G5 flow computer products
μFLO^{G5} (microFLO^{G5})

Accurate, reliable, and with the capability to measure and monitor gas flow in compliance with AGA, API, and ISO standards

ABB

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Typographical conventions

Element	Convention	Example
Cross-reference to a figure or table in the document	Hyperlink the figure or table label and number. If the figure or table is not immediately following the cross-reference, add the page number where it is located.	See Figure 2 or See Table 3 (page 12).
Cross-reference to a specific section in the document	Hyperlink both the section number and title, with the section title in italics	Go to section 2.1, *Device setup*.
Greater than character (>)	Indicates that the following item is an additional menu selection.	Use the key pad to locate and select **Calibrate** > **Diff. Press. Sensor** > **Calibration Units** > **Edit**.
Menu item names in instructions	Bold text, and the capitalization of names agrees with the names as displayed on the HMI menu.	Use the right soft key to enter the **Main Menu**.
Programs, including utility and accessory programs	Title capitalization	Microsoft Word
URL	All lowercase for a fully specified URL. If necessary, break long URLs before a forward slash or break a long URL before it begins	http://www.microsoft.com/ seattle.sidewalk.com
User input	Lowercase, unless case sensitive. Bold or italic, depending on element. If the user input string contains placeholder text, use italics for that text.	Type **Name tag**

Cyber security

This product is designed to be connected, and communicate information and data, via a network interface, which should be connected to a secure network. It is the customer's sole responsibility to provide and continuously ensure a secure connection between the product and the customer network or any other network (as the case may be). The customer shall establish and maintain appropriate measures (such as, but not limited to, the installation of firewalls, application of authentication measures, encryption of data, installation of antivirus programs, etc.) to protect this product, the network, its system and interfaces against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB Inc. and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Although ABB provides functionality testing on the products and updates that it releases, the customer should institute its own testing program for any product updates or other major system updates (to include, but not limited to, code changes, configuration file changes, third party software updates or patches, hardware change out, etc.) to ensure that the security measures that the customer has implemented have not been compromised and that system functionality in the customer's environment is as expected.

Additional publications

Additional free publications for the *µ*FLO^{G5} are available for download at www.abb.com/totalflow

*µ*FLO^{G5} flow computer startup guide	2105513
*µ*FLO^{G5} component replacement application guide	2105514
*µ*FLO^{G5} upgrade kit	2105515
*µ*FLO^{G5} flow computer data sheet	2102800
*µ*FLO^{G5} (2104939 BD) wiring guide	2105507
*µ*FLO^{G5} enclosure measurements	2105508
*µ*FLO^{G5} I/O expansion board (2104395 BD) installation and wiring guide	2105506
*µ*FLO^{G5} (2104939 BD) solar panel connection	2105509
NRTL/C (Class 1, Div 2) 60 °C	2015246
NRTL/C (Class 1, Div 2) 70 °C	2104615
ATEX Cert, EX II 3G, Ex nA IIB (Zone 2)	2104152
IECEx Cert, Ex nA IIB (Zone 2)	2100750

1 Health and safety

1.1 General information and notes for the reader

Read these instructions carefully prior to installation and commissioning. For reasons of clarity, these instructions do not contain all details about every type or version of the product, and therefore, do not take into account every conceivable assembly, operating, or maintenance scenario. For further information, or if specific problems arise which are not addressed in the instructions, please ask the manufacturer. The content of these instructions is neither part of, nor provided for changing a previous or existing agreement, promise, or legal relationship. All obligations to ABB result from the respective sales contract, which also contains the full and solely valid warranty clauses. These are neither limited to, nor extended by the content of these instructions.

Observe warning signs on the packaging and on the device.

1.2 Safety, warning, and note symbols

DANGER – Serious damage to health / risk to life. This symbol, in conjunction with the signal word "DANGER", indicates an imminent danger. Failure to observe this safety information will result in death or severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.

DANGER – Serious damage to health / risk to life. This symbol, in conjunction with the signal word "DANGER", indicates an imminent electrical hazard. Failure to observe this safety information will result in death or severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.

WARNING – Bodily injury. This symbol, in conjunction with the signal word "WARNING", indicates a potentially dangerous situation. Failure to observe this safety information may result in severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.

WARNING – Bodily injury. This symbol, in conjunction with the signal word "WARNING", indicates a potential electrical hazard. Failure to observe this safety information may result in death or severe injury. The text may state the hazard, how to avoid the hazard, and what the result would be if not followed.

CAUTION – Minor injuries. This symbol, in conjunction with the signal word "CAUTION", indicates a potentially dangerous situation. Failure to observe this safety information may result in minor or moderate injury.

NOTICE – Property damage. This symbol indicates a potentially damaging situation. Failure to observe this safety information may result in damage to or destruction of the product and / or other system components.

IMPORTANT NOTE: This symbol indicates operator tips, particularly useful information, or important information about the product or its further uses. The signal word "IMPORTANT NOTE" does not indicate a dangerous or harmful situation.

Although "WARNING" hazards are related to personal injury and "NOTICE" hazards are associated with equipment or property damage, it must be understood that under certain operating conditions, operating damaged equipment can result in degraded system / process performance leading to serious or life-threatening injuries. Therefore, compliance with all "WARNING" or "NOTICE" hazards is required at all times.

Only qualified and authorized specialists are to be employed for the assembly, electrical connection, commissioning, and maintenance of the transmitter. Qualified specialists have the appropriate experience for such work, for example:

— Training, instruction, and authorization to operate and maintain devices or systems according to safety engineering standards for electrical circuits, high pressures, and corrosive media

— Training or instruction in accordance with safety engineering standards regarding the maintenance and use of adequate safety systems

WARNING – Bodily injury. For electrical connections, use sufficiently insulated tools, according to the EN 60900 standard.

Follow the applicable standards, regulations, and recommendations for installation, including:

— The construction and operation of electrical installations. For example, the regulation for technical working materials (safety guidelines for tools)

— Explosion protection, if transmitters with explosion protection are installed

The device can be operated at high levels of pressure and with corrosive media. Serious injury and/or considerable material damage can result if the transmitter is handled incorrectly. Ensure compliance with the regulations applicable in the country of use when working with transmitters.

1.3   Potential safety hazards

The μFLO^{G5} equipment operates on 9 - 30 Vdc. However, optional equipment may convert power from Vac to Vdc. No hazardous voltages are present.

Pressurized natural gas is present in the measurement pipeline. Because of this, a possibility exists for natural gas to escape from the pipeline or tubing during installation or calibration, or following damage to the pipeline or tubing. Only properly trained and authorized personnel should work in hazardous locations.

2 Compliance

EU Directive 2012/19/EU - Waste Electrical and Electronic Equipment (WEEE)

ABB Industrial Automation, Measurement and Analytics, is committed to actively protecting the environment. Do not dispose of WEEE as unsorted municipal waste. Collect WEEE separately. Participation in the management of WEEE is critical to the success of WEEE collection.

Electrical and electronic equipment marked using the crossed-out wheeled bin symbol shall not be mixed with general household waste. Correct disposal at a recycling facility will help save valuable resources and prevent potential negative effects on health and the environment. These steps ensure compliance with the Waste Electrical and Electronic Equipment (WEEE) Directive.

Waste electrical and electronic equipment (WEEE) shall be treated separately using the national collection framework available to customers for the return, recycling, and treatment of WEEE.

3 System description

The ABB Totalflow® *µ*FLO^G5 flow computer is extremely accurate and reliable with the capability to measure and monitor gas flow in accordance with AGA, API, and ISO standards.

The *µ*FLO^G5 is a low power, microprocessor-based unit designed to meet a wide range of measurement, monitor and alarming applications for remote gas systems. The flow computer may be powered by an internal battery using a solar panel or other suitable Vdc supply for charging or by an external 9 to 30 Vdc approved power supply.

The *µ*FLO^G5 is a versatile product for Div 2 and general purpose custody measurement projects. Two versions of the integrated multi-variable sensor (IMV) are available: one with differential pressure, static pressure, and temperature for DP measurement applications, and one with static pressure and temperature for linear measurement applications.

Multi-tube capability is available in each unit and is easily invoked with a few configuration changes and an interface connection to external transducers, either digital or analog.

The symbol *µ* stands for the Greek word meaning micro or mu. The letters FLO are an abbreviation of the word 'flow' and G5 represents the 5th generation of Totalflow flow computers.

3.1 User interface software: PCCU32

PCCU32 software is required for initial and advanced setup of the flow computer. Running in a PC Windows® environment, it offers the most capabilities for programming the *µ*FLO^G5. In addition to setup, it is also used to calibrate, configure, and collect data. The Windows environment features user-friendly help files and easy-to-follow menus.

> **i**
>
> **IMPORTANT NOTE:** For full feature support in the *µ*FLO^G5, including loading of new flashes, PCCU32 version 7.58 (or newer) is required. Earlier versions of PCCU32 may be used for basic operations such as calibration and collection of data records.

Minimum computer system requirements include a Pentium IV processor or newer, 3 GB memory, 1 GB program storage, USB or Serial port (9 pin), and a Windows® operating system. PCCU32 features include:

— Local interface to all ABB Totalflow products

— Data graphing and reporting

— Trending and historical files

— Diagnostics and troubleshooting

— Real-time status monitoring

If configured with the USB option, the PC connects via the cable directly to the connector on the side of the *µ*FLO^G5. Once this physical connection has been made, the user may begin communicating through the software.

PCCU32 offers three (3) viewing mode levels: Basic, Advanced, and Expert. Basic and Advanced modes are for viewing and changing functionality based on limits. Expert mode should only be used by very experienced and trained personnel. These mode levels are also tied to meter security and role assignments. Information regarding setting up security can be found in section 6.3, *Security systems*, on page 67.

3.2 Embedded device software

The *µ*FLO^G5 software platform uses object-oriented design principles. These principles keep the software stable, flexible, and modularized. Software applications, or objects, may be turned on to enable additional functionality, or disabled to reduce the allocation of resources. Basic applications are enabled from the factory depending upon the measurement standard requested.

The following standards are available:

— Flow and energy calculations per AGA3-85, AGA3-92, AGA3-2012, AGA-7, AGA-5, ISO 5167, API 11.1, API 11.2.2, API 11.2.4 and API 11.4.1

— The latest version of API 21.1 and API 21.2 standards for custody measurement devices

— Flow computer requirements as stated in AGA Report No. 9, "Measurement of Gas by Multi-path Ultrasonic Meters"

— Super compressibility calculations per NX-19, AGA8-92 gross or detail, ISO 12213

Data retention is user-configurable (may be limited by file space on the device) and defaults are set to:

— 40 days of hourly log period data records

— 50 days of daily data records

— 200 event registers

3.2.1 Functionality

Functions of the *µ*FLO^{G5} reflect a design that is practical, straightforward and efficient. This functionality allows for saving time that is usually spent on calculations and report preparation. The *µ*FLO^{G5} allows the user to perform the following with a minimum of effort, maximum speed and greater accuracy.

3.2.1.1 AGA3 measurement

All log period flow and operational records that are reported hourly (default), including:

— Average static pressure

— Average differential pressure

— Average flowing temperature

— Integral flow rate

— Corrected volume total

— Corrected energy total

— Operating status and alarms

— Flow time

All daily flow records, including:

— Average static pressure

— Average differential pressure

— Average flowing temperature

— Average integral flow rate

— Corrected volume total

— Corrected energy total

— Operating status and alarms

All daily operation statistics, including:

— Percent flowing time

— Percent back flow time

— Percent out of limits (programmable) on SP, DP, Tf and flow rate

— Minimum and maximum values for SP, DP, Tf and flow rate

3.2.1.2 AGA7 measurement

All log period flow and operational records that are reported hourly (default), including:

— Average counts

— Average static pressure

— Average flowing temperature

— Uncorrected volume total

— Corrected volume total

— Corrected energy total

— Operating status and alarms

— Flow time

All daily flow records, including:

— Average total counts

— Average static pressure

— Average flowing temperature

— Average uncorrected volume

— Corrected volume total

— Corrected energy total

— Operating status and alarms

All daily operation statistics

— Percent flowing time

— Percent (low/high) uncorrected volume

— Percent out-of-limits (programmable) on SP, Tf and flow rate

— Minimum and maximum values for SP, Tf and flow rate

3.2.2   Calculation methods

The records and statistics generated are based on the following calculation methods of the μFLO^{G5}:

— Calculation of flow rates and volumes is in accordance with AGA3-85, AGA3-92, AGA3-2012, AGA-7 or ISO-5167.

— Calculation of the flow rates and volumes is in accordance with AGA-8 92 Gross or Detail or NX-19 Supercompressibility Standards.

— Calculation of the flow integral for the AGA 3-92 equation is: $\sqrt{\dfrac{DP*SP}{Tf+459.77}}$, once per second.

— The flow extension reported for the log period is the total of the volume calculation divided by 3600.
The total volume calculation period extensions are the sum of one second extensions. Each one second extension is:
$\sqrt{\dfrac{DP*SP}{Tf+459.77}}$

— Calculation of the flow extension for the AGA 3-85 equation is: $\sqrt{DP*SP}$, once per second.

— Extrapolation of the flow accumulation during transducer calibration or calibration checks using the values for DP, SP and temperature at the time of entering Calibration mode.

— DP, SP and Tf are dynamic factors. Calculations that use these factors are based on the average of one second samples.

— Snapshots of the last calculation period inputs and calculation results can be used to verify calculation.

— Monitoring of the operational limits (minimums and maximums) to ensure detection and reporting of malfunctions or abnormal site conditions

— Acceptance and storage of system constants from PCCU32 or remote communication protocols

— The number of log records, daily records and events is user-configurable.

3.2.3   Additional features

Additional features of the ABB Totalflow system's flexibility include the following:

— Programmable differential pressure no flow cutoff

— Programmable bi-level security codes or user-configurable Role Based Security Access (RBAC) to prevent unauthorized access to and configuration of the flow computer

— Internal 100 ohm platinum RTD resistance curve fit with user-programmable single point offset or 3/5-point user-calibration of the RTD input

— Quick, simple calibration procedures for the transducer

— Real-time clock providing a highly stable time base for the system

3.2.4 Display application

The primary function of the µFLO^{G5} is to provide complete volume and operational records. During operation, the display application continuously scrolls through the default operating parameters and also displays status, alarm, or unusual conditions. The µFLO^{G5} display application is customizable; non-default parameters and annunciators may be added and display times may be adjusted from 1 to 255 seconds long (default is five seconds). Programming additional parameters can be accomplished by identifying the register address and defining the display duration. Setting the display duration of any parameter to zero seconds will eliminate the parameter from the display scroll. Additional display programming information may be found in the PCCU32 help. Typically displayed parameters are listed in Table 1.

Table 1: Default display parameters

Standard display	Format	Description
Station information		
STATION ID	XXXXXXXXXXXXXXXXX	ID of the unit
DATE/TIME	MM/DD/YY HH:MM:SS	Current date and time, 24-hour clock
CHARGER	NNNNNNNN.N Volts	Input voltage of the charging unit
BATTERY VOLTAGE	NNNNNNNN.N Volts	Battery voltage as supplied by the external unit
LITHIUM BACK-UP?	[Yes or No]	Lithium battery used as backup
Measurement tube identification and information		
TUBE # ID	XXXXXXXXXXXXXXXX	ID of the tube
TUBE # ORIFICE DIAMETER	N.NNN INCHES	Size of the orifice plate
TUBE # SP	NNN.N PSIA	Static pressure absolute, PSIA
TUBE # DP	NNN.N IN. H2O	Differential pressure, inches H2O
TUBE # TEMPERATURE	NN.N DEG F	Flowing temperature, °F
TUBE # FLOW RATE	NNNNNN.N SCF/HR	Current flow rate, programmable SCF, MCF or MMCF per hour
TUBE # LAST CALC.	NNNNNNNN.N SCF	Last calculated volume
TUBE # YEST. VOL.	NNNN.N MCF	Yesterday's volume, programmable SCF, MCF or MMCF
TUBE # ACCUM. VOL.	NNNNNN.NN MCF	Total accumulated volume, programmable SCF, MCF or MMCF

In the µFLO^{G5}, the annunciator area is also user-programmable. This allows the user to program each annunciator to reflect custom status information for different application or tube types. As supplied from the factory, a typical device will come with a standard display configuration, but that can be modified. Whenever an alarm is indicated, the µFLO^{G5} records it in the appropriate log period flow record. These are automatically retrieved when data is collected. The µFLO^{G5} status and alarm descriptions are described in Table 2.

Table 2: Visual alarm and status descriptions

Indicator	Description
Auxiliary I/O	
LL	Low Lithium Battery Alarm: When LL (low lithium) is displayed, the lithium battery voltage is below 2.5 Vdc. A new lithium battery measures approximately 3.6 Vdc.
LC	Low Charger: When LC (low charger) is displayed the µFLO^{G5} battery charging voltage is (+) 0.4 Vdc or is less than or equal to the battery voltage.

Indicator	Description
Communication protocols	
→	Transmitting Data: Sending a response
←	Receiving Data: Processing request
!	Nak: Negative acknowledgement with packet list
+	Ack: Positive acknowledgement of receipt of request
╥	Waiting for Ack: Waiting for response after transmission
?	Exception Alarm Processing
¥	ID Recognized: Recognized and receiving request
‡	Listen Cycle: Flashes if this remote port is active and running Totalflow Remote Protocol. Flashes in sync with the listening cycle that occurs at 1, 2 or 4 second intervals. When the baud rate is faster than 2400, then the flashing symbol may not be visible. The annunciator will remain on listening cycle if the listen cycle is set to zero.
M	MODBUS® ASCII: MODBUS® ASCII protocol is selected for the port assigned to this annunciator.
m	MODBUS® RTU: MODBUS® RTU protocol is selected for the port assigned to this annunciator.
L	Local Protocol: Displayed when the PCCU32 port is active and running Totalflow Local Protocol
¥	ID Recognized: The ID has been recognized but is waiting for sync.
u	USB Protocol: Displayed when the USB port is active and running Totalflow Remote
n	Ethernet Protocol: Displayed when the Totalflow/TCP port is active
Measurement applications	
BF	Back Flow Condition: Visible only when DP variable is displayed
Z	Zero Flow Condition: Visible only when the flow rate is displayed
H	Hold: Displayed when PCCU32 has entered Hold mode
A	Alarm Condition: Need to view alarm. Compare application limits to the current values to determine where the alarm condition is present.
AD	A to D Failure: Displayed if the A to D converter's absolute differential pressure, absolute static pressure, or temperature readings exceed the maximum counts or are less than the minimum counts
Display applications	
1	A number represents the display group number currently being displayed.
↑	The displayed item's value is above the Data High Limit value that is specified on the display Item Setup screen.
↓	The displayed item's value is below the Data Low Limit value that is specified on the display Item Setup screen.

3.2.5   Log period data records

Log period data entries are made every 60 minutes, by default. The user may change this period to any one of seven (7) choices (1, 2, 5, 10, 20, 30, or 60 minutes). The log period must never be less than the volume calculation period.

Volume calculation period entries are made every second, by default. API 21.1 strongly suggests a volume calculation period (QCP) of once per second. The volume calculation period should never be greater than the log period and should be evenly divisible into the log period. Volume calculations are completed following the top of the current period (i.e., top of the hour, top of the minute, each second).

3.2.5.1   AGA3

Each AGA3 log period record has entries, reported hourly by default, that contain the following information:

— Average differential pressure

— Average static pressure

— Average flow temperature

— Integral flow rate

— Calculated volume

— Calculated energy content

— Alarms

— Non-zero flow

3.2.5.2   AGA7

Each AGA7 log period record has entries, reported hourly by default, that contain the following information:

— Average counts

— Average static pressure

— Average flow temperature

— Calculated volume

— Calculated energy content

— Average uncorrected volume

— Alarms

— Non-zero flow

3.2.6   Applications and licensing

The μFLO^{G5} flow computer requires applications to handle basic and advanced operations of the flow computer. Applications are divided into two primary categories: Standard and general. In addition, IEC and CO2 (NIST) applications are available but require additional, non-standard configuration.

Standard applications handle the most basic operations of the flow computer and support the general applications. The following standard applications are included with the flow computer:

— System Application

— Communications

— Auxiliary I/O

— Pulse Accumulator

— Operations

— Holding Registers

— Units Conversion

— Host Interface

— Displays

— Alarm System

— Shutdown

General applications typically provide some type of measurement, control, logging and/or archival function. Two (2) general application licenses are included with the purchase of the μFLO^{G5}. General applications include:

— AGA-3 Measurement

— AGA-7 Measurement

— V-Cone Measurement

— Coriolis Gas

Due to the limited scope of the μFLO^{G5}, no additional general applications are required or usable. Other XSeries equipment is capable of using additional general applications, therefore the use, acquisition, and transfer of these credits are outside the scope of this document.

3.3 Hardware overview

The μFLO^{G5} includes an integrated high accuracy digital multi-variable sensor (IMV) to measure pressures and temperature. The IMV is housed inside the flow computer enclosure and is characterized and calibrated at the ABB factory.

Representing the latest model, the μFLO^{G5} features a powerful 300 MHz 32 bit microprocessor and the Linux operating system. The processor, memory, base I/O, and communication components are all on a single electronics board. The increased processing and memory capability of this device provides for more applications to run faster than ever before.

The components that comprise the μFLO^{G5} are:

— Aluminum, NEMA/TYPE 3R enclosure (lockable to prevent access)

  – Battery shelf

  – Communication area

— Integral multi-variable transducer (IMV) with μFLO^{G5} board

— Liquid crystal display (LCD), programmable

— Resistive temperature detector (RTD)

— Two (2) available power source options:

  – Lead acid battery

    - External solar panel (standard)

    - Vdc charger

  – External 9-30 Vdc power supply (not available with the battery option)

In addition to the basic flow computer inputs (DP, SP, and temperature), the standard device includes:

— One digital output

— One digital input which can be configured as either a status input or high speed pulse accumulator input (up to 20 kHz).

— One local configuration (MMI) port

— One communication port for RS-232, RS-422, or RS-485 (software selectable)

— One integrated 10/100 Base-T Ethernet port (half / full duplex)

— USB port (Flash download and local communication)

— Ability to add third-party communication systems

— I/O expansion board port.

An optional I/O expansion board may be purchased to extend the onboard I/O. The I/O expansion board contains One (1) serial communication port, one (1) DI/PI, one (1) DO, and two (2) AIs.

3.3.1 General specifications

The general specifications for the μFLO^{G5} are as follows:

Item	Description
Max battery	Capacity 26AH
Enclosure	Powder coated aluminum; Type 3R
Certification(hazardous location classification)	– CSA C/US Class 1, Division 2, Groups C & D T3 -40° F (40° C) to +140° F (+60° C), (-40° F (40° C) to +158° F (+70° C) temperature rating without battery or radios) – ATEX Zone 2, Sira 10ATEX4138X, II 3G Ex nA IIB T3 IP54 Ta = -40° C to +60° C (meets European Union Directive 94/9/EC) – IECEx CSA09.0013X, Ex nA IIB T3 IP54 (-40° C ≤ Tamb ≤ +60° C)
Mounting	Wall, pipe, or direct
Operating temperature(ambient)	-40° to 158° F (-40° to +70° C) Note: see Certification (Hazardous Location Classification) above

Item	Description
Humidity	0 - 95% non-condensing
Electromagnetic Compatibility Requirements (EMC)	Emissions: European Regions per EN 61000-6-3: 2006, Residential locations: Radiated Emissions: 30-1000MHz, 1-6GHz, Class B Limits Conducted Emissions (Telecomm Port): 0.15-30MHz, Class B Limits North America & other regions: CFR 47, Part 15, Subpart B, Class B, FCC Emissions ICES-003 Issue 4 CAN/CSA-CEI/IEC CISPR 22:02, Class B ITE Emissions AS/NZS CISPR 22-2009 (Australia/New Zealand) Immunity levels: per EN 61000-6-2: 2005, industrial locations EN61000-4-2: Electrostatic Discharge, Criterion A[1], 8kV Air, 4kV Contact EN61000-4-3: Radiated Immunity, Criterion A[1], 80MHz-2.7GHz 10V/m EN61000-4-4: Fast Transients, Criterion A[1], 1kV DC & Signal EN61000-4-6: Conducted Immunity, Criterion B[2], 0.15-80MHz 10Vrms EN61000-4-8: Magnetic Fields, Criterion A[1], 10A/m 50/60Hz

3.3.2   Enclosure

The aluminum enclosure consists of a hinged-door box. The door provides a watertight, corrosion-resistant seal between the outside elements and the μFLO^{G5} components. It is rated NEMA/TYPE 3R or IP54.

Table 3 describes the enclosure and installation information. Figure 1 and Figure 2 indicate the outside dimensions of the enclosure and transducer.

Table 3: μFLO^{G5} dimensions, installation, and weight

Unit	Width	Height	Height with transducer	Depth	Pipe-mounted Depth	Wall-mounted Depth	Weight (without battery)
US	12.76 in	14.88 in	17.78 in	10.276 in	11.58 in	11.02 in	15.10 lbs
Metric	32.4 cm	37.795 cm	45.16 cm	26.101 cm	29.42 cm	27.99 cm	10.60 kg

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[1] No degradation of performance or loss of function.

[2] Temporary degradation of performance in which signals deviate during disturbance but self-recover when disturbance is removed.
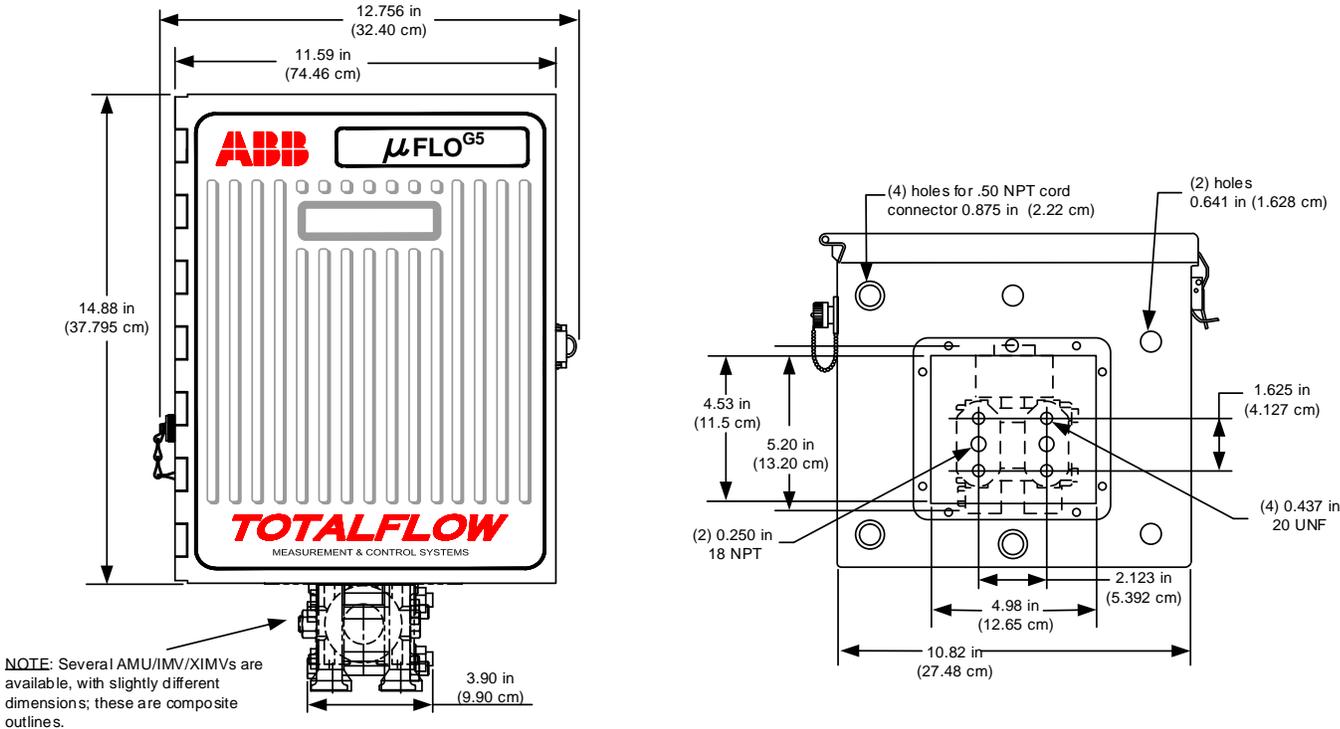
Figure 1: *µ*FLO^{G5} enclosure, front and bottom
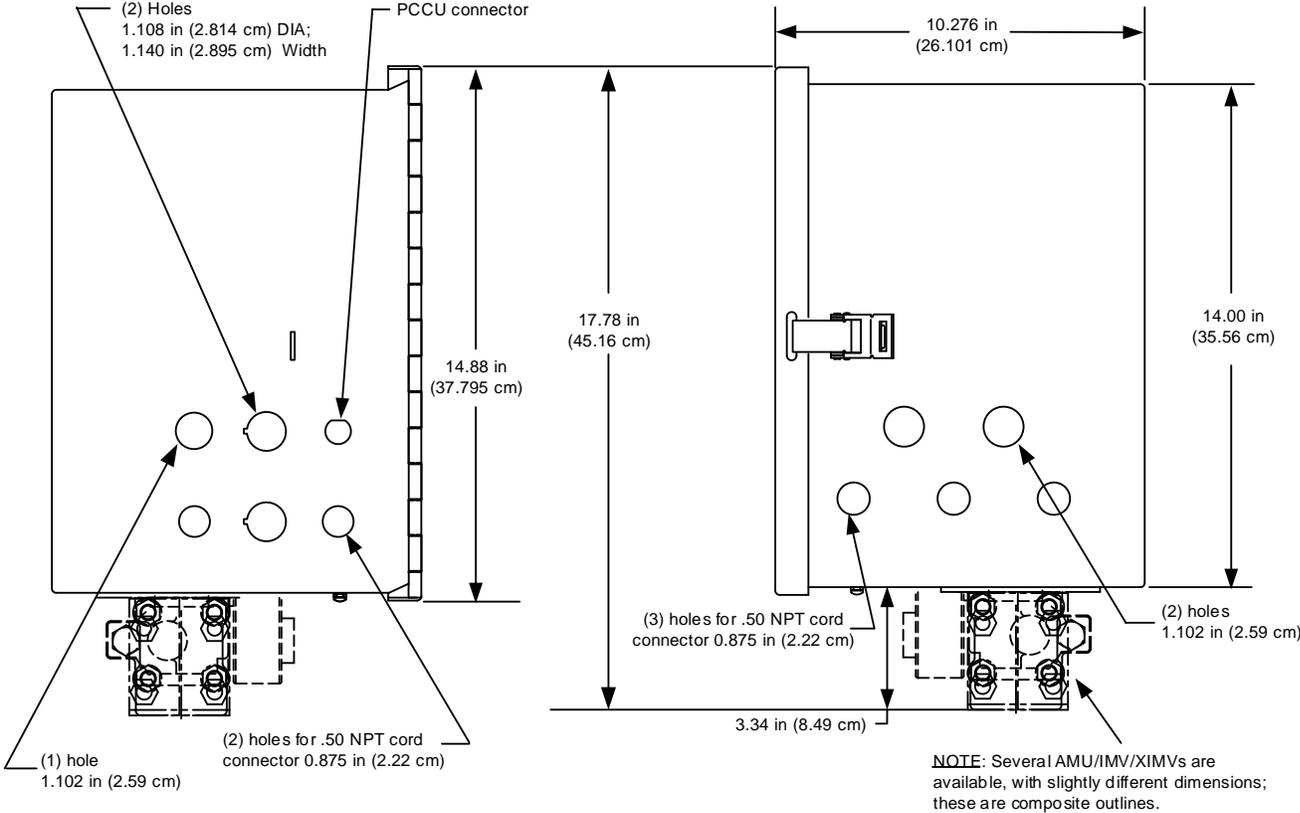
Figure 2: *µ*FLO^{G5} enclosure, left and right side

Opening the enclosure door allows access to the Integral Multivariable Transducer (IMV), the battery shelf, and the communication area (Figure 3). If the *µ*FLO^{G5} is configured with an internal battery and solar charger, the battery is housed

inside of the enclosure on the battery shelf. If configured with remote communication equipment, the equipment is mounted to a bracket and installed in the communication equipment area.
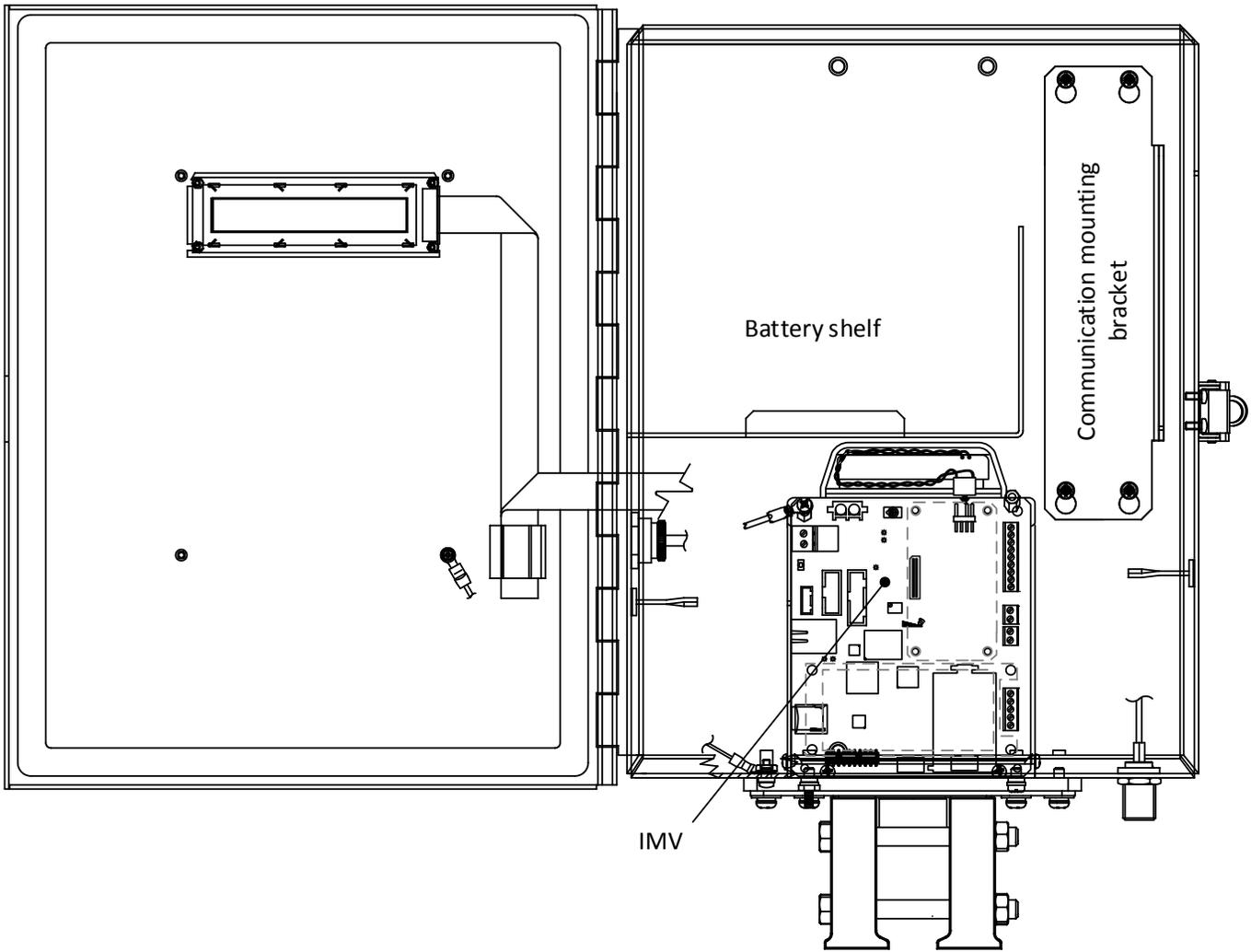
Figure 3: *µ*FLO^{G5} enclosure interior

3.3.3 Liquid Crystal Display (LCD) assembly

The LCD assembly consists of a display screen, a control board, and a ribbon cable to connect the assembly to the *µ*FLO^{G5} flow computer electronic board. The function of the LCD assembly is to provide complete volume and operational records. During operation, the front panel liquid crystal display (LCD) continuously scrolls through the operating parameters, status information, and alarm or unusual conditions (Figure 4).
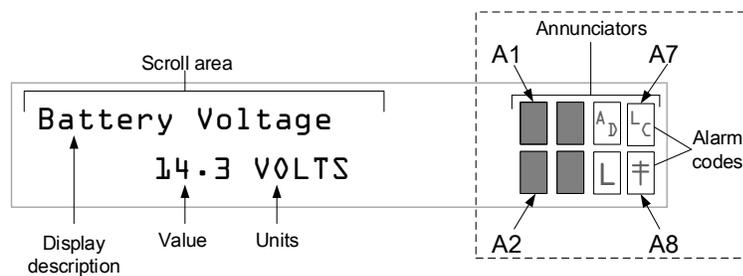
Figure 4: Liquid Crystal Display and annunciators

3.3.4 Integral multivariable (IMV) assembly

The IMV assembly includes the electronic board, lithium battery, the multivariable transducer, and the optional I/O expansion board, if installed.
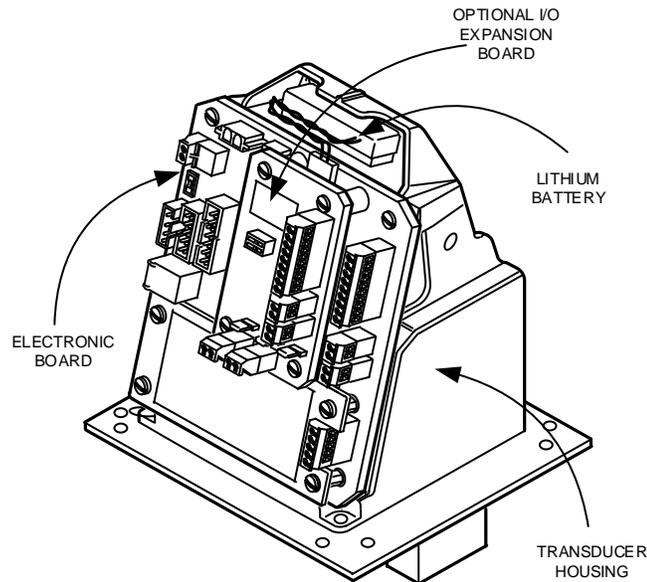
Figure 5: *µ*FLO^{G5} IMV assembly (complete)

3.3.4.1 *µ*FLO^{G5} electronic board

The *µ*FLO^{G5} electronic board is mounted directly on the IMV. Table 4 lists the electronic board specifications.

Table 4: *µ*FLO^{G5} electronic board specifications

Item	Description
Power	Auto detect circuitry to determine if battery powered or external power supplied: Battery mode: 12 Vdc SLA battery input or, External power mode (no battery): 9 Vdc to 30 Vdc (exceeding 30 Vdc will damage the device)
Charger	(Connects to J17) Solar: Nominal 12 Vdc charger controller, solar panel maximum 30 Watt, Maximum 30 Ah SLA battery when using integrated controller Alternate charger: 14.5 Vdc to 15.5 Vdc
Current draw	Basic single differential measurement application without communications enabled: ~33.9mA @ 13.8 V (~468mW) Basic single differential measurement application with Ethernet enabled: ~46.4mA @ 13.8 V (~640mW)
Memory	– Linux operating system – Programs/Applications/Data storage 16 GB of solid state persistent memory. 256 MB of LPDDR RAM for program execution. Lithium battery (J18) NOT required to maintain programs /applications or data. – *µ*SD (future applications)
LCD interface	Dedicated interface for 2 X 24 Liquid Crystal Display (LCD)
Security switch	On / Off dual-level on-board security switch; also supports enhanced Role Based Access Control (user configurable, multilevel, multi-user security)
Time base stability	± 7.5 ppm (parts per million)
IO scan rate	1 Time per Second (1 Hz)
AGA3/AGA7/ ISO5167/VCone calculations	Calculations are tested and verified to be within ± 50 ppm (parts per million) as stated in API 14.3.4 Liquid Calculations verified within 8 significant digits per API 11.1.5
Communication Ports	– COMM 1 J10 - One (1) onboard serial port for remote communications, software configurable: RS-232/RS-485/RS-422.

- MMI J9 - One (1) RS-232 port for local PCCU connection
- Ethernet J1 - One (1) 10/100 Base-T Ethernet port (half / full duplex)
- USB J4 – USB host/device port

Optional:

- One (1) USB device port and/or one (1) USB host port. Requires use of USB Adapter cable.

Figure 6 shows the electronic board components and connections.
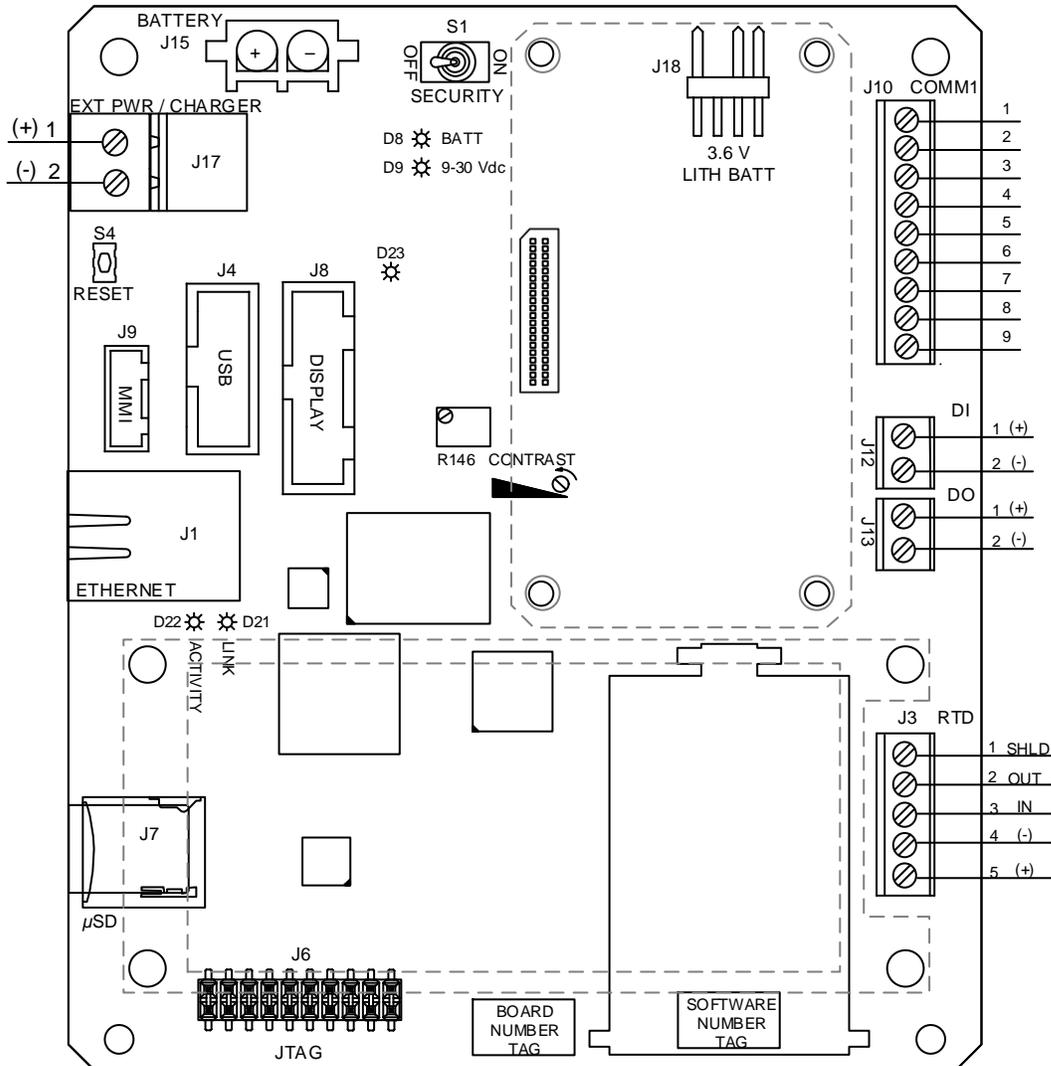
Figure 6: *µ*FLO^{G5} main electronic board

End-user connections and settings on this board consist of the following:

Table 5: *µ*FLO^{G5} main electronic board end-user connections

Component	Description
Battery power (J15)	The battery connector is dedicated for an internal 12 Vdc lead-acid battery only. In this configuration, it is mandatory that J17 (EXT PWR/CHARGER) be connected to an ABB Totalflow-approved charging source (14.5 to 15.5 Vdc).
Battery charging source (J17)	Only use an ABB Totalflow-approved charging source when an internal 12 Vdc lead-acid battery is connected to J15. The input voltage on EXT PWR/CHARGER J17 must be between 14.5 and 15.5 Vdc maximum.
External Power (J17)	When supplying external power (9-30 Vdc) to EXT PWR/CHARGER (J17), a battery must not be connected to J15.

Component	Description
	WARNING: Power at J17 (up to 30 Vdc) is applied to the communication connector terminals as power for radios, etc. Radio operation and the inhibit feature may not work properly if other than a nominal 12 Vdc power source is used. Communication equipment connected to J10 must be capable of handling 9-30 Vdc if the power source connected to J17 is 9-30 Vdc.
RTD (J3)	Dedicated RTD input for temperature measurement.
Communication port 1 (J10)	Serial communication port for remote communications, software configurable: RS-232/RS-485/RS-422. WARNING: If the unit is powered externally at 9-30 Vdc, then the external power will be present on pin 1 (power) and pin 3 (switched power) on COMM 1 (J10). The auxiliary equipment connected to J10 should be capable of operating from the externally supplied Vdc range.

3.3.4.2 Digital input / Pulse input

The μFLO^{G5} provides one digital/pulse input capable of 20 kHz as a means to monitor external equipment.

The digital input reads an external contact. The device's state of on or off is application-specific. See the PCCU32 help for additional information.

Table 6: Digital input (J12) specifications

Item	Description
Electrical specification (each point)	− Open circuit voltage: 5 Vdc (internally pulled up to 5 Vdc nom.) − Short circuit leakage current: -395 uA typical − Input capacitance: 0.1 uf typical − Maximum allowable voltage range on input: -0.5 Vdc to 30 Vdc − Maximum frequency input: 100 Hz at 50% duty cycle with debounce enabled. − Maximum frequency input: 20 kHz at 50% duty cycle with debounce disabled.
Input specifications	− Dry contact (form A), Open Collector or Active voltage − Minimum contact resistance to activate input 1000 Ω − Voltage threshold to deactivate the input 3.1 V (referenced to GND terminal) − Voltage threshold to activate the input: 0.5 V (referenced to GND terminal) − Conductor pairs must be shielded to prevent spurious signals

Figure 7 shows a typical DI point schematic for the onboard DI/PI. Figure 8 provides examples of typical connections
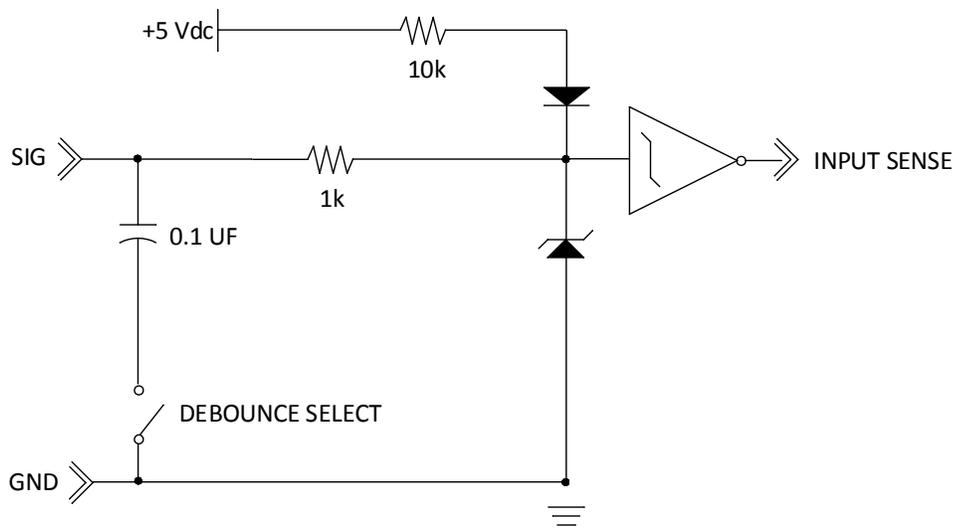
Figure 7: Typical point schematic

POINT CONNECTIONS

SIG

NPN

GND

SIG

OPTO
COUPLER

GND

OR

SIG

SWITCH

GND

OR

+5 Vdc

10 K

SIG

1 K

0.1 UF

GND

DEBOUNCE SELECT

INPUT
SENSE

TYPICAL VOLTAGE INPUT FIELD

FIELD DEVICE

SIGNAL
OUTPUT

COMMON
(GND)

3.1 Vdc

0.5 Vdc

-0.5 Vdc MIN

15 Vdc MAX

SIG

GND

+5 Vdc

10 K

SIG

1 K

0.1 UF

GND

DEBOUNCE SELECT

INPUT
SENSE
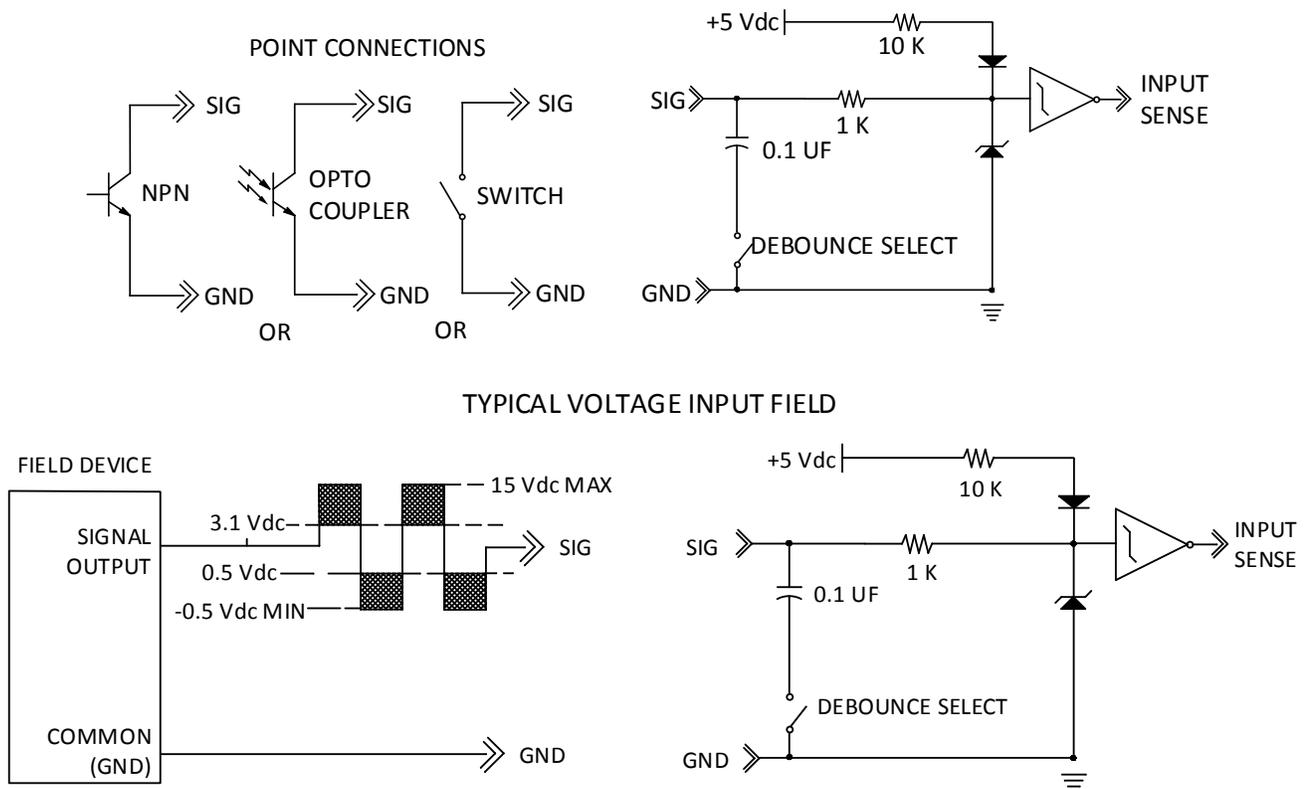
Figure 8: Onboard DI connection examples

3.3.4.3   Digital output

The μFLO^{G5} provides one (1) digital output as a means to control external equipment. The digital output provides a ground for the external device.

The use of the DO is application-specific. See the application specifications for further information.

Table 7: Digital output (J13) specifications

Item	Description	
Electrical specification (each point)	– Open circuit voltage:	0 Vdc
	– Short circuit leakage current:	0 uA typical
	– Output capacitance:	1000 PF typical
	– Maximum allowable voltage range on output:	0 Vdc to a maximum of 30 Vdc
Output specification	– Open drain FET type	
	– ON resistance (including PTC fuse resistance)	0.22 Ω typical
	– Maximum pulse current	3 A for five (5) seconds
	– Maximum continuous sink current: 1.85 A at 23 °C, 1 A at 70 °C, 0.85 at 85 °C	

Figure 9 shows a typical DO point schematic for the onboard DI/PI. Figure 10 provides an example of a typical connection.
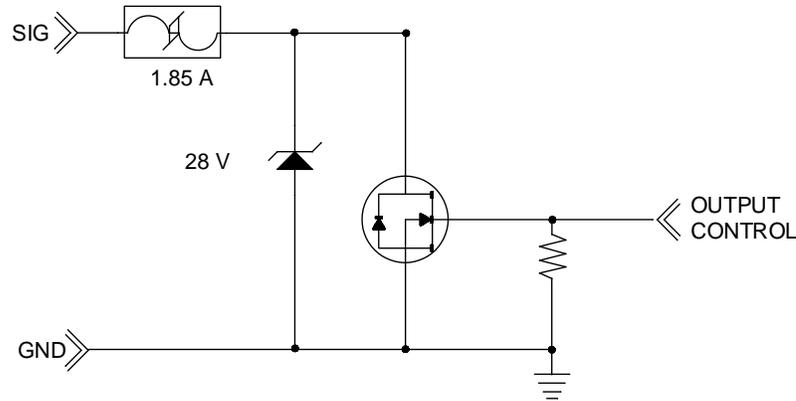
Figure 9: Typical point schematic
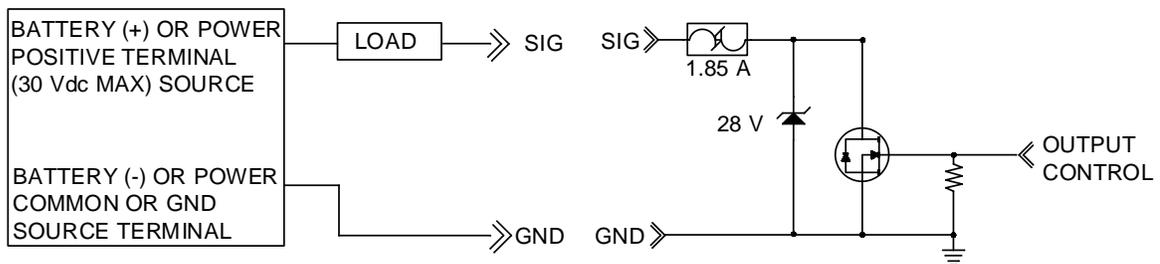
Figure 10: Example connection

3.3.4.4   Integral multivariable transducer (IMV)

The integral multivariable transducer (IMV) contains circuitry for analog-to-digital processing and provides the primary measurement capability for the μFLO^{G5}. The unit is designed to provide EMI/RFI protection when the electronic board and RF gasket are installed properly and to protect the circuitry from other environmental effects.

The IMV is characterized over temperature so that any changes occurring in the IMV or in the electronics can be compensated.

The IMV always measures static pressure on the high pressure side. The IMV can be ordered from the factory with the IMV unit rotated in the meter enclosure; however, this is only offered as an aid to the mechanical installation process. Static pressure is still measured on the high pressure side (refers to DP only).

The IMV contains a single circuit stamp board that contains the analog-to-digital converter and analog conditioning circuitry necessary for the IMV and the RTD (see Table 8).

Table 8: IMV specifications

Item	Description	
Multivariable unit		
Temperature limits	Compensated:	-20 °F to 140 °F (-29 °C to 60 °C)
	Operational:	-40 °F to 158 °F (-40 °C to 70 °C)
	Storage:	-40 °F to 185 °F (-40 °C to 85 °C)
Resolution	24 bit analog-to-digital conversion (0.000012% FS) (0.0012% FS effective signal resolution	
Vibration performance	1.5 INW per G (2 G maximum) at 1 Hz, decreasing to zero (0) at 1 kHz in straight line mode	
Mounting specification	Change from perpendicular (front to back, around X-axis) will be ≤ 0.5% URL (This can be corrected with calibration)	
Reference conditions	Temperature at most recent factory or user calibration; SP and DP < 100% of URL	
Static pressure		

Item	Description
Accuracy	Includes the effects of linearity, hysteresis and repeatability at reference conditions: Standard Accuracy: ± 0.075% of user-calibrated spans from 20% to 100% of URL
Ambient temperature effect within the operational temperature limit	± 0.075% of URL ± 0.06% of reading
Stability (for 12 months)	± 0.1% of URL when operated in the compensated thermal band and ≤ 100% of the stated static and differential pressure ranges
Differential pressure (differential version only)	
Accuracy	Includes the effects of linearity, hysteresis and repeatability at reference conditions: Standard Accuracy: ± 0.075% of user-calibrated spans from 20% to 100% of URL
Ambient temperature effect within the operational temperature limit	± 0.075% of URL ± 0.06% of reading
Stability (for 12 months)	± 0.1% of URL when operated in the compensated thermal band and ≤ 100% of the stated static and differential pressure ranges
SP effect	DP Zero per 1500 PSI: ± 0.03% of URL (3200 PSI maximum) DP Span per 1500 PSI: ± 0.1% of reading (3200 PSI maximum)
Temperature	
Process range	-80 °F to +750 °F (-62 °C to 399 °C)
Accuracy (as shipped from factory)	± 0.35°F (± 0.2°C) over operating range
Accuracy (after single point field calibration)	± 0.2°F (± 0.12°C) repeatability over operating range

3.3.5 Local communication connections

Making a local connection to the *µ*FLO^{G5} may be accomplished one of two ways. Traditionally, local connections have been made using the RS-232 PCCU cable with the round military connector on one end and a serial port 9-pin connector on the other. A second method involves making the local connection using a USB cable, Ethernet, or optional external USB Bluetooth® adapter.

3.3.5.1 PCCU32 RS-232 serial cable (round military connector)

The local connection (serial military connector) requires an RS-232 serial port on the host computer (generally a PC). A PCCU cable is required to connect the host computer to the flow computer's round military connector. Connecting the PCCU cable to the meter will cause an annunciator in the LCD to display an upper case letter "L" for local connect.

Military
Connector

9-Pin
RS-232

Figure 11: RS-232 local communication cable

3.3.5.2   PCCU32 USB cable

The local USB connection requires the use of a USB cable connected to the host computer (generally a PC). A USB PCCU cable is required to connect the host computer to the flow computer's client connector. Connecting the PCCU cable to the meter will cause an annunciator in the LCD to display a lower case letter "u" for local connect.

Client   **Host**

Figure 12: USB local communication cable

---

i   **IMPORTANT NOTE:** The USB local connection is optional and may be included when ordering or added later. A special cable connection to the main electronic board is required in addition to a standard USB client-to-host communication cable.

3.3.5.3   Bluetooth® connectivity

The µFLO^G5 has the option of performing a local connection using Bluetooth® functionality. This option can be accessed through PCCU32 but requires optional third party hardware and cables and a Bluetooth® enabled PC.

3.3.6   Power supply equipment

The µFLO^G5 has two power configurations: A 12 volt battery with solar panel charger and an external power supply.

---

i   **IMPORTANT NOTE:** The RMC design includes a super capacitor (Super CAP) that serves as a short-term power reservoir. In the event of a loss of power or reset, the charged super capacitor prevents the supply voltage from falling to zero for a short period of time (2.5 seconds). This delay allows the system time to save all persistent data such as trending, restart configuration, etc.

3.3.6.1   12 volt battery and solar panel power configuration

The battery-powered configuration includes a 12 volt sealed lead acid (SLA) battery sized between 8 and 26 ampere hours, depending upon installation requirements. Solar panel chargers are available in 10, 20, and 30 watt kits. The battery is installed inside of the µFLO^G5 enclosure and the solar panel mounts on the enclosure mounting pipe or on the roof of a nearby structure.

3.3.6.2   External power supply

The power supply configuration includes a 9–30 Vdc ABB-approved external power supply and is external to the flow computer enclosure. When a power supply is connected to the main electronic board, a battery should not be connected to the board.

3.3.7   Resistive Temperature Detector (RTD)

An optional, 100 Ω, platinum RTD (.000385 Alpha) measures real-time flowing temperature of the process gas. A dedicated input is available on the main electronic board.

3.3.8   I/O expansion board (option)

An I/O expansion board can be added to extend the hardware I/O and communications capability of the µFLO^G5 and includes:

— One (1) communications port:

    – User-selectable RS-232, RS-422, or RS-485

— One (1) DO

— One (1) DI/PI (supports up to 20 kHz)

— Two (2) Analog Inputs (4-20 mA or 1-10 Vdc)

The expansion board digital input and output specifications are the same as the μFLO^{G5} onboard digital I/O. Please see section 3.3.4.2, *Digital input / Pulse input*, on page 27 for those specifications. Terminations, jumper settings, and wiring points are detailed in Figure 13
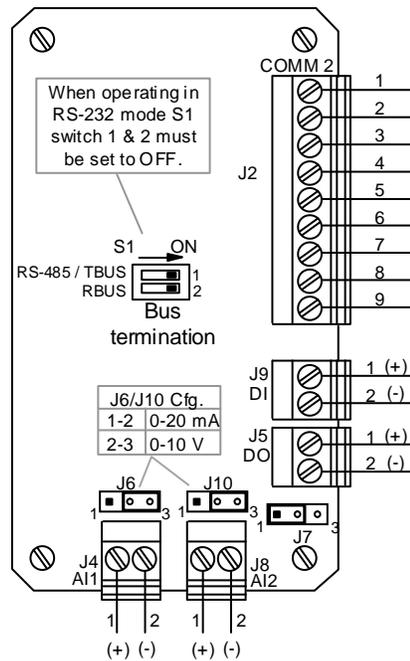
Figure 13: Optional I/O expansion board

The I/O expansion board AI specifications are listed in Table 9.

Table 9: I/O expansion board analog input specifications

Item	Description
Voltage mode (each point)	Input Impedance ≥ 400KΩ; Drift = ± 0.0053%/°C Maximum Measurable Input Voltage = 10V Resolution = 0.615mV/Bit (12.99 Bits from 0-5V)
Current mode (each point)	Input Impedance 255Ω; Drift = ± 0.008%/°C Maximum Measureable Input Current = 44 mA (limited by power dissipation) Resolution = 2.4µA/Bit (12.7 Bits from 4 - 20 mA)

3.4 Network connectivity (dynamic IP with router)

When operating the μFLO^{G5} in a network environment, using Ethernet is a practical solution. PCCU32 communication with the meter over an Ethernet connection (TCP/IP) requires the use of a hub, switch or router along with appropriate cabling. Ethernet (local) communication may also be used for local PCCU connection. The cable and connection to the exterior of the enclosure is an option and may be included when ordering or it may be added later.

Figure 14: Ethernet communication cable

4 Installation

This chapter provides information and procedures for the *µ*FLO^{G5} flow computer installation. Instructions provided in this section are designed for a typical installation. Although there may be other methods of installation, it is recommended that technicians perform the procedures in the order presented in this manual.

i | **IMPORTANT NOTES:** Read through this chapter before beginning to plan the installation.
|
| If there are questions that are not addressed in this manual or in the additional documentation listed in the front of this manual, call the ABB office, listed under *Contact us*, on the back cover of this manual.

Installation personnel must be knowledgeable of local and national codes as they apply to hazardous areas, communication wiring, and electrical wiring.

⚠ | **WARNING – Bodily injury.** The *µ*FLO^{G5} flow computer manual does not address any requirements for the installation of product(s) in hazardous (classified) locations. Refer to the ABB installation drawing that is indicated on the unit's name plate, and local and national electrical codes for installation requirements in hazardous (classified) locations.

4.1 Unpack and inspect

The flow computer and optionally purchased parts are shipped separately in specially designed shipping cartons. Optional parts may include a mounting kit, an RTD, and a solar panel with mounting kit.

i | **IMPORTANT NOTE:** If there is any damage to the shipping carton, keep the carton and packing materials until the contents are inspected and found to be damage-free.

1. Inspect all of the shipping cartons for damage.

2. Carefully unpack and remove the items from each carton and inspect for damage:

    – The exterior of the flow computer
    – The LCD on the flow computer enclosure door
    – Optional equipment, if purchased

3. Claims for items damaged during shipment should be made directly with the common carrier.

4. Compare the packing list with the materials received. Check for missing or incorrect parts.

5. To report discrepancies, call the ABB office, listed under *Contact us*, on the back cover of this manual.

i | **IMPORTANT NOTE:** Do not return equipment to ABB without prior written consent. Returns are subject to the terms and conditions specified by ABB.

4.2 Flow computer installation

4.2.1 Flow computer pipe and wall mount installation

The *µ*FLO^{G5} can be pipe-mounted or wall-mounted. The user will need to decide which installation scenario best suits their needs and then use the corresponding procedures.

— For pipe mount installation instructions see section 4.2.1.1.

— For wall mount installation instructions see section 4.2.1.2 on page 36.

— For direct mount installation see section 4.2.2 on page 37.

i | **IMPORTANT NOTES:** Select a mounting location that allows for easy access, is close to the tap valves, and complies with all local and national codes.

Installation of the orifice plate, senior fitting, tap valves, or other peripheral equipment is outside the scope of this document.

4.2.1.1   Pipe mount installation

The following information provides the steps for installing the *µ*FLO^G5 onto the meter run using a pipe saddle mounting kit. Before beginning, review the procedure and the materials required for installation. Figure 15 shows a typical pipe mount installation.
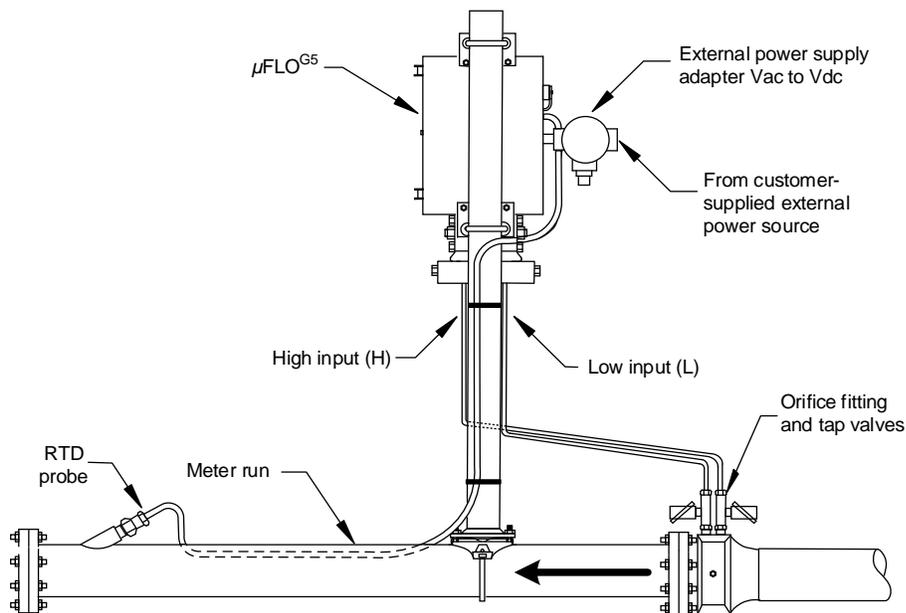
Figure 15: Typical pipe installation

Requisite materials:

— One (1) flow computer mounting kit

— One (1) pipe saddle kit (size determined by technician)

— One (1) 2 inch x 40 inch pipe (length may be extended if mounting a solar panel)

To pipe-mount the flow computer:

1. Position the pipe saddle on the meter run and temporarily attach the saddle to the meter run pipe using the associated hardware (Figure 16).
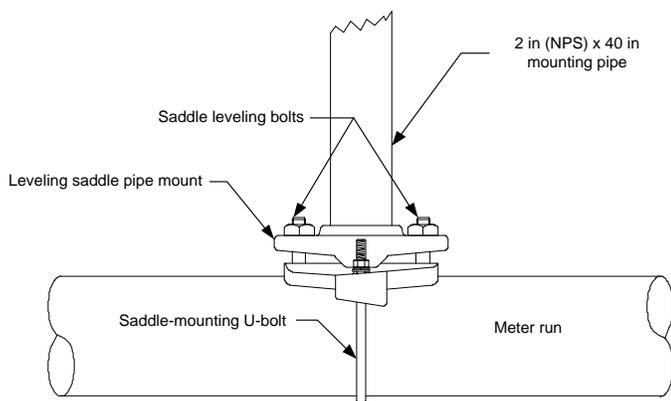
Figure 16: Typical pipe saddle installation

2. Screw the mounting pipe into the saddle until it is tight.

3. Level the mounting pipe:

    a. Level the pipe and saddle so that the pipe is centered on the top of the meter run, then tighten the saddle-mounting U-bolt.

    b. Level the pipe so that the pipe is perpendicular to the meter run using the saddle leveling bolts (if available) on the mounting saddle.

4. Finalize the saddle mount installation by tightening the saddle-mounting U-bolt, to avoid vibration-related issues.

5. Install the flow computer mounting brackets to the back of the enclosure using the pipe mount instructions supplied in the mounting kit.

6. Attach the enclosure to the mounting pipe:

    a. Hold the enclosure in place against the mounting pipe and insert a U-bolt around the pipe and through the corresponding holes on the upper mounting bracket.

    b. Add the flat washer and split washer onto the U-bolt, then screw the nut onto the U-bolt.

    c. Repeat steps 6a and 6b for the second mounting bracket.

7. Raise the flow computer into position on the mounting pipe.

---

i   **IMPORTANT NOTE:** Position the flow computer high enough to allow some downward slope from the externally mounted manifold to the tap valves.

---

8. Secure the flow computer in place by tightening the U-bolt nuts. Tighten the nuts to avoid vibration-related issues.

The flow computer is now pipe-mounted. To install the manifold and connect the input lines to the meter run, see section 4.2.1.3, *Manifold and input line installation*, page 37.

4.2.1.2   Wall mount installation

The following information provides the steps for installing the *µ*FLO^G5 onto the outside or inside wall of a meter shed. Before beginning, review the procedure and the materials required for installation.

Requisite materials:

—   One (1) flow computer mounting kit

—   Four (4) wall fasteners (length and girth determined by technician based on wall thickness and materials)

To wall-mount the flow computer:

---

i   **IMPORTANT NOTE:** The enclosure mounting kit contains more parts than needed for mounting the enclosure on a meter house wall.

---

1. Inspect the installation location to:

    a. Verify that the wall has sufficient strength to support the hanging weight of the unit, approximately 16 pounds (7.26 kg).

    b. Verify that there are no obstructions that would prevent opening the enclosure door.

    c. Verify that there are no obstacles that would prevent the solar panels, if installed, from charging during daylight hours.

!   **NOTICE – Property damage.** Mounting the flow computer on a structure wall that lacks sufficient support may cause the mounting bolts to pull through the wall, allowing the flow computer to fall to the ground. Should the flow computer mounting bolts pull through the wall, the structure wall and flow computer would be damaged. Screw the mounting bolts into a wall stud or wall support of sufficient strength to support the weight of the flow computer.

---

2. Install the flow computer mounting brackets on the back of the enclosure using the pipe mount instructions supplied in the mounting kit.

3. Determine the appropriate mounting height for the flow computer.

> **IMPORTANT NOTE:** Position the flow computer high enough to allow some downward slope from the externally mounted manifold to the tap valves.

4. Drill the upper mounting holes in the wall support.

5. Measure the distance between the top and bottom mounting bracket holes.

6. Locate and drill the lower mounting holes in the wall support.

7. Lift and align the enclosure on the wall so that the mounting bolt holes match the pre-drilled holes.

8. Insert the mounting bolts through the upper bracket holes and screw in the bolts until tight. Repeat this step for the lower bracket.

The flow computer is now wall-mounted. To install the manifold and connect the input lines to the meter run, see section 4.2.1.3, *Manifold and input line installation*, page 37.

4.2.1.3   Manifold and input line installation

The following procedure provides a generalized guideline to follow for the manifold and tubing installation.

Requisite materials:

— Stainless steel tubing (length determined by technician)

— Four (4) sets of tube fittings, including ferrule and nut pairs

— One (1) manifold (3 or 5 valve manifold determined by technician)

To install the manifold and input lines:

1. Install the manifold on the flow computer IMV using the manufacturer's supplied instructions.

2. Locate the tap valves on the meter run orifice and the corresponding high and low inputs on the installed manifold.

3. Measure, cut, and bend the tubing to ease installation of the fittings into the orifice tap valves and the manifold.

4. Install the nut and ferrule onto the tubing end.

5. Insert the ferrule into the fitting and slide the nut onto the ferrule; engage the nut threads and tighten.

> **NOTICE – Property damage.** To avoid damage to the stainless steel tubing, fittings, and valves, always use a backup wrench to stabilize and eliminate tension on both sides of the connection when tightening. Damaged connections may introduce leaks into the system resulting in inaccurate measurement.

6. Repeat step 5 for each tubing connection point.

The manifold and input lines are now installed. To leak-test the manifold and tap valve connections, see section 4.3, *Leak-test manifold and tubing connections,* on page 38.

4.2.2   Direct mount installation

When mounting the flow computer directly on the meter run orifice, follow the instructions supplied with the manifold and stabilizer installation kits.

Requisite materials:

— One (1) manifold (5 valve manifold)

— Two (2) stabilized manifold connectors (compatible with the manifold)

Figure 17 shows a direct-mounted flow computer installed on a meter run.
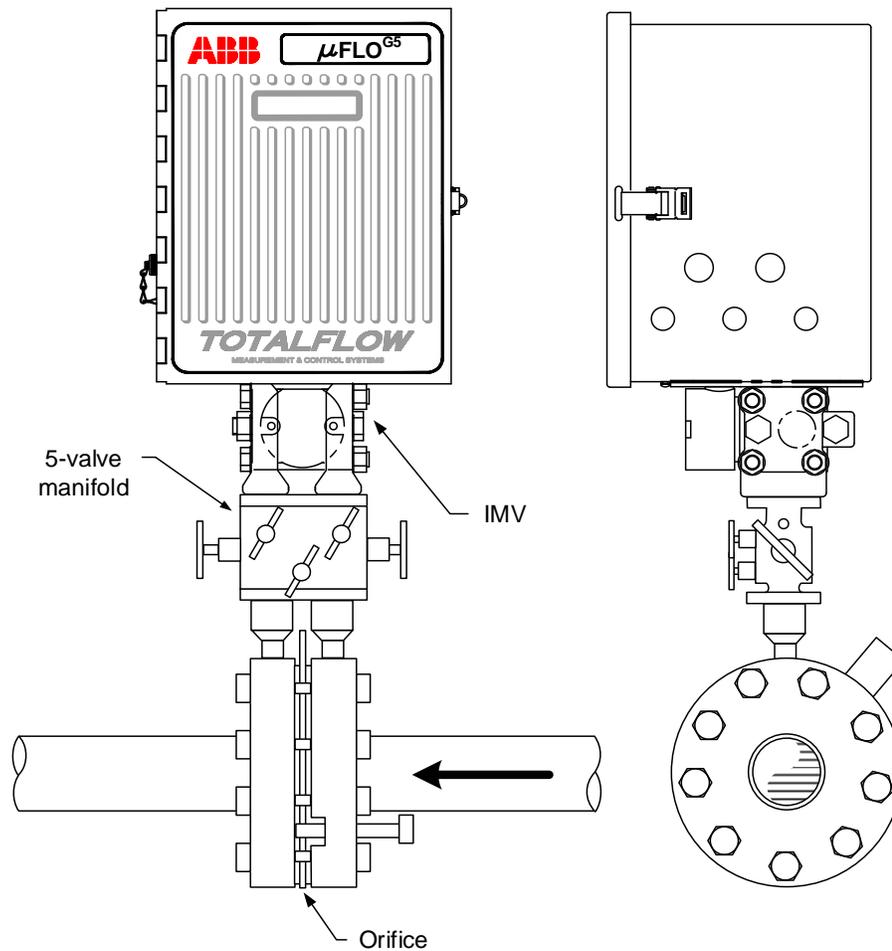
Figure 17: Typical direct mount installation

After installation, see section 4.3, *Leak-test manifold and tubing connections,* on page 38.

4.3 Leak-test manifold and tubing connections

Manifold and tubing connections must be leak-tested prior to power application. Connection leaks between the orifice tap valves, the manifold, and the IMV can introduce measurement and calibration errors.

Requisite tools and materials:

— Liquid leak detector

— Pressure calibration device

> **DANGER – Serious damage to health/risk to life.** Manifold and tubing connection leaks could create a build-up of explosive gases in the immediate vicinity. Power should not be applied before the tubing and connections are leak-free, the area is ventilated, and explosive gases have dissipated.

1. Open the equalizer valves (Figure 18, items A and B) and close the vent valve (item C).
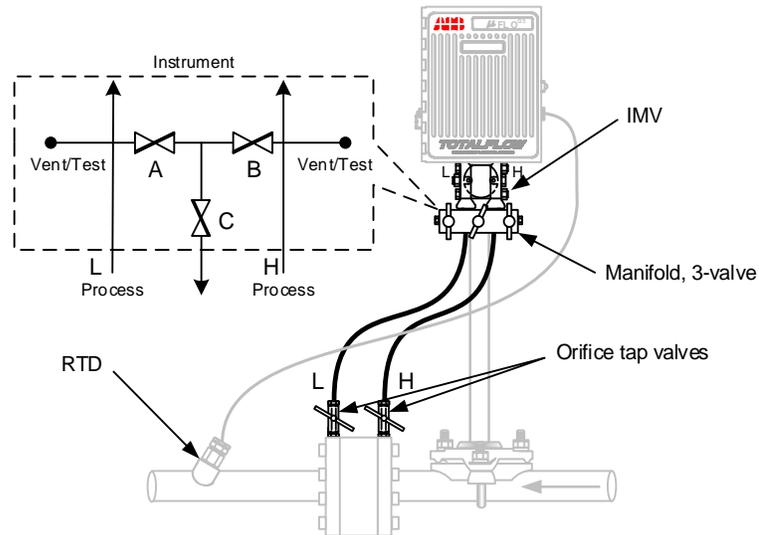
Figure legend:
A) Low side equalizer valve
B) High side equalizer valve
C) Manifold vent valve
H) High pressure side
L) Low pressure side

Figure 18: *µ*FLO^{G5} flow computer with IMV and 3-valve manifold

2. Connect the pressure device to the vent/test port.

3. Apply pressure to the port based on the transducer range (100% of range).

4. Squirt liquid leak detector onto the following connections:

    –   High and low pressure tap valve connections
    –   High and low pressure manifold tubing connections
    –   Connection points between the flange and the manifold

5. Bubbles in the liquid indicate a loose or poor connection.

6. Using the appropriate size wrench, tighten any loose connections, then recheck with the liquid leak detector. Do not over-tighten the connections.

When all connections are leak-free, see section 4.4, *RTD installation and wiring*, to install an RTD.

4.4   RTD installation and wiring

The RTD probe measures flowing gas temperature. The following procedure indicates how to install the RTD into the meter run and wire the leads to the electronic board inside of the flow computer enclosure.

Requisite tools and materials:

—   RTD probe with cable and cable gland installed (probe and cable length determined by technician)

—   Nylon tie wraps

To install and wire the RTD:

1. Insert the RTD probe into the thermowell to determine the depth setting for the probe spring (Figure 19).
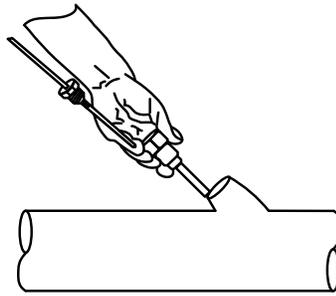
Figure 19: Typical RTD installation

2. Using snap-ring pliers, adjust the retaining ring below the spring on the probe (Figure 20). Probe depth should be set so that it is spring-loaded against the bottom of the thermowell.
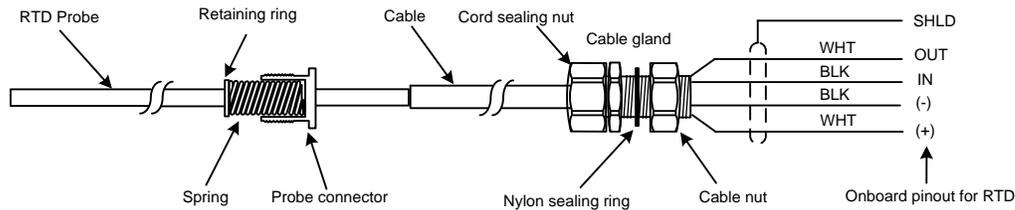

Figure 20: RTD probe connector

3. Screw the probe connector into the thermowell.

4. Run the RTD cable along the side of the process stream pipeline in a straight line. Use nylon tie wraps to secure the cable to the pipeline. Do not wrap the RTD cable around the pipeline.

5. Install the RTD cable into the flow computer enclosure:

    a. Remove a shipping plug from the right side of the flow computer enclosure.

    b. Remove the cable nut from the gland and insert the RTD cable end through the access hole in the enclosure. Leave enough cable inside the enclosure to accommodate wiring to the J3 RTD terminal block.

    c. Replace the cable nut on the cord and screw the cable nut onto the cable gland inside of the enclosure.

    d. Tighten the cord sealing nut to the cable gland against the RTD cable.

    e. Secure the cable outside of the gland so that the cable turns down immediately. This will keep moisture from seeping into the housing along the RTD cable.

6. Wire the RTD sensor cable to the J3 terminal block using the wires identified in Figure 20 and the point definitions identified in Figure 21:
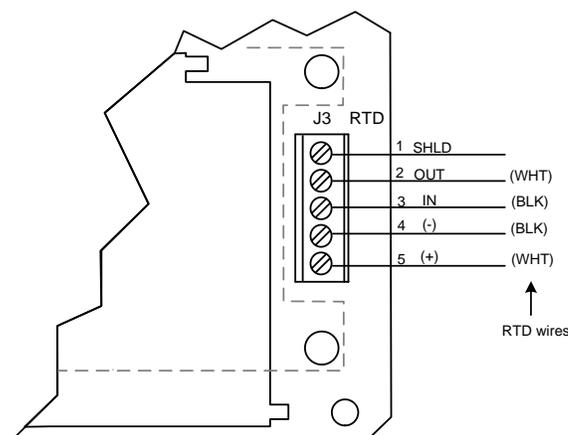

Figure 21: RTD sensor wiring to μFLO^G5 electronic board

> ⚠️ **WARNING – Bodily injury.** Electrical wiring must be installed according to requirements for the area classification. For further information, refer to the certification drawing indicated on the device's name tag, and national and local codes.
>
> Wiring peripheral devices to the flow computer electronic board should be performed prior to applying power. If the flow computer is already powered-up, disconnect power before performing any field wiring.

    a.   Open the flow computer enclosure door.

    b.   Using a small slotted screwdriver, remove the terminal connector from the J3 terminal block on the electronic board.

    c.   On the RTD probe wire, remove the spade lugs if installed, and trim the wire cover ends back ¼ inch (6.35 mm).

    d.   Loosen the screws for points 1 through 5, insert the corresponding wires as identified in Figure 21, and gently tighten.

> ❗ **NOTICE – Property damage.** Do not overtighten the terminal connector screws as this may damage the wires.

    e.   Replace the terminal connector in the J3 terminal block.

Installation of the RTD is complete. See section 4.5, *Power equipment installation.*

4.5 Power equipment installation

The flow computer has two power options:

— 12 volt battery with a solar panel charger (section 4.5.1, *Battery with solar panel charger*)

— External power (section 4.5.2, *External power supply*, page 44)

4.5.1 Battery with solar panel charger

The battery supplies the flow computer with operating power. The solar panel charging system uses sunlight to recharge the battery. The following subsections provide instructions for the installation of a typical system. These instructions should be adapted for alternate installations.

4.5.1.1 Solar panel installation

The solar panel is designed for outdoor mounting on a 2 inch pipe. When the flow computer is pipe-mounted, the solar panel may be installed on the upper end of the mounting pipe or an extension may be added. For wall- or direct-mount flow computer installations, the solar panel may be mounted on a stand-alone pipe or the top or side of a meter house.

> ℹ️ **IMPORTANT NOTES:** For questions about mounting the solar panel on the top or side of a meter house, call the ABB office, listed under *Contact us*, on the back cover of this manual.
>
> For optimum charging, avoid placing the solar panel where it will be in shadows for any part of the day.
>
> Clean the solar panel on a regular basis to ensure maximum charging.

Requisite tools and materials:

— One (1) solar panel with cable

— One (1) solar panel mounting kit (includes U-bolts, brackets, and hardware)

— Mounting pipe extension and coupling if required (length determined by technician depending on the size of the solar panel)

— Nylon tie wraps

> ❗ **NOTICE – Property damage.** Exercise caution when handling the solar panel to avoid damaging it.

To install the solar panel:

1. Verify that the solar panel is operating properly before installation:

a. Check the solar panel using a digital voltmeter to verify polarity and output voltage before installation.

b. If the measured output voltage is within the manufacturer's specification, as defined by the specification sheet supplied with the panel, continue with the installation.

c. If the measured voltage is out of specification, contact ABB for a replacement panel.

2. Install the mounting bracket on the solar panel using the provided hardware.

3. If installation requires a mounting pipe extension:

a. Attach the pipe coupling to the top end of the flow computer mounting pipe.

b. Securely tighten the pipe coupling.

c. Attach the extension pipe to the pipe coupling.

4. Attach the solar panel mounting plate to the top end of the mounting pipe with the U-bolts and associated mounting hardware (Figure 22). Do not tighten completely.
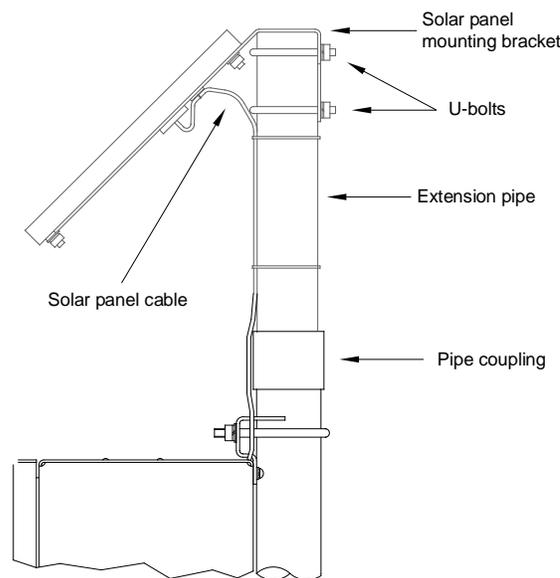
Figure 22: Solar panel installation

5. For northern hemispheres, position the solar panel facing south. For southern hemispheres, position the solar panel facing north.

i   **IMPORTANT NOTE:** Ensure that the solar panel is correctly positioned before tightening the U-bolts.

6. Tighten the solar panel mounting hardware.

⚠️   **WARNING – Bodily injury.** Electrical wiring must be installed according to requirements for the area classification. Refer to the certification drawing indicated on the device's name tag, and national and local electrical codes.

7. Secure the solar panel cable to the pipe:

a. Run the solar panel cable along the mounting pipe and use nylon tie wraps to secure the cable. Do not wrap the cable around the mounting pipe.

b. Gather excess cable and attach it to the mounting pipe using a nylon tie wrap.

8. Install the cable and cable gland in the enclosure:

a. Remove a shipping plug from the left side of the flow computer enclosure.

b. Open the hinged door on the flow computer and visually locate the J17 EXT PWR / CHARGER terminal block.

    c.   Remove the cable nut from the cable conduit elbow and insert the cable and conduit ends through the access hole in the enclosure.

    d.   Pull the cable into the enclosure leaving enough cable to reach the J17 connecter.

    e.   Replace the cable nut on the cord and conduit end inside of the enclosure and screw the nut onto the conduit end finger-tight.

    f.   Position the conduit elbow so that moisture will not follow the cable and seep into the gland. Tighten the cable nut.

9.   Wire the solar panel cable to the J17 EXT PWR / CHARGER terminal block:

    a.   Using a small slotted screwdriver, remove the terminal connector from the J17 terminal block on the electronic board.

    b.   On the solar panel cable, trim the wire cover ends back ¼ inch (6.35 mm) if necessary.

    c.   Loosen the terminal connector screws for points 1 and 2.

    d.   Insert each solar panel cable wire, as identified by the cable label (+ or -), into the corresponding point (1 or 2), as shown in Figure 23, and gently tighten the terminal connector screws.
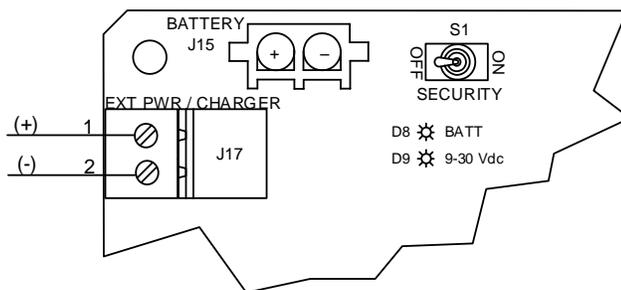

Figure 23: μFLO^{G5} power connections and power option selector

---

![!] **NOTICE – Property damage.** Do not overtighten the terminal connector screws as this may damage the wires.

---

10. Stop. Do not re-insert the EXT (J17) terminal connector into the terminal block until instructed to do so in section 4.8.

![!] **NOTICE – Property damage.** Connecting the solar panel to the electronic board before the battery has been connected will damage the board and void any warranty.

The solar panel charger wiring is now complete.

4.5.1.2   Battery installation

The battery is designed to be mounted inside of the flow computer enclosure and connected to the main electronic board. Before installation, inspect the power cables (where they terminate on the battery) and the connectors for breakage.

Material:

—   One (1) battery with cable attached.

To install the battery:

1.   Open the hinged door on the flow computer and visually locate the battery compartment (Figure 24).
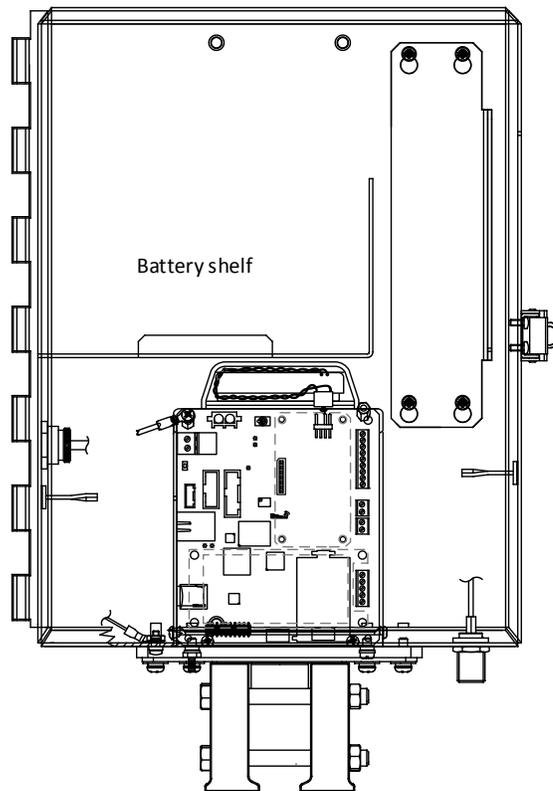
Figure 24: *μ*FLO^G5 enclosure inside view

2. Place the battery on the compartment shelf, taking care to keep the battery terminals from contacting any metal surface inside of the enclosure.

⚠ **WARNING – Bodily injury and property damage.** Do not allow the battery terminals to come in contact with any metal surface. When the positive and negative battery terminals contact a conductive material it creates a short circuit and could result in sparks, property damage, and possible explosion.

3. Stop. Do not connect the battery cable into the BAT (J15) onboard connector until instructed to do so.

⚠ **WARNING – Bodily injury and property damage.** Wiring peripheral devices to the flow computer electronic board should be performed prior to applying power.

The battery and solar panel installation is now complete. Go to section 4.6, *Onboard wiring,* on page 45.

4.5.2   External power supply (9–30 Vdc)

The flow computer may receive power from an optional ABB-approved external power supply.

ℹ **IMPORTANT NOTES:** Make sure that the external power supply voltage is 9 Vdc to 30 Vdc.

Radio operation and the Inhibit feature may not work properly if other than a nominal 12 Vdc power source is used. When connected to supply voltage less than 12 Vdc nominal, Sleep Mode voltage must be adjusted to be equal to or less than supply voltage.

⚠ **WARNING – Equipment damage.** A battery cannot be used when the controller is in the EXT PWR mode.

> ⚠️ **WARNING – Bodily injury.** Electrical wiring must be installed according to requirements for the area classification. Refer to the certification drawing indicated on the device's name tag, and national and local electrical codes.

To wire an external power source to the µFLO^G5 board:

1. To install the external power supply, follow the manufacturer's instructions supplied with the power supply.

2. The power source may be connected to the external power supply; however, do not activate power to the power supply yet.

3. Install the cable into the flow computer enclosure, adapting these instructions as necessary:

   a. Remove a shipping plug from the left side of the flow computer enclosure.

   b. Open the hinged door on the flow computer and visually locate the J17 EXT PWR / CHARGER terminal block.

   c. Remove the cable nut from the cable conduit elbow and insert the cable and conduit ends through the access hole in the enclosure.

   d. Pull the cable into the enclosure, leaving enough cable to reach the J17 connecter.

   e. Replace the cable nut on the cord and conduit end inside of the enclosure, and screw the nut onto the conduit end finger-tight.

   f. Position the conduit elbow so that moisture will not follow the cable and seep into the gland. Tighten the cable nut.

4. Wire the power supply cable to the J17 terminal block:

   a. Visually locate the J17 EXT PWR / CHARGER terminal block.

   b. Using a small slotted screwdriver, loosen the terminal connector from the J17 terminal block on the electronic board.

   c. Trim the power supply wire cover ends back ¼ inch (6.35 mm) if necessary.

   d. Loosen the terminal connector screws for points 1 and 2.

   e. Insert each power supply cable wire (+ or -) into the corresponding point (1 or 2), as shown in Figure 23, page 43, and gently tighten the terminal connector screws.

> ❗ **NOTICE – Property damage.** Do not overtighten the terminal connector screws as this may damage the wires.

   f. Stop. Do not re-connect the external power supply terminal connector to the EXT (J17) onboard connector until instructed to do so in section 4.8.

> ⚠️ **WARNING – Bodily injury and property damage.** Wiring peripheral devices to the flow computer electronic board should be performed prior to applying power.

The external power supply is now installed and wired. Go to section 4.6, *Onboard wiring,* on page 45.

4.6 Onboard wiring

The following information provides guidelines for enabling memory backup and for wiring the onboard communication port, the digital I/Os, and the I/O expansion board, if installed onboard. All onboard wiring should be completed before power is applied to the flow computer.

> ⚠️ **WARNING – Bodily injury and property damage.** When connecting or disconnecting any wires on the µFLO^G5 electronic board, the board should not be receiving power and personnel must be properly grounded.

4.6.1   Lithium battery installation

The lithium battery maintains the real-time clock operating continuously in the flow computer should the power be lost or removed. To ensure that the continuity of the date and time is kept for accurate record keeping, the battery must be installed and connected to the *μ*FLO^G5 board.

> **IMPORTANT NOTE:** The purpose of the lithium battery in the *μ*FLO^G5 differs from legacy versions of the model in that, the battery maintains only the real-time clock, but does not provide backup to memory (RAM) as legacy models did. Instead, if sudden power loss occurs, a super capacitor provides back up power for 2.5 seconds to save RAM contents into permanent memory. See section 3.3.6, *Power supply equipment.*

To install the lithium battery and enable the real-time clock backup:

1. Open the hinged door on the flow computer enclosure and visually locate the LITH (J18) onboard connector and the lithium battery plug.

2. Plug the lithium battery cable onto the LITH onboard connector (J18) so that the red wire is making a connection to pin 1 and the black wire is making a connection to pin 4 (Figure 25).
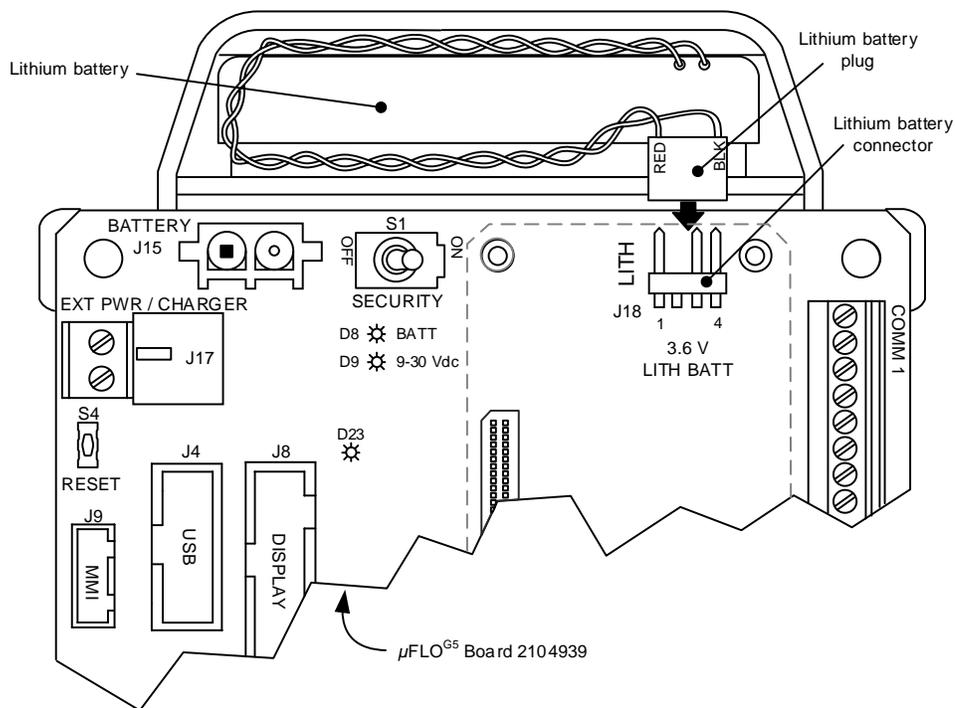

Figure 25: Lithium battery and connector

4.6.2   Communication and onboard I/O

Wire the appropriate communication and digital input and output using the information provided in Figure 26 and the communication points in Table 10.

> **IMPORTANT NOTE:** Bus termination for the *μ*FLO^G5 onboard communication port differs from legacy flow computers. For the *μ*FLO^G5, when wiring COMM 1 for an RS-422 or RS-485 bus, and it is the last or only board in the series, the bus termination must be selected in the communication setup in PCCU32. Those instructions will be detailed in *COMM1 communication setup*, later in this guide.
>
> Additionally, the digital output and external power do not require configuration using pinned jumpers.
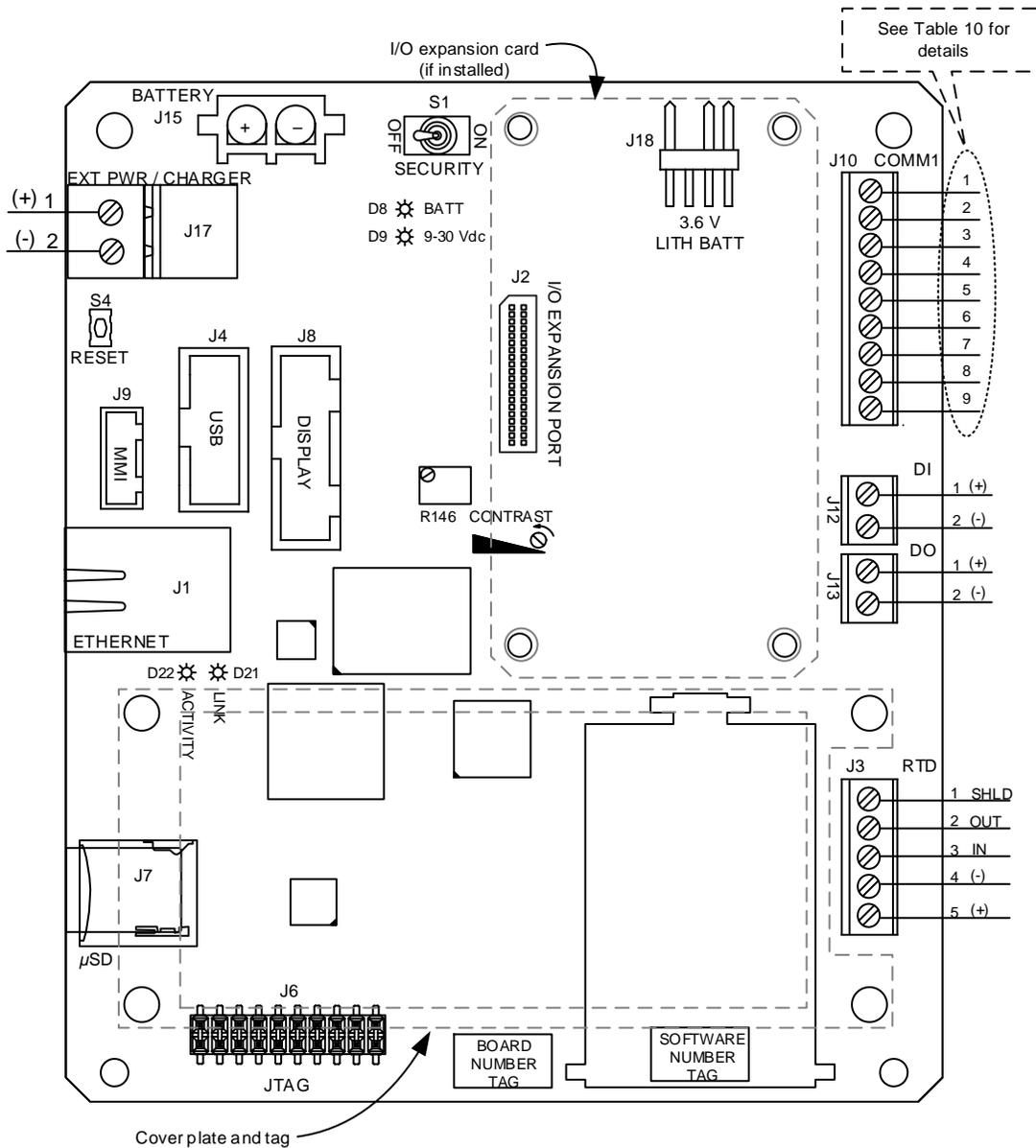
Figure 26: *µ*FLO^{G5} board point definitions

Table 10: COMM 1 (J10) communication point definitions

Point	RS-232	RS-422	RS-485
1	Volts out	Volts out	Volts out
2	Ground	Ground	Ground
3	Switched volts out	Switched volts out	Switched volts out
4	Operate	Operate	Operate
5	N/A	Remote request to send	Remote request to send
6	Request to send	Transmit bus +	Transmit bus +
7	Transmit data	Transmit bus –	Transmit bus –
8	Receive data	Receive bus +	N/A
9	Clear to send	Receive bus -	N/A

> **IMPORTANT NOTES:** COMM 1, point 1 (volts out) and point 3 (switched volts out) output voltage is dependent upon the external power supply voltage connected to J17. Verify that all peripheral devices are compatible with the input voltage at J17 before connecting.

4.7 I/O expansion board (optional)

The I/O expansion board adds one (1) software-selectable communication port (COMM 2), 2 AIs, 1 DI/PI, and 1 DO (Figure 27). The board installs onto the μFLO^G5 expansion port (J2) shown in Figure 26, page 47. Table 11 defines the points for COMM 2.
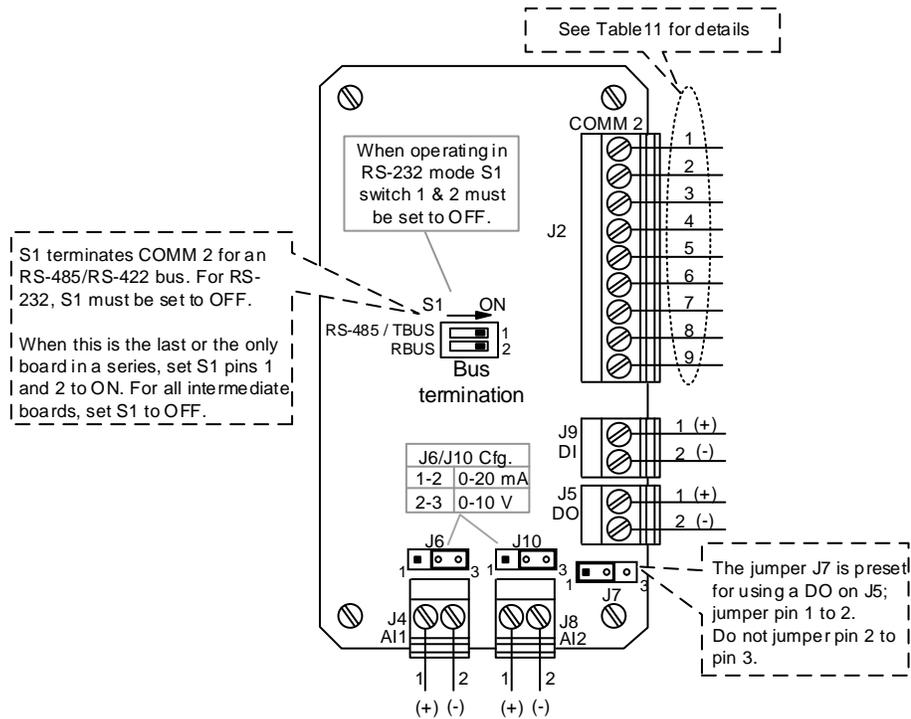
Figure 27: I/O expansion board

Table 11: I/O expansion board COMM 2 (J2) point definitions

Point	RS-232	RS-422	RS-485
1	Volts out	Volts out	Volts out
2	Ground	Ground	Ground
3	Switched volts out	Switched volts out	Switched volts out
4	Operate	Operate	Operate
5	N/A	Remote request to send	Remote request to send
6	Request to send	Transmit bus +	Transmit bus +
7	Transmit data	Transmit bus –	Transmit bus –
8	Receive data	Receive bus +	N/A
9	Clear to send	Receive bus -	N/A

> **IMPORTANT NOTES:** COMM 2, point 1 (volts out) and point 3 (switched volts out) output voltage is dependent upon the external power supply voltage connected to J17. Verify that all peripheral devices are compatible with the input voltage at J17 before connecting.

To install and wire the I/O expansion board:

1. Fit the I/O board connector (J1) onto the I/O expansion port (J2) on the main electronic board (Figure 26, page 47), but do not push down the board to seat.

2. Using a small slotted screwdriver, begin turning each captive screw a few turns each, moving sequentially to each of the four (4) corners of the board, to slowly seat the board into the onboard connector. Continue until the board is fully seated.

3. Field wire the required terminal connectors on the I/O expansion board:

    a. Using a small slotted screwdriver, loosen the terminal connector from the terminal block on the electronic board.

    b. Trim each wire cover end back ¼ inch (6.35 mm) if necessary.

    c. Loosen the terminal connector screws for the appropriate points.

    d. Insert each wire into the corresponding point, and gently tighten the terminal connector screws.

> **!** **NOTICE – Property damage.** Do not overtighten the terminal connector screws as this may damage the wires.

    e. Re-insert each terminal connector to the corresponding terminal block.

4. If COMM 2 is wired for communication:

    a. For RS-422 or RS-485 communication:

        – And this is the last or only board in the series, then terminate the bus by setting the S1 switch pins 1 and 2 to ON.
        – And this is an intermediate board in the series, then set the S1 switch pins 1 and 2 to OFF.

    b. For RS-232 communication, the S1 switch pins 1 and 2 should be set to OFF.

5. If AI1 (J4) or AI2 (J8) is wired as a 0-20 mA input, then the configuration jumper pin (J6 or J10 respectively) should be moved to jumper pins 2 and 3.

> **i** **IMPORTANT NOTE:** AI1 (J4) or AI2 (J8) configuration is set to the 0-10 volt configuration by default. The configuration jumper pins (J6 or J10 respectively) should have pins 1 and 2 jumpered.

The installation and wiring of the I/O expansion board is now complete. Additional software configuration is required and is addressed in section 5.3.2, *COMM2 communication setup*, on page 61.

4.8 Power supply and charger connections

All wiring connections and jumper configurations on the flow computer and I/O expansion board should be completed before beginning this section.

— To connect the battery and a solar panel charger or ABB-approved battery charging source to the electronic board, see section 0.

— To connect an ABB-approved external power supply to the electronic board, see section 4.8.2, *External power supply*, on page 50.

> **i** **IMPORTANT NOTE:** The μFLO^{G5} charger controller for the external power supply/charger terminal block (J17) is integrated and differs from legacy flow computers. The μFLO^{G5} internal charger controller does not require an onboard jumper to distinguish between an external power supply and an external charger.

4.8.1 Battery and charger connections

To connect the battery and a solar panel or other ABB-approved battery charging source:

1. Insert the battery connector into the electronic board's battery plug (Item J15, Figure 28).
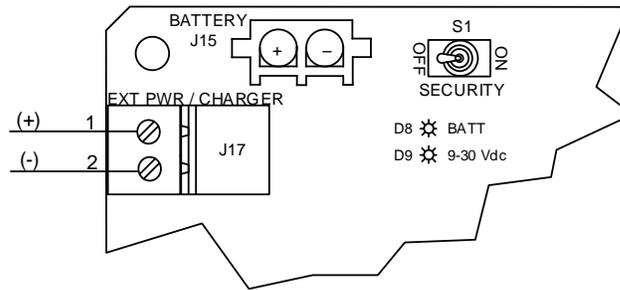
Figure 28: *µ*FLO^{G5} power connections and power option selector

2. Observe that the liquid crystal display (LCD) is cycling through the startup diagnostics sequence.

3. Confirm that the BATT LED is red (Item D8).

4. Connect the charging source terminal connector to the EXT PWR / CHARGER (J17) terminal block on the electronic board.

---

i **IMPORTANT NOTES:** An ABB-approved charging source is mandatory when a battery is connected to J15.

The maximum allowable input voltage on J17 must be less than 15.5 Vdc when a battery is connected to J15.

When a battery is connected to the J15 terminal block, the real-time input voltage is measured and written to the Battery Voltage register in the I/O interface node in PCCU32.

---

5. Verify that all peripheral devices powered from the *µ*FLO^{G5} are receiving power. If not, refer to section 9.3, *Power troubleshooting* in this manual.

4.8.2   External power supply

⚠ **CAUTION – Equipment damage.** A battery cannot be used when the controller is in the EXT PWR mode.

The allowable external power input voltage on J17 is between 9 and 30 Vdc. J17 provides power to all external powered peripheral devices. Verify that all peripheral devices are compatible with the input voltage at J17 before connecting.

To connect an ABB-approved external power supply:

1. Connect the power supply terminal connector to the EXT PWR / CHARGER (J17) terminal block on the electronic board (Figure 28, page 50).

2. Observe that the liquid crystal display (LCD) is cycling through the startup diagnostics sequence.

3. Confirm that the 9-30 Vdc LED is red (Item D9).

---

i **IMPORTANT NOTES:** When an external power supply is connected to the J17 terminal block, the real-time input voltage is measured and written to the External/Charger voltage register in the I/O interface node in PCCU32.

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4. Verify that all peripheral devices powered from the *µ*FLO^{G5} are receiving power. If not, refer to section 9.3, *Power troubleshooting*, on page 127.

5 *µ*FLO^{G5} configuration and startup

The following chapter describes the steps required to get a newly installed *µ*FLO^{G5} system configured and operational using PCCU32. Specific information required to complete each step is also discussed in the PCCU32 help.

> **i**   **IMPORTANT NOTE:** Before beginning, the user should complete the tasks covered in section 4, *Installation*.

5.1 PCCU32 installation and setup

For full feature support, including loading of new flashes, PCCU32 version 7.58 (or newer) is required. Earlier versions of PCCU32 may be used for basic operations such as calibration and collection of data records.

PCCU32 software running in a Windows® environment offers the most capabilities for programming. It features user-friendly help files and easy-to-follow menus.

1. Insert the PCCU32 disk into the PC drive. If the drive is set to AutoPlay, the installation program should begin; otherwise go to Windows® **Start** > **Run**. At the **Run** prompt, type **D:\Disk1\setup.exe**. D is the CD drive designation.

2. Follow the screen prompts during the software installation.

3. At the screen prompt asking for user information, type in the relevant information.

4. Click **Next**.

5. If necessary, change the default destination directory and click **Next**.

6. If the installation requests a computer restart, restart the computer. A restart may be required before running PCCU32 software.

7. Click **Finish**.

5.2 Basic configuration using PCCU32

The following sections detail the setup for a basic configuration and include establishing local communication, station setup, and measurement application setup.

5.2.1 Establish local communication

1. Connect the PC to the flow computer with either an MMI cable (RS-232) or a USB cable.

2. Verify the port is active by view the local protocol annunciator in position A6 of the LCD.

3. Launch the PCCU32 software program by double-clicking the desktop icon or selecting **PCCU32** from the **Start** > **Program** menu.

4. Define the local connection parameter:

    a. Click the **Setup** icon on the toolbar or click **Operate** > **Setup** > **System Setup**.

    b. On the **PCCU Com. Port** menu under **Connection Parameters**:

        i. Select the **PCCU Connect Method**:

            - Select **Serial port** for an MMI cable or USB cable connection.
            - Select **TCP/IP** for a local Ethernet connection.

ii.   Define the **Connection parameter**. To connect via the serial port, select the PC communication port containing the local cable connection (Figure 29) as the **PCCU Com. Port.**
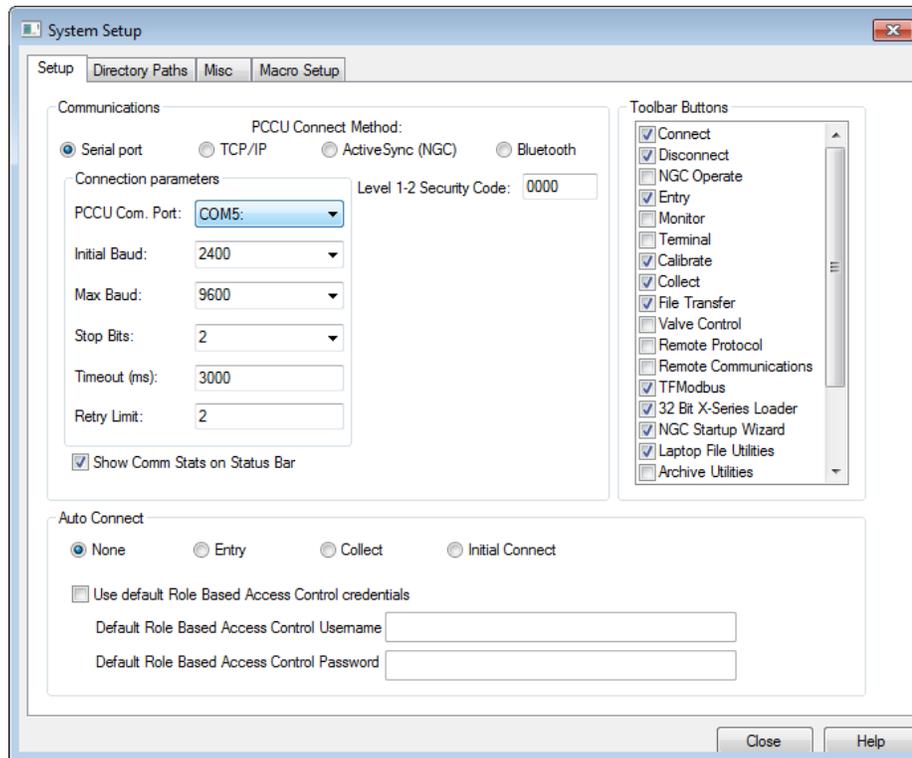
Figure 29: Serial local communication setup

c.   If a security code has been assigned to the flow computer, type the code in the **Level 1-2 Security Code** field.

d.   Click **Close**.

5.   Click the **Entry** icon on the PCCU32 toolbar (Figure 30) to connect to the flow computer and go directly to the **Entry mode** user interface (Figure 31).
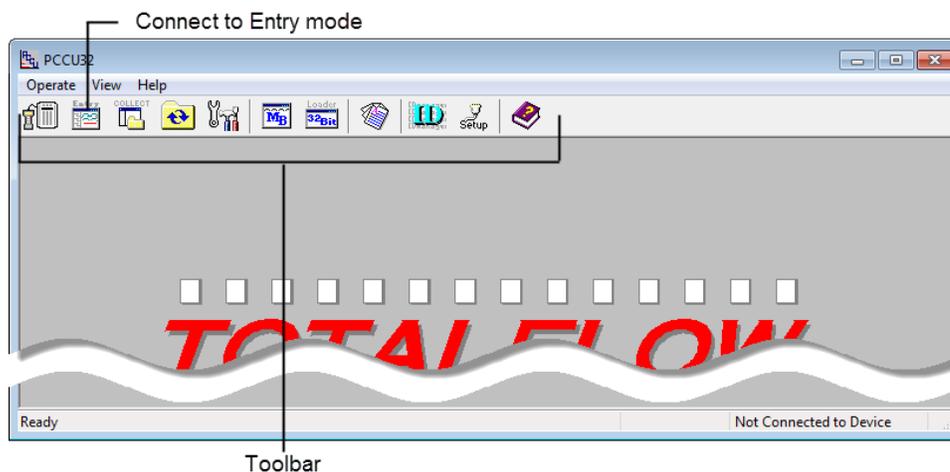
Figure 30: Local connection screen

i

IMPORTANT NOTE: If local communication fails:

—   Determine if a security code was assigned to the flow computer.

- If no security code was assigned, it may be necessary to enter the default security code (default is 0000) into the **Level 1-2 Security Code** field, click **Close,** and try to reconnect.

- If a security code was assigned, but not entered into the **Level 1-2 Security Code** field, enter the code, click **Close,** and try to reconnect.

- If a security code was assigned and entered into the field, and communication has failed, the flow computer may have been cold-started. A cold start will reset the flow computer, delete historical data, and reset the security code to the default value. Type the default value (0000) into the **Level 1-2 Security Code** field, click **Close,** and try to reconnect.

- For more information about the security code, refer to the help files linked to this screen by clicking **Help**.

— Determine if the communication parameters are correct. The **PCCU Com. Port** field is the computer port in which the PCCU cable is plugged. The remaining parameters should be correct as determined by the connection method selected. Make necessary changes to the **Connection Parameters**, click **Close,** and try to reconnect.

— If TCP/IP communication was interrupted at any point, it may be necessary to press the Restart button (S4) while the Ethernet cable is still connected, allowing time for the connection to be reestablished. When connectivity is established, the Link LED (D21) will be lit and the Activity LED (D22) will flash.
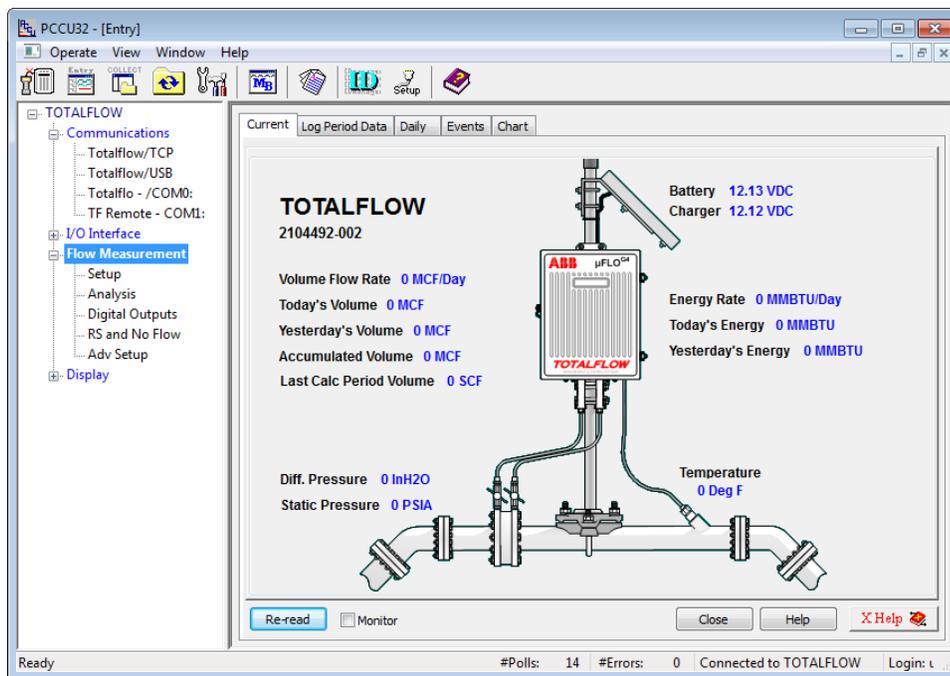
Figure 31: User interface screen

i **IMPORTANT NOTES:** The first time PCCU32 communicates with a new flow computer, a dialog box will indicate that the flow computer and PCCU32 date and time do not agree. Select **Yes** to set the flow computer date and time. Selecting **No** will require the date and time be set during *station setup* covered next in this manual.

5.2.2   Station setup

To set up the flow computer station:

1.   Click the top node of the navigation tree, the **Station ID** name, to see the **Station Setup** screen and tab (Figure 32).
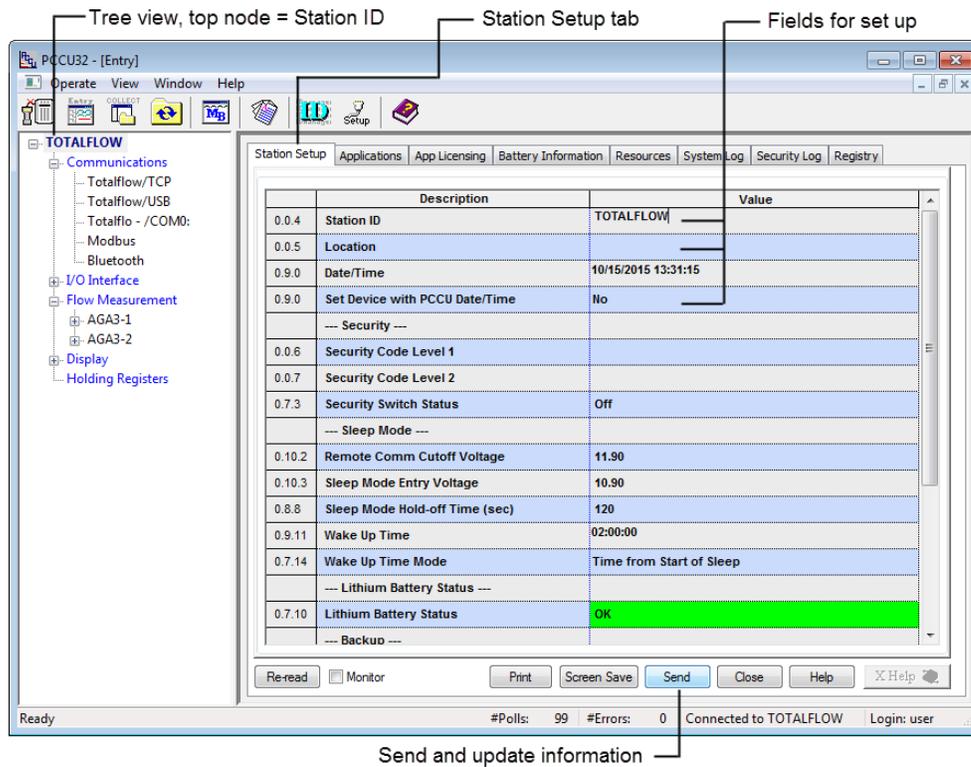
Figure 32: Station Setup tab

2. On the **Station Setup** tab, change the following settings if necessary, and any other settings that may need to be changed:

— **Station ID**: A unique 10-digit alphanumeric identifier that differentiates one device from another

i   **IMPORTANT NOTES:** Multiple measurement applications may reside in the device and each application should also be uniquely identified by editing the application ID, [**measurement application**] > **Setup** > **Device/APP ID**.

Each added application will have unique setup requirements. Information about setting up applications is located in the PCCU32 help.

— **Location**: A 24-digit alphanumeric description of the device location
— **Date/Time**: This field displays the current date and time values. A request to reset this field should have been received when local communication was first established with the flow computer. If this field is not correct, select **Yes** from the value field submenu.

3. Click **Send** when all changes and selections have been made.

5.2.3 Measurement application setup

To set up the flow computer measurement application:

1. In the navigation tree, click **Flow Measurement** > **Adv Setup** (Figure 33).
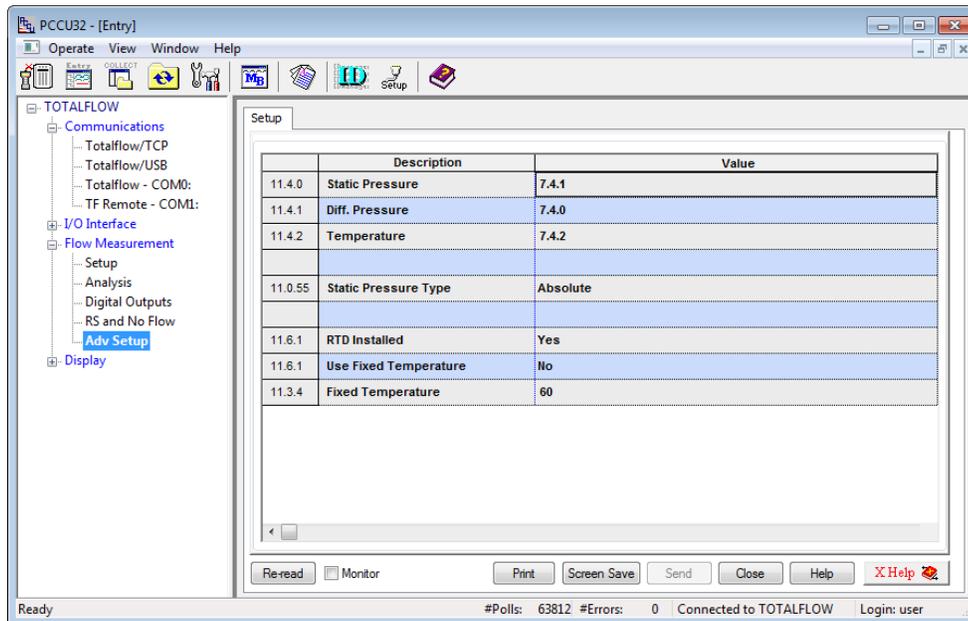
Figure 33: Measurement Adv Setup tab

2. On the **Setup** tab, verify, and change if necessary, the following settings and any other settings that may need to be changed:

    — **RTD Installed:** Select **Yes** if live readings from an RTD are used for flowing temperature.
    — **Use Fixed Temperature**: Select **Yes** if using a fixed temperature instead of live readings.
    — **Fixed Temperature**: Type the value to be used for the fixed temperature.

3. On the navigation tree, click **Flow Measurement** > **Setup**.

4. On the **General** tab (Figure 34), verify, and change if necessary, the following settings and any other settings that may need to be changed:

    — **Calculation Type**: Select the calculation standard for this tube (Table 12).
    — **Fpv Method**: Select the compressibility method for this tube (Table 13).
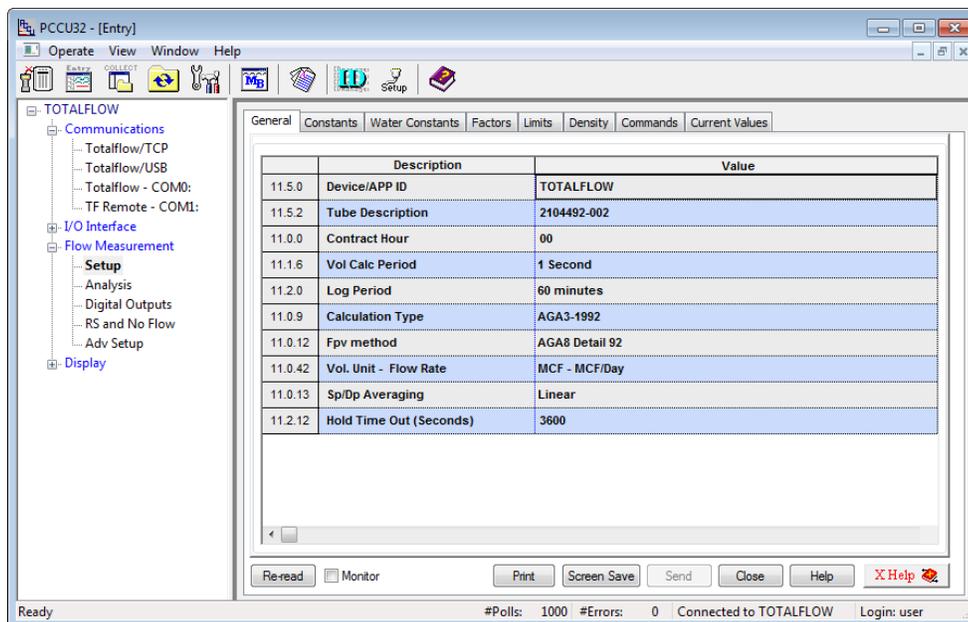
Figure 34: Measurement setup tabs

Table 12: Calculation type configurable factors

Calculation Parameter	Configurable			
	AGA3-1985	AGA3-1992	AGA3-2012	AGA7
Fpb (pressure base factor)	Yes	Not applicable	Not applicable	Not applicable
Ftb (temperature base factor)	Yes	Not applicable	Not applicable	Not applicable
Fg (specific gravity factor)	Yes	Not applicable	Not applicable	Not applicable
Fb (orifice factor)	Yes	Not applicable	Not applicable	Not applicable
Fb calculation	Yes	Not applicable	Not applicable	Not applicable
Ftf (flowing temperature factor)	Yes	Not applicable	Not applicable	Not applicable
Y (expansion factor)	Yes	Yes	Yes	Not applicable
Fr (Reynolds number)	Yes	Not applicable	Not applicable	Not applicable
Fa (orifice thermal expansion factor)	Yes	Not applicable	Not applicable	Not applicable
Fpv (supercompressibility factor)[3]	Yes	Yes	Yes	Not applicable
*Fw (water vapor factor)[4]	Yes	Yes	Yes	Not applicable
*Faux[5]	Yes	Yes	Yes	Yes
Cd (coefficient of discharge)	Not applicable	Yes	Yes	Not applicable
Fp (for Fpv method = NX19 Fixed)	Yes	Yes	Yes	Not applicable
Ft (for Fpv method = NX19 Fixed)	Yes	Yes	Yes	Not applicable
Fpc (pressure correction factor)	Not applicable	Not applicable	Not applicable	Yes
Ftc (temperature correction factor)	Not applicable	Not applicable	Not applicable	Yes
Fs (compressibility factor)	Not applicable	Not applicable	Not applicable	Yes

Table 13: Fpv analysis data

Analysis data	Default value	Units	Configurable		
			NX19 Fixed Ft/Fp	AGA-8 1992 Detail	All others[6]
Fp (for Fpv method NX19 Fixed)	1.000	Not applicable	Yes	No	No
Ft (for Fpv method NX19 Fixed)	1.000	Not applicable	Yes	No	No
Argon	0.0000	mol %	No	Yes	No
Carbon dioxide	0.0000	mol %	Yes	Yes	Yes
Carbon monoxide	0.0000	mol %	No	Yes	No
Ethane	0.0000	mol %	No	Yes	No
Hydrogen sulfide	0.0000	mol %	No	Yes	No
Heating value[7]	1000.0000	Btu/SCF	Yes	Yes	Yes

---

[3] NX19 GCN, NX19 GCNM, AGA-8 1992 Gross and AGA-8 1992 Detail.

[4] Fw is not an AGA factor. Fw is a factor which compensates for water vapor in the gas stream and its effect on volume measurements.

[5] Faux is not an AGA factor. Faux is a user-set multiplier. It defaults to 1.

[6] NX19 GCN, NX19 GCNM, AGA-8 1992 Gross

[7] Enter the heating value in Btu per SCF. Not used in volume calculations. Only used for calculating MMBTU for reports.

Analysis data	Default value	Units	Configurable		
			NX19 Fixed Ft/Fp	AGA-8 1992 Detail	All others[6]
Helium	0.0000	mol %	No	Yes	No
Hydrogen	0.0000	mol %	No	Yes	No
iButane	0.0000	mol %	No	Yes	No
iPentane	0.0000	mol %	No	Yes	No
Methane	100.000	mol %	No	Yes	Yes
nButane	0.0000	mol %	No	Yes	No
nDecane	0.0000	mol %	No	Yes	No
nHeptane	0.0000	mol %	No	Yes	No
nHexane	0.0000	mol %	No	Yes	No
nitrogen	0.0000	mol %	Yes	Yes	Yes
nNonane	0.0000	mol %	No	Yes	No
nOctane	0.0000	mol %	No	Yes	No
nPentane	0.0000	mol %	No	Yes	No
Oxygen	0.0000	mol %	No	Yes	No
Propane	0.0000	mol %	No	Yes	No
Specific gravity	0.6000	Not applicable	Yes	Yes	Yes
Water	0.0000	mol %	No	Yes	No

5. Click **Send** when all changes and selections have been made.

6. Select the **Constants** tab.

7. Verify, and change if necessary, the following settings and any other constants that may need to be changed (Table 14):

   — **Barometric pressure**: Enter the value, which is subtracted from the absolute pressure readings when calibrating in gauge pressure.
   — **Orifice diameter**: Enter the orifice plate diameter in inches.
   — **Pipe diameter**: Enter the pipe diameter in inches.
   — **Temperature base (Tb)**: Enter the value as defined by the existing contractual agreement (default is 60 °F).

Table 14: Gas orifice constants

Parameter	Default Value	Units	Configurable		
			AGA3-1985	AGA3-1992	AGA3-2012[8]
Auxiliary factor (Faux)	1.0	Not applicable	Yes	Yes	Yes
Barometric pressure	14.73	PSIA	Yes	Yes	Yes
Basic orifice factor (Fb)	210.2256	Not applicable	Yes	Not applicable	Not applicable
DP zero cutoff	0.0000	Inches H_2O	Yes	Yes	Yes
Fixed Cd	0.6	Not applicable	Not applicable	Yes	Yes
Orifice diameter	1.0000	Not applicable	Yes	Yes	Yes
Orifice plate expansion coefficient[9]	9.2500	Inches per degree F	No	Yes	Yes

[8] Uses the expansion (Y) calculation published in API 14.3.1 (published in Sept. 2012).

[9] Orifice plate expansion coefficient value is based upon the orifice material selected (stainless, Monel, or carbon steel).

Parameter	Default Value	Units	Configurable		
			AGA3-1985	AGA3-1992	AGA3-2012[8]
Pipe diameter	2.0670	Inches	Yes	Yes	Yes
Pipe expansion coefficient[10]	6.2000	Inches per degree F	Not applicable	Yes	Yes
Pressure base (Pb Contract)	14.7300	PSIA	Yes	Yes	Yes
SP tap location	Upstream	Not applicable	Yes	Yes	Yes
Specific heat ratio	1.3000	Not applicable	Yes	Yes	Yes
Tap type	Flange	Not applicable	Yes	No	No
Temperature base (Tb)	60.0000	Degrees F	Yes	Yes	Yes
Viscosity	0.0103	Centipoise	Yes	Yes	Yes
Z of air at Tb and Pb (base condition)	0.9996	Not applicable	Not applicable	Yes	Yes

8. Click **Send** when all changes and selections have been made.

9. Select the **Limits** tab.

10. Verify, and change if necessary, any limit settings that may need to be changed (Table 15):

Table 15: Alarm limits

Parameter	Default Value	Units	Configurable		
			AGA3-1985	AGA3-1992	AGA3-2012
DP High Limit	2047	In H_2O	Yes	Yes	Yes
DP Low Limit	0	In H_2O	Yes	Yes	Yes
Flow Rate High Limit	24,000	MCF/Day	Yes	Yes	Yes
Flow Rate Low Limit	0	MCF/Day	Yes	Yes	Yes
RTD High Limit	420	Degrees F	Yes	Yes	Yes
RTD Low Limit	0	Degrees F	Yes	Yes	Yes
SP High Limit	2047.969	PSIA	Yes	Yes	Yes
SP Low Limit	0	PSIA	Yes	Yes	Yes

11. Continue to the other tabs and verify, or change if necessary, the other settings.

12. Click **Send** when all changes and selections on each tab have been made.

13. Select the **Commands** tab.

! **NOTICE – Inaccurate data.** Since the flow computer volume calculations are made each volume calculation period, any changes that are made during the period would affect the volume calculations (such as changing the orifice plate size). To avoid introducing errors during setup, use the Reset Volume command. This command forces the flow computer to perform volume calculations for the elapsed time since a previous volume calculation was made. A new partial period volume is added to the volume accumulator. An event is logged before the volume is reset to zero (0).

---

14. Select **Yes** from the **Reset Volume** value to perform a volume reset.

---

[10] Pipe expansion coefficient value is based upon the pipe material selected (stainless, Monel, or carbon steel).

i **IMPORTANT NOTE:** When the user resets the volume accumulator, the µFLO^G5 will:

- Store the time, date and previous accumulated partial calculation period volumes into the historical record file
- Zero the remaining partial calculation period accumulations
- Complete all computations for the present flow file daily records
- Begin a new flow file daily record
- Zero the total volume accumulator and log the event with an accumulator value before zeroing the accumulator

15. Click **Send** and select **Yes** on the verification screen to reset the volume.

This completes the basic setup for a single measurement tube.

5.3 Remote communication configuration

i **IMPORTANT NOTE:** These instructions are only applicable if remote communication wiring was installed during installation and if it conforms to the pinouts and switch settings provided in section 4.6.2, *Communication and onboard I/O,* on page 46.

To communicate with a remote host, the µFLO^G5 uses the remote communications port (COMM 1) which can function as an RS-232, RS-422, or RS-485 port. If the I/O expansion board was installed to enable COMM 2, then additional setup is required (see Section 5.3.2, *COMM2 communication setup*, page 61).

5.3.1 COMM1 communication setup

The following instructions provide the steps to configure a typical communication port.

1. On the navigation tree, click **Communications** (Figure 35).

i **IMPORTANT NOTE:** In a standard configuration, the µFLO^G5 is shipped with **TF Remote - COM1:** for port name and **Totalflow Remote** as the default for protocol.
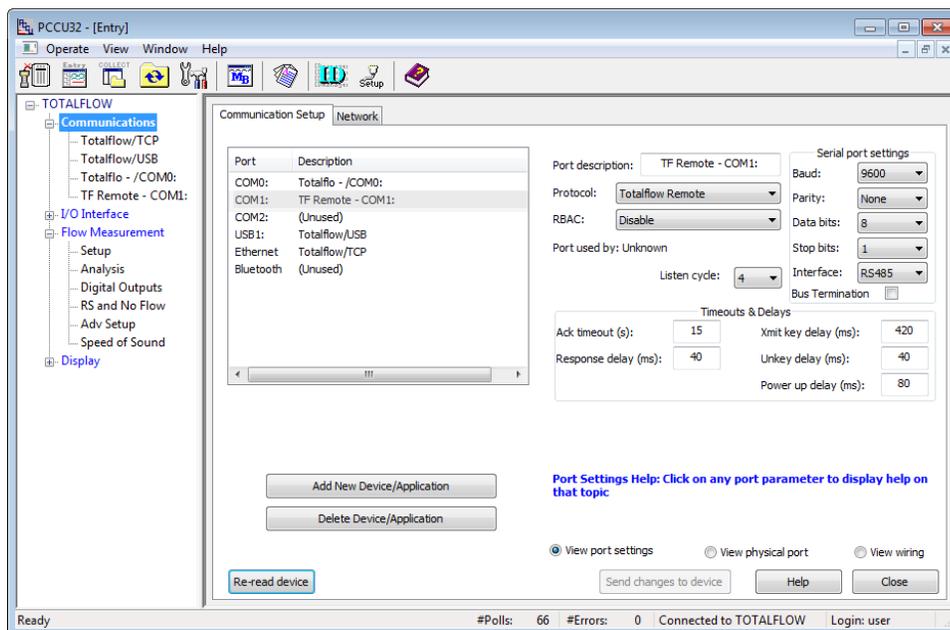
Figure 35: Communications setup screen

2. Highlight the **COM1: TF Remote – COM 1:** port.

3. On the **Protocol** menu, select the appropriate protocol.

4. On the **Interface** menu, under **Serial port settings**, select the communication interface (RS-232, RS-422, RS-485, or RS-232 Modem).

5. Verify, and change if necessary, the remaining serial port settings and timeouts and delays (Table 16).

Table 16: Communication setup parameters

Timeouts and delays		Serial port settings	
Parameter	Default	Parameter	Default
Ack timeout (s)	15	Baud	9600
Response delay (ms)	40	Parity	None
Xmit key delay (ms)	420	Data bits	8
Unkey delay (ms)	40	Stop bits	2
Power up delay (ms)	80		

6. For RS-422 and RS-485 communication:

    a. Select the **Bus Termination** check box if this is the last or only board in the series.

    b. If this is an intermediate board in the series, verify that the **Bus Termination** check box is cleared.

7. Click **Send changes to device** after all values have been set.

8. Observe the LCD on the enclosure door. The annunciator, position A8, should periodically flash the ‡ symbol to indicate that the COM1 port is active and listening for communication (Figure 36).
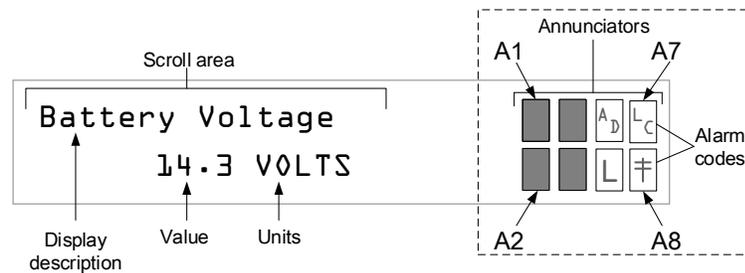
Figure 36: µFLO^G5 annunciators

> **IMPORTANT NOTES:** The ‡ symbol flashes according to the listen cycle defined for the communication port. The default listen cycle is 4. If set to zero, the symbol should be displayed continuously. See the PCCU32 help for communication port setup to learn how this setting effects power usage.
>
> For a full description of the alarm characters, locations, and descriptions, see section 9.2, Troubleshooting visual alarm codes, on page 123.

9. To set up and schedule the remote communication port for power conservation:

    a. Select the communication port node on the navigation tree. For example, **TF Remote – COM1:**.

    b. Select the **Schedule** tab. Parameter definitions may be located by clicking **Help**.

    c. Click **Send** after all values have been set.

10. If **RS-232 Modem** was selected in step 4:

    a. Select the **Modem** tab to set up modem parameters. Parameter definitions may be located by clicking **Help**.

    b. Click **Send** after all values have been set.

COMM 1 communication configuration is now complete.

5.3.2   COMM2 communication setup

When the I/O expansion board is installed for an additional communication port, COMM 2 must be set up in PCCU32. Use the following procedure to set up COMM 2:

1. Click **Communications** on the navigation tree (Figure 37).
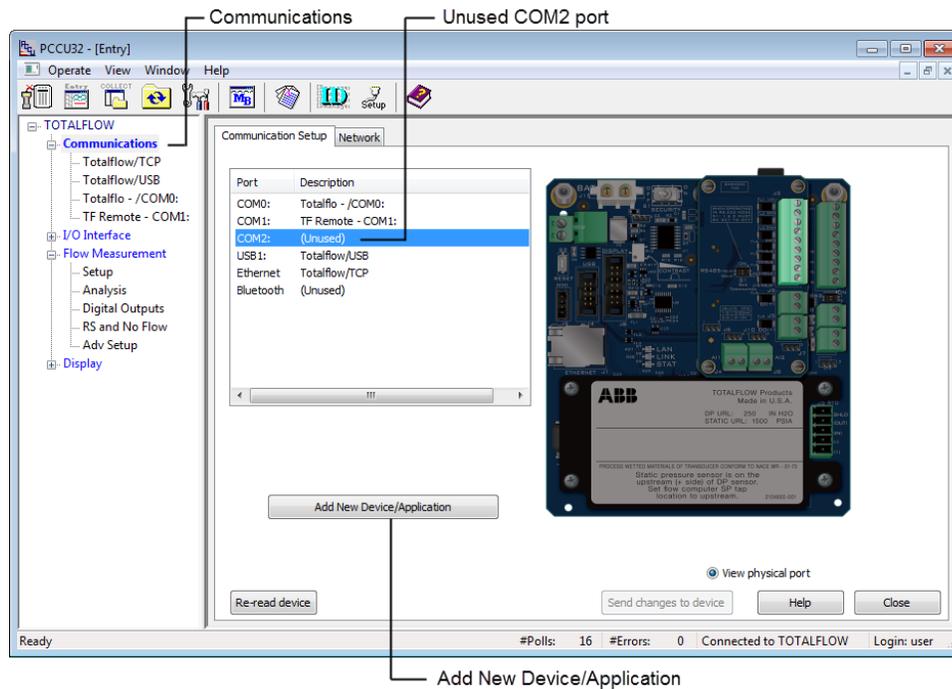
Figure 37: Add the I/O expansion communication port

2. Highlight the **COM2: (Unused)** port and click **Add New Device/Application.**

3. On the **Select Application** menu, select the type of communication being added. For RS-232/422/485, select **Generic Com App** (Figure 38).
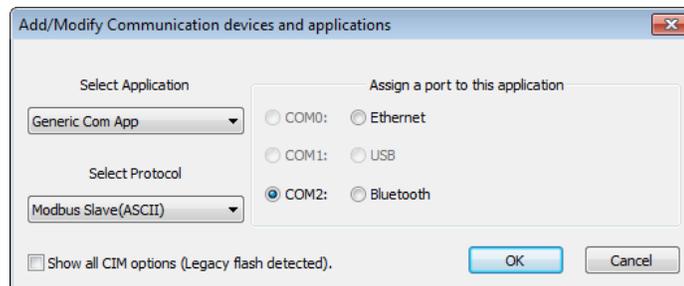
Figure 38: COMM 2 port definition

i   **IMPORTANT NOTE:** For additional information about other communication applications, click **Cancel** and click **Help** on the previous screen.

4. On the **Select Protocol** menu, select the appropriate protocol.

5. Assign a port to this application by selecting **COM2:** then click **OK**.

6. On the Communication Setup screen, define **COM2**:

    a. Highlight **COM2:** [Generic Com App or other communication type] and type an appropriate description in the description field. For example: **TF Remote - COM2**.

b.   Verify or change other fields as required.

c.   Click **Send changes to device** when all changes and selections have been made.

> **i**   **IMPORTANT NOTE:** The navigation tree should reflect the additional port added as named in step 6a.

COMM 2 communication configuration is now complete.

5.4 Commission the *µ*FLO^{G5}

Commissioning the *µ*FLO^{G5} is a two-part process. The flow computer measurement must be validated and then the flow computer put into service.

5.4.1   Validate the measurement

The *µ*FLO^{G5} is calibrated at the factory before shipping. However, shipping and installation may introduce errors into the measurement results. Pressure checks should be completed before commissioning the flow computer to verify measurement accuracy.

> **i**   **IMPORTANT NOTE:** For applications that require calibration to the end user's standards, see section 8, *Calibration*, on page 113.

1.   Perform static pressure (SP) and differential pressure (DP) calibration pressure checks. For more information about calibration pressure checks refer to section 8, *Calibration*, on page 113.

2.   If it is necessary to correct errors in the measurement system, proceed to the calibration instructions in section 8.

5.4.2   Place the transmitter in service

> **!**   **NOTICE – Tainted results.** Carefully follow these instructions to avoid a calibration shift.

The following instructions provide general guidelines for placing the transmitter in service:

> **i**   **IMPORTANT NOTE:** The following procedure is based on a flow computer attached to a 3-valve manifold. For all other applications, adapt these instructions to the specific manifold.

1.   Verify the high and low pressure tap valve connections on the stream are closed to shut off the process flow (Figure 18, items L and H, page 39).

2.   Verify that the equalization valves (items A and B) are open.

3.   Verify that the manifold vent valve (item C) is closed.

4.   Slowly open the stream tap valves (items H and L) to open the process stream, creating flow. Wait until the system has pressurized, typically less than 1 minute, before continuing.

5.   Close the equalizing valves (items A and B) on the manifold. The transmitter is now commissioned into operation.

The flow computer is now in service.

6   Optional setup

Beyond the basic setup, additional functionality of the *μ*FLO^{G5} flow computer may be set up. This section includes information for setting up Ethernet, Bluetooth®, and device security.

6.1   Set up Ethernet network connectivity

These instructions assume that the flow computer is operational and is using either an RS-232 or USB cable for communication with the PC.

Use the following procedure to establish Ethernet network connectivity:

1.   Connect the PC to the flow computer with either an MMI cable (RS-232) or a USB cable.

2.   Verify that the port is active by ensuring the A6 annunciator on the LCD is flashing an **L** (local protocol).

3.   Launch PCCU32 software by double-clicking the desktop icon or selecting **PCCU32** from the **Start** > **Program** menu.

4.   Select **Communications** on the Entry mode navigation tree, then click on the **Network** tab. (Figure 39).
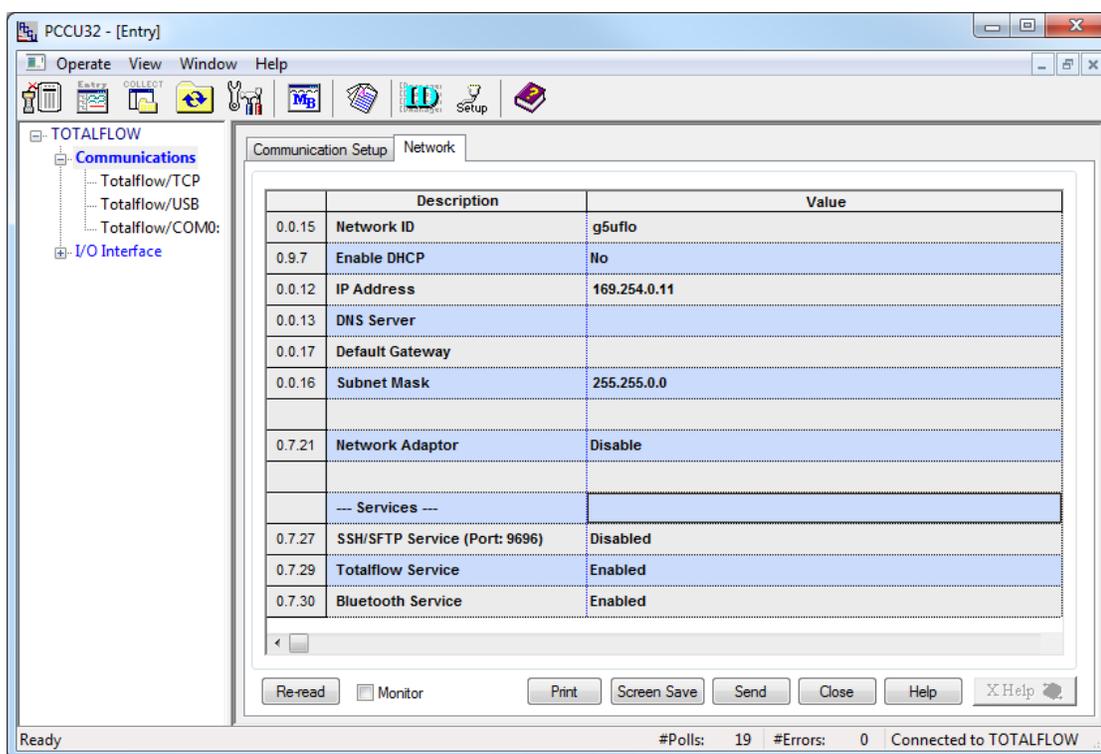
Figure 39: Network communication setup

5.   Configure the Ethernet network. Go to step 5a for manual IP configuration, or step 5b for automatic IP configuration.

   a.   For manual IP configuration

      i.   Type the **Network ID** in the value field.

      ii.   Type the **IP address** in the value field.

      iii.   Type the **DNS server** IP address in the value field.

      iv.   Type the **Default Gateway** address in the value field.

      v.   Type the **Subnet Mask** address in the value field.

   b.   For automatic IP configuration (only an option when DHCP services are available in the network).

      i.   Enable DHCP by clicking **Yes.**

6.   Set the Network Adaptor to **Enable**.

7. Click **Send**.

8. A message will appear: "Remember to warm start the device." Click **OK**.

9. Connect the flow computer to the network port using an Ethernet cable.

10. Disconnect PCCU from the flow computer by clicking the **Disconnect** icon.

11. Open the flow computer door and press the Reset button (S4).

12. If automatic IP configuration (step 5b) was used to configure the IP parameters, the flow computer should automatically obtain the IP parameters. Complete the following sub-steps to verify proper execution. If manual IP configuration (step 5a) was used to configure the IP parameters, go to step 13.

    a. Reconnect communication between PCCU and the flow computer by clicking the **Connect** icon.

    b. Select **Communications** on the navigation tree, then click on the **Network** tab.

    c. Verify that the network parameters have been automatically populated.

    d. If the parameters are populated, take note of the IP address assigned to the flow computer.

    e. Click **OK.**

    f. Disconnect communication between PCCU and the flow computer by clicking the **Disconnect** icon.

13. Connect the PC to the network port using an Ethernet cable. Do not disconnect the serial cable.

14. Reconfigure PCCU to communicate with the flow computer using TCP/IP:

    a. Click the **Setup** icon on the PCCU toolbar or click **Operate** > **Setup** > **System Setup** (Figure 40).
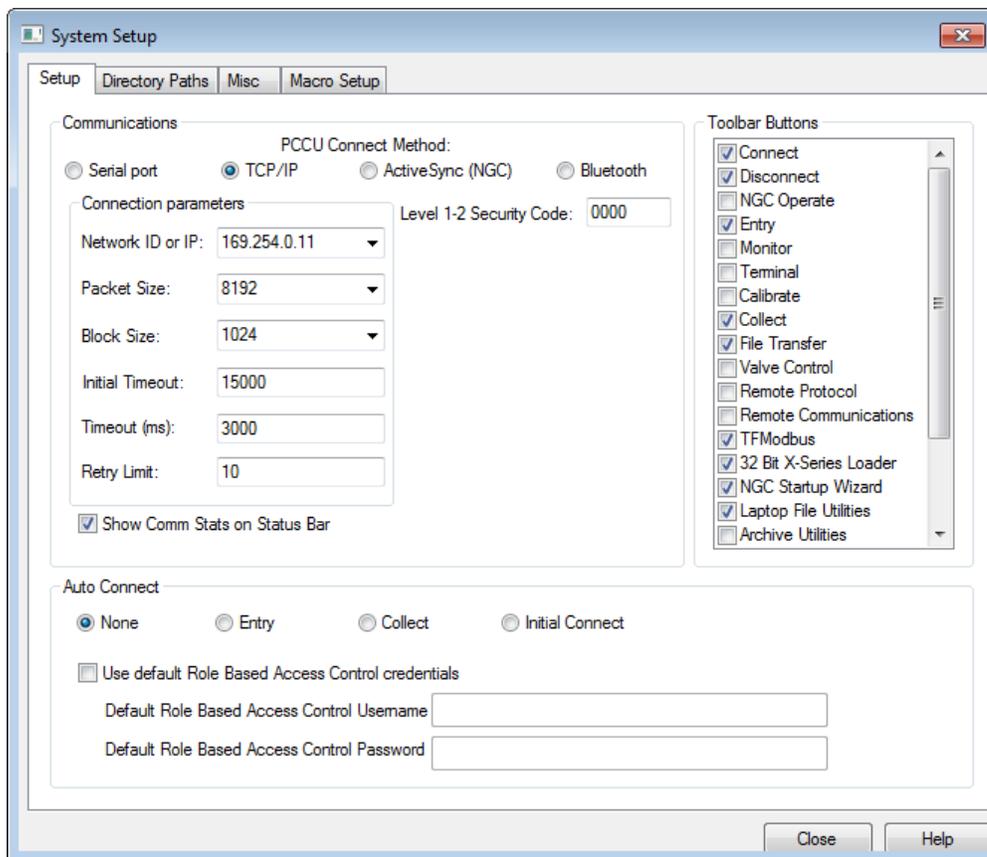
Figure 40: System Setup dialog box

    b. Select **TCP/IP** as the connection method.

    c. Enter the Network ID or the device IP address from step 5a or step 12d.

    d. Click **Close**.

15. Reconnect PCCU to the flow computer by clicking the **Connect** icon.

When PCCU connects to the flow computer successfully, then Ethernet communication has been properly configured.

6.2 Bluetooth® connectivity

The following instructions detail the steps necessary for setting up the µFLO^G5 for Bluetooth® connectivity.

> **i** **IMPORTANT NOTE:** To communicate with a flow computer using Bluetooth®, the PC must have Bluetooth® capability or use a Bluetooth® dongle (older computers). The Bluetooth® dongle must be USB 1.1 compatible or backward compatible to USB 1.1.

To setup Bluetooth® connectivity:

1. Activate Bluetooth® capability in the PC setup or install dongle into a USB port on the PC.

2. Plug a USB cable into the µFLO^G5 electronic board (J4) and the PC USB port or dongle.

3. Open and connect to PCCU32.

4. On the PCCU32 navigation tree, click on the **Communications** menu. The Communication Setup tab displays.

5. On the Communications Setup tab, locate the Bluetooth® option within the Port section. Click **Bluetooth®**, then click **Add New Device/Application** (Figure 41).
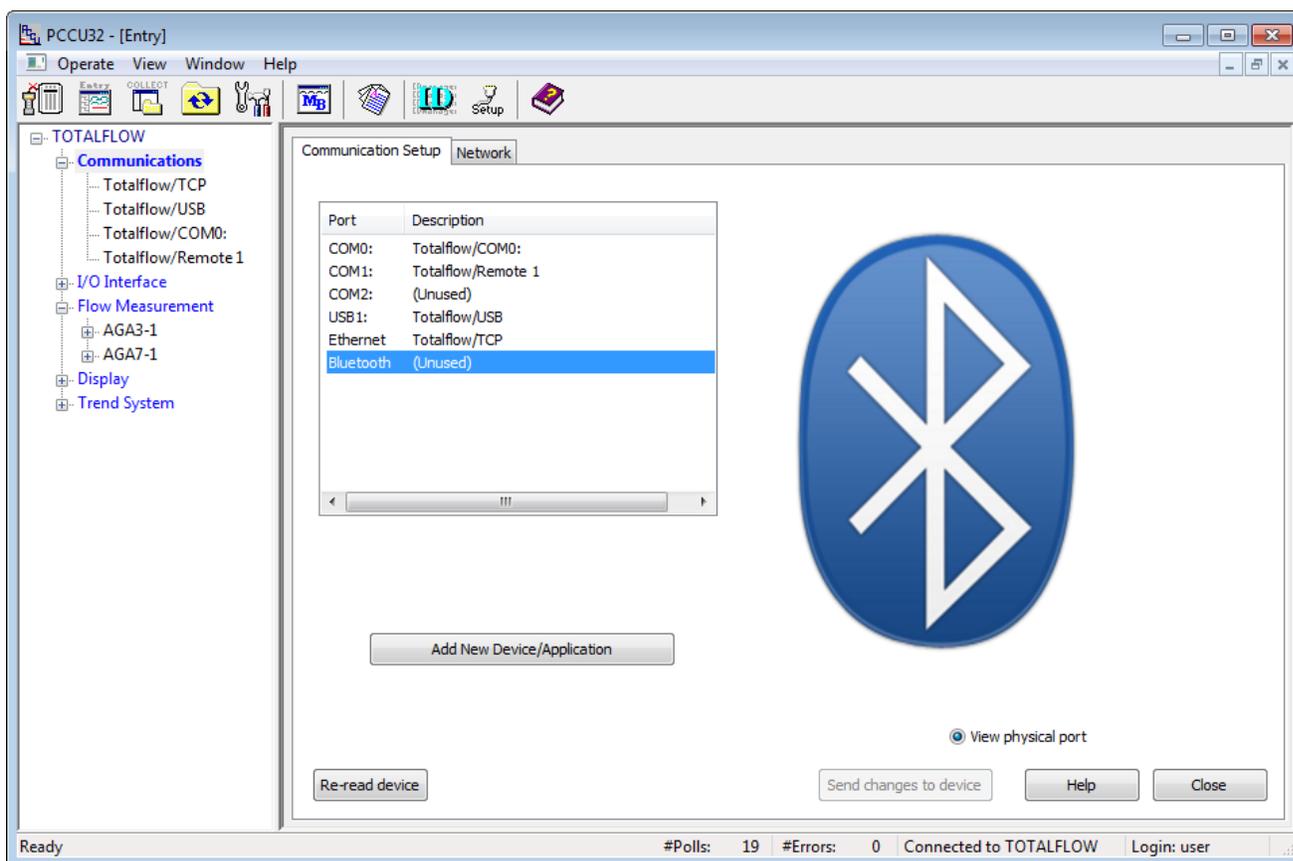
Figure 41: Communications Setup tab - Bluetooth®

6. The Add/Modify Communication devices and applications dialog box displays (Figure 42).
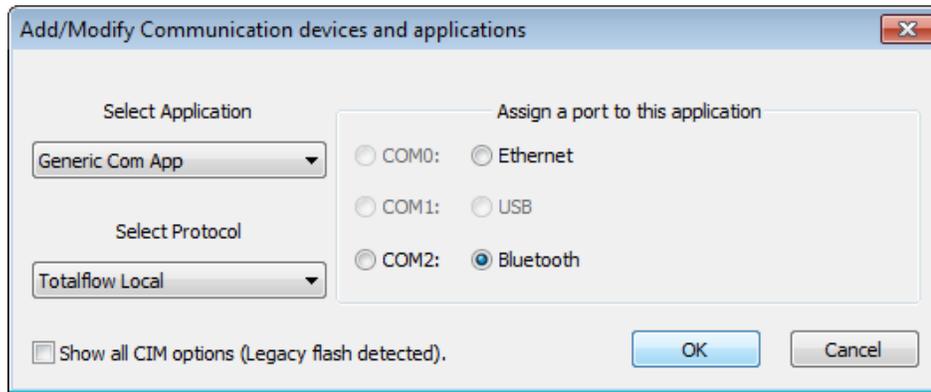
Figure 42: Add/Modify Communication devices and applications dialog box - Bluetooth®

7. Ensure that the Bluetooth® radio button is selected. Click **OK**. In the Communications Setup dialog window, the Bluetooth® port has now been assigned.

8. On the Communication Setup tab, click **Send Changes to Device**.

9. A Bluetooth® sub-menu displays under the Communication option. Click on the sub-menu to view the settings that are established for the Bluetooth® device.

ℹ️   Leave the parameter fields at their default settings.

---

10. Click the **Setup** icon on the PCCU32 standard toolbar. The System Setup dialog box displays.

11. On the System Setup dialog box, select **Bluetooth**® in PCCU Connect Method (Figure 43).
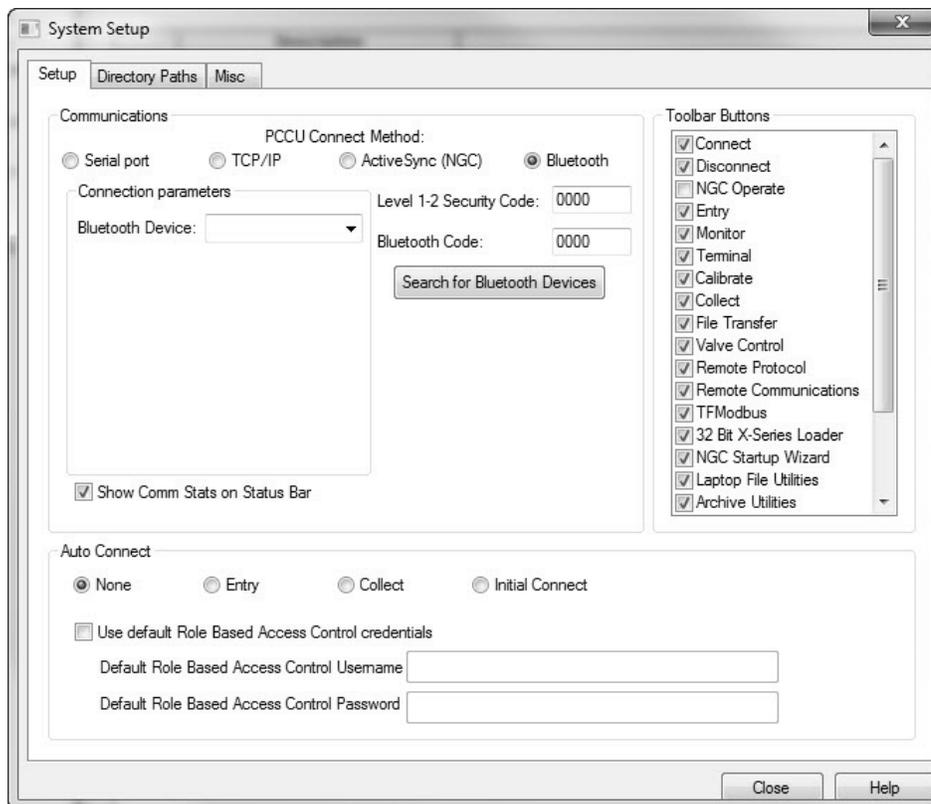
Figure 43: System Setup dialog box - Bluetooth®

12. After the Bluetooth® option is selected, several parameter fields display that are related solely to Bluetooth®. Click **Search for Bluetooth®** Devices to display the Select a Bluetooth® Device dialog box displays.

13. Clear the Filter check box, and then wait for the device to complete the search for available Bluetooth® devices. When the search is complete, it may be necessary to click **Search Again**.
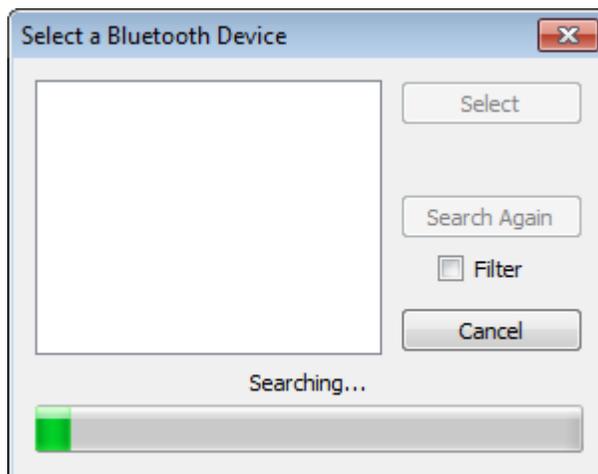
Figure 44: Select a Bluetooth® Device dialog box

14. A list of possible Bluetooth® devices display. Distinguish a particular Bluetooth® device with the naming convention: Network ID + Mac Address (media access control address). For example, if the network ID for the device is "TFLocal", then the Bluetooth® device displays as "TFLocal,X:XX:XX:XX:XX:XX.

> **i** A single Bluetooth® dongle can be used for multiple devices. When employing this method, the name of the device is not critical, but the Mac address needs to be consistent across all of the devices.

15. Select the Bluetooth® device in the dialog box. Upon choosing the correct one, click **Select**. The Setup tab displays within the System Setup dialog box. The Bluetooth® Device parameter field is populated with the Bluetooth® dongle information.

16. Click **Close** to finish the process.

6.3   Security systems

There are three (3) types of security:

— Device-enforced legacy level 1-2 security

— WinCCU-enforced legacy security

— Device and PCCU32-enforced Role Based Access (RBAC) security

The following sections will cover these security options.

6.3.1   Device-enforced legacy security

Data and configuration security is spread across three elements: the flow computer, PCCU32 and WinCCU.

Flow computer security must be disabled before security codes may be defined using PCCU32. Once defined, security is enabled again and access to the flow computer through PCCU requires the appropriate security code for level 1 or level 2 access.

The level 1 code, read only, will allow data and configuration values to be read but not altered. The level 2 code, read/write, will allow full access to read and write.

6.3.1.1   Meter security

To establish meter security:

1. Set the S1 Security switch on the electronic board to **OFF**.

2. Establish a local connection to the flow computer using PCCU32.

3. Click the top node of the navigation tree, the **Station ID** name, to see the **Station Setup** screen (Figure 45).
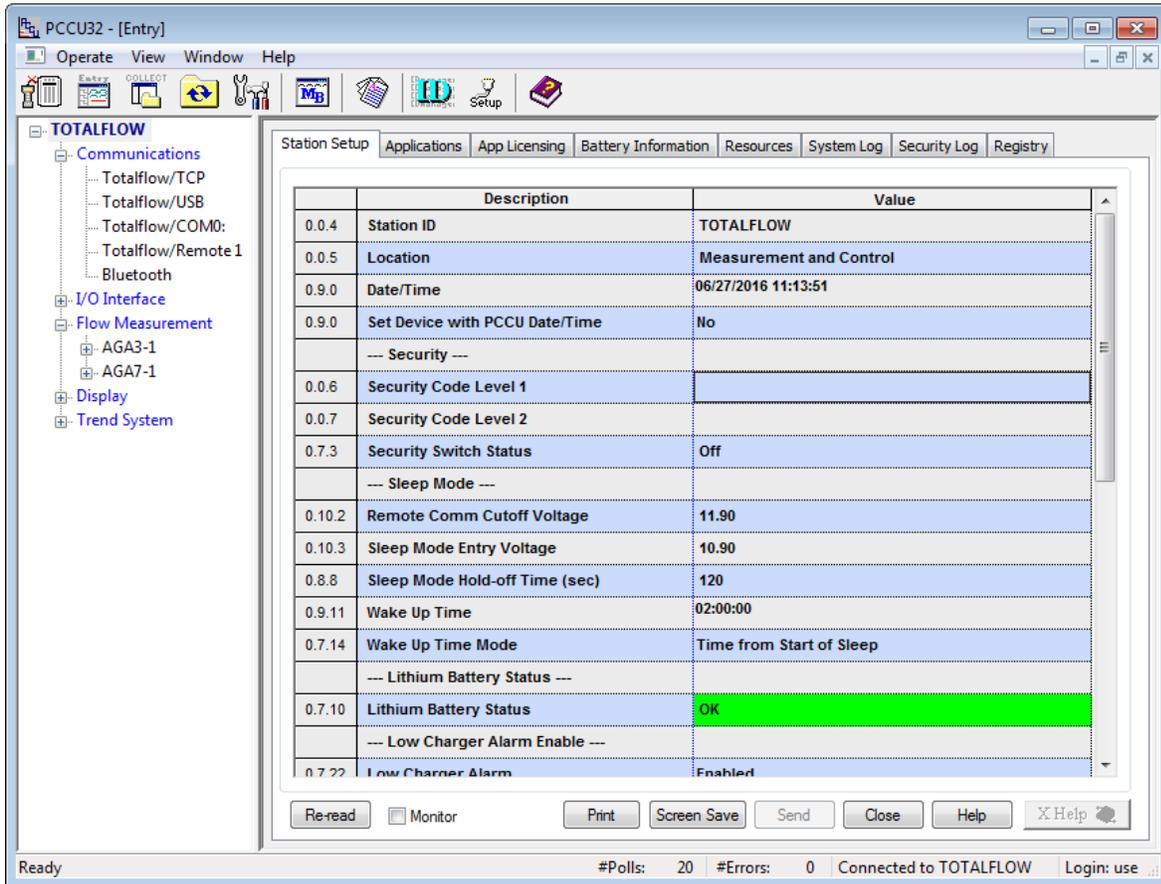
Figure 45: Setting station security codes

4. Type the level 1 four-digit security code into the field for **Security Code Level 1**.

5. Type the level 2 four-digit security code into the field for **Security Code Level 2**.

6. Click **Send**.

7. Set the S1 security switch on the electronic board to **ON**.

The flow computer security is now set up and enabled.

In the provided example (Figure 45), the access code for level 1 security is defined as **1234**. The access code for level 2 security is defined as **5678**. These codes will be referenced again for the example in section 6.3.1.2, *PCCU32 security* and section 6.3.2, *WinCCU32 security.*

See section 6.3.1.2, *PCCU32 security*, to set up the PCCU32 security access codes for the flow computer. See section 6.3.2, *WinCCU32 security*, on page 70 to set up the WinCCU32 security access codes for the flow computer.

i   **IMPORTANT NOTES:** To gain access to the flow computer data and configuration, PCCU32 and WinCCU32 will need to supply the appropriate access code to communicate with the meter.

Should the S1 security switch be turned OFF, PCCU32 (local communication software) will not need the access codes to communicate with the flow computer. Securing the enclosure door with a padlock or other security measure will ensure against unauthorized entry.

WinCCU32 (remote communication software) always requires the proper access codes, regardless of the position of the security switch (S1). Turning the security switch OFF does not allow unprotected access for a WinCCU32 operator.

MODBUS® access to the meters is not protected by the security codes.

6.3.1.2   PCCU32 security

When the S1 security switch on the flow computer electronic board is set to **ON**, the appropriate security code must be set up in PCCU32 to access the flow computer. To set up the security code in PCCU32:

1. Click the **Setup** icon on the toolbar or click **Operate** > **Setup** > **System Setup**.

2. Type the security code in the field for **Level 1-2 Security Code**.

3. Click **Close**.

In the provided example (Figure 46), the read-only access code (**1234**) was entered. To provide full read/write access to the meter, code **5678** would be entered.

> **i**   **IMPORTANT NOTE:** If the security level is breached, a message will indicate a lack of privileges for the action, and the action will fail.
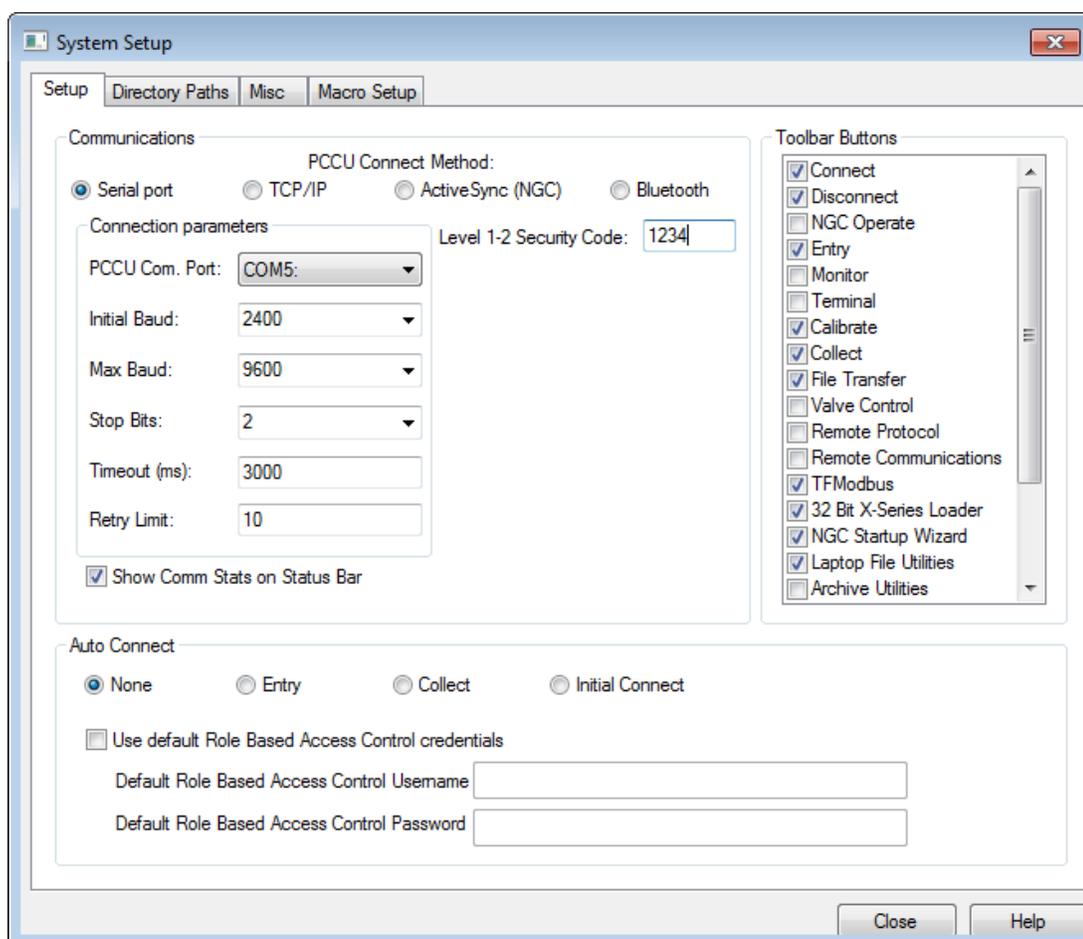
Figure 46: Setting the PCCU32 security access code

6.3.2   WinCCU32 security

Regardless of the security switch (S1) setting on the electronic board, if bi-level security codes were defined during the station setup, the appropriate security code must still be setup in WinCCU32 to remotely access the flow computer. To setup the security code in WinCCU32:

1.   In WinCCU32, highlight the appropriate meter.

2.   Click **Edit ID**.

3.   Type the security code in the field for **Security Code**.

4.   Click **OK**.

In the provided example (Figure 47), the full read/write access code (**5678**) was entered. To provide read-only access to the meter, code **1234** would be entered.

---

i   **IMPORTANT NOTE:** MODBUS® access to the meter is not protected by the security code.

Figure 47: Setting the WinCCU32 security access code

6.3.3   Role Based Access Control (RBAC)

Role Based Access Control (RBAC) is a feature within PCCU32 that is designed to allow an administrator to designate roles and control access levels to various applications and processes in the flow computer. RBAC security files are supported by G4 and newer flow computers and NGC devices. Each security file may be configured for the specific device type.

When designing an RBAC security system, it will be necessary to consider all required user-access to the system and assign roles for each user. Each user, including an administrator, should be created and assigned a default role. Default roles are automatically installed with PCCU32. These default roles are as follows:

—   Administrator

—   Expert

—   Advanced

—   Basic

—   File Admin

The Administrator role has the highest level access rights to all functions, including the addition of users, the definition of roles, and the ability to save security configuration files to a PC. Expert, Advanced, and Basic roles have decreasing levels of access rights. The File Admin role has the access rights of the Basic role plus minimum rights required for sending/reading RBAC security files to and from G4 and newer devices. The security files may be uploaded to multiple flow computers for implementation.

> **NOTICE – Security override.** When RBAC is implemented, it overrides the device-enforced bi-level security (flow computer) and PCCU32-enforced security. When RBAC is enforced, it replaces all other security and is specifically implemented on a port-by-port basis.

RBAC security configuration restricts applications and disables functions that are not approved for the current user. Restricted applications are hidden from view in the PCCU32 navigation tree and functions that are restricted are disabled. When an application with read-only functionality is accessed, the Send button is also grayed out.

6.3.3.1 Setup and create a new RBAC security control file

> **IMPORTANT NOTE:** To set up a new RBAC security system, the following activities must take place:
>
> – Create a security control file.
> – Create an administrator account.
> – Create individual user accounts and assign default roles.
> – Create customized roles if necessary.
> – Configure communication ports.
> – Save the security file.

To create a new security file:

1. On the main PCCU32 menu, click **Operate** > **Security** > **Role Based Access Control** > **Role Administration** (Figure 48).
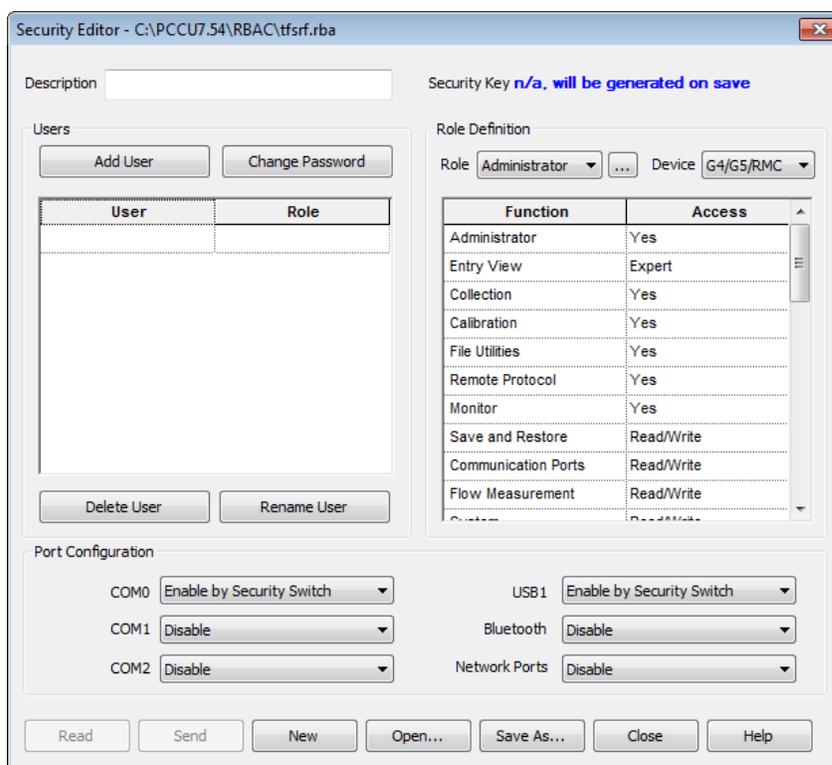
Figure 48: Security Editor screen

2. In the Security Editor dialog box, create the RBAC administrator before creating any other users:

   a. Ensure that **Role** is set to **Administrator** in the Role Definition section.

   b.   Click **Add User** on the RBAC Security Editor screen.

   c.   Type the user name in the **Name** field in the User Name and Password dialog box (Figure 49).

   d.   Type the password in the Password field.

   e.   Click OK.

3. Follow the procedures detailed in 6.3.3.3, *Create a new* user account, on page 72, to create user accounts with standard roles. Return here when complete.

4. To define or customize a role see section

5. , on page 74. Return here when complete.

6. To assign RBAC security to a communication port, see section 6.3.3.4, *Communication port configuration*, on page 74. Return here when complete.

7. Type a description of the security file in the **Description** field.

8. Save the new security control file. Click **Save As…**.

9. Type a password for the security file and then click **OK**.

10. Click **Save** to keep the default file name or change the name and then click **Save**.

ⓘ **IMPORTANT NOTES:** On the top right corner of the Security Editor screen is the **Security Key**. Before the security file is saved for the first time, or after changes have been made, the key field reads "**n/a. will be generated on save**". Following a **Save As…** a new security key will be assigned and logged into the Security Log and a copy of the security file saved on the PC connected to the device. Following any modifications to the security file, the previous key will disappear and a new one will be assigned, logged, and saved to the PC. The security control file is automatically saved in the **PCCU** > **RBAC** folder on the PC and given a default file name of **tfsrf.rba**.

Additional information regarding the RBAC security log may be found in section 6.3.3.11, *Security Log*, on page 81.

6.3.3.2   Edit the security file

1. To editing an existing security control file:

   a.   From the Security Editor screen, click **Open…** (Figure 48).

   b.   Browse, if necessary, to **PCCU** > **RBAC** > [**file name.rba**] and click **Open**.

2. Make the necessary changes.

3. Click **Save As…**.

4. Type a password for the security file and then click **OK**.

5. Click **Save** to keep the default file name or change the name and then click **Save**.

6.3.3.3   Create a new user account

To add a new user to the RBAC security system:

1. Click **Add User** on the RBAC Security Editor screen.

2. Type the user name in the Name field in the User Name and Password dialog box (Figure 49).
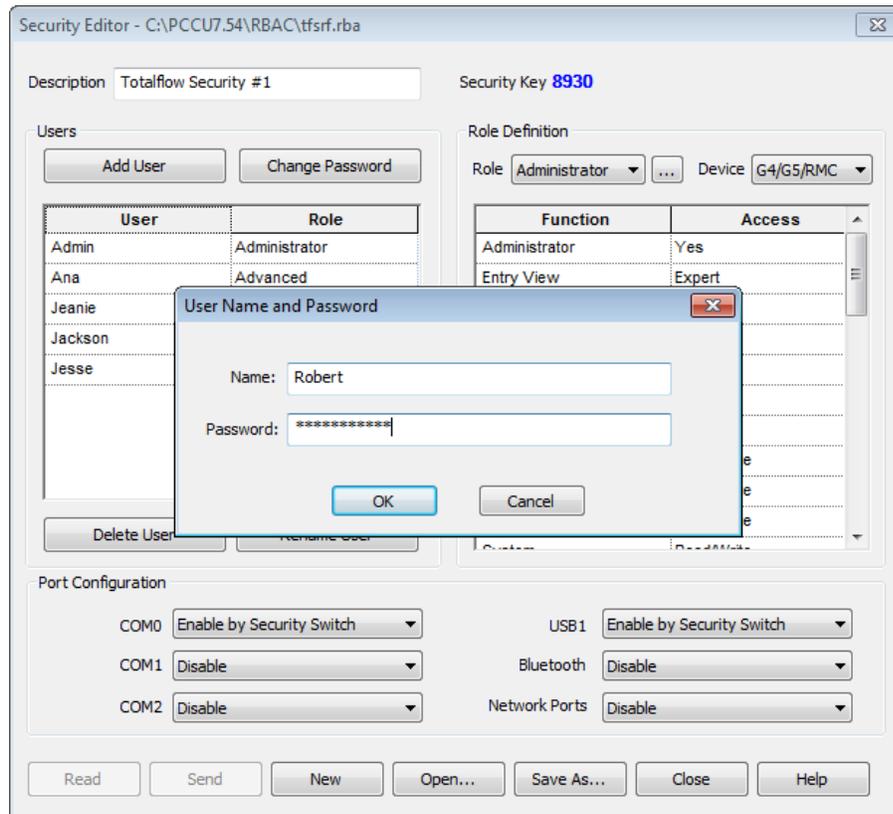
Figure 49: User Name and Password dialog box

3. Type the user password in the Password field and click **OK**. The new user account will appear in the list of users.

4. Click the **Role** beside the new user account and assign the appropriate role (Figure 50).

---

i | **IMPORTANT NOTE:** During the initial setup, no customized roles exist yet. Create at least one additional user account before creating a customized role. After creating a customized role, the new role may be assigned to a new or existing user account. See section 6.3.3.8, *Role customization and definition*, on page 77 for additional information.
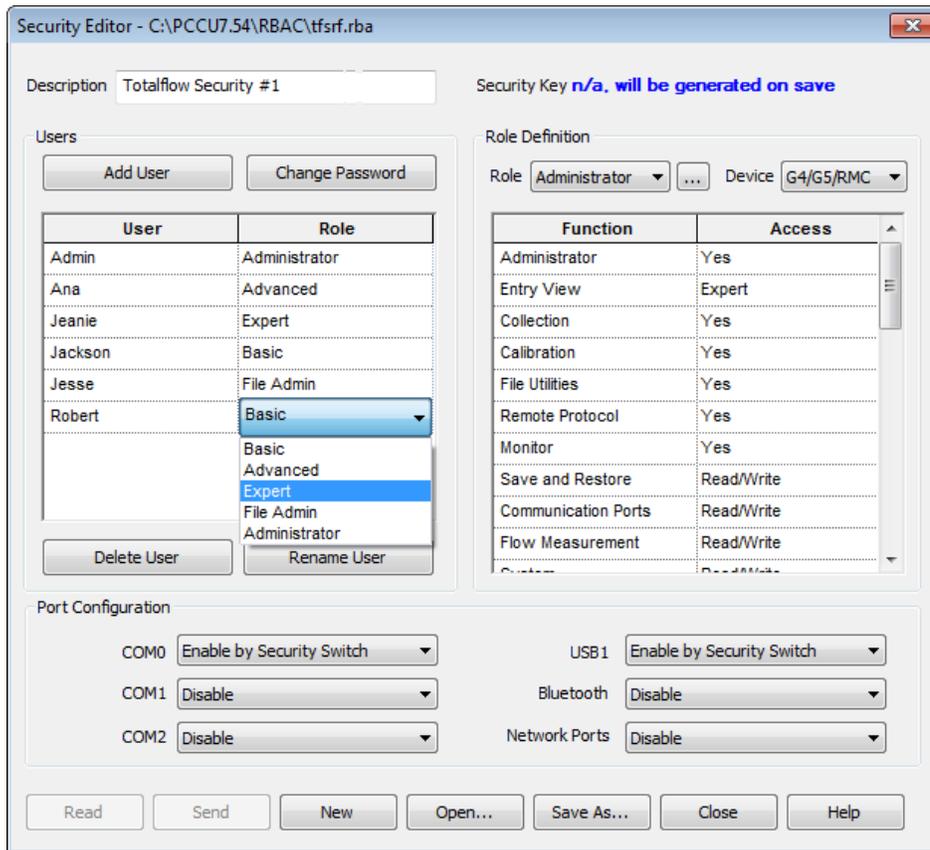
Figure 50: User role assignment

5. Repeat steps 1 through 5 for each user account.

> **IMPORTANT NOTE:** To avoid assigning an unsuitable role to a new user, the user role may be selected in the **Role Definition** > **Role** selection list before clicking **Add User**. The ability to assign a role before adding the user is only available after the first user account has been added. However, assigning the role after adding the user works equally well.

6. Click **Save As…** to save and name the new security control file.

7. Type a password for the security control file in the Current Password field and click **OK**.

> **IMPORTANT NOTES:** On the top right corner of the Security Editor screen is the **Security Key**. Before the security file is saved for the first time, or after changes have been made, the key field reads "**n/a. will be generated on save**". Following a **Save As…** a new security key will be assigned and logged into the Security Log and a copy of the security file saved on the PC connected to the device. Following any modifications to the security file, the previous key will disappear and a new one will be assigned, logged, and saved to the PC. The security control file is automatically saved in the **PCCU** > **RBAC** folder on the PC and given a default file name of **tfsrf.rba**.
>
> Additional information regarding the RBAC security log may be found in section 6.3.3.11, *Security Log*, on page 81.

6.3.3.4 Communication port configuration account

Access to each communication port, including local ports, may be configured individually in RBAC. They may also be configured using the Entry mode when RBAC is not enabled or does not include the ports. Configuration in Entry mode and in RBAC is quite similar:

To use a RBAC security configuration to configure communication port security:

1. Select the preferred security value for each port (Figure 51).

Figure 51: Communication port configuration - RBAC

2. Click **Save As…** to save changes to the security control file.

3. Type the password for the security control file for the Current Password and click **OK**.

To use Entry mode (in Advanced or Expert view) to configure or override RBAC:

1. In PCCU32 Entry mode click the communication port to secure.

2. Set the Authentication value to **Disabled**, **Enabled** or **Enable by Security Switch** (Figure 52). See Table 17 for additional information about the authentication values.
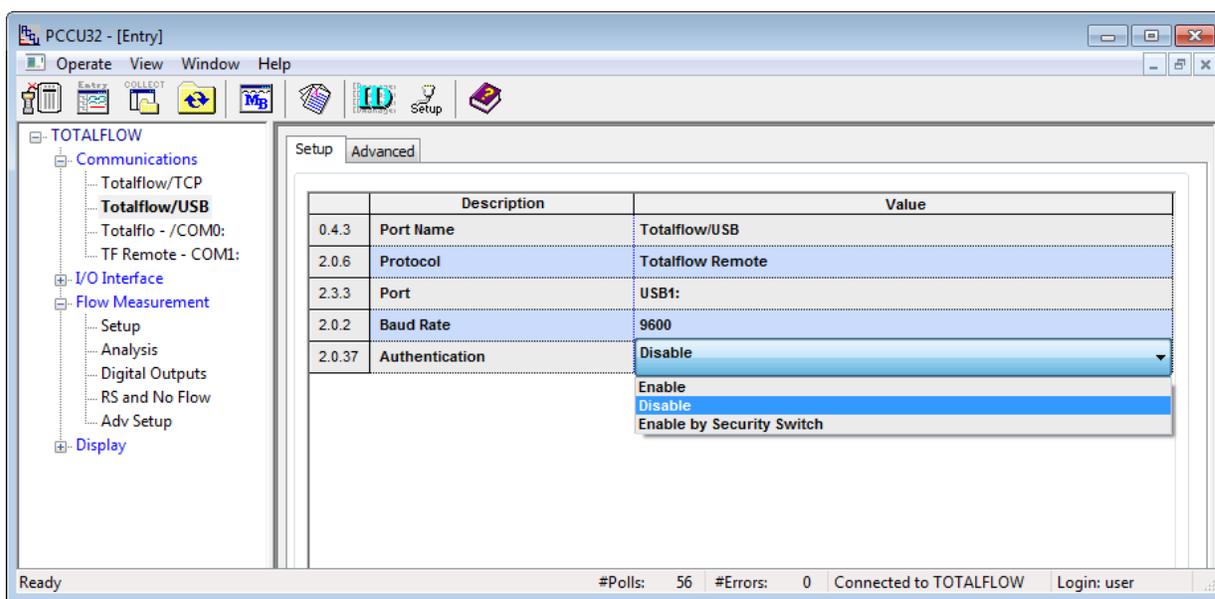
Figure 52: Communication port authentication - Entry mode

Table 17: Communication port functionality when set in Entry mode

Port security setting	Functionality
Disabled	Does not perform any RBAC security functions on the port.
Enabled	Enables full security over the port to RBAC. If the administrator name and/or password are lost or forgotten, it will be necessary to use follow the instructions in section 7.4.7, on page 94, to *Restart using factory configuration*. This will reset the device to the default factory configuration. Note that all data and the running configuration will be deleted.
Enable by Security Switch	Enables security over the port to RBAC but allows the electronic board security switch to override RBAC security. If the administrator name and/or password are lost or forgotten, RBAC may be disabled using the legacy security switch. By setting the switch to the OFF position, a user may log in and reconfigure the security access. No data will be lost.

3. Click **Send**.

6.3.3.5   Remote communications

While it is currently possible to enable RBAC on a remote port, this will block any access to the port since no host software (WinCCU) currently supports RBAC.

6.3.3.6   User login and auto connection

Each time PCCU connects to a flow computer via an RBAC-enabled port, a login screen requests the User name and Password for access (Figure 53).
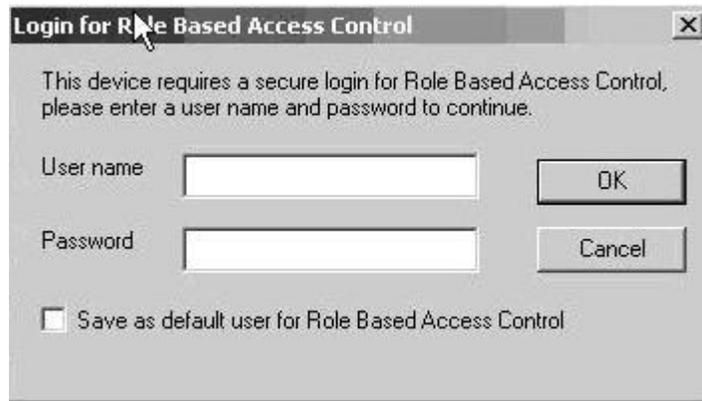
Figure 53: Login dialog box

The User name and Password may be set as default credentials in PCCU. When set as the default, the user name and password fields are automatically populated with the default credentials on subsequent logins.

To create, change or disable the RBAC credentials in PCCU:

1.   Click the **Setup** icon on the main toolbar or click **Operate** > **Setup** > **System Setup**.

2.   Set the following under **Auto Connect**:

     a.   Check **Use default Role Based Access Control credentials** (Figure 54):

     b.   Type in the **Default Role Based Access Control Username**.

     c.   Type in the **Default Role Based Access Control Password**.
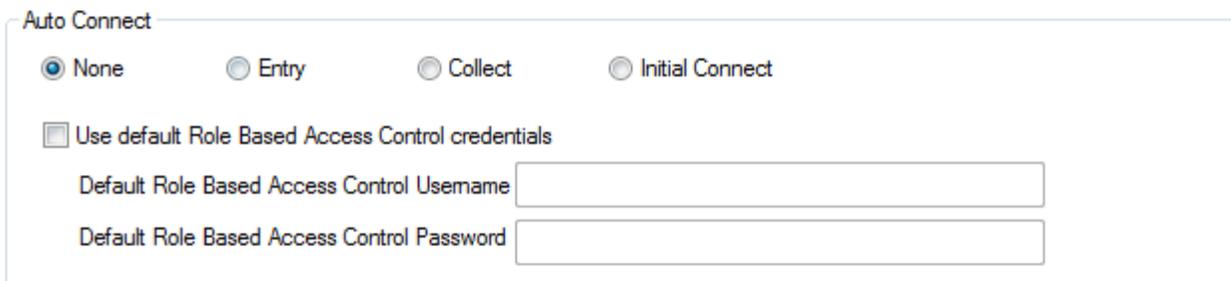
Figure 54: System Setup Auto Connect and RBAC credentials

3.   To connect directly to a PCCU function (Entry, Collect, or Initial Connect) on connection, click on the function button.

4.   Click **Close**.

6.3.3.7   Port an RBAC security file to another device

When setting up multiple flow computers it is helpful to design the RBAC security file, save it to a PC, then send it to additional flow computers. The following instructions assume that an RBAC security file has been created and saved to a PC.

To set up multiple devices with the same security settings:

1.   Establish a local connection to the flow computer using PCCU32.

2. On the PCCU main menu, select **Operate** > **Securit**y > **Role Based Access Control** > **Send Security File** to display the Send Role Based Access Control File dialog box (Figure 55).
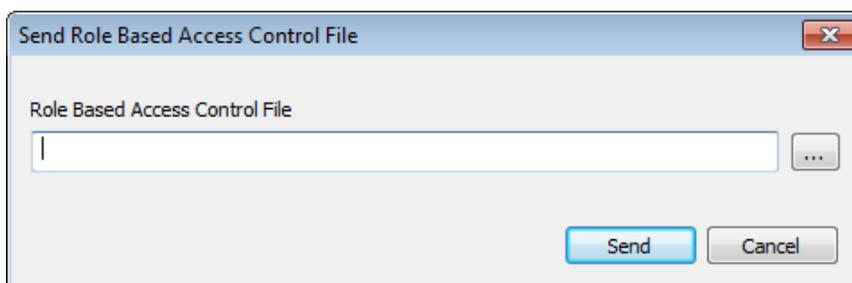
Figure 55: Send Role Based Access Control File

3. In the dialog box, click the Browse button **[. . .]** to locate the required file.

4. Select the appropriate file, and click **Send** to send the security file. A warning screen will appear.

5. Read the warning (Figure 56). To continue sending the new security file to the flow computer, click **OK**. Otherwise, click **Cancel** to exit the procedure.
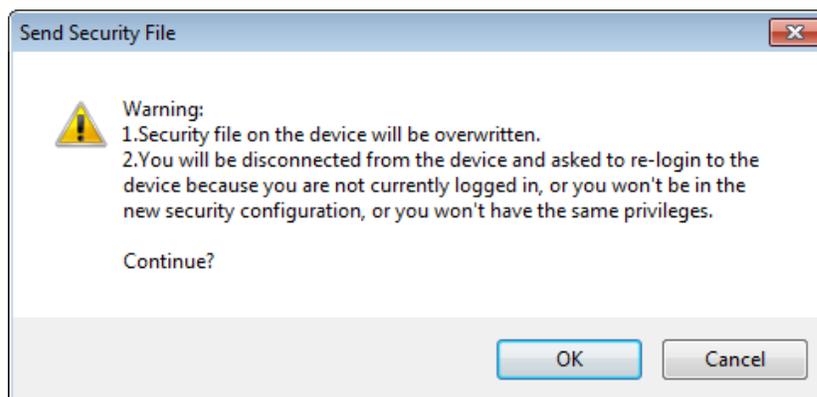
Figure 56: Send Security File warning

6.3.3.8   Role customization and definition

When an existing role definition does not provide the proper functions and capabilities, a new one can be created and then assigned to a user account. The Entry View function sets the highest selectable viewing level for the PCCU screens and has the options of None, Basic, Advanced, or Expert. Other functions have either a Yes | No option or a No Access | Read-Only (RO) | Read/Write (R/W) option.

Beginning with the functions assigned to default roles, it is possible to design, duplicate, rename, and delete customized roles that are relevant to the required role hierarchy (Table 18).

Table 18: Security functions and default roles

Function	Default roles				
	Administrator	Expert	Advanced	Basic	File Admin
Administrator	Yes	No	No	No	Yes
Entry View	Expert	Expert	Advanced	Basic	Basic
Collection	Yes	Yes	Yes	Yes	Yes
Calibration	Yes	Yes	Yes	No	No
File Utilities	Yes	Yes	No	No	No
Remote Protocol	Yes	Yes	Yes	No	No
Monitor	Yes	Yes	Yes	Yes	Yes

Function	Default roles				
	Administrator	Expert	Advanced	Basic	File Admin
Save and Restore	R/W	R/W	R/W	No Access	R/W
Communication Ports	R/W	R/W	R/W	RO	RO
Flow Measurement	R/W	R/W	R/W	RO	RO
System	R/W	R/W	R/W	RO	R/W
I/O Subsystem	R/W	R/W	R/W	RO	RO
Display	R/W	R/W	R/W	No Access	No Access
Trend	R/W	R/W	R/W	No Access	No Access
Alarm	R/W	R/W	R/W	No Access	No Access
Holding	R/W	R/W	R/W	No Access	No Access
Operator	R/W	R/W	R/W	No Access	No Access
XMV Interface	R/W	R/W	R/W	No Access	No Access
Pump Interface	R/W	R/W	R/W	No Access	No Access
Wireless I/O	R/W	R/W	R/W	No Access	No Access
LevelMaster	R/W	R/W	R/W	No Access	No Access
Therms Master	R/W	R/W	R/W	No Access	No Access
Therms Slave	R/W	R/W	R/W	No Access	No Access
NGC Client	R/W	R/W	R/W	No Access	No Access
Analysis Trend	R/W	R/W	R/W	No Access	No Access
Units Conversion	R/W	R/W	R/W	No Access	No Access
Pulse Accumulator	R/W	R/W	R/W	No Access	No Access
PID Controller	R/W	R/W	R/W	No Access	No Access
Valve Control	R/W	R/W	R/W	No Access	No Access
Oil Transfer	R/W	R/W	R/W	No Access	No Access
Plunger Lift	R/W	R/W	R/W	No Access	No Access
Safety System	R/W	R/W	R/W	No Access	No Access
Pad Controller	R/W	R/W	R/W	No Access	No Access
IEC 61131-3	R/W	R/W	R/W	No Access	No Access

To create a new role from an existing role:

1. Click the browse button **[. . .]** under Role Definition (Figure 57).
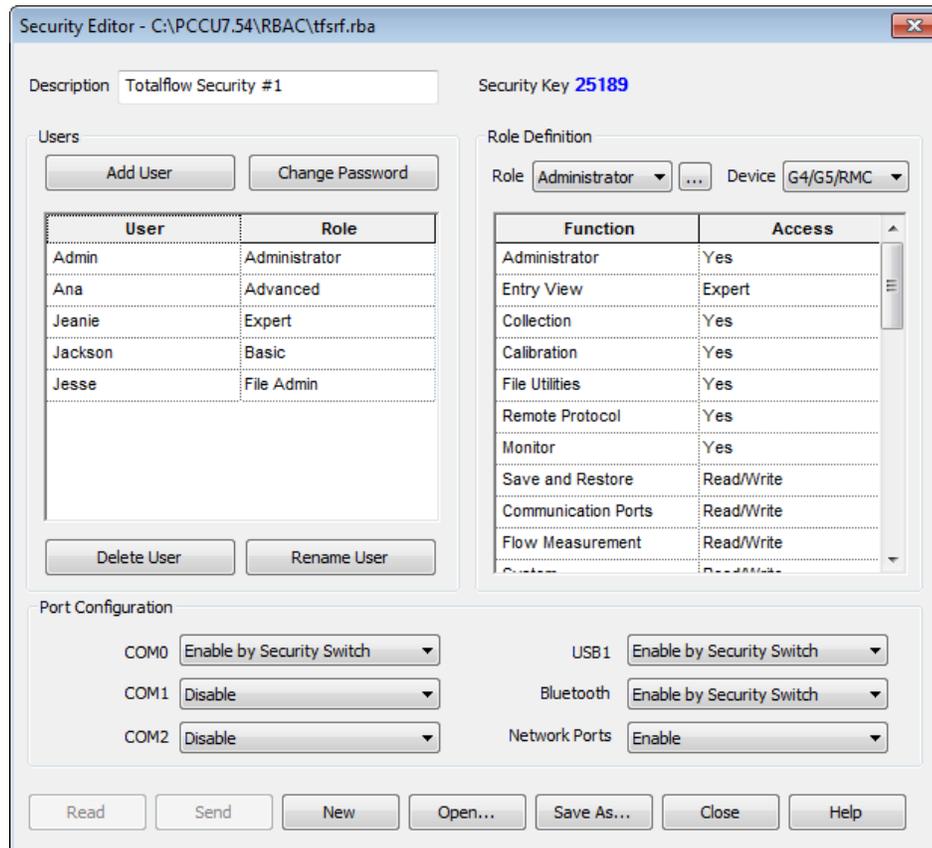
Figure 57: Editing the security control file, customizing roles

2. Select the role to use as a basis for the new role being created (Figure 58).
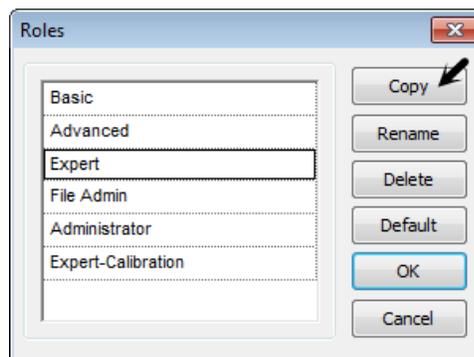
Figure 58: Default role selections

3. Click **Copy**.

4. Type the new role name In the Role Name window and click **OK**. The new role is now available in the list of roles.

5. Select the new role, **Role Definition** > **Role** > [**new role**] (Figure 59).

Figure 59: Customizing role definition

6. Locate any functions that need to be changed (see Table 18, *Security functions and default roles*, on page 77).

7. Click the access field for each function and select the appropriate level for that function.

8. When complete, assign the new role to the appropriate user:

   a. Click the Role field for the User.

   b. Select the new role from the drop-down list.

Figure 60: Edit RBAC user role

   c. Click **Save As…** to save changes to the security control file.

   d. Type the password to the security control file and click **OK**.

> **!** **NOTICE – Loss of security settings.** Changes to the security control file require a save be performed. Exiting the Security Editor without saving recent changes will reset the control file to the most recent saved control file. Any changes to the control file will reset the Security Key to "**n/a. will be generated on save**". After the control file has been saved, a new security key will be generated and an event logged into the security log file.

6.3.3.9   Additional security configuration for the calibration function

In order to perform a calibration, additional function access rights are required. The following functions require read/write access:

— Calibration

— System

— Flow measurement

— Auxiliary I/O

— Display application

To calibrate the IMV, the following functions require read/write access:

— IMV Interface

— Communication Port

To calibrate wireless I/Os, the following functions require read/write access:

— Wireless I/O

— Communication Port

6.3.3.10   Additional security configuration for the collection function

In order to perform a collection, additional function access rights are required. The following functions require access:

— Collection

— System (read-only access)

To collect the measurement tube data, read-only access to the Flow Measurement function is required.

To collect trend data, read-only access to the Trend function is required.

To collect analysis trend data, read-only access to the Analysis Trend function is required.

To collect analyzer stream data, read-only access to the Analyzer Stream and the Analyzer Operation functions are required.

6.3.3.11   Security Log

To track access to the flow computer, a security log is kept that indicates the date and time when a user logs in, the user name, the port where the access was made and the actions taken before logout. Log entries are also generated when a security file is downloaded and/or processed. Additionally, the results of applying the configurations will also be logged every time a new security file is downloaded. This tab is available in Advanced and Expert view modes (Figure 61).
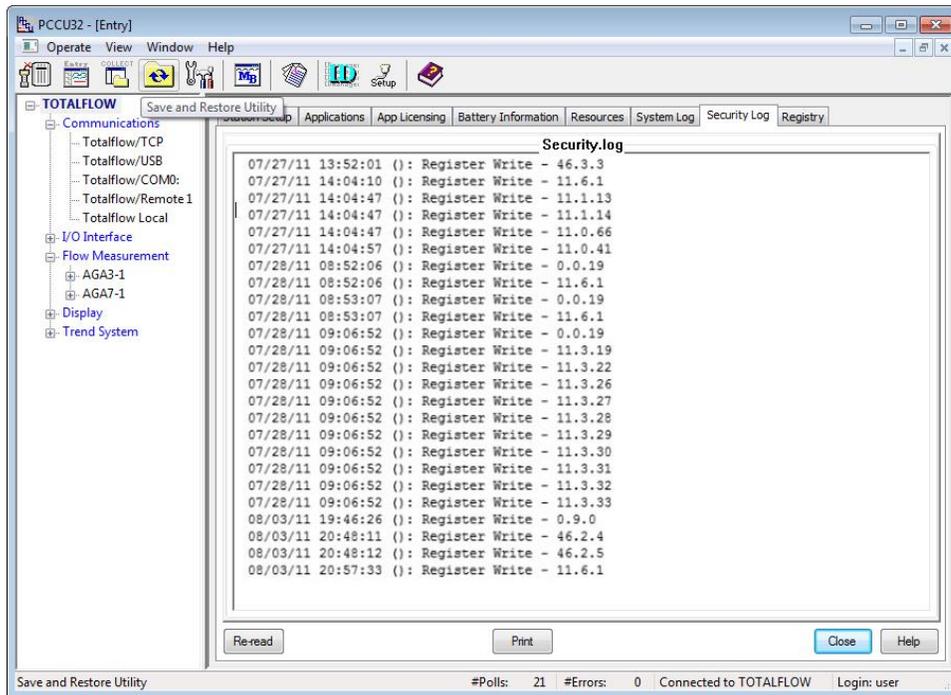
Figure 61: Security log

The security key is logged in the security log every time the security file is sent to a device or a warm restart is performed. Additionally, the security key can be used to verify that the security file on the device is the one created by the security administrator.

RBAC security files are saved with a unique extension (.rba), by default. There is also a default directory that hosts these files (Figure 62). The directory is configurable by selecting the menu item **Operate** > **Setup** > **System Setup**.
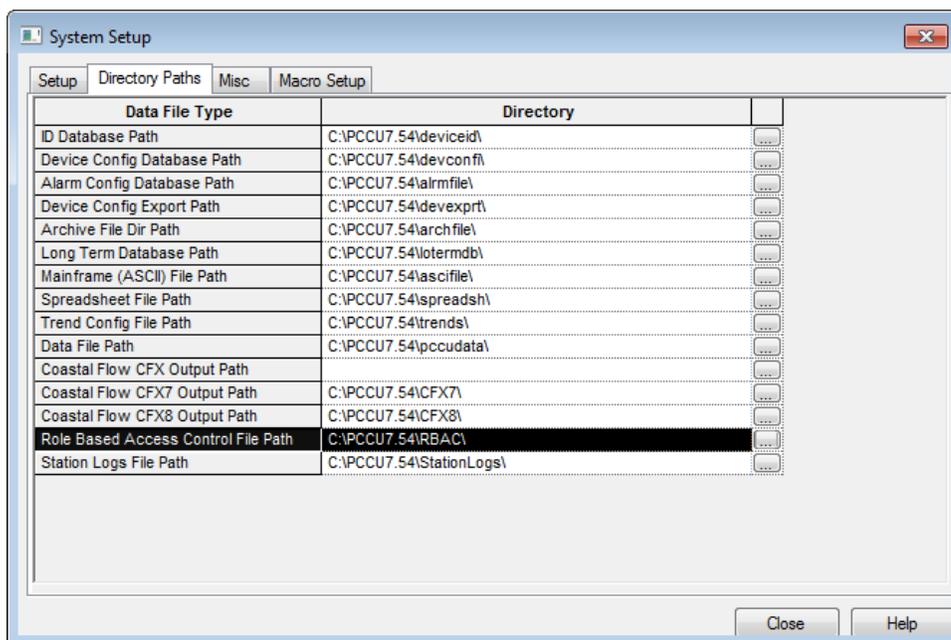
Figure 62: System Setup dialog box – Directory Paths tab

When connected to a *µ*FLOG5, the Read button is enabled for all users and reads a security file from the device for editing. The Send button is enabled only for users with Administrator rights and is used to send and apply the security configuration to a device.

7   Service and maintenance

The following chapter includes a list of replacement parts, instructions for replacing spare parts, and other maintenance procedures for the μFLO^{G5}.

i   **IMPORTANT NOTE:** Because a μFLO^{G5} installation is typically exposed to external environmental conditions, it is important that it be regularly inspected for cleanliness, both externally and internally. Foreign contaminants can cause damage to interior-mounted components that can render the μFLO^{G5} inoperable. When the flow computer is power by a battery with a solar panel charger, it is very important to keep the face of the solar panel clean. Dirt and debris that cover photovoltaic cells will reduce the charging ability of the panel.

It is recommended that the user develop a regularly scheduled maintenance program and maintain a selection of spare components to minimize downtime.

⚠   **CAUTION – Equipment / Property damage.** Prior to performing any service on the flow computer, data should be collected and the configuration file saved for a possible restoration. Failure to collect data and save the configuration file could result in a loss of measurement data and require a complete system configuration.

⚠   **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

Do not reconnect the external power/charger and battery connections until all other cables, boards and field connections have been reconnected.

7.1   Preserving data and configuration files

It is very important to preserve data and configuration files before performing any maintenance procedure. The following procedure meets the full requirements to avoid a reset-to-factory configuration and eliminates the obstacles associated with reconfiguring the μFLO^{G5} should any problem arise. This procedure includes:

— Collect data

— Update TfCold configuration with the running (warm) configuration

— Save TfCold configuration to the PC

7.1.1   Collect data

To collect the data from the flow computer.

1. Connect the PC to the flow computer using the local communication cable previously configured.

2. Launch the PCCU32 software program by double-clicking the desktop icon or selecting **PCCU32** from the **Start** > **Program** menu.

3. Click the **Collect** icon on the PCCU toolbar.

4. On the collection screen, select the measurement application in the navigation tree (Figure 63).
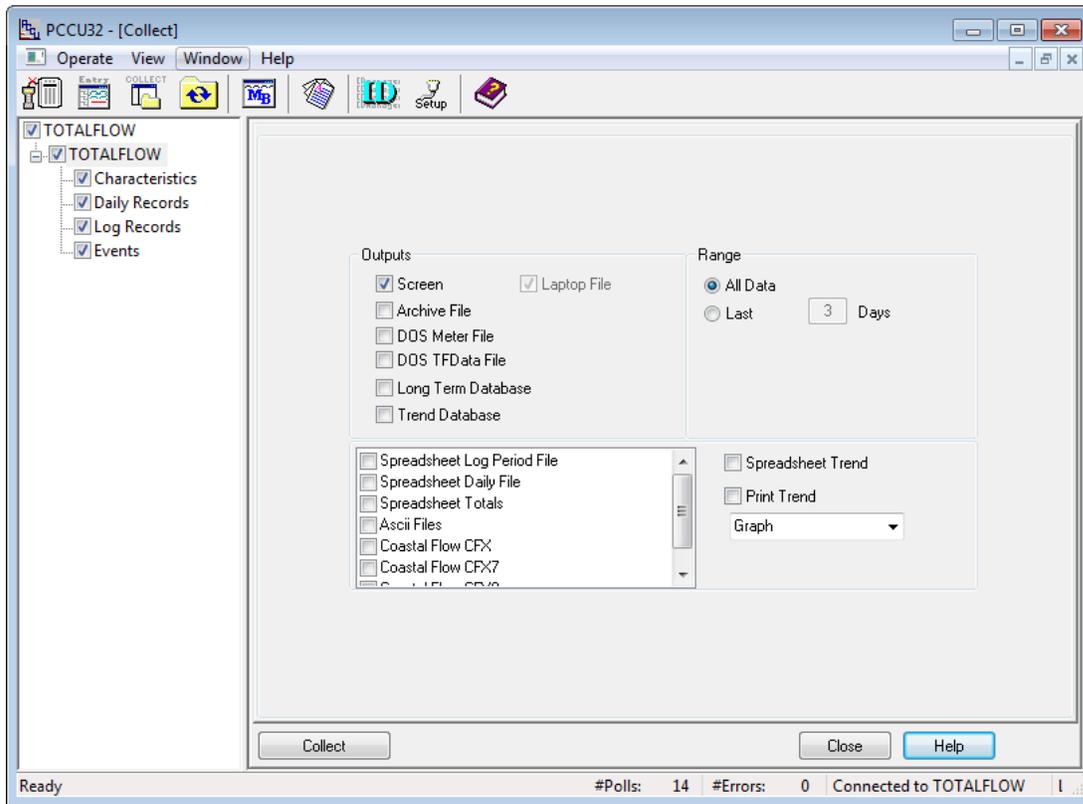
Figure 63: Data collection screen

5. Select the desired output type. A PC (laptop) file is collected by default.

6. Select the range of data to be collected.

7. Click **Collect**.

8. Click **Close**.

> **IMPORTANT NOTE:** Additional information about data collections may be found by clicking **Help** at the bottom corner of the collection screen.

7.1.2 Update TFCold (cold) configuration with the running (warm) configuration

To update the cold start configuration:

a. Click on the top node of the navigation tree to display the **Station Setup** tab.

b. Use the scroll bar to locate **Backup** > **Update Cold Start Configuration** and select **Delete and Recreate TFCold** to write the running (warm) configuration to the startup (cold) configuration (Figure 64).
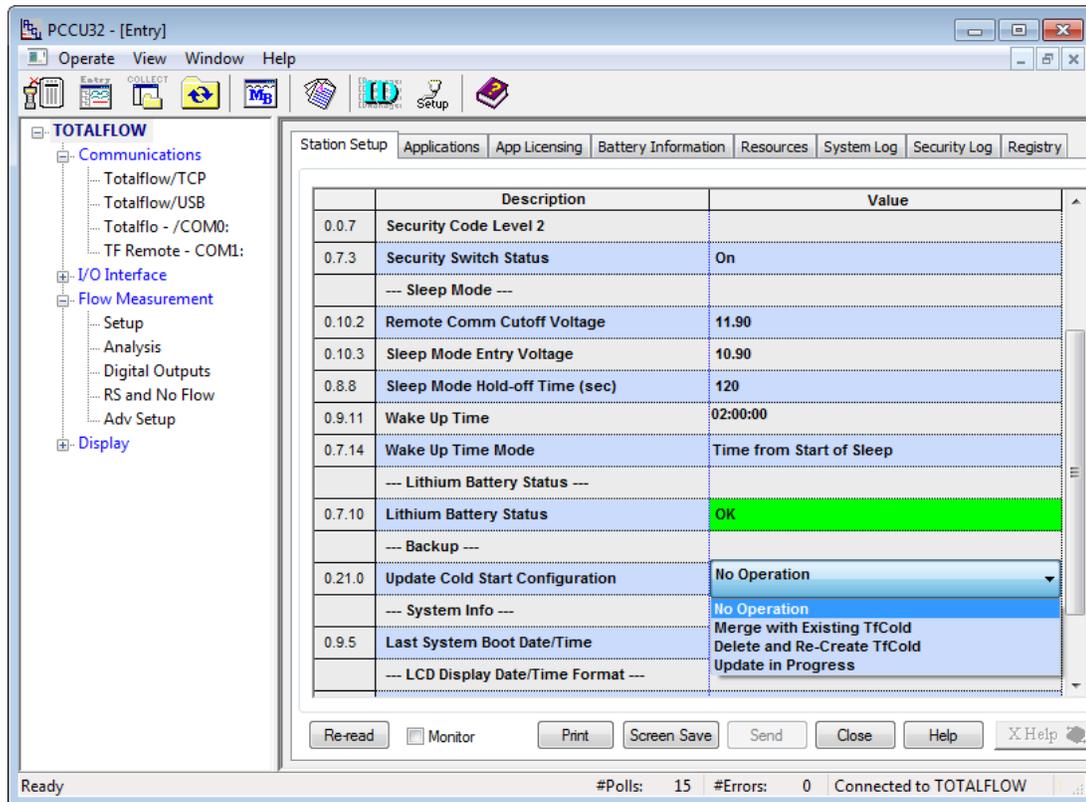
Figure 64: Delete and recreate the TFCold configuration

---

i   **IMPORTANT NOTE:** If there are calibration files included in the warm configuration, the calibration files are also saved during the startup configuration backup. The saved calibration files are linked with the device's electronic board serial number and are not applicable to any other device. If the configuration package is used in another device, the calibration files cannot be sent.

---

    c.   Click **Send**.

---

i   **IMPORTANT NOTE:** The cold start configuration (TFCold) is now current and agrees with the running configuration (warm). In case of a cold restart, the flow computer should resume normal operation.

7.1.3   Save the TFCold (cold) configuration to the PC

To preserve the configuration package file in case a restoration is required:

1. Open PCCU32. Ensure that PCCU is not connected to the flow computer. If connected, disconnect local communication between the PC and the flow computer by clicking the **Disconnect** icon.

2. Click the **32 Bit Loader** icon.

3. Click **Yes** to continue to the loader connection screen (Figure 65).
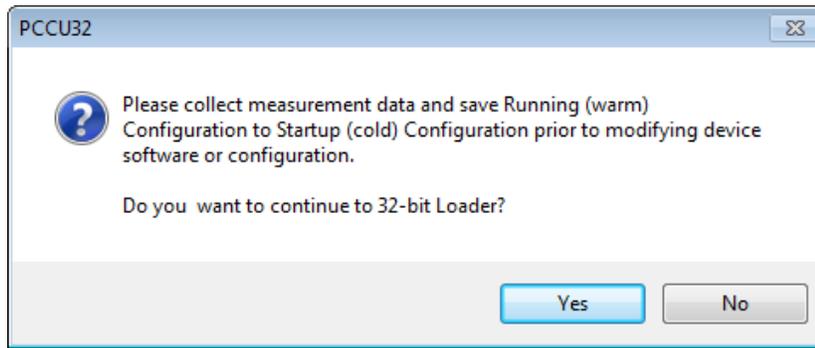
Figure 65: File and configuration preservation message

4. Select the Connection Type, the local communication Port, and enter the Security Code if required (Figure 66).
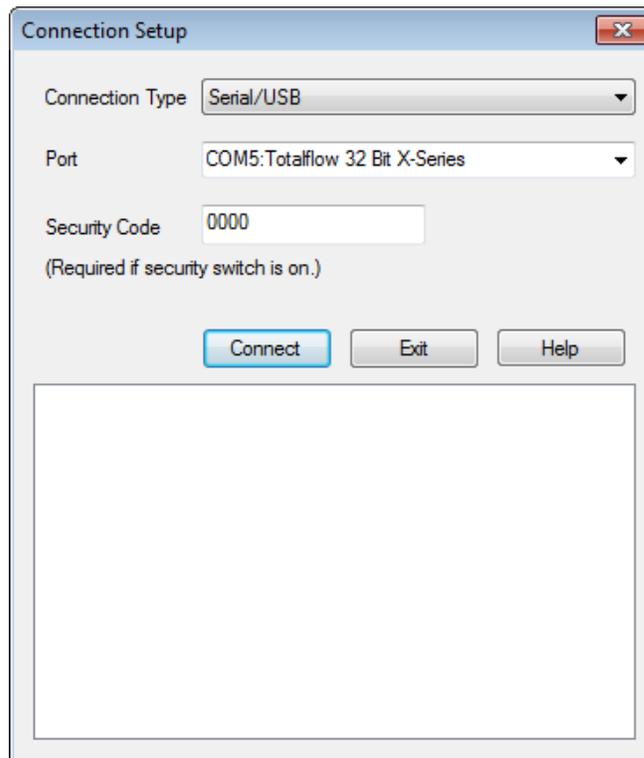
Figure 66: 32 Bit Loader connection configuration

5. Click **Connect**.

6. Select **Services** > **Save…** to select the contents to include in the station package.

7. Ensure that all selections are checked to back up all of the device software, called a super-package (Figure 67). This full backup should include the OS, applications, configurations, and calibration data (if an onsite calibration has been performed).
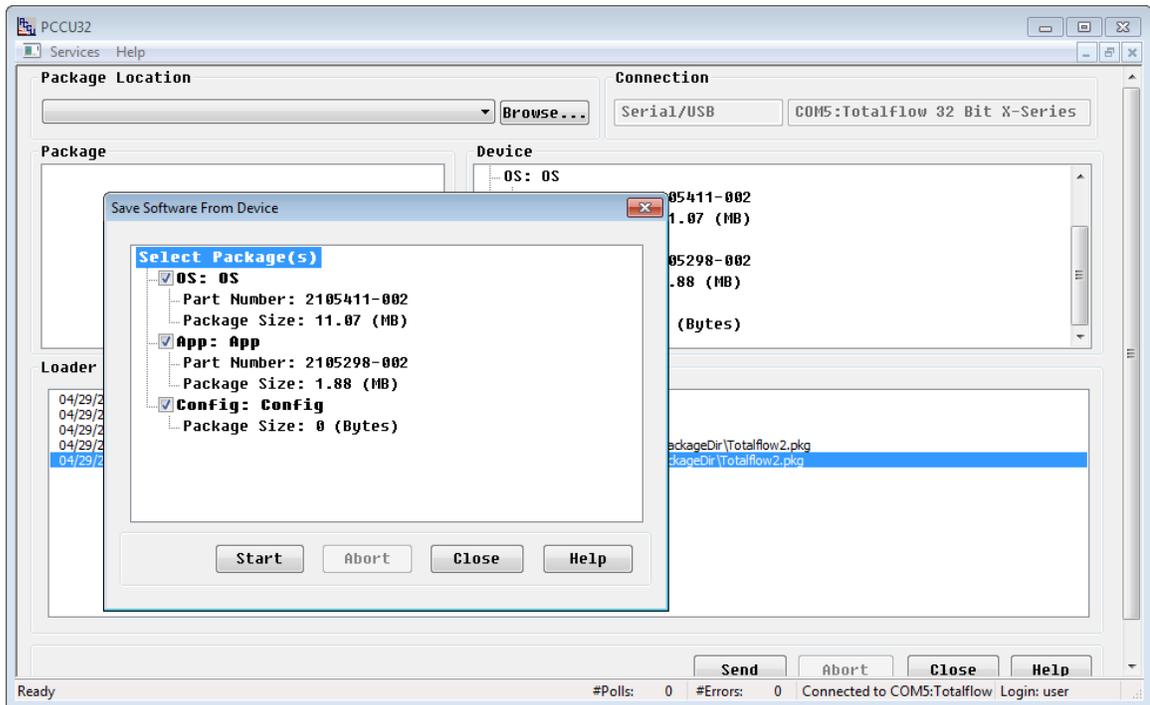
Figure 67: Device software selection

8. Click **Start**.

9. During the save process it will be necessary to assign the package a file name. Type the file name and click **Save**.

10. Click **Close** to exit the Save screen.

11. Click **Close** to exit the 32 Bit Loader screen.

All configuration files have been preserved in preparation for performing a maintenance procedure.

7.2   Restoring the configuration package

This procedure is used to restore a configuration package file to the μFLO^{G5} if previously saved to a PC or laptop.

> **NOTICE – Loss of normal operation.** Preserving the configuration of the flow computer should take place following any configuration updates to ensure that normal operation can be restored. See section 7.1.2, on page 84, to update the running configuration to TFCold, and section 7.1.3, on page 85, to Save the TFCold configuration package to a PC for preservation.

The restore function sends the configuration package into the μFLO^{G5} tfCold drive. This safeguards the configuration data and allows the user to restart the unit without the obstacle of reconfiguring the μFLO^{G5} should any problem arise.

1. If connected, disconnect local communication between the PC and the flow computer by clicking the **Disconnect** icon.

2. Click the **32 Bit Loader** icon.

3. Click **Yes** to continue to the loader connection screen.

4. Select the Connection Type, Local Communication Port, and enter the Security Code if required.

5. Click **Connect**.

6. Click **Browse** to display the browser window.

7. Locate and select the configuration file package and click **Open**. The selected package details display in the Package field (Figure 68).
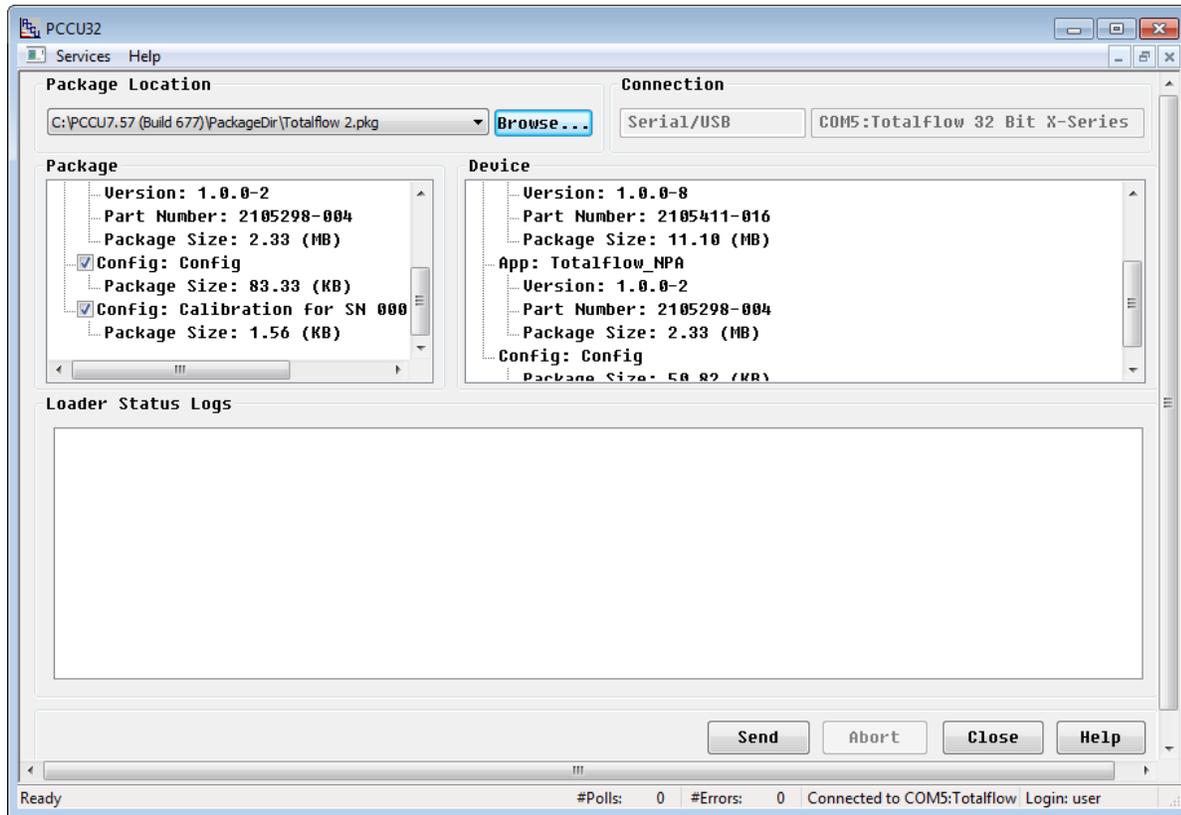
Figure 68: Restore the device configuration package

8. Verify the configuration package is displayed and selected in the Package field.

9. Verify that the calibration configuration (if needed) is selected in the Package field.

> **NOTICE – Tainted results.** Do not select the calibration configuration in the Package field if restoring the configuration package made from another µFLO^{G5} flow computer transducer. Restoring the calibration files from a different device will corrupt the last field calibration records and skew the results. The calibration configuration file should only be restored to the unit from which it was created.

10. Click **Send**.

11. Monitor the progress in Loader Status Logs. Verify that the package was sent successfully.

12. When finished, the system should restart. Verify that the configuration is active and that the "Device info updated" message displays.

7.3 Changing the flow computer clock

When a measurement application is running in the flow computer, a clock change could affect the times when log period entries are made. To protect the integrity of the accounting audit trail, the flow computer handles these types of clock changes as follows:

7.3.1 Backward or forward clock change not crossing an hourly boundary

When the clock is changed, and an hourly boundary is not crossed, an additional log period entry is not required.

Example: If the present time is 4:15 p.m. and clock is changed to 4:05 p.m. of the same day, the daily flow record is the same. The log period entry reflects averages accumulated over a 70-minute time period (15 minutes plus 55 minutes).

7.3.2 Forward clock change crossing an hourly boundary

This forces a log period entry for the part of the hour that has accumulated since the last hourly entry. The flow computer then begins a new log record beginning with the new clock time.

Example: If the present time is 4:55 p.m. and the clock is changed to 5:05 p.m. of the same day, the log entry reflects only a 55-minute average accumulation. When the next log record is written, the period is also based on a 55-minute accumulation.

7.3.3 Backward clock change crossing an hourly boundary

This forces a log period entry for the part of the hour that has accumulated since the previous log entry. A new flow record is begun with the new clock time and the new record maintains the balance of the hourly data.

Example: If the present time is 5:05 p.m. and the clock is changed to 4:55 p.m. of the same day, the log period entry reflects only a five-minute average accumulation. When the next log record is written, the period is based on a 60-minute accumulation.

---

i **IMPORTANT NOTE:** A backward clock change uses two (2) records to maintain data integrity. This ensures that previously recorded data is not overwritten.

If it is necessary to make small, backward time changes of less than one (1) hour, the user should simply wait until the current hour has progressed far enough to make a change that does not cross an hour boundary.

7.4 Restarting the system

Restarting the flow computer can be accomplished using multiple methods resulting in different outcomes. Of the various restart methods, three primary procedures merit more discussion: warm, cold, and factory restarts.

A warm restart may be required as part of a maintenance or troubleshooting procedure. It is used to shut down all applications and to back up the running data, configuration, and logs to persistent memory. A warm restart also resets the onboard microprocessor. When a power or communication interruption locks up the microprocessor, a warm restart may be helpful in resetting the applications. A warm restart may also be instigated automatically following a software update or required after updating network settings.

A cold restart should only be performed as part of particular service or maintenance procedures or when specifically directed to by ABB technical support. Restarting the flow computer using the cold configuration will delete calibration and measurement data and restart the device using the last saved configuration file. For additional information about how to preserve data and configuration files, see section 7.1, *Preserving data and configuration files*, on page 83.

A factory restart may be performed when it is necessary or desirable to return the flow computer to the original configuration as shipped from the factory.

⚠ **CAUTION – Equipment / Property damage.** Prior to performing any service on the flow computer, data should be collected and the configuration file saved for a possible restoration. Failure to collect data and save the configuration file could result in a loss of measurement data and require a complete system configuration.

Other less desirable methods of performing a restart are also discussed in Table 19.

Table 19: System restart types

Restart type and description	When appropriate	Restart action	Sub-section name
Warm restart. All applications are shut down normally. The running data, configuration, and logs are backed up to persistent memory.	– Following a software update – Following network setup or changes – To write configuration data to persistent memory prior to maintenance or service.	S4 Reset button on the electronic board.	7.4.1 Warm restart using the reset button, page 90
		Device loader restart using running (warm) configuration	7.4.2 Warm restart using the device loader, page 90
		System Shutdown, then Restart command	7.4.3 Warm restart using the System Shutdown / then Reset command (Expert view only), page 91
		Terminal mode command	7.4.4 Warm restart using terminal mode, page 92
Cold restart. All applications are shut down. The running		Device loader restart using startup (cold) configuration	7.4.5 Cold restart using the device loader, page 92

| Restart type and description	When appropriate	Restart action	Sub-section name
data and logs are backed up to persistent memory. The running configuration is deleted and repopulated using the startup configuration.	– To restore the startup configuration o Following a startup configuration update	Terminal mode command	7.4.6 Cold restart using terminal mode, page 93
Factory restart. All applications are shut down. The running configuration is deleted and repopulated using the factory configuration.	– To restore the factory configuration – Following relocation	Device loader restart using factory configuration	7.4.7 Restart using factory configuration, page 94
Power loss restart. All data logs and configurations within the current minute are lost.	Not recommended	Temporarily removing charger and battery power.	Not available

7.4.1 Warm restart using the reset button

To restart the flow computer using the reset button:

1. Open the flow computer door and locate the Reset button (S4) on the μFLO^{G5} board (see Figure 69).
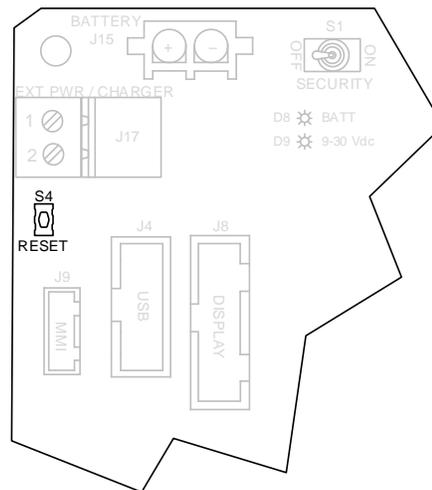
Figure 69: S4 Reset button location

2. Momentarily press the reset button. The unit will restart using the warm (running) configuration.

IMPORTANT NOTE: If the flow computer seems to be stuck or is not restarting as expected, force a restart by pressing the reset button for at least 8 seconds.

7.4.2 Warm restart using the device loader

To restart the flow computer using the device loader:

1. Open PCCU32. Ensure that PCCU is not connected to the flow computer. If connected, disconnect local communication between the PC and the flow computer by clicking the **Disconnect** icon.

2. Click the **32 Bit Loader** icon. A message box displays.

3. Click **Yes** to continue to the loader connection screen.

4. Select the Connection Type, the Local Communication Port, and enter the Security Code if required.

5. Click **Connect**.

6. Click **Services** in the menu bar and select **Restart** > **Restart using Running (Warm) configuration** (Figure 70).
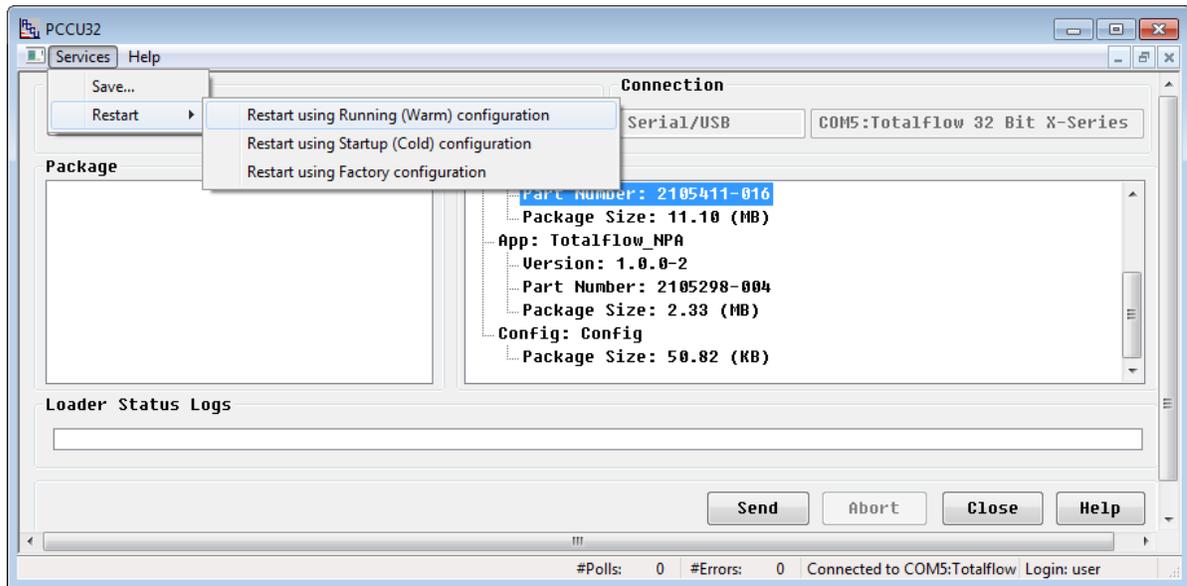
Figure 70: Warm restart using the device loader

7.4.3 Warm restart using the System Shutdown / then Reset command (Expert view only)

To restart the flow computer using the System Shutdown / then Reset command:

1. Establish a local connection to the flow computer using PCCU32.

2. On the PCCU menu bar, select **View** > **Expert**.

3. Click the top node of the navigation tree, the Station ID name, to see the **Station Setup** screen.

4. Scroll down to the System Startup / Shutdown area (Figure 71).

5. Set the **System Shutdown / then Reset** field to **Yes**.

6. Click **Send**.

Warm restart in Expert view
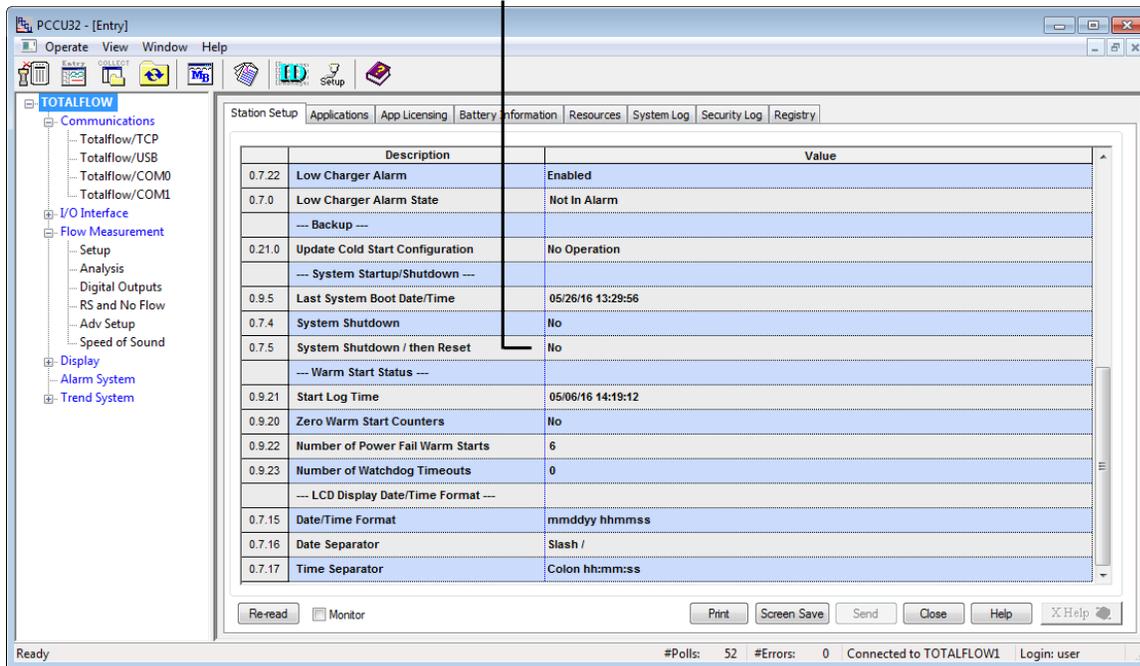
Figure 71: Warm restart on the Station Setup tab (Expert view)

7.4.4   Warm restart using terminal mode

To restart the flow computer using terminal mode:

1.   Establish a local connection to the flow computer using PCCU32.

2.   On the PCCU menu bar, select **Operate** > **Communications** > **Terminal**.

3.   At the terminal prompt (->), type the command **BOOT=WARM** (Figure 72).
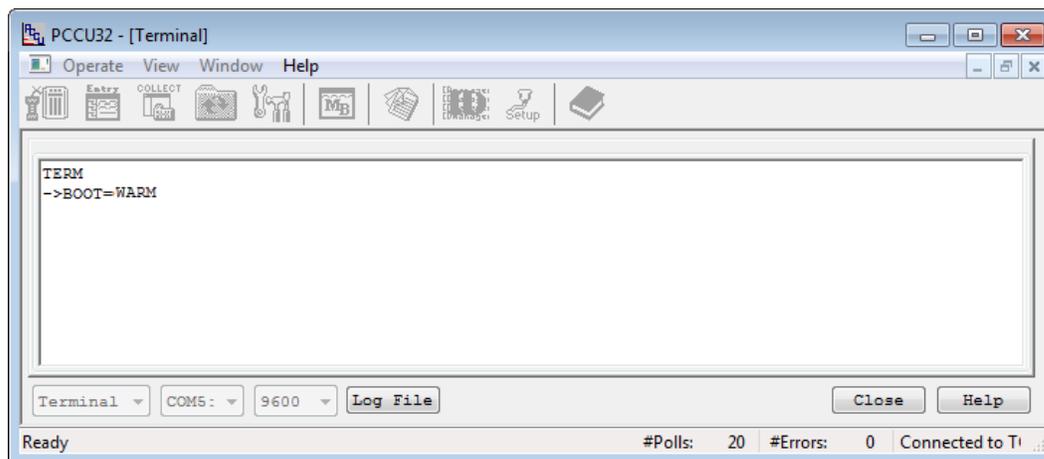
Figure 72: Terminal mode warm restart

4.   Press **Enter**.

7.4.5   Cold restart using the device loader

To restart the flow computer using the device loader:

1.   Open PCCU32. Ensure that PCCU is not connected to the flow computer. If connected, disconnect local communication between the PC and the flow computer by clicking the **Disconnect** icon.

2. Click the **32 Bit Loader** icon. A message box displays.

3. Click **Yes** to continue to the loader connection screen.

4. Select the Connection Type, the Local Communication Port, and enter the Security Code if required.

5. Click **Connect**.

6. Click **Services** in the menu bar and select **Restart** > **Restart using Startup (Cold) configuration** (Figure 73).
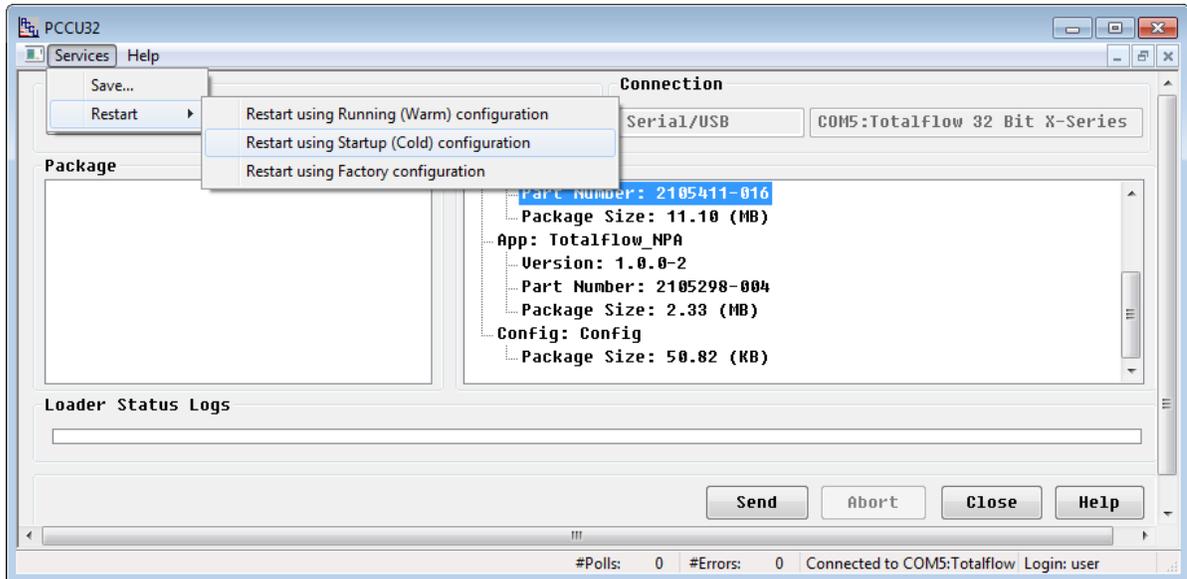
Figure 73: Cold restart using the device loader

7.4.6   Cold restart using terminal mode

To restart the flow computer using terminal mode:

1. Establish a local connection to the flow computer using PCCU32.

2. On the PCCU menu bar, select **Operate** > **Communications** > **Terminal**.

3. At the terminal prompt (->), type the command **BOOT=COLD** (Figure 74).
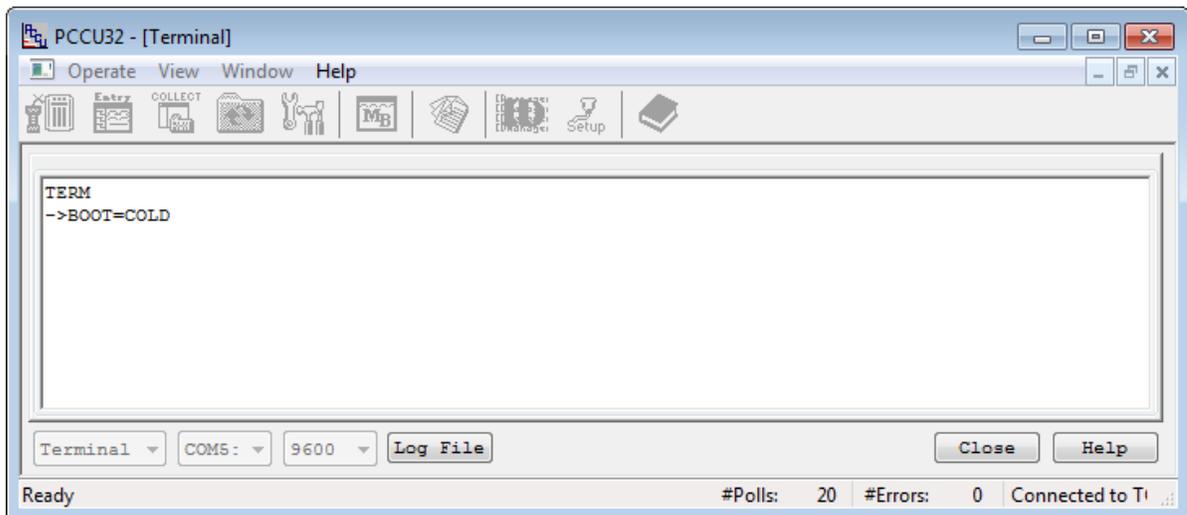
Figure 74: Terminal mode cold restart

4. Press **Enter**.

7.4.7   Restart using factory configuration

This procedure restores the device's startup configuration to its factory defaults.

> ! **NOTICE – Data loss.** All previous configurations are deleted.

To restore factory configuration:

1. Open PCCU32. Ensure that PCCU is not connected to the flow computer. If connected, disconnect local communication between the PC and the flow computer by clicking the **Disconnect** icon.

2. Click the **32 Bit Loader** icon. A message box displays.

3. Click **Yes** to continue to the loader connection screen.

4. Select the Connection Type, the Local Communication Port, and enter the Security Code if required.

5. Click **Connect**.

6. Click **Services** in the menu bar and select **Restart** > **Restart using Factory configuration** (Figure 75).
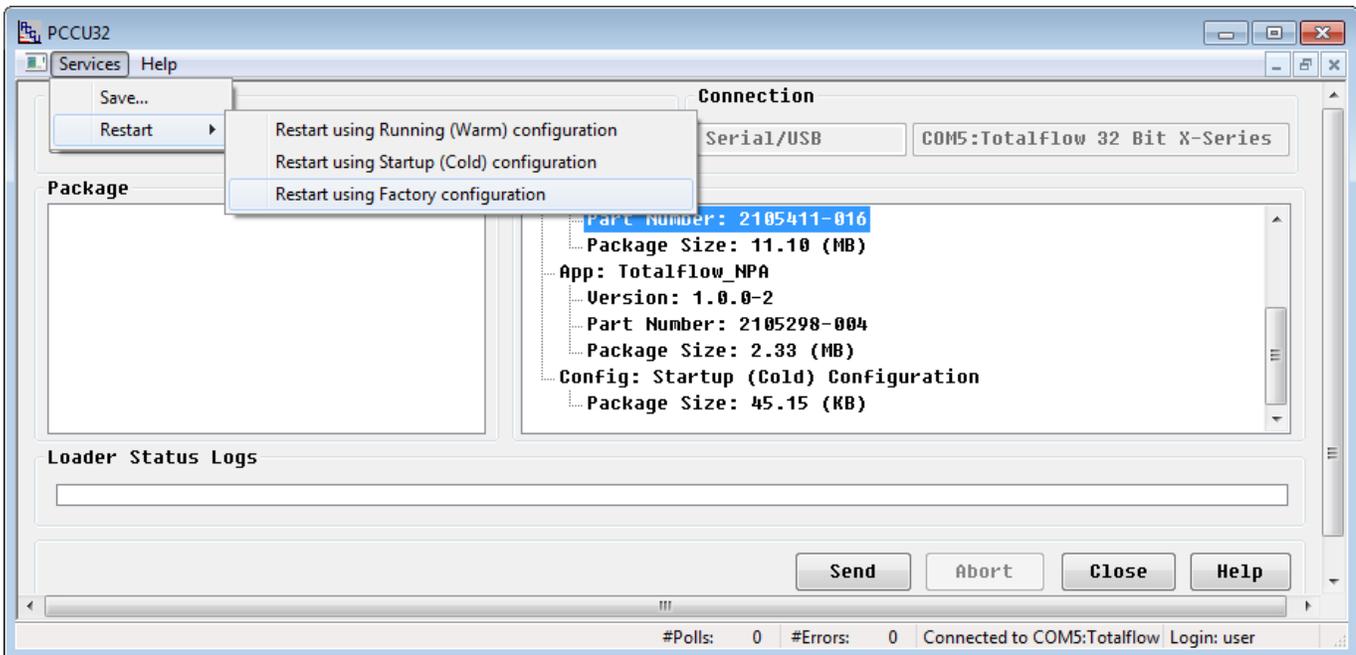
Figure 75: Restart using factory configuration

7.5   Flow computer maintenance and cleanliness

The flow computer enclosure is designed for exposure to the environment, but the internal components are not. The enclosure door should remain closed except during maintenance or service procedures that require access to the internal components. The enclosure, door, and access holes should be inspected regularly to ensure that all seals and gaskets are clean, intact and that environmental elements have not been allowed inside of the enclosure.

Connected cabling should be regularly inspected to ensure that protective coverings are in place and intact. If the installation includes a solar panel, the cell surface of the panel should be cleaned regularly to ensure that dust and debris are not present on the cell surface. Dust and debris will inhibit the charging ability of the solar panel. All other peripheral equipment should be inspected to ensure that it is maintained properly.

7.6   Remove and restore power

This procedure does not directly address any requirements for verifying that the onboard RAM remains powered.

> ⚠ **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

7.6.1 Removing power from the electronic board

1. Disconnect the external power/charger terminal connector (J17) from the µFLO^{G5} electronic board (Figure 76).
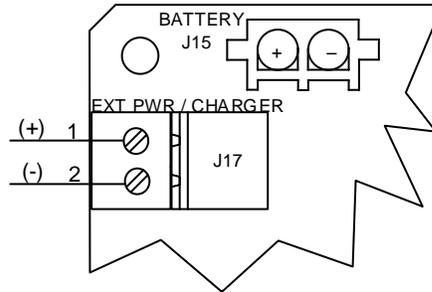
Figure 76: µFLO^{G5} electronic board power connections

2. Disconnect the battery cable from the µFLO^{G5} electronic board connector (J15).

7.6.2 Reconnecting power to the electronic board

> ⚠ **CAUTION – Equipment / Property damage.** The external power/charger and battery connections should not be reconnected until all service procedures are completed; including reconnecting all wires, plugs, terminations, and peripheral equipment. Failure to observe this caution may result in property damage. Do not perform this procedure until instructed to do so.

1. Reconnect the battery cable to J15 on the µFLO^{G5} electronic board (Figure 76).

2. Reconnect the external power/charger connector to J17 on the µFLO^{G5} electronic board.

7.7 Adjusting the LCD contrast

The LCD contrast is controlled by the onboard potentiometer (R146). To adjust the contrast:

1. Using an extra small slotted screwdriver, turn the potentiometer screw (R146), located on the µFLO^{G5} electronic board, clockwise as far as possible (Figure 77).

2. Turn the potentiometer screw counter-clockwise until the LCD screen is readable.
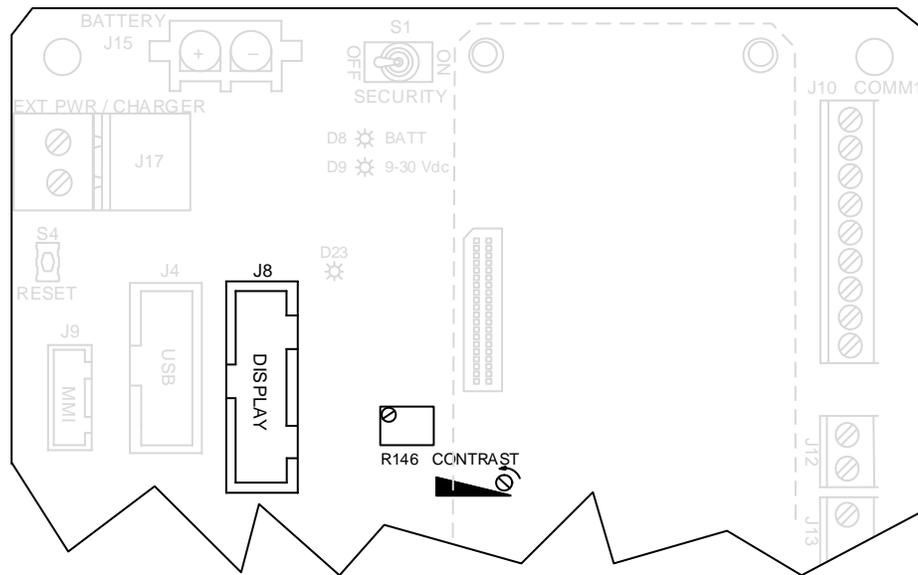
Figure 77: LCD contrast adjustment

7.8 *μ*FLO^{G5} replacement parts

The *μ*FLO^{G5} flow computer field-replaceable parts are:

— *μ*FLO^{G5} electronic board

— I/O expansion board

— *μ*FLO^{G5} complete IMV assembly

— LCD assembly

— Lithium battery

— Transducer

— 12 V battery

Disassembly and reassembly of the flow computer follows a linear pattern. Figure 78 shows an exploded view of the *μ*FLO^{G5} flow computer, which will assist with disassembly and reassembly.
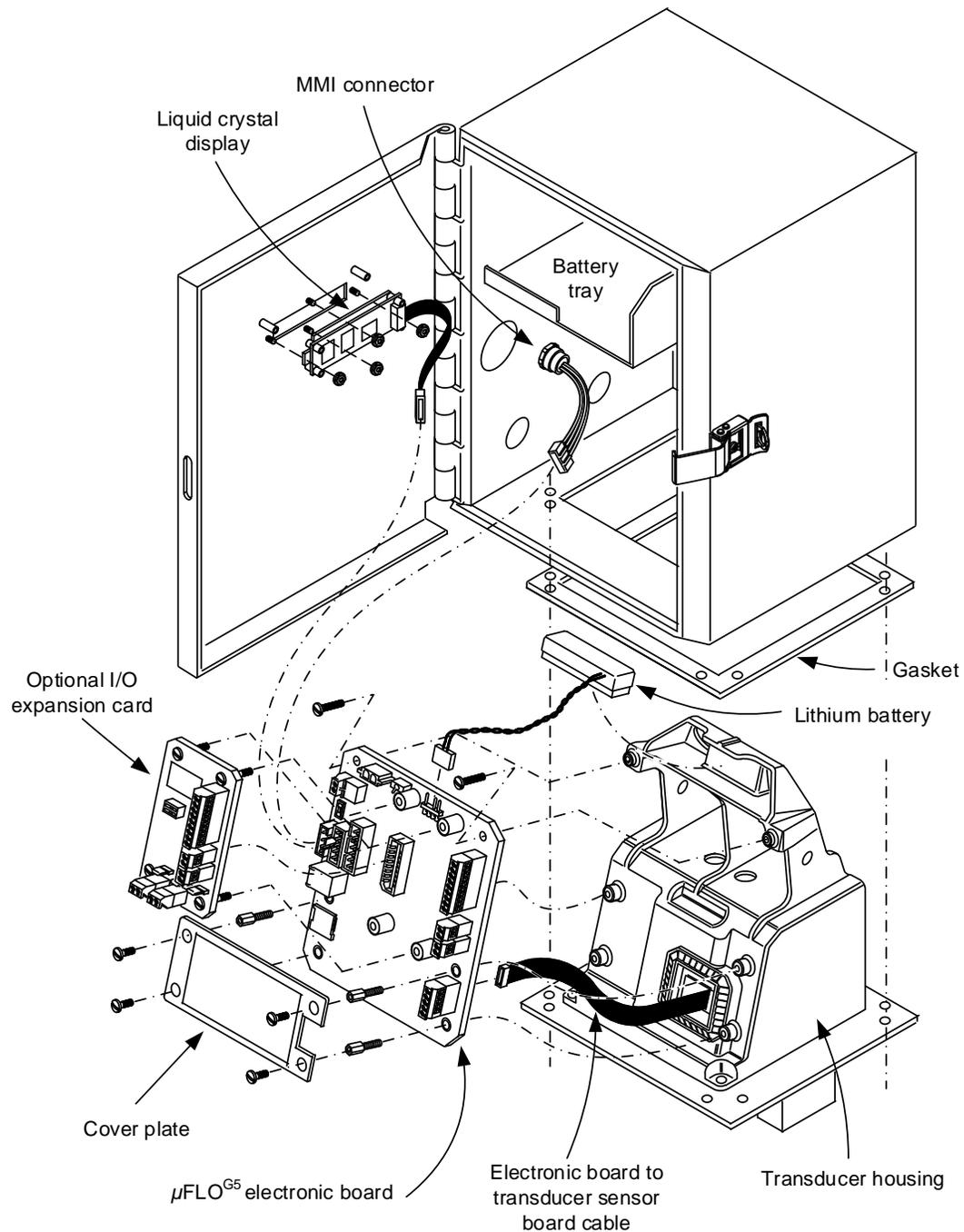
Figure 78: *μ*FLO^{G5} exploded view

7.8.1   Replacing the *μ*FLO^{G5} battery

Use following procedure for removal and replacement of the *μ*FLO^{G5} flow computer battery.

> **IMPORTANT NOTE:** To extend the life of the battery, fully charge the battery prior to installation. A system using solar panels may not fully charge the battery. Additionally, a fast charge, which the solar panel cannot provide, will improve the life of the battery.
>
> To recharge a battery, a quick charge will remove buildup in the battery much more effectively than a trickle charge. A battery slowly drained by low light conditions on a solar-charged system or sitting in storage will be less likely to recover than a battery that was quickly discharged from a short. Store batteries in a cool environment for less drainage.

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files* on page 83. Return here when completed.

2. Open the *µ*FLO^G5 door.

3. Verify that the J18 lithium battery is connected to the electronic board (Figure 79).
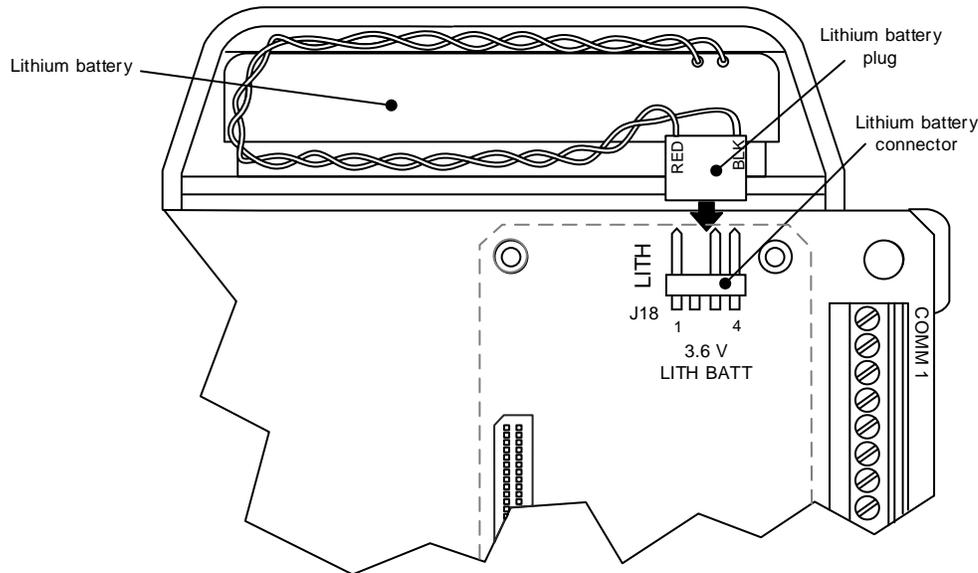
Figure 79: *µ*FLO^G5 electronic board components

4. Verify the RAM is protecting the real-time clock:

   a. View the scrolling data on the LCD. When **Lithium Back-up?** displays, the value should read **Yes**. This indicates that the lithium battery is connected to the board. If the value reads **No**, connect the lithium battery cable to J18 on the main electronic board.

   b. Verify the "LL" battery alarm is not being displayed on the *µ*FLO^G5 LCD, annunciator position A7. If "LL" is displayed, and the lithium battery is connected, the lithium battery may need to be replaced. Measure the lithium battery and make sure that it is > 3.0 V.

   > **NOTICE – Corrupted data.** When removing the battery, do not remove the lithium battery from the *µ*FLO^G5 electronic board. The lithium battery prevents the date and time clock from being reset.

5. Disconnect the battery charger (solar or ac charging source, J17) from the electronic board.

6. Disconnect the battery cable from J15 on the electronic board.

7. Remove the battery from the battery compartment.

8. Insert the new battery into the battery compartment. Ensure that the battery terminals are not touching the keeper lip on the shelf or any metal surface inside of the unit (Figure 80).
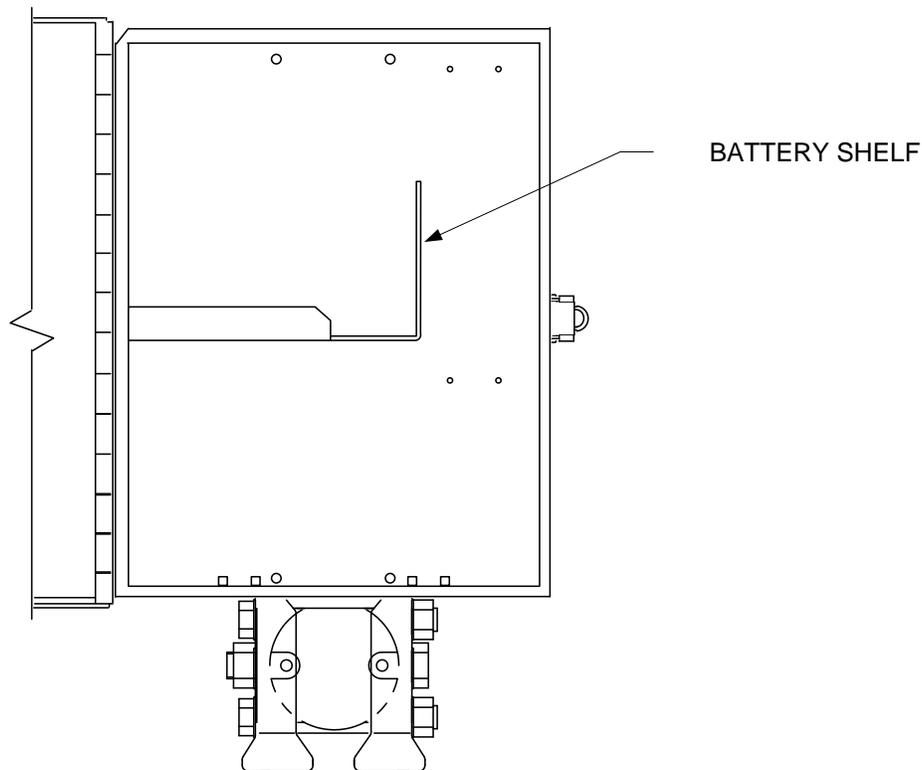
BATTERY SHELF

Figure 80: Battery shelf

9. Reconnect the battery cable to J15 on the electronic board.

10. Reconnect the battery charger to J17 on the electronic board.

11. After closing the flow computer door, check the door-mounted LCD for normal operational readings.

7.8.2   Replacing the lithium battery

⚠ **CAUTION – Loss of data.** Do not remove power to the unit. Loss of power to the unit will initiate a cold restart and all data and configuration files could be lost.

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files* on page 83. Return here when completed.

2. On the *µ*FLO^G5 board, gently remove the lithium battery cable from the lithium battery connector (J18, Figure 85, on page 104).
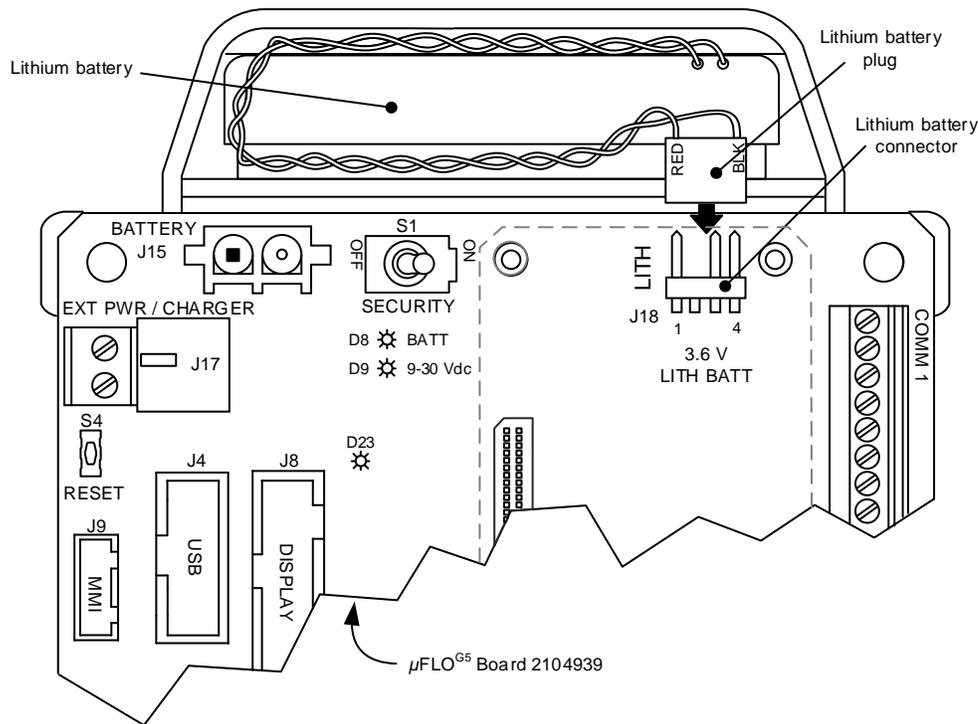
Figure 81: Lithium battery cable and connector

3. The lithium battery is housed in the top portion of the transducer housing and is held in place with a hook and loop strip. Using care, remove the lithium battery from its compartment.

4. Attach the edge of the new lithium battery (with hook or loop strip), to the opposing strip within the enclosure.

5. Plug the lithium battery cable into the lithium battery connector (J18) on the electronic board.

7.8.3 I/O expansion board replacement

The I/O expansion board attaches directly to the μFLO^{G5} board. To remove and replace the I/O expansion board, use the following procedures:

7.8.3.1 Removing the I/O expansion board

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files,* on page 83. Return here when completed.

2. Verify that the "LL" battery alarm is not being displayed on the μFLO^{G5}. If it is being displayed, ensure that the lithium battery is connected (J18). If the battery is connected, go to section 9.2.2, *Troubleshooting a Low Lithium alarm (LL)*, on page 124 to troubleshoot the lithium battery before disconnecting the power. If necessary, instructions for replacing the lithium battery may be found in section 7.8.2, on page 99.

3. Follow the procedure detailed in section 7.6.1, *Removing power from the electronic board*, on page 95. Return here when completed.

⚠ **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

4. If removing the I/O expansion board as part of another service procedure, it may not be necessary to disconnect the field wiring. Otherwise, disconnect the following field wiring connections on the I/O expansion board (Figure 82):

   – Communication wiring from J2
   – DI wiring from J9
   – DO wiring from J5
   – AI-1 wiring from J4

–   AI-2 wiring from J8.
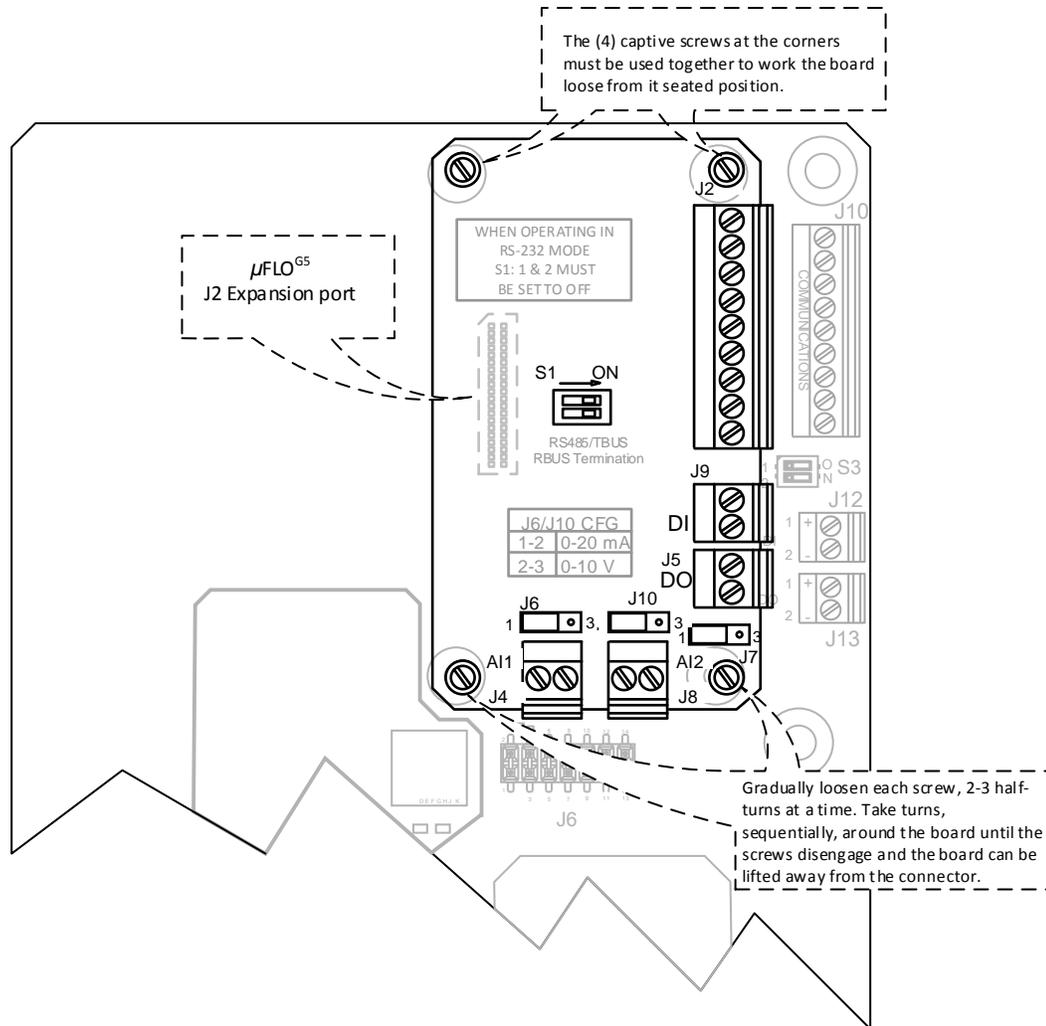
Figure 82: *μ*FLO^G5 board – I/O expansion board removal

5. Use a small slotted screwdriver to loosen the four (4) mounting screws that attach the I/O board to the *μ*FLO^G5 board. Alternate between the four screws, one to two turns each. As the screws are loosened, the J2 connector is gradually disconnected from the electronic board socket.

> **IMPORTANT NOTE:** The I/O expansion board mounting screws are held in place with a screw keeper. Do not attempt to remove the screws from the board.

6. Grasp the expansion board on either side and gently lift it up from the *μ*FLO^G5 electronic board.

7.8.3.2   Replacing the I/O expansion board

1. Fit the I/O board connector (J1) onto the I/O expansion port (J2) on the electronic board, but do not push down to seat the expansion board.

2. Using a small slotted screwdriver, alternate tightening the screws, one to two turns, until the expansion board is secure and seated into the board socket.

Fit the I/O card connector J1 into J2 on the board. Do not push down to seat.

The (4) captive screws at the corners must be used together to work the board into its correct position.

WHEN OPERATING IN RS-232 MODE S1: 1 & 2 MUST BE SET TO OFF

S1 ___ ON

RS485/TBUS RBUS Termination

J6/J10 CFG	
1-2	0-20 mA
2-3	0-10 V

Gradually tighten the screws, 2-3 half-turns at a time. Take turns, sequentially, around the board until the board is secure and the connector is properly seated.

Figure 83: *µ*FLO^G5 board – I/O expansion board replacement

3. Reconnect the following field-wiring connections on the I/O expansion board:

   – Communication wiring from J2
   – DI wiring from J9
   – DO wiring from J5
   – AI #1 wiring from J4
   – AI #2 wiring from J8.

IMPORTANT NOTE: If performing additional service procedures, do not continue to step 4. Power connection will be addressed in the other service procedure.

4. Follow the procedure detailed in section 7.6.2, *Reconnecting power to the electronic board*, on page 95 to restore power to the flow computer.

7.8.4   *µ*FLO^(G5) electronic board replacement

7.8.4.1   Removing the electronic board

The *µ*FLO^(G5) board is mounted on the transducer housing. To access and remove the *µ*FLO^(G5) electronic board, perform the following procedure:

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files,* on page 83. Return here when completed.

2. Verify that the "LL" battery alarm is not being displayed on the *µ*FLO^(G5). If it is being displayed, ensure that the lithium battery is connected (J18). If the battery is connected, go to section 9.2.2, *Troubleshooting a Low Lithium alarm (LL)*, on page 124 to troubleshoot the lithium battery before disconnecting the power. If necessary, instructions for replacing the lithium battery may be found in section 7.8.2, on page 99.

3. Follow the procedure detailed in section 7.6.1, *Removing power from the electronic board*, on page 95. Return here when completed.

⚠ **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

---

4. Follow the procedure detailed in section 7.8.3.1, *Removing the I/O expansion board*, on page 100, if installed. It is not necessary to disconnect the field wiring on the I/O expansion board.

5. On the transducer housing assembly, use a phillips screwdriver to remove the four (4) screws holding the cover plate in place. Remove and set the plate aside (Figure 84). The cover plate contains the transducer information and should stay with the IMV assembly.
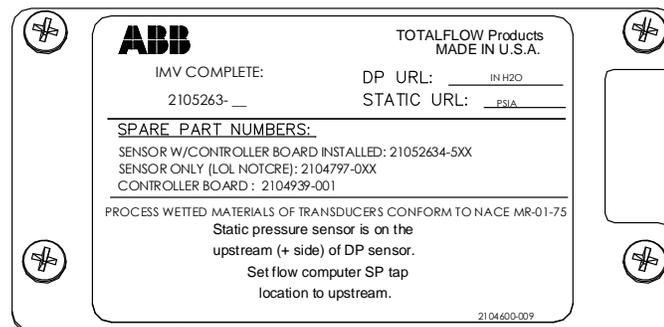
Figure 84: Cover plate with transducer information

6. Loosen the lithium battery unit from the head of the transducer assembly (Figure 78, *µFLOG5 exploded view*, page 97). The battery will need to remain connected to, and moved with, the electronic board.

7. Disconnect the following, if connected:

   a. LCD display cable from J8 connector.

   b. Communication connections:
      - MMI communication cable plug from J9
      - USB cable plug from J4
      - Ethernet cable plug from J1

   c. Field wiring connections:
      - Communication wiring from J10
      - DI wiring from J12
      - DO wiring from J13
      - RTD sensor from J3

8. Using a ¼ inch hex driver, remove the six (6) hex standoffs that attach the *µ*FLO^(G5) electronic board to the transducer housing (Figure 85).
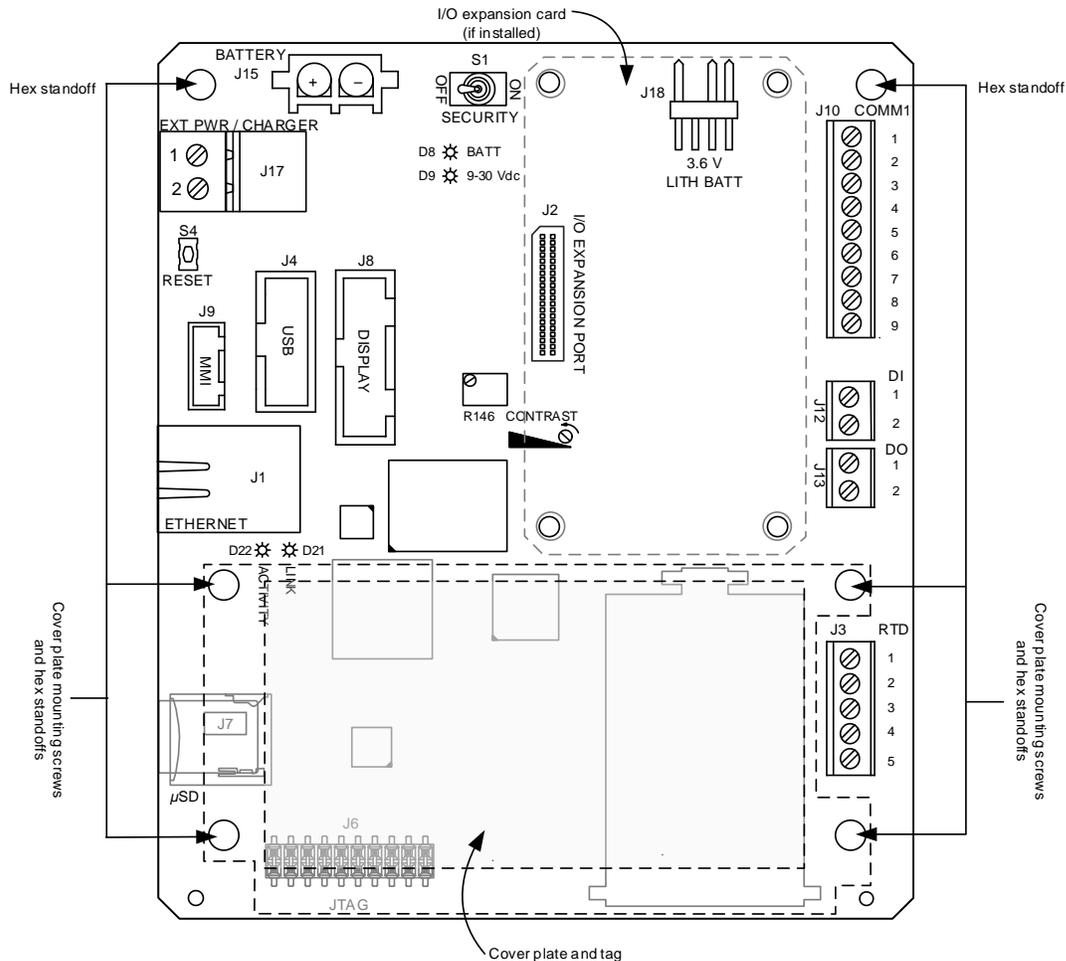
Figure 85: *µ*FLO^{G5} electronic board hex standoffs

9. Lift the board away from the transducer housing carefully. The electronic board-to-transducer sensor cable is very short, approximately 3 inches. Do not pull the board completely away until the cable has been disconnected from the back of the board.

10. Grasp the electronic board-to-transducer sensor cable at the back of the board and disconnect it.

ⅈ **IMPORTANT NOTE:** The *µ*FLO^{G5} electronic board spare part may be ordered in two configurations: new or refurbished. Both configurations are delivered with the latest operating system, standard configuration file, and standard applications loaded. Non-standard application and configuration files are outside the scope of this document. If the device software is backed up, it may be restored to the flow computer electronic board after startup.

7.8.4.2   Replacing the electronic board

1. On the back of the replacement board, attach the electronic board-to-transducer sensor cable to the connector.

2. Carefully feed the excess cable back into the transducer housing, and align the board mounting holes with their respective standoffs.

3. Using a ¼ inch socket driver, reinstall the six hex standoffs and tighten.

4. Using a phillips screwdriver, reinstall the cover plate set aside in step 10 of section 7.8.4.1, *Removing the electronic board*, on page 103.

5. Reconnect the I/O expansion board, if uninstalled, using the replacement instruction in section 7.8.3.2, *Replacing the I/O expansion board*, on page 101.

6. Reconnect the following, if disconnected:

    a. LCD display cable to J8 connector

    b. Lithium battery cable to J18 connector

    c. Communication connections:

        –   MMI communication cable plug to J9
        –   USB cable plug to J4
        –   Ethernet cable plug to J1

    d. Field wiring connections:

        –   Communication wiring to J10
        –   DI wiring to J12
        –   DO wiring to J13
        –   RTD sensor to J3

7. Follow the instructions in section 4.8, *Power supply and charger connections*, on page 49 to apply power to the flow computer. Return here when completed.

8. Follow the instructions in section 7.2, *Restoring the configuration package*, on page 87 to restore the configuration package saved in step 1 of this procedure.

> ! **NOTICE – Tainted results.** Restore the calibration configuration file during the restoration process. This procedure is only replacing the electronic board. Therefore the calibration file previously saved is still valid for the IMV transducer. Check the calibration configuration file before restoring the configuration package.

This completes the replacement of the electronic board.

7.8.5   LCD assembly replacement

7.8.5.1   Removing the LCD

The LCD board is mounted on the backside of the hinged door. The following procedure will detail the steps necessary for removing the LCD board (see Figure 78, *µFLOG5 exploded view*, on page 97).

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files* on page 83. Return here when completed.

2. Verify that the "LL" battery alarm is not being displayed on the $µFLO^{G5}$. If it is being displayed, ensure that the lithium battery is connected (J18). If the battery is connected, go to section 9.2.2, *Troubleshooting a Low Lithium alarm (LL)*, on page 124 to troubleshoot the lithium battery before disconnecting the power. If necessary, instructions for replacing the lithium battery may be found in section 7.8.2, on page 99.

3. Follow the procedure detailed in section 7.6.1, *Removing power from the electronic board*, on page 95. Return here when completed.

> ⚠ **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

4. Disconnect the $µFLO^{G5}$ LCD port connector (J8, Figure 85, on page 104).

5. Using a 3/16 nut driver, remove the four nylon hexagon mounting standoffs (Figure 78, on page 97). Lift the board from the door-mounted standoffs.

7.8.5.2   Replacing the LCD

1. Place the LCD assembly on the door-mounted standoffs.

2. Using a 3/16 nut driver, replace the four nylon mounting standoffs. Be careful not to over-tighten them; doing so could cause damage to the board and associated circuitry.

3. Reconnect the LCD port connector (J8, Figure 85, on page 104).

4. Follow the procedure detailed in section 7.6.2, *Reconnecting power to the electronic board*, on page 95. Return here when completed.

5. Once the unit has powered up, it may be necessary to adjust the LCD contrast. To adjust the contrast, follow the instructions in section 7.7, *Adjusting the LCD contrast*, on page 95.

7.8.6   Transducer assembly (only) replacement

To replace the transducer assembly only, the electronic board must be removed from the old assembly and reinstalled onto the replacement assembly. The following procedure covers the replacement of the assembly and the transfer of the electronic board.

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files,* on page 83. Return here when completed.

2. Follow the procedure detailed in section 7.6.1, *Removing power from the electronic board*, on page 95. Return here when completed.

> ⚠ **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

3. Disconnect the following, if connected:

   a. LCD display cable from J8 connector.

   b. Communication connections:
   - MMI communication cable plug from J9
   - USB cable plug from J4
   - Ethernet cable plug from J1

   c. Field wiring connections:
   - Communication wiring from J10
   - DI wiring from J12
   - DO wiring from J13
   - RTD sensor from J3

> ⚠ **DANGER – Serious damage to health / risk to life.** Preparation for removing the IMV should include taking the meter run out of service and disconnecting the high and low input lines or manifold connections. Depending on company policy, other steps may be required but are outside the scope of this document. Complete all requirements before continuing.

4. Following the procedure detailed in section 7.9, *Shut in the measurement sensor*, on page 110. Return here when completed.

5. Remove the IMV assembly from the enclosure following the procedure detailed in section 7.8.8, on page 108. Return here when completed.

6. Transfer the electronic board from the old transducer assembly to the replacement assembly:

   a. On the replacement transducer assembly, use a phillips screwdriver to remove the four (4) screws that secure the transducer cover plate containing the transducer information (Figure 84, page 103). Remove and set the plate aside.

   b. On the old transducer assembly, also remove the cover plate and set aside separately to reinstall on the old transducer assembly after the board has been transferred.

   c. On the old transducer assembly, use a ¼ inch socket driver to remove the six (6) hex standoffs that attach the μFLO^{G5} electronic board to the transducer housing.

   d. Lift the board away from the transducer housing carefully. The electronic board to transducer sensor cable is very short, approximately 3 inches. Do not pull the board completely away until the cable is disconnected from the back of the board. Grasp the electronic board-to-transducer sensor cable at the back of the board and disconnect it.

   e. Move the electronic board to the replacement assembly. Attach the electronic board-to-transducer sensor cable to the connector on the back of the electronic board.

f.   Carefully feed the excess cable back into the transducer housing, and align the board mounting holes with their respective standoffs.

g.   Using a ¼ inch socket driver, tighten the six hex standoffs.

h.   Remount the cover plate that came with the new transducer assembly onto the electronic board using a phillips screwdriver.

i.   Remount the old cover plate onto the old transducer assembly. The replacement IMV assembly is now assembled and ready to be installed and reconnected.

7.   Follow the instructions in section 7.8.9, *Replacing the IMV assembly*, on page 109, to install the IMV assembly with the replacement transducer. Return here when completed.

8.   Reconnect the following, if disconnected:

a.   LCD display cable to J8 connector

b.   Communication connections:

– MMI communication cable plug to J9
– USB cable plug to J4
– Ethernet cable plug to J1

c.   Field wiring connections:

– Communication wiring to J10
– DI wiring to J12
– DO wiring to J13
– RTD sensor to J3

9.   Follow the instructions in section 4.2.1.3, *Manifold and input line installation*, on page 37 to connect manifold lines to the transducer. Return here when completed.

10.   Follow the instructions in section 4.3, *Leak-test manifold and tubing connections*, on page 38 to leak-test all connections. Return here when completed.

11.   Follow the instructions in section 4.8, *Power supply and charger connections*, on page 49 to apply power to the flow computer. Return here when completed.

12.   Follow the instructions in section 7.2, Restoring the configuration package, on page 87 to restore the configuration package saved in step 1 of this procedure.

> **!** **NOTICE – Tainted results.** Do not restore the calibration configuration file during the restoration. This procedure is replacing the transducer. The replacement assembly is factory-calibrated, therefore the calibration file previously saved is no longer valid for the device. Uncheck the calibration configuration file before restoring the configuration package.

The transducer assembly replacement is complete.

7.8.7   IMV assembly replacement

The following procedure details the steps necessary to for replacing the whole IMV assembly versus removing the IMV to replace the transducer assembly.

1.   Follow the procedure detailed in section 7.1, *Preserving data and configuration files* on page 83. Return here when completed.

2.   Follow the procedure detailed in section 7.6.1, *Removing power from the electronic board*, on page 95. Return here when completed.

> **⚠** **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

3.   Disconnect the following, if connected:

a.   LCD display cable from J8 connector

   b.   Communication connections:

   –   MMI communication cable plug from J9

   –   USB cable plug from J4

   –   Ethernet cable plug from J1

   c.   Field wiring connections:

   –   Communication wiring from J10

   –   DI wiring from J12

   –   DO wiring from J13

   –   RTD sensor from J3

> ⚠️ **DANGER – Serious damage to health / risk to life.** Preparation for removing the IMV should include shutting in the measurement sensor and disconnecting the high and low input lines or manifold connections. Depending on company policy, other steps may be required, but are outside the scope of this document. Complete all requirements before continuing.

4.   Shut in the measurement sensor following the procedure detailed in section 7.9, *Shut in the measurement sensor*, on page 110. Return here when completed.

5.   Remove the IMV assembly from the enclosure following the procedure detailed in section 7.8.8, on page 108. Return here when completed.

6.   Follow the instructions in section 7.8.9, Replacing the IMV assembly, on page 109, to install the IMV assembly.

7.   Reconnect the following, if disconnected:

   a.   LCD display cable to J8 connector

   b.   Communication connections:

   –   MMI communication cable plug to J9

   –   USB cable plug to J4

   –   Ethernet cable plug to J1

   c.   Field wiring connections:

   –   Communication wiring to J10

   –   DI wiring to J12

   –   DO wiring to J13

   –   RTD sensor to J3

8.   Follow the instructions in section 4.2.1.3, *Manifold and input line installation*, on page 37 to connect manifold lines to the transducer. Return here when completed.

9.   Follow the instructions in section 4.3, *Leak-test manifold and tubing connections*, on page 38 to leak-test all connections. Return here when completed.

10.   Follow the instructions in section 4.8, *Power supply and charger connections*, on page 49 to apply power to the flow computer. Return here when completed.

11.   Follow the instructions in section 7.2, *Restoring the configuration package*, on page 87 to restore the configuration package saved in step 1 of this procedure.

> ❗ **NOTICE – Tainted results.** Do not restore the calibration configuration file during the restoration. This procedure is replacing the transducer and the electronic board. The replacement assembly is factory calibrated, therefore the calibration file previously saved is no longer valid for the device. Uncheck the calibration configuration file before restoring the configuration package.

The IMV assembly replacement is complete.

7.8.8   Removing the IMV assembly

Removal of the complete IMV assembly is necessary and applicable in two component replacement procedures:

— Transducer assembly replacement (either differential or linear assemblies)

— Complete IMV assembly replacement

Certain procedures require that the IMV assembly be removed. It is assumed that a direction to perform this procedure is instigated from another set of instructions. Once completed, return to the original procedure.

To remove the IMV assembly:

1. Rotate the enclosure, if necessary, to allow removal of the IMV:

    a. Using a ½ inch hex socket with ratchet, loosen the *µ*FLO enclosure mounting clamp bolts and rotate the enclosure a sufficient distance to allow removal of the IMV, approximately 11 inches.

> ⚠ **CAUTION – Equipment damage.** When rotating the enclosure, be careful to not stress or damage the wires and cables connected through the enclosure access points.

    b. After rotation, tighten the clamp bolts to hold the *µ*FLO in place.

2. Using a phillips screwdriver, remove the eight (8) mounting screws, washers and lock washers, located on the bottom of the enclosure, that secure the IMV to the *µ*FLO cabinet (Figure 78, on page 97). Be careful not to drop the screws.

3. Loosen the IMV by tilting it slightly forwards and then backwards. Carefully slide the upper body of the assembly down through the bottom access cutout until clear.

4. The weather-sealing gasket is affixed to the top side of the IMV mounting flange and may be stuck to the bottom of the enclosure. Remove any remaining gasket that is adhered to the bottom of the cabinet.

> ⚠ **CAUTION – Equipment damage.** The gasket area should be clean and free of any materials that may hinder the seal of a new gasket. An improper gasket seal may allow moisture or dirt to enter the enclosure and damage the electronic components.

7.8.9 Replacing the IMV assembly

Replacing the complete IMV assembly is necessary and applicable in two component replacement procedures:
— Transducer assembly replacement (either differential or linear assemblies)
— Complete IMV assembly replacement

Certain procedures require that the IMV assembly be replaced. It is assumed that a direction to perform this procedure is instigated from another set of instructions. Once completed, return to the original procedure.

To install the complete IMV assembly, perform the following steps:

1. Place the clean weather sealing gasket over the upper body of the IMV assembly and move the gasket down to the mounting plate just below the electronic board (Figure 86).
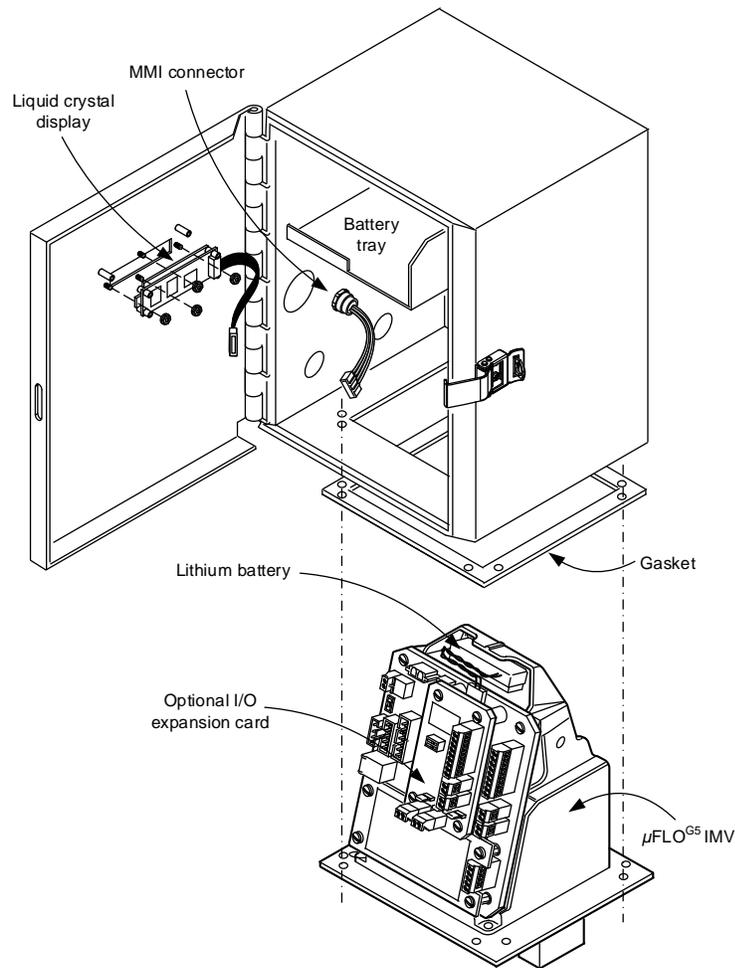
Figure 86: *µ*FLO IMV replacement

2.   Carefully move the IMV up into the access cutout.

3.   Place the split washer, then the flat washer on the screw and screw into the mounting plate and up into the corresponding screw hole.

4.   Repeat step 3 for the remaining mounting screws.

5.   Securely tighten all eight mounting screws to keep out external environmental elements.

This completes the installation of the IMV assembly.

7.9   Shut in the measurement sensor

Certain procedures require that the measurement sensor be shut in. It is assumed that a direction to perform this procedure is instigated from another set of instructions. Once completed, return to the original procedure.

The following are general guidelines and should be adjusted according to specific site requirements and company policies. To shut in the measurement sensor:

1.   Using the high/low control valves on the manifold, equalize the pressure to the IMV.

2.   Using the high/low tap valves, close off both lines. These two valves connect the meter run high/low output lines to the *µ*FLO.

3.   Vent the manifold to atmosphere using the vent valve.

4.   Completely disconnect the high/low manifold lines from the IMV.

7.10 Changing the orifice plate

Use one of the following procedures when changing the orifice plate:

7.10.1 Taking the meter run out of service (simplex fitting)

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files,* on page 83. Return here when completed.

2. Take the meter run out of service and relieve all pressure from the meter run, per your company policies and procedures.

3. Replace the physical orifice plate.

4. To end the current log record and begin a new record with the new orifice size (as stated in API 21.1):

   a. In PCCU Entry mode, select **Setup** under the measurement tube tree node.

   b. Select the **Commands** tab.

   c. Change the Reset Log Period field to **Yes**.

> **i** **IMPORTANT NOTES:** The Reset Log Period command writes an ending log record based on the old orifice plate size and then begins a new log record based on the new orifice plate size.
>
> Alternately, the Reset Volume command may be used to simultaneously zero the accumulated volume and reset the log period.

   d. Click **Send**.

5. Select the **Constants** tab.

6. Select the value field beside **Orifice Diameter** and type in the new orifice plate size.

7. Click **Send**.

8. Return the meter run to service using the instructions in section 5.4.2, *Place the transmitter in service*, on page 62.

7.10.2 Leaving meter run in service (senior fitting)

1. Place the *µ*FLO^G5 in Hold mode by selecting **Calibration** on the tool bar.

> **i** **IMPORTANT NOTES:** Entering Calibration mode automatically places the flow measurement mode in Hold. This enables the constant SP, DP, and temperature values to be used during maintenance.

2. Replace the orifice plate following manufacturer's instructions.

3. Exit **Calibration** mode to release the flow computer from Hold mode.

4. To end the current log record and begin a new record with the new orifice size (as stated in API 21.1):

   a. In PCCU Entry mode, select **Setup** under the measurement tube tree node.

   b. Select the **Commands** tab.

   c. Change the Reset Log Period to **Yes**.

> **i** **IMPORTANT NOTES:** The Reset Log Period procedure writes an ending log record based on the old orifice plate size and then begins a new log record based on the new orifice plate size.
>
> Alternately, the Reset Volume command may be used to simultaneously zero the accumulated volume and reset the log period.

   d. Click **Send**.

5. Select the **Constants** tab.

6. Select the value field for Orifice Diameter and type in the new orifice plate size.

7. Click **Send**.

i **IMPORTANT NOTE:** At the top of the Volume Calculation Period, the *µ*FLO^{G5} will perform calculations based on the new orifice plate diameter for the part of the period after the log was reset.

7.11 Exiting Hold mode

When calibrating or performing maintenance on the flow computer or meter run, or when setting up a fixed temperature, PCCU32 will instruct the flow computer to ignore live values for the flow calculation during that period of time. This prevents real-time flow calculations from being affected during calibration or maintenance. While in Hold mode, the flow computer uses the SP, DP and temperature that were captured at the time Hold mode was entered.

When Calibrate is selected on the PCCU Local Connect screen, the flow computer is placed in Hold mode.

To exit Hold mode:

1. Exit Calibration mode.

2. Unplug the PCCU cable at the *µ*FLO^{G5} connector.

8 Calibration

8.1 Measurement pressure checks and calibration

The Calibration mode enables the user to calibrate, check, and zero the static and differential pressure. Additionally, this mode allows the user to calibrate or set the bias for the resistance temperature detector (RTD). During the initial calibration, the parameters in Table 20 will need to be configured.

Table 20: Calibration configurable parameters

Parameter	Default Value	Units
RTD Installed	No	Not applicable
RTD Bias	0.00	Degrees F
Use Fixed Temperature (TF)	No	Not applicable
Fixed Temperature	60.000	Degrees F

The following test equipment is required to calibrate the μFLO^{G5} IMV:

— PCCU32, version 7.58 or newer

— Deadweight tester or equivalent calibration standard

— Test gauge capable of dual range measurement (PSIG and inches)

— Barometer or another means which can determine barometric pressure

— Nitrogen or compressed air source

> **IMPORTANT NOTE:** ABB Totalflow recommends performing a five-point calibration check before (as found) and after (as left) calibration. During normal operation, either cell could be knocked out of calibration (typically due to a slug of liquid).
>
> WinCCU, the host software, is capable of recalculating the volume based on the differences between the previous five-point check and the current five-point check. After a secure audit trail is archived, WinCCU recalculates the flow volume based on the previous and current markers. This allows more accurate results of the flow volume.

8.1.1 Static Pressure (SP) checks

The flow computer supports SP calibration pressure checks and logs the pressure marker check points. Perform this check prior to and directly following the calibration.

During normal operation of the flow computer, the display provides continuous SP readouts. However, during this procedure the flow computer is placed in a temporary Hold mode.

A minimum of three (3) SP markers should be set; however, as many SP markers as needed may be entered. For a three (3) point check, enter a low, mid, and high value. For a five (5) point check, enter a low, mid-low, mid, mid-high and high value.

> **IMPORTANT NOTES:** Recording too many markers could cause the flow computer to overwrite existing, older events. Only the last five checks are used by the WINCCU editor for calibration adjustment.

Refer to API 21.1 and company procedures for additional guidance on performing pressure checks.

> **CAUTION – Property damage.** During this procedure, both sides of the cell will be pressurized by closing both the high and low side orifice valves, opening the vent to atmosphere, closing the atmosphere vent, and then opening both the high and low bypass valves. The resulting comparison pressure must not be greater than the maximum pressure rating of the static pressure cell.

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Checks tab, select **SP** from the Calibration drop-down menu.

4. Define the SP display value: **Absolute** or **Gauge** (Figure 87).

---

i **IMPORTANT NOTES:** Selecting Absolute will display the value with the barometric pressure (defined in step 7) added in. Subsequent values require that the barometric pressure be added to the value before it is entered.

Selecting Gauge will display values in gauge pressure. Subsequent values require that the entered values be in gauge pressure.
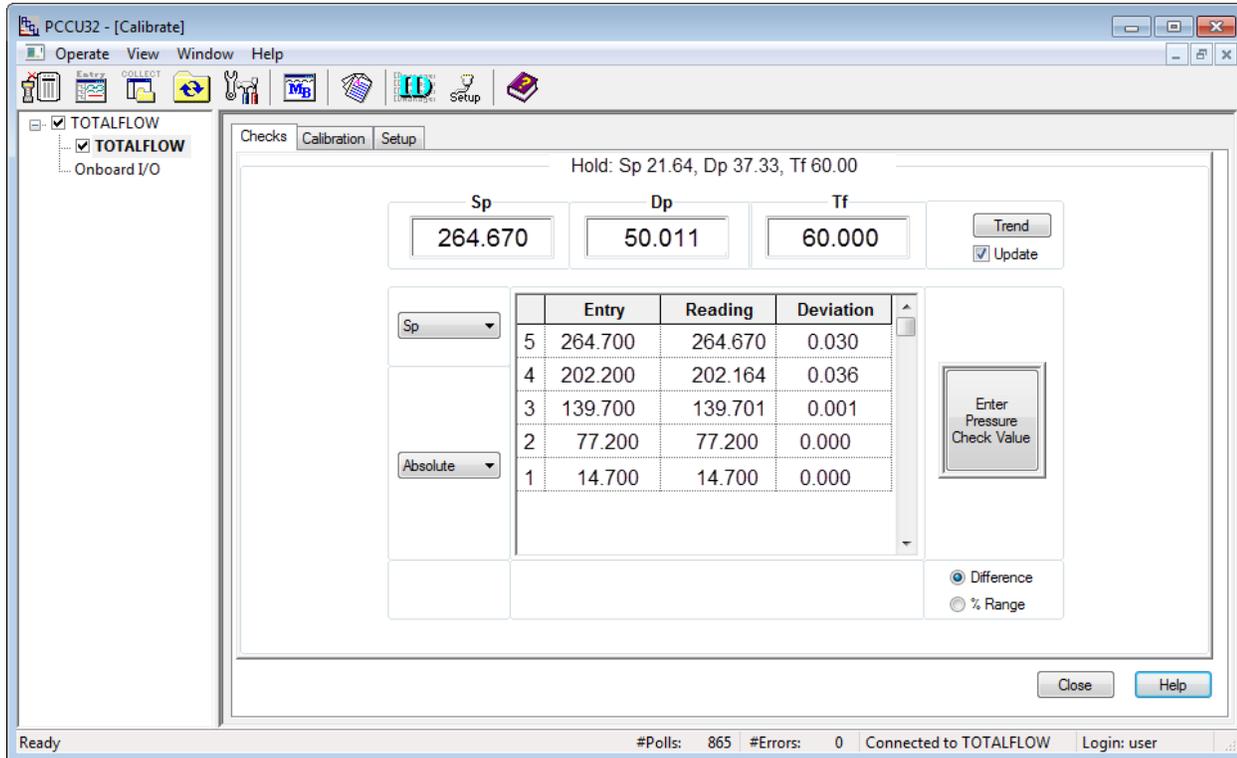

Figure 87: SP calibration pressure checks

5. Click **Enter Pressure Check Value**.

6. In the Enter Pressure dialog box, select the **Continuous** checkbox to update the current reading.

7. Verify that the vent valve is closed.

8. Open both the high and low equalizer valves.

9. Close both the downstream and upstream tap valves.

10. Open the atmospheric vent valve.

11. Enter a pressure marker for atmospheric pressure (PSIA). Enter zero if in Gauge mode, or the barometric pressure (or contract value) if in Absolute mode.

12. Click **OK**.

13. Close the atmospheric vent valve.

14. Click **Enter Pressure Check Value**.

15. Connect the calibration standard to the calibration test port.

16. Apply pressure to the next verification pressure.

17. When the current reading stabilizes, enter the pressure value from the calibration source. Remember to add the barometric pressure if the pressure type is Absolute. Click **OK**.

18. Repeat steps 16 through 17 for each pressure check value.

19. When all the static pressure markers have been set, determine if calibration is required. Continue to section 8.1.2, *Differential pressure (DP) checks* if DP checks are needed. If calibration is not required, return the manifold to service before exiting Calibration mode. Use the instructions in section 5.4.2, *Place the transmitter in service*, on page 62.

8.1.2   Differential pressure (DP) checks

As discussed in the previous section, it is recommended that DP calibration pressure checks be performed prior to and directly following calibration.

A minimum of three (3) DP markers should be set; however, as many DP markers as are needed can be entered. For a three (3) point check, enter a low, mid, and high value. For a five (5) point check, enter a low, mid-low, mid, mid-high and high value.

> **i**   **IMPORTANT NOTES:** Recording too many markers could cause the flow computer to overwrite existing, older events. Only the last five checks are used by the WINCCU editor for calibration adjustment.

Refer to API 21.1 and company procedures for additional guidance on performing pressure checks.

> ⚠ **CAUTION – Property damage.** During this procedure, the high side of the cell will be pressurized by closing both the high and low side orifice valves, opening the vent to atmosphere and the low side bypass valve, and closing the high side bypass valve.

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Checks tab, select **DP** from the Calibration drop-down menu (Figure 88).
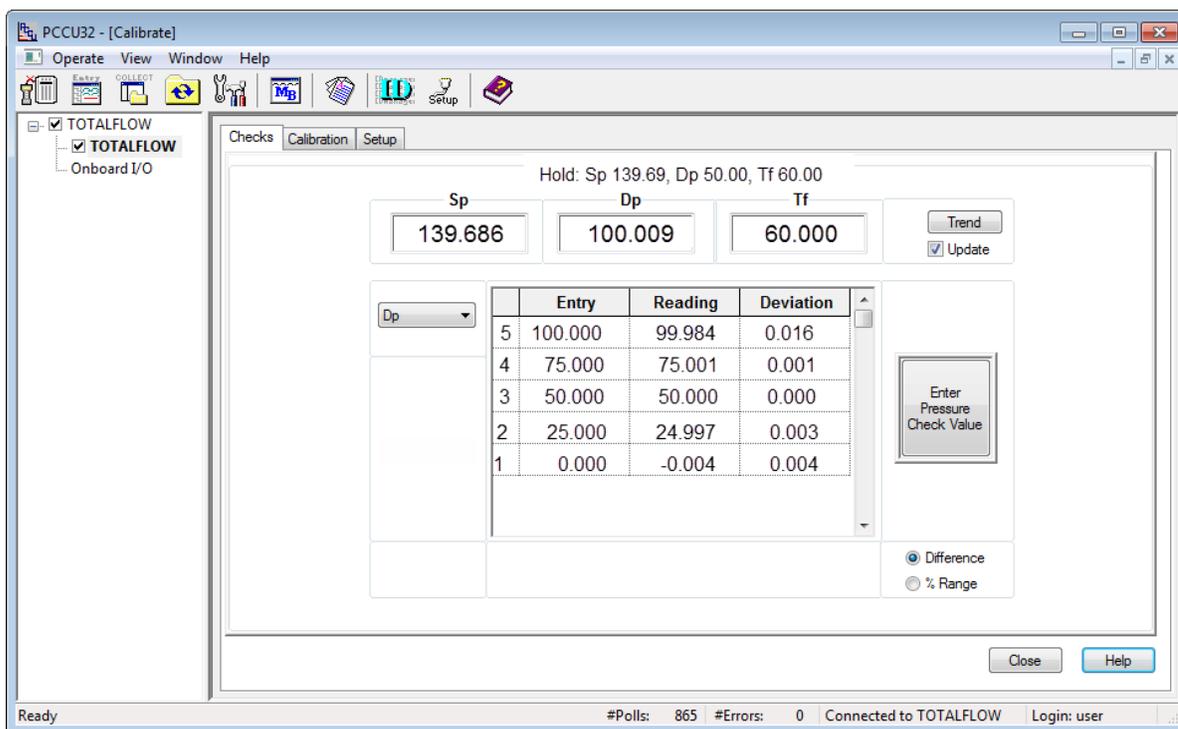
Figure 88: DP calibration pressure checks

4. Click **Enter Pressure Check Value**.

5. In the Enter Pressure dialog box, select the **Continuous** checkbox to update the current reading.

6. Verify that the vent valve is closed.

7. Open both the high and low equalizer valves.

8. Close both the downstream and upstream tap valves.

9. Open the atmospheric vent valve.

10. Enter a pressure marker for differential pressure, "0.0", then click **OK**.

11. Close the high side equalizer valve.

12. Connect the calibration standard to the calibration test port.

13. Apply pressure to the next preferred verification pressure.

14. When the current reading stabilizes, enter the pressure value from the calibration source, and click **OK**.

15. When all of the differential pressure markers have been set, determine if calibration is required. If calibration is not required, return the manifold to service before exiting Calibration mode. Use the instructions in section 5.4.2, *Place the transmitter in service*, on page 62. If calibration is required, continue to section 8.1.3, *Calibrating Static Pressure (SP)*.

8.1.3   Calibrating Static Pressure (SP)

A three- or five-point pressure method is used to calibrate the flow computer SP cell. Different pressures are applied to the cell from a known, traceable source with resultant pressure values entered into the flow computer using PCCU32 software.

---

i **IMPORTANT NOTE:** The flow computer uses an absolute static pressure (SP) cell. Absolute pressure measures the referenced pressure to a vacuum or sealed pressure. This differs from a gauge cell which measures the referenced pressure to the atmosphere. Since the SP cell is an absolute device, it always measures the true pressure, relative to a vacuum or sealed chamber. As such, when vented, it measures the true barometric pressure. For other points of calibration, add the reading of the PSI and the barometric pressure to arrive at the PSIA. Once this has happened, enter the reading.

8.1.3.1   Absolute vs. Gauge

It is recommended that the initial calibration point be at vented conditions. Additionally, when this takes place, ensure that the barometric pressure reading (in PSI) is used as the initial point.

When operating in PCCU32 Absolute mode, other points of calibration are determined by adding the PSI reading and the barometric pressure to arrive at the PSIA. Once this has happened, enter this reading.

When operating in PCCU32 Gauge mode, the readings may be entered as read. Upon completion, a barometric pressure reading is entered.

8.1.3.2   Calculating PSI

To convert barometric pressure measured from inches of mercury to barometric pressure in PSI, perform the following calculation:

Barometric pressure (in inches of mercury) x 0.4912 (or ÷ 2.036) equals barometric pressure in PSI.

8.1.3.3   SP Calibration

When performing the following procedures, wait for the flow computer display to stabilize before entering the new values. If the flow computer is not in Calibration mode, the display will not necessarily match the applied cell pressures.

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Calibration tab, select **SP** from the Calibration drop-down menu.

4. Select either a **3**- or **5**-point calibration from the corresponding drop-down menu.

5. Select the **Range** (URL) of the transducer SP pressure cell. The range should agree with the tag attached to the transducer.

6. Define the SP display value: **Absolute** or **Gauge**.

IMPORTANT NOTES: Selecting Absolute will display the value with the barometric pressure (defined in step 7) added in. If calibrating in Absolute mode, the barometric pressure is the low calibration target point. Subsequent values require that the barometric pressure be added to the value before the value is entered.

Selecting Gauge will display values in gauge pressure. Subsequent values require that the entered values be in gauge pressure.

7. Enter the barometric pressure in the bottom field before proceeding.

8. Verify that the vent valve is closed.

9. Open both the high and low equalizer valves.

10. Close both the downstream and upstream tap valves.

11. Open the atmosphere vent valve.

12. Click **Low Cal Point**. Verify the current reading is continuously updated. This should represent the lowest calibration point.

13. When the current reading stabilizes, click **OK**; otherwise, enter a different value, and then click **OK**.

14. After the previous value is accepted, the next calibration point button will automatically activate. Click the activated button.

IMPORTANT NOTE: This procedure details the calibration procedure for a three (3) point calibration. Available pressure points will be displayed in the calibration window and will become active in the prescribed calibration order: Low Cal Point, 100% Cal Point, and 50% Cal Point.

Although these instructions are specific to a three (3) point calibration, they are easily adapted for a five (5) point calibration. When 5 point is selected, five pressure points will be displayed in the prescribed order: Low Cal Point, 100% Cal Point, 75% Cal Point, 50% Cal Point, and 25% Cal Point.

15. Connect the calibration standard to the calibration test port.

16. Close the atmosphere vent valve.

17. Apply pressure to 100% of the transducer range (URL or 100% of the target value).

18. When the current reading stabilizes, click **OK**; otherwise, enter a different value (pressure value from the calibration source), and then click **OK**.

19. After the previous value is accepted, the next calibration point button will activate. Click the activated button.

20. Apply pressure to the next target value as shown in the Calibration window.

IMPORTANT NOTE: In a 3-point calibration, this will be the final calibration point and is equal to 50% of the URL of the transducer. The pressure value for 50% of the URL will be displayed in the window.

Example: If the transducer has a URL of 1500, then 50% of that pressure, or the Target pressure, is 750.

In a 5 Point calibration, this will be the third value and will be equal to 75% of the transducers URL.

Example: If the transducer has a URL of 1500, then 75% of that pressure, or the Target pressure, is 1125.

21. When the current reading stabilizes, click **OK**; otherwise, enter a different value (pressure value from the calibration source), and then click **OK**.

IMPORTANT NOTE: For a 3-point calibration, SP calibration is now complete.

For a 5 Point calibration, two more points must be calibrated: 50% and 25%.

22. Repeat steps 19 through 21 until all calibration points have been pressured.

23. Go to section 8.1.1, Static Pressure (SP) checks, on page 113 to perform the As Left pressure checks.

24. Use the instructions in section 8.1.4, *Calibrating Differential Pressure (DP)*, to calibrate DP if required.

25. Return the manifold to service before exiting Calibration mode. Use the instructions in section 5.4.2, *Place the transmitter in service*, on page 62.

8.1.4   Calibrating Differential Pressure (DP)

A three- or five-point pressure method is used to calibrate the flow computer DP cell. Different pressures are applied to the cell from a known, traceable source, with resultant pressure values entered in the flow computer using PCCU32 software.

During factory calibration, any differential pressure (DP) shifts resulting from a static pressure effect are corrected. These corrections are not user-configurable and cannot be modified by a field or user calibration. This ensures that the readings received in the field are accurate. The factory set shift is also not user-configurable. If readings appear incorrect, check for leaks and then recalibrate the DP.

When performing the following procedures, wait for the flow computer display to stabilize before entering the new values. If the flow computer is not in Calibration mode, the display will not necessarily match the applied cell pressures.

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Calibration tab, select **DP** from the Calibration drop-down menu.

4. Select either a **3**- or **5**-point calibration from the corresponding drop-down menu.

5. Select the **Range** (URL) of the transducer DP pressure cell. The range should agree with the tag attached to the transducer and target values based on the URL will display in the Calibration table.

6. Verify that the vent valve is closed.

7. Open both the high and low equalizer valves.

8. Close both the downstream and upstream tap valves.

9. Open the atmospheric vent valve.

10. Click **Low Cal Point**. Verify the current reading is continuously updated. This should represent the lowest calibration point.

11. When the current reading stabilizes, click **OK**; otherwise, enter a different value and then click **OK**.

12. After the previous value is accepted, the next calibration point button will activate. Click the activated button.

> **i**
>
> **IMPORTANT NOTE:** This procedure details the calibration procedure for a three (3) point calibration. Available pressure points will be displayed in the calibration window and will become active in the prescribed calibration order: Low Cal Point, 100% Cal Point, and 50% Cal Point.
>
> Although these instructions are specific to a three (3) point calibration, they are easily adapted for a five (5) point calibration. When 5-point is selected, five pressure points will be displayed in the prescribed order: Low Cal Point, 100% Cal Point, 75% Cal Point, 50% Cal Point, and 25% Cal Point.

13. Connect the calibration standard to the calibration test port.

14. Close the high side equalizer valve, and verify that the low side is vented to atmosphere.

15. Apply pressure to 100% of the transducer range (URL or 100% of the target value).

16. When the current reading stabilizes, click **OK**; otherwise, enter a different value (pressure value from the calibration source), and then click **OK**.

17. After the previous value is accepted, the next calibration point button will activate. Click the activated button.

18. Apply pressure to the next target value as shown in the Calibration window.

> **i**
>
> **IMPORTANT NOTE:** In a 3-point calibration, this will be the final calibration point and is equal to 50% of the URL of the transducer. The pressure value for 50% of the URL will be displayed in the window.
>
> Example: If the transducer has a URL of 1500, then 50% of that pressure, or the Target pressure, is 750.
>
> In a 5-point calibration, this will be the third value and will be equal to 75% of the transducers URL.

Example: If the transducer has a URL of 1500, then 75% of that pressure, or the Target pressure, is 1125.

19. When the current reading stabilizes, click **OK**; otherwise, enter a different value (pressure value from the calibration source), and then click **OK**.

> **i** **IMPORTANT NOTE:** For a 3-point calibration, SP calibration is now complete.
>
> For a 5-point calibration, two more points must be calibrated: 50% and 25%.

20. Repeat steps 17 through 19 until all calibration points have been pressured.

21. Go to section 8.1.2, Differential pressure (DP) checks, on page 115 to perform the As Left pressure checks.

22. Return the manifold to service before exiting Calibration mode. Use the instructions in section 5.4.2, *Place the transmitter in service*, on page 62.

8.2 Zero transducer

Following the initial installation of a flow computer, it may be desirable to use the Zero Transducer command to baseline the flow computer measurement.

Using Zero transducer to adjust pressures during regular maintenance is also an option. While performing As Found pressure checks, the associated pressures may be found out of alignment by exactly the same amount, it may be concluded that the readings are the result of a linear shift.

> **i** **IMPORTANT NOTE:** Always follow the company recommended policies and procedures.

The process of performing "as found" pressure checks records an event and manages the records in a manner that assures accountability and continuity. Follow the instructions in section 8.1.1 and 8.1.2, beginning on page 113 to perform "as found" pressure checks.

> **!** **NOTICE – Tainted results.** Using the Zero Transducer command following pressure checks assumes that the pressure shift is linear. This means that at each different level of pressure the transducer is off by exactly the same amount. If this is not the case, recalibrate the transducer instead.

8.2.1 Static pressure

The SP can be zeroed without recalibrating. If the SP indicates a linear shift, a new barometric pressure value may be entered. This shifts the SP transducer curve. After the Hold state initiates, select Zero Transducer.

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Calibration tab, select **SP** from the Calibration drop-down menu.

4. Define the SP display value: **Absolute** or **Gauge**.

> **i** **IMPORTANT NOTE:** Selecting Absolute requires that the barometric pressure be entered for zero. Selecting Gauge requires zero to be entered but assumes the barometric pressure in the BP window to be correct.
>
> Target values will correspond according to the mode selected.

5. Open the atmospheric vent valve.

6. Click **Zero Transducer**.

7. Checkmark **Continuous Update**.

8. When the current reading stabilizes, enter a zero (for Gauge mode) or enter the barometric pressure (for Absolute mode) and click **OK**.

8.2.2   Differential pressure

The DP can be zeroed without recalibrating. If the DP indicates a linear shift, enter a new zero (0). This shifts the DP curve. After the Hold state initiates, select Zero Transducer.

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Calibration tab, select **DP** from the Calibration drop-down menu.

4. Open the atmospheric vent valve.

5. Click **Zero Transducer**.

6. Checkmark **Continuous Update**.

7. When the current reading stabilizes, enter a zero [**0**] and click **OK**.

8.3   RTD calibration

The flow computer has one onboard RTD input. The registers representing the RTD input are normally assigned to a measurement tube. To calibrate the RTD:

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Calibration tab, select **Tf** from the Calibration drop-down menu.

4. Connect a variable resistor or an RTD calibration test box to J3 on the μFLOG5 electronic board (Table 21).

---

i **IMPORTANT NOTE:** When using a 100 Ω RTD probe to calibrate the RTD, refer to the 100 Ohm Probe resistance table linked from the *Calibrating the RTD* Help topic in PCCU.

Table 21: J3 RTD wiring pinouts

Terminal	J3
1	SHLD
2	Out
3	Plus (+)
4	Minus (-)
5	In

5. Select either a **3-** or **5-**point calibration from the corresponding drop-down menu.

6. Select the temperature **Range** (URL) of the RTD or edit and define a non-standard range. The range should agree with the tag attached to the transducer, and target values based on the range will display in the Calibration table.

---

i **IMPORTANT NOTE:** If Reasonability Checks box is checked, two separate conditions are tested. If the limits for these conditions are exceeded, one of the following warning messages will appear:

−   Measured value exceeds entered value by more than 2% of range.
−   Temperature point appears to be out of order.

Turn off Reasonability Checks, by clearing the checkbox, if the current range is different from the previous calibration.

---

7. Click **Low Cal Point**, and apply the resistance for the low calibration point. The PCCU32 Help topic for the RTD calibration screen contains a link containing information about temperatures and their corresponding resistance.

8. When the current reading stabilizes, click **OK**; otherwise, enter a different value (temperature value from the calibration source), and then click **OK**.

9. After the previous value is accepted, the next calibration point button will activate. Click the activated button.

10. Apply the resistance equal to 100% of the transducer temperature range for the high calibration point.

11. When the current reading stabilizes, click **OK**; otherwise, enter a different value (temperature value from the calibration source), and then click **OK**.

12. After the previous value is accepted, the next calibration point button will activate. Click the activated button.

13. Apply the resistance equal to the next target value as shown in the Calibration window.

> **i** **IMPORTANT NOTE:** In a 3-point calibration, this will be the final calibration point and is equal to 50% of the URL of the transducer. The temperature value for 50% of the URL will be displayed in the window.
>
> Example: If the transducer has a URL of 650 °F, then 50% of that pressure, or the Target temperature, is 325 °F.
>
> In a 5-point calibration, this will be the third value and will be equal to 75% of the transducers URL.
>
> Example: If the transducer has a URL of 650 °F, then 75% of that pressure, or the Target pressure, is 487 °F.
>
> Although these instructions are specific to a three (3) point calibration, they are easily adapted for a five (5) point calibration. When 5-point is selected, five pressure points will be displayed in the prescribed order: Low Cal Point, 100% Cal Point, 75% Cal Point, 50% Cal Point, and 25% Cal Point.

14. When the current reading stabilizes, click **OK**; otherwise, enter a different value (pressure value from the calibration source), and then click **OK**.

> **i** **IMPORTANT NOTE:** For a 3-point calibration, the Tf calibration is now complete.
>
> For a 5-point calibration, two more points must be calibrated: 50% and 25%.

15. Repeat steps 12 through 14 until all calibration points have been completed.

16. After the last point is entered, PCCU32 will automatically calibrate the RTD.

8.4 RTD bias

If electing to use bias as a calibration method, the RTD temperature will always be biased by this value. The bias does not affect the fixed temperature that is specified on the Setup tab.

1. Place the flow computer in Hold mode by selecting **Calibration** on the tool bar.

2. Select the measurement tube in the navigation tree.

3. On the Calibration tab, select **Tf** from the Calibration drop-down menu.

4. Click in the **Bias** field to open the Enter RTD Bias window and enter a new value.

> **i** **IMPORTANT NOTE:** To enter a negative value in the Bias field, use a minus sign (-) before the value.

5. Click **OK**.

6. On the Setup tab, select **RTD Installed** for the RTD temperature and bias value to be used.

> **i** **IMPORTANT NOTE:** The current temperature value (Tf) will increase or decrease to reflect the effect of the bias. The bias value will not affect the Fixed Temperature, which is specified on the Setup tab.

7. Click **Close** to exit Calibration and exit Hold mode.

8. Click **OK**.

9 Troubleshooting

9.1 Overview

To serve as an aid in troubleshooting, a flowchart (Figure 89) is provided to assist in narrowing the focus to a particular area of troubleshooting. By following the logic in this flowchart, directions to specific tests, instructions, and other logic-based flowcharts will assist in problem identification and correction. All testing procedures are located in this section; however, spare part replacement procedures and component removal instructions are located in section 7, *Service and maintenance*, beginning on page 83.
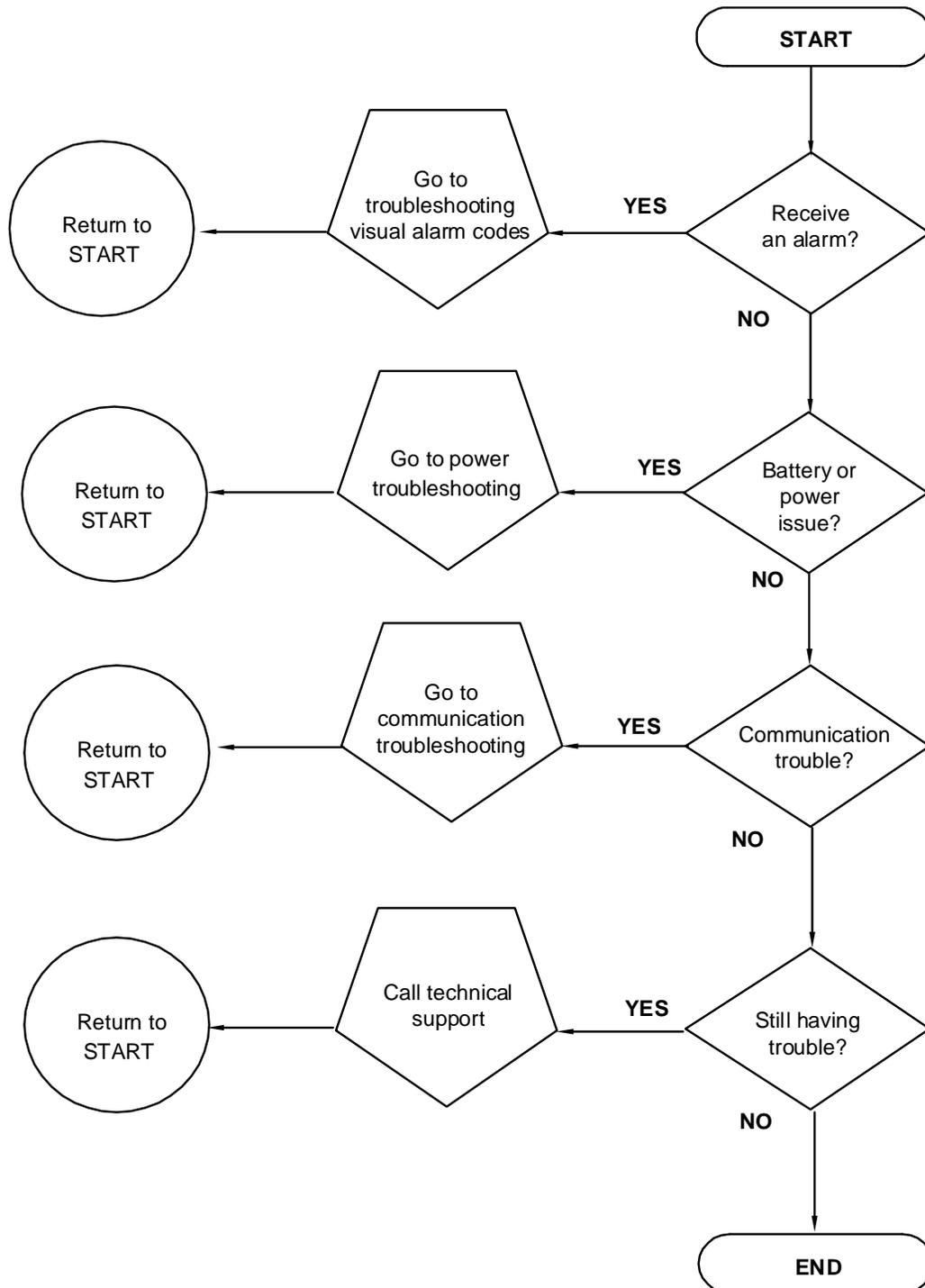
Figure 89: Troubleshooting flowchart

9.2 Troubleshooting visual alarm codes

The flow computer LCD (Figure 90) scrolls a list of operational values as well as alarm and status indicators. The annunciator area, located on the right side of the LCD, informs the observer of operational problems and operational limit violations. The entire list of status and alarm codes can be found in section 3.2.4, Table 2 on page 18.
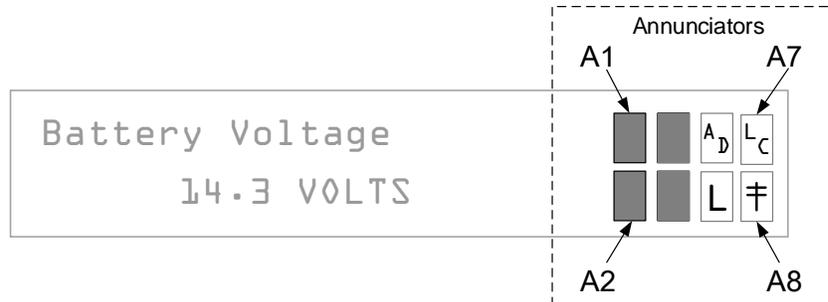
Figure 90: Display and annunciators

This section contains information about those codes that reflect errors or provide information that is useful in troubleshooting the device. Alarm codes indicate that an operational problem exists.

For the purposes of troubleshooting, only those codes considered alarms or codes used to assist troubleshooting are discussed here (Table 22). This table contains a description of each μFLO^{G5} alarm code and the probable cause. An alarm can be a word, character, letter or symbol.

Table 22: Visual alarm codes

Indicator	Description	Alarm
Auxiliary I/O		
LL	Low Lithium Alarm: When LL (low lithium) is displayed, the lithium battery voltage is below 2.5 Vdc. If the battery voltage is above 2.5 Vdc, A7 appears shaded. A new lithium battery measures approximately 3.6 Vdc.	Y
LC	Low Charger: Displayed if the μFLO^{G5} battery charging voltage is less than (+) 0.4 Vdc higher than the battery voltage. If the charging voltage is (+) 0.4 Vdc greater than the battery voltage, the annunciator is shaded	Y
Measurement Application		
AD	A to D Failure: Displayed if the A to D Converter absolute differential pressure, absolute static pressure or temperature readings exceed maximum counts or are less than the minimum counts. If the A to D Converter readings are within range, the AD is shaded.	Y
Communication Protocols		
→	Transmitting Data: sending a response	N
←	Receiving Data: processing a request	N
!	Nak: negative acknowledgement with packet list	N
+	Ack: positive acknowledgement of receipt of request	N
⊤	Waiting for Ack: waiting for response after transmission	N
?	Exception Alarm Processing	N
ⵏ	ID Recognized: recognized and receiving request	N
‡	Listen Cycle: flashes if this remote port is active and running Totalflow remote protocol. Flashes in sync with the listening cycle that occurs at 1, 2 or 4 second intervals	N
M	MODBUS® ASCII: MODBUS® ASCII protocol selected for the port assigned to this annunciator	N
m	MODBUS® RTU: MODBUS® RTU protocols selected for the port assigned to this annunciator	N
L	Local Protocol: displayed when the PCCU port is active and running Totalflow local protocol	N
¥	ID Recognized: The ID has been recognized but is waiting for sync.	N

9.2.1   Troubleshooting a blank LCD screen

When the LCD is blank, it means that the unit has entered SLEEP mode. This generally indicates the battery voltage has dropped below 10.9 Vdc.

1. Make a local connection with the μFLO^{G5}. This wakes up the unit so that the user may check all alarm conditions and determine the problem.

2. Check the battery cable. It must make a good, secure electrical connection with the μFLO^{G5} board BATT connector, J15 (Figure 91).
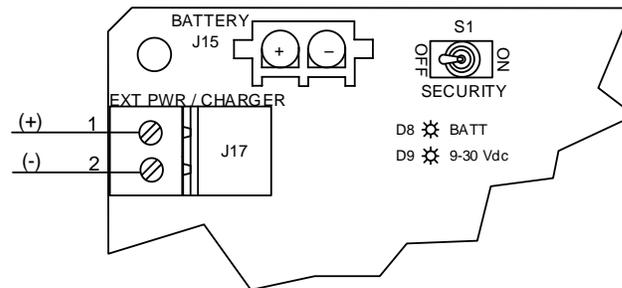
Figure 91: Battery charger and battery connections

3. Check that the battery cable is securely connected.

4. Check the battery voltage. If the voltage is low, replace with another battery.

5. If the voltage is still low, investigate the power issues using the *Power Troubleshooting* flow chart (Figure 92 on page 128).

9.2.2   Troubleshooting a Low Lithium alarm (LL)

When the Low Lithium alarm displays, the lithium battery should be replaced immediately. Failure to replace the lithium battery could result in a loss of data following a power loss. Instructions for replacing the lithium battery can be found in Chapter 4.

9.2.3   Troubleshooting a Low Charger alarm (LC)

The Low Charger alarm is typically displayed if the battery charging voltage is less than (+) 0.4 Vdc higher than the battery voltage. Another factor could be low light conditions when the system is charged using a solar power charger.

1. Check the battery cable. It must make a good, secure electrical connection with the μFLO^{G5} board BATT connector, J15 (Figure 91).

2. Check that the battery cable is securely connected.

3. Check the battery charging source in PCCU32. Open PCCU32, and move to the I/O Interface node on the navigation tree. Select the Auxiliary I/O sub-menu. After selection, the Analog tab displays. Within the tab, view both the battery and charger voltage. If the charger voltage is less than +0.4 Vdc, proceed to the *Power troubleshooting* section 9.3, on page 127.

9.2.4   Troubleshooting an Analog to Digital Failure alarm (AD)

The μFLO^{G5} must have a measurement tube application running to receive this error. If the A to D Failure alarm code is present, or the device is in the SLEEP mode but is still receiving minimum voltage, it may be necessary to test the data link between the μFLO^{G5} board and the transducer. Follow the instructions below to check the transducer.

Probable causes of receiving the A to D failure include:

—   A/D converter is over or under range (DP, SP or Tf)

—   Loose or corroded wiring connections

—   Faulty RTD probe

If the A to D converter readings are not within range, AD will display as an annunciator.

1. Follow the procedure detailed in section 7.1, *Preserving data and configuration files,* on page 83. Return here when completed.

2. View the event log in PCCU32 for an event labeled **Site code.** In PCCU32, click the measurement application in the navigation tree and select the Events tab. Table 23 lists 2 associated values.

Table 23: Analog to Digital failure related site code

Code value	Description
-99	Analog to Digital converter could not be read
-100	Analog to Digital converter could be read again

3. If the event code is found, follow the guidelines in section 9.5, *Customer service and support*, on page 137 for returning the transducer to ABB Totalflow for repair or replacement. If the event code is not found, continue to the next step

4. Open PCCU32, and select the I/O Interface node on the navigation tree. Click on the Analog Inputs tab. Check the SP, DP and temperature to determine which measurement channel is causing the alarm.

    – If the alarm is caused by the SP or SP channel, equalize and vent the manifold. If the alarm disappears: the SP or DP cell is not ranged properly or the manifold may have blockage.
    – If the alarm is still present, replace the IMV.
    – If the alarm is caused by the temperature channel, move to step 9; otherwise, move to the next step.

5. Set the IMV back to Factory calibration. If this corrects the alarm, recalibrate the IMV to correct the field calibration. If the alarm is not corrected, continue to the next step.

6. Perform a warm start on the unit. Verify that the unit is not displaying a low lithium (LL) alarm. Upon verification, remove power from the unit. Once power is removed, return power to unit. If the A/D Failure alarm is not corrected, continue to the next step.

7. Perform a cold start on the unit. Follow instructions in section 7.4.5, *Cold restart using the device loader*, on page 92. If the problem is not corrected, continue to the next step.

8. Check the RTD wiring at the IMV.

9. Perform the three procedures found in this manual:

    – 9.2.5, RTD continuity test, on page 125
    – 9.2.6, RTD current source (resistive) test, on page 126
    – 9.2.7, RTD impedance test, on page 127

10. Contact ABB Totalflow to repair or replace the IMV. Go to section 9.5, *Customer service and support*, on page 137 for instructions.

9.2.5   RTD continuity test

Should the readings from the RTD be suspect, follow the instructions below to test the RTD probe.

Required equipment:

— Digital MultiMeter (DMM) with alligator clip leads

1. Disconnect the power and communications from the flow computer electronic board.

⚠ **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

2. Disconnect the RTD from the electronic board.

3. Perform the continuity test on the wires leading to the probe. Set the DMM to 200 Ω or Continuity Audio.

4. Check the continuity of the first wire pair (typically red or black) by connecting one lead to each wire. The meter should read zero or close to zero.

5. If there is continuity, move to step 7. If there is no continuity, verify that the wiring at the RTD head is correct.

6. If the wiring at the connection head is correct, the RTD is defective. Replace the probe; otherwise continue to the next step.

7. Check the continuity of the second wire pair (typically white) by connecting one lead to each wire. The meter should read zero or close to zero.

8. Check the continuity of each wire (first pair either red or black, as identified in step 4) to the probe or shield. If there is continuity, the RTD is defective. Replace the probe. If there is no continuity, continue to the next step.

9. Check the continuity of each second wire pair (white or as identified in step 7) to the probe or shield. If there is continuity, the RTD is defective. Replace the probe. If there is no continuity, continue to the next step.

10. Check the continuity of each first wire pair (as identified in step 4) to each second wire pair (as identified in step 7). The meter should read approximately 100 to 140 Ω. If this is the case, continue to the next step. If not, the RTD is defective and should be replaced.

11. If the probe is still not functioning correctly, recheck the wiring using the supplied diagram. If no wiring error was found, follow the instructions in section 9.2.6, *RTD current source (resistive) test*.

9.2.6   RTD current source (resistive) test

If the readings from the RTD are still suspect following the RTD probe continuity test, follow the instructions below to test the current source on the μFLO^{G5} board to verify it is receiving power.

Requisite equipment:

— Totalflow diagnostic kit

— Digital multi-meter with alligator clip leads

1. Disconnect power and communications from the flow computer electronic board, if not already done.

⚠ **CAUTION – Equipment damage.** The external power/charger and battery connections must be removed before removing all other cables, boards, and field connections. Connecting or disconnecting cables and wires on the electronic board while power is applied can damage the electronic components.

2. Disconnect the RTD from the electronic board, if not already done.

3. Set the DMM to 200 Vdc.

4. Select the RTD test resistance value by selecting the resistor test connector from the Totalflow diagnostic kit. The user can also create one by using a resistor appropriate for their unit.

   – Substitute the RTD probe wiring by connecting either a 100 Ω or 123 Ω resistor across connector terminals 4 and 5.
   – Connect a jumper wire between terminals 2 and 5.
   – Connect a jumper wire between terminals 3 and 4.

5. Clip the positive lead of the DMM to the upper side of the RTD test resistor.

6. Clip the negative lead of the DMM to the lower side of the RTD test resistor.

7. Restore power to the unit.

8. Once running, the measured value across the RTD test resistor should be either:

   – 100 Ω resistor: minimum of 100 mV to a maximum of 125 mV
   – 123 Ω resistor: minimum of 123 mV to a maximum of 155 mV

9. The RTD measurement temperature on the μFLO^{G5} display should read either:

   – 100 Ω resistor: 31.0 °F to 33.0 °F
   – 123 Ω resistor: 140.8 °F to 142.8 °F

10. If either of the measured values are outside of range, remove power. The RTD needs to be replaced.

11. Restore power and perform steps 9 and 10 again. If either of the measured values are outside of range, remove power. The μFLO^{G5} board needs to be replaced.

12. Restore power and perform steps 9 and 10. If either of the measured values are outside of range, remove power. The IMV needs to be replaced.

9.2.7   RTD impedance test

If readings from the RTD are still suspect following the RTD probe test, follow the instructions below to test the current source on the µFLO^{G5} board to verify it is receiving power.

Requisite equipment:

— Ice bath

— Digital MultiMeter

1. Immerse the RTD probe in the ice bath.

2. Perform a continuity check between any two similarly colored wires. Measured resistance should be 1 Ω or less.

3. Perform a continuity check between any two dissimilar colored wires. Measured resistance should be approximately 100 Ω.

4. Perform a continuity check between the shield wire and any other wires. Measured resistance should be in the MΩ range.

5. If any values are out of range, the RTD probe is defective. Replace the RTD.

9.3   Power troubleshooting

This section focuses on determining what has caused the µFLO^{G5} to lose power. Generally, loss of power can be attributed to only the power supply system. However, if the power supply system is used for powering a transceiver or other peripheral equipment, an issue with that equipment may drain the battery and cause the µFLO^{G5} to lose power. Notice that the *Power troubleshooting flowchart* (Figure 92) outlines several tests but may also indicate using the *Communication troubleshooting flowchart* (Figure 95, on page 133).

START

Go to power supply test

Go to solar panel charging system test

NO

Externally Vac powered?

YES

Go to Vac charging system test

RETURN

Perform isolation tests sequentially as required

Go to auxiliary equipment power isolation test

Go to TFIO module isolation test

Go to remote communication test chart

YES

END

Power issue located?

NO

Return to test sequence
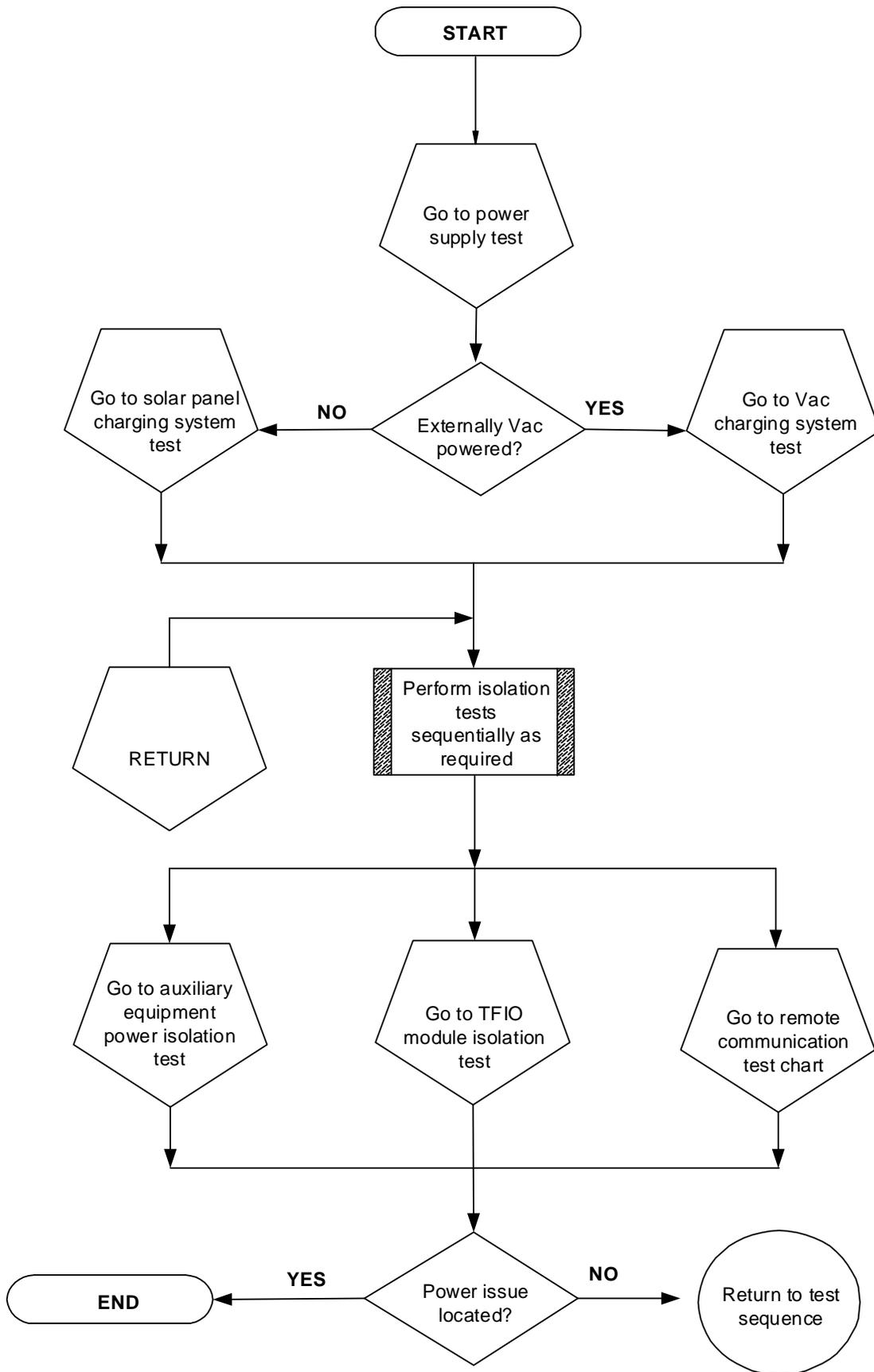
Figure 92: Power troubleshooting flowchart

9.3.1 Solar panel overview

When a solar panel is attached to the unit as a means of providing a charging source for the battery, cleanliness and positioning play an important part as do proper electrical and cabling techniques. More detailed information about power consumption can be found at www.abb.com/upstream.

9.3.2 Power supply test

Various equipment configurations will necessitate moving to one or more additional tests from this location.

1. Check that the power supply voltage setting, the power supply current rating, and the cables used for the installation meet the recommended requirements.

2. If this is a new installation and external equipment is being powered from the *µ*FLO^{G5}, call the ABB office, listed under *Contact us*, on the back cover of this manual for assistance in evaluating the cable and power supply installation requirements.

3. Correct and retest, as necessary.

4. Check for a poor cable connection in the cable between the *µ*FLO^{G5}, the J15 battery and the J17 charging source (Figure 93). Verify all field wiring screw terminals are tight.
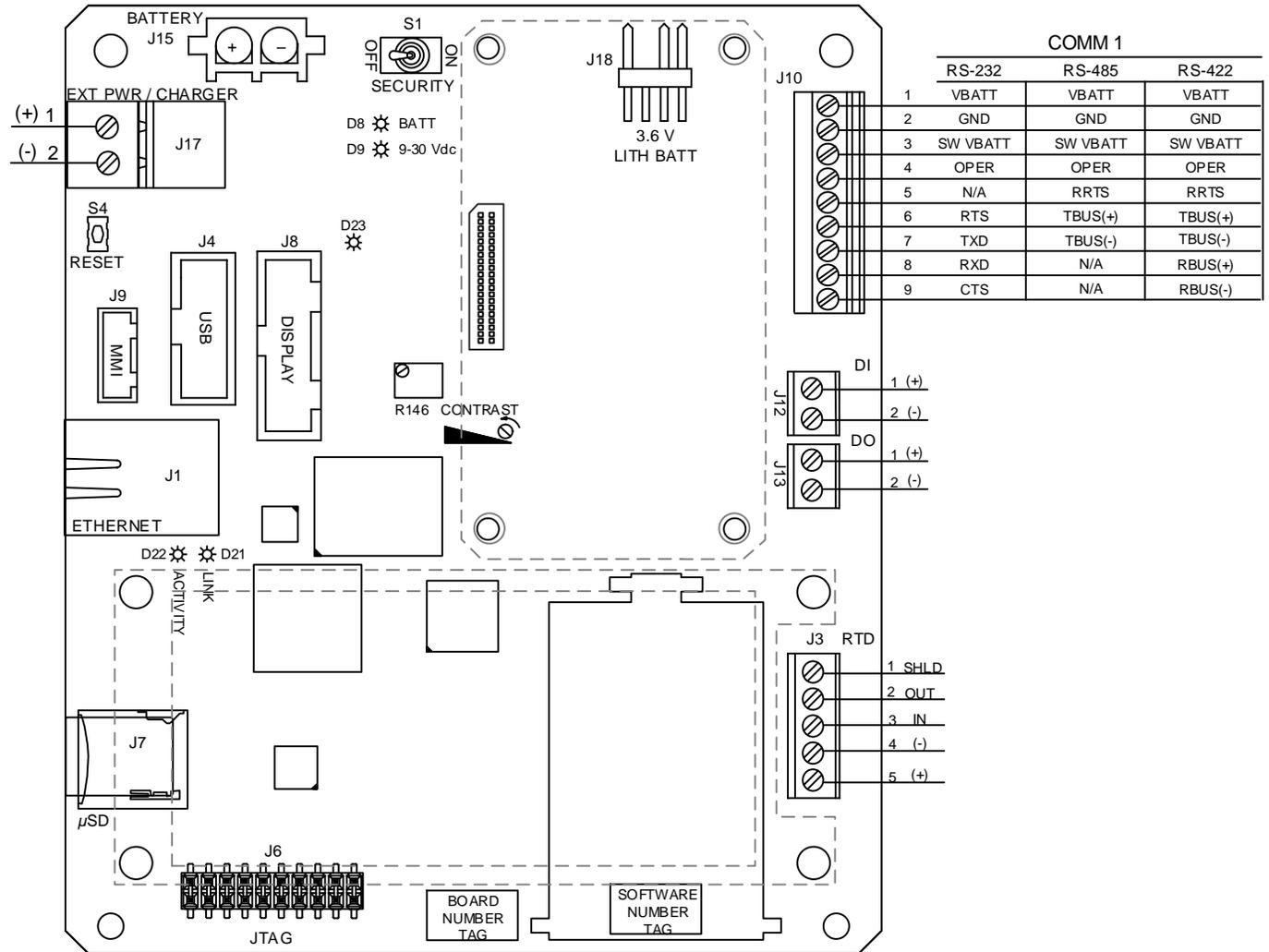
Figure 93: *µ*FLO^{G5} board field wiring connections

5. Correct and retest as necessary.

6. Verify that there are no other devices that may drop an excessive voltage across them in the power supply circuit (to the flow computer).

7. Correct and retest as necessary.

8. Disconnect the charging source cable from the electronic board J17 connector.

9. Replace the battery with a known, good battery. See section 7.8.1, *Replacing the µFLOG5 battery*, on page 97.

10. Reconnect the charging source cable to the electronic board J17 connector.

11. Measure the voltage at the charging source cable. Measure the voltage at the battery. Compare the voltages. If the charging source voltage is less than (+) 0.4 Vdc higher than the battery voltage, return to Figure 92, *Power troubleshooting flowchart*, on page 128.

9.3.3   Solar panel charging system test

If the system setup includes a solar panel charger connected to the flow computer electronic board and it is not supplying the required voltage to the flow computer, test the solar panel.

1. Check the solar panel angle and direction. In the northern hemisphere, the panel should face due south. In the southern hemisphere, the panel should face due north.

2. Correct and retest as necessary.

3. Check the solar panel for any physical damage or obstructions to sunlight. Sunlight obstruction prevents the solar panel from receiving enough sunlight to charge the installed battery.

4. Correct and retest as necessary.

5. The solar panel should be positioned so it receives the most sunlight. Do not place it in a shaded area.

6. Correct and retest as necessary.

7. Check the solar panel wiring to be certain it is correctly connected to the associated J17 charger input termination block (Figure 93, on page 129).

8. Correct and retest as necessary.

9. Measure the solar panel voltage at the connector using a DMM that connects the (+) and (-) leads to the (+) and (-) solar panel wires. The loaded voltage should be greater than or equal to the specifications listed in Table 24. If the solar panel is not above the minimum, replace the solar panel and retest.

Table 24: Specifications for solar panels

Panel	Max	Volts at P_{MAX}	Open Circuit	Load Resistance	Loaded Voltage
10	10 W	16.8 V	21 V	30 Ω 25 W	16-18 Vdc
20	20 W	16.8 V	21 V	15 Ω 25 W	16-18 Vdc
30	30 W	16.8 V	21 V	10 Ω 40 W	16-18 Vdc

10. Disconnect the solar panel from the flow computer electronic board.

11. Set the DMM range to read over 20 Vdc.

12. Determine if the open circuit voltage is greater than or equal to the specifications listed in Table 24 by clipping the positive lead of the DMM to the positive wire and clipping the negative lead of the DMM to the negative wire. If the solar panel is not above the minimum, continue to the next step.

13. Using the selected resistor from Table 24 for the solar panel wattage, attach the selected resistor between the two solar panel wires.

14. Clip the positive lead of the DMM to one side of the test resistor.

15. Clip the negative lead of the DMM to the other side of the test resistor.

16. Determine if the loaded voltage is greater than or equal to the specifications listed in Table 24. If the solar panel is not above the minimum, replace the solar panel and retest.

17. If an issue still exists, return to Figure 92, *Power troubleshooting flowchart*, on page 128.

9.3.4   Vac charging system test

If the system setup includes a Vac charger connected to the *μ*FLO^{G5} board and it is not supplying the required voltage to the unit, the user may need to test the Vac charger.

1. Check the Vdc wiring to the J17 charger input termination block connector. Be certain the wiring is correct.

2. Correct and retest as necessary.

3. Check the input Vac power supply voltage to the external Vac charging unit. Be certain the primary Vac voltage is correct.

4. Correct and retest as necessary.

5. If the primary Vac input level is correct, wiring to the *μ*FLO^{G5} board terminal is correct, and there is no Vdc output from the charger. Replace the charger fuse.

6. Correct and retest as necessary.

7. If the fuse is not faulty or there is no charger Vdc output voltage after replacing the fuse, replace the Vac charging unit.

8. Correct and retest as necessary.

9. If an issue still exists, return to Figure 92, *Power troubleshooting flowchart*, on page 128.

9.3.5   Auxiliary equipment isolation test

This test will need to be performed if the battery output voltage is not remaining consistent and no errors were found during the previous Power supply, Solar panel charging system or Vac charging circuit tests.

1. Disconnect the solar panel charger or Vac charger from the J17 charger input.

2. Disconnect the battery cable from J15 on the *μ*FLO^{G5} board. Substitute a known good battery, if not already done.

3. Disconnect any auxiliary equipment that draws power from the *μ*FLO^{G5} or the battery. This is not limited to, but should include, removing the J10 communication connector, if used.

4. Connect the current measurement troubleshooting cable (Figure 94) to a known, good battery. Reconnect to the *μ*FLO^{G5} board.
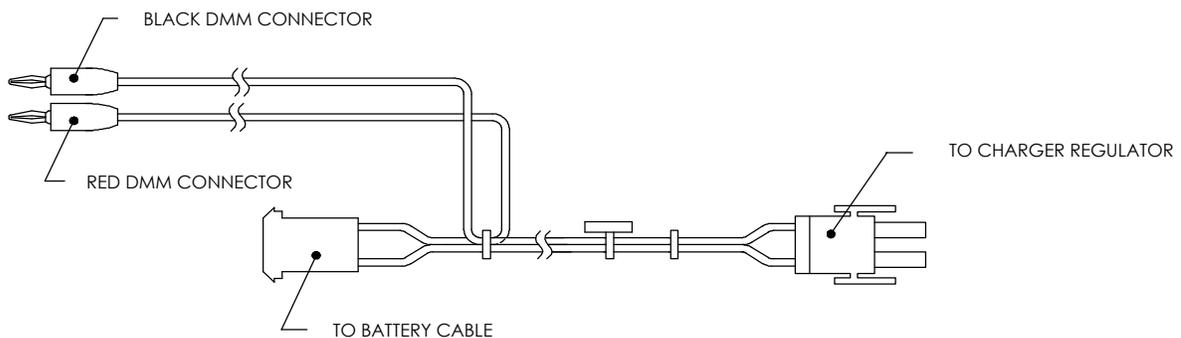
Figure 94: Current measurement troubleshooting cable

5. Using the DMM, connect to the troubleshooting cable, and measure the average current. If it is equal to or greater than 80 mA at 12 Vdc, disconnect the battery and reconnect one (1) auxiliary item and continue to the next step. If the average current is less than the specification, replace the *μ*FLO^{G5} electronic board. Follow the procedures detailed in section 7.8.4, *μFLOG5 electronic board replacement*, on page 103.

6. Reconnect the battery, and measure the average current. If the average current is less than or equal to the equipment specification, disconnect the battery. Upon completion, reconnect to the next auxiliary item.

7. Repeat steps 5 and 6 until the auxiliary items have been tested and/or the equipment causing the power drain has been located.

8. If the power drain has not been located, return to Figure 92, *Power troubleshooting flowchart*, on page 128.

9.3.6   Sleep mode

Totalflow units are designed to move into a low power mode, Sleep, when an insufficient supply voltage (< 11 Vdc) is present for a period of time. Sleep mode is a safety feature which maintains the RAM but discontinues data measurement calculations and control functions.

When the flow computer enters Sleep mode, waking up the unit will be insufficient for correcting the problem. At issue is the reason for insufficient supply voltage, and therefore issues relating to the system's power supply should be investigated. This mode is designed for a nominal 12 Vdc system with battery backup.

Connecting the local communication cable to the flow computer will wake the unit. Disconnecting the local communication cable when the battery voltage is ≤ 10.9 Vdc, will return the flow computer to Sleep mode. If the battery voltage is above 11 Vdc, the flow computer will remain awake.

The flow computer has a real-time clock which maintains the time and date during Sleep mode. Each time the flow computer enters or leaves Sleep mode, an event record is recorded. Additionally, upon wake-up, the μFLO^{G5} performs the following functions:

—   Stores present calculation period accumulations in historical record.

—   Zeros present calculation period accumulations.

—   Ends the current daily record and starts a new daily record.

To wake the flow computer:

1.   Connect locally to the μFLO^{G5}. This should wake-up the unit for troubleshooting the supply voltage.

2.   Check the battery cable. It must make a good, secure electrical connection with the flow computer board's battery connector, J15 (Figure 93, *μFLOG5 board*, on page 129).

3.   If the battery cable is securely connected, check the battery voltage. If the voltage is low, follow the instructions in section 7.8.1, *Replacing the μFLOG5 battery*, on page 97, to replace the battery.

9.4   Troubleshooting communications

These troubleshooting procedures are applicable to the μFLO^{G5} with an installed radio. The radio/modem may be powered one of two ways: always on or switched. The specific system setup will determine what steps are needed to power the radio/modem.

When switching power to a radio with Inhibit (Sleep) mode, the communication 1 port or 2 switched power line will go to the radios inhibit (Sleep) mode input. Power out will go to the radios.

The three basic types of radio communications that can be used between the flow computer and a radio receiver are:

—   RS-232 communications

—   RS-485 communications

—   RS-422 communications

Troubleshooting the communications for this unit requires that both pieces of equipment are tested: the flow computer communication ports and the communication device. Other communication troubleshooting information is given in the following categories: RS-232, RS-485, and RS-422 Communications. Use Figure 95 as an aid for troubleshooting communication problems.
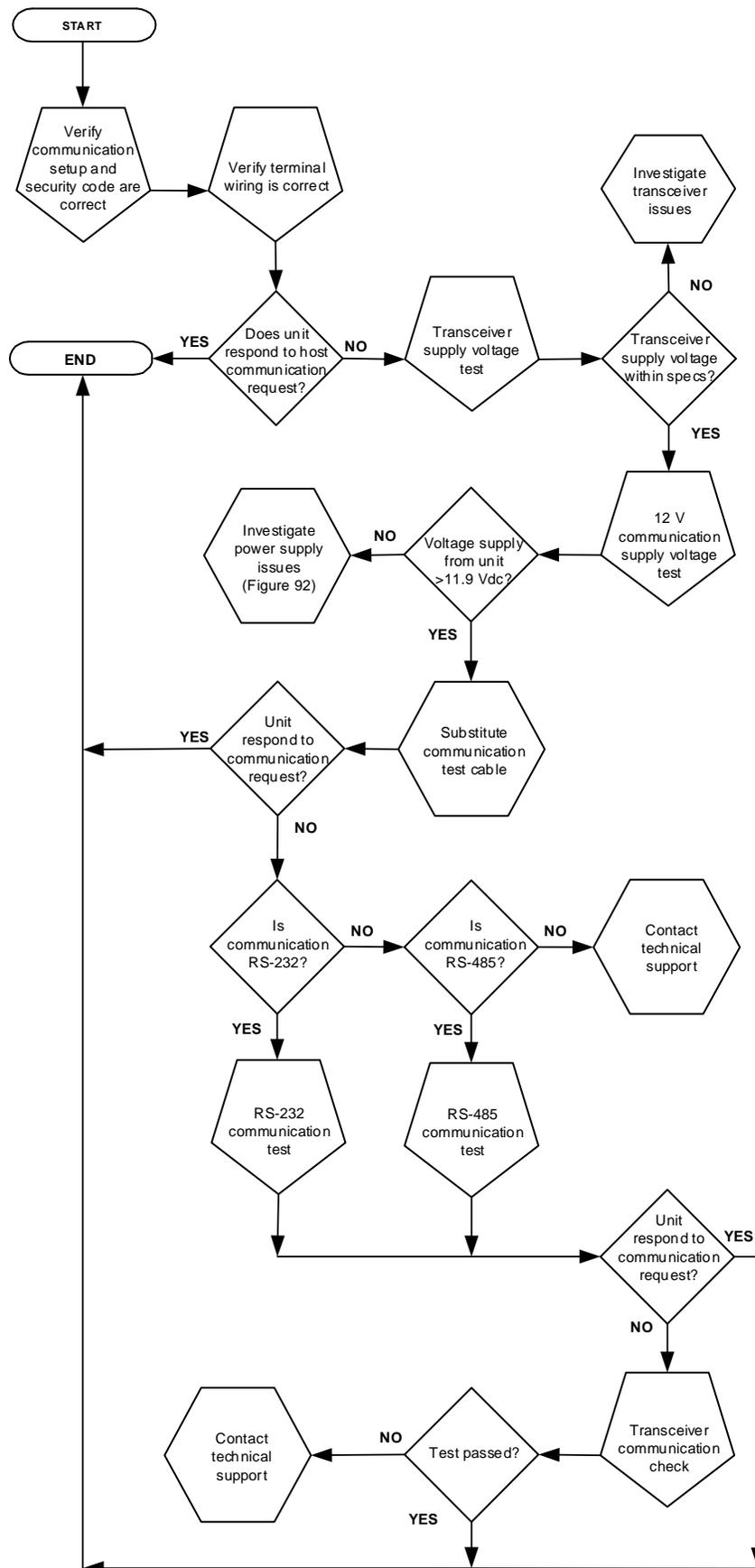
Figure 95: Communication troubleshooting flowchart

9.4.1   Verify communication wiring and equipment

After installation of the communication equipment and before placing the communication system into operation, the user should note the following:

— Verify that the radio cable is correctly wired at the flow computer electronic board.

— Verify that the radio cable or wiring is correctly installed at the radio.

— Verify the communication interface mode and terminations are correctly configured in PCCU.

— Check the flow computer identifier (ID). Log the ID for future reference.

— Log the flow computer access security code, baud rate, listen cycle, protocol, and interface for future reference.

IMPORTANT NOTE: After communication installation and setup:

– If the communication port is assigned to an annunciator, it displays the $\rightarrow$ after it recognizes the flow computer.

– Check the baud rate of the flow computer transmission and timing. The baud rate and timing settings can be changed when PCCU32 is in Entry mode.

– The minimum power required for operating the remote communications is 11.9 Vdc (default) or as set by the user. Should the power fall below this level, remote communications are terminated.

– Test the remote communications using the RS -232 troubleshooting cable. Use the RS-232 to RS-485 communication converter in conjunction with the RS-232 troubleshooting cable to test the RS-485 remote communications.

9.4.2   Transceiver supply voltage test

Using the wiring information and guidelines supplied by the transceiver manufacturer, verify that the transceiver is receiving the manufacturer's suggested voltage.

IMPORTANT NOTE: If the transceiver is not receiving sufficient voltage, investigate power supply issues. These may involve wiring irregularities at either the EXT PWR/CHARGER or BATTERY connections on the electronic board.

9.4.3   12 Vdc communication supply voltage test

If the transceiver does not feature inhibit (Sleep) mode the power is supplied through an operational relay, perform test 1. If the transceiver features inhibit (Sleep) mode or is continuously powered, perform test 2.

— Test 1: If the transceiver does not feature a Sleep mode and receives power through the μFLO^{G5} switched power, activate port 1 Switched Power Out (point 3). Using a DMM set to Vdc, measure the voltage at J10 between: GND (point 2) and SWVBAT (point 3), see Figure 96. The voltage should be greater than 11.9 Vdc for this unit. If the voltage is equal to or less than 11.9 Vdc, return to the test sequence outlined in the *Power troubleshooting flowchart* (Figure 92, on page 128).

— Test 2: If the transceiver features a Sleep mode or is continuously powered, using a DMM set to Vdc, measure the voltage at J10 between: GND (point 2) and VBATT (point 1), see Figure 96. The voltage should be greater than 11.9 Vdc for this unit. If the voltage is equal to or less than 11.9 Vdc, return to the test sequence outlined in the *Power troubleshooting flowchart* (Figure 92, on page 128).

Figure 96: *µ*FLO^{G5} Communication Wiring

	COMM 1		
	RS-232	RS-485	RS-422
1	VBATT	VBATT	VBATT
2	GND	GND	GND
3	SW VBATT	SW VBATT	SW VBATT
4	OPER	OPER	OPER
5	N/A	RRTS	RRTS
6	RTS	TBUS(+)	TBUS(+)
7	TXD	TBUS(-)	TBUS(-)
8	RXD	N/A	RBUS(+)
9	CTS	N/A	RBUS(-)
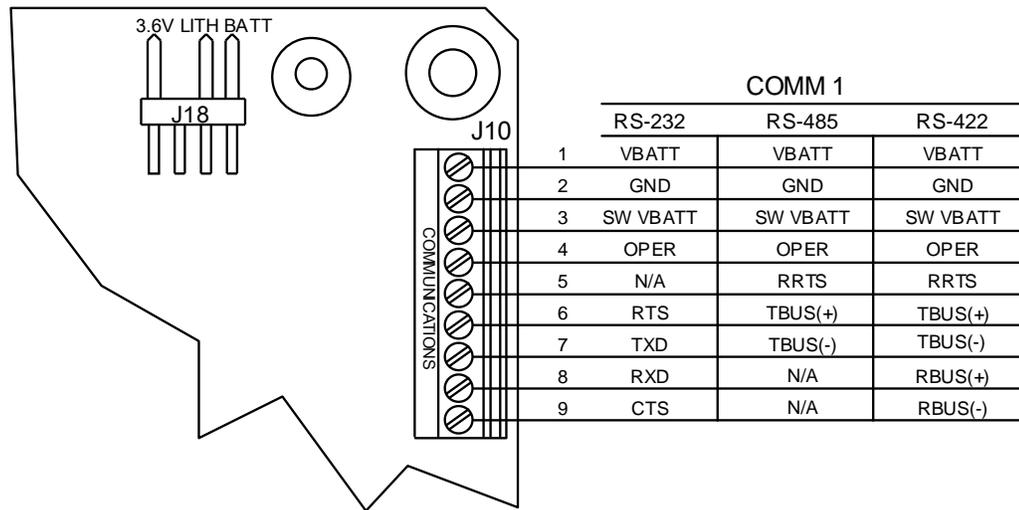
9.4.4   Transceiver check

1. If available, use a wattmeter to check the transceiver output power. Refer to the manufacturer's documentation for measuring instructions.

2. If available, use two (2) hand-held transceivers, and verify the communication path between the master and remote sites. A voice-activated interface can be used, if available.

3. Verify that the transceiver is set to the correct frequency. Refer to the manufacturer's documentation for checking frequency instructions.

4. If a directional antenna is used, verify the orientation of the antenna to the master site.

i   IMPORTANT NOTE: If a communication problem still exists and the unit has passed the transceiver check test, contact ABB Totalflow using the information in section 9.5, *Customer service and support*, on page 137 for additional help.

9.4.5   RS-232 communication test

The following test procedure will assist in deducing possible causes for indicated error messages.

i   IMPORTANT NOTE: Voltage on the following steps may be difficult to see using a digital multimeter. If available, an oscilloscope provides a more accurate reading. To verify, the host software must be continuously polling the flow computer.

1. Using an oscilloscope and Table 25, measure the Receiving data (RXD) voltage on the *µ*FLO^{G5} board COMM 1 J10 between GND (point 2) and RXD (point 8).

Table 25: RS-232 field wiring on *µ*FLO^{G5} electronic board, COMM 1

Point	Description
1	V Battery
2	GND
3	Switched V Battery
4	Operator
5	Not applicable
6	RTS
7	TXD

Point	Description
8	RXD
9	CTS

2.   When the unit is receiving data from the host, the voltage should vary between -5 Vdc and +5 Vdc. This indicates that the unit is receiving data; continue to step 3. Otherwise, if the unit is not receiving data, investigate incorrect wiring.

3.   Using an oscilloscope, measure the Request to Send (RTS) voltage on the μFLO^{G5} board COMM 1 J10 between GND (point 2) and RTS (point 6).

4.   When the unit is communicating with the host, the voltage should be +5 Vdc and remain +5 Vdc until the μFLO^{G5} transmission stops. This indicates that the unit is transmitting data; continue to step 5. Otherwise, if the unit is not receiving data, investigate incorrect wiring.

5.   Using an oscilloscope, measure the Transmit data (TXD) voltage on the μFLO^{G5} board COMM 1 J10 between GND (point 2) and TXD (point 7).

6.   When the unit is transmitting to the host, the voltage should vary between -5 Vdc and +5 Vdc. This indicates that the unit is transmitting data. If the unit is still not responding, return to the *Communication troubleshooting flowchart* (Figure 95, on page 133) and continue.

The tests performed on the μFLO^{G5} board will only verify incorrect or damaged wiring. If all previous testing passed and all wiring and jumper and terminations have been verified correct, the board will need to be replaced. Contact ABB Totalflow Technical Support to initiate this process.

9.4.6   RS-485 Communication test

The following test procedure will assist in deducing possible causes for indicated error messages.

> **IMPORTANT NOTE:** Voltage on the following steps may be difficult to see using a digital multimeter. If available, an oscilloscope provides a more accurate reading. To verify, the host software must be continuously polling the flow computer.

1.   Using an oscilloscope and Table 26, measure the driver voltage on the μFLO^{G5} electronic board COMM 1 J10 between TBUS+ (point 6) and TBUS- (point 7).

Table 26: RS-485 field wiring on the μFLO^{G5} electronic board, COMM 1

Point	Description
1	V Battery
2	Ground
3	Switched V Battery
4	Operator
5	RRTS
6	TBUS (+)
7	TBUS (-)0
8	Not applicable
9	Not applicable

2.   When the unit is receiving data from the host, the voltage should vary between 0 Vdc and +5 Vdc. This indicates that the unit is receiving data; continue to step 3. Otherwise, if the unit is not receiving data, investigate incorrect or damaged wiring.

3.   Using an oscilloscope, measure the Remote Request to Send (RRTS) voltage on the μFLO^{G5} electronic board COMM 1 J10 between GND (point 2) and RRTS (point 5.)

4.   When the unit is transmitting data, the voltage should vary between 0 Vdc and +5 Vdc. This indicates that the transmitting data, continue to step 5. Otherwise, if the unit is not transmitting data, investigate the incorrect or damaged wires.

5.   If a communication problem still exists and the unit has passed these tests, additional testing will be required. Call the ABB office, listed under *Contact us*, on the back cover of this manual for additional assistance.

9.5 Customer service and support

9.5.1 Determine hardware and software versions

When requesting support for the transmitter, it will be necessary to supply the hardware and software version of the device. To locate the version, use the following procedure.

1. Note the model and serial number from the plate located on each unit.

2. Note the Board Part #, the Flash Software Part #, and the OS Software Part #:

    a. Using PCCU, connect locally to the flow computer.

    b. Select the Station ID on the top line of the navigation tree.

    c. Go to the Registry tab.

3. Note any alarms or messages as they appear.

4. Be prepared to provide a detailed description of the problem.

9.5.2 Customer services

To contact ABB, use one of the following methods.

— Toll Free Number (USA): 1-800-442-3097

— International Number: +1 918-338-4880

— Fax: 918-338-4607

— Email: totalflow.order@us.abb.com

— Email: totalflowsupport@us.abb.com

9.5.3 Transmitter return information

Use the original packaging, or a secure transport container, to return the transmitter for repair. Comply with the following instructions concerning the return of equipment.

— All returns to ABB require a Return Authorization (RA) number before shipping.

— Contact the Returns department at 1-800-442-3097 (USA) or 1-918-338-4880 (International), prompt 1. Include the following information when requesting a return:

    – Reason for return

    – P.O. number for exchanges and repairs not covered by warranty

    – Warranty sticker expiration date

— Transmitters should be free from any hazardous materials (acids, alkalis, solvents, etc.)

— Any material returned to ABB without an RA number will be returned to the customer at the customer's expense.

Appendix A   I/O expansion board AI calibration

The calibrations for analog input may be a 3-point or 5-point calibration.

Table 27: AI calibration points

Type of calibration	Points
3-point	Low, 50%, and 100%
5-point	Low, 25%, 50%, 75% and 100%

i   **IMPORTANT NOTE:** To properly calibrate the AI, the measurement range and signal type of the external device must be determined.

A.1   Connecting calibration equipment

For the analog input calibration, a calibrator simulates the external device attached to the flow computer AI. The calibrator applies the signal (voltage or current) values that would be expected from the external device.

CAUTION – Equipment / Property damage. Ensure that the voltage or current values from the calibrator do not exceed the analog input acceptable ranges. And ensure that the signal is the same type as the type the AI is configured for.

To prepare and connect the calibration equipment:

1. Disconnect the wires from the external device if connected.

2. Set the I/O expansion card AI signal type using the corresponding jumper:

   — J6 for AI-1

   — J10 for AI-2

   a. For voltage input, jumper pins 2 and 3

   b. For current input, jumper pins 1 and 2

3. Set the calibrator to the correct signal type (voltage or current) that the AI is configured for.

NOTICE – Tainted results. The wire length from the external device to the AI affects the calibration. When connecting the calibrator, make sure to use wires with the length required from the flow computer to the external device. Or place the calibrator at the location where the external device is installed.

4. Connect the calibrator to the wire ends that were removed from the external device. Observe the polarity and connect to the correct wire: positive probe to the signal wire and the negative probe to the negative or ground wire. Figure 97 shows the setup of equipment to calibrate an AI with voltage or current.
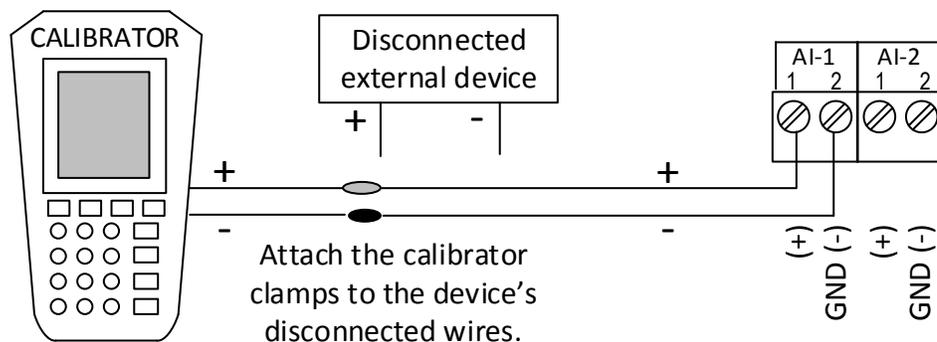
Figure 97: AI calibration equipment

A.2   Analog input calibration (voltage mode)

To calibrate the analog input set to voltage mode:

1.   Connect the PC running PCCU32 to the flow computer, and click **Entry** icon.

2.   Verify that the I/O expansion corresponding jumper for the AI is set for voltage input (Figure 98).
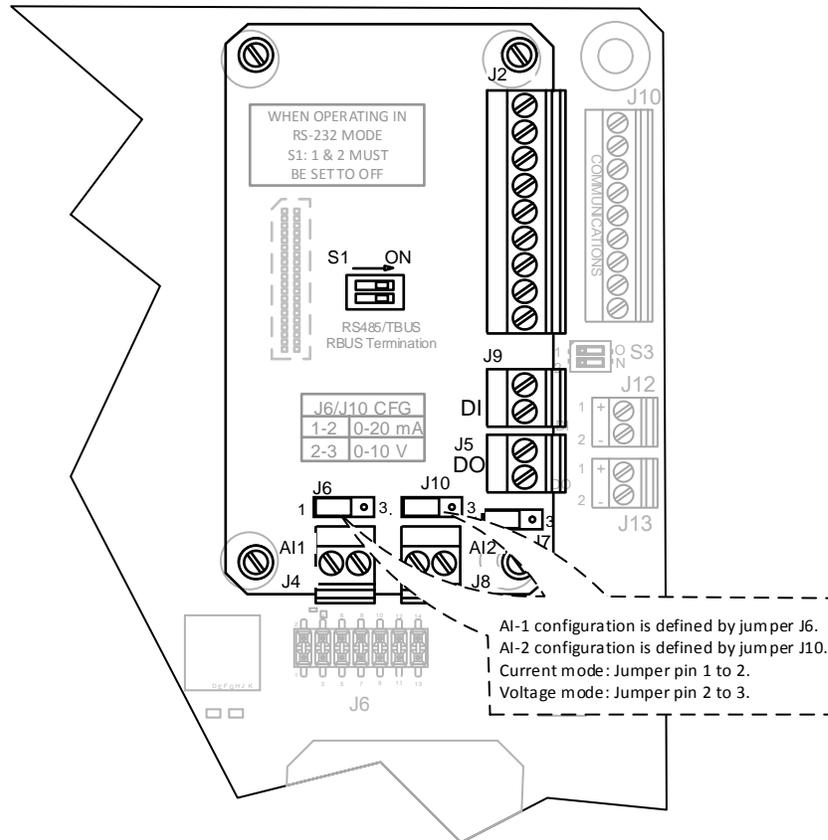
Figure 98: Analog Input mode selection

3.   Verify that the calibrator is set to voltage signal type.

4.   Turn the calibrator on to supply the signal.

5.   Click the **Calibrate** icon on the PCCU toolbar (roll the mouse over the icons and the icon name displays. The Calibrate icon depicts tools.)

6.   Click **I/O Card** on the navigation tree

7.   Click the **AI** tab to be calibrated.

8.   Select either a **3**- or **5**-point calibration from the corresponding drop-down menu (Figure 99).
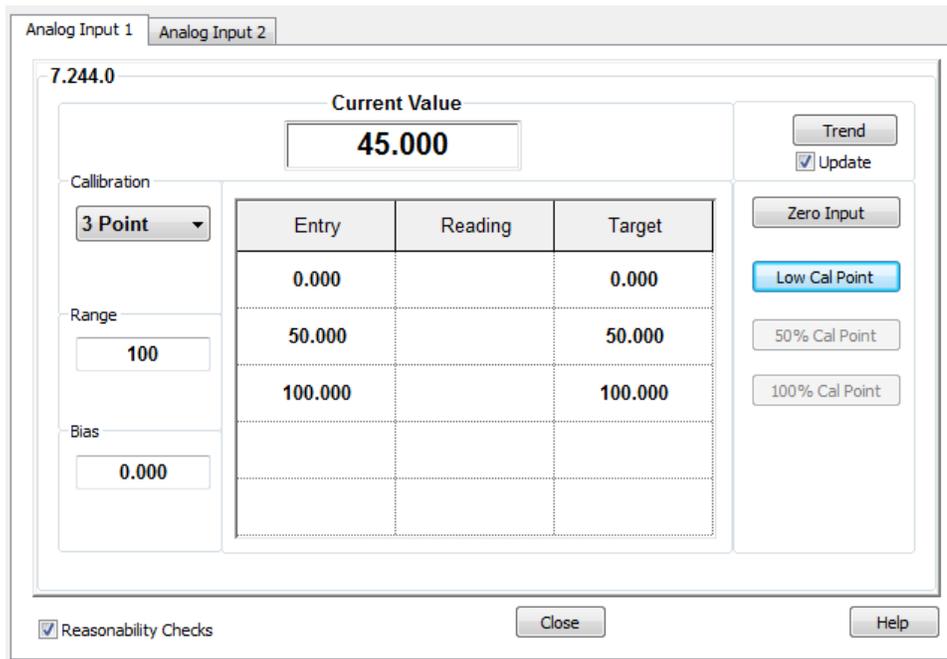
Figure 99: 3-point AI calibration screen (voltage mode)

9. Verify that only the Zero Input and Low Cal Point buttons are enabled. The system enables the buttons in the order required for the calibration.

10. Click into the **Range** field to display the Analog Input Range entry screen.

11. Type the external device measurement range value, and click **OK**.

---

i **IMPORTANT NOTES:**

‒ For illustrative purposes, this procedure uses 100 as the measurement range value.

‒ This procedure details the calibration procedure for a three (3) point calibration. Available target values will be displayed in the calibration window and will become active in the prescribed calibration order: Low Cal Point, 100% Cal Point, and 50% Cal Point.

12. Click **Low Cal Point**. This should represent the lowest calibration point. In this example it should equal zero (0) for a 0-100 range.

   a. Adjust the calibrator to apply the low value of the signal range. For example, if the signal range of the external device is 1 to 5 Vdc, apply 1 Vdc.

   b. When the current reading stabilizes, click **OK.** (Figure 100).
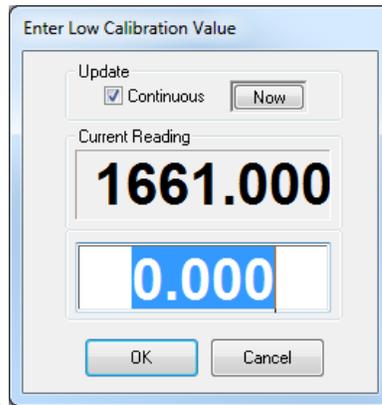
Figure 100: AI low calibration value (voltage mode)

13. After the previous value is accepted, the next calibration point button will activate. Click the activated button.

i

IMPORTANT NOTE: This procedure details the calibration procedure for a three (3) point calibration. Available pressure points will be displayed in the calibration window and will become active in the prescribed calibration order: Low Cal Point, 100% Cal Point, and 50% Cal Point.

Although these instructions are specific to a three (3) point calibration, they are easily adapted for a five (5) point calibration. When 5-point is selected, five pressure points will be displayed in the prescribed order: Low Cal Point, 100% Cal Point, 75% Cal Point, 50% Cal Point, and 25% Cal Point.

14. Click the **100% Cal button**. This should represent the highest calibration point. In this example it should equal 100 for a 0-100 range.

    a. Adjust the calibrator to apply the 100% value of the external device (100% of the target value). With a defined signal range of 1 to 5 Vdc, apply 5 Vdc.

    b. When the current reading stabilizes, click **OK.**

15. After the previous value is accepted, the next calibration point button will activate. Click the activated button (**50% Cal button**).

16. This should represent the mid-range calibration point. In this example it should equal 50 for a 0-100 range.

    a. Adjust the calibrator to apply the 50% value of the external device (50% of the target value). With a defined signal range of 1 to 5 Vdc, apply 3 Vdc.

    b. When the current reading stabilizes, click **OK.**

i

IMPORTANT NOTE: For a 3-point calibration, SP calibration is now complete.

For a 5-point calibration, two more points must be calibrated: 75% (4 Vdc) and 25% (2 Vdc).

17. For a 5-point calibration, repeat step 16, using the adjusted current for the 75% (4 Vdc) and 25% (2 Vdc) points respectively, until all points have been calibrated.

18. When "Calibration Complete" displays, click **OK**.

19. Verify the **Entry** values are updated and the Current Value field displays the calibrated value based on the range defined (Figure 101).
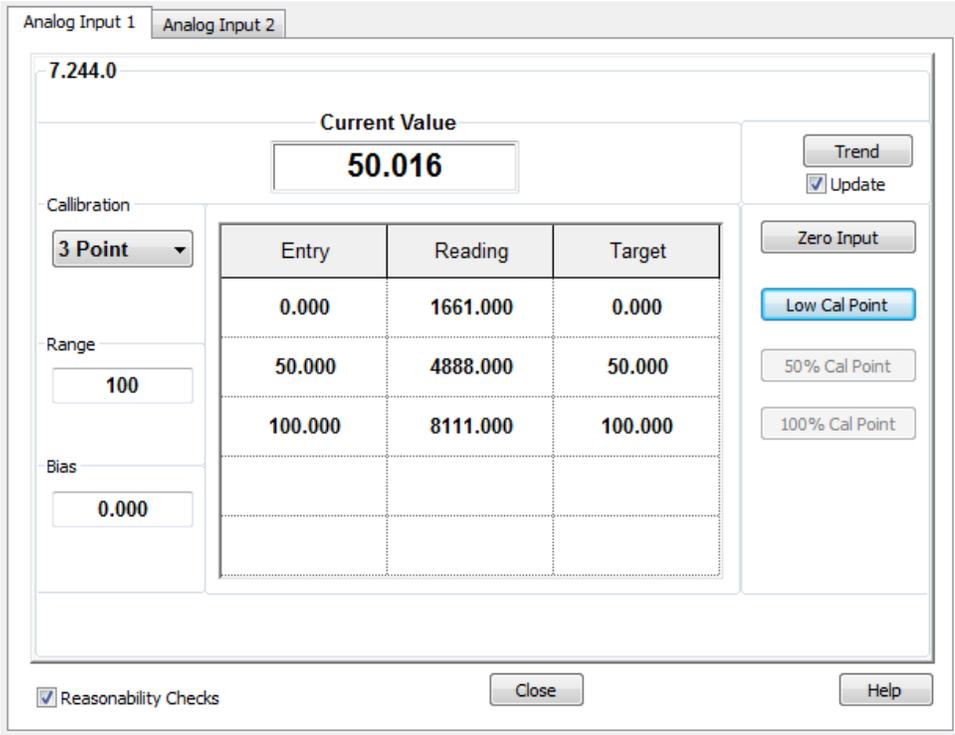
Figure 101: Calibrated AI example (voltage mode)

20. Remain in the calibration screen and keep the calibrator connected to the AI.

21. To verify the calibration, proceed to A.4, *Verify analog input calibration*.

A.3   Analog input calibration (current mode))

To calibrate the analog input set to current mode:

1. Connect the PC running PCCU32 to the flow computer, and click **Entry** icon.

2. Turn the calibrator on to supply the current.

3. Verify that the I/O expansion corresponding jumper for the AI is set for current input (Figure 98, *Analog Input mode selection*, on page 139).

4. Verify that the calibrator is set to current signal type.

5. Click **Calibrate** on the PCCU toolbar.

6. Click **I/O Card** on the navigation tree.

7. Click the **AI** tab to be calibrated (Figure 102).

Figure 102: 3-point AI calibration screen (current mode)

8. Select either a **3**- or **5**-point calibration from the corresponding drop-down menu.

9. Verify that only the Zero Input and Low Cal Point buttons are enabled. The system enables the buttons in the order required for the calibration.

10. Click into the **Range** field to display the Analog Input Range entry screen.

11. Type the external device measurement range value, and click **OK**.

---

i

IMPORTANT NOTES:

−   For illustrative purposes, this procedure uses 100 as the measurement range value.

−   This procedure details the calibration procedure for a three (3) point calibration. Available target values will be displayed in the calibration window and will become active in the prescribed calibration order: Low Cal Point, 100% Cal Point, and 50% Cal Point.

---

12. Click **Low Cal Point**. This should represent the lowest calibration point. In this example it should equal zero (0) for a 0-100 range.

    a.   Adjust the calibrator to apply the low value of the signal range. For example, if the signal range of the external device is 4 to 20 mA, apply 4 mA.

    b.   When the current reading stabilizes, click **OK.** (Figure 103).
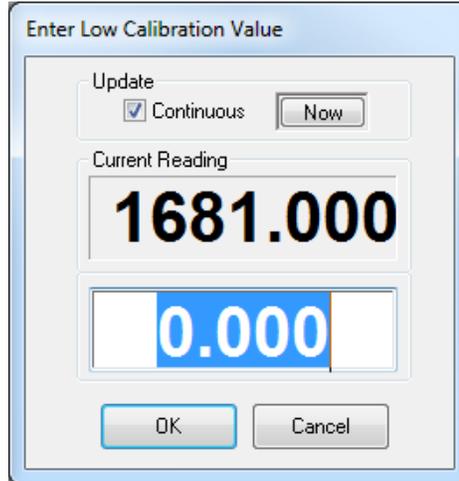
Figure 103: AI low calibration value (current mode)

13. After the previous value is accepted, the next calibration point button will activate. Click the activated button.

> **IMPORTANT NOTE:** This procedure details the calibration procedure for a three (3) point calibration. Available pressure points will be displayed in the calibration window and will become active in the prescribed calibration order: Low Cal Point, 100% Cal Point, and 50% Cal Point.
>
> Although these instructions are specific to a three (3) point calibration, they are easily adapted for a five (5) point calibration. When 5-point is selected, five pressure points will be displayed in the prescribed order: Low Cal Point, 100% Cal Point, 75% Cal Point, 50% Cal Point, and 25% Cal Point.

14. Click the **100% Cal button**. This should represent the highest calibration point. In this example it should equal 100 for a 0-100 range.

    a.   Adjust the calibrator to apply the 100% value of the external device (100% of the target value). With a defined signal range of 4 to 20 mA, apply 20 mA.

    b.   When the current reading stabilizes, click **OK.**

15. After the previous value is accepted, the next calibration point button will activate. Click the activated button (**50% Cal button**).

16. This should represent the mid-range calibration point. In this example it should equal 50 for a 0-100 range.

    a.   Adjust the calibrator to apply the 50% value of the external device (50% of the target value). With a defined signal range of 4 to 20 mA, apply 12 mA.

    b.   When the current reading stabilizes, click **OK.**

> **IMPORTANT NOTE:** For a 3-point calibration, SP calibration is now complete.
>
> For a 5-point calibration, two more points must be calibrated: 75% (16 mA) and 25% (8 mA).

17. For a 5-point calibration, repeat step 16, using the adjusted current for the 75% (16 mA) and 25% (8 mA) points respectively, until all points have been calibrated.

18. When "Calibration Complete" displays, click **OK**.

19. Verify the **Entry** values are updated and the Current Value field displays the calibrated value based on the range defined (Figure 104).

Figure 104: Calibrated AI example (current mode)

20. Remain in the calibration screen and keep the calibrator connected to the AI.

21. To verify the calibration, proceed to section A.4, *Verify analog input calibration.*

A.4   Verify analog input calibration

After calibration is completed, the Current Value field should display the calibrated values based on the range defined. To verify the values, continue to use the calibrator to apply different input signal values to the AI and verify that the value displayed in the Current Value field reflects the calibration range.

The instructions in this procedure apply to current and voltage modes. The example used in these instructions is current mode.

To verify the analog input calibration:

1.   Adjust the calibrator to apply the minimum (low) value of the signal range.

2.   Wait for the value displayed in the **Current Value** field to stabilize.

3.   Verify that the **Current Value** field displays a value equal or close to the target range low (0%) value (Figure 105).
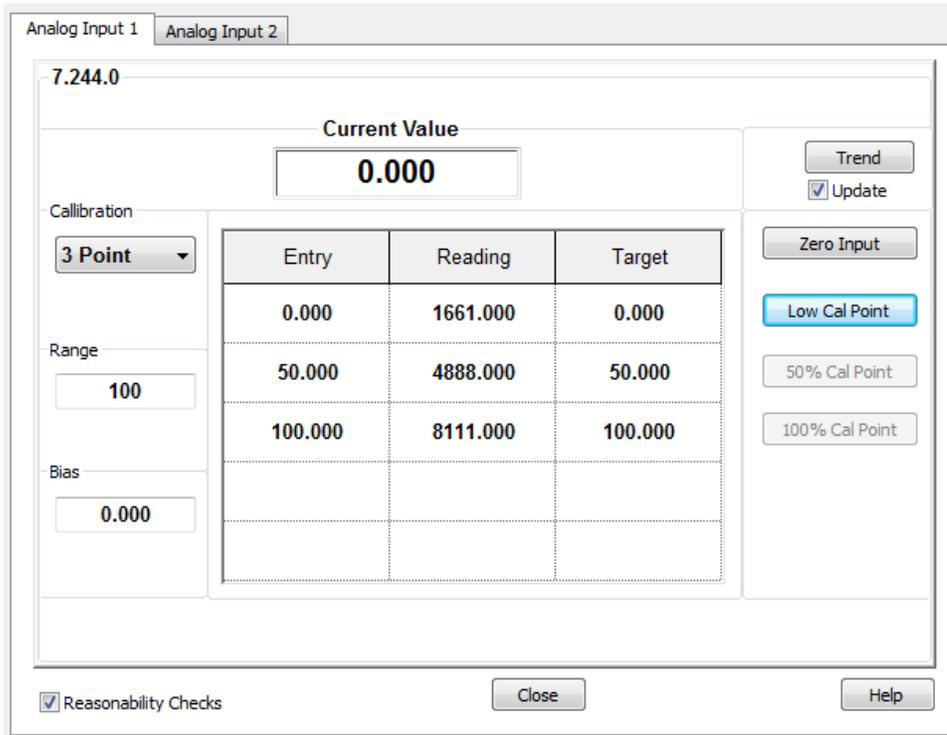
Figure 105: Low range value verification

4. Adjust the calibrator to apply the high (100%) value of the signal range.

5. Wait for the value displayed in **Current Value** field to stabilize.

6. Verify that the **Current Value** field displays a value equal or close to the target range high (100%) value (Figure 106).
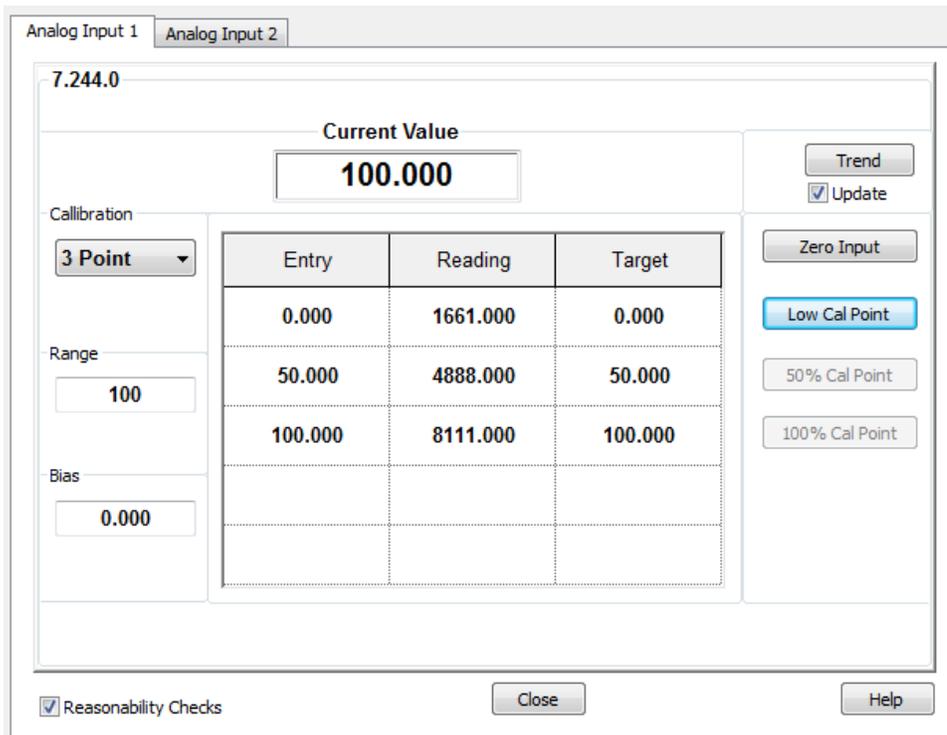
Figure 106: High range value verification

7. If all of the values displayed are correct, calibrate the next AI or click **Close** to exit the calibration screen. When calibration for all required AIs is successfully completed, remove the calibrator.

8. If errors are found, proceed to section A.5, *Repeat Calibration in case of* errors.

A.5 Repeat calibration in case of errors

If the displayed values are not valid or do not stabilize, the calibration may not be correct.

To perform the calibration again:

1. Click **Close** to exit calibration.

2. Click the **Entry** icon on the PCCU toolbar.

3. Expand **I/O System** on the navigation tree and select **I/O Card** (Figure 107).
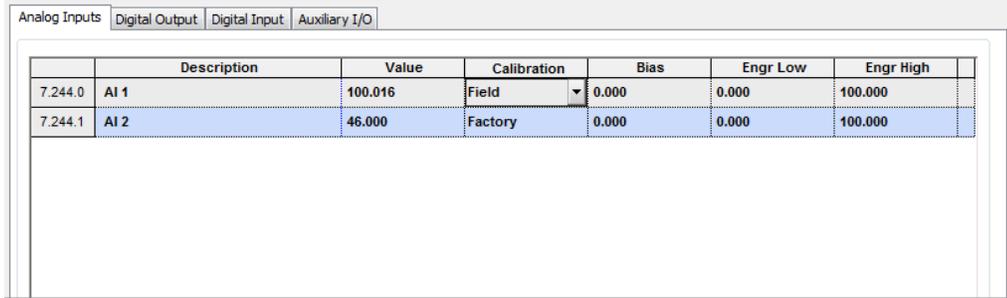
	Description	Value	Calibration		Bias	Engr Low	Engr High	
7.244.0	AI 1	100.016	Field	▼	0.000	0.000	100.000	
7.244.1	AI 2	46.000	Factory		0.000	0.000	100.000	

Tabs: Analog Inputs | Digital Output | Digital Input | Auxiliary I/O

Figure 107: Reset AI calibration to factory

4. On the **Analog Inputs** tab, change the value of the calibration field for the appropriate AI to **Factory**.

5. Click **Send**.

6. Repeat the calibration procedure in section A.2*, Analog input calibration (voltage mode)* or section A.3, *Analog input calibration (current mode).*

7. Repeat the steps in section A.4, *Verify analog input calibration*.

Appendix B   Index

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2105614-Rev. AD.

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