA RCAN RCNA RDNA RMBA
Word1
Word2
Word3
Speed ref.
AI1 AI2 AI3 AI4
-10V
+10V
AO1 Motor speed
AO2 act. Arm. volt.
IACT act. current
Encoder
DI1 Jog1
DI2 Jog2
DI3 External fault
DI4 External alarm
DI5 ESTOP 10.09
DI6 Reset 10.03
DI7 OnOff1
DI8 StartStop
+24V
DO1 ReadyRun
DO2 Ready Ref
DO3 Fault or Alarm
DO4 Zero speed
NC NC NC
Converter module
'on board' field exciter
90...270V
30...90V
AITAC
0V
X1: 1 2 3 4 5 6 7 8 9 10
X2: 1 2 3 4 5 6 7 8 9 10
X3: 1...10
X4: 1 2 3 4 5 6 7 8 9 10
X5: 1 2 3 4 5 6 7 8
C 1
D 1
F+ F-
X10: 2 1
K15
if there are intermediate terminals
the polarities are shown for motoring
E
M
T
Legend
fuse
reactor
push button
switch
NO
NC
SF_800_010_macro_b.ai

Man / Const



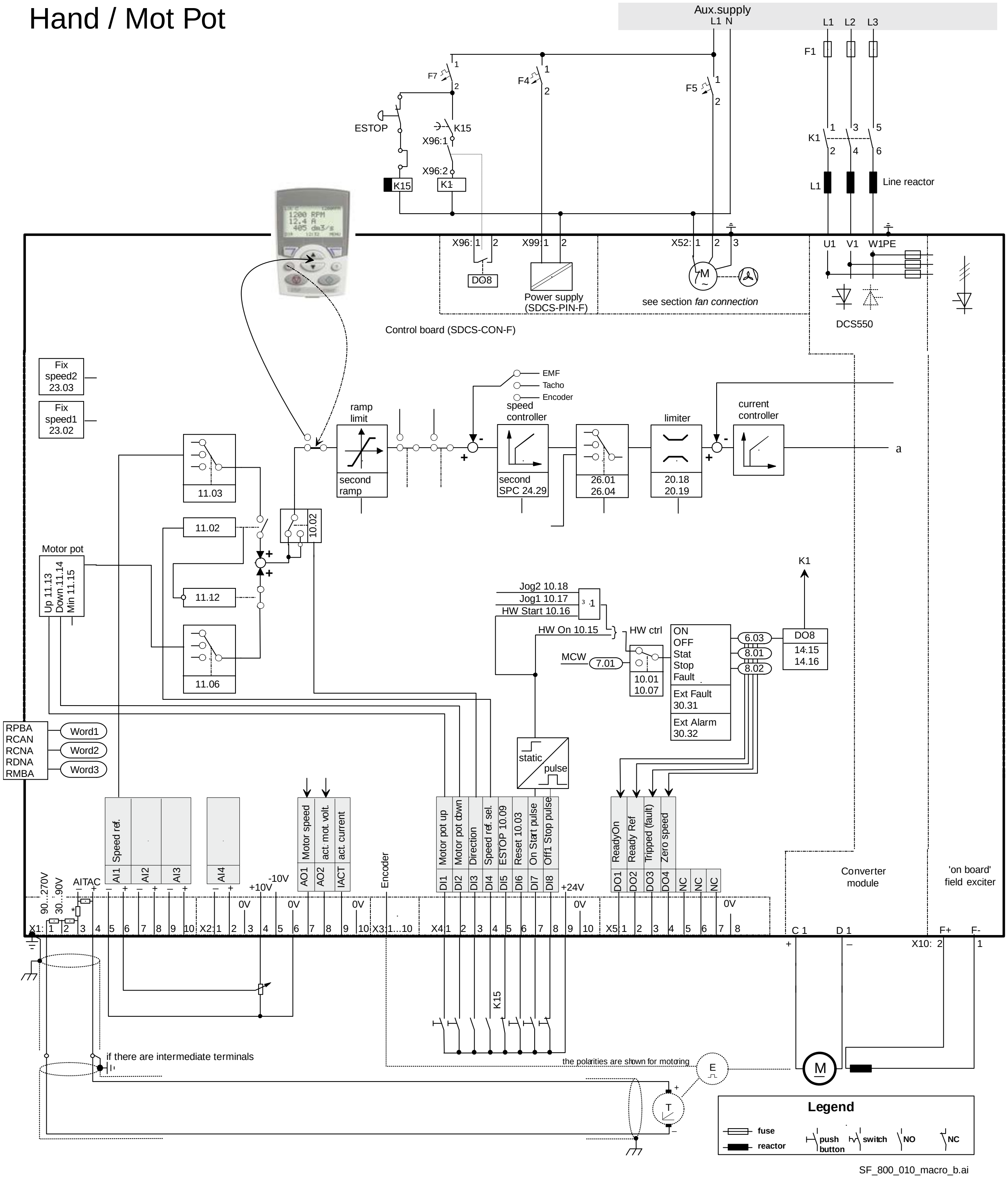
SF_800_010_macro_b.ai

Hand / Auto



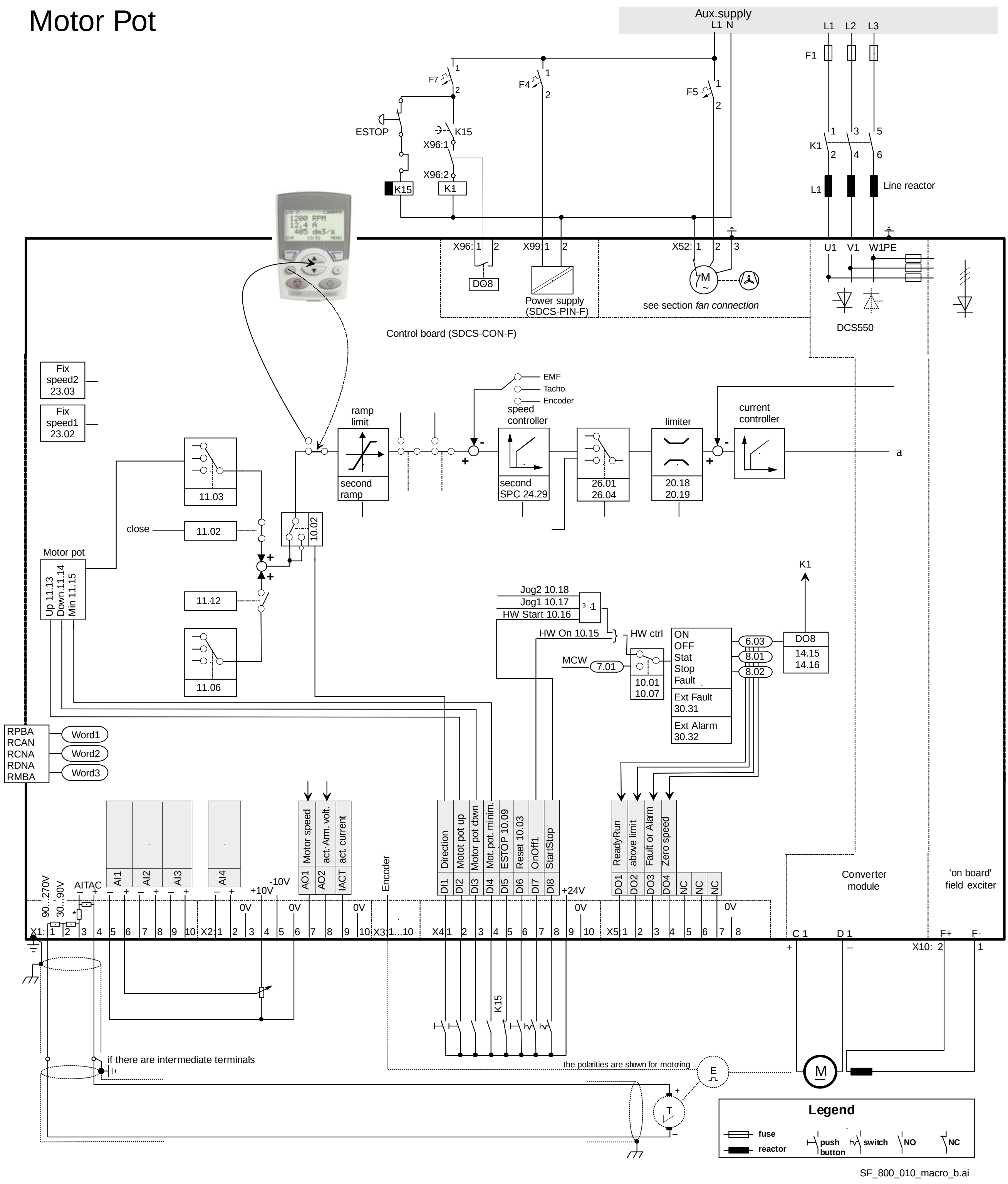
Aux.supply
L1 N
L1 L2 L3
F1
F7
F4
F5
ESTOP
K15
X96:1
X96:2
K15
K1
K1
L1
Line reactor
X96: 1 2
X99: 1 2
X52: 1 2 3
U1 V1 W1PE
DO8
Power supply (SDCS-PIN-F)
see section fan connection
DCS550
Control board (SDCS-CON-F)
Fix speed2 23.03
Fix speed1 23.02
EMF
Tacho
Encoder
speed controller
ramp limit
current controller
limiter
second ramp
second SPC 24.29
26.01 26.04
20.18 20.19
a
11.03
11.02
10.02
Motor pot
Up 11.13
Down 11.14
Min 11.15
11.12
11.06
K1
Jog2 10.18
Jog1 10.17
HW Start 10.16
HW On 10.15
HW ctrl
MCW
7.01
10.01 10.07
ON
OFF
Stat
Stop
Fault
Ext Fault 30.31
Ext Alarm 30.32
6.03
8.01
8.02
DO8
14.15 14.16
RPBA
RCAN
RCNA
RDNA
RMBA
Word1
Word2
Word3
Speed ref.
AI1 AI2 AI3 AI4
AO1 Motor speed
AO2 act. mot. curr.
IACT act. current
Encoder
StartStop
HandAuto
Direction
ESTOP 10.09
Reset 10.03
OnOff1
DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8
ReadyOn
Ready Ref
Tripped (fault)
Zero speed
DO1 DO2 DO3 DO4 NC NC NC
Converter module
'on board' field exciter
90...270V
30...90V
AITAC
+10V
-10V
0V
+24V
X1: 1 2 3 4 5 6 7 8 9 10
X2: 1 2 3 4 5 6 7 8 9 10
X3: 1...10
X4: 1 2 3 4 5 6 7 8 9 10
X5: 1 2 3 4 5 6 7 8
C 1
D 1
F+ F-
X10: 2 1
K15
if there are intermediate terminals
the polarities are shown for motoring
E
M
T
Legend
fuse
reactor
push button
switch
NO
NC
SF_800_010_macro_b.ai

Hand / Mot Pot



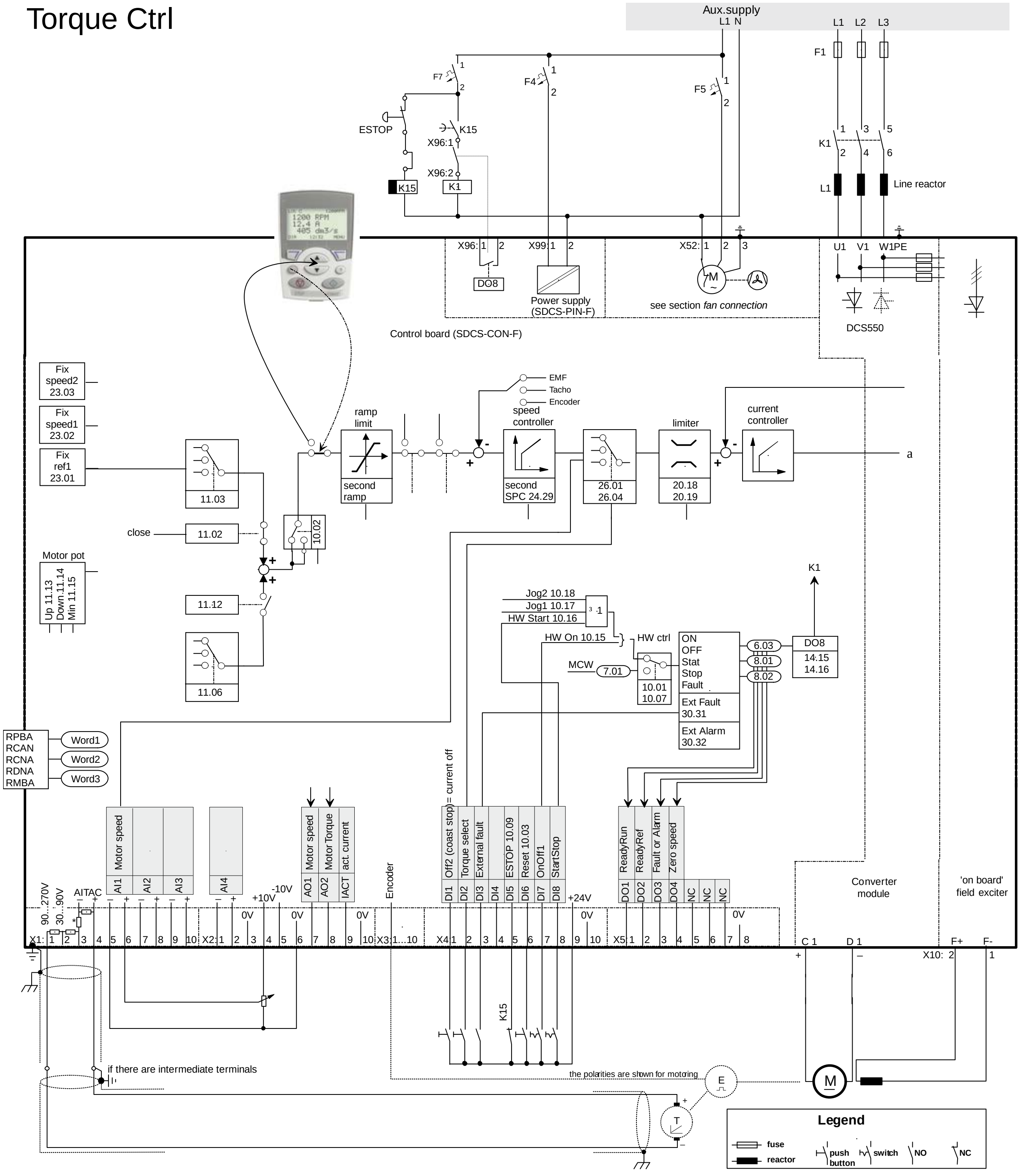
Aux.supply
L1 N
L1 L2 L3
F1
F7
F4
F5
ESTOP
K15
X96:1
X96:2
K1
Line reactor
X96: 1 2
X99: 1 2
X52: 1 2 3
U1 V1 W1PE
DO8
Power supply
(SDCS-PIN-F)
see section fan connection
DCS550
Control board (SDCS-CON-F)
Fix speed2 23.03
Fix speed1 23.02
EMF
Tacho
Encoder
ramp limit
speed controller
limiter
current controller
second ramp
second SPC 24.29
26.01 26.04
20.18 20.19
11.03
11.02
10.02
Motor pot
Up 11.13
Down 11.14
Min 11.15
11.12
11.06
Jog2 10.18
Jog1 10.17
HW Start 10.16
HW On 10.15
HW ctrl
MCW
7.01
10.01 10.07
ON
OFF
Stat
Stop
Fault
Ext Fault 30.31
Ext Alarm 30.32
6.03
8.01
8.02
DO8
14:15
14.16
RPBA
RCAN
RCNA
RDNA
RMBA
Word1
Word2
Word3
static pulse
Speed ref.
AI1 AI2 AI3 AI4
Motor speed
act. mot. volt.
act. current
AO1 AO2 IACT
Encoder
Motor pot up
Motor pot down
Direction
Speed ref. sel.
ESTOP 10.09
Reset 10.03
On Start pulse
Off1 Stop pulse
DI1 DI2 DI3 DI4 DI5 DI6 DI7 DI8
+24V
ReadyOn
Ready Ref
Tripped (fault)
Zero speed
DO1 DO2 DO3 DO4 NC NC NC
Converter module
'on board' field exciter
90...270V
30...90V
AITAC
-10V
+10V
0V
X1: 1 2 3 4 5 6 7 8 9 10
X2: 1 2 3 4 5 6 7 8 9 10
X3: 1...10
X4 1 2 3 4 5 6 7 8 9 10
X5 1 2 3 4 5 6 7 8
C 1
D 1
F+ F-
X10: 2 1
if there are intermediate terminals
the polarities are shown for motoring
Legend
fuse
reactor
push button
switch
NO
NC
SF_800_010_macro_b.ai

Motor Pot



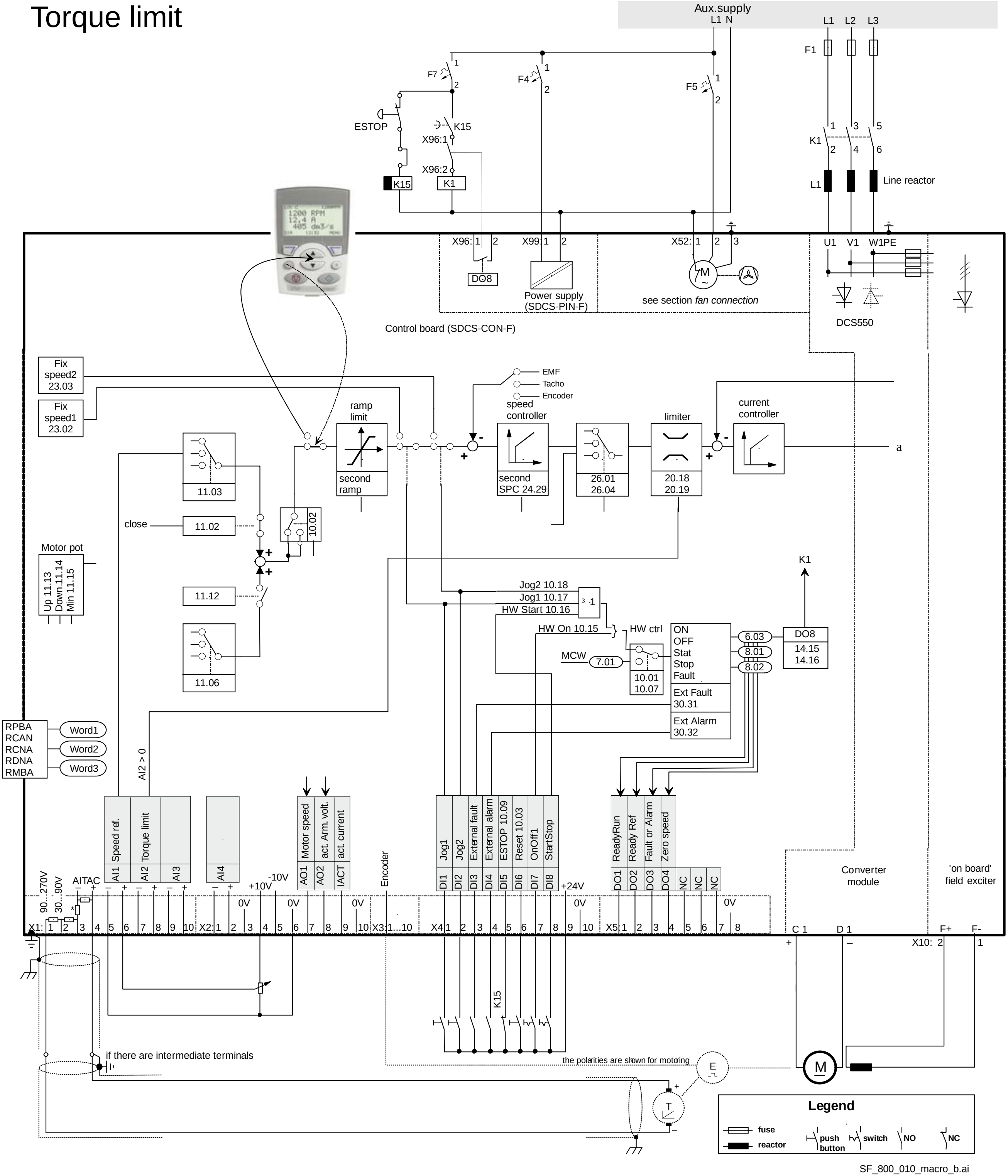
Aux.supply
L1 N
L1 L2 L3
F1
F7
F4
F5
ESTOP
K15
X96:1
X96:2
K1
Line reactor
L1
X96: 1 2
X99: 1 2
X52: 1 2 3
U1 V1 W1PE
DO8
Power supply (SDCS-PIN-F)
see section fan connection
DCS550
Control board (SDCS-CON-F)
EMF
Tacho
Encoder
Fix speed2 23.03
Fix speed1 23.02
ramp limit
speed controller
limiter
current controller
second ramp
second SPC 24.29
26.01 26.04
20.18 20.19
11.03
close
11.02
10.02
Motor pot
Up 11.13
Down 11.14
Min 11.15
11.12
11.06
K1
Jog2 10.18
Jog1 10.17
HW Start 10.16
HW On 10.15
HW ctrl
MCW
7.01
10.01 10.07
ON
OFF
Stat
Stop
Fault
Ext Fault 30.31
Ext Alarm 30.32
6.03
8.01
8.02
DO8
14.15
14.16
RPBA
RCAN
RCNA
RDNA
RMBA
Word1
Word2
Word3
AI1
AI2
AI3
AI4
AO1 Motor speed
AO2 act. Arm. volt.
IACT act. current
Encoder
DI1 Direction
DI2 Motot pot up
DI3 Motor pot down
DI4 Mot. pot. minim.
DI5 ESTOP 10.09
DI6 Reset 10.03
DI7 OnOff1
DI8 StartStop
DO1 ReadyRun
DO2 above limit
DO3 Fault or Alarm
DO4 Zero speed
NC
NC
NC
Converter module
'on board' field exciter
90...270V
30...90V
AITAC
+10V
-10V
0V
+24V
X1: 1 2 3 4 5 6 7 8 9 10
X2: 1 2 3 4 5 6 7 8 9 10
X3: 1...10
X4: 1 2 3 4 5 6 7 8 9 10
X5: 1 2 3 4 5 6 7 8
C 1
D 1
F+
F-
X10: 2 1
K15
if there are intermediate terminals
the polarities are shown for motoring
E
M
T
Legend
fuse
reactor
push button
switch
NO
NC
SF_800_010_macro_b.ai

Torque Ctrl

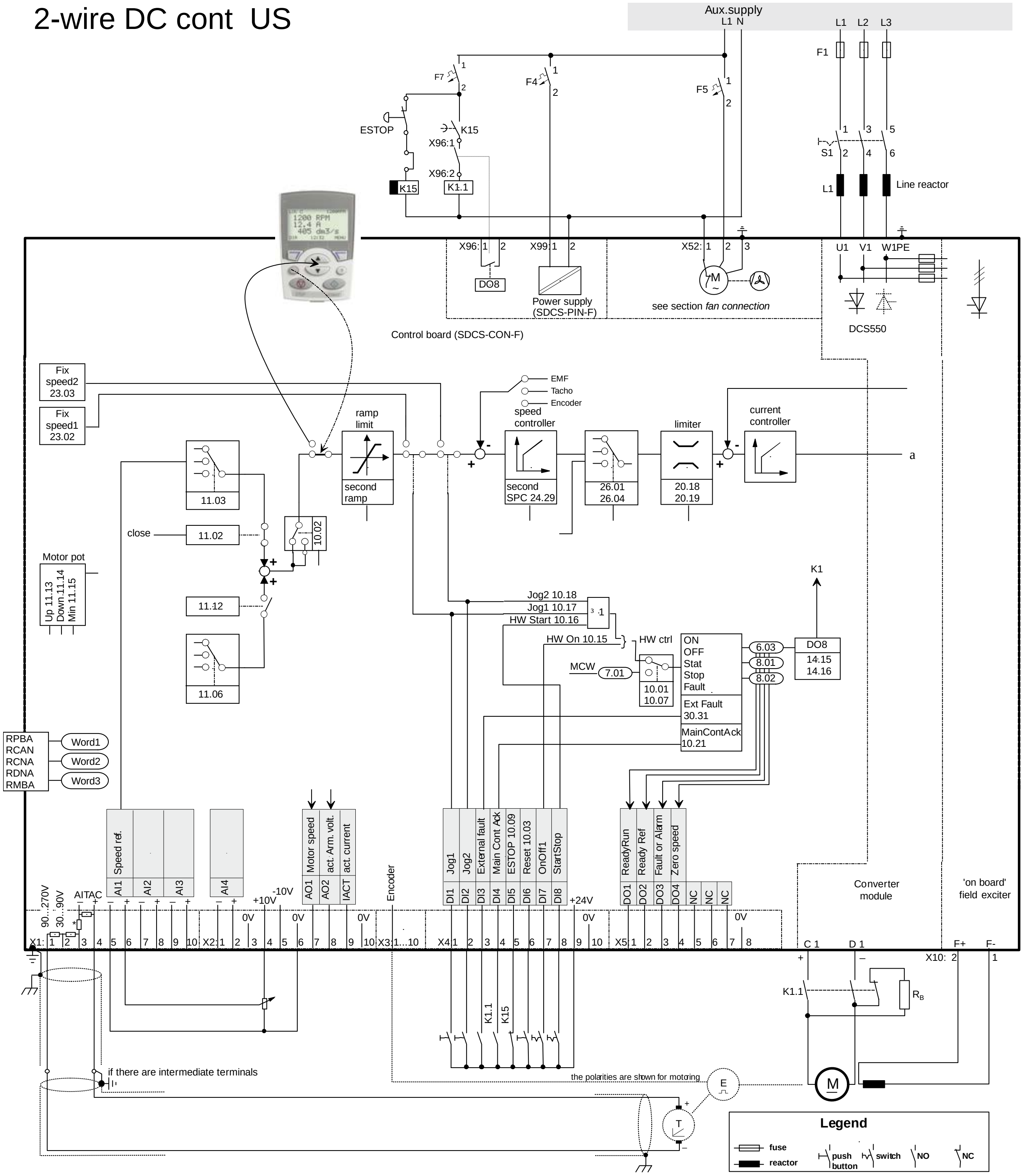


SF_800_010_macro_b.ai

Torque limit



2-wire DC cont US



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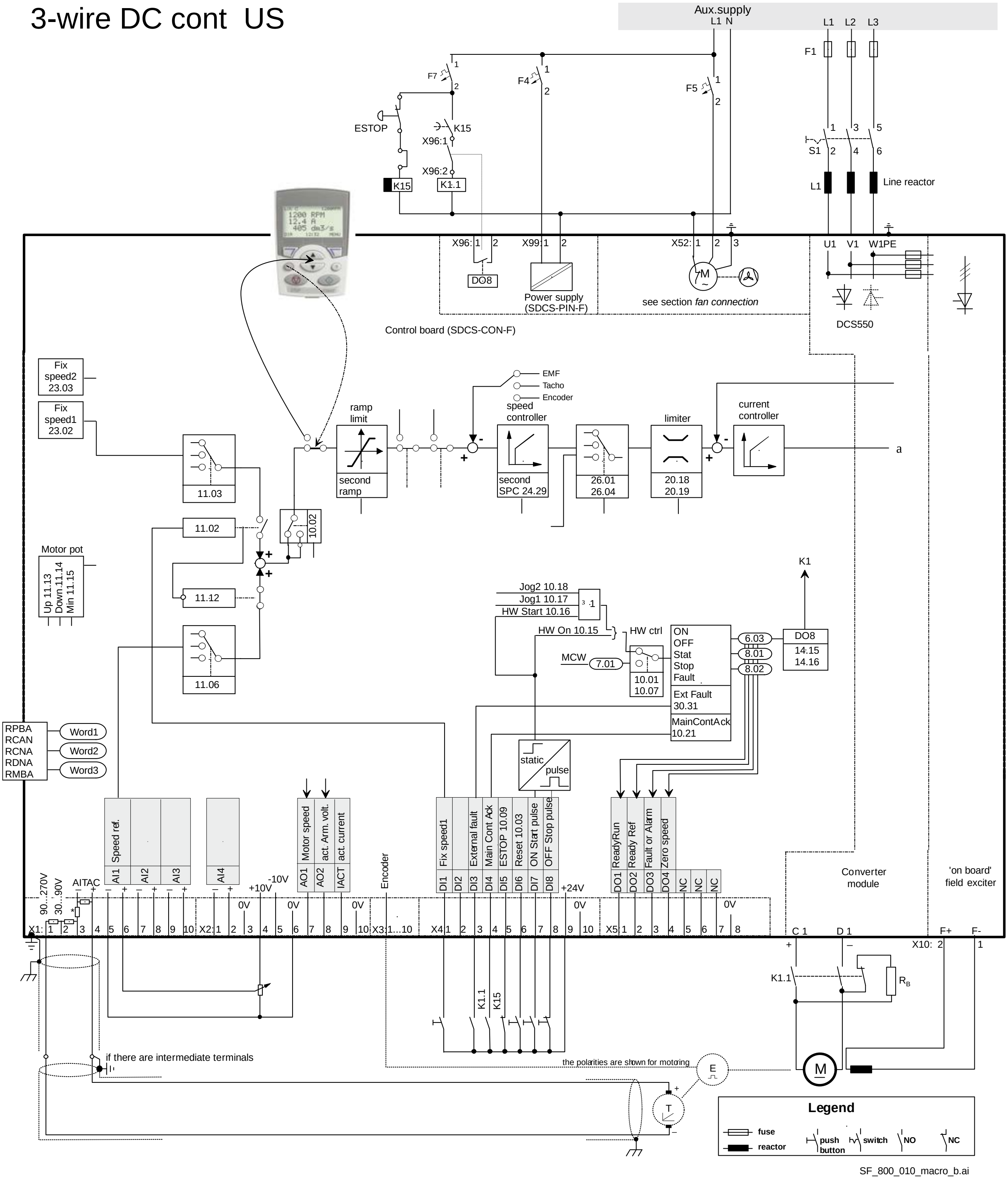
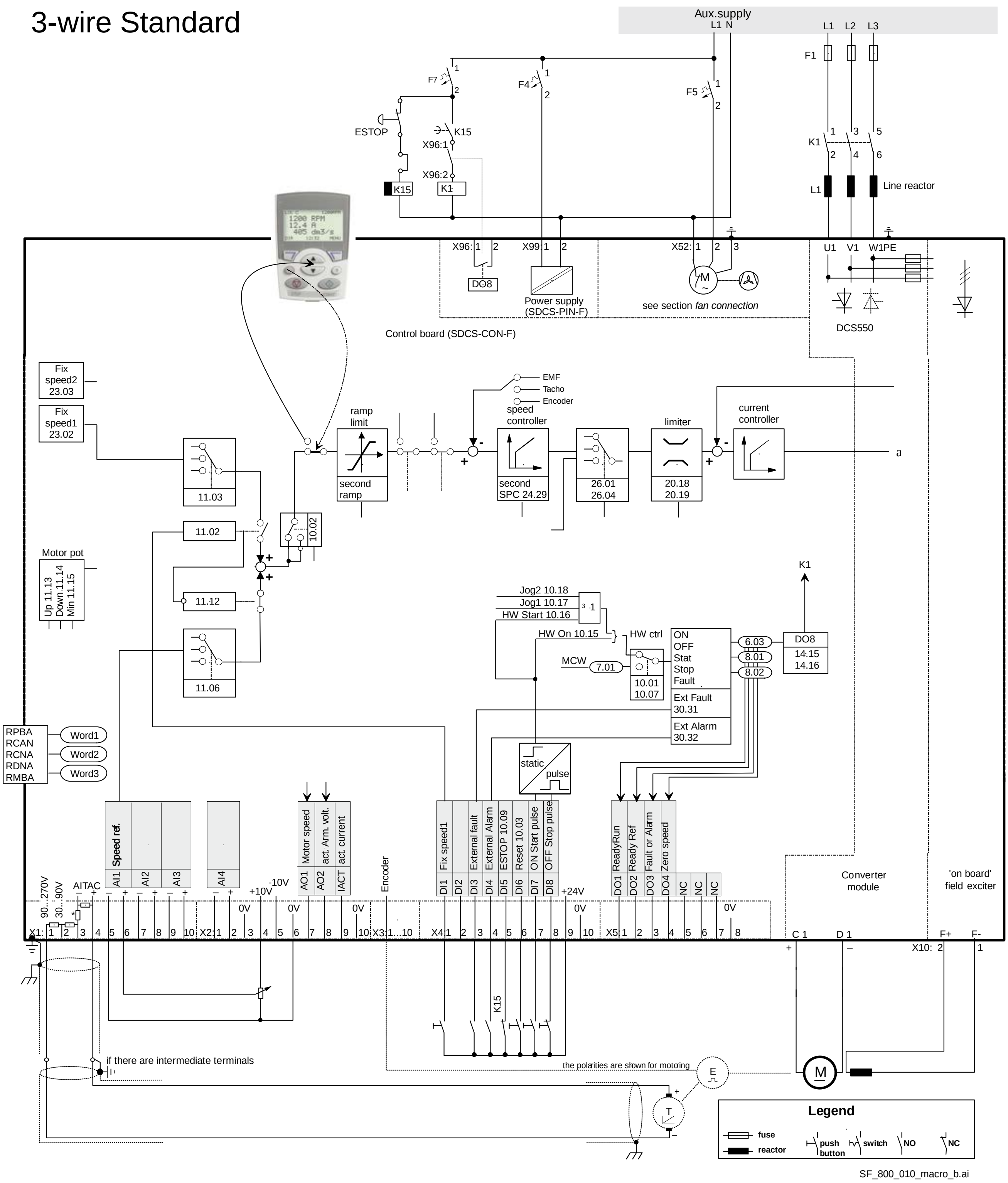
3-wire DC cont US



3-wire Standard



Firmware description

Chapter overview

This chapter describes how to control the DCS550 with **standard** firmware.

Identification of the firmware versions

The DCS550 is controlled by the SCDS-CON-F. Check the firmware version and type from:
- *FirmwareVer (4.01)* and
- *FirmwareType (4.02)*.

Start / stop sequences

General

The drive is controlled by control words [*MainCtrlWord (7.01)* or *UsedMCW (7.04)*]. The *MainStatWord (8.01)* provides the handshake and interlocking for the overriding control.
The overriding control uses the *MainCtrlWord (7.01)* or hardware signals to command the drive. The actual status of the drive is displayed in the *MainStatWord (8.01)*. The marks (e.g. ➊) describe the order of the commands according to Profibus standard. Connect the overriding control via:
- serial communication (e.g. Profibus) or
- hardware signals - see *CommandSel (10.01)* = **Local I/O**

Start the drive

The start sequence given below is only valid for *MainContCtrlMode (21.16)* = **On**.
Attention:
Maintain all signals. **On**- and **Run** [*MainCtrlWord (7.01)* bit 0 and 3] commands are only taken over with their rising edges.

Overriding Control *MainCtrlWord (7.01)*		Drive *MainStatWord (8.01)*
		When the drive is ready to close the main contactor **RdyOn** state is set
	➊	⇦ **RdyOn** = 1; (bit 0)
The overriding control commands **On**		
On = 1; (bit 0) ⇨	➋	
		The drive closes the main contactor and the contactors for converter and motor fans. After the mains voltage and all acknowledges are checked and the field current is established, the drive sets state **RdyRun.**
	➌	⇦ **RdyRun** = 1; (bit 1)
The overriding control commands **Run**		
Run = 1; (bit 3) ⇨	➍	
		The drive releases the ramp, all references, all controllers and sets state **RdyRef**
	➎	⇦ **RdyRef** = 1; (bit 2)

Now the drive follows the speed or torque references
Note:
To give **On** and **Run** at the same time set *OnOff1 (10.15) = StartStop (10.16)*.

Stop the drive

The drive can be stopped in two ways, either by taking away the **On** command directly which opens all contactors as fast as possible after stopping the drive according to *Off1Mode (21.02)* or by means of the following sequence:

Overriding Control *MainCtrlWord (7.01)*		Drive *MainStatWord (8.01)*
The overriding control removes **Run**		
Run = 0; (bit 3) ⇨	❶	
		In speed control mode, the drive stops according to *StopMode (21.03)*. In torque control mode, the torque reference is reduced to zero. When zero speed or zero torque is reached the state **RdyRef** is removed.
	❷	⇦ **RdyRef** = 0; (bit 2)
The overriding control can keep the **On** command if the drive has to be started up again The overriding control removes **On**		
On = 0; (bit 0) ⇨	❸	
		All contactors are opened - the fan contactors stay in according to *FanDly (21.14)* - and the state **RdyRun** is removed
	❹	⇦ **RdyRun** = 0; (bit 1)

Besides, in *MainStatWord (8.01)*, the drive's state is shown in *DriveStat (8.08)*. **Off2** (Coast Stop) and **Off3** (E-stop) see chapter *Start, Stop and E-stop control*.

Excitation

General

The DCS550 is equipped with an integrated field exciter its function is explained here.

Field control

The integrated field exciter is controlled by means of *FldCtrlMode (44.01)*:

Mode	Functionality	Armature converter
Fix	constant field (no field weakening), EMF controller blocked, default	2-Q or 4-Q
EMF	field weakening active, EMF controller released	2-Q or 4-Q

Field current monitoring

Field minimum trip

During normal operation, the field current is compared with *M1FldMinTrip (30.12)*. The drive trips with **F541 M1FexLowCur** [*FaultWord3 (9.03)* bit 8] if the field current drops below this limit and is still undershot when *FldMinTripDly (45.18)* is elapsed.

Note:

M1FldMinTrip (30.12) is not valid during field heating. In this case, the trip level is automatically set to 50 % of *M1FldHeatRef (44.04).* The drive trips with **F541 M1FexLowCur** [*FaultWord3 (9.03)* bit 8] if 50 % of *M1FldHeatRef (44.04)* is still undershot when *FldMinTripDly (45.18)* is elapsed.

Field Heating

Overview

Field heating (also referred to as “field warming and field economy”) is used for a couple of reasons.
Previous generations of DC-drives used voltage-controlled field supplies, meaning that the only thing the field supply could directly control was the field voltage. For DC-motors to maintain optimal torque, it is important to maintain the field current. Ohm’s law (U = R*I) tells us that voltage equals resistance multiplied by current. So as long as resistance remains constant, current is proportional to voltage. However, field resistance increases with temperature. Therefore, a cold motor would have a higher field current than a warm motor, even though voltage remained unchanged. To keep the resistance and thus the current constant, the field was left on to keep it warm. Then the voltage-controlled field supply works just fine.
The new generation of drives, including the integrated field exciter used with the DCS550, is current controlled. Thus, the field supply directly controls field current. This means that field heating may no longer be necessary when the DCS550 is employed.
Another reason field heating is used is to keep moisture out of the motor.
Use following parameters to turn on and control field heating:

- *FldHeatSel (21.18)*,
- *M1FldHeatRef (44.04)*

Modes of operation

There is one mode of operation in which the field current will be at a reduced level, determined by *M1FldHeatRef (44.04)*. With *FldHeatSel (21.18)* = **OnRun** the field heating is on as long as **On** = 1, **Run** = 0 [*UsedMCW (7.04)* bit 3], **Off2N** = 1 and **Off3N** = 1. In general, field heating will be on as long as the OnOff input is set, the Start/Stop input is not set and no Coast Stop or E-stop is pending.

On [*UsedMCW (7.04)* bit 0]	**Run** [*UsedMCW (7.04)* bit 3]	**Off2N** [*UsedMCW (7.04)* bit 1]*	**Result**
0	x	x	field is turned off
1	0	1	reduced field current**
1	1	1	normal field current
1	1 → 0	1	normal field current, then reduced** after stop
1	x	1 → 0	field is turned off as motor coasts to stop and cannot turned back on again as long as Coast Stop is pending

*see *Off2 (10.08)*
**the field current will be at the level set by means of *M1FldHeatRef (44.04)* while motor is stopped

E-stop

A pending E-stop - see *E Stop (10.09)* - switches the field off. It cannot be turned back on again as long as the E-stop is pending. If the E-stop is cleared while in motion, the motor stops according to *E StopMode (21.04)* and then field and drive will be turned off.

DC-breaker

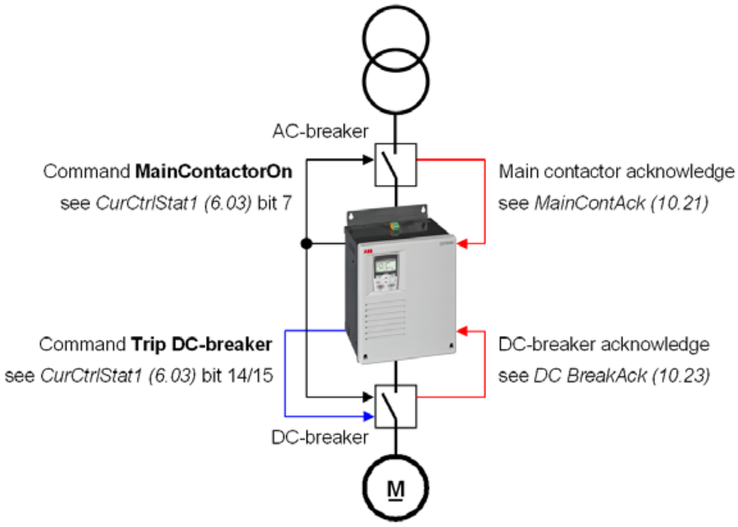
General

The DC-breaker is used to protect the DC-motor or - in case of too low mains voltage or voltage dips - the generating bridge of the drive from overcurrent. In case of an overcurrent the DC-breaker is forced open by its own tripping spring.
DC-breakers have different control inputs and trip devices:

– an On / Off coil with a typical time delay of 100 to 200 ms,
– a high speed tripping coil (e.g. Secheron = CID) to trip the DC-breaker within 2 ms from e.g. the drive,
– an internal tripping spring which is released by overcurrent and set mechanically

There are different ways how to control the DC-breaker depending on the available hardware and the customers on / off philosophy. The following is the most common.

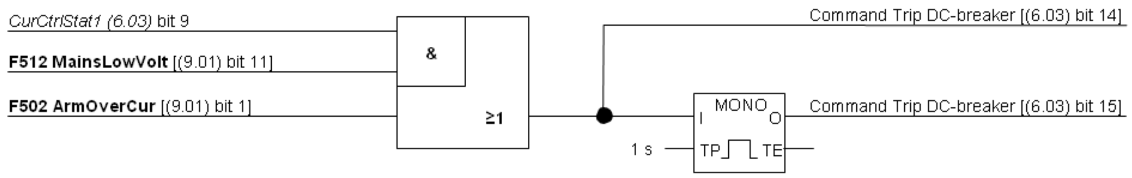
AC- and DC-breaker controlled by the drive



AC- and DC-breaker controlled by the drive

In the above example, the drive controls both, the AC- and the DC-breaker. The drive closes and opens both breakers with the command **MainContactorOn**. The result is checked by means of *MainContAck (10.21)* and *DC BreakAck (10.23)*. In case the main contactor acknowledge is missing **F524 MainContAck** [*FaultWord2 (9.02)* bit 7] is set. In case the DC-breaker acknowledge is missing **A103 DC BreakAck** [*AlarmWord1 (9.06)* bit 2] is set, ± is forced to 150° and single firing pulses are given.
Trip the DC-breaker actively by the command **Trip DC-breaker**

Command Trip DC-breaker



*Command **Trip DC-breaker***

The firmware sets the:

– command **Trip DC-breaker** (continuous signal) [*CurCtrlStat1 (6.03)* bit 14] and
– command **Trip DC-breaker** (4 s pulse signal) [*CurCtrlStat1 (6.03)* bit 15]

by means of

– **F512 MainsLowVolt** [FaultWord1 *(9.01)* bit 11] in regenerative mode or
– **F502 ArmOverCur** [FaultWord1 *(9.01)* bit 1].

In case a digital output - see group 14 - is assigned to one of the two signals, it is updated immediately after detecting the fault and thus actively tripping the DC-breaker.

Dynamic braking

General

Dynamic braking can stop the drive. The principle is to transfer the power of the machine inertia into a braking resistor. Therefore, the armature circuit has to be switched over from the drive to a braking resistor. Additionally flux and field current have to be maintained.

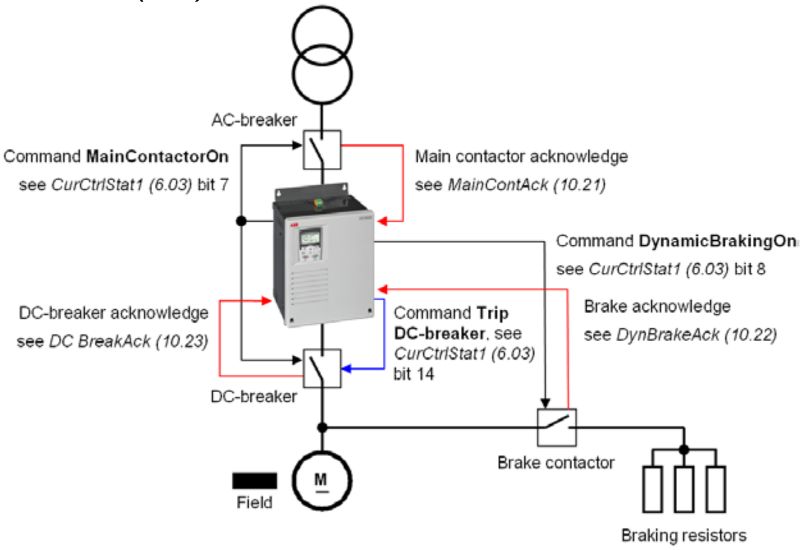
Operation

Activation

Dynamic breaking can be activated by all stop modes, in cases of a fault or due to communication breaks:

- *Off1Mode (21.02)* when *UsedMCW (7.04)* bit 0 **On** is set to low,
- *StopMode (21.03)* when *UsedMCW (7.04)* bit 3 **Run** is set to low,
- *E StopMode (21.04)* when *UsedMCW (7.04)* bit 2 **Off3N** is set to low,
- *FaultStopMode (30.30)* in case of a trip level 4 fault,
- *SpeedFbFltMode (30.36)* in case of a trip level 3 fault,
- *LocalLossCtrl (30.27)* when local control is lost,
- *ComLossCtrl (30.28)* when communication is lost,

In addition dynamic braking can be forced by setting *AuxCtrlWord (7.02)* bit 5 to high. At the same time, *UsedMCW (7.04)* bit 3 **Run** must be set to low.



Application example of dynamic breaking

Function

During dynamic braking the field current is maintained by keeping the field exciter activated. The integrated field exciter will be supplied via the main contactor, thus *CurCtrlStat1 (6.03)* bit 7 stays high (**MainContactorOn)** until zero speed is reached.

① The activation of dynamic braking immediately sets *CurCtrlStat1 (6.03)* bit 6 to high (dynamic braking active**)**.

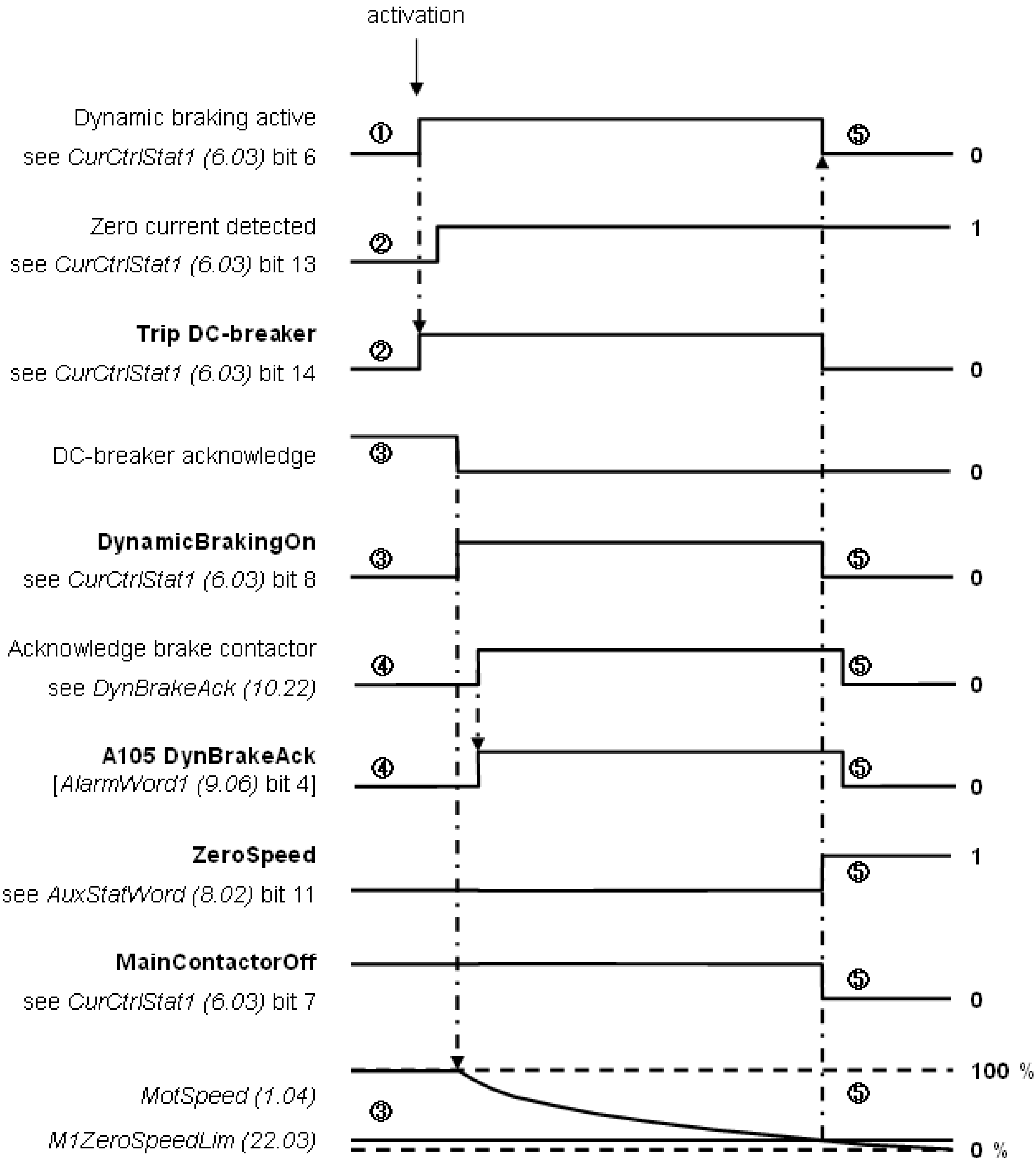
② Dynamic braking forces the armature current to zero and opens the DC-breaker by setting *CurCtrlStat1 (6.03)* bit 14 to high (**Trip DC-breaker)**.

③ After the armature current is zero and the DC-breaker acknowledge is gone *CurCtrlStat1 (6.03)* bit 8 is set to high (**DynamicBrakingOn)**. Connect this signal to a digital output (see group 14) and used it to close the brake contactor. As soon as the brake contactor is closed, dynamic braking starts and decreases the speed.

④ With DynBrakeAck *(10.22)* it is possible to select a digital input for the brake resistor acknowledge. This input sets **A105 DynBrakeAck** [*AlarmWord1 (9.06)* bit 4] as long as the acknowledge is present. Thus the drive cannot be started or re-started while dynamic braking is active.

Deactivation

⑤ Dynamic braking is deactivated as soon as zero speed is reached and *AuxStatWord (8.02)* bit 11 **ZeroSpeed** is set to high.
In case of dynamic braking with EMF feedback [*M1SpeedFbSel (50.03)* = **EMF**] there is no valid information about the motor speed and thus no zero speed information. To prevent an interlocking of the drive after dynamic braking the speed is assumed zero after *DynBrakeDly (50.11)* is elapsed:



Dynamic braking sequence
For usage of US style DC-breakers see *MainContCtrlMode (21.16)*.

Digital I/O configuration

Chapter overview

This chapter describes the I/O configuration of digital and analog inputs and outputs with different hardware possibilities.

Digital inputs (DI's)

The basic I/O board is the SDCS-CON-F with 8 standard DI's. Extend them by means of one or two RDIO-01 digital I/O extension modules. Thus, the maximum number of DI's is 14.
Select the hardware source by:

1. *DIO ExtModule1 (98.03)* for DI9 to DI11 and
2. *DIO ExtModule2 (98.04)* for DI12 to DI14

SDCS-CON-F

On the SDCS-CON-F, the standard DI's are filtered and not isolated.

– Maximum input voltage is 48 V_{DC}
– Scan time for DI1 to DI6 is 5 ms
– Scan time for DI7 and DI8 is 3.3 ms / 2.77 ms (synchronized with mains frequency)

1st and 2nd RDIO-01

All extension DI's are isolated and filtered. Selectable hardware filtering time is 2 ms or 5 ms to 10 ms.

– Input voltages 24 V_{DC} to 250 V_{DC}, 110 V_{AC} to 230 V_{AC} for more details see *RDIO-01 User's Manual*
– Scan time for DI9 to DI14 is 5 ms

Configuration

All DI's can be read from *DI StatWord (8.05)*:

bit	DI	configurable	default setting
0	1	yes	-
1	2	yes	*MotFanAck (10.06)*
2	3	yes	*MainContAck (10.21)*
3	4	yes	*Off2 (10.08)*
4	5	yes	*E Stop (10.09)*
5	6	yes	*Reset (10.03)*
6	7	yes	*OnOff1 (10.15)*
7	8	yes	*StartStop (10.16)*
8	9	yes	-
9	10	yes	-
10	11	yes	-
11	12	no	not selectable
12	13	no	not selectable
13	14	no	not selectable

Configurable = yes:

– The DI's can be connected to several converter functions and it is possible to invert the DI's - *DI1Invert (10.25)* to *DI11Invert (10.35)*. In addition the DI's can be used by AP or overriding control.

Configurable = no:

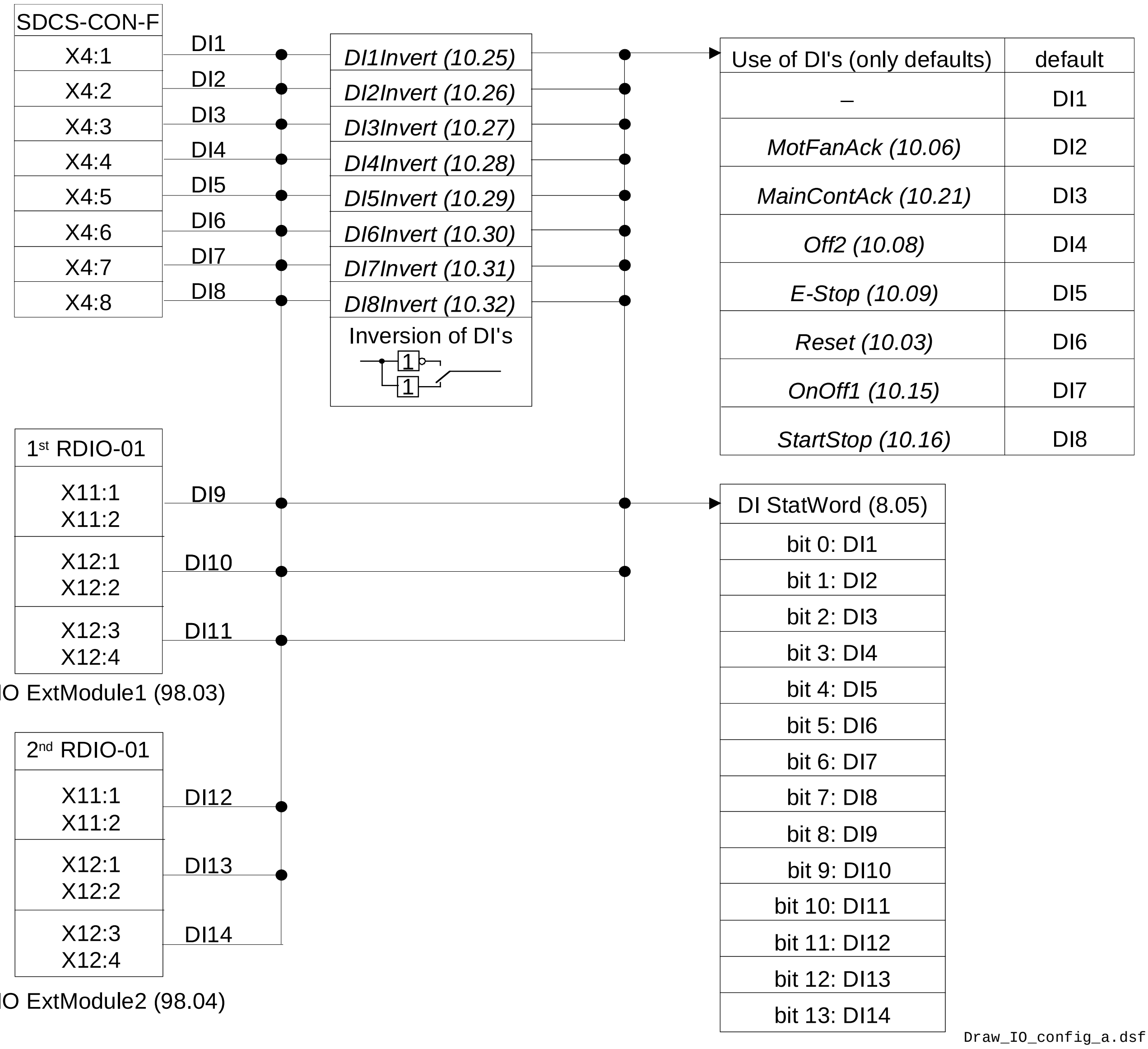
– The DI's can only be used by AP or overriding control.

Configurable DI's are defined by means of following parameters:

– *Direction (10.02)*
– *Reset (10.03)*
– *MotFanAck (10.06)*
– *HandAuto (10.07)*
– *Off2 (10.08)*
– *E Stop (10.09)*
– *ParChange (10.10)*
– *OnOff1 (10.15)*
– *DynBrakeAck (10.22)*
– *DC BreakAck (10.23)*
– *Ref1Mux (11.02)*
– *Ref2Mux (11.12)*
– *MotPotUp (11.13)*
– *MotPotDown (11.14)*
– *MotPotMin (11.15)*
– *Par2Select (24.29)*

- *StartStop (10.16)*
- *Jog1 (10.17)*
- *Jog2 (10.18)*
- *MainContAck (10.21)*
- *TorqMux (26.05)*
- *ExtFaultSel (30.31)*
- *ExtAlarmSel (30.32)*
- *M1KlixonSel (31.08)*

Following restrictions apply:
DI12 to DI14 are only available in the *DI StatWord (8.05)*, thus they can only be used by AP or overriding control.



Structure of DI's

Digital outputs (DO's)

The basic I/O board is the SDCS-CON-F with 4 standard DO's. The 5th standard DO named DO8 is located on the SDCS-PIN-F. Extend them by means of one or two RDIO-01 digital I/O extension modules. Thus, the maximum number of DO's is 9.
Select the hardware source by:

- *DIO ExtModule1 (98.03)* for DO9 and DO10
- *DIO ExtModule2 (98.04)* for DO11 and DO12

SDCS-CON-F

On the SDCS-CON-F, the standard DO's are relay drivers. DO8 is located on the SDCS-PIN-F and an isolated by means of a relay.

- Maximum output value for DO1 to DO4 on the SDCS-CON-F is 50 mA / 22 V_{DC} at no load
- Maximum output values for DO8 on the SDCS-PIN-F are 3 A / 24 V_{DC}, 0.3 A / 115 V_{DC} / 230 V_{DC} or 3 A / 230 V_{AC}
- Cycle time for DO1 to DO4 and DO8 is 5 ms

1st and 2nd RDIO-01

The extension DO's are isolated by means of relays.

- Maximum output values are 5 A / 24 V_{DC}, 0.4 A / 120 V_{DC} or 1250 VA / 250 V_{AC} for more details see *RDIO-01 User's Manual*
- Cycle time for DO9 to DO12 is 5 ms

Configuration

All DO's can be read from *DO StatWord (8.06)*:

bit	DO	configurable	default setting	
0	1	yes	**FansOn**; *CurCtrlStat1 (6.03)*	bit0
1	2	yes	-	
2	3	yes	**MainContactorOn**; *CurCtrlStat1 (6.03)*	bit7
3	4	yes	-	
4	-	-	-	
5	-	-	-	
6	-	-	-	
7	8	yes	**MainContactorOn**; *CurCtrlStat1 (6.03)*	bit7
8	9	no	not selectable	
9	10	no	not selectable	
10	11	no	not selectable	
11	12	no	not selectable	

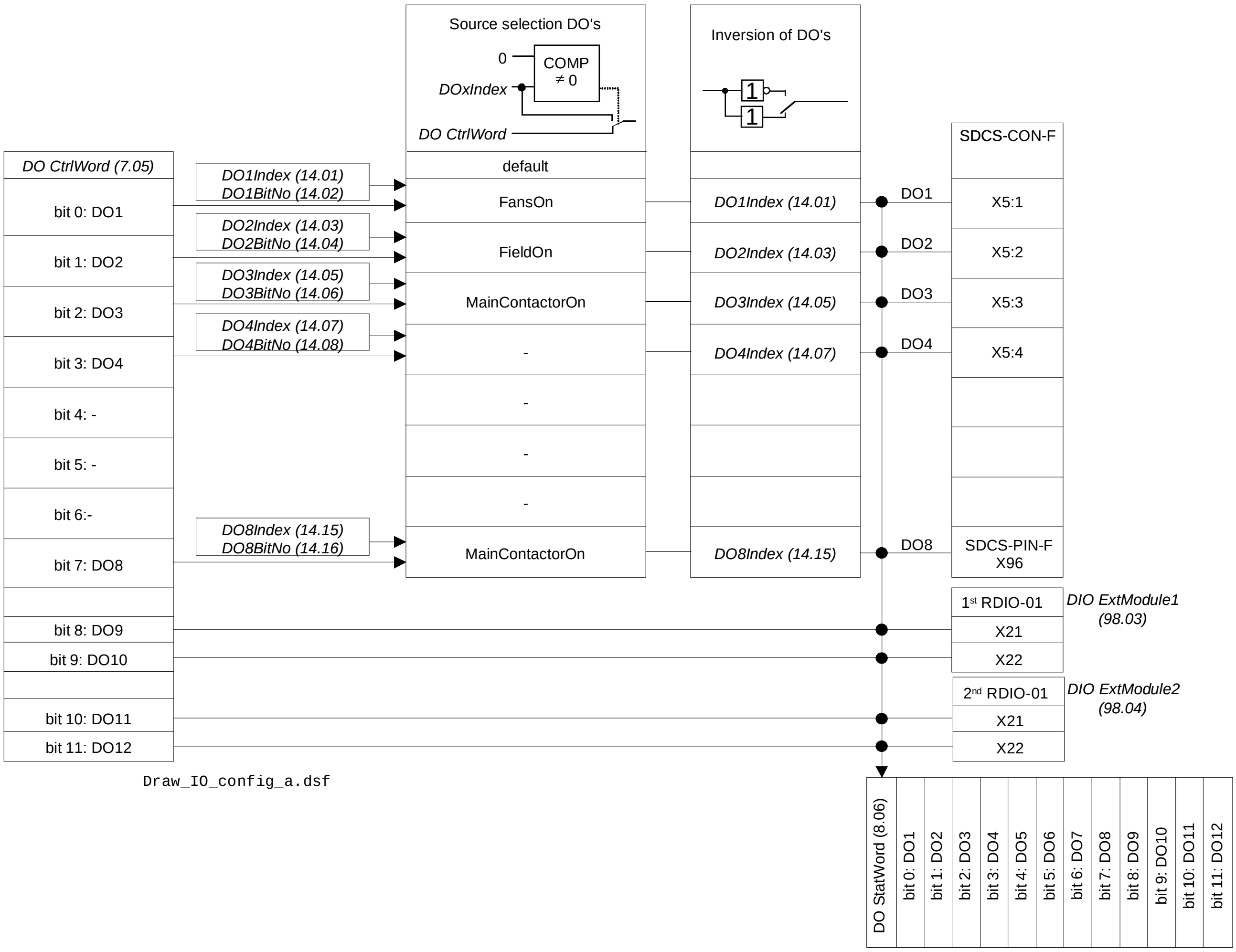
Configurable = yes:

- The DO's can be connected to any integer or signed integer of the drive by means of group 14. It is possible to invert the DO's by simply negate *DO1Index (14.01)* to *DO8Index (14.15)*. In addition the DO's can be used by AP or overriding control if the corresponding *DOxIndex (14.xx)* is set to zero - see *DO CtrlWord (7.05)*.

Configurable = no:

- The DO's can only be used by AP or overriding control - see *DO CtrlWord (7.05)*.

Note:
DO8 is only available as relay output on the SDCS-PIN-F.



Structure of DO's

Analog I/O configuration

Analog inputs (AI's)

The basic I/O board is the SDCS-CON-F with 4 standard AI's. Extend them by means of one RAIO-01 analog I/O extension module. Thus, the maximum number of AI's is 6.
Select the hardware source by:

- *AIO ExtModule (98.06)* for AI5 and AI6

SDCS-CON-F

Hardware setting:

- switching from voltage input to current input by means of jumper S2 and S3

Input range AI1 and AI2 set by parameter:

- ±10 V, 0 V to 10 V, 2 V to 10 V, 5 V offset, 6 V offset
- ±20 mA, 0 mA to 20 mA, 4 mA to 20 mA, 10 mA offset, 12 mA offset

Input range AI3 and AI4 set by parameter:

- ±10 V, 0 V to 10 V, 2 V to 10 V, 5 V offset, 6 V offset

Resolution:

- 15 bits + sign

Scan time for AI1 and AI2:

- 3.3 ms / 2.77 ms (synchronized with mains frequency)

Scan time for AI3 and AI4:

- 5 ms

RAIO-01

Hardware setting:

- input range and switching from voltage to current by means of a DIP switch, for more details see *RAIO-01 User's Manual*

Input range AI5 and AI6 set by parameter:

- ±10 V, 0 V to 10 V, 2 V to 10 V, 5 V offset, 6 V offset
- ±20 mA, 0 mA to 20 mA, 4 mA to 20 mA, 10 mA offset, 12 mA offset

Resolution:

- 11 bits + sign

Scan time for AI5 and AI6:

- 10 ms

Additional functions:

- all AI's are galvanically isolated

Configuration

The value of AI1 to AI6 and AITacho can be read from group 5.

AI	configurable	default setting
1	yes	-
2	yes	-
3	yes	-
4	yes	-
5	yes	-
6	yes	-

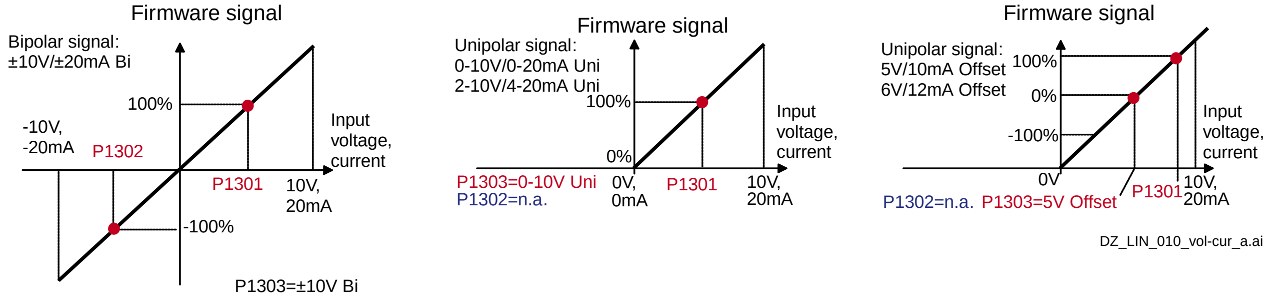
Configurable = yes:

- The AI's can be connected to several converter functions and it is possible to scale them by means of group 13. In addition the AI's can be read by AP or overriding control.

Configurable AI's are defined by means of following parameters:
- *Ref1Sel (11.03)*
- *Ref2Sel (11.06)*
- *TorqUsedMaxSel (20.18)*
- *TorqUsedMinSel (20.19)*
- *TorqRefA Sel (25.10)*
- *M1TempSel (31.05)*
- *CurSel (43.02)*

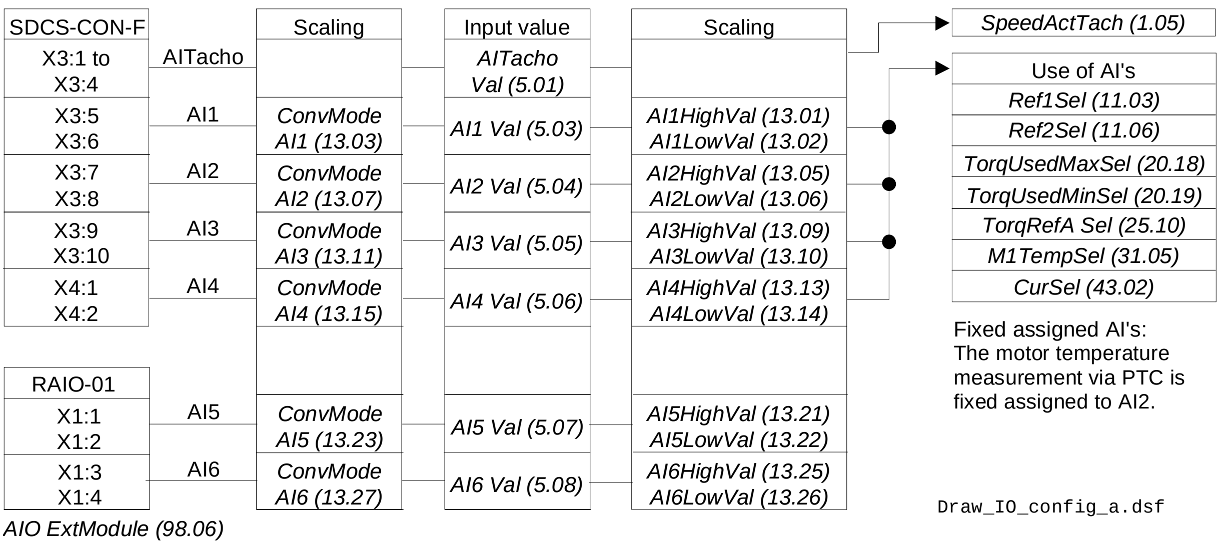
Following restrictions apply:
- the motor temperature measurement via PTC is fixed assigned to AI2, if activated via *M1TempSel (31.05)*

Scaling



It is possible to scale AI1 to AI6 and AITacho with 3 parameters each:
- the range of each AI is set by means of a jumper - distinguishing between current and voltage - and *ConvModeAI1 (13.03)* to *ConvModeAI6 (13.27)*
- +100 % of the input signal connected to an AI is scaled by means of *AI1HighVal (13.01)* to *AI6HighVal (13.25)*
- -100 % of the input signal connected to an AI is scaled by means of *AI1LowVal (13.02)* to *AI6LowVal (13.26)*

Example:
- In case the min. / max. voltage (±10 V) of AI1 should equal ±250 % of *TorqRefExt (2.24)*, set:
  1. *TorqRefA Sel (25.10)* = **AI1**
  2. *ConvModeAI1 (13.03)* = **±10V Bi**
  3. *AI1HighVal (13.01)* = 4000 mV
  4. *AI1LowVal (13.02)* = -4000 mV



Structure of AI's

Analog outputs (AO's)

The basic I/O board is the SDCS-CON-F with 3 standard AO's. Two AO's are programmable, the third one is fixed and used to display the actual armature current taken directly from the burden resistors. They can be extended by means of one RAIO-01 analog I/O extension module. Thus, the maximum number of AO's is 5. The hardware source is selected by:

– *AIO ExtModule (98.06)* for AO3 and AO4

SDCS-CON-F

Output range AO1 and AO2 set by parameter:

– ±10 V, 0 V to 10 V, 2 V to 10 V, 5 V offset, 6 V offset

Output range fixed AO I-act:

– 8 V equals the minimum of 325 % *M1NomCur (99.03)* or 230 % *ConvNomCur (4.05)* see also *IactScaling (4.26)*

Resolution:

– 11 bits + sign

Cycle time for AO1 and AO2:

– 5 ms

Cycle time fixed AO I-act:

– directly taken from hardware

RAIO-01

Output range AO3 and AO4 set by parameter:

– 0 mA to 20 mA, 4 mA to 20 mA, 10 mA offset, 12 mA offset

Resolution:

– 12 bits

Cycle time for AO3 and AO4:

– 5 ms

Additional functions:

– all AO's are galvanically isolated

Configuration

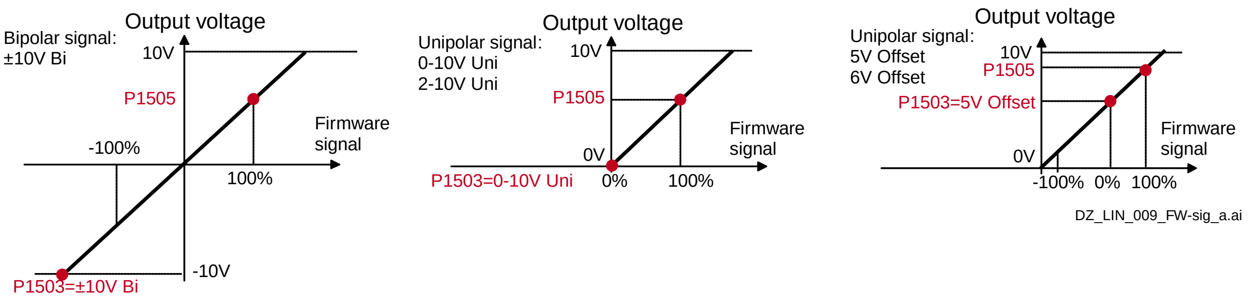
The value of AO1 and AO2 can be read from group 5.

AO	configurable	default setting
1	yes	-
2	yes	-
3	yes	-
4	yes	-
Curr	fixed	not selectable

Configurable = yes:

– The AO's can be connected to any integer or signed integer of the drive by means of group 15. It is possible to invert the AO's by simply negate *IndexAO1 (15.01)* to *IndexAO4 (15.16)*.

Scaling

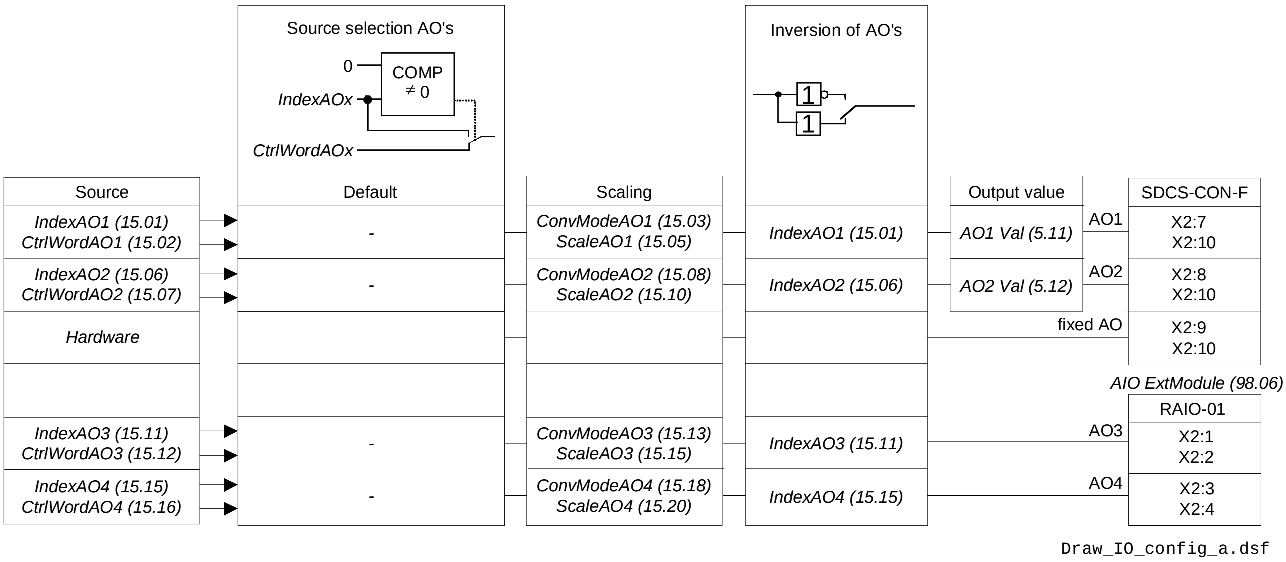


It is possible to scale AO1 to AO4 with 2 parameters each:

- the range of each AO is set by means of *ConvModeAO1 (15.03)* to *ConvModeAO4 (15.18)*
- if the range is set to bipolar or unipolar signals with offset, ±100 % of the input signal connected to an AO is scaled by means of *ScaleAO1 (15.05)* to *ScaleAO4 (15.20)*
- If the range is set to unipolar signals without offset, only +100 % of the input signal connected to an AO is scaled by means of *ScaleAO1 (15.05)* to *ScaleAO4 (15.20).* The smallest value is always zero.
- It is possible to invert the AO's by simply negate *IndexAO1 (15.01)* to *IndexAO4 (15.16)*

Example:

- In case the min. / max. voltage (±10 V) of AO1 should equal ±250 % of *TorqRefUsed (2.13)*, set:
  1. *IndexAO1 (15.01)* = 213
  2. *ConvModeAO1 (15.03)* = **±10V Bi**
  3. *ScaleAO1 (15.05)* = 4000 mV



Structure of AO's

Serial field bus communication

Chapter overview

This chapter describes the serial communication of the DCS550.

CANopen communication with fieldbus adapter RCAN-01

General

This chapter gives additional information using the CANopen adapter RCAN-01 together with the DCS550.

RCAN-01 - DCS550

The CANopen communication with the drive requires the option RCAN-01.

Related documentation

User's Manual CANopen Adapter Module RCAN-01. The quoted page numbers correspond to the User's Manual.

Overriding control configuration

Supported operation mode is **PDO21** (see page 43 and 44).

EDS file

The EDS file for RCAN-01 and DCS550 is available. Please ask Your local ABB agent for the newest one concerning the current DCS550 firmware.

Mechanical and electrical installation

If not already done so insert the RCAN-01 into slot 1 of the drive.

Drive configuration

Activate the CANopen adapter by means of *CommModule (98.02)*. Please note that the DCS550 works with the operation mode **PDO21** (see page 43 and 44).

Parameter setting example 1 using group 51

Communication via group 51 is using 4 data words in each direction. The following table shows the parameter setting using group 51:

Drive parameters	Settings	Comments
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

ModuleType (51.01)	**CANopen***	
Node ID (51.02)	1**	set node address as required
Baudrate (51.03)	8**	8 = 1 Mbits/s
PDO21 Cfg (51.04)	1	0 = Configuration via CANopen objects 1 = Configuration via RCAN-01 adapter parameters
RX-PDO21-Enable (51.05)	769	This value has to be calculated with 300 Hex = 768 + *Node ID (51.02)*. Here 768 + 1 = 769
RX-PDO21-TxType (51.06)	255	255 = **Asynchronous** (see page 83)
RX-PDO21-1stObj (51.07)	8197	2005 Hex = 8197 = **Transparent Control Word** (see page 62)
RX-PDO21-1stSubj (51.08)	0	
RX-PDO21-2ndObj (51.09)	8198	2006 Hex = 8198 = **Transparent Reference Speed** (see page 62)
RX-PDO21-2ndSubj (51.10)	0	
RX-PDO21-3rdObj (51.11)	16409	This value has to be calculated with 4000 Hex = 16384 + parameter group number. E.g. with *TorqRefA (25.01)* follows 16384 + 25 = 16409

		(see page 64)
RX-PDO21-3rdSubj (51.12)	1	This value has to be taken from the parameters index. E.g. with *TorqRefA (25.01)* follows 1 (see page 64)
RX-PDO21-4thObj (51.13)	16391	This value has to be calculated with 4000 Hex = 16384 + parameter group number. E.g. with *AuxCtrlWord (7.02)* follows 16384 + 7 = 16391 (see page 64)
RX-PDO21-4thSubj (51.14)	2	This value has to be taken from the parameters index. E.g. with *AuxCtrlWord (7.02)* follows 2 (see page 64)
TX-PDO21-Enable (51.15)	641	This value has to be calculated with 280 Hex = 640 + *Node ID (51.02)*. Here 640 + 1 = 641
TX-PDO21-TxType (51.16)	255	255 = **Asynchronous** (see page 83)
TX-PDO21-EvTime (51.17)	10	10 = 10 ms
TX-PDO21-1stObj (51.18)	8199	2007 Hex = 8199 = **Transparent Status Word** (see page 62)
TX-PDO21-1stSubj (51.19)	0	
TX-PDO21-2ndObj (51.20)	8200	2008 Hex = 8200 = **Transparent Actual Speed** (see page 62)
TX-PDO21-2ndSubj (51.21)	0	
TX-PDO21-3rdObj (51.22)	16386	This value has to be calculated with 4000 Hex = 16384 + parameter group number. E.g. with *TorqRef2 (2.09)* follows 16384 + 2 = 16386 (see page 64)
TX-PDO21-3rdSubj (51.23)	9	This value has to be taken from the parameters index. E.g. with *TorqRef2 (2.09)* follows 9 (see page 64)
TX-PDO21-4thObj (51.24)	16392	This value has to be calculated with 4000 Hex = 16384 + parameter group number. E.g. with *AuxStatWord (8.02)* follows 16384 + 8 = 16392 (see page 64)
TX-PDO21-4thSubj (51.25)	2	This value has to be taken from the parameters index. E.g. with *AuxStatWord (8.02)* follows 2 (see page 64)
TransparentIProfil (51.26)	1	1 = **Transparent**
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by CANopen adapter
** The values can be automatically set via the rotary switches of the RCAN-01

Note:

± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Further information

RX and TX parameters 51.07, …, 51.14 and 51.18, …, 51.25 are directly connected to the desired DCS550 parameters. Take care, that the used parameters are deleted from group 90 and 92 to prevent data trouble.

Parameter setting example 2 using groups 90 and 92

Communication via groups 90 and 92 is using 4 data words in each direction. The following table shows the parameter setting using groups 90 and 92.

Drive parameters	Settings	Comments
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

DsetXVal1 (90.01)	701, default	*MainCtrlWord (7.01)*;

		output data word 1 (control word) 1st data word from overriding control to drive
DsetXVal2 (90.02)	2301, default	*SpeedRef (23.01)*; output data word 2 (speed reference) 2nd data word from overriding control to drive
DsetXVal3 (90.03)	2501, default	*TorqRefA (25.01)*; output data word 3 (torque reference) 3rd data word from overriding control to drive
DsetXplus2Val1 (90.04)	702, default	*AuxCtrlWord (7.02)*; output data word 4 (auxiliary control word) 4th data word from overriding control to drive
DsetXplus1Val1 (92.01)	801, default	*MainStatWord (8.01)*; input data word 1 (status word) 1st data word from drive to overriding control
DsetXplus1Val2 (92.02)	104, default	*MotSpeed (1.04)*; input data word 2 (speed actual) 2nd data word from drive to overriding control
DsetXplus1Val3 (92.03)	209, default	*TorqRef2 (2.09)*; input data word 3 (torque reference) 3rd data word from drive to overriding control
DsetXplus3Val1 (92.04)	802, default	*AuxStatWord (8.02)*; input data word 4 (auxiliary status word) 4th data word from drive to overriding control

ModuleType (51.01)	**CANopen***	
Node ID (51.02)	1**	set node address as required
Baudrate (51.03)	8**	8 = 1 Mbits/s
PDO21 Cfg (51.04)	1	0 = Configuration via CANopen objects 1 = Configuration via RCAN-01 adapter parameters
RX-PDO21-Enable (51.05)	769	This value has to be calculated with 300 Hex = 768 + *Node ID (51.02)*. Here 768 + 1 = 769
RX-PDO21-TxType (51.06)	255	255 = **Asynchronous** (see page 83)
RX-PDO21-1stObj (51.07)	16384	4000 Hex = 16384 = **Control Word** (see page 63); Data set 1 word 1
RX-PDO21-1stSubj (51.08)	1	1 Hex = 1 = **Control Word** (see page 63); Data set 1 word 1
RX-PDO21-2ndObj (51.09)	16384	4000 Hex = 16384 = **Reference 1** (see page 63); Data set 1 word 2
RX-PDO21-2ndSubj (51.10)	2	2 Hex = 2 = **Reference 1** (see page 63); Data set 1 word 2
RX-PDO21-3rdObj (51.11)	16384	4000 Hex = 16384 = **Reference 2** (see page 63); Data set 1 word 3
RX-PDO21-3rdSubj (51.12)	3	3 Hex = 3 **Reference 2** (see page 63); Data set 1 word 3
RX-PDO21-4thObj (51.13)	16384	4000 Hex = 16384 = **Reference 3** (see page 63); Data set 3 word 1
RX-PDO21-4thSubj (51.14)	7	7 Hex = 7 **Reference 3** (see page 63); Data set 3 word 1
TX-PDO21-Enable (51.15)	641	This value has to be calculated with 280 Hex = 640 + *Node ID (51.02)*. Here 640 + 1 = 641
TX-PDO21-TxType (51.16)	255	255 = **Asynchronous** (see page 83)
TX-PDO21-EvTime (51.17)	10	10 = 10 ms

TX-PDO21-1stObj (51.18)	16384	4000 Hex = 16384 = **Status Word** (see page 63); Data set 2 word 1
TX-PDO21-1stSubj (51.19)	4	4 Hex = 4 = **Status Word** (see page 63); Data set 2 word 1
TX-PDO21-2ndObj (51.20)	16384	4000 Hex = 16384 = **Actual Value 1** (see page 63); Data set 2 word 2
TX-PDO21-2ndSubj (51.21)	5	5 Hex = 5 = **Actual Value 1** (see page 63); Data set 2 word 2
TX-PDO21-3rdObj (51.22)	16384	4000 Hex = 16384 = **Actual Value 2** (see page 63); Data set 2 word 3
TX-PDO21-3rdSubj (51.23)	6	6 Hex = 6 = **Actual Value 2** (see page 63); Data set 2 word 3
TX-PDO21-4thObj (51.24)	16384	4000 Hex = 16384 = **Actual Value 3** (see page 63); Data set 4 word 1
TX-PDO21-4thSubj (51.25)	10	A Hex = 10 = **Actual Value 3** (see page 63); Data set 4 word 1
TransparentIProfil (51.26)	1	1 = **Transparent**
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by CANopen adapter

** The values can be automatically set via the rotary switches of the RCAN-01

Note:

± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Switch on sequence

Please see the example at the end of this chapter.

ControlNet communication with fieldbus adapter RCNA-01

General

This chapter gives additional information using the ControlNet adapter RCNA-01 together with the DCS550.

RCNA-01 - DCS550

The ControlNet communication with the drive requires the option RCNA-01.

Related documentation

User's Manual ControlNet Adapter Module RCNA-01. The quoted page numbers correspond to the User's Manual.

Overriding control configuration

Please refer to the Scanner documentation for information how to configure the system for communication with RCNA-01.

EDS file

The EDS file for RCNA-01 and DCS550 is available. Please ask Your local ABB agent for the newest one concerning the current DCS550 firmware.

Mechanical and electrical installation

If not already done so insert the RCNA-01 into slot 1 of the drive (see page 17).

Drive configuration

Activate the ControlNet adapter by means of *CommModule (98.02)*. Please note that the DCS550 works with the instances **User transparent assembly** and **Vendor specific assembly**. The instances **Basic speed control** and **Extended speed control** (instance 20 / 70 and 21 / 71) are also supported, but with these instances, it is not possible to use the full flexibility of the DCS550. For more information, see User's Manual.

Parameter setting example 1 using ABB Drives assembly

ABB Drives assembly is using 2 data words in each direction. The following table shows the parameter setting using this profile.

Drive parameters	Settings	Comments
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

DsetXVal1 (90.01)	701, default	*MainCtrlWord (7.01)*; output data word 1 (control word) 1st data word from overriding control to drive
DsetXVal2 (90.02)	2301, default	*SpeedRef (23.01)*; output data word 2 (speed reference) 2nd data word from overriding control to drive
DsetXplus1Val1 (92.01)	801, default	*MainStatWord (8.01)*; input data word 1 (status word) 1st data word from drive to overriding control
DsetXplus1Val2 (92.02)	104, default	*MotSpeed (1.04)*; input data word 2 (speed actual) 2nd data word from drive to overriding control

ModuleType (51.01)	**CONTROLNET***	
Module macid (51.02)	4**	set node address as required
Module baud rate (51.03)	2**	2 = 500 kBits/s
HW/SW option (51.04)	0	0 = **Hardware** 1 = **Software**
Stop function (51.05)	NA	not applicable when using **ABB Drives assembly**
Output instance (51.06)	100	100 = **ABB Drives assembly**

Input instance (51.07)	101	101 = **ABB Drives assembly**
Output I/O par 1 (51.08) to *Input I/O par 9 (51.25)*	NA	not applicable when using **ABB Drives assembly**
VSA I/O size (51.26)	NA	not applicable when using **ABB Drives assembly**
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27) =* **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by ControlNet adapter.
** If *HW/SW option (51.04)* = 0 (Hardware), the values are automatically set via the rotary switches of the RCNA-01.

Note:

± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Parameter setting example 2 using Vendor specific assembly

Vendor specific assembly can run with up to 9 data words in each direction. The following table shows the parameter setting using this profile.

Drive parameters	**Settings**	**Comments**
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

ModuleType (51.01)	**CONTROLNET***	
Module macid (51.02)	4**	set node address as required
Module baud rate (51.03)	5	5 = 5 Mbits/s
HW/SW option (51.04)	0	0 = **Hardware** 1 = **Software**
Stop function (51.05)	NA	not applicable when using **Vendor specific assembly**
Output instance (51.06)	102	102 = **Vendor specific assembly**
Input instance (51.07)	103	103 = **Vendor specific assembly**
Output I/O par 1 (51.08) to *Input I/O par 9 (51.25)*	1 - 18	Set these values according table: Setting of parameter groups 51, 90 and 92 depending on desired data words and according to the desired numbers of data words
VSA I/O size (51.26)	1 - 9	Defines the length of the **Vendor specific assembly** in pairs of data words. E.g. a parameter value of 4 means 4 word as output and 4 words as input.
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27) =* **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by ControlNet adapter
** If *HW/SW option (51.04)* = 0 (**Hardware**), the values are automatically set via the rotary switches of the RCNA-01

Note:

± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Setting of parameter groups 51, 90 and 92

Parameter group 51				Direction	ABB	Parameter group 90 and 92			
	name	set value		PLC<->Drive	Datasets		name	def. value	
51,08	Output I/O par 1	=	**1***	⇒	1,1	90,01	DsetXVal1	=	701
51,09	Output I/O par 2	=	**2***	⇒	1,2	90,02	DsetXVal2	=	2301
51,10	Output I/O par 3	=	**3**	⇒	1,3	90,03	DsetXVal3	=	2501
51,11	Output I/O par 4	=	**7**	⇒	3,1	90,04	DsetXplus2Val1	=	702
51,12	Input I/O par 1	=	**4***	⇐	2,1	92,01	DsetXplus1Val1	=	801
51,13	Input I/O par 2	=	**5***	⇐	2,2	92,02	DsetXplus1Val2	=	104
51,14	Input I/O par 3	=	**6**	⇐	2,3	92,03	DsetXplus1Val3	=	209
51,15	Input I/O par 4	=	**10**	⇐	4,1	92,04	DsetXplus3Val1	=	802
51,16	Output I/O par 5	=	**8**	⇒	3,2	90,05	DsetXplus2Val2	=	703
51,17	Output I/O par 6	=	**9**	⇒	3,3	90,06	DsetXplus2Val3	=	0
51,18	Output I/O par 7	=	**13**	⇒	5,1	90,07	DsetXplus4Val1	=	0
51,19	Output I/O par 8	=	**14**	⇒	5,2	90,08	DsetXplus4Val2	=	0
51,20	Output I/O par 9	=	**15**	⇒	5,3	90,09	DsetXplus4Val3	=	0
51,21	Input I/O par 5	=	**11**	⇐	4,2	92,05	DsetXplus3Val2	=	101
51,22	Input I/O par 6	=	**12**	⇐	4,3	92,06	DsetXplus3Val3	=	108
51,23	Input I/O par 7	=	**16**	⇐	6,1	92,07	DsetXplus5Val1	=	901
51,24	Input I/O par 8	=	**17**	⇐	6,2	92,08	DsetXplus5Val2	=	902

*For proper communication shown values have to be used

Further information

Output and input parameters 51.08, …, 51.25 can also be connected directly to the desired DCS550 parameters. In this case please take care that the RCNA-01 adapter gets the changed values and also take care, that the used parameters are deleted from group 90 to prevent data trouble.

Switch on sequence

Please see the example at the end of this chapter.

DeviceNet communication with fieldbus adapter RDNA-01

General

This chapter gives additional information using the DeviceNet adapter RDNA-01 together with the DCS550.

RDNA-01 - DCS550

The DeviceNet communication with the drive requires the option RDNA-01.

Related documentation

User's Manual DeviceNet Adapter Module RDNA-01. The quoted page numbers correspond to the User's Manual.

Overriding control configuration

Supported assemblies with DCS550 are **ABB Drives assembly** (Output instance: 100; Input instance: 101) and **User specific assembly** (Output instance: 102; Input instance: 103) (see page 35). The assemblies **Basic speed control** and **Extended speed control** (20 / 70 and 21 / 71) are also supported.

EDS file

The EDS file for RDNA-01 and DCS550 is available. Please ask Your local ABB agent for the newest one concerning the current DCS550 firmware.

Mechanical and electrical installation

If not already done so insert the RDNA-01 into slot 1 of the drive (see page 21).

Drive configuration

Activate the DeviceNet adapter by means of *CommModule (98.02).* Please note that the DCS550 works with the instances **ABB Drives assembly** and **User specific assembly**. The instances **Basic speed control** and **Extended speed control** (20 / 70 and 21 / 71) are also supported. With these instances, it is not possible to use the full flexibility of the DCS550. For more information, see User's Manual.

Parameter setting example 1 using ABB Drives assembly

ABB Drives assembly is using 2 data words in each direction. The following table shows the parameter setting using this profile.

Drive parameters	Settings	Comments
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

DsetXVal1 (90.01)	701, default	*MainCtrlWord (7.01)*; output data word 1 (control word) 1st data word from overriding control to drive
DsetXVal2 (90.02)	2301, default	*SpeedRef (23.01)*; output data word 2 (speed reference) 2nd data word from overriding control to drive
DsetXplus1Val1 (92.01)	801, default	*MainStatWord (8.01)*; input data word 1 (status word) 1st data word from drive to overriding control
DsetXplus1Val2 (92.02)	104, default	*MotSpeed (1.04)*; input data word 2 (speed actual) 2nd data word from drive to overriding control

ModuleType (51.01)	**DEVICENET***	
Module macid (51.02)	4**	set node address as required
Module baud rate (51.03)	2**	2 = 500 kBits/s
HW/SW option (51.04)	0	0 = **Hardware** 1 = **Software**
Stop function (51.05)	NA	not applicable when using **ABB Drives assembly**

Output instance (51.06)	100	100 = **ABB Drives assembly**
Input instance (51.07)	101	101 = **ABB Drives assembly**
Output I/O par 1 (51.08) to *Input I/O par 9 (51.25)*	NA	not applicable when using **ABB Drives assembly**
VSA I/O size (51.26)	NA	not applicable when using **ABB Drives assembly**
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by DeviceNet adapter
** If *HW/SW option (51.04)* = 0 (**Hardware**), the values are automatically set via DIP switches of the RDNA-01
Note:
± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Parameter setting example 2 using User specific assembly

User specific assembly can run with up to 9 data words in each direction. The following table shows the parameter setting using this profile.

Drive parameters	Settings	Comments
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

ModuleType (51.01)	**DEVICENET***	
Module macid (51.02)	4**	set node address as required
Module baud rate (51.03)	2**	2 = 500 kBits/s
HW/SW option (51.04)	0	0 = **Hardware** 1 = **Software**
Stop function (51.05)	NA	not applicable when using **User specific assembly**
Output instance (51.06)	102	102 = **User specific assembly**
Input instance (51.07)	103	103 = **User specific assembly**
Output I/O par 1 (51.08) to *Input I/O par 9 (51.25)*	1 - 18	Set these values according table: Setting of parameter groups 51, 90 and 92 depending on desired data words and according to the desired numbers of data words
VSA I/O size (51.26)	1 - 9	Defines the length of the **User specific assembly** in pairs of data words. E.g. a parameter value of 4 means 4 word as output and 4 words as input.
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by DeviceNet adapter
** If *HW/SW option (51.04)* = 0 (**Hardware**), the values are automatically set via DIP switches of the RDNA-01
Note:
± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Setting of parameter groups 51, 90 and 92

Parameter group 51				Direction	ABB	Parameter group 90 and 92			
	name	set value		PLC<->Drive	Datasets		name	def. value	
51,08	Output I/O par 1	=	**1***	→	1,1	90,01	DsetXVal1	=	701
51,09	Output I/O par 2	=	**2***	→	1,2	90,02	DsetXVal2	=	2301
51,10	Output I/O par 3	=	**3**	→	1,3	90,03	DsetXVal3	=	2501
51,11	Output I/O par 4	=	**7**	→	3,1	90,04	DsetXplus2Val1	=	702
51,12	Input I/O par 1	=	**4***	←	2,1	92,01	DsetXplus1Val1	=	801
51,13	Input I/O par 2	=	**5***	←	2,2	92,02	DsetXplus1Val2	=	104
51,14	Input I/O par 3	=	**6**	←	2,3	92,03	DsetXplus1Val3	=	209
51,15	Input I/O par 4	=	**10**	←	4,1	92,04	DsetXplus3Val1	=	802
51,16	Output I/O par 5	=	**8**	→	3,2	90,05	DsetXplus2Val2	=	703
51,17	Output I/O par 6	=	**9**	→	3,3	90,06	DsetXplus2Val3	=	0
51,18	Output I/O par 7	=	**13**	→	5,1	90,07	DsetXplus4Val1	=	0
51,19	Output I/O par 8	=	**14**	→	5,2	90,08	DsetXplus4Val2	=	0
51,20	Output I/O par 9	=	**15**	→	5,3	90,09	DsetXplus4Val3	=	0
51,21	Input I/O par 5	=	**11**	←	4,2	92,05	DsetXplus3Val2	=	101
51,22	Input I/O par 6	=	**12**	←	4,3	92,06	DsetXplus3Val3	=	108
51,23	Input I/O par 7	=	**16**	←	6,1	92,07	DsetXplus5Val1	=	901
51,24	Input I/O par 8	=	**17**	←	6,2	92,08	DsetXplus5Val2	=	902

*For proper communication shown values have to be used

Further information

Output and input parameters 51.08, …, 51.25 can also be connected directly to the desired DCS550 parameters. In this case, please take care that the RDNA-01 adapter gets the changed values and take care, that the used parameters are deleted from group 90 to prevent data trouble.

Switch on sequence

Please see the example at the end of this chapter.

Ethernet/IP communication with fieldbus adapter RETA-01

General

This chapter gives additional information using the Ethernet adapter RETA-01 together with the DCS550.

RETA-01 - DCS550

The Ethernet/IP communication with the drive requires the option RETA-01.

Related documentation

User's Manual Ethernet Adapter Module RETA-01. The quoted page numbers correspond to the User's Manual.

EDS file

The EDS file for RETA-01 and DCS550 is available. Please ask Your local ABB agent for the newest one concerning the current DCS550 firmware.

Mechanical and electrical installation

If not already done so insert RETA-01 into slot 1 of the drive.

Drive configuration

Activate the Ethernet adapter by means of *CommModule (98.02)*. Please note that the DCS550 works with the instances 102 / 103, if *Protocol (51.16)* is set to **2 (Ethernet/IP ABB Drives communication profile)**. The instances 100 / 101, 20 / 70 and 21 / 71 are also supported, if *Protocol (51.16)* is set to **1 (Ethernet/IP AC/DC communication profile)**. With these instances, it is not possible to use the full flexibility of the DCS550. For more information, see User's Manual.

Parameter setting example using Ethernet/IP ABB Drives communication profile

Ethernet/IP ABB Drives communication profile uses up to 4 data words in each direction by default. The internal connection from and to the DCS550 has to be done by means of parameter group 51.
Ethernet/IP ABB Drives communication profile uses up to 12 data words in each direction.
Note:
The DCS550 supports up to 10 data words.
The configuration has to be done via fieldbus link configuration using Vendor Specific Drive I/O Object (Class 91h).

Drive parameters	**Settings**	**Comments**
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

DsetXVal1 (90.01)	701, default	*MainCtrlWord (7.01)*; output data word 1 (control word) 1st data word from overriding control to drive
DsetXVal2 (90.02)	2301, default	*SpeedRef (23.01)*; output data word 2 (speed reference) 2nd data word from overriding control to drive
DsetXplus1Val1 (92.01)	801, default	*MainStatWord (8.01)*; input data word 1 (status word) 1st data word from drive to overriding control
DsetXplus1Val2 (92.02)	104, default	*MotSpeed (1.04)*; input data word 2 (speed actual) 2nd data word from drive to overriding control

ModuleType (51.01)	**ETHERNET TCP***	
Comm rate (51.02)	0	Auto-negotiate; automatic, set baud rate as required
DHCP (51.03)	0	DHCP disabled;

		IP address setting from following parameters
IP address 1 (51.04)	192**	e.g. IP address: 192.168.0.1
IP address 2 (51.05)	168**	
IP address 3 (51.06)	0**	
IP address 4 (51.07)	1**	
Subnet mask 1 (51.08)	255	e.g. subnet mask: 255.255.255.0
Subnet mask 2 (51.09)	255	
Subnet mask 3 (51.10)	255	
Subnet mask 4 (51.11)	0	
GW address 1 (51.12)	0	e.g. gateway address: 0.0.0.0
GW address 2 (51.13)	0	
GW address 3 (51.14)	0	
GW address 4 (51.15)	0	
Protocol (51.16)	2	1 = **Ethernet/IP AC/DC communication profile** 2 = **Ethernet/IP ABB Drives communication profile**
Modbus timeout (51.17)	22	0 = no monitoring 1 = 100 ms 22 = 2200 ms
Stop function (51.18)	0	0 = Ramp stop
Output 1 (51.19)	1	data word 1; setting via parameter 90.01
Output 2 (51.20)	2	data word 2; setting via parameter 90.02
Output 3 (51.21)	3	data word 3; setting via parameter 90.03
Output 4 (51.22)	7	data word 4; setting via parameter 90.04
Input 1 (51.23)	4	data word 1; setting via parameter 92.01
Input 2 (51.24)	5	data word 2; setting via parameter 92.02
Input 3 (51.25)	6	data word 3; setting via parameter 92.03
Input 4 (51.26)	10	data word 4; setting via parameter 92.04
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by Ethernet adapter

** If all DIP switches (S1) are OFF; the IP address is set according to parameters 51.04, …, 51.07. In case at least one DIP switch is on, the last byte of the IP address [*IP address 4 (51.07)*] is set according to the DIP switches (see page 42).

Note:

± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Up to 4 data words

The content of Input/Output 1 to 4 can be configured with the RETA-01 configuration parameters. Please see table RETA-01 Ethernet/IP configuration parameters, which contains all the necessary basic settings.

Up to 10 data words

The DCS550 supports up to 10 data words in each direction. The first configuration of the RETA-01 adapter has to be done according to the table RETA-01 Ethernet/IP configuration parameters, which contains all the necessary basic settings.

The additional desired data words have to be configured via the fieldbus network using Vendor Specific Drive I/O Object (Class 91h). The adapter will automatically save the configuration.

The table RETA-01 Ethernet/IP configuration parameters shows the index configuration numbers and the corresponding data words (via data sets).

Please note: The grayed index is also addressed via group 51, please set the outputs and inputs to the same configuration numbers as shown in the table RETA-01 Ethernet/IP configuration parameters.

Example:
Task: The 5th data word of the telegram (index05) should be connected to *AuxCtrlWord (7.03)*.
To do:*AuxCtrlWord (7.03)* is the default content of *DsetXplus2Val2 (90.05).* The corresponding index configuration number of *DsetXplus2Val2 (90.05)* is 8. Therefore, the configuration has to be done using the following values in the IP address (all values are in hex):

service	**0x10**	(write single)	class	**0x91**	(drive IO map function)
instance	**0x01**	(output)	attribute	**5**	(index05)
data	**08 00**	(2 char hex value)			

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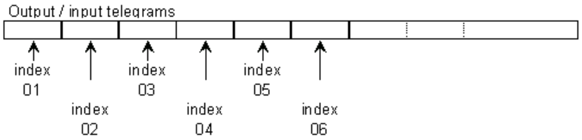
	RETA-01 Class 91h		index configuration no.	ABB Datasets	Parameter group 90 and 92 no.	name		def. value
	Instance 1 (Output)							
PLC ==> Drive	index 01	=	1	1,1	90,01	DsetXVal1	=	701
	index 02	=	2	1,2	90,02	DsetXVal2	=	2301
	index 03	=	3	1,3	90,03	DsetXVal3	=	2501
	index 04	=	7	3,1	90,04	DsetXplus2Val1	=	702
	index 05	=	8	3,2	90,05	DsetXplus2Val2	=	703
	index 06	=	9	3,3	90,06	DsetXplus2Val3	=	0
	index 07	=	13	5,1	90,07	DsetXplus4Val1	=	0
	index 08	=	14	5,2	90,08	DsetXplus4Val2	=	0
	index 09	=	15	5,3	90,09	DsetXplus4Val3	=	0
	index 10	=	19	7,1	90,10	DsetXplus6Val1	=	0
	Instance 2 (Input)							
PLC <== Drive	index 01	=	4	2,1	92,01	DsetXplus1Val1	=	801
	index 02	=	5	2,2	92,02	DsetXplus1Val2	=	104
	index 03	=	6	2,3	92,03	DsetXplus1Val3	=	209
	index 04	=	10	4,1	92,04	DsetXplus3Val1	=	802
	index 05	=	11	4,2	92,05	DsetXplus3Val2	=	101
	index 06	=	12	4,3	92,06	DsetXplus3Val3	=	108
	index 07	=	16	6,1	92,07	DsetXplus5Val1	=	901
	index 08	=	17	6,2	92,08	DsetXplus5Val2	=	902
	index 09	=	18	6,3	92,09	DsetXplus5Val3	=	903
	index 10	=	22	8,1	92,10	DsetXplus7Val1	=	904

RETA-01 Ethernet/IP configuration parameters

After configuration, the packed telegram is defined:



Switch on sequence

Please see the example at the end of this chapter.

Modbus (RTU) communication with fieldbus adapter RMBA-01

General

This chapter gives additional information using the Modbus adapter RMBA-01 together with the DCS550.

RMBA-01 - DCS550

The Modbus communication with the drive requires the option RMBA-01. The protocol Modbus RTU (**R**emote **T**erminal **U**nit using serial communication) is supported.

Related documentation

User's Manual Modbus Adapter Module RMBA-01. The quoted page numbers correspond to the User's Manual.

Mechanical and electrical installation

If not already done so insert RMBA-01 into a slot of the drive. Slot 1 has to be used, if the Modbus should control the drive.

Drive configuration

The Modbus adapter is activated by means of *CommModule (98.02)* and *ModBusModule2 (98.08)*. The serial communication parameters of the RMBA-01 adapter have to be set by means of group 52. Up to 10 data words in each direction are possible.

Parameter setting example controlling a drive

In data set mode (cyclic communication), the drive will be controlled from the overriding control using the Modbus. Up to 10 data words in each direction are possible. The following table shows the parameter settings.

Drive parameters	Settings	Comments
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Modbus**	

StationNumber (52.01)	1, …, 247	desired station number
BaudRate (52.02)	5	5 = 9600 Baud
Parity (52.03)	4	4 = Even

DsetXVal1 (90.01)	701, default	*MainCtrlWord (7.01)*; output data word 1 (control word) 1st data word from overriding control to drive (40001 => data word 1.1)
DsetXVal2 (90.02)	2301, default	*SpeedRef (23.01)*; output data word 2 (speed reference) 2nd data word from overriding control to drive (40002 => data word 1.2)
DsetXVal3 (90.03)	2501, default	*TorqRefA (25.01)*; output data word 3 (torque reference) 3rd data word from overriding control to drive (40003 => data word 1.3)
up to, …,		
DsetXplus6Val1 (90.10)	0, default	not connected; output data word 10 (not connected) 10th data word from overriding control to drive (40019 <= data word 7.1)
DsetXplus1Val1 (92.01)	801, default	*MainStatWord (8.01)*; input data word 1 (status word) 1st data word from drive to overriding control (40004 <= data word 2.1)

DsetXplus1Val2 (92.02)	104, default	*MotSpeed (1.04)*; input data word 2 (speed actual) 2nd data word from drive to overriding control (40005 <= data word 2.2)
DsetXplus1Val3 (92.03)	209, default	*TorqRef2 (2.09)*; input data word 3 (torque reference) 3rd data word from drive to overriding control (40006 <= data word 2.3)
up to, …,		
DsetXplus7Val1 (92.10)	904, default	*Faultword4 (9.04)*; input data word 10 (fault word 4) 10th data word from drive to overriding control (40022 <= data word 8.1)

Notes:

- New settings of group 52 take effect only after the next power up of the adapter.
- ± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Setting of PLC, parameter groups 90 and 92

Set in PLC	Direction PLC<->Drive	ABB Datasets	Parameter group 90 and 92	name		def. value
40001	→	1,1	90.01	DsetXVal1	=	701
40002	→	1,2	90.02	DsetXVal2	=	2301
40003	→	1,3	90.03	DsetXVal3	=	2501
40004	←	2,1	92.01	DsetXplus1Val1	=	801
40005	←	2,2	92.02	DsetXplus1Val2	=	104
40006	←	2,3	92.03	DsetXplus1Val3	=	209
40007	→	3,1	90.04	DsetXplus2Val1	=	702
40008	→	3,2	90.05	DsetXplus2Val2	=	703
40009	→	3,3	90.06	DsetXplus2Val3	=	0
40010	←	4,1	92.04	DsetXplus3Val1	=	802
40011	←	4,2	92.05	DsetXplus3Val2	=	101
40012	←	4,3	92.06	DsetXplus3Val3	=	108
40013	→	5,1	90.07	DsetXplus4Val1	=	0
40014	→	5,2	90.08	DsetXplus4Val2	=	0
40015	→	5,3	90.09	DsetXplus4Val3	=	0
40016	←	6,1	92.07	DsetXplus5Val1	=	901
40017	←	6,2	92.08	DsetXplus5Val2	=	902
40018	←	6,3	92.09	DsetXplus5Val3	=	903
40019	→	7,1	90.10	DsetXplus6Val1	=	0
40022	←	8,1	92.10	DsetXplus7Val1	=	904

Setting of PLC, parameter groups 90 and 92 depending on desired data words

Switch on sequence

Please see the example at the end of this chapter.

Modbus/TCP communication with fieldbus adapter RETA-01

General

This chapter gives additional information using the Ethernet adapter RETA-01 together with the DCS550.

RETA-01 - DCS550

The Modbus/TCP communication with the drive requires the option RETA-01. The protocol Modbus TCP (Ethernet) is supported.

Related documentation

User's Manual Ethernet Adapter Module RETA-01. The quoted page numbers correspond to the User's Manual.

Mechanical and electrical installation

If not already done so insert RETA-01 into slot 1 of the drive.

Drive configuration

Activate the Ethernet adapter by means of *CommModule (98.02)*. Please note that the DCS550 works with **Modbus/TCP**, if *Protocol (51.16)* is set to 0 (**Modbus/TCP**).

Parameter setting example using Modbus/TCP

Modbus/TCP is using 4 data words in each direction. The following table shows the parameter setting using this protocol.

Drive parameters	**Settings**	**Comments**
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

DsetXVal1 (90.01)	701, default	*MainCtrlWord (7.01)*; output data word 1 (control word) 1st data word from overriding control to drive
DsetXVal2 (90.02)	2301, default	*SpeedRef (23.01)*; output data word 2 (speed reference) 2nd data word from overriding control to drive
DsetXplus1Val1 (92.01)	801, default	*MainStatWord (8.01)*; input data word 1 (status word) 1st data word from drive to overriding control
DsetXplus1Val2 (92.02)	104, default	*MotSpeed (1.04)*; input data word 2 (speed actual) 2nd data word from drive to overriding control

ModuleType (51.01)	**ETHERNET TCP***	
Comm rate (51.02)	0	Auto-negotiate; automatic, set baud rate as required
DHCP (51.03)	0	DHCP disabled; IP address setting from following parameters
IP address 1 (51.04)	192**	e.g. IP address: 192.168.0.1
IP address 2 (51.05)	168**	
IP address 3 (51.06)	0**	
IP address 4 (51.07)	1**	
Subnet mask 1 (51.08)	255	e.g. subnet mask: 255.255.255.0
Subnet mask 2 (51.09)	255	
Subnet mask 3 (51.10)	255	
Subnet mask 4 (51.11)	0	

GW address 1 (51.12)	0	e.g. gateway address: 0.0.0.0
GW address 2 (51.13)	0	
GW address 3 (51.14)	0	
GW address 4 (51.15)	0	
Protocol (51.16)	0	0 = **Modbus/TCP**
Modbus timeout (51.17)	22	0 = no monitoring 1 = 100 ms 22 = 2200 ms
Stop function (51.18)	NA	not applicable when using **Modbus/TCP**
Output 1 (51.19)	1	data word 1; setting via parameter 90.01
Output 2 (51.20)	2	data word 2; setting via parameter 90.02
Output 3 (51.21)	3	data word 3; setting via parameter 90.03
Output 4 (51.22)	7	data word 4; setting via parameter 90.04
Input 1 (51.23)	4	data word 1; setting via parameter 92.01
Input 2 (51.24)	5	data word 2; setting via parameter 92.02
Input 3 (51.25)	6	data word 3; setting via parameter 92.03
Input 4 (51.26)	10	data word 4; setting via parameter 92.04
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by Ethernet adapter
** If all DIP switches (S1) are OFF; the IP address is set according to parameters 51.04, …, 51.07. In case at least one DIP switch is on, the last byte of the IP address [*IP address 4 (51.07)*] is set according to the DIP switches (see page 42).

Note:
± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Switch on sequence

Please see the example at the end of this chapter.

Profibus communication with fieldbus adapter RPBA-01

General

This chapter gives additional information using the Profibus adapter RPBA-01 together with the DCS550.

RPBA-01 - DCS550

The Profibus communication with the drive requires the option RPBA-01.

Related documentation

User's Manual PROFIBUS DP Adapter Module RPBA-01. The quoted page numbers correspond to the User's Manual.

Overriding control configuration

Supported operation mode is **VENDOR SPECIFIC** for ABB Drives (see page 19 and 20). The RPBA-01 uses data consistent communication, meaning that the whole data frame is transmitted during a single program cycle. Some overriding controls handle this internally, but others must be programmed to transmit data consistent telegrams.

Mechanical and electrical installation

If not already done so insert RPBA-01 into slot 1 of the drive (see page 21).

Drive configuration

Activate the Profibus adapter by means of *CommModule (98.02)* (see page 22). Please note that the DCS550 works only with the ABB Drives profile.

Parameter setting example 1 using PPO Type 1

ABB Drives profile (Vendor-specific) with **PPO Type 1** (DP-V0) (see page 25). The first two data words (PZD1 OUT, PZD2 OUT) from the overriding control to the drive are fixed connected as control word and speed reference at the Profibus side and cannot be changed. The first two data words (PZD1 IN, PZD2 IN) from the drive to the overriding control are fixed connected as status word and speed actual at the Profibus side and cannot be changed.

Drive parameters	Settings	Comments
CommandSel (10.01)	**MainCtrlWord**	
Ref1Sel (11.03)	**SpeedRef2301**	
CommModule (98.02)	**Fieldbus**	

DsetXVal1 (90.01)	701, default	*MainCtrlWord (7.01)*; PZD1 OUT (control word) 1st data word from overriding control to drive
DsetXVal2 (90.02)	2301, default	*SpeedRef (23.01)*; PZD2 OUT (speed reference) 2nd data word from overriding control to drive
DsetXplus1Val1 (92.01)	801, default	*MainStatWord (8.01)*; PZD1 IN (status word) 1st data word from drive to overriding control
DsetXplus1Val2 (92.02)	104, default	*MotSpeed (1.04)*; PZD2 IN (speed actual) 2nd data word from drive to overriding control

ModuleType (51.01)	**PROFIBUS DP***	
Node address (51.02)	4	set node address as required
Baud rate (51.03)	1500*	
PPO-type (51.04)	**PPO1***	
…		
DP Mode (51.21)	0	0 = DPV0; 1 = DPV1
FBA PAR REFRESH (51.27)	**DONE**, default	If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.

* Read-only or automatically detected by Profibus adapter

Note:

± 20,000 speed units (decimal) for speed reference [*SpeedRef (23.01)*] and speed actual [*MotSpeed (1.04)*] corresponds to the speed shown in *SpeedScaleAct (2.29)*.

Parameter setting example 2 using PPO types 2, 4, 5 and 6

The first two data words (PZD1 OUT, PZD2 OUT) from the overriding control to the drive are fixed connected as control word and speed reference at the Profibus side and cannot be changed. The first two data words (PZD1 IN, PZD2 IN) from the drive to the overriding control are fixed connected as status word and speed actual at the Profibus side and cannot be changed.

Further data words are to be connected to the desired parameters respectively signals by means of parameters in group 51:

- *PZD3 OUT (51.05)* means 3rd data word from overriding control to drive,
- *PZD3 IN (51.06)* means 3rd data word from Drive to overriding control
  to
- *PZD10 OUT (51.18)* means 10th data word from overriding control to drive,
- *PZD10 IN (51.19)* means 10th data word from drive to overriding control

or by means of setting parameters in group 90 and group 92.

Care has to be taken that the DP Mode in 51.21 correspond to the currently used GSD file:

DP Mode (51.21)	0	0 = **DPV0**; 1 = **DPV1 (stringently required for PPO6)**

Communication via group 51

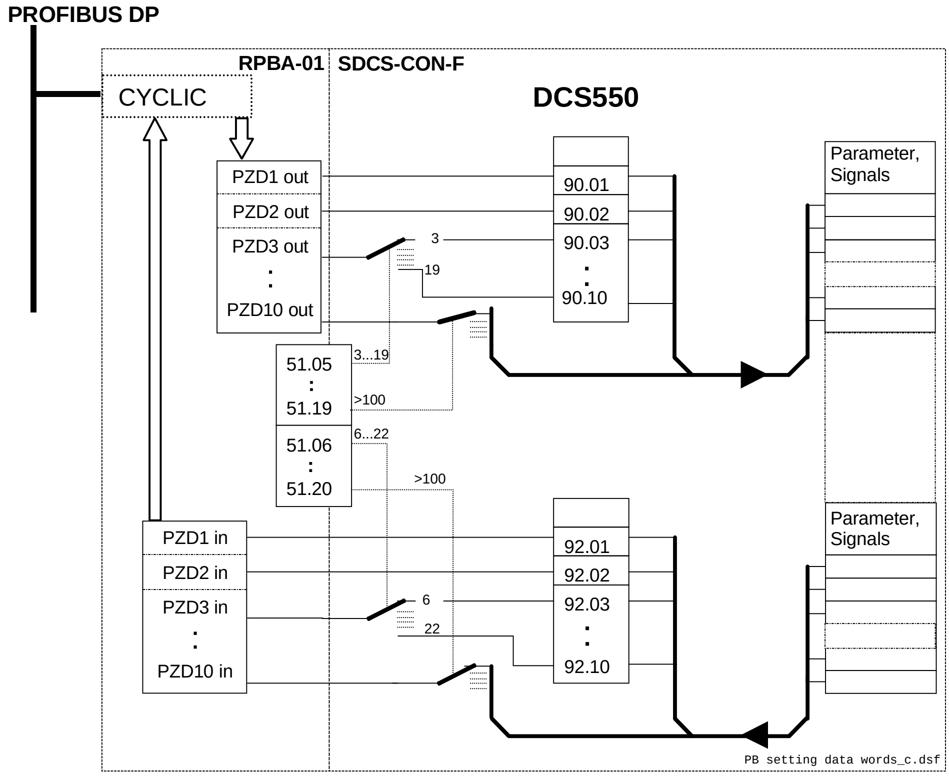
E.g. the 3rd data word from overriding control to drive should be the torque reference and the 3rd data word from the drive to the overriding control should be the actual motor torque. Therefore, following settings have to be made:

- *PZD3 OUT (51.05)* = 2501 [*TorqRefA (25.01)*] and
- *PZD3 IN (51.06)* = 107 [*MotTorqFilt (1.07)*].

After changing parameters in group 51 please do not forget to reset the RPBA-01 adapter by means of *FBA PAR REFRESH (51.27)* = **RESET**. Now the corresponding parameters in group 90 and group 92 are disabled.

Attention:

Make sure, that the used parameters, like *TorqRefA (25.01)* are removed from groups 90 and 91.



Setting of data words using only group 51 or using group 90 and group 92

Communication via group 90 and group 92

The other possibility is to connect via group 90 and group 92. Again, the 3rd data word from overriding control to drive should be the torque reference and the 3rd data word from the drive to the overriding control should be the actual motor torque. Therefore, following settings have to be made (values see table below):

- *PZD3 OUT (51.05)* = 3 and
- *PZD3 IN (51.06)* = 6.

After changing parameters in group 51 please do not forget to reset the RPBA-01 adapter by means of *FBA PAR REFRESH (51.27)* = **RESET**. Now the corresponding parameters in group 90 and group 92 are enabled. Following settings have to be made now:

- *DsetXVal3 (90.03)* = 2501 [*TorqRefA (25.01)*] and
- *DsetXplus1Val3 (92.03)* = 107 [*MotTorqFilt (1.07)*].

PPO	Parameter group 51	name	set value	Direction PLC<->Drive	ABB Datasets	Parameter group 90 and 92	name		def. value
PPO 1, PPO 3		fixed connection		→	1,1	90,01	DsetXVal1	=	701
PPO 1, PPO 3		fixed connection		←	2,1	92,01	DsetXplus1Val1	=	801
PPO 1, PPO 3		fixed connection		→	1,2	90,02	DsetXVal2	=	2301
PPO 1, PPO 3		fixed connection		←	2,2	92,02	DsetXplus1Val2	=	104
PPO 2 , PPO 4	**51,05**	PZD3 OUT	= **3**	→	1,3	90,03	DsetXVal3	=	2501
PPO 2 , PPO 4	**51,06**	PZD3 IN	= **6**	←	2,3	92,03	DsetXplus1Val3	=	209
PPO 2 , PPO 4	**51,07**	PZD4 OUT	= **7**	→	3,1	90,04	DsetXplus2Val1	=	702
PPO 2 , PPO 4	**51,08**	PZD4 IN	= **10**	←	4,1	92,04	DsetXplus3Val1	=	802
PPO 2 , PPO 4	**51,09**	PZD5 OUT	= **8**	→	3,2	90,05	DsetXplus2Val2	=	703
PPO 2 , PPO 4	**51,10**	PZD5 IN	= **11**	←	4,2	92,05	DsetXplus3Val2	=	101
PPO 2 , PPO 4	**51,11**	PZD6 OUT	= **9**	→	3,3	90,06	DsetXplus2Val3	=	0
PPO 2 , PPO 4	**51,12**	PZD6 IN	= **12**	←	4,3	92,06	DsetXplus3Val3	=	108
PPO 5	**51,13**	PZD7 OUT	= **13**	→	5,1	90,07	DsetXplus4Val1	=	0
PPO 5	**51,14**	PZD7 IN	= **16**	←	6,1	92,07	DsetXplus5Val1	=	901
PPO 5	**51,15**	PZD8 OUT	= **14**	→	5,2	90,08	DsetXplus4Val2	=	0
PPO 5	**51,16**	PZD8 IN	= **17**	←	6,2	92,08	DsetXplus5Val2	=	902
PPO 5	**51,17**	PZD9 OUT	= **15**	→	5,3	90,09	DsetXplus4Val3	=	0
PPO 5	**51,18**	PZD9 IN	= **18**	←	6,3	92,09	DsetXplus5Val3	=	903
PPO 5	**51,19**	PZD10 OUT	= **19**	→	7,1	90,10	DsetXplus6Val1	=	0
PPO 5	**51,20**	PZD10 IN	= **22**	←	8,1	92,10	DsetXplus7Val1	=	904

Setting of data words using group 90 and group 92

ProfiNet communication with fieldbus adapter RETA-02

Additional information for the operation of fieldbus adapter RETA-02 combined with DCS550 can be found in document **3ADW000389R0101** (Quick Start Up Guide).

Switch on sequence

Bit	15 ... 11	RemoteCmd 10	Inching2 09	Inching1 08	Reset 07	RampInZero 06	RampHold 05	RampOutZero 04	Run 03	Off3N 02	Off2N 01	On 00	**Dec.**	**Hex.**
Reset		1	x	x	1	x	x	x	x	x	x	x	**1270**	**04F6**
Off (before On)		1	0	0	0	x	x	x	0	1	1	0	**1142**	**0476**
On (main cont. On)		1	0	0	0	x	x	x	0	1	1	1	**1143**	**0477**
Run (with reference)		1	0	0	0	1	1	1	1	1	1	1	**1151**	**047F**
E-Stop		1	x	x	x	1	1	1	1	0	1	1	**1147**	**047B**
Start inhibit		1	x	x	x	x	x	x	x	x	0	x	**1140**	**0474**

Examples for the MainCtrlWord (7.01)

Data set table

Many fieldbus communications use the data set table to transmit data words. The next table shows the configuration number of each data word and the corresponding pointer:

Data set no.	Configuration no.	Parameter (pointer) from PLC to DCS550	Parameter (pointer) from DCS550 to PLC
1.1	1	90.01	
1.2	2	90.02	
1.3	3	90.03	
2.1	4		92.01
2.2	5		92.02
2.3	6		92.03
3.1	7	90.04	
3.2	8	90.05	
3.3	9	90.06	
4.1	10		92.04
4.2	11		92.05
4.3	12		92.06
5.1	13	90.07	
5.2	14	90.08	
5.3	15	90.09	
6.1	16		92.07
6.2	17		92.08
6.3	18		92.09
7.1	19	90.10	
8.1	20		92.10

Configuration numbers of each data word and its corresponding pointer

AP (Adaptive Program)

Chapter overview

This chapter describes the basics of AP and instructs how to build an application. All needed parameters can be found in the groups 83 to 86.

What is AP?

Conventionally, the user can control the operation of the drive by parameters. Each parameter has a fixed set of choices or a setting range. The parameters make adapting of the drive easy, but the choices are limited. It is not possible to customize the drive any further. AP makes customizing possible without the need of a special programming tool or language:

- AP is using function blocks,
- DWL AP is the programming and documentation tool.

The maximum size of AP is 16 function blocks. The program may consist of several separate functions.

Features

AP of DCS550 provides the following features:

- 16 function blocks,
- more than 20 block types,
- password protection,
- 4 different cycle times selectable,
- shift functions for function blocks,
- debug functions,
    - output forcing,
    - breakpoint,
    - single step,
    - single cycle,
- additional output write pointer parameter for each block (group 86) and
- 10 additional user constants (group 85) used as data container

How to build the program

The programmer connects a function block to other blocks through a Block Parameter Set. The sets are also used for reading values from the firmware and transferring data to the firmware. Each Block Parameter Set consists of six parameters in group 84 and a write pointer in group 86. The figure below shows the use of Block Parameter Set 1 in the firmware (parameters 84.04 to 84.09 and 86.01):

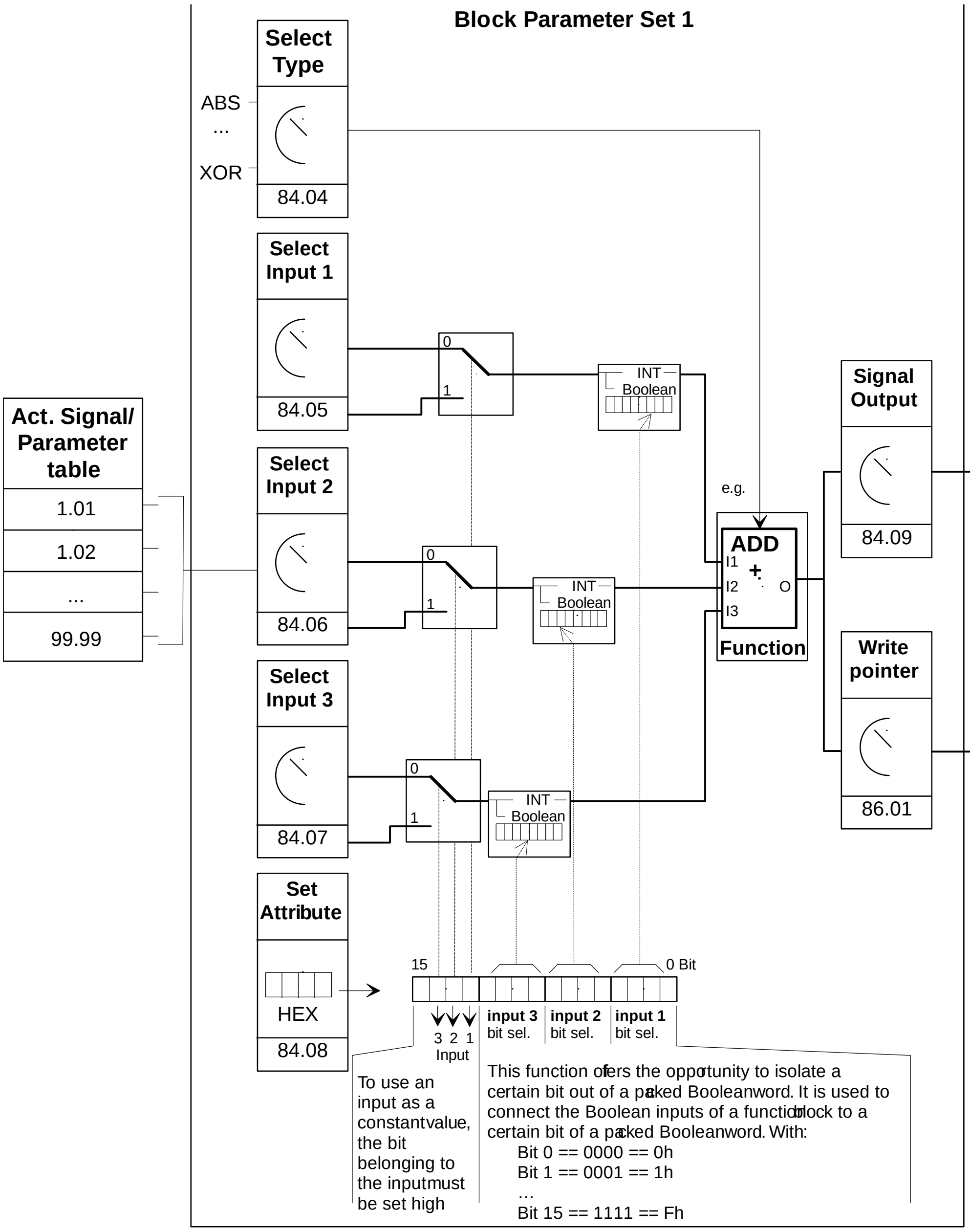
- *Block1Type (84.04)* selects the function block type.
- *Block1In1 (84.05)* selects the source of IN1. A negative value means that the source will be inverted.
- *Block1In2 (84.06)* selects the source of IN2. A negative value means that the source will be inverted.
- *Block1In3 (84.07)* selects the source of IN3. A negative value means that the source will be inverted.
- *Block1Attrib (84.08)* defines the attributes of the inputs.
- *Block1Output (84.09)* provides the value of the function block output, which can be used further for other input selections. The user cannot edit this parameter value.
- The output value is also available in write pointer *Block1Out (86.01)*. *Block1Out (86.01)* contains the destination parameter, into which the value is written.

How to connect AP with the firmware

The outputs of AP need to be connected to the firmware. For that purpose, there are two possibilities:

- The outputs, e.g. *Block1Output (84.09)*, can be selected for further functions.
- The output values are available in the write pointers, e.g. *Block1Out (86.01)*. These parameters contain the destination parameters, into which the values are written.

Block Parameter Set of block 1



SB_550_002_block-param_a.ai

Example:
Add a constant value and an external additional reference to the speed reference:
1. Set 84.04 = 2 (selection of ADD function)
2. Set 84.05 = xx.xx (selection of the speed reference for Input 1)
3. Set 84.06 = xx.xx (selection of an external ref for Input 2)
4. Set 84.07 = 1500 (constant value for Input 3)
5. Set 84.08 = 4000h (because Input 3 = constant ⇒ Bit 14=1 ⇒ 4000h)
6. Set 86.01 = xx.xx (write processed value to destination parameter for further processing)
7. 84.09: contains the processed value

How to control the execution of AP

AP executes the function blocks in numerical order according to the block number 1, …, 16. All blocks use the same time level. The user cannot change this. The user can:

- select the operation mode of AP (stop, start, editing, single cycling, single stepping),
- adjust the execution time level of AP and
- activate or de-activate blocks.

Function blocks, general rules

The use of block input 1 (BlockxIn1) is compulsory (it must be connected). Use of input 2 (BlockxIn2) and input 3 (BlockxIn3) is voluntary for the most blocks. As a rule of thumb, an unconnected input does not affect the output of the block.
The Attribute Input (BlockxAttrib) is to set with the attributes, like declaration of constant and bits, of all three inputs. DWL AP does this automatically.
The constant attribute defines a block constant, which can only be changed or modified in EDIT mode.

Block inputs

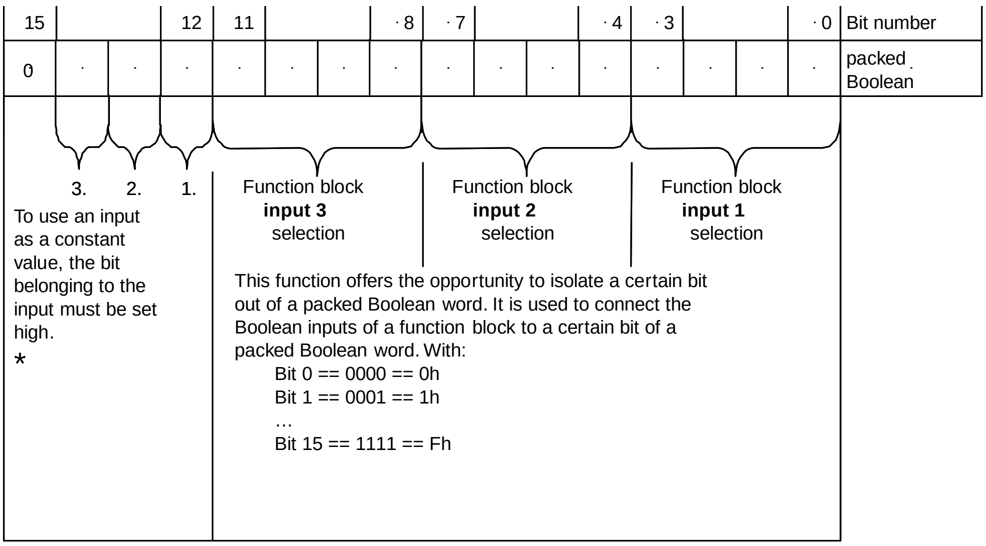
The blocks use two input formats:

- integer or
- boolean

The used format depends on the function block type. For example, the ADD block uses integer inputs and the OR block boolean inputs.
Note:
The inputs of the block are read when the execution of the block starts, not simultaneously for all blocks!

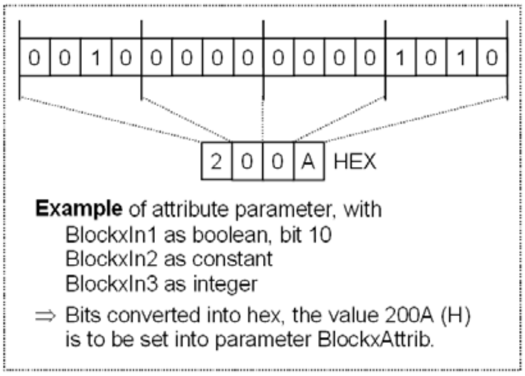
Block input attributes

Connect block inputs to the parameter of the signal source or a user constant, e.g. *Constant1 (85.01)*.
Depending on the used block type and the desired function, the attributes of all three inputs are to be set as integer, constant or as selection of a bit of a 16-bit word source.
Therefore, it is used a 16-bit word, which is defined as following:



SB_550_002_block-param_a.ai

* this type of constant defines a Block Constant. Modification is only possible in EDIT mode.
Example:



Parameter value as an integer input

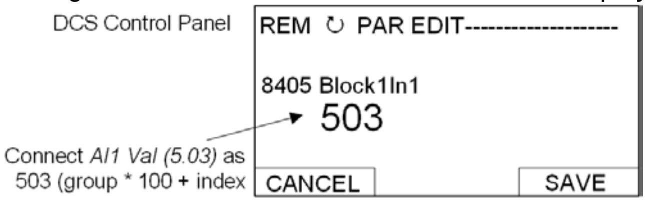
How the block handles the input

The block reads the selected value in as an integer.
Note:
The parameter selected as an input should be an integer value. The internal scaling for each parameter is available in chapter *Parameters*.

How to select the input

- Scroll to the input selection parameter of the block and switch to edit mode (Enter).
- Set the address, from which the input value is to be read, with group * 100 + index, e.g. *AccTime1 (22.01)* == 2201. A negative address (e.g. -2201) will act an inversion of the connected value.

The figure below shows the DCS Control Panel display when *Block1In1 (84.05)* is in edit mode:



Example:
AI1 is supplied with a voltage source of 5.8 V. Connect AI1 to the block as follows:

- Scroll to *Block1In1 (84.05)* and shift to edit mode (Enter). Set to 503, because the value of AI1 is shown in group 5 with index 3 - *AI1 Val (05.03)* == 05 * 100 + 3 = 503.
- The value at the input of the block is 5800, since the integer scaling of *AI1 Val (05.03)* is 1000 == 1 V see chapter *Parameters*.

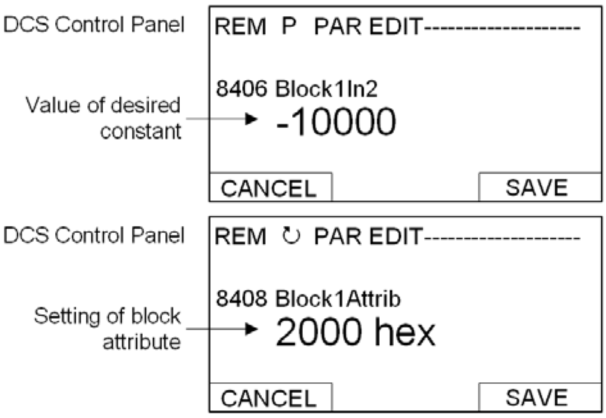
Constant as an integer input

How to set and connect the input

Option 1:

- Scroll to the input selection parameter of the block and switch to edit mode (Enter).
- Give the constant value to this input parameter (arrow keys).
- Accept with Enter.
- Scroll to attribute parameter, e.g. *Block1Attrib (84.08).*
- Set the bit for constant attribute of this input in *Block1Attrib (84.08).*
- Accept by Enter.

The constant may have a value from -32768 to 32767. It is not possible to change the constant while AP is running. The figures below shows the DCS Control Panel display when *Block1In2 (84.06)* is in edit mode and the constant field is visible:



Option 2:

– User constants 85.01 to 85.10 are reserved for AP. Use them for custom setting. Use parameters 19.01 to 19.12 in the same way, but they are not stored in the flash.
– Connect the user constant to a block as usual by the input selection parameter.

It is possible to change user constants while AP is running. They may have values from -32767 to 32767.

Parameter value as a boolean input

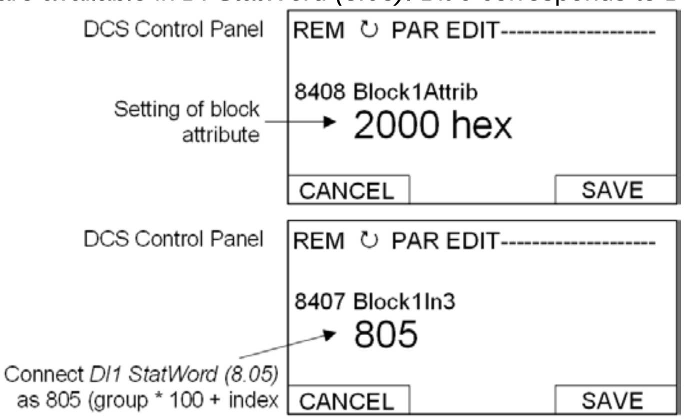
How the block handles the input

The block:

– reads the selected value as an integer,
– uses the bit defined by the bit field as the boolean input and
– interprets bit value 1 as true and 0 as false.

Example:

The figure below shows the value of *Block1In3 (84.07)* when the input is connected to DI2. All digital inputs are available in *DI StatWord (8.05)*. Bit 0 corresponds to DI1 and bit 1 to DI2.



Note:

The parameter selected as an input should have a packed boolean value (binary data word).

Constant as a boolean input

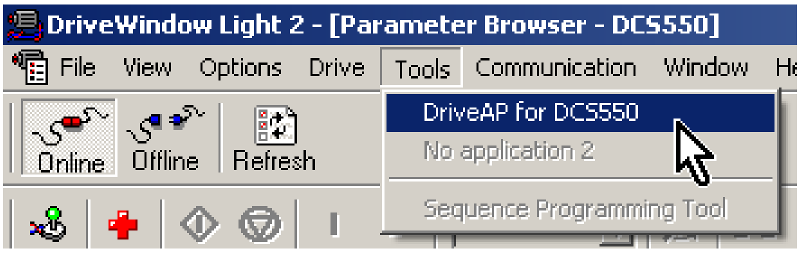
How to set and connect the input

– Scroll to the input selection parameter of the block and switch to edit mode (Enter).
– If boolean value true is needed, set the constant to 1. If boolean value false is needed, set to 0.
– Accept by Enter.
– Scroll to attribute parameter (BlockxAttrib).
– Set the bit for constant attribute of this input in BlockxAttrib parameter.
– Accept by Enter.

DWL AP

General

Another way to create applications is with DWL AP. It is a program plugged into DWL and can be opened with *Tools* and *DriveAP for DCS550*:



Important keys and buttons

Control DWL AP by means of following keys and buttons:

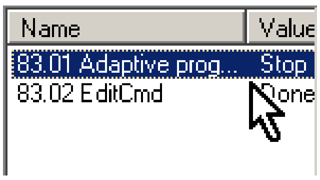
Keys and buttons	Function
Ctrl + left mouse button on a box or function block	Change / insert function blocks, connect in- and outputs in **Edit** mode
Shift + left mouse button on the red cross	View actual values in **Start** mode
Cancel	Abort the action
Help	Open the online help

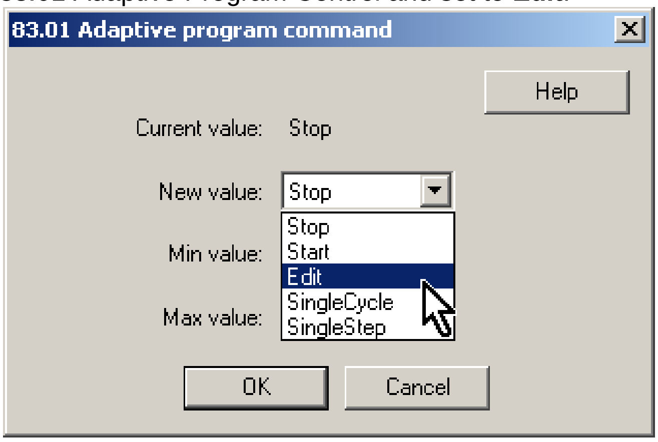
Program modes

There are 5 modes, see *AdapProgCmd (83.01)*:
- **Stop:** AP is not running and cannot be edited,
- **Start:** AP is running and cannot be edited,
- **Edit:** AP is not running and can be edited,
- Use **SingleCycle** and **SingleStep** for testing.

Change to Edit mode

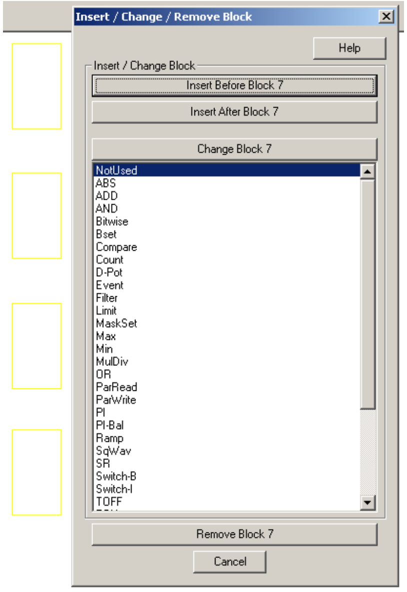
Use *Ctrl + left mouse button* on 83.01 Adaptive Program Control and set to **Edit**:





Insert function blocks

Use *Ctrl + left mouse button* on one of the yellow boxes. This opens the pop-up window *Insert / Change / Remove Block*:

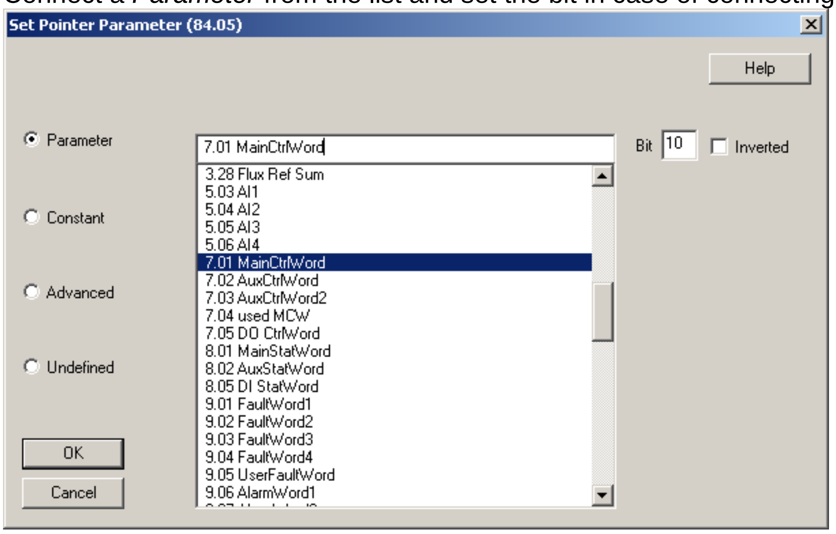


In this manner, it is possible to insert up to 16 function blocks from the list to the desktop. The button *Change Block xx* changes the selected block. The button *Insert Before Block xx* inserts the new block before the selected block. Button *Insert After Block xx* inserts the new block after the selected block:

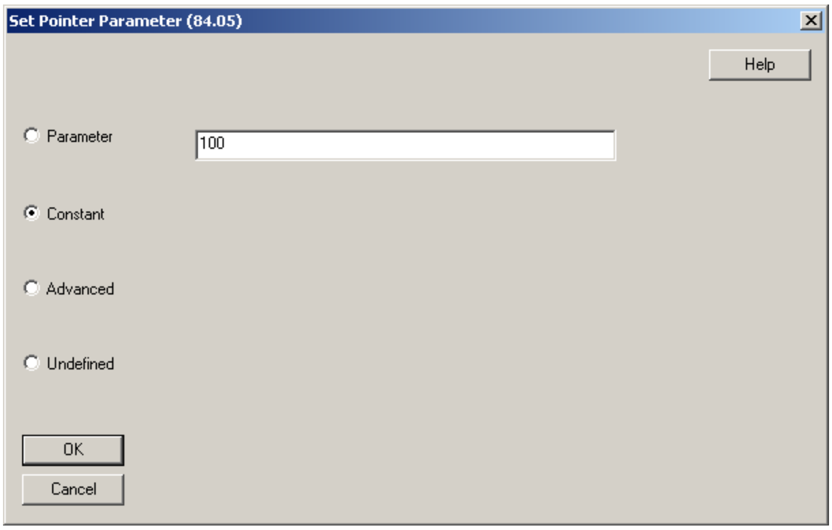
Connect function blocks

It is possible to connect function blocks to other blocks or to firmware parameters. To connect use *Ctrl + left mouse button* on the red cross at the input. This opens the pop-up window *Set Pointer Parameter*. This window provides several connection possibilities:

– Connect a *Parameter* from the list and set the bit in case of connecting a packed boolean value:

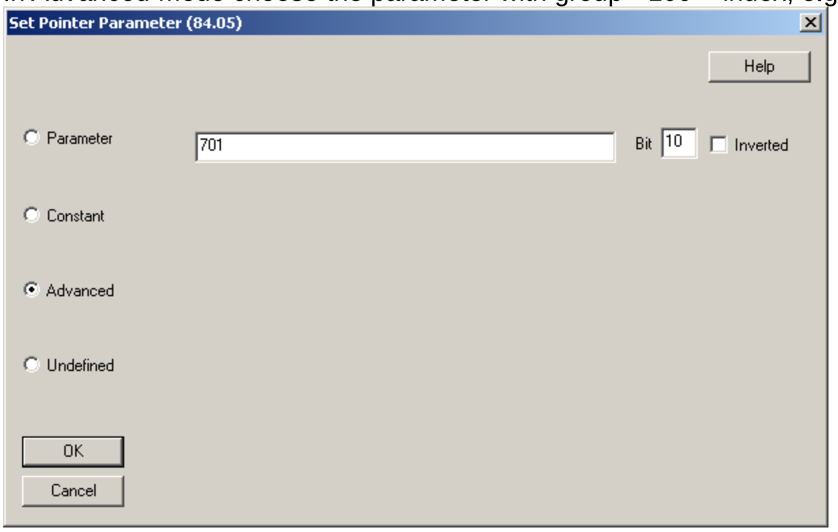


– Connect a *Constant* value to the input:

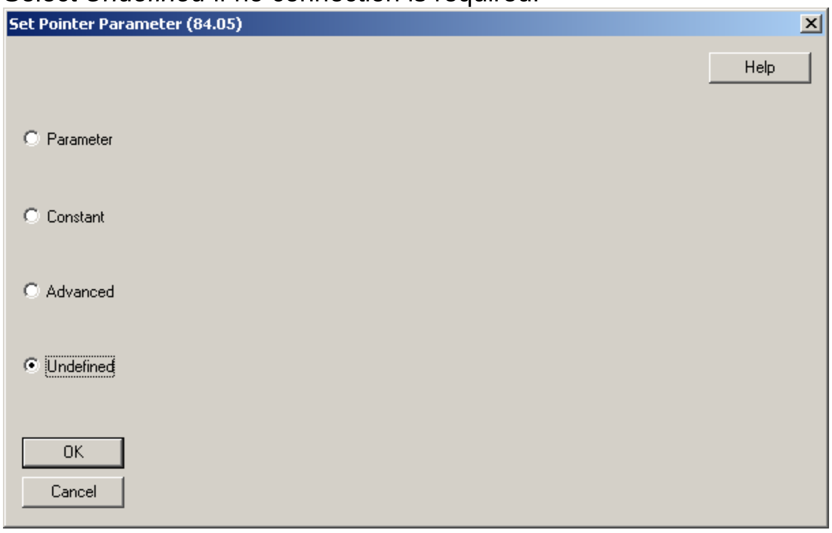


–

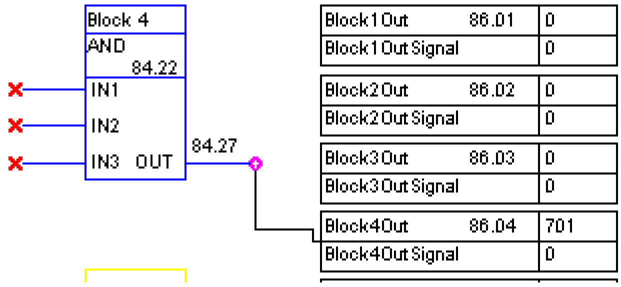
– In *Advanced* mode choose the parameter with group * 100 + index, e.g. *MainCtrlWord (7.01)* == 701:



– Select *Undefined* if no connection is required:

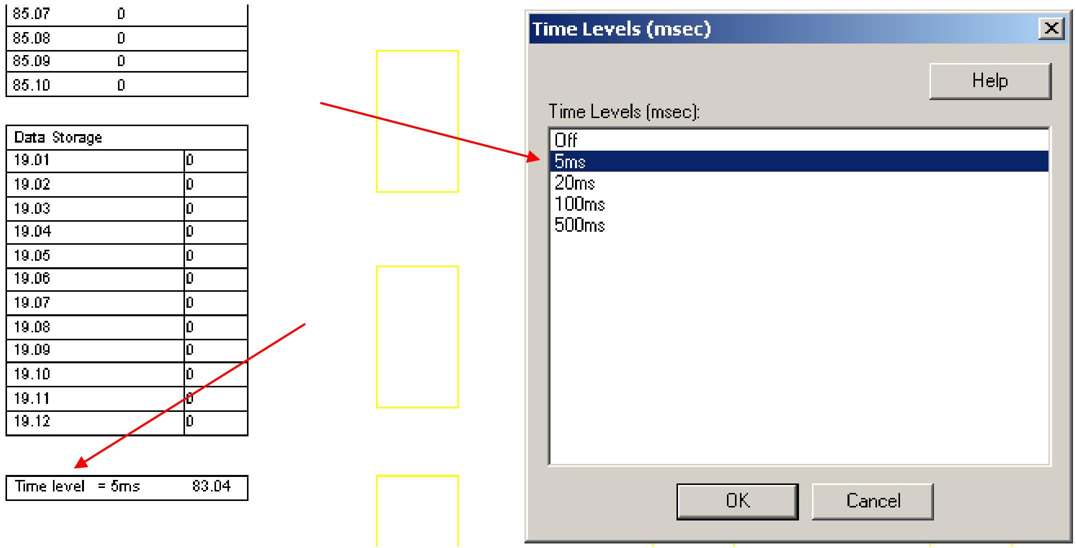


– Connections of outputs to firmware parameters can be done by means of the output pointers on the right side of the desktop:



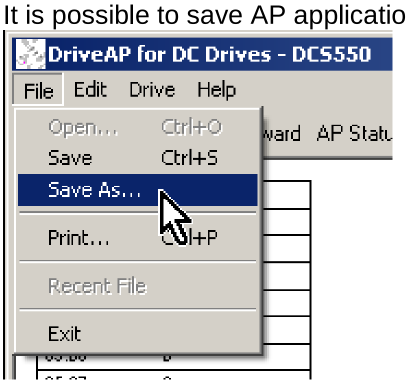
To connect an output of a function block with an input of a function block, simply select the output's parameter at the input.

Set the *Time level*



Saving AP applications

It is possible to save AP applications as *.*ap* files:



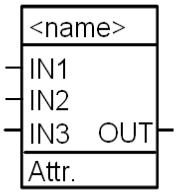
Function blocks

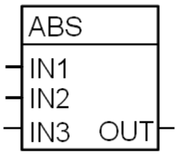
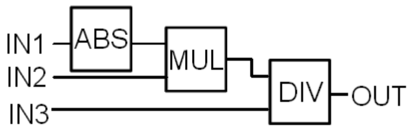
General

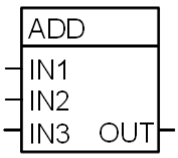
Each of the 16 function blocks has three input parameters IN1 to IN3. It is possible to connect them to the firmware, outputs of other function blocks or constants. Boolean values are interpreted like this:

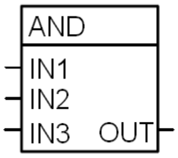
- 1 as true and
- 0 as false.

A 4th parameter is used for the attributes of the inputs. Manually set this attribute, if the functions blocks are edited with the DCS Control Panel or DWL. The attribute is set automatically when DWL AP is used. The output OUT can connected with the inputs of function blocks. To write output values into firmware parameters connect the necessary output pointer (group 86) to the desired parameter.

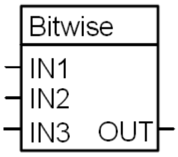
Function block	-
Illustration	

ABS	Arithmetical function
Illustration	
Operation	OUT is the absolute value of IN1 multiplied by IN2 and divided by IN3. OUT = |IN1| * IN2 / IN3 
Connections	IN1, IN2 and IN3: 16 bit integer (15 bit + sign) OUT: 16 bit integer (15 bit + sign)

ADD	Arithmetical function
Illustration	
Operation	OUT is the sum of the inputs. OUT = IN1 + IN2 + IN3
Connections	IN1, IN2 and IN3: 16 bit integer (15 bit + sign) OUT: 16 bit integer (15 bit + sign)

AND	Logical function
Illustration	
Operation	OUT is true if all connected inputs are true, otherwise OUT is false. Truth table:
Connections	IN1, IN2 and IN3: boolean OUT: 16 bit integer (packed boolean)

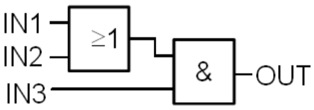
IN1	**IN2**	**IN3**	**OUT** (binary)	**OUT (**value on display)
0	0	0	false (all bits 0)	0
0	0	1	false (all bits 0)	0
0	1	0	false (all bits 0)	0
0	1	1	false (all bits 0)	0
1	0	0	false (all bits 0)	0
1	0	1	false (all bits 0)	0
1	1	0	false (all bits 0)	0
1	1	1	true (all bits 1)	-1

Bitwise	Logical function
Illustration	
Operation	The block compares the bits of three 16 bit word inputs and forms the output bits as follows: OUT = (IN1 **OR** IN2) **AND** IN3. Example: Single bit:

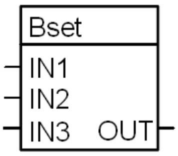
IN1	**IN2**	**IN3**	**OUT**
0	0	0	0
0	1	0	0
1	0	0	0
1	1	0	0
0	0	1	0
0	1	1	1
1	0	1	1
1	1	1	1

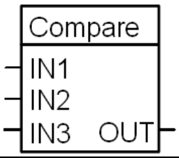
Example:
Whole words:

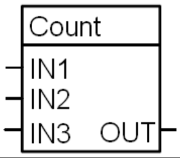
Input [word]		15															0		Output [word]
20518	=> IN1	0	**1**	0	**1**	0	0	0	0	0	0	**1**	0	0	**1**	**1**	0		
4896	=> IN2	0	0	0	**1**	0	0	**1**	**1**	0	0	0	0	0	0	0	0		
17972	=> IN3	0	**1**	0	0	0	**1**	**1**	0	0	0	**1**	**1**	0	**1**	0	0		
		0	**1**	0	0	0	0	**1**	0	0	0	**1**	0	0	**1**	0	0	=> OUT	16932

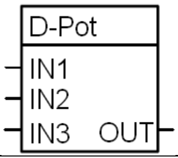


Connections	IN1, IN2 and IN3: 16 bit integer (packed boolean) OUT: 16 bit integer (packed boolean)

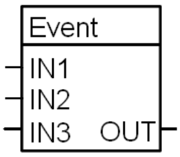
Bset	Logical function
Illustration	
Operation	With Bset, it is possible to set the value of a certain bit in a word. Connect the word to be processed at IN1. Define the number of the bit to be changed at IN2. Define the desired bit value at IN3 (e.g. 1 for true and 0 for false). OUT is the result of the operation. Connect OUT to the word to be processed.
Connections	IN1: 16-bit integer (packed boolean); word to be processed e.g. *MainCtrlWord (7.01)* IN2: 0 … 15; bit to be changed IN3: boolean; desired bit value OUT: 16-bit integer (packed boolean), result

Compare	Arithmetical function
Illustration	
Operation	Only bits 0, 1 and 2 of OUT are valid: – If IN1 > IN2 ⇒ OUT = 001 (OUT bit 0 is true), – if IN1 = IN2 ⇒ OUT = 010 (OUT bit 1 is true) and – if IN1 < IN2 ⇒ OUT = 100 (OUT bit 2 is true).
Connections	IN1 and IN2: 16 bit integer (15 bit + sign) IN3: not used OUT: 16 bit integer (15 bit + sign)

Count	Arithmetical function
Illustration	
Operation	The counter counts the rising edges of IN1. Rising edges at IN2 reset the counter. IN3 limits OUT. IN3 > 0: OUT increases to the set limit. IN3 < 0: OUT increases up to the absolute maximum value (32768). When the maximum value is reached, the output will be set to 0 and the counter starts counting from zero.
Connections	IN1: boolean; counts rising edges IN2: boolean; reset input (high active) IN3: 16 bit integer (15 bit + sign); limit OUT: 16 bit integer (15 bit + sign); shows the counted value

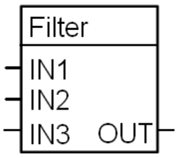
D-Pot	Arithmetical function
Illustration	

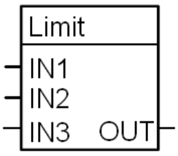
Operation	IN1 increases OUT. IN2 decreases OUT. The absolute value of IN3 is the ramp time in ms, which is needed to increase OUT from 0 to 32767. With positive IN3, the output range is limited from 0 to 32767. With negative IN3, the output range is between -32767 and +32767. If both IN1 and IN2 are true, IN2 overwrites IN1.
Connections	IN1: boolean; ramp up IN2: boolean; ramp down IN3: 16 bit integer (15 bit + sign); ramp time scale OUT: 16 bit integer (15 bit + sign); ramp value

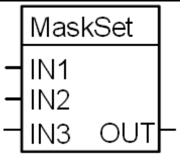
Event	Display function
Illustration	
Operation	IN1 triggers the event. IN2 selects the fault, alarm or notice. IN3 is the event delay in ms. The name of the event can be changed by means of *String1 (85.11)* to *String5 (85.15)* using DriveWindow.

IN1	Activation input (boolean)			
	0 -> 1	trigger event		
	0	block deactivated		
IN2	Selection of the message to be displayed. 15 different messages exist. Select them by using the shown numbers as constants. The default message is shown in the brackets. Change it by means of the string parameters.			
	Alarms	Faults	Notices	Associated string parameter
	301 (APAlarm1)	601 (APFault1)	801 (…)	*String1 (85.11)*
	302 (APAlarm2)	602 (APFault2)	802 (…)	*String2 (85.12)*
	303 (APAlarm3)	603 (APFault3)	803 (…)	*String3 (85.13)*
	304 (APAlarm4)	604 (APFault4)	804 (…)	*String4 (85.14)*
	305 (APAlarm5)	605 (APFault5)	805 (…)	*String5 (85.15)*
IN3	delay in ms			

Connections	IN1: boolean IN2: Choice of alarm, fault or notice. The shown numbers must be connected as constants. IN3: 16 bit integer OUT: not used

Filter	Arithmetical function
Illustration	
Operation	OUT is the filtered value of IN1. IN2 is the filter time in ms. OUT = IN1 $(1 - e^{-t/IN2})$ **Note**: The internal calculation uses 32 bits accuracy to avoid offset errors.
Connections	IN1: 16 bit integer (15 bits + sign); value to be filtered IN2: 16 bit integer (15 bits + sign); filter time in ms IN3: not used OUT: 16 bit integer (15 bits + sign); filtered value

Limit	Logical function
Illustration	
Operation	The value, connected to IN1 will be limited with IN2 as upper limit and IN3 as lower limit. OUT is the limited input value. OUT stays 0, if IN3 is >= IN2.
Connections	IN1: 16 bit integer (15 bits + sign); value to be limited IN2: 16 bit integer (15 bits + sign); upper limit IN3: 16 bit integer (15 bits + sign); lower limit OUT: 16 bit integer (15 bits + sign); limited value

MaskSet	Logical function
Illustration	
Operation	The block sets or resets the bits in IN1 and IN2. Example: Single bit

IN3 = set

IN1	**IN2**	**IN3**	**OUT**
0	0	true	0
1	0	true	**1**
1	1	true	**1**
0	1	true	**1**

IN3 = reset

IN1	**IN2**	**IN3**	**OUT**
0	0	false	0
1	0	false	**1**
1	1	false	0
0	1	false	0

Example:

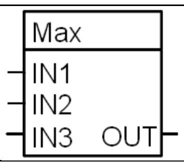
Whole word with IN3 = set

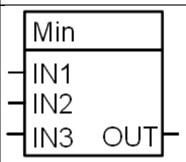
Input [word]		bits 15															0		Output [word]
26214	=> IN1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0		
-13108	=> IN2	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0		
		1	1	1	0	1	1	1	0	1	1	1	0	1	1	1	0	=> OUT	-4370

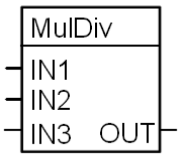
Whole word with IN3 = reset

Input [word]		bits 15															0		Output [word]
26214	=> IN1	0	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0		
-13108	=> IN2	1	1	0	0	1	1	0	0	1	1	0	0	1	1	0	0		
		0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0	=> OUT	8738

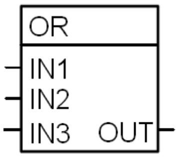
Connections	IN1: 16 bit integer (packed boolean); word input IN2: 16 bit integer (packed boolean); word input IN3: boolean; set / reset IN2 in IN1 OUT: 16 bit integer (packed boolean); result

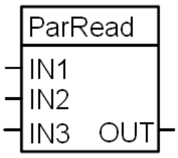
Max	Arithmetical function
Illustration	
Operation	OUT is the highest input value. OUT = MAX (IN1, IN2, IN3) **Note:** An open input is ignored.
Connections	IN1, IN2 and IN3: 16 bit integer (15 bits + sign) OUT: 16 bit integer (15 bits + sign)

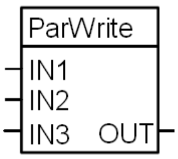
Min	Arithmetical function
Illustration	
Operation	OUT is the lowest input value. OUT = MIN (IN1, IN2, IN3) **Note:** An open input is ignored.
Connections	IN1, IN2 and IN3: 16 bit integer (15 bits + sign) OUT: 16 bit integer (15 bits + sign)

MulDiv	Arithmetical function
Illustration	
Operation	OUT is the IN1 multiplied with IN2 and divided by IN3. OUT = (IN1 * IN2) / IN3
Connections	IN1, IN2 and IN3: 16 bit integer (15 bits + sign) OUT: 16 bit integer (15 bits + sign)

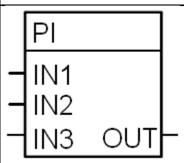
NotUsed	-
Illustration	
Operation	Block is not enabled and not working, default
Connections	-

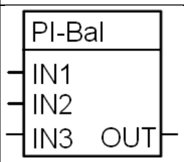
<table>
<tr><td>OR</td><td>Logical function</td></tr>
<tr><td>Illustration</td><td>
</td></tr>
<tr><td>Operation</td><td>OUT is true if any of the connected inputs is true, otherwise OUT is false. Truth table:
<table>
<tr><td>IN1</td><td>IN2</td><td>IN3</td><td>OUT (binary)</td><td>OUT (value on display)</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>false (all bits 0)</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>true (all bits 1)</td><td>-1</td></tr>
</table></td></tr>
<tr><td>Connections</td><td>IN1, IN2 and IN3: boolean value
OUT: 16 bit integer (packed boolean)</td></tr>
</table>

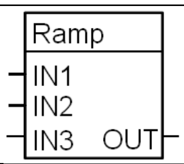
ParRead	Parameter function
Illustration	
Operation	OUT shows the value of a parameter. IN1 defines the group. IN2 defines the index. Example: Reading *AccTime1 (22.01)*: IN1 = 22 and IN2 = 01
Connections	IN1: 16 bit integer (15 bits + sign); group IN2: 16 bit integer (15 bits + sign); index IN3: not used OUT: 16 bit integer (15 bits + sign); parameter value

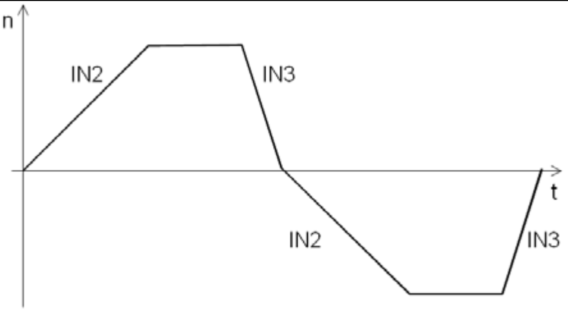
ParWrite	Parameter function
Illustration	
Operation	Value of IN1 is written into a parameter defined by IN2 as group * 100 + index, e.g. *MainCtrlWord (7.01)* == 701. The block is activated with a change of IN1. IN3 determines if the value is saved in the flash. **Attention:** **Cyclic saving of values in the flash will damage it! Do not set IN3 constantly to true!** OUT gives the error code, if parameter access is denied. Examples: Set *AccTime1 (22.01)* = 150, not saving into flash: IN1 = 150, desired value, this must be a defined as a constant IN2 = 2201, this must be a defined as a constant IN3 = false Set *SpeedRef (23.01)* = by means of AI1, not saving into flash:

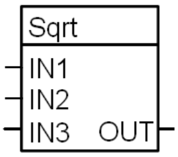
	IN1 = 517, desired signal, this must be defined as a parameter IN2 = 2201, this must be a defined as a constant IN3 = false
Connections	IN1: 16 bit integer (15 bits + sign); desired value IN2: 16 bit integer (15 bits + sign); group * 100 + index IN3: boolean; true = save in flash, false = don’t save in flash OUT: 16 bit integer (packed boolean); error code

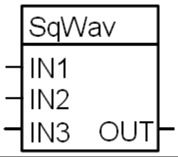
PI	Arithmetical controller
Illustration	
Operation	OUT is IN1 multiplied by (IN2 / 100) plus integrated IN1 multiplied by (IN3 / 100). $O = I1 * I2/100 + (I3/100) * \int I1$ **Note**: The internal calculation uses 32 bits accuracy to avoid offset errors.
Connections	IN1: 16 bit integer (15 bit + sign); error (e.g. speed error) IN2: 16 bit integer (15 bit + sign); p-part (30 == 0.3, 100 == 1) IN3: 16 bit integer (15 bit + sign); i-part (250 == 2.5, 5,000 == 50) OUT: 16 bit integer (15 bits + sign); the range is limited from -20,000 to +20,000

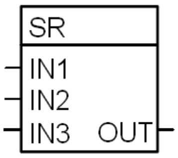
PI-Bal	Arithmetical function
Illustration	
Operation	The PI-Bal block initializes the PI block. The PI-Bal block must follow directly behind the PI block. It can only be used together with the PI block. When IN1 is true, the PI-Bal block writes the value of IN2 directly into OUT of the PI block. When IN1 is false, the PI-Bal block releases OUT of the PI block. Normal operation continues starting with the set output value - bumpless transition.
Connections	IN1: boolean; true = balance PI block, false = no balancing IN2: 16 bit integer (15 bits + sign); balance value IN3: not used OUT: affects PI block

Ramp	Arithmetical function
Illustration	
Operation	IN1 is the input. IN2 and IN3 are the times. OUT increases or decreases until the input value is reached.

	
Connections	IN1: 16 bit integer (15 bit + sign); ramp input IN2: 16 bit integer (15 bit + sign); ramp up time in ms (related to 20,000), acceleration IN3: 16 bit integer (15 bit + sign); ramp down time in ms, (related to 20,000), deceleration OUT: 16 bit integer (15 bit + sign); ramp output

Sqrt	Arithmetical function
Illustration	
Operation	OUT is the square root of IN1 * IN2. With IN3 = true IN1 and IN2 are read as absolute values: $OUT = \sqrt{\|IN1\| * \|IN2\|}$ With IN3 = false OUT is set to zero if IN1 * IN2 is negative: $OUT = \sqrt{IN1 * IN2}; \quad if\ IN1 * IN2 \geq 0$ $OUT = 0 \quad\quad\quad\quad if\ IN1 * IN2 < 0$
Connections	IN1: 16 bit integer (15 bits + sign) IN2: 16 bit integer (15 bits + sign) IN3: boolean OUT: 16 bit integer

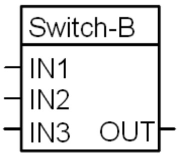
SqWav	Arithmetical function
Illustration	
Operation	OUT alternates between the value of IN3 and zero (0), if the block is enabled with IN1 = true. The period is set with IN2 in ms.
Connections	IN1: boolean; true = enable SqWav, false = disable SqWav IN2: 16 bit integer; cycle time in ms IN3: 16 bit integer (15 bits + sign); height of square wave OUT: 16 bit integer (15 bits + sign); square wave

SR	Logical function
Illustration	

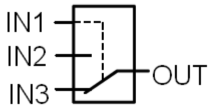
Operation	Set/reset block. IN1 (S) sets OUT. IN2 (R) or IN3 (R) reset OUT. If IN1, IN2 and IN3 are false, the current value remains at OUT. The SR is reset dominant. Truth table:

IN1	**IN2**	**IN3**	**OUT** (binary)	**OUT** (value on display)
0	0	0	no change	no change
0	0	1	false (all bits 0)	0
0	1	0	false (all bits 0)	0
0	1	1	false (all bits 0)	0
1	0	0	true (all bits 1)	-1
1	0	1	false (all bits 0)	0
1	1	0	false (all bits 0)	0
1	1	1	false (all bits 0)	0

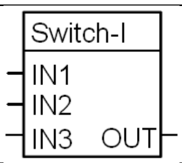
Connections	IN1, IN2 and IN3: boolean OUT: 16 bit integer (15 bits + sign)

Switch-B	Logical function
Illustration	
Operation	OUT is equal to IN2 if IN1 is true. OUT is equal to IN3 if IN1 is false.

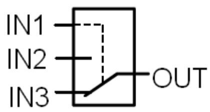
IN1	**OUT**
0	= IN3
1	= IN2



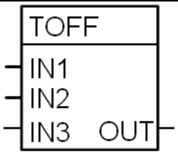
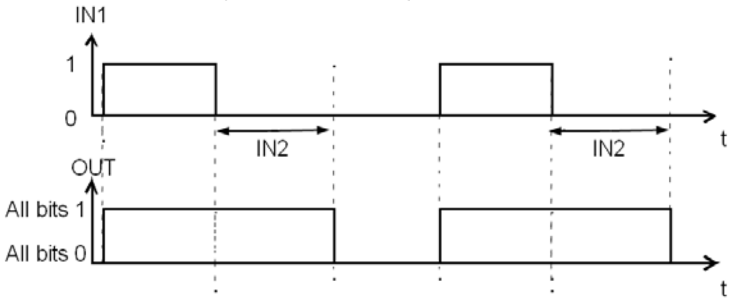
Connections	IN1: boolean IN2 and IN3: boolean OUT: 16 bit integer (packed boolean)

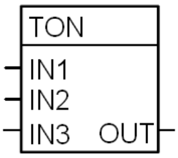
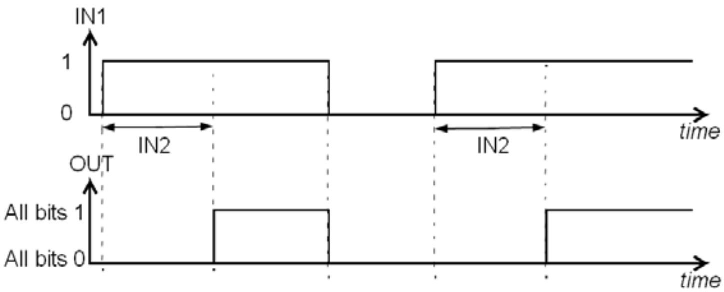
Switch-I	Arithmetical function
Illustration	
Operation	OUT is equal to IN2 if IN1 is true. OUT is equal to IN3 if IN1 is false.

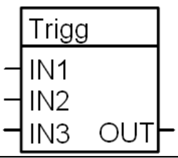
IN1	**OUT**
0	= IN3
1	= IN2

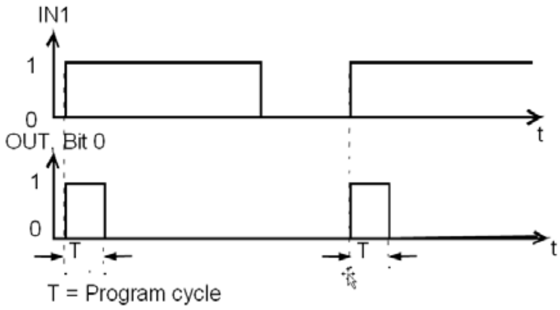


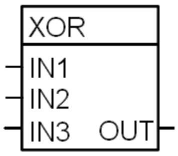
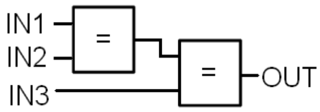
Connections	IN1: boolean IN2 and IN3: 16 bit integer (15 bits + sign) OUT: 16 bit integer (15 bits + sign)

TOFF	Logical function
Illustration	
Operation	OUT is true when IN1 is true. OUT is false when IN1 has been false for a time >= IN2. OUT remains true as long as IN1 is true plus the time defined in IN2. 
Connections	IN1: boolean, input IN2: 16 bit integer; delay time in ms (IN3 = false) or s (IN3 = true) IN3: boolean; determines unit of time OUT: 16 bit integer (packed boolean); result with values on display: True = -1, false = 0

TON	Logical function
Illustration	
Operation	OUT is true when IN1 has been true for a time >= IN2. 
Connections	IN1: boolean, input IN2: 16 bit integer; delay time in ms (IN3 = false) or s (IN3 = true) IN3: boolean; determines unit of time OUT: 16 bit integer (packed boolean); result with values on display: True = -1, false = 0

Trigg	Logical function
Illustration	
Operation	The rising edge of IN1 sets OUT bit 0 for one program cycle. The rising edge of IN2 sets OUT bit 1 for one program cycle.

<table>
<tr><td></td><td>The rising edge of IN3 sets OUT bit 2 for one program cycle.

</td></tr>
<tr><td>Connections</td><td>IN1, IN2 and IN3: boolean
OUT: 16 bit integer value (packed boolean)</td></tr>
</table>

<table>
<tr><td>XOR</td><td>Logical function</td></tr>
<tr><td>Illustration</td><td>
</td></tr>
<tr><td>Operation</td><td>OUT is true if one input is true, otherwise OUT is false. Truth table:
<table>
<tr><th>IN1</th><th>IN2</th><th>IN3</th><th>OUT (binary)</th><th>OUT (value on display)</th></tr>
<tr><td>0</td><td>0</td><td>0</td><td>false (all bits 0)</td><td>0</td></tr>
<tr><td>0</td><td>0</td><td>1</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>0</td><td>1</td><td>0</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>0</td><td>1</td><td>1</td><td>false (all bits 0)</td><td>0</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>true (all bits 1)</td><td>-1</td></tr>
<tr><td>1</td><td>0</td><td>1</td><td>false (all bits 0)</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>false (all bits 0)</td><td>0</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>true (all bits 1)</td><td>-1</td></tr>
</table>

</td></tr>
<tr><td>Connections</td><td>IN1, IN2 and IN3: boolean
OUT: 16 bit integer (packed boolean)</td></tr>
</table>

Winder

Chapter overview

This chapter describes the winder and instructs how to use the winder blocks of the DCS550. All needed parameters can be found in the groups 61 to 66.

Winder basics

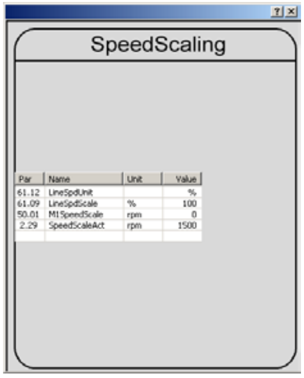
Activate the winder by means of following steps:

1. choose a winder macro with *WinderMacro (61.01)*,
2. activate the winder blocks by setting *WiProgCmd (66.01)* = **Start**,
3. the outputs of the winder blocks are activated and send references to the speed control chain using *WriteToSpdChain (61.02).*

Winder blocks

The winder blocks are sorted according to their default execution sequence.

Speed reference scaling



The Line speed reference is converted to motor speed reference by the diameter calculation. That means:

– 100 % line speed reference - see *LineSpdScale (61.09)* - correspond to 100 % motor speed - see *SpeedScaleAct (2.29)* - at minimum diameter - see *DiameterMin (62.05)*.

M1SpeedScale (50.01) is set according to maximum needed motor speed and not to rated motor speed.

Commissioning hints:

For proper calculation following rules apply:

– Maximum motor speed (n_{max}) is reached with minimum diameter (D_{min}) at maximum line speed (v_{max}).

– The scaling of line speed and motor speed is needed, because the winder works with relative values (percent):

1. Set *LineSpdUnit (61.12)* to the desired unit.
2. Set *LineSpdScale (61.09)* to the maximum line speed. Thus, the maximum line speed corresponds to 20,000 internal line speed units.
3. Set *LineSpdPosLim (61.10)* to maximum line speed.
4. Calculate the maximum needed motor speed:

$$n_{\max} = \frac{60s}{\min} * \frac{v_{\max}}{\pi * D_{\min}} * i$$

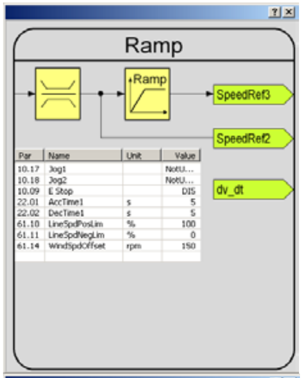
n_{max} [rpm]	maximum needed motor speed
v_{max} [m/s]	maximum line speed
D_{min} [m]	minimum diameter
i	gear ratio (motor / load)

5. Set *M1SpeedScale (50.01)* = n_{max}, even if the motor data allow a wider speed range. Thus, the maximum motor speed corresponds to 20,000 internal speed units.
6. Set *M1SpeedMax (20.02)* = n_{max} + max. *WindSpdOffset (61.14)* in rpm, even if the motor data allow a wider speed range.
7. Set *M1SpeedMin (20.01)* = - [n_{max} + max. *WindSpdOffset (61.14)* in rpm], even if the motor data allow a wider speed range.

– *WindSpdOffset (61.14)* is used to saturate the speed controller and thus only active when *WinderMacro (61.01)* = **IndirectTens** or **DirectTens**.

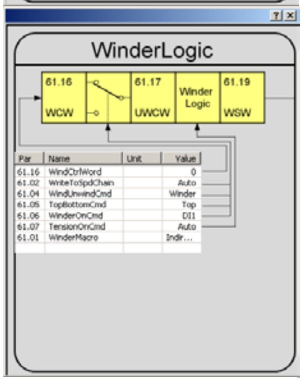
Ramp

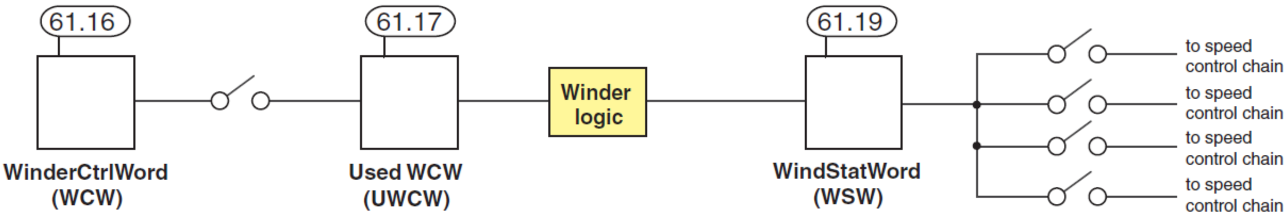
The standard rpm ramp is re-configured for the winder control to become a line speed ramp.

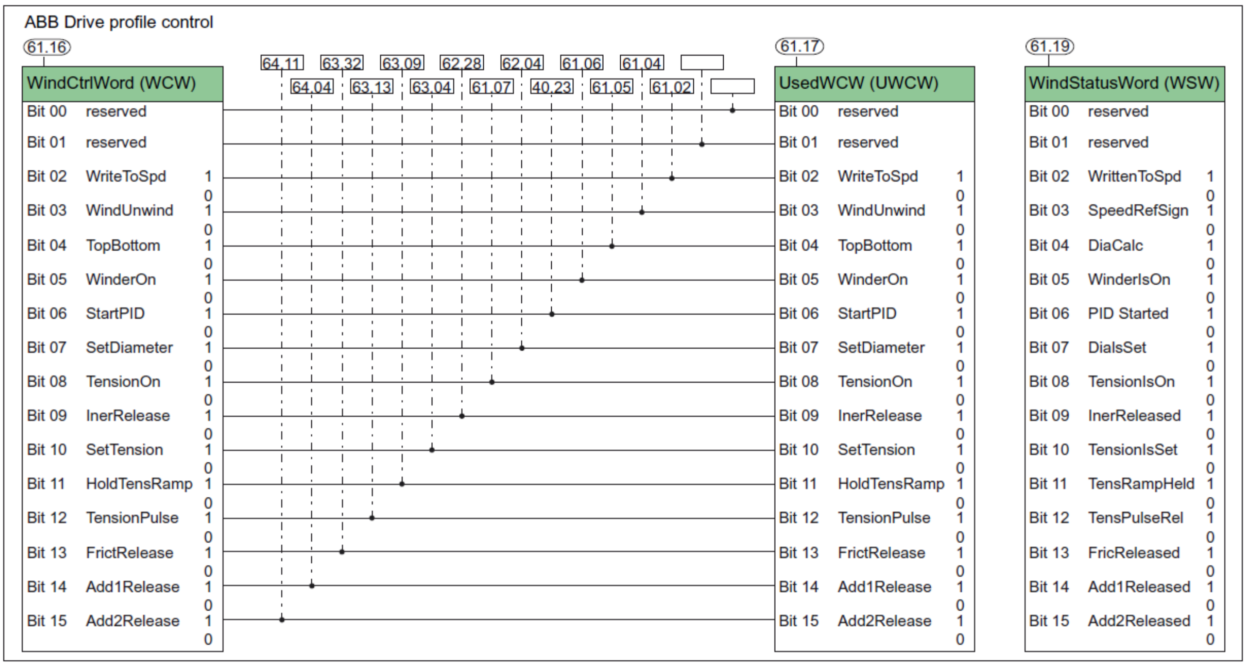


WinderLogic (winder logic)

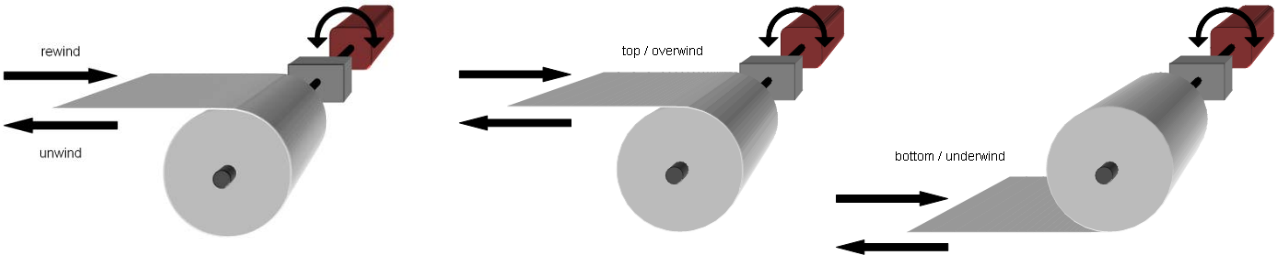
The winder logic is reacting to the used winder control word and thus generating the control signals for all other winder blocks. *UsedWCW (61.17)* contains all winder depending commands. It is possible to write on the commands from the overriding control system via the winder control word, see *WindCtrlWord (61.16)*, or via parameters. The normal command source should be automatic. Details see chapter [Appendix B: Firmware structure diagrams](#).







Choose the winder configuration by means of *WindUnwindCmd (61.04)* and *TopBottomCmd (61.05)*:



Commissioning Hints:

TensionOn [WCW Bit 8]:
Aktivates the independant torque limits of the speed controller [20.24 / 20.25] while switching from speed control (TensionOn == FALSE) to torque control (TensionOn == TRUE && speed controller output limited). See also signal CtrlMode [1.25]. If TensionOnCmd [61.07] = Auto then new independant torque limits [20.24 / 20.25] are aktivated with the appropriate sign or deaktivated, respectively if this is necessary (E-Stop etc. with Direct / Indirect Tension Control).
WinderOn [WCW Bit 5] and WriteToSpeedChain [WCW Bit 2]:
See following table for Auto Modes:

<u>Set- / Reset condition for the Modes "Auto" as "Control Command" Parameter Set Up</u>

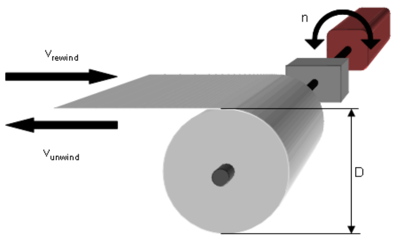
Control Command = Auto	Par. Nr.	Bit Nr.	Set Condition 1		Set Condition 2	Reset Condition
PID ReleaseCmd	40,23	WCW B6	Macro == DirectTens OR Dancer	**AND**	WinderOn == TRUE	**Set Condition** == FALSE (UNTRUE)
WriteToSpdChain	61,02	WCW B2	RdyRef == TRUE	**AND**	(Off3N + JogN) == TRUE	**Set Condition** == FALSE (UNTRUE)
WinderOnCmd	61,06	WCW B5	RdyRef == TRUE	---	---	**Set Condition** == FALSE (UNTRUE)
TensionOnCmd	61,07	WCW B8	Macro == Indirect OR DirectTens	**AND**	WinderOn == TRUE	WriteToSpd == FALSE
InerReleaseCmd	62,28	WCW B9	Macro != Velocity	**AND**	WinderOn == TRUE	**Set Condition** == FALSE (UNTRUE)
TensSetCmd	63,04	WCW B10	WinderOn == FALSE	**OR**	SpeedRef3 == 0 for > 20sec	**Set Condition** == FALSE (UNTRUE)
TensPulseCmd	63,13	WCW B12	Rising Edge from WinderOn	---	---	**Set Condition** == FALSE (UNTRUE)
FrictReleaseCmd	63,32	WCW B13	Macro != Velocity	**AND**	WinderOn == TRUE	**Set Condition** == FALSE (UNTRUE)
Add1ReleaseCmd	64,04	WCW B14	Macro == Indirect OR DirectTens	---	---	**Set Condition** == FALSE (UNTRUE)
Add2ReleaseCmd	64,11	WCW B15	Macro != Velocity	---	---	**Set Condition** == FALSE (UNTRUE)

DiameterAct (diameter calculation)

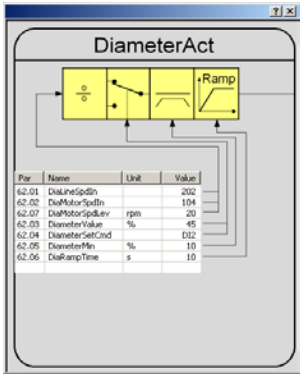
In most cases, the actual diameter must be calculated from the line speed - see *SpeedRef3 (2.02)* - and measured motor speed - see *MotSpeed (1.04)*, because a diameter sensor does not exist. This is done by means of *DiaLineSpdIn (62.01)* and *DiaMotorSpdIn (62.02)*:

$$D = \frac{60s}{\min} * \frac{v}{\pi * n} * i$$

D [m]	diameter
v [m/s]	line speed
n [rpm]	motor speed
i	gear ratio (motor / load)



Use the diameter calculation to calculate the actual diameter from the line speed and the actual motor speed. It is possible to force or preset the diameter of the coil. To avoid steps the calculated diameter is passed through a ramp generator. The minimum diameter is used as the lower limit.

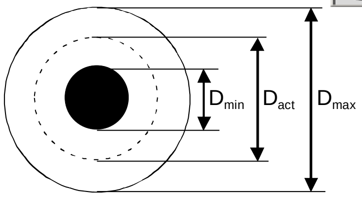


Commissioning hints:

– The diameter calculation works with relative diameters in percent of the maximum allowed diameter, so the physical values must be converted.

$$DiameterMin\ (62.05) = \frac{D_{\min}}{D_{\max}} * 100\ \%$$

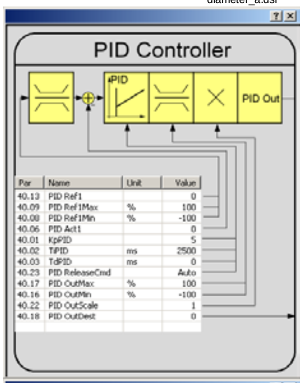
$$DiameterValue\ (62.03) = \frac{D_{act}}{D_{\max}} * 100\ \%$$



D_{max} = max. diameter [m]
D_{max} = 100 % == 10,000
D_{act} = actual diameter [m]
D_{min} = core diameter [m]

diameter_a.dsf

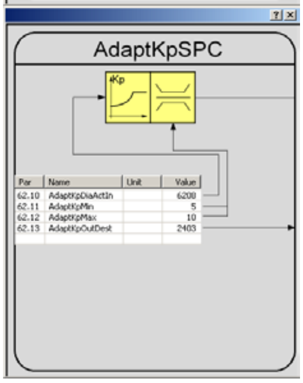
PID Control (PID controller)



The PID controller is used as tension controller for direct tension control. The actual tension position is connected to analog input 3 via *PID Act1 (40.01)*. The tension reference comes from the output of winder block TensionRef and is connected to *PIDRef1 (40.13)*. The PID controller output *PID Out (3.09)* is connected to winder block TensToTorq.

In case of dancer control, the PID controller is configured as position controller. The actual dancer position is connected to analog input 3 via *PID Act1 (40.01)*. The dancer reference is to be written into *Data1 (19.01)* and connected to *PIDRef1 (40.13)*. The PID controller output *PID Out (3.09)* is connected to *SpeedCorr (23.04).*

AdaptSPC Kp (p-part adaption)

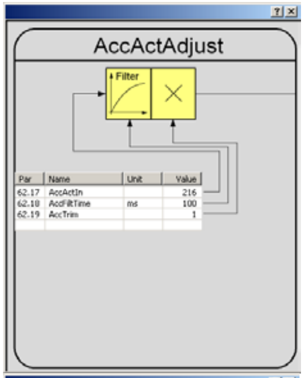


Use the p-part adaption to adapt the speed controller p-part according to actual diameter of the coil. It is variable between minimum diameter and maximum diameter. Use the smallest p-part with minimum diameter. With maximum diameter, send the largest p-part to the speed controller.

Commissioning hints:

– Active, if WriteToSpeedChain [WCW Bit 2] == TRUE.
  The falling edge from WCW Bit 2 sets the output to *AdaptKpMin (62.11)*.
– *AdaptKpMin (62.11)* has to be determined by manual tuning of the speed controller. Only the spool is on the winder and *set WinderMacro (61.01) =* **NotUsed**.
– *AdaptKpMax (62.12)* has to be determined by manual tuning of the speed controller. The largest coil (maximum diameter and maximum width) has to be on the winder and *set WinderMacro (61.01)* = **NotUsed**.

AccActAdjust (acceleration adjustment)

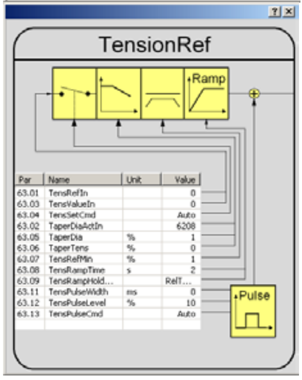


The actual acceleration adjustment filters e.g. the *dv_dt (2.16)* output of the ramp with a PT1-filter. This filter is always active. The output has to be 100 % with maximum acceleration using the shortest ramp time. To achieve this goal a trimming input is available.

Commissioning hints:

– *AccTrim (62.19)* has to be determined with acceleration trials. *AccActAdjust (62.21)* has to be 100 % with maximum acceleration using the shortest ramp time.
– Autotuning is possible with *WinderTuning (61.21)* = **InerMechComp**.

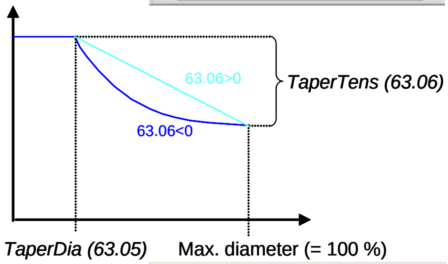
TensionRef (tension reference)



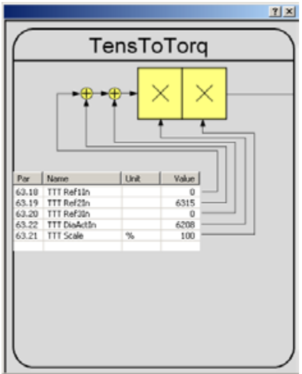
The tension reference block contains four functions.

1. By means of the tension reference, it is possible to force or preset the tension set point.
2. Tension reference is limited by a minimum and then passed through a ramp with hold function to prevent tension steps.
3. If the friction is very high, a start tension pulse is helpful to break away the machine. The width, amplitude and release of the start impulse can be set via parameters.
4. Use the taper function to reduce the tension depending on an increasing diameter. The reduction of the tension begins with diameters over the taper diameter and ends at the maximum diameter. Following formula is valid at the maximum diameter:

$$Tension_{Output} = Tension_{Input} - TaperTens\,(63.06)$$



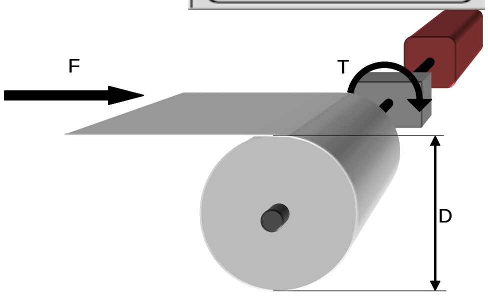
TensToTorq (tension to torque)



For winders it is important that the tension fit to the web. With too low tension, the web does not wind correctly. With too high tension, the web might rip. This is the worst case, because the winder will accelerate, if there is no web break monitoring. The tension is a force measured in Newton [N]. When the tension is multiplied by the radius of the coil, the necessary torque for the selected tension can be calculated. Most torque is needed with maximum diameter at lowest motor speed. This winder block features 3 tension inputs and 1 torque output.

$$T = \frac{F * D}{2 * i}$$

T [Nm]	torque
F [N]	tension
D [m]	diameter
i	gear ratio (motor / load)



Commissioning hints:

For proper calculation following rules apply:

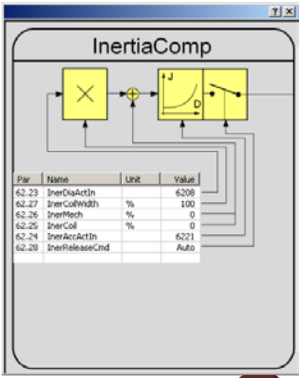
– Maximum torque (T_{max}) is reached at maximum diameter (D_{max}), means with a diameter of 100 %.
– The motor torque - see *MotTorqNom (4.23)* - must be larger than maximum torque (T_{max}).
– The torque scaling is needed, because the tension to torque function works with relative values.

$$TTTScale\ (63.21) = \frac{T_{\max}}{T_{Mot}} * 100\ \%$$

$$T_{\max} = \frac{F_{\max} * D_{\max}}{2 * i}$$

T_{max} [Nm]	maximum needed torque
T_{Mot} [Nm]	nominal motor torque, see *MotTorqNom (4.23)*
F_{max} [N]	maximum tension
D_{max} [m]	maximum diameter
i	gear ratio (motor / load)

InertiaComp (inertia / acceleration compensation)

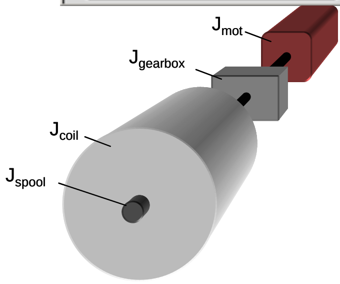


During the winding operation, the motor must only generate the torque for the needed tension. For acceleration, an additional torque is necessary. The acceleration torque (inertia compensation) depends on the inertia of the complete winder (motor, gearbox, spool and coil). The inertia of motor, gearbox and spool is constant. The inertia of the coil is a function of the diameter. In case the diameter is small, the inertia is small. With increasing diameter, the inertia increases. That means more acceleration torque (inertia compensation) is needed. The problem in many applications is that the inertia is not available. Thus, it has to be determined by means of acceleration tests.

$$T_{acc} = J * \frac{d\omega}{dt}$$

J_{mot}, $J_{gearbox}$, J_{spool} = J_{mech} = const.
J_{coil} ~ D^4

T_{acc} [Nm]	torque needed for acceleration
J [kg m^2]	inertia of the complete winder
dÉ / dt [1/s^2]	angular acceleration



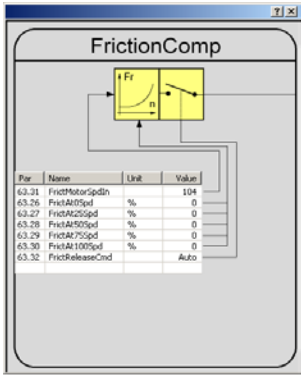
Commissioning hints:

– *InerMech (62.26)* has to be determined by means of acceleration trials with maximum acceleration using the shortest ramp time. Only the spool is on the winder. The result is available in *MotTorqFilt (1.07)* during the acceleration. Autotuning is possible with *WinderTuning (61.21)* = **InerMechComp**.
– *InerCoil (62.25)* has to be determined by means of acceleration trials with maximum acceleration using the shortest ramp time. The largest coil (maximum diameter and maximum width) has to be on the winder. The result is available in *MotTorqFilt (1.07)* during the acceleration. Autotuning is possible with *WinderTuning (61.21)* = **InerCoilComp**.
– Do not forget to subtract the average friction losses from the measured values - see *FrictAt0Spd (63.26)* to *FrictAt100Spd (63.30)*.
– The width calculation works with relative width in percent of the maximum width, so the physical values must be converted.

$$InerCoilWidth\ (62.27) = \frac{Width_{act}}{Width_{\max}} * 100\ \%$$

– *InerReleaseCmd (62.28)* releases *InertiaComp (62.30)*. The output is forced to zero if the switch is open.

FrictionComp (friction / loss compensation)

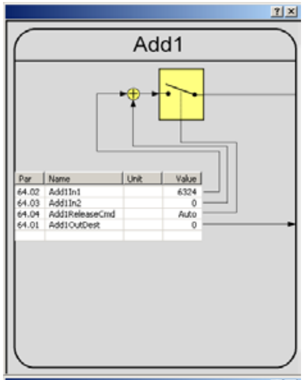


During the winding operation, the motor must only generate the torque for the needed tension. The mechanics of the winder generate losses from friction. These losses depend on the motor speed and must be measured in speed trials. They are non-linear and must be saved in a characteristic curve with supporting points. The friction compensation calculates the torque needed to compensate the losses of the winder mechanics depending on the speed.

Commissioning hints:

- *FrictAt0Spd (63.26)* is the static friction. It can be determined by slowly increasing the torque reference until the motor starts turning. For this trial all mechanics have to be connected.
- *FrictAt25Spd (63.27)* has to be determined by means of constant speed trials at 25 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictAt50Spd (63.28)* has to be determined by means of constant speed trials at 50 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictAt75Spd (63.29)* has to be determined by means of constant speed trials at 75 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictAt100Spd (63.30)* has to be determined by means of constant speed trials at 100 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictReleaseCmd (63.32)* releases *FrictionComp (63.34)*. The output is forced to zero if the switch is open.
- Autotuning is possible with *WinderTuning (61.21)* = **FrictionComp**.

Add1 (adder 1)

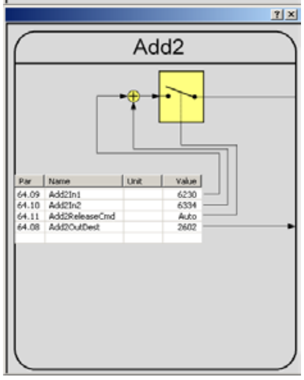


Adder 1 provides two torque inputs. The sum of *Add1 (64.06)* can be written to other parameters by means of *Add1OutDest (64.01).* Usually adder 1 is used to write on the torque limit of the speed controller.

Commissioning hints:

- *Add1ReleaseCmd (64.04)* releases *Add1 (64.06)*. The output is forced to zero if the switch is open.

Add2 (adder 2)



Adder 2 provides two torque inputs. The sum of *Add2 (64.13)* can be written to other parameters by means of *Add2OutDest (64.08).* Usually adder 2 is used to write on the load compensation for inertia and friction compensation.

Commissioning hints:

- *Add2ReleaseCmd (64.11)* releases *Add2 (64.13)*. The output is forced to zero if the switch is open.

Hint: Winder Blocks, which write to Standard Firmware Parameters:
(Condition: WriteToSpeedChain [WSW Bit 2] == TRUE):

Block:	**Parameter:**	**Comment:**
DiameterAct:	*SpeedRefScale* (23.16)	Sign +/- via SpeedRefSign (WCW Bit 3)
PID Ctrl:	*SpeedCorr* (23.04)	Dancer Mode && 40.18 = 23.04 (Default for Dancer Macro)
AdaptSPC Kp:	*KpS* (24.03)	62.13 = 24.03 (Default)
Add1:	*IndepTorqMaxSPC* (20.24) / (20.25)	Tension Mode && 64.01 = 20.24 (Default for Tension Macros)
Add2:	*LoadComp* (26.02) ! = Speed Mode && 64.08 = 26.02 (Default)	

SpeedCorr (23.04) is written directly from the Winder Logic in Tension Mode:
TensionOn (WSW Bit 8) == TRUE -> 23.04 = 61.14 [Sign +/- via TopBottom (WCW Bit 4)]
TensionOn (WSW Bit 8) == FALSE -> 23.04 = 0 (falling edge)

Winder macros

Winder macros are pre-programmed parameter sets. During start-up, configure the winder easily without changing individual parameters. The functions of inputs, outputs and control structure are macro dependent. Any winder macro can be adapted by changing individual parameters without restrictions. Select a winder macro by means of *WinderMacro (61.01)*. The following tables and diagrams show the structure of the macros.

NotUsed

Winder is blocked, default setting. Following parameters are set when using *WinderMacro (61.01)* = **NotUsed**:

Parameter name	NotUsed	Factory (default)
TorqMaxSPC (20.07)	325 %	325 %
TorqMinSPC (20.08)	-325 %	-325 %
IndepTorqMaxSPC (20.24)	325 %	325 %
IndepTorqMinSPC (20.25)	-325 %	-325 %
SpeedCorr (23.04)	0 rpm	0 rpm
SpeedRefScale (23.16)	100 %	100 %
TorqSel (26.01)	**Speed**	**Speed**
LoadComp (26.02)	0 %	0 %
PID Act1 (40.06)	0	0
PID Ref1 (40.13)	0	0
PID OutMin (40.16)	-100 %	-100 %
PID OutMax (40.17)	100 %	100 %
PID OutDest (40.18)	0	0
PID ReleaseCmd (40.23)	**NotUsed**	**Auto**
AdaptKpOutDest (62.13)	0	0
Add1OutDest (64.01)	0	0
Add2OutDest (64.08)	0	0

Velocity control

Velocity control calculates the coil diameters and motor speed references. By means of the diameter, it is possible to adapt the speed controller to all coil diameters. The tension is not controlled. Following parameters are set when using *WinderMacro (61.01)* = **VelocityCtrl**:

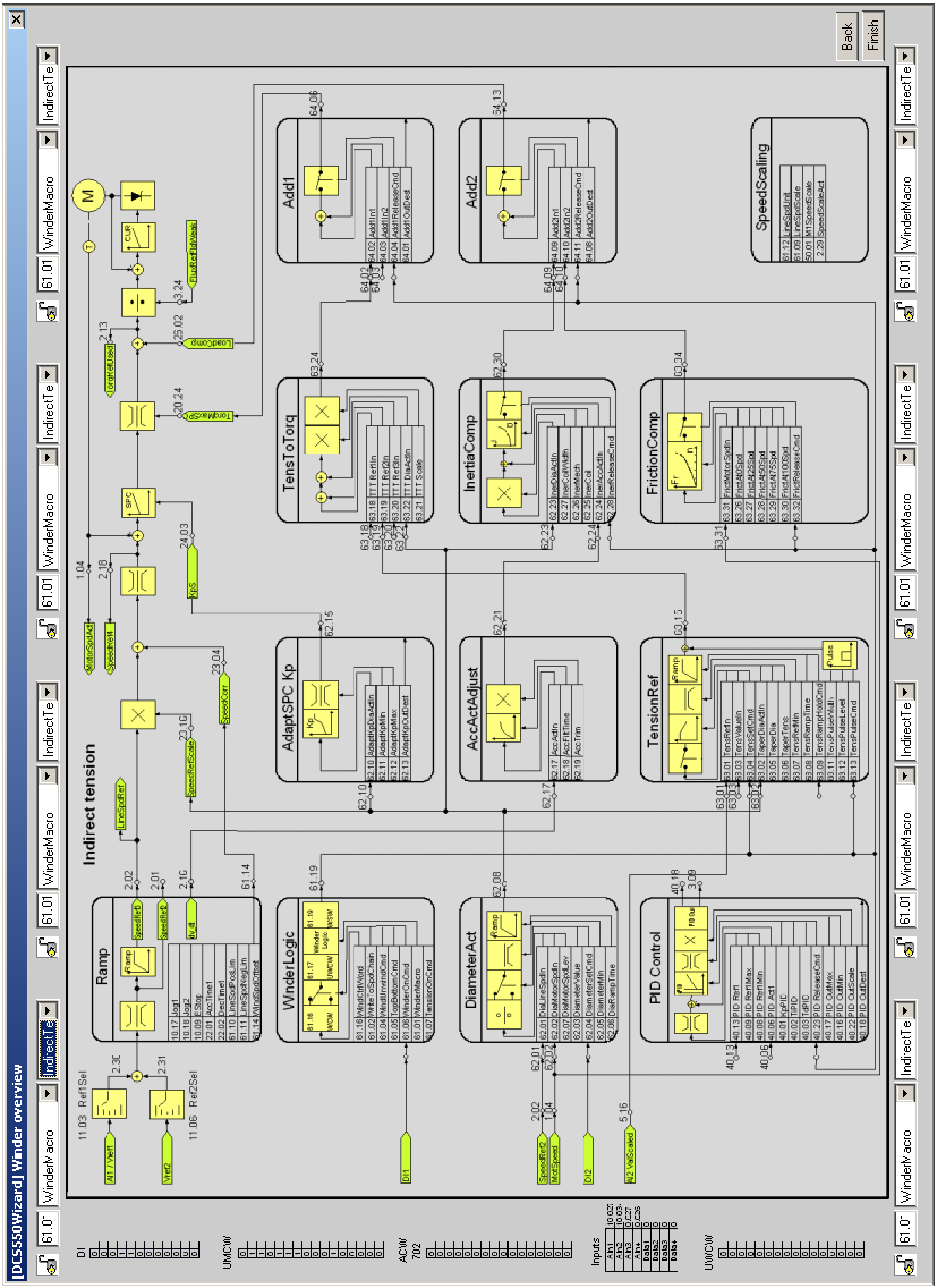
Parameter name	VelocityCtrl	Factory (default)
Ref1Sel (11.03)	**AI1**	**SpeedRef2301**
TorqMaxSPC (20.07)	325 %	325 %
TorqMinSPC (20.08)	-325 %	-325 %
IndepTorqMaxSPC (20.24)	325 %	325 %
IndepTorqMinSPC (20.25)	-325 %	-325 %
SpeedCorr (23.04)	0 rpm	0 rpm
SpeedRefScale (23.16)	100 %	100 %
TorqSel (26.01)	**Speed**	**Speed**
TorqMuxMode (26.04)	**TorqSel2601**	**TorqSel2601**
LoadComp (26.02)	0 %	0 %
KpPID (40.01)	5	5
TiPID (40.02)	2500	2500
PID Act1 (40.06)	0	0
PID Ref1 (40.13)	0	0
PID OutMin (40.16)	-100 %	-100 %
PID OutMax (40.17)	100 %	100 %
PID OutDest (40.18)	0	0
PID ReleaseCmd (40.23)	**Auto**	**Auto**
WriteToSpdChain (61.02)	**Auto**	**Auto**
WindUnwindCmd (61.04)	**WindCtrlWord**	**WindCtrlWord**
TopBottomCmd (61.05)	**WindCtrlWord**	**WindCtrlWord**
WinderOnCmd (61.06)	**DI1**	**Auto**
TensionOnCmd (61.07)	**Auto**	**Auto**
WindSpdOffset (61.14)	0	0
DiaLineSpdIn (62.01)	202 = *SpeedRef2 (2.02)*	202 = *SpeedRef2 (2.02)*
DiaMotorSpdIn (62.02)	104 = *MotSpeed (1.04)*	104 = *MotSpeed (1.04)*
DiameterSetCmd (62.04)	**DI2**	**NotUsed**
AdaptKpDiaActIn (62.10)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
AdaptKpOutDest (62.13)	2403 = *KpS (24.03)*	0
AccActIn (62.17)	216 = *dv_dt (2.16)*	216 = *dv_dt (2.16)*
InerDiaActIn (62.23)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
InerAccActIn (62.24)	6221 = *AccActAdjust (62.21)*	6221 = *AccActAdjust (62.21)*
InerReleaseCmd (62.28)	**Auto**	**Auto**
TensRefIn (63.01)	0	0
TaperDiaActIn (63.02)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
TensValueIn (63.03)	0	0
TensSetCmd (63.04)	**Auto**	**Auto**
TensRampHoldCmd (63.09)	**RelTensRamp**	**RelTensRamp**
TensPulseCmd (63.13)	**Auto**	**Auto**
TTT Ref1In (63.18)	0	0
TTT Ref2In (63.19)	6315 = *TensionRef (63.15)*	6315 = *TensionRef (63.15)*
TTT Ref3In (63.20)	0	0
TTT DiaActIn (63.22)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
FrictMotorSpdIn (63.31)	0	104 = *MotSpeed (1.04)*
FrictReleaseCmd (63.32)	**Auto**	**Auto**
Add1OutDest (64.01)	0	0
Add1In1 (64.02)	6324 = *TensToTorq (63.24)*	6324 = *TensToTorq (63.24)*
Add1In2 (64.03)	0	0
Add1ReleaseCmd (64.04)	**Auto**	**Auto**
Add2OutDest (64.08)	0	0
Add2In1 (64.09)	6230 = *InertiaComp (62.30)*	6230 = *InertiaComp (62.30)*
Add2In2 (64.10)	6334 = *FrictionComp (63.34)*	6334 = *FrictionComp (63.34)*
Add2ReleaseCmd (64.11)	**Auto**	**Auto**


[DCS550Wizard] Winder overview
Velocity control
Ramp
WinderLogic
DiameterAct
PID Control
AdaptSPC Kp
AccActAdjust
TensionRef
TensToTorq
InertiaComp
FrictionComp
Add1
Add2
SpeedScaling
Back
Finish

Indirect tension control

Indirect tension control is an open loop control, since the actual tension is not measured. The tension is controlled via diameter and pre-set charts for inertia and friction. The speed controller stays active, but is saturated. This structure provides a very robust control behavior because no physical tension measurement is required. Following parameters are set when using *WinderMacro (61.01)* = **IndirectTens**:

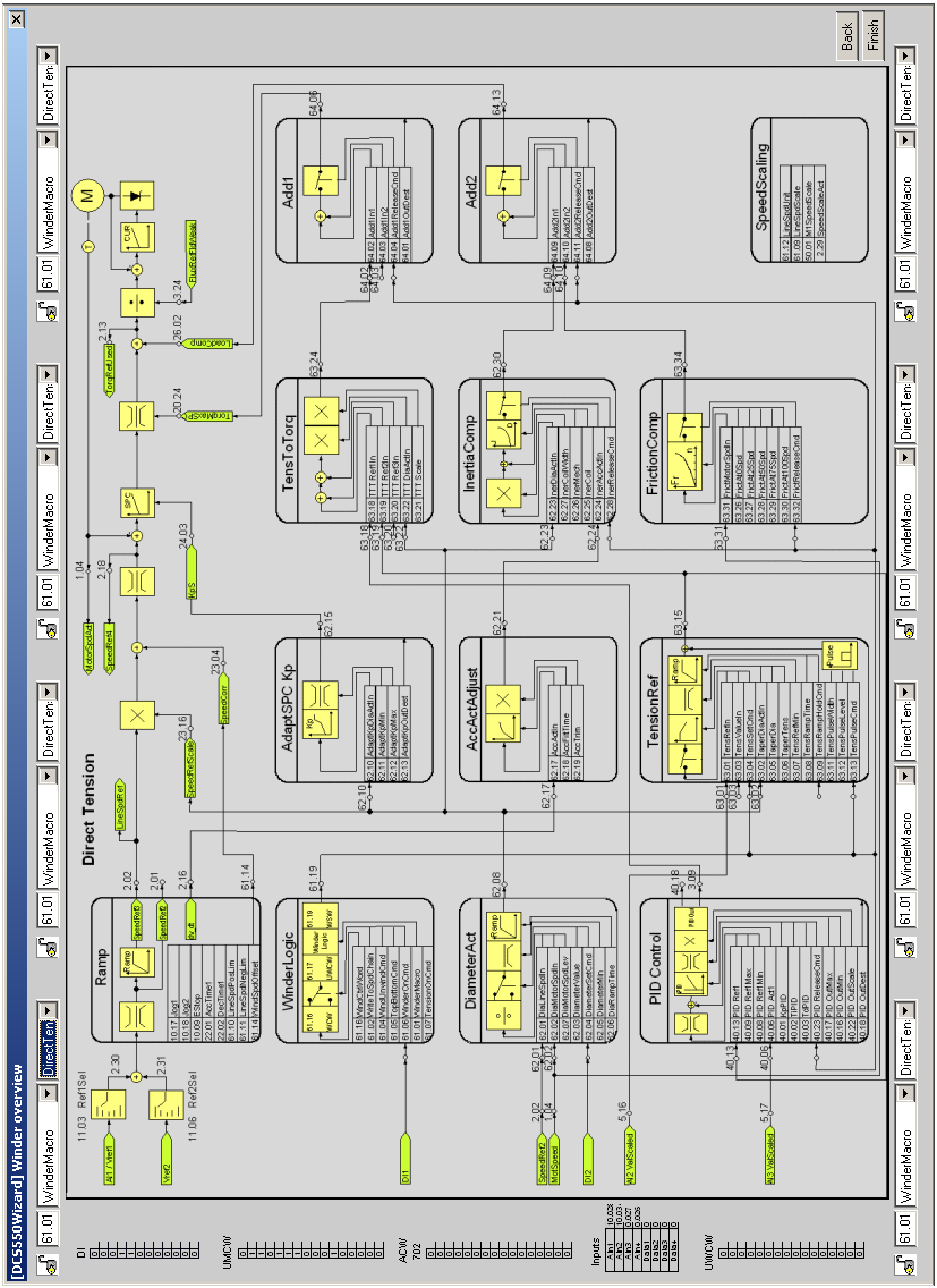
Parameter name	IndirectTens	Factory (default)
Ref1Sel (11.03)	**AI1**	**SpeedRef2301**
TorqMaxSPC (20.07)	120 %	325 %
TorqMinSPC (20.08)	-120 %	-325 %
IndepTorqMaxSPC (20.24)	325 %	325 %
IndepTorqMinSPC (20.25)	-10 %	-325 %
SpeedCorr (23.04)	0 rpm	0 rpm
SpeedRefScale (23.16)	100 %	100 %
TorqSel (26.01)	**Speed**	**Speed**
TorqMuxMode (26.04)	**TorqSel2601**	**TorqSel2601**
LoadComp (26.02)	0 %	0 %
KpPID (40.01)	5	5
TiPID (40.02)	2500	2500
PID Act1 (40.06)	0	0
PID Ref1 (40.13)	0	0
PID OutMin (40.16)	-100 %	-100 %
PID OutMax (40.17)	100 %	100 %
PID OutDest (40.18)	0	0
PID ReleaseCmd (40.23)	**Auto**	**Auto**
WriteToSpdChain (61.02)	**Auto**	**Auto**
WindUnwindCmd (61.04)	**WindCtrlWord**	**WindCtrlWord**
TopBottomCmd (61.05)	**WindCtrlWord**	**WindCtrlWord**
WinderOnCmd (61.06)	**DI1**	**Auto**
TensionOnCmd (61.07)	**Auto**	**Auto**
WindSpdOffset (61.14)	150 rpm, connected to *SpeedCorr (23.04)*	0
DiaLineSpdIn (62.01)	202 = *SpeedRef2 (2.02)*	202 = *SpeedRef2 (2.02)*
DiaMotorSpdIn (62.02)	104 = *MotSpeed (1.04)*	104 = *MotSpeed (1.04)*
DiameterSetCmd (62.04)	**DI2**	**NotUsed**
AdaptKpDiaActIn (62.10)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
AdaptKpOutDest (62.13)	2403 = *KpS (24.03)*	0
AccActIn (62.17)	216 = *dv_dt (2.16)*	216 = *dv_dt (2.16)*
InerDiaActIn (62.23)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
InerAccActIn (62.24)	6221 = *AccActAdjust (62.21)*	6221 = *AccActAdjust (62.21)*
InerReleaseCmd (62.28)	**Auto**	**Auto**
TensRefIn (63.01)	516 = *AI2 ValScaled (5.16)*	0
TaperDiaActIn (63.02)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
TensValueIn (63.03)	0	0
TensSetCmd (63.04)	**Auto**	**Auto**
TensRampHoldCmd (63.09)	**RelTensRamp**	**RelTensRamp**
TensPulseCmd (63.13)	**Auto**	**Auto**
TTT Ref1In (63.18)	0	0
TTT Ref2In (63.19)	6315 = *TensionRef (63.15)*	6315 = *TensionRef (63.15)*
TTT Ref3In (63.20)	0	0
TTT DiaActIn (63.22)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
FrictMotorSpdIn (63.31)	104 = *MotSpeed (1.04)*	104 = *MotSpeed (1.04)*
FrictReleaseCmd (63.32)	**Auto**	**Auto**
Add1OutDest (64.01)	2024 =*IndepTorqMaxSPC (20.24)*	0
Add1In1 (64.02)	6324 = *TensToTorq (63.24)*	6324 = *TensToTorq (63.24)*
Add1In2 (64.03)	0	0
Add1ReleaseCmd (64.04)	**Auto**	**Auto**
Add2OutDest (64.08)	2602 = *LoadComp (26.02)*	0
Add2In1 (64.09)	6230 = *InertiaComp (62.30)*	6230 = *InertiaComp (62.30)*
Add2In2 (64.10)	6334 = *FrictionComp (63.34)*	6334 = *FrictionComp (63.34)*
Add2ReleaseCmd (64.11)	**Auto**	**Auto**


[DCS550Wizard] Winder overview
Indirect tension
Ramp
WinderLogic
DiameterAct
PID Control
AdaptSPC Kp
AccActAdjust
TensionRef
TensToTorq
InertiaComp
FrictionComp
Add1
Add2
SpeedScaling
Back
Finish

Direct tension control

Direct tension control (load cell control) is a closed loop control for the tension. The actual tension is measured by means of a load cell and fed into the drive via analog input (AI3) and PID controller in group 40. The speed controller stays active, but is saturated. Following parameters are set when using *WinderMacro (61.01)* = **DirectTens**:

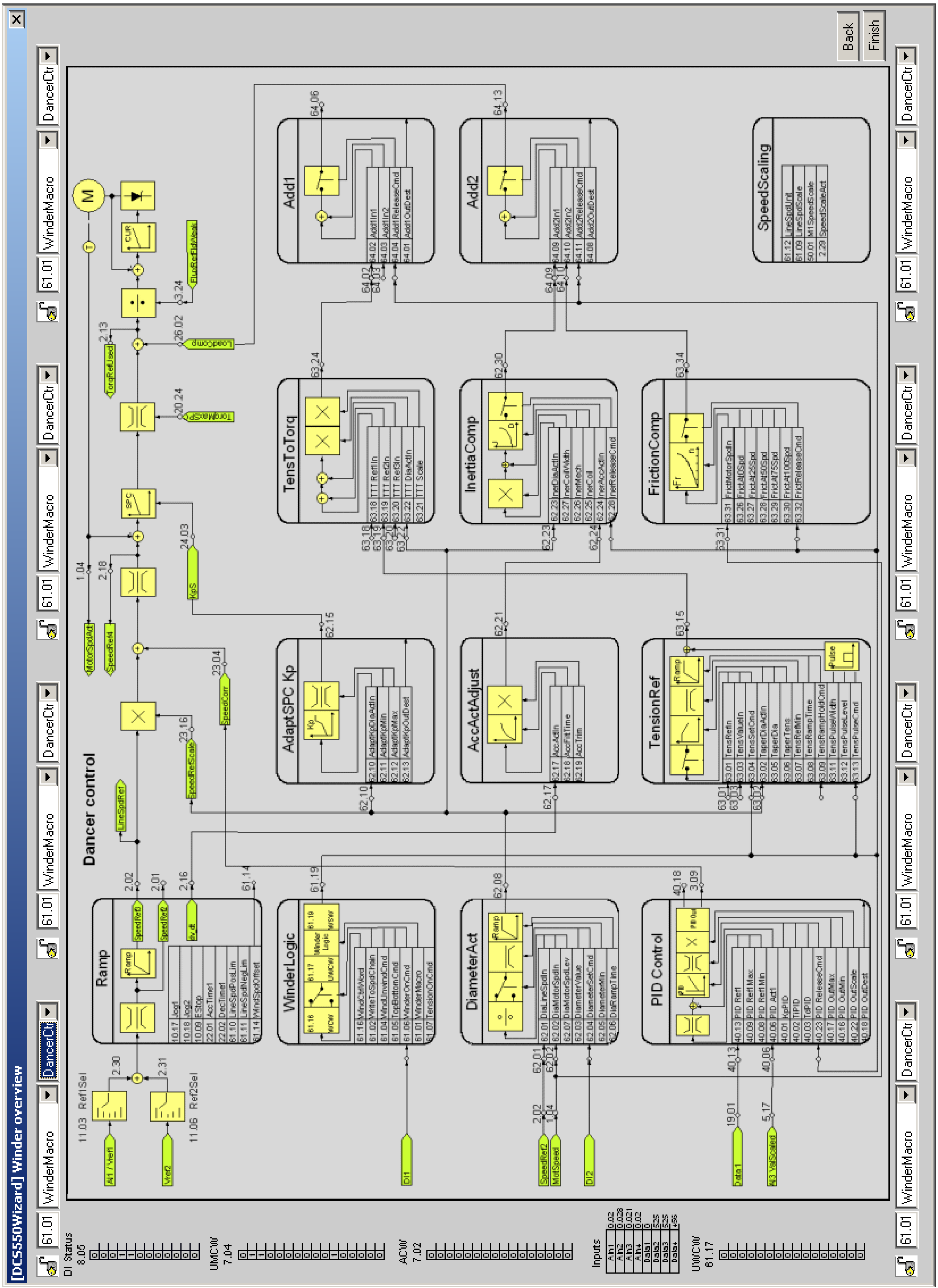
Parameter name	DirectTens	Factory (default)
Ref1Sel (11.03)	**AI1**	**SpeedRef2301**
TorqMaxSPC (20.07)	120 %	325 %
TorqMinSPC (20.08)	-120 %	-325 %
IndepTorqMaxSPC (20.24)	325 %	325 %
IndepTorqMinSPC (20.25)	-10 %	-325 %
SpeedCorr (23.04)	0 rpm	0 rpm
SpeedRefScale (23.16)	100 %	100 %
TorqSel (26.01)	**Speed**	**Speed**
TorqMuxMode (26.04)	**TorqSel2601**	**TorqSel2601**
LoadComp (26.02)	0 %	0 %
KpPID (40.01)	1	5
TiPID (40.02)	1000	2500
PID Act1 (40.06)	517 = *AI3 ValScaled (5.17)*	0
PID Ref1 (40.13)	6315 = *TensionRef (63.15)*	0
PID OutMin (40.16)	-10 %	-100 %
PID OutMax (40.17)	10 %	100 %
PID OutDest (40.18)	0	0
PID ReleaseCmd (40.23)	**Auto**	**Auto**
WriteToSpdChain (61.02)	**Auto**	**Auto**
WindUnwindCmd (61.04)	**WindCtrlWord**	**WindCtrlWord**
TopBottomCmd (61.05)	**WindCtrlWord**	**WindCtrlWord**
WinderOnCmd (61.06)	**DI1**	**Auto**
TensionOnCmd (61.07)	**Auto**	**Auto**
WindSpdOffset (61.14)	150 rpm, connected to *SpeedCorr (23.04)*	0
DiaLineSpdIn (62.01)	202 = *SpeedRef2 (2.02)*	202 = *SpeedRef2 (2.02)*
DiaMotorSpdIn (62.02)	104 = *MotSpeed (1.04)*	104 = *MotSpeed (1.04)*
DiameterSetCmd (62.04)	**DI2**	**NotUsed**
AdaptKpDiaActIn (62.10)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
AdaptKpOutDest (62.13)	2403 = *KpS (24.03)*	0
AccActIn (62.17)	216 = *dv_dt (2.16)*	216 = *dv_dt (2.16)*
InerDiaActIn (62.23)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
InerAccActIn (62.24)	6221 = *AccActAdjust (62.21)*	6221 = *AccActAdjust (62.21)*
InerReleaseCmd (62.28)	**Auto**	**Auto**
TensRefIn (63.01)	516 = *AI2 ValScaled (5.16)*	0
TaperDiaActIn (63.02)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
TensValueIn (63.03)	0	0
TensSetCmd (63.04)	**Auto**	**Auto**
TensRampHoldCmd (63.09)	**RelTensRamp**	**RelTensRamp**
TensPulseCmd (63.13)	**Auto**	**Auto**
TTT Ref1In (63.18)	309 = *PID Out (3.09)*	0
TTT Ref2In (63.19)	6315 = *TensionRef (63.15)*	6315 = *TensionRef (63.15)*
TTT Ref3In (63.20)	0	0
TTT DiaActIn (63.22)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
FrictMotorSpdIn (63.31)	104 = *MotSpeed (1.04)*	104 = *MotSpeed (1.04)*
FrictReleaseCmd (63.32)	**Auto**	**Auto**
Add1OutDest (64.01)	2024 =*IndepTorqMaxSPC (20.24)*	0
Add1In1 (64.02)	6324 = *TensToTorq (63.24)*	6324 = *TensToTorq (63.24)*
Add1In2 (64.03)	0	0
Add1ReleaseCmd (64.04)	**Auto**	**Auto**
Add2OutDest (64.08)	2602 = *LoadComp (26.02)*	0
Add2In1 (64.09)	6230 = *InertiaComp (62.30)*	6230 = *InertiaComp (62.30)*
Add2In2 (64.10)	6334 = *FrictionComp (63.34)*	6334 = *FrictionComp (63.34)*
Add2ReleaseCmd (64.11)	**Auto**	**Auto**


[DCS550Wizard] Winder overview
Direct Tension
Ramp
WinderLogic
DiameterAct
PID Control
AdaptSPC Kp
AccActAdjust
TensionRef
TensToTorq
InertiaComp
FrictionComp
Add1
Add2
SpeedScaling
Back
Finish

Dancer control

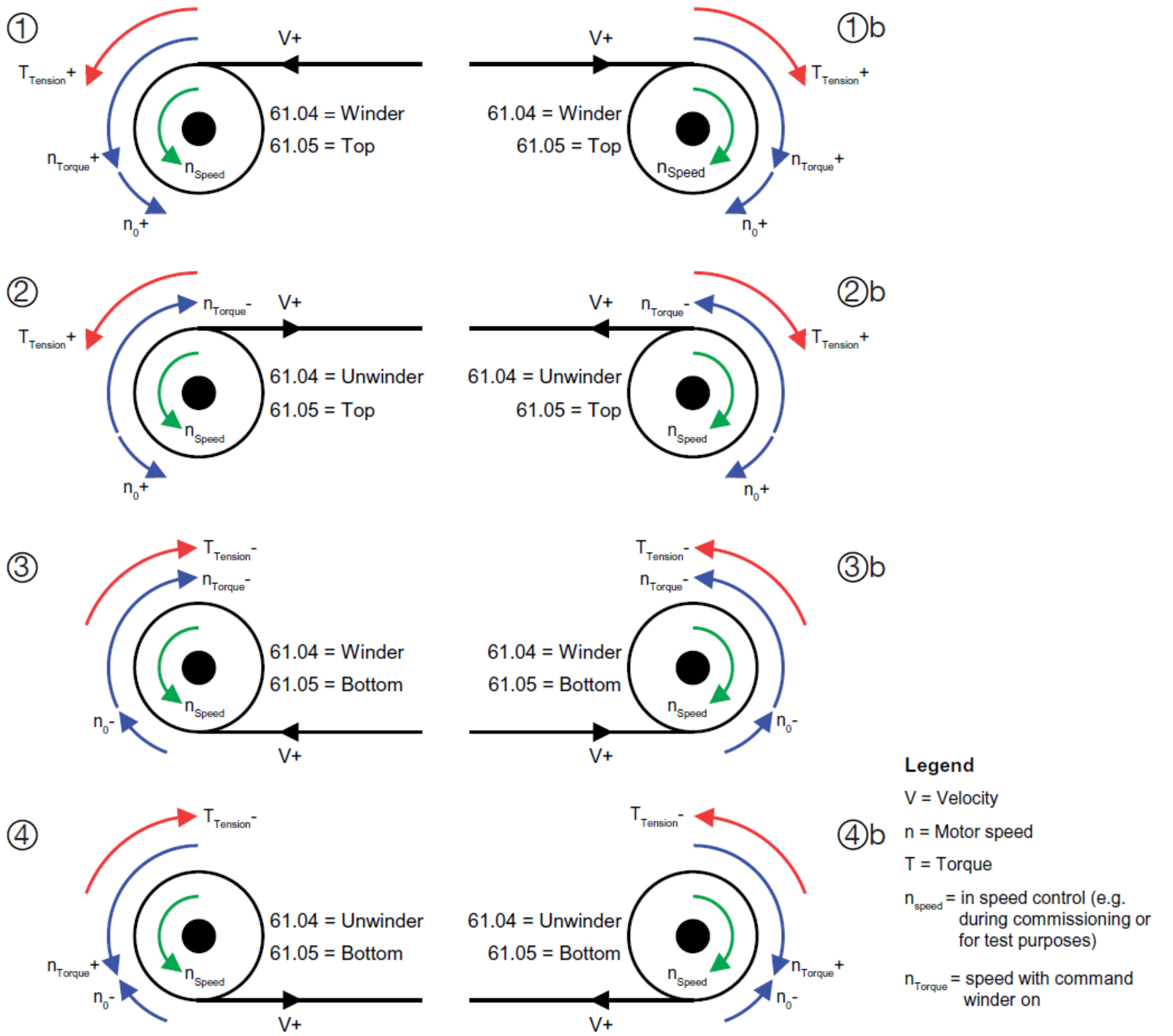
In dancer control the tension is established through the dancer's weight. The position of the dancer is read by means of an analog input (AI3). Its position is controlled by an additional speed reference coming from the PID controller in group 40.
Following parameters are set when using *WinderMacro (61.01)* = **DancerCtrl**:

Parameter name	DancerCtrl	Factory (default)
Ref1Sel (11.03)	**AI1**	**SpeedRef2301**
TorqMaxSPC (20.07)	325 %	325 %
TorqMinSPC (20.08)	-325 %	-325 %
IndepTorqMaxSPC (20.24)	325 %	325 %
IndepTorqMinSPC (20.25)	-325 %	-325 %
SpeedCorr (23.04)	0 rpm	0 rpm
SpeedRefScale (23.16)	100 %	100 %
TorqSel (26.01)	**Speed**	**Speed**
TorqMuxMode (26.04)	**TorqSel2601**	**TorqSel2601**
LoadComp (26.02)	0 %	0 %
KpPID (40.01)	1	5
TiPID (40.02)	1000	2500
PID Act1 (40.06)	517 = *AI3 ValScaled (5.17)*	0
PID Ref1 (40.13)	1901 = *Data1 (19.01)*	0
PID OutMin (40.16)	-10 %	-100 %
PID OutMax (40.17)	10 %	100 %
PID OutDest (40.18)	2304 = *SpeedCorr (23.04)*	0
PID ReleaseCmd (40.23)	**Auto**	**Auto**
WriteToSpdChain (61.02)	**Auto**	**Auto**
WindUnwindCmd (61.04)	**WindCtrlWord**	**WindCtrlWord**
TopBottomCmd (61.05)	**WindCtrlWord**	**WindCtrlWord**
WinderOnCmd (61.06)	**DI1**	**Auto**
TensionOnCmd (61.07)	**Auto**	**Auto**
WindSpdOffset (61.14)	0	0
DiaLineSpdIn (62.01)	202 = *SpeedRef2 (2.02)*	202 = *SpeedRef2 (2.02)*
DiaMotorSpdIn (62.02)	104 = *MotSpeed (1.04)*	104 = *MotSpeed (1.04)*
DiameterSetCmd (62.04)	**DI2**	**NotUsed**
AdaptKpDiaActIn (62.10)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
AdaptKpOutDest (62.13)	2403 = *KpS (24.03)*	0
AccActIn (62.17)	216 = *dv_dt (2.16)*	216 = *dv_dt (2.16)*
InerDiaActIn (62.23)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
InerAccActIn (62.24)	6221 = *AccActAdjust (62.21)*	6221 = *AccActAdjust (62.21)*
InerReleaseCmd (62.28)	**Auto**	**Auto**
TensRefIn (63.01)	0	0
TaperDiaActIn (63.02)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
TensValueIn (63.03)	0	0
TensSetCmd (63.04)	**Auto**	**Auto**
TensRampHoldCmd (63.09)	**RelTensRamp**	**RelTensRamp**
TensPulseCmd (63.13)	**Auto**	**Auto**
TTT Ref1In (63.18)	0	0
TTT Ref2In (63.19)	6315 = *TensionRef (63.15)*	6315 = *TensionRef (63.15)*
TTT Ref3In (63.20)	0	0
TTT DiaActIn (63.22)	6208 = *DiameterAct (62.08)*	6208 = *DiameterAct (62.08)*
FrictMotorSpdIn (63.31)	104 = *MotSpeed (1.04)*	104 = *MotSpeed (1.04)*
FrictReleaseCmd (63.32)	**Auto**	**Auto**
Add1OutDest (64.01)	0	0
Add1In1 (64.02)	6324 = *TensToTorq (63.24)*	6324 = *TensToTorq (63.24)*
Add1In2 (64.03)	0	0
Add1ReleaseCmd (64.04)	**Auto**	**Auto**
Add2OutDest (64.08)	2602 = *LoadComp (26.02)*	0
Add2In1 (64.09)	6230 = *InertiaComp (62.30)*	6230 = *InertiaComp (62.30)*
Add2In2 (64.10)	6334 = *FrictionComp (63.34)*	6334 = *FrictionComp (63.34)*
Add2ReleaseCmd (64.11)	**Auto**	**Auto**


[DCS550Wizard] Winder overview
Dancer control
Ramp
WinderLogic
DiameterAct
PID Control
AdaptSPC Kp
AccActAdjust
TensionRef
TensToTorq
InertiaComp
FrictionComp
Add1
Add2
SpeedScaling
Back
Finish

Winder commissioning

Before starting the winder commissioning the operation modes of the winder as well as the directions of speed and torque have to be defined clearly as described in the following.



This has to be checked during commissioning:

n_{Speed} = Rotating direction of the mandrell in speed control. The speed reference is positive, **no** winder on command - see *WinderOnCmd (61.06)* - and *WinderMacro (61.01)* = **NotUsed**. To change the speed direction swap the field cables at F1 and F2. Additionally swap the analog tacho cables or the encoder tracks A+ and A- respectively.	See diagram above: n_{speed} or n_{speed}
V+ = Direction of the velocity reference for the whole plant. Always considered positive, see *SpeedRef3 (2.02).*	See diagram above: V+ or V+

These values are determined by *WindUnwindCmd (61.04)* and *TopBottomCmd (61.05)*:

	①, ①b	②, ②b	③, ③b	④, ④b
WindUnwindCmd (61.04) =	**Winder**	**Unwinder**	**Winder**	**Unwinder**
TopBottomCmd (61.05) =	**Top**	**Top**	**Bottom**	**Bottom**
n_{Torque}* = Direction of speed with command winder on, see *MotSpeed (1.04)*	+	-	-	+
$T_{Tension}$** = Direction of torque for tension, see *TensToTorq (63.24)*	+	+	-	-
$T_{Acceleration}$* = Direction of torque for acceleration, see *InertiaComp (62.30)*	+	-	-	+
$T_{Decleration}$* = Direction of torque for deceleration, see *InertiaComp (62.30)*	-	+	+	-
$T_{Inertia}$* = Direction of torque for inertia compensation, see *InertiaComp (62.30)*	+	-	-	+
$T_{Friction}$* = Direction of torque for friction compensation, see *FrictionComp (63.34)*	+	-	-	+
n_0** = Speed offset used e.g. for indirect tension control, see *WindSpdOffset (61.14)*. Always use a positive value!	+10 %	+10 %	-10 %	-10 %

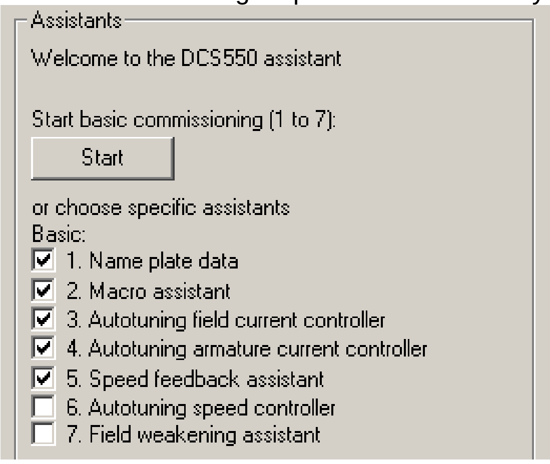
* Depending on setting of *WindUnwindCmd (61.04)* and *TopBottomCmd (61.05)*

** Depending on setting of *TopBottomCmd (61.05)*

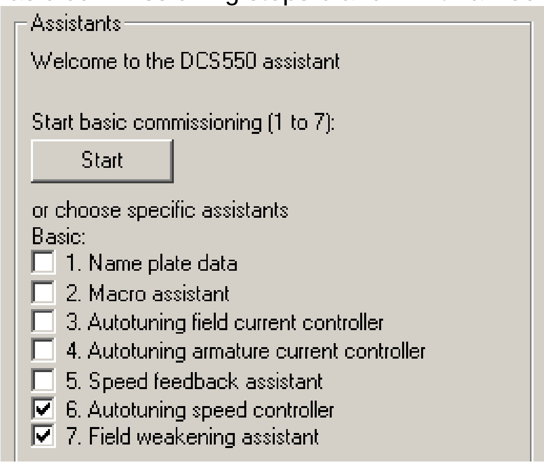
Basic commissioning

Before starting the winder commissioning following steps have to be done first:

1. Basic commissioning steps 1 to 5 with a freely turning machine, no mechanics connected:

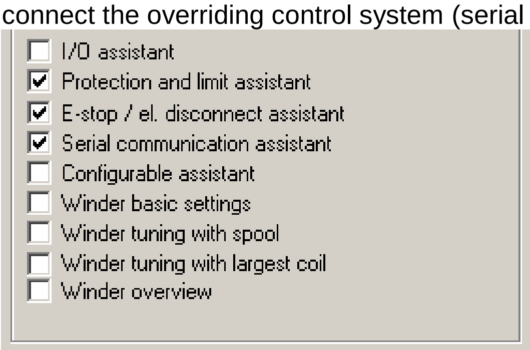


2. Basic commissioning steps 6 and 7 with a freely turning machine, gearbox and spool connected, no web:



Advanced commissioning

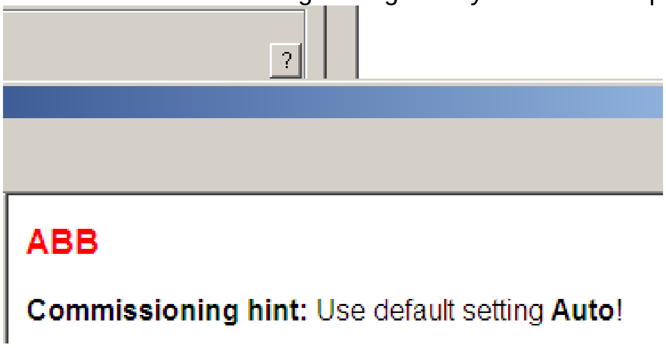
1. Set all necessary protections and limits, make sure the E-stop / el. Disconnect is working properly and connect the overriding control system (serial communication):



Winder commissioning

Commissioning hints

– Follow the commissioning hints given by the online help using the question mark:

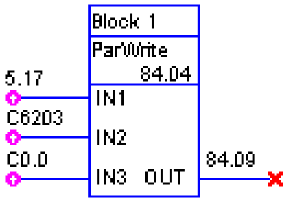


Following default settings should be kept:
WriteToSpdChain (61.02) = **Auto**
TensionOnCmd (61.07) = **Auto**
LineSpdNegLim (61.11) = Zero
LineSpdUnit (61.12) = **%**
AccFiltTime (62.18) = 100 ms
InerReleaseCmd (62.28) = **Auto**
TensSetCmd (63.04) = **Auto**
TensRampHoldCmd (63.09) = **RelTensRamp**
TensPulseCmd (63.13) = **Auto**
TTT Ref2In (63.19) = 6315 (tension reference)
FrictReleaseCmd (63.32) = **Auto**

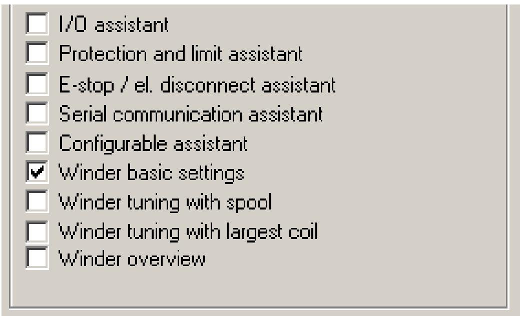
– To go back to normal speed control set *WiProgCmd (66.01)* = **Stop**, but keep the winder macro selected - see *WinderMacro (61.01)* - this will keep the parameter settings.

Commissioning

1. Print out the winder overview diagram according to the chosen winder macro.
2. Specify the needed in- and outputs for the winder.
   Example using serial communication:
   Set *CommandSel (10.01)* = **MainCtrlWord**.
   For additional winder commands use the auxiliary control bits of the *MainCtrlWord (7.01)*, e.g.:
   – Rewind / Unwind command via bit 11, set *WindUnwindCmd (61.04)* = **MCW B11**.
   – Top / Bottom Command via bit 12, set *TopBottomCmd (61.05)* = **MCW B12**.
   – Winder on command via bit 13, set *WinderOnCmd (61.06)* = **MCW B13**.
   – Diameter set command via bit 14, set *DiameterSetCmd (62.04)* = **MCW B14**.
   Write the line speed reference on *SpeedRef (23.01)* and set *Ref1Sel (11.03)* = **SpeedRef2301**.
   Write the initial diameter on *DiameterValue (62.03)*.
   Write the tension reference e.g. on *Data1 (19.01)* and set *TensRefIn (63.01)* = 1901.
   Example using serial local I/O:
   Set *CommandSel (10.01)* = **Local I/O**.
   For additional winder commands use digital inputs, e.g.:
   – DI1 for winder on command, set *WinderOnCmd (61.06)* = **DI1**.
   – DI2 for diameter set command, set *DiameterSetCmd (62.04)* = **DI2**.
   – DI3 for rewind / unwind command, set *WindUnwindCmd (61.04)* = **DI3**.
   DI4 for Coast Stop, set *Off2 (10.08)* = **DI4**.
   DI5 for E-stop, set *E Stop (10.09)* = **DI5**.
   DI6 for reset, set *Reset (10.03)* = **DI6**
   DI7 for **On**, set *OnOff1 (10.15)* = **DI7**.
   DI8 for **Run**, set *StartStop (10.16)* = **DI8**.
   AI1 for line speed reference, set *Ref1Sel (11.03)* = **AI1**.
   AI2 for tension reference, set *TensRefIn (63.01)* = 516. see *AI2 ValScaled (5.16)*.
   AI3 for initial diameter use - see *AI3 ValScaled (5.17)* and *DiameterValue (62.03)* - AP block ParWrite:

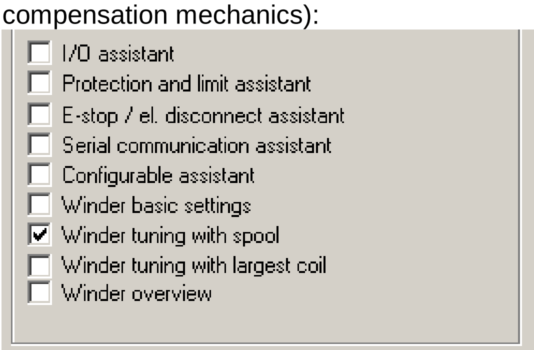


3. Set the winder basics:

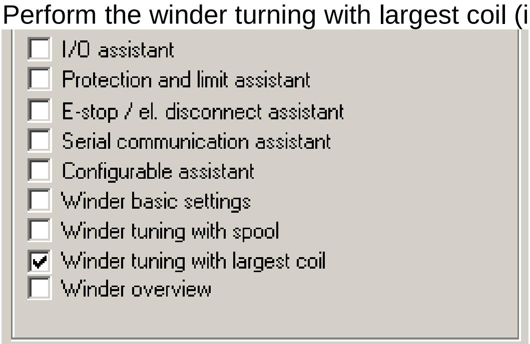


4. Adjust the torque limits. Set
   - *TorqMax (20.05)*,
   - *TorqMin (20.06)*,
   - *TorqMaxSPC (20.07)*,
   - *TorqMin SPC (20.08)*,
   - *M1CurLimBrdg1 (20.12)* and
   - *M1CurLimBrdg2 (20.13)* to around ±120 %.
   - Set *IndepTorqMinSPC (20.25)* = -10 %.

   Attention:
   Set the above torque limits that they are greater than the sum of tension torque, friction torque and acceleration torque (Torque limits > $T_{Tension}$ +$T_{Friction}$ + $T_{Acceleration}$)
5. Put an empty spool on the winder and adapt *AdaptKpMin (62.11)*.
6. Perform the winder turning with spool (includes Autotuning friction compensation and Autotuning inertia compensation mechanics):



7. Put the largest coil on the winder and adapt *AdaptKpMax (62.12)*.
8. Perform the winder turning with largest coil (includes Autotuning inertia compensation coil):



   Attention:
   During the autotuning the motor will run up to maximum line speed, see *LineSpdScale (61.09)* and *LineSpdPosLim (61.10).* It is possible to limit the speed by means of *LineSpdPosLim (61.10)*.

Signal and parameter list

Chapter overview

This chapter describes all signals and parameters of the DCS550.

Signal groups list

Signals are measured and calculated actual values of the drive. This includes the control-, status-, limit-, fault- and alarm words. The drive's signals are available in groups 1 to 9. None of the values inside these groups is stored in the flash and thus volatile.

Note:

Signals in group 7 can be written to by means of DWL, DCS Control Panel, AP or overriding control.

The following table gives an overview of all signal groups:

Group	Description
1	*Physical actual values*
2	*Speed controller signals*
3	*Reference actual values*
4	*Information*
5	*Analog I/O*
6	*Drive logic signals*
7	*Control words*
8	*Status / limit words*
9	*Fault / alarm words*

Signal / Parameter name	min.	max.	def.	unit
1.08 **MotTorq (motor torque)** Motor torque in percent of *MotNomTorque (4.23)*: – Filtered by means of a 6th order FIR filter (sliding average filter), filter time is 1 mains voltage period. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.17 **SpeedRefUsed (used speed reference)** Used speed reference selected with: – *Ref1Mux (11.02)* and *Ref1Sel (11.03)* or – *Ref2Mux (11.12)* and *Ref2Sel (11.06)* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm

Sample of signals

All signals are read-only. However, the overriding control can write to the control words, but it only affects the RAM.

Min., max., def.:

Minimum, maximum and default values are not valid for groups 1 to 9.

Unit:

Shows the physical unit of a signal, if applicable. The unit is displayed in the DCS Control Panel and DWL.

Group.Index:

Signal and parameter numbers consists of group number and its index.

Integer Scaling:

Communication between the drive and the overriding control uses 16-bit integer values. The overriding control has to use the information given in integer scaling to read the value of the signal properly.

Example1:

If the overriding control reads *MotTorq (1.08)* 100 corresponds to 1 % torque.

Example2:

If the overriding control reads *SpeedRefUsed (2.17)* 20,000 equals the speed (in rpm) shown in *SpeedScaleAct (2.29)*.

Type:
A short code shows the data type:
I = 16-bit integer value (0, …, 65536)
SI = 16-bit signed integer value (-32768, …, 32767)
C = text string (ENUM)

Volatile:
Y = values are NOT stored in the flash, they will be lost when the drive is de-energized
N = values are stored in the flash, they will remain when the drive is de-energized

Parameter groups list

This chapter explains the function and valid values or selections for all parameters. They are arranged in groups by their function. The following table gives an overview of all parameter groups:

Group	Description
10	*Start / stop select*
11	*Speed reference inputs*
12	*Constant speeds*
13	*Analog inputs*
14	*Digital outputs*
15	*Analog outputs*
16	*System control inputs*
19	*Data storage*
20	*Limits*
21	*Start / stop*
22	*Speed ramp*
23	*Speed reference*
24	*Speed control*
25	*Torque reference*
26	*Torque reference handling*
30	*Fault functions*
31	*Motor temperature*
34	*DCS Control Panel display*
40	*PID controller*
43	*Current control*
44	*Field excitation*
45	*Field converter settings*
50	*Speed measurement*
51	*Fieldbus*
52	*Modbus*
61	*Winder control*
62	*Diameter adaption*
63	*Tension torque*
64	*Write selection*
66	*Winder program control*
83	*AP control*
84	*AP*
85	*User constants*
86	*AP outputs*
88	*Internal*
90	*Receiving data sets addresses*
92	*Transmit data sets addresses*
97	*Measurement*
98	*Option modules*
99	*Start-up data*

Signal / Parameter name	min.	max.	def.	unit
20.07 **TorqMaxSPC (maximum torque speed controller)** Maximum torque limit - in percent of *MotNomTorque (4.23)* - at the output of the speed controller: – *TorqRef2 (2.09)* **Note:** The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). The limit with the smallest value is valid. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	325	%
23.01 **SpeedRef (speed reference)** Main speed reference input for the speed control of the drive. Can be connected to *SpeedRefUsed (2.17)* via: – *Ref1Mux (11.02)* and *Ref1Sel (11.03)* or – *Ref2Mux (11.12)* and *Ref2Sel (11.06)* Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ to\ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: Y	-10000	10000	0	rpm

Sample of parameters

Parameter changes by DCS Control Panel or DWL are stored in the flash. Changes made by the overriding control are only stored in the RAM.

Min., max., def.:

Minimum and maximum value or selection of parameter.
Default value or default selection of parameter.

Unit:

Shows the physical unit of a parameter, if applicable. The unit is displayed in the DCS Control Panel and DWL.

Group.Index:

Signal and parameter numbers consists of group number and its index.

Integer Scaling:

Communication between the drive and the overriding control uses 16-bit integer values. The overriding control has to use the information given in integer scaling to change the value of the parameter properly.

Example1:

If the overriding control writes on *TorqMaxSPC (20.07)* 100 corresponds to 1 %.

Example2:

If the overriding control writes on *SpeedRef (23.01)* 20,000 equals the speed (in rpm) shown in *SpeedScaleAct (2.29)*.

Type:

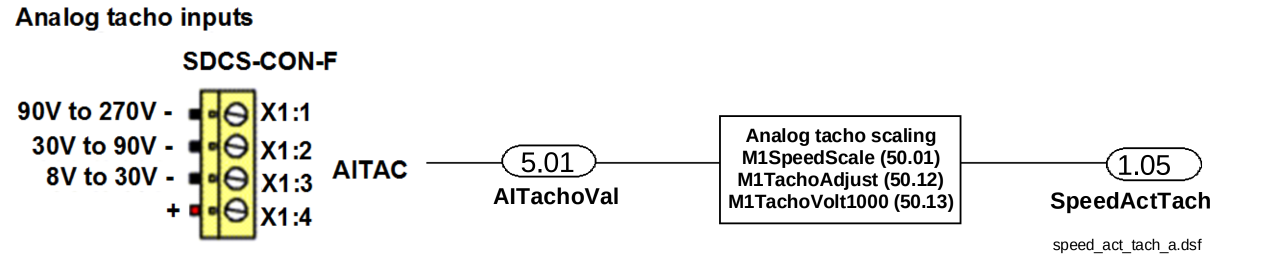
A short code shows the data type:
I = 16-bit integer value (0, …, 65536)
SI = 16-bit signed integer value (-32768, …, 32767)
C = text string (ENUM)

Volatile:

Y = values are NOT stored in the flash, they will be lost when the drive is de-energized
N = values are stored in the flash, they will remain when the drive is de-energized

Signals

Signal / Parameter name	min.	max.	def.	unit
Group 1: Physical actual values				
1.01 **MotSpeedFilt (filtered motor speed)** Filtered actual speed feedback: – Choose motor speed feedback with *M1SpeedFbSel (50.03)* – Filtered with 1 s and *SpeedFiltTime (50.06)* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
1.02 **SpeedActEMF (speed actual EMF)** Actual speed calculated from EMF. Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
1.03 **SpeedActEnc (speed actual encoder)** Actual speed measured with pulse encoder. Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
1.04 **MotSpeed (motor speed)** Actual motor speed: – Choose motor speed feedback with *M1SpeedFbSel (50.03)*. – *SpeedFiltTime (50.06)* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm

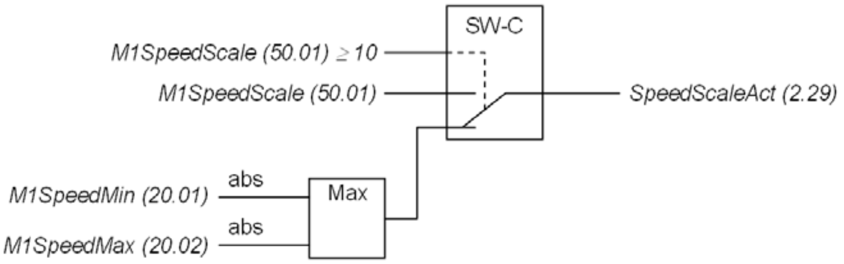


Signal / Parameter name	min.	max.	def.	unit
1.05 **SpeedActTach (speed actual tacho)** Actual speed measured with analog tacho. **Note:** This value is only valid, if an analog tacho is connected! Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
1.06 **MotCur (motor current)** Relative actual motor current in percent of *M1NomCur (99.03)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
1.07 **MotTorqFilt (filtered motor torque)** Relative filtered motor torque in percent of *MotNomTorque (4.23)*: – Filtered by means of a 6th order FIR filter (sliding average filter), filter time is 1 mains voltage period plus – *TorqActFiltTime (97.20)* **Notes:** – The cycle time is 20 ms – The value is calculated the following way: $MotTorqFilt\ (1.07) = \frac{Flux\mathrm{Re}\,fFldWeak\ (3.24) * MotCur\ (1.06)}{100}$ *with* $Flux\mathrm{Re}\,fFldWeak\ (3.24) = FluxMax * \frac{M1BaseSpeed\ (99.04)}{\lvert MotSpeed\ (1.04)\rvert};\ for\ n > M1BaseSpeed\ (99.04)$ *or* $Flux\mathrm{Re}\,fFldWeak\ (3.24) = FluxMax = 100\ \%;\ for\ n \le M1BaseSpeed\ (99.04)\ or\ M1UsedFexType\ (99.12) = NotUsed$ Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%

Signal / Parameter name	min.	max.	def.	unit
1.08 **MotTorq (motor torque)** Motor torque in percent of *MotNomTorque (4.23)*: – Filtered by means of a 6th order FIR filter (sliding average filter), filter time is 1 mains voltage period. **Notes:** – The cycle time is 20 ms – The value is calculated the following way: $MotTorq\ (1.08) = \frac{FluxRefFldWeak\ (3.24) * MotCur\ (1.06)}{100}$ *with* $FluxRefFldWeak\ (3.24) = FluxMax * \frac{M1BaseSpeed\ (99.04)}{\lvert MotSpeed\ (1.04)\rvert};\ for\ n > M1BaseSpeed\ (99.04)$ *or* $FluxRefFldWeak\ (3.24) = FluxMax = 100\ \%;\ for\ n \le M1BaseSpeed\ (99.04)\ or\ M1UsedFexType\ (99.12) = NotUsed$ Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
1.09 Unused				
1.10 **CurRippleFilt (filtered current ripple)** Relative filtered current ripple monitor output in percent of *M1NomCur (99.03)* filtered with 200 ms. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
1.11 **MainsVoltActRel (relative actual mains voltage)** Relative actual mains voltage in percent of *NomMainsVolt (99.10).* Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%
1.12 **MainsVoltAct (actual mains voltage)** Actual mains voltage filtered with 10 ms. Int. Scaling: 1 == 1 V Type: I Volatile: Y	-	-	-	V
1.13 **ArmVoltActRel (relative actual armature voltage)** Relative actual armature voltage in percent of *M1NomVolt (99.02)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
1.14 **ArmVoltAct (actual armature voltage)** Actual armature voltage filtered with 10 ms. Int. Scaling: 1 == 1 V Type: SI Volatile: Y	-	-	-	V
1.15 **ConvCurActRel (relative actual converter current [DC])** Relative actual converter current in percent of *ConvNomCur (4.05).* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
1.16 **ConvCurAct (actual converter current [DC])** Actual converter current filtered with 10 ms. Int. Scaling: 1 == 1 A Type: SI Volatile: Y	-	-	-	A
1.17 **EMF VoltActRel (relative actual EMF)** Relative actual EMF in percent of *M1NomVolt (99.02):* – *EMF VoltActRel (1.17).* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
1.18 - 1.19 Unused				
1.20 **Mot1TempCalc (calculated temperature)** Calculated temperature from motor thermal model in percent - see *M1AlarmLimLoad (31.03)* and *M1FaultLimLoad (31.04)*. Used for motor overload protection. – *M1AlarmLimLoad (31.03)* – *M1FaultLimLoad (31.04)* Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%
1.21 Unused				

Signal / Parameter name	min.	max.	def.	unit
1.22 **Mot1TempMeas (motor measured temperature)** Motor measured temperature. Used for motor overtemperature protection: – Unit depends on setting of *M1TempSel (31.05):* 0 = **NotUsed** 1 = reserved 2 = **PTC** Ω Int. Scaling: 1 == 1 Ω / 1 Type: I Volatile: Y	-	-	-	°Ω / -
1.23 Unused				
1.24 **BridgeTemp (actual bridge temperature)** Actual bridge temperature in degree centigrade. Int. Scaling: 1 == 1 °C Type: I Volatile: Y	-	-	-	°C
1.25 **CtrlMode (control mode)** Used control mode: – *see TorqSel (26.01)* 0 = **NotUsed** 1 = **SpeedCtrl** speed control 2 = **TorqCtrl** torque control 3 = **CurCtrl** current control Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
1.26 - 1.28 Unused				
1.29 **Mot1FldCurRel (relative actual field current)** Relative field current in percent of *M1NomFldCur (99.11).* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
1.30 **Mot1FldCur (actual field current)** Field current filtered with 500 ms. Int. Scaling: 10 == 1 A Type: SI Volatile: Y	-	-	-	A
1.31 - 1.37 Unused				
1.38 **MainsFreqAct (internal mains frequency)** Calculated and internally controlled mains frequency. Output of PLL controller. See also: – *DevLimPLL (97.13)* – *KpPLL (97.14)* Int. Scaling: 100 == 1 Hz Type: I Volatile: Y	-	-	-	Hz
Group 2: Speed controller signals				
2.01 **SpeedRef2 (speed reference 2)** Speed reference after limiter: – *M1SpeedMin (20.01)* – *M1SpeedMax (20.02)* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
2.02 **SpeedRef3 (speed reference 3)** Speed reference after speed ramp and jog input. Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
2.03 **SpeedErrNeg (Δn)** Δn = speed actual - speed reference. Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
2.04 **TorqPropRef (proportional part of torque reference)** P-part of the speed controllers output in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.05 **TorqIntegRef (integral part of torque reference)** I-part of the speed controllers output in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.06 **TorqDerRef (derivation part of torque reference)** D-part of the speed controllers output in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%

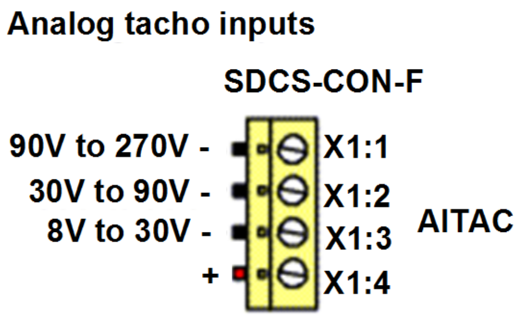
Signal / Parameter name	min.	max.	def.	unit
2.07 Unused				
2.08 **TorqRef1 (torque reference 1)** Relative torque reference value in percent of *MotNomTorque (4.23)* after limiter for the external torque reference: – *TorqMaxTref (20.09)* – *TorqMinTref (20.10)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.09 **TorqRef2 (torque reference 2)** Output value of the speed controller in percent of *MotNomTorque (4.23)* after limiter: – *TorqMaxSPC (20.07)* – *TorqMinSPC (20.08)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.10 **TorqRef3 (torque reference 3)** Relative torque reference value in percent of *MotNomTorque (4.23)* after torque selector: *TorqSel (26.01)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.11 **TorqRef4 (torque reference 4)** = *TorqRef3 (2.10)* + *LoadComp (26.02)* in percent of *MotNomTorque (4.23).* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.12 Unused				
2.13 **TorqRefUsed (used torque reference)** Relative final torque reference value in percent of *MotNomTorque (4.23)* after torque limiter: – *TorqMax (20.05)* – *TorqMin (20.06)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.14 - 2.15 Unused				
2.16 **dv_dt (dv/dt)** Acceleration/deceleration (speed reference change) at the output of the speed reference ramp. Int. Scaling: (2.29)/s Type: SI Volatile: Y	-	-	-	rpm/s
2.17 **SpeedRefUsed (used speed reference)** Used speed reference selected with: – *Ref1Mux (11.02)* and *Ref1Sel (11.03)* or – *Ref2Mux (11.12)* and *Ref2Sel (11.06)* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
2.18 **SpeedRef4 (speed reference 4)** = *SpeedRef3 (2.02)* + *SpeedCorr (23.04).* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
2.19 **TorqMaxAll (torque maximum all)** Relative calculated positive torque limit in percent of *MotNomTorque (4.23)*. Calculated from the smallest maximum torque limit, field weakening and armature current limits: – *TorqUsedMax (2.22)* – *FluxRefFldWeak (3.24)* and – *M1CurLimBrdg1 (20.12)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.20 **TorqMinAll (torque minimum all)** Relative calculated negative torque limit in percent of *MotNomTorque (4.23)*. Calculated from the largest minimum torque limit, field weakening and armature current limits: – *TorqUsedMax (2.22)* – *FluxRefFldWeak (3.24)* and – *M1CurLimBrdg2 (20.13)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.21 Unused				

Signal / Parameter name	min.	max.	def.	unit
2.22 **TorqUsedMax (used torque maximum)** Relative positive torque limit in percent of *MotNomTorque (4.23)*. Selected with: – *TorqUsedMaxSel (20.18)* Connected to torque limiter after TorqRef4 (2.11). Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.23 **TorqUsedMin (used torque minimum)** Relative negative torque limit in percent of *MotNomTorque (4.23)*. Selected with: – *TorqUsedMinSel (20.19)* Connected to torque limiter after TorqRef4 (2.11). Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.24 **TorqRefExt (external torque reference)** Relative external torque reference value in percent of *MotNomTorque (4.23)* after torque reference A selector: – *TorqRefA (25.01)* and – *TorqRefA Sel (25.10)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
2.25 Unused				
2.26 **TorqLimAct (actual used torque limit)** Shows parameter number of the actual active torque limit: 0 = **0** no limitation active 1 = **2.19** *TorqMaxAll (2.19)* is active, includes current limits and field weakening 2 = **2.20** *TorqMinAll (2.20)* is active, includes current limits and field weakening 3 = **2.22** *TorqUsedMax (2.22)* selected torque limit is active 4 = **2.23** *TorqUsedMin (2.23)* selected torque limit is active 5 = **20.07** *TorqMaxSPC (20.07)* speed controller limit is active 6 = **20.08** *TorqMinSPC (20.08)* speed controller limit is active 7 = **20.09** *TorqMaxTref (20.09)* external reference limit is active 8 = **20.10** *TorqMinTref (20.10)* external reference limit is active 9 = **20.22** *TorqGenMax (20.22)* regenerating limit is active 10 = **20.24** *IndepTorqMaxSPC (20.24)* independent speed controller limit is active 11 = **20.25** *IndepTorqMinSPC (20.25)* independent speed controller limit is active 12 = **2.08** *TorqRef1 (2.08)* limits *TorqRef2 (2.09)*, see also *TorqSel (26.01)* Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
2.27 - 2.28 Unused				
2.29 **SpeedScaleAct (actual used speed scaling)** The value of *SpeedScaleAct (2.29)* equals 20,000 internal speed units. Thus follows 20,000 speed units == *M1SpeedScale (50.01*), in case *M1SpeedScale (50.01)* ≥ 10 or 20,000 speed units == maximum absolute value of *M1SpeedMin (20.01)* and *M1SpeedMax (20.02),* in case *M1SpeedScale (50.01)* < 10. Mathematically speaking: If *(50.01)* ≥ 10 then 20,000 == *(50.01)* in rpm If *(50.01)* < 10 then 20,000 == Max [|*(20.01)*|, |*(20.02)*|] in rpm  Int. Scaling: 1 == 1 rpm Type: SI Volatile: Y	-	-	-	rpm
2.30 **SpeedRefExt1 (external speed reference 1)** External speed reference 1 after reference 1 multiplexer: – *Ref1Mux (11.02)* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm

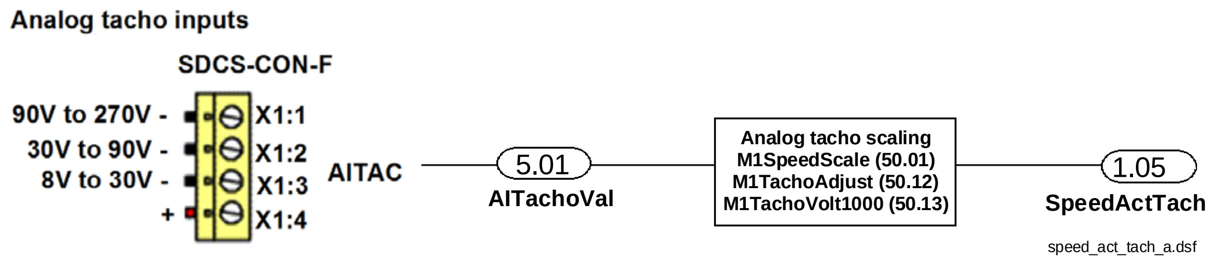
Signal / Parameter name	min.	max.	def.	unit
2.31 **SpeedRefExt2 (external speed reference 2)** External speed reference 2 after reference 2 multiplexer: – *Ref2Mux (11.12)* Int. Scaling: (2.29) Type: SI Volatile: Y	-	-	-	rpm
2.32 **SpeedRampOut (speed ramp output)** Speed reference after ramp Int. Scaling: (2.29) Type: SI Volatile: Y				rpm
Group 3: Reference actual values				
3.01 - 3.02 Unused				
3.03 **SquareWave (square wave)** Output signal of the square wave generator, see: – *Pot1 (99.15),* – *Pot2 (99.16),* – *SqrWavePeriod (99.17),* – *SqrWaveIndex (99.18)* and – *TestSignal (99.19)* Int. Scaling: 1==1 Type: SI Volatile: Y	-	-	-	-
3.04 - 3.08 Unused				
3.09 **PID Out (output PID controller)** PID controller output value in percent of the used PID controller input (see group 40). Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	-
3.10 Unused				
3.11 **CurRef (current reference)** Relative current reference in percent of *M1NomCur (99.03)* after adaption to field weakening. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
3.12 **CurRefUsed (used current reference)** Relative current reference in percent of *M1NomCur (99.03)* after current limitation: – *M1CurLimBrdg1 (20.12)* – *M1CurLimBrdg2 (20.13)* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
3.13 **ArmAlpha (armature α, firing angle)** Firing angle (α). Int. Scaling: 1 == 1 ° Type: I Volatile: Y	-	-	-	°
3.14 - 3.19 Unused				
3.20 **PLL In (phase locked loop input)** Actual measured mains voltage cycle (period) time. Is used as input of the PLL controller. The value should be: – 1/50 Hz = 20 ms = 20,000 or 1/60 Hz = 16.7 ms = 16,667 See also *DevLimPLL (97.13), KpPLL (97.14)* and *TfPLL (97.15).* Int. Scaling: 1 == 1 Type: I Volatile: Y	-	-	-	-
3.21 Unused				
3.22 **CurCtrlIntegOut (integral part of current controller output)** I-part of the current controllers output in percent of *M1NomCur (99.03).* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
3.23 Unused				
3.24 **FluxRefFldWeak (flux reference for field weakening)** Relative flux reference for speeds above the field weakening point (base speed) in percent of nominal flux. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
3.25 **VoltRef1 (EMF voltage reference 1)** Relative EMF voltage reference in percent of *M1NomVolt (99.02)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
3.26 Unused				

Signal / Parameter name	min.	max.	def.	unit
3.27 **FluxRefEMF (flux reference after EMF controller)** Relative EMF flux reference in percent of nominal flux after EMF controller. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
3.28 **FluxRefSum (sum of flux reference)** *FluxRefSum (3.28) = FluxRefEMF (3.27) + FluxRefFldWeak (3.24)* in percent of nominal flux. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
3.29 Unused				
3.30 **FldCurRefM1 (field current reference)** Relative field current reference in percent of *M1NomFldCur (99.11).* Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
Group 4: Information				
4.01 **FirmwareVer (firmware version)** Name of the loaded firmware version. The format is: **yyy** or **-yyy** with: **yyy** = consecutively numbered version and **-yyy** = single-phase firmware for demo units. Int. Scaling: - Type: C Volatile: Y	-	-	-	-
4.02 **FirmwareType (firmware type)** Type of the loaded firmware version. The format is: 55 = Standard firmware Int. Scaling: - Type: C Volatile: Y	-	-	-	-
4.03 Unused				
4.04 **ConvNomVolt (converter nominal AC voltage measurement circuit)** Adjustment of AC voltage measuring channels (SDCS-PIN-F). Read from *TypeCode (97.01)*. Int. Scaling: 1 == 1 V Type: I Volatile: Y	-	-	-	V
4.05 **ConvNomCur (converter nominal DC current measurement circuit)** Adjustment of DC current measuring channels (SDCS-PIN-F). Read from *TypeCode (97.01)*. Int. Scaling: 1 == 1 A Type: I Volatile: Y	-	-	-	A
4.06 **Mot1FexType (type of field exciter)** Field exciter type. Read from *M1UsedFexType (99.12)*: 0 = **NotUsed** no or third party field exciter connected 1 = **OnBoard** integrated 1-Q field exciter, default Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
4.07 - 4.13 Unused				
4.14 **ConvType (converter type)** Recognized converter type. Read from *TypeCode (97.01):* 0 = reserved 1 = **F1** F1 converter 2 = **F2** F2 converter 3 = **F3** F3 converter 4 = **F4** F4 converter Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
4.15 **QuadrantType (quadrant type of converter; 1 or 2 bridges)** Recognized converter quadrant type. Read from *TypeCode (97.01)* or set with *S BlockBrdg2 (97.07)*: – Read from *TypeCode (97.01)* if *S BlockBrdg2 (97.07)* = 0 – Read from *S BlockBrdg2 (97.07)* if *S BlockBrdg2 (97.07)* ≠ 0 0 = **BlockBridge2** bridge 2 blocked (== 2-Q operation) 1 = **RelBridge2** bridge 2 released (== 4-Q operation), default Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
4.16 **ConvOvrCur (converter overcurrent [DC] level)** Converter current tripping level. This signal is set during initialization of the drive, new values are shown after the next power-up. Int. Scaling: 1 == 1 A Type: I Volatile: Y	-	-	-	A

Signal / Parameter name	min.	max.	def.	unit
4.17 **MaxBridgeTemp (maximum bridge temperature)** Maximum bridge temperature in degree centigrade. Read from *TypeCode (97.01)* or set with *S MaxBrdgTemp (97.04)*: – Read from *TypeCode (97.01)* if *S MaxBrdgTemp (97.04)* = 0 – Read from *S MaxBrdgTemp (97.04)* if *S MaxBrdgTemp (97.04)* ≠ 0 The drive trips with **F504 ConvOverTemp** [*FaultWord1 (9.01)* bit 3], when *MaxBridgeTemp (4.17)* is reached. **A104 ConvOverTemp** [*AlarmWord1 (9.06)* bit 3] is set, when the actual converter temperature is approximately 5°C below *MaxBridgeTemp (4.17)*. Int. Scaling: 1 == 1 °C Type: I Volatile: Y	-	-	-	°C
4.18 - 4.19 Unused				
4.20 **Ext IO Stat (external IO status)** Status of external I/O: Bit Value Comment B0 1 RAIO-xx detected, see *AIO ExtModule (98.06)* 0 RAIO-xx not existing or faulty B1-B3 reserved --- B4 1 first RDIO-xx detected, see *DIO ExtModule1 (98.03)* 0 first RDIO-xx not existing or faulty B5 1 second RDIO-xx detected, see *DIO ExtModule2 (98.04)* 0 second RDIO-xx not existing or faulty B6-B7 reserved --- B8-B11 reserved --- B12 reserved B13 1 SDCS-COM-8 detected 0 SDCS-COM-8 faulty B14 - B15 reserved Int. Scaling: 1 == 1 Type: C Volatile: Y				
4.21 **CPU Load (load of processor)** The calculating power of the processor is divided into two parts: – *CPU Load (4.21)* shows the load of the firmware and – *ApplLoad (4.22)* shows the load of AP and the winder macro. Neither should reach 100%. Int. Scaling: 10 == 1 % Type: I Volatile: Y	-	-	-	%
4.22 **ApplLoad (load of application)** The calculating power of the processor is divided into two parts: – *CPU Load (4.21)* shows the load of the firmware and – *ApplLoad (4.22)* shows the load of AP and the winder macro. Neither should reach 100%. Int. Scaling: 10 == 1 % Type: I Volatile: Y	-	-	-	%
4.23 **MotTorqNom (motor nominal torque)** Calculated nominal motor torque: $MotTorqNom(4.23) = \frac{60}{2*\pi} * \frac{[M1NomVolt(99.02) - M1MotCur(99.03) * M1ArmR(43.10)] * M1NomCur(99.03)}{M1BaseSpeed(99.04)}$ Int. Scaling: 1 == 1 Nm Type: I Volatile: Y	-	-	-	Nm
4.24 **ProgressSignal (progress signal for auto tunings)** Progress signal for auto tunings used for Startup Assistants. Int. Scaling: 1 == 1 % Type: I Volatile: Y	-	-	-	%

Signal / Parameter name	min.	max.	def.	unit
4.25 **TachoTerminal (tacho terminal to be used)** Depending on the analog tacho output voltage - e.g. 60 V at 1000 rpm - and the maximum speed of the drive system - which is the maximum of *SpeedScaleAct (2.29)*, *M1OvrSpeed (30.16)* and *M1BaseSpeed (99.04)* - different inputs connections at the SDCS-CON-F have to be used:  *TachoTerminal (4.25)* shows which terminal has to be used depending on the setting of *M1TachoVolt1000 (50.13)* and the actual maximum speed of the drive system: 0 = **NotUsed** if *M1TachoVolt1000 (50.13)* = 0 V, no analog tacho used or not set jet 1 = **X1:3 8-30V** result if *M1TachoVolt1000 (50.13)* ≥ 1 V 2 = **X1:2 30-90V** result if *M1TachoVolt1000 (50.13)* ≥ 1 V 3 = **X1:1 90-120V** result if *M1TachoVolt1000 (50.13)* ≥ 1 V 4 = **Auto** result if *M1TachoVolt1000 (50.13)* = -1 V after the tacho gain was successfully measured by means of the speed feedback assistant Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
4.26 **IactScaling (scaling of the fixed actual current output I-act)** Scaling of analog output for the actual output current in Ampere per 10 V output voltage. See SDCS-CON-F X2:9. Int. Scaling: 1 == 1 A Type: SI Volatile: Y	-	-	-	A

Group 5: Analog I/O



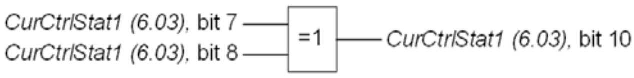
Signal / Parameter name	min.	max.	def.	unit
5.01 **AITacho Val (analog input for tacho)** Measured actual voltage at analog tacho input. The integer scaling may differ, depending on the connected hardware and jumper setting. **Notes:** – This value is not valid, if an analog tacho is connected! – A value of 11 V equals 1.25 * *M1TachMaxSpeed (88.25)* Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.02 Unused				
5.03 **AI1 Val (analog input 1 value)** Measured actual voltage at analog input 1. The integer scaling may differ, depending on the connected hardware and jumper settings. Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.04 **AI2 Val (analog input 2 value)** Measured actual voltage at analog input 2. The integer scaling may differ, depending on the connected hardware and jumper settings. Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V

Signal / Parameter name	min.	max.	def.	unit
5.05 **AI3 Val (analog input 3 value)** Measured actual voltage at analog input 3. The integer scaling may differ, depending on the connected hardware and jumper settings. Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.06 **AI4 Val (analog input 4 value)** Measured actual voltage at analog input 4. The integer scaling may differ, depending on the connected hardware and jumper settings. Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.07 **AI5 Val (analog input 5 value)** Measured actual voltage at analog input 5. The integer scaling may differ, depending on the connected hardware and DIP-switch settings. Available only with RAIO extension module see *AIO ExtModule (98.06).* Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.08 **AI6 Val (analog input 6 value)** Measured actual voltage at analog input 6. The integer scaling may differ, depending on the connected hardware and DIP-switch settings. Available only with RAIO extension module see *AIO ExtModule (98.06).* Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.09 - 5.10 Unused				
5.11 **AO1 Val (analog output 1 value)** Measured actual voltage at analog output 1. Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.12 **AO2 Val (analog output 2 value)** Measured actual voltage at analog output 2. Int. Scaling: 1000 == 1 V Type: SI Volatile: Y	-	-	-	V
5.13 - 5.14 Unused				
5.15 **AI1 ValScaled (analog input 1 scaled value)** Internally scaled value of analog input 1. Depending on setting of *AI1HighVal (13.01)* and *AI1LowVal (13.02)*. Example: Setting of *AI1HighVal (13.01) = AI1LowVal (13.02)* = 4,000 mV gives a value of 250 % when AI1 = 10 V. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
5.16 **AI2 ValScaled (analog input 2 scaled value)** Internally scaled value of analog input 2. Depending on setting of *AI2HighVal (13.05)* and *AI2LowVal (13.06)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
5.17 **AI3 ValScaled (analog input 3 scaled value)** Internally scaled value of analog input 3. Depending on setting of *AI3HighVal (13.09)* and *AI3LowVal (13.10)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
5.18 **AI4 ValScaled (analog input 4 scaled value)** Internally scaled value of analog input 4. Depending on setting of *AI4HighVal (13.13)* and *AI4LowVal (13.14)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
5.19 **AI5 ValScaled (analog input 5 scaled value)** Internally scaled value of analog input 5. Depending on setting of *AI5HighVal (13.21)* and *AI5LowVal (13.22)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
5.20 **AI6 ValScaled (analog input 6 scaled value)** Internally scaled value of analog input 6. Depending on setting of *AI6HighVal (13.25)* and *AI6LowVal (13.26)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
Group 6: Drive logic signals				
6.01 **SystemTime (converter system time)** Shows the time of the converter in minutes. The system time can be either set by means of *SetSystemTime (16.11)* or via the DCS Control Panel. Int. Scaling: 1 == 1 min Type: I Volatile: Y	-	-	-	min
6.02 Unused				
6.03 **CurCtrlStat1 (1st current controller status)**				

Signal / Parameter name	min.	max.	def.	unit

1st current controller status word:

Bit	Value	Comment
B0	1	command **FansOn**
	0	command **FansOff**; See also trip levels in paragraph *Fault signals* of this manual
B1	1	one mains phase missing
	0	no action
B2		reserved
B3	1	motor heating function active
	0	motor heating function not active
B4-5		reserved
B6	1	dynamic braking active / started
	0	dynamic braking not active
B7	1	command to close main contactor: **MainContactorOn**
	0	command to open main contactor: **MainContactorOff**
B8	1	command to close contactor for dynamic braking resistor (armature current is zero): **DynamicBrakingOn**
	0	command to open contactor for dynamic braking resistor: **DynamicBrakingOff**
B9	1	drive is generating
	0	drive is motoring
B10	1	command to close the US style changeover DC-contactor (close the DC-contact, open the resistor contact): **US DCContactorOn**
	0	command to open the US style changeover DC-contactor (open the DC-contact, close the resistor contact): **US DCContactorOff**



Bit	Value	Comment
B11	1	firing pulses active (on)
	0	firing pulses blocked
B12	1	continuous current
	0	discontinuous current
B13	1	zero current detected
	0	current not zero
B14	1	command **Trip DC-breaker** (continuous signal)
	0	no action
B15	1	command **Trip DC-breaker** (1 s pulse)
	0	no action

Int. Scaling: 1 == 1 Type: I Volatile: Y

6.04 **CurCtrlStat2 (2nd current controller status)**

2nd current controller status word. The current controller will be blocked, *CurRefUsed (3.12)* is forced to zero and *ArmAlpha (3.13)* is forced to the value of *ArmAlphaMax (20.14)* if any of the bits is set (0 == OK):

Bit	Value	Meaning
B0	1	overcurrent, **F502 ArmOverCur** [*FaultWord1 (9.01)* bit 1]
	0	no action
B1	1	mains overvoltage (AC), **F513 MainsOvrVolt** [*FaultWord1 (9.01)* bit 12]
	0	no action
B2	1	mains undervoltage (AC), **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11]
	0	no action
B3	1	waiting for reduction of EMF to match the mains voltage [see *RevVoltMargin (44.21)*]
	0	no action
B4-7		reserved
B8-9		reserved
B10	1	waiting for zero current, if *ZeroCurTimeOut (97.19)* is elapsed before bit 10 is set back to 0 **F557ReversalTime** [*FaultWord4 (9.04)* bit 8] is set
	0	no action
B11		reserved

Signal / Parameter name	min.	max.	def.	unit

B12 reserved
B13 1 current controller not released, because *DevLimPLL (97.13)* is reached
0 no action
B14 1 mains not in synchronism (AC), **F514 MainsNotSync** [*FaultWord1 (9.01)* bit 13]
0 no action
B15 1 Current controller not released.
0 no action

Note:
A set bit does not necessarily lead to a fault message it depends also on the status of the drive.
Int. Scaling: 1 == 1 Type: I Volatile: Y

6.05 **SelBridge (selected bridge)**
Selected (current-conducting) bridge:
0 = **NoBridge** no bridge selected
1 = **Bridge1** bridge 1 selected (motoring bridge)
2 = **Bridge2** bridge 2 selected (generating bridge)
Int. Scaling: 1 == 1 Type: C Volatile: Y

min.	max.	def.	unit
-	-	-	-

Group 7: Control words

It is possible to write on all signals in this group - except *UsedMCW (7.04)* - my means of DWL, DCS Control Panel, AP or overriding control.

7.01 **MainCtrlWord (main control word, MCW)**
The main control word contains all drive depending commands and can be written to by AP or overriding control:

Bit	Name	Value	Comment
B0	**On (Off1N)**	1	Command to **RdyRun** state. With *MainContCtrlMode (21.16)* = **On**: Closes contactors, starts field exciter and fans. With *MainContCtrlMode (21.16)* = **On&Run**: **RdyRun** flag in *MainStatWord (8.01)* is forced to 1
		0	Command to **Off** state. Stopping via *Off1Mode (21.02)*.
B1	**Off2N**	1	No **Off2** (Emergency Off / Coast Stop)
		0	Command to **OnInhibit** state. Stop by coasting. The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. **Off2N** has priority over **OffN3** and **On**.
B2	**Off3N**	1	No **Off3** (E-stop)
		0	Command to **OnInhibit** state. Stopping via *E StopMode (21.04)*. **Off3N** has priority over **On**.
B3	**Run**	1	Command to **RdyRef** state. The firing pulses are released and the drive is running with the selected speed reference.
		0	Command to **RdyRun** state. Stop via *StopMode (21.03).*
B4	**RampOutZero**	1	no action
		0	speed ramp output is forced to zero
B5	**RampHold**	1	no action
		0	freeze (hold) speed ramp
B6	**RampInZero**	1	no action
		0	speed ramp input is forced to zero
B7	**Reset**	1	acknowledge fault indications with the positive edge
		0	no action
B8	**Inching1**	1	constant speed defined by *FixedSpeed1 (23.02)*, active only with *CommandSel (10.01)* = **MainCtrlWord** and **RampOutZero** = **RampHold** = **RampInZero** = 0; **Inching2** overrides **Inching1** alternatively *Jog1 (10.17)* can be used
		0	no action
B9	**Inching2**	1	constant speed defined by *FixedSpeed2 (23.03)*, active only with *CommandSel (10.01)* = **MainCtrlWord** and **RampOutZero** = **RampHold** = **RampInZero** = 0; **Inching2** overrides **Inching1** alternatively *Jog2 (10.18)* can be used
		0	no action

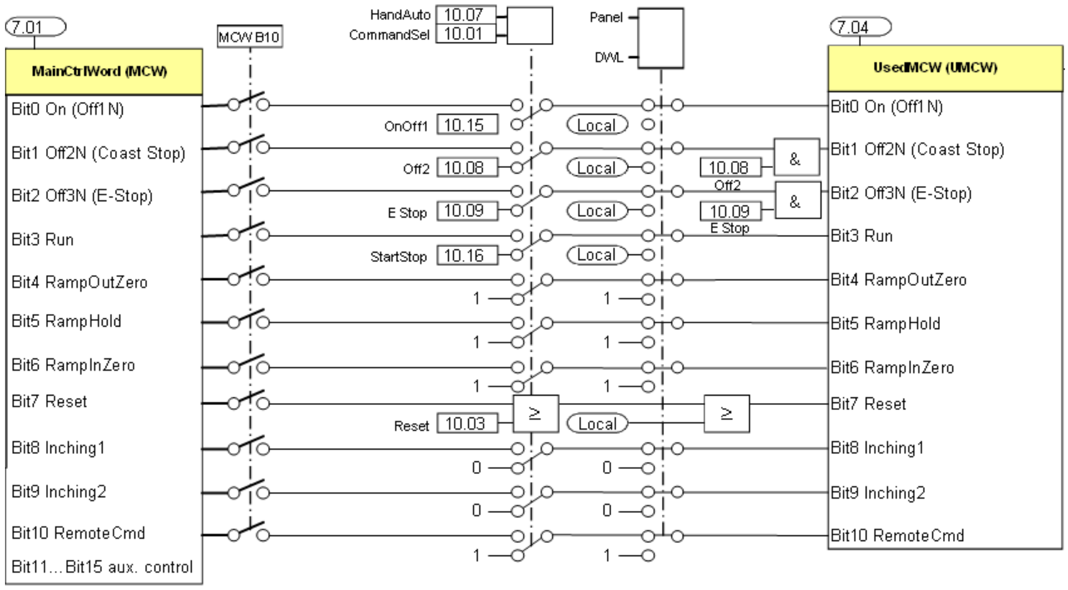
Signal / Parameter name	min.	max.	def.	unit
B10 **RemoteCmd** 1 overriding control enabled (overriding control has to set this bit to 1) 0 The last *UsedMCW (7.04)* and the last references [*SpeedRef (23.01)*, *AuxSpeedRef (23.13)*, *TorqRefA (25.01)*] are retained*.* On control place change - see *CommandSel (10.01*) - the drive is stopped. The aux. control bits (B11 to B15) are not affected. B11 aux. ctrl x used by AP or overriding control to control various functions selected by parameters B12-15 aux. ctrl x used by AP or overriding control to control various functions selected by parameters Int. Scaling: 1 == 1 Type: I Volatile: Y				
7.02 **AuxCtrlWord (auxiliary control word 1, ACW1)** The auxiliary control word 1 can be written to by AP or overriding control: Bit Name Value Comment B0-1 reserved B2 **RampBypass** 1 bypass speed ramp (speed ramp output is forced to value of speed ramp input) 0 no action B3 **BalRampOut** 1 speed ramp output is forced to *BalRampRef (22.08)* 0 no action B4 reserved B5 **DynBrakingOn** 1 force dynamic braking independent from *Off1Mode (21.02)*, *StopMode (21.03)* or *E StopMode (21.04)* 0 no action B6 **HoldSpeedCtrl** 1 freeze (hold) the I-part of the speed controller 0 no action B7 **WindowCtrl** 1 release window control 0 block window control B8 **BalSpeedCtrl** 1 speed controller output is forced to *BalRef (24.11)* 0 no action B9-11 reserved B12-15 reserved Int. Scaling: 1 == 1 Type: I Volatile: Y				
7.03 **AuxCtrlWord2 (auxiliary control word 2, ACW2)** The auxiliary control word 2 can be written to by AP or overriding control: Bit Name Value Comment B0-2 reserved B3 **EnableMailbox** 1 Mailbox funktion enabled 0 Mailbox function disabled B4 **DisableBridge1** 1 bridge 1 blocked 0 bridge 1 released B5 **DisableBridge2** 1 bridge 2 blocked 0 bridge 2 released B6 reserved B7 **ForceAlphaMax** 1 force single firing pulses and set firing angle (±) to *ArmAlphaMax (20.14)* 0 normal firing pulses released B8 **DriveDirection** 1 drive direction reverse (see note), changes the signs of *MotSpeed (1.04)* and *CurRef (3.11)* 0 drive direction forward (see note) B9 **ResetSPC** 1 reset integral part of speed controller 0 no action B10 **DirectSpeedRef** 1 speed ramp output is overwritten and forced to *DirectSpeedRef (23.15)* 0 speed ramp is active B11 reserved B12-14 reserved B15 **ResetPIDCtrl** 1 reset and hold PID-controller				

Signal / Parameter name	min.	max.	def.	unit

0 release PID controller

Note:
Changes of **DriveDirection** become active only in drive state **RdyRun**. Changing the speed direction of a running drive (**RdyRef** state) by means of **DriveDirection** is not possible.
Int. Scaling: 1 == 1 Type: I Volatile: Y

7.04 **UsedMCW (used main control word, UMCW)**
Internal used (selected) main control word is read only and contains all drive depending commands. The selection is depending on the drives local/remote control setting, *CommandSel (10.01)* and *HandAuto (10.07)*.
The bit functionality of bit 0 to bit 10 is the same as the in the *MainCtrlWord (7.01)*. Not all functions are controllable from local control or local I/O mode.
B0-10 see *MainCtrlWord (7.01)*
B11-15 reserved



Attention:
The *UsedMCW (7.04)* is write protected, thus it is not possible to write on the used main control word by means of Master-follower, AP or overriding control.
Int. Scaling: 1 == 1 Type: I Volatile: Y

7.05 **DO CtrlWord (digital output control word, DOCW)**
The DO control word 1 can be written to by AP or overriding control. To connect bits of the *DO CtrlWord (7.05)* with **DO1** to **DO8** use the parameters in group 14 (Digital outputs). **DO9** to **DO12** are directly sent to the extension I/O. Thus, they are only available for AP or overriding control.

Bit	Name	Comment
B0	**DO1**	this bit has to be send to the digital output via the parameters of group 14 (Digital outputs)
B1	**DO2**	this bit has to be send to the digital output via the parameters of group 14 (Digital outputs)
B2	**DO3**	this bit has to be send to the digital output via the parameters of group 14 (Digital outputs)
B3	**DO4**	this bit has to be send to the digital output via the parameters of group 14 (Digital outputs)
B4-B6	reserved	
B7	**DO8**	this bit has to be send to the digital output via the parameters of group 14 (Digital outputs)
B8	**DO9**	this bit is written directly to DO1 of the extension IO defined by *DIO ExtModule1 (98.03)*
B9	**DO10**	this bit is written directly to DO2 of the extension IO defined by *DIO ExtModule1 (98.03)*
B10	**DO11**	this bit is written directly to DO1 of the extension IO defined by *DIO ExtModule2 (98.04)*
B11	**DO12**	this bit is written directly to DO2 of the extension IO defined by *DIO ExtModule2 (98.04)*

B12-15 reserved
Int. Scaling: 1 == 1 Type: I Volatile: Y

Signal / Parameter name	min.	max.	def.	unit

Group 8: Status / limit words

8.01 **MainStatWord (main status word, MSW)**
Main status word:

Bit	Name	Value	Comment
B0	**RdyOn**	1	ready to switch on
		0	not ready to switch on
B1	**RdyRun**	1	ready to generate torque
		0	not ready to generate torque
B2	**RdyRef**	1	operation released **(Running)**
		0	operation blocked
B3	**Tripped**	1	fault indication
		0	no fault
B4	**Off2NStatus**	1	**Off2** not active
		0	**Off2** (**OnInhibit** state) active
B5	**Off3NStatus**	1	**Off3** not active
		0	**Off3** (**OnInhibit** state) active
B6	**OnInhibited**	1	**OnInhibited** state is active after a: – fault – Emergency Off / Coast Stop **(Off2)** – E-stop **(Off3)** – **OnInhibited** via digital input *Off2 (10.08)* or *E Stop (10.09)*
		0	**OnInhibit** state not active
B7	**Alarm**	1	alarm indication
		0	no alarm
B8	**AtSetpoint**	1	setpoint - *SpeedRef4 (2.18)* - and actual value - *MotSpeed (1.04)* - in the tolerance zone
		0	setpoint - *SpeedRef4 (2.18)* - and actual value - *MotSpeed (1.04)* - out of the tolerance zone
B9	**Remote**	1	remote control
		0	local control
B10	**AboveLimit**	1	speed greater than defined in *SpeedLev (50.10)*
		0	speed lower or equal than defined *SpeedLev (50.10)*
B11	reserved		
B12-B15	reserved		

Int. Scaling: 1 == 1 Type: I Volatile: Y

8.02 **AuxStatWord (auxiliary status word, ASW)**
Auxiliary status word:

Bit	Name	Value	Comment
B0	reserved		
B1	**OutOfWindow**	1	actual speed is out of window defined by *WinWidthPos (23.08)* and *WinWidthNeg (23.09)*
		0	actual speed is inside the defined window
B2	reserved		
B3	**User1**	1	macro **User1** active, see *ApplMacro (99.08)*
		0	macro **User1** not active
B4	**User2**	1	macro **User2** active, see *ApplMacro (99.08)*
		0	macro **User2** not active
B5-7	reserved		
B8	reserved		
B9	**Limiting**	1	drive is in a limit, see *LimWord (8.03)*
		0	drive is not in a limit,
B10	**TorqCtrl**	1	drive is torque controlled
		0	no action
B11	**ZeroSpeed**	1	actual motor speed is in the zero speed limit defined by *M1ZeroSpeedLim (20.03)*

Signal / Parameter name | min. | max. | def. | unit

		0	actual motor speed is out of the zero speed limit
B12	**EMFSpeed**	1	*M1SpeedFbSel (50.03)* = **EMF**
		0	no action
B13	**FaultOrAlarm**	1	fault or alarm indication
		0	no fault or alarm indication
B14	**DriveDirectionNeg**	1	negative drive direction active - controlled by bit 8 of *AuxCtrlWord2 (7.03)*
		0	positive drive direction active - controlled by bit 8 of *AuxCtrlWord2 (7.03)*
B15	**AutoReclosing**	1	auto reclosing logic is active
		0	no action

Int. Scaling: 1 == 1 Type: I Volatile: Y

8.03 **LimWord (limit word, LW)**

Limit word:

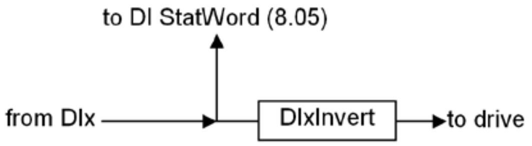
Bit	active limit
B0	*TorqMax (20.05)* or *TorqMaxAll (2.19)*
B1	*TorqMin (20.06)* or *TorqMinAll (2.20)*
B2	*TorqMaxSPC (20.07)* or *TorqMaxAll (2.19)*
B3	*TorqMinSPC (20.08)* or *TorqMinAll (2.20)*
B4	*IndepTorqMaxSPC (20.24)*
B5	*IndepTorqMinSPC (20.25)*
B6	*TorqMaxTref (20.09)*
B7	*TorqMinTref (20.10)*
B8	*M1SpeedMax (20.02)*
B9	*M1SpeedMin (20.01)*
B10	*M1CurLimBrdg1 (20.12)*
B11	*M1CurLimBrdg2 (20.13)*
B12-15	reserved

Int. Scaling: 1 == 1 Type: I Volatile: Y

8.04 Unused

8.05 **DI StatWord (digital inputs status word, DISW)**

Digital input word, shows the value of the digital inputs before inversion [DI1Invert (10.25), …, DI11Invert (10.35)]:



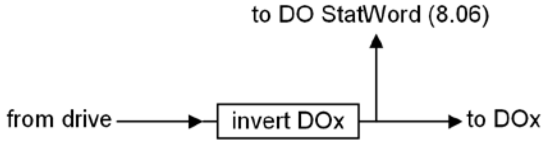
Bit	Name	Comment / default setting
B0	**DI1**	*ConvFanAck (10.20)*, actual setting depends on macro
B1	**DI2**	*MotFanAck (10.06)*, actual setting depends on macro
B2	**DI3**	*MainContAck (10.21)*, actual setting depends on macro
B3	**DI4**	*Off2 (10.08)*, actual setting depends on macro
B4	**DI5**	*E Stop (10.09)*, actual setting depends on macro
B5	**DI6**	*Reset (10.03)*, actual setting depends on macro
B6	**DI7**	*OnOff (10.15)*, actual setting depends on macro
B7	**DI8**	*StartStop (10.16)*, actual setting depends on macro
B8	**DI9**	DI1 of the extension IO defined by *DIO ExtModule1 (98.03)*
B9	**DI10**	DI2 of the extension IO defined by *DIO ExtModule1 (98.03)*
B10	**DI11**	DI3 of the extension IO defined by *DIO ExtModule1 (98.03)*
B11	**DI12**	DI1 of the extension IO defined by *DIO ExtModule2 (98.04).* Only available for AP or overriding control.
B12	**DI13**	DI2 of the extension IO defined by *DIO ExtModule2 (98.04).* Only available for AP or overriding control.
B13	**DI14**	DI3 of the extension IO defined by *DIO ExtModule2 (98.04).* Only available for AP or overriding control.
B14-15	reserved	

Signal / Parameter name	min.	max.	def.	unit

Int. Scaling: 1 == 1 Type: I Volatile: Y

8.06 **DO StatWord (digital outputs status word, DOSW)**

Digital output word, shows the value of the digital outputs after inversion:



Bit	Name	Comment / default setting
B0	**DO1**	*DO1Index (14.01)* = 603 and *DO1BitNo (14.02)* = 15, **FansOn**, actual setting depends on macro
B1	**DO2**	*DO2Index (14.03)* = 603 and *DO2BitNo (14.04)* = 5, not connected, actual setting depends on macro
B2	**DO3**	*DO3Index (14.05)* = 603 and *DO3BitNo (14.06)* = 7, **MainContactorOn**, actual setting depends on macro
B3	**DO4**	*DO4Index (14.07)* = 0 and *DO4BitNo (14.08)* = 0, not connected, actual setting depends on macro
B4-B6	reserved	
B7	**DO8**	*DO8Index (14.15)* = 603 and *DO8BitNo (14.16)* = 7, **MainContactorOn**, actual setting depends on macro
B8	**DO9**	DO1 of the extension IO defined by *DIO ExtModule1 (98.03),* written to by *DO CtrlWord (7.05)* bit 8
B9	**DO10**	DO2 of the extension IO defined by *DIO ExtModule1 (98.03),* written to by *DO CtrlWord (7.05)* bit 9
B10	**DO11**	DO1 of the extension IO defined by *DIO ExtModule2 (98.04),* written to by *DO CtrlWord (7.05)* bit 10
B11	**DO12**	DO2 of the extension IO defined by *DIO ExtModule2 (98.04),* written to by *DO CtrlWord (7.05)* bit 11
B12-15	reserved	

Int. Scaling: 1 == 1 Type: I Volatile: Y

8.07 Unused

8.08 **DriveStat (drive status)**

Drive status:

0 = **OnInhibited**	drive is in **OnInhibit** state
1 = **ChangeToOff**	drive is changing to **Off**
2 = **Off**	drive is **Off**
3 = **RdyOn**	drive is ready on
4 = **RdyRun**	drive is ready run
5 = **Running**	drive is **Running**
6 = **Stopping**	drive is **Stopping**
7 = **Off3**	drive is in **Off3** state (E-stop)
8 = **Off2**	drive is in **Off2** state (Emergency Off or Coast Stop)
9 = **Tripped**	drive is **Tripped**

Int. Scaling: 1 == 1 Type: C Volatile: Y

8.09 Unused

8.10 **MacroSel (selected macro)**

Currently selected macro:

0 = **None**	default
1 = **Factory**	factory (default) parameter set
2 = **User1**	**User1** parameter set
3 = **User2**	**User2** parameter set
4 = **Standard**	standard parameter set
5 = **Man/Const**	manual / constant speed
6 = **Hand/Auto**	hand (manual) / automatic
7 = **Hand/MotPot**	hand (manual) / motor potentiometer
8 = reserved	reserved
9 = **MotPot**	motor potentiometer
10 = **TorqCtrl**	torque control
11 = **TorqLimit**	torque limit
12 = **DemoStandard**	demo standard
13 = **2WreDCcontUS**	2 wire with US style DC-breaker

Signal / Parameter name	min.	max.	def.	unit

14 = **3WreDCcontUS** 3 wire with US style DC-breaker
15 = **3WreStandard** 3 wire standard
See ApplMacro *(99.08)*
Int. Scaling: 1 == 1 Type: C Volatile: Y

Group 9: Fault / alarm words

9.01 **FaultWord1 (fault word 1)**
Fault word 1:

Bit	Fault text	Fault code and trip level		Comment
B0	**AuxUnderVolt**	F501	1	auxiliary undervoltage
B1	**ArmOverCur**	F502	3	armature overcurrent, *ArmOvrCurLev (30.09)*
B2	**ArmOverVolt**	F503	3	armature overvoltage, *ArmOvrVoltLev (30.08)*
B3	**ConvOverTemp**	F504	2	converter overtemperature, *ConvTempDly (97.05)*, shutdown temperature see *MaxBridgeTemp (4.17)*
B4	reserved			
B5	**M1OverTemp**	F506	2	measured overtemperature, *M1FaultLimTemp (31.07)* or *M1KlixonSel (31.08)*
B6	**M1OverLoad**	F507	2	calculated overload (thermal model), *M1FaultLimLoad (31.04)*
B7	**I/OBoardLoss**	F508	1	I/O board not found or faulty, *DIO ExtModule1 (98.03)*, *DIO ExtModule2 (98.04)*, *AIO ExtModule (98.06)*
B8 - B10	reserved			
B11	**MainsLowVolt**	F512	3	mains low (under-) voltage, *PwrLossTrip (30.21), UNetMin1 (30.22)*, *UNetMin2 (30.23)*
B12	**MainsOvrVolt**	F513	1	mains overvoltage, actual mains voltage is > 1.3 * *NomMainsVolt (99.10)* for longer than 10 s
B13	**MainsNotSync**	F514	3	mains not in synchronism
B14	**M1FexOverCur**	F515	1	field exciter overcurrent, *M1FldOvrCurLev (30.13)*
B15	reserved			

Int. Scaling: 1 == 1 Type: I Volatile: Y

9.02 **FaultWord2 (fault word 2)**
Fault word 2:

Bit	Fault text	Fault code and trip level		Comment
B0	**ArmCurRipple**	F517	3	armature current ripple, *CurRippleMode (30.18), CurRippleLim (30.19)*
B1-3	reserved			
B4	reserved			
B5	**SpeedFb**	F522	3	selected motor: speed feedback, *SpeedFbFltSel (30.17), SpeedFbFltMode (30.36), M1SpeedFbSel (50.03)*
B6	**ExtFanAck**	F523	4	external fan acknowledge missing *MotFanAck (10.06)*
B7	**MainContAck**	F524	3	main contactor acknowledge missing, *MainContAck (10.21)*
B8	**TypeCode**	F525	1	type code mismatch, *TypeCode (97.01)*
B9	**ExternalDI**	F526	1	external fault via binary input, *ExtFaultSel (30.31)*
B10	reserved			
B11	**FieldBusCom**	F528	5	fieldbus communication loss, *ComLossCtrl (30.28), FB TimeOut (30.35), CommModule (98.02)*
B12-13	reserved			
B14	**MotorStalled**	F531	3	selected motor: motor stalled, *StallTime (30.01), StallSpeed (30.02), StallTorq (30.03)*
B15	**MotOverSpeed**	F532	3	selected motor: motor overspeed, *M1OvrSpeed (30.16)*

Int. Scaling: 1 == 1 Type: I Volatile: Y

9.03 **FaultWord3 (fault word 3)**
Fault word 3:

Signal / Parameter name					min.	max.	def.	unit
Bit	Fault text	Fault code and trip level		Comment				
B0-3	reserved							
B4-6	reserved							
B7	**COM8Faulty**	F540	1	SDCS-COM-8 faulty				
B8	**M1FexLowCur**	F541	1	low field current, *M1FldMinTrip (30.12), FldMinTripDly (45.18)*				
B9	reserved							
B10	**COM8Com**	F543	5	SDCS-COM-8 communication loss				
B11	reserved							
B12	reserved							
B13	**LocalCmdLoss**	F546	5	local command loss, *LocalLossCtrl (30.27)*				
B14	**HwFailure**	F547	1	hardware failure, see *Diagnosis (9.11)*				
B15	**FwFailure**	F548	1	firmware failure, see *Diagnosis (9.11)*				
Int. Scaling: 1 == 1		Type: I		Volatile: Y				
9.04 **FaultWord4 (fault word 4)** Fault word 4:								
Bit	Fault text	Fault code and trip level		Comment				
B0	**ParComp**	F549	1	parameter compatibility, the parameter causing the fault can be identified in *Diagnosis (9.11)*				
B1	**ParMemRead**	F550	1	reading the actual parameter set or a user parameter set from the parameter flash failed (checksum fault)				
B2	**AIRange**	F551	4	analog input range, *AI Mon4mA (30.29)*				
B3	reserved							
B4	**TachPolarity**	F553	3	selected motor: tacho respectively pulse encoder polarity				
B5	**TachoRange**	F554	3	Overflow of AITacho input				
B6-7	reserved							
B8	**ReversalTime**	F557	3	reversal time, *ZeroCurTimeOut (97.19), RevDly (43.14)*				
B9-10	reserved							
B11	**APFault1**	F601	1	AP fault 1				
B12	**APFault2**	F602	1	AP fault 2				
B13	**APFault3**	F603	1	AP fault 3				
B14	**APFault4**	F604	1	AP fault 4				
B15	**APFault5**	F605	1	AP fault 5				
Int. Scaling: 1 == 1		Type: I		Volatile: Y				
9.05 Unused								
9.06 **AlarmWord1 (alarm word 1)** Alarm word 1:								
Bit	Alarm text	Alarm code and alarm level		Comment				
B0	**Off2ViaDI**	A101	1	**Off2** (Emergency Off / Coast Stop) pending via digital input, Off2 (10.08)				
B1	**Off3ViaDI**	A102	1	**Off3** (E-stop) pending via digital input, *E Stop (10.09)*				
B2	**DC BreakAck**	A103	3	selected motor: DC-breaker acknowledge missing, *DC BreakAck (10.23)*				
B3	**ConvOverTemp**	A104	2	converter overtemperature, shutdown temperature see *MaxBridgeTemp (4.17)*. The converter overtemperature alarm will already appear at approximately 5°C below the shutdown temperature.				
B4	**DynBrakeAck**	A105	1	selected motor: dynamic braking acknowledge is still pending, *DynBrakeAck (10.22)*				
B5	**M1OverTemp**	A106	2	measured motor overtemperature, *M1AlarmLimTemp (31.06)*				
B6	**M1OverLoad**	A107	2	calculated motor overload (thermal model), *M1AlarmLimLoad (31.03)*				
B7	**MotCurReduce**	A108	4	I^2T-protection active and motor current is reduced, see *M1LoadCurMax (31.10)*,				

Signal / Parameter name				min.	max.	def.	unit
			M1OvrLoadTime (31.11) and *M1RecoveryTime (31.12)*				
B8-9	reserved						
B10	**MainsLowVolt**	A111 3	mains low (under-) voltage, *PwrLossTrip (30.21), UNetMin1 (30.22)*, *UNetMin2 (30.23)*				
B11	reserved						
B12	**COM8Com**	A113 4	SDCS-COM-8 communication loss				
B13	**ArmCurDev**	A114 3	armature current deviation				
B14	**TachoRange**	A115 4	Overflow of AITacho input or *M1OvrSpeed (30.16)* has been changed				
B15	reserved						
Int. Scaling: 1 == 1		Type: I	Volatile: Y				
9.07 **AlarmWord2 (alarm word 2)** Alarm word 2:							
Bit	Alarm text	Alarm code and alarm level	Comment				
B0	**ArmCurRipple**	A117 4	armature current ripple, *CurRippleMode (30.18, CurRippleLim (30.19)*				
B1-3	reserved						
B4	**AutotuneFail**	A121 4	autotuning failure, *Diagnosis (9.11)*				
B5	reserved						
B6	**FaultSuppres**	A123 4	at least one fault message is mask				
B7	**SpeedScale**	A124 4	speed scaling out of range, *M1SpeedScale (50.01)* and *M1BaseSpeed (99.04)*, the parameter causing the alarm can be identified in *Diagnosis (9.11)*				
B8	**SpeedFb**	A125 4	selected motor: speed feedback, *M1SpeedFbSel (50.03)*, *SpeedFbFltMode (30.36)*, *SpeedFbFltSel (30.17)*				
B9	**ExternalDI**	A126 4	external alarm via binary input, *ExtAlarmSel (30.32)*				
B10	**AIRange**	A127 4	analog input range, *AI Mon4mA(30.29)*				
B11	**FieldBusCom**	A128 4	fieldbus communication loss, *ComLossCtrl (30.28)*				
B12	**ParRestored**	A129 4	The parameters found in flash are invalid at power-up (checksum fault). The parameters were restored from the parameter backup.				
B13	**LocalCmdLoss**	A130 4	local command loss, *LocalLossCtrl (30.27)*				
B14	**ParAdded**	A131 4	A new firmware with a different amount of parameters was downloaded. The new parameters are set to their default values. The parameters causing the alarm can be identified in *Diagnosis (9.11)*.				
B15	**ParConflict**	A132 4	parameter setting conflict, the parameter causing the alarm can be identified in *Diagnosis (9.11)*				
Int. Scaling: 1 == 1		Type: I	Volatile: Y				
9.08 **AlarmWord3 (alarm word 3)** Alarm word 3:							
Bit	Alarm text	Alarm code and alarm level	Comment				
B0	**RetainInv**	A133 -	retain data invalid				
B1	**ParComp**	A134 4	parameter compatibility, the parameter causing the alarm can be identified in *Diagnosis (9.11)*				
B2	**ParUpDwnLoad**	A135 4	The *checksum* verification failed during up- or download of parameters. Please try again.				
B3	**NoAPTaskTime**	A136 4	AP task for not set in *TimeLevSel (83.04)*				
B4	**SpeedNotZero**	A137 1	Re-start of drive is not possible. Speed zero -see *M1ZeroSpeedLim (20.03)* - has not been reached. In case of a trip set **On** = **Run** = 0 to reset the alarm.				
B5	**Off2FieldBus**	A138 1	**Off2** (Emergency Off / Coast Stop) pending via fieldbus, Off2 (10.08)				
B6	**Off3FieldBus**	A139 1	**Off3** (E-stop) pending via fieldbus, *E Stop (10.09)*				
B7	**IllgFieldBus**	A140 4	the fieldbus parameters in group 51 (fieldbus) are not set according to the fieldbus adapter or the device has not been selected				
B8	**COM8FwVer**	A141 4	invalid combination of SDCS-CON-F firmware and SDCS-COM-8 firmware				

Signal / Parameter name	min.	max.	def.	unit
B9-10 reserved B11 **APAlarm1** A301 4 AP alarm 1 --- B12 **APAlarm2** A302 4 AP alarm 2 B13 **APAlarm3** A303 4 AP alarm 3 B14 **APAlarm4** A304 4 AP alarm 4 B15 **APAlarm5** A305 4 AP alarm 5 Int. Scaling: 1 == 1 Type: I Volatile: Y				
9.09 Unused				
9.10 **SysFaultWord (system fault word)** Operating system faults from SDCS-COM-8 board: Bit Fault text — Fault code F B0 Factory macro parameter file error — default parameters are invalid B1 User macro parameter file error — one of the User macros is invalid B2 Non volatile operating system error — AMCOS fault, please contact Your local ABB agent B3 File error in flash — problems when writing to the flash memory, please try again --- B4 Internal time level T2 overflow (100 µs) — timeout of task T2, if happens frequently please contact Your local ABB agent B5 Internal time level T3 overflow (1 ms) — timeout of task T3, if happens frequently please contact Your local ABB agent B6 Internal time level T4 overflow (50 ms) — timeout of task T4, if happens frequently please contact Your local ABB agent B7 Internal time level T5 overflow (1 s) — timeout of task T5, if happens frequently please contact Your local ABB agent --- B8 State overflow — timeout of task State, if happens frequently please contact Your local ABB agent B9 Application window ending overflow — application on SDCS-COM-8 faulty B10 Application program overflow — application on SDCS-COM-8 faulty B11 Illegal instruction — crash of CPU due to EMC or hardware problems --- B12 Register stack overflow — overflow due to EMC or firmware bug B13 System stack overflow — overflow due to EMC or firmware bug B14 System stack underflow — underflow due to crash of CPU or firmware bug B15 reserved Int. Scaling: 1 == 1 Type: I Volatile: Y				
9.11 **Diagnosis (diagnosis)** **Attention:** *Diagnosis (9.11)* is set to zero by means of **Reset**. Displays diagnostics messages: 0 = no message **Firmware:** 1 = default setting of parameters wrong 2 = parameter flash image too small for all parameters 3 = reserved 4 = illegal write attempt on a signal or write-protected parameter, e.g. writing on *UsedMCW (7.04)* 5 = reserved 6 = wrong type code 7 = an un-initialized interrupted has occurred 8, 9 = reserved 10 = wrong parameter value **Autotuning:** 11 = autotuning aborted by fault or removing the **Run** command [UsedMCW (7.04) bit 3] 12 = autotuning timeout, **Run** command [UsedMCW (7.04) bit 3] is not set in time 13 = motor is still turning, no speed zero indication				

Signal / Parameter name	min.	max.	def.	unit
14 = field current not zero 15 = armature current not zero 16 = armature voltage measurement circuit open (e.g. not connected) or interrupted, check also current and torque limits 17 = armature circuit and/or armature voltage measurement circuit wrongly connected 18 = no load connected to armature circuit 19 = invalid nominal armature current setting; – armature current *M1MotNomCur (99.03)* is set to zero 20 = field current does not decrease when the excitation is switched off 21 = field current actual doesn't reach field current reference; – no detection of field resistance; – field circuit open (e.g. not connected) respectively interrupted 22 = no writing of control parameters of speed controller 23 = tacho adjustment faulty or not OK or the tacho voltage is too high during autotuning 24 = tuning of speed controller, speed feedback assistant or tacho fine tuning not possible due to speed limitation - see e.g. *M1SpeedMin (20.01)* and *M1SpeedMax (20.02)* 25 = Tuning of speed controller, speed feedback assistant or tacho fine tuning not possible due to voltage limitation. During the tuning of the speed controller, the speed feedback assistant or the tacho fine-tuning base speed [*M1BaseSpeed (99.04)*] might be reached. Thus full armature voltage [*M1NomVolt (99.02)*] is necessary. In case the mains voltage is too low to provide for the needed armature voltage the autotuning procedure is canceled. Check and adapt if needed: – Mains voltage – *M1NomVolt (99.02)* – *M1BaseSpeed (99.04)* 26 = field weakening not allowed, see *M1SpeedFbSel (50.03)* and *FldCtrlMode (44.01)* 27 = discontinuous current limit could not be determined due to low current limitation in *M1CurLimBrdg1 (20.12)* or M1CurLimBrdg2 *(20.13)* 28 = reserved 29 = no field exciter selected, see *M1UsedFexType (99.12)* 30 = reserved 31 = DCS Control Panel up- or download not started 32 = DCS Control Panel data not up- or downloaded in time 33 = reserved 34 = DCS Control Panel up -or download checksum faulty 35 = DCS Control Panel up- or download software faulty 36 = DCS Control Panel up- or download verification failed 37-40 reserved 41 = The flash is written to cyclic by AP (e.g. block ParWrite). Cyclic saving of values in the flash will damage it! Do not write cyclic on the flash! 42-49 reserved Hardware: 50 = parameter flash faulty (erase) 51 = parameter flash faulty (program) 52 = check connector X12 on SDCS-CON-F and connector X12 and X22 on SDCS-PIN-F 53-69 reserved **A132 ParConflict** (alarm parameter setting conflict): 70 = reserved 71 = flux linearization parameters not consistent 72 = wrong firing angle limitation (Max and Min value 20.14 and 20.15) 73 = armature data not consistent. Check if: – *M1NomCur (99.03)* is set to zero, – *M1NomVolt (99.02)* and *M1NomCur (99.03)* are fitting with the drive. In case they are much smaller than the drive the internal calculation of *M1ArmL (43.09)* and *M1ArmR (43.10)* can cause an internal overflow. Set *M1ArmL (43.09)* and *M1ArmR (43.10)* to zero. For *M1ArmL (43.09)* following limitation is valid:				

Signal / Parameter name	min.	max.	def.	unit

$$\frac{(43.09)*4096*(99.03)}{1000*(99.02)} \leq 32767$$

For *M1ArmR (43.10)* following limitation is valid:

$$\frac{(43.10)*4096*(99.03)}{1000*(99.02)} \leq 32767$$

74 = reserved
75 = I^2T-function: *M1RecoveryTime (31.12)* is set too short compared to *M1OvrLoadTime (31.11)*
76 = reserved
77 = Encoder 1 parameters for not consistent. Check:
- *SpeedScaleAct (2.29)*
- *M1EncPulseNo (50.04)*

At scaling speed - see *SpeedScaleAct (2.29)* - the pulse frequency must be greater than 600 Hz according to following formula:

$$f \geq 600\,Hz = \frac{ppr * evaluation * speed\ scaling}{60\,s}$$

$$f \geq 600\,Hz = \frac{(50.04)*(50.02)*(2.29)}{60\,s}$$

E.g. the speed scaling must be ≥ 9 rpm for a pulse encoder with 1024 pulses and A+-/B+- evaluation.
78-79 reserved

Autotuning:
80 = speed does not reach setpoint (EMF control)
81 = motor is not accelerating or wrong tacho polarity (tacho / encoder)
82 = not enough load (too low inertia) for the detection of speed controller parameters
83 = drive not in speed control mode, see *TorqSel (26.01)* and *TorqMuxMode (26.04)*
84 = winder tunings: measured torque is not constant (ripple > 7,5 %)
85-89 reserved

Thyristor diagnosis:
90 = shortcut caused by V1
91 = shortcut caused by V2
92 = shortcut caused by V3
93 = shortcut caused by V4
94 = shortcut caused by V5
95 = shortcut caused by V6
96 = thyristor block test failed
97 = shortcut caused by V15 or V22
98 = shortcut caused by V16 or V23
99 = shortcut caused by V11 or V24
100 = shortcut caused by V12 or V25
101 = shortcut caused by V13 or V26
102 = shortcut caused by V14 or V21
103 = motor connected to ground
104 = armature winding is not connected
105-
120 reserved

AI monitoring:
121 = AI1 below 4 mA
122 = AI2 below 4 mA
123 = AI3 below 4 mA
124 = AI4 below 4 mA
125 = AI5 below 4 mA
126 = AI6 below 4 mA

Signal / Parameter name	min.	max.	def.	unit

127 = AITAC below 4 mA
128-
149 reserved

Option modules:
150 = fieldbus module missing see *CommModule (98.02)*
151-
154 reserved
155 = RAIO-xx in option slot on SDCS-CON-F missing see group 98
156 reserved
157 = RDIO-xx in option slot on SDCS-CON-F missing see group 98
158-
164 reserved

A134 ParComp (alarm parameter compatibility conflict):
10000 … 19999 = the parameter with the compatibility conflict can be identified by means of the last 4 digits

ParNoCyc (notice parameter not cyclic):
20000 … 29999 = the not cyclic parameter which is being written to by means of a pointer parameter [e.g. *DsetXVal1 (90.01)*] can be identified by means of the last 4 digits

F548 FwFailure (fault firmware failure):
20000 … 29999 = the read only parameter which is being written to by means of a pointer parameter [e.g. *DsetXVal1 (90.01)*] or AP can be identified by means of the last 4 digits

Thyristor diagnosis:
30000 = possibly trigger pulse channels are mixed up
31xdd = V1 or V11 not conducting
32xdd = V2 or V12 not conducting
33xdd = V3 or V13 not conducting
34xdd = V4 or V14 not conducting
35xdd = V5 or V15 not conducting
36xdd = V6 or V16 not conducting
x = 0: only a single thyristor in bridge 1 is not conducting (e.g. 320dd means V2 respectively V12 is not conducting)
x = 1 … 6: additionally a second thyristor in bridge 1 is no conducting (e.g. 325dd means V2 and V5 respectively V12 and V15 are not conducting)
dd = don’t care, the numbers of this digits do not carry any information about the thyristors of the first bridge.
Example:
36030: means V16 in bridge 1 and V23 in bridge 2 are not conducting

3dd1y = V21 not conducting
3dd2y = V22 not conducting
3dd3y = V23 not conducting
3dd4y = V24 not conducting
3dd5y = V25 not conducting
3dd6y = V26 not conducting
y = 0: only a single thyristor in bridge 2 is not conducting (e.g. 3dd20 means V22 is not conducting)
y = 1 … 6: additionally a second thyristor in bridge 2 is no conducting (e.g. 3dd25 means V22 and V25 are not conducting)
dd = don’t care, the numbers of this digits do not carry any information about the thyristors of the second bridge.
Example:
36030: means V16 in bridge 1 and V23 in bridge 2 are not conducting

A124 SpeedScale (alarm speed scaling):
40000 … 49999 = the parameter with the speed scaling conflict can be identified by means of the last 4 digits

F549 ParComp (fault parameter compatibility conflict):
50000 … 59999= the parameter with the compatibility conflict can be identified by means of the last 4 digits
Int. Scaling: 1 == 1 Type: I Volatile: Y

Signal / Parameter name	min.	max.	def.	unit
9.12 **LastFault (last fault)** Displays the last fault: **F<Fault code> <FaultName>** (e.g. **F2 ArmOverCur**) Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
9.13 **2nd LastFault (2nd last fault)** Displays the 2nd last fault: **F<Fault code> <FaultName>** (e.g. **F2 ArmOverCur**) Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
9.14 **3rd LastFault (3rd last fault)** Displays the 3rd last fault: **F<Fault code> <FaultName>** (e.g. **F2 ArmOverCur**) Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-

Parameters

Signal / Parameter name	min.	max.	def.	unit
Group 10: Start / stop select				
10.01 **CommandSel (command selector)** *UsedMCW (7.04)* selector: 0 = **Local I/O** Drive is controlled via local I/O. *Reset (10.03)* = DI6; *UsedMCW (7.04)* bit 7, default *OnOff1 (10.15)* = DI7; *UsedMCW (7.04)* bit 0, default and *StartStop (10.16)* = DI8; *UsedMCW (7.04)* bit 3, default 1 = **MainCtrlWord** drive is controlled via *MainCtrlWord (7.01)* 2 = **Key** Automatic switchover from **MainCtrlWord** to **Local I/O** in case of **F528 FieldBusCom** [*FaultWord2 (9.02)* bit 11]. It is still possible to control the drive via local I/O. *OnOff1 (10.15)* = DI7; *UsedMCW (7.04)* bit 0, default and *StartStop (10.16)* = DI8; *UsedMCW (7.04)* bit 3, default. The used speed reference is set by means of *FixedSpeed1 (23.02).* **Notes:** – Local control mode has higher priority than the selection made with *CommandSel (10.01)*. – The commands *Off2 (10.08), E Stop (10.09)* and *Reset (10.03)* are always active (in case they are assigned) regardless of *CommandSel (10.01)* setting. Int. Scaling: 1 == 1 Type: C Volatile: N	Local I/O	Key	Local I/O	-
10.02 **Direction (direction of rotation)** Binary signal for **Direction**. *Direction (10.02)* allows to change the direction of rotation by negating the speed reference in remote operation: 0 = **NotUsed** default 1 = **DI1** 1 = **Reverse,** 0 = **Forward** 2 = **DI2** 1 = **Reverse,** 0 = **Forward** 3 = **DI3** 1 = **Reverse,** 0 = **Forward** 4 = **DI4** 1 = **Reverse,** 0 = **Forward** 5 = **DI5** 1 = **Reverse,** 0 = **Forward** 6 = **DI6** 1 = **Reverse,** 0 = **Forward** 7 = **DI7** 1 = **Reverse,** 0 = **Forward** 8 = **DI8** 1 = **Reverse,** 0 = **Forward** 9 = **DI9** 1 = **Reverse,** 0 = **Forward,** only available with digital extension board 10 = **DI10** 1 = **Reverse,** 0 = **Forward,** only available with digital extension board 11 = **DI11** 1 = **Reverse,** 0 = **Forward,** only available with digital extension board 12 = **MCW Bit11** 1 = **Reverse,** 0 = **Forward,** *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1 = **Reverse,** 0 = **Forward,** *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1 = **Reverse,** 0 = **Forward,** *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1 = **Reverse,** 0 = **Forward,** *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1 = **Reverse,** 0 = **Forward,** *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-

Signal / Parameter name	min.	max.	def.	unit
10.03 **Reset (Reset command)** Binary signal for **Reset**, *UsedMCW (7.04)* bit 7: 0 = **NotUsed** 1 = **DI1** **Reset** by rising edge (0 → 1) 2 = **DI2** **Reset** by rising edge (0 → 1) 3 = **DI3** **Reset** by rising edge (0 → 1) 4 = **DI4** **Reset** by rising edge (0 → 1) 5 = **DI5** **Reset** by rising edge (0 → 1) 6 = **DI6** **Reset** by rising edge (0 → 1), default 7 = **DI7** **Reset** by rising edge (0 → 1) 8 = **DI8** **Reset** by rising edge (0 → 1) 9 = **DI9** **Reset** by rising edge (0 → 1), only available with digital extension board 10 = **DI10** **Reset** by rising edge (0 → 1), only available with digital extension board 11 = **DI11** **Reset** by rising edge (0 → 1), only available with digital extension board 12 = **MCW Bit11** **Reset** by rising edge (0 → 1), *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** **Reset** by rising edge (0 → 1), *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** **Reset** by rising edge (0 → 1), *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** **Reset** by rising edge (0 → 1), *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** **Reset** by rising edge (0 → 1), *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	DI6	-
10.04 - 10.05 Unused				
10.06 **MotFanAck (motor fan acknowledge)** The drive trips with **F523 ExtFanAck** [*FaultWord2 (9.02)* bit 6] if a digital input for an external fan is selected and the acknowledge is missing for 10 seconds: 0 = **NotUsed** 1 = **DI1** 1= **acknowledge** OK, 0 = no **acknowledge** 2 = **DI2** 1= **acknowledge** OK, 0 = no **acknowledge**, default 3 = **DI3** 1= **acknowledge** OK, 0 = no **acknowledge** 4 = **DI4** 1= **acknowledge** OK, 0 = no **acknowledge** 5 = **DI5** 1= **acknowledge** OK, 0 = no **acknowledge** 6 = **DI6** 1= **acknowledge** OK, 0 = no **acknowledge** 7 = **DI7** 1= **acknowledge** OK, 0 = no **acknowledge** 8 = **DI8** 1= **acknowledge** OK, 0 = no **acknowledge** 9 = **DI9** 1= **acknowledge** OK, 0 = no **acknowledge,** only available with digital extension board 10 = **DI10** 1= **acknowledge** OK, 0 = no **acknowledge,** only available with digital extension board 11 = **DI11** 1= **acknowledge** OK, 0 = no **acknowledge,** only available with digital extension board Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI11	DI2	-

Signal / Parameter name	min.	max.	def.	unit
10.07 **HandAuto (Hand/Auto command)** Binary signal to switch between **Hand** (**Local I/O**) and **Auto** (**MainCtrlWord**) control. Thus the selection made by *CommandSel (10.01)* is overwritten: 0 = **NotUsed** 1 = **DI1** 1 = **Auto**, 0 = **Hand** 2 = **DI2** 1 = **Auto**, 0 = **Hand** 3 = **DI3** 1 = **Auto**, 0 = **Hand** 4 = **DI4** 1 = **Auto**, 0 = **Hand** 5 = **DI5** 1 = **Auto**, 0 = **Hand** 6 = **DI6** 1 = **Auto**, 0 = **Hand** 7 = **DI7** 1 = **Auto**, 0 = **Hand** 8 = **DI8** 1 = **Auto**, 0 = **Hand** 9 = **DI9** 1 = **Auto**, 0 = **Hand,** only available with digital extension board 10 = **DI10** 1 = **Auto**, 0 = **Hand**, only available with digital extension board 11 = **DI11** 1 = **Auto**, 0 = **Hand**, only available with digital extension board 12 = **MCW Bit11** 1 = **Auto**, 0 = **Hand,** *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1 = **Auto**, 0 = **Hand,** *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1 = **Auto**, 0 = **Hand,** *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1 = **Auto**, 0 = **Hand,** *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1 = **Auto**, 0 = **Hand,** *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-
10.08 **Off2 (Off2 command, electrical disconnect)** Binary signal for **Off2** (Emergency Off / Coast Stop), *UsedMCW (7.04)* bit 1. For fastest reaction use fast digital inputs DI7 or DI8: 0 = **NotUsed** 1 = **DI1** 1= no **Off2**, 0 = **Off2** active 2 = **DI2** 1= no **Off2**, 0 = **Off2** active 3 = **DI3** 1= no **Off2**, 0 = **Off2** active 4 = **DI4** 1= no **Off2**, 0 = **Off2** active, default 5 = **DI5** 1= no **Off2**, 0 = **Off2** active 6 = **DI6** 1= no **Off2**, 0 = **Off2** active 7 = **DI7** 1= no **Off2**, 0 = **Off2** active 8 = **DI8** 1= no **Off2**, 0 = **Off2** active 9 = **DI9** 1= no **Off2**, 0 = **Off2** active, only available with digital extension board 10 = **DI10** 1= no **Off2**, 0 = **Off2** active, only available with digital extension board 11 = **DI11** 1= no **Off2**, 0 = **Off2** active, only available with digital extension board 12 = **MCW Bit11** 1= no **Off2**, 0 = **Off2** active, *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1= no **Off2**, 0 = **Off2** active, *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1= no **Off2**, 0 = **Off2** active, *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1= no **Off2**, 0 = **Off2** active, *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1= no **Off2**, 0 = **Off2** active, *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	DI4	-

Signal / Parameter name	min.	max.	def.	unit
10.09 **E Stop (emergency stop command)** Binary signal for **Off3** (E-Stop), *UsedMCW (7.04)* bit 2. For fastest reaction use fast digital inputs DI7 or DI8: 0 = **NotUsed** 1 = **DI1** 1= no **E Stop**, 0 = **E Stop** active 2 = **DI2** 1= no **E Stop**, 0 = **E Stop** active 3 = **DI3** 1= no **E Stop**, 0 = **E Stop** active 4 = **DI4** 1= no **E Stop**, 0 = **E Stop** active 5 = **DI5** 1= no **E Stop**, 0 = **E Stop** active, default 6 = **DI6** 1= no **E Stop**, 0 = **E Stop** active 7 = **DI7** 1= no **E Stop**, 0 = **E Stop** active 8 = **DI8** 1= no **E Stop**, 0 = **E Stop** active 9 = **DI9** 1= no **E Stop**, 0 = **E Stop** active, only available with digital extension board 10 = **DI10** 1= no **E Stop**, 0 = **E Stop** active, only available with digital extension board 11 = **DI11** 1= no **E Stop**, 0 = **E Stop** active, only available with digital extension board 12 = **MCW Bit11** 1= no **E Stop**, 0 = **E Stop** active, *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1= no **E Stop**, 0 = **E Stop** active, *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1= no **E Stop**, 0 = **E Stop** active, *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1= no **E Stop**, 0 = **E Stop** active, *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1= no **E Stop**, 0 = **E Stop** active, *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	DI5	-
10.10 **ParChange (parameter change)** Binary signal to release **User1** or **User2**. 0 = **NotUsed** default 1 = **DI1** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 2 = **DI2** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 3 = **DI3** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 4 = **DI4** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 5 = **DI5** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 6 = **DI6** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 7 = **DI7** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 8 = **DI8** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) 9 = **DI9** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) only available with digital extension board 10 = **DI10** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) only available with digital extension board 11 = **DI11** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0) only available with digital extension board 12 = **MCW Bit11** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0)**,** *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0)**,** *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0)**,** *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0)**,** *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** switch to **User2** by rising edge (0 → 1)**,** switch to **User1** by falling edge (1 → 0)**,** *MainCtrlWord (7.01)* bit 15 **Notes:** – The macro selection made by *ParChange (10.10*) overrides the selection made with *ApplMacro (99.08*). It takes about 2 s, until the new parameter values are active. – If **User1** is active, *AuxStatWord (8.02)* bit 3 is set. If **User2** is active, *AuxStatWord (8.02)* bit 4 is set. – In case macros **User1** or **User2** are loaded by means of *ParChange (10.10),* they are not saved into the flash and thus not valid after the next power on. – When changing parameters in a user macro first call the macro with *ApplMacro (99.08*), then change the parameters and save them with *ApplMacro (99.08*)**.** – *ParChange (10.10)* itself is not overwritten. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-

Signal / Parameter name	min.	max.	def.	unit
10.11 - 10.14 Unused				
10.15 **OnOff1 (On/Off1 command)** Binary signal for **OnOff1**, *UsedMCW (7.04)* bit 0: 0 = **NotUsed** 1 = **DI1** **On** by rising edge (0 → 1), 0 = **Off1** 2 = **DI2** **On** by rising edge (0 → 1), 0 = **Off1** 3 = **DI3** **On** by rising edge (0 → 1), 0 = **Off1** 4 = **DI4** **On** by rising edge (0 → 1), 0 = **Off1** 5 = **DI5** **On** by rising edge (0 → 1), 0 = **Off1** 6 = **DI6** **On** by rising edge (0 → 1), 0 = **Off1** 7 = **DI7** **On** by rising edge (0 → 1), 0 = **Off1**, default 8 = **DI8** **On** by rising edge (0 → 1), 0 = **Off1** 9 = **DI9** **On** by rising edge (0 → 1), 0 = **Off1**, only available with digital extension board 10 = **DI10** **On** by rising edge (0 → 1), 0 = **Off1**, only available with digital extension board 11 = **DI11** **On** by rising edge (0 → 1), 0 = **Off1**, only available with digital extension board 12 = **MCW Bit11** **On** by rising edge (0 → 1), 0 = **Off1**, *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** **On** by rising edge (0 → 1), 0 = **Off1**, *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** **On** by rising edge (0 → 1), 0 = **Off1**, *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** **On** by rising edge (0 → 1), 0 = **Off1**, *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** **On** by rising edge (0 → 1), 0 = **Off1**, *MainCtrlWord (7.01)* bit 15 17-20 = reserved 21 = **DI7DI8** **On** and **Start** by rising edge (0 → 1) of DI7, **Stop** and **Off1** by falling edge (1 → 0) of DI8. Following settings apply: *OnOff1 (10.15)* = *StartStop (10.16)* = **DI7DI8**. **Note:** To give **On** and **Run** at the same time set *OnOff1 (10.15)* = *StartStop (10.16)*. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI7DI8	DI7	-
10.16 **StartStop (Start/Stop command)** Binary signal for **StartStop**, *UsedMCW (7.04)* bit 3: 0 = **NotUsed** 1 = **DI1** **Start** by rising edge (0 → 1), 0 = **Stop** 2 = **DI2** **Start** by rising edge (0 → 1), 0 = **Stop** 3 = **DI3** **Start** by rising edge (0 → 1), 0 = **Stop** 4 = **DI4** **Start** by rising edge (0 → 1), 0 = **Stop** 5 = **DI5** **Start** by rising edge (0 → 1), 0 = **Stop** 6 = **DI6** **Start** by rising edge (0 → 1), 0 = **Stop** 7 = **DI7** **Start** by rising edge (0 → 1), 0 = **Stop** 8 = **DI8** **Start** by rising edge (0 → 1), 0 = **Stop**, default 9 = **DI9** **Start** by rising edge (0 → 1), 0 = **Stop**, only available with digital extension board 10 = **DI10** **Start** by rising edge (0 → 1), 0 = **Stop**, only available with digital extension board 11 = **DI11** **Start** by rising edge (0 → 1), 0 = **Stop**, only available with digital extension board 12 = **MCW Bit11** **Start** by rising edge (0 → 1), 0 = **Stop**, *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** **Start** by rising edge (0 → 1), 0 = **Stop**, *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** **Start** by rising edge (0 → 1), 0 = **Stop**, *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** **Start** by rising edge (0 → 1), 0 = **Stop**, *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** **Start** by rising edge (0 → 1), 0 = **Stop**, *MainCtrlWord (7.01)* bit 15 17-20 = reserved 21 = **DI7DI8** **On** and **Start** by rising pulse (0 → 1) of DI7, **Stop** and **Off1** by falling pulse (1 → 0) of DI8. Following settings apply: *OnOff1 (10.15)* = *StartStop (10.16)* = **DI7DI8**. **Note:** To give **On** and **Run** at the same time set *OnOff1 (10.15)* = *StartStop (10.16)*. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI7DI8	DI8	-

Signal / Parameter name	min.	max.	def.	unit
10.17 **Jog1 (jogging 1 command)** Binary signal for **Jog1**. Selects speed reference set in *FixedSpeed1 (23.02):* 0 = **NotUsed** default 1 = **DI1** 1= **Jog1** active, 0 = no **Jog1** 2 = **DI2** 1= **Jog1** active, 0 = no **Jog1** 3 = **DI3** 1= **Jog1** active, 0 = no **Jog1** 4 = **DI4** 1= **Jog1** active, 0 = no **Jog1** 5 = **DI5** 1= **Jog1** active, 0 = no **Jog1** 6 = **DI6** 1= **Jog1** active, 0 = no **Jog1** 7 = **DI7** 1= **Jog1** active, 0 = no **Jog1** 8 = **DI8** 1= **Jog1** active, 0 = no **Jog1** 9 = **DI9** 1= **Jog1** active, 0 = no **Jog1,** only available with digital extension board 10 = **DI10** 1= **Jog1** active, 0 = no **Jog1,** only available with digital extension board 11 = **DI11** 1= **Jog1** active, 0 = no **Jog1,** only available with digital extension board 12 = **MCW Bit11** 1= **Jog1** active, 0 = no **Jog1,** *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1= **Jog1** active, 0 = no **Jog1,** *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1= **Jog1** active, 0 = no **Jog1,** *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1= **Jog1** active, 0 = no **Jog1,** *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1= **Jog1** active, 0 = no **Jog1,** *MainCtrlWord (7.01)* bit 15 **Notes:** – *Jog2 (10.18)* overrides *Jog1 (10.17)* – *CommandSel (10.01)* = **Local I/O**: The drive has to be in state **RdyRun** (**RdyRef** is still zero). When **Jog1** command is given the drives sets automatically **RampOutZero** = **RampHold** = **RampInZero** = 0 [see *MainCtrlWord (7.01)*] and goes into state **Running** and turns with speed set in *FixedSpeed1 (23.02).* – *CommandSel (10.01)* = **MainCtrlWord**: Use **Inching1** [see *MainCtrlWord (7.01)*] – Acceleration and deceleration time for jogging is selected by *JogAccTime (22.12)* and *JogDecTime (22.13).* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-
10.18 **Jog2 (jogging 2 command)** Binary signal for **Jog2**. Selects speed reference set in *FixedSpeed2 (23.03):* Selections see *Jog1 (10.17).* **Notes:** – See *Jog1 (10.17).* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-
10.19 - 10.20 Unused				
10.21 **MainContAck (main contactor acknowledge)** The drive trips with **F524 MainContAck** [*FaultWord2 (9.02)* bit 7] if a digital input for the main contactor is selected and the acknowledge is missing for 10 seconds: 0 = **NotUsed** 1 = **DI1** 1= **acknowledge** OK, 0 = no **acknowledge** 2 = **DI2** 1= **acknowledge** OK, 0 = no **acknowledge** 3 = **DI3** 1= **acknowledge** OK, 0 = no **acknowledge**, default 4 = **DI4** 1= **acknowledge** OK, 0 = no **acknowledge** 5 = **DI5** 1= **acknowledge** OK, 0 = no **acknowledge** 6 = **DI6** 1= **acknowledge** OK, 0 = no **acknowledge** 7 = **DI7** 1= **acknowledge** OK, 0 = no **acknowledge** 8 = **DI8** 1= **acknowledge** OK, 0 = no **acknowledge** 9 = **DI9** 1= **acknowledge** OK, 0 = no **acknowledge**, only available with digital extension board 10 = **DI10** 1= **acknowledge** OK, 0 = no **acknowledge**, only available with digital extension board 11 = **DI11** 1= **acknowledge** OK, 0 = no **acknowledge**, only available with digital extension board **Note**: The acknowledge is also dependent on the setting of *MainContCtrlMode (21.16).* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI11	DI3	-

Signal / Parameter name	min.	max.	def.	unit
10.22 **DynBrakeAck (dynamic braking acknowledge)** The drive sets **A105 DynBrakeAck** [*AlarmWord1 (9.06)* bit 4] if a digital input for dynamic braking is selected and the acknowledge (dynamic braking active) is still present when **On** [*UsedMCW (7.04)* bit 3] is set. Selections see *MainContAck (10.21).* **A105 DynBrakeAck** [*AlarmWord1 (9.06)* bit 4] should prevent the drive to be started while dynamic braking is active. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI11	NotUsed	-
10.23 **DC BreakAck (DC breaker acknowledge)** The drive sets **A103 DC BreakAck** [*AlarmWord1 (9.06)* bit 2] if a digital input for the DC-breaker is selected and the acknowledge is missing. Selections see *MainContAck (10.21).* The motor will coast if **A103 DC BreakAck** [*AlarmWord1 (9.06)* bit 2] is set. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI11	NotUsed	-
10.24 Unused				
10.25 **DI1Invert (invert digital input 1)** Inversion selection for digital input 1: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.26 **DI2Invert (invert digital input 2)** Inversion selection for digital input 2: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.27 **DI3Invert (invert digital input 3)** Inversion selection for digital input 3: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.28 **DI4Invert (invert digital input 4)** Inversion selection for digital input 4: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.29 **DI5Invert (invert digital input 5)** Inversion selection for digital input 5: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.30 **DI6Invert (invert digital input 6)** Inversion selection for digital input 6: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.31 **DI7Invert (invert digital input 7)** Inversion selection for digital input 7: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.32 **DI8Invert (invert digital input 8)** Inversion selection for digital input 8: 0 = **Direct** 1 = **Inverted** Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-

Signal / Parameter name	min.	max.	def.	unit
10.33 **DI9Invert (invert digital input 9)** Inversion selection for digital input 9: 0 = **Direct** only available with digital extension board 1 = **Inverted** only available with digital extension board Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.34 **DI10Invert (invert digital input 10)** Inversion selection for digital input 10: 0 = **Direct** only available with digital extension board 1 = **Inverted** only available with digital extension board Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
10.35 **DI11Invert (invert digital input 11)** Inversion selection for digital input 11: 0 = **Direct** only available with digital extension board 1 = **Inverted** only available with digital extension board Int. Scaling: 1 == 1 Type: C Volatile: N	Direct	Inverted	Direct	-
Group 11: Speed reference inputs				
11.01 Unused				
11.02 **Ref1Mux (speed reference 1 selector/multiplexer)** Speed reference 1 selector: 0 = **Open** switch for speed ref. 1 is fixed open 1 = **Close** switch for speed ref 1 is fixed closed, default 2 = **DI1** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 3 = **DI2** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 4 = **DI3** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 5 = **DI4** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 6 = **DI5** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 7 = **DI6** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 8 = **DI7** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 9 = **DI8** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0 10 = **DI9** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; only available with digital extension board 11= **DI10** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; only available with digital extension board 12 = **DI11** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; only available with digital extension board 13 = **MCW Bit11** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 11 14 = **MCW Bit12** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 12 15 = **MCW Bit13** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 13 16 = **MCW Bit14** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 14 17 = **MCW Bit15** 1= switch is **closed**, speed ref 1 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	Open	MCW Bit15	Close	-

Signal / Parameter name	min.	max.	def.	unit
11.03 **Ref1Sel (speed reference 1 select)** Speed reference 1 value: 0 = **SpeedRef2301** *SpeedRef (23.01),* default 1 = **AuxSpeedRef** *AuxSpeedRef (23.13)* 2 = **AI1** analog input AI1 3 = **AI2** analog input AI2 4 = **AI3** analog input AI3 5 = **AI4** analog input AI4 6 = **AI5** analog input AI5 7 = **AI6** analog input AI6 8 = **FixedSpeed1** *FixedSpeed1 (23.02)* 9 = **FixedSpeed2** *FixedSpeed2 (23.03)* 10 = **MotPot** motor pot controlled by *MotPotUp (11.13), MotPotDown (11.14)* and *MotPotMin (11.15)* 11 = **MinAI2AI4** minimum of AI2 and AI4 12 = **MaxAI2AI4** maximum of AI2 and AI4 Int. Scaling: 1 == 1 Type: C Volatile: N	SpeedRef2301	MaxAI2AI4	SpeedRef2301	-
11.04 - 11.05 Unused				
11.06 **Ref2Sel (speed reference 2 select)** Speed reference 2 value: 0 = **SpeedRef2301** *SpeedRef (23.01),* default 1 = **AuxSpeedRef** *AuxSpeedRef (23.13)* 2 = **AI1** analog input AI1 3 = **AI2** analog input AI2 4 = **AI3** analog input AI3 5 = **AI4** analog input AI4 6 = **AI5** analog input AI5 7 = **AI6** analog input AI6 8 = **FixedSpeed1** *FixedSpeed1 (23.02)* 9 = **FixedSpeed2** *FixedSpeed2 (23.03)* 10 = **MotPot** motor pot controlled by *MotPotUp (11.13), MotPotDown (11.14)* and *MotPotMin (11.15)* Int. Scaling: 1 == 1 Type: C Volatile: N	SpeedRef2301	MotPot	SpeedRef2301	-
11.07 - 11.11 Unused				

Signal / Parameter name	min.	max.	def.	unit
11.12 **Ref2Mux (speed reference 2 selector/multiplexer)** Speed reference 2 selector: 0 = **Invert1102** Invert speed ref. 1 selection; implements a change over switch together with speed ref 2 selection. E.g. if speed ref. 1 selection switch is open the switch for speed ref. 2 is closed and vice versa. 1 = **Open** switch for speed ref. 2 is fixed open, default 2 = **Close** switch for speed ref 2 is fixed closed 3 = **DI1** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 4 = **DI2** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 5 = **DI3** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 6 = **DI4** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 7 = **DI5** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 8 = **DI6** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 9 = **DI7** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 10 = **DI8** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0 11 = **DI9** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; only available with digital extension board 12= **DI10** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; only available with digital extension board 13 = **DI11** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; only available with digital extension board 14 = **MCW Bit11** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 11 15 = **MCW Bit12** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 12 16 = **MCW Bit13** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 13 17 = **MCW Bit14** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 14 18 = **MCW Bit15** 1= switch is **closed**, speed ref 2 is active; 0 = switch is **open**, speed ref = 0; *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	Invert1102	MCW Bit15	Open	-
11.13 **MotPotUp (motor pot up)** With the motor pot up function, the motor speed is increased by means of the selected binary input. *AccTime1 (22.01)* limits the acceleration. *MotPotDown (11.14)* overrides *MotPotUp (11.13)*: 0 = **NotUsed** default 1 = **DI1** 1= **increase** speed, 0 = **hold** speed 2 = **DI2** 1= **increase** speed, 0 = **hold** speed 3 = **DI3** 1= **increase** speed, 0 = **hold** speed 4 = **DI4** 1= **increase** speed, 0 = **hold** speed 5 = **DI5** 1= **increase** speed, 0 = **hold** speed 6 = **DI6** 1= **increase** speed, 0 = **hold** speed 7 = **DI7** 1= **increase** speed, 0 = **hold** speed 8 = **DI8** 1= **increase** speed, 0 = **hold** speed 9 = **DI9** 1= **increase** speed, 0 = **hold** speed**,** only available with digital extension board 10 = **DI10** 1= **increase** speed, 0 = **hold** speed**,** only available with digital extension board 11 = **DI11** 1= **increase** speed, 0 = **hold** speed**,** only available with digital extension board 12 = **MCW Bit11** 1= **increase** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1= **increase** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1= **increase** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1= **increase** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1= **increase** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 15 **Note:** The speed reference is selected by means of *Ref1Sel (11.03)* = **MotPot** respectively *Ref2Sel (11.06)* = **MotPot**. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	

Signal / Parameter name	min.	max.	def.	unit
11.14 **MotPotDown (motor pot down)** With the motor pot down function, the motor speed is decreased by means of the selected binary input. *DecTime1 (22.02)* limits the deceleration until zero speed or *MotPotMin (11.15)* is reached. *MotPotDown (11.14)* overrides *MotPotUp (11.13)*: 0 = **NotUsed** default 1 = **DI1** 1= **decrease** speed, 0 = **hold** speed 2 = **DI2** 1= **decrease** speed, 0 = **hold** speed 3 = **DI3** 1= **decrease** speed, 0 = **hold** speed 4 = **DI4** 1= **decrease** speed, 0 = **hold** speed 5 = **DI5** 1= **decrease** speed, 0 = **hold** speed 6 = **DI6** 1= **decrease** speed, 0 = **hold** speed 7 = **DI7** 1= **decrease** speed, 0 = **hold** speed 8 = **DI8** 1= **decrease** speed, 0 = **hold** speed 9 = **DI9** 1= **decrease** speed, 0 = **hold** speed**,** only available with digital extension board 10 = **DI10** 1= **decrease** speed, 0 = **hold** speed**,** only available with digital extension board 11 = **DI11** 1= **decrease** speed, 0 = **hold** speed**,** only available with digital extension board 12 = **MCW Bit11** 1= **decrease** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1= **decrease** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1= **decrease** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1= **decrease** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1= **decrease** speed, 0 = **hold** speed**,** *MainCtrlWord (7.01)* bit 15 17 = **DI1 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed 18 = **DI2 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed 19 = **DI3 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed 20 = **DI4 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed 21 = **DI5 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed 22 = **DI6 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed 23 = **DI7 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed 24 = **DI8 + Stop** DI1 = 1 OR Stop command active => **decrease** speed, 0 = **hold** speed **Note:** The speed reference is selected by means of *Ref1Sel (11.03)* = **MotPot** respectively *Ref2Sel (11.06)* = **MotPot**. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI8 + Stop	NotUsed	
11.15 **MotPotMin (motor pot minimum)** The motor pot minimum function sets the minimum speed limit defined by *FixedSpeed1 (23.02)*. When the drive is started the motor accelerates to *FixedSpeed1 (23.02).* It is not possible to set the speed below *FixedSpeed1 (23.02)* by means of the motor pot function: 0 = **NotUsed** default 1 = **DI1** 1= **released**, 0 = **blocked** 2 = **DI2** 1= **released**, 0 = **blocked** 3 = **DI3** 1= **released**, 0 = **blocked** 4 = **DI4** 1= **released**, 0 = **blocked** 5 = **DI5** 1= **released**, 0 = **blocked** 6 = **DI6** 1= **released**, 0 = **blocked** 7 = **DI7** 1= **released**, 0 = **blocked** 8 = **DI8** 1= **released**, 0 = **blocked** 9 = **DI9** 1= **released**, 0 = **blocked,** only available with digital extension board 10 = **DI10** 1= **released**, 0 = **blocked,** only available with digital extension board 11 = **DI11** 1= **released**, 0 = **blocked,** only available with digital extension board 12 = **MCW Bit11** 1= **released**, 0 = **blocked,** *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1= **released**, 0 = **blocked,** *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1= **released**, 0 = **blocked,** *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1= **released**, 0 = **blocked,** *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1= **released**, 0 = **blocked,** *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	
Group 12: Constant speeds				
12.01 Unused				

Signal / Parameter name	min.	max.	def.	unit
12.02 **ConstSpeed1 (constant speed 1)** Defines constant speed 1 in rpm. The constant speed can be connected by AP. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: N	-10000	10000	0	rpm
12.03 **ConstSpeed2 (constant speed 2)** Defines constant speed 2 in rpm. The constant speed can be connected by AP. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: N	-10000	10000	0	rpm
Group 13: Analog inputs				
13.01 **AI1HighVal (analog input 1 high value)** +100 % of the input signal connected to analog input 1 is scaled to the voltage in *AI1HighVal (13.01).* Example: In case the min. / max. voltage (±10 V) of analog input 1 should equal ±250 % of *TorqRefExt (2.24)*, set: – *TorqRefA Sel (25.10)* = **AI1** – *ConvModeAI1 (13.03)* = **±10 V Bi**, – *AI1HighVal (13.01)* = 4000 mV and – *AI1LowVal (13.02)* = -4000 mV **Note:** To use current please set the jumper on the SDCS-CON-F accordingly and calculate 20 mA to 10 V. Int. Scaling: 1 == 1 mV Type: I Volatile: N	-10000	10000	10000	mV
13.02 **AI1LowVal (analog input 1 low value)** -100 % of the input signal connected to analog input 1 is scaled to the voltage in *AI1LowVal (13.02).* **Notes:** – *AI1LowVal (13.02)* is only valid if *ConvModeAI1 (13.03)* = **±10 V Bi**. – To use current please set the jumper on the SDCS-CON-F accordingly and calculate 20 mA to 10 V. Int. Scaling: 1 == 1 mV Type: SI Volatile: N	-10000	10000	-10000	mV
13.03 **ConvModeAI1 (conversion mode analog input 1)** The distinction between voltage and current is done via jumpers on the SDCS-CON-F: 0 = **±10V Bi** -10 V to 10 V / -20 mA to 20 mA bipolar input, default 1 = **0V-10V Uni** 0 V to 10 V / 0 mA to 20 mA unipolar input 2 = **2V-10V Uni** 2 V to 10 V / 4 mA to 20 mA unipolar input 3 = **5V Offset** 5 V / 10 mA offset in the range 0 V to 10 V / 0 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **6V Offset** 6 V / 12 mA offset in the range 2 V to 10 V / 4 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) Int. Scaling: 1 == 1 Type: C Volatile: N	±10V Bi	6V Offset	±10V Bi	-
13.04 **FilterAI1 (filter time analog input 1)** Analog input 1 filter time. The hardware filter time is ≤ 2ms. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
13.05 **AI2HighVal (analog input 2 high value)** +100 % of the input signal connected to analog input 2 is scaled to the voltage in *AI2HighVal (13.05).* **Note:** To use current please set the jumper on the SDCS-CON-F accordingly and calculate 20 mA to 10 V. Int. Scaling: 1 == 1 mV Type: I Volatile: N	-10000	10000	10000	mV
13.06 AI2LowVal (analog input 2 low value) -100 % of the input signal connected to analog input 2 is scaled to the voltage in *AI2LowVal (13.06).* **Notes:** – *AI2LowVal (13.06)* is only valid if *ConvModeAI2 (13.07)* = **±10V Bi**. – To use current please set the jumper on the SDCS-CON-F accordingly and calculate 20 mA to 10 V. Int. Scaling: 1 == 1 mV Type: SI Volatile: N	-10000	10000	-10000	mV

Signal / Parameter name	min.	max.	def.	unit
13.07 **ConvModeAI2 (conversion mode analog input 2)** The distinction between voltage and current is done via jumpers on the SDCS-CON-F: 0 = **±10V Bi** -10 V to 10 V / -20 mA to 20 mA bipolar input, default 1 = **0V-10V Uni** 0 V to 10 V / 0 mA to 20 mA unipolar input 2 = **2V-10V Uni** 2 V to 10 V / 4 mA to 20 mA unipolar input 3 = **5V Offset** 5 V / 10 mA offset in the range 0 V to 10 V / 0 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **6V Offset** 6 V / 12 mA offset in the range 2 V to 10 V / 4 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) Int. Scaling: 1 == 1 Type: C Volatile: N	±10V Bi	6V Offset	±10V Bi	-
13.08 **FilterAI2 (filter time analog input 2)** Analog input 2 filter time. The hardware filter time is ≤ 2ms. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
13.09 **AI3HighVal (analog input 3 high value)** +100 % of the input signal connected to analog input 3 is scaled to the voltage in *AI3HighVal (13.09).* **Note:** Can only be used for voltage measurement. Int. Scaling: 1 == 1 mV Type: I Volatile: N	-10000	10000	10000	mV
13.10 **AI3LowVal (analog input 3 low value)** -100 % of the input signal connected to analog input 3 is scaled to the voltage in *AI3LowVal (13.10).* **Notes:** – *AI3LowVal (13.10)* is only valid if *ConvModeAI3 (13.11)* = **±10V Bi**. – Can only be used for voltage measurement. Int. Scaling: 1 == 1 mV Type: SI Volatile: N	-10000	10000	-10000	mV
13.11 **ConvModeAI3 (conversion mode analog input 3)** Analog input 3 on the SDCS-CON-F is only working with voltage: 0 = **±10V Bi** -10 V to 10 V, default 1 = **0V-10V Uni** 0 V to 10 V unipolar input 2 = **2V-10V Uni** 2 V to 10 V unipolar input 3 = **5V Offset** 5 V offset in the range 0 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **6V Offset** 6 V offset in the range 2 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) Int. Scaling: 1 == 1 Type: C Volatile: N	±10V Bi	6V Offset	±10V Bi	-
13.12 **FilterAI3 (filter time analog input 3)** Analog input 3 filter time. The hardware filter time is ≤ 2 ms. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
13.13 **AI4HighVal (analog input 4 high value)** +100 % of the input signal connected to analog input 4 is scaled to the voltage in *AI4HighVal (13.13).* **Note:** Can only be used for voltage measurement. Int. Scaling: 1 == 1 mV Type: I Volatile: N	-10000	10000	10000	mV
13.14 **AI4LowVal (analog input 4 low value)** -100 % of the input signal connected to analog input 4 is scaled to the voltage in *AI4LowVal (13.14).* **Notes:** – *AI3LowVal (13.14)* is only valid if *ConvModeAI4 (13.15)* = **±10V Bi**. – Can only be used for voltage measurement. Int. Scaling: 1 == 1 mV Type: SI Volatile: N	-10000	10000	-10000	mV

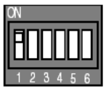
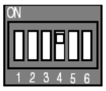
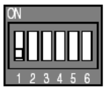
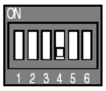
Signal / Parameter name	min.	max.	def.	unit
13.15 **ConvModeAI4 (conversion mode analog input 4)** Analog input 4 on the SDCS-CON-F is only working with voltage: 0 = **±10V Bi** -10 V to 10 V bipolar input, default 1 = **0V-10V Uni** 0 V to 10 V unipolar input 2 = **2V-10V Uni** 2 V to 10 V unipolar input 3 = **5V Offset** 5 V offset in the range 0 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **6V Offset** 6 V offset in the range 2 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) Int. Scaling: 1 == 1 Type: C Volatile: N	±10V Bi	6V Offset	±10V Bi	-
13.16 **FilterAI4 (filter time analog input 4)** Analog input 4 filter time. The hardware filter time is ≤ 2 ms. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
13.17 – 13.20 Unused				
13.21 **AI5HighVal (analog input 5 high value)** +100 % of the input signal connected to analog input 5 is scaled to the voltage in *AI5HighVal (13.21).* **Note:** To use current please set the DIP-switches (RAIO-01) accordingly and calculate 20 mA to 10 V. Int. Scaling: 1 == 1 mV Type: I Volatile: N	-10000	10000	10000	mV
13.22 **AI5LowVal (analog input 5 low value)** -100 % of the input signal connected to analog input 5 is scaled to the voltage in *AIO5LowVal (13.22).* **Notes:** – *AI5LowVal (13.22)* is only valid if *ConvModeAI5 (13.23)* = **±10V Bi**. – To use current please set the DIP-switches (RAIO-01) accordingly and calculate 20 mA to 10 V. Int. Scaling: 1 == 1 mV Type: SI Volatile: N	-10000	10000	-10000	mV

Signal / Parameter name	min.	max.	def.	unit

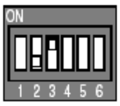
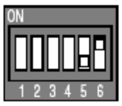
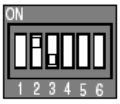
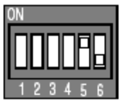
13.23 **ConvModeAI5 (conversion mode analog input 5)**
The distinction between bipolar and unipolar respectively voltage and current is done via DIP-switches on the RAIO-01 board:

0 = **±10V Bi**	-10 V to 10 V / -20 mA to 20 mA bipolar input, default
1 = **0V-10V Uni**	0 V to 10 V / 0 mA to 20 mA unipolar input
2 = **2V-10V Uni**	2 V to 10 V / 4 mA to 20 mA unipolar input
3 = **5V Offset**	5 V / 10 mA offset in the range 0 V to 10 V / 0 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.)
4 = **6V Offset**	6 V / 12 mA offset in the range 2 V to 10 V / 4 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.)

Bipolar and unipolar:

DIP switch setting		Input signal type
Analogue input AI1	**Analogue input AI2**	
		±0(4)…20 mA ±0(2)…10 V ±0…2 V
		0(4)…20 mA 0(2)…10 V 0…2 V (Default)

Voltage and current:

Input signal type	DIP switch settings	
	Analogue input 1	**Analogue input 2**
Current signal ±0(4)…20 mA (Default)		
Voltage signal ±0(2)…10 V		

Int. Scaling: 1 == 1 Type: C Volatile: N

min.	max.	def.	unit
±10V Bi	6V Offset	±10V Bi	-

13.24 Unused

13.25 **AI6HighVal (analog input 6 high value)**
+100 % of the input signal connected to analog input 6 is scaled to the voltage in *AI6HighVal (13.25).*
Note:
To use current please set the DIP-switches (RAIO-01) accordingly and calculate 20 mA to 10 V.
Int. Scaling: 1 == 1 mV Type: I Volatile: N

min.	max.	def.	unit
-10000	10000	10000	mV

13.26 **AI6LowVal (analog input 6 low value)**
-100 % of the input signal connected to analog input 6 is scaled to the voltage in *AIO6LowVal (13.26).*
Notes:
- *AI6LowVal (13.26)* is only valid if *ConvModeAI6 (13.27)* = **±10V Bi**.
- To use current please set the DIP-switches (RAIO-01) accordingly and calculate 20 mA to 10 V.

Int. Scaling: 1 == 1 mV Type: SI Volatile: N

min.	max.	def.	unit
-10000	10000	-10000	mV

Signal / Parameter name	min.	max.	def.	unit
13.27 **ConvModeAI6 (conversion mode analog input 6)** The distinction between bipolar and unipolar respectively voltage and current is done via DIP-switches on the RAIO-01 board: 0 = **±10V Bi** -10 V to 10 V / -20 mA to 20 mA bipolar input, default 1 = **0V-10V Uni** 0 V to 10 V / 0 mA to 20 mA unipolar input 2 = **2V-10V Uni** 2 V to 10 V / 4 mA to 20 mA unipolar input 3 = **5V Offset** 5 V / 10 mA offset in the range 0 V to 10 V / 0 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **6V Offset** 6 V / 12 mA offset in the range 2 V to 10 V / 4 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) Int. Scaling: 1 == 1 Type: C Volatile: N	±10V Bi	6V Offset	±10V Bi	-
Group 14: Digital outputs				
14.01 **DO1Index (digital output 1 index)** Digital output 1 is controlled by a selectable bit - see *DO1BitNo (14.02)* - of the source (signal/parameter) selected with this parameter. The format is **-xxyy**, with: **-** = invert digital output, **xx** = group and **yy** = index. Examples: – If *DO1Index (14.01)* = 801 (main status word) and *DO1BitNo (14.02)* = 1 (**RdyRun**) digital output 1 is high when the drive is **RdyRun**. – If DO1Index *(14.01)* = -801 (main status word) and *DO1BitNo (14.02)* = 3 (**Tripped**) digital output 1 is high when the drive is not faulty. Digital output 1 default setting is: command **FansOn** *CurCtrlStat1 (6.03)* bit 0. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	603	-
14.02 **DO1BitNo (digital output 1 bit number)** Bit number of the signal/parameter selected with *DO1Index (14.02*). Int. Scaling: 1 == 1 Type: I Volatile: N	0	15	0	-
14.03 **DO2Index (digital output 2 index)** Digital output 2 is controlled by a selectable bit - see *DO2BitNo (14.04)* - of the source (signal/parameter) selected with this parameter. The format is **-xxyy**, with: **-** = invert digital output, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
14.04 **DO2BitNo (digital output 2 bit number)** Bit number of the signal/parameter selected with *DO2Index (14.03*). Int. Scaling: 1 == 1 Type: I Volatile: N	0	15	0	-
14.05 **DO3Index (digital output 3 index)** Digital output 3 is controlled by a selectable bit - see *DO3BitNo (14.06)* - of the source (signal/parameter) selected with this parameter. The format is **-xxyy**, with: **-** = invert digital output, **xx** = group and **yy** = index. Digital output 3 default setting is: command **MainContactorOn** *CurCtrlStat1 (6.03)* bit 7. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	603	-
14.06 **DO3BitNo (digital output 3 bit number)** Bit number of the signal/parameter selected with *DO3Index (14.05*). Int. Scaling: 1 == 1 Type: I Volatile: N	0	15	7	-
14.07 **DO4Index (digital output 4 index)** Digital output 4 is controlled by a selectable bit - see *DO4BitNo (14.08)* - of the source (signal/parameter) selected with this parameter. The format is **-xxyy**, with: **-** = invert digital output, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
14.08 **DO4BitNo (digital output 4 bit number)** Bit number of the signal/parameter selected with *DO4Index (14.07*). Int. Scaling: 1 == 1 Type: I Volatile: N	0	15	0	-
14.09 - 14.14 Unused				
14.15 **DO8Index (digital output 8 index)** Digital output 8 is controlled by a selectable bit - see *DO8BitNo (14.16)* - of the source (signal/parameter) selected with this parameter. The format is **-xxyy**, with: **-** = invert digital output, **xx** = group and **yy** = index. Digital output 8 default setting is: command **MainContactorOn** *CurCtrlStat1 (6.03)* bit 7 Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	603	-

Signal / Parameter name	min.	max.	def.	unit
14.16 **DO8BitNo (digital output 8 bit number)** Bit number of the signal/parameter selected with *DO8Index (14.15*). Int. Scaling: 1 == 1 Type: I Volatile: N	0	15	7	-

Group 15: Analog outputs

Signal / Parameter name	min.	max.	def.	unit
15.01 **IndexAO1 (analog output 1 index)** Analog output 1 is controlled by a source (signal/parameter) selected with *IndexAO1 (15.01).* The format is **-xxyy**, with: **-** = negate analog output, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
15.02 **CtrlWordAO1 (control word analog output 1)** Analog output 1 can be written to via *CtrlWordAO1 (15.02)* using AP or overriding control if *IndexAO1 (15.01)* is set to zero. Further description see *group 19 Data Storage*. Int. Scaling: 1 == 1 Type: SI Volatile: Y	-32768	32767	0	-
15.03 **ConvModeAO1 (convert mode analog output 1)** Analog output 1 signal offset: 0 = **±10V Bi** -10 V to 10 V bipolar output, default 1 = **0V-10V Uni** 0 V to 10 V unipolar output 2 = **2V-10V Uni** 2 V to 10 V unipolar output 3 = **5V Offset** 5 V offset in the range 0 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **6V Offset** 6 V offset in the range 2 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) 5 = **0V-10V Abs** absolute 0 V to 10 V unipolar output (negative values are shown positive) Int. Scaling: 1 == 1 Type: C Volatile: N	±10V Bi	0V-10V Abs	±10V Bi	-
15.04 **FilterAO1 (filter analog output 1)** Analog output 1 filter time. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
15.05 **ScaleAO1 (scaling analog output 1)** 100 % of the signal/parameter selected with *IndexAO1 (15.01)* is scaled to the voltage in *ScaleAO1 (15.05).* Example: In case the min. / max. voltage (±10 V) of analog output 1 should equal ±250 % of *TorqRefUsed (2.13),* set: – *IndexAO1 (15.01)* = 213, – *ConvModeAO1 (15.03)* = **±10V Bi** and – *ScaleAO1 (15.05)* = 4000 mV Int. Scaling: 1 == 1 mV Type: I Volatile: N	0	10000	10000	mV
15.06 **IndexAO2 (analog output 2 index)** Analog output 2 is controlled by a source (signal/parameter) selected with *IndexAO2 (15.06).* The format is **-xxyy**, with: **-** = negate analog output, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
15.07 **CtrlWordAO2 (control word analog output 2)** Analog output 2 can be written to via *CtrlWordAO2 (15.07)* using AP or overriding control if *IndexAO2 (15.06)* is set to zero. Further description see *group 19 Data Storage*. Int. Scaling: 1 == 1 Type: SI Volatile: Y	-32768	32767	0	-
15.08 **ConvModeAO2 (convert mode analog output 2)** Analog output 2 signal offset: 0 = **±10V Bi** -10 V to 10 V bipolar output, default 1 = **0V-10V Uni** 0 V to 10 V unipolar output 2 = **2V-10V Uni** 2 V to 10 V unipolar output 3 = **5V Offset** 5 V offset in the range 0 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **6V Offset** 6 V offset in the range 2 V to 10 V for testing or indication of bipolar signals (e.g. torque, speed, etc.) 5 = **0V-10V Abs** absolute 0 V to 10 V unipolar output (negative values are shown positive) Int. Scaling: 1 == 1 Type: C Volatile: N	±10V Bi	0V-10V Abs	±10V Bi	-

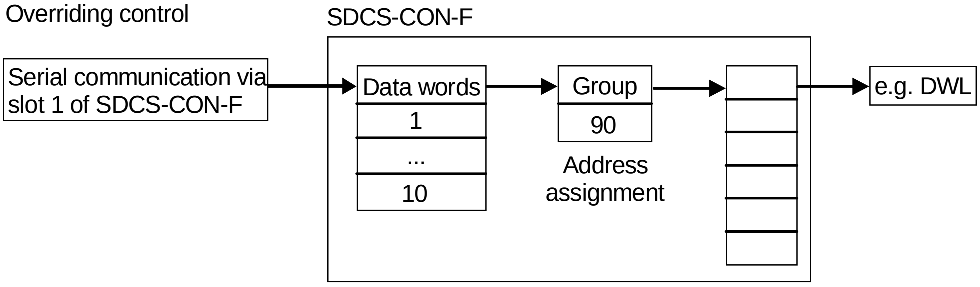
Signal / Parameter name	min.	max.	def.	unit
15.09 **FilterAO2 (filter analog output 2)** Analog output 2 filter time. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
15.10 **ScaleAO2 (scaling analog output 2)** 100 % of the signal/parameter selected with *IndexAO2 (15.06)* is scaled to the voltage in *ScaleAO2 (15.10).* Int. Scaling: 1 == 1 mV Type: I Volatile: N	0	10000	10000	mV
15.11 **IndexAO3 (analog output 3 index)** Analog output 3 is controlled by a source (signal/parameter) selected with *IndexAO3 (15.11).* The format is **-xxyy**, with: **-** = negate analog output, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	-	-
15.12 **CtrlWordAO3 (control word analog output 3** Analog output 3 can be written to via *CtrlWordAO3 (15.12)* using AP or overriding control if *IndexAO3 (15.11)* is set to zero. Further description see *group 19 Data Storage*. Int. Scaling: 1 == 1 Type: SI Volatile: Y	-32768	32767	0	-
15.13 **ConvModeAO3 (convert mode analog output 3)** Analog output 3 signal offset: 0 = **0mA-20mA Uni** 0 mA to 20 mA unipolar output 1 = **4mA-20mA Uni** 4 mA to 20 mA unipolar output, default 2 = **10mA Offset** 10 mA offset in the range 0 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) 3 = **12mA Offset** 12 mA offset in the range 4 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **0mA-20mA Abs** absolute 0 mA to 20 mA unipolar output (negative values are shown positive) Int. Scaling: 1 == 1 Type: C Volatile: N	4mA-20mA Uni	0mA-20mA Abs	4mA-20mA Uni	-
15.14 **FilterAO3 (filter analog output 3)** Analog output 3 filter time. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
15.15 **ScaleAO3 (scaling analog output 3)** 100 % of the signal/parameter selected with *IndexAO3 (15.11)* is scaled to the current in *ScaleAO3 (15.15).* Int. Scaling: 1 == 1 Type: I Volatile: N	0	20	20	mA
15.16 **IndexAO4 (analog output 4 index)** Analog output 4 is controlled by a source (signal/parameter) selected with *IndexAO4 (15.16).* The format is **-xxyy**, with: **-** = negate analog output, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999		
15.17 **CtrlWordAO4 (control word analog output 4)** Analog output 4 can be written to via *CtrlWordAO4 (15.17)* using AP or overriding control if *IndexAO4 (15.17)* is set to zero. Further description see *group 19 Data Storage*. Int. Scaling: 1 == 1 Type: SI Volatile: Y	-32768	32767	0	-
15.18 **ConvModeAO4 (convert mode analog output 4)** Analog output 4 signal offset: 0 = **0mA-20mA Uni** 0 mA to 20 mA unipolar output 1 = **4mA-20mA Uni** 4 mA to 20 mA unipolar output, default 2 = **10mA Offset** 10 mA offset in the range 0 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) 3 = **12mA Offset** 12 mA offset in the range 4 mA to 20 mA for testing or indication of bipolar signals (e.g. torque, speed, etc.) 4 = **0mA-20mA Abs** absolute 0 mA to 20 mA unipolar output (negative values are shown positive) Int. Scaling: 1 == 1 Type: C Volatile: N	4mA-20mA Uni	0mA-20mA Abs	4mA-20mA Uni	-
15.19 **FilterAO4 (filter analog output 4)** Analog output 4 filter time. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
15.20 **ScaleAO4 (scaling analog output 4)** 100 % of the signal/parameter selected with *IndexAO4 (15.16)* is scaled to the current in *ScaleAO4 (15.20).* Int. Scaling: 1 == 1 Type: I Volatile: N	0	20	20	mA

Signal / Parameter name	min.	max.	def.	unit
Group 16: System control inputs				
16.01 Unused				
16.02 **ParLock (parameter lock)** The user can lock all parameters by means of *ParLock (16.02)* and *SysPassCode (16.03)*. To lock parameters set *SysPassCode (16.03)* to the desired value and change *ParLock (16.02)* from **Open** to **Locked**. Unlocking of parameters is only possible if the proper pass code (the value that was present during locking) is used. To open parameters set *SysPassCode (16.03)* to the proper value and change *ParLock (16.02)* from **Locked** to **Open**. After the parameters are locked or opened the value in *SysPassCode (16.03)* is automatically changed to 0: 0 = **Open** parameter change possible, default 1 = **Locked** parameter change not possible Int. Scaling: 1 == 1 Type: C Volatile: N	Open	Locked	Open	-
16.03 **SysPassCode (system pass code)** The *SysPassCode (16.03*) is a number between 1 and 30,000 to lock all parameters by means of *ParLock (16.02)*. After using **Open** or **Locked** *SysPassCode (16.03)* is automatically set back to zero. **Attention:** Do not forget the pass code! Int. Scaling: 1 == 1 Type: I Volatile: Y	0	30000	0	-
16.04 **LocLock (local lock)** Local control can be disabled by setting *LocLock (16.04)* to **True**. If *LocLock (16.04)* is released in local control, it becomes valid after the next changeover to remote control. No pass code is required to change *LocLock (16.04):* 0 = **False** local control released, default 1 = **True** local control blocked Int. Scaling: 1 == 1 Type: C Volatile: N	False	True	False	-
16.05 Unused				
16.06 **ParApplSave (save parameters)** If parameters are written to cyclic, e.g. from an overriding control, they are only stored in the RAM and not in the flash. By means of *ParApplSave (16.06),* all parameter values are saved from the RAM into the flash: 0 = **Done** parameters are saved, default 1 = **Save** saves the actual used parameters into the flash After the action is finished *ParApplSave (16.06)* is changed back to **Done**. This will take max. 1 second. **Note:** Do not use the parameter save function unnecessarily **Note:** Parameters changed by DCS Control Panel or commissioning tools are immediately saved into the flash. Int. Scaling: 1 == 1 Type: C Volatile: Y	Done	Save	Done	-
16.07 - 16.10 Unused				
16.11 **SetSystemTime (set the drive's system time)** Sets the time of the converter in minutes. The system time can be either set by means of *SetSystemTime (16.11)* or via the DCS Control Panel. Int. Scaling: 1 == 1 min Type: I Volatile: Y	0	64000	0	min
16.12 - 16.13 Unused				
16.14 **ToolLinkConfig (tool link configuration)** The communication speed of the serial communication for the commissioning tool and the application program tool can be selected with *ToolLinkConfig (16.14)*: 0 = **9600** 9600 Baud 1 = **19200** 19200 Baud 2 = **38400** 38400 Baud, default 3 = **57600** 57600 Baud 4 = **115200** 115200 Baud If *ToolLinkConfig (16.14)* is changed its new value is taken over after the next power up. Int. Scaling: 1 == 1 Type: C Volatile: N	9600	115200	38400	

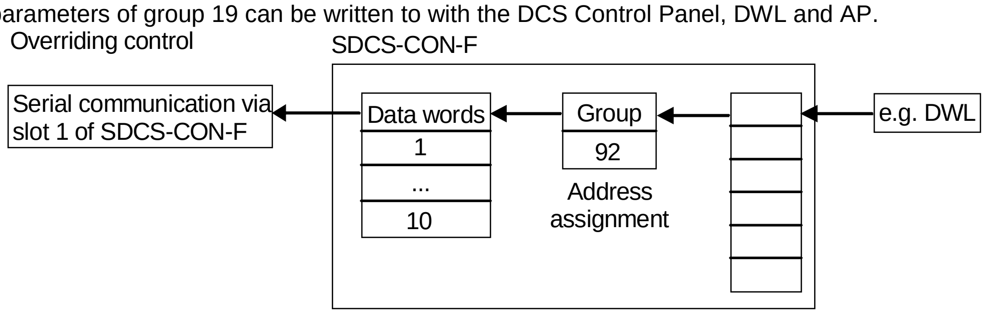
Signal / Parameter name	min.	max.	def.	unit

Group 19: Data storage

This parameter group consists of unused parameters for linking, testing and commissioning purposes.
Example1:
A value can be send from the overriding control to the drive via group 90 to individual parameters in group 19. The parameters of group 19 can be read with the DCS Control Panel, DWL and AP.



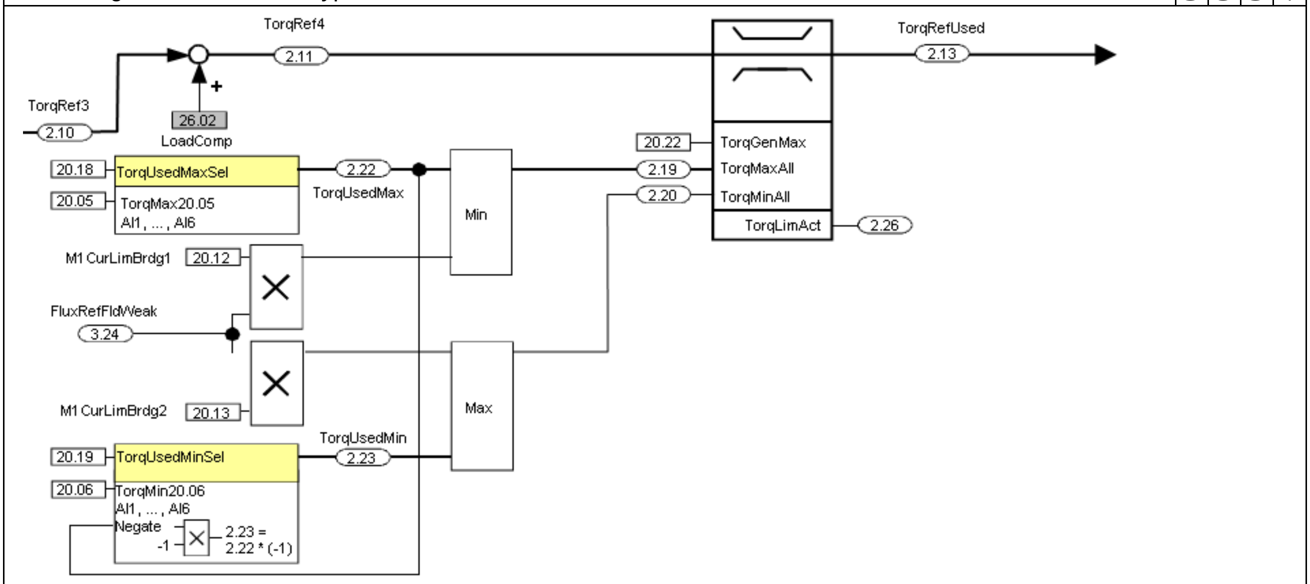
Example2:
A value can be send from the drive to the overriding control from individual parameters in group 19 via group 92. The parameters of group 19 can be written to with the DCS Control Panel, DWL and AP.



Note:
This parameter group can be used as well for reading/writing analog inputs/outputs.

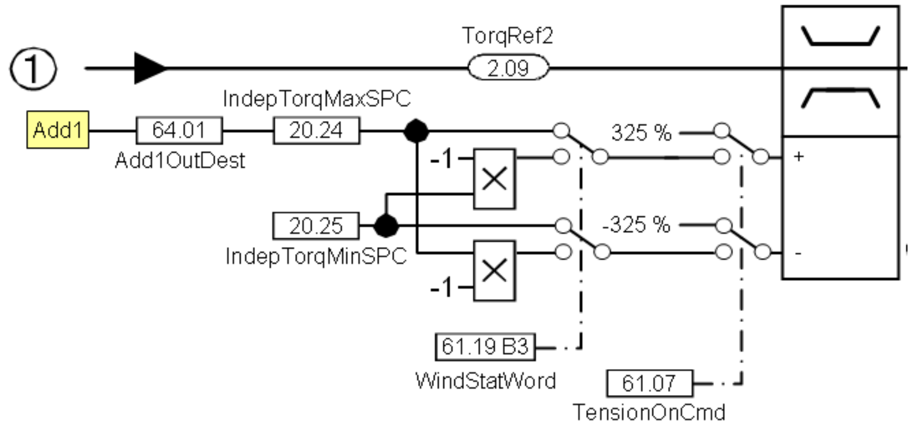
Signal / Parameter name	min.	max.	def.	unit
19.01 **Data1 (data container 1)** Data container 1 (see group description above). This data container is of the type retain. Its value will be saved when the drive is de-energized. Thus, it will not lose its value. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.02 **Data2 (data container 2)** Data container 2 (see group description above). This data container is of the type retain. Its value will be saved when the drive is de-energized. Thus, it will not lose its value. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.03 **Data3 (data container 3)** Data container 3 (see group description above). This data container is of the type retain. Its value will be saved when the drive is de-energized. Thus, it will not lose its value. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.04 **Data4 (data container 4)** Data container 4 (see group description above). This data container is of the type retain. Its value will be saved when the drive is de-energized. Thus, it will not lose its value. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.05 **Data5 (data container 5)** Data container 5 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.06 **Data6 (data container 6)** Data container 6 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.07 **Data7 (data container 7)** Data container 7 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-

Signal / Parameter name	min.	max.	def.	unit
19.08 **Data8 (data container 8)** Data container 8 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.09 **Data9 (data container 9)** Data container 9 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.10 **Data10 (data container 10)** Data container 10 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.11 **Data11 (data container 11)** Data container 11 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.12 **Data12 (data container 12)** Data container 12 (see group description above) Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
19.20 **ParNum (Parameter number)** This parameter contains the Parameter number to be written with Mailbox function enabled (7.03 Bit 3 = 1) Int. Scaling: 1 == 1 Type: SI Volatile: N	0	9999	0	-
19.21 **ParVal (Parameter value)** This parameter contains the Parameter value to be written with Mailbox function enabled (7.03 Bit 3 = 1) Int. Scaling: 1 == 1 Type: SI Volatile: N	0x0000	0xFFFF	0	-
19.22 **MailboxCW (Mailbox control word)** Control word for the Mailbox function. Parameter defined in 19.20 und 19.21 are written with command value 0x0001 while Mailbox function is enabled (7.03 Bit 3 = 1) After a writing command is executed the status of the operation can be read back by value of 19.22 (read only value): parameter written successful: 0xCD11; not written successful: 0xFE01 **Note**: Due to the nature of this access method the data are only written to RAM area. So after all parameters have been changed successfully, parameter 16.06 has to be written by value 1 to save the RAM data into Flash area. Int. Scaling: 1 == 1 Type: SI Volatile: N	0x0000	0xFE01	0	-



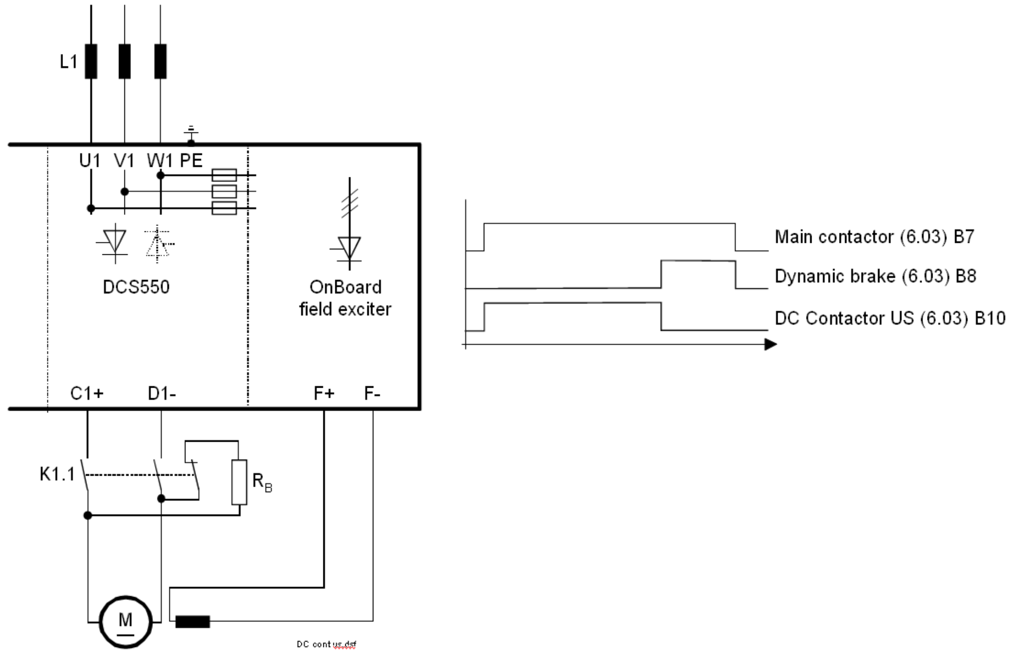
Signal / Parameter name	min.	max.	def.	unit
20.01 **M1SpeedMin (minimum speed)** Negative speed reference limit in rpm for: – *SpeedRef2 (2.01)* – *SpeedRefUsed (2.17)* Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ **Notes:** – *M1SpeedMin (20.01)* is must be set in the range of 0.625 to 5 times of *M1BaseSpeed (99.04).* If the scaling is out of range **A124 SpeedScale** [*AlarmWord2 (9.07)* bit 7] is generated. – *M1SpeedMin (20.01)* is also applied to *SpeedRef4 (2.18*) to avoid exceeding the speed limits by means of *SpeedCorr (23.04).* Int. Scaling: (2.29) Type: SI Volatile: N	-10000	10000	-1500	rpm
20.02 **M1SpeedMax (maximum speed)** Positive speed reference limit in rpm for: – *SpeedRef2 (2.01)* – *SpeedRefUsed (2.17)* Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ **Notes:** – *M1SpeedMax (20.02)* is must be set in the range of 0.625 to 5 times of *M1BaseSpeed (99.04).* If the scaling is out of range **A124 SpeedScale** [*AlarmWord2 (9.07)* bit 7] is generated. – *M1SpeedMax (20.02)* is also applied to *SpeedRef4 (2.18*) to avoid exceeding the speed limits by means of *SpeedCorr (23.04).* Int. Scaling: (2.29) Type: SI Volatile: N	-10000	10000	1500	rpm
20.03 **M1ZeroSpeedLim (zero speed limit)** When the **Run** command is removed [set *UsedMCW (7.04)* bit 3 to zero], the drive will stop as chosen by *StopMode (21.03)*. As soon as the actual speed reaches the limit set by *M1ZeroSpeedLim (20.03)* the motor will coast independent of the setting of *StopMode (21.03)*. Existing brakes are closed (applied). While the actual speed is in the limit, **ZeroSpeed** [*AuxStatWord (8.02)* bit 11] is high. Internally limited from: $0\,rpm\ \ to\ \ (2.29)*\frac{32767}{20000}\ rpm$ Int. Scaling: (2.29) Type: I Volatile: N	0	1000	75	rpm
20.04 Unused				
20.05 **TorqMax (maximum torque)** Maximum torque limit - in percent of *MotNomTorque (4.23)* - for selector *TorqUsedMaxSel (20.18).* **Note:** The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). The limit with the smallest value is valid. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	100	%
20.06 **TorqMin (minimum torque)** Minimum torque limit - in percent of *MotNomTorque (4.23)* - for selector *TorqUsedMinSel (20.19).* **Notes:** – The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). The limit with the largest value is valid. – Do not change the default setting of *TorqMin (20.06)* for 2-Q drives, because *M1CurLimBrdg2 (20.13)* is internally set to 0 % if *QuadrantType (4.15)* = **BlockBridge2** (2-Q drive). Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-100	%
20.07 **TorqMaxSPC (maximum torque speed controller)** Maximum torque limit - in percent of *MotNomTorque (4.23)* - at the output of the speed controller: – *TorqRef2 (2.09)* **Note:** The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). The limit with the smallest value is valid. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	325	%

Signal / Parameter name	min.	max.	def.	unit
20.08 **TorqMinSPC (minimum torque speed controller)** Minimum torque limit - in percent of *MotNomTorque (4.23)* - at the output of the speed controller. – *TorqRef2 (2.09)* **Notes:** – The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). The limit with the largest value is valid. – Do not change the default setting of *TorqMinSPC (20.08)* for 2-Q drives, because *M1CurLimBrdg2 (20.13)* is internally set to 0 % if *QuadrantType (4.15)* = **BlockBridge2** (2-Q drive). Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-325%	%
20.09 **TorqMaxTref (maximum torque of torque reference A/B)** Maximum torque limit - in percent of *MotNomTorque (4.23)* - for external references: – *TorqRefA (25.01)* – *TorqRefB (25.04)* **Note:** The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). The limit with the smallest value is valid. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0.	325	325	%
20.10 **TorqMinTref (minimum torque of torque reference A/B)** Minimum torque limit - in percent of *MotNomTorque (4.23)* - for external references: – *TorqRefA (25.01)* – *TorqRefB (25.04)* **Note:** The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). The limit with the largest value is valid. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-325	%
20.11 Unused				
20.12 **M1CurLimBrdg1 (current limit of bridge 1)** Current limit bridge 1 in percent of *M1NomCur (99.03)*. **Notes:** – Setting *M1CurLimBrdg1 (20.12)* to 0 % disables bridge 1. – The used current limit depends also on the converter's actual limitation situation (e.g. torque limits, other current limits, field weakening). The limit with the smallest value is valid. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	100	%
20.13 **M1CurLimBrdg2 (current limit of bridge 2)** Current limit bridge 2 in percent of *M1NomCur (99.03).* **Notes:** – Setting *M1CurLimBrdg2 (20.13)* to 0 % disables bridge 2. – The used current limit depends also on the converter's actual limitation situation (e.g. torque limits, other current limits, field weakening). The limit with the largest value is valid. – *M1CurLimBrdg2 (20.13)* is internally set to 0 % if *QuadrantType (4.15)* = **BlockBridge2** (2-Q drive). Thus, do not change the default setting for 2-Q drives. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-100	%
20.14 **ArmAlphaMax (maximum firing angle)** Maximum firing angle (α) in degrees. The maximum firing angle can be forced using *AuxCtrlWord2 (7.03)* bit 7. Int. Scaling: 1 == 1 deg Type: SI Volatile: N	0	165	150	deg
20.15 **ArmAlphaMin (minimum firing angle)** Minimum firing angle (α) in degrees. Int. Scaling: 1 == 1 deg Type: SI Volatile: N	0	165	15	deg
20.16 - 20.17 Unused				

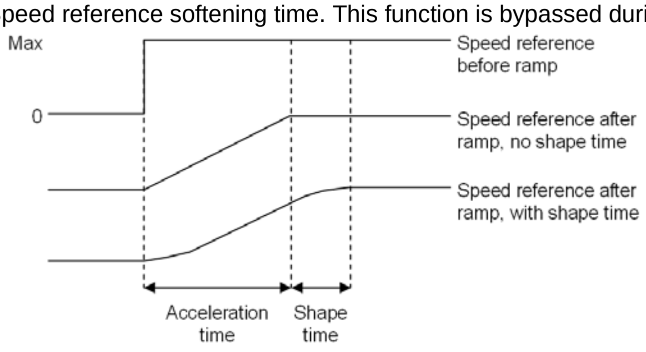
Signal / Parameter name	min.	max.	def.	unit
20.18 **TorqUsedMaxSel (maximum used torque selector)** *TorqUsedMax (2.22)* selector: 0 = **TorqMax2005** *TorqMax (20.05),* default 1 = **AI1** analog input 1 2 = **AI2** analog input 2 3 = **AI3** analog input 3 4 = **AI4** analog input 4 5 = **AI5** analog input 5 6 = **AI6** analog input 6 Int. Scaling: 1 == 1 Type: C Volatile: N	TorqMax2005	AI6	TorqMax2005	-
20.19 **TorqUsedMinSel (minimum used torque selector)** *TorqUsedMin (2.23)* selector: 0 = **TorqMin2006** *TorqMin (20.06),* default 1 = **AI1** analog input 1 2 = **AI2** analog input 2 3 = **AI3** analog input 3 4 = **AI4** analog input 4 5 = **AI5** analog input 5 6 = **AI6** analog input 6 7 = **Negate2018** negated output of *TorqUsedMaxSel (20.18)* is used Int. Scaling: 1 == 1 Type: C Volatile: N	TorqMin2006	Negate	TorqMin2006	-
20.20 - 20.21 Unused				
20.22 **TorqGenMax (maximum and minimum torque limit during regenerating)** Maximum and minimum torque limit - in percent of *MotNomTorque (4.23)* - only during regenerating. **Note:** The used torque limit depends also on the converter's actual limitation situation (e.g. other torque limits, current limits, field weakening). Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	325	%
20.23 Unused				
Independent torque limitation for *WinderMacro (61.01)* = **IndirectTens** and **DirectTens**:  				
20.24 **IndepTorqMaxSPC (independent maximum torque speed controller)** Independent maximum torque limit - in percent of *MotNomTorque (4.23)* - behind *TorqRef2 (2.09)*. *IndepTorqMaxSPC (20.24)* is written to by the winder block adder 1 - see group 64 - to drive the speed controller into saturation. In case *TensionOnCmd (61.07)* is given *IndepTorqMaxSPC (20.24)* is valid, otherwise the positive side of the limiter is set to 325 %. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	325	%
20.25 **IndepTorqMinSPC (independent minimum torque speed controller)** Independent minimum torque limit - in percent of *MotNomTorque (4.23)* - behind *TorqRef2 (2.09)*. In case *TensionOnCmd (61.07)* is given *IndepTorqMinSPC (20.25)* is valid, otherwise the negative side of the limiter is set to -325 %. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-325%	%

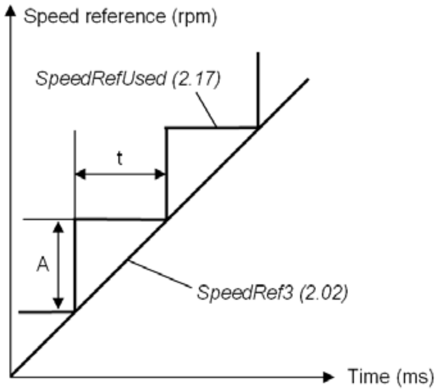
Signal / Parameter name	min.	max.	def.	unit
Group 21: Start / stop				
21.01 Unused				
21.02 **Off1Mode (off 1 mode)** Conditions for motor deceleration when *UsedMCW (7.04)* bit 0 **On** (respectively **Off1N**) is set to low: 0 = **RampStop** The input of the drives ramp is set to zero. Thus, the drive stops according to *DecTime1 (22.02)*. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped, default. 1 = **TorqueLimit** The output of the drives ramp is set to zero. Thus, the drive stops at the active torque limit. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 2 = **CoastStop** The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 3 = **DynBraking** dynamic braking **Note:** In case *UsedMCW (7.04)* bit 0 **On** and *UsedMCW (7.04)* bit 3 **Run** are set to low (run and on commands are taken away) at the same time or nearly contemporary *Off1Mode (21.02)* and *StopMode (21.03)* **must** have the same setting. Int. Scaling: 1 == 1 Type: C Volatile: N	RampStop	DynBraking	RampStop	-
21.03 **StopMode (stop mode)** Conditions for motor deceleration when *UsedMCW (7.04)* bit 3 **Run** is set to low: 0 = **RampStop** The input of the drives ramp is set to zero. Thus, the drive stops according to *DecTime1 (22.02)*. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, default. 1 = **TorqueLimit** The output of the drives ramp is set to zero. Thus, the drive stops at the active torque limit. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked. 2 = **CoastStop** The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked. 3 = **DynBraking** dynamic braking **Note:** In case *UsedMCW (7.04)* bit 0 **On** and *UsedMCW (7.04)* bit 3 **Run** are set to low (run and on commands are taken away) at the same time or nearly contemporary *Off1Mode (21.02)* and *StopMode (21.03)* **must** have the same setting. Int. Scaling: 1 == 1 Type: C Volatile: N	RampStop	DynBraking	RampStop	-
21.04 **E StopMode (emergency stop mode)** Conditions for motor deceleration when *UsedMCW (7.04)* bit 2 **Off3N** (respectively E-stop) is set low: 0 = **RampStop** The input of the drives ramp is set to zero. Thus, the drive stops according to *E StopRamp (22.04)*. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 1 = **TorqueLimit** The output of the drives ramp is set to zero. Thus, the drive stops at the active torque limit. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 2 = **CoastStop** The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 3 = **DynBraking** dynamic braking **Note:** *E StopMode (21.04)* overrides *Off1Mode (21.02)* and *StopMode (21.03)*. Int. Scaling: 1 == 1 Type: C Volatile: N	RampStop	DynBraking	CoastStop	-

<table>
<tr><th>Signal / Parameter name</th><th>min.</th><th>max.</th><th>def.</th><th>unit</th></tr>
<tr><td>21.05 - 21.13 Unused</td><td></td><td></td><td></td><td></td></tr>
<tr><td>21.14 FanDly (fan delay)
After the drive has been switched off [UsedMCW (7.04) bit 0 On = 0], both fans (motor and converter) mustn't switched off before FanDly (21.14) has elapsed. If motor or converter overtemperature is pending, the delay starts after the temperature has dropped below the overtemperature limit.
Int. Scaling: 1 == 1 s Type: I Volatile: N</td><td>0</td><td>300</td><td>0</td><td>s</td></tr>
<tr><td>21.15 Unused</td><td></td><td></td><td></td><td></td></tr>
<tr><td>21.16 MainContCtrlMode (main contactor control mode)
MainContCtrlMode (21.16) determines the reaction to On and Run commands [UsedMCW (7.04) bits 0 and 3]:
0 = On main contactor closes with On = 1, default
1 = On&Run main contactor closes with On = Run = 1
2 = DCcontact If a DC-breaker is used as a main contactor, it will be closed with On = 1. Additionally the armature voltage measurements are adapted to an open DC-breaker by clamping SpeedActEMF (1.02), ArmVoltActRel (1.13), ArmVoltAct (1.14) and EMF VoltActRel (1.17) to zero when the drive is Off.
The clamping is released:
– either 100 ms after an On command (MCW bit 0) is given in case DCBreakAck (10.23) = NotUsed or
– when using the DC-breaker acknowledge with DCBreakAck (10.23) = DIx until the acknowledge signal indicates that the DC-breaker closed.
Note:
The DC-breaker (US style) K1.1 is a special designed DC-breaker with one normally closed contact for the dynamic braking resistor RB and two normally open contacts for C1 and D1. The DC-breaker should be controlled by CurCtrlStart1 (6.03) bit 10. The acknowledge signal can be connected to either MainContAck (10.21) or DCBreakAck (10.23):

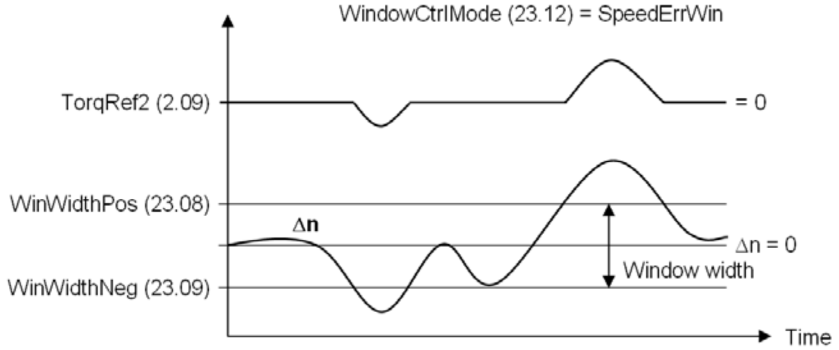


Int. Scaling: 1 == 1 Type: C Volatile: N</td><td>On</td><td>DCcontact</td><td>On</td><td>-</td></tr>
</table>

Signal / Parameter name	min.	max.	def.	unit
21.18 **FldHeatSel (field heat selector)** *FldHeatSel (21.18)* releases the field heating: 0 = **NotUsed** field heating is off, default 1 = **On** field heating is on, as long as: **On** = 0 [*UsedMCW (7.04)* bit 0], **Off2N** = 1 [*UsedMCW (7.04)* bit 1] and **Off3N** = 1 [*UsedMCW (7.04)* bit 2] 2 = **OnRun** field heating is on as long as: **On** = 1, **Run** = 0 [*UsedMCW (7.04)* bit 3], **Off2N** = 1 and **Off3N** = 1 **Notes:** – The field heating reference is set with *M1FldHeatRef (44.04).* Field heating can be disabled when the reference is set to zero. – Field nominal current is set with *M1NomFldCur (99.11).* – In case field heating is used following settings apply: *MainContCtrlMode (21.16)* = **On** *FldHeatSel (21.18)* = **OnRun** Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	ACW Bit15	NotUsed	-
Group 22: Speed ramp				
22.01 **AccTime1 (acceleration time 1)** The time within the drive will accelerate from zero speed to *SpeedScaleAct (2.29). AccTime1 (22.01)* can be released with *Ramp2Sel (22.11).* Int. Scaling: 100 == 1 s Type: I Volatile: N	0	300	20	s
22.02 **DecTime1 (deceleration time 1)** The time within the drive will decelerate from *SpeedScaleAct (2.29)* to zero speed. *DecTime1 (22.02)* can be released with *Ramp2Sel (22.11).* Int. Scaling: 100 == 1 s Type: I Volatile: N	0	300	20	s
22.03 Unused				
22.04 **E StopRamp (emergency stop ramp)** The time within the drive will decelerate from *SpeedScaleAct (2.29)* to zero speed. When emergency stop is released and *E StopMode (21.04)* = **RampStop** or as reaction to a fault of trip level 4 and *FaultStopMode (30.30)* = **RampStop**. Int. Scaling: 10 == 1 s Type: I Volatile: N	0	3000	20	s
22.05 **ShapeTime (shape time)** Speed reference softening time. This function is bypassed during an emergency stop:  Int. Scaling: 100 == 1 s Type: I Volatile: N	0	30	0	s
22.06 Unused				

Signal / Parameter name	min.	max.	def.	unit
22.07 **VarSlopeRate (variable slope rate)** Variable slope is used to control the slope of the speed ramp during a speed reference change. It is active only with *VarSlopeRate (22.07)* ≠ 0. Variable slope rate and the drive's internal ramp are connected in series. Thus follows that the ramp times - *AccTime1 (22.01)* and *DecTime1 (22.02)* - have to be faster than the complete variable slope rate time. *VarSlopeRate (22.07)* defines the speed ramp time **t** (ms) for the speed reference change **A** (rpm):  **t** (ms) = cycle time of the overriding control (e.g. speed reference generation) **A** (rpm) = speed reference change during cycle time **t** **Note:** In case the overriding control system's cycle time **t** (ms) of the speed reference and *VarSlopeRate (22.07)* are equal, the shape of *SpeedRef3 (2.02)* is a strait line. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	30000	0	ms
22.08 **BalRampRef (balance ramp reference)** The output of the speed ramp can be forced to the value defined by *BalRampRef (22.08)*. The function is released by setting *AuxCtrlWord (7.02)* bit 3 = 1. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm \ \ to \ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: N	-10000	10000	0	rpm
22.09 **AccTime2 (acceleration time 2)** The time within the drive will accelerate from zero speed to *SpeedScaleAct (2.29). AccTime2 (22.09)* can be released with *Ramp2Sel (22.11).* Int. Scaling: 100 == 1 s Type: I Volatile: N	0	300	20	s
22.10 **DecTime2 (deceleration time 2)** The time within the drive will decelerate from *SpeedScaleAct (2.29)* to zero speed. *DecTime2 (22.10)* can be released with *Ramp2Sel (22.11).* Int. Scaling: 100 == 1 s Type: I Volatile: N	0	300	20	s

Signal / Parameter name	min.	max.	def.	unit
22.11 **Ramp2Select (ramp 2 selector)** Select active ramp parameters: 0 = **Acc/Dec1** parameter set 1 [*AccTime1 (22.01)* and *DecTime1 (22.02)*] is active, default 1 = **Acc/Dec2** parameter set 2 [*AccTime2 (22.09)* and *DecTime2 (22.10)*] is active 2 = **SpeedLevel** If |*SpeedRef3 (2.02)*| ≤ |*SpeedLev (50.10)*|, then parameter set1 is active. If |*SpeedRef3 (2.02)*| > |*SpeedLev (50.10)*|, then parameter set 2 is active. 3 = **DI1** 0 = parameter set 1 is active, 1 = parameter set 2 is active 4 = **DI2** 0 = parameter set 1 is active, 1 = parameter set 2 is active 5 = **DI3** 0 = parameter set 1 is active, 1 = parameter set 2 is active 6 = **DI4** 0 = parameter set 1 is active, 1 = parameter set 2 is active 7 = **DI5** 0 = parameter set 1 is active, 1 = parameter set 2 is active 8 = **DI6** 0 = parameter set 1 is active, 1 = parameter set 2 is active 9 = **DI7** 0 = parameter set 1 is active, 1 = parameter set 2 is active 10 = **DI8** 0 = parameter set 1 is active, 1 = parameter set 2 is active 11 = **DI9** 0 = parameter set 1 is active, 1 = parameter set 2 is active, only available with digital extension board 12 = **DI10** 0 = parameter set 1 is active, 1 = parameter set 2 is active, only available with digital extension board 13 = **DI11** 0 = parameter set 1 is active, 1 = parameter set 2 is active, only available with digital extension board 14 = **MCW Bit11** 0 = parameter set 1 is active, 1 = parameter set 2 is active, MainCtrlWord (7.01) bit 11 15 = **MCW Bit12** 0 = parameter set 1 is active, 1 = parameter set 2 is active, MainCtrlWord (7.01) bit 12 16 = **MCW Bit13** 0 = parameter set 1 is active, 1 = parameter set 2 is active, MainCtrlWord (7.01) bit 13 17 = **MCW Bit14** 0 = parameter set 1 is active, 1 = parameter set 2 is active, MainCtrlWord (7.01) bit 14 18 = **MCW Bit15** 0 = parameter set 1 is active, 1 = parameter set 2 is active, MainCtrlWord (7.01) bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	Acc/Dcc1	MCW Bit15	Acc/Dcc1	-
22.12 **JogAccTime (acceleration time jogging)** The time within the drive will accelerate from zero speed to *SpeedScaleAct (2.29)* in case of jogging*:* – When using jog command *Jog1 (10.17)* or *MainCtrlWord (7.01)* bit 8 speed is set by *FixedSpeed1 (23.02)* – When using jog command *Jog2 (10.18))* or *MainCtrlWord (7.01)* bit 9 speed is set by *FixedSpeed2 (23.03)* Int. Scaling: 100 == 1 s Type: I Volatile: N	0	300	20	s
22.13 **JogDecTime (deceleration time jogging)** The time within the drive will decelerate from *SpeedScaleAct (2.29)* to zero speed in case of jogging*:* – When using jog command *Jog1 (10.17)* or *MainCtrlWord (7.01)* bit 8 speed is set by *FixedSpeed1 (23.02)* – When using jog command *Jog2 (10.18))* or *MainCtrlWord (7.01)* bit 9 speed is set by *FixedSpeed2 (23.03)* Int. Scaling: 100 == 1 s Type: I Volatile: N	0	300	20	s
Group 23: Speed reference				
23.01 **SpeedRef (speed reference)** Main speed reference input for the speed control of the drive. Can be connected to *SpeedRefUsed (2.17)* via: – *Ref1Mux (11.02)* and *Ref1Sel (11.03)* or – *Ref2Mux (11.12)* and *Ref2Sel (11.06)* Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: Y	-10000	10000	0	rpm
23.02 **FixedSpeed1 (fixed speed 1)** *FixedSpeed1 (23.02)* is specifying a constant speed reference and overrides *SpeedRef2 (2.01)* at the speed ramps input. It can be released by *Jog1 (10.17)* or *MainCtrlWord (7.01)* bit 8. The ramp times are set with *JogAccTime (22.12)* and *JogDecTime (22.13)*. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: N	-10000	10000	0	rpm

Signal / Parameter name	min.	max.	def.	unit
23.03 **FixedSpeed2 (fixed speed 2)** *FixedSpeed2 (23.03)* is specifying a constant speed reference and overrides *SpeedRef2 (2.01)* at the speed ramps input. It can be released by *Jog2 (10.18)* or *MainCtrlWord (7.01)* bit 9. The ramp times are set with *JogAccTime (22.12)* and *JogDecTime (22.13)*. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: N	-10000	10000	0	rpm
23.04 **SpeedCorr (speed correction)** The *SpeedCorr (23.04)* is added to the ramped reference *SpeedRef3 (2.02).* Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ **Note:** Since this speed offset is added after the speed ramp, it must be set to zero prior to stopping the drive. Int. Scaling: (2.29) Type: SI Volatile: Y	-10000	10000	0	rpm
23.05 **SpeedShare (speed sharing)** Scaling factor *SpeedRefUsed (2.17).* Before speed ramp. Int. Scaling: 10 == 1 % Type: SI Volatile: N	-400	400	100	%
23.06 **SpeedErrFilt (filter for Δn)** Speed error (Δn) filter time 1. There are three different filters for actual speed and speed error (Δn): – *SpeedFiltTime (50.06)* is filtering the actual speed and should be used for filter times smaller than 30 ms. – *SpeedErrFilt (23.06)* and *SpeedErrFilt2 (23.11)* are filtering the speed error (Δn) and should be used for filter times greater than 30 ms. It is recommended to set *SpeedErrFilt (23.06) = SpeedErrFilt2 (23.11)*. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
23.07 Unused				
Idea of Window Control: The idea of the Window Control is to block the speed controller as long as the speed error (Δn) remains within the window set by *WinWidthPos (23.08)* and *WinWidthNeg (23.09).* This allows the external torque reference - *TorqRef1 (2.08)* - to affect the process directly. If the speed error (Δn) exceeds the programmed window, the speed controller becomes active and influences the process by means of *TorqRef2 (2.09)*. To release window control set *TorqSel (26.01)* = Add and *AuxCtrlWord (7.02)* bit 7 = 1. This function could be called over/underspeed protection in torque control mode:  **Note:** to open a window with a width of 100 rpm set *WinWidthPos (23.08)* = 50 rpm and *WinWidthNeg (23.09)* = -50 rpm.				
23.08 **WinWidthPos (positive window width)** Positive speed limit for the window control, when the speed error ($\Delta n = n_{ref} - n_{act}$) is positive. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: I Volatile: N	-10000	10000	0	rpm

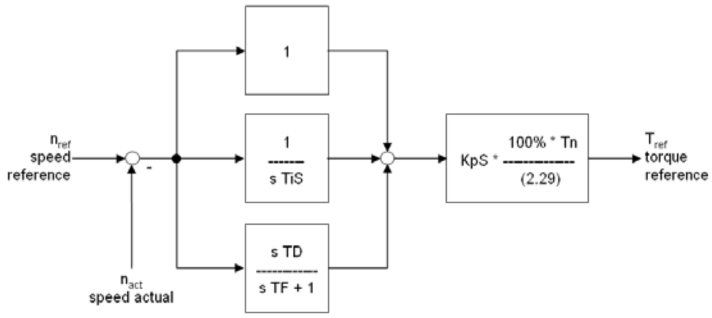
Signal / Parameter name	min.	max.	def.	unit
23.09 **WinWidthNeg (negative window width)** Negative speed limit for the window control, when the speed error ($\Delta n = n_{ref} - n_{act}$) is negative. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: I Volatile: N	-10000	10000	0	rpm
23.10 **SpeedStep (speed step)** *SpeedStep (23.10)* is added to the speed error (Δn) at the speed controller's input. The given min./max. values are limited by *M1SpeedMin (20.02)* and *M1SpeedMax (20.02).* Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ **Note:** Since this speed offset is added after the speed ramp, it must be set to zero prior to stopping the drive. Int. Scaling: (2.29) Type: SI Volatile: Y	-10000	10000	0	rpm
23.11 **SpeedErrFilt2 (2nd filter for Δn)** Speed error (Δn) filter time 2. There are three different filters for actual speed and speed error (Δn): – *SpeedFiltTime (50.06)* is filtering the actual speed and should be used for filter times smaller than 30 ms. – *SpeedErrFilt (23.06)* and *SpeedErrFilt2 (23.11)* are filtering the speed error (Δn) and should be used for filter times greater than 30 ms. It is recommended to set *SpeedErrFilt (23.06) = SpeedErrFilt2 (23.11)*. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
23.12 Unused				
23.13 **AuxSpeedRef (auxiliary speed reference)** Auxiliary speed reference input for the speed control of the drive. Can be connected to *SpeedRefUsed (2.17)* via: – *Ref1Mux (11.02)* and *Ref1Sel (11.03)* or – *Ref2Mux (11.12)* and *Ref2Sel (11.06)* Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: Y	-10000	10000	0	rpm
23.14 Unused				
23.15 **DirectSpeedRef (direct speed reference)** Direct speed input is connected to *SpeedRef3 (2.02)* by means of *AuxCtrlWord2 (7.03)* bit 10 = 1 and replaces the speed ramp output. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ **Note:** Since this speed offset is added after the speed ramp, it must be set to zero prior to stopping the drive. Int. Scaling: (2.29) Type: SI Volatile: Y	-10000	10000	0	rpm
23.16 **SpeedRefScale (speed reference scaling)** Speed reference scaling. After *SpeedRef3 (2.02)* and before *SpeedRef4 (2.18)*. Int. Scaling: 100 == 1 % Type: I Volatile: N	-325	325	100	%

Group 24: Speed control

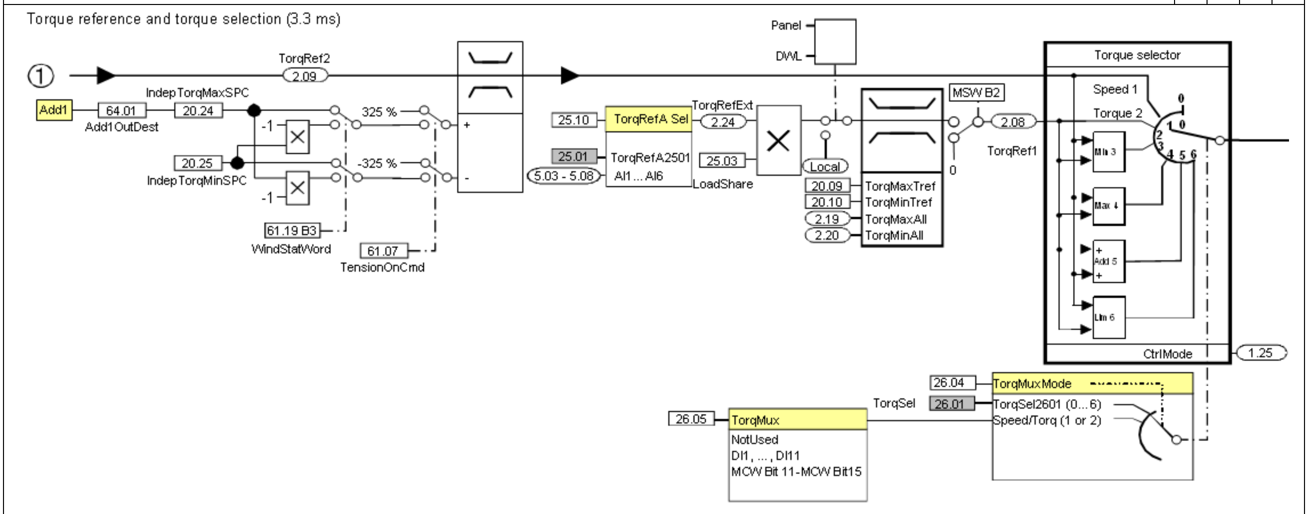
The Speed controller is based on a PID algorithm and is presented as follows:

$$T_{ref(s)} = KpS * \left[\left(n_{ref(s)} - n_{act(s)}\right) * \left(1 + \frac{1}{sTiS} + \frac{sTD}{sTF+1}\right)\right] * \frac{100\% * T_n}{(2.29)}$$

with:
- T_{ref} = torque reference
- KpS = proportional gain [*KpS (24.03)*]
- N_{ref} = speed reference
- N_{act} = speed actual
- TiS = Integration time [*TiS (24.09)]*

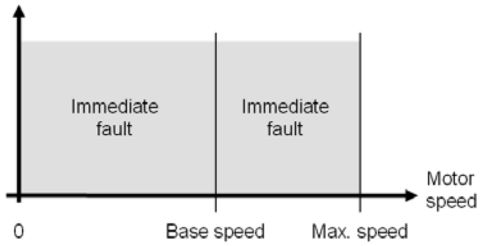
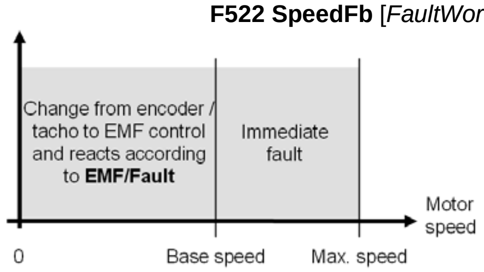
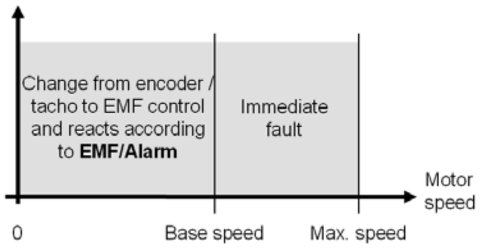
Signal / Parameter name	min.	max.	def.	unit
– TD = Derivation time [*DerivTime (24.12)]* – TF = Derivation filter time [*DerivFiltTime (24.13)]* – T_n = nominal motor torque – (2.29) = actual used speed scaling [*SpeedScaleAct (2.29)*] 				
24.01 - 24.02 Unused				
24.03 **KpS (p-part speed controller)** Proportional gain of the speed controller can be released by means of *Par2Select (24.29).* Example: The controller generates 15 % of motor nominal torque with *KpS (24.03)* = 3, if the speed error (Δn) is 5 % of *SpeedScaleAct (2.29).* Int. Scaling: 100 == 1 Type: I Volatile: N	0	325	5	-
24.04 - 24.08 Unused				
24.09 **TiS (i-part speed controller)** Integral time of the speed controller can be released by means of *Par2Select (24.29). TiS (24.09)* defines the time within the integral part of the controller achieves the same value as the proportional part. Example: The controller generates 15 % of motor nominal torque with *KpS (24.03)* = 3, if the speed error (Δn) is 5 % of *SpeedScaleAct (2.29).* On that condition and with *TiS (24.09)* = 300 ms follows: – the controller generates 30 % of motor nominal torque, if the speed error (Δn) is constant, after 300 ms are elapsed (15 % from proportional part and 15 % from integral part). Setting *TIS (24.09)* to 0 ms disables the integral part of the speed controller and resets its integrator. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	64000	2500	ms
24.10 **TiSInitValue (initial value for i-part speed controller)** Initial value of the speed controller integrator, in percent of *MotNomTorque (4.23)*. The integrator is set as soon as **RdyRef** [*MainStatWord (8.01)*] becomes valid. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	325	0	%
24.11 **BalRef (balance speed reference)** External value in percent of *MotNomTorque (4.23)*. Both, i-part and output of the speed controller are forced to *BalRef (24.11)* when *AuxCtrlWord (7.02)* bit 8 = 1. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	325	0	%
24.12 **DerivTime (d-part speed controller)** Speed controller derivation time. *DerivTime (24.12)* defines the time within the speed controller derives the error value. The speed controller works as PI controller, if *DerivTime (24.12)* is set to zero. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
24.13 **DerivFiltTime (filter time for d-part speed controller)** Derivation filter time. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	8	ms
24.14 - 24.26 Unused				
24.27 **KpS2 (2nd p-part speed controller)** 2nd proportional gain of the speed controller can be released by means of *Par2Select (24.29).* Int. Scaling: 100 == 1 Type: I Volatile: N	0	325	5	-

Signal / Parameter name	min.	max.	def.	unit
24.28 **TiS2 (2nd i-part speed controller)** 2nd integral time of the speed controller can be released by means of *Par2Select (24.29).* Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	64000	2500	ms
24.29 **Par2Select (selector for 2nd set of speed controller parameters)** Select active speed controller parameters: 0 = **ParSet1** parameter set 1 [*KpS (24.03)* and *TiS (24.09)*] is active, default 1 = **ParSet2** parameter set 2 [*KpS2 (24.27)* and *TiS2 (24.28)*] is active 2 = **SpeedLevel** If |*MotSpeed (1.04)*| ≤ |*SpeedLev (50.10)*|, then parameter set1 is active. If |*MotSpeed (1.04)*| > |*SpeedLev (50.10)*|, then parameter set 2 is active. 3 = **SpeedError** If |*SpeedErrNeg (2.03)*| ≤ |*SpeedLev (50.10)*|, then parameter set1 is active. If | *SpeedErrNeg (2.03)*| > |*SpeedLev (50.10)*|, then parameter set 2 is active. 4 = **DI1** 0 = parameter set 1 is active, 1 = parameter set 2 is active 5 = **DI2** 0 = parameter set 1 is active, 1 = parameter set 2 is active 6 = **DI3** 0 = parameter set 1 is active, 1 = parameter set 2 is active 7 = **DI4** 0 = parameter set 1 is active, 1 = parameter set 2 is active 8 = **DI5** 0 = parameter set 1 is active, 1 = parameter set 2 is active 9 = **DI6** 0 = parameter set 1 is active, 1 = parameter set 2 is active 10 = **DI7** 0 = parameter set 1 is active, 1 = parameter set 2 is active 11 = **DI8** 0 = parameter set 1 is active, 1 = parameter set 2 is active 12 = **DI9** 0 = parameter set 1 is active, 1 = parameter set 2 is active, only available with digital extension board 13 = **DI10** 0 = parameter set 1 is active, 1 = parameter set 2 is active, only available with digital extension board 14 = **DI11** 0 = parameter set 1 is active, 1 = parameter set 2 is active, only available with digital extension board 15 = **MCW Bit11** 0 = parameter set 1 is active, 1 = parameter set 2 is active, *MainCtrlWord (7.01)* bit 11 16 = **MCW Bit12** 0 = parameter set 1 is active, 1 = parameter set 2 is active, *MainCtrlWord (7.01)* bit 12 17 = **MCW Bit13** 0 = parameter set 1 is active, 1 = parameter set 2 is active, *MainCtrlWord (7.01)* bit 13 18 = **MCW Bit14** 0 = parameter set 1 is active, 1 = parameter set 2 is active, *MainCtrlWord (7.01)* bit 14 19 = **MCW Bit15** 0 = parameter set 1 is active, 1 = parameter set 2 is active, *MainCtrlWord (7.01)* bit 15 **Note:** Load and speed dependent adaptation parameters are valid regardless of the selected parameter set. Int. Scaling: 1 == 1 Type: C Volatile: N	ParSet1	MCW Bit15	ParSet1	
Group 25: Torque reference				
25.01 **TorqRefA (torque reference A)** External torque reference in percent of *MotNomTorque (4.23)*. *TorqRefA (25.01)* can be scaled by *LoadShare (25.03).* **Note:** *TorqRefA (25.01)* is only valid, if *TorqRefA Sel (25.10)* = **TorqRefA2501**. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-325	325	0	%
25.02 Unused				
25.03 **LoadShare (load share)** Scaling factor *TorqRefA (25.01).* Int. Scaling: 10 == 1 % Type: SI Volatile: N	-400	400	100	%
25.04 - 24.09 Unused				
25.10 **TorqRefA Sel (torque reference A selector)** Selector for *TorqRefExt (2.24)*: 0 = **TorqRefA2501** *TorqRefA (25.01),* default 1 = **AI1** analog input AI1 2 = **AI2** analog input AI2 3 = **AI3** analog input AI3 4 = **AI4** analog input AI4 5 = **AI5** analog input AI5 6 = **AI6** analog input AI6 Int. Scaling: 1 == 1 Type: C Volatile: N	TorqRefA2501	AI6	TorqRefA2501	-

Signal / Parameter name	min.	max.	def.	unit
Group 26: Torque reference handling				
26.01 **TorqSel (torque selector)** Torque reference selector: 0 = **Zero** zero control, torque reference = 0 1 = **Speed** speed control, default 2 = **Torque** torque control 3 = **Minimum** minimum control: min [*TorqRef1 (2.08), TorqRef2 (2.09)*] 4 = **Maximum** maximum control: max [*TorqRef1 (2.08), TorqRef2 (2.09)*] 5 = **Add** add control: *TorqRef1 (2.08)* +*TorqRef2 (2.09)*, used for window control 6 = **Limitation** limitation control: *TorqRef1 (2.08)* limits *TorqRef2 (2.09)*. If *TorqRef1 (2.08)* = 50%, then *TorqRef2 (2.09)* is limited to ±50%. The output of the torque reference selector is *TorqRef3 (2.10).* The currently used control mode is displayed in *CtrlMode (1.25)*. If the drive is in torque control, *AuxStatWord (8.02)* bit 10 is set. **Note:** *TorqSel (26.01)* is only valid, if *TorqMuxMode (26.04)* = **TorqSel2601**. Int. Scaling: 1 == 1 Type: C Volatile: N	Zero	Limitation	Speed	-
26.02 **LoadComp (load compensation)** Load compensation - in percent of *MotNomTorque (4.23)* -added to *TorqRef3 (2.10).* The sum of *TorqRef3 (2.10)* and the *LoadComp (26.02)* results in *TorqRef4 (2.11).* **Note:** Since this torque offset is added, it must be set to zero prior to stopping the drive. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	325	0	%
26.03 Unused				
 				
26.04 **TorqMuxMode (torque multiplexer mode)** *TorqMuxMode (26.04)* selects a pair of operation modes. The change between operation modes is done by means of *TorqMux (26.05).* Torque reference multiplexer: 0 = **TorqSel2601** operation mode depends on *TorqSel (26.01)*, default 1 = **Speed/Torq** operation mode depends on *TorqMux (26.05)*: – binary input = 0 ⇒ speed control (1) – binary input = 1 ⇒ torque control (2) Int. Scaling: 1 == 1 Type: C Volatile: N	TorqSel2601	Speed/Torq	TorqSel2601	-

Signal / Parameter name	min.	max.	def.	unit
26.05 **TorqMux (torque multiplexer)** *TorqMux (26.05)* selects a binary input to change between operation modes. The choice of the operation modes is provided by means of *TorqMuxMode (26.04)*. Torque reference multiplexer binary input: 0 = **NotUsed** operation mode depends on *TorqSel (26.01)*, default 1 = **DI1** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 2 = **DI2** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 3 = **DI3** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 4 = **DI4** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 5 = **DI5** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 6 = **DI6** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 7 = **DI7** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 8 = **DI8** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)* 9 = **DI9** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, only available with digital extension board 10= **DI10** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, only available with digital extension board 11 = **DI11** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, only available with digital extension board 12 = **MCW Bit11** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 0 = speed control, 1 = depends on *TorqMuxMode (26.04)*, *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-
Group 30: Fault functions				
30.01 **StallTime (stall time)** The time allowed for the drive to undershoot *StallSpeed (30.02)* and exceed *StallTorq (30.03).* A triggered stall protection leads to **F531 MotorStalled** *[FaultWord2 (9.02)* bit 14]. The stall protection is inactive, if *StallTime (30.01)* is set to zero. Int. Scaling: 1 == 1 s Type: I Volatile: N	0	200	0	s
30.02 **StallSpeed (stall speed)** Actual speed limit used for stall protection. Internally limited from: $0\,rpm\ \ to\ \ (2.29)\,rpm$ Int. Scaling: (2.29) Type: I Volatile: N	0	1000	5	rpm
30.03 **StallTorq (stall torque)** Actual torque limit - in percent of *MotNomTorque (4.23)* - used for stall protection. Int. Scaling: 100 = 1 % Type: I Volatile: N	0	325	75	%
30.04 - 30.07 Unused				
30.08 **ArmOvrVoltLev (armature overvoltage level)** The drive trips with **F503 ArmOverVolt** [*FaultWord1 (9.01)* bit 2] if *ArmOvrVoltLev (30.08)* - in percent of *M1NomVolt (99.02)* - is exceeded. It is recommended to set *ArmOvrVoltLev (30.08)* at least 20 % higher than *M1NomVolt (99.02)*. Example: With *M1NomVolt (99.02)* = 525 V and *ArmOvrVoltLev (30.08)* = 120 % the drive trips with armature voltages > 630 V. The overvoltage supervision is inactive, if *ArmOvrVoltLev (30.08)* is set to 328 % or higher. Int. Scaling: 10 == 1 % Type: I Volatile: N	20	500	120	%
30.09 **ArmOvrCurLev (armature overcurrent level)** The drive trips with **F502 ArmOverCur** [*FaultWord1 (9.01)* bit 1] if *ArmOvrCurLev (30.09)* - in percent of *M1NomCur (99.03)* - is exceeded. It is recommended to set *ArmOvrCurLev (30.09)* at least 25 % higher than *M1NomCur (99.03)*. Example: With *M1NomCur (99.03)* = 850 A and *ArmOvrCurLev (30.09)* = 250 % the drive trips with armature currents > 2125 A. Int. Scaling: 10 == 1 % Type: I Volatile: N	20	400	250	%

Signal / Parameter name	min.	max.	def.	unit
30.10 - 30.11 Unused				
30.12 **M1FldMinTrip (minimum field trip)** The drive trips with **F541 M1FexLowCur** [*FaultWord3 (9.03)* bit 8] if *M1FldMinTrip (30.12)* - in percent of *M1NomFldCur (99.11)* - is still undershot when *FldMinTripDly (45.18)* is elapsed. **Note:** *M1FldMinTrip (30.12)* is not valid during field heating. In this case, the trip level is automatically set to 50 % of *M1FldHeatRef (44.04).* The drive trips with **F541 M1FexLowCur** [*FaultWord3 (9.03)* bit 8] if 50 % of *M1FldHeatRef (44.04)* is still undershot when *FldMinTripDly (45.18)* is elapsed. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	50	%
30.13 **M1FldOvrCurLev (field overcurrent level)** The drive trips with **F515 M1FexOverCur** [*FaultWord1 (9.01)* bit 14] if *M1FldOvrCurLev (30.13)* - in percent of *M1NomFldCur (99.11)* - is exceeded. It is recommended to set *M1FldOvrCurtLev (30.13)* at least 25 % higher than *M1NomFldCur (99.11)*. The field overcurrent fault is inactive, if *M1FldOvrCurLev (30.13)* is set to 135 %. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	135	125	%
30.14 **SpeedFbMonLev (speed feedback monitor level)** The drive reacts according to *SpeedFbFltSel (30.17)* or trips with **F553 TachPolarity** [*FaultWord4 (9.04)* bit 4] if the measured speed feedback [*SpeedActEnc (1.03)* or *SpeedActTach (1.05)*] does not exceed *SpeedFbMonLev (30.14)* while the measured EMF exceeds *EMF FbMonLev (30.15).* Internally limited from: $0rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Example: With *SpeedFbMonLev (30.14)* = 15 rpm and *EMF FbMonLev (30.15)* = 50 V the drive trips when the EMF is > 50 V while the speed feedback is ≤ 15 rpm. Int. Scaling: (2.29) Type: I Volatile: N	0	10000	15	rpm
30.15 **EMF FbMonLev (EMF feedback monitor level)** The speed measurement monitoring function is activated, when the measured EMF exceeds *EMF FbMonLev (30.15).* See also *SpeedFbMonLev (30.14)*. Int. Scaling: 1 == 1 V Type: I Volatile: N	0	2000	50	V
30.16 **M1OvrSpeed (overspeed)** The drive trips with **F532 MotOverSpeed** [*FaultWord2 (9.02)* bit 15] if *M1OvrSpeed (30.16)* is exceeded. It is recommended to set *M1OvrSpeed (30.16)* at least 20 % higher than the maximum motor speed. Internally limited from: $0rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ The overspeed fault is inactive, if *M1OvrSpeed (30.16)* is set to zero. Int. Scaling: (2.29) Type: I Volatile: N	0	10000	1800	rpm

Signal / Parameter name	min.	max.	def.	unit
30.17 **SpeedFbFltSel (speed feedback fault selector)** *SpeedFbFltSel (30.17)* determines the reaction to a speed feedback problem: 0 = **NotUsed** 1 = **Fault** the drive trips according to *SpeedFbFltMode (30.36)* and sets **F522 SpeedFb** [*FaultWord2 (9.02)* bit 5], default  2 = **EMF/Fault** The speed feedback is switched to EMF, the drive stops according to *E StopRamp (22.11)* and sets **F522 SpeedFb** [*FaultWord2 (9.02)* bit 5]. In case speed actual is greater than base speed the drive trips according to *SpeedFbFltMode (30.36)* and sets **F522 SpeedFb** [*FaultWord2 (9.02)* bit 5].  3 = **EMF/Alarm** The speed feedback is switched to EMF and **A125 SpeedFb** [*AlarmWord2 (9.07)* bit 8] is set. In case speed actual is greater than base speed the drive trips according to *SpeedFbFltMode (30.36)* and sets **F522 SpeedFb** [*FaultWord2 (9.02)* bit 5].  Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	EMF/Alarm	Fault	-
30.18 **CurRippleSel (current ripple selector)** *CurRippleSel (30.18)* determines the reaction when *CurRippleLim (30.19)* is reached: 0 = **NotUsed** 1 = **Fault** the drive trips with **F517 ArmCurRipple** [*FaultWord2 (9.02)* bit 0], default 2 = **Alarm** **A117 ArmCurRipple** [*AlarmWord2 (9.07)* bit 0] is set **Note:** The current ripple function detects: – a broken fuse, thyristor or current transformer (T51, T52) – too high gain of the current controller Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	Alarm	Fault	-
30.19 **CurRippleLim (current ripple limit)** Threshold for *CurRippleSel (30.18),* in percent of *M1NomCur (99.03)*. Typical values when a thyristor is missing: – armature about 300 % – high inductive loads (e.g. excitation) about 90 % Int. Scaling: 100 == 1 % Type: I Volatile: N	0	650	150	%
30.20 Unused				

Signal / Parameter name	min.	max.	def.	unit
30.21 **PwrLossTrip (power loss trip)** The action taken, when the mains voltage undershoots *UNetMin2 (30.23):* 0 = **Immediately** the drive trips immediately with **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11], default 1 = **Delayed** **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set as long as the mains voltage recovers before *PowrDownTime (30.24)* is elapsed, otherwise **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated Int. Scaling: 1 == 1 Type: C Volatile: N	Immediately	Delayed	Immediately	-
30.22 **UNetMin1 (mains voltage minimum 1)** First (upper) limit for mains undervoltage monitoring in percent of *NomMainsVolt (99.10).* If the mains voltage undershoots *UNetMin1 (30.22)* following actions take place: – the firing angle is set to *ArmAlphaMax (20.14)*, – single firing pulses are applied in order to extinguish the current as fast as possible, – the controllers are frozen, – the speed ramp output is updated from the measured speed and – **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set as long as the mains voltage recovers before *PowrDownTime (30.24)* is elapsed, otherwise **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated. **Notes:** – *UNetMin2 (30.23)* is not monitored, unless the mains voltage drops below *UNetMin1 (30.22)* first. Thus for a proper function of the mains undervoltage monitoring *UNetMin1 (30.22)* has to be larger than *UNetMin2 (30.23)*. – In case the **On** command [*UsedMCW (7.04)* bit 0] is given and the measured mains voltage is too low for more than 500 ms **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set. It the problem persist for more than 10 s **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	150	80	%
30.23 **UNetMin2 (mains voltage minimum 2)** Second (lower) limit for mains undervoltage monitoring in percent of *NomMainsVolt (99.10).* If the mains voltage undershoots *UnetMin2 (30.23)* following actions take place: – if *PwrLossTrip (30.21)* = **Immediately**: – the drive trips immediately with **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] – if *PwrLossTrip (30.21)* = **Delayed**: – field acknowledge signals are ignored, – the firing angle is set to *ArmAlphaMax (20.14)*, – single firing pulses are applied in order to extinguish the current as fast as possible, – the controllers are frozen – the speed ramp output is updated from the measured speed and – **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set as long as the mains voltage recovers before *PowrDownTime (30.24)* is elapsed, otherwise **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated. **Notes:** – *UNetMin2 (30.23)* is not monitored, unless the mains voltage drops below *UNetMin1 (30.22)* first. Thus for a proper function of the mains undervoltage monitoring *UNetMin1 (30.22)* has to be larger than *UNetMin2 (30.23)*. – In case the **On** command [*UsedMCW (7.04)* bit 0] is given and the measured mains voltage is too low for more than 500 ms **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set. It the problem persist for more than 10 s **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	150	60	%
30.24 **PowrDownTime (power down time)** The mains voltage must recover (over both limits) within *PowrDownTime (30.24).* Otherwise **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] will be generated. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	64000	500	ms
30.25 - 30.26 Unused				

Overview local and communication loss:

Device	Loss control	Time out	Related fault	Related alarm

Signal / Parameter name					min.	max.	def.	unit
DCS Control Panel DWL	*LocalLossCtrl (30.27)*	fixed to 10 s	**F546 LocalCmdLoss**	**A130 LocalCmdLoss**				
R-type fieldbus	*ComLossCtrl (30.28)*	*FB TimeOut (30.35)*	**F528 FieldBusCom**	**A128 FieldBusCom**				
SDCS-COM-8			**F543 COM8Com**	**A113 COM8Com**				

30.27 **LocalLossCtrl (local loss control)**
LocalLossCtrl (30.27) determines the reaction to a local loss (DCS Control Panel, DWL).
F546 LocalCmdLoss [*FaultWord3 (9.03)* bit 13] is set with:

- 0 = **RampStop** The input of the drives ramp is set to zero. Thus, the drive stops according to *E StopRamp (22.04)*. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped.
- 1 = **TorqueLimit** The output of the drives ramp is set to zero. Thus, the drive stops at the active torque limit. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped.
- 2 = **CoastStop** The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped.
- 3 = **DynBraking** dynamic braking

A130 LocalCmdLoss [*AlarmWord2 (9.07)* bit 13] is set with:

- 4 = **LastSpeed** the drive continues to run at the last speed before the warning
- 5 = **FixedSpeed1** the drive continuous to run with *FixedSpeed1 (23.02)*

Note:
The time out for *LocalLossCtrl (30.27)* is fixed to 10 s.
Int. Scaling: 1 == 1 Type: C Volatile: N

min.: RampStop | max.: FixedSpeed1 | def.: RampStop | unit: -

30.28 **ComLossCtrl (communication loss control)**
ComLossCtrl (30.28) determines the reaction to a communication control loss (R-type fieldbusses) see also *CommandSel (10.01)*.
F528 FieldBusCom [*FaultWord2 (9.02)* bit 11] is set with:

- 0 = **RampStop** The input of the drives ramp is set to zero. Thus, the drive stops according to *E StopRamp (22.04)*. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped.
- 1 = **TorqueLimit** The output of the drives ramp is set to zero. Thus, the drive stops at the active torque limit. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped.
- 2 = **CoastStop** The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped.
- 3 = **DynBraking** dynamic braking

A128 FieldBusCom [*AlarmWord2 (9.02)* bit 11] is set with:

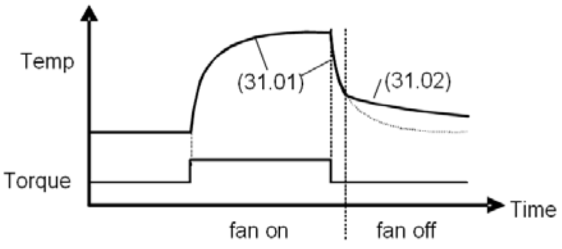
- 4 = **LastSpeed** the drive continues to run at the last speed before the warning
- 5 = **FixedSpeed1** the drive continuous to run with *FixedSpeed1 (23.02)*

Note:
The time out for *ComLossCtrl (30.28)* is set by *FB TimeOut (30.35)* for all R-type fieldbusses.
Int. Scaling: 1 == 1 Type: C Volatile: N

min.: RampStop | max.: FixedSpeed1 | def.: RampStop | unit: -

Signal / Parameter name	min.	max.	def.	unit
30.29 **AI Mon4mA (analog input 4 mA fault selector)** *AI Mon4mA (30.29)* determines the reaction to an undershoot of one of the analog inputs under 4 mA / 2 V - if it is configured to this mode: 0 = **NotUsed** 1 = **Fault** the drive stops according to *FaultStopMode (30.30)* and trips with **F551 AIRange** [*FaultWord4 (9.04)* bit 2], default 2 = **LastSpeed** the drive continues to run at the last speed and sets **A127 AIRange** [*AlarmWord2 (9.07)* bit 10] 3 = **FixedSpeed1** the drive continues to run with *FixedSpeed1 (23.02)* and sets **A127 AIRange** [*AlarmWord2 (9.07)* bit 10] Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	FixedSpeed1	Fault	-
30.30 **FaultStopMode (fault stop mode)** *FaultStopMode (30.30)* determines the reaction to a fault of trip level 4: 0 = **RampStop** The input of the drives ramp is set to zero. Thus, the drive stops according to *E StopRamp (22.04)*. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 1 = **TorqueLimit** The output of the drives ramp is set to zero. Thus, the drive stops at the active torque limit. When reaching *M1ZeroSpeedLim (20.03)* the firing pulses are set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 2 = **CoastStop** The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 3 = **DynBraking** dynamic braking **Note:** *FaultStopMode (30.30)* does not apply to communication faults. Int. Scaling: 1 == 1 Type: C Volatile: N	RampStop	DynBraking	RampStop	-
30.31 **ExtFaultSel (external fault selector)** The drive trips with **F526 ExternalDI** [*FaultWord2 (9.02)* bit 9] if a binary input for an external fault is selected and 1: 0 = **NotUsed** default 1 = **DI1** 1 = fault, 0 = no fault 2 = **DI2** 1 = fault, 0 = no fault 3 = **DI3** 1 = fault, 0 = no fault 4 = **DI4** 1 = fault, 0 = no fault 5 = **DI5** 1 = fault, 0 = no fault 6 = **DI6** 1 = fault, 0 = no fault 7 = **DI7** 1 = fault, 0 = no fault 8 = **DI8** 1 = fault, 0 = no fault 9 = **DI9** 1 = fault, 0 = no fault, Only available with digital extension board 10 = **DI10** 1 = fault, 0 = no fault, Only available with digital extension board 11 = **DI11** 1 = fault, 0 = no fault, Only available with digital extension board 12 = **MCW Bit11** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-

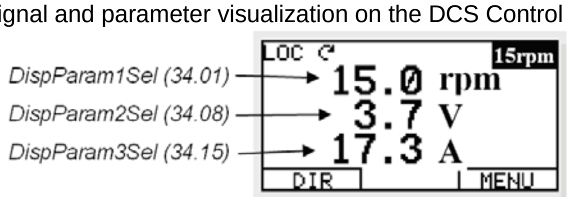
Signal / Parameter name	min.	max.	def.	unit
30.32 **ExtAlarmSel (external alarm selector)** The drive sets **A126 ExternalDI** [*AlarmWord2 (9.07)* bit 9] if a binary input for an external alarm is selected and 1: 0 = **NotUsed** default 1 = **DI1** 1 = fault, 0 = no fault 2 = **DI2** 1 = fault, 0 = no fault 3 = **DI3** 1 = fault, 0 = no fault 4 = **DI4** 1 = fault, 0 = no fault 5 = **DI5** 1 = fault, 0 = no fault 6 = **DI6** 1 = fault, 0 = no fault 7 = **DI7** 1 = fault, 0 = no fault 8 = **DI8** 1 = fault, 0 = no fault 9 = **DI9** 1 = fault, 0 = no fault. Only available with digital extension board 10 = **DI10** 1 = fault, 0 = no fault. Only available with digital extension board 11 = **DI11** 1 = fault, 0 = no fault. Only available with digital extension board 12 = **MCW Bit11** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 11 13 = **MCW Bit12** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 12 14 = **MCW Bit13** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 13 15 = **MCW Bit14** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 14 16 = **MCW Bit15** 1 = fault, 0 = no fault, *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	MCW Bit15	NotUsed	-
30.33 - 30.34 Unused				
30.35 FB **TimeOut (fieldbus time out)** Time delay before a communication break with a fieldbus is declared. Depending on the setting of *ComLossCtrl (30.28)* either **F528 FieldBusCom** [*FaultWord2 (9.02)* bit 11] or **A128 FieldBusCom** [*AlarmWord2 (9.07)* bit 11] is set. The communication fault and alarm are inactive, if *FB TimeOut (30.35)* is set to 0 ms. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	64000	100	ms
30.36 **SpeedFbFltMode (speed feedback fault mode)** *SpeedFbFltMode (30.36)* determines the reaction of all faults of trip level 3: 0 = **CoastStop** The firing pulses are immediately set to 150 degrees to decrease the armature current. When the armature current is zero the firing pulses are blocked, the contactors are opened, field exciter and fans are stopped. 1 = **DynBraking** dynamic braking **Note:** *SpeedFbFltMode (30.36)* does not apply to communication faults. Int. Scaling: 1 == 1 Type: C Volatile: N	CoastStop	DynBraking	CoastStop	-
Group 31: Motor temperature				
31.01 **M1ModelTime (model time constant)** Thermal time constant for motors with fan/forced cooling. The time within the temperature rises to 63% of its nominal value. The motor thermal model is blocked, if *M1ModelTime (31.01)* is set to zero. The value of *Mot1TempCalc (1.20)* is saved at power down of the drives electronics. Energizing the drives electronics the very first time the motor's ambient temperature is set to 30°C. **WARNING!** The model does not protect the motor if it is not properly cooled e.g. due to dust and dirt. Int. Scaling: 10 == 1 s Type: I Volatile: N	0	6400	240	s

Signal / Parameter name	min.	max.	def.	unit
31.02 **M1ModelTime2 (model time 2 constant)** Thermal time constant for motors with fan/forced cooling if motor fan is switched off.  **Attention:** For motors without fan set *M1ModelTime (31.01) = M1ModelTime2 (31.02).* Int. Scaling: 10 == 1 % Type: I Volatile: N	0	6400	2400	s
31.03 **M1AlarmLimLoad (alarm limit load)** The drive sets **A107 M1OverLoad** [*AlarmWord1 (9.06)* bit 6] if *M1AlarmLimLoad (31.03)* - in percent of *M1NomCur (99.03)* - is exceeded. Output value is *Mot1TempCalc (1.20).* Int. Scaling: 10 == 1 % Type: I Volatile: N	10	325	102	%
31.04 **M1FaultLimLoad (fault limit load)** The drive trips with **F507 M1OverLoad** [*FaultWord1 (9.01)* bit 6] if *M1FaultLimLoad (31.04)* - in percent of *M1NomCur (99.03)* - is exceeded. Output value is *Mot1TempCalc (1.20).* Int. Scaling: 10 == 1 % Type: I Volatile: N	10	325	106	%
31.05 **M1TempSel (temperature selector)** *M1TempSel (31.05)* selects the measured temperature input for the connected motor. The result is displayed in *Mot1TemopMeas (1.22)*. Only one single PTC can be connected. 0 = **NotUsed** motor temperature measurement is blocked, default 1 = **1PTC AI2/Con** one PTC connected to AI2 on SDCS-CON-F For more information, see section *Motor protection*. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1PTC AI2/Con	NotUsed	-
31.06 **M1AlarmLimTemp (alarm limit temperature)** The drive sets **A106 M1OverTemp** [*AlarmWord1 (9.06)* bit 5] if *M1AlarmLimTemp (31.06)* is exceeded. Output value is *Mot1TempMeas (1.22).* **Note:** The unit depends on *M1TempSel (31.05).* Int. Scaling: 1 == 1 Ω / 1 Type: SI Volatile: N	-10	4000	0	°C / Ω / -
31.07 **M1FaultLimTemp (fault limit temperature)** The drive trips with **F506 M1OverTemp** [*FaultWord1 (9.01)* bit 5] if *M1FaultLimTemp (31.07)* is exceeded. Output value is *Mot1TempMeas (1.22).* **Note:** The unit depends on *M1TempSel (31.05).* Int. Scaling: 1 == 1 Ω / 1 Type: SI Volatile: N	-10	4000	0	°C / Ω / -

Signal / Parameter name	min.	max.	def.	unit
31.08 **M1KlixonSel (klixon selector)** The drive trips with **F506 M1OverTemp** [*FaultWord1 (9.01)* bit 5] if a digital input selected and the klixon is open: 0 = **NotUsed** default 1 = **DI1** 0 = fault, 1 = no fault 2 = **DI2** 0 = fault, 1 = no fault 3 = **DI3** 0 = fault, 1 = no fault 4 = **DI4** 0 = fault, 1 = no fault 5 = **DI5** 0 = fault, 1 = no fault 6 = **DI6** 0 = fault, 1 = no fault 7 = **DI7** 0 = fault, 1 = no fault 8 = **DI8** 0 = fault, 1 = no fault 9 = **DI9** 0 = fault, 1 = no fault. Only available with digital extension board 10 = **DI10** 0 = fault, 1 = no fault. Only available with digital extension board 11 = **DI11** 0 = fault, 1 = no fault. Only available with digital extension board **Note:** It is possible to connect several klixons in series. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DI11	NotUsed	-
31.10 **M1LoadCurMax (maximum overload current I^2T-function)** Maximum overload current of the connected motor in % of *M1NomCur (99.03)*. The overload current is independent of its sign and applies to both current directions. Thus an activated I^2T-function limits *M1CurLimBrdg1 (20.12)* and *M1CurLimBrdg2 (20.13).* The I^2T-function is inactive, if *M1LoadCurMax (31.10)* is set to values ≤ 100 %. In case the I^2T-function is reducing the armature current **A108 MotCurReduce** [*AlarmWord1 (9.06)* bit 7] is set. **Notes:** – The used current limit depends also on the converter's actual limitation situation (e.g. torque limits, other current limits, field weakening). Int. Scaling: 100 == 1 % Type: I Volatile: N	0	325	100	%
31.11 **M1OvrLoadTime (overload time I^2T-function)** Longest permissible time for the maximum overload current defined in *M1LoadCurMax (31.10)*. The I^2T-protection is inactive, if *M1OvrLoadTime (31.11)* is set to zero. In case the I^2T-protection is reducing the armature current **A108 MotCurReduce** [*AlarmWord1 (9.06)* bit 7] is set. Int. Scaling: 1 == 1 s Type: I Volatile: N	0	180	0	s
31.12 **M1RecoveryTime (recovery time I^2T-function)** Recovery time during which a reduced current must flow. The I^2T-protection is inactive, if *M1RecoveryTime (31.12)* is set to zero. In case the I^2T-protection is reducing the armature current **A108 MotCurReduce** [*AlarmWord1 (9.06)* bit 7] is set. Int. Scaling: 1 == 1 s Type: I Volatile: N	0	3600	0	s

Group 34: DCS Control Panel display

Signal and parameter visualization on the DCS Control Panel:



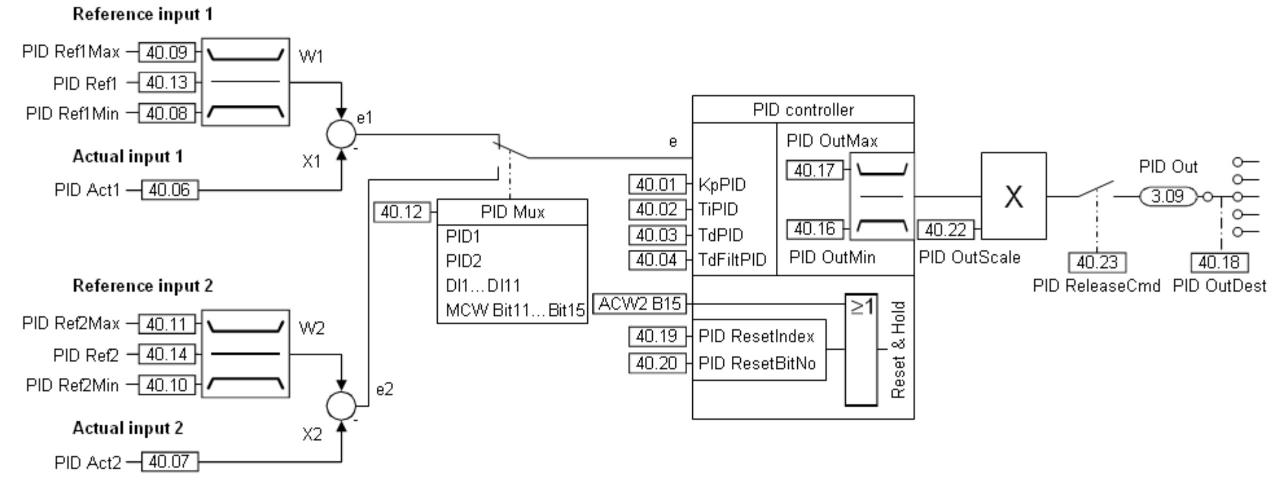
Setting a display parameter to 0 results in no signal or parameter displayed.
Setting a display parameter from 101 to 9999 displays the belonging signal or parameter. If a signal or parameter does not exist, the display shows “n.a.”.

Signal / Parameter name	min.	max.	def.	unit
34.01 **DispParam1Sel (select signal / parameter to be displayed in the DCS Control Panel row 1)** Index pointer to the source of the DCS Control Panel first display row [e.g. 101 equals *MotSpeedFilt (1.01)*]. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	101	-
34.02 - 34.07 Unused				

Signal / Parameter name	min.	max.	def.	unit
34.08 **DispParam2Sel (select signal / parameter to be displayed in the DCS Control Panel row 2)** Index pointer to the source of the DCS Control Panel second display row [e.g. 114 equals *ArmVoltAct (1.14)*]. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	114	-
34.09 - 34.14 Unused				
34.15 **DispParam3Sel (select signal / parameter to be displayed in the DCS Control Panel l row 3)** Index pointer to the source of the DCS Control Panel third display row [e.g. 116 equals *ConvCurAct (1.16)*]. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	116	-

Group 40: PID controller

Overview of the PID controller:



Signal / Parameter name	min.	max.	def.	unit
40.01 **KpPID (p-part PID controller)** Proportional gain of the PID controller. Example: The controller generates 15 % output with *KpPID (40.01)* = 3, if the input is 5 %. Int. Scaling: 100 == 1 Type: I Volatile: N	0	325	5	-
40.02 **TiPID (i-part PID controller)** Integral time of the PID controller. *TiPID (40.02)* defines the time within the integral part of the controller achieves the same value as the proportional part. Example: The controller generates 15 % output with *KpPID (40.01)* = 3, if the input is 5 %. On that condition and with *TiPID (40.02)* = 300 ms follows: – the controller generates 30 % output, if the input is constant, after 300 ms are elapsed (15 % from proportional part and 15 % from integral part). Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	64000	2500	ms
40.03 **TdPID (d-part PID controller)** PID controller derivation time. *TdPID (40.03)* defines the time within the PID controller derives the error value. The PID controller works as PI controller, if *TdPID (40.03)* is set to zero. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
40.04 **TdFiltPID (filter time for d-part PID controller)** Derivation filter time. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	10	ms
40.05 Unused				
40.06 **PID Act1 (PID controller actual input value 1 index)** Index pointer to the source of the PID controller actual input value 1. The format is **-xxyy**, with: **-** = negate actual input value 1, **xx** = group and **yy** = index [e.g. 101 equals *MotSpeedFilt (1.01)*]. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-

Signal / Parameter name	min.	max.	def.	unit
40.07 **PID Act2 (PID controller actual input value 2 index)** Index pointer to the source of the PID controller actual input value 2. The format is **-xxyy**, with: **-** = negate actual input value 2, **xx** = group and **yy** = index [e.g. 101 equals *MotSpeedFilt (1.01)*]. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
40.08 **PID Ref1Min (PID controller minimum limit reference input value 1)** Minimum limit of the PID controller reference input value 1 in percent of the source of *PID Ref1 (40.13)*. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-100	%
40.09 **PID Ref1Max (PID controller maximum limit reference input value 1)** Maximum limit of the PID controller reference input value 1 in percent of the source of *PID Ref1 (40.13)*. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	100	%
40.10 **PID Ref2Min (PID controller minimum limit reference input value 2)** Minimum limit of the PID controller reference input value 2 in percent of the source of *PID Ref2 (40.14)*. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-100	%
40.11 **PID Ref2Max (PID controller maximum limit reference input value 2)** Maximum limit of the PID controller reference input value 2 in percent of the source of *PID Ref2 (40.14)*. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	100	%
40.12 **PID Mux (PID controller reference input selector/multiplexer)** PID controller reference input selector: 0 = **PID1** reference input 1 is selected, default 1 = **PID2** reference input 2 is selected 2 = **DI1** 1= reference input 2 is selected; 0 = reference input 1 is selected 3 = **DI2** 1= reference input 2 is selected; 0 = reference input 1 is selected 4 = **DI3** 1= reference input 2 is selected; 0 = reference input 1 is selected 5 = **DI4** 1= reference input 2 is selected; 0 = reference input 1 is selected 6 = **DI5** 1= reference input 2 is selected; 0 = reference input 1 is selected 7 = **DI6** 1= reference input 2 is selected; 0 = reference input 1 is selected 8 = **DI7** 1= reference input 2 is selected; 0 = reference input 1 is selected 9 = **DI8** 1= reference input 2 is selected; 0 = reference input 1 is selected 10 = **DI9** 1= reference input 2 is selected; 0 = reference input 1 is selected; only available with digital extension board 11= **DI10** 1= reference input 2 is selected; 0 = reference input 1 is selected; only available with digital extension board 12 = **DI11** 1= reference input 2 is selected; 0 = reference input 1 is selected; only available with digital extension board 13 = **MCW Bit11** 1= reference input 2 is selected; 0 = reference input 1 is selected; *MainCtrlWord (7.01)* bit 11 14 = **MCW Bit12** 1= reference input 2 is selected; 0 = reference input 1 is selected; *MainCtrlWord (7.01)* bit 12 15 = **MCW Bit13** 1= reference input 2 is selected; 0 = reference input 1 is selected; *MainCtrlWord (7.01)* bit 13 16 = **MCW Bit14** 1= reference input 2 is selected; 0 = reference input 1 is selected; *MainCtrlWord (7.01)* bit 14 17 = **MCW Bit15** 1= reference input 2 is selected; 0 = reference input 1 is selected; *MainCtrlWord (7.01)* bit 15 Int. Scaling: 1 == 1 Type: C Volatile: N	PID1	MCW Bit15	PID1	
40.13 **PID Ref1 (PID controller reference input value 1 index)** Index pointer to the source of the PID controller reference input value 1. The format is **-xxyy**, with: **-** = negate reference input value 1, **xx** = group and **yy** = index [e.g. 201 equals *SpeedRef2 (2.01)*]. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
40.14 **PID Ref2 (PID controller reference input value 2 index)** Index pointer to the source of the PID controller reference input value 2. The format is **-xxyy**, with: **-** = negate reference input value 2, **xx** = group and **yy** = index [e.g. 201 equals *SpeedRef2 (2.01)*]. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
40.15 Unused				

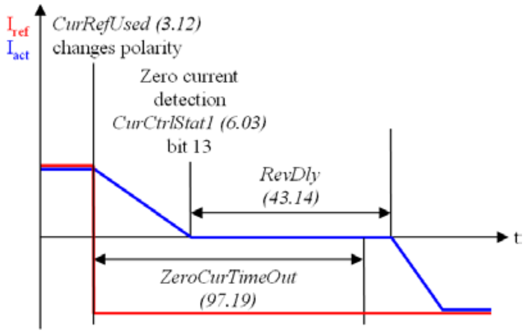
Signal / Parameter name	min.	max.	def.	unit
40.16 **PID OutMin (PID controller minimum limit output value)** Minimum limit of the PID controller output value in percent of the used PID controller input. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	0	-100	%
40.17 **PID OutMax (PID controller maximum limit output value)** Maximum limit of the PID controller output value in percent of the used PID controller input. Int. Scaling: 100 == 1 % Type: SI Volatile: N	0	325	100	%
40.18 **PID OutDest (PID controller destination of output value)** Index pointer to the sink for the PID controller output value. The format is **-xxyy**, with: **-** = negate output value, **xx** = group and **yy** = index. As default, nothing is connected to the output. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
40.19 **PID ResetIndex (PID controller reset index)** The PID controller reset and hold can be controlled by a selectable bit - see *PID ResetBitNo (40.20)* - of the source (signal/parameter) selected with this parameter. The format is **-xxyy**, with: **-** = invert reset signal, **xx** = group and **yy** = index. Examples: – If *PID ResetIndex (40.19)* = 701 (main control word) and *PID ResetBitNo (40.20)* = 12 then the PID controller reset is active when bit 12 is high. – If *PID ResetIndex (40.19)* = -701 (main control word) and *PID ResetBitNo (40.20)* = 12 then the PID controller reset is active when bit 12 is low. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
40.20 **PID ResetBitNo (PID controller reset bit number)** Bit number of the signal/parameter selected with *PID ResetIndex (40.19)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	15	0	-
40.21 Unused				
40.22 **PID OutScale (PID controller output scaling)** PID output scaling before *PID Out (3.09).* Int. Scaling: 100 == 1 Type: I Volatile: N	0.05	6	1	-
40.23 **PID ReleaseCmd (PID controller release command)** Source to release / block the PID controller: 0 = **NotUsed** constant 0; block PID controller 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release PID controller 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 6 4 = **DI1** 1= release; 0 = block PID controller 5 = **DI2** 1= release; 0 = block PID controller 6 = **DI3** 1= release; 0 = block PID controller 7 = **DI4** 1= release; 0 = block PID controller 8 = **DI5** 1= release; 0 = block PID controller 9 = **DI6** 1= release; 0 = block PID controller 10 = **DI7** 1= release; 0 = block PID controller 11 = **DI8** 1= release; 0 = block PID controller 12= **DI9** 1= release; 0 = block PID controller; only available with digital extension board 13 = **DI10** 1= release; 0 = block PID controller; only available with digital extension board 14 = **DI11** 1= release; 0 = block PID controller; only available with digital extension board 15 = **MCW Bit11** 1= release; 0 = block PID controller; *MainCtrlWord (7.01)* bit 11 16 = **MCW Bit12** 1= release; 0 = block PID controller; *MainCtrlWord (7.01)* bit 12 17 = **MCW Bit13** 1= release; 0 = block PID controller; *MainCtrlWord (7.01)* bit 13 18 = **MCW Bit14** 1= release; 0 = block PID controller; *MainCtrlWord (7.01)* bit 14 19 = **MCW Bit15** 1= release; 0 = block PID controller; *MainCtrlWord (7.01)* bit 15 20 = **19.05Bit0** 1= release; 0 = block PID controller; *Data5 (19.05)* bit 0 21 = **19.05Bit1** 1= release; 0 = block PID controller; *Data5 (19.05)* bit 1 22 = **19.05Bit2** 1= release; 0 = block PID controller; *Data5 (19.05)* bit 2 23 = **19.05Bit3** 1= release; 0 = block PID controller; *Data5 (19.05)* bit 3 Int. Scaling: 1 == 1 Type: I Volatile: N	NotUsed	1905Bit3	Auto	-

Signal / Parameter name	min.	max.	def.	unit
Group 43: Current control				
43.01 Unused				
43.02 **CurSel (current reference selector)** *CurSel (43.02)* selector: 0 = **CurRef311** *CurRef (3.11)* calculated from torque reference as armature current reference, default 1 = **CurRefExt** *CurRefExt (43.03)* as armature current reference 2 = **AI1** analog input AI1 as armature current reference 3 = **AI2** analog input AI2 as armature current reference 4 = **AI3** analog input AI3 as armature current reference 5 = **AI4** analog input AI4 as armature current reference 6 = **AI5** analog input AI5 as armature current reference 7 = **AI6** analog input AI6 as armature current reference 8 = **CurZero** forces single firing pulses and sets *CurRefUsed (3.12)* to zero Int. Scaling: 1 == 1 Type: C Volatile: N	CurRef311	AI6	CurRef311	-
43.03 **CurRefExt (external current reference)** External current reference in percent of *M1NomCur (99.03).* **Note:** *CurRefExt (43.03)* is only valid, if *CurSel (43.02)* = **CurRefExt**. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-325	325	0	
43.04 **CurRefSlope (current reference slope)** *CurRefSlope (43.04)* in percent of *M1NomCur (99.03)* per 1 ms. The di/dt limitation is located at the input of the current controller. Int. Scaling: 100 == 1 %/ms Type: I Volatile: N	0.2	40	10	%/ms
43.05 Unused				
43.06 **M1KpArmCur (p-part armature current controller)** Proportional gain of the current controller. Example: The controller generates 15 % of motor nominal current [*M1NomCur (99.03)*] with *M1KpArmCur (43.06)* = 3, if the current error is 5 % of *M1NomCur (99.03)*. Int. Scaling: 100 == 1 Type: I Volatile: N	0	100	0.1	-
43.07 **M1TiArmCur (i-part armature current controller)** Integral time of the current controller. *M1TiArmCur (43.07)* defines the time within the integral part of the controller achieves the same value as the proportional part. Example: The controller generates 15 % of motor nominal current [*M1NomCur (99.03)*] with *M1KpArmCur (43.06)* = 3, if the current error is 5 % of *M1NomCur (99.03)*. On that condition and with *M1TiArmCur (43.07)* = 50 ms follows: – the controller generates 30 % of motor nominal current, if the current error is constant, after 50 ms are elapsed (15 % from proportional part and 15 % from integral part). Setting *M1TiArmCur (43.07)* to 0 ms disables the integral part of the current controller and resets its integrator. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	50	ms
43.08 **M1DiscontCurLim (discontinuous current limit)** Threshold continuous / discontinuous current in percent of *M1NomCur (99.03).* The actual continuous / discontinuous current state can be read from *CurCtrlStat1 (6.03)* bit 12. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	325	100	%
43.09 **M1ArmL (armature inductance)** Inductance of the armature circuit in mH. Used for the EMF compensation: $EMF = U_A - R_A * I_A - L_A * \frac{dI_A}{dt}$ **Attention:** Do not change the default values of *M1ArmL (43.09)* and *M1ArmR (43.10)*! Changing them will falsify the results of the autotuning. Int. Scaling: 100 == 1 mH Type: I Volatile: N	0	640	0	mH

<table>
<tr><th>Signal / Parameter name</th><th>min.</th><th>max.</th><th>def.</th><th>unit</th></tr>
<tr><td>43.10 M1ArmR (armature resistance)
Resistance of the armature circuit in mΩ. Used for the EMF compensation:

$$EMF = U_A - R_A * I_A - L_A * \frac{dI_A}{dt}$$

Attention:
Do not change the default values of M1ArmL (43.09) and M1ArmR (43.10)! Changing them will falsify the results of the autotuning.
Int. Scaling: 1 == 1 mΩ Type: I Volatile: N</td><td>0</td><td>65500</td><td>0</td><td>mΩ</td></tr>
<tr><td>43.11 - 43.13 Unused</td><td></td><td></td><td></td><td></td></tr>
<tr><td>43.14 RevDly (reversal delay)
RevDly (43.14) defines the delay time in ms for the bridge reversal after zero current has been detected - see CurCtrlStat1 (6.03) bit 13.



The reversal delay starts when zero current has been detected - see CurCtrlStat1 (6.03) bit 13 - after a command to change current direction - see CurRefUsed (3.12) - has been given. After a command to change the current direction the opposite current has to be reached before ZeroCurTimeOut (97.19) has been elapsed otherwise the drive trips with F557 ReversalTime [FaultWord4 (9.04) bit 8].
Note:
ZeroCurTimeOut (97.19) must be longer than RevDly (43.14).
Int. Scaling: 1 == 1 ms Type: I Volatile: N</td><td>0</td><td>600</td><td>5</td><td>ms</td></tr>
<tr><td colspan="5">

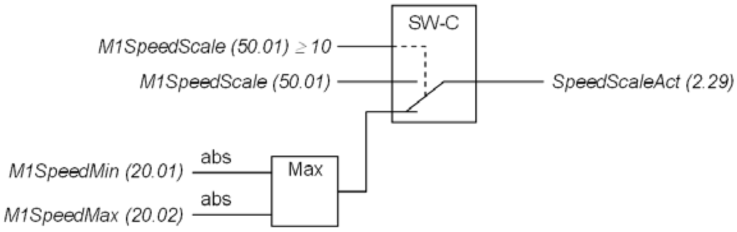
Group 44: Field excitation

</td></tr>
<tr><td>44.01 FldCtrlMode (field control mode)
Field control mode selection:
0 = Fix constant field (no field weakening), EMF controller blocked, field reversal blocked, optitorque blocked, default
1 = EMF field weakening active, EMF controller released, field reversal blocked, optitorque blocked
Note:
It is not possible to go into field weakening range when M1SpeeFbSel (50.03) = EMF.
Int. Scaling: 1 == 1 Type: C Volatile: N</td><td>Fix</td><td>EMF/Rev/Opti</td><td>Fix</td><td>-</td></tr>
<tr><td>44.02 M1KpFex (p-part field current controller)
Proportional gain of the field current controller.
Example:
The controller generates 15 % of motor nominal field current [M1NomFldCur (99.11)] with M1KpFex (44.02) = 3, if the field current error is 5 % of M1NomFldCur (99.11).
Int. Scaling: 100 == 1 Type: I Volatile: N</td><td>0</td><td>325</td><td>0.2</td><td>-</td></tr>
</table>

Signal / Parameter name	min.	max.	def.	unit
44.03 **M1TiFex (i-part field current controller)** Integral time of the field current controller. *M1TiFex (44.03)* defines the time within the integral part of the controller achieves the same value as the proportional part. Example: The controller generates 15 % of motor nominal field current [*M1NomFldCur (99.11)*] with *M1KpFex (44.02)* = 3, if the field current error is 5 % of *M1NomFldCur (99.11)*. On that condition and with *M1TiFex (44.03)* = 200 ms follows: – the controller generates 30 % of motor nominal field current, if the current error is constant, after 200 ms are elapsed (15 % from proportional part and 15 % from integral part). Setting *M1TiFex (44.03)* to 0 ms disables the integral part of the field current controller and resets its integrator. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	64000	200	ms
44.04 **M1FldHeatRef (field heating reference)** Field current reference - in percent of *M1NomFieldCur (99.11)* - for field heating. Field heating is released according to *FldHeatSel (21.18)*. Int. Scaling: 1 == 1 % Type: I Volatile: N	0	100	100	%
44.05 - 44.06 Unused				
44.07 **EMF CtrlPosLim (positive limit EMF controller)** Positive limit for EMF controller in percent of nominal flux. Int. Scaling: 1 == 1 % Type: I Volatile: N	0	100	10	%
44.08 **EMF CtrlNegLim (negative limit EMF controller)** Negative limit for EMF controller in percent of nominal flux. Int. Scaling: 1 == 1 % Type: I Volatile: N	-100	0	-100	%
44.09 **KpEMF (p-part EMF controller)** Proportional gain of the EMF controller. Example: The controller generates 15 % of motor nominal EMF with *KpEMF (44.09)* = 3, if the EMF error is 5% of *M1NomVolt (99.02)*. Int. Scaling: 100 == 1 Type: I Volatile: N	0	325	0.5	-
44.10 **TiEMF (i-part EMF controller)** Integral time of the EMF controller. *TiEMF (44.10)* defines the time within the integral part of the controller achieves the same value as the proportional part. Example: The controller generates 15 % of motor nominal EMF with *KpEMF (44.09)* = 3, if the EMF error is 5% of *M1NomVolt (99.02)*. On that condition and with *TiEMF (44.10)* = 20 ms follows: – the controller generates 30 % of motor nominal EMF, if the EMF error is constant, after 20 ms are elapsed (15 % from proportional part and 15 % from integral part). Setting *TiEMF (44.10)* to 0 ms disables the integral part of the EMF controller and resets its integrator. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	64000	50	ms
44.11 Unused				
44.12 **FldCurFlux40 (field current at 40% flux)** Field current at 40 % flux in percent of *M1NomFldCur (99.11).* Int. Scaling: 1 == 1 % Type: I Volatile: N	0	100	40	%
44.13 **FldCurFlux70 (field current at 70% flux)** Field current at 70 % flux in percent of *M1NomFldCur (99.11).* Int. Scaling: 1 == 1 % Type: I Volatile: N	0	100	70	%
44.14 **FldCurFlux90 (field current at 90% flux)** Field current at 90 % flux in percent of *M1NomFldCur (99.11).* Int. Scaling: 1 == 1 % Type: I Volatile: N	0	100	90	%
Group 45: Field converter settings				
45.01 Unused				

Signal / Parameter name	min.	max.	def.	unit
45.02 **M1PosLimCtrl (positive voltage limit for field exciter)** Positive voltage limit for the field exciter in percent of the maximum field exciter output voltage. Example: With a 3-phase supply voltage of 400 V_{AC} the field current controller can generate a maximum output voltage of 521 V_{DC}. In case the rated field supply voltage is 200 V_{DC}, then it is possible to limit the controller's output voltage to 46 %. That means the firing angle of the field current controller is limited in such a way that the average output voltage is limited to a maximum of 230V_{DC}. Int. Scaling: 100 = 1 % Type: I Volatile: N	0	100	100	%
45.03 - 45.17 Unused				
45.18 **FldMinTripDly (delay field current minimum trip)** *FldMinTripDly (45.18)* delays **F541 M1FexLowCur** [*FaultWord3 (9.03)* bit 8]. If the field current recovers before the delay is elapsed **F541** will be disregarded: – *M1FldMinTrip (30.12)* Int. Scaling: 1 == 1 ms Type: I Volatile: N	50	10000	2000	ms

Group 50: Speed measurement

Signal / Parameter name	min.	max.	def.	unit
50.01 **M1SpeedScale (speed scaling)** Speed scaling in rpm. *M1SpeedScale (50.01)* defines the speed - in rpm - that corresponds to 20,000 internal speed units. The speed scaling is released when *M1SpeedScale (50.01)* ≥ 10:  – 20,000 speed units == *M1SpeedScale (50.01)*, in case *M1SpeedScale (50.01)* ≥ 10 – 20,000 speed units == maximum absolute value of *M1SpeedMin (20.01)* and *M1SpeedMax (20.02),* in case *M1SpeedScale (50.01)* < 10 Mathematically speaking: If *(50.01)* ≥ 10 then 20,000 == *(50.01)* in rpm If *(50.01)* < 10 then 20,000 == Max [|*(20.01)*|, |*(20.02)*|] in rpm The actual used speed scaling is visible in *SpeedScale Act (2.29).* **Notes:** – *M1SpeedScale (50.01)* has to be set in case the speed is read or written by means of an overriding control via fieldbus. – *M1SpeedScale (50.01)* is must be set in the range of: 0.625 to 5 times of *M1BaseSpeed (99.04)*, because the maximum amount of speed units is 32,000. If the scaling is out of range **A124 SpeedScale** [*AlarmWord2 (9.07)* bit 7] is generated. **Commissioning hint:** – Set *M1SpeedScale (50.01)* to maximum speed – Set *M1BaseSpeed (99.04)* to base speed – Set *M1SpeedMax (20.02)* / *M1SpeedMin (20.01)* to ± maximum speed Int. Scaling: 10 == 1 rpm Type: I Volatile: N	0	6500	0	rpm
50.02 Unused				

Signal / Parameter name	min.	max.	def.	unit

50.03 **M1SpeedFbSel (speed feedback selector)**
Speed feedback selection:

0 = **EMF**	speed is calculated by means of the EMF feedback with flux compensation, default
1 = **Encoder**	speed is measured by means of a pulse encoder
2 = **Tacho**	speed is measured by means of an analog tacho
3 = **External**	*MotSpeed (1.04)* is updated by Adaptive Program or overriding control

Notes:
- It is not possible to go into field weakening range when *M1SpeeFbSel (50.03)* = **EMF**.
- When using EMF speed feedback together with a DC-breaker wrong voltage measurements can lead to **F532 MotOverSpeed** [*FaultWord2 (9.02)* bit 15]. In case of an open DC-breaker the voltage measurement might show high values caused by leakage currents through the snubber circuits of the thyristors, because there is no load on the DC side. To prevent these trips set *MainContAck (10.21)* = **DCcontact**.

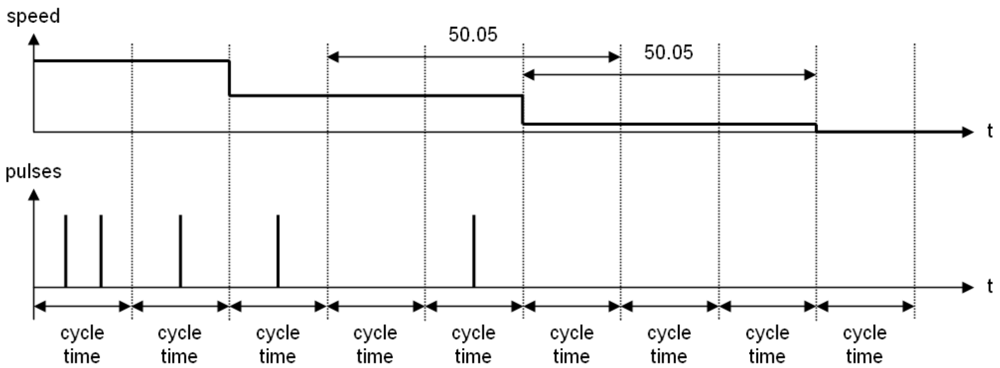
Int. Scaling: 1 == 1 Type: C Volatile: N

min.	max.	def.	unit
EMF	External	EMF	-

50.04 **M1EncPulseNo (encoder 1 pulse number)**
Amount of pulses per revolution (ppr) for the pulse encoder.
Int. Scaling: 1 == 1 ppr Type: I Volatile: N

min.	max.	def.	unit
20	10000	1024	ppr

50.05 **MaxEncoderTime (maximum encoder time)**
When an encoder is used as speed feedback device the actual speed is measured by counting the amount of pulses per cycle time. The cycle time for the measurement is synchronized with the mains (every 3.3 ms or 2.77 ms).
In case very small speeds have to be measured - that means there is less than one pulse per cycle time - it is possible to increase the measuring time by means of *MaxEncoderTime (50.05)*. The speed is set to zero after *MaxEncoderTime (50.05)* is elapsed without a measured pulse.



Notes:
- Formula to calculate the maximum speed using an encoder:

$$n_{\max}[rpm] = \frac{300\ kHz * 60\ s}{ppr}$$

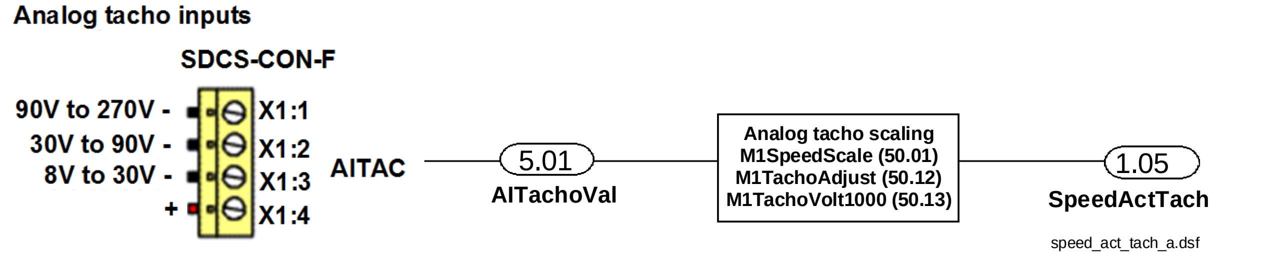
with: ppr = pulses per revolution - see *M1EncPulseNo (50.04)*
- Formula to calculate the minimum speed resolution using an encoder:

$$n_{\min}[rpm] = \frac{60\ s}{k * ppr * t_{cycle}}$$

with: k = 4 (speed evaluation factor)
ppr = pulses per revolution - see *M1EncPulseNo (50.04)*
t_{cycle} = cycle time of the speed controller, either 3.3 ms or 2.77 ms

Int. Scaling: 1 == 1 ms Type: I Volatile: N

min.	max.	def.	unit
3	200	3	ms

Signal / Parameter name	min.	max.	def.	unit
50.06 **SpeedFiltTime (actual speed filter time)** Speed actual filter time for *MotSpeed (1.04)*. There are three different filters for actual speed and speed error (Δn): – *SpeedFiltTime (50.06)* is filtering the actual speed and should be used for filter times smaller than 30 ms. – *SpeedErrFilt (23.06)* and *SpeedErrFilt2 (23.11)* are filtering the speed error (Δn) and should be used for filter times greater than 30 ms. It is recommended to set *SpeedErrFilt (23.06)* = *SpeedErrFilt2 (23.11)*. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	5	ms
50.07 - 50.09 Unused				
50.10 **SpeedLev (speed level)** When *MotSpeed (1.04)* reaches *SpeedLev (50.10)*, the bit **AboveLimit** [*MainStatWord (8.01)* bit 10] is set. Internally limited from: $-(2.29)*\frac{32767}{20000}rpm \;\; to \;\; (2.29)*\frac{32767}{20000}rpm$ **Note:** With *SpeedLev (50.10)* it is possible to automatically switch between the two p- and i-parts of the speed controller, see *Par2Select (24.29)* = **SpeedLevel** or **SpeedError**. Int. Scaling: (2.29) Type: I Volatile: N	0	10000	1500	rpm
50.11 **DynBrakeDly (dynamic braking delay)** In case of dynamic braking with EMF feedback [*M1SpeedFbSel (50.03)* = **EMF**] or a speed feedback fault there is no valid information about the motor speed and thus no zero speed information. To prevent an interlocking of the drive after dynamic braking the speed is assumed zero after *DynBrakeDly (50.11)* is elapsed: **-1 s** = the motor voltage is measured directly at the motor terminals and is thus valid during dynamic braking **0 s** = no zero speed signal for dynamic braking is generated **1 s to 3000 s** = zero speed signal for dynamic braking is generated after the programmed time is elapsed Int. Scaling: 1 == 1 s Type: I Volatile: N	-1	3000	0	s
				
50.12 **M1TachoAdjust (tacho adjust)** Fine tuning of analog tacho. The value equals the actual speed measured by means of a hand held tacho: *M1TachoAdjust (50.12)* = speed $actual_{HandHeldTacho}$ Internally limited to: $\pm(2.29)*\frac{32767}{20000}rpm$ **Note:** Changes of *M1TachoAdjust (50.12)* are only valid during tacho fine-tuning [*ServiceMode (99.06)* = **TachFineTune**]. During tacho fine-tuning *M1SpeedFbSel (50.03)* is automatically forced to **EMF**. **Attention:** The value of *M1TachoAdjust (50.12)* has to be the speed measured by the hand held tacho and **not** the delta between speed reference and measured speed. Int. Scaling: (2.29) Type: I Volatile: Y	-10000	10000	0	rpm
50.13 **M1TachoVolt1000 (tacho voltage at 1000 rpm)** *M1TachoVolt1000 (50.13)* is used to adjust the voltage the analog tacho is generating at a speed of 1000 rpm: – *M1TachoVolt1000 (50.13)* ≥ 1 V, the setting is used to calculate the tacho gain – *M1TachoVolt1000 (50.13)* = 0 V, the tacho gain is measured by means of the speed feedback assistant – *M1TachoVolt1000 (50.13)* = -1 V, the tacho gain was successfully measured and set by means of the speed feedback assistant Int. Scaling: 10 == 1 V Type: I Volatile: N	0	270	60	V

Signal / Parameter name	min.	max.	def.	unit
Group 51: Fieldbus				
This parameter group defines the communication parameters for fieldbus adapters. The parameter names and the number of the used parameters depend on the selected fieldbus adapter (see fieldbus adapter manual). **Note:** If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter.				
51.01 **Fieldbus1 (fieldbus parameter 1)** Fieldbus parameter 1 Int. Scaling: 1 == 1 Type: C Volatile: Y	-	-	-	-
…				
51.15 **Fieldbus15 (fieldbus parameter 15)** Fieldbus parameter 15 Int. Scaling: 1 == 1 Type: I Volatile: N	0	32767	0	-
51.16 **Fieldbus16 (fieldbus parameter 16)** Fieldbus parameter 16 Int. Scaling: 1 == 1 Type: I Volatile: N	0	32767	0	-
…				
51.27 **FBA PAR REFRESH (fieldbus parameter refreshing)** If a fieldbus parameter is changed its new value takes effect only upon setting *FBA PAR REFRESH (51.27)* = **RESET** or at the next power up of the fieldbus adapter. *FBA PAR REFRESH (51.27)* is automatically set back to **DONE** after the refreshing is finished. 0 = **DONE** default 1 = **RESET** refresh the parameters of the fieldbus adapter Int. Scaling: 1 == 1 Type: C Volatile: N	DONE	RESET	DONE	-
…				
51.36 **Fieldbus36 (fieldbus parameter 36)** Fieldbus parameter 36 Int. Scaling: 1 == 1 Type: I Volatile: N	0	32767	0	-
Group 52: Modbus				
This parameter group defines the communication parameters for the Modbus adapter RMBA-xx (see also Modbus adapter manual). **Note:** If a Modbus parameter is changed its new value takes effect only upon the next power up of the Modbus adapter.				
52.01 **StationNumber (station number)** Defines the address of the station. Two stations with the same station number are not allowed online. Int. Scaling: 1 == 1 Type: I Volatile: N	1	247	1	-
52.02 **BaudRate (baud rate)** Defines the transfer rate of the Modbus link: 0 = reserved 1 = **600** 600 Baud 2 = **1200** 1200 Baud 3 = **2400** 2400 Baud 4 = **4800** 4800 Baud 5 = **9600** 9600 Baud, default 6 = **19200** 19200 Baud Int. Scaling: 1 == 1 Type: C Volatile: N	600	19200	9600	-

Signal / Parameter name	min.	max.	def.	unit
52.03 **Parity (parity)** Defines the use of parity and stop bit(s). The same setting must be used in all online stations: 0 = reserved 1 = **None1Stopbit** no parity bit, one stop bit 2 = **None2Stopbit** no parity bit, two stop bits 3 = **Odd** odd parity indication bit, one stop bit 4 = **Even** even parity indication bit, one stop bit, default Int. Scaling: 1 == 1 Type: C Volatile: N	reserved	Even	Even	-
Group 61: Winder control				
61.01 **WinderMacro (winder control, winder macro)** *WinderMacro (61.01)* selects and activates a winder macro: 0 = **NotUsed** winder macro is blocked, default 1 = **VelocityCtrl** Velocity control calculates the coil diameters and motor speed references. By means of the diameter, it is possible to adapt the speed controller to all coil diameters. The tension is not controlled. 2 = **IndirectTens** Indirect tension control is an open loop control, since the actual tension is not measured. The tension is controlled via diameter and pre-set charts for inertia and friction. The speed controller stays active, but is saturated. This structure provides a very robust control behavior because no physical tension measurement is required. 3 = **DirectTens** Direct tension control (load cell control) is a closed loop control for the tension. The actual tension is measured by means of a load cell and fed into the drive via analog input (AI3) and PID controller in group 40. The speed controller stays active, but is saturated. 4 = **DancerCtrl** In dancer control the tension is established through the dancer's weight. The position of the dancer is read by means of an analog input (AI3). Its position is controlled by an additional speed reference coming from the PID controller in group 40. **Note:** The winder program is only running when *WiProgCmd (66.01)* = **Start** Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	DancerCtrl	NotUsed	-

Signal / Parameter name (min. / max. / def. / unit)

61.02 **WriteToSpdChain (winder control, write to speed chain)**

WriteToSpdChain (61.02) controls the outputs of the winder blocks:

0 = **NotUsed**	constant 0; values of connected block outputs are not written to the speed control chain
1 = **Auto**	values of connected block outputs are written to the speed control chain, depending on winder logic and winder macro, see *WinderMacro (61.01)*, default
2 = **Release**	constant 1; values of connected block outputs are written to the speed control chain
3 = **WindCtrlWord**	according to *WindCtrlWord (61.16)* bit 2
4 = **DI1**	1= written; 0 = not written
5 = **DI2**	1= written; 0 = not written
6 = **DI3**	1= written; 0 = not written
7 = **DI4**	1= written; 0 = not written
8 = **DI5**	1= written; 0 = not written
9 = **DI6**	1= written; 0 = not written
10 = **DI7**	1= written; 0 = not written
11 = **DI8**	1= written; 0 = not written
12 = **DI9**	1= written; 0 = not written; only available with digital extension board
13 = **DI10**	1= written; 0 = not written; only available with digital extension board
14 = **DI11**	1= written; 0 = not written; only available with digital extension board
15 = **MCW Bit11**	1= written; 0 = not written; *MainCtrlWord (7.01)* bit 11
16 = **MCW Bit12**	1= written; 0 = not written; *MainCtrlWord (7.01)* bit 12
17 = **MCW Bit13**	1= written; 0 = not written; *MainCtrlWord (7.01)* bit 13
18 = **MCW Bit14**	1= written; 0 = not written; *MainCtrlWord (7.01)* bit 14
19 = **MCW Bit15**	1= written; 0 = not written; *MainCtrlWord (7.01)* bit 15
20 = **19.05Bit0**	1= written; 0 = not written; *Data5 (19.05)* bit 0
21 = **19.05Bit1**	1= written; 0 = not written; *Data5 (19.05)* bit 1
22 = **19.05Bit2**	1= written; 0 = not written; *Data5 (19.05)* bit 2
23 = **19.05Bit3**	1= written; 0 = not written; *Data5 (19.05)* bit 3

Note:

The connections itself are set by the selected winder macro and by the user.

Int. Scaling: 1 == 1 Type: C Volatile: N

min.	max.	def.	unit
NotUsed	1905Bit3	Auto	-

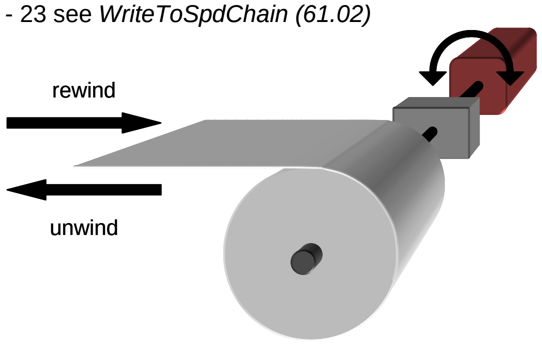
61.03 Unused

61.04 **WindUnwindCmd (winder control, rewind / unwind command)**

Source for the rewind / unwind command:

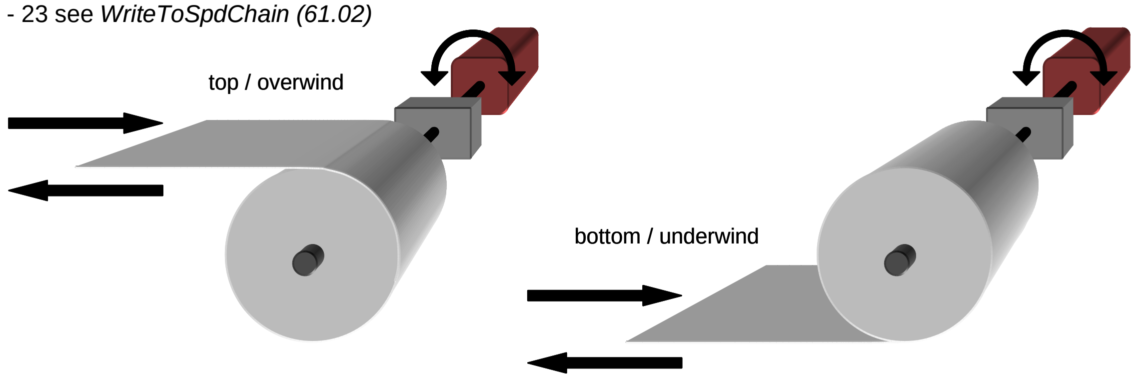
0 = **NotUsed**	no action
1 = **Winder**	constant 1; rewinder, default
2 = **Unwinder**	constant 0; unwinder
3 = **WindCtrlWord**	according to *WindCtrlWord (61.16)* bit 3
4 = **DI1**	1= rewinder; 0 = unwinder

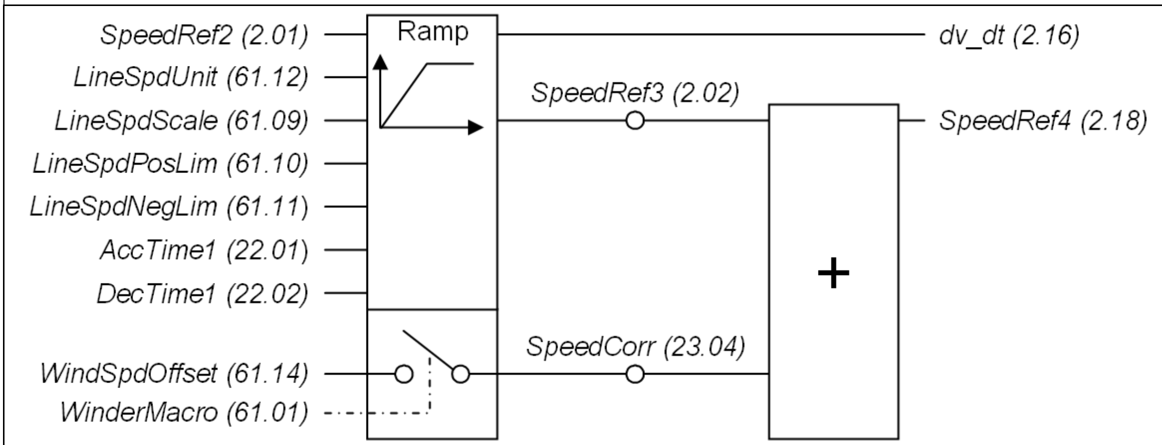
5 - 23 see *WriteToSpdChain (61.02)*



Int. Scaling: 1 == 1 Type: C Volatile: N

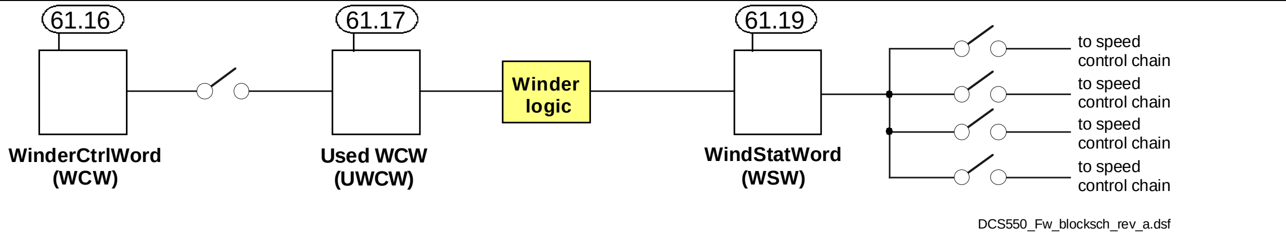
min.	max.	def.	unit
NotUsed	1905Bit3	Winder	-

Signal / Parameter name	min.	max.	def.	unit
61.05 **TopBottomCmd (winder control, top / bottom command)** Source for the top (overwind) / bottom (underwind) command: 0 = **NotUsed** no action 1 = **Top** constant 1; top (overwind) , default 2 = **Bottom** constant 0; bottom (underwind) 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 4 4 = **DI1** 1= Top (overwind); 0 = bottom (underwind) 5 - 23 see *WriteToSpdChain (61.02)*  Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Top	-
61.06 **WinderOnCmd (winder control, winder on command)** Source to release / block winder functions: 0 = **NotUsed** constant 0; block winder functions 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release winder functions 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 5 4 = **DI1** 1= release winder functions; 0 = block winder functions 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Auto	-
61.07 **TensionOnCmd (winder control, tension on command)** Source to release / block the independent speed controller torque limits - *IndepTorqMaxSPC (20.24)* and - *IndepTorqMinSPC (20.25)* - for tension control: 0 = **NotUsed** constant 0; no tension control 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release tension control 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 8 4 = **DI1** 1= release tension control; 0 = no tension control 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Auto	-
61.08 Unused				



Signal / Parameter name	min.	max.	def.	unit
The standard ramp will be re-configured for the winder control. **Commissioning hints:** For proper calculation following rules apply: – Maximum motor speed (n_{max}) is reached with minimum diameter (D_{min}) at maximum line speed (v_{max}). – The scaling of line speed and motor speed is needed, because the winder works with relative values (percent). 1. Set *LineSpdUnit (61.12)* to the desired unit. 2. Set *LineSpdScale (61.09)* to the maximum line speed. Thus, the maximum line speed corresponds to 20,000 internal line speed units. 3. Set LineSpdPosLim *(61.10)* to maximum line speed. 4. Calculate the maximum needed motor speed: $n_{max} = \frac{60s}{\min} * \frac{v_{max}}{\pi * D_{min}} * i$ n_{max} [rpm] maximum needed motor speed v_{max} [m/s] maximum line speed D_{min} [m] minimum diameter i gear ratio (motor / load) 5. Set *M1SpeedScale (50.01)* = n_{max} even if the motor data allow a wider speed range. Thus, the maximum motor speed corresponds to 20,000 internal speed units. 6. Set *M1SpeedMax (20.02)* = n_{max} + max *WindSpdOffset (61.14)* in rpm, even if the motor data allow a wider speed range. 7. Set *M1SpeedMin (20.01)* = - [n_{max} + max. *WindSpdOffset (61.14)* in rpm], even if the motor data allow a wider speed range. – *WindSpdOffset (61.14)* is only active when *WinderMacro (61.01)* = **IndirectTens** or **DirectTens**.				
61.09 **LineSpdScale (winder set, line speed scaling)** Line speed scaling. *LineSpdScale (61.09)* defines the line speed that corresponds to 20,000 internal speed units. The line speed scaling should be set in a way, that 20,000 internal speed units equal 100 % line speed. The line speed unit is defined in *LineSpdUnit(61.12)*: – *LineSpdScale (61.09)* == 20,000 speed units == 100 % Int. Scaling: 10 == 1 (61.12) Type: I Volatile: N	0	6500	100	(61.12)
61.10 **LineSpdPosLim (ramp, maximum line speed limit)** Maximum line speed reference limit at the ramp. Int. Scaling: 1 == 1 (61.12) Type: SI Volatile: N	0	10000	100	(61.12)
61.11 **LineSpdNegLim (ramp, minimum line speed limit)** Minimum line speed reference limit at the ramp. Int. Scaling: 1 == 1 (61.12) Type: SI Volatile: N	-10000	0	0	(61.12)
61.12 **LineSpdUnit (winder set, line speed unit)** The line speed unit: 0 = **%** percent, default 1 = **m/s** meters per second 2 = **m/min** meters per minute 3 = **ft/s** feet per second 3 = **ft/min** feet per minute 4 = **rpm** rpm Int. Scaling: 1 == 1 Type: C Volatile: N	%	rpm	%	-
61.13 Unused				
61.14 **WindSpdOffset (winder control, winder speed offset)** Winder speed offset connected to *SpeedCorr (23.04)* is used to saturate the speed controller. Active only when *WinderMacro (61.01)* = **IndirectTens** or **DirectTens**. Should be 10 % of *SpeedScaleAct (2.29)*. Int. Scaling: 1 == 1 rpm Type: SI Volatile: N	-10000	10000	0	rpm
61.15 Unused				
Link between *WindCtrlWord (61.16)*, *UsedWCW (61.17)* and *WindStatWord (61.19)*: (details see appendix)				

Signal / Parameter name	min.	max.	def.	unit



61.16 **WindCtrlWord (winder control, winder control word, WCW)**
The winder control word contains all winder depending commands and can be written to by AP or overriding control:

Bit	Name	Value	Comment
B0 - 1	reserved		
B2	**WriteToSpd**	1	signals connected to the speed control chain are released
		0	signals connected to the speed control chain are blocked
B3	**WindUnwind**	1	rewinder
		0	unwinder
B4	**TopBottom**	1	top (overwind)
		0	bottom (underwind)
B5	**WinderOn**	1	release winder
		0	block winder
B6	**StartPID**	1	release PID controller in group 40
		0	block PID controller in group 40
B7	**SetDiameter**	1	read *DiameterValue (62.03)* and connect it to *DiameterAct (62.08)*
		0	calculate diameter and connect it to *DiameterAct (62.08)*
B8	**TensionOn**	1	release tension
		0	block tension
B9	**InerRelease**	1	release inertia compensation
		0	block inertia compensation
B10	**SetTension**	1	release standstill tension reference
		0	release tension reference
B11	**HoldTensRamp**	1	hold tension ramp
		0	release tension ramp
B12	**TensionPulse**	1	release tension pulse
		0	no action
B13	**FrictRelease**	1	release friction compensation
		0	block friction compensation
B14	**Add1Release**	1	release adder 1
		0	block adder 1
B15	**Add2Release**	1	release adder 2
		0	block adder 2

Int. Scaling: 1 == 1 Type: I Volatile: Y

61.17 **UsedWCW (winder control, used winder control word output, UWCW)**
The used winder control word is read only and contains all winder depending commands. The sources are selectable depending on the parameter setting. The bit functionality is the same as the in the *WinderCtrlWord (61.16)*.
Attention:
The *UsedWCW (61.17)* is write protected, thus it is not possible to write on the used winder control word by AP or overriding control.
Int. Scaling: 1 == 1 Type: I Volatile: Y

61.18 Unused

61.19 **WindStatWord (winder control, winder status word, WSW)**
The winder status word is read only and contains the winder status bits.

Bit	Name	Value	Comment
B0 - 1	reserved		
B2	**WrittenToSpd**	1	all winder block outputs are released and values of the connected ones are written to the speed control chain

Signal / Parameter name				min.	max.	def.	unit
		0	all winder block outputs are blocked and forced to zero				
B3	**SpeedRefSign**	1	forward				
		0	reverse				
B4	**DiaCalc**	1	diameter calculation is released				
		0	diameter calculator is blocked				
B5	**WinderIsOn**	1	winder functions released				
		0	winder functions blocked				
B6	**PID Started**	1	PID controller in group 40 released				
		0	PID controller in group 40 blocked				
B7	**DiaIsSet**	1	initial diameter of the coil was set				
		0	no action				
B8	**TensionIsOn**	1	tension released				
		0	tension blocked				
B9	**InerReleased**	1	inertia compensation released				
		0	inertia compensation blocked				
B10	**TensionIsSet**	1	standstill tension reference released				
		0	tension reference released				
B11	**TensRampHeld**	1	tension ramp held				
		0	tension ramp released				
B12	**TensPulseRel**	1	tension pulse released				
		0	no action				
B13	**FricReleased**	1	friction compensation released				
		0	friction compensation blocked				
B14	**Add1Released**	1	adder 1 released				
		0	adder 1 blocked				
B15	**Add2Released**	1	adder 2 released				
		0	adder 2 blocked				
Int. Scaling: 1 == 1		Type: I	Volatile: Y				
61.20 Unused							
61.21 **WinderTuning (winder autotuning)** *WinderTuning (61.21)* contains all winder autotuning procedures. The drive mode is automatically set to **NotUsed** after an autotuning procedure is finished or failed. In case errors occur during the selected procedure **A121 AutotuneFail** [*AlarmWord2 (9.07)* bit 4] is generated. The reason of the error can be seen in *Diagnosis (9.11).* 0 = **NotUsed** no winder autotuning active, default 1 = **FrictionComp** Autotuning friction compensation, sets *FrictAt0Spd (63.26)* to *FrictAt100Spd (63.26)*. Only a spool is on the winder. 2 = **InerMechComp** Autotuning actual acceleration adjustment and inertia compensation of the connected mechanics, sets *AccTrim (62.19)* and *InerMech (62.26)*. Only a spool is on the winder. 3 = **InerCoilComp** Autotuning inertia compensation of the coil, sets *InerCoil (62.25)*. The largest coil has to be on the winder (maximum coil diameter and maximum coil width). Int. Scaling: 1 == 1 Type: C Volatile: Y				NotUsed	InerCoilComp	NotUsed	-

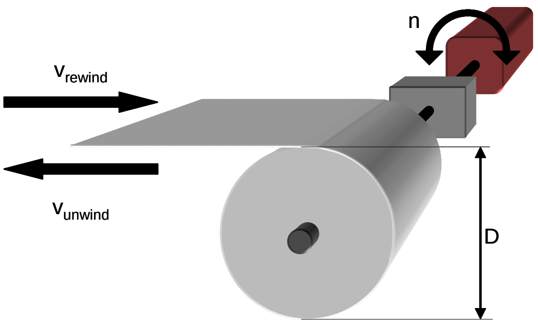
Group 62: Diameter adaption

Diameter:
In most cases, the actual diameter must be calculated from the measured line speed and measured motor speed, because a diameter sensor does not exist:

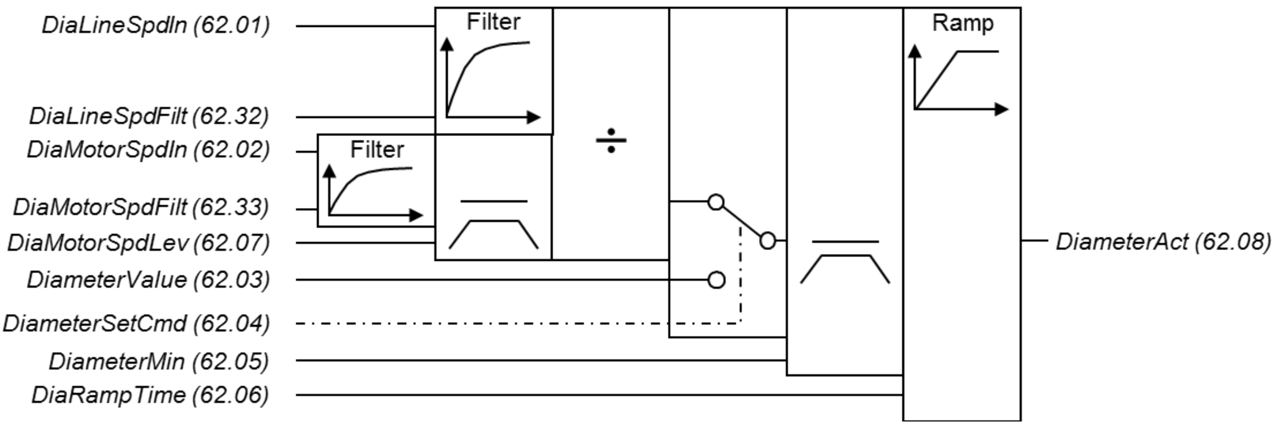
Signal / Parameter name

$$D = \frac{60s}{\min} * \frac{v}{\pi * n} * i$$

D [m]	diameter
v [m/s]	line speed
n [rpm]	motor speed
i	gear ratio (motor / load)



The diameter calculation is used to calculate the actual diameter from the actual line speed and the actual motor speed. It is possible to force or preset the diameter of the coil. To avoid steps the calculated diameter is passed through a ramp generator. The minimum diameter is used as the lower limit.

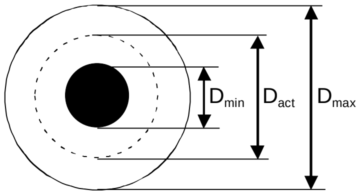


Commissioning hint:

- The diameter calculation works with relative diameters in percent of the maximum allowed diameter, so the physical values must be converted.

$$DiameterMin\ (62.05) = \frac{D_{min}}{D_{max}} * 100\ \%$$

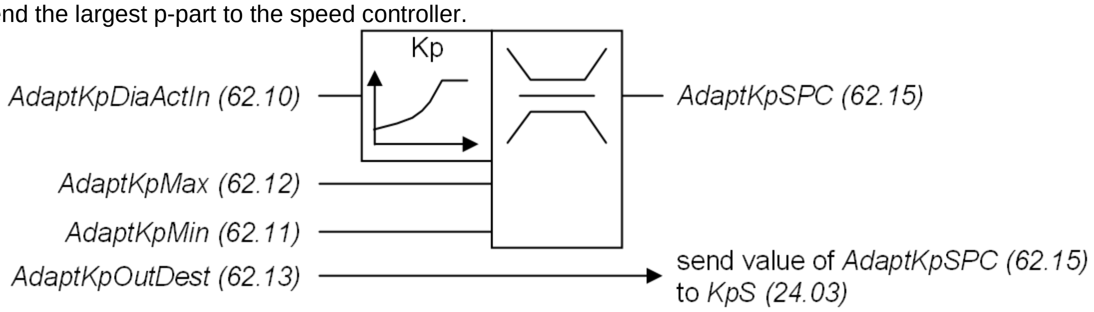
$$DiameterValue\ (62.03) = \frac{D_{act}}{D_{max}} * 100\ \%$$



D_{max} = max. diameter [m]
D_{max} = 100 % == 10,000
D_{act} = actual diameter [m]
D_{min} = core diameter [m]

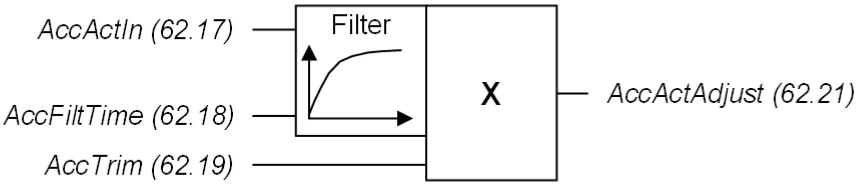
diameter_a.dsf

Signal / Parameter name	min.	max.	def.	unit
62.01 **DiaLineSpdIn (diameter calculation, line speed input)** Source (signal/parameter) for the line speed input of the diameter calculation. The format is **-xxyy**, with: **-** = negate input, **xx** = group and **yy** = index. Default setting of 202 equals *SpeedRef3 (2.02)*. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	202	-
62.02 **DiaMotorSpdIn (diameter calculation, motor speed input)** Source (signal/parameter) for the motor speed input of the diameter calculation. The format is **-xxyy**, with: **-** = negate input, **xx** = group and **yy** = index. Default setting of 104 equals *MotSpeed (1.04)*. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	104	-
62.03 **DiameterValue (diameter calculation, initial diameter value)** Initial diameter of the coil in percent of the maximum diameter. To be set by means of *DiameterSetCmd (62.04)*. Int. Scaling: 100 == 1 % Type: I Volatile: N	1	100	45	%

Signal / Parameter name	min.	max.	def.	unit
62.04 **DiameterSetCmd (diameter calculation, set initial diameter value command)** Source for command to set the initial diameter of the coil: 0 = **NotUsed** constant 0; no action, default 1 = reserved 2 = **Set** constant 1; read *DiameterValue (62.03)* and connect it to *DiameterAct (62.08)* 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 7 4 = **DI1** 1= read *DiameterValue (62.03)* and connect it to *DiameterAct (62.08)*; 0 = calculate diameter and connect it to *DiameterAct (62.08)* 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	NotUsed	-
62.05 **DiameterMin (diameter calculation, minimum diameter)** Minimum diameter of the coil in percent of the maximum diameter. Int. Scaling: 100 == 1 % Type: I Volatile: N	1	100	10	%
62.06 **DiaRampTime (diameter calculation, ramp time)** Filter time for the diameter calculation to adapt the initial diameter to the actual diameter. – The slope is dependent on a PT1-filter using positive times. – The slope of the ramp is diameter dependent using negative ramp times. Int. Scaling: 100 == 1 s Type: I Volatile: N	-300	300	10	s
62.07 **DiaMotorSpdLev (diameter calculation, motor speed level)** As soon as the motor speed reaches the level set by *DiaMotorSpdLev (62.07)* the diameter calculation is released. Internally limited from: $0rpm\ \ to\ \ (2.29)rpm$ Int. Scaling: (2.29) Type: I Volatile: N	0	1000	20	rpm
62.08 **DiameterAct (diameter calculation, actual diameter output)** Output of the diameter calculation. Calculated actual diameter in percent of the maximum diameter. This value is automatically written to *SpeedRefScale (23.16)* in case *WinderMacro (61.01)* = **VelocityCtrl**, **IndirectTens**, **DirectTens** or **DancerCtrl** and *WriteToSpdChain (61.02)* is high. Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%
62.09 Unused				
Use the p-part adaption to adapt the speed controller p-part according to actual diameter of the coil. It is variable between minimum diameter and maximum diameter. Use the smallest p-part with minimum diameter. With maximum diameter, send the largest p-part to the speed controller.  **Commissioning hint:** – *AdaptKpMin (62.11)* has to be determined by manual tuning of the speed controller. Only the spool is on the winder and set *WinderMacro (61.01)* = **NotUsed**. – *AdaptKpMax (62.12)* has to be determined by manual tuning of the speed controller. The largest coil (maximum diameter and maximum width) has to be on the winder and set *WinderMacro (61.01)* = **NotUsed**.				
62.10 **AdaptKpDiaActIn (speed controller p-part adaption, actual diameter input)** Source (signal/parameter) for the actual diameter input of the speed controller adaption. The format is **xxyy**, with: **xx** = group and **yy** = index. Default setting of 6208 equals *DiameterAct (62.08).* Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	6208	-
62.11 **AdaptKpMin (speed controller p-part adaption, minimum p-part)** Proportional gain of the speed controller with minimum diameter (spool). Int. Scaling: 100 == 1 Type: I Volatile: N	0	325	5	-

Signal / Parameter name	min.	max.	def.	unit
62.12 **AdaptKpMax (speed controller p-part adaption, maximum p-part)** Proportional gain of the speed controller with maximum diameter (larges coil). Int. Scaling: 100 == 1 Type: I Volatile: N	0	325	10	-
62.13 **AdaptKpOutDest (speed controller p-part adaption, destination of output value)** Index pointer to the sink for speed controller p-part adaption output value. The format is **xxyy**, with: **xx** = group and **yy** = index. As default, nothing is connected to the output. Int. Scaling: 1 == 1 Type: SI Volatile: N	0	9999	0	-
62.14 Unused				
62.15 **AdaptKpSPC (speed controller p-part adaption, adapted p-part output)** Output of the speed controller p-part adaption. Calculated actual p-part of the speed controller depending on the coil diameter. The adapted p-part is automatically written onto *KpS (24.03)* when the speed controller p-part adaption is released, see *AdaptKpOutDest (62.13)*. Int. Scaling: 100 == 1 Type: I Volatile: Y	-	-	-	-
62.16 Unused				

The actual acceleration adjust filters e.g. the *dv_dt (2.16)* output of the ramp with a PT1-filter. The output has to be 100 % with maximum acceleration using the shortest ramp time. To achieve this goal a trimming input is available.



Commissioning hint:

- *AccTrim (62.19)* has to be determined with acceleration trials. *AccActAdjust (62.21)* has to be 100 % with maximum acceleration using the shortest ramp time.
- Autotuning is possible with *WinderTuning (61.21)* = **InerMechComp**.

Signal / Parameter name	min.	max.	def.	unit
62.17 **AccActIn (actual acceleration adjustment, actual acceleration input)** Source (signal/parameter) for the actual acceleration input of the actual acceleration adjustment. The format is **-xxyy**, with: **-** = negate input, **xx** = group and **yy** = index. Default setting of 216 equals *dv_dt (2.16).* Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	216	-
62.18 **AccFiltTime (actual acceleration adjustment, filter time)** Actual acceleration filter time. Can usually be left on default. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	30000	100	ms
62.19 **AccTrim (actual acceleration adjustment, trimming)** Trimming / scaling of the actual acceleration. Int. Scaling: 100 == 1 Type: SI Volatile: N	-325	325	1	-
62.20 Unused				
62.21 **AccActAdjust (actual acceleration adjustment, output)** Output of the actual acceleration adjustment. Adjusted actual acceleration in percent of maximum acceleration. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
62.22 Unused				

Inertia compensation (acceleration compensation):

During the winding operation, the motor must only generate the torque for the needed tension. For acceleration, an additional torque is necessary. The acceleration torque (inertia compensation) depends on the inertia of the complete winder (motor, gearbox, spool and coil). The inertia of motor, gearbox and spool is constant. The inertia of the coil is a function of the diameter. In case the diameter is small, the inertia is small. With increasing diameter, the inertia increases. That means more acceleration torque (inertia compensation) is needed. The problem in many applications is that the inertia is not available. Thus, it has to be determined by means of acceleration tests.

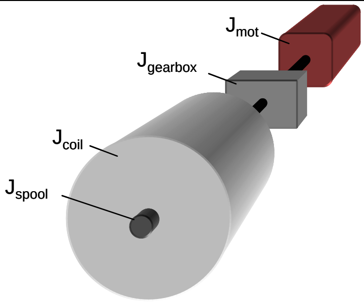
Signal / Parameter name	min.	max.	def.	unit

$$T_{acc} = J * \frac{d\omega}{dt}$$

T_{acc} [Nm] torque needed for acceleration
J [kg m^2] inertia of the complete winder
dÉ / dt [1/s^2] angular acceleration

J_{mot}, $J_{gearbox}$, J_{spool} = J_{mech} = const.

$J_{coil} \sim D^4$



The inertia compensation calculates the acceleration torque needed to compensate the inertia of the winder mechanics plus the inertia of the coil. To adapt the inertia of the coil its diameter and width is needed.

Commissioning hint:

- *InerMech (62.26)* has to be determined by means of acceleration trials with maximum acceleration using the shortest ramp time. Only the spool is on the winder. The result is available in *MotTorqFilt (1.07)* during the acceleration. Autotuning is possible with *WinderTuning (61.21)* = **InerMechComp**.
- *InerCoil (62.25)* has to be determined by means of acceleration trials with maximum acceleration using the shortest ramp time. The largest coil (maximum diameter and maximum width) has to be on the winder. The result is available in *MotTorqFilt (1.07)* during the acceleration. Autotuning is possible with *WinderTuning (61.21)* = **InerCoilComp**.
- Do not forget to subtract the average friction losses from the measured values - see *FrictAt0Spd (63.26)* to *FrictAt100Spd (63.30)*.
- The width calculation works with relative width' in percent of the maximum width, so the physical values must be converted.

$$InerCoilWidth\ (62.27) = \frac{Width_{act}}{Width_{max}} * 100\ \%$$

- *InerReleaseCmd (62.28)* releases *InertiaComp (62.30)*. The output is forced to zero if the switch is open.

Signal / Parameter name	min.	max.	def.	unit
62.23 **InerDiaActIn (inertia compensation, actual diameter input)** Source (signal/parameter) for the actual diameter input of the inertia compensation. The format is **xxyy**, with: **xx** = group and **yy** = index. Default setting of 6208 equals *DiameterAct (62.08).* Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	6208	-
62.24 **InerAccActIn (inertia compensation, actual acceleration input)** Source (signal/parameter) for the actual acceleration input of the inertia compensation. The format is **-xxyy**, with: **-** = negate input, **xx** = group and **yy** = index. Default setting of 6221 equals *AccActAdjust (62.21).* Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	6221	-
62.25 **InerCoil (inertia compensation, coil inertia)** Acceleration torque for the inertia of the coil in percent of *MotNomTorque (4.23)*. Acceleration trials have to be done with the largest (maximum diameter and maximum width) coil available. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	0	%
62.26 **InerMech (inertia compensation, mechanics inertia)** Acceleration torque for the inertia of the winder mechanics in percent of *MotNomTorque (4.23)*. Acceleration trials have to be done with an empty spindle or empty spool. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	0	%

Signal / Parameter name	min.	max.	def.	unit
62.27 **InerCoilWidth (inertia compensation, coil width)** Width of the coil in percent of the maximum allowed coil width. Is used to adapt the coil inertia. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	100	%
62.28 **InerReleaseCmd (inertia compensation, release command)** Source to release / block the inertia compensation: 0 = **NotUsed** constant 0; block inertia compensation 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release inertia compensation 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 9 4 = **DI1** 1= release inertia compensation; 0 = block inertia compensation 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Auto	-
62.29 Unused				
62.30 **InertiaComp (inertia compensation, output)** Output of the inertia compensation. Calculated inertia compensation torque in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%
62.32 **DiaLineSpdFilt (diameter calculation, line speed filter time)** Line speed filter time. Default value is 0 ms. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms
62.33 **DiaMotorSpdFilt (diameter calculation, motor speed filter time)** Motor speed filter time. Default value is 0 ms. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	0	ms

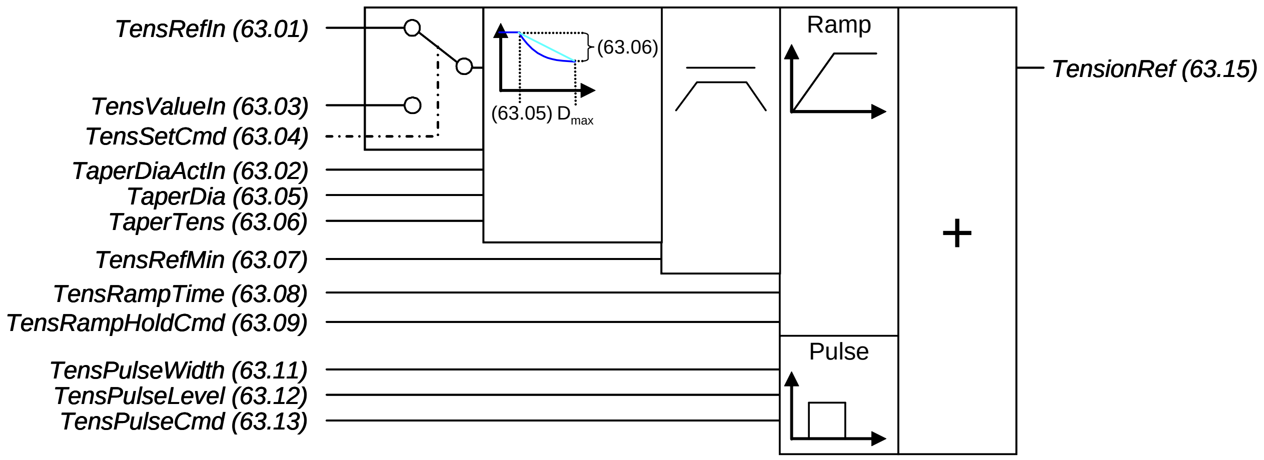
Group 63: Tension torque

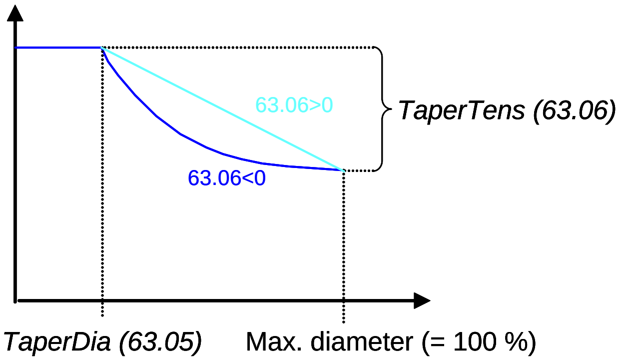
The tension reference block contains four functions:

1. By means of the tension reference, it is possible to force or preset the tension set point.
2. Use the taper function to reduce the tension depending on an increasing diameter. The reduction of the tension begins with diameters over the taper diameter and ends at the maximum diameter. Following formula is valid at the maximum diameter:

$$Tension_{Output} = Tension_{Input} - TaperTens\,(63.06)$$

3. Tension reference is limited by a minimum and then passed through a ramp with hold function to prevent tension steps.
4. If the friction is very high, a start tension pulse is helpful to break away the machine. The width, amplitude and release of the start impulse can be set via parameters.



Signal / Parameter name	min.	max.	def.	unit
				
63.01 **TensRefIn (tension reference, tension reference input)** Source (signal/parameter) for the tension reference input of the tension reference. The format is **xxyy**, with: **xx** = group and **yy** = index. As default, nothing is connected to the input. Examples: – Setting of 516 uses *AI2 Val (5.16)* as tension reference. – Setting of 1901 uses *Data1 (19.01)* and could be used for reference via fieldbus – Setting of 8501 uses *Constant1 (85.01)* and could be used as constant reference Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-
63.02 **TaperDiaActIn (tension reference, actual diameter input)** Source (signal/parameter) for the actual diameter input of the tension reference used for taper tension calculation. The format is **xxyy**, with: **xx** = group and **yy** = index. Default setting of 6208 equals *DiameterAct (62.08).* Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	6208	-
63.03 **TensValueIn (tension reference, standstill tension value input)** Source (signal/parameter) for the standstill tension reference input of the tension reference. The format is **xxyy**, with: **xx** = group and **yy** = index. The standstill tension is usually set when the line speed is zero. As default, nothing is connected to the input. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-
63.04 **TensSetCmd (tension reference, set tension value command)** Source to release the standstill tension reference - see *TensValueIn (63.03)* - or release the tension reference - see *TensRefIn (63.01):* 0 = **TensionRef** constant 0; release tension reference 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **StanstilTens** constant 1; release standstill tension reference 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 10 4 = **DI1** 1 = release standstill tension reference; 0 = release tension reference 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	TensionRef	1905Bit3	Auto	-
63.05 **TaperDia (tension reference, taper diameter)** Diameter of the coil, in percent of the maximum diameter, from where the tension reduction for tapering begins. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	1	%
63.06 **TaperTens (tension reference, taper tension)** Diameter dependent tension reduction, in percent of the maximum tension, for tapering. The value of *TaperTens (63.06)* is reached at the maximum diameter. Setting *TaperTens (63.06)* = 0 disables the function. To reduce the tension linear use positive values. To reduce the tension hyperbolic use negative values. Int. Scaling: 100 == 1 % Type: I Volatile: N	-100	100	0	%
63.07 **TensRefMin (tension reference, minimum tension reference)** Minimum tension reference in percent of the maximum tension. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	1	%
63.08 **TensRampTime (tension reference, ramp time)** Ramp time of for the tension reference from zero percent tension to 100 % tension. Int. Scaling: 1 == 1 Type: C Volatile: N	0	300	2	s

Signal / Parameter name	min.	max.	def.	unit
63.09 **TensRampHoldCmd (tension reference, tension ramp hold command)** Source to hold / release the tension ramp: 0 = **RelTensRamp** constant 0; release tension ramp, default 1 = reserved 2 = **HoldTensRamp** constant 1; hold tension ramp 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 11 4 = **DI1** 1= hold tension ramp; 0 = release tension ramp 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	RelTensRamp	1905Bit3	RelTensRamp	-
63.10 Unused				
63.11 **TensPulseWidth (tension reference, tension pulse width)** Width of the tension pulse used to overcome the friction of the winder mechanics. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	30000	0	ms
63.12 **TensPulseLevel (tension reference, tension pulse level)** Level of the tension pulse used to overcome the friction of the winder mechanics in percent of maximum tension. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	10	%
63.13 **TensPulseCmd (tension reference, tension pulse command)** Source for command to release the tension pulse to overcome the friction of the winder mechanics: 0 = **NotUsed** constant 0; no action 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release tension pulse once 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 12 4 = **DI1** 1= release tension pulse; 0 = no action 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Auto	-
63.14 Unused				
63.15 **TensionRef (tension reference, output)** Output of the tension reference. Tension reference in percent of the maximum tension. Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%
63.16 - 63.17 Unused				

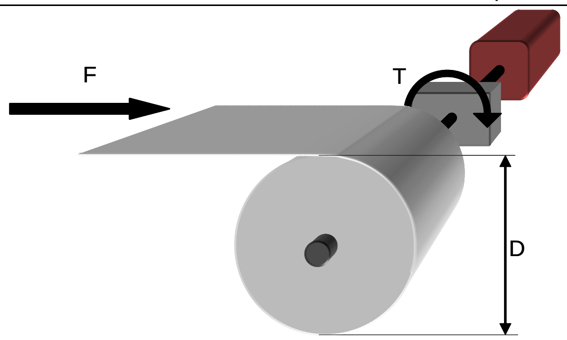
Tension to torque:

For winders it is important that the tension fit to the web. With too low tension, the web does not wind correctly. With too high tension, the web might rip. This is the worst case, because the winder will accelerate, if there is no web break monitoring.

The tension is a force measured in Newton [N]. When the tension is multiplied by the radius of the coil, the necessary torque for the selected tension can be calculated. Most torque is needed with maximum diameter at lowest motor speed.

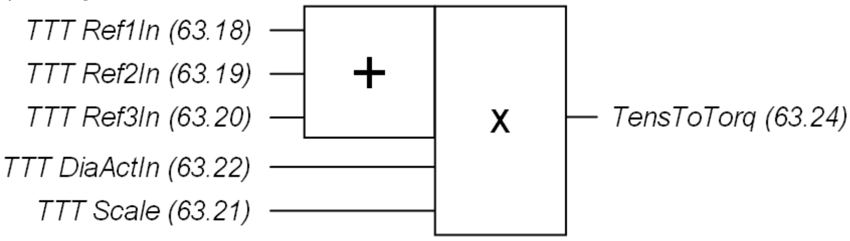
$$T = \frac{F * D}{2 * i}$$

T [Nm]	torque
F [N]	tension
D [m]	diameter
i	gear ratio (motor / load)



Signal / Parameter name	min.	max.	def.	unit

The tension to torque function provides three inputs for tension references and uses them to convert tension into torque depending on the actual diameter.



Commissioning hint:
For proper calculation following rules apply:
- Maximum torque (T_{max}) is reached with maximum diameter (D_{max}), means with a diameter of 100 %.
- The motor torque - see *MotTorqNom (4.23)* - must be larger than maximum torque (T_{max}).
- The torque scaling is needed, because the tension to torque function works with relative values.

$$T_{\max} = \frac{F_{\max} * D_{\max}}{2*i}$$

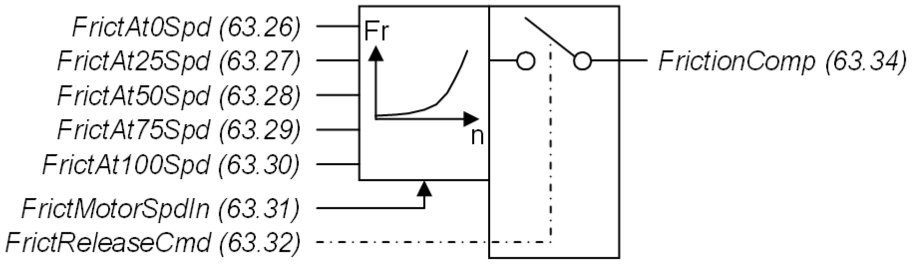
$$TTTScale\ (63.21) = \frac{T_{\max}}{T_{Mot}} * 100\ \%$$

T_{max} [Nm] maximum needed torque
T_{Mot} [Nm] nominal motor torque, see *MotTorqNom (4.23)*
F_{max} [N] maximum tension
D_{max} [m] maximum diameter
i gear ratio (motor / load)
Attention:
T_{Mot} must be larger than T_{max}!

Signal / Parameter name	min.	max.	def.	unit
63.18 **TTT Ref1In (tension to torque, reference 1 input)** Source (signal/parameter) for tension reference input 1 of tension to torque calculation. The format is **xxyy**, with: **xx** = group and **yy** = index. As default, nothing is connected to the input. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-
63.19 **TTT Ref2In (tension to torque, reference 2 input)** Source (signal/parameter) for tension reference input 2 of tension to torque calculation. The format is **xxyy**, with: **xx** = group and **yy** = index. Default setting of 6315 equals *TensionRef (63.15).* Int. Scaling: 1 == 1 Type: C Volatile: N	0	9999	6315	-
63.20 **TTT Ref3In (tension to torque, reference 3 input)** Source (signal/parameter) for tension reference input 3 of tension to torque calculation. The format is **xxyy**, with: **xx** = group and **yy** = index. As default, nothing is connected to the input. Int. Scaling: 1 == 1 Type: C Volatile: N	0	9999	0	-
63.21 **TTT Scale (tension to torque, torque scaling)** Torque scaling. Int. Scaling: 100 == 1 % Type: SI Volatile: N	-325	325	100	%
63.22 **TTT DiaActIn (tension to torque, actual diameter input)** Source (signal/parameter) for the actual diameter input of tension to torque calculation. The format is **xxyy**, with: **xx** = group and **yy** = index. Default setting of 6208 equals *DiameterAct (62.08).* Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	6208	-
63.23 Unused				
63.24 **TensToTorq (tension to torque, torque reference output)** Output of the tension to torque calculation. Torque reference in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: SI Volatile: Y	-	-	-	%
63.25 Unused				

Friction compensation (loss compensation):
During the winding operation, the motor must only generate the torque for the needed tension. The mechanics of the winder generate losses from friction and torsion. These losses depend on the motor speed and measure them in speed trials. They are non-linear and must be saved in a characteristic curve with supporting points. The friction compensation calculates the torque needed to compensate the losses of the winder mechanics depending on the speed.

Signal / Parameter name	min.	max.	def.	unit



Commissioning hint:

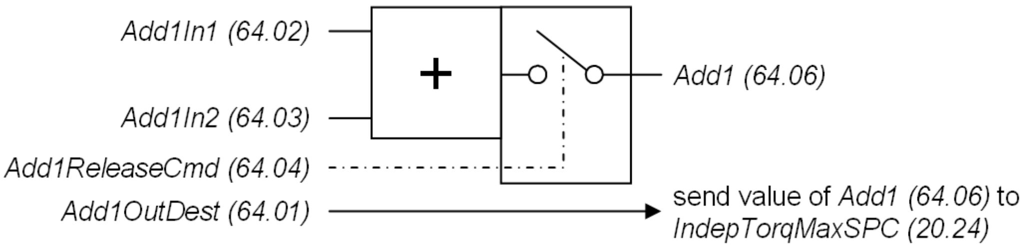
- *FrictAt0Spd (63.26)* is the static friction. It can be determined by slowly increasing the torque reference until the motor starts turning. For this trial all mechanics have to be connected.
- *FrictAt25Spd (63.27)* has to be determined by means of constant speed trials at 25 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictAt50Spd (63.28)* has to be determined by means of constant speed trials at 50 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictAt75Spd (63.29)* has to be determined by means of constant speed trials at 75 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictAt100Spd (63.30)* has to be determined by means of constant speed trials at 100 % speed. See the result in *MotTorqFilt (1.07)*.
- *FrictReleaseCmd (63.32)* releases *FrictionComp (63.34)*. The output is forced to zero if the switch is open.
- Autotuning is possible with *WinderTuning (61.21)* = **FrictionComp**.

Signal / Parameter name	min.	max.	def.	unit
63.26 **FrictAt0Spd (friction compensation, static friction)** Torque in percent of *MotNomTorque (4.23)* to compensate the static friction of the mechanics (breakaway torque). It can be determined by slowly increasing the torque reference until the motor starts turning. For this trial all mechanics have to be connected. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	0	%
63.27 **FrictAt25Spd (friction compensation, friction at 25 % motor speed)** Torque in percent of *MotNomTorque (4.23)* to compensate the friction of the mechanics at 25 % motor speed. Do the trials with constant speed and all mechanics connected. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	0	%
63.28 **FrictAt50Spd (friction compensation, friction at 50 % motor speed)** Torque in percent of *MotNomTorque (4.23)* to compensate the friction of the mechanics at 50 % motor speed. Do the trials with constant speed and all mechanics connected. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	0	%
63.29 **FrictAt75Spd (friction compensation, friction at 75 % motor speed)** Torque in percent of *MotNomTorque (4.23)* to compensate the friction of the mechanics at 75 % motor speed. Do the trials with constant speed and all mechanics connected. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	0	%
63.30 **FrictAt100Spd (friction compensation, friction at 100 % motor speed)** Torque in percent of *MotNomTorque (4.23)* to compensate the friction of the mechanics at 100 % motor speed. Do the trials with constant speed and all mechanics connected. Int. Scaling: 100 == 1 % Type: I Volatile: N	0	100	0	%
63.31 **FrictMotorSpdIn (friction compensation, motor speed input)** Source (signal/parameter) for the motor speed input of the friction compensation. The format is **-xxyy**, with: **-** = negate input, **xx** = group and **yy** = index. Default setting of 104 equals *MotSpeed (1.04).* Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	104	-

Signal / Parameter name	min.	max.	def.	unit
63.32 **FrictReleaseCmd (friction compensation, release command)** Source to release / block the friction compensation: 0 = **NotUsed** constant 0; block friction compensation 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release friction compensation 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 13 4 = **DI1** 1= release friction compensation; 0 = block friction compensation 5 - 23 see *WriteToSpdChain (61.02)* Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Auto	-
63.33 Unused				
63.34 **FrictionComp (friction compensation, output)** Output of the friction compensation. Calculated friction compensation torque in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%

Group 64: Write selection

Adder 1 provides two torque inputs. The sum of *Add1 (64.06)* can be written to other parameters by means of *Add1OutDest (64.01)*. Usually adder 1 is used to write on the torque limit of the speed controller.



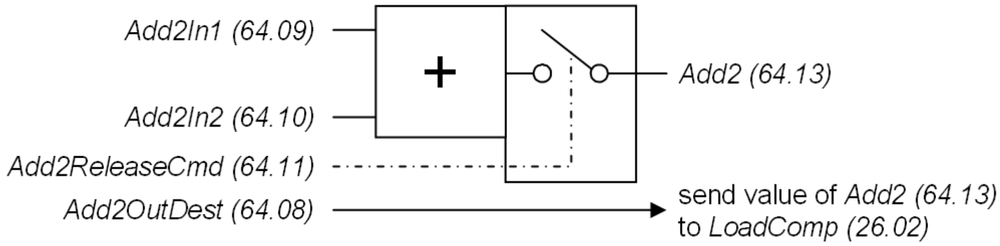
Commissioning hint:

– *Add1Cmd (64.04)* releases *Add1 (64.06)*. The output is forced to zero if the switch is open.

Signal / Parameter name	min.	max.	def.	unit
64.01 **Add1OutDest (adder 1, destination of output value)** Index pointer to the sink for adder 1 output value. The format is **-xxyy**, with: **-** = negate output value, **xx** = group and **yy** = index. As default, nothing is connected to the output. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
64.02 **Add1In1 (adder 1, input 1)** Source (signal/parameter) for adder 1 input 1. The format is **-xxyy**, with: **-** = negate output value, **xx** = group and **yy** = index. Default setting of 6324 equals *TensToTorq (63.24).* Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	6324	-
64.03 **Add1In2 (adder 1, input 2)** Source (signal/parameter) for adder 1 input 2. The format is **-xxyy**, with: **-** = negate output value, **xx** = group and **yy** = index. As default, nothing is connected to the input. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
64.04 **Add1ReleaseCmd (adder 1, release command)** Source to release / block adder 1: 0 = **NotUsed** constant 0; block adder 1 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release adder 1 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 14 4 = **DI1** 1= release adder 1; 0 = block adder 1 5 - 23 see *WriteToSpdChain (61.02)* **Note:** Blocking adder 1 forces its output to zero - *Add1 (64.06)* = 0. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Auto	-
64.05 Unused				

Signal / Parameter name	min.	max.	def.	unit
64.06 **Add1 (adder 1, output)** Output of adder 1 in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%
64.07 Unused				

Adder 2 provides two torque inputs. The sum of *Add2 (64.13)* can be written to other parameters by means of *Add2OutDest (64.08)*. Usually adder 2 is used to write on the load compensation for inertia and friction compensation.



Commissioning hint:
- *Add2Cmd (64.11)* releases *Add2 (64.13)*. The output is forced to zero if the switch is open.

Signal / Parameter name	min.	max.	def.	unit
64.08 **Add2OutDest (adder 2, destination of output value)** Index pointer to the sink for adder 2 output value. The format is **-xxyy**, with: **-** = negate output value, **xx** = group and **yy** = index. As default, nothing is connected to the output. Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	0	-
64.09 **Add2In1 (adder 2, input 1)** Source (signal/parameter) for adder 2 input 1. The format is **-xxyy**, with: **-** = negate output value, **xx** = group and **yy** = index. Default setting of 6230 equals *InertiaComp (62.30).* Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	6230	-
64.10 **Add2In2 (adder 2, input 2)** Source (signal/parameter) for adder 2 input 2. The format is **-xxyy**, with: **-** = negate output value, **xx** = group and **yy** = index. Default setting of 6334 equals *FrictionComp (63.34).* Int. Scaling: 1 == 1 Type: SI Volatile: N	-9999	9999	6334	-
64.11 **Add2ReleaseCmd (adder 2, release command)** Source to release / block adder2: 0 = **NotUsed** constant 0; block adder 2 1 = **Auto** depending on winder logic and winder macro, see *WinderMacro (61.01)*, default 2 = **Release** constant 1; release adder 2 3 = **WindCtrlWord** according to *WindCtrlWord (61.16)* bit 15 4 = **DI1** 1= release adder 2; 0 = block adder 2 5 - 23 see *WriteToSpdChain (61.02)* **Note:** Blocking adder 2 forces its output to zero - *Add2 (64.11)* = 0. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	1905Bit3	Auto	-
64.12 Unused				
64.13 **Add2 (adder 2, output)** Output of adder 2 in percent of *MotNomTorque (4.23)*. Int. Scaling: 100 == 1 % Type: I Volatile: Y	-	-	-	%

Signal / Parameter name	min.	max.	def.	unit
Group 66: Winder program control				
66.01 **WiProgCmd (winder program, command)** Selects the operation mode for the winder program: 0 = **Stop** Execution of winder blocks stopped. Speed control chain parameters are set back to default parameter values, e.g. *SpeedCorr (23.04)*, *SpeedRefScale (23.16), LoadComp (26.02)*. 1 = **Start** Enable execution of winder blocks if a winder macro is selected. 2 = **Edit** reserved 3 = **EditExecTab** reserved 4 = **SingleCycle** reserved 5 = **SingleStep** reserved Int. Scaling: 1 == 1 Type: C Volatile: N	Stop	SingleStep	Stop	-
66.02 - 66. 03 Unused				
66.04 **WiUserMode (winder program, user mode)** 0 = **Standard** reserved 1 = **Expert** reserved Int. Scaling: 1 == 1 Type: C Volatile: N	Standard	Expert	Standard	
66.05 **WiPassCode** reserved Int. Scaling: 1 == 1 Type: C Volatile: N	0	30000	0	-

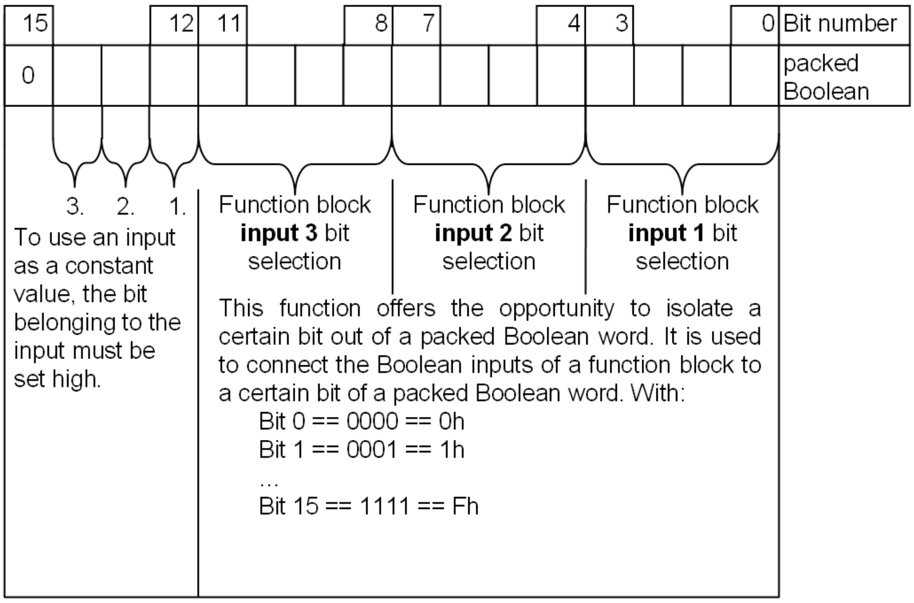
Signal / Parameter name	min.	max.	def.	unit
Group 83: AP control				
83.01 **AdapProgCmd (AP command)** Selects the operation mode for AP: 0 = **Stop** stop, AP is not running and cannot be edited, default 1 = **Start** running, AP is running and cannot be edited 2 = **Edit** edit, AP is not running and can be edited 3 = **SingleCycle** AP runs only once. If a breakpoint is set with *BreakPoint (83.06),* AP will stop before the breakpoint. After the **SingleCycle** *AdapProgCmd (83.01)* is automatically set back to **Stop**. 4 = **SingleStep** Runs only one function block. *LocationCounter (84.03)* shows the function block number, which will be executed during the next **SingleStep**. After a **SingleStep** *AdapProgCmd (83.01)* is automatically set back to **Stop**. *LocationCounter (84.03)* shows the next function block to be executed. To reset *LocationCounter (84.03)* to the first function block set *AdapProgCmd (83.01)* to **Stop** again (even if it is already set to **Stop**). **A136 NoAPTaskTime** [*AlarmWord3 (9.08)* bit 3] is set when *TimeLevSel (83.04)* is not set to **5 ms, 20 ms, 100 ms** or **500 ms** but *AdapProgCmd (83.01)* is set to **Start**, **SingleCycle** or **SingleStep** **Note:** *AdapProgCmd (83.01)* = **Start**, **SingleCycle** or **SingleStep** is only valid, if *AdapPrgStat (84.01)* ≠ **Running**. Int. Scaling: 1 == 1 Type: C Volatile: N	Stop	SingleStep	Stop	-
83.02 **EditCmd (edit command)** Edit AP. *EditCmd (83.02)* is automatically set back to **Done** after the chosen action is finished: 0 = **Done** no action or edit of AP completed, default 1 = **Push** Shifts the function block in the spot defined by *EditBlock (83.03)* and all subsequent function blocks one spot forward. A new function block can be placed in the now empty spot by programming its parameter set as usual. Example: A new function block needs to be placed in between the function block number four (84.22) to (84.27) and five (84.28) to (84.33). In order to do this: 1. set *AdapProgCmd (83.01)* = **Edit** 2. set *EditBlock (83.03)* = 5 (selects function block 5 as the desired spot for the new function block) 3. set *EditCmd (83.02)* = **Push** (shifts function block 5 and all subsequent function blocks one spot forward) 4. program empty spot 5 by means of (84.28) to (84.33) 2 = **Delete** Deletes the function block in the spot defined by *EditBlock (83.03)* and shifts all subsequent function blocks one spot backward. To delete all function blocks set *EditBlock (83.03)* = 17. 3 = **Protect** Turns all parameters of AP into protected mode (parameters cannot be read or written to). Before using the **Protect** command set the pass code by means of *PassCode (83.05).* **Attention:** Do not forget the pass code! 4 = **Unprotect** Reset of protected mode. Before the **Unprotect** command can be used, *PassCode (83.05)* has to be set. **Attention:** Use the proper pass code! Int. Scaling: 1 == 1 Type: C Volatile: Y	Done	Unprotect	Done	-
83.03 **EditBlock (edit block)** Defines the function block which is selected by *EditCmd (83.02)* = **Push** or **Delete**. After a **Push** or **Delete** *EditBlock (83.03)* is automatically set back to 1. **Note:** To delete all function blocks set *EditBlock (83.03)* = 17. Int. Scaling: 1 == 1 Type: I Volatile: Y	0	17	0	-

Signal / Parameter name	min.	max.	def.	unit
83.04 **TimeLevSel (time level select)** Selects the cycle time for AP. This setting is valid for all function blocks. 0 = **Off** no task selected 1 = **5ms** AP runs with 5 ms 2 = **20ms** AP runs with 20 ms 3 = **100ms** AP runs with 100 ms 4 = **500ms** AP runs with 500 ms **A136 NoAPTaskTime** [*AlarmWord3 (9.08)* bit 3] is set when *TimeLevSel (83.04)* is not set to **5 ms, 20 ms, 100 ms** or **500 ms** but *AdapProgCmd (83.01)* is set to **Start**, **SingleCycle** or **SingleStep**. Int. Scaling: 1 == 1 Type: C Volatile: N	Off	500ms	Off	-
83.05 **PassCode (pass code)** The pass code is a number between 1 and 65535 to write protect AP by means of *EditCmd (83.02)*. After using **Protect** or **Unprotect** *PassCode (83.05)* is automatically set back to zero. **Attention:** Do not forget the pass code! Int. Scaling: 1 == 1 Type: I Volatile: Y	0	65535	0	-
83.06 **BreakPoint (break point)** Breakpoint for *AdapProgCmd (83.01)* = **SingleCycle**. The break point is not used, if *BreakPoint (83.06)* is set to zero. Int. Scaling: 1 == 1 Type: I Volatile: Y	0	16	0	-
Group 84: AP				
84.01 **AdapPrgStat (AP status word)** AP status word: Bit Name Value Comment B0 **Bit 0** 1 AP is running 0 AP is stopped B1 **Bit 1** 1 AP can be edited 0 AP cannot be edited B2 **Bit 2** 1 AP is being checked 0 no action B3 **Bit 3** 1 AP is faulty 0 AP is OK B4 **Bit 4** 1 AP is protected 0 AP is unprotected Faults in AP can be: – used function block with not at least input 1 connection – used pointer is not valid – invalid bit number for function block **Bset** – location of function block **PI-Bal** after **PI** function block Int. Scaling: 1 == 1 Type: I Volatile: Y	-	-	-	-
84.02 **FaultedPar (faulted parameters)** AP will be checked before running. If there is a fault, *AdapPrgStat (84.01)* is set to “faulty” and *FaultedPar (84.02)* shows the faulty input. **Note:** In case of a problem, check the value and the attribute of the faulty input. Int. Scaling: 1 == 1 Type: I Volatile: Y	-	-	-	-
84.03 **LocationCounter (location counter)** Location counter for *AdapProgCmd (83.01)* = **SingleStep** shows the function block number, which will be executed next. Int. Scaling: 1 == 1 Type: I Volatile: Y	-	-	-	-

Signal / Parameter name	min.	max.	def.	unit
84.04 **Block1Type (function block 1 type)** Selects the type for function block 1 [Block Parameter Set 1 (BPS1)]. Detailed description of the type can be found in chapter '*Function blocks'*: 0 = **NotUsed** function block is not used 1 = **ABS** absolute value 2 = **ADD** sum 3 = **AND** AND 4 = **Bitwise** bit compare 5 = **Bset** bit set 6 = **Compare** compare 7 = **Count** counter 8 = **D-Pot** ramp 9 = **Event** event 10 = **Filter** filter 11 = **Limit** limit 12 = **MaskSet** mask set 13 = **Max** maximum 14 = **Min** minimum 15 = **MulDiv** multiplication and division 16 = **OR** OR 17 = **ParRead** parameter read 18 = **ParWrite** parameter write 19 = **PI** PI-controller 20 = **PI-Bal** initialization for PI-controller 21 = **Ramp** ramp 22 = **SqWav** square wave 23 = **SR** SR flip-flop 24 = **Switch-B** switch Boolean 25 = **Switch-I** switch integer 26 = **TOFF** timer off 27 = **TON** timer on 28 = **Trigg** trigger 29 = **XOR** exclusive OR 30 = **Sqrt** square root Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	Sqrt	NotUsed	-
84.05 **Block1In1 (function block 1 input 1)** Selects the source for input 1 of function block 1 (BPS1). There are 2 types of inputs, signals/parameters and constants: – Signals/parameters are all signals and parameters available in the drive. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Example: To connect negated *SpeedRef (23.01)* set *Block1In1 (84.05)* = -2301 and *Block1Attrib (84.08)* = 0h. To get only a certain bit e.g. **RdyRef** bit 3 of *MainStatWord (8.01)* set *Block1In1 (84.05)* = 801 and *Block1Attrib (84.08)* = 3h. – Constants are feed directly into the function block input. Declare them by means of *Block1Attrib (84.08).* Example: To connect the constant value of 12345 set *Block1In1 (84.05)* = 12345 and *Block1Attrib (84.08)* = 1000h. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
84.06 **Block1In2 (function block 1 input 2)** Selects the source for input 2 of function block 1 (BPS1). Description see *Block1In1 (84.05)*, except: To get only a certain bit e.g. **RdyRef** bit 3 of *MainStatWord (8.01)* set *Block1In2 (84.06)* = 801 and *Block1Attrib (84.08)* = 30h. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
84.07 **Block1In3 (function block 1 input 3)** Selects the source for input 3 of function block 1 (BPS1). Description see *Block1In1 (84.05)*, except: To get only a certain bit e.g. **RdyRef** bit 3 of *MainStatWord (8.01)* set *Block1In3 (84.07)* = 801 and *Block1Attrib (84.08)* = 300h. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-

Signal / Parameter name	min.	max.	def.	unit

84.08 **Block1Attrib (function block 1 attribute)**
Defines the attributes of function block 1 for all three inputs [*Block1In1 (84.05)*, *Block1In2 (84.06)* and *Block1In3 (84.07)*] (BPS1).
Block1Attrib (84.08) is divided into 4 parts:
- Bit number 0 - 3 for input 1 to get a certain bit out of a packed Boolean word.
- Bit number 4 - 7 for input 2 to get a certain bit out of a packed Boolean word.
- Bit number 8 - 11 for input 3 to get a certain bit out of a packed Boolean word.
- Bit number 12 - 14 for input 1 - 3 to feed a constant directly into the input



Int. Scaling: 1 == 1 Type: h Volatile: N

min.: 0h, max.: FFFFh, def.: 0h, unit: -

84.09 **Block1Output (function block 1 output)**
Function block 1 output, can be used as an input for further function blocks.
Int. Scaling: 1 == 1 Type: SI Volatile: Y

min.: -, max.: -, def.: -, unit: -

84.10 to 84.99
The description of the parameters for function blocks 2 to 16 is the same as for function block 1. For Your convenience the following table shows the parameter numbers of all function blocks1:

Function block	BlockxType	BlockxIn1 input 1	BlockxIn2 input 2	BlockxIn3 input 3	BlockxAttrib	BlockxOutput signal	BlockxOut pointer
1	84.04	84.05	84.06	84.07	84.08	84.09	86.01
2	84.10	84.11	84.12	84.13	84.14	84.15	86.02
3	84.16	84.17	84.18	84.19	84.20	84.21	86.03
4	84.22	84.23	84.24	84.25	84.26	84.27	86.04
5	84.28	84.29	84.30	84.31	84.32	84.33	86.05
6	84.34	84.35	84.36	84.37	84.38	84.39	86.06
7	84.40	84.41	84.42	84.43	84.44	84.45	86.07
8	84.46	84.47	84.48	84.49	84.50	84.51	86.08
9	84.52	84.53	84.54	84.55	84.56	84.57	86.09
10	84.58	84.59	84.60	84.61	84.62	84.63	86.10
11	84.64	84.65	84.66	84.67	84.68	84.69	86.11
12	84.70	84.71	84.72	84.73	84.74	84.75	86.12
13	84.76	84.77	84.78	84.79	84.80	84.81	86.13
14	84.82	84.83	84.84	84.85	84.86	84.87	86.14
15	84.88	84.89	84.90	84.91	84.92	84.93	86.15
16	84.94	84.95	84.96	84.97	84.98	84.99	86.16

Signal / Parameter name	min.	max.	def.	unit
Group 85: User constants				
85.01 **Constant1 (constant 1)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.02 **Constant2 (constant 2)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.03 **Constant3 (constant 3)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.04 **Constant4 (constant 4)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.05 **Constant5 (constant 5)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.06 **Constant6 (constant 6)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.07 **Constant7 (constant 7)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.08 **Constant8 (constant 8)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.09 **Constant9 (constant 9)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.10 **Constant10 (constant 10)** Sets an integer constant for AP. Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
85.11 **String1 (string 1)** Sets a string for AP (only possible with DriveWindow).This string is shown in the DCS Control Panel. Int. Scaling: 1 == 1 Type: SI/C Volatile: N	‘string’	‘string’	‘ ’	-
85.12 **String2 (string 2)** Sets a string for AP (only possible with DriveWindow).This string is shown in the DCS Control Panel. Int. Scaling: 1 == 1 Type: SI/C Volatile: N	‘string’	‘string’	‘ ’	-
85.13 **String3 (string 3)** Sets a string for AP (only possible with DriveWindow).This string is shown in the DCS Control Panel. Int. Scaling: 1 == 1 Type: SI/C Volatile: N	‘string’	‘string’	‘ ’	-
85.14 **String4 (string 4)** Sets a string for AP (only possible with DriveWindow).This string is shown in the DCS Control Panel. Int. Scaling: 1 == 1 Type: SI/C Volatile: N	‘string’	‘string’	‘ ’	-
85.15 **String5 (string 5)** Sets a string for AP (only possible with DriveWindow).This string is shown in the DCS Control Panel. Int. Scaling: 1 == 1 Type: SI/C Volatile: N	‘string’	‘string’	‘ ’	-
Group 86: AP outputs				
86.01 **Block1Out (block 1 output)** The value of function block 1 output [*Block1Output (84.09)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-

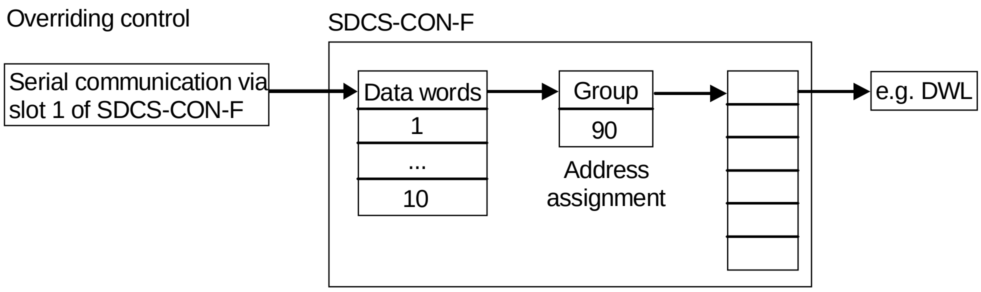
Signal / Parameter name	min.	max.	def.	unit
86.02 **Block2Out (block 2 output)** The value of function block 2 output [*Block2Output (84.15)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.03 **Block3Out (block 3 output)** The value of function block 3 output [*Block3Output (84.21)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.04 **Block4Out (block 4 output)** The value of function block 4 output [*Block1Output (84.27)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.05 **Block5Out (block 5 output)** The value of function block 5 output [*Block1Output (84.33)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.06 **Block6Out (block 6 output)** The value of function block 6 output [*Block1Output (84.39)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.07 **Block7Out (block 7 output)** The value of function block 7 output [*Block1Output (84.45)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.08 **Block8Out (block 8 output)** The value of function block 8 output [*Block1Output (84.51)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.09 **Block9Out (block 9 output)** The value of function block 9 output [*Block1Output (84.57)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.10 **Block10Out (block 10 output)** The value of function block 10 output [*Block1Output (84.63)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.11 **Block11Out (block 11 output)** The value of function block 11 output [*Block1Output (84.69)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.12 **Block12Out (block 12 output)** The value of function block 12 output [*Block1Output (84.75)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-

Signal / Parameter name	min.	max.	def.	unit
86.13 **Block13Out (block 13 output)** The value of function block 13 output [*Block1Output (84.81)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.14 **Block14Out (block 14 output)** The value of function block 14 output [*Block1Output (84.87)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.15 **Block15Out (block 15 output)** The value of function block 15 output [*Block1Output (84.93)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
86.16 **Block16Out (block 16 output)** The value of function block 16 output [*Block16Output (84.99)*] is written to a sink (signal/parameter) by means of this index pointer [e.g. 2301 equals *SpeedRef (23.01)*]. The format is **-xxyy**, with: **-** = negate signal/parameter, **xx** = group and **yy** = index. Int. Scaling: 1 == 1 Type: I Volatile: N	-9999	9999	0	-
Group 88: Internal				
This parameter group contains internal variables and should not be changed by the user				
88.01 - 88.24 Reserved				
88.25 **M1TachMaxSpeed (maximum tacho speed)** Internally used maximum tacho speed. This value is depending on the analog tacho output voltage - e.g. 60 V at 1000 rpm - and the maximum speed of the drive system - which is the maximum of *SpeedScaleAct (2.29)*, *M1OvrSpeed (30.16)* and *M1BaseSpeed (99.04)*. This value should only be written to by: – tacho fine tuning via *ServiceMode (99.06)* = **SpdFbAssist**, – via *M1TachVolt1000 (50.13)*, – TachoAdjust block in AP and – parameter download Internally limited from: $-(2.29)*\frac{32767}{20000}rpm\ \ to\ \ (2.29)*\frac{32767}{20000}rpm$ Int. Scaling: (2.29) Type: SI Volatile: N	0	10000	0	rpm
88.26 Reserved				
88.27 **M1TachoTune (tacho tuning factor)** Internally used tacho fine tuning factor. This value should only be written to by: – tacho fine tuning via *ServiceMode (99.06)* = **SpdFbAssist**, – TachoAdjust block in AP and – parameter download Int. Scaling: 1000 == 1 Type: I Volatile: N	0.3	3	1	-
88.28 Reserved				
88.29 **M1TachoGain (tacho tuning gain)** Internally used tacho gain tuning. This value should only be written to by: – tacho gain tuning via *ServiceMode (99.06)* = **SpdFbAssist**, – *M1TachoVolt1000 (50.13)* and – parameter download Int. Scaling: 1 == 1 Type: I Volatile: N	0	15	15	-
88.30 Reserved				

Signal / Parameter name	min.	max.	def.	unit
88.31 **AnybusModType (last connected serial communication module)** Internally used memory for the last attached serial communication module. This value should only be written to by: – the DCS550 firmware and – parameter download Int. Scaling: 1 == 1 Type: I Volatile: N	0	65535	0	-

Group 90: Receiving data sets addresses

Addresses for the received data transmitted from the overriding control to the drive.
The format is **xxyy**, with: **xx** = group and **yy** = index.

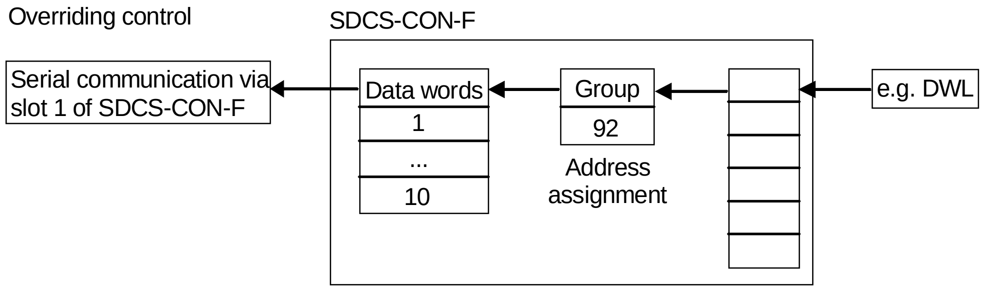


Signal / Parameter name	min.	max.	def.	unit
90.01 **DsetXVal1 (data set X value 1)** Data set 1 value 1 (interval: 3 ms). Default setting of 701 equals *MainCtrlWord (7.01)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	701	-
90.02 **DsetXVal2 (data set X value 2)** Data set 1 value 2 (interval: 3 ms). Default setting of 2301 equals *SpeedRef (23.01)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	2301	-
90.03 **DsetXVal3 (data set X value 3)** Data set 1 value 3 (interval: 3 ms). Default setting of 2501 equals *TorqRefA (25.01)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	2501	-
90.04 **DsetXplus2Val1 (data set X+2 value 1)** Data set 3 value 1 (interval: 3 ms). Default setting of 702 equals *AuxCtrlWord (7.02)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	702	-
90.05 **DsetXplus2Val2 (data set X+2 value 2)** Data set 3 value 2 (interval: 3 ms). Default setting of 703 equals *AuxCtrlWord2 (7.03)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	703	-
90.06 **DsetXplus2Val3 (data set X+2 value 3)** Data set 3 value 3 (interval: 3 ms). Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-
90.07 **DsetXplus4Val1 (data set X+4 value 1)** Data set 5 value 1 (interval: 3 ms). Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-
90.08 **DsetXplus4Val2 (data set X+4 value 2)** Data set 5 value 2 (interval: 3 ms). Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-
90.09 **DsetXplus4Val3 (data set X+4 value 3)** Data set 5 value 3 (interval: 3 ms). Data set address = *Ch0 DsetBaseAddr (70.24)* + 4. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-

Signal / Parameter name	min.	max.	def.	unit
90.10 **DsetXplus6Val1 (data set X+6 value 1)** Data set 7 value 1 (interval: 3 ms). Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	0	-

Group 92: Transmit data sets addresses

Addresses for the transmit data send from the drive to the overriding control.
The format is **xxyy**, with: **xx** = group and **yy** = index.



Signal / Parameter name	min.	max.	def.	unit
92.01 **DsetXplus1Val1 (data set X+1 value 1)** Data set 2 value 1 (interval: 3 ms) Default setting of 801 equals *MainStatWord (8.01)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	801	-
92.02 **DsetXplus1Val2 (data set X+1 value 2)** Data set 2 value 2 (interval: 3 ms). Default setting of 104 equals *MotSpeed (1.04)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	104	-
92.03 **DsetXplus1Val3 (data set X+1 value 3)** Data set 2 value 3 (interval: 3 ms). Default setting of 209 equals *TorqRef2 (2.09)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	209	-
92.04 **DsetXplus3Val1 (data set X+3 value 1)** Data set 4 value 1 (interval: 3 ms). Default setting of 802 equals *AuxStatWord (8.02)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	802	-
92.05 **DsetXplus3Val2 (data set X+3 value 2)** Data set 4 value 2 (interval: 3 ms). Default setting of 101 equals *MotSpeedFilt (1.01)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	101	-
92.06 **DsetXplus3Val3 (data set X+3 value 3)** Data set 4 value 3 (interval: 3 ms). Default setting of 108 equals *MotTorq (1.08)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	108	-
92.07 **DsetXplus5Val1 (data set X+5 value 1)** Data set 6 value 1 (interval: 3 ms). Default setting of 901 equals *FaultWord1 (9.01)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	901	-
92.08 **DsetXplus5Val2 (data set X+5 value 2)** Data set 6 value 2 (interval: 3 ms). Data. Default setting of 902 equals *FaultWord2 (9.02)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	902	-
92.09 **DsetXplus5Val3 (data set X+5 value 3)** Data set 6 value 3 (interval: 3 ms). Default setting of 903 equals *FaultWord3 (9.03)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	903	-

Signal / Parameter name	min.	max.	def.	unit
92.10 **DsetXplus7Val1 (data set X+7 value 1)** Data set 8 value 1 (interval: 3 ms). Default setting of 904 equals *FaultWord4 (9.04)*. Int. Scaling: 1 == 1 Type: I Volatile: N	0	9999	904	-

Group 97: Measurements

97.01 **TypeCode (type code)**
TypeCode (97.01) is preset in the factory and is write protected. It identifies the drives current-, voltage-, temperature measurement and its quadrant type. To un-protect the type code set *ServiceMode (99.06)* = **SetTypeCode**. The change of the type code is immediately taken over and *ServiceMode (99.06)* is automatically set back to **NormalMode**:

0 = **None** no type code set
1 = **S01-0020-05** type code, see table
to
xxx = **S02-1000-05** type code, see table

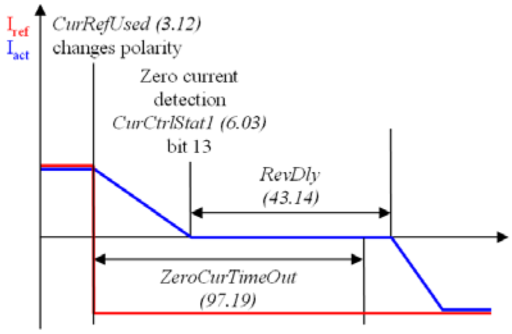
The drive's basic type code: DCS550-AAX-YYYY-ZZ			
Product family:	DCS550		
Type:	AA	= S0	Standard converter modules
Bridge type:	X	= 1	Single bridge (2-Q)
		= 2	2 anti parallel bridges (4-Q)
Module type:	YYYY	=	Rated DC current
Rated AC voltage:	ZZ	= 05	$230\ V_{AC}$ - $525\ V_{AC}$

Int. Scaling: 1 == 1 Type: C Volatile: Y

min.: None; max.: S01-5203-05; def.: factory preset value; unit: -

97.02 - 97.03 Unused

Signal / Parameter name	min.	max.	def.	unit
97.04 **S MaxBrdgTemp (set: maximum bridge temperature)** Adjustment of the converters heat sink temperature tripping level in degree centigrade: **0 °C** = take value from *TypeCode (97.01)*, default **1 °C to 149 °C** = take value from *S MaxBrdgTemp (97.04)* **150 °C** = the temperature supervision is inactive, if *S MaxBrdgTemp (97.04)* is set to 150 °C This value overrides the type code and is immediately visible in *MaxBridgeTemp (4.17)*. Int. Scaling: 1 == 1 °C Type: I Volatile: N	0	150	0	°C
97.05 - 97.06 Unused				
97.07 **S BlockBridge2 (set: block bridge 2)** Bridge 2 can be blocked: 0 = **Auto** operation mode is taken from *TypeCode (97.01),* default 1 = **BlockBridge2** block bridge 2 (== 2-Q operation), for e.g. 2-Q rebuild kits 2 = **RelBridge2** release bridge 2 (== 4-Q operation), for e.g. 4-Q rebuild kits This value overrides the type code and is immediately visible in *QuadrantType (4.15)*. Int. Scaling: 1 == 1 Type: C Volatile: N	Auto	RelBridge2	Auto	-
97.08 Unused				
97.09 **MainsCompTime (mains compensation time)** Mains voltage compensation filter time constant. Is used for the mains voltage compensation at the current controller output. Setting MainsCompTime (97.09) to 1000 ms disables the mains voltage compensation. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	1000	10	ms
97.10 - 97.12 Unused				

<table>
<tr><th>Signal / Parameter name</th><th>min.</th><th>max.</th><th>def.</th><th>unit</th></tr>
<tr><td>97.13 DevLimPLL (phase locked loop deviation limit)
Maximum allowed deviation of the PLL controller. The current controller is blocked in case the limit is reached - see CurCtrlStat2 (6.04) bit 13:
for 50 Hz mains is valid: $360° == 20ms = \frac{1}{50Hz} == 20.000$
for 60 Hz mains is valid: $360° == 16.67ms = \frac{1}{60Hz} == 16.667$
The PLL input can be seen in PLLIn (3.20). The PLL output can be seen in MainsFreqAct (1.38).
Int. Scaling: 100 == 1 ° Type: I Volatile: N</td><td>5</td><td>20</td><td>10</td><td>°</td></tr>
<tr><td>97.14 KpPLL (phase locked loop p-part)
Gain of firing unit's phase lock loop.
Int. Scaling: 100 == 1 Type: I Volatile: N</td><td>0.25</td><td>5</td><td>2</td><td>-</td></tr>
<tr><td>97.15 TfPLL (phase locked loop filter)
Filter of firing unit's phase lock loop.
Int. Scaling: 1 == 1 ms Type: I Volatile: N</td><td>0</td><td>1000</td><td>0</td><td>ms</td></tr>
<tr><td>97.16 Unused</td><td></td><td></td><td></td><td></td></tr>
<tr><td>97.17 OffsetIDC (offset DC current measurement)
Offset value - in percent of M1NomCur (99.03) - added to the armature current measurement. OffsetIDC (97.17) adjusts ConvCurAct (1.16) and the real armature current.
Setting OffsetIDC (97.17) to 0 disables the manual offset.
Commissioning hint:
In case a 2-Q converter module is used and the motor turns with speed reference equals zero increase OffsetIDC (97.17) until the motor is not turning anymore.
Int. Scaling: 100 == 1 % Type: I Volatile: N</td><td>-5</td><td>5</td><td>0</td><td>%</td></tr>
<tr><td>97.18 Unused</td><td></td><td></td><td></td><td></td></tr>
<tr><td>97.19 ZeroCurTimeOut (zero current timeout)
After a command to change current direction - see CurRefUsed (3.12) - the opposite current has to be reached before ZeroCurTimeOut (97.19) has been elapsed otherwise the drive trips with F557 ReversalTime [FaultWord4 (9.04) bit 8].


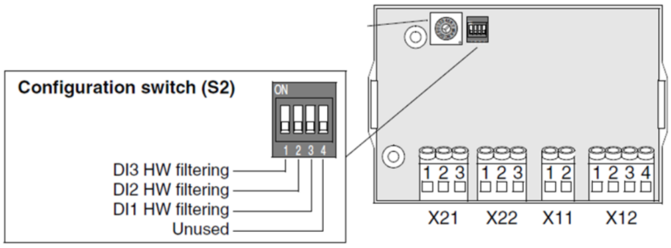
The reversal delay time starts when zero current has been detected - see CurCtrlStat1 (6.03) bit 13 - after a command to change current direction - see CurRefUsed (3.12) - has been given. The time needed to change the current direction can be longer when changing from motoring mode to regenerative mode at high motor voltages, because the motor voltage must be reduced before switching to regenerative mode - see also RevVoltMargin (44.21).
Note:
ZeroCurTimeOut (97.19) must be longer than RevDly (43.14).
Int. Scaling: 1 == 1 ms Type: I Volatile: N</td><td>0</td><td>12000</td><td>20</td><td>ms</td></tr>
<tr><td>97.20 TorqActFiltTime (actual torque filter time)
Torque actual filter time constant for MotTorqFilt (1.07). Is used for the EMF controller and the EMF feed forward.
Int. Scaling: 1 == 1 ms Type: I Volatile: N</td><td>0</td><td>10000</td><td>1000</td><td>ms</td></tr>
<tr><td>97.21 - 97.24 Unused</td><td></td><td></td><td></td><td></td></tr>
</table>

Signal / Parameter name	min.	max.	def.	unit
97.25 **EMF ActFiltTime (actual EMF filter time)** EMF actual filter time constant for *EMF VoltActRel (1.17).* Is used for the EMF controller and the EMF feed forward. Int. Scaling: 1 == 1 ms Type: I Volatile: N	0	10000	10	ms
97.26 - 97.28 Unused				
Group 98: Option modules				
98.01 Unused				
98.02 **CommModule (communication modules)** For the communication modules following selections are available: 0 = **NotUsed** no communication used, default 1 = **Fieldbus** The drive communicates with the overriding control via an R-type fieldbus adapter connected in option slot 1. This choice is not valid for the Modbus. 2 = **Modbus** The drive communicates with the overriding control via the Modbus (RMBA-xx) connected in option slot 1. **Attention:** To ensure proper connection and communication of the communication modules with the SDCS-CON-F use the screws included in the scope of delivery. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	Fieldbus	NotUsed	-

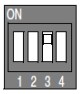
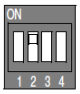
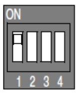
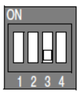
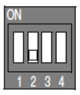
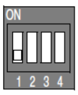
Signal / Parameter name	min.	max.	def.	unit
98.03 DIO ExtModule1 (digital extension module 1)	NotUsed	Slot3	NotUsed	-

98.03 **DIO ExtModule1 (digital extension module 1)**
First RDIO-xx extension module interface selection. *DIO ExtModule1 (98.03)* releases DI9, DI10, DI11, DO9 and DO10.
The module can be connected in option slot 1 or 3:
0 = **NotUsed** no first RDIO-xx is used, default
1 = **Slot1** first RDIO-xx is connected in option slot 1
2 = reserved
3 = **Slot3** first RDIO-xx is connected in option slot 3
The drive trips with **F508 I/OBoardLoss** [*FaultWord1 (9.01)* bit 7], if the RDIO-xx extension module is chosen, but not connected or faulty.
Notes:
- For faster input signal detection disable the hardware filters of the RDIO-xx by means of dip switch S2. Always have the hardware filter enabled when an AC signal is connected.
- The digital outputs are available via *DO CtrlWord (7.05).*

Attention:
To ensure proper connection and communication of the RDIO-xx board with the SDCS-CON-F use the screws included in the scope of delivery.
Switches on the 1st RDIO-xx:



Configuration switch (S2)
For faster detection the hardware filter of the digital input in question can be disabled. Disabling the hardware filtering will however reduce the noise immunity of the input.

Hardware Filtering	DIP switch settings		
	Digital input DI1	Digital input DI2	Digital input DI3
Enabled (Default)			
Disabled			

Int. Scaling: 1 == 1 Type: C Volatile: N

Signal / Parameter name	min.	max.	def.	unit

98.04 **DIO ExtModule2 (digital extension module 2)**
Second RDIO-xx extension module interface selection. *DIO ExtModule2 (98.04)* releases DI12, DI13, DI14, DO11 and DO12.
The module can be connected in option slot 1 or 3:

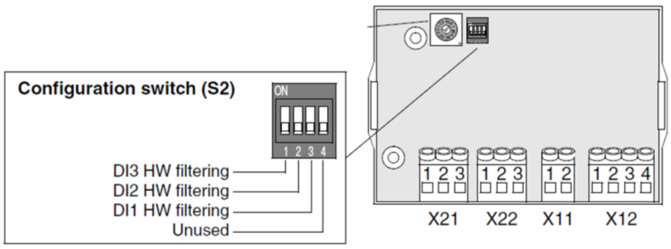
0 = **NotUsed** no second RDIO-xx is used, default
1 = **Slot1** second RDIO-xx is connected in option slot 1
2 = reserved
3 = **Slot3** second RDIO-xx is connected in option slot 3

The drive trips with **F508 I/OBoardLoss** [*FaultWord1 (9.01)* bit 7], if the RDIO-xx extension module is chosen, but not connected or faulty.

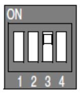
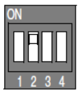
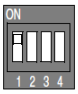
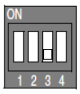
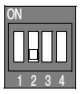
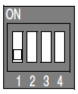
Notes:
- For faster input signal detection disable the hardware filters of the RDIO-xx by means of dip switch S2. Always have the hardware filter enabled when an AC signal is connected.
- The digital inputs are available via *DI StatWord (8.05)*
- The digital outputs are available via *DO CtrlWord (7.05).*

Attention:
To ensure proper connection and communication of the RDIO-xx board with the SDCS-CON-F use the screws included in the scope of delivery.

Switches on the 2nd RDIO-xx:



Configuration switch (S2)
For faster detection the hardware filter of the digital input in question can be disabled. Disabling the hardware filtering will however reduce the noise immunity of the input.

Hardware Filtering	DIP switch settings		
	Digital input DI1	Digital input DI2	Digital input DI3
Enabled (Default)			
Disabled			

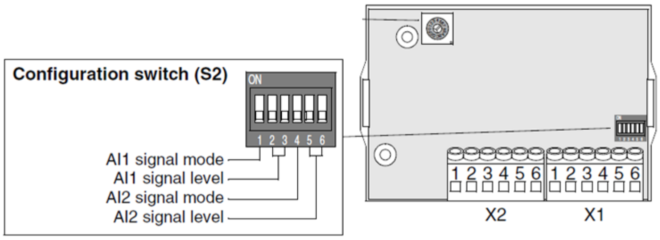
Int. Scaling: 1 == 1 Type: C Volatile: N

	min.	max.	def.	unit
98.04	NotUsed	Slot3	NotUsed	-

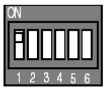
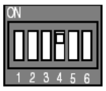
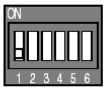
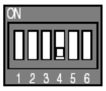
98.05 Unused

Signal / Parameter name	min.	max.	def.	unit
98.06 **AIO ExtModule (analog extension module)** (see below)	NotUsed	Slot3	NotUsed	-

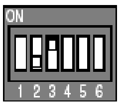
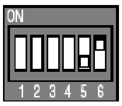
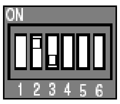
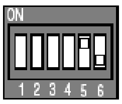
98.06 **AIO ExtModule (analog extension module)**
RAIO-xx extension module interface selection. *AIO ExtModule (98.06)* releases AI5, AI6, AO3 and AO4. The module can be connected in option slot 1 or 3:
0 = **NotUsed** no RAIO-xx is used, default
1 = **Slot1** RAIO-xx is connected in option slot 1
2 = reserved
3 = **Slot3** RAIO-xx is connected in option slot 3
The drive trips with **F508 I/OBoardLoss** [*FaultWord1 (9.01)* bit 7], if the RAIO-xx extension module is chosen, but not connected or faulty.
Attention:
To ensure proper connection and communication of the RAIO-xx board with the SDCS-CON-F use the screws included in the scope of delivery.
Switches on the 1st RAIO-xx:



Configuration switch (S2)
Select the operation of the analog inputs using the configuration DIP switch (S2) on the circuit board of the module. The drive parameters must be set accordingly.
Input mode selection:
In bipolar mode, the analog inputs can handle positive and negative signals. The resolution of the A/D conversion is 11 data bits (+ 1 sign bit). In unipolar mode (default), the analog inputs can handle positive signals only. The resolution of the A/D conversion is 12 data bits.

DIP switch setting		Input signal type
Analogue input AI1	Analogue input AI2	
		±0(4)…20 mA ±0(2)…10 V ±0…2 V
		0(4)…20 mA 0(2)…10 V 0…2 V (Default)

Input signal type selection:
Each input can be used with a current or voltage signal.

Input signal type	DIP switch settings	
	Analogue input 1	Analogue input 2
Current signal ±0(4)…20 mA (Default)		
Voltage signal ±0(2)…10 V		

Int. Scaling: 1 == 1 Type: C Volatile: N

Signal / Parameter name	min.	max.	def.	unit
Group 99: Start-up data				
99.01 **Language (language)** Select language: 0 = **English** default 1 = reserved 2 = **Deutsch** 3 = **Italiano** 4 = **Español** 5 = reserved 6 = reserved 7 = **Français** Int. Scaling: 1 == 1 Type: C Volatile: N	English	English	English	-
99.02 **M1NomVolt (nominal DC voltage)** Nominal armature voltage (DC) from the motor rating plate. Int. Scaling: 1 == 1 V Type: I Volatile: N	5	700	350	V
99.03 **M1NomCur (nominal DC current)** Nominal armature current (DC) from the motor rating plate. Int. Scaling: 1 == 1 A Type: I Volatile: N	0	1000	0	A
99.04 **M1BaseSpeed (base speed)** Base speed from the rating plate, usually the field weak point. *M1BaseSpeed (99.04)* is must be set in the range of: – 0.2 to 1.6 times of *SpeedScaleAct (2.29).* If the scaling is out of range **A124 SpeedScale** [*AlarmWord2 (9.07)* bit 7] is generated. Int. Scaling: 10 == 1 rpm Type: I Volatile: N	10	6500	1500	rpm
99.05 Unused				
99.06 **ServiceMode (service mode)** *ServiceMode (99.06)* contains several test- and auto tuning procedures. The drive mode is automatically set to **NormalMode** after an autotuning procedure or after the thyristor diagnosis is finished or failed. In case errors occur during the selected procedure **A121 AutotuneFail** [*AlarmWord2 (9.07)* bit 4] is generated. The reason of the error can be seen in *Diagnosis (9.11).* **SetTypeCode** is automatically set to **NormalMode** after the next power up. 0 = **NormalMode** normal operating mode depending on *OperModeSel (43.01)*, default 1 = **ArmCurAuto** autotuning armature current controller 2 = **FieldCurAuto** autotuning field current controller 3 = **EMF FluxAuto** autotuning EMF controller and flux linearization 4 = **SpdCtrlAuto** autotuning speed controller 5 = **SpdFbAssist** test speed feedback, see *M1SpeedFbSel (50.03), M1EncPulseNo (50.04)* and *M1TachoVolt1000 (50.13)* 6 = **TachFineTune** tacho fine tuning, see *M1TachoAdjust (50.12)* 7 = **ThyDiagnosis** thyristor diagnosis, the result is shown in *Diagnosis (9.11)* 8 = **FindDiscCur** find discontinuous current limit 9 = **SetTypeCode** set type code, releases following parameters: *TypeCode (97.01)* 10 = **LD FB Config** reserved for future use (load fieldbus configuration file) **Note:** The reference chain is blocked while ServiceMode (99.06) ≠ **NormalMode**. Int. Scaling: 1 == 1 Type: C Volatile: Y	NormalMode	FindDiscCur	NormalMode	-

Signal / Parameter name	min.	max.	def.	unit
99.07 **ApplRestore (application restore)** Setting *ApplRestore (99.07)* = **Yes** starts the loading / storing of the macro (preset parameter set) selected by means of *ApplMacro (99.08). ApplRestore (99.07)* is automatically set back to **Done** after the chosen action is finished: 0 = **Done** no action or macro change completed, default 1 = **Yes** macro selected with *ApplMacro (99.08)* will be loaded into the drive **Notes:** – Macro changes are only accepted in **Off** state [*MainStatWord (8.01)* bit 1 = 0]. – It takes about 2 s, until the new parameter values are active. Int. Scaling: 1 == 1 Type: C Volatile: Y	Done	Yes	Done	-
99.08 **ApplMacro (application macro)** *ApplMacro (99.08)* selects the macro (preset parameter sets) to be loaded / stored into the RAM and flash. In addition to the preset macros, two user-defined macros (**User1** and **User2**) are available. The operation selected by *ApplMacro (99.08)* is **started** immediately by setting *ApplRestore (99.07)* = **Yes**. *ApplMacro (99.08)* is automatically set back to **NotUsed** after the chosen action is finished. The selected macro is shown in *MacroSel (8.10)*: 0 = **NotUsed** default 1 = **Factory** load macro factory (default parameter set) into RAM and flash - **User1** and **User2** will not be influenced 2 = **User1Load** load macro **User1** into RAM and flash 3 = **User1Save** save actual parameter set form RAM into macro **User1** 4 = **User2Load** load macro **User2** into RAM and flash 5 = **User2Save** save actual parameter set form RAM into macro **User2** 6 = **Standard** load macro standard into RAM and flash 7 = **Man/Const** load macro manual / constant speed into RAM and flash 8 = **Hand/Auto** load macro hand (manual) / automatic into RAM and flash 9 = **Hand/MotPot** load macro hand (manual) / motor potentiometer into RAM and flash 10 = reserved 11 = **MotPot** load macro motor potentiometer into RAM and flash 12 = **TorqCtrl** load macro torque control into RAM and flash 13 = **TorqLimit** load macro torque limit into RAM and flash 14 = **DemoStandard** load macro demo standard into RAM and flash 15 = **2WreDCcontUS** load macro 2 wire with US style DC-breaker into RAM and flash 16 = **3WreDCcontUS** load macro 3 wire with US style DC-breaker into RAM and flash 17 = **3WreStandard** load macro 3 wire standard into RAM and flash **Notes:** – When loading a macro, group 99 is set / reset as well. – If **User1** is active, AuxStatWord (8.02) bit 3 is set. If **User2** is active, AuxStatWord (8.02) bit 4 is set. – It is possible to change all preset parameters of a loaded macro. On a macro change or an application restore command of the actual macro the macro depending parameters are restored to the macro's default values. – In case macro **User1** or **User2** is loaded by means of *ParChange (10.10),* it is not saved into the flash and thus not valid after the next power on. Int. Scaling: 1 == 1 Type: C Volatile: Y	NotUsed	TorqCtrl	NotUsed	-
99.09 **DeviceName (device name)** *DeviceName (99.09)* is fixed set to DCS550 and cannot be changed. **Note:** This parameter is only visible if a SDCS-COM-8 is connected. Int. Scaling: 1 == 1 Type: C Volatile: N	DCS550	DCS550	DCS550	-
99.10 **NomMainsVolt (nominal AC mains voltage)** Nominal mains voltage (AC) of the supply. The default and maximum values are preset automatically according to *TypeCode (97.01)*. Absolute max. is 525 V Int. Scaling: 1 == 1 V Type: I Volatile: N	0	(97.01)	(97.01)	V
99.11 **M1NomFldCur (nominal field current)** Nominal field current from the motor rating plate. Int. Scaling: 100 == 1 A Type: I Volatile: N	0.3	35	0.3	A

Signal / Parameter name	min.	max.	def.	unit
99.12 **M1UsedFexType (used field exciter type)** Used field exciter type: 0 = **NotUsed** no field exciter connected 1 = **OnBoard** integrated 1-Q field exciter, default If the fex type is changed, its new value is taken over after the next power-up. Int. Scaling: 1 == 1 Type: C Volatile: N	NotUsed	OnBoard	OnBoard	-
99.13 - 99.14 Unused				
99.15 **Pot1 (potentiometer 1)** Constant test reference 1 for the square wave generator. **Note:** The value is depending on the chosen destination of the square wave [e.g. *SqrWaveIndex (99.18)* = 2301 relates to *SpeedScaleAct (2.29)*]: – 100 % voltage == 10,000 – 100 % current == 10,000 – 100 % torque == 10,000 – 100 % speed == *SpeedScaleAct (2.29)* == 20,000 Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
99.16 **Pot2 (potentiometer 2)** Constant test reference 2 for the square wave generator. **Note:** The value is depending on the chosen destination of the square wave [e.g. *SqrWaveIndex (99.18)* = 2301 relates to *SpeedScaleAct (2.29)*]: – 100 % voltage == 10,000 – 100 % current == 10,000 – 100 % torque == 10,000 – 100 % speed == *SpeedScaleAct (2.29)* == 20,000 Int. Scaling: 1 == 1 Type: SI Volatile: N	-32768	32767	0	-
99.17 **SqrWavePeriod (square wave period)** The time period for the square wave generator. Int. Scaling: 100 == 1 s Type: I Volatile: N	0.01	655	10	s
99.18 **SqrWaveIndex (square wave index)** Index pointer to the source (signal/parameter) for the square wave generator. E.g. signal [e.g. 2301 equals SpeedRef (23.01)]. **Note:** After a power-up, SqrWaveIndex (99.18) is set back to 0 and thus disables the square wave generator. Int. Scaling: 1 == 1 Type: I Volatile: Y	0	9999	0	-
99.19 **TestSignal (square wave signal form)** Signal forms for the square wave generator: 0 = **SquareWave** a square wave is used, default 1 = **Triangle** a triangle wave is used 2 = **SineWave** a sine wave is used 3 = **Pot1** a constant value set with *Pot1 (99.15)* is used Int. Scaling: 1 == 1 Type: C Volatile: Y	SquareWave	Pot1	SquareWave	-

DCS Control Panel

Chapter overview

This chapter describes the handling of the DCS Control Panel.

Start-up

The commissioning configures the drive and sets parameters that define how the drive operates and communicates. Depending on the control and communication requirements, the commissioning requires any or all of the following:

– The Start-up Assistant (via DCS Control Panel or DWL) steps you through the default configuration. The DCS Control Panel Start-up Assistant runs automatically at the first power up, or can be accessed at any time using the main menu.
– Select application macros to define common, system configurations.
– Additional adjustments can be made using the DCS Control Panel to manually select and set individual parameters. See *chapter* *Signal and parameter list*.

DCS Control Panel

Use the DCS Control Panel to control the drive, to read status data, to adjust parameters and to use the pre-programmed assistants.

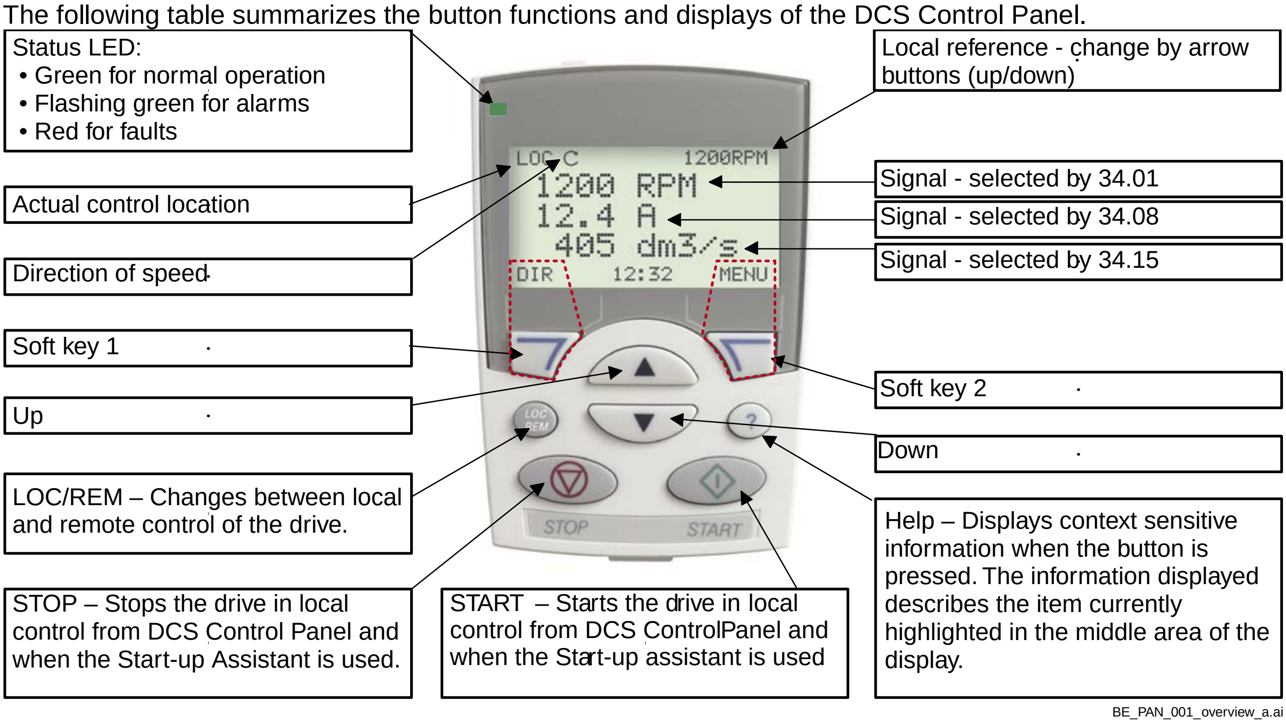
Features:

The DCS Control Panel features:

– Alphanumeric LCD display
– Language selection for the display by means of *Language (99.01)*
– Panel can be connected or detached at any time
– Start-up Assistant for ease drive commissioning
– Copy function, parameters can be copied into the DCS Control Panel memory to be downloaded to other drives or as backup
– Context sensitive help
– Fault- and alarm messages including fault history

Display overview

The following table summarizes the button functions and displays of the DCS Control Panel.



General display features

Soft key functions:
The text displayed just above each key defines the soft key functions.
Display contrast:
To adjust display contrast, simultaneously press the MENU key and UP or DOWN, as appropriate.

Output mode

Use the output mode to read information on the drive's status and to operate the drive. To reach the output mode, press EXIT until the LCD display shows status information as described below.
Status information:

LOC ↻	
15.0 rpm **3.7 V** **17.3 A**	
DIR	MENU

Top: The top line of the LCD display shows the basic status information of the drive:
- LOC indicates that the drive control is local from the DCS Control Panel.
- REM indicates that the drive control is remote, via local I/O or overriding control.
- ↻ indicates the drive and motor rotation status as follows:

DCS Control Panel display	Significance
Rotating arrow (clockwise or counter clockwise)	Drive is running and at setpoint Shaft direction is forward ↻ or reverse ↺
Rotating dotted blinking arrow	Drive is running but not at setpoint
Stationary dotted arrow	Start command is present, but motor is not running. E.g. start enable is missing

- Upper right position shows the active reference, when in local from DCS Control Panel.

Middle: Using parameter Group 34, the middle of the LCD display can be configured to display up to three parameter values:
- By default, the display shows three signals.
- Use *DispParam1Sel (34.01)*, *DispParam2Sel (34.08)* and *DispParam3Sel (34.15)* to select signals or parameters to display. Entering value 0 results in no value displayed. For example, if 34.01 = 0 and 34.15 = 0, then only the signal or parameter specified by 34.08 appears on the DCS Control Panel display.

Bottom: The bottom of the LCD display shows:
- Lower corners show the functions currently assigned to the two soft keys.
- Lower middle displays the current time (if configured to do so).

Operating the Drive:
LOC/REM: Each time the drive is powered up, it is in remote control (REM) and is controlled as specified in *CommandSel (10.01)*.

To switch to local control (LOC) and control the drive using the DCS Control Panel, press the LOC/REM button.

To switch back to remote control (REM) press the LOC/REM button.
- When switching from remote control (REM) to local control (LOC) the drive's status (e.g. **On**, **Run**) and the speed reference of the remote control are taken.

Start/Stop: To start and stop the drive press the START and STOP buttons.

Shaft direction: To change the shaft direction press DIR.

Speed reference: To modify the speed reference (only possible if the display in the upper right corner is highlighted) press the UP or DOWN button (the reference changes immediately).

Modify the speed reference via the DCS Control Panel when in local control (LOC).
Note:
The START / STOP buttons, shaft direction (DIR) and reference functions are only valid in local control (LOC).

Other modes

Below the output mode, the DCS Control Panel has:
– Other operating modes are available through the MAIN MENU.
– A fault mode that is triggered by faults. The fault mode includes a diagnostic assistant mode.
– An alarm mode that is triggered by drive alarms.

```
LOC ↻ MAIN MENU----------------1

ASSISTANTS
MACROS
EXIT                      ENTER
```

Access to the MAIN MENU and other modes:
To reach the MAIN MENU:
1. Press EXIT, as necessary, to step back through the menus or lists associated with a particular mode. Continue until you are back to the output mode.
2. Press MENU from the output mode. At this point, the middle of the display is a listing of the other modes, and the top-right text says “MAIN MENU”.
3. Press UP/DOWN to scroll to the desired mode.
4. Press ENTER to enter the mode that is highlighted.

Following modes are available in the MAIN MENU:
1. Parameters mode
2. Start-up assistants mode
3. Macros mode (currently not used)
4. Changed parameters mode
5. Fault logger mode
6. Clock set mode
7. Parameter backup mode
8. I/O settings mode (currently not used)

The following sections describe each of the other modes.

Parameters mode:
Use the parameters mode to view and edit parameter values:
1. Press UP/DOWN to highlight PARAMETERS in the MAIN MENU, then press ENTER.

```
LOC ↻ MAIN MENU----------------1

ASSISTANTS
MACROS
EXIT                      ENTER
```

2. Press UP/DOWN to highlight the appropriate parameter group, then press SEL.

```
LOC ↻ PAR GROUPS------------01

01 Phys Act Values
02 SPC Signals
03 Ref/Act Values
04 Information
EXIT                      SEL
```

3. Press UP/DOWN to highlight the appropriate parameter in a group, then press EDIT to enter PAR EDIT mode.

```
LOC ↻ PARAMETERS--------------
9901 Language


9903 M1NomCur
9904 M1BaseSpeed
EXIT                    EDIT
```

Note:
The current parameter value appears below the highlighted parameter.

4. Press UP/DOWN to step to the desired parameter value.

```
LOC ↻ PAR EDIT--------------------

9902 M1NomVolt
        60 V

CANCEL                  SAVE
```

Note:
To get the parameter default value press UP/DOWN simultaneously.

5. Press SAVE to store the modified value and leave the PAR EDIT mode or press CANCEL to leave the PAR EDIT mode without modifications.
6. Press EXIT to return to the listing of parameter groups, and again to step back to the MAIN MENU.

Start-up assistants mode:
Use the start-up assistants mode for basic commissioning of the drive.
When the drive is powered up the first time, the start-up assistants guide you through the setup of the basic parameters.
There are seven start-up assistants available. They can be activated one after the other, as the ASSISTANTS menu suggests, or independently. The use of the assistants is not required. It is also possible to use the parameter mode instead.
The assistant list in the following table is typical:

Name plate data	Enter the motor data, the mains (supply) data, the most important protections and follow the instructions of the assistant. After filling out the parameters of this assistant it is - in most cases - possible to turn the motor for the first time.
Macro assistant	Selects an application macro.
Autotuning field current controller	Enter the field circuit data and follow the instructions of the assistant. During the autotuning the main respectively field contactor will be closed, the field circuit is measured by means of increasing the field current to nominal field current and the field current control parameters are set. The armature current is not released while the autotuning is active and thus the motor should not turn. When the autotuning is finished successfully, the parameters changed by the assistant are shown for confirmation. If the assistant fails, it is possible to enter the fault mode for more help.
Autotuning armature current controller	Enter the motor nominal current, the basic current limitations and follow the instructions of the assistant. During the autotuning the main contactor will be closed, the armature circuit is measured by means of armature current bursts and the armature current control parameters are set. The field current is not released while the autotuning is active and thus the motor should not turn, but due to remanence in the field circuit about 40% of all motors will turn (create torque). Lock these motors. When the autotuning is finished successfully, the parameters changed by the assistant are shown for confirmation. If the assistant fails, it is possible to enter the fault mode for more help.
Speed feedback assistant	Enter the EMF speed feedback parameters, - if applicable - the parameters for the pulse encoder respectively the analog tacho and follow the instructions of the assistant. The speed feedback assistant detects the kind of speed feedback the drive is using and provides help to set up pulse encoders or analog tachometers. During the autotuning the main contactor and the field contactor - if existing - will be closed and the motor will run up to base speed [*M1BaseSpeed (99.04)*]. During the whole procedure, the drive will be in EMF speed control despite the setting of *M1SpeedFbSel (50.03)*. When the assistant is finished successfully, the speed feedback is set. If the assistant fails, it is possible to enter the fault mode for more help.
Autotuning speed controller	Enter the motor base speed, the basic speed limitations, the speed filter time and follow the instructions of the assistant.

	During the autotuning the main contactor and the field contactor - if existing - will be closed, the ramp is bypassed and torque respectively current limits are valid. The speed controller is tuned by means of speed bursts up to base speed [*M1BaseSpeed (99.04)*] and the speed controller parameters are set. **Attention:** During the autotuning the torque limits will be reached. When the autotuning is finished successfully, the parameters changed by the assistant are shown for confirmation. If the assistant fails, it is possible to enter the fault mode for more help. **Attention:** This assistant is using the setting of *M1SpeedFbSel (50.03)*. If using setting **Encoder** or **Tacho** make sure, the speed feedback is working properly!
Field weakening assistant (only used when maximum speed is higher than base speed)	Enter the motor data, the field circuit data and follow the instructions of the assistant. During the autotuning the main contactor and the field contactor - if existing - will be closed and the motor will run up to base speed [*M1BaseSpeed (99.04)*]. The EMF controller data are calculated, the flux linearization is tuned by means of a constant speed while decreasing the field current and the EMF controller respectively flux linearization parameters are set. When the autotuning is finished successfully, the parameters changed by the assistant are shown for confirmation. If the assistant fails, it is possible to enter the fault mode for more help.

1. Press UP/DOWN to highlight ASSISTANTS in the MAIN MENU, then press ENTER.
2. Press UP/DOWN to highlight the appropriate start-up assistant, then press SEL to enter PAR EDIT mode.
3. Make entries or selections as appropriate.
4. Press SAVE to save settings. Each individual parameter setting is valid immediately after pressing SAVE.

Press EXIT to step back to the MAIN MENU.

Macros mode:
Currently not used!

Changed parameters mode:
Use the changed parameters mode to view and edit a listing of all parameter that have been changed from their default values:

1. Press UP/DOWN to highlight CHANGED PAR in the MAIN MENU, then press ENTER.
2. Press UP/DOWN to highlight a changed parameter, then press EDIT to enter PAR EDIT mode.

Note:
The current parameter value appears below the highlighted parameter.

3. Press UP/DOWN to step to the desired parameter value.

Note:
To get the parameter default value press UP/DOWN simultaneously.

4. Press SAVE to store the modified value and leave the PAR EDIT mode or press CANCEL to leave the PAR EDIT mode without modifications.

Note:
If the new value is the default value, the parameter will no longer appear in the changed parameter list.

5. Press EXIT to step back to the MAIN MENU.

Fault logger mode:
Use the fault logger mode to see the drives fault, alarm and event history, the fault state details and help for the faults:

1. Press UP/DOWN to highlight FAULT LOGGER in the MAIN MENU, then press ENTER to see the latest faults (up to 20 faults, alarms and events are logged).
2. Press DETAIL to see details for the selected fault. Details are available for the three latest faults, independent of the location in the fault logger.
3. Press DIAG to get additional help (only for faults).
4. Press EXIT to step back to the MAIN MENU.

Clock set mode:

- Use the Clock set mode to:
- Enable or disable the clock function.
- Select the display format.

Set date and time.

1. Press UP/DOWN to highlight CLOCK SET in the MAIN MENU, then press ENTER.
2. Press UP/DOWN to highlight the desired option, then press SEL.

3. Choose the desired setting, and then press SEL or OK to store the setting or press CANCEL to leave without modifications.
4. Press EXIT to step back to the MAIN MENU.

Note:
To get the clock visible on the LCD display at least one change has to be done in the clock set mode and the DCS Control Panel has to be de-energized and energized again.

Parameter backup mode:
The DCS Control Panel can store a full set of drive parameters.
- AP will be uploaded and downloaded.
- The type code of the drive is write protected and has to be set manually by means of *ServiceMode (99.06)* = SetTypeCode and *TypeCode (97.01)*.

The parameter backup mode has following functions:
- UPLOAD TO PANEL: Copies all parameters from the drive into the DCS Control Panel. This includes both user sets (User1 and User2) - if defined - and internal parameters such as those created by tacho fine tuning. The DCS Control Panel memory is non-volatile and does not depend on its battery. Can only be done in drive state Off and local from DCS Control Panel.
- DOWNLOAD FULL SET: Restores the full parameter set from the DCS Control Panel into the drive. Use this option to restore a drive, or to configure identical drives. Can only be done in drive state Off and local from DCS Control Panel.

Note:
This download does not include the user sets.
- DOWNLOAD APPLICATION: Currently not used!
-

The general procedure for parameter backup operations is:
1. Press UP/DOWN to highlight PAR BACKUP in the MAIN MENU, then press ENTER.
2. Press UP/DOWN to highlight the desired option, then press SEL.
3. Wait until the service is finished, then press OK.
4. Press EXIT to step back to the MAIN MENU.

I/O settings mode:
Currently not used!

Maintenance

Cleaning:
Use a soft damp cloth to clean the DCS Control Panel. Avoid harsh cleaners, which could scratch the display window.

Battery:
A battery is used in the DCS Control Panel to keep the clock function available and enabled. The battery keeps the clock operating during power interruptions. The expected life for the battery is greater than ten years. To remove the battery, use a coin to rotate the battery holder on the back of the control panel. The type of the battery is CR2032.

Note:
The battery is not required for any DCS Control Panel or drive functions, except for the clock.

Fault tracing

Chapter overview

This chapter describes the protections and fault tracing of the drive.

Fault modes

Depending on the trip level of the fault, the drive reacts differently. The drive’s reaction to a fault with trip level 1 and 2 is fixed. See also paragraph *Fault signals* of this manual. The reaction to a fault of level 3 and 4 can be chosen by means of *SpeedFbFltMode (30.36)* respectively *FaultStopMode (30.30)*.

Converter protection

Auxiliary undervoltage

If the auxiliary supply voltage fails while the drive is in **RdyRun** state (MSW bit 1), fault **F501 AuxUnderVolt** is generated.

Auxiliary supply voltage	Trip level
230 V_{AC}	< 95 V_{AC}
115 V_{AC}	< 95 V_{AC}
230 V_{DC}	< 140 V_{DC}

Armature overcurrent

The nominal value of the armature current is set with *M1NomCur (99.02)*. The overcurrent level is set by means of *ArmOvrCurLev (30.09)*. Additionally the actual current is monitored against the overcurrent level of the converter module. The converter’s actual overcurrent level can be read from *ConvOvrCur (4.16)*.
Exceeding one of the two levels causes **F502 ArmOverCur**.

Converter overtemperature

The maximum temperature of the bridge can be read from *MaxBridgeTemp (4.17)* and is automatically set by *TypeCode (97.01)* or manually set by *S MaxBrdgTemp (97.04)*.
Exceeding this level causes **F504 ConvOverTemp**. The threshold for **A104 ConvOverTemp** is 5 °C below the tripping level. The measured temperature can be read from *BridgeTemp (1.24)*.
If the measured temperature drops below minus 10 °C, **F504 ConvOverTemp** is generated.

Auto-reclosing (mains undervoltage)

Auto-reclosing allows continuing drive operation immediately after a short mains undervoltage without any additional functions in the overriding control system.
In order to keep the overriding control system and the drive control electronics running through short mains undervoltage, an UPS is needed for the 115/230 V_{AC} auxiliary voltages. Without the UPS all DI like e.g. E-stop, start inhibition, acknowledge signals etc. would have false states and trip the drive although the system itself could stay alive. In addition, the control circuits of the main contactor must be supplied during the mains undervoltage.
Auto-reclosing defines whether the drive trips immediately with **F512 MainsLowVolt** or if the drive will continue running after the mains voltage returns. To activate the auto-reclosing set *PwrLossTrip (30.21)* = **Delayed**.

Short mains undervoltage

The supervision of mains undervoltage has two levels:
1. *UNetMin1 (30.22)* alarm, protection and trip level
2. *UNetMin2 (30.23)* trip level

If the mains voltage falls below *UNetMin1 (30.22)* but stays above *UNetMin2 (30.23)*, the following actions take place:
1. the firing angle is set to *ArmAlphaMax (20.14)*,
2. single firing pulses are applied in order to extinguish the current as fast as possible,
3. the controllers are frozen,
4. the speed ramp output is updated from the measured speed and

5. **A111 MainsLowVolt** is set as long as the mains voltage recovers, before *PowrDownTime (30.24)* is elapsed. Otherwise, **F512 MainsLowVolt** is generated.

If the mains voltage returns before *PowrDownTime (30.24)* is elapsed and the overriding control keeps the commands **On** (MCW bit 0) and **Run** (MCW bit 3) = 1, the drive will start again after 2 seconds. Otherwise, the drive trips with **F512 MainsLowVolt**.

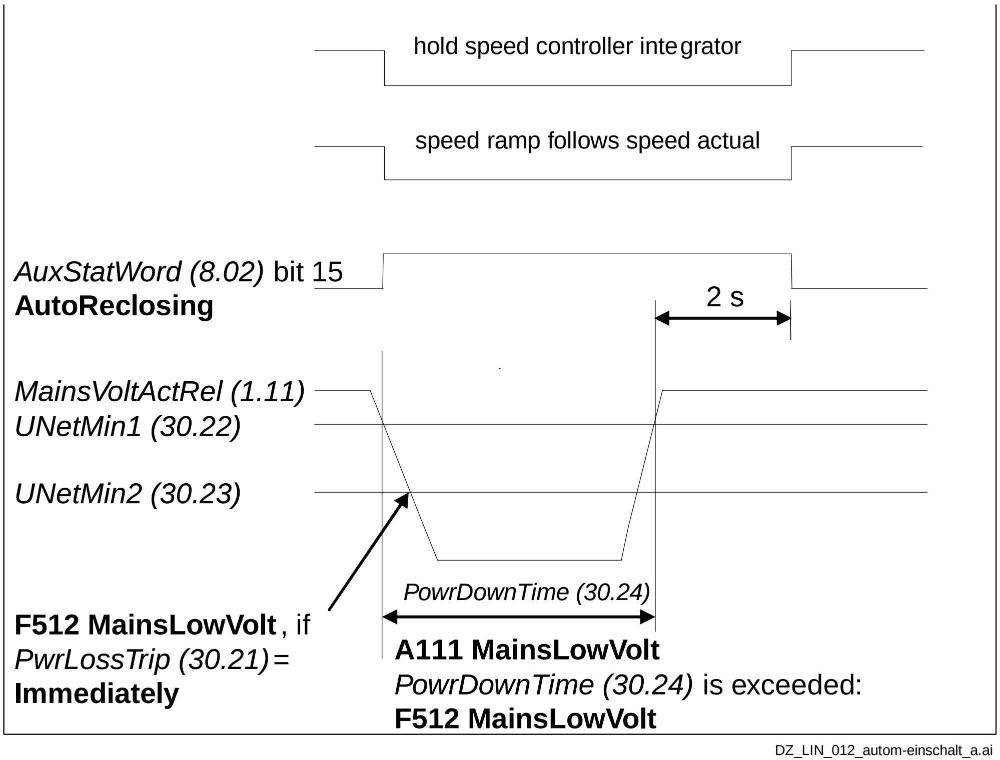
When the mains voltage drops below *UNetMin2 (30.23)*, the action is selected by means of *PwrLossTrip (30.21)*:

1. the drive is immediately tripped with **F512 MainsLowVolt** or
2. the drive starts up automatically, see description for *UNetMin1 (30.22)*. Below *UNetMin2 (30.23)* the field acknowledge signals are ignored and blocked

Notes:

– *UNetMin2 (30.23)* is not monitored, unless the mains voltage drops below *UNetMin1 (30.22)*. Thus, for proper operation, *UNetMin1 (30.22)* must be larger than *UNetMin2 (30.23)*.
– If no UPS is available, set *PwrLossTrip (30.21)* to **Immediately**. Thus, the drive will trip with **F512 MainsLowVolt** avoiding secondary phenomena due to missing power for AI's and DI's.
– In case the **On** command [*UsedMCW (7.04)* bit 0] is given and the measured mains voltage is too low for more than 500 ms **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set. It the problem persist for more than 10 s **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated.

Drive behavior during auto-reclosing



Auto-reclosing

Mains synchronism

As soon as the main contactor is closed and the firing unit is synchronized with the incoming voltage, supervising of the synchronization is activated. If the synchronization fails, **F514 MainsNotSync** will be generated.

The synchronization of the firing unit takes typically 300 ms before the current controller is ready.

Mains overvoltage

The overvoltage level is fixed to 1.3 * *NomMainsVolt (99.10)*. Exceeding this level for more than 10 s and RdyRun = 1 causes **F513 MainsOvrVolt**.

Communication loss

The communication to several devices is supervised. Choose the reaction to a communication loss by means of *LocalLossCtrl (30.27)* or *ComLossCtrl (30.28)*:

Overview local and communication loss:				
Device	**Loss control**	**Time out**	**Related fault**	**Related alarm**
DCS Control Panel	*LocalLossCtrl (30.27)*	fixed to 5 s	**F546 LocalCmdLoss**	**A130 LocalCmdLoss**
DWL				
R-type fieldbus	*ComLossCtrl (30.28)*	*FB TimeOut (30.35)*	**F528 FieldBusCom**	**A128 FieldBusCom**
SDCS-COM-8			**F543 COM8Com**	**A113 COM8Com**

Overview local and communication loss

Mains contactor acknowledge

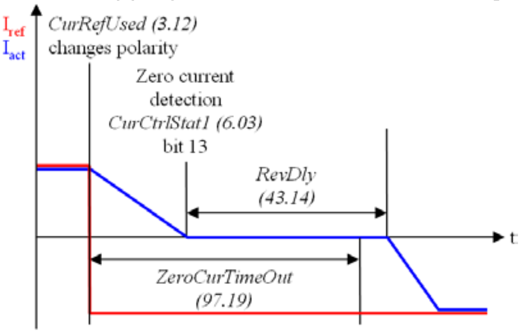
When the drive is switched **On** (MCW bit 0), the main contactor is closed and waited for its acknowledge. If the acknowledge is not received during 10 seconds after the **On** command (MCW bit 0) is given, the corresponding fault is generated. These are:
1. **F523 ExtFanAck**, see *MotFanAck (10.06)*
2. **F524 MainContAck**, see *MainContAck (10.21)*

External fault

The user has the possibility to connect external faults to the drive. The source can be connected to DI's or *MainCtrlWord (7.01)* and is selectable by *ExtFaultSel (30.31)*. External faults generate **F526 ExternalDI**. In case inverted fault inputs are needed, it is possible to invert the DI's.

Bridge reversal

With a 6-pulse converter, the bridge reversal is initiated by changing the polarity of the current reference - see *CurRefUsed (3.12)*. Upon zero current detection - see *CurCtrlStat1 (6.03)* bit 13 - the bridge reversal is started. Depending on the moment, the new bridge may be "fired" either during the same or during the next current cycle.
The switchover can be delayed by *RevDly (43.14)*. The delay starts after zero current has been detected - see *CurCtrlStat1 (6.03)* bit 13. Thus, *RevDly (43.14)* is the length of the forced current gap during a bridge changeover. After the reversal delay is elapsed the system changes to the selected bridge without any further consideration.
This feature may prove useful when operating with large inductances. Also the time needed to change the current direction can be longer when changing from motoring mode to regenerative mode at high motor voltages, because the motor voltage must be reduced before switching to regenerative mode.
After a command to change current direction - see *CurRefUsed (3.12)* - the opposite current has to be reached before *ZeroCurTimeOut (97.19)* has been elapsed otherwise the drive trips with **F557 ReversalTime** [*FaultWord4 (9.04)* bit 8].
Example:
Drive is tripping with **F557 ReversalTime** [*FaultWord4 (9.04)* bit 8]:



Bridge reversal

Fault tracing

Analog input monitor

In case the analog input is set to 2 V to 10 V or 4 mA to 20 mA respectively it is possible to check for wire breakage by means of *AI Mon4mA (30.29)*. In case the threshold is undershooting one of the following actions will take place:

1. the drive stops according to *FaultStopMode (30.30)* and trips with **F551 AIRange**
2. the drive continues to run at the last speed and sets **A127 AIRange**
3. the drive continues to run with *FixedSpeed1 (23.02)* and sets **A127 AIRange**

Motor protection

Armature overvoltage

The nominal value of the armature voltage is set with *M1NomVolt (99.02)*.
The overvoltage level is set by means of *ArmOvrVoltLev (30.08)*. Exceeding this level causes **F503 ArmOverVolt**.

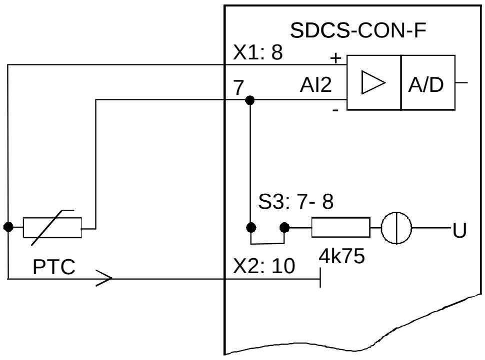
Measured motor temperature

General

It is possible to indicate the temperatures of the motor. Alarm and tripping levels are selected by means of *M1AlarmLimTemp (31.06)* and *M1FaultLimTemp (31.07)*. If the levels are exceeded either **A106 M1OverTemp** or **F506 M1OverTemp** is set. The motor fan will continue to work until the motor is cooled down to alarm limit. Configure this supervision by means of *M1TempSel (31.05)*.

SDCS-CON-F:

The SDCS-CON-F provides a connection possibility for max. 1 PTC via AI2. For jumper settings, see *chapter Control board*. All parameters for AI2 in group 13 have to set to default.
ATTENTION: PTC must be double isolated against power circuit.



PTC and SDCS-CON-F

Klixon

It is possible to supervise the temperature of the motor by means of klixons. The klixon is a thermal switch, opening its contact at a defined temperature. Use it for supervision of the temperature by means of connecting the switch to a digital input of the drive. Select the digital input for the klixon(s) with *M1KlixonSel (31.08)*. The drive trips with **F506 M1OverTemp** when the klixon opens. The motor fan will continue to work until the klixon is closed again.

Note:

It is possible to connect several klixons in series.

Motor thermal model

General

The drive includes a thermal model for the connected motor. It is recommended to use the thermal model of the motor if a direct motor temperature measurement is not available and the current limits of the drive are set higher than the motor nominal current.
The thermal model is based on the actual motor current related to motor nominal current and rated ambient temperature. Thus, the thermal model does not directly calculate the temperature of the motor, but it

calculates the ***temperature rise*** of the motor. This is because the motor will reach its end temperature after the specified time when starting to run the cold motor (40°C) with nominal current. This time is about four times the motor thermal time constant.
The temperature rise of the motor behaves like the time constant which is proportional with the motor current to the power of two:

$$\Phi = \frac{I_{act}^2}{I_{Motn}^2} * \left(1 - e^{-\frac{t}{\tau}}\right) \quad (1)$$

When the motor is cooling down, following temperature model is valid:

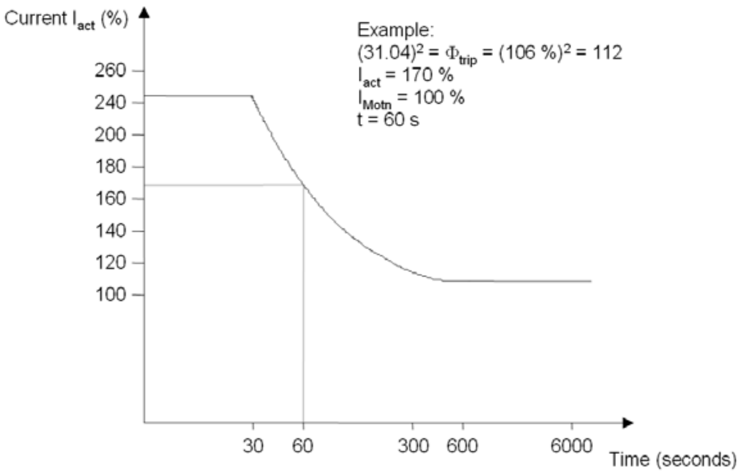
$$\Phi = \frac{I_{act}^2}{I_{Motn}^2} * e^{-\frac{t}{\tau}} \qquad (2)$$

with: Φ_{alarm} = temperature rise == [*M1AlarmLimLoad (31.03)*]^2
Φ_{trip} = temperature rise == [*M1FaultLimLoad (31.04)*]^2
Φ = temperature rise == *Mot1TempCalc (1.20)*
i_{act} = actual motor current (overload e.g. 170%)
i_{MotN} = nominal motor current (100%)
t = length of overload (e.g. 60 s)
τ = temperature time constant (in seconds) == *M1ModelTime (31.01)*
As from the formulas (1) and (2) can be seen, the temperature model uses the same time constant when the motor is heating or cooling down.

Alarm and tripping levels
Alarm and tripping levels are selected by means of *M1AlarmLimLoad (31.03)* and *M1FaultLimLoad (31.04)*. If the levels are exceeded either **A107 M1OverLoad** or **F507 M1OverLoad** is set. The motor fan will continue to work until the motor is cooled down under the alarm limit. The default values are selected in order to achieve quite high overload ability. Recommended value for alarming is 102 % and for tripping 106 % of nominal motor current. Thus the temperature rise is:
– Φ_{alarm} == [*M1AlarmLimLoad (31.03)*]^2 = (102%)^2 = 1.02^2 = 1.04 and
– Φ_{trip} == [*M1FaultLimLoad (31.04)*]^2= (106%)^2 = 1.06^2 = 1.12.
The temperature rise output of the model is shown in *Mot1TempCalc (1.20)*.

Thermal model selection
The thermal models is activated by setting *M1ModelTime (31.01)* greater than zero.

Thermal time constant
Set the time constant for the thermal model by means of *M1ModelTime (31.01)*. If the thermal time constant of a motor is given by the manufacturer just write it into *M1ModelTime (31.01)*. In many cases, the motor manufacturer provides a curve that defines how long the motor can be overloaded by a certain overload factor. In this case, calculate the proper thermal time constant.
Example:
The drive is designed to trip if the motor current exceeds 170 % of motor nominal current for more than 60 seconds. Selected tripping base level is 106 % of nominal motor current, thus *M1FaultLimLoad (31.04)* = 106 %.



Motor load curve

Using formula (1) we can calculate the correct value for τ, when starting with a cold motor.

With: $$(31.04)^2 = \Phi_{trip} = \frac{I_{act}^2}{I_{Motn}^2} * \left(1 - e^{-\frac{t}{\tau}}\right)$$

Follows: $$\tau = -\frac{t}{\ln\left(1 - (31.04)^2 * \frac{{I_{Motn}}^2}{{I_{act}}^2}\right)} = -\frac{60s}{\ln\left(1 - 1.06^2 * \frac{1.0^2}{1.7^2}\right)} = 122s$$

Set *M1ModelTime (31.01)* = 122 s.

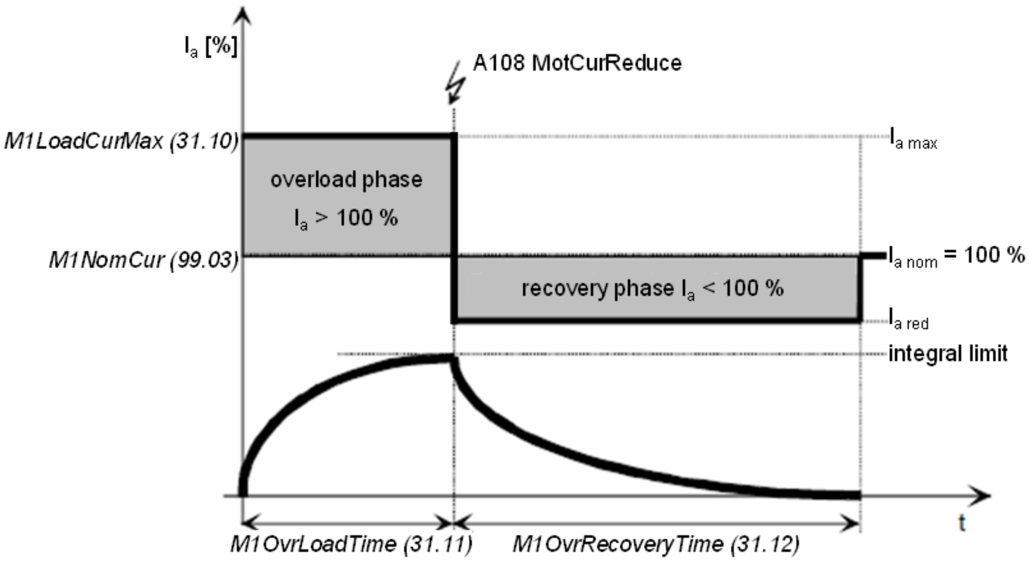
I^2T-function (reducing armature current)

The drive is equipped with an I^2t-function. It uses the ampere value in *M1MotNomCur (99.03)* as 100 %. All current depending values are related to this parameter.

The I^2t-function is enabled if *M1OvrLoadTime (31.11)* and *M1RecoveryTime (31.12)* are greater than zero and the maximum overload current in *M1LoadCurMax (31.10)* is greater than 100 %.

If *M1RecoveryTime (31.12)* is set too short compared to *M1OvrLoadTime (31.11)*, **A132ParConflict** is generated, see also *Diagnosis (9.11)*.

Ensure that *M1OvrLoadTime (31.11)* and *M1RecoveryTime (31.12)* fit to the overload capability of motor and drive. This must be taken into account during the engineering of the drive system.



The overload phase is calculated using *M1LoadCurMax (31.10)* and *M1OvrLoadTime (31.11)*. The recovery phase is calculated using *M1RecoveryTime (31.12)*. In order not to overload the motor, the I^2t-areas of overload phase and recovery phase have to be identical:

$$(I_{a\max}^2 - I_{a\,nom}^2) * overload\ time = (I_{a\,nom}^2 - I_{a\,red}^2) * recovery\ time$$

In this case, it is ensured that the mean value of the armature current does not exceed 100 %. To calculate the recovery current following formula is used:

$$I_{a\,red} = \sqrt{I_{a\,nom}^2 - \frac{overload\ time}{recovery\ time} * (I_{a\max}^2 - I_{a\,nom}^2)}$$

With parameters follows:

$$I_{a\,red} = \sqrt{(100\%)^2 - \frac{(31.11)}{(31.12)} * \left[(31.10)^2 - (100\%)^2\right]}$$

After an overload phase, the armature current is automatically reduced / limited to $I_{a\,red}$ during the recovery phase. The current reduction during the recovery phase is signaled by means of **A108 MotCurReduce**.

Field overcurrent

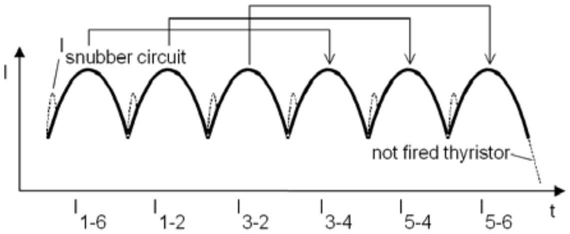
The nominal value of the field current is set with *M1NomFldCur (99.11)*.
Set the overcurrent level by means of *M1FldOvrCurLev (30.13)*. Exceeding this level causes **F515 M1FexOverCur**.

Armature current ripple

The current control is equipped with a current ripple monitor. This function can detect:

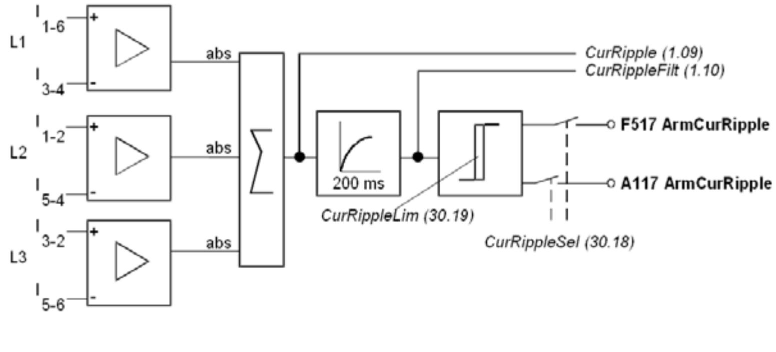
1. a broken fuse or thyristor
2. too high gain (e.g. wrong tuning) of the current controller
3. a broken current transformer (T51, T52)

The current ripple monitor level is set by means of *CurRippleLim (30.19)*. Exceeding this level causes either **F517 ArmCurRipple** or **A117 ArmCurRipple** depending on *CurRippleSel (30.18)*.
Current ripple monitor method is based on comparing positive and negative currents of each phase. The calculation is done per thyristor pair:



Current ripple monitor method

CurRipple (1.09) is calculated as abs (I_{1-6}-I_{3-4}) + abs (I_{1-2}-I_{5-4}) + abs (I_{3-2}-I_{5-6}). By low-pass filtering with 200 ms, *CurRippleFilt (1.10)* is generated and compared against *CurRippleLim (30.19)*.



Current ripple monitor calculation

Note:

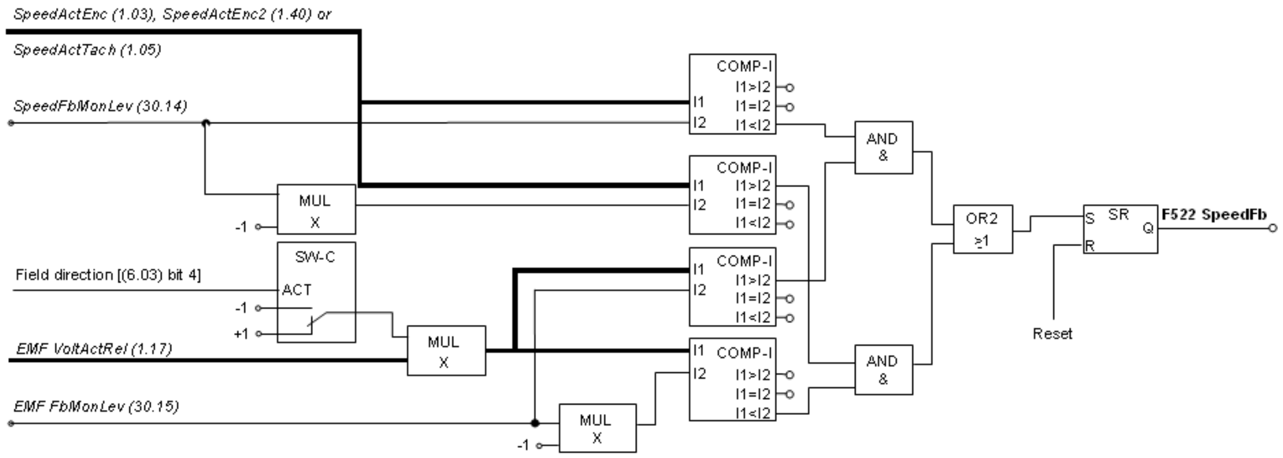
The load influences the error signal *CurRippleFilt (1.10)*.

– Current near discontinuous level will create values of about 300 % * *ConvCurActRel (1.15)* if a thyristor is not fired.
– High inductive loads will create values of about 90% * *ConvCurActRel (1.15)* if a thyristor is not fired.

Commissioning hint:
It is not possible to pre-calculate clear levels. The current control reacts to unstable current feedback. The load is continuously driving the current if a thyristor is not fired.

Speed feedback monitor

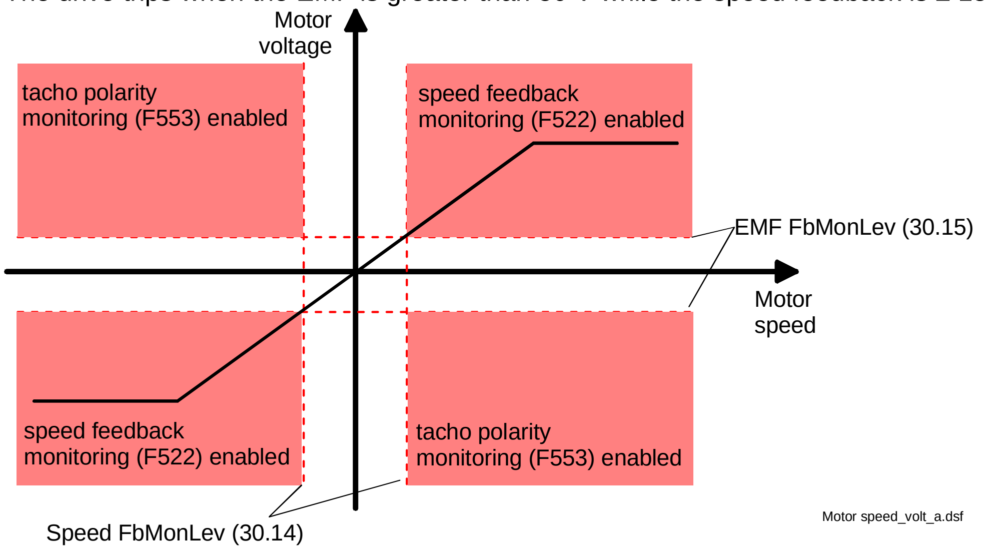
The speed feedback monitor supervises an attached analog tacho or encoder for proper function by means of measured speed and measured EMF. Above a certain EMF, the measured speed feedback must be above a certain threshold. The sign of the speed measurement must be correct as well:



Speed measurement supervision
The drive reacts according to *SpeedFbFltSel (30.17)* when:
1. the measured EMF is greater than *EMF FbMonLev (30.15)* and
2. the measured speed feedback *SpeedActEnc (1.03), SpeedActTach (1.05)* or *SpeedActEnc2 (1.42)* is lower than *SpeedFbMonLev (30.14)*.

Example:
– *SpeedFbMonLev (30.14)* = 15 rpm
– *EMF FbMonLev (30.15)* = 50 V

The drive trips when the EMF is greater than 50 V while the speed feedback is ≤ 15 rpm.



Speed feedback monitor
SpeedFbFltSel (30.17) selects the reaction to a speed feedback problem:

1. the drive is immediately tripped with **F522 SpeedFb**
2. the speed feedback is switched to EMF and the drive is stopped according to *E StopRamp (22.11),* then **F522 SpeedFb** is set
3. the speed feedback is switched to EMF and **A125 SpeedFb** is set

In case of field weakening, the drive is immediately tripped with **F522 SpeedFb**.

Stall protection

The stall protection trips the converter with **F531 MotorStalled** when the motor is in apparent danger of overheating. The rotor is either mechanically stalled or the load is continuously too high. It is possible to adjust the supervision (time, speed and torque). The stall protection trips the drive if:

1. the actual speed is below *StallSpeed (30.02)* and
2. the actual torque *- in percent of MotNomTorque (4.23) -* exceeds *StallTorq (30.03)*
3. for a time longer than programmed in *StallTime (30.01).*

Overspeed protection

The motor is protected against overspeed e.g. in a case when the drive is in torque control mode and the load drops unexpected. Set the overspeed level by means of *M1OvrSpeed (30.16)*. Exceeding this level causes **F532 MotOverSpeed**.

Field undercurrent

The nominal value of the field current is set with *M1NomFldCur (99.11)*.
Set the minimum field current level by means of *M1FldMinTrip (30.12)*. Undershooting this level causes **F541 M1FexLowCur**. *FldMinTripDly (45.18)* delays **F541 M1FexLowCur**.

Tacho / pulse encoder polarity

The polarity of the analog tacho or pulse encoder [depending on *M1SpeedFbSell (50.03)*] is checked against the EMF. A wrong polarity generates **F553 TachPolarity**.

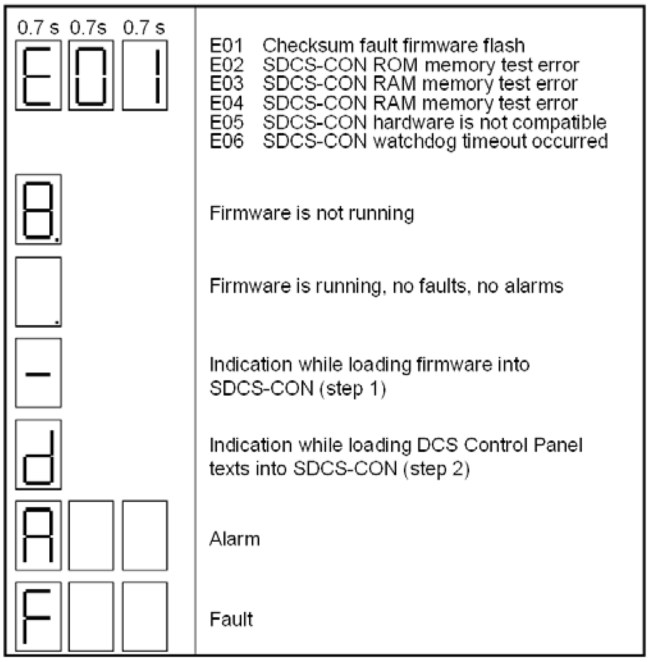
Tacho range

An imminent overflow of the AITacho input generates **F554 TachoRange**. Check for the right connections (X1:1 to X1:4) on the SDCS-CON-F.

Display of status, fault messages and error codes

Categories of signals and display options

A seven-segment display (H2500) is located on the control board SDCS-CON-F and it shows the state of drive:



The seven-segment display shows the messages in code. The letters and numbers of multi-character codes are displayed one after the other for 0.7 seconds at a time. Plain text messages are available on the DCS Control Panel and in the fault logger DWL.

0.7s 0.7s 0.7s 0.7s

⇒ ⇒ ⇒

⇑ ⇐ ⇐ ⇓ **F514** = mains not in synchronism

For evaluation via digital outputs or communication to the overriding control, 16 bit words are available, containing all fault and alarm signals as binary code:

- *FaultWord1 (9.01),*
- *FaultWord2 (9.02),*
- *FaultWord3 (9.03),*
- *FaultWord4 (9.04),*
- *UserFaultWord (9.05),*
- *AlarmWord1 (9.06),*
- *AlarmWord2 (9.07),*
- *AlarmWord3 (9.08) and*
- *UserAlarmWord (9.09)*

General messages

General messages will only be indicated on the seven-segment display of the SDCS-CON-F.

7-segment display	Text on DCS Control Panel and DWL	Definition	Remark
8	not available	firmware is not running	1
.	not available	firmware is running, no faults, no alarms	-
-	not available	indication while loading firmware into SDCS-CON-F	-
d	not available	indication while loading DCS Control Panel texts into SDCS-CON-F	-
u	not available	DCS Control Panel text now formatting in the flash - don't switch off	-

Power-up errors (E)

Power-up errors will only be indicated on the seven-segment display of the SDCS-CON-F. With a power-up error active, it is not possible to start the drive.

7-segment display	Text on DCS Control Panel and DWL	Definition	Remark
E01	not available	Checksum fault firmware flash	1,2
E02	not available	SDCS-CON-F ROM memory test error	1,2
E03	not available	SDCS-CON-F RAM memory test error (even addresses)	1,2
E04	not available	SDCS-CON-F RAM memory test error (odd addresses)	1,2
E05	not available	SDCS-CON-F hardware is not compatible, unknown board	1,2,3
E06	not available	SDCS-CON-F watchdog timeout occurred	1,2

1. Units should be de- and re-energized. If the fault occurs again, check the SDCS-CON-F and SDCS-PIN-F boards and change them if necessary.
2. Power-up errors are only enabled immediately after power on. If a power-up error is indicated during normal operation, the reason is usually caused by EMC. In this case, please check for proper grounding of cables, converter and cabinet.
3. Try to re-load the firmware.

Fault signals (F)

To avoid dangerous situations, damage of the motor, the drive or any other material some physical values must not exceed certain limits. Therefore, limit values can be specified for these values by parameter setting which cause an alarm or a fault when the value exceeds the limits (e.g. max. armature voltage, max. converter temperature). Faults can also be caused by situations, which inhibit the drive from normal operation (e.g. blown fuse).
A fault is a condition, which requires an immediate stop of the drive in order to avoid danger or damage. The drive is stopped automatically and cannot be restarted before removing its cause. All fault signals, with the exception of:
- **F501 AuxUnderVolt,**
- **F525 TypeCode,**
- **F547 HwFailure and**
- **F548 FwFailure**

are resetable in case the fault is eliminated. To reset a fault following steps are required:
- remove the **Run** and **On** commands [*UsedMCW (7.04)* bit 3 and 0]
- eliminate the faults
- acknowledge the fault with **Reset** [*UsedMCW (7.04)* bit 7] via digital input, overriding control system or in **Local** mode with DCS Control Panel or DWL
- depending on the systems condition, generate **Run** and **On** commands [*UsedMCW (7.04)* bit 3 and 0] again

The fault signals will switch the drive off completely or partly depending on its trip level.

Trip level 1:
- main contactor is switched off immediately
- fan contactor is switched off immediately

Trip level 2:
- main contactor is switched off immediately
- fan contactor stays on as long as the fault is pending or as long as *FanDly (21.14)* is running

Trip level 3:
- main contactor is switched off immediately
- fan contactor stays on as long as *FanDly (21.14)* is running

At standstill the
- main contactor cannot be switched on again

Trip level 4:
As long as the drive is stopping via *FaultStopMode (30.30),* the
- main contactor is switched off immediately in case of *FaultStopMode (30.30)* = **CoastStop** or **DynBraking**, but it stays on in case of *FaultStopMode (30.30)* = **RampStop** or **TorqueLimit**
- fan contactor is switched off immediately in case of *FaultStopMode (30.30)* = **CoastStop**, but stays on in case of *FaultStopMode (30.30)* = **RampStop**, **TorqueLimit** or **DynBraking**

At standstill the
- main contactor is switched off immediately
- fan contactor stays on as long as *FanDly (21.14)* is running

Trip level 5
As long as the drive is stopping via any com. loss control [*LocalLossCtrl (30.27)* or *ComLossCtrl (30.28)*], the
- main contactor is switched off immediately or stays on depending on the selected com. loss control
- fan contactor is switched off immediately or stays on depending on the selected com. loss control

At standstill
- main contactor is switched off immediately
- fan contactor stays on as long as *FanDly (21.14)* is running

In case a fault occurs, it stays active until the cause is eliminated and a **Reset** [*UsedMCW (7.04)* bit 7] is given.

Fault name	Fault number	Fault name	Fault number
AIRange	F551	M1FexLowCur	F541
ArmCurRipple	F517	M1FexOverCur	F515
ArmOverCur	F502	M1OverLoad	F507
ArmOverVolt	F503	M1OverTemp	F506
AuxUnderVolt	F501	MainContAck	F524
		MainsLowVolt	F512
COM8Com	F543	MainsNotSync	F514
COM8Faulty	F540	MainsOvrVolt	F513
		MotorStalled	F531
ConvOverTemp	F504	MotOverSpeed	F532
ExternalDI	F526	ParComp	F549
ExtFanAck	F523	ParMemRead	F550
FieldBusCom	F528	ReversalTime	F557
FwFailure	F548		
		SpeedFb	F522
HwFailure	F547		
		TachPolarity	F553
I/OBoardLoss	F508	TachoRange	F554
		TypeCode	F525
LocalCmdLoss	F546		

For additional fault messages, see *SysFaultWord (9.10)*.

<table>
<tr><th>7-segment display</th><th>Text on DCS Control Panel and DWL</th><th>Definition / Action</th><th>Fault-word</th><th>Fault is active when</th><th>Triplevel</th></tr>
<tr><td>F501</td><td>501
AuxUnderVolt</td><td>Auxiliary undervoltage:
The auxiliary voltage is too low while the drive is in operation. If resetting fails, check:
– internal auxiliary voltages (SDCS-CON-F)
– change SDCS-CON-F and / or SDCS-PIN-F
<table>
<tr><td>Auxiliary supply voltage</td><td>Trip level</td></tr>
<tr><td>230 V_{AC}</td><td>< 95 V_{AC}</td></tr>
<tr><td>115 V_{AC}</td><td>< 95 V_{AC}</td></tr>
<tr><td>230 V_{DC}</td><td>< 140 V_{DC}</td></tr>
</table></td><td>9.01,
bit 0</td><td>RdyRun = 1</td><td>1</td></tr>
<tr><td>F502</td><td>502 ArmOverCur</td><td>Armature overcurrent:
Check:
– ArmOvrCurLev (30.09)
– parameter settings of group 43 (current control: armature current controller tuning)
– current and torque limitation in group 20
– all connections in the armature circuit, especially the incoming voltage for synchronizing. If the synchronizing voltage is not taken from the mains (e.g. via synchronizing transformer or 230 V / 115 V network) check that there is no phase shift between the same phases (use an oscilloscope).
– for faulty thyristors
– armature cabling
– if TypeCode (97.01) is set properly</td><td>9.01,
bit 1</td><td>always</td><td>3</td></tr>
<tr><td>F503</td><td>503 ArmOverVolt</td><td>Armature overvoltage (DC):
Check:
– if setting of ArmOvrVoltLev (30.08) is suitable for the system
– parameter settings of group 44 (field excitation: field current controller tuning, EMF controller tuning, flux linearization)
– too high field current (e.g. problems with field weakening)
– if the motor was accelerated by the load,
– overspeed
– does the speed scaling fit, see SpeedScaleAct (2.29)
– proper armature voltage feedback
– connector X12 and X13 on SDCS-CON-F
– connector X12 and X13 on SDCS-PIN-F</td><td>9.01,
bit 2</td><td>always</td><td>1</td></tr>
<tr><td>F504</td><td>504
ConvOverTemp</td><td>Converter overtemperature:
Wait until the converter is cooled down. Shutdown temperature see MaxBridgeTemp (4.17). Check:
– converter cover missing
– converter fan supply voltage
– converter fan direction of rotation
– converter fan components
– converter cooling air inlet (e.g. filter)
– converter cooling air outlet
– ambient temperature
– inadmissible load cycle</td><td>9.01,
bit 3</td><td>always</td><td>2</td></tr>
</table>

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Fault-word	Fault is active when	Triplevel
		– connector X12 on SDCS-CON-F – connector X12 and X22 on SDCS-PIN-F – if *TypeCode (97.01)* and *S MaxBridgeTemp (97.04)* are set properly			
F506	506 M1OverTemp	**Motor measured overtemperature:** Wait until the motor is cooled down. The motor fan will continue to work until the motor is cooled down under the alarm level. It is not possible to reset the fault as long as the motor remains too hot. Check: – *M1FaultLimTemp (31.07)*, *M1KlixonSel (31.08)* – *M1AlarmLimTemp (31.06)* – motor temperature – motor fan supply voltage – motor fan direction of rotation – motor fan components – motor cooling air inlet (e.g. filter) – motor cooling air outlet – motor temperature sensors and cabling – ambient temperature – inadmissible load cycle – inputs for temperature sensor on SDCS-CON-F	9.01, bit 5	always	2
F507	507 M1OverLoad	**Motor calculated overload:** Wait until the motor is cooled down. The motor fan will continue to work until the motor is calculated down under the alarm level. It is not possible to reset the fault as long as the motor remains too hot. Check: – *M1FaultLimLoad (31.04)* – *M1AlarmLimLoad (31.03)*	9.01, bit 6	always	2
F508	508 I/OBoardLoss	**I/O board not found or faulty:** Check: – *Diagnosis (9.11)* – *Ext IO Status (4.20)* – SDCS-COM-8 – *CommModule (98.02), DIO ExtModule1 (98.03), DIO ExtModule2 (98.04), AIO ExtModule (98.06)*	9.01, bit 7	always	1
F512	512 MainsLowVolt	**Mains low (under-) voltage (AC):** Check: – *PwrLossTrip (30.21), UNetMin1 (30.22), UNetMin2 (30.23), PowrDownTime (30.24)* – if all 3 phases are present: – measure the fuses F100 to F102 on the SDCS-PIN-F) – if the mains voltage is within the set tolerance – if the main contactor closes and opens – if the mains voltage scaling is correct *[NomMainsVolt (99.10)]* – connector X12 and X13 on SDCS-CON-F – connector X12 and X13 on SDCS-PIN-F – check if the field circuit has no short circuit or ground fault – In case the **On** command [*UsedMCW (7.04)* bit 0] is	9.01, bit 11	RdyRun = 1	3

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Fault-word	Fault is active when	Triplevel
		given and the measured mains voltage is too low for more than 500 ms **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set. It the problem persist for more than 10 s **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated.			
F513	513 MainsOvrVolt	**Mains overvoltage (AC):** Actual mains voltage is > 1.3 * *NomMainsVolt (99.10)* for more than 10 s and RdyRun = 1. Check: – if the mains voltage is within the set tolerance – if the mains voltage scaling is correct *[NomMainsVolt (99.10)]* – connector X12 and X13 on SDCS-CON-F – connector X12 and X13 on SDCS-PIN-F	9.01, bit 12	RdyRun = 1	1
F514	514 MainsNotSync	**Mains not in synchronism (AC):** The synchronization with the mains frequency has been lost. Check: – mains supply – fuses etc. – mains frequency (50 Hz ±5 Hz; 60 Hz ±5 Hz) and stability (df/dt = 17 %/s) see *PLLIn (3.20)* at 50 Hz one period == 360° == 20 ms = 20,000 and at 60 Hz one period == 360° == 16.7 ms = 16,6667	9.01, bit 13	RdyRun = 1	3
F515	515 M1FexOverCur	**Field exciter overcurrent:** Check: – in case this fault happens during field exciter autotuning deactivate the supervision by setting *M1FldOvrCurLev (30.13)* = 135 – *M1FldOvrCurLev (30.13)* – parameter settings of group 44 (field excitation: field current controller tuning) – connections of field exciter – insulation of cables and field winding – resistance of field winding	9.01, bit 14	RdyRun = 1	1
F517	517 ArmCurRipple	**Armature current ripple:** One or several thyristors may carry no current. Check: – *CurRippleSel (30.18), CurRippleLim (30.19)* – for too high gain of current controller *[M1KpArmCur (43.06)]* – current feedback with oscilloscope (6 pulses within one cycle visible?) – thyristor gate-cathode resistance – thyristor gate connection	9.02, bit 0	RdyRef = 1	3
F522	522 SpeedFb	**Speed feedback:** The comparison of the speed feedback from pulse encoder or analog tacho has failed. Check: – *M1SpeedFbSel (50.03), SpeedFbFltMode (30.36), SpeedFbFltSel (30.17)*, *EMF FbMonLev (30.15)*, *SpeedFbMonLev (30.14)* – pulse encoder: encoder itself, alignment, cabling, coupling, power supply (feedback might be too low), mechanical disturbances, jumper S4 on SDCS-CON-F	9.02, bit 5	always	3

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Fault-word	Fault is active when	Triplevel
		– analog tacho: tacho itself, tacho polarity and voltage, alignment, cabling, coupling, mechanical disturbances, jumper S1 on SDCS-CON-F – EMF: connection converter - armature circuit closed – SDCS-CON-F			
F523	523 ExtFanAck	**External fan acknowledge missing:** Check: – *MotFanAck (10.06)* – external fan contactor – external fan circuit – external fan supply voltage – used digital inputs and outputs (group 14)	9.02, bit 6	RdyRun = 1	4
F524	524 MainContAck	**Main contactor acknowledge missing:** Check: – *MainContAck (10.21)* – *MainContCtrlMode (21.16)* – switch on - off sequence – auxiliary contactor (relay) switching the main contactor after On/Off command – safety relays – used digital inputs and outputs (group 14)	9.02, bit 7	RdyRun = 1	3
F525	525 TypeCode	**Type code mismatch:** Check: – *TypeCode (97.01)*	9.02, bit 8	always	1
F526	526 ExternalDI	**External fault via binary input:** There is no problem with the drive itself! Check: – *ExtFaultSel (30.31)*	9.02, bit 9	Always or RdyRun = 1	1
F528	528 FieldBusCom	**Fieldbus communication loss:** **F528 FieldBusCom** is only activated after the first data set from the overriding control is received by the drive. Before the first data set is received, only **A128 FieldBusCom** is active. The reason is to suppress unnecessary faults (the start up of the overriding control is usually slower than the one of the drive). Check: – *CommandSel (10.01), ComLossCtrl (30.28), FB TimeOut (30.35), CommModule (98.02)* – parameter settings of group 51 (fieldbus) – fieldbus cable – fieldbus termination – fieldbus adapter	9.02, bit 11	always if *FB TimeOut (30.35)* ≠ 0	5
F531	531 MotorStalled	**Motor stalled:** The motor torque exceeded *StallTorq (30.03)* for a time longer than *StallTime (30.01)* while the speed feedback was below *StallSpeed (30.02)*. Check: – motor stalled (mechanical couplings of the motor) – proper conditions of load – correct field current – parameter settings of group 20 (limits: current and torque limits)	9.02, bit 14	RdyRef = 1	3
F532	532 MotOverSpeed	**Motor overspeed:** Check:	9.02, bit 15	always	3

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Fault-word	Fault is active when	Triplevel
		– *M1OvrSpeed (30.16)* – parameter settings of group 24 (speed control: speed controller) – scaling of speed controller loop *[SpeedScaleAct (2.29)]* – drive speed *[MotSpeed (1.04)]* vs. measured motor speed (hand held tacho) – field current too low – speed feedback (encoder, tacho) – connection of speed feedback – if the motor was accelerated by the load – the armature circuit is open (e.g. DC-fuses, DC-breaker)			
F540	540 COM8Faulty	SDCS-COM-8 faulty: Check: – Change SDCS-COM-8 and / or SDCS-CON-F	9.03, bit 7	RdyOn = 1	1
F541	541 M1FexLowCur	**Field exciter low (under-) current:** Check: – *M1FldMinTrip (30.12) , FldMinTripDly (45.18)* – parameter settings of group 44 (field excitation: field current controller tuning, EMF controller tuning, flux linearization) – motor name plate for minimum current at maximum field weakening (maximum speed) – field circuit fuses – if the field current oscillates – if the motor is not compensated and has a high armature reaction	9.03, bit 8	always	1
F543	543 COM8Com	**SDCS-COM-8 com. loss:** Check: – Change SDCS-COM-8 and / or SDCS-CON-F	9.03, bit 10	RdyOn = 1	5
F546	546 LocalCmdLoss	**Local command loss:** Com. fault with DCS Control Panel, DWL during local mode. Check: – *LocalLossCtrl (30.27)* – if control DCS Control Panel is disconnected – connection adapter – cables	9.03, bit 13	local	5
F547	547 HwFailure	**Hardware failure:** For more details, check *Diagnosis (9.11).*	9.03, bit 14	always	1
F548	548 FwFailure	**Firmware failure:** For more details, check *Diagnosis (9.11)*.	9.03, bit 15	always	1
F549	549 ParComp	**Parameter compatibility:** When downloading parameter sets or during power-up the firmware attempts to write their values. If the setting is not possible or not compatible, the parameter is set to default. The parameters causing the fault can be identified in *Diagnosis (9.11)*. Check: – parameter setting	9.04, bit 0	always	1
F550	550 ParMemRead	**Parameter read:** Reading the actual parameter set or a user parameter set	9.04, bit 1	always	1

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Fault-word	Fault is active when	Triplevel
		from either flash or Memory Card failed (checksum fault). Check: – one or both parameter sets (User1 and / or User2) have not been saved properly - see *ApplMacro (99.08)* – SDCS-CON-F			
F551	551 AIRange	**Analog input range:** Undershoot of one of the analog input values under 4mA / 2V. Check: – *AI Mon4mA (30.29)* – used analog inputs connections and cables – polarity of connection	9.04, bit 2	always	4
F553	553 TachPolarity	**Tacho polarity:** The polarity of the analog tacho respectively pulse encoder [depending on *M1SpeedFbSell (50.03)*] is checked against the EMF. Check: – *EMF FbMonLev (30.15)*, *SpeedFbMonLev (30.14)* – polarity of tacho cable – polarity of pulse encoder cable (e.g. swap channels A and A not) – polarity of armature and field cables – direction of motor rotation	9.04, bit 4	always	3
F554	554 TachoRange	**Tacho range:** Overflow of AITacho input. Check: – for the right connections (X1:1 to X1:4) on the SDCS-CON-F	9.04, bit 5	always	3
F557	557 ReversalTime	**Reversal time:** Current direction not changed before *ZeroCurTimeOut (97.19)* is elapsed. Check: – for high inductive motor – too high motor voltage compared to mains voltage – lower *RevDly (43.14)* if possible and – increase *ZeroCurTimeOut (97.19)*	9.04, bit 8	RdyRef = 1	3
F601	601 APFault1	User defined fault by AP	9.04, bit 11	always	1
F602	602 APFault2	User defined fault by AP	9.04, bit 12	always	1
F603	603 APFault3	User defined fault by AP	9.04, bit 13	always	1
F604	604 APFault4	User defined fault by AP	9.04, bit 14	always	1
F605	605 APFault5	User defined fault by AP	9.04, bit 15	always	1

Alarm signals (A)

An alarm is a message, that a condition occurred, which may lead to a dangerous situation. It is displayed and written into the fault logger. However, the cause for the alarm can inhibit the drive from continuing with normal operation. If the cause of the alarm disappears, the alarm will be automatically reset. The fault logger shows the appearing alarm (A**1**xx) with a plus sign and the disappearing alarm (A**2**xx) with a minus sign. An appearing user defined alarm is indicated as A**3**xx. A disappearing user defined alarm is indicated as A**4**xx. The alarm handling must provides 4 alarm levels.

Alarm level 1:
- the drive keeps on running and the alarm is indicated
- after the drive is stopped, the main contactor cannot be switched on again (no re-start possible)

Alarm level 2:
- the drive keeps on running and the alarm is indicated
- fan contactor stays on as long as the alarm is pending
- if the alarm disappears *FanDly (21.14)* will start

Alarm level 3:
- **AutoReclosing** (auto re-start) is [*AuxStatWord (8.02)* bit 15] active
- **RdyRun** [*MainStatWord (8.01)* bit 1] is disabled, but the drive is automatically restarted when the alarm condition vanishes
- ± is set to 150°
- single firing pulses

Alarm level 4:
the drive keeps on running and the alarm is indicated
In case an alarm occurs, it stays active until the cause is eliminated. Then the alarm will automatically disappear, thus a **Reset** [*UsedMCW (7.04)* bit 7] is not needed and will have no effect.

Alarm name	**Alarm number**		**Alarm name**	**Alarm number**	
	appearing	**disappearing**		**appearing**	**disappearing**
AIRange	A127	A227	MainsLowVolt	A111	A211
ArmCurDev	A114	A214	MotCurReduce	A108	A208
ArmCurRipple	A117	A217			
AutotuneFail	A121	A221	NoAPTaskTime	A136	A236
COM8Com	A113	A213	Off2FieldBus	A138	A238
COM8FwVer	A141	A241	Off2ViaDI	A101	A201
ConvOverTemp	A104	A204	Off3FieldBus	A139	A239
			Off3ViaDI	A102	A202
DC BreakAck	A103	A203			
DynBrakeAck	A105	A205	ParAdded	A131	A231
			ParComp	A134	A234
ExternalDI	A126	A226	ParConflict	A132	A232
			ParRestored	A129	A229
FaultSuppres	A123	A223	ParUpDwnLoad	A135	A235
FieldBusCom	A128	A228			
			RetainInv	A133	A233
IllgFieldBus	A140	A240			
			SpeedFb	A125	A225
LocalCmdLoss	A130	A230	SpeedNotZero	A137	A237
			SpeedScale	A124	A224
M1OverLoad	A107	A207			
M1OverTemp	A106	A206	TachoRange	A115	A215

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Alarm-word	Alarm is active when	Alarmlevel
A101	101 Off2ViaDI	**Off2 (Emergency Off / Coast stop) pending via digital input - start inhibition:** There is no problem with the drive itself! Check: – *Off2 (10.08)*, if necessary invert the signal (group 10)	9.06, bit 0	RdyRun = 1	1
A102	102 Off3ViaDI	**Off3 (E-stop) pending via digital input:** There is no problem with the drive itself! Check: – *E Stop (10.09)*, if necessary invert the signal (group 10)	9.06, bit 1	RdyRun = 1	1
A103	103 DC BreakAck	**DC-Breaker acknowledge missing:** α is set to 150° and single firing pulses are given, thus the drive cannot be started or re-started while the DC-breaker acknowledge is missing. Check: – *DC BreakAck (10.23)*, if necessary invert the signal (group 10)	9.06, bit 2	RdyRun = 1	3
A104	104 ConvOverTemp	**Converter overtemperature:** Wait until the converter is cooled down. Shutdown temperature see *MaxBridgeTemp (4.17).* The converter overtemperature alarm will already appear at approximately 5°C below the shutdown temperature. Check: – *FanDly (21.14)* – converter cover missing – converter fan supply voltage – converter fan direction of rotation – converter fan components – converter cooling air inlet (e.g. filter) – converter cooling air outlet – ambient temperature – inadmissible load cycle – connector X12 on SDCS-CON-F – connector X12 and X22 on SDCS-PIN-F – if *TypeCode (97.01)* and *S MaxBridgeTemp (97.04)* are set properly	9.06, bit 3	always	2
A105	105 DynBrakeAck	**Dynamic braking is still pending:** α is set to 150° and single firing pulses are given. Check: – *DynBrakeAck (10.22)*	9.06, bit 4	RdyRun = 1	3
A106	106 M1OverTemp	**Motor measured overtemperature:** Check: – *M1AlarmLimTemp (31.06)* – motor temperature – motor fan supply voltage – motor fan direction of rotation – motor fan components – motor cooling air inlet (e.g. filter) – motor cooling air outlet – motor temperature sensors and cabling – ambient temperature – inadmissible load cycle – inputs for temperature sensor on SDCS-CON-F	9.06, bit 5	always	2

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Alarm-word	Alarm is active when	Alarmlevel
A107	107 M1OverLoad	**Motor calculated overload:** Check: *M1AlarmLimLoad (31.03)*	9.06, bit 6	always	2
A108	108 MotCurReduce	**Motor current reduced:** Is shown, when the I^2T-function is active and the motor current is reduced. Check: – *M1LoadCurMax (31.10)*, *M1OvrLoadTime (31.11)* and *M1RecoveryTime (31.12)*	9.06, bit 7	always	4
A111	111 MainsLowVolt	**Mains low (under-) voltage (AC):** α is set to 150°; single firing pulses. Check: – *PwrLossTrip (30.21), UNetMin1 (30.22), UNetMin2 (30.23)*, – If all 3 phases are present – if the mains voltage is within the set tolerance – if the main contactor closes and opens – if the mains voltage scaling is correct *[NomMainsVolt (99.10)]* – connector X12 and X13 on SDCS-CON-F – connector X12 and X13 on SDCS-PIN-F – In case the **On** command [*UsedMCW (7.04)* bit 0] is given and the measured mains voltage is too low for more than 500 ms **A111 MainsLowVolt** [*AlarmWord1 (9.06)* bit 10] is set. If the problem persist for more than 10 s **F512 MainsLowVolt** [*FaultWord1 (9.01)* bit 11] is generated.	9.06, bit 10	RdyRun = 1	3
A113	113 COM8Com	**SDCS-COM-8 com. loss:** Check: – Change SDCS-COM-8 and / or SDCS-CON-F	9.06, bit 12	always	4
A114	114 ArmCurDev	**Armature Current Deviation:** Is shown, if the current reference [*CurRefUsed (3.12)*] differs from current actual [*MotCur (1.06)*] for longer than 5 sec by more than 20% of nominal motor current. In other words if the current controller cannot match the given reference, the alarm signal is created. Normally the reason is a too small incoming voltage compared to the motor EMF. Check: – DC fuses blown – ratio between mains voltage and armature voltage (either the mains voltage is too low or the motor's armature voltage is too high) – *ArmAlphaMin (20.15)* is set too high	9.06, bit 13	RdyRef = 1	4
A115	115 TachoRange	**Tacho range:** If **A115 TachoRange** comes up for longer than 10 seconds, there is an overflow of the AITacho input. Check: – for the right connections (X1:1 to X1:4) on the SDCS-CON-F If **A115 TachoRange** comes up for 10 seconds and vanishes again *M1OvrSpeed (30.16)* has been changed. In this case a new tacho fine tuning has to be done [*ServiceMode (99.06)* = **TachFineTune**].	9.06, bit 14	always	4
A117	117	**Armature current ripple:**	9.07,	RdyRef = 1	4

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Alarm-word	Alarm is active when	Alarmlevel
	ArmCurRipple	One or several thyristors may carry no current. Check: – *CurRippleSel (30.18), CurRippleLim (30.19)* – for too high gain of current controller *[M1KpArmCur (43.06)]* – current feedback with oscilloscope (6 pulses within one cycle visible?) – thyristor gate-cathode resistance – thyristor gate connection	bit 0		
A121	121 AutotuneFail	**Autotuning failed:** For more details, check *Diagnosis (9.11)*. To clear the alarm set *ServiceMode (99.06)* = **NormalMode** or *WinderTuning (61.21)* = **NotUsed**	9.07, bit 4	always	4
A123	123 FaultSuppres	**Fault suppressed:** At least one fault message is currently active and suppressed.	9.07, bit 6	always	4
A124	124 SpeedScale	**Speed scaling out of range:** The parameters causing the alarm can be identified in *Diagnosis (9.11)*. α is set to 150°; single firing pulses. Check: – *M1SpeedMin (20.01), M1SpeedMax (20.02), M1SpeedScale (50.01), M1BaseSpeed (99.04)*	9.07, bit 7	always	3
A125	125 SpeedFb	**Speed feedback:** The comparison of the speed feedback from pulse encoder or analog tacho has failed. Check: – *M1SpeedFbSel (50.03), SpeedFbFltMode (30.36), SpeedFbFltSel (30.17)*, *EMF FbMonLev (30.15)*, *SpeedFbMonLev (30.14)* – pulse encoder: encoder itself, alignment, cabling, coupling, power supply (feedback might be too low), mechanical disturbances jumper S4 on SDCS-CON-F – analog tacho: tacho itself, tacho polarity and voltage, alignment, cabling, coupling, mechanical disturbances, jumper S1 on SDCS-CON-F – EMF: connection converter - armature circuit closed – SDCS-CON-F	9.07, bit 8	always	4
A126	126 ExternalDI	**External alarm via binary input:** There is no problem with the drive itself! Check: – *ExtAlarmSel (30.32)*, alarm = 0, ExtAlarmOnSel *(30.34)*	9.07, bit 9	always	4
A127	127 AIRange	**Analog input range:** Undershoot of one of the analog input values under 4mA / 2V. Check: – *AI Mon4mA (30.29)* – used analog inputs connections and cables – polarity of connection	9.07, bit 10	always	4
A128	128 FieldBusCom	**Fieldbus communication loss:** **F528 FieldBusCom** is only activated after the first data set from the overriding control is received by the drive. Before the first data set is received, only **A128 FieldBusCom** is active. The reason is to suppress unnecessary faults (the start up of the overriding control is	9.07, bit 11	always if *FB TimeOut (30.35)* $\neq$ 0	4

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Alarm-word	Alarm is active when	Alarmlevel
		usually slower than the one of the drive). Check: – *ComLossCtrl (30.28), FB TimeOut (30.35), CommModule (98.02)* – parameter settings of group 51 (fieldbus) – fieldbus cable – fieldbus termination – fieldbus adapter			
A129	129 ParRestored	**Parameter restored:** The parameters found in the flash were invalid at power-up (checksum fault). All parameters were restored from the parameter backup.	9.07, bit 12	always	4
A130	130 LocalCmdLoss	**Local command loss:** Connection fault with DCS Control Panel or DWL. Check: – *LocalLossCtrl (30.27)* – if control DCS Control Panel is disconnected – connection adapter – cables	9.07, bit 13	local	4
A131	131 ParAdded	**Parameter added:** A new firmware with a different amount of parameters was downloaded. The new parameters are set to their default values. The parameters causing the alarm can be identified in *Diagnosis (9.11)*. Check: – new parameters and set them to the desired values	9.07, bit 14	after download of firmware for max. 10 s	4
A132	132 ParConflict	**Parameter setting conflict:** Is triggered by parameter settings conflicting with other parameters. The parameters causing the alarm can be identified in *Diagnosis (9.11)*.	9.07, bit 15	always	4
A133	133 RetainInv	**Retain data invalid:** Set when the retain data in the flash are invalid during power-up. In this case, the backup data are used. **Note:** The backup of the lost retain data reflects the status at the previous power-up. Examples for retain data are: – fault logger data, – *Data1 (19.01)* to *Data4 (19.04)* and – I/O options (see group 98) The situation of invalid retain data occurs, if the auxiliary voltage of the DCS550 is switched off about 2 seconds after power-up (while the retain data sector is being rearranged). Check: – if the flash of the SDCS-CON-F is defective and – if the auxiliary power supply has a problem	9.08, bit 0	directly after energizing of electronics for max. 10 s	4
A134	134 ParComp	**Parameter compatibility:** When downloading parameter sets or during power-up the firmware attempts to write the parameters. If the setting is not possible or not compatible, the parameter is set to default. The parameters causing the alarm can be identified in *Diagnosis (9.11)*. Check: – parameter setting	9.08, bit 1	after download of a parameter set for max. 10 s	4
A135	135	**Parameter up- or download failed:**	9.08,	after up- or	4

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Alarm-word	Alarm is active when	Alarmlevel
	ParUpDwnLoad	The checksum verification failed during up- or download of parameters. Please try again. Two or more parameter set actions were requested at the same time. Please try again.	bit 2	download of parameters for max. 10 s	
A136	136 NoAPTaskTime	**AP task time not set:** AP task time is not set, while AP is started. Check: – that *TimeLevSel (83.04)* is set to **5 ms, 20 ms, 100 ms** or **500 ms** when *AdapProgCmd (83.01)* is set to **Start**, **SingleCycle** or **SingleStep**	9.08, bit 3	always	4
A137	137 SpeedNotZero	**Speed not zero:** Re-start of drive is not possible. Speed zero [see *M1ZeroSpeedLim (20.03)*] has not been reached. In case of an alarm set **On** = **Run** = 0 and check if the actual speed is within the zero speed limit. This alarm is valid for: – normal stop, **Off1N** [UsedMCW (7.04) bit 0], – Coast Stop, **Off2N** [UsedMCW (7.04) bit 1], – E-stop, **Off3N** [UsedMCW (7.04) bit 2] and – if the drive is de-energized and then re-energized. Check: – *M1ZeroSpeedLim (20.03)* – *M1SpeedFbSel (50.03)* – for proper function of the used speed feedback devices (analog tacho / encoder)	9.08, bit 4	Not active if RdyRef = 1	1
A138	138 Off2FieldBus	**Off2 (Emergency Off / Coast Stop) pending via** *MainCtrlWord (7.01)* **/ fieldbus - start inhibition:** There is no problem with the drive itself! Check: – *MainCtrlWord (7.01)* bit1 Off2N	9.08, bit 5	RdyRun = 1	1
A139	139 Off3FieldBus	**Off3 (E-stop) pending via** *MainCtrlWord (7.01)* **/ fieldbus:** There is no problem with the drive itself! Check: – *MainCtrlWord (7.01)* bit2 Off3N	9.08, bit 6	RdyRun = 1	1
A140	140 IllgFieldBus	**Illegal fieldbus settings:** The fieldbus parameters in group 51 (fieldbus) are not set according to the fieldbus adapter or the device has not been selected. Check: – group 51 (fieldbus) – configuration of fieldbus adapter	9.08, bit 7	always	4
A141	141 COM8FwVer	**SDCS-COM-8 firmware version conflict:** Invalid combination of SDCS-CON-F firmware and SDCS-COM-8 firmware. Check: – for valid combination of SDCS-CON-F [*FirmwareVer (4.01)*] and SDCS-COM-8 [*Com8SwVersion (4.11)*] firmware version according to the release notes	9.08, bit 8	always	4
A2xx	2xx <alarm name>	Disappearing system alarm	-	-	
A301	301 APAlarm1	User defined alarm by AP	9.08, bit 11	always	4
A302	302 APAlarm2	User defined alarm by AP	9.08, bit 12	always	4
A303	303 APAlarm3	User defined alarm by AP	9.08,	always	4

7-segment display	Text on DCS Control Panel and DWL	Definition / Action	Alarm-word	Alarm is active when	Alarmlevel
			bit 13		
A304	304 APAlarm4	User defined alarm by AP	9.08, bit 14	always	4
A305	305 APAlarm5	User defined alarm by AP	9.08, bit 15	always	4
A4xx	4xx UserAlarmxx	Disappearing user alarm	-	-	

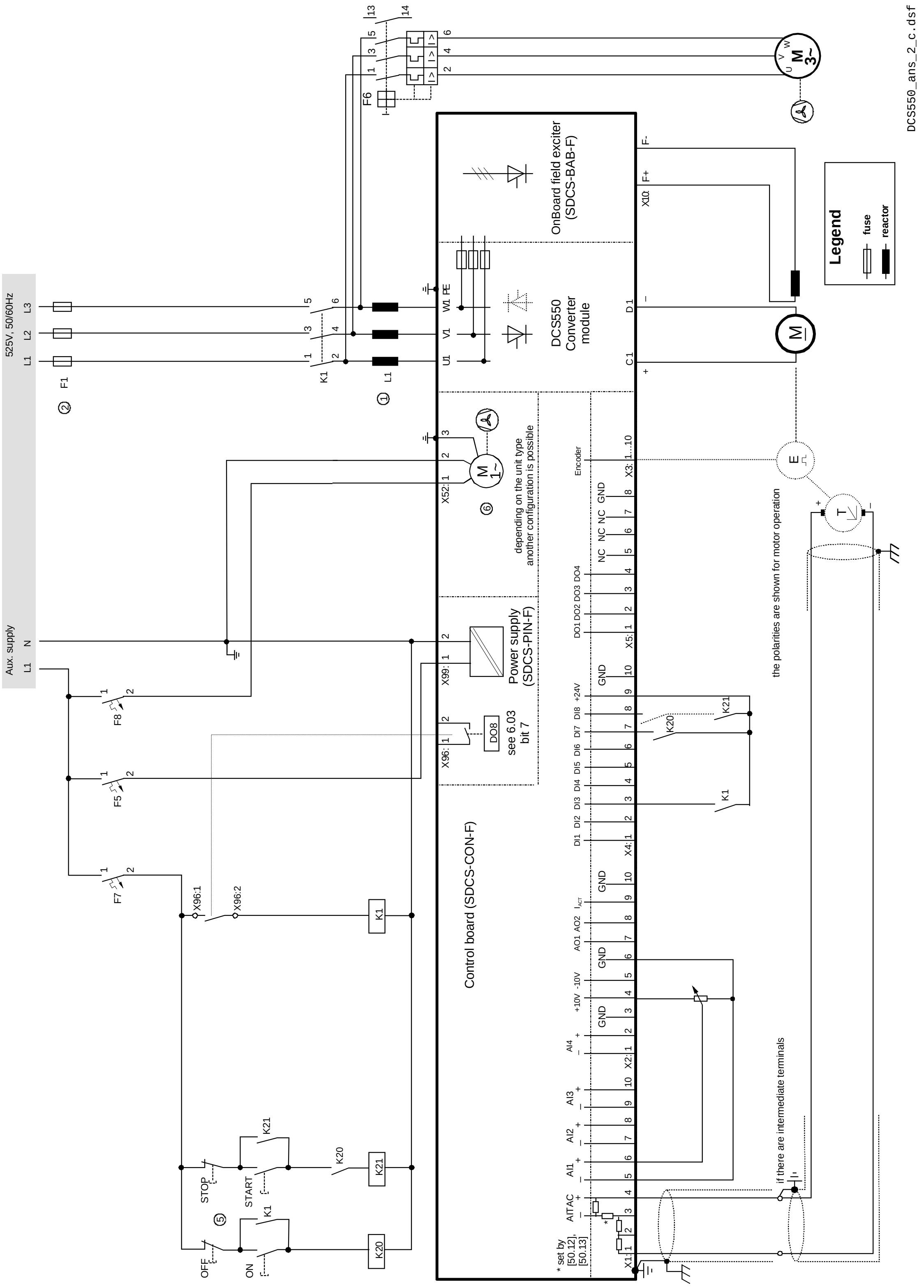
Notices

A notice is a message to inform the user about a specific occurrence which happened to the drive.

Text on DCS Control Panel	Definition / Action
718 PowerUp	**Energize electronics:** The auxiliary voltage for the drives electronics is switched on
719 FaultReset	**Reset:** Reset of all faults which can be acknowledged
801 APNotice1	**User defined notice by AP**
802 APNotice2	**User defined notice by AP**
803 APNotice3	**User defined notice by AP**
804 APNotice4	**User defined notice by AP**
805 APNotice5	**User defined notice by AP**
ParNoCyc	**Cyclic parameters:** A non-cyclical parameter is written to (e.g. the overriding control writes cyclical on a non-cyclical parameter). The parameters causing the notice can be identified in *Diagnosis (9.11)*.
PrgInvMode	**AP not in Edit mode:** Push or Delete action while AP is not in Edit mode. Check: – *EditCmd (83.02)* – *AdapProgCmd (83.01)*
PrgFault	**AP faulty:** AP faulty. Check: – *FaultedPar (84.02)*
PrgProtected	**AP protected:** AP is protected by password and cannot be edited. Check: – *PassCode (83.05)*
PrgPassword	**AP wrong password:** Wrong password is used to unlock AP, Check: – *PassCode (83.05)*
FB found	**R-type fieldbus adapter found:** R-type fieldbus adapter found
Modbus found	**R-type Modbus adapter found:** R-type Modbus adapter found
COM8 found	**SDCS-COM-8 found:** Communication board SDCS-COM-8 found
AIO found	**Analog extension module found:** Analog extension module found
DIO found	**Digital extension module found:** Digital extension module found
Drive not responding	**Drive not responding:** The communication between drive and DCS Control Panel was not established or was interrupted. Check: – Change the DCS Control Panel – Change the cable / connector which is used to connect the DCS Control Panel to the SDCS-CON-F – Change the SDCS-CON-F – Change the SDCS-PIN-F

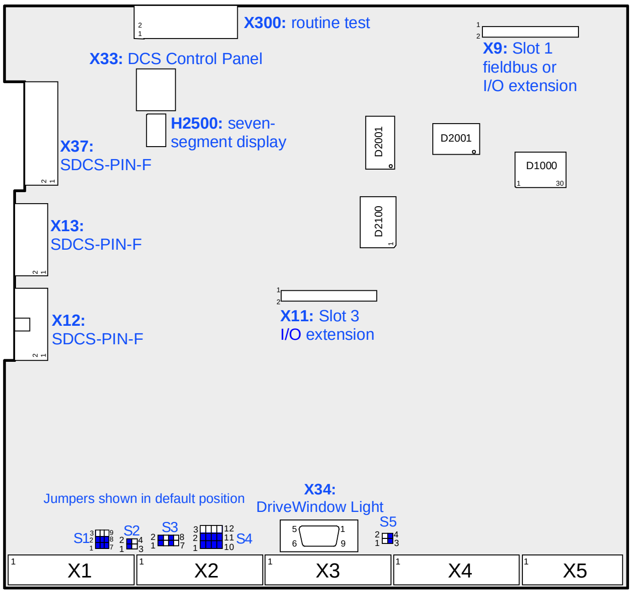
Appendix A: Quick start-up diagrams

Drive configuration with reduced components



Terminal locations

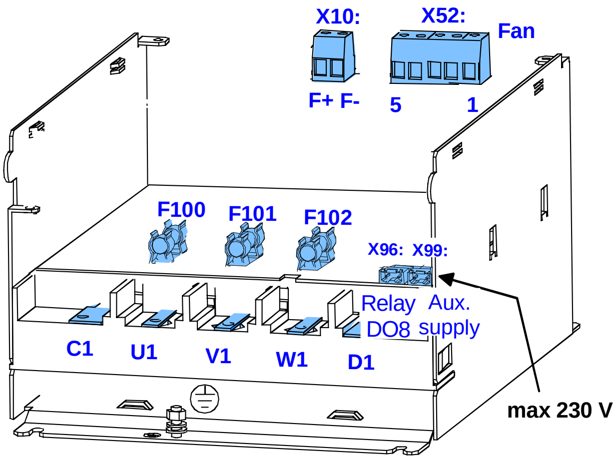
SDCS-CON-F connector allocation



DCS550 module

Terminal allocation

F2 / F3 135 A - 520 A	F4 610 A - 1000 A
Fan supply 230 V_{AC} X52: 5 4 3 2 1	Fan supply 230 V_{AC} X52: 5 4 3 2 1
Fan supply 115 V_{AC} X52: 5 4 3 2 1	

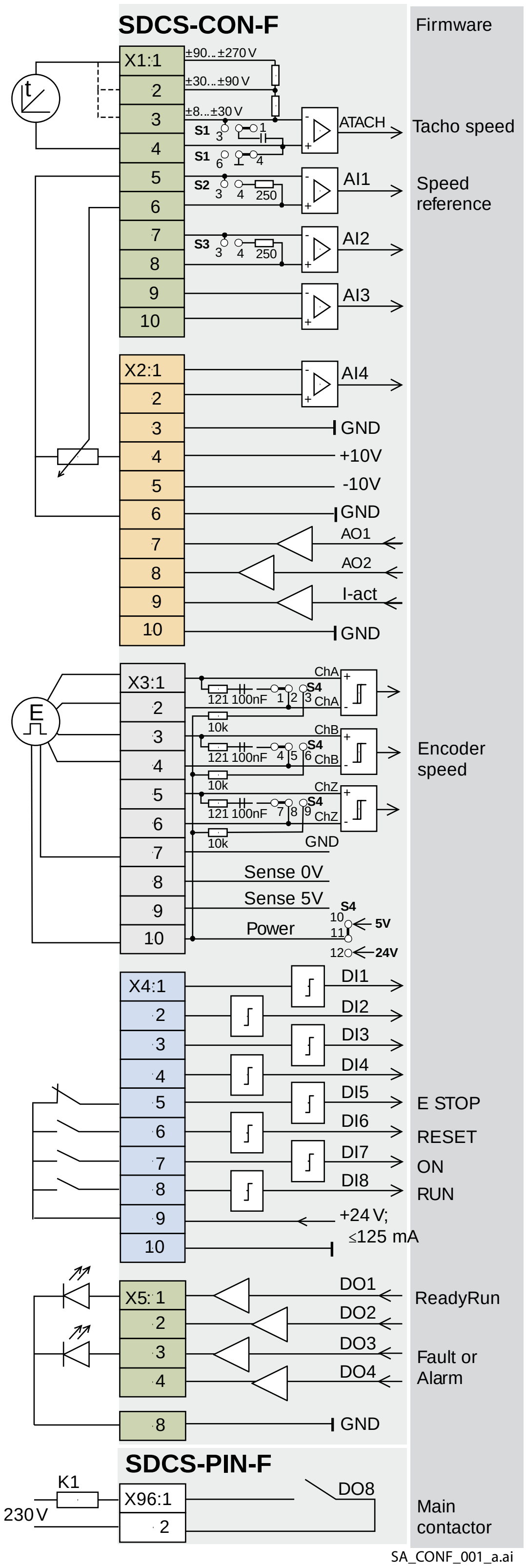


SDCS-CON-F: Terminal allocation

Terminal	1	2	3	4	5	6	7	8	9	10
X1 Tacho and AI	±90…±270V	±30…±90V	±8…±30V	AITAC+	AI1-	AI1+	AI2-	AI2+	AI3-	AI3+
X2 AI and AO	AI4-	AI4+	GND	+10V	-10V	GND	AO1	AO2	I_{act}	GND
X3 Encoder	Ch. A+	Ch. A-	Ch. B+	Ch. B-	Ch. Z+	Ch. Z-	GND	Sense GND	Sense +5V	+5V or +24V
X4 DI	DI1	DI2	DI3	DI4	DI5	DI6	DI7	DI8	+24	GND
X5 DO	DO1	DO2	DO3	DO4	NC	NC	NC	GND		

F100, F101, F102	KTK 25
F401, F402, F403	KTK 30

I/O connections



Resolution [bit]	In- / output values hardware	Scaling by	Common mode range	Remarks
15 + sign	±90 V, ..., 270 V ±30 V, ..., 90 V ±8 V, ..., 30 V	Firmware	±15 V	
15 + sign	±10	Firmware	±15 V	
15 + sign	±10	Firmware	±15 V	
15 + sign	±10	Firmware	±15 V	
15 + sign	±10	Firmware	±15V	

			Power	
	+10 V		d 5 mA	
	-10 V		d 5 mA	
11 + sign	±10	Firmware	d 5 mA	
11 + sign	±10	Firmware	d 5 mA	
	±10	Firmware, Hardware	d 5 mA	8 V ⇒ min. of 325% of (99.03) or 230% of (4.05)

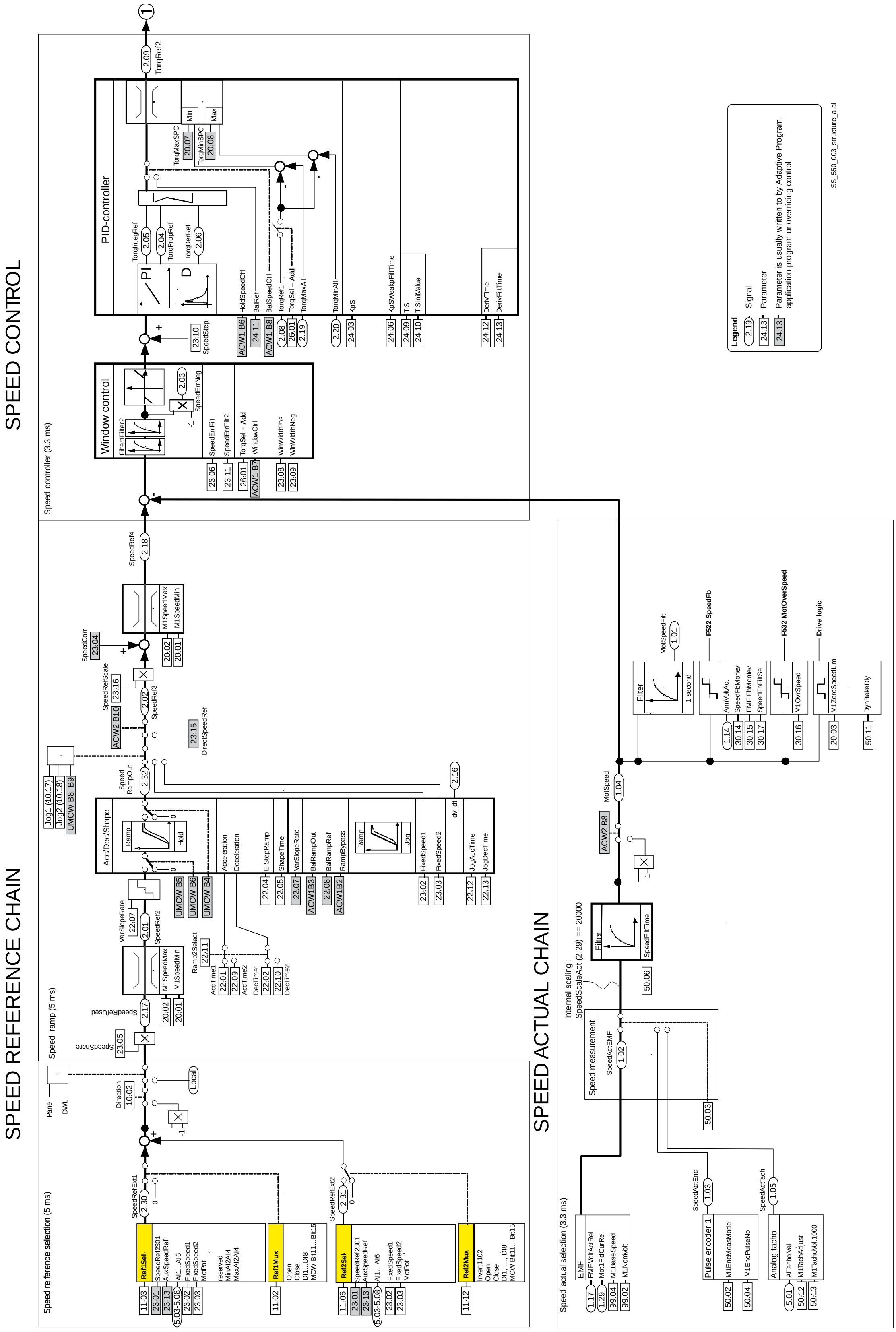
Encoder supply		Remarks
		Inputs are not isolated Impedance = 120 ©, if selected maximum frequency ≤ 300 kHz
5 V 24 V	□≤ 250 mA ≤ 200 mA	Sense lines for GND and supply to correct voltage drops on cable (only available for 5 V encoders)

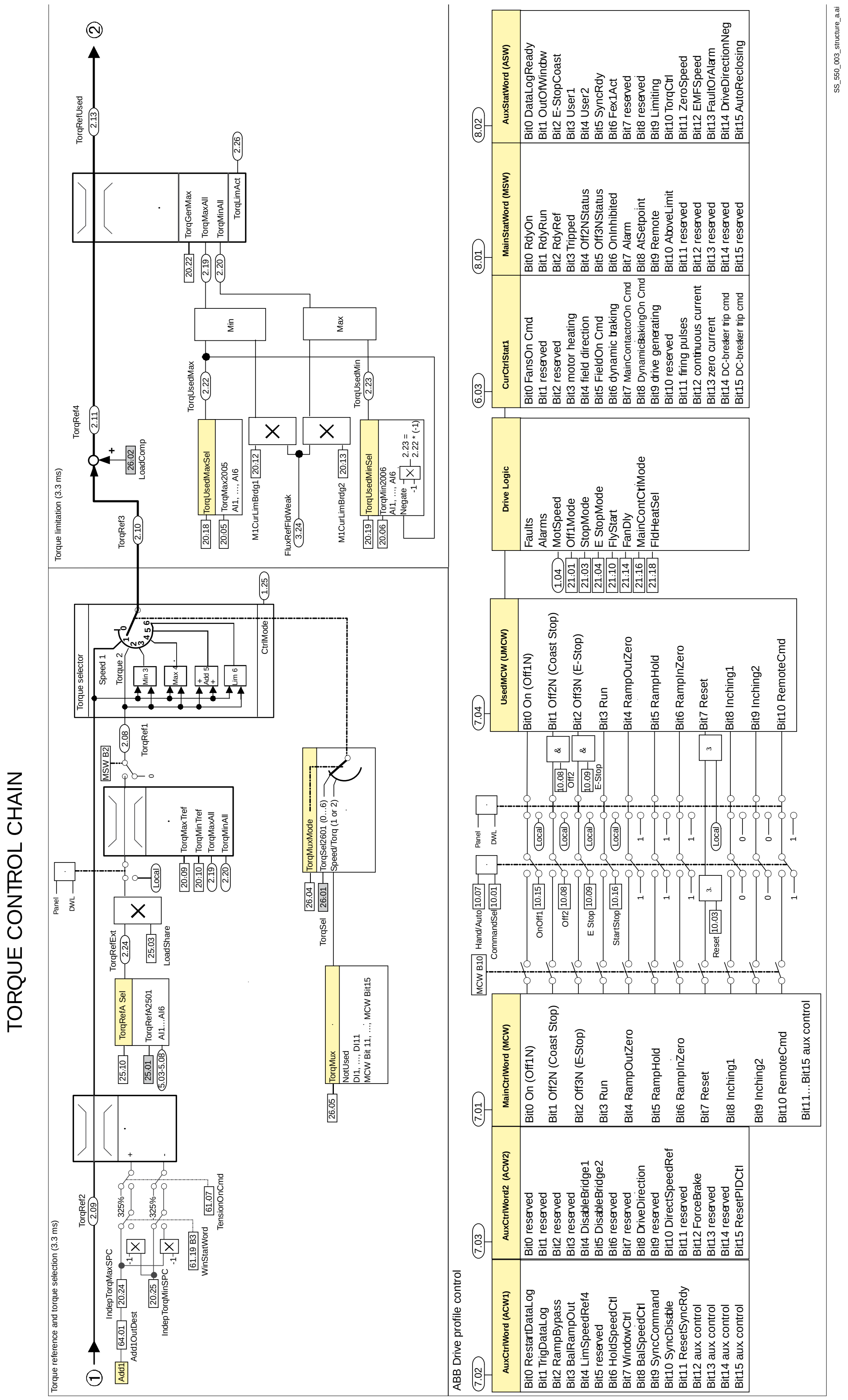
Input	Signal definition	Remarks
0...7.3 V 7.5...50 V	Firmware	⇒ “0“ status ⇒ “1“ status

Output	Signal definition	Remarks
50* mA; 22 V at no load	Firmware	Current limit for all 7 outputs together is maximum160 mA. Do not apply any reverse voltages!

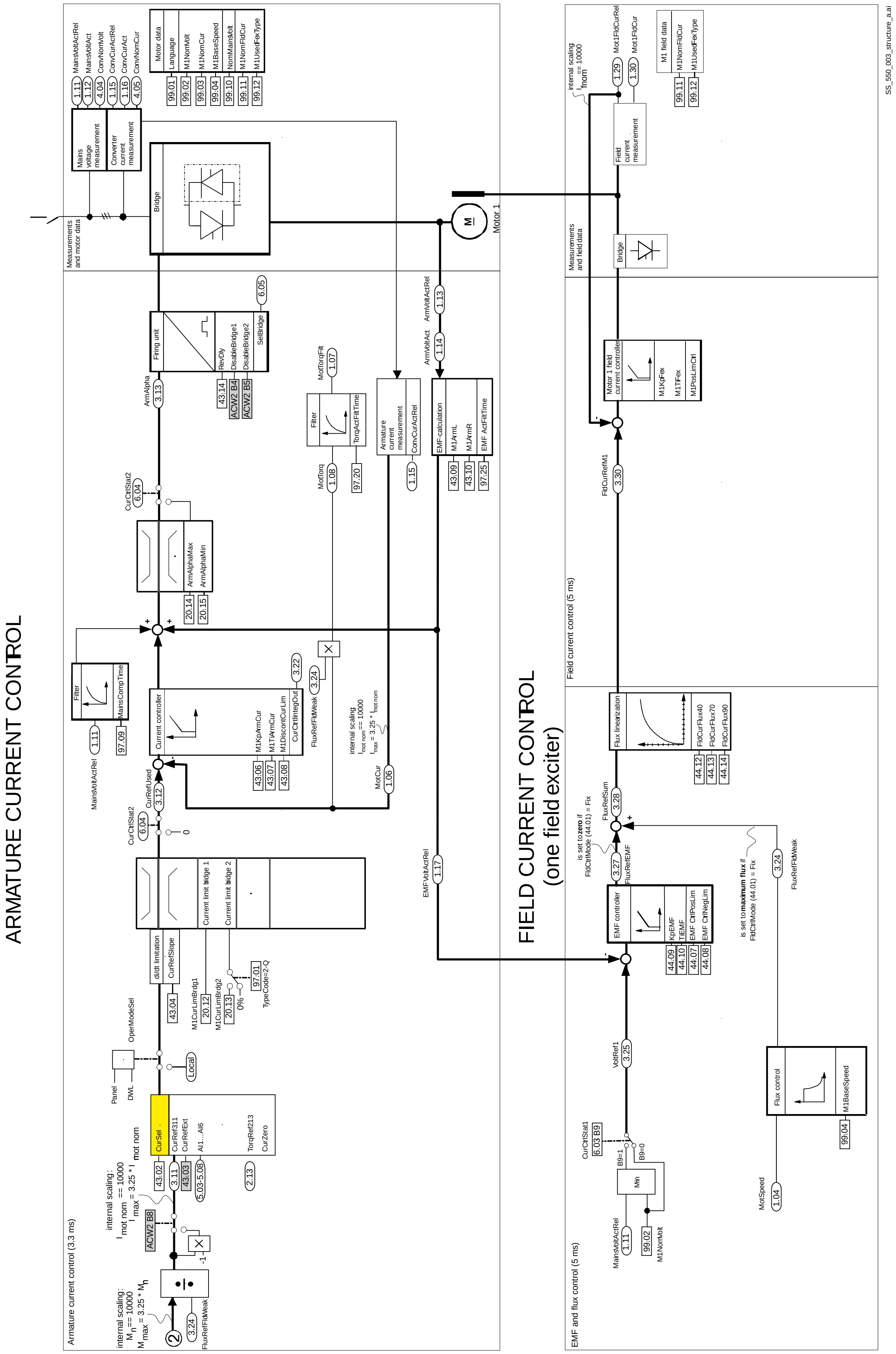
* short circuit protected

Appendix B: Firmware structure diagrams

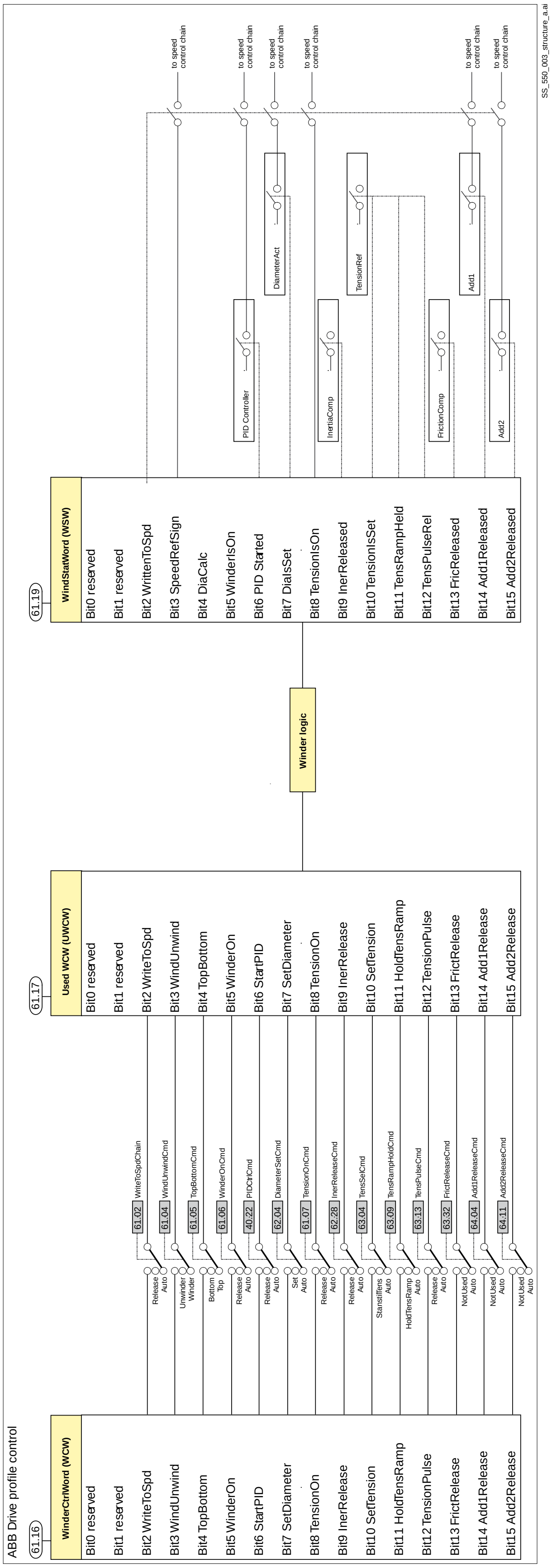




Appendix B: Firmware structure diagrams


ARMATURE CURRENT CONTROL
Armature current control (3.3 ms)
Measurements and motor data
Motor data
Mains voltage measurement
Converter current measurement
Bridge
Firing unit
Current controller
Armature current measurement
EMF-calculation
Filter
Motor 1
FIELD CURRENT CONTROL
(one field exciter)
EMF and flux control (5 ms)
Field current control (5 ms)
Measurements and field data
M1 field data
Field current measurement
Motor 1 field current controller
Flux linearization
EMF controller
Flux control
SS_550_003_structure_a.ai

Winder



Appendix B: Firmware structure diagrams

Appendix C: Index of signals and parameters

Index of signals and parameters (alphabetic order)

DCS family

DCS550-S modules
The **compact** drive for
machinery application

20 … 1,000 A_{DC}
0 … 610 V_{DC}
230 … 525 V_{AC}
IP00

- Compact
- Robust design
- Adaptive and winder program
- High field exciter current

DCS800-S modules
The versatile drive for
processindustry

20 … 5,200 A_{DC}
0 … 1,160 V_{DC}
230 … 1,000 V_{AC}
IP00

- Compact
- Highest power ability
- Simple operation
- Comfortable assistants, e.g. for commissioning or fault tracing
- Scalable to all applications
- Free programmable by means of integrated IEC61131-PLC

DCS800-A enclosed
converters
Complete drive solutions

20 … 20,000 A_{DC}
0 … 1,500 V_{DC}
230 … 1,200 V_{AC}
IP21 – IP54

- Individually adaptable to customer requirements
- User-defined accessories like external PLC or automation systems can be included
- High power solutions in 6- and 12-pulse up to 20,000 A, 1,500 V
- In accordance to usual standards
- Individually factory load tested
- Detailed documentation

DCS800-E series
Pre-assembled drive-kits

20 … 2,000 A_{DC}
0 … 700 V_{DC}
230 … 600 V_{AC}
IP00

- DCS800 module with all necessary accessories mounted and fully cabled on a panel
- Very fast installation and commissioning
- Squeezes shut-down-times in revamp projects to a minimum
- Fits into Rittal cabinets
- Compact version up to 450 A and Vario version up to 2,000 A

DCS800-R Rebuild Kit
Digital control-kit for
existing powerstacks

20 … 20,000 A_{DC}
0 … 1,160 V_{DC}
230 … 1,200 V_{AC}
IP00

- Proven long life components are re-used, such as power stacks, (main) contactors, cabinets and cabling / busbars, cooling systems
- Use of up-to-date communication facilities
- Increase of production and quality
- Very cost-effective solution
- Open Rebuild Kits for nearly all existing DC drives
- tailor-made solutions for…
  - BBC PxD
  - BBC SZxD
  - ASEA Tyrak
  - other manufacturers

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