

ABB MEASUREMENT & ANALYTICS | 2106026MNAA

# XSeries G5 User Manual

XFC<sup>G5</sup>/XRC<sup>G5</sup>



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<b>List of figures .....</b>	<b>6</b>
<b>List of tables.....</b>	<b>9</b>
<b>Additional information.....</b>	<b>10</b>
<b>Safety .....</b>	<b>11</b>
Safety symbol conventions.....	11
Potential safety hazards for this equipment .....	12
<b>1 System Description .....</b>	<b>13</b>
1.1 XSeries <sup>G5</sup> enhancements and backwards compatibility .....	13
1.2 Embedded software (overview) .....	14
1.2.1 Operating system.....	14
1.2.2 XFC <sup>G5</sup> functionality .....	14
1.2.3 XRC <sup>G5</sup> functionality .....	15
1.2.4 XSeries <sup>G5</sup> calculation methods..	16
1.2.5 Log period data records .....	16
1.2.6 Applications.....	16
1.2.7 Display application .....	17
1.2.8 Configuration files .....	18
1.2.9 Customer data collection files .....	19
1.2.10 Licensing.....	19
1.2.11 Additional features .....	19
1.3 Hardware overview.....	20
1.3.1 Enclosures.....	20
1.3.2 Liquid Crystal Display (LCD) assembly .....	20
1.3.3 Integral multivariable (XIMV) assembly .....	20
1.3.4 Electronic board .....	21
1.3.5 Communication connections .....	21
1.4 User interface software description: PCCU32.....	23
1.5 Power supply equipment .....	23
1.5.1 Battery and charger power configurations .....	24
1.5.2 External power supply configuration .....	24
1.6 Resistive Temperature Detector (RTD) .....	24
<b>2 Site planning and requirements .....</b>	<b>26</b>
2.1 Enclosures.....	26
2.2 Power requirements.....	26
2.3 Location specification and design.....	26
2.4 Wiring requirements .....	26
2.5 Download PCCU .....	27
2.5.1 Install PCCU .....	27
<b>3 Installation .....</b>	<b>28</b>
3.1 Assumptions.....	28
3.2 Required tools and materials .....	28
3.3 Unpack and inspect .....	29

3.4	Pipe mount installation.....	29
3.5	Wall mount installation .....	30
3.6	Direct-mount installation.....	31
3.7	XRC <sup>G5</sup> 6990 rack mount installation .....	32
3.7.1	Overview .....	32
3.7.2	Termination panel .....	33
3.7.3	Rack mount enclosure .....	33
3.8	Ground equipment .....	34
3.9	Leak-test manifold and tubing connections .....	34
3.10	Install the RTD.....	35
3.11	Wire the RTD to the XFC <sup>G5</sup> .....	37
3.12	Install antenna (for wireless functionality).....	38
3.13	Install the radio .....	38
<b>4</b>	<b>Install battery and charger .....</b>	<b>39</b>
4.1	Install the battery .....	39
4.2	Install the solar panel .....	39
<b>5</b>	<b>Wire COMM ports .....</b>	<b>43</b>
5.1	COMM port description.....	43
5.2	XFC <sup>G5</sup> COMM pinouts.....	44
5.3	XRC COMM pinouts .....	47
<b>6</b>	<b>Wire I/Os.....</b>	<b>49</b>
6.1	General I/O description.....	49
6.1.1	Analog inputs (AI) .....	50
6.1.2	Digital or Pulse Inputs (DI/PI).....	50
6.1.3	Digital outputs (DO) .....	51
6.2	Analog input (AI) pinouts .....	51
6.2.1	XFC <sup>G5</sup> AI .....	51
6.2.2	XRC <sup>G5</sup> AI .....	51
6.3	Digital input and output (DI/DO) pinouts XFC <sup>G5</sup> DI/DO.....	52
6.3.1	XRC <sup>G5</sup> DI/DO .....	53
<b>7</b>	<b>Powering the Device .....</b>	<b>54</b>
7.1	Super capacitor charging at boot time.....	54
7.2	Power-on sequence .....	54
7.3	Power with battery and charger .....	54
7.3.1	Connect the battery (dc power) .....	55
7.3.2	Connect the charger .....	55
7.4	Power with external power supply .....	56
7.5	Enable real time clock backup .....	57
<b>8</b>	<b>Basic configuration and startup .....</b>	<b>58</b>
8.1	Setup PCCU for connection .....	58
8.2	Establish initial connection with the XFC <sup>G5</sup> or XRC <sup>G5</sup> .....	59
8.3	Change to Expert view .....	60
8.4	Station setup .....	61
8.5	Change the default time and date format .....	62

8.6	Initial measurement application setup.....	62
8.7	Configure communication .....	64
8.7.1	Configure COM1 .....	64
8.7.2	Configure COM2 .....	67
8.7.3	Configure for network communication.....	68
8.7.4	Enable and configure Ethernet .....	68
8.7.5	Enable Wi-Fi .....	69
8.7.6	Enable Bluetooth.....	71
8.8	Commission the device .....	74
8.8.1	Validate the device measurement.....	74
8.8.2	Place the device in service.....	74
8.8.3	Optional volume reset (recommended) .....	75
<b>9</b>	<b>Configure security (recommended).....</b>	<b>76</b>
9.1	Access points .....	76
9.2	Communication interfaces .....	76
9.2.1	User-enabled services.....	76
9.2.2	Open Transmission Control Protocol (TCP) ports.....	77
9.3	Denial of service (DOS) thresholds rates .....	78
9.4	Security guidelines .....	78
9.5	Configure bi-level security with security switch .....	79
9.6	Configure Role-Based Access Control (RBAC) .....	81
9.6.1	Default access roles.....	81
9.6.2	Setup and create a new RBAC security control file.....	81
9.6.3	Edit the security file.....	83
9.6.4	Create a new user account .....	83
9.6.5	Enable RBAC authentication on communication ports.....	84
9.6.6	Use default RBAC credentials.....	85
9.7	Secure the SSH/SFTP service.....	87
9.7.1	Supported SSH/SFTP accounts.....	87
9.7.2	SSH/SFTP authentication.....	87
9.7.3	Update default SSH/SFTP keys.....	88
<b>10</b>	<b>Service and maintenance .....</b>	<b>100</b>
10.1	Preserve data and configuration .....	100
10.1.1	Collect data .....	100
10.1.2	Save the device configuration .....	101
10.2	Change the XSeries <sup>G5</sup> clock.....	105
10.2.1	Backward or forward clock change not crossing an hour boundary.....	106
10.2.2	Forward clock change crossing an hour boundary .....	106
10.2.3	Backward clock change crossing an hour boundary .....	106
10.3	Remove and replace parts .....	106
10.4	Restart the system .....	106
10.4.1	Restart types overview .....	106
10.4.2	Warm restart with onboard RESET button .....	107
10.4.3	Warm restart from the device loader .....	108

10.4.4	Warm restart from PCCU entry mode .....	109
10.4.5	Warm restart using terminal mode .....	110
10.4.6	Cold restart with onboard COLDBOOT button .....	110
10.4.7	Cold restart from the device loader .....	111
10.4.8	Cold restart from terminal mode .....	112
10.4.9	Restart using the factory configuration.....	113
10.5	Remove and restore power.....	114
10.5.1	Remove power from the electronic board .....	114
10.5.2	Reconnect power to the electronic board .....	115
10.6	Adjust the LCD contrast .....	115
10.7	XSeries <sup>G5</sup> replacement parts and procedures .....	116
10.7.1	Replace the 12 Vdc battery.....	116
10.7.2	Replace the lithium battery.....	117
10.7.3	Replace the XSeries <sup>G5</sup> electronic board.....	117
10.7.4	Replace the LCD assembly.....	118
10.7.5	Replace or add communication modules (COMM modules).....	120
10.7.6	Replace the transducer (XFC <sup>G5</sup> only) .....	121
<b>11 Calibration .....</b>	<b>122</b>	
11.1	Measurement pressure checks and calibration.....	122
11.1.1	Static pressure checks .....	122
11.1.2	Differential pressure checks.....	123
11.1.3	Calibrating static pressure .....	125
11.1.4	Calibrating differential pressure (DP) .....	126
11.2	Zero transducer .....	127
11.2.1	Static pressure .....	128
11.2.2	Differential pressure .....	128
11.3	RTD calibration .....	128
11.4	Resistance temperature detectors (RTD) bias.....	130
11.5	Analog input calibration.....	130
11.5.1	Connect calibration equipment.....	131
11.5.2	Set the AI to the correct input signal mode .....	131
11.5.3	Analog input calibration (voltage mode) .....	132
11.5.4	Analog input calibration (current mode) .....	134
11.5.5	Verify analog input calibration.....	136
11.5.6	Repeat calibration in case of errors.....	137
<b>12 Troubleshooting .....</b>	<b>139</b>	
12.1	LCD visual alarm and status codes .....	139
12.2	Failure to start .....	140
12.3	Screen locked-up .....	140
12.4	Remote communication failure .....	141
<b>Appendix A      Typographical conventions.....</b>	<b>142</b>	
<b>Appendix B      Cyber security .....</b>	<b>143</b>	
<b>Appendix C      Compliance .....</b>	<b>144</b>	
<b>Contact us .....</b>	<b>145</b>	

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## List of figures

Figure 1-1: XFC <sup>G5</sup> inside the enclosure .....	20
Figure 1-2: XRC <sup>G5</sup> inside the enclosure.....	20
Figure 1-3: Liquid Crystal Display and annunciators.....	20
Figure 1-4: XFC <sup>G5</sup> Electronic board .....	21
Figure 1-5: XRC <sup>G5</sup> Electronic board .....	21
Figure 3-1: Mounting pipe .....	30
Figure 3-2: XFC <sup>G5</sup> with XIMV attached to a 5-valve manifold .....	32
Figure 3-3:XRC <sup>G5</sup> 6990 rack mount.....	33
Figure 3-4: 6990 Rack mount enclosure .....	34
Figure 3-5: XFC <sup>G5</sup> with XIMV and 5-valve manifold .....	35
Figure 3-6: Typical RTD installation.....	36
Figure 3-7: RTD probe connector.....	36
Figure 3-8: RTD sensor wiring to XFC <sup>G5</sup> electronic board.....	37
Figure 4-1: Solar panel .....	40
Figure 4-2: CHRG terminal block on the XFC <sup>G5</sup> .....	42
Figure 5-1: XFC <sup>G5</sup> R-232 COMM1 .....	44
Figure 5-2: XFC <sup>G5</sup> R-232 COMM2 .....	45
Figure 5-3: XFC <sup>G5</sup> R-485 COMM1 .....	46
Figure 5-4: XFC <sup>G5</sup> R-485 COMM2 .....	46
Figure 5-5: XRC RS-232 COMM 1 .....	47
Figure 5-6: XRC RS-485 COMM 1 .....	48
Figure 6-1: XFC <sup>G5</sup> AI terminals .....	51
Figure 6-2: XRC AI terminals and input mode selector jumpers .....	52
Figure 6-3: XFC <sup>G5</sup> DI/PI/DO terminals and input mode switches .....	52
Figure 6-4: XRC DI/PI/DO terminals, input mode switches, and debounce jumpers.....	53
Figure 7-1: XFCG5 Display startup messages (part numbers are examples).....	54
Figure 7-2: XFC <sup>G5</sup> BATT connector .....	55
Figure 7-3: Reset button and coldboot button .....	55
Figure 7-4: XFC <sup>G5</sup> charger connection .....	56
Figure 7-5: Connect the external power supply .....	56
Figure 7-6: Battery and switch .....	57
Figure 8-1: System Setup.....	59
Figure 8-2: PCCU32 Tool bar and Entry .....	59
Figure 8-3: PCCU32 Date/Time synchronization warning .....	60
Figure 8-4: PCCU32 XFC <sup>G5</sup> Entry screen .....	60
Figure 8-5: PCCU32 Views .....	61
Figure 8-6: Station Setup .....	61
Figure 8-7: Station Setup detail .....	62
Figure 8-8: Flow Measurement Advanced Setup (Gas orifice).....	63
Figure 8-9: Flow measurement > Setup > General tab.....	63
Figure 8-10: Constants tab .....	64
Figure 8-11: XFC <sup>G5</sup> COMM terminals (Module in COMM1 slot shown) .....	65
Figure 8-12: TF Remote - COM 1 .....	65
Figure 8-13: Verify the communications set up for COMM1 .....	66
Figure 8-14: Spare - COM 2.....	67
Figure 8-15: Network tab – Configure network ID .....	68
Figure 8-16: Enable and configure Ethernet communication.....	69
Figure 8-17: Wi-Fi tab screen.....	70
Figure 8-18: Network connections .....	71
Figure 8-19: Enable Bluetooth.....	72

Figure 8-20: Communication Setup for Bluetooth .....	72
Figure 8-21: Add/Assign Bluetooth application to Bluetooth interface .....	73
Figure 8-22: Verify Bluetooth application assignment .....	73
Figure 8-23: PCCU Connection Setup for Bluetooth .....	74
Figure 8-24: Flow computer with 5-valve manifold .....	75
Figure 9-1: Totalflow/TCP application instance with non-default TCP port .....	78
Figure 9-2: S1 Security switch .....	80
Figure 9-3: Station Setup tab – Security switch status .....	80
Figure 9-4: Security Editor screen .....	82
Figure 9-5: User Name and Password dialog box .....	83
Figure 9-6: User role assignment .....	84
Figure 9-7: Enable port authentication from RBAC security editor .....	85
Figure 9-8: Enabling communication port authentication - Entry mode .....	85
Figure 9-9: Login dialog box .....	86
Figure 9-10: System Setup Auto Connect and RBAC credentials .....	86
Figure 9-11: Puttygen Key Generator .....	89
Figure 9-12: Puttygen Key Generator Key blank field .....	89
Figure 9-13: New public key .....	90
Figure 9-14: New private key and passphrase .....	91
Figure 9-15: Save private key and passphrase .....	91
Figure 9-16: Select location to save private key file .....	92
Figure 9-17: Select public key content from Puttygen key generator key field .....	92
Figure 9-18: Copy generated public key .....	93
Figure 9-19: Enable the SSH/SFTP service .....	94
Figure 9-20: Enable and configure Ethernet (Network Adapter) .....	94
Figure 9-21: FileZilla Site Manager connection setup .....	95
Figure 9-22: Type private key passphrase (password) .....	96
Figure 9-23: FileZilla New Site window .....	96
Figure 9-24: Open the /Flash/AppData/.ssh/ directory .....	97
Figure 9-25: Upload public key from laptop to device .....	97
Figure 9-26: Verify public key upload is complete .....	97
Figure 9-27: Restart Totalflow device after public key update .....	98
Figure 10-1: Collect data .....	101
Figure 10-2: Station Setup and Backup .....	102
Figure 10-3: 32Bit Loader confirmation pop-up .....	103
Figure 10-4: Connection Setup .....	103
Figure 10-5: Save Software from Device window .....	104
Figure 10-6: Config checkbox .....	104
Figure 10-7: Select location to save config file .....	105
Figure 10-8: Loader status logs .....	105
Figure 10-9: XFC <sup>G5</sup> Onboard RESET button .....	108
Figure 10-10: XRC <sup>G5</sup> Onboard RESET button .....	108
Figure 10-11: Warm restart with device loader .....	109
Figure 10-12: Warm restart on the Station Setup tab (Expert view) .....	110
Figure 10-13: XFC <sup>G5</sup> Onboard COLDBOOT button .....	111
Figure 10-14: XRC <sup>G5</sup> Onboard COLDBOOT button .....	111
Figure 10-15: Cold restart using the device loader .....	112
Figure 10-16: Terminal menu option .....	113
Figure 10-17: Terminal screen – cold boot .....	113
Figure 10-18: Restart using factory configuration .....	114
Figure 10-19: XFC <sup>G5</sup> .....	114
Figure 10-20: XRC <sup>G5</sup> .....	114
Figure 10-21: LCD contrast adjustment .....	115
Figure 10-22: Exploded view of an XSeries <sup>G5</sup> enclosure .....	116

Figure 10-23: Change time/date factory defaults on a new board .....	118
Figure 10-24: XFC <sup>G5</sup> Display connector.....	119
Figure 10-25: XRC <sup>G5</sup> Display connector .....	119
Figure 10-26: XFC <sup>G5</sup> COMM ports.....	120
Figure 10-27: XRC <sup>G5</sup> COMM ports .....	120
Figure 11-1: SP calibration pressure checks .....	123
Figure 11-2: DP calibration pressure checks.....	124
Figure 11-3: Calibration equipment connection to XRC <sup>G5</sup> AI.....	131
Figure 11-4: XRC <sup>G5</sup> AIs .....	132
Figure 11-5: XRC <sup>G5</sup> AIs and mode selector jumpers (default setting).....	132
Figure 11-6: AI voltage default calibration values .....	133
Figure 11-7: Low calibration value for voltage .....	134
Figure 11-8: Calibrated AI example (voltage mode).....	134
Figure 11-9: AI current default calibration values .....	135
Figure 11-10: Low calibration value for current .....	136
Figure 11-11: Low range value verification .....	137
Figure 11-12: High range value verification .....	137
Figure 12-1: XSeries <sup>G5</sup> annunciators.....	139

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## List of tables

Table 0-1: Related Documentation .....	10
Table 1-1: XSeries <sup>G5</sup> product enhancements and backward compatibility .....	13
Table 1-2: XFC <sup>G5</sup> applications .....	15
Table 1-3: XRC <sup>G5</sup> applications.....	15
Table 1-4: Applications available with XSeries <sup>G5</sup> .....	17
Table 1-5: Default display parameters.....	18
Table 1-6: Local communication ports/wireless support (local operator access) .....	22
Table 1-7: Serial remote or local connections (COMM ports).....	22
Table 1-8: Network connection (Ethernet) .....	23
Table 1-9: Battery power mode connections.....	24
Table 1-10: External power supply mode connection .....	24
Table 3-1: XRC <sup>G5</sup> Main electronic board to termination panel correlation chart.....	33
Table 5-1: Serial (COMM) port description .....	43
Table 5-2: Serial communication specifications.....	44
Table 5-3: XFC <sup>G5</sup> RS-232 COMM1 and COMM2 pinouts.....	45
Table 5-4: XFC <sup>G5</sup> RS-485 COMM1 and COMM 2 .....	46
Table 5-5: XRC COMM 1 and COMM 2 pinouts .....	48
Table 6-1: I/O general description .....	49
Table 6-2: XSeries <sup>G5</sup> Analog input (AI) mode and range .....	50
Table 6-3: XSeries <sup>G5</sup> pulse input mode and debounce capabilities.....	50
Table 6-4: XFC <sup>G5</sup> AI Pinouts .....	51
Table 6-5: XRC AI Pinouts.....	52
Table 6-6: XFC <sup>G5</sup> DI/PI/DO pinouts .....	52
Table 6-7: XRC DI/PI/DO Pinouts.....	53
Table 8-1: Cables required for local communication .....	58
Table 8-1: Required station setup .....	61
Table 8-2: Communication setup parameters .....	66
Table 8-3: RS-485 Termination on COMM1.....	66
Table 8-4: RS-485 Termination on COMM2 .....	67
Table 9-1: Default communication ports in XSeries <sup>G5</sup> .....	76
Table 9-2: Wireless interfaces in XSeries <sup>G5</sup> .....	76
Table 9-3: User-enabled services on XSeries <sup>G5</sup> .....	77
Table 9-4: Open TCP ports on an XSeries <sup>G5</sup> .....	77
Table 9-5: Denial of Service (DOS) threshold rates .....	78
Table 9-6: XSeries <sup>G5</sup> security guidelines .....	78
Table 9-7: Per-port RBAC authentication options .....	84
Table 9-8: Security keys.....	87
Table 10-1: XSeries <sup>G5</sup> restart options .....	107
Table 10-2: Exploded view Legend.....	116
Table 11-1: Calibration configurable parameters .....	122
Table 11-2: RTD wiring pinouts .....	129
Table 11-3: AI calibration points.....	130
Table 11-4: Typical calibration point values .....	130
Table 12-1: XSeries <sup>G5</sup> status and alarm codes .....	139
Table 12-2: Typographical of conventions .....	142

## Additional information

Additional free publications for the device are available for download at [www.abb.com/totalflow](http://www.abb.com/totalflow) or by scanning this code:



Table 0-1: Related Documentation

Documents:	Document number
<b>XSeries<sup>G5</sup> XFC<sup>G5</sup>/XRC<sup>G5</sup> Quick Start Guide (QSG)</b>	<a href="#">2106141</a>
<b>XSeries<sup>G5</sup> Startup Guide for XRC<sup>G5</sup> and XFC<sup>G5</sup> (SUG)</b>	<a href="#">2106001</a>
<b>XSeries<sup>G5</sup> Board Replacement Kit Guide</b>	<a href="#">2106079</a>
<b>Product Return Policy Information</b>	<a href="#">AKK106713A7549</a>
<b>2600T Series Pressure Transmitters</b>	<a href="#">2105216</a>
<b>266 MODBUS® Multivariable Transmitter</b>	
<b>Wi-Fi Antenna Kit</b>	<a href="#">2106123</a>
<b>TFIO Module User Manual</b>	<a href="#">2101226</a>
User Drawings:	Document number
<b>XFC<sup>G5</sup> Generic Pinout</b>	<a href="#">2106114</a>
<b>XRC<sup>G5</sup> Generic Pinout</b>	<a href="#">2106113</a>

# Safety

Read these instructions carefully prior to installation and commissioning. The instructions do not contain all the details for all types of product and, therefore, do not list all assembly, operating, or maintenance scenarios. For further information or if specific problems arise which are not addressed in the instructions, 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 ABB obligations result from the respective sales contract, which also contains the full and solely valid warranty clauses. These are neither limited nor extended by the content of these instructions.

Observe warning signs on packaging and on the device, etc.

Only qualified and authorized specialists are to be employed for the assembly, electrical connection, commissioning, and maintenance of the device. Qualifications include:

- Training or instruction and/or authorization to operate and maintain devices or systems according to safety engineering standards for electrical circuits, high pressures, and aggressive media
- Training or instruction in accordance with safety engineering standards regarding maintenance and use of adequate safety systems



**WARNING – Bodily injury:** According to EN 60 900, only sufficiently insulated tools may be used for the electrical connection.

Compliance is required for the applicable standards and safety regulations concerning the construction and operation of electrical installations:

- The regulation on technical working materials (safety guidelines for tools)
- The regulations and recommendations relating to explosion protection, if transmitters with explosion protection are to be installed
- The recommendations for safe working in the case of installation in an SIL loop

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

## Safety symbol conventions

The following conventions are used throughout this document to bring attention to important information:

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.



**DANGER – Serious damage to health / risk to life.** These symbols and the signal word "DANGER", indicate imminent danger or 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 the result if not followed. The lightning bolt is for electrical danger; the exclamation point is for general dangers.



**DANGER – Serious damage to health / risk to life.** This symbol, and the signal word "DANGER", indicate imminent danger or explosive 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 the result if not followed.



**WARNING – Bodily injury.** These symbols and the signal word "WARNING", indicate a potentially dangerous situation. Failure to observe this safety information could result in death or severe injury. The text may state the hazard, how to avoid the hazard, and the result if not followed. The bolt is for electrical warnings; the exclamation point is for general warnings.



**NOTICE – Equipment damage or loss of data.** This symbol indicates a potential for equipment damage, loss of data or another unintended outcome. Failure to observe this 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.

## Potential safety hazards for this equipment

The XFC<sup>G5</sup> and XRC<sup>G5</sup> use nominal 12 Vdc voltages in the range of 9 Vdc to 15.5 Vdc. There are no hazardous voltages present in the device. However, some optional power sources may convert power from Vac to Vdc.

Pressurized natural gas is present in the measurement pipeline. Natural gas may escape from the pipeline during installation, calibration, or following damage to the pipeline. Only properly trained and authorized personnel should work in hazardous locations.

There are no chemical or burn hazards. Personal Protection Equipment is not required



**WARNING – Bodily injury:** Apply power only after the procedures are complete. Technicians must perform the procedures in order: plan, install, wire, verify the power-on sequence, and configure.



**WARNING – Bodily injury:** Read and follow instructions contained in this guide and on warning tags on the equipment before and during equipment installation. Failure to do so could result in bodily injury or equipment damage.



**WARNING – Bodily injury:** Ensure there is no hazardous atmosphere present when performing maintenance on the unit. Do not separate components when energized. This applies to all connectors and connections, cabling and wiring.



**WARNING – Equipment damage:** Potential electrostatic charging hazard: clean only with damp cloth.

# 1 System Description

This section introduces the Totalflow® fifth Generation XSeries flow computers (XFC<sup>G5</sup>) and remote controllers (XRC<sup>G5</sup>).

The XSeries<sup>G5</sup> devices are low power, microprocessor-based units designed to meet a wide range of oil and gas applications. The devices have built-in, pre-engineered applications for data collection, trending and long-term data storage. The units are extendable; they support hardware expansion and modular applications that can be enabled as needed.

## 1.1 XSeries<sup>G5</sup> enhancements and backwards compatibility

The XSeries<sup>G5</sup> products provide additional features, upgraded hardware and embedded software technology while maintaining full backward-compatibility with the XSeries<sup>G4</sup>.

The following table highlights the enhancements of this new product generation. This list applies to both the XFC<sup>G5</sup> and XRC<sup>G5</sup> models. Backward compatibility ensures minimal impact on the operation and management of devices. Upgrade or replacement to XSeries<sup>G5</sup> or management of sites with a combination of product generations should be seamless.

Table 1-1: XSeries<sup>G5</sup> product enhancements and backward compatibility

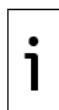
XSeries <sup>G5</sup> System feature or component	Enhancements/changes	Backward compatibility/retained features
<b>Enclosure</b>	Enclosure doors looks updated (aesthetic change only)	Same models and configurations (identical form factor) available per device-type.
<b>Electronic board design</b>	Updated microprocessor, includes supercapacitor for persistent memory backup in the event of power removal/loss	Same form factor, common and device-specific board components and interfaces on same locations and with same identification per board type
	Locking-type cable connectors: latches secure connections, preventing loose contact or inadvertent disconnection.  All cable connectors are compatible with existing cables except the Keypad. If using the keypad connector, order the cable required.	
<b>Local communication options</b>	Additional wireless options: Wi-Fi, Onboard Bluetooth (antenna certification is pending for IECEx and ATEX.)  Onboard support for antenna connection, single antenna supports both Wi-Fi and onboard Bluetooth  Ethernet port upgrade to 10/100Base-T, Full Duplex	USB, MMI (RS-232), Bluetooth with USB dongle
<b>Input/Outputs</b>	Hardware-selectable Pulse Input voltage range options using onboard switch	Same onboard I/O count per device type Same I/O expansion interface to support TFIO modules Same connector/terminal type and pinouts per device type
<b>Cold boot process</b>	Hardware-based cold boot using onboard switch	Cold boot from the user interface (PCCU)

XSeries <sup>G5</sup> <b>System feature or component</b>	<b>Enhancements/changes</b>	<b>Backward compatibility/retained features</b>
<b>Real time clock backup</b>	With lithium battery Without Lithium battery, clock keeps operating for up to 24-48 hours after power is removed and without lithium battery	Backup with lithium battery activated with onboard switch
<b>Memory backup</b>	Solid state persistent storage backup (by super capacitor)	
<b>Embedded software</b>	Updated to a Linux-based operating system (OS)	Upgradable Seamless support for all Totalflow applications Backward-compatible protocol transactions for all supported measurement applications, trending applications, and alarm logs, etc. Register-based transaction Support for XFC <sup>G4</sup> and XRC <sup>G4</sup> configuration files.

## 1.2 Embedded software (overview)

The XSeries<sup>G5</sup> embedded software is modularized and flexible. The software includes a complete suite of applications, each of which can be activated and configured to meet specific functionality requirements or disabled to reduce allocation of system resources. XSeries<sup>G5</sup> devices ship with default standard applications required for basic system operation and local communication. Additional applications can be enabled at the factory, per request, or activated later by the customer.

While both the XFC<sup>G5</sup> and XRC<sup>G5</sup> support the same suite of embedded Totalflow applications, they are designed for different field scenarios and implementation scope. The type and number of applications enabled in each device type will vary depending on the site scenario. The following sections describe device-specific functionality and typical use.



**IMPORTANT NOTE:** This manual does not provide an exhaustive list and description of all the applications available. For detailed application description see PCCU online help topics. Each application has context-sensitive help for each of its related configuration/monitoring screens.

Data retention (may be limited by file space on the device) values are set to:

- 40 days of hourly log period data records
- 50 days of daily data records
- 200 event registers

### 1.2.1 Operating system

The XSeries<sup>G5</sup> devices use a thread priority preemptive real-time operating system (OS) (Linux-based). This design prioritizes real-time functionality (measurement and control applications) before executing non-real-time functionality (post measurement data processing and file system access).

The OS file system is composed of a RAM file system and an eMMC data journaling file system. The applications access the RAM file system, which provides increased performance. The RAM file system is backed up into the eMMC file system for the following triggers:

- One time per minute on the fourth second of each minute
- Before all warm restarts (triggered from PCCU32 Station Setup, terminal mode, PCCU32 device loader, or reset button)

A large capacitor provides power for 2.5 seconds to the system in the event of a power loss. This allows the software to safely shutdown the eMMC file system. The system data not backed up by the one-minute periodic update will be lost.

### 1.2.2 XFC<sup>G5</sup> functionality

The ABB Totalflow® XFC<sup>G5</sup> flow computer is extremely accurate and reliable with the capability to measure and monitor gas flow in accordance with AGA, API, and ISO standards.

What are the typical scenarios other than custody transfer?

The table below lists the six XFC<sup>G5</sup> models available. They are engineered to be flexible and enable increased productivity and improved asset utilization. These different models provide different enclosure size options for small- to large-scale implementations and space for additional equipment and expansion of I/O capability.

All models support single or multi-tube capability (single or multiple wells) with custody transfer measurement features. The XFC<sup>G5</sup> integrates a multivariable sensor for a single tube. Additional tubes require the connection of external multivariable transmitters, but the Totalflow application suite allows the activation of additional tube applications as needed.

By default, the XFC<sup>G5</sup> stores daily and log period records over a 40-day period and logs 200 events. These defaults can be extended and are limited only by the file space on the device.

Two versions of the integrated multi-variable sensor (XIMV) 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.

Table 1-2: XFC<sup>G5</sup> applications

XFC <sup>G5</sup> Model	Scope	Typical applications/monitoring (See Help Files)
<b>6410, 6413 and 6713</b>	Small, medium, and large scale for Differential (orifice) meters	AGA-3 options for flow rate and volume calculations Maintain alarm history for: Differential pressure (DP), average Static Pressure (SP), average flowing temperature (Tf), accumulated volume and energy
<b>6411, 6414 and 6714</b>	Small, medium, and large scale for Pulse (linear) meters	AGA-7 options for flow rate and volume calculations Maintain uncorrected volume accumulator

### 1.2.3 XRC<sup>G5</sup> functionality

The ABB Totalflow® XRC<sup>G5</sup> remote controller is a highly customizable device which can be used in a wide range of applications: control automation, monitor, alarming and measurement applications. The device is optimized for use in oil and gas production, transmission, and distribution, site monitoring and control, but can also have application in water and waste system and monitoring, etc.

Four XRC<sup>G5</sup> models are available: 6490, 6790, 6890 and 6990. They are engineered to be flexible and enable increased productivity and improved asset utilization. These different models provide different enclosure size options for small- to large-scale implementations and space for additional equipment and expansion of I/O capability.

In addition to the default Totalflow applications, the XRC<sup>G5</sup> is the ideal system for custom programming of advanced control or shutdown logic. Custom programming is supported with IEC 61131 applications.



**IMPORTANT NOTE:** XSeries<sup>G5</sup> devices support several IEC application types. ABB-built IEC applications are available off-the-shelf or can be designed upon request. Customer-built IEC applications (developed by the customer or other third-party IEC programmers) are also supported. All IEC applications must be properly licensed. Required license credits depend on IEC application type.

Table 1-3: XRC<sup>G5</sup> applications

XRC <sup>G5</sup> Model	Scope	Typical applications/monitoring (See Help Files)
<b>6490, 6790, 6990</b>	Small/medium scale	Default Totalflow applications: Valve control, Plunger lift, etc. Custom control applications: ABB-built IEC applications
<b>6890</b>	Large scale	Same as above

## 1.2.4 XSeries<sup>G5</sup> calculation methods

The records and statistics generated are based on the following calculation methods of the XSeries<sup>G5</sup>:

- Calculation of flow rates and volumes is in accordance with AGA 3-85, AGA 3-92, AGA 3-2012, 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:  $\sqrt{\frac{DP * SP}{Tf + 459.77}}$ , 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:  $\sqrt{\frac{DP * SP}{Tf + 459.77}}$
- 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.

## 1.2.5 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).

The event/change, alarm, and system logs provide event, error, or alarm messages logged by active applications or by the system. These files are stored with the running configuration data (tfData).

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

## 1.2.6 Applications

The following applications are available to add and activate to the XSeries<sup>G5</sup>. The applications are identified for use in the United States (US) or they are selectable (SU).

\*US - Standard System: standard or customary system of measurement (also called the English, Imperial or American) is the most commonly used system of measurement in the United States.

\*SU – Selectable Units: pressure controllers and pressure transducers have dedicated pressure sensors that are referenced to absolute, gauge or differential pressure. Engineering units may be changed within these pressure types.



**IMPORTANT NOTE:** Use the following steps to determine supported XSeries<sup>G5</sup> applications.

1. Launch PCCU and click Entry to connect with the XSeriesG5 device in Entry mode.
2. Click Application/License Management>Credit/App Info to display the most up-to-date XSeriesG5-supported applications.
3. Click Help for additional information.

Table 1-4: Applications available with XSeries<sup>G5</sup>

<b>Application</b>	<b>XSeries - US</b>	<b>XSeries- SU</b>
AGA-3 Measurement	X	
AGA-7 Measurement	X	
Alarm System	X	X
Analysis Trend File	X	X
API Liquid SU	X	X
Communications	X	X
Coriolis Interface	X	X
Coriolis SU	X	X
Display XSeries	X	X
ENRON Interface	X	X
Facility Management App	X	X
Gas Lift	X	X
Gas Orifice SU		X
Gas Turbine SU		X
Holding Registers	X	X
Host Interface	X	X
I/O Interface XSeries	X	X
IP Multiplexer	X	X
LevelMaster	X	X
NGC Client	X	X
NIST14 Gas SU	X	X
NIST14 Liquid SU	X	X
Nozzle SU	X	X
Oil Transfer Measurement	X	X
Operations	X	X
Pad Controller	X	X
PID Controller	X	X
Plunger Control	X	
Plunger SU		X
Pulse Accumulator	X	X
Pump Interface	X	X
Shutdown System	X	X
System	X	X
TFWeb Server	X	X
Therms Master	X	X
Therms Slave	X	X
Trend System	X	X
Units Conversion	X	X
Valve Control	X	X
V-Cone Measurement	X	
V-Cone SU		X
Wedge Gas SU	X	X
Wireless Remote I/O	X	X
XMV Interface	X	X

## 1.2.7 Display application

The Display application is used to program the XSeries<sup>G5</sup> LCD (See section [1.3.2 Liquid Crystal Display \(LCD\) assembly](#)). It is one of the standard applications enabled at the factory. During operation, the

display application manages the continuous display of operating parameters, status, alarm, or unusual conditions on the LCD. Displayed parameters and other indicators help operators obtain quick visual information on the status and health of the system. Displayed values scroll in the LCD at programmable time intervals and duration.

You can customize the basic factory default LCD configuration. For example:

- Change the default parameter display time of 5 seconds (value range: 1 to 255 seconds)
- Add/define additional applications and their parameters for additional monitoring
- Activate additional annunciators or alarm indicators and assign to desired applications



**IMPORTANT NOTE:** PCCU provides online help topics for the Display application. Click **Help** from any of the display application screens for configuration information.

For default parameters, see the table below. For default annunciators, see section [12.1 LCD visual alarm and status codes](#).

Table 1-5: Default display parameters

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

## 1.2.8 Configuration files

The configuration files contain application and parameter settings which define how the device operates. The XSeries<sup>G5</sup> device contains the following configuration files:

- Factory configuration is the ABB default configuration, or a customer-specific configuration programmed into the factory folder during final assembly. The factory configuration is read-only and stored in persistent memory. It can only be updated at the factory.
- Startup (cold) configuration is used for a cold restart of the device or when a configuration package is sent to the device by the PCCU loader. The startup configuration is stored in the tfCold directory and can be modified or updated as needed.
- Running (warm) configuration is used by the device during normal operation. The running configuration is stored in the tfData directory and can be modified or updated as needed.

### 1.2.9 Customer data collection files

The customer data collection files contain all the measurement and calculation data the XSeries<sup>G5</sup> generates. These data files are in the tfData directory with the running configuration files. The type and amount of collection data depends on the number and type of applications active on the controller.



**IMPORTANT NOTE:** The tfData directory also contains trend data for the applications and calibration files if the controller has been field-calibrated.

### 1.2.10 Licensing

Device operation requires licensed applications. ABB provides a secure USB flash drive with the application licenses in the form of credits. Required credits depend on the application type. XSeries<sup>G5</sup> devices ship with the standard applications required for basic system operation (free of charge) and 4 non-removable general credits (included in the base price). Additional general or explicit (custom) applications require additional credits. Depending on the purchase order, additional application credits may already be available on the device. Check the credits available on the device. If there are not enough credits, use the credit key to transfer credits for all required applications. Call the ABB main office listed on the last page of this manual to purchase additional credits as needed.



**IMPORTANT NOTE:** Detailed information on application licensing is included in the PCCU online help. Select the **Application/ License Management** tab and click **Help** for more information.



**IMPORTANT NOTE:** The only program that can write to or read the USB flash drive is PCCU32. Install the credit key on each available USB port if the same USB port will not be used each time the credit key is inserted.

To determine if additional credits must be purchased:

1. Launch PCCU and click **Entry** to connect with the controller in Entry mode.
2. Click the top item on the navigation tree, then click **Application/License Management**. The Application/License Management tab displays.
3. Click **Credit/App Info** to display the Applications Credits Information screen. Locate the application on the list. Then view and take note of the required credit type for that application.
4. Click **Close**. The Application/Licensing Management tab redisplays.
5. View available and surplus credits in the Device Credits window.
6. Insert the key USB flash drive in one of the laptop's USB ports.
7. View available credits in the Key Credits window.

If the credits on the device or the key are insufficient or not of the required type, call the ABB to purchase additional credits. See [Contact us](#) on the last page of this manual. Request the specific type of credit you need and the number of credits.

### 1.2.11 Additional features

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

- Programmable differential pressure no flow cutoff

- Programmable secure access 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 (XFC)
- Quick, simple calibration procedures for the transducer in the XFC<sup>G5</sup>
- Real-time clock providing a highly stable time base for the system

## 1.3 Hardware overview

### 1.3.1 Enclosures

There are different enclosure sizes available depending on the customer needs for battery size, TFIO modules, additional equipment and connections.

Figure 1-1: XFC<sup>G5</sup> inside the enclosure



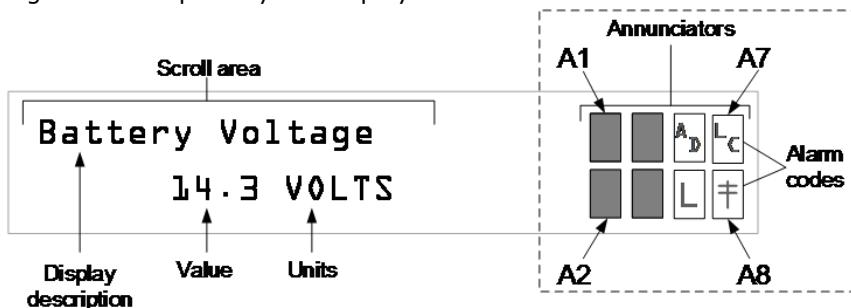
Figure 1-2: XRC<sup>G5</sup> inside the enclosure



### 1.3.2 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 XSeries<sup>G5</sup> electronic board. The function of the LCD assembly is to provide complete volume and operational records. During operation, the front panel LCD continuously scrolls through the operating parameters, status information, and alarm or unusual conditions. The definition of application parameters and annunciators is customizable. See section [12.1 LCD visual alarm and status codes](#) for details.

Figure 1-3: Liquid Crystal Display and annunciators



### 1.3.3 Integral multivariable (XIMV) assembly

The External Integral Multi-Variable (XIMV) contains circuitry for processing all analog measurements and provides the primary measurement capability for the XFC<sup>G5</sup> flow computer. The unit is designed to provide EMI/RFI protection of the low-level signals and to protect the circuitry from other environmental effects. The XIMV contains a single circuit board which contains the analog to digital converter and analog conditioning circuitry necessary for the XIMVs, the RTD and two general purpose analog inputs.

Because the XIMV is characterized over temperature at the factory, the unit is not field-repairable. All repairs should be performed at an authorized Totalflow service center or returned to the factory. The XIMV is characterized over temperature so that any changes occurring in the XIMV or in the electronics can be compensated.

The XIMV always measures static pressure on the high side. The XIMV can be ordered from the factory with the XIMV unit rotated on 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.



**IMPORTANT NOTE:** For clarity, the XIMV is a multi-variable transducer (includes a static pressure cell, a differential cell and an RTD input). The XIMVs new technology offers high accuracy, better linearity and better overall performance over the previous equipment.

### 1.3.4 Electronic board

The electronic board on the XSeriesG5 devices is mounted on the inside of the enclosure door. Both the XFCG5 and XRCG5 boards have modular terminal connectors for onboard I/O and serial communication wiring, interfaces for: I/O expansion, external local ports, LCD, and optional keypads supported on some models.

Figure 1-4: XFC<sup>G5</sup> Electronic board

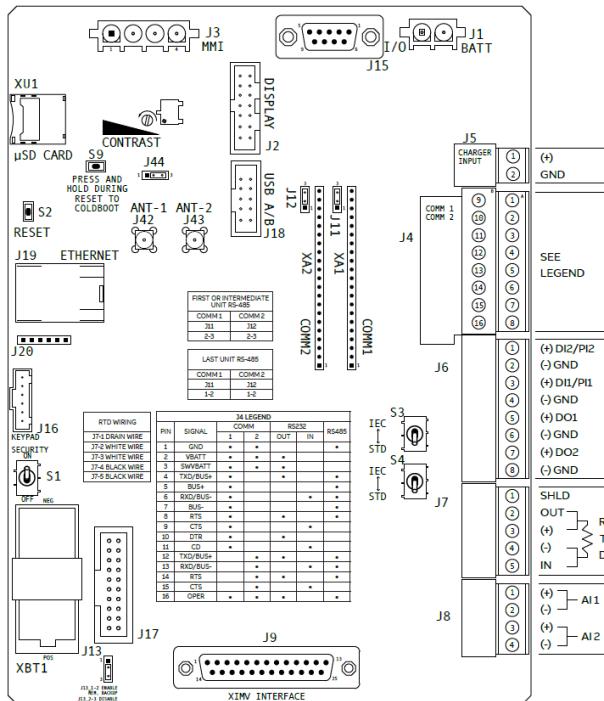
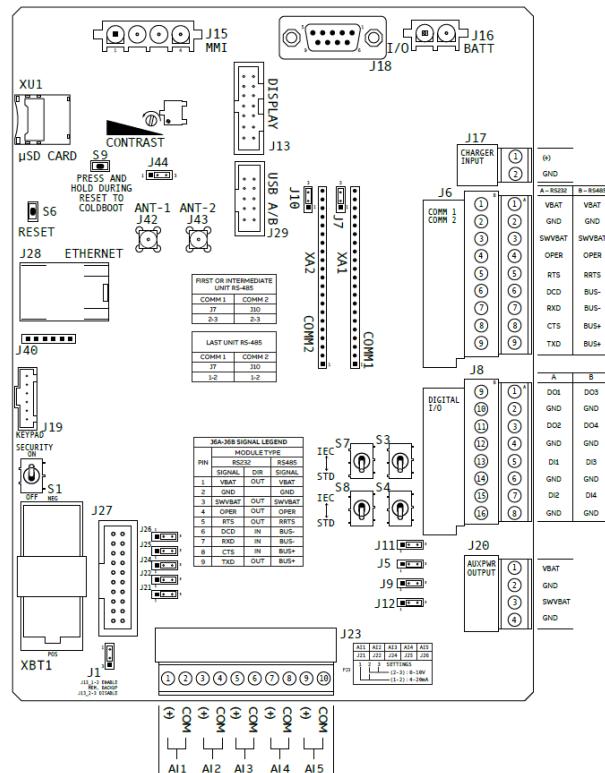


Figure 1-5: XRC<sup>G5</sup> Electronic board



### 1.3.5 Communication connections

Communication interfaces or ports connect the XSeries<sup>G5</sup> device with host systems or external devices. Some factory pre-configured ports support typical communication scenarios and are enabled at the factory. Other options must be enabled and configured during initial startup and configuration. Several communication protocols are available and supported by the ports.

#### 1.3.5.1 Local communication

Ports configured for local communication (direct connection) support local access from a host system for setup and maintenance purposes.

The XFC<sup>G5</sup> and XRC<sup>G5</sup> support several local communication options (Table 1-6):

- For wired connections (requiring physical cables for connection): MMI, USB, and Ethernet
- For wireless connections, there are two options: Wi-Fi and Bluetooth.

Ethernet, Wi-Fi and Bluetooth are disabled by default. Users can enable them after installation and startup if using any of these interfaces.



**IMPORTANT NOTE:** Wi-Fi and Bluetooth (onboard mode) require the installation of an antenna on the XSeries<sup>G5</sup>. See [Additional information](#).



**IMPORTANT NOTE:** External connectors (MMI, USB, Ethernet) are weather-proof only when not connected. Use these ports only for local communication for setup and maintenance purposes, never for permanent field connections.



**DANGER – Serious damage to health / risk to life.** Do not use the MMI port, USB port or connect any USB dongle to the USB port when an explosive atmosphere is present.

Table 1-6: Local communication ports/wireless support (local operator access)

Port/Interface	Connector to use	Connection type
<b>MMI</b>	External, weather-proof circular military-type connector on the side of enclosure	Local serial communication (RS-232)
<b>USB</b>	External, weather-proof connector on the side of enclosure, USB type B	Local communication (high-speed serial local operator interface)
<b>ETHERNET</b>	External, weather-proof connector on the side of enclosure, RJ-45	Local communications (high-speed TCP/IP-based local operator interface)
<b>Wi-Fi (Access Point)</b>	Not applicable, wireless	Local communication with Wi-Fi clients (high-speed TCP/IP-based local operator wireless access)
<b>Bluetooth (onboard)</b>	Not applicable, wireless Bluetooth functionality integrated onboard	Local communication with Bluetooth clients (operator access) Onboard Bluetooth connections require an antenna.
<b>Bluetooth (USB dongle)</b>	Use USB port (Bluetooth-to-USB dongle connects to USB port)	Local communication with Bluetooth clients (operator access) Bluetooth-to-USB dongles (adapter) have the antenna integrated. No additional antenna needed.

### 1.3.5.2 Remote serial communication

Ports configured for remote serial communication connect the XSeries<sup>G5</sup> device to a communication network and allow remote access or management over that network.

**IMPORTANT NOTE:** Connections on serial ports require communication modules for the correct serial interface type (RS-232, RS-422 or RS-485).



Devices with standard configuration ship with COMM1 already pre-configured for remote communication. COMM2 can also be configured to support remote serial communications if needed, provided that the correct module type is also installed. COMM2 is typically left as spare to support serial connections with measurement equipment.

Table 1-7: Serial remote or local connections (COMM ports)

Port/Interface	Connector to use	Connection type
<b>COMM 1, or COMM 2</b>	Internal (need access to electronic board to wire) Removable terminal connectors blocks (XFC <sup>G5</sup> : J4, XRC <sup>G5</sup> : J6), screw termination. Wire gauge 12 AWG to 22 AWG	Remote serial communication for remote access to the device (typical equipment are radios, legacy serial communication devices)

### 1.3.5.3 Network communication (Ethernet)

The Ethernet interface can be configured for remote network communication. Ethernet connects the XSeries<sup>G5</sup> device to a communication network and allows remote access or management over that network.

**IMPORTANT NOTE:** XSeries<sup>G5</sup> devices have only one Ethernet interface. If the device is configured and connected for network communication, direct connection to the Ethernet port for local access is not supported without disconnection from network. Use other options for local access in this case.

The default Ethernet configuration supports direct connection for local communication. To support a network connection, Ethernet requires the change of the default configuration to one valid for the network.

Table 1-8: Network connection (Ethernet)

Port/Interface	Connector to use	Use (connections)
ETHERNET	Permanent Ethernet connections should use the internal Ethernet connector (Onboard RJ-45).	Remote communication using TCP/IP connections over a network (management port)

## 1.4 User interface software description: PCCU32

The PCCU32 software running in a Windows® environment is the main user interface to the XSeries<sup>G5</sup> device. PCCU32 supports several view levels and can be configured to provide role-based secure access to the device for the following tasks:

- Initial configuration and commissioning (setup)
- Operation and performance monitoring
- Adding, configuring and optimizing applications (configuration, customization)
- Calibration
- Data collection
- Device configuration backup
- Device software updates
- Application licensing
- Report view and generation
- Troubleshooting

PCCU32 supports local or remote connections with the XSeries<sup>G5</sup> device over serial (RS-232), USB, Ethernet, or wireless (Bluetooth/Wi-Fi) interfaces.

**IMPORTANT NOTE:** PCCU32 includes context-sensitive online help topics for most screens. Topics contain parameter and function description as well as step-by-step instructions. Additional information or reference topics may be available for complex functions. Click **Help** from the screen of interest to display its associated topic.

## 1.5 Power supply equipment

The XSeries<sup>G5</sup> supports the following power configurations:

1. 12V Battery and 12V Solar Panel
2. 12V Battery and External DC power supply connected to the charger input connector, voltage set to 14.5V to 15.5V, power supply must be rated for 2A minimum.
3. External 12Vdc to 14Vdc power connected to the Battery input connector.

**IMPORTANT NOTE:** The XSeries<sup>G5</sup> 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, and other information.

### 1.5.1 Battery and charger power configurations

The battery mode consists of the 12-volt battery and a charger. The configuration depends on the type of charger used: a solar panel charger or a power supply used as charging source.

<b>i</b>	<b>IMPORTANT NOTE:</b> Battery sizes vary between 8 and 26 ampere hours, depending upon installation requirements. The battery can be model-option specific, including larger battery sizes.
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Table 1-9: Battery power mode connections

Port	Connector to use	Connection type
BATT	XFC: J1 XRC: J16	Connect to the 12-volt SLA Battery
CHRG	XFC: J5 XRC: J17	Connect to: Solar panel or DC power supply charging source

#### 1.5.1.1 12-volt battery with solar panel configuration

This battery-powered configuration includes a 12-volt sealed lead acid (SLA) and a solar panel as the charger. Solar panel chargers are available in 10, 20, and 30-watt kits.

The battery is installed inside the enclosure. The solar panel mounts on the enclosure mounting pipe or on the roof of a nearby structure.

#### 1.5.1.2 12-volt battery with power supply configuration

This battery-powered configuration includes a 12-volt sealed lead acid (SLA) and a DC power supply as the charging source. The power supply must be set to 14.5 to 15.5 Vdc and must be rated for 2A minimum.

### 1.5.2 External power supply configuration

The external power supply configuration includes a power supply as the power source to the device. The voltage range must be from 12Vdc to 14Vdc.

<b>i</b>	<b>IMPORTANT NOTE:</b> Power supplies can be installed outside or inside of enclosures. Power supplies that are installed inside must be ABB-approved and must fit in the selected enclosure. Verify the options available for your enclosure size and requirements.
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Table 1-10: External power supply mode connection

Port	Connector to use	Connection type
BATT	XFC: J1 XRC: J16	Connect to external power supply
CHRG	NOT USED	NOT USED

## 1.6 Resistive Temperature Detector (RTD)

The RTD is a separate sensor which provides the temperature inputs to the XFC<sup>G5</sup> IXMV or external measurement transmitters. This is a 100 Ω platinum RTD designed to measure the real-time flowing temperature of the process gas. The XFC<sup>G5</sup> electronic board supports a dedicated input terminal for connection with an RTD.

<b>i</b>	<b>IMPORTANT NOTE:</b> The XRC <sup>G5</sup> electronic board does not have an integrated multivariable measurement system or a dedicated RTD input port. RTDs are used in conjunction with external measurement transmitters which connect to other communication interfaces on the XRC <sup>G5</sup> . Support of additional tubes on the XFC <sup>G5</sup> also requires external transmitters and additional RTDs.
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## 2 Site planning and requirements

The XFC<sup>G5</sup> and XRC<sup>G5</sup> enclosures, power sources, wiring, and location must comply with the specifications described in this section.

The installation of the meters, senior fitting, tap valves, or other peripheral equipment, is outside the scope of this document.

PCCU32 is required for initial configuration and to place the device in service. Download the correct PCCU32 version. Versions older than 7.65 are not compatible with XSeries<sup>G5</sup> devices.



**WARNING – Bodily injury:** Select compliant equipment listed in this section. Carefully review the specifications. Failure to comply with these specifications may create unsafe conditions, resulting in bodily injury and equipment damage.



**NOTICE – Equipment damage or loss of data:** Equipment damage or loss of data. Customers who supply their own ancillary equipment must ensure that equipment is compliant with the requirements in this document.

### 2.1 Enclosures

The aluminum enclosure consists of a hinged-door box. The enclosure is rain-proof; it has a corrosion-resistant seal between the outside elements and the components. It is rated TYPE 3R or IP54.

Plan the installation based on enclosure dimensions and battery weight per model. For details on the enclosure weight and specifications, refer to the Data Sheets.

### 2.2 Power requirements

Plan the power equipment installation based on the requirements for the power source selected. ABB-approved battery/charger systems and external power supplies are available. See section [1.5 Power supply equipment](#) for details. Space and materials should be available for power equipment installed outside of the enclosure.

### 2.3 Location specification and design

Determine the device installation location. Review the options in [3 Installation](#).

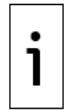
Ensure the required mounting kits and materials are available.

The installation location must allow access to the XFC<sup>G5</sup> or XRC<sup>G5</sup>, power sources, cables, and connections. More information is available in section [3 Installation](#).

For solar panel use, determine where and how to install the solar panel outdoors. For optimum charging, avoid placing the solar panel where it will be in shadow any part of the day. More information is available in section [4.2 Install the solar panel](#). Section [3 Installation](#) describes the installation of the power equipment. All wiring must be complete before the device is energized.

### 2.4 Wiring requirements

All onboard screw terminal connectors support a wire gauge range of 12 AWG to 22 AWG.



**IMPORTANT NOTE:** The smaller the wire gauge, the larger the wire size. If terminal pins may connect to more than one wire, select appropriate wire size to ensure the terminal contact can accommodate the wires.

Select the wire gauge compliant with the local electrical code for the type of signal on the connection, voltage and current load, and wire length.



**WARNING – Bodily injury:** Area classification requirements determine electrical wiring installation. For more information, refer to the certification drawing indicated on the device's name tag, and national and local codes.

## 2.5 Download PCCU

PCCU is routinely updated to reflect new features and bug fixes. If you already have PCCU installed, make sure that the version supports the XSeries<sup>G5</sup> devices (PCCU 7.65 and later). To review versions available and release notes for information on equipment supported, visit [www.abb.com/upstream](http://www.abb.com/upstream). If you determine that you need to install a new version of PCCU, follow the procedures in this section.

ABB makes the software available online in compressed format. You must download the software from the ABB library or as directed by ABB technical support personnel. PCCU must be installed in the laptop that will be used to connect to the device in the field. We recommend you obtain the software prior to field installation in case you are unable to access online ABB resources from the field.



**IMPORTANT NOTE:** If you are unable to locate or download the PCCU software or need assistance during its installation on your laptop, call ABB technical support. See [Contact us](#).

To download or review release notes for the latest PCCU32 version:

1. Go to [www.abb.com/upstream](http://www.abb.com/upstream).
2. Scroll down the main page and locate User interface.
3. Select **PCCU**. The Local configuration and collection (PCCU) page displays.
4. Scroll down, locate, and select the **Downloads** tab.
5. On the navigation pane, scroll down, locate, and select the software category. The list of available versions displays.
6. Locate and select the required version and release notes.
7. Click the **ZIP** icon to download the software.
8. Save the file in the desired laptop directory.

### 2.5.1 Install PCCU

To install PCCU:

1. Unzip the PCCU file downloaded in section
2. Locate and select the **install.exe** to begin installation.
3. Follow the install wizard instructions.

## 3 Installation

The XFC<sup>G5</sup> and XRC<sup>G5</sup> can be pipe-mounted or wall-mounted, or direct-mounted to the meter run.



**IMPORTANT NOTE:** Do not direct-mount the larger enclosures (for XFC<sup>G5</sup> – 6713, 6714 and for XRC<sup>G5</sup> – 6790, 6890).

### 3.1 Assumptions

The following is assumed:

The XFC<sup>G5</sup> and XRC<sup>G5</sup> are designed to adapt to different site scenarios. This guide covers a standard single-tube configuration for the XFC<sup>G5</sup> flow computer for a common site scenario which requires:

- Mounting kit
- Resistance temperature detector (RTD)
- Solar panel charger and mounting kit

This guide assumes an orifice plate as the meter element. The XFC<sup>G5</sup> and XRC<sup>G5</sup> support other meter types.

### 3.2 Required tools and materials

To perform installations and tests, the following tools and materials are required:

Pipe mount installation:

- One (1) enclosure mounting kit (includes instructions, brackets, U-bolts and fastening hardware)
- One (1) pipe saddle with mounting hardware (size determined by technician)
- One (1) 2-inch x 40-inch pipe (length may be extended if mounting a solar panel).
- EFM plus bolts and washers
- 5-valve manifold
- 2 stabilizers (futbols) plus bolts and washers

Wall mount installation:

- One (1) enclosure mounting kit (includes instructions, brackets, U-bolts and fastening hardware)
- Four (4) wall fasteners (length and girth determined by technician based on wall thickness and materials)
- EFM plus bolts and washers

Direct mount installation for XFC<sup>G5</sup>:

- One (1) enclosure mounting kit (includes instructions, brackets, U-bolts and fastening hardware)

Install input lines and manifold:

- Stainless steel tubing (length determined by technician)
- Four (4) sets of tube fittings, including ferrule and nut pairs
- One (1) manifold (3-valve or 5-valve manifold, determined by technician)

Leak-test manifold and tubing connections:

- Liquid leak detector
- Pressure calibration device

Install and wire the RTD to the XFC<sup>G5</sup>:

- RTD probe with cable and cable gland installed (probe and cable length determined by technician)
- Nylon tie wraps

Antenna installation:

- Refer to: XSeries<sup>G5</sup> Wi-Fi Kit 2106049AIAA

Solar panel installation:

- 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

Install the battery:

- One (1) battery with cable attached

### 3.3 Unpack and inspect

The XFC<sup>G5</sup> and XRC<sup>G5</sup> and additional parts ship in a specially-designed shipping carton with a Quick start guide, Safety and compliance notice, and packing list.



**IMPORTANT NOTE:** Inspect the contents for damage before discarding the shipping and packing materials.

Unpack the XFC<sup>G5</sup> or XRC<sup>G5</sup> and inspect for damaged, missing or incorrect parts:

4. Inspect the shipping carton for damage.
5. Carefully remove items from the carton.
6. Keep all shipping materials to return any damaged or incorrect parts.
7. Compare the packing list with the materials received. Check for missing or incorrect parts.
8. Inspect each item for damage: XFC<sup>G5</sup> or XRC<sup>G5</sup> exterior, LCD display, optional equipment if purchased.
9. If there are missing, incorrect, damaged parts or noticeable defects, call the ABB main office number listed in [Contact us](#).



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

### 3.4 Pipe mount installation



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

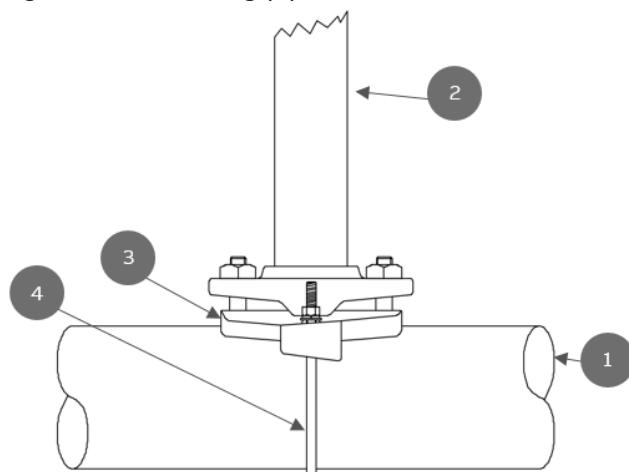
Materials:

- One (1) enclosure mounting kit (includes instructions, brackets, U-bolts and fastening hardware)
- One (1) pipe saddle with mounting hardware (size determined by technician)
- One (1) 2-inch x 40-inch pipe (length may be extended if mounting a solar panel). See [Figure 4-1: Solar panel](#).

Pipe-mount the XFC<sup>G5</sup> (XRC<sup>G5</sup> is similar):

1. Position the pipe saddle on the meter run and temporarily attach the saddle to the meter run pipe using the associated hardware.

Figure 3-1: Mounting pipe



**Legend: Mounting pipe**

<b>1</b>	Meter run	<b>3</b>	Saddle
<b>2</b>	2-inch x 40-inch Mounting pipe	<b>4</b>	U Mounting bolt

2. Screw the mounting pipe into the saddle until it is tight.
3. Level the mounting pipe:
  - a. Level and center the pipe and saddle on the top of the meter run. 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. Tighten the saddle-mounting U-bolt as tight as possible to avoid vibration-related issues.
5. Install the XFC<sup>G5</sup> or XRC<sup>G5</sup> 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.
  - c. Add the flat washer and split washer onto the U-bolt, then screw the nut onto the U-bolt.
  - d. Repeat steps 6a and 6b for the second mounting bracket.
7. Raise the XFC<sup>G5</sup> or XRC<sup>G5</sup> into position on the mounting pipe.



**IMPORTANT NOTE:** Position the XFC<sup>G5</sup> or XRC<sup>G5</sup> high enough to allow some downward slope from the externally mounted manifold to the tap valves.

8. Secure the XFC<sup>G5</sup> or XRC<sup>G5</sup> in place by tightening the U-bolt nuts. This will help to avoid vibration-related issues.

For the XFC<sup>G5</sup>: To install the manifold and connect the input lines to the meter run, see section [3.6 Direct-mount installation](#).

## 3.5 Wall mount installation



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



**IMPORTANT NOTE:** Large enclosures are heavy and bulky. More than one person may be required for installation.

The following steps detail the procedures for wall-mounting the XFC<sup>G5</sup> or XRC<sup>G5</sup> by the meter run.

Materials:

- One (1) enclosure mounting kit (includes instructions, brackets, U-bolts and fastening hardware)
- Four (4) wall fasteners (length and girth determined by technician based on wall thickness and materials)

Wall-mount the XFC<sup>G5</sup> or the XRC<sup>G5</sup>:

Inspect the installation location:

- Verify that the wall has sufficient strength to support the hanging weight of the unit. For details on the enclosure weight and specifications, refer to the Data Sheets.
- Verify that there are no obstructions to prevent opening the enclosure door.
- Verify that there are no obstacles to prevent the solar panels from charging during daylight hours (if installed.)



**NOTICE – Equipment damage.** Screw the mounting bolts into a wall stud or wall support of sufficient strength to support the weight of the XFC<sup>G5</sup> or XRC<sup>G5</sup>.

1. Install the XFC<sup>G5</sup> or XRC<sup>G5</sup> mounting brackets on the back of the enclosure using the pipe mount instructions supplied with the mounting kit.
2. Determine the appropriate mounting height for the XFC<sup>G5</sup> or XRC<sup>G5</sup> to allow some downward slope from the XIMV and manifold to the meter run tap valves. This allows condensate to drain back into the pipe.
3. Drill the upper mounting holes in the wall support.
4. Measure the distance between the top and bottom mounting bracket holes.
5. Locate and drill the lower mounting holes in the wall support.
6. Lift and align the enclosure on the wall so that the mounting bolt holes match the pre-drilled holes.
7. Insert the mounting bolts through the upper bracket holes and screw in the bolts until tight.
8. Repeat this procedure for the lower bracket.

### 3.6 Direct-mount installation

Follow the instructions supplied with the manifold and stabilizer installation kits to mount the XFC<sup>G5</sup> or XRC<sup>G5</sup> directly on the meter run orifice.

Materials:

- One (1) 5-valve manifold
- Two (2) stabilized manifold connectors (compatible with the manifold)

Install the input lines and manifold:

1. Install the manifold on the XIMV using the manufacturer's 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.

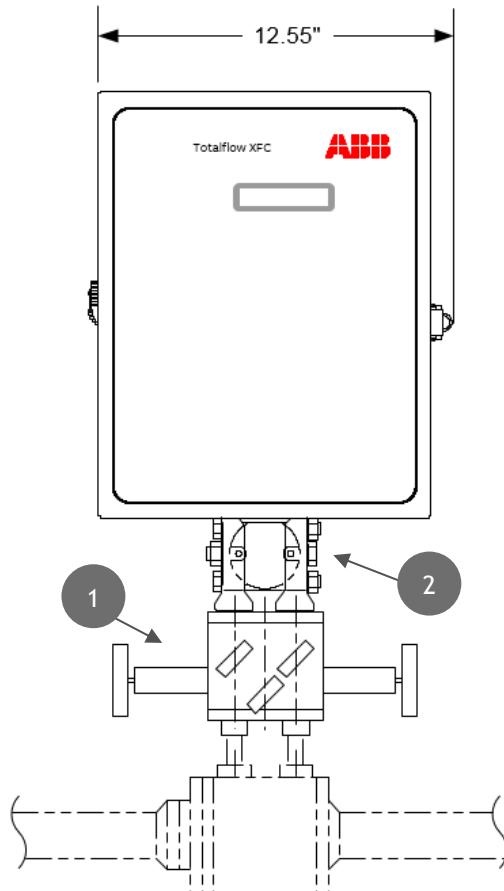


**NOTICE – Equipment damage.** To avoid damage to the stainless-steel tubing, fittings, and valves, always use a backup wrench to stabilize and eliminate tension on both sides of the connection when tightening. Damaged connections may introduce leaks into the system resulting in inaccurate measurement.

5. Insert the ferrule into the fitting and slide the nut onto the ferrule and tighten.
6. Repeat step 5 for each tubing connection point.

Leak-test the manifold and tap valve connections. See section 3.9 [Leak-test manifold and tubing connections](#).

Figure 3-2: XFC<sup>G5</sup> with XIMV attached to a 5-valve manifold



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**Legend - XFC<sup>G5</sup> with XIMV attached to a 5-valve manifold**

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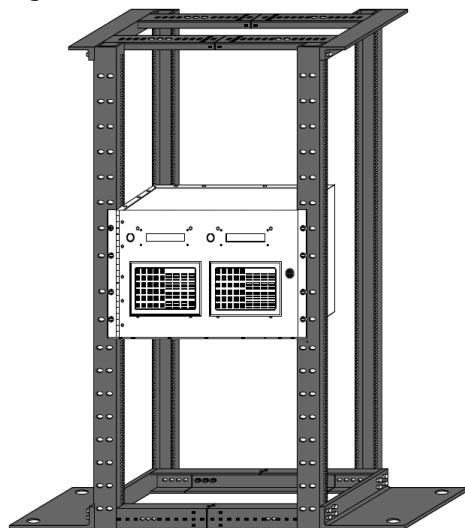
- 1** Instrument manifold, 5-valve
- 
- 2** XIMV
- 

## 3.7 XRC<sup>G5</sup>6990 rack mount installation

### 3.7.1 Overview

The XRC<sup>G5</sup>6990 is intended for rack-mounting. For purposes of these instructions, we assume that the mounting rack is already in place and that instructions are not required for mounting the unit into the rack.

Figure 3-3:XRC<sup>G5</sup> 6990 rack mount



### 3.7.2 Termination panel

User connections to the XRC<sup>G5</sup> 6990 are made on the termination panel on the rear of the enclosure. No internal wiring connections should have to be made by the user. Two termination panels are available, depending upon whether the user ordered a single XRC<sup>G5</sup> 6990 or a Dual Unit with two XRC<sup>G5</sup> controller boards.

Terminal designations on the back panel are identical to designated pin outs on the XRC<sup>G5</sup> main electronic board(s). Any wiring instruction (WI) or User Drawing (UD) applicable to the XRC<sup>G5</sup> will be applicable to the XRC<sup>G5</sup> 6990 but wired to the corresponding plug on the rear of the enclosure. Table 10 shows XRC<sup>G5</sup> jumper/termination panel correlation.

Table 3-1: XRC<sup>G5</sup> Main electronic board to termination panel correlation chart

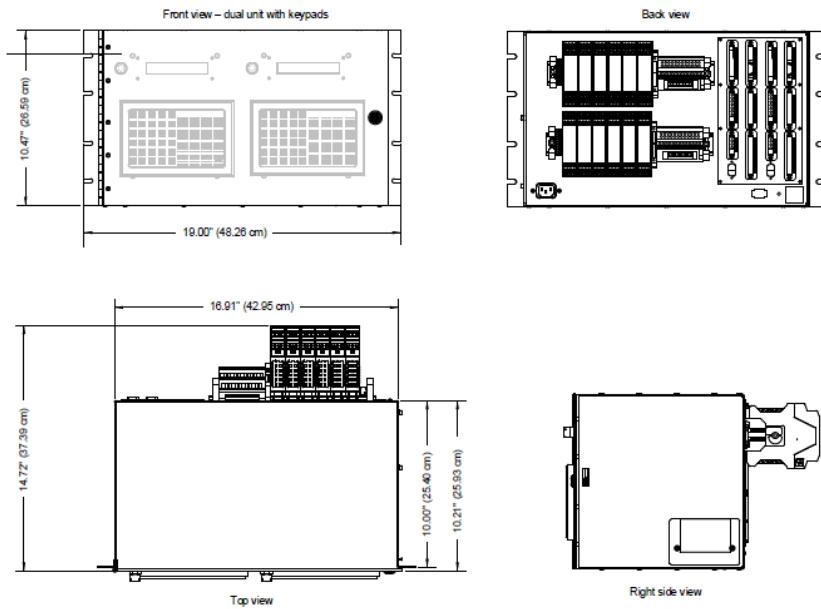
XRC <sup>G5</sup> main electronic board	XRC <sup>G5</sup> 6990 termination panel
J6-COMM1	P6A
J6-COMM2	P6B
J8-Digital I/O A	P8A
J8-Digital I/O B	P8B
J20-AuxPwr Output	P20
J23-Analog Inputs	P23
J18-TFIO Modules	P18

### 3.7.3 Rack mount enclosure

The XRC<sup>G5</sup> 6990 enclosure is designed for 19" rack mount. This enclosure may be configured to house up to two XRC<sup>G5</sup> boards, up to two LCD displays and up to two optional key pads. This unit is not designed for exposure to the elements.

Except for the local PCCU connector, all terminals are located on the back panel of the enclosure.

Figure 3-4: 6990 Rack mount enclosure



## 3.8 Ground equipment

Refer to the requirements of national and local electrical codes for the location. The grounding lug is located on the bottom front of the XFC<sup>G5</sup> or XRC<sup>G5</sup> enclosure.



**WARNING - Bodily injury / Equipment damage:** The equipment must be bonded to an earthing terminal. The bonding conductor must have a cross sectional area of at least 12 AWG or 4mm<sup>2</sup>.

## 3.9 Leak-test manifold and tubing connections

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

Materials:

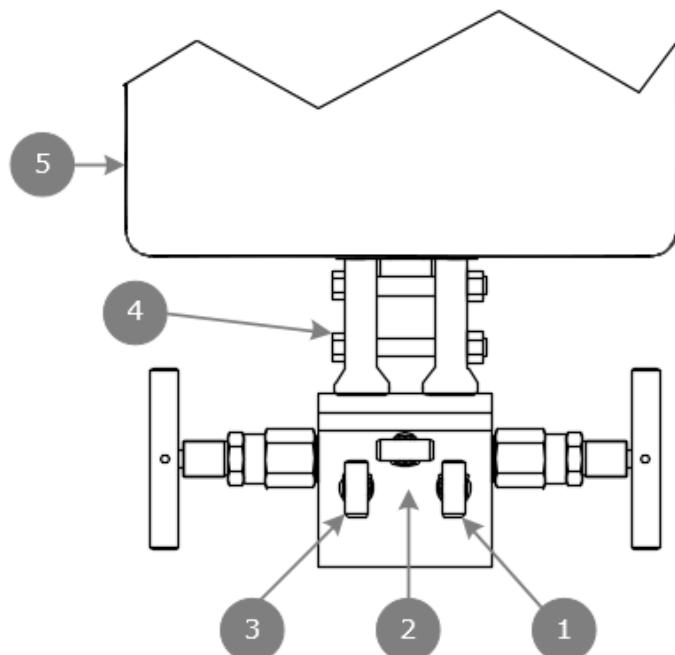
- Liquid leak detector
- Pressure calibration device



**DANGER – Serious damage to health / risk to life.** Manifold and tubing connection leaks could create a build-up of explosive gases. Do not apply power before the tubing and connections are leak-free, and explosive gases have dissipated.

1. Open the equalizer valves (see [Figure 3-5: XFCG5 with XIMV and 5-valve](#) manifold items 1 and 3) and close the manifold vent valve (item 2).

Figure 3-5: XFC<sup>G5</sup> with XIMV and 5-valve manifold



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**Legend XFC<sup>G5</sup> with XIMV and 5-valve manifold**

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<b>1</b>	High side equalizer valve	<b>4</b>	XIMV
<b>2</b>	Manifold vent valve	<b>5</b>	Enclosure
<b>3</b>	Low side equalizer valve		

---

2. Connect the pressure device to the 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



**IMPORTANT NOTE:** Bubbles in the liquid indicate a loose or poor connection.

5. Use a wrench to tighten connections and recheck.



**NOTICE – Equipment damage:** Do not over-tighten the connections.

After verification that all connections are leak-free, proceed to install the RTD.

### 3.10 Install the 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.

The RTD probe measures flowing gas temperature. The following procedure describes:

- Installation of the RTD onto the meter run
- Wiring the RTD leads to the XFC<sup>G5</sup> electronic board



**WARNING: Bodily injury.** Install electrical wiring according to requirements for the area classification. Refer to the certification drawing indicated on the device's name tag, and national and local codes.



**IMPORTANT NOTE:** This procedure applies to the XFC<sup>G5</sup> only. The XRC<sup>G5</sup> does not have onboard support for RTD inputs.

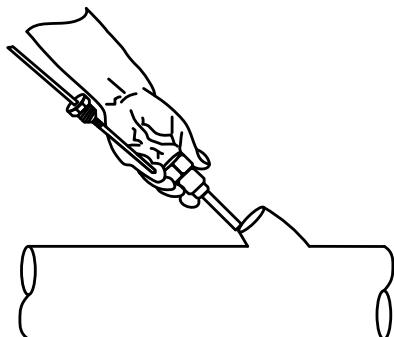
Materials:

- RTD probe with cable and cable gland installed (probe and cable length determined by technician)
- Nylon tie wraps

Install the RTD probe:

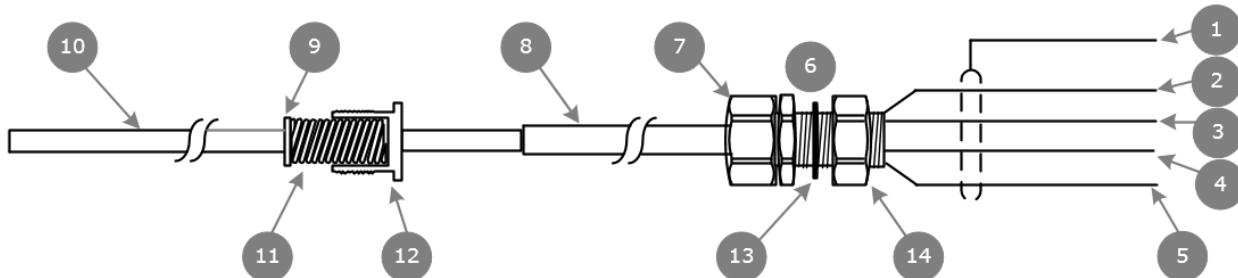
1. Insert the RTD probe into the thermowell to determine the depth setting for the probe spring.

Figure 3-6: Typical RTD installation



2. Use snap-ring pliers to adjust the retaining ring below the spring on the probe. Probe depth should be set so it is spring-loaded against the bottom of the thermowell.

Figure 3-7: RTD probe connector



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**Legend: RTD Probe Connector**

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<b>1</b>	SHLD (Drain wire= Green wire)	<b>8</b>	Cable
<b>2</b>	OUT (White wire)	<b>9</b>	Retaining ring
<b>3</b>	(+) (White wire)	<b>10</b>	RTD probe
<b>4</b>	(-) (Black wire)	<b>11</b>	Spring
<b>5</b>	IN (Black wire)	<b>12</b>	Probe connector
<b>6</b>	Cable gland	<b>13</b>	Nylon sealing ring
<b>7</b>	Cord sealing nut	<b>14</b>	Cable nut

---

- Screw the probe connector into the thermowell.



**IMPORTANT NOTE:** Do not wrap the RTD cable around the pipeline. 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.

Install the RTD cable into the flow computer enclosure:

- Remove the shipping plug from the right side of the flow computer enclosure.
- 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 RTD terminal block (J7).
- Replace the cable nut on the cord and screw the cable nut onto the cable gland inside the enclosure.
- Tighten the cord sealing nut to the cable gland against the RTD cable.
- 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.

### 3.11 Wire the RTD to the XFC<sup>G5</sup>



**WARNING: Bodily injury.** Wire peripheral devices to the flow computer electronic board before power is applied. If the flow computer has been powered-up, disconnect power before performing field wiring.

Wire the RTD:

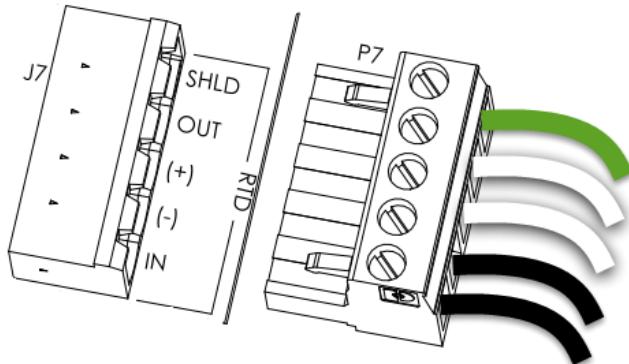
- Open the flow computer enclosure door.
- Using a small slotted screwdriver, remove the RTD terminal connector from the J7 terminal block.
- On the RTD probe wire, remove the spade lugs if installed, and trim the wire cover ends back  $\frac{1}{4}$  inch (6.35 mm).
- Loosen the screws on the terminal connector for pins 1 through 5.



**IMPORTANT NOTE:** If the shield is not shorted to the probe, insert the shield wire to pin 1. Do not connect if the shield wire is shorted to the probe.

- Insert the corresponding wires as identified in [Figure 3-7: RTD probe connector](#) in the RTD pins identified below.

Figure 3-8: RTD sensor wiring to XFC<sup>G5</sup> electronic board



- Gently retighten the terminal connector screws.



**NOTICE – Equipment damage:** Do not over-tighten the terminal connector screws as this may damage the wires.

7. Reinsert the terminal connector in the J7 terminal block.

## 3.12 Install antenna (for wireless functionality)



**IMPORTANT NOTE:** The XSeries<sup>G5</sup> Wi-Fi Kit 2106049AIAB is required for antenna installation. See [Additional information](#).

1. Install the antenna to support onboard Bluetooth® and Wi-Fi® wireless interfaces.
2. Use onboard connector ANT-1 (J42) to connect the antenna.
3. Use the cap to isolate the unused antenna connector (ANT-2).

## 3.13 Install the radio

Place communication equipment, such as a radio in the communication compartment, inside of the enclosure. For radios with serial interfaces, use the available onboard COMM port. COMM1 port is preconfigured for remote communication and can be used for the radio. See section [5.1 COMM port description](#).

## 4 Install battery and charger

Follow this procedure to install a battery and a solar panel charger if operating the XFC<sup>G5</sup> or XRC<sup>G5</sup> in the battery mode configuration described in section [1.5.1.1 12-volt battery with solar panel configuration](#).

**IMPORTANT NOTE:** If not using a solar panel as the charger, install the required charging source as required for your enclosure size. See section [1.5.1.2 12-volt battery with power supply configuration](#).



**WARNING - Bodily injury.** After the device has power, do not wire peripherals.

This section describes the installation of the power equipment. All wiring must be complete before connecting the battery and the charger to the board. See sections [5 Wire COMM ports](#) and [6 Wire I/Os](#).

### 4.1 Install the battery

The battery mounts inside the flow computer enclosure. Before installation, inspect the power cables (where they terminate on the battery) and the connectors for damage.

Material:

- One (1) battery with cable attached.

Install the battery:

1. Open the hinged door on the XFC<sup>G5</sup> or XRC<sup>G5</sup>. Locate the battery shelf.
2. Place the battery on the compartment shelf; do not allow the battery terminals to contact any metal surface inside the enclosure.



**DANGER – Bodily injury:** Do not allow the battery terminals to contact 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.



**NOTICE – Equipment damage:** Do not connect the battery cable to the BATT (J1 on XFC<sup>G5</sup>, J16 on XRC<sup>G5</sup>) until instructed to do so in section [7.3.1 Connect the battery \(dc power\)](#).



**Warning – Bodily injury:** All wiring must be complete before the device has power.

### 4.2 Install the solar panel

Mount the solar panel outside on a 2-inch pipe. See [Figure 4-1: Solar panel](#). After the flow computer is pipe-mounted, install the solar panel on the upper end of the mounting pipe. Add a pipe extension if necessary. For wall- or direct-mount installations, mount the solar panel on a stand-alone pipe or on the top or on the side of a meter house.



**IMPORTANT NOTE:** For optimum charging, place the solar panel in full sun. Do not place the solar panel where it will be in shadow for any part of the day.

Clean the solar panel on a regular basis to ensure maximum charging.



**IMPORTANT NOTE:** For questions about mounting the solar panel on the top or side of a meter house, call the main office listed at the back of this guide and select technical support from the menu options.

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 – Equipment damage:** Exercise caution when handling the solar panel to avoid damage.

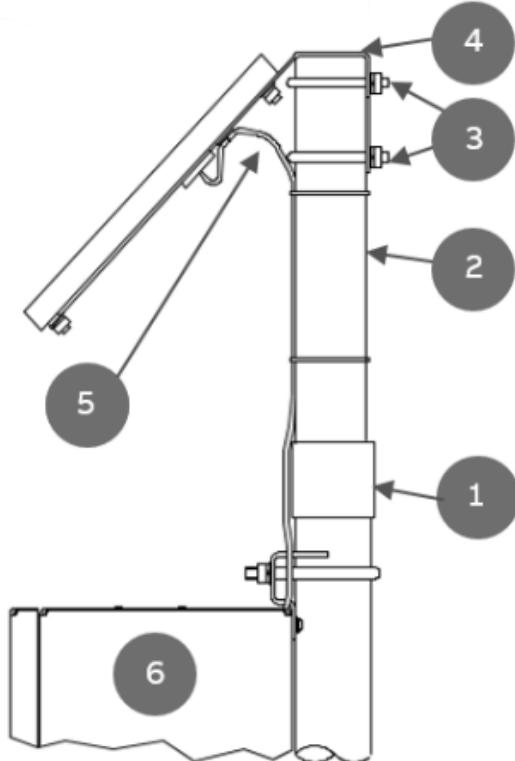
Verify that the solar panel is operating properly before installation:

1. Check the solar panel using a digital voltmeter to verify polarity and output voltage before installation.
2. 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.
3. If the measured voltage is out of specification, contact ABB for a replacement panel.
4. Install the mounting bracket on the solar panel using the provided hardware.

If installation requires a mounting pipe extension:

1. Attach the pipe coupling to the top end of the flow computer mounting pipe.
2. Securely tighten the pipe coupling.
3. Attach the extension pipe to the pipe coupling.
4. Attach the solar panel mounting bracket to the top end of the mounting pipe with the U-bolts and associated mounting hardware. Do not tighten completely.

Figure 4-1: Solar panel



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**Legend: Solar panel**

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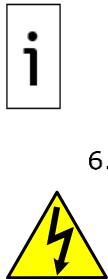
<b>1</b>	Pipe coupling	<b>4</b>	Solar mounting bracket
<b>2</b>	Extension pipe	<b>5</b>	Solar panel cable
<b>3</b>	U-bolts	<b>6</b>	Flow computer

---

5. In the northern hemisphere, position the solar panel facing south. In the southern hemisphere, position the solar panel facing north.



**IMPORTANT NOTE:** Position the solar panel correctly before tightening the U-bolts.



**WARNING – Bodily injury.** Install the electrical wiring 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.

Secure the solar panel cable to the pipe:

1. Do not wrap the cable around the mounting pipe. Run the solar panel cable along the mounting pipe and use nylon tie wraps to secure the cable.
2. Gather excess cable and attach it to the mounting pipe using a nylon tie wrap.

Install the cable and cable gland in the enclosure:

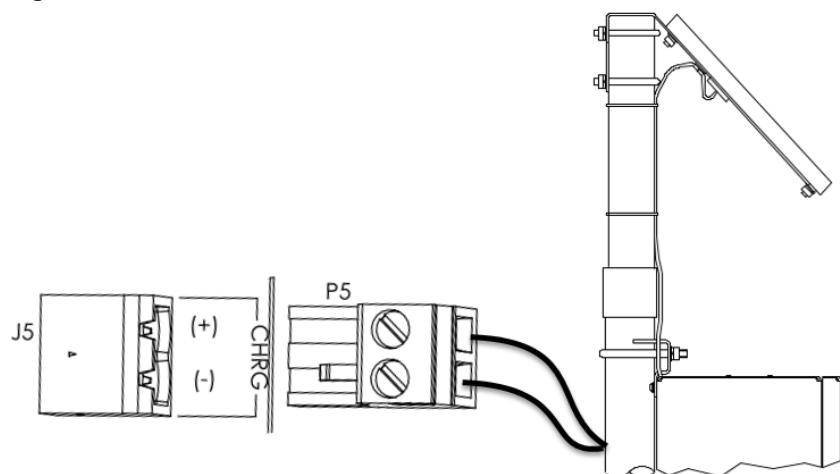
1. Remove a shipping plug from the left side of the flow computer enclosure.
2. Open the hinged door on the flow computer and visually locate the CHRG terminal block (J5 on the XFC<sup>G5</sup>, J17 on the XRC<sup>G5</sup>).
3. Remove the cable nut from the cable conduit elbow and insert the cable and conduit ends through the access hole in the enclosure.
4. Pull the cable into the enclosure leaving enough cable to reach the CHRG terminal block (J5 on the XFC<sup>G5</sup>, J17 on the XRC<sup>G5</sup>).
5. Replace the cable nut on the cord and conduit end inside of the enclosure and screw the nut onto the conduit end finger-tight.
6. Position the conduit elbow so that moisture will not follow the cable and seep into the gland. Tighten the cable nut.
7. Using a small slotted screwdriver, remove the terminal connector from the CHRG terminal block (J5 on the XFC<sup>G5</sup>, J17 on the XRC<sup>G5</sup>).



**NOTICE – Equipment damage or loss of data.** Do not insert the connector into the CHRG terminal block (J5 on the XFC<sup>G5</sup>, J17 on the XRC<sup>G5</sup>) until instructed to do so in section [7.3.2 Connect the charger](#).

8. Wire the solar panel cable to the unattached CHRG connector:
  - a. On the solar panel cable, trim the wire cover ends back 1/4 inch (6.35 mm) if necessary.
  - b. Loosen the terminal connector screws for pins 1 and 2.
  - c. Insert each solar panel cable wire, as identified by the cable label (+ or -), into the corresponding CHRG pin (+ or -), as shown in the figure below. Gently tighten the terminal connector screws.

Figure 4-2: CHRG terminal block on the XFC<sup>G5</sup>



**NOTICE – Equipment damage or loss of data.** Do not over-tighten the terminal connector screws as this may damage the wires.



**NOTICE – Equipment damage or loss of data.** Do not connect the solar panel to the electronic board before battery connection. Damage to the board will void any warranty.

## 5 Wire COMM ports

Wire the XFC<sup>G5</sup> or XRC<sup>G5</sup> COMM ports to communicate with and power external devices. Wiring for communication depends on the type of serial interface required by the device. Wiring for power is required if there is no external supply powering the external device.

Install the required communication modules in the correct slot on the XFC<sup>G5</sup> or XRC<sup>G5</sup> board.



**IMPORTANT NOTE:** Refer to the XFC<sup>G5</sup> or XRC<sup>G5</sup> user drawings for COMM generic wiring or detailed wiring for specific external devices.

External devices can be powered from the (VBAT) or (SW VBAT) pins on the XFC<sup>G5</sup> or XRC<sup>G5</sup> COMM ports.

The output voltage at these pins is dependent upon the external power supply connected to the CHRG connector (J5 on XFC<sup>G5</sup>, J17 on XRC<sup>G5</sup>). The voltage range at J5 or J17 can be from 9 Vdc to 15.5 Vdc. (The XFC<sup>G5</sup> and XRC<sup>G5</sup> are 12 Vdc nominal powered devices).



**NOTICE – Equipment damage or loss of data.** Before connecting an external device to VBAT or SW BAT, ensure that the device is compatible with the voltage range. Connecting an incompatible device may result in damage to the device.

### 5.1 COMM port description

COMM 1 and COMM 2 connect XSeries<sup>G5</sup> to devices with serial interfaces (RS-232 or RS-485), For example:

- Communication equipment – Serial Radio systems, Modems (legacy)
- External measurement equipment - Single or multivariable measurement transmitters

The following table provides the ports general description.

Table 5-1: Serial (COMM) port description

Board	ID: Port	Connector type	Data transfer rate (port speed)	Use (connection type)
XFC <sup>G5</sup>	J4: COMM1 and COMM2	Removable terminal connector ( <b>8 POS</b> ), screw termination. Wire gauge 12 AWG to 22 AWG	Baud Rate: 2,400 to 115,200 bps	Remote or local serial communication for either RS-232 or RS-485 Communication modules required to activate port.
XRC <sup>G5</sup>	J6-A: COMM 1, J6-B: COMM 2	Removable terminal connector ( <b>9 POS</b> ), screw termination. Wire gauge 12 AWG to 22 AWG	Same as above	Same as above



**IMPORTANT NOTE:** XFC<sup>G5</sup> COMM1 and COMM2 connections use pins across both terminal connector blocks (J4, pins 1-16). XRC<sup>G5</sup> COMM1 and COMM2 connections use pins on J6-A (pins 1-9) and J6-B (pins 1-9) respectively.

Maximum serial communication speed is dependent on the serial interface type and the distance between the XFC<sup>G5</sup> or XRC<sup>G5</sup> and the connected external device. When installing and wiring external devices to COMM ports take in consideration the wiring distance limitations as shown in the table below.

Table 5-2: Serial communication specifications

Type	Maximum Length
RS-232	50 feet (15 meters)
RS-485	4000 feet (1220 meters)

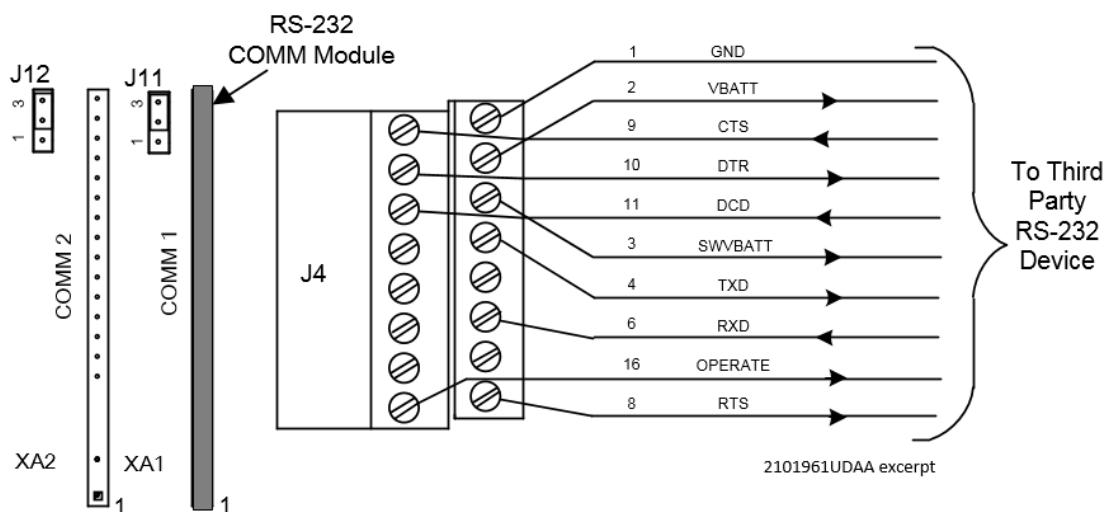
## 5.2 XFC<sup>G5</sup> COMM pinouts

To wire equipment to the XFC<sup>G5</sup> serial communication ports, determine the COMM port to use, insert the correct communication module type in the available slot, then refer to the generic wiring drawings or pinout tables.



**IMPORTANT NOTE:** Use pins on both terminal blocks to wire COMM1 or COMM2 on the XFC<sup>G5</sup>. Remove both terminal block connectors from the board to wire based on communication type. For RS-232, refer to Figures below (COMM1), (COMM2), and [Table 5-3](#). For RS-485, refer to [Figure 5-3](#) (COMM1), [Figure 5-4](#) (COMM2) and [Table 5-4](#)

Figure 5-1: XFC<sup>G5</sup> R-232 COMM1



**IMPORTANT NOTE:** Typically, only TXD, RXD and GND may be required to communicate with a third-party RS-232 device. The figure above illustrates all lines associated with the COMM1 or COMM2 RS-232 module.

Figure 5-2: XFC<sup>G5</sup> R-232 COMM2

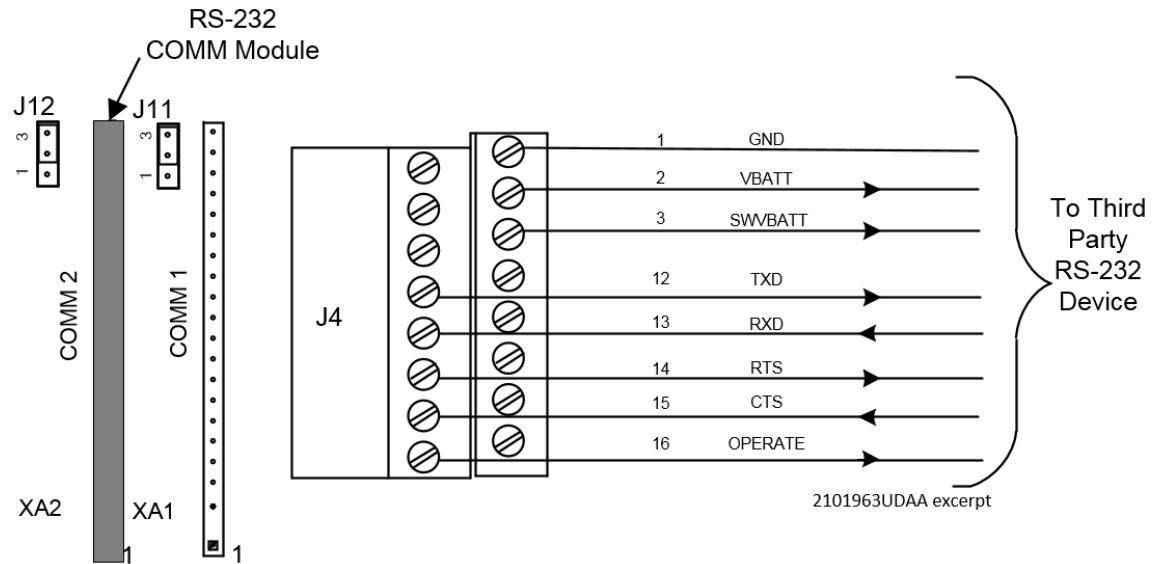


Table 5-3: XFC<sup>G5</sup> RS-232 COMM1 and COMM2 pinouts

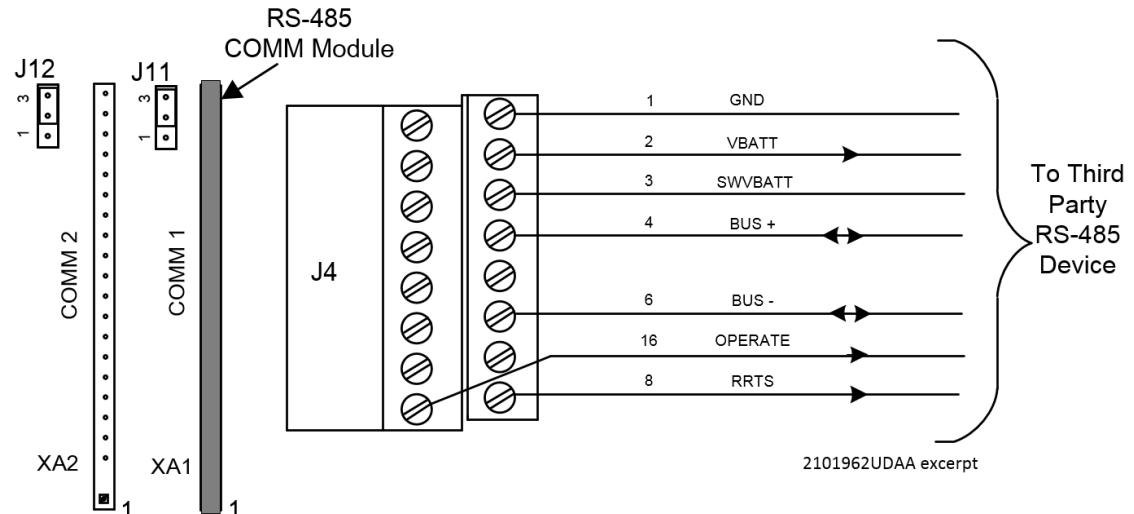
PIN	RS-232 COMM1	RS-232 COMM2
<b>1</b>	GND	GND
<b>2</b>	VBATT	VBATT
<b>3</b>	Sw VBATT	Sw VBATT
<b>4</b>	TXD	
<b>5</b>		
<b>6</b>	RXD	
<b>7</b>		
<b>8</b>	RTS	
<b>9</b>	CTS	
<b>10</b>	DTR	
<b>11</b>	DCD	
<b>12</b>		TXD
<b>13</b>		RXD
<b>14</b>		RTS
<b>15</b>		CTS
<b>16</b>	OPERATE	OPERATE

\*Blank cells carry no signal.



**IMPORTANT NOTE:** [Figure 5-3](#) (COMM1) and [Figure 5-4](#) (COMM2) show connection lines to a single device. RS-485 supports multiple devices per port. For additional wiring options, search additional user drawings at [www.abb.com/upstream](http://www.abb.com/upstream).

Figure 5-3: XFC<sup>G5</sup> R-485 COMM1



**IMPORTANT NOTE:** Typically, only BUS+, BUS- and GND may be required to communicate with a third-party RS-485 device. The figure above illustrates all lines associated with the COMM1 or COMM2 RS-485 module.

Figure 5-4: XFC<sup>G5</sup> R-485 COMM2

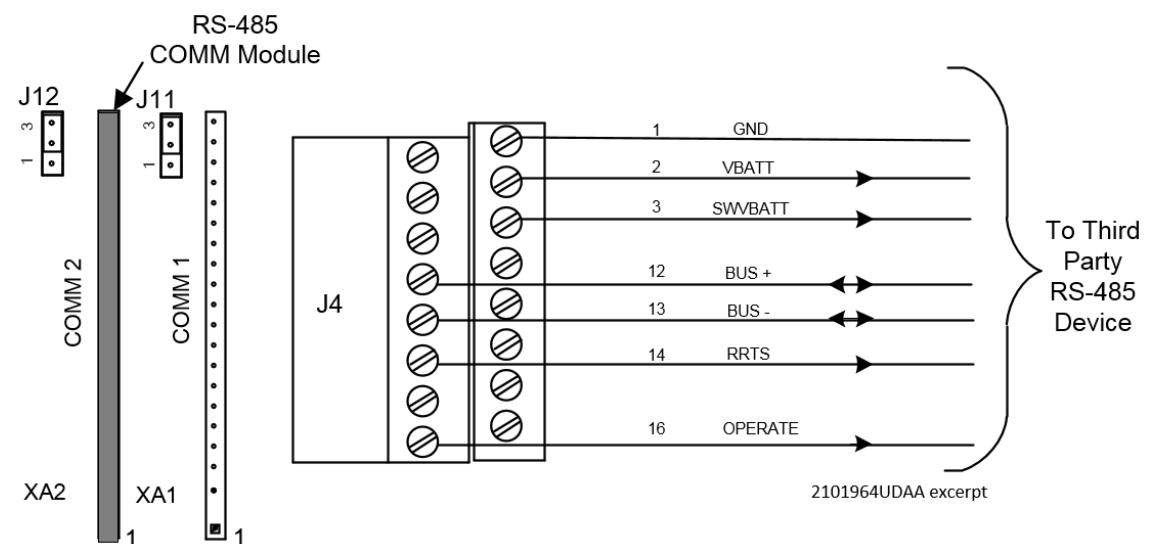


Table 5-4: XFC<sup>G5</sup> RS-485 COMM1 and COMM 2

PIN	RS-485 COMM1	RS-485 COMM2
<b>1</b>	GND	GND
<b>2</b>	VBATT	VBATT
<b>3</b>	Sw VBATT	Sw VBATT
<b>4</b>	BUS (+)	
<b>5</b>	BUS (+)	
<b>6</b>	BUS (-)	
<b>7</b>	BUS (-)	
<b>8</b>	RRTS	
<b>12</b>		BUS (+)
<b>13</b>		BUS (-)
<b>14</b>		RRTS

PIN	RS-485 COMM1	RS-485 COMM2
16	OPERATE	OPERATE

\*Blank cells carry no signal.



**IMPORTANT NOTE:** If wiring for RS-485 communication, set the termination jumpers (J11 or J12) in the correct position.

## 5.3 XRC COMM pinouts

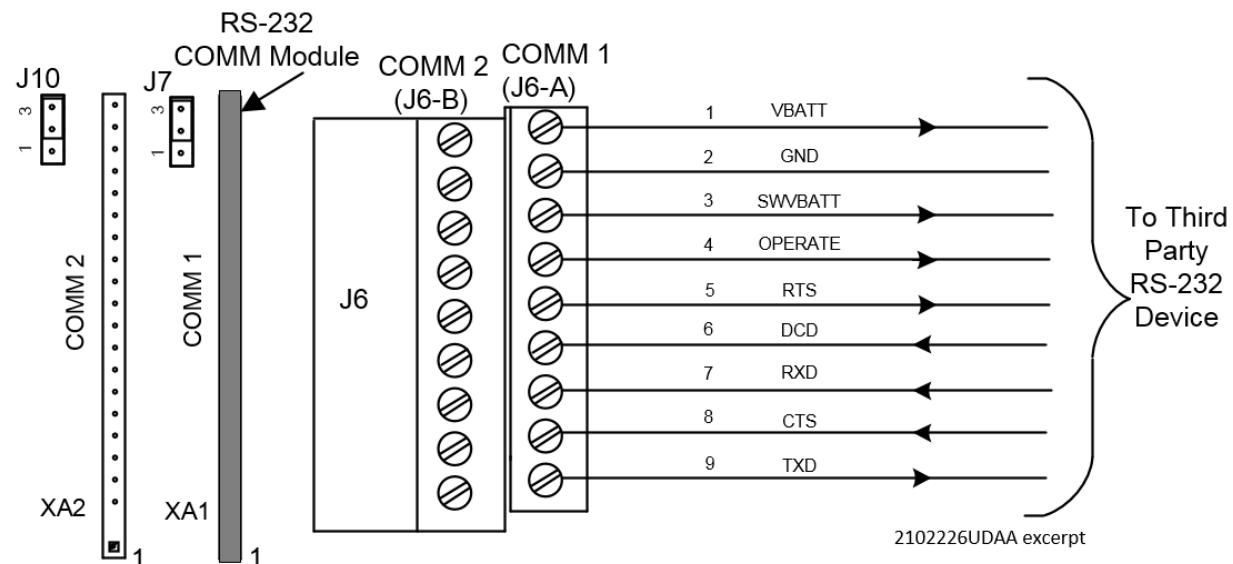
To wire equipment to the XRC<sup>G5</sup> serial communication ports, determine the port, insert the correct communication module type in the available slot, then refer to the generic wiring diagram or pinout table.

COMM 1 and COMM 2 have identical pinouts. Use J6-A to wire COMM1 or J6-B to wire COMM2. See [Figure 5-5](#) (RS 232) or [Figure 5-6](#) (RS 485). Refer to [Table 5-4](#) for complete pinout for both ports.



**IMPORTANT NOTE:** Wiring for RS-485 communication, set the termination jumpers (J7 or J10).

Figure 5-5: XRC RS-232 COMM 1



**IMPORTANT NOTE:** Typically, only TXD, RXD and GND may be required to communicate with a third-party RS-232 device. The figure above illustrates all lines associated with the COMM1 or COMM2 RS-232 module.



**IMPORTANT NOTE:** [Figure 5-6](#) (RS 485 COMM1) shows connection lines to a single device. RS-485 supports multiple devices per port. For additional wiring options, search additional user drawings at [www.abb.com/upstream](http://www.abb.com/upstream).

Figure 5-6: XRC RS-485 COMM 1

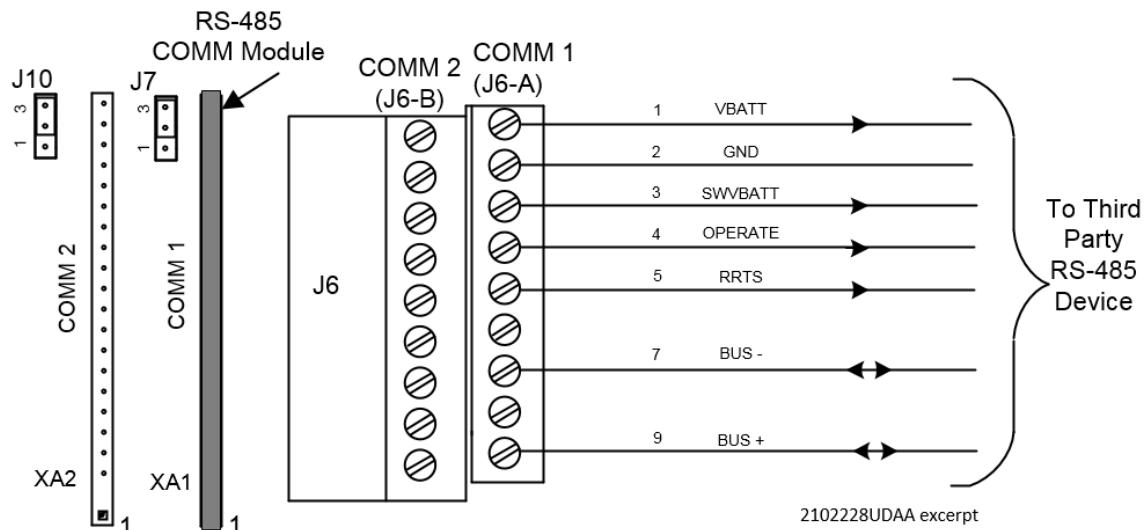


Table 5-5: XRC COMM 1 and COMM 2 pinouts

PIN	RS-232 COMM 1 and 2	RS-485 COMM 1 and 2
1	VBATT	VBATT
2	GND	GND
3	SW VBATT	SW VBATT
4	OPER	OPER
5	RTS	RRTS
6	DCD	BUS-
7	RXD	BUS-
8	CTS	BUS+
9	TXD	BUS+

## 6 Wire I/Os

Wire the XFC<sup>G5</sup> or XRC<sup>G5</sup> I/O ports to monitor or control external devices. This section includes a general description of the XSeries<sup>G5</sup> I/Os, detailed pinouts for each I/O type, and general information about the TFIO module support. TFIO modules are optional expansion interfaces used to provide additional I/O points, when the ones provided onboard are not sufficient.



**IMPORTANT NOTE:** Refer to the XFC<sup>G5</sup> or XRC<sup>G5</sup> user drawings for I/O wiring details for specific external devices. See [Additional information](#).

**NOTICE – Equipment damage.** An external device can be powered from VBAT or SW VBAT pins on the COMM terminals.



The output voltage at these pins is dependent upon the external power supply connected to the CHRG connector (J5 on XFC<sup>G5</sup>, J17 on XRC<sup>G5</sup>). The voltage range at J5 or J17 can be from 9 Vdc to 15.5 Vdc. The XFC<sup>G5</sup> and XRC<sup>G5</sup> are 12 Vdc nominal powered devices.

Before connecting an external device to VBAT or SW BAT, ensure that the device is compatible with this voltage range. Connecting an incompatible device may result in damage to the device.

### 6.1 General I/O description

Inputs provide the ability to read and monitor signals transmitted from external devices. Outputs provide the ability to send signals to control external devices.

The following table provides the I/O general description. For detailed specifications visit [www.abb.com/upstream](http://www.abb.com/upstream) to review product datasheets.



**IMPORTANT NOTE:** Onboard input/output information is also available in the PCCU online help topics. Click **Help** from any of the I/O and calibration screens.

Table 6-1: I/O general description

Board	ID: I/O	Connector type	Use
XFC <sup>G5</sup>	J8: 2 AIs J6: 2 DI/PIs, 2 DOs J7: RTD input	Removable terminal connectors: J8: 4-POS, J7: 5-POS J6: 8-POS  Screw termination. Wire gauge 12 AWG to 22 AWG	Monitor analog input (AI) or digital/pulse input (DI/PI) signals received from external equipment  Send digital output (DO) signals to control external equipment  Dedicated RTD (on XFC <sup>G5</sup> only) input for temperature measurement
	J23: 5 AIs J8-A: 2 DI/PIs, 2 DOs J8-B: 2 DI/PIs, 2 DOs	Removable terminal connectors: J23: 10-POS, J8-A/J8-B: 9-POS  Screw termination. Wire gauge 12 AWG to 22 AWG	Same as above (except, no dedicated RTD on the XRC <sup>G5</sup> )

## 6.1.1 Analog inputs (AI)

Analog inputs (AIs) on XSeries<sup>G5</sup> devices support the monitoring of a variety of external devices with different measurement and operating ranges. Typical external devices include measurement transmitters such as pressure and temperature transmitters. These devices convert measured values into electrical signals which are then read and detected by the AI.

Each AI is capable of handling voltage or current inputs. The table below describes the AI input mode and range supported per device type. The AI ranges are compatible with the output signal ranges of common external devices (1-5 Vdc and 4-20mA).

Table 6-2: XSeries<sup>G5</sup> Analog input (AI) mode and range

AI feature	XFC <sup>G5</sup>	XRC <sup>G5</sup>
<b>Input Mode</b>	Voltage	Voltage and current,
<b>Supported (Signal type)</b>	The AI native mode is voltage only, but the AI can be set to current mode by externally inserting a precision resistor across the AI pins on the selected port. A common resistor value is 250 ohms.	Mode selectable with onboard pins (J21, J22, J24, J25, J26): Voltage mode (default): Jumper pins 2-3 Current mode: Jumper pins 1 and 2
<b>Input value range</b>	Voltage mode: 0-5 Vdc Current mode: 0-20 mA	Voltage Mode: 0-10 Vdc Current Mode: 0-20 mA

## 6.1.2 Digital or Pulse Inputs (DI/PI)

Digital or pulse inputs (DI/PIs) on XSeries<sup>G5</sup> devices support the monitoring of external devices. Both DIs and PIs are supported on the same terminals:

- Digital inputs can read an external contact. This is primarily used as a status input to read external equipment. This contact must be closed to be considered on. The on condition is recorded in the log period alarms and can trigger the action of the flow computer's digital voltage (12 Vdc) output is off is defined as an open contact.
- The Pulse input is a hardware event counter that accumulates the number of OPEN to CLOSE transitions that occur on the DI input.

### 6.1.2.1 Selectable Pulse Input

The XSeries<sup>G5</sup> devices support selectable pulse input operation. This can be set with the onboard IEC/STD switch. This switch selects the electrical voltage threshold point which defines when a DI state is either OPEN or CLOSED.



**IMPORTANT NOTE:** The IEC mode supports the ABB Coriolis Master primary meter's high-speed pulse output.

### 6.1.2.2 Debounce

XSeries<sup>G5</sup> pulse inputs support debounce capability. When debounce is enabled (turned on) the slew rate of the signal is slower to remove the mechanical-switching chatter associated with mechanical switches. Therefore, debounce should not be enabled for high-speed pulses.

The table below describes the pulse input and debounce capabilities per device type.

Table 6-3: XSeries<sup>G5</sup> pulse input mode and debounce capabilities

PI	XFC <sup>G5</sup>	XRC <sup>G5</sup>
<b>Selectable mode</b>	Yes, hardware selectable with onboard IEC/STD switches: S3, S4	Yes, hardware selectable with onboard IEC/STD switches: S3, S4, S7, S8

PI	XFC <sup>G5</sup>	XRC <sup>G5</sup>
<b>Debounce</b>	Yes, software selectable from user interface (PCCU): Debounce can be enabled/disabled on each PI.	Yes, hardware selectable with onboard pins (J5, J9, J11, J12): Debounce on (default): Jumper pins 2-3 Debounce off: Jumper pins 1 and 2

### 6.1.3 Digital outputs (DO)

Digital outputs (DO) on XSeries<sup>G5</sup> devices are used to control external equipment.

## 6.2 Analog input (AI) pinouts

**i** **IMPORTANT NOTE:** Analog inputs must be compatible with the external devices they connect to. Review the external device's specifications to ensure that the AI can support the device's output signal type and range.

### 6.2.1 XFC<sup>G5</sup> AI

The XFC<sup>G5</sup> has two onboard analog inputs. Each AI consists of an input signal pin and an input ground pin.

Determine which AI to use and refer to the pinout table for wiring.

**i** **IMPORTANT NOTE:** The XFC<sup>G5</sup> AIs support voltage inputs by default. To support current (4 – 20 mA) inputs, add a 250-ohm resistor across the + and – terminals. See section [6.1.1 Analog inputs \(AI\)](#), for additional information on input mode and range.

Figure 6-1: XFC<sup>G5</sup> AI terminals

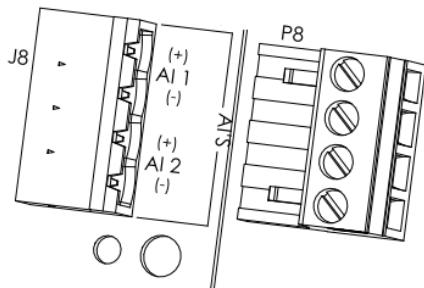


Table 6-4: XFC<sup>G5</sup> AI Pinouts

Input	Pin	Description
<b>AI-1</b>	1	(+) Input signal
	2	(-) Input ground
<b>AI-2</b>	3	(+) Input signal
		(-) Input ground

### 6.2.2 XRC<sup>G5</sup> AI

The XRC<sup>G5</sup> has five onboard analog inputs. Determine which AI to use and refer to the pinout table for wiring.

[Figure 6-2](#) shows the XRC<sup>G5</sup> analog input terminals and the input mode selector jumpers. Use these jumpers to set the analog input for the type of input signal expected (voltage or current). Follow the legend to set the correct AI to the correct mode. By default, all analog inputs are set for voltage inputs (0 -10 V, pins 2 and 3 are jumpered). See [6.1.1, Analog inputs \(AI\)](#) for additional information on input mode and range.

Figure 6-2: XRC AI terminals and input mode selector jumpers

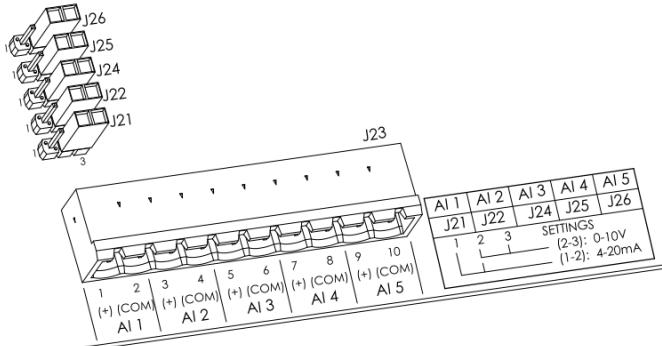


Table 6-5: XRC AI Pinouts

Input	Pin	Description
AI-1	1	(+) Input signal
	2	(COM) Input ground
AI-2	3	(+) Input signal
	4	(COM) Input ground
AI-3	5	(+) Input signal
	6	(COM) Input ground
AI-4	7	(+) Input signal
	8	(COM) Input ground
AI-5	9	(+) Input signal
	10	(COM) Input ground

### 6.3 Digital input and output (DI/DO) pinouts XFC<sup>G5</sup> DI/DO

The XFC<sup>G5</sup> has 2 onboard digital outputs and 2 onboard digital inputs. Figure 6-3 shows the Digital I/O terminals on the XFC<sup>G5</sup> and the input mode switches. The input mode switches support standard pulse inputs (STD) or pulse inputs from Coriolis (IEC). Remember to set the switch to the correct position based on the type of pulse input signal expected. Use S3 for DI/PI 1 or S4 for DI/PI 2.

Listed below are the DIs and DOs for the XFC<sup>G5</sup>.

Figure 6-3: XFC<sup>G5</sup> DI/PI/DO terminals and input mode switches

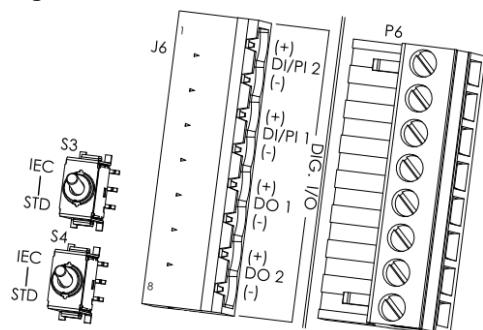


Table 6-6: XFC<sup>G5</sup> DI/PI/DO pinouts

I/O	Pin J6	Description
<b>DI2/PI2</b>	1	(+) Input signal
	2	(-) Input ground
<b>DI1/PI1</b>	3	(+) Input signal
	4	(-) Input ground

I/O	Pin J6	Description
<b>DO1</b>	5	(+) Output signal
	6	(-) Output ground
<b>DO2</b>	7	(+) Output signal
	8	(-) Output ground

### 6.3.1 XRC<sup>G5</sup> DI/DO

The XRC<sup>G5</sup> has four onboard digital outputs and four onboard digital inputs. [Figure 6-4](#) shows the digital I/O terminals on the XRC<sup>G5</sup>, the input mode switches, and the debounce jumpers. The input mode switches support standard pulse inputs (STD) or pulse inputs from Coriolis (IEC). Remember to set the switch to the correct position based on the pulse input signal expected. (Use S3 for DI/PI 1, S4 for DI/PI 2, S7 for DI/PI 3 and S8 for DI/PI 4.)

By default, the debounce jumpers are set to enable debounce on the DI/PI.

Listed below are the DIs and DOs for the XRC<sup>G5</sup>.

Figure 6-4: XRC DI/PI/DO terminals, input mode switches, and debounce jumpers

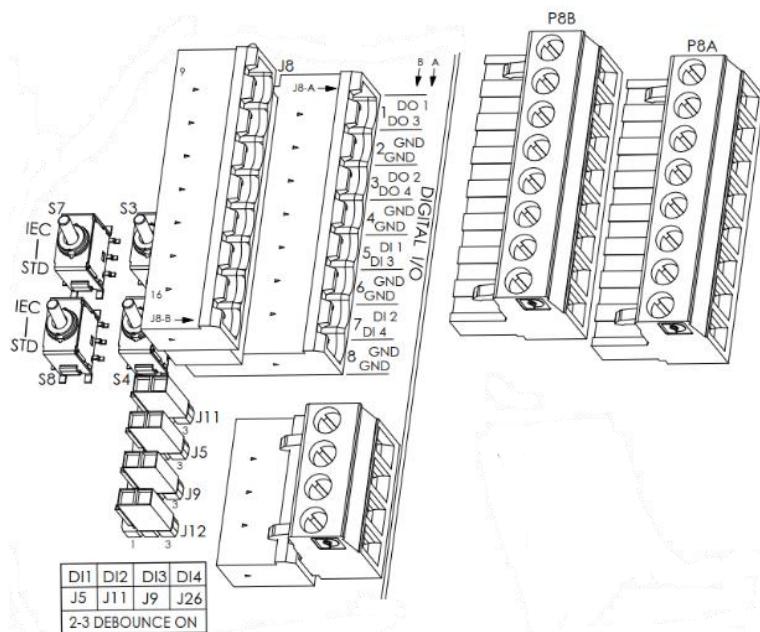


Table 6-7: XRC DI/PI/DO Pinouts

I/O	Pin J8-A	Description	I/O	Pin J8-B	Description
DO1	1	Signal	DO3	1	Signal
	2	GND		2	GND
DO2	3	Signal	DO4	3	Signal
	4	GND		4	GND
DI1/PI1	5	Signal	DI3/PI3	5	Signal
	6	GND		6	GND
DI2/PI2	7	Signal	DI4/PI4	7	Signal
	8	GND		8	GND

## 7 Powering the Device

Apply power to the XFC<sup>G5</sup> or XRC<sup>G5</sup> by making the correct connections for the power mode chosen. The XFC<sup>G5</sup> and XRC<sup>G5</sup> support two power modes:

- Battery mode: The primary power source is a 12-volt battery with a charger.
- External power mode: The primary power source is an external power supply.

### 7.1 Super capacitor charging at boot time

The XFC<sup>G5</sup> and XRC<sup>G5</sup> design includes a super capacitor (Super CAP) that serves as a short-term power reservoir. Allow 2 minutes to charge the Super CAP the first time you connect the unit to power. The Super CAP must recharge if the XFC<sup>G5</sup> or XRC<sup>G5</sup> is powered off for several hours. After the capacitor is fully charged, the boot time is considerably less.

**IMPORTANT NOTE:** 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 and restart configuration.

### 7.2 Power-on sequence

The XFC<sup>G5</sup> and XRC<sup>G5</sup> power-on sequence is initiated as soon as power is connected. The LCD displays the following information as the controller completes the startup:

Figure 7-1: XFCG5 Display startup messages (part numbers are examples)



**IMPORTANT NOTE:** If the LCD fails to display the startup sequence, try adjusting the contrast first as described in section [10.6 Adjust the LCD contrast](#). If adjusting the contrast does not show any items on the LCD, see section [12 Troubleshooting](#).

### 7.3 Power with battery and charger

Operating in battery power mode requires a 12-volt sealed lead acid (SLA) battery and a charger to recharge the battery. This mode requires connection of the battery and the charger. The battery and charger must be installed. See section [4 Install battery and charger](#). Adapt these instructions for alternate installations.

### 7.3.1 Connect the battery (dc power)

Connect the 12-volt SLA battery using the battery cable.



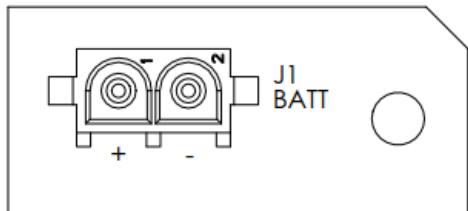
**WARNING– Bodily injury and property damage.** Complete all wiring of peripheral or external devices to the controller before power is applied.

Connect the battery before connecting the charger cable.

Connect the battery:

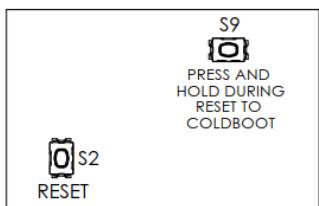
1. Connect the battery to the BATT terminals on the XFC<sup>G5</sup> (J1 as shown below) or XRC<sup>G5</sup> (J16). Observe the polarity (+ and -).

Figure 7-2: XFC<sup>G5</sup> BATT connector



2. Confirm that the battery is supplying power to the XFC<sup>G5</sup> or XRC<sup>G5</sup> by observing the power-on sequence information scrolling on the LCD (see details in [section 7.1 Super capacitor charging at boot time](#)).
3. If LCD does not display the power-on sequence, try adjusting the contrast. Refer to section [10.6, Adjust the LCD contrast](#).
4. If the power-on sequence fails to initiate or complete, press the reset button (shown below).

Figure 7-3: Reset button and coldboot button



### 7.3.2 Connect the charger

To connect the charger, select the procedure applicable to the type of charger used. It is assumed that the charger has been wired to the terminal connector removed from the CHRG onboard terminal block.

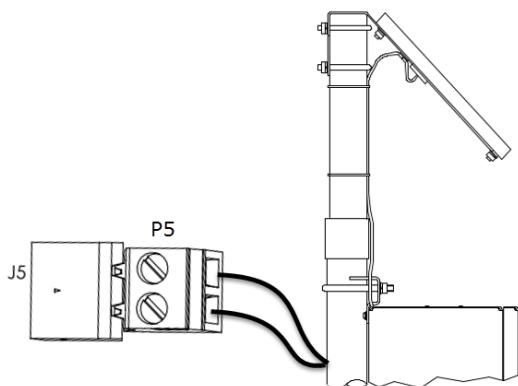


**NOTICE – Equipment damage:** Always connect the battery to the BATT port before connecting the solar panel or alternate charger cable to the XFC<sup>G5</sup> or XRC<sup>G5</sup>.

#### 7.3.2.1 Connect the solar panel charger

Reinsert the CHRG connector wired to the solar panel charger cable to the CHRG terminal on the XFC<sup>G5</sup> (J5 shown below) or XRC<sup>G5</sup> (J17).

Figure 7-4: XFC<sup>G5</sup> charger connection



### 7.3.2.2 Connect another charger

The charger can also be a power supply converting another voltage level to nominal 12 Vdc. The nominal 12 Vdc level must be between 14.5 Vdc to 15.5 Vdc to charge the battery and provide a voltage value that is safe for the device.

To connect the charging power supply:

Reinsert the CHRG connector wired to the charging power supply to the CHRG terminal on the XFC<sup>G5</sup> (J5) or XRC<sup>G5</sup> (J17).

## 7.4 Power with external power supply

If powering with an external power supply, follow the procedure in this section.

The XFC<sup>G5</sup> and XRC<sup>G5</sup> are 12 Vdc nominal powered devices. The voltage range from an external supply must be 12Vdc to 14Vdc.



**NOTICE – Equipment damage:** A battery cannot be used when the XFC<sup>G5</sup> or XRC<sup>G5</sup> is in external power mode.

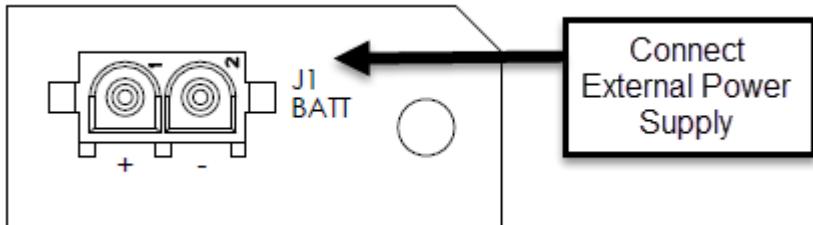
To connect the external power supply:

1. Review the manufacturer's instruction supplied with the external power supply.
2. Connect the external power supply cable to the BATT connector as shown below. Observe the polarity (+ and -).



**IMPORTANT NOTE:** Connections to the BATT connector require a special cable adapter. The adapter should be available.

Figure 7-5: Connect the external power supply



3. Confirm that the XFC<sup>G5</sup> or XRC<sup>G5</sup> is receiving power by observing the power-on sequence information scrolling on the LCD (see details in section [7.1 Super capacitor charging at boot time](#)).
4. If LCD does not display the power-on sequence, try adjusting the contrast. Refer to section [10.6 Adjust the LCD contrast](#).
5. If the power-on sequence fails to initiate or complete, see section [12.2 Failure to start](#).

## 7.5 Enable real time clock backup

The lithium battery maintains operation of the real time clock. The lithium battery backup is recommended and can be set onboard with the backup jumper (J13).

The two settings are:

- Enable – Jumper settings 1-2. The lithium battery backs up the real time clock. If power is lost or disconnected, the real time clock continues to operate until depletion of the lithium battery.
- Disable – Jumper settings 2-3. The lithium battery does not back up the real time clock. The real time clock will continue to operate for 24-36 hours under typical conditions. The real time clock will stop operation and lose time without power. At the next startup, the system will restore the last known good time which can be one of the following:
  - Last Totalflow Running Time: The last time Totalflow was running or when the power was lost. This is the time most often used.
  - OS Build Time: In case the Last Totalflow Running Time could not be retrieved, the build time of the OS will be used as the last known good time.

If system time is lost, the system and event logs will display the following messages:

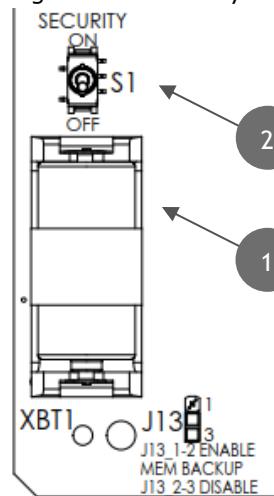
- System Log: "System time was lost, so restoring the last known time."
- Event Log in Tube: "System Time Lost."

**IMPORTANT NOTE:** This procedure assumes the Lithium battery is fully charged and in good condition. Measure the voltage across the lithium battery to verify that it registers more than 3.0 V. If not, use a new battery.

To enable clock backup:

1. Locate the backup jumper (J13) located near the lithium battery slot ([Figure 7-6](#)).
2. Ensure the lithium battery is installed on the board.
3. Remove jumper from pins 2 and 3 (default position).
4. Position the jumper on pins 1 and 2.

Figure 7-6: Battery and switch



### Legend – S1 Security switch

- |          |                 |
|----------|-----------------|
| <b>1</b> | Battery         |
| <b>2</b> | Security switch |

## 8 Basic configuration and startup

Initial communication with the XFC<sup>G5</sup> or XRC<sup>G5</sup> can be established with a direct connection to the RS-232 (MMI) or USB ports. Note that communication on the USB port is faster.

Use the appropriate cable for each port. Additional adapters may be required depending on the ports available on the laptop or PC used to communicate with the XSeriesG5 device. See table below.

Table 8-1: Cables required for local communication

Port	Cable required	Notes
MMI	RS-232 (referred to as MMI or PCCU cable)	Cable: Military connector-to-serial DB9, part number 2015240-004  The serial DB9 connector on this cable plugs into legacy RS-232 serial interfaces. If using a PC or laptop without legacy serial ports, use a serial-to-USB converter with the RS-232 (MMI) cable and connect to a USB port on the PC. The Digi® Edgeport®/1 converter is recommended and can be purchased from ABB (part number 1801382-001). Contact technical support to order or for more details.
USB	USB cable	P/N 1801800-xxx
ETHERNET	Ethernet cable	Use any standard straight thru Ethernet cable for all connections. XSeries <sup>G5</sup> Ethernet ports autosense cable type.



**IMPORTANT NOTE:** PCCU32 version 7.65 software or newer is required to communicate with the XFC<sup>G5</sup> or XRC<sup>G5</sup> for configuration. Previous versions of PCCU32 are not compatible. It is assumed that PCCU32 is already installed in the PC or laptop used to connect to the XFC<sup>G5</sup> or XRC<sup>G5</sup>. If not, see section [2.5 Download PCCU](#).



**IMPORTANT NOTE:** PCCU32 has context-sensitive online help. Click **Help** on the screen of interest to view the topic applicable to that screen.



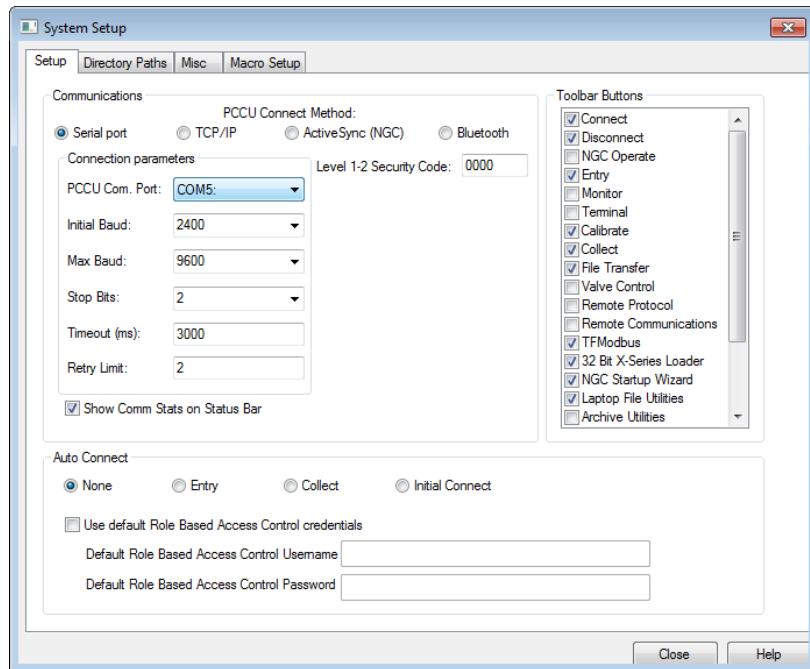
**IMPORTANT NOTE:** Local communication using Ethernet, Bluetooth or Wi-Fi are all supported on the XFC<sup>G5</sup> and XRC<sup>G5</sup>, but these interfaces must be enabled. See section [8.7 Configure communication](#).

### 8.1 Setup PCCU for connection

Configure PCCU for the type of port used:

1. Connect the laptop or PC running PCCU32 to the flow computer with either an MMI cable (RS-232) or a USB cable.
2. Start the PCCU32 software program by double-clicking the desktop icon or selecting **PCCU32** from the **Start > Program** menu.
3. Define the local connection parameter:
  - a. Click the Setup icon on the toolbar or click **Operate > Setup > System Setup**. The System Setup window displays.
  - b. Under Communications, select **Serial** port.
  - c. Under Connection Parameters, on the PCCU Com. Port drop-down list, select the port on the PC or laptop assigned to the local connection.

Figure 8-1: System Setup



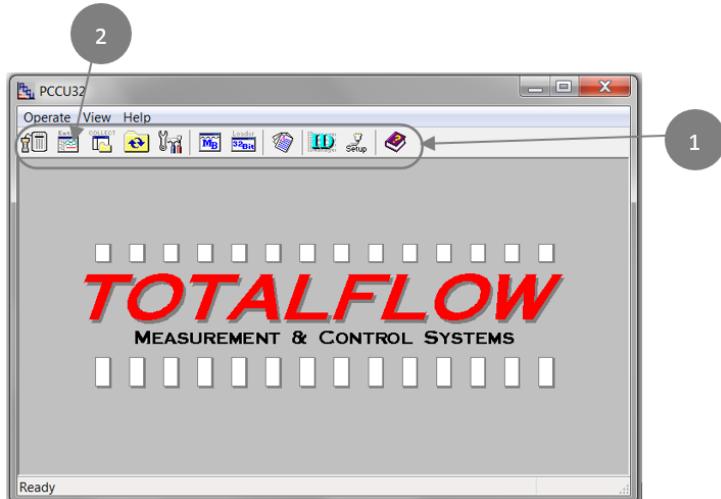
4. Click **Close**.

## 8.2 Establish initial connection with the XFC<sup>G5</sup> or XRC<sup>G5</sup>

Connect to the device entry mode:

1. On the PCCU32 tool bar, click **Entry** to connect to the device.

Figure 8-2: PCCU32 Tool bar and Entry

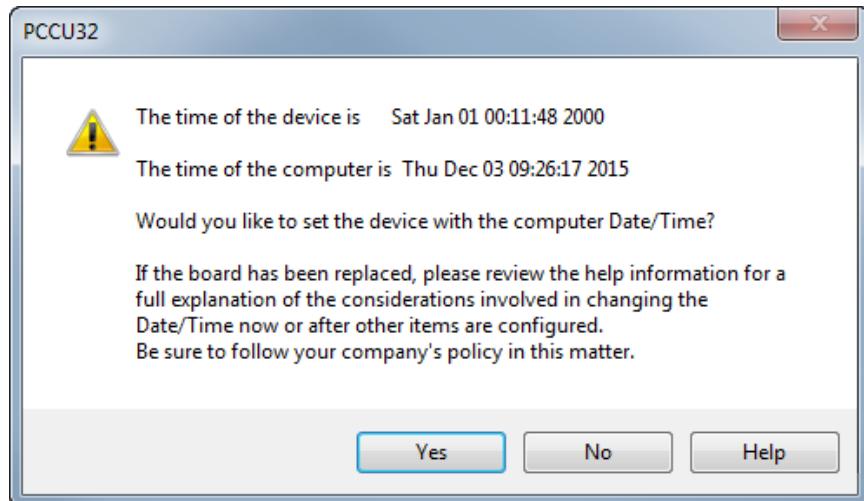


Legend: PCCU 32 Elements

Number	Element name
1	Tool bar
2	Entry button

If the XFC<sup>G5</sup> or XRC<sup>G5</sup> clock date and time are different from the laptop's, a message box displays with the option to synchronize the date and time.

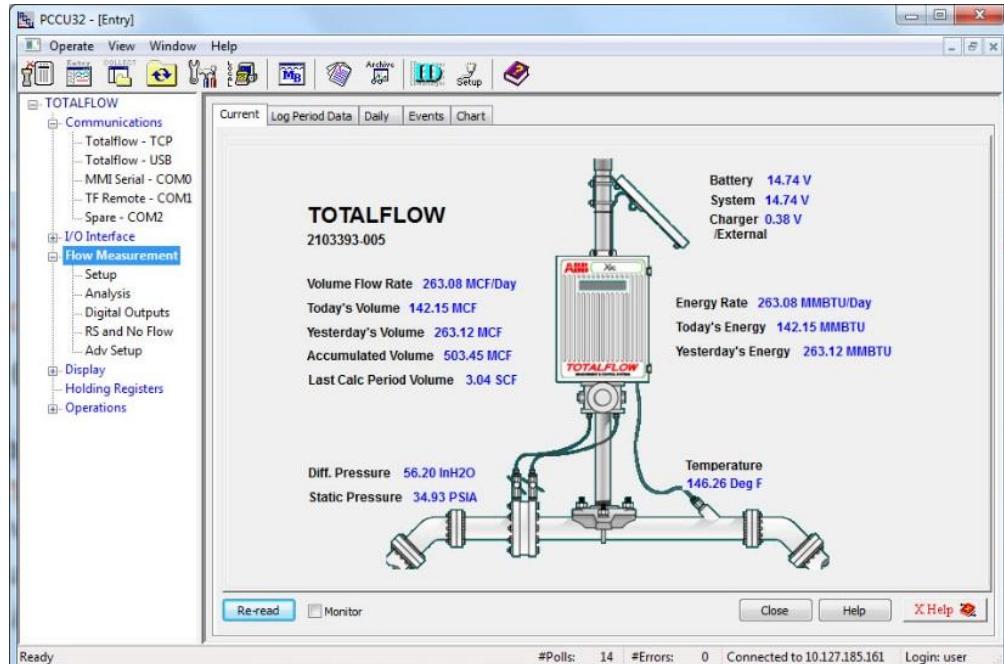
Figure 8-3: PCCU32 Date/Time synchronization warning



**IMPORTANT NOTE:** Click **Help** for more information.

1. Click **No** to set the time and date later during the installation or click **Yes** to synchronize date and time now. When successfully connected to the XFC<sup>G5</sup> or XRC<sup>G5</sup>, the screen displays the device and measurement variables.

Figure 8-4: PCCU32 XFC<sup>G5</sup> Entry screen

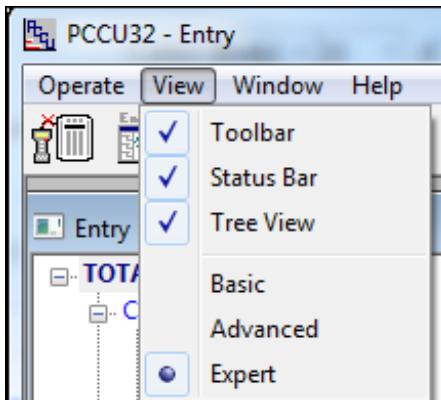


## 8.3 Change to Expert view

Use PCCU Expert view to complete initial and advanced configuration. Change the view while connected to the XFC<sup>G5</sup> or XRC<sup>G5</sup>:

1. While connected to the XFC<sup>G5</sup> or XRC<sup>G5</sup> (Entry mode), on the top PCCU32 menu bar, select **View**.
2. Select **Expert**.

Figure 8-5: PCCU32 Views



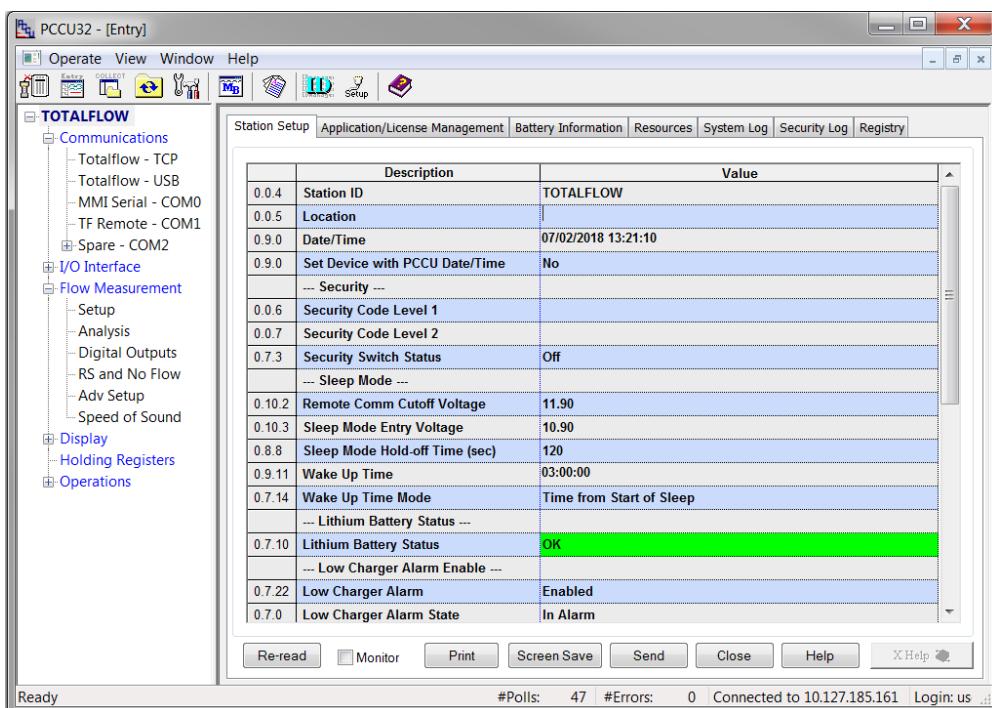
3. Click **Yes** at the warning notice and wait for the PCCU32 Entry mode screen to refresh.
4. Wait for the Entry mode screen to reappear.

## 8.4 Station setup

Configure basic station parameters:

1. At the PCCU32 Entry screen, click the station ID (**TOTALFLOW**) at the top of the navigation tree. The Station Setup tab displays.

Figure 8-6: Station Setup



2. Set up the basic station configuration parameters identified in the following table.

Table 8-2: Required station setup

<b>Entry</b>	<b>Format</b>	<b>Description</b>
<b>Station ID</b>	10 digits alphanumeric	The station identifier code is unique. If running a multiple tube station, the station ID is the same for all tubes on the device. If left blank on a single tube device, the station ID will be the same as the device ID.
<b>Location</b>	24 digits alphanumeric	The location identifier describes the location, such as the county name or a road number. It is not mandatory.

<b>Entry</b>	<b>Format</b>	<b>Description</b>
<b>Date/ Time</b>	MM/DD/YYYY HH:MM: SS (24-hour clock)	Date and time must be set correctly and should agree with the collection equipment if measurement tubes are instantiated.
		<ol style="list-style-type: none"> <li>3. Verify the Lithium Battery Status is OK with a green bar, see <a href="#">Figure 8-6: Station Setup</a>.</li> <li>4. If the status is Low Voltage or Not Connected, then the field background color is red.</li> <li>5. Change settings in the Station Setup tab as needed. Leave PCCU open on the Station Setup tab.</li> </ol>

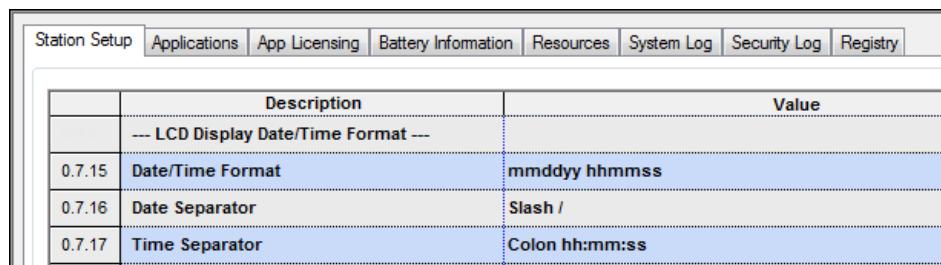
## 8.5 Change the default time and date format

The factory configuration has a default date and time format displayed on the LCD.

Change the default format to preferred settings:

1. On the Station Setup tab, scroll down to the LCD Display Date/Time Format. See the figure below.

Figure 8-7: Station Setup detail



2. Select the preferred Date/Time Format (mmddyy or yyymmdd).
3. Select the preferred Date Separator (slash, dash, or period).
4. Select the preferred Time Separator (colon or period).
5. Click **Send** to save the station settings.

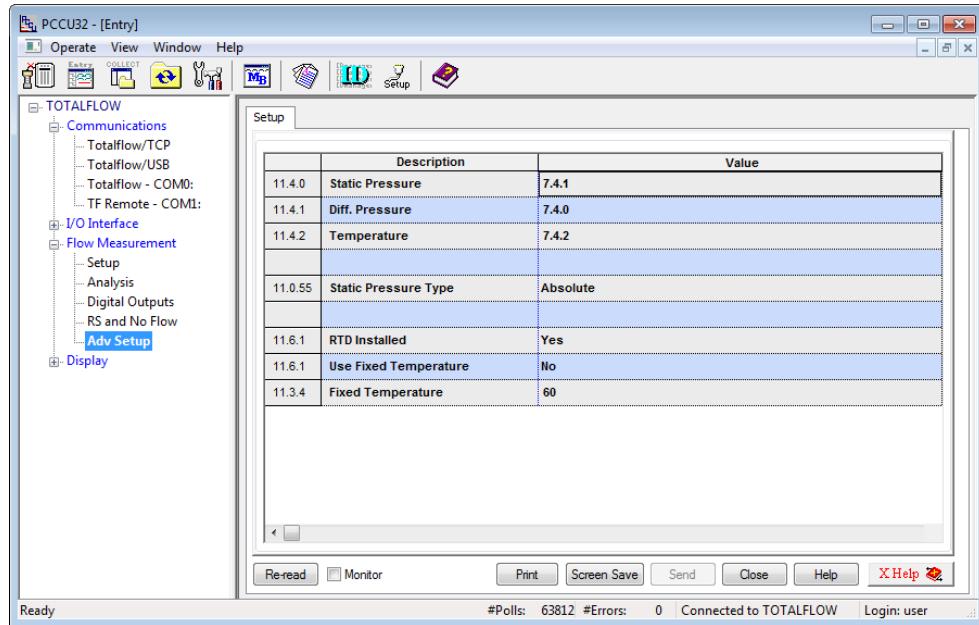
## 8.6 Initial measurement application setup

The XFC<sup>G5</sup> or XRC<sup>G5</sup> shipped with standard configuration and the gas orifice measurement application configured by default. This procedure describes the setup of that flow measurement application (single tube). To set up additional tubes or different measurement application types, refer to the online help topics in PCCU. Click **Help** on the specific application screens for application-specific topics.

Set up the gas orifice flow measurement application:

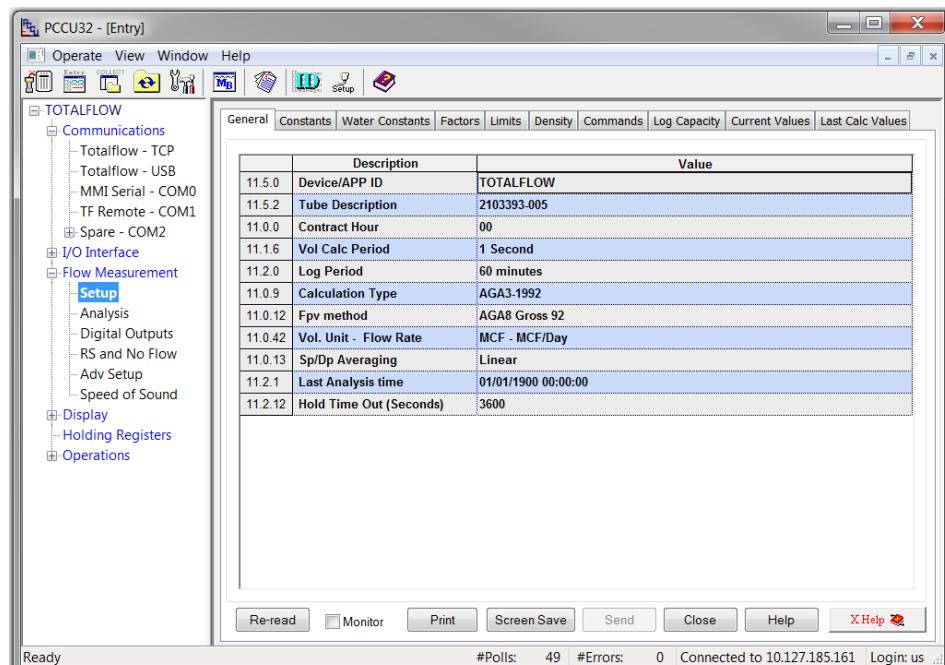
1. On the PCCU navigation tree, click **Flow Measurement > Adv Setup**.

Figure 8-8: Flow Measurement Advanced Setup (Gas orifice).



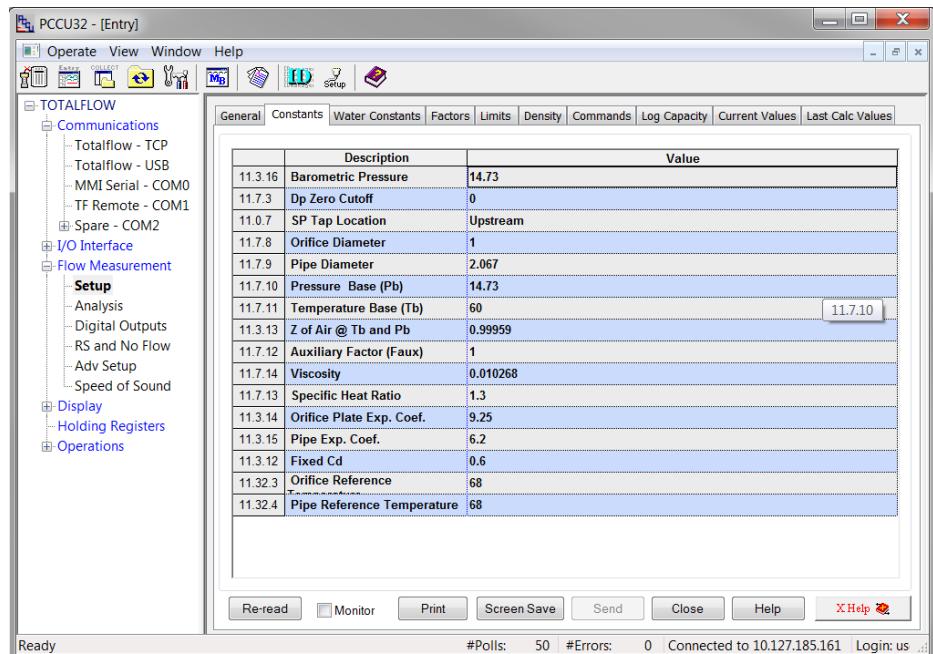
2. On the **Setup** tab, verify and change if necessary, the following settings:
  - a. If receiving live flowing temperature values from an RTD, set the RTD Installed field to **Yes**.
  - b. If using a fixed temperature value instead of live readings, set the Use Fixed Temperature field to **Yes**.
  - c. In the Fixed Temperature field, type the value for the fixed temperature.
3. On the navigation tree, click **Flow Measurement > Setup**.
4. On the General tab, verify and change if necessary, the required parameters:
  - a. In the Calculation Type field, select the calculation standard for this tube.
  - b. In the Fpv Method field, select the compressibility method for this tube.

Figure 8-9: Flow measurement > Setup > General tab



5. Click **Send**.
6. Select the **Constants** tab.

Figure 8-10: Constants tab



7. Verify or update the following:

- For Barometric pressure, type the value, subtracted from the absolute pressure readings when calibrating in gauge pressure.



**IMPORTANT NOTE:** Barometric pressure is area-dependent. Use the correct barometric pressure for the area or the contracted value.

- For Orifice diameter, type the diameter in inches.
- For Pipe diameter, type the pipe diameter in inches.
- For Temperature base (Tb), type the value as defined by the existing contractual agreement (default is 60 °F).

8. Click **Send**.

9. Continue to the other tabs for additional configuration if needed.



**IMPORTANT NOTE:** The previous steps are the minimum requirements to get a Totalflow XFC<sup>G5</sup> or XRC<sup>G5</sup> online and measuring gas. There are many more steps depending on the site and company requirements.

## 8.7 Configure communication

Configure and enable communication interfaces when needed:

- Before configuration, wire communication or peripheral equipment to the serial communication (COMM) terminals. See section [5 Wire COMM ports](#).
- For remote or local network communication, note that enabling Ethernet, Wi-Fi or Bluetooth will cause additional power consumption.

### 8.7.1 Configure COM1

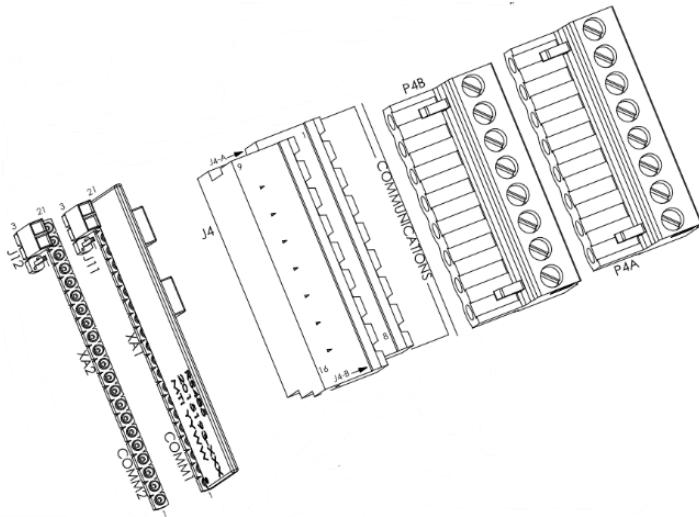
The XFC<sup>G5</sup> and XRC<sup>G5</sup> have standard configurations with COM1 configured for remote communications with a host. COM1 is the name associated with the COMM1 terminal. The port TF-Remote – COM1 is configured to support the Totalflow Remote Protocol by default.

For additional details, click **Help** from the Communications Setup tab screen.

Configure COM1:

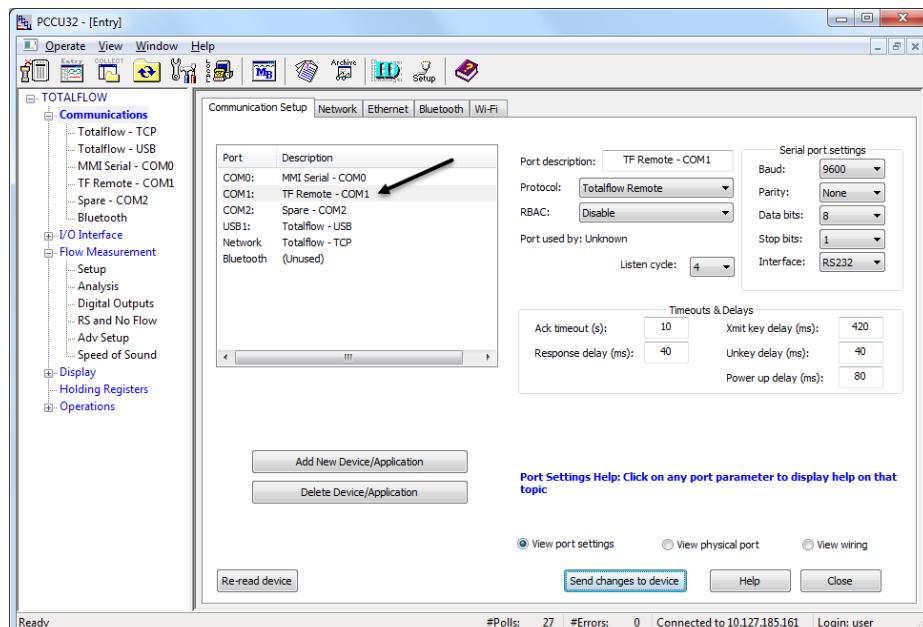
1. Install the communication module for the required serial interface type (RS-232 or RS-485) in the COMM1 slot on the XFCG<sup>5</sup> or XRCG<sup>5</sup> board.

Figure 8-11: XFCG<sup>5</sup> COMM terminals (Module in COMM1 slot shown)



2. Wire the communication equipment according to the type of serial interface required. See section [5 Wire COMM ports](#).
3. In the PCCU navigation tree, click **Communications**.
4. On the Communication Setup tab, select **COM1: TF Remote – COM 1**.

Figure 8-12: TF Remote - COM 1



5. On the Protocol menu, select the appropriate protocol if not using the default Totalflow Remote.
6. Under Serial Port Settings, on the Interface menu, select the communication interface (RS-232, RS-485, or RS-232 Modem).
7. Verify, and change if necessary, the remaining serial port settings and timeouts and delays.

Table 8-3: 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	1
Power up delay (ms)	80		

- For RS-485 communication, position the termination jumpers according to the following table:

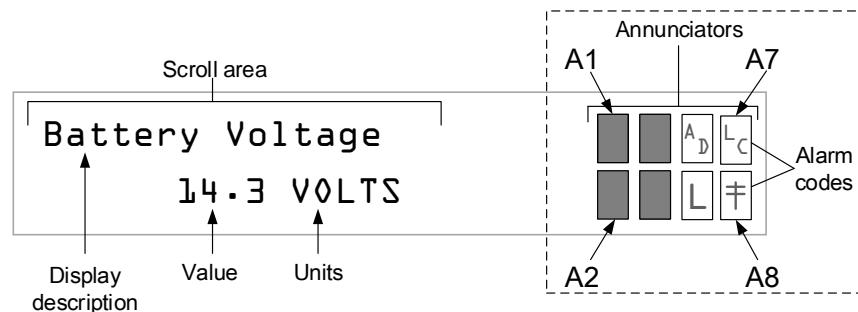
Table 8-4: RS-485 Termination on COMM1

Position of the device on the Bus	XFCG5 J11	XRC J7
Last or only unit	1-2	1-2
Intermediate	2-3	2-3

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

Observe the LCD on the enclosure door. The annunciator in position A8 should periodically flash the  $\ddagger$  symbol to indicate that the COMM1 port is active and listening for communication. See the following figure.

Figure 8-13: Verify the communications set up for COMM1



**IMPORTANT NOTE:** The  $\ddagger$  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 files for communication port setup to learn how this setting effects power usage.

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

- Select **TF Remote – COM1** in the navigation tree.
- Select the **Schedule** tab. Click **Help** to locate schedule parameter definitions.
- Set required values and Click **Send**.

If RS-232 Modem was selected:

- Select the **Modem** tab to set up modem parameters. Click **Help** to locate parameter definitions.
- Click **Send** after all values have been set.

## 8.7.2 Configure COM2

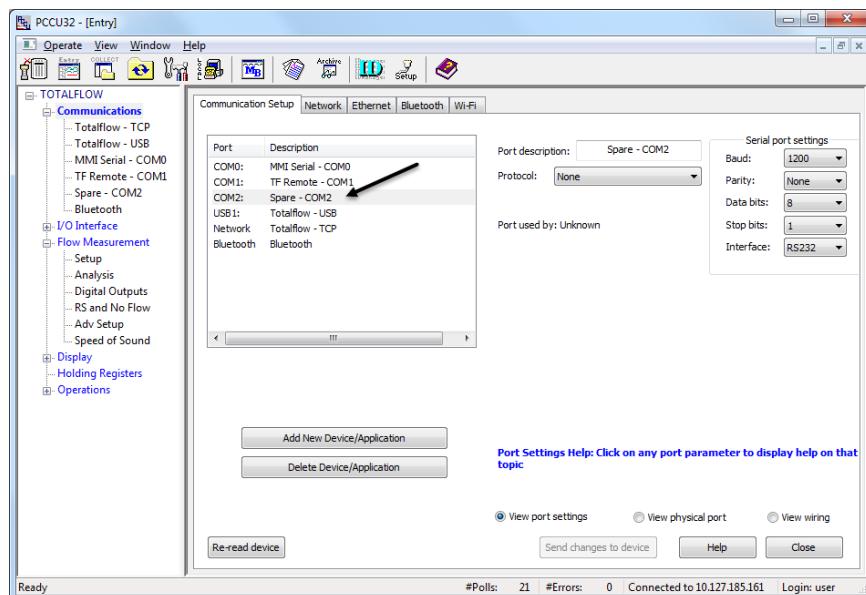
The XFC<sup>G5</sup> and XRC<sup>G5</sup> standard configurations come with COM2 configured as a spare port and set up for generic serial communication.

**IMPORTANT NOTE:** This procedure assumes that the default generic serial communication configuration is used. Additional configuration options which optimize support for specific ABB products (for example, the XMV Interface application) are also available. For details about these options, click **Help** from the Communications Setup tab screen and configure the port as required by the external device.

Configure COM2:

1. Install the communication module for the required serial interface type (RS-232 or RS-485) in the COMM2 slot on the XFC<sup>G5</sup> or XRC<sup>G5</sup> board.
2. Wire the communication equipment according to the type of serial interface required (see section [5 Wire COMM ports](#).)
3. On the PCCU navigation tree, click **Communications**.

Figure 8-14: Spare - COM 2



4. On the Communication Setup screen, select **COM2: Spare - COM2**.
5. In the Port description field, type a description for the port. Ensure that the port description uniquely identifies the port.
6. From the Protocol menu, select the protocol required by the external device.

**IMPORTANT NOTE:** If the protocol selected is any of the MODBUS® options in the list, select the appropriate register format (in the Modbus Format Settings fields).

7. Verify or configure the serial port settings to match the settings of the external device.
8. For RS-485 communication, position the onboard termination jumpers according to the following table:

Table 8-5: RS-485 Termination on COMM2

Position of the device on the Bus	XFCG5 J12	XRC J10
Last or only unit	1-2	1-2
Intermediate	2-3	2-3

- Click **Send changes to device** when configuration is complete.

Verify that the new port name displays under Communications on the navigation tree.

### 8.7.3 Configure for network communication

The XFC<sup>G5</sup> and XRC<sup>G5</sup> can connect to several types of wired or wireless networks. The Ethernet port supports connection for both local and remote communication. The Wi-Fi and onboard Bluetooth wireless interfaces support connection for local wireless communication.

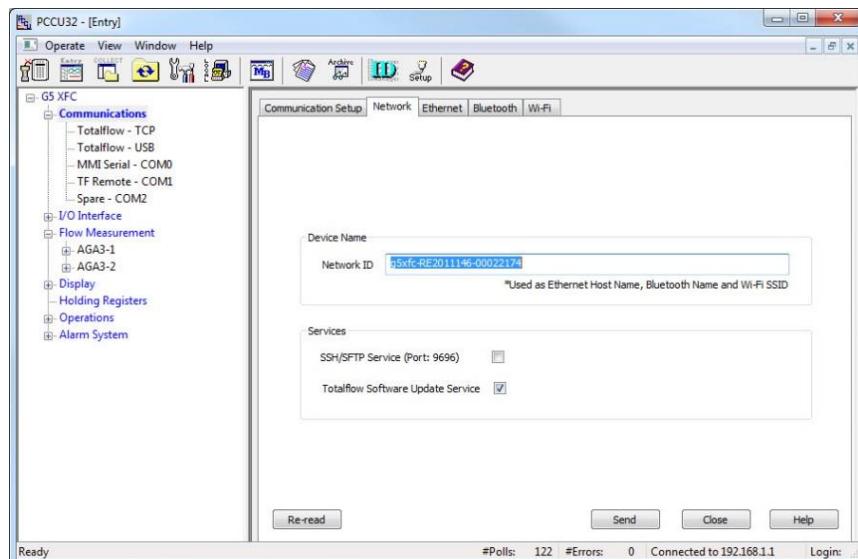
When planning to enable Ethernet, Wi-Fi or Bluetooth communication, configure the Network ID of the XFC<sup>G5</sup> or XRC<sup>G5</sup>. Use the same Network ID for all three types of connections. This procedure is required before enabling Ethernet, Wi-Fi or Bluetooth.

**IMPORTANT NOTE:** The Network ID is the name or ID that uniquely identifies the device on Ethernet, Wi-Fi, or Bluetooth networks. The default network ID combines the device type (name) and serial number. If changing the default, ensure that the name is unique. The Network ID is the name broadcast on the wireless networks and must be detected by wireless devices prior to establishing connection.

Configure the network ID:

- On the PCCU Entry mode navigation tree, select **Communications**.
- Select the **Network** tab.
- To change the default in the Network ID field, type the desired name (not recommended).
- Click **Send** to save.
- Use the Network ID to identify the XFC<sup>G5</sup> or XRC<sup>G5</sup> for connections on Wi-Fi or Bluetooth.

Figure 8-15: Network tab – Configure network ID



### 8.7.4 Enable and configure Ethernet

To connect the XFC<sup>G5</sup> or XRC<sup>G5</sup> to a network, enable the Ethernet interface and configure the device with a valid public IP address. The Ethernet interface supports static (manual) or dynamic (DHCP) IP addressing. If configuring the address manually, obtain a valid IP address from the IT administrator.

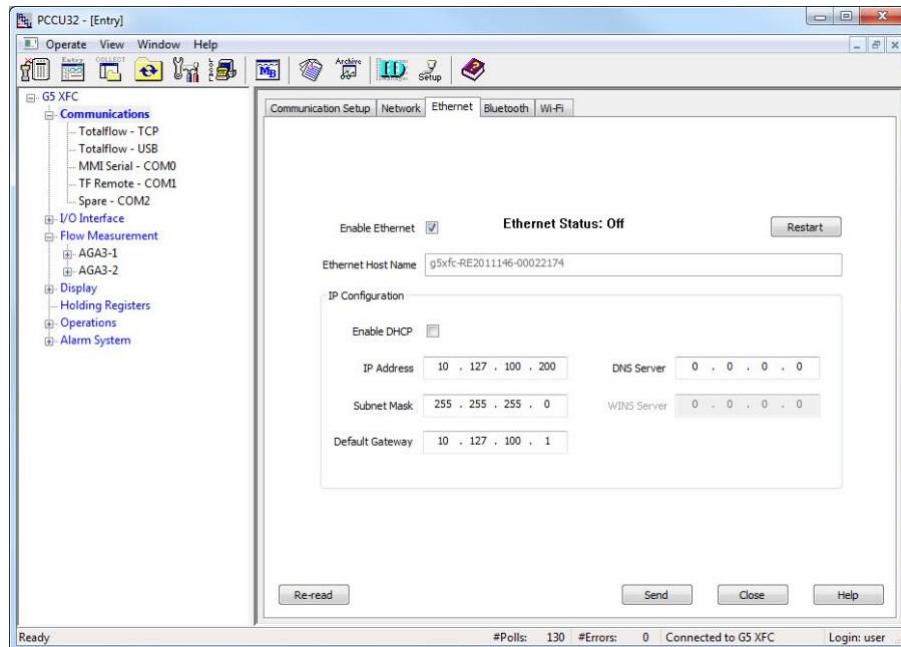
For additional details, click **Help** from the Ethernet tab screen.

Configure the Ethernet interface:

- Configure Network ID.
- Connect the Ethernet cable from the XFC<sup>G5</sup> or XRC<sup>G5</sup> to the network communication equipment (hub, switch, router, etc.).
- On the PCCU Entry mode navigation tree, select **Communications**.
- Select the **Ethernet** tab.

5. Select the **Enable Ethernet** checkbox.
6. If using static addresses, type the IP Address, Subnet Mask, and Default Gateway, provided by the IT administrator.
7. If using DHCP for dynamic addressing, select the **Enable DHCP** checkbox.

Figure 8-16: Enable and configure Ethernet communication



8. Click **Send**. A message to confirm the change displays.
9. Click **Yes** to confirm.
10. Click **Re-read** to refresh the screen and verify that the Ethernet Status displays Ready.
11. Verify that the saved IP configuration is correct.
  - a. If DHCP is enabled, the IP parameters automatically configure.
  - b. If the IP parameters are not displayed, the device did not obtain the parameters from the DHCP server.
    - Ensure that the connection to the corporate network is active and verify that the DHCP server is running and available.
    - If unable to connect to the DHCP server, contact the IT administrator.
12. Ping the IP address of the device from the corporate network or local switch and verify that the device replies.



**IMPORTANT NOTE:** To restart or reinitialize the Ethernet interface, click the **Restart** button on the Ethernet screen. It is no longer necessary to restart the device.

### 8.7.5 Enable Wi-Fi

The XFC<sup>G5</sup> and XRC<sup>G5</sup> support Wi-Fi Access Point (AP) functionality. This allows wireless local access for clients with Wi-Fi wireless capabilities. When enabling Wi-Fi, the factory default parameters offer the highest security and number of users. Change the default configuration to meet field security requirements.

This procedure enables Wi-Fi and changes the default security passcode (recommended). For non-default configuration or additional details click **Help** from the Wi-Fi tab screen.



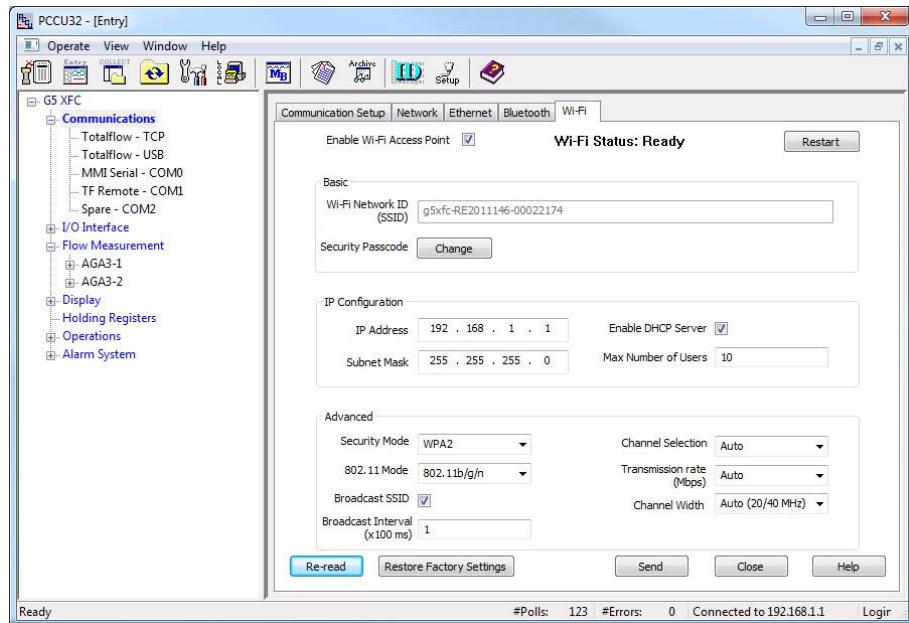
**IMPORTANT NOTE:** An XFC<sup>G5</sup> or XRC<sup>G5</sup> enabled as a Wi-Fi Access Point does not provide bridging or routing between the wireless (Wi-Fi) and the wired (Ethernet) networks.

Enable as a Wi-Fi Access Point:

Install the antenna. (See section [3.12 Install antenna](#).)

1. Configure the Network ID.
2. On the PCCU Entry mode navigation tree, select **Communications**.
3. Select the **Wi-Fi** tab.

Figure 8-17: Wi-Fi tab screen



4. Select the Enable Wi-Fi Access Point checkbox.
5. Change the default security passcode, click **Change**.
6. At the dialog box, type the factory default passcode: **totalflow**. Type and confirm a new passcode and click **OK**.

Take note of the new security passcode and keep it safe as it will be required to establish a connection from Wi-Fi clients.



**IMPORTANT NOTE:** If planning to leave the XFC<sup>G5</sup> or XRC<sup>G5</sup> with the security switch on, make sure to test the passcode before leaving the field. Turn off the onboard security switch to reset to factory defaults remotely if the new passcode is lost. Resetting Wi-Fi to factory defaults resets all Wi-Fi parameters, not only the passcode.

7. Click **Send** to save the new passcode.
8. Click **Yes** to confirm. A message displays indicating that the passcode change is successful.

Take note of the IP address (default: 192.168.1.1) as it is required to establish connection using PCCU.



**IMPORTANT NOTE:** The default IP address assigned to the XFC<sup>G5</sup> and XRC<sup>G5</sup> for Wi-Fi connections is not the same as the default IP address assigned to Ethernet. When configuring PCCU for either type of connection, make sure to use the correct address.

Test that the Wi-Fi enabled XFC<sup>G5</sup> or XRC<sup>G5</sup> is available and establish connection. This test can be performed from the same laptop or PC used during this configuration if it is enabled for Wi-Fi.

1. On the laptop, click the Windows Start button and go to Control Panel>Network and Internet>Network and Sharing Center>Connect to a network.
2. View wireless networks detected and verify that the network ID assigned to the XFC<sup>G5</sup> or XRC<sup>G5</sup> displays.
3. Select Network ID and click Connect.

Figure 8-18: Network connections



4. When prompted, provide the security passcode and click **OK**.
5. View the list of wireless networks again and verify that the client shows Connected. A connected status indicates that the Wi-Fi client has been authenticated and automatically assigned an IP address.

Verify connection from PCCU:

1. Start a new instance of PCCU or close the current PCCU connection. The main PCCU screen displays.
2. On the PCCU toolbar, click **Setup**.
3. On the Setup tab, for Communications/PCCU Connect Method, select **TCP/IP**.
4. In the Network ID or IP field, type the IP address assigned to the XFC<sup>G5</sup> or XRC<sup>G5</sup> for the Wi-Fi network (default: **192.168.1.1**).
5. Click **Close** to exit PCCU setup and return to the main PCCU screen.
6. On the PCCU toolbar, click **Entry** and verify connection is established.

### 8.7.6 Enable Bluetooth

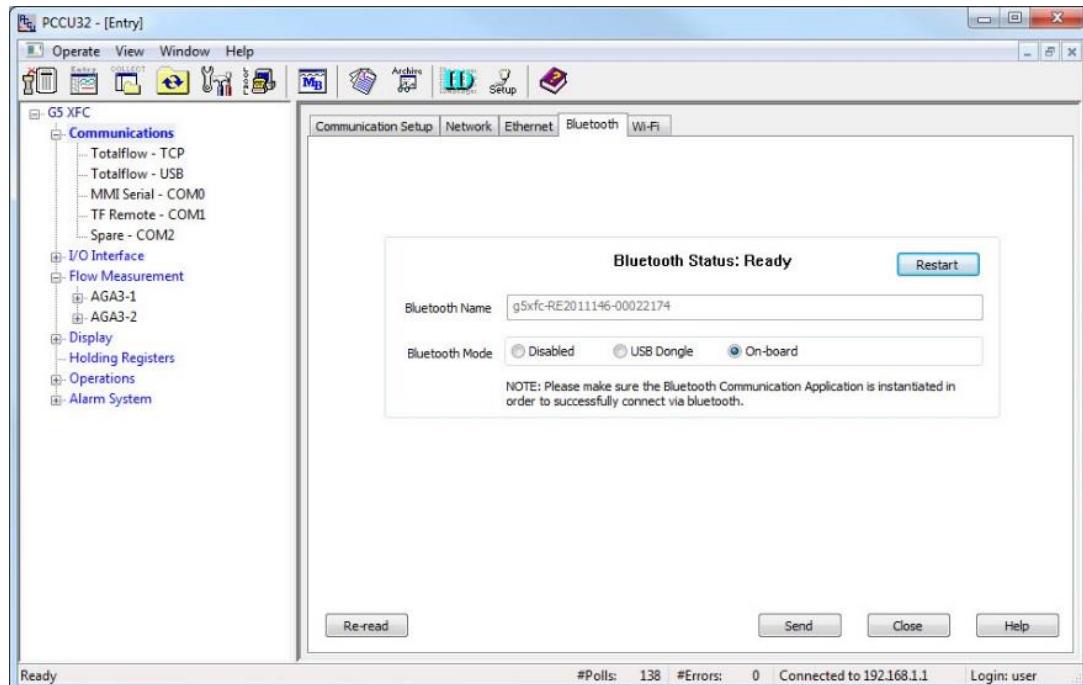
The XFC<sup>G5</sup> and XRC<sup>G5</sup> support Bluetooth functionality to allow wireless local access. This procedure enables onboard Bluetooth.

For additional details, or if using a USB dongle, click **Help** from the Bluetooth tab screen.

Enable onboard Bluetooth:

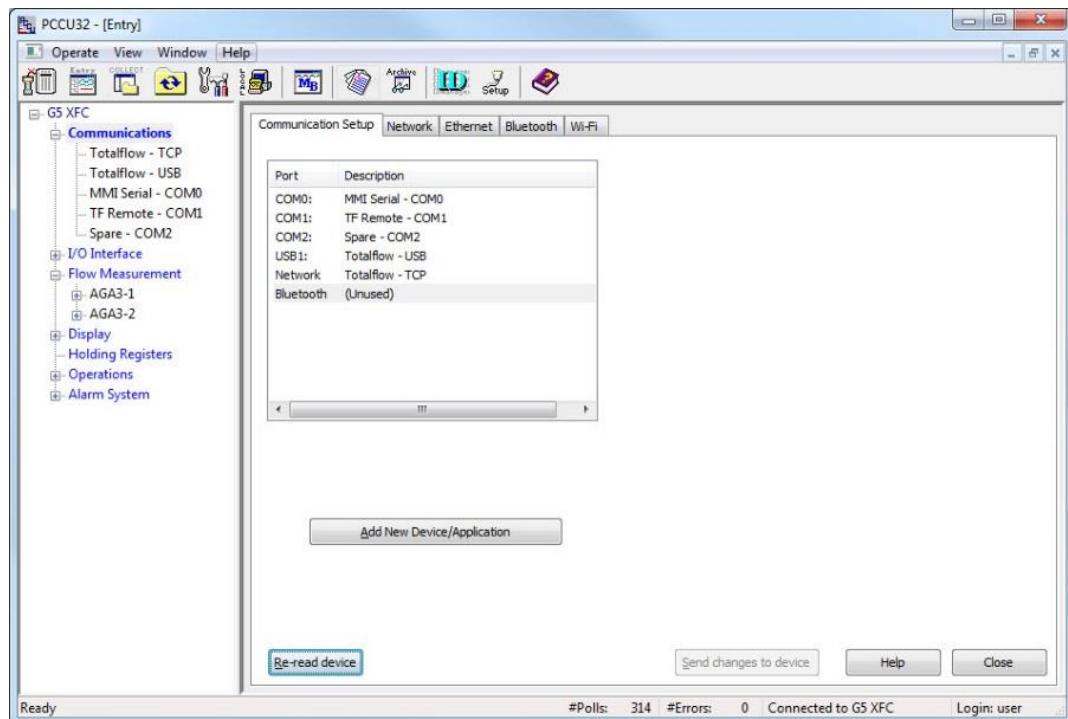
1. Ensure the antenna has been installed. See section [3.12 Install antenna](#).
2. Configure the Network ID. See section [8.7.3 Configure for network communication](#).
3. On the Entry mode navigation tree, select **Communications**.
4. Select the **Bluetooth** tab.
5. For the Bluetooth mode, select **On-board**.
6. Click **Send**.
7. Click **Yes** to confirm. Wait for Bluetooth to initialize.
8. Verify that the Bluetooth Status displays Ready.

Figure 8-19: Enable Bluetooth



9. Select the **Communication Setup** tab. The Bluetooth interface is unused in the port list.

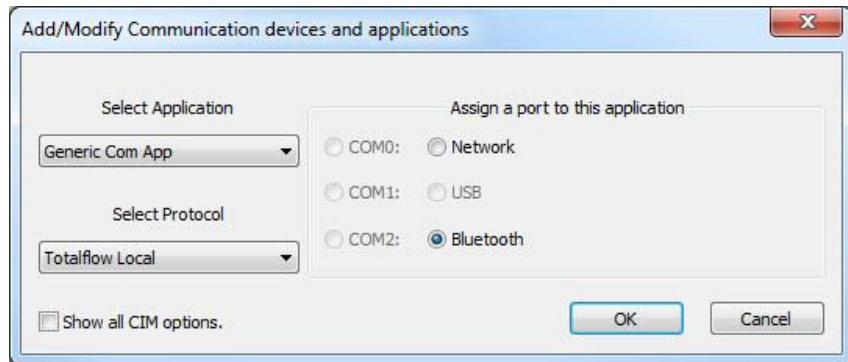
Figure 8-20: Communication Setup for Bluetooth



10. Select **Bluetooth** (Unused).

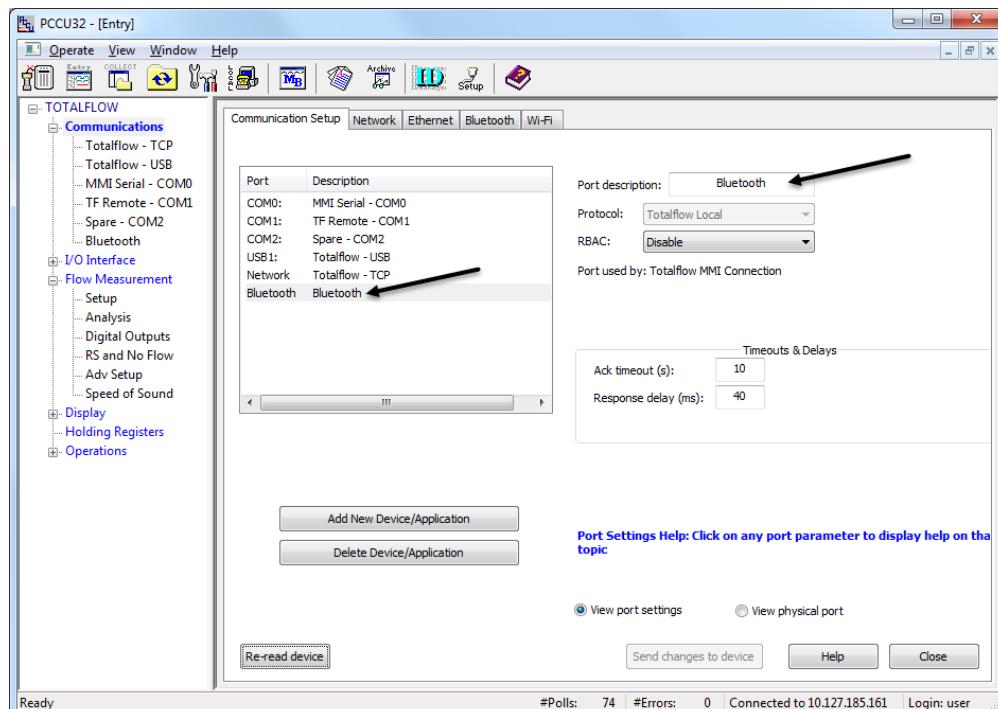
11. Select **Add New Device/Application**. See the figure below.

Figure 8-21: Add/Assign Bluetooth application to Bluetooth interface



12. Select Bluetooth.
13. Click **OK**.
14. Click Send Changes to device.
15. On the Communication Setup tab, verify that the port list and the description both display Bluetooth. See the figure below.

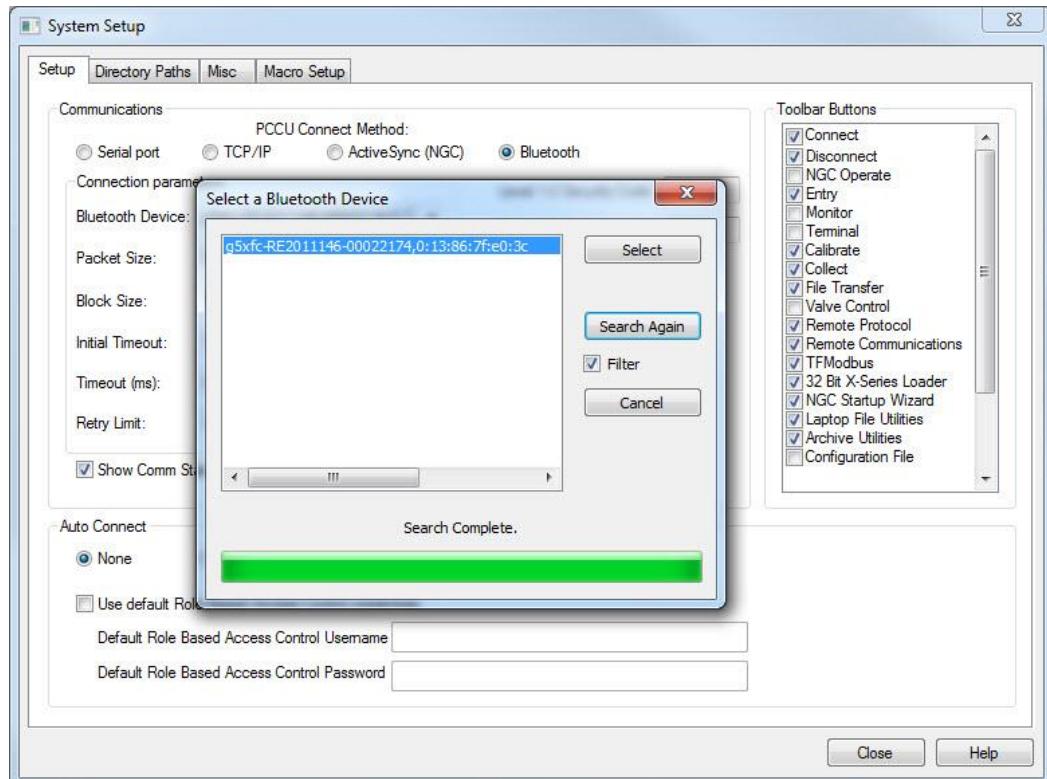
Figure 8-22: Verify Bluetooth application assignment



Start a new instance of PCCU to test the Bluetooth connection or close the current connection:

1. Start PCCU, from the top menu, and select **Setup**.
2. Under Communications/ PCCU Connect method, select **Bluetooth**.
3. Select Search for Bluetooth devices.
4. Verify that the XFC<sup>G5</sup> or XRC<sup>G5</sup> Network ID displays in the list of detected devices.
5. Select the device on the list and highlight.
6. Click **Select**.

Figure 8-23: PCCU Connection Setup for Bluetooth



7. Click **Close** to exit PCCU connection setup.
8. On the top PCCU menu, click **Entry** to connect to the XFC<sup>G5</sup> or XRC<sup>G5</sup>.
9. When the connection is successful, continue with configuration procedures or click **Close** to close the Bluetooth connection.

For further configuration or changes to the Bluetooth setup, refer to the Bluetooth help topics.

## 8.8 Commission the device

Commissioning the XFC<sup>G5</sup> or XRC<sup>G5</sup> is a two-part process:

- Validate the device measurement
- Place the device in service.

### 8.8.1 Validate the device measurement

The XFC<sup>G5</sup> and XRC<sup>G5</sup> are calibrated at the factory before shipping. However, shipping and installation may introduce errors into the measurement results. To verify measurement accuracy, perform pressure checks.



**IMPORTANT NOTE:** Save the device's data and configuration before and after calibration procedures. For details on calibration or device data backup, see section [11 Calibration](#).

Validate measurement:

1. Perform static pressure (SP) and differential pressure (DP) calibration pressure checks.
2. If it is necessary to correct errors in the measurement system, proceed to section [11 Calibration](#).

### 8.8.2 Place the device in service

The following instructions provide general guidelines for placing the XFC<sup>G5</sup> in service.

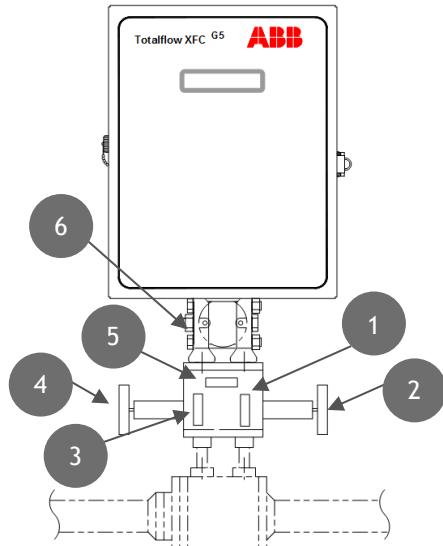


**IMPORTANT NOTE:** The following procedure is based on the flow computer attached to a 3-valve manifold. For all other applications, adapt these instructions to the specific manifold.

Place the XFC<sup>G5</sup> in service:

1. Close the high and low pressure tap valve connections on the stream to shut off the process flow.

Figure 8-24: Flow computer with 5-valve manifold



#### Legend XFC<sup>G5</sup> with XIMV and 5-valve manifold

<b>1</b>	High side equalizer valve	<b>4</b>	Low side tap valve
<b>2</b>	High side tap valve...	<b>5</b>	Manifold vent valve
<b>3</b>	Low side equalizer valve	<b>6</b>	XIMV

2. Verify the equalization valves (items 1 and 3) are open.
3. Verify the manifold vent valve is closed.
4. Slowly open the stream tap valves to open the process stream, creating flow.
5. Wait until the system has pressurized (typically less than 1 minute) before continuing.
6. Close the equalization valves (items 1 and 3) on the manifold.

### 8.8.3 Optional volume reset (recommended)

This procedure allows the device to have an official starting point for valid live data. The Events file maintains the record of the volume reset and time stamp.

To reset volume:

1. On the PCCU navigation tree, click **Flow Measurement > Setup > Commands**.
2. On the Reset Volume value field, select **Yes**.
3. Click **Send** and select **Yes** to confirm.

## 9 Configure security (recommended)

To secure access to the XSeries<sup>G5</sup> devices, review the security features implemented.

### 9.1 Access points

Totalflow user interfaces and host products support connection with the XSeries<sup>G5</sup> devices through several types of communication ports, protocols, and services. These constitute points of entry that could be subject to inexperienced, unauthorized or malicious access through a point-to-point connection or a connection established over a network. Local and remote access must be protected by controlling physical access to the ports, enabling on-board security, or enforcing authentication prior to establishing a connection using any of the ports.

This section lists the communication ports, services, protocols, and the open Transmission Control Protocol (TCP) ports that need to be taken into consideration when securing devices.

### 9.2 Communication interfaces

The table below lists the default communication ports available in XSeries<sup>G5</sup> devices with standard configuration. These ports are pre-configured from the factory. When enabled, these ports are ready for use, but are not secured.

Unprotected ports make the full functionality of the device available to any user. Configure security passcode or role-based authentication to prevent indiscriminate access.

Table 9-1: Default communication ports in XSeries<sup>G5</sup>

Wired connections communication ports, default names	Default state	Default protocol	Security feature available
<b>MMI</b> , port name: MMI Serial - COM0	Enabled	Totalflow Local (Read-only)	Bi-Level Security code authentication or Role-base Authentication (RBAC)
<b>USB</b> , port name: Totalflow - USB	Enabled	Totalflow Local (Read-only)	Bi-Level Security code authentication or Role-base Authentication (RBAC)
<b>Ethernet</b> , port name: Totalflow - TCP	Disabled	Totalflow/TCP (Read-only)	Bi-Level Security code authentication or Role-base Authentication (RBAC)
<b>COMM1</b> , port name: TF - Remote	Enabled	Totalflow Remote (Configurable)	Bi-Level Security code authentication or Role-base Authentication (RBAC)

The Table below lists the wireless interfaces available in XSeries<sup>G5</sup> devices with standard configuration.

Table 9-2: Wireless interfaces in XSeries<sup>G5</sup>

Wireless connections communication interfaces	Default state	Protocol	Security feature available
<b>Wi-Fi</b> , Wi-Fi Access Point functionality	Disabled	Totalflow Local/TCP	Passcode protection and standards-based Wi-Fi security modes (WPA, WPA2)
<b>Onboard Bluetooth</b> , Port Name: Bluetooth	Disabled	Totalflow Local	Role-Based Authentication (RBAC)
<b>Bluetooth via USB Dongle</b> , Port Name: Bluetooth	Disabled	Totalflow Local	Role-Based Authentication (RBAC)

#### 9.2.1 User-enabled services

Services are software processes that run on the XSeries<sup>G5</sup> device. The table below lists user-enabled services that open access to the embedded software file system. Unauthorized or malicious use of these services can cause file corruption and render a device inoperable.

Table 9-3: User-enabled services on XSeries<sup>G5</sup>

<b>Service Name</b>	<b>Default state</b>	<b>Description</b>	<b>Security feature available</b>
SSH/SFTP Service	Disabled	Serves connection requests for secure login shell and file transfer. Supports connection requests from third-party SSH/SFTP clients	Authentication based on private-public key pairs, passphrase-protected keys
Totalflow Software Update Service	Enabled	Enables or blocks the ability of the device loader to update the embedded software.	None specific to the service. Must use Bi-level security passcode or Role-Based Authentication (RBAC)

## 9.2.2 Open Transmission Control Protocol (TCP) ports

The table below lists the open TCP ports on an XSeries<sup>G5</sup> device. These ports are used for all TCP/IP based connections which are supported by the Ethernet and Wi-Fi interfaces.

Protocols over TCP can be standard like SSH, or proprietary like Totalflow (Remote or Local).

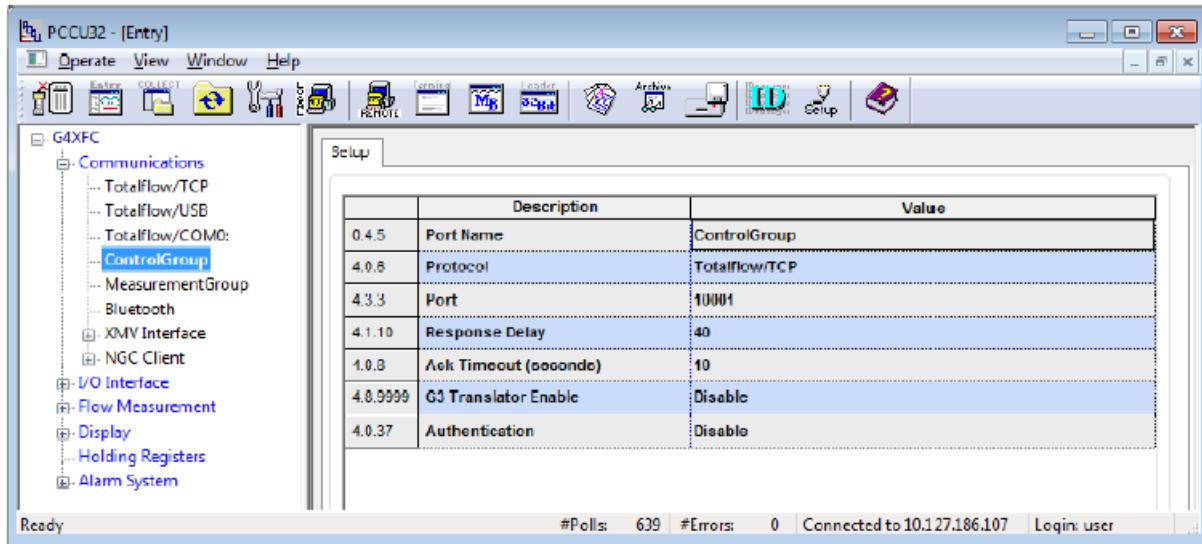
Table 9-4: Open TCP ports on an XSeries<sup>G5</sup>

<b>Default TCP port</b>	<b>User-configurable</b>	<b>Protocol using the port</b>	<b>Description</b>
9999	Yes	Totalflow/TCP	Assigned to connections used for device monitoring, configuration and data collection or polling. PCCU, WinCCU, TDS and third-party SCADA systems request these connections.
65535	No	Device Loader/TCP	Assigned to the device loader connections for device software update. PCCU requests this type of connection.
9696	No	SSH/TCP	Assigned to secure shell (SSH/SFTP) connections. Third-party SSH/SFTP clients request these connections.
502	Yes	Modbus /TCP	Assigned to connections between the XSeries <sup>G5</sup> devices and external Modbus devices for communication and data transfer

**IMPORTANT NOTE:** For connections with user-configurable ports assigned, customers can use the default value or assign a different port number in the range of 1024 to 65534. Connections using non-default TCP ports are handled by additional Totalflow/TCP communication or Modbus TCP applications configured with different TCP ports. For example, the figure below shows an additional Totalflow/TCP application (named ControlGroup) with a different TCP port (10001).



Figure 9-1: Totalflow/TCP application instance with non-default TCP port



**IMPORTANT NOTE:** TCP port numbers from 0 to 1023 are universally reserved for well-known ports and should never be used.

## 9.3 Denial of service (DOS) thresholds rates

Protection of ports used for TCP/IP communication such as Ethernet, is very important. Several cybersecurity threats can make a device unavailable for connection.

If the Totalflow devices suffers a Denial of Service (DOS) attack, the device cannot grant requests for connection and stops responding. The following table provides the DOS threshold rates per packet type at which the device stops responding.

Table 9-5: Denial of Service (DOS) threshold rates

Packet type	Description
Ethernet	5 Mbps (7440 packets/sec)
ARP	2 Mbps (2976 packets/sec)
IP	3 Mbps (4464 packets/sec)
ICMP	4 Mbps (5952 packets/sec)
UDP	3 Mbps (4464 packets/sec)
TCP	1 Mbps (1488 packets/sec)

## 9.4 Security guidelines

The following table describes recommended guidelines to secure access to the XSeries<sup>G5</sup> devices. Procedures for secure configuration are included throughout this manual, quick start guides and online PCCU help files.

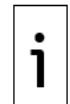
Table 9-6: XSeries<sup>G5</sup> security guidelines

Recommendation	Description
<b>Secure physical access to the device</b>	Access to the device, its internal components, and connected peripherals, should be controlled.

Recommendation	Description
<b>Secure access with security switch</b>	Turn the onboard security switch on to enforce authentication through bi-level security codes or RBAC. (See section <a href="#">9.5 Configure bi-level security with security switch.</a> )
<b>Configure Bi-level security codes</b>	Change default security codes to private codes (the default security code for both level 1 and level 2 is 0000). (See section <a href="#">9.5 Configure bi-level security with security switch.</a> )
<b>Enable Role-Based Access Control (RBAC)</b>	Configure RBAC. (See section <a href="#">9.6, Configure Role-Based Access Control (RBAC).</a> ) Enable Role-Based access and enable authentication for each of the communication ports. The default RBAC passwords and security codes should be changed.
<b>Secure Network connection</b>	The device should only be connected to a protected (by firewall) private network. It is not intended to be connected to the Internet.
<b>Secure Wi-Fi® access</b>	Enable the Wi-Fi Access Point only when required. The Wi-Fi Access Point should always be password-protected to enforce authentication of Wi-Fi clients. The default Wi-Fi Access Point password should be changed to a strong and private password.
<b>Secure Bluetooth® access</b>	Enable Bluetooth only when required. Enable RBAC authentication on the port. ( <a href="#">See 9.6.5 Enable RBAC authentication on communication ports.</a> )
<b>Secure SSH/SFTP access</b>	Enable the SSH/SFTP service only when required. The default SSH/SFTP private keys should be changed for all accounts. The SSH/SFTP private keys should always be passphrase-protected. (See section <a href="#">9.7 Secure the SSH/SFTP service.</a> )
<b>Secure software updates</b>	Enable the Totalflow Software Update service only when required. Limit the ability to enable/disable this service with RBAC.
<b>Manage credentials</b>	All private credentials, keys, and security codes should be stored in safe locations. Share private credentials, keys, and security codes only with properly trained and authorized personnel. Change or update private credentials, keys, and security codes as needed.

## 9.5 Configure bi-level security with security switch

This procedure activates secured access to the XFC<sup>G5</sup> or XRC<sup>G5</sup> by changing the default (OFF) position of the onboard security switch and configuring bi-level security codes.

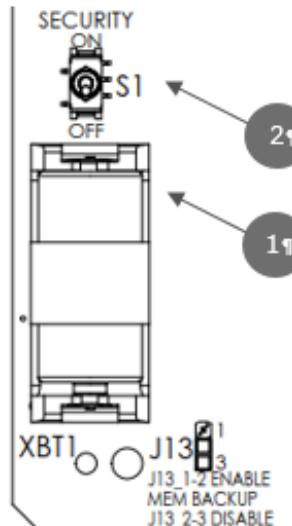


**IMPORTANT NOTE:** After this procedure is completed, connection to the XFC<sup>G5</sup> or XRC<sup>G5</sup> is restricted to users with the correct security codes. This procedure requires opening the enclosure to access to the XFC<sup>G5</sup> or XRC<sup>G5</sup> board.

To enable security:

1. Open the XFC<sup>G5</sup> or XRC<sup>G5</sup> enclosure door and locate the onboard security switch (S1). See the figure below.

Figure 9-2: S1 Security switch



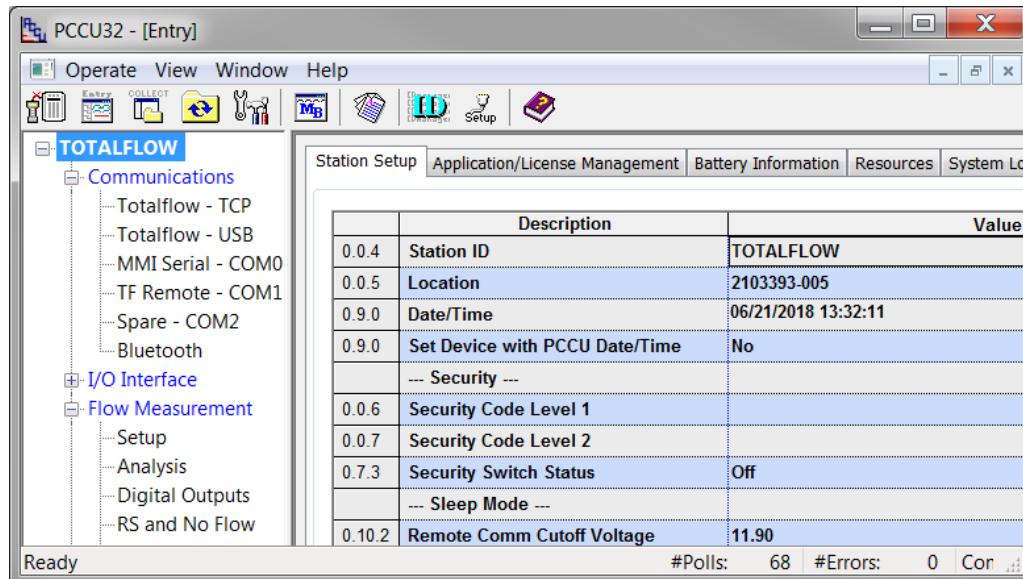
#### Legend – S1 Security switch

**1** Battery

**2** Security switch

2. Ensure the security switch is set to **OFF**.
3. On the Station Setup tab, verify that the Security Switch Status field shows **Off**.

Figure 9-3: Station Setup tab – Security switch status



4. Type a four-digit security code for Security Code Level 1 (read only access).
5. Type a four-digit security code for Security Code Level 2 (read and write access).



**IMPORTANT NOTE:** Record the security codes. Once saved, they are not visible on the Station Setup tab.

6. Click **Send**.
7. On the board, set the XFC<sup>G5</sup> or XRC<sup>G5</sup> security switch to **ON**.

8. On the Station Setup tab, click **Re-read** and check that the security switch status is On. Enforcement of the security codes is in effect.



**IMPORTANT NOTE:** The codes will be required the next time PCCU32 attempts to connect to the device.

## 9.6 Configure 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 G5 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.

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.



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

### 9.6.1 Default access roles

Default roles are automatically available in PCCU32:

- Administrator
- Expert
- Advanced
- Basic
- File Admin

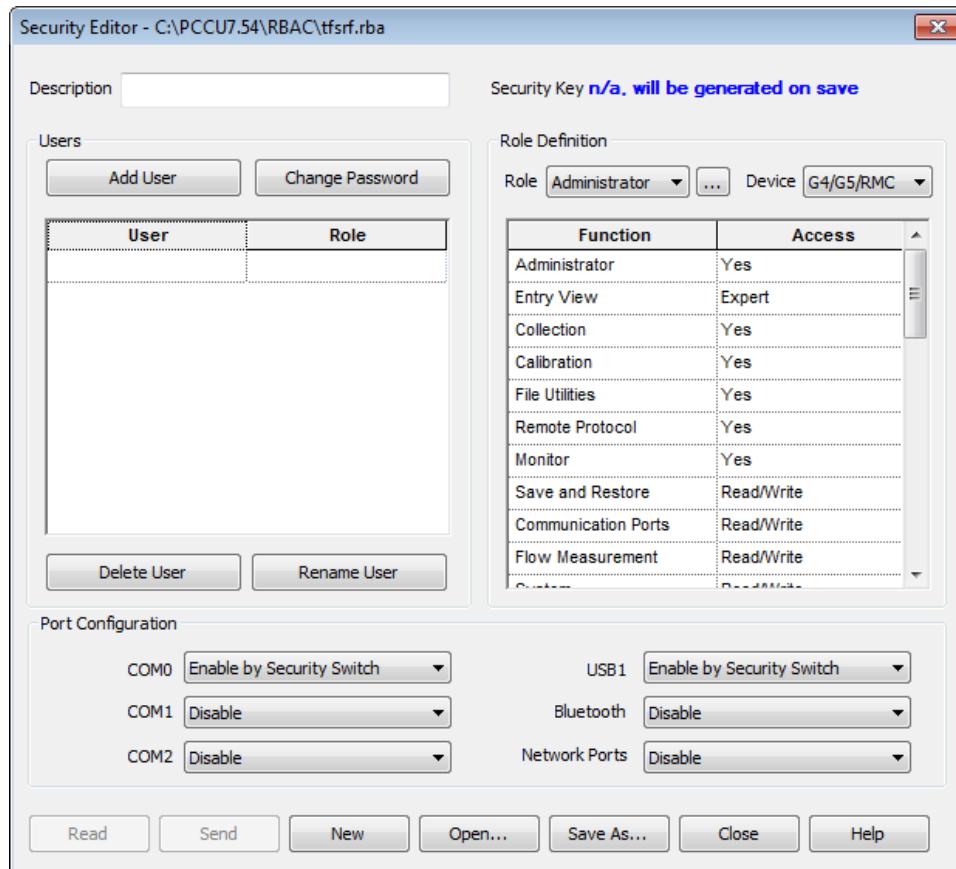
The Administrator role has the highest-level access rights to all functions, including adding users, defining roles, and the ability to save security configuration files to a PC. Expert, Advanced, and Basic roles have decreasing levels of access rights. The File Admin role has the access rights of the Basic role plus minimum rights required for sending/reading RBAC security files to and from G5 and newer devices. The security files may be uploaded to multiple flow computers for implementation.

### 9.6.2 Setup and create a new RBAC security control file

To set up a new RBAC security system:

- 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.
1. On the main PCCU32 menu, click Operate > Security > Role Based Access Control > Role Administration.

Figure 9-4: 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.
  - d. Type the password in the Password field.
  - e. Click **OK**.
3. Follow the procedures detailed in section [9.6.4 Create a new user account](#), to create user accounts with standard roles. Return here when complete.
4. To define or customize a role, see section [9.6.4 Create a new user account](#). Return here when complete.
5. To assign RBAC security to a communication port, see section [9.6.5 Enable RBAC authentication on communication ports](#). Return here when complete.
6. Type a description of the security file in the Description field.
7. Save the new security control file. Click **Save As...**
8. Type a password for the security file and click **OK**.
9. Click **Save** to keep the default file name or change the name and click **Save**.

**IMPORTANT NOTE:** At 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 will be 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.

### 9.6.3 Edit the security file

To edit an existing security control file:

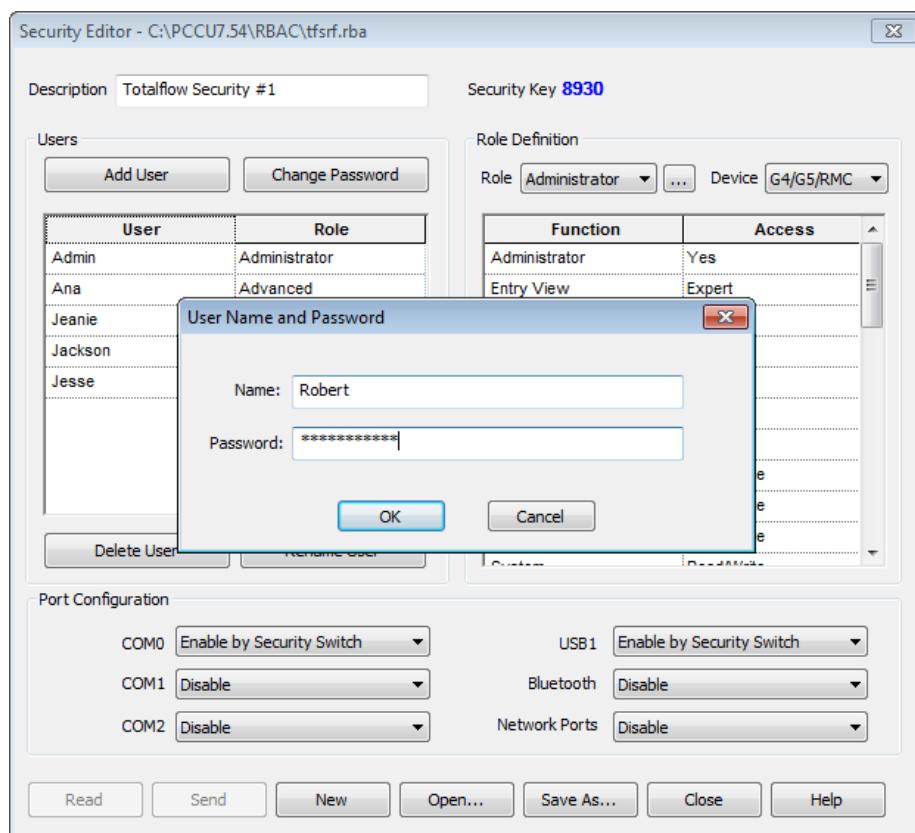
1. From the Security Editor screen, click **Open**.
2. Browse to PCCU > RBAC > [file name.rba]. Click **Open**.
3. Make the necessary changes.
4. Click **Save As....**
5. Type a password for the security file. Click **OK**.
6. Click **Save** to keep the default file name, or change the name then click **Save**.

### 9.6.4 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 of the User Name and Password dialog box.

Figure 9-5: User Name and Password dialog box

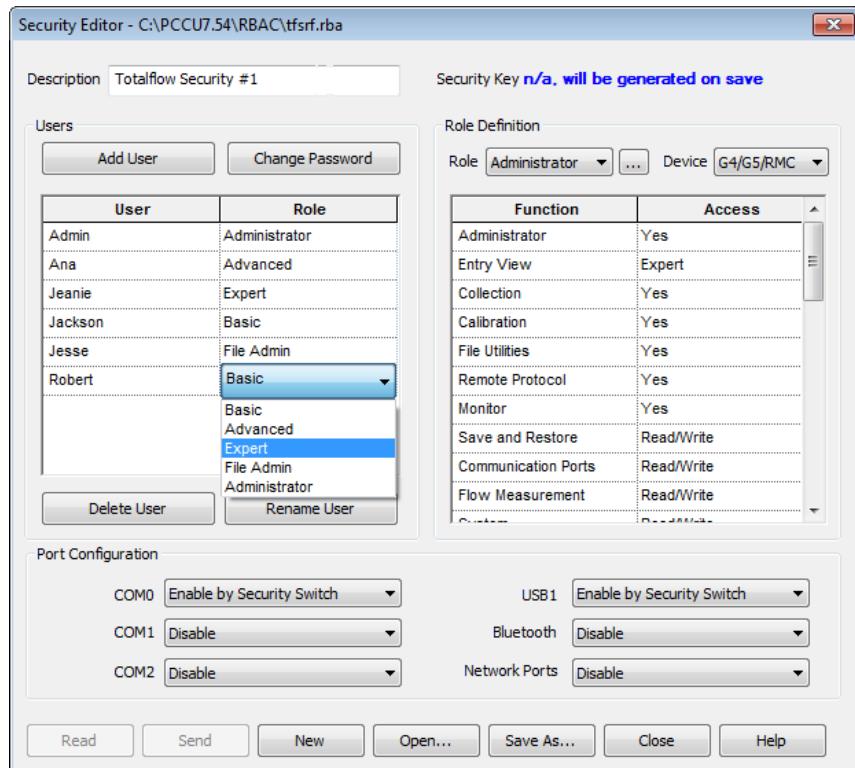


3. Type the user password in the Password field. Click **OK**. The new user account will appear in the list of users.
4. Click **Role** beside the new user account and assign the appropriate role.



**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.

Figure 9-6: User role assignment



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

## 9.6.5 Enable RBAC authentication on communication ports

Enabling RBAC authentication on communication ports secures access to the device. Connection to the ports requires authentication with correct credentials. Select one of the methods described in this section. Review the authentication options in [Table 9-7](#).

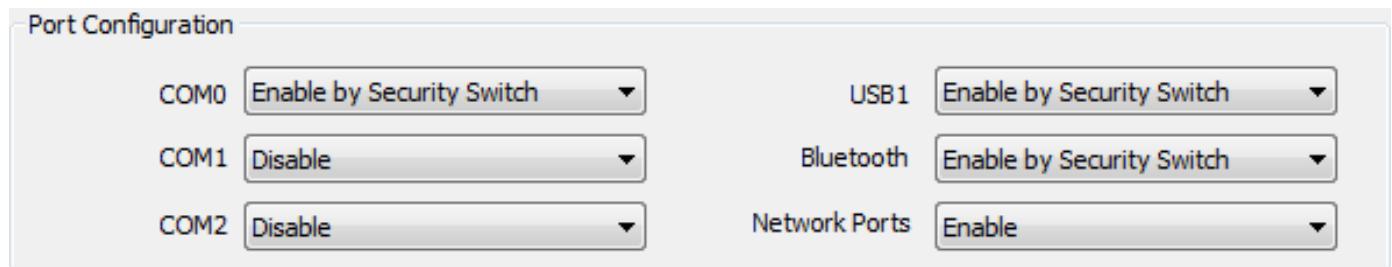
Table 9-7: Per-port RBAC authentication options

Port security setting	Functionality
<b>Disabled</b>	Does not perform any RBAC security functions on the port
<b>Enabled</b>	Enables full security over the port to RBAC. If the administrator name and/or password are lost or forgotten, it will be necessary to reset to the factory default configuration. Note that all data and the running configuration will be deleted.
<b>Enable by Security Switch</b>	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 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.

### 9.6.5.1 Enable authentication from the RBAC security editor

1. Select the preferred authentication option for each port ([Figure 9-7](#)).

Figure 9-7: Enable port authentication from RBAC security editor



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**.

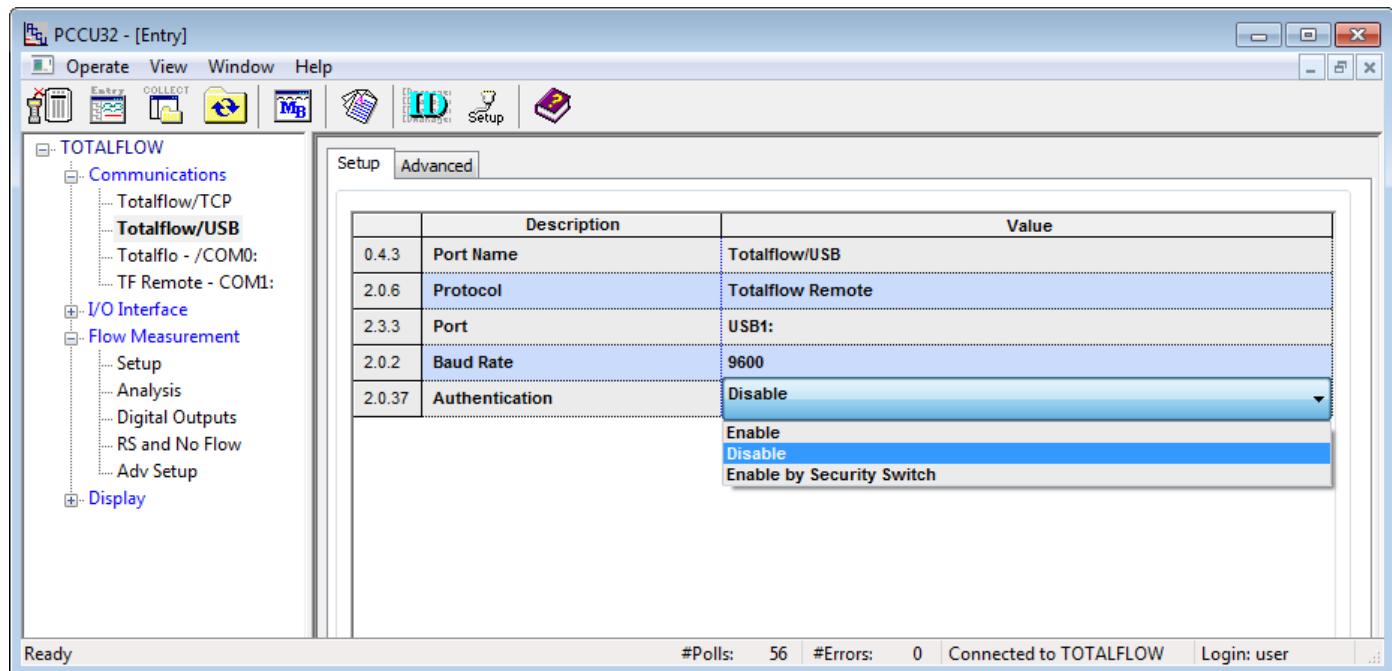
#### 9.6.5.2 Enable authentication from the Entry mode

Enabling RBCA authentication from the Entry mode requires enabling one port at a time.

To use entry mode (in Advanced or Expert view) to configure or override communication port security:

1. In PCCU32 Entry mode, click the communication port to secure.
2. Set the Authentication value to Enabled or Enable by Security Switch in the Setup tab ([Figure 9-8](#)).
3. Click **Send**.
4. Repeat steps 1-3 for each of the communication ports.

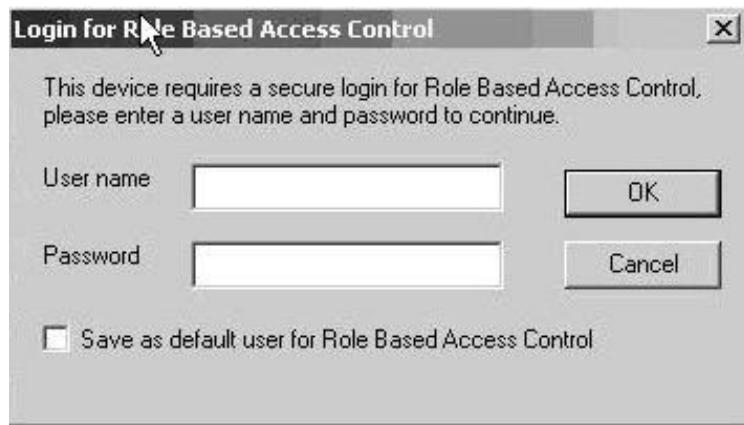
Figure 9-8: Enabling communication port authentication - Entry mode



#### 9.6.6 Use default RBAC credentials

Each time PCCU connects to a flow computer via an RBAC-enabled port, a login screen requests the User name and Password for access. The PCCU connection request is granted when the correct credentials are provided.

Figure 9-9: Login dialog box

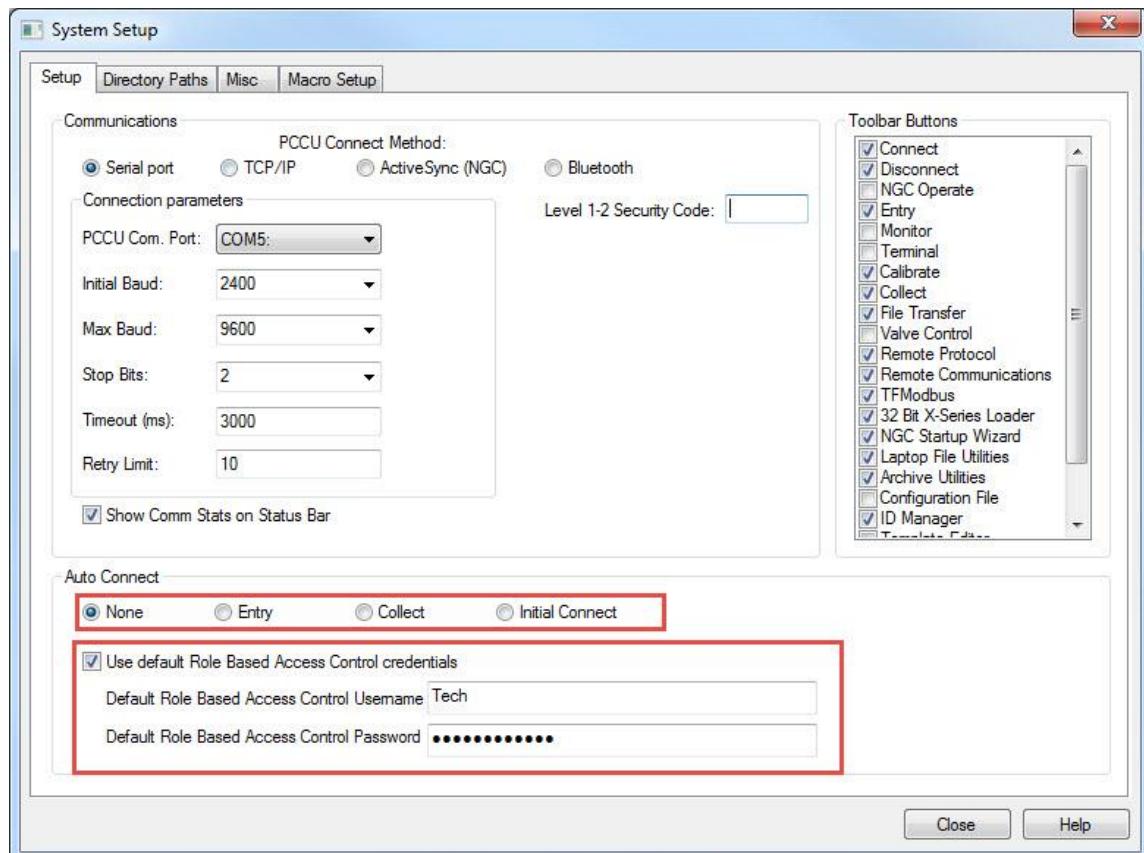


The User name and Password may be set as default credentials in PCCU. When set as the default, the user name and password fields are automatically populated with the default credentials on subsequent logins.

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 ([Figure 9-10](#)):
  - Set the default connection mode (Entry, Collect, etc). Click **Help** for additional details.
  - Select **Use Default Role Based Access Control credentials**.
  - Type in the Default Role Based Access Control Username.
  - Type in the Default Role Based Access Control Password.

Figure 9-10: System Setup Auto Connect and RBAC credentials



3. Click **Close** to exit PCCU connection setup.

## 9.7 Secure the SSH/SFTP service

The Secure Shell (SSH) and Secure File Transfer Protocol (SFTP) service is implemented on the XSeries<sup>G5</sup> devices. This service provides secure shell login access and file transfer capability from a client PC or laptop.

SSH and SFTP provides secure access, instead of the unsecured access of Telnet and FTP in earlier device generations.

SSH/SFTP communication is client-server based. The SSH/SFTP server is implemented in the Totalflow device. The SSH/SFTP client is implemented in third-party software installed in the computer used to communicate with the device.

When the SSH/SFTP service is enabled, the SSH/SFTP server initializes and enters listening mode. With the server in listening mode, it can process requests for connection from SSH/SFTP clients. The service grants connections only to properly authenticated clients.

### 9.7.1 Supported SSH/SFTP accounts

The table below lists the three accounts defined for SSH/SFTP. Customers can access the Totalflow-user account, which is read-only. The developer and tech-support accounts are only available to ABB personnel for service and troubleshooting, or to advanced users and cybersecurity managers who want to generate private keys to replace factory default keys.



**IMPORTANT NOTE:** Request Totalflow-user account default private keys from ABB. Call ABB Customer Support listed on the last page of this manual. For instructions to establish read-only SFTP connections, see the SSH and SFTP service overview topic in PCCU online help.

Table 9-8: Security keys

Account Name	Access privileges	Default keys	Access
Totalflow-user	Only SFTP access (Read-only)	Totalflow-user private key	The following folders and their contents are available for download: <ul style="list-style-type: none"><li>— Crash Dumps</li><li>— Flash: Main Totalflow application (App), Factory configuration, Startup (cold) configuration</li><li>— Logs: System and device loader log files</li><li>— tfData: Running (warm) configuration files</li></ul>
Developer	Full SSH/SFTP access (Read-write)	Developer private key	All file system
Tech support	Full SSH/SFTP access (Read-write)	Tech support private key	All file system

### 9.7.2 SSH/SFTP authentication

Session keys encrypt the communication between the client and the SSH/SFTP server to provide security. Authentication requires specific private-public key pairs for the type of access. Default private keys and passphrases are requested from ABB and kept by the customer. The default public keys are stored at the factory in a protected storage location in the device's flash. They remain unchanged by updates of any of the device software components.

When an SFTP/SSH client requests a connection to the SSH/SFTP service, it must provide its private key and passphrase. The service compares the private key with the public key stored in the Totalflow device. If the keys pair correctly, it grants the connection.



**IMPORTANT NOTE:** Private keys are not shipped with the product or user interface software. ABB keeps the keys and credentials safely stored. Request keys if SSH/SFTP access is needed. Enable the service only if needed.

### 9.7.3 Update default SSH/SFTP keys

ABB Totalflow generates default keys, but customers must generate their own private keys for security. Updating the private key requires the update of the corresponding public key stored on the XSeries<sup>G5</sup> device. This procedure describes how to regenerate a private key and update its corresponding public key on the device.



**IMPORTANT NOTE:** This procedure should be performed by an authorized expert user. Failure to follow the procedure in its entirety will lock access to the SSH/SFTP service. This procedure requires developer or tech-support access. To obtain default keys for this type of access, call ABB Customer Support (see the last page of this manual.)

#### 9.7.3.1 Update requirements

Key update requires third-party software. Two commonly-used products and a link to their download sites is provided.

Obtain the following before update:

- Third-party software to generate new keys such as [Puttygen](#). Download Puttygen as part of a putty package or as a standalone utility.
- Third-party SFTP client software to establish SFTP connections with the device ([Filezilla](#)).
- Latest PCCU from ABB. Download PCCU from [www.abb.com/upstream](http://www.abb.com/upstream).
- The private keys for developer or tech support accounts along with their respective passphrases for SFTP. If changing the keys for the first time, request the default keys from ABB. If the keys have been previously updated, use those keys instead.



**IMPORTANT NOTE:** There are other options for the third-party software. Puttygen and Filezilla are used as examples to illustrate the update procedure. If using other software, the update procedure is similar.

#### 9.7.3.2 Generate private-public key pair

This procedure generates and saves a new private-public key pair. The private key, passphrase and public key are stored safely on the user's laptop or PC. The public key must be saved also in the XSeries<sup>G5</sup> device. The new private key and its passphrase are required to access accounts after its corresponding public key is updated on the device.

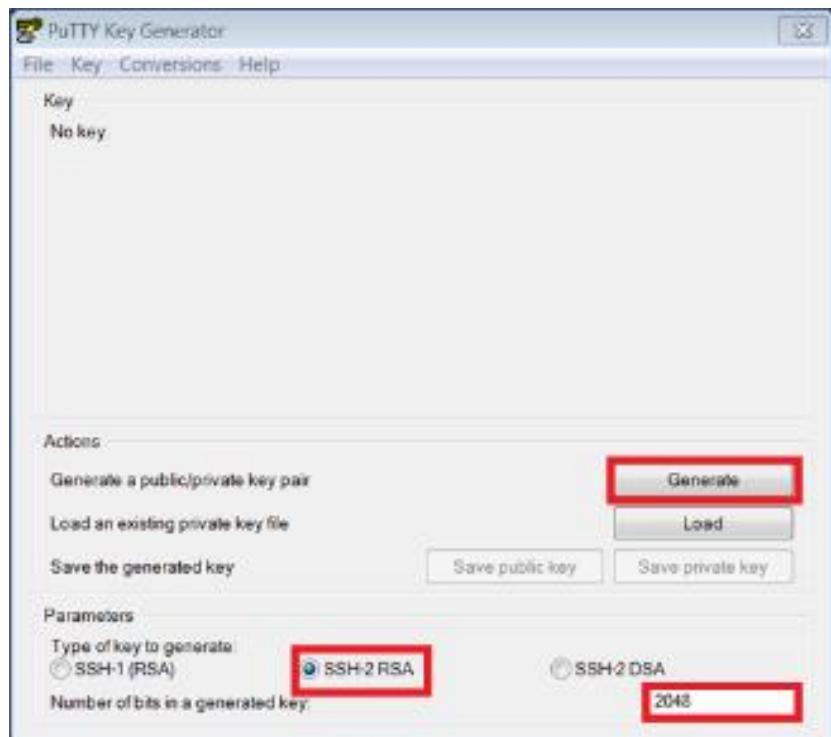


**IMPORTANT NOTE:** If default public keys are replaced on the device, default private keys will no longer work. Make sure all newly generated keys and their passphrases are stored in a safe location.

To generate new keys:

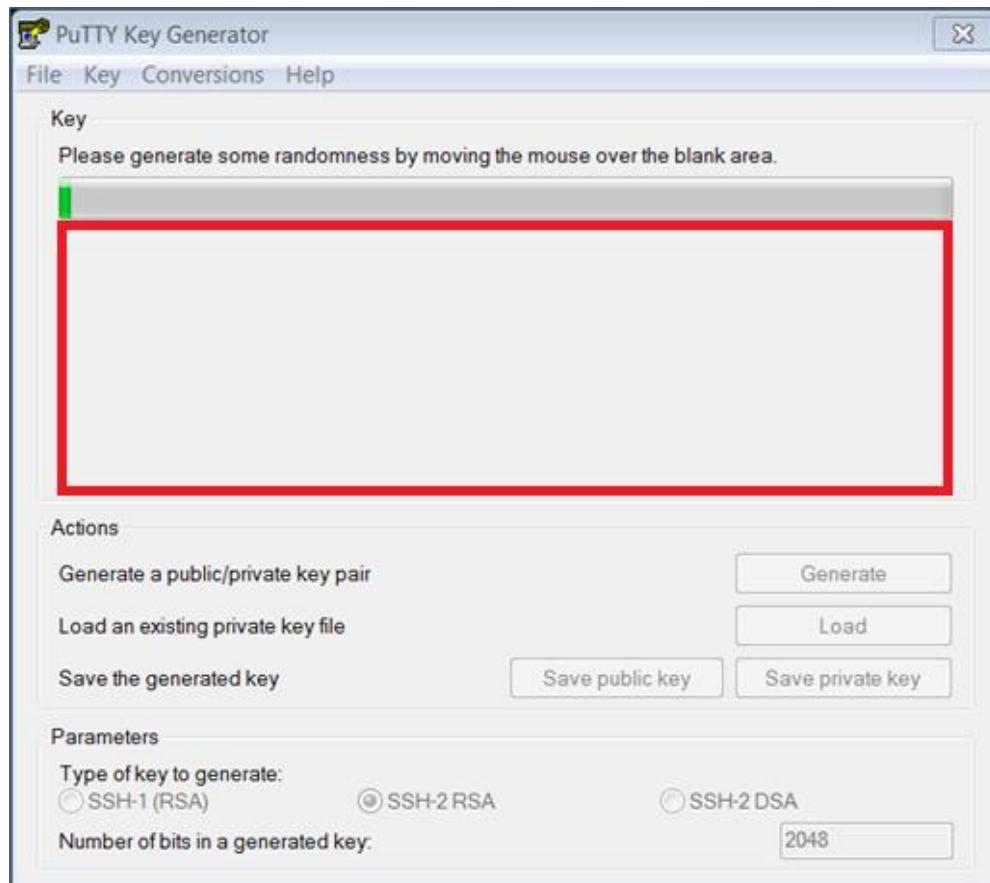
1. Download and install the latest version of Puttygen from the link provided in section [9.7.3.1, Update requirements](#).
2. Launch the Puttygen application. In the Puttygen Key Generator window make sure that the "Type of key to generate" is set to SSH-2 RSA and "Number of bits in a generated key" is set to 2048. Click **Generate**.

Figure 9-11: Puttygen Key Generator



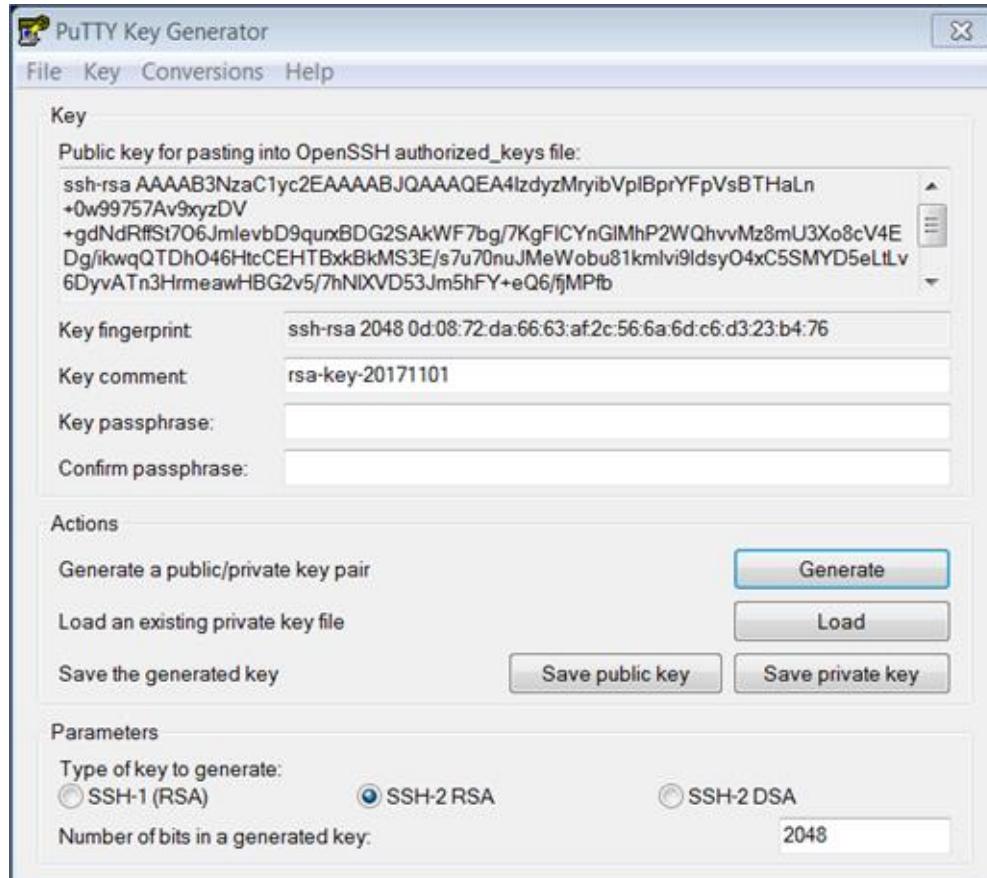
3. Move the mouse to the Key blank field, under the progress bar (see highlighted area below).

Figure 9-12: Puttygen Key Generator Key blank field



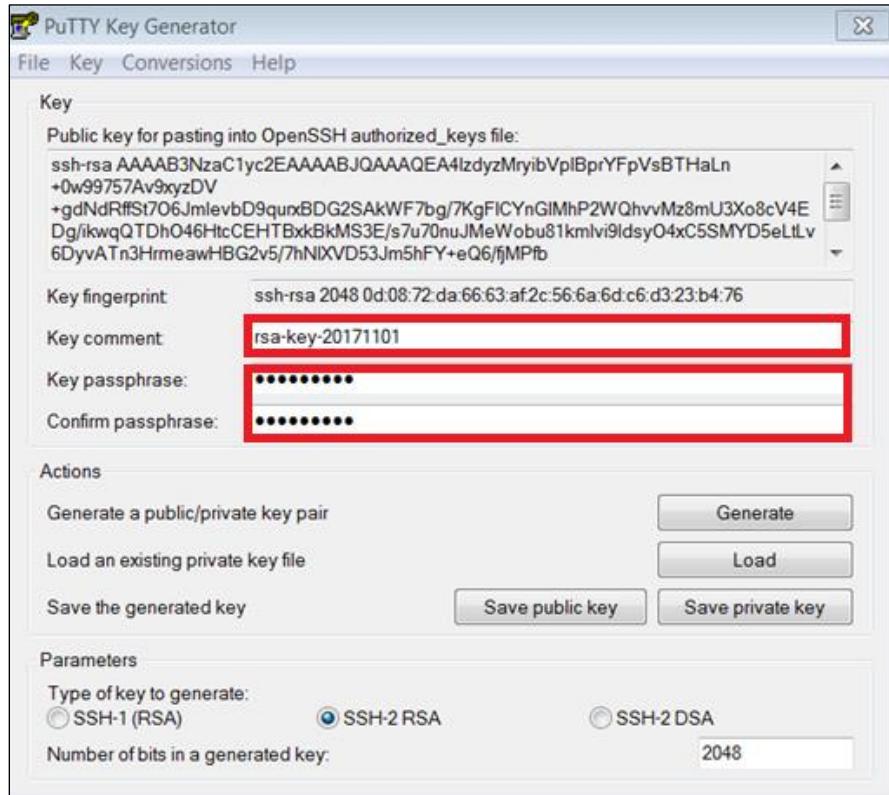
4. Wait until the program completes the new key generation (the progress bar reaches 100 %). The Key field displays the new public key.

Figure 9-13: New public key



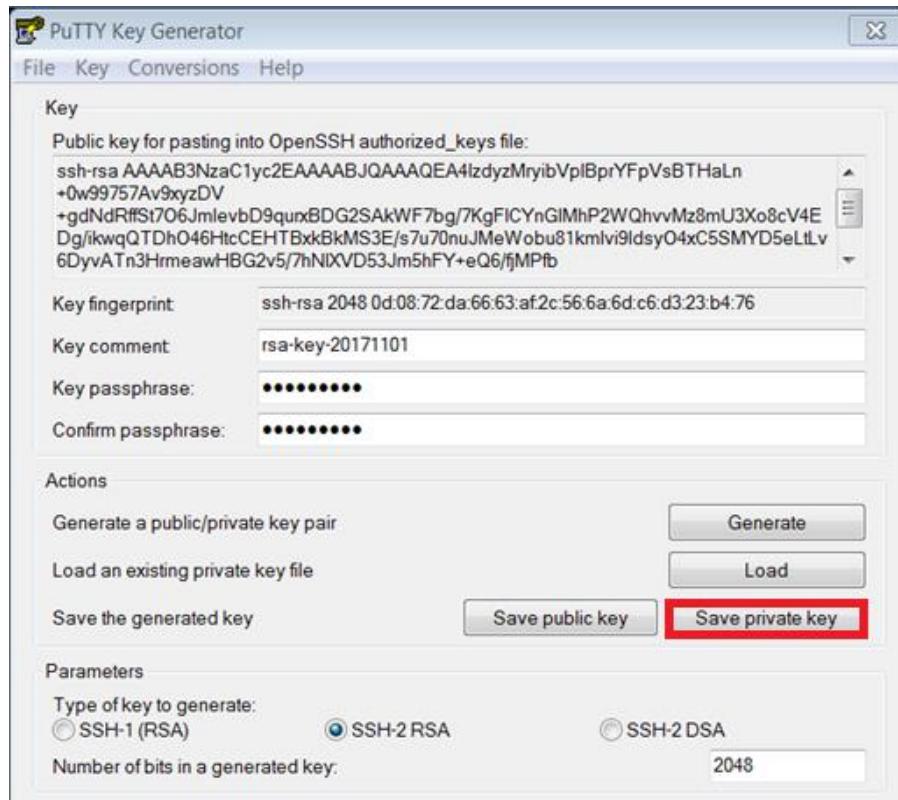
5. In the Key comment field: leave default (includes the date of key generation) or another preferred description
6. In the Key passphrase and Confirm passphrase fields: create a strong private passphrase (a passphrase protects the use of the private key. It is recommended for additional security).

Figure 9-14: New private key and passphrase



7. Click Save private key.

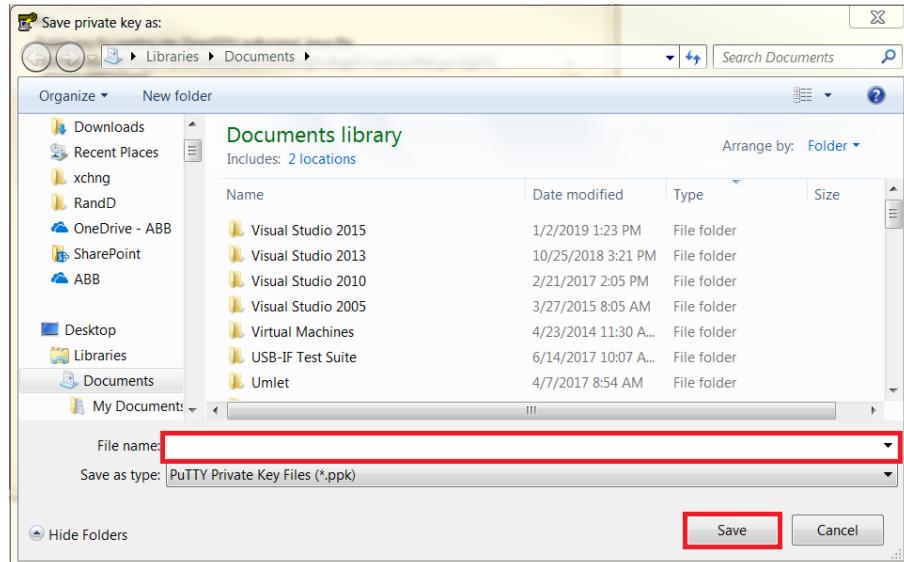
Figure 9-15: Save private key and passphrase



8. Type the file name and select the desired location to store the key file at file browser window. The private key file has the ".ppk" extension. This new private key along with its

passphrase would be used for accessing the accounts after its corresponding public key is updated on the device.

Figure 9-16: Select location to save private key file



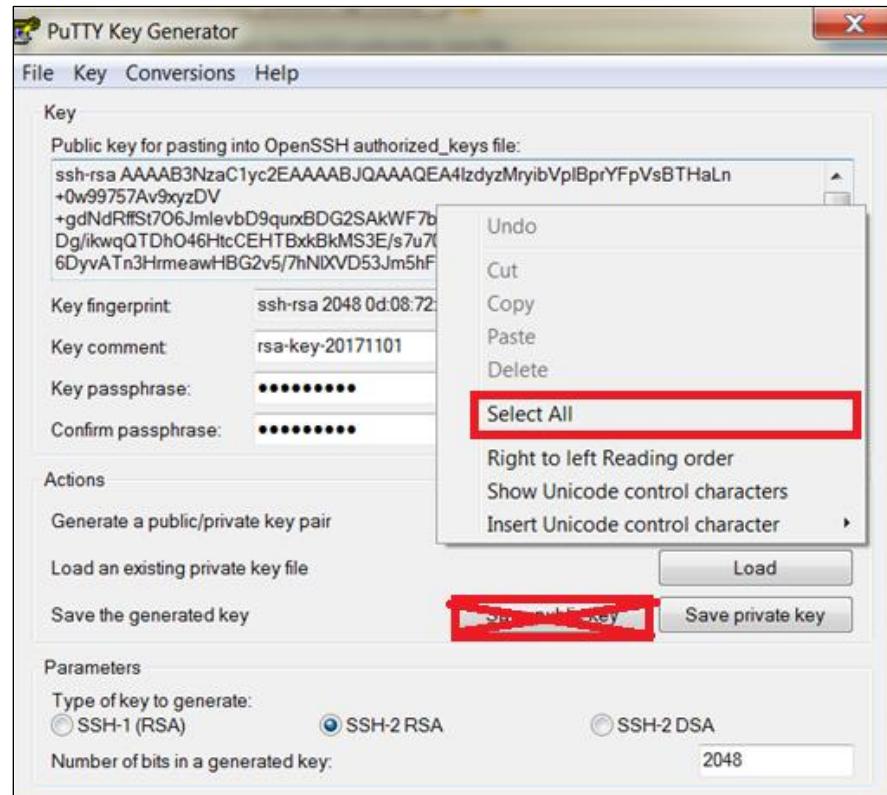
9. Click **Save**. The file browser closes.

10. Right-click on the Key field where the public key displays. Click **Select All**.



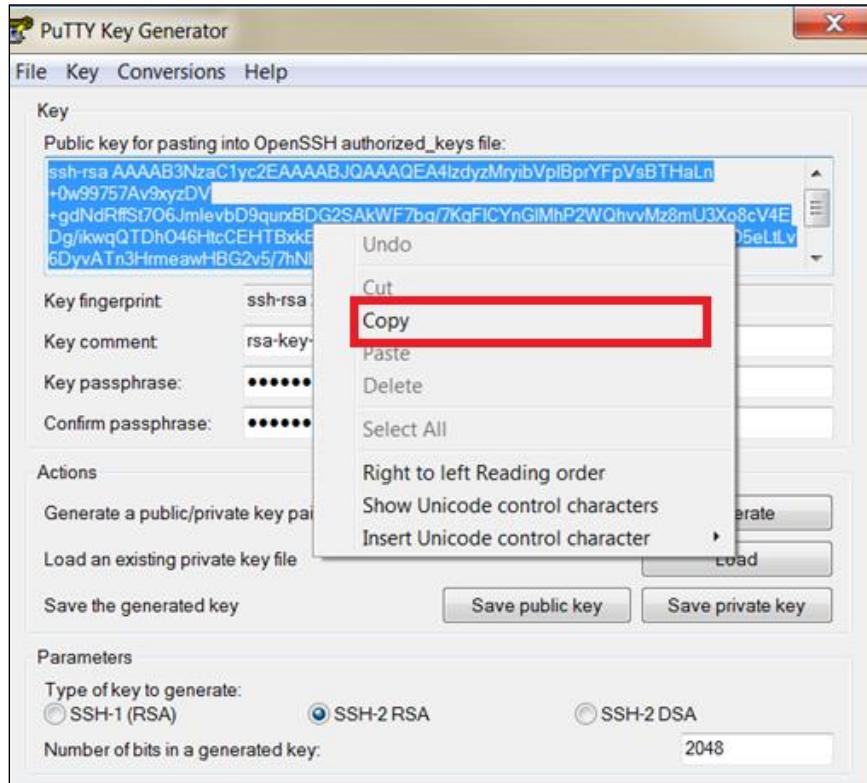
**IMPORTANT NOTE:** Do not click **Save public key** for this process.

Figure 9-17: Select public key content from Puttygen key generator key field



11. After the public key is selected, right click on the highlighted text and click **Copy**.

Figure 9-18: Copy generated public key



12. Create a new text file in your laptop or PC and paste the copied public key contents into this file.
13. Save the text file using one of following names (choose the name based on the account type and on whether the keys will be added to or replace the existing keys on the device):
  - **A\_userkey.txt**: A key with this name is appended (A) to the available Totalflow-user public keys in the device. After the key update operation, the Totalflow-user account can be accessed either by the newly created private key or the previous set of private keys for the Totalflow-user account.
  - **R\_userkey.txt**: A key with this name replaces (R) all the available Totalflow-user public keys in the device. After the key update operation, the Totalflow-user account can only be accessed by the newly created private key.
  - **A\_rootkey.txt**: A key with this name is appended (A) to the available developer and tech-support public keys in the device. After the key update operation, the developer and tech-support accounts can be accessed either by the newly created private key or the previous set of private keys for developer and tech-support accounts.
  - **R\_rootkey.txt**: A key with this name replaces (R) all the available developer and tech-support public keys in the device. After the key update operation, the developer and tech-support accounts can only be accessed by the newly created private key.

The key generation is complete. There is a new private key stored in a key file with the ".ppk" extension and a corresponding public key text file with one of the four specified names.

#### 9.7.3.3 Update public keys on device

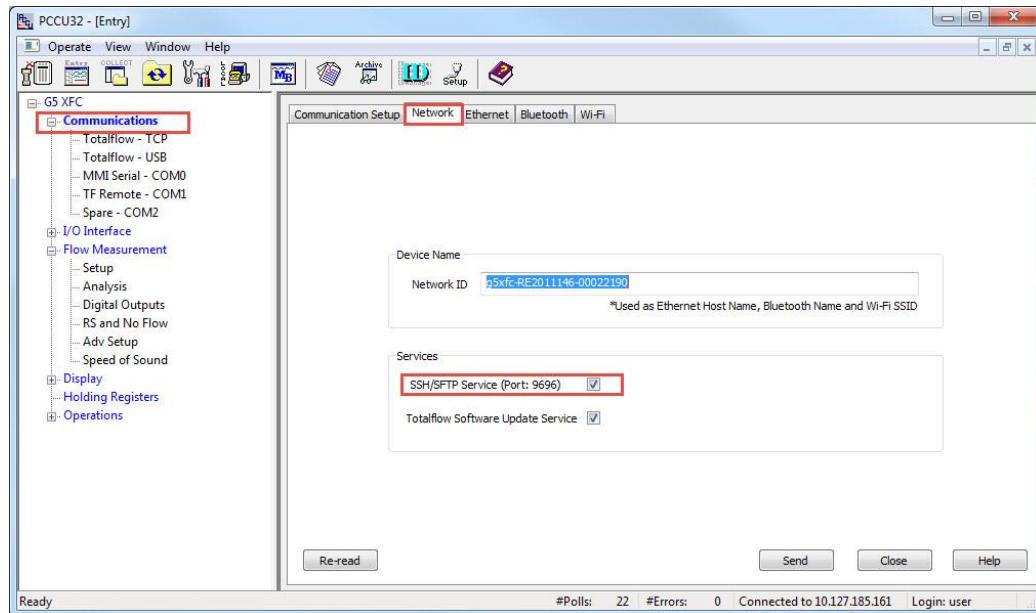
This procedure saves the new public key on the XSeries<sup>G5</sup> device. The new key is either appended to or replaces an existing key. This procedure requires a TCP/IP-based connection with the device. Make sure that the device has a valid IP configuration. The valid IP configuration depends on the type of connection. You can use an Ethernet network or point-to-point connection for this procedure.

To save the public key:

1. Download and install the latest version of Filezilla from the link provided in section [9.7.3.1, Update requirements](#).
2. Connect to the device's MMI or USB port.

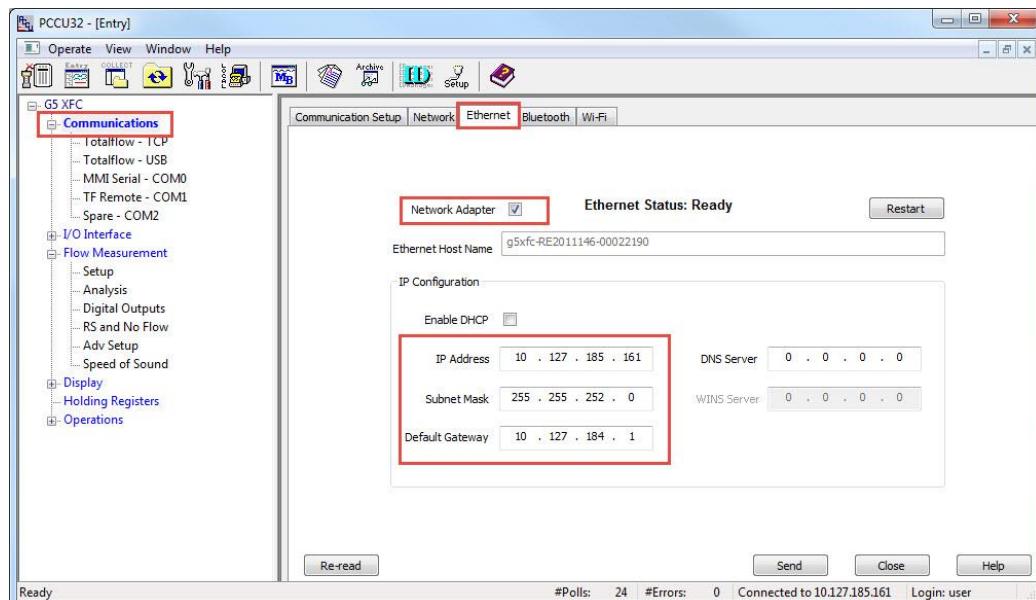
3. Start PCCU and use Entry mode to connect to the device.
4. Select Communications > Network.
5. Select the **SSH/SFTP service** checkbox.

Figure 9-19: Enable the SSH/SFTP service



6. Click **Send**.
7. Select **Ethernet** to enable, verify or configure valid IP parameters. The figure below shows an example of a valid IP configuration to access the device over a network. If using a local point-to-point to connection, configure accordingly. Click **Help** for additional details.

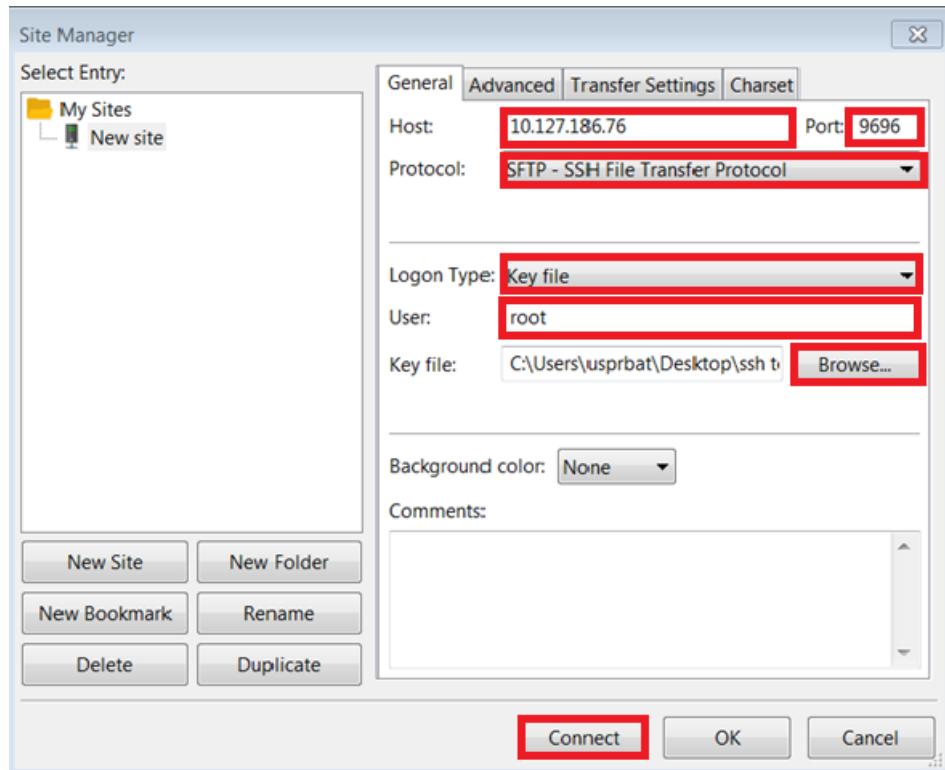
Figure 9-20: Enable and configure Ethernet (Network Adapter)



8. Click **Send** to save any changes.
9. Connect the XSeries<sup>G5</sup> device to the network or to the laptop or PC (if the Ethernet connection is local). Keep your serial or USB connection open.
10. Launch the FileZilla application.
11. Click **Open the Site Manager**. The Site Manager window displays ([Figure 9-21](#)).
12. Configure the **General** tab parameters as follows:

- Host: Type the device's IP address.
  - Port: Type **9696**.
  - Protocol: Select **SFTP- SSH File Transfer Protocol** from the drop-down menu.
  - Logon Type: Select **Key file** from the drop-down menu.
  - User: Type **root**.
13. Click **Browse** to select the current private key. If the keys are being changed for the first time, use the default developer or tech-support private key provided by ABB. If the keys were previously updated, then use those keys instead.
14. Click **Connect**.

Figure 9-21: FileZilla Site Manager connection setup



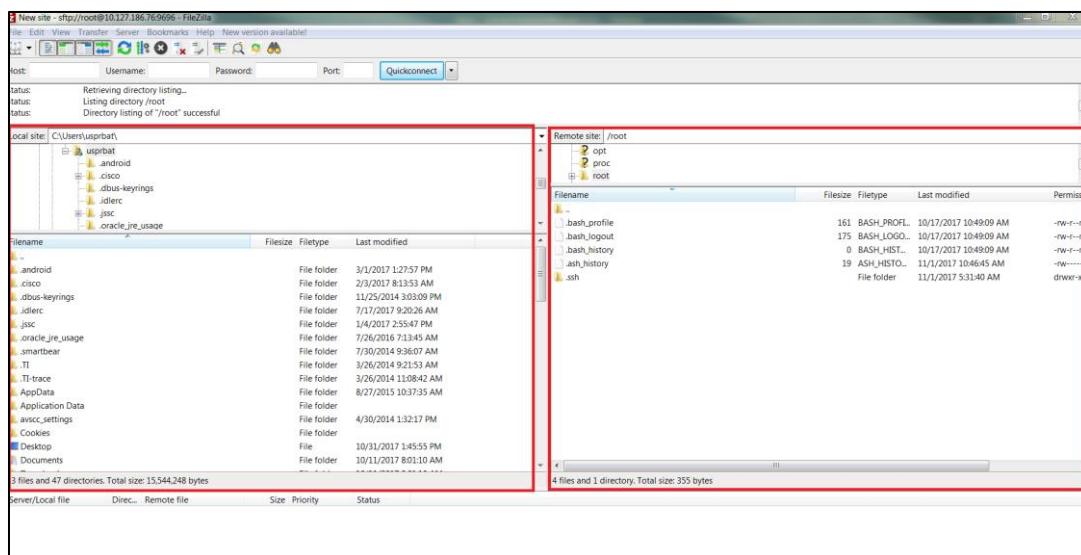
15. If the private key is passphrase-protected, a window requesting the passphrase displays before granting the connection ([Figure 9-22](#)).
16. Type the passphrase in the Password field. For a default key, use the passphrase provided by ABB. For an updated key, use the passphrase defined for that key.
17. Click **OK**.

Figure 9-22: Type private key passphrase (password)



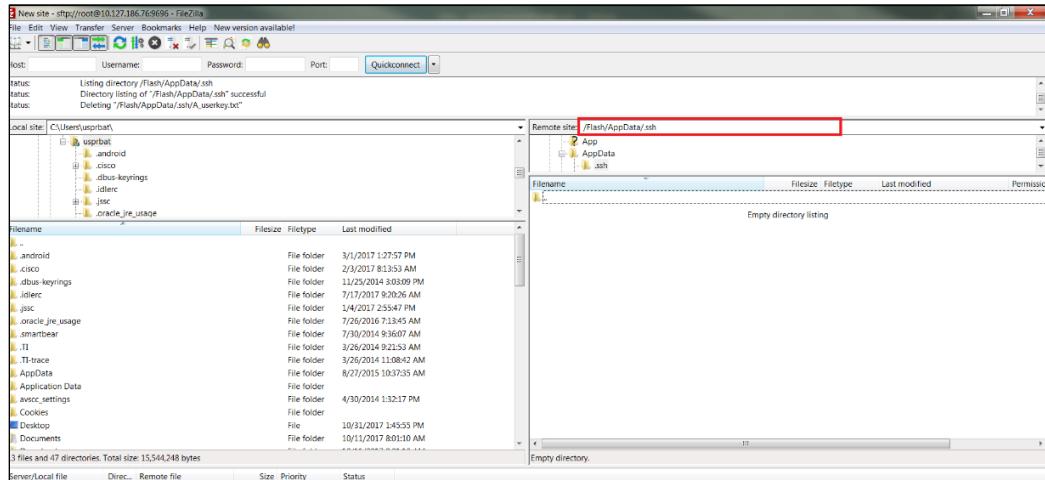
18. Verify that the connection with the device is established successfully when the FileZilla new site window displays. This window displays the file directories of the laptop or PC (on the left) and the device (on the right).

Figure 9-23: FileZilla New Site window



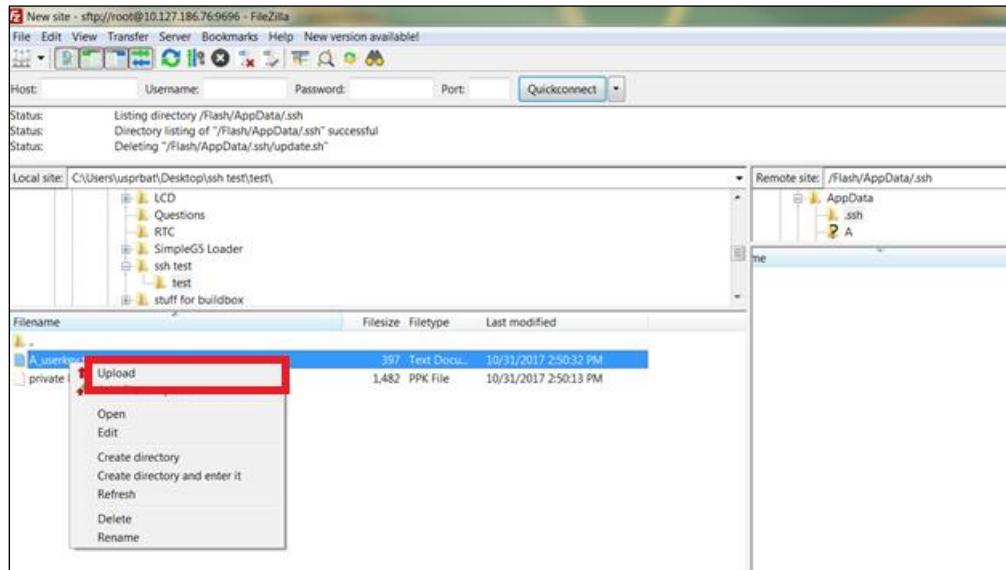
19. Navigate to and open the directory containing the newly created public key text file (on the left).
20. Navigate to and open the /Flash/AppData/.ssh/ directory on the Totalflow device (on the right). The device updates the keys only if it finds them in them in the specified directory.

Figure 9-24: Open the /Flash/AppData/.ssh/ directory



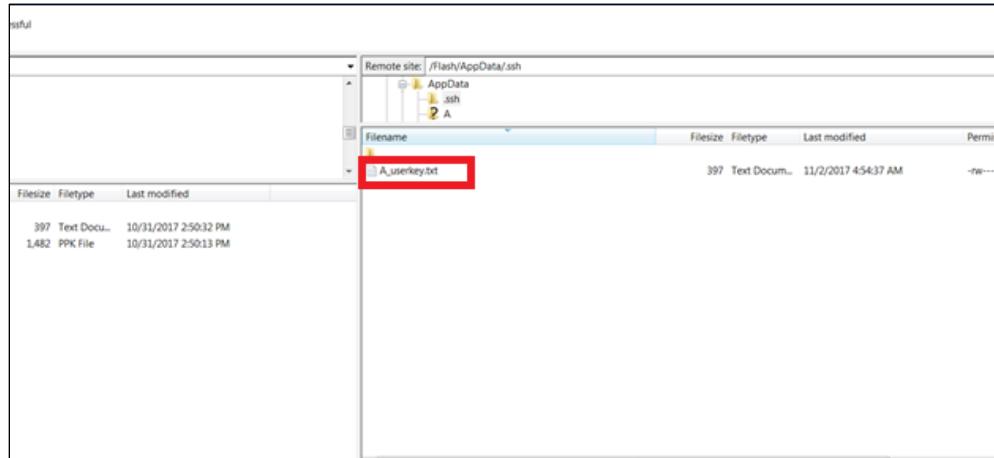
21. Right-click on the newly created public key file and select **Upload** from the drop-down menu.

Figure 9-25: Upload public key from laptop to device



22. Verify that the file is copied to the /Flash/AppData/.ssh/ directory. The name of the file should display under that directory when the upload is complete.

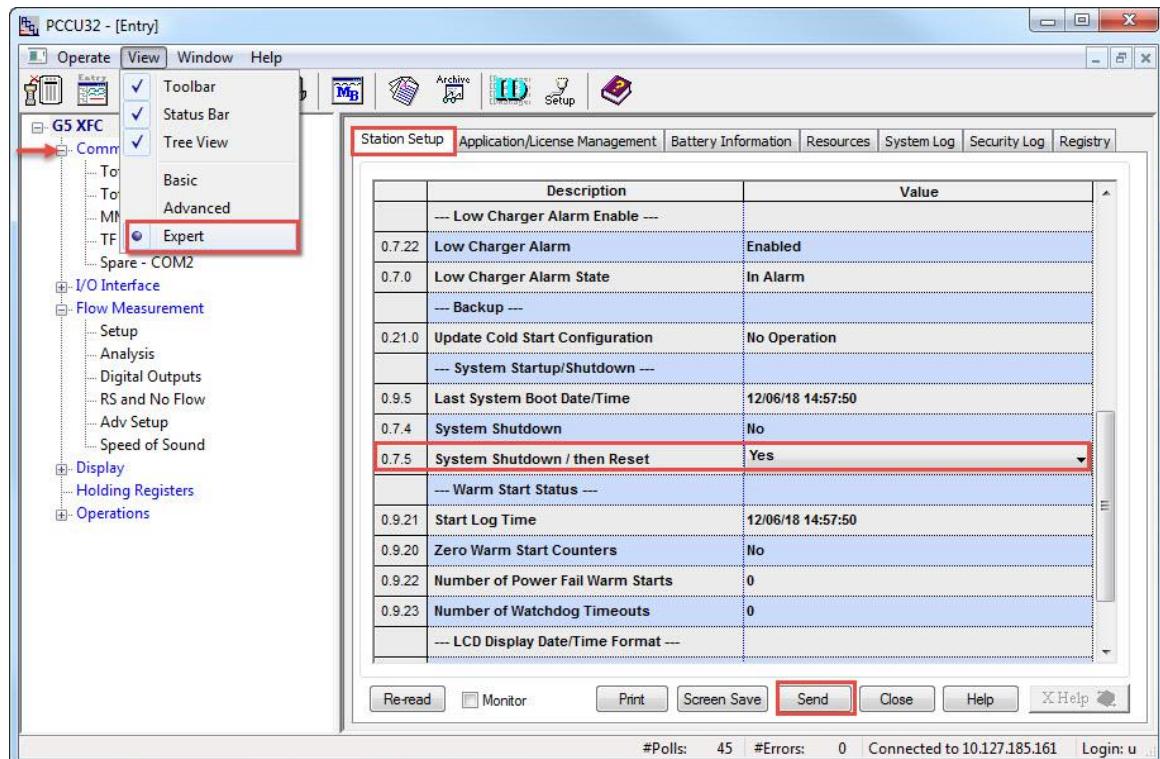
Figure 9-26: Verify public key upload is complete



23. Restart the device for the public key update to take effect ([Figure 9-27](#)).

- Return to PCCU (if you remained connected via MMI or USB).
- Select **View>Expert** on the top PCCU menu. Wait for the view to change.
- Select the station name at the top of the navigation tree.
- Select **Station Setup**.
- On the System Shutdown/then Reset value field select **Yes** from the dropdown.
- Click **Send**. Wait for the device to restart. Note that the FileZilla STFP connection will be closed when the device restarts.

Figure 9-27: Restart Totalflow device after public key update



With the key upload complete, a new private-public key pair is available for authentication. Test the authentication with these new keys next.

#### 9.7.3.4 Verify authentication with new private-public key pair

Verify that the public key update is successful by establishing a new SFTP connection from FileZilla, using the newly created key and passphrase to authenticate.

To verify:

1. Restart FileZilla.
2. Click **Open the Site Manager**. The Site Manager window displays.
3. Configure the General tab parameters as follows:
  - Host: Type the device's IP address
  - Port: Type **9696**
  - Protocol: Select **SFTP- SSH File Transfer Protocol** from the drop-down menu.
  - Logon Type: Select **Key file** from the drop-down menu.
  - User: Type the user required per account type (For the Totalflow-user account, type "totalflow". For the developer or tech-support accounts, type "root".)
4. Click **Browse** to locate and select the newly created private key.
5. Click **Connect**.
6. At the passphrase prompt, type the passphrase for the newly created private key.
7. When the connection is successful, the FileZilla's new site screen displays showing the device file system (directories).



**IMPORTANT NOTE:** Keep private key files stored in a safe location accessible only to authorized personnel and security managers.

## 10 Service and maintenance

The following chapter includes procedures required for the service and maintenance of the XSeriesG5 devices. These include: data and configuration backup, device software updates, part replacement (spare parts list included), real-time clock maintenance, device restart, and power removal and restoration. Follow your company policies to schedule appropriate maintenance windows. Review and plan service or maintenance carefully.



**DANGER – Serious damage to health / risk to life.** Do not perform maintenance when an explosive atmosphere is present.

An XSeries G5 installation is typically exposed to external environmental conditions. It is important to regularly inspect for cleanliness, both externally and internally. Foreign contaminants can cause damage to interior-mounted components that can render the XSeries G5 inoperable.



**IMPORTANT NOTE:** When the flow computer is powered 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. Develop a regularly scheduled maintenance program and maintain a selection of spare components to minimize downtime.



**NOTICE – Equipment 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 reconfiguration.



**NOTICE – 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.

### 10.1 Preserve data and configuration

It is very important to preserve data and configuration files before performing any maintenance procedure or software upgrade. Follow the procedures in this section to ensure that backups of the data and device configuration are available in a separate location from the device. You can move collected data files to other systems for safe-keeping or import them into customer databases as necessary.

Saved configuration files preserve the configuration of all the applications operating in the device. Save the configuration in a separate location from the controller to restore or reuse. This can save a considerable amount of time if configurations are complex and it prevents the need to configure a controller from scratch.

The procedures in this section describe how to:

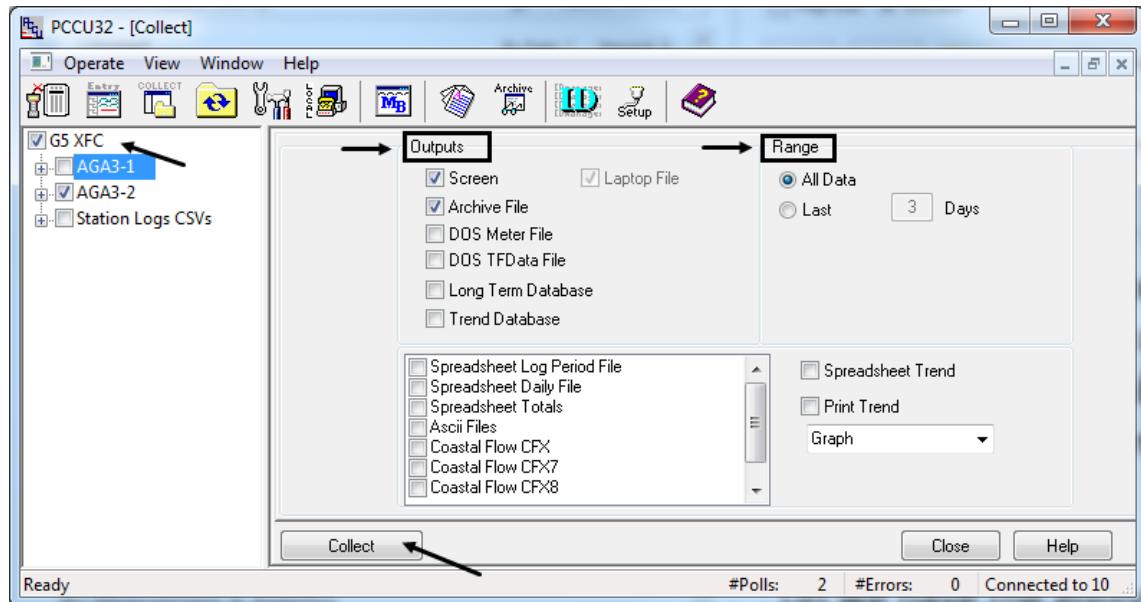
- Perform a data collection
- Update the startup (cold) configuration
- Save the startup (cold) configuration

#### 10.1.1 Collect data

Collect data to preserve measurement and log data:

1. Connect the laptop running PCCU to the device.
2. Start PCCU and connect to the device in Entry mode.
3. Click **Collect** on the top PCCU toolbar. The Collect screen displays.

Figure 10-1: Collect data



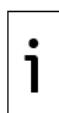
4. On the navigation tree, select the tubes and applications for data collection. If collecting all device data, select all items.
5. Select the outputs and data range.
6. Click **Collect**.
7. Click **Close** to exit data collection and return to the entry mode screen.

### 10.1.2 Save the device configuration

The following procedures are required to save the configuration of the Totalflow device for backup purposes. The device stores a running (warm) and a startup (cold) configuration which contain configuration files for all enabled/active applications. Any configuration performed after the device is started for the first time is kept in the running configuration. The startup configuration is not automatically updated to reflect those configuration changes.

To perform a backup of the most up-to-date configuration, you must update the startup configuration first, and then save it on a laptop or PC.

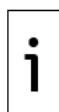
You can use backup configuration files to restore service in the event of equipment failure, part replacement, or to replicate the configuration in other devices.



**IMPORTANT NOTE:** tfData and tfCold, warm and cold, are terms used to refer to the running and startup configuration respectively.

#### 10.1.2.1 Update the startup (cold) configuration

This procedure saves the running (warm) configuration to the startup (cold) configuration. With this procedure both the startup and the running configuration reflect the most current configuration. A cold restart event with the most-up-to-date configuration resumes device operation without the need to reconfigure the device.



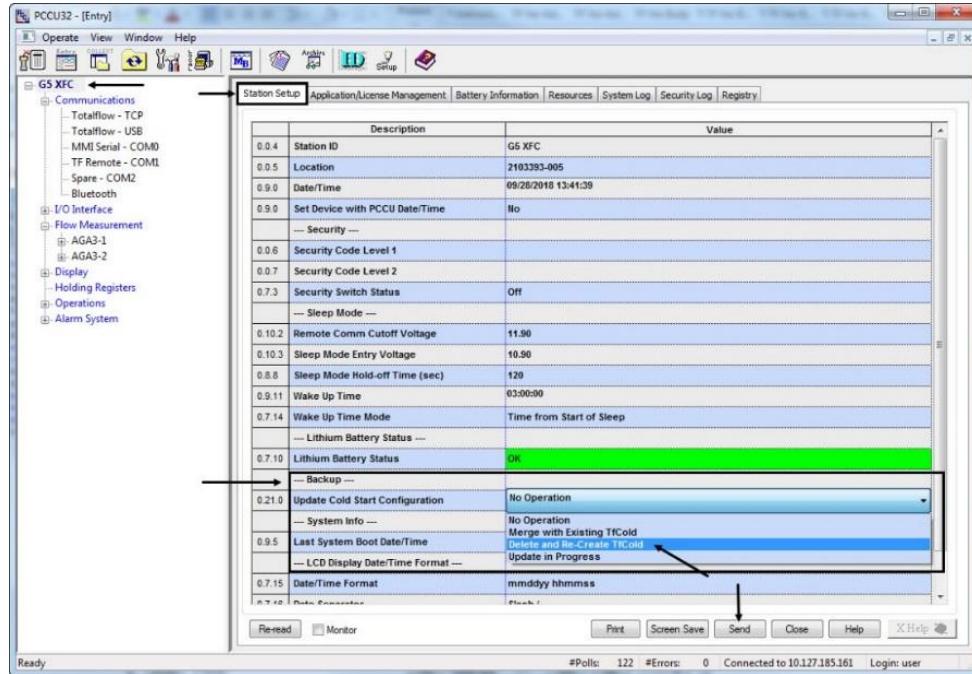
**IMPORTANT NOTE:** The running (warm) configuration may contain calibration files. These files are also saved in the startup configuration during the update. Calibration files are linked with the device's electronic board serial number and are not applicable to any other device.

To update the startup (cold) configuration:

1. From the PCCU Entry mode screen, click the top node of the navigation tree to display the **Station Setup** tab.
2. Locate the Backup section.

3. Click the value for Update Cold Start Configuration and select Delete and Recreate TfCold.
4. Click **Send**.

Figure 10-2: Station Setup and Backup



5. Click **Close** to terminate the Entry mode connection with the device and return to the main PCCU screen.
6. Save the updated startup configuration.

#### 10.1.2.2 Save the startup (cold) configuration to a laptop or PC

This procedure saves the startup (cold) configuration to a laptop or PC using the 32-Bit Loader. This requires a separate connection established from the loader, not from entry mode.

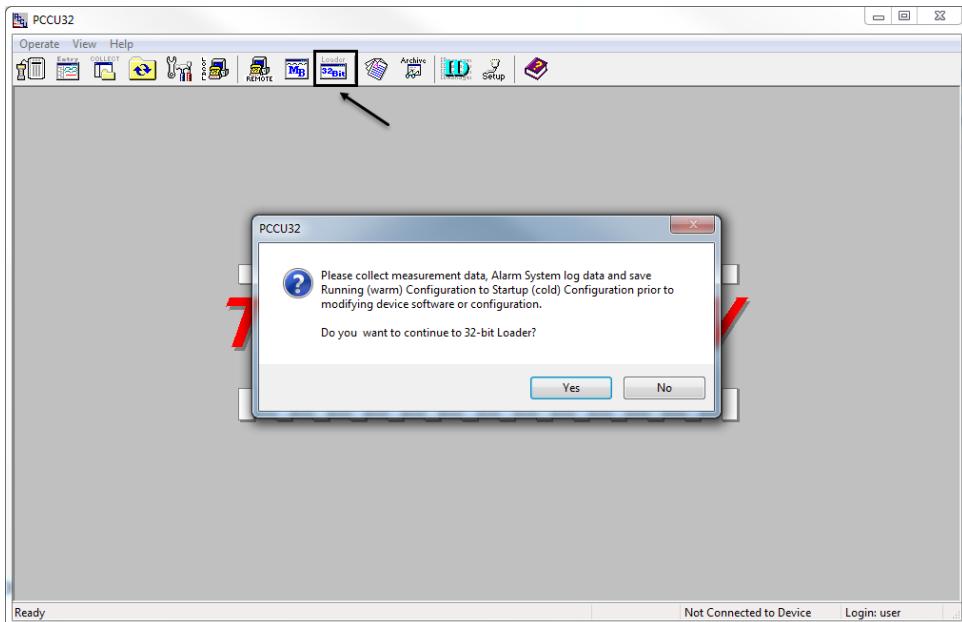


**IMPORTANT NOTE:** Click **Help** on the 32-Bit Loader screens for additional details.

To save the startup configuration:

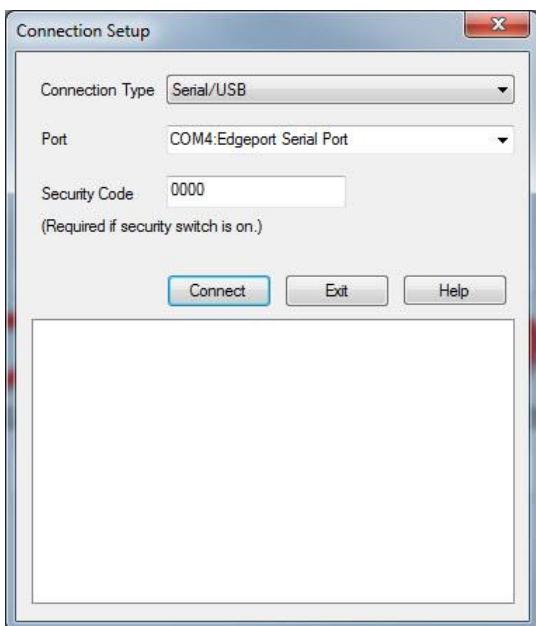
1. If still connected with the device on entry mode, close that connection to return to the PCCU main screen.
2. Click the 32-bit Loader icon in the PCCU toolbar. The warning to collect data and update the startup configuration displays.

Figure 10-3: 32Bit Loader confirmation pop-up



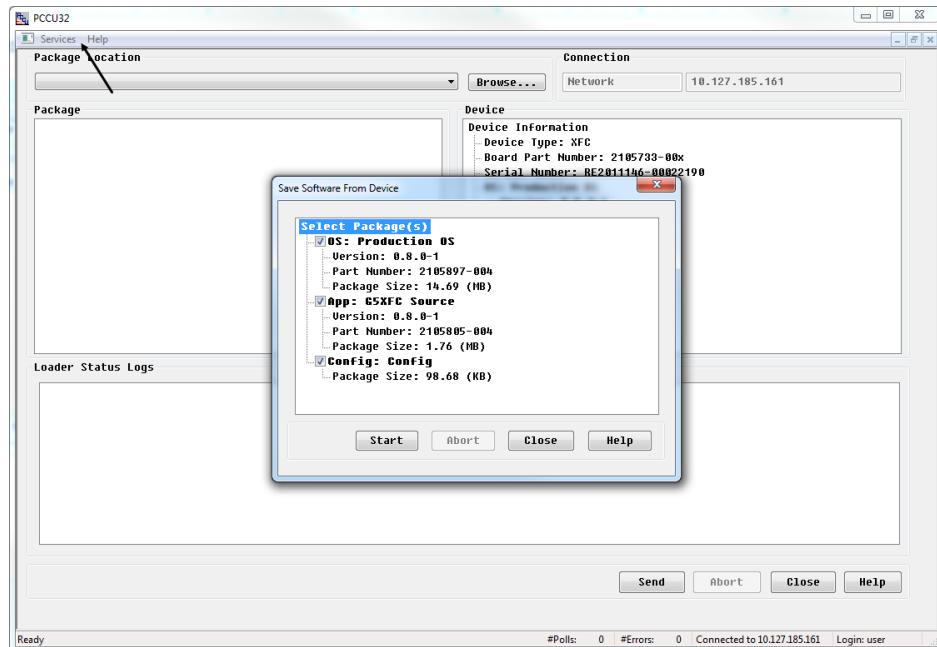
3. Click **Yes**. The Connection setup window displays.

Figure 10-4: Connection Setup



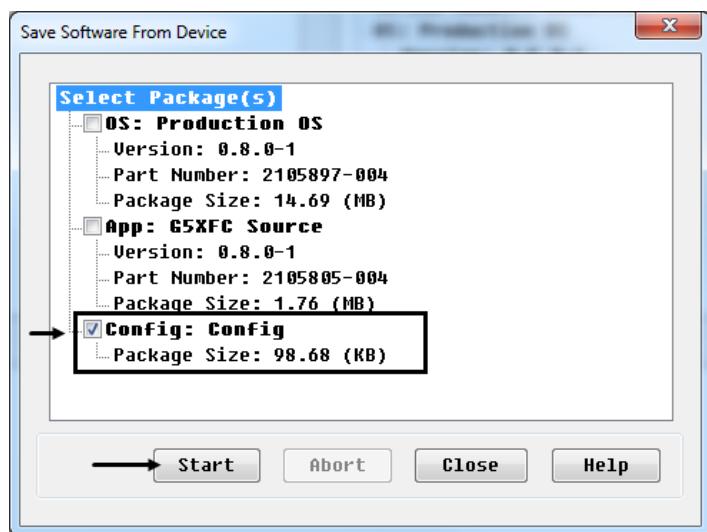
4. Type the connection setup parameters and click **Connect**. When the connection is successful, the main loader screen displays.
5. Click **Services > Save** from the menu bar on the main Loader screen. The Save Software from Device window displays.

Figure 10-5: Save Software from Device window



6. To save only the configuration, clear all options except **Config**.

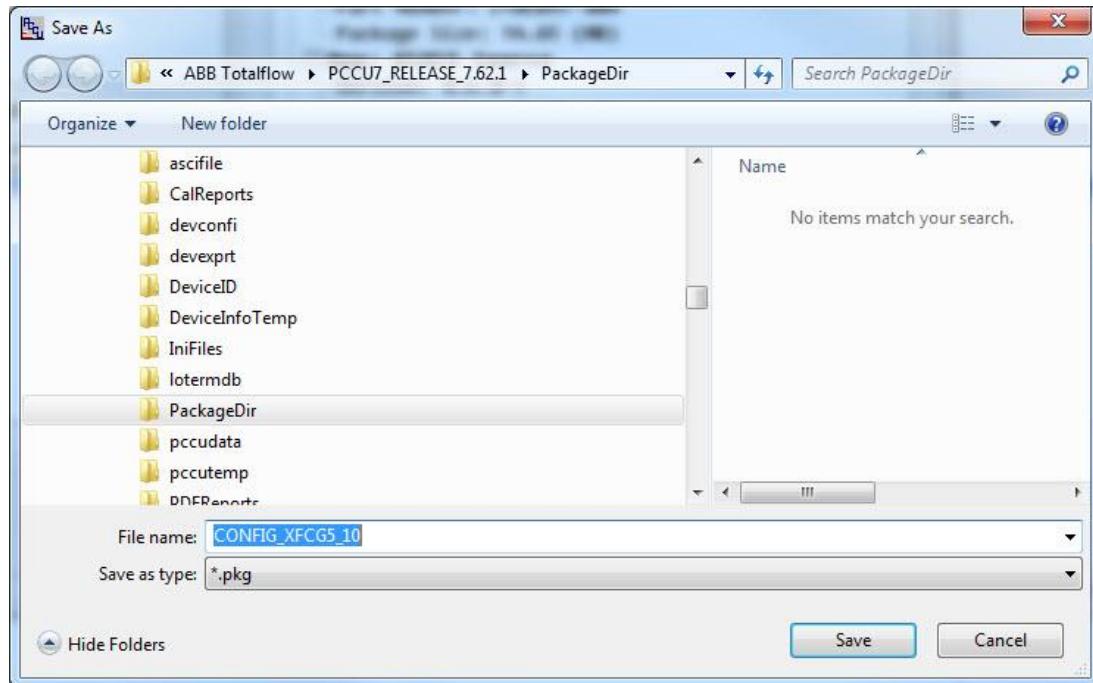
Figure 10-6: Config checkbox



7. Click **Start**. A browser window displays.

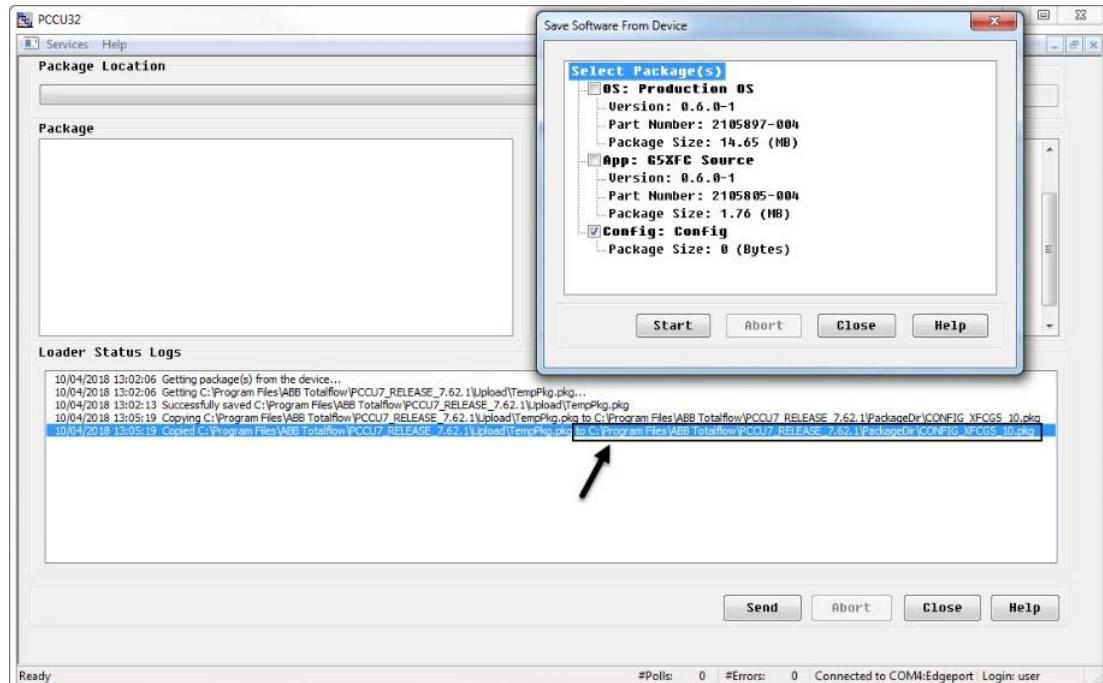
8. Locate the destination folder for the configuration, type the file name, and click **Save**. Take note of the location of the configuration file.

Figure 10-7: Select location to save config file



9. Monitor progress in the Loader Status logs view. Verify that the configuration package is copied in the selected directory.

Figure 10-8: Loader status logs



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

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

## 10.2 Change the XSeries<sup>G5</sup> clock

When a measurement application is running, 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:

### **10.2.1 Backward or forward clock change not crossing an hour 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 70-minutes (15 minutes plus 55 minutes).

### **10.2.2 Forward clock change crossing an hour 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.

### **10.2.3 Backward clock change crossing an hour 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.

## **10.3 Remove and replace parts**



**CAUTION – Equipment/Property damage.** Follow the procedures in section [10.5 Remove and restore power](#) when instructed to do so in any of the procedures included in this section.

## **10.4 Restart the system**

Several options for restart are available for XSeries<sup>G5</sup> devices. This section provides an overview of those options and the corresponding procedures for manually-triggered restarts.



**NOTICE – Data loss.** Some of the restart procedures described in this section cause customer data, device configuration, or calibration data loss. Backup data and configuration as described in section [10.1 Preserve data and configuration](#).

### **10.4.1 Restart types overview**

There are several ways to restart an XSeries<sup>G5</sup> device. Restarts can be manually triggered or performed automatically after software updates, power removal, or other system events. Manually triggered restarts are performed onboard or from the user interface (PCCU).

The table below provides a description of device restarts. Review carefully the implications of each restart type to select the appropriate method. There may be several methods for the same type of restart.

Table 10-1: XSeries<sup>G5</sup> restart options

<b>Restart type</b>	<b>Description</b>	<b>Use</b>	<b>User-triggered restart Procedure</b>
<b>Warm restart</b>	The device: Shuts down all applications. Backs up the running data, configuration, and logs to persistent memory. Restarts with running (warm) configuration.	<b>Automatic trigger:</b> After software update <b>Manual trigger:</b> A warm restart may be required as part of general installation, maintenance or troubleshooting procedures. For example, a warm restart restores operation if the device is locked up due to power or communication interruption.	<a href="#">10.4.2, Warm restart with onboard RESET button</a> <a href="#">10.4.3, Warm restart from the device loader</a> <a href="#">10.4.4, Warm restart from PCCU entry mode</a> <a href="#">10.4.5, Warm restart using terminal mode</a>
<b>Cold restart</b>	The device: Shuts down all applications. Deletes the running configuration and repopulates it using the startup (cold) configuration. Restarts with startup (cold) configuration.	<b>Automatic trigger:</b> Following a startup configuration update <b>Manual trigger:</b> Only as part of a service or maintenance procedure or when specifically directed to by ABB technical support.  A cold restart causes running configuration loss (which may also include calibration files). To back up before restart, follow procedures in section <a href="#">10.1 Preserve data and configuration</a>	<a href="#">10.4.6 Cold restart with onboard COLDBOOT button</a> <a href="#">10.4.7 Cold restart from the device loader</a> <a href="#">10.4.8 Cold restart from terminal mode</a>
<b>Factory restart</b>	The device: Shuts down all applications. Deletes the running configuration and repopulates it using the factory configuration. Restarts with factory defaults	<b>Manual trigger:</b> When it is necessary or desirable to return the flow computer to the original configuration as shipped from the factory. For example: if the device is relocated, or to start a configuration from scratch after file corruption or failed update.  A reset to factory defaults causes data, running, and startup configuration loss (which may also include calibration files). To back up before going back to factory defaults, follow procedures in section <a href="#">10.1 Preserve data and configuration</a> .	<a href="#">10.4.9, Restart using the factory configuration</a>
<b>Restart due to Power loss</b>	All data logs and configurations within the current minute are lost.	Ensure the Lithium battery is enabled	Power removal is <b>not</b> a method recommended for restart.

## 10.4.2 Warm restart with onboard RESET button

The warm restart resets the XSeries<sup>G5</sup> microprocessor. Use a warm restart to take the XSeries<sup>G5</sup> out of service for maintenance or troubleshooting. Only use a warm restart when a power or communication interruption causes the XSeries<sup>G5</sup> microprocessor to lock-up.

This procedure uses the RESET button on the electronic board to restart the device. It causes the device to restart using the running (warm) configuration. You must have physical access to the device and be able to open the enclosure door and access the electronic board.

To restart with the reset button:

1. Open the door to the unit.
2. Locate the RESET button (S2 on the XFC<sup>G5</sup>, S6 on the XRC<sup>G5</sup>), above the onboard Ethernet connector on the left-hand side of the board.

Figure 10-9: XFC<sup>G5</sup> Onboard RESET button

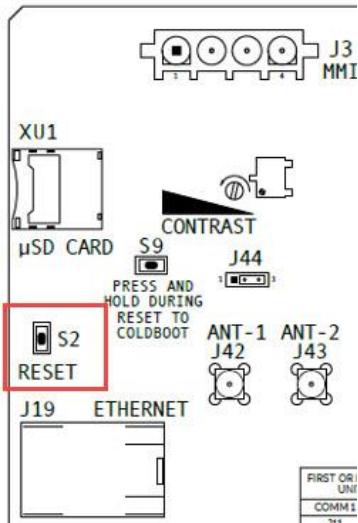
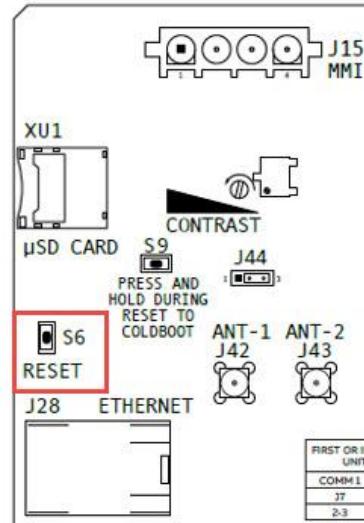


Figure 10-10: XRC<sup>G5</sup> Onboard RESET button



3. Observe the display. The LCD shows that the unit is shutting down and restarting.



**IMPORTANT NOTE:** If the device does not restart, press and hold the RESET button for eight seconds.

### 10.4.3 Warm restart from the device loader

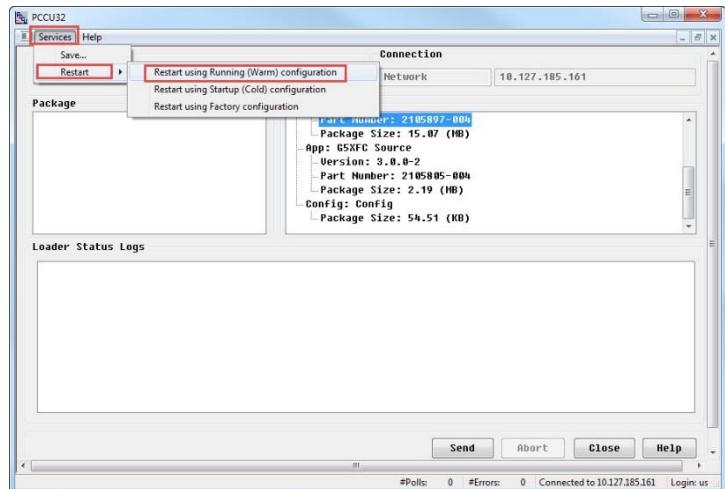
This procedure performs the warm restart from the 32-bit loader. The procedure can be performed while on a local or remote Loader connection.

The procedure causes the device to restart with the running (warm) configuration.

To complete a warm restart from the device loader:

1. Launch PCCU.
2. Click the 32-Bit Loader icon in the toolbar. A message box displays.
3. Click **Yes**.
4. Verify or type the connection setup parameters and click **Connect**. The Loader screen displays.
5. Click Services>Restart. Select Restart using Running (Warm) configuration from the drop-down list.

Figure 10-11: Warm restart with device loader



6. Click **Help** for more information.

#### 10.4.4 Warm restart from PCCU entry mode

This procedure restarts the device using the System Shutdown/Then reset function from the Station Setup screen in PCCU. It causes the device to restart with the running (warm) configuration.

The procedure can be performed while on a local or remote PCCU connection.

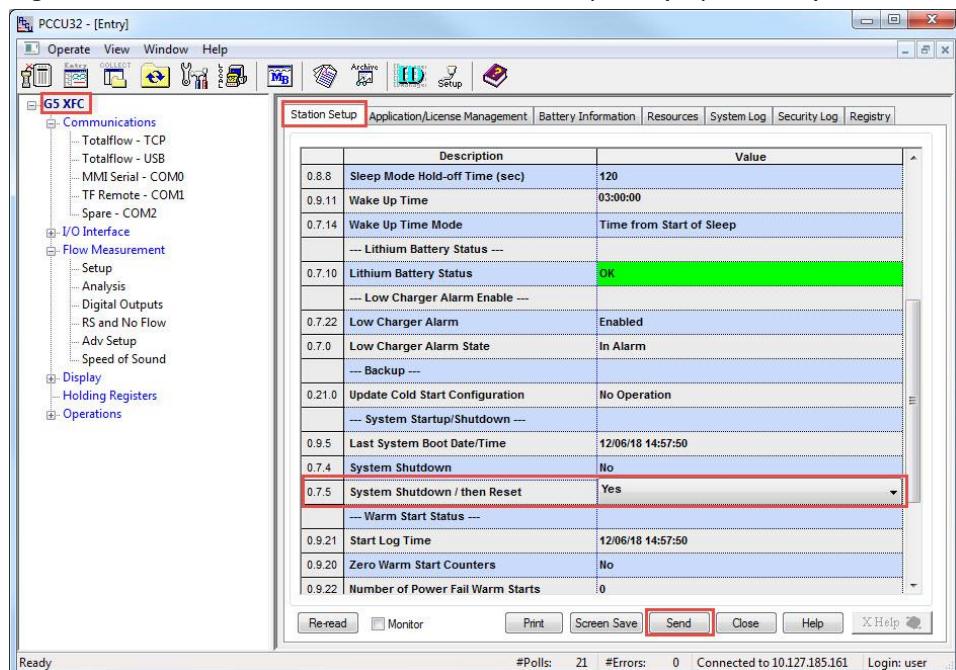


**IMPORTANT NOTE:** This procedure requires Expert view.

To restart the controller using System Shutdown/then Reset:

1. Connect the PC running PCCU32 to the flow computer.
2. Launch PCCU32 and click **Entry**.
3. Click **View** on the PCCU32 menu and select **Expert** from the drop-down list.
4. Click the top item on the navigation tree. The Station Setup tab displays.
5. Scroll down to System Startup/Shutdown ([Figure 10-12](#)).
6. Select **Yes** from the System Shutdown / then Reset drop-down list.
7. Click **Send**.
8. Click **OK** to confirm.

Figure 10-12: Warm restart on the Station Setup tab (Expert view)



#### 10.4.5 Warm restart using terminal mode

This procedure performs the warm restart from the terminal mode. It causes the device to restart using the running (warm) configuration.

The procedure can be performed while physically connected to the device or remotely. Terminal mode can be invoked from entry mode or from the PCCU splash screen. This method of warm restart requires you to type a command.

To perform the warm restart:

1. Connect the PC running PCCU32 to the flow computer.
2. Select **Entry** mode within PCCU.
3. Click the Terminal icon on the PCCU toolbar.
4. Move the cursor to the terminal prompt (->)
5. Type in the following: "**BOOT=WARM**".
6. Press **Enter** on the keyboard to initiate the warm boot.

#### 10.4.6 Cold restart with onboard COLDBOOT button

This procedure uses the COLDBOOT and RESET buttons on the electronic board to restart a device. It causes the device to restart using the startup (cold) configuration.

You must have physical access to the device and be able to open the enclosure door and access the electronic board.



**NOTICE - Loss of data:** Perform the procedures in section [10.1 Preserve data and configuration](#) before a cold start. This avoids loss of the data and the need for a complete system reconfiguration. If the startup (cold) configuration does not have the latest network connection configuration, the restart causes loss of network connectivity. Updating the startup configuration (tfCold) avoids loss of network connection and reconfiguration.

To perform a cold restart:

1. Open the door to the unit.
2. Locate the COLDBOOT button (S9) on the top left-hand side of the electronic board.
3. Locate the RESET button (XFC<sup>G5</sup> S2 and XRC<sup>G5</sup> S6) on the top left-hand side of the electronic board.

Figure 10-13: XFC<sup>G5</sup> Onboard COLDBOOT button

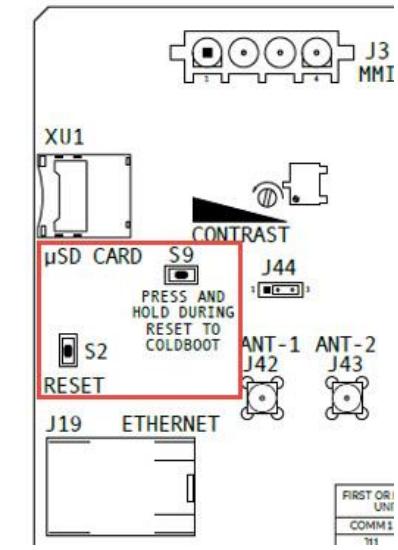
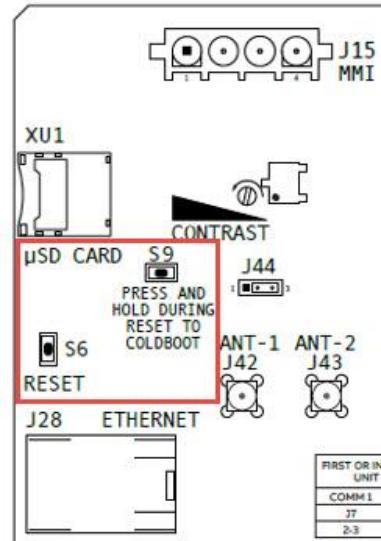


Figure 10-14: XRC<sup>G5</sup> Onboard COLDBOOT button



4. Press and hold the **COLDBOOT** button and at the same time press and hold the **RESET** button for 10 seconds.
5. The LCD displays "Loading Boot Loader".
6. Verify the Power On sequence is completed.
7. If the display moves through the startup screens and begins cycling correctly, the COLDBOOT was successful.
8. If the display does not begin cycling correctly or locks up on one of the startup screens, contact technical support for additional instructions.

#### 10.4.7 Cold restart from the device loader

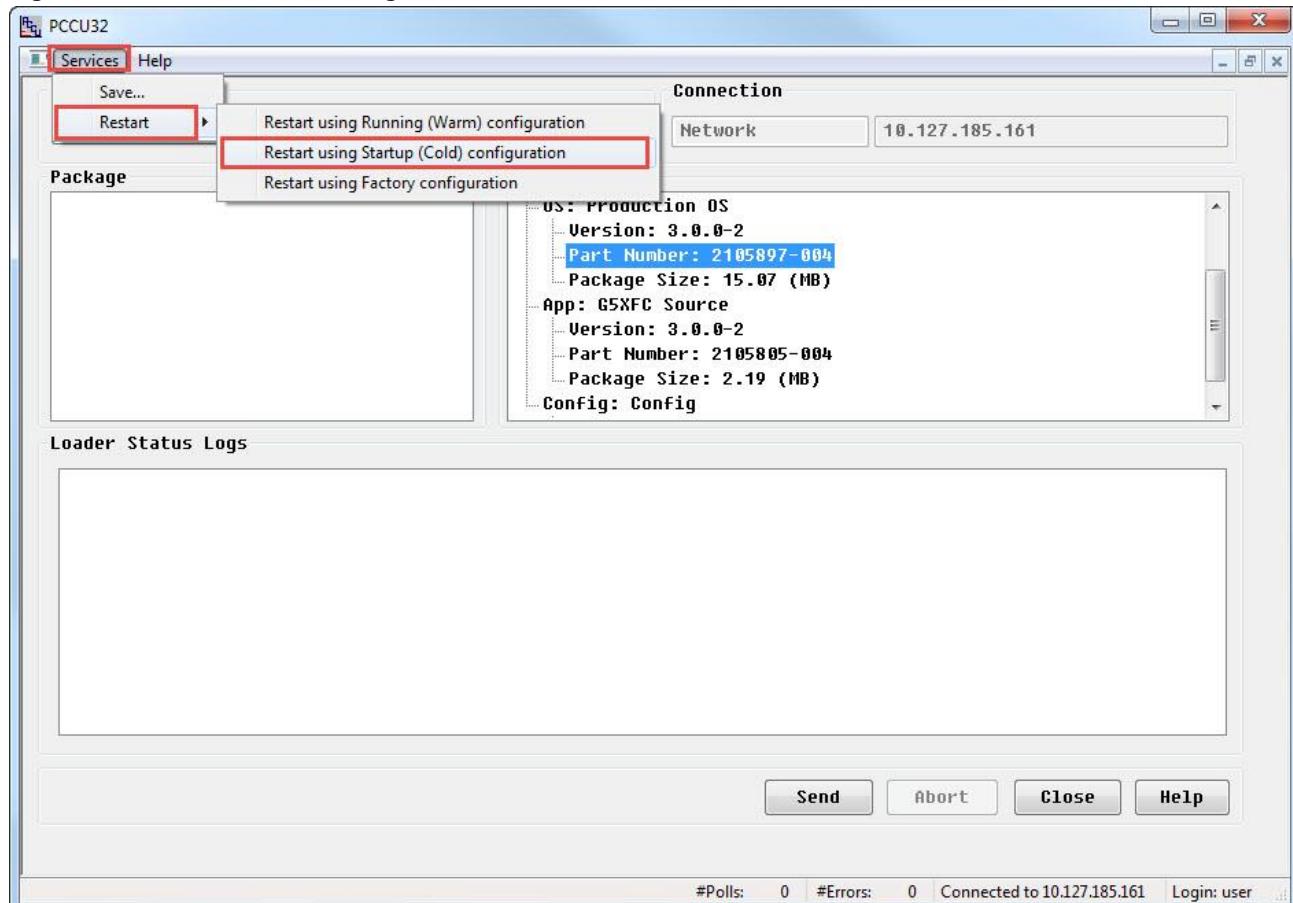
This procedure performs the cold start from the 32-bit loader. The procedure can be performed while on a local or remote Loader connection, but it is highly recommended that the cold restart is performed locally. The cold restart causes the device to restart using the startup (cold) configuration.



**NOTICE - Loss of data:** Perform the procedures in [10.1 Preserve data and configuration](#) before a cold start. This avoids loss of the data and the need for a complete system reconfiguration. If the startup (cold) configuration does not have the latest network connection configuration, the restart causes loss of network connectivity. Updating the startup configuration (tfCold) avoids loss of network connection and reconfiguration.

1. Launch PCCU.
2. Click the 32-Bit Loader icon in the toolbar. A message box displays.
3. Click **Yes**.
4. Verify or type the connection setup parameters and click **Connect**. The Loader screen displays.
5. Click **Services>Restart** in the menu bar, and select **Restart using Startup (Cold) configuration** from the drop-down list.

Figure 10-15: Cold restart using the device loader



6. Click **Help** for more information.

#### 10.4.8 Cold restart from terminal mode

This procedure performs the cold start from the terminal mode. It causes the device to restart using the startup (cold) configuration.

The procedure can be performed while on a local or remote connection, but it is highly recommended that the cold restart is performed locally. Terminal mode can be invoked from entry mode or from the PCCU splash screen. This method of cold restart requires you to type a command.

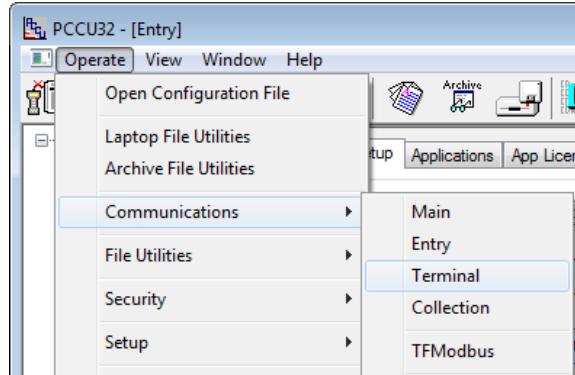


**NOTICE - Loss of data:** Perform the procedures in section [10.1 Preserve data and configuration](#) before a cold start. This avoids loss of the data and the need for a complete system reconfiguration. If the startup (cold) configuration does not have the latest network connection configuration, the restart causes loss of network connectivity. Updating the startup configuration (tfCold) avoids loss of network connection and reconfiguration.

To complete a cold restart in terminal mode:

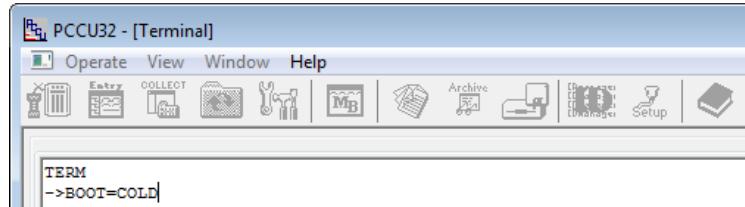
1. Launch PCCU.
2. Click the Entry icon in the toolbar. The Entry screen displays.
3. Click **Operate** in the menu bar and select **Communications>Terminal** from the drop-down list ([Figure 10-16](#)). The Terminal screen displays.

Figure 10-16: Terminal menu option



4. Type the command **BOOT=COLD** at the terminal prompt.

Figure 10-17: Terminal screen – cold boot



5. Press **Enter**.

#### 10.4.9 Restart using the factory configuration

This procedure restores the device's startup configuration to its factory defaults from the 32-bit loader. Factory defaults can include a generic base configuration or a custom configuration. Customers can request custom configurations to address specific requirements in addition to the basic configuration.

Restoring to factory configuration on a device already in service will cause service disruption and loss of network connectivity.

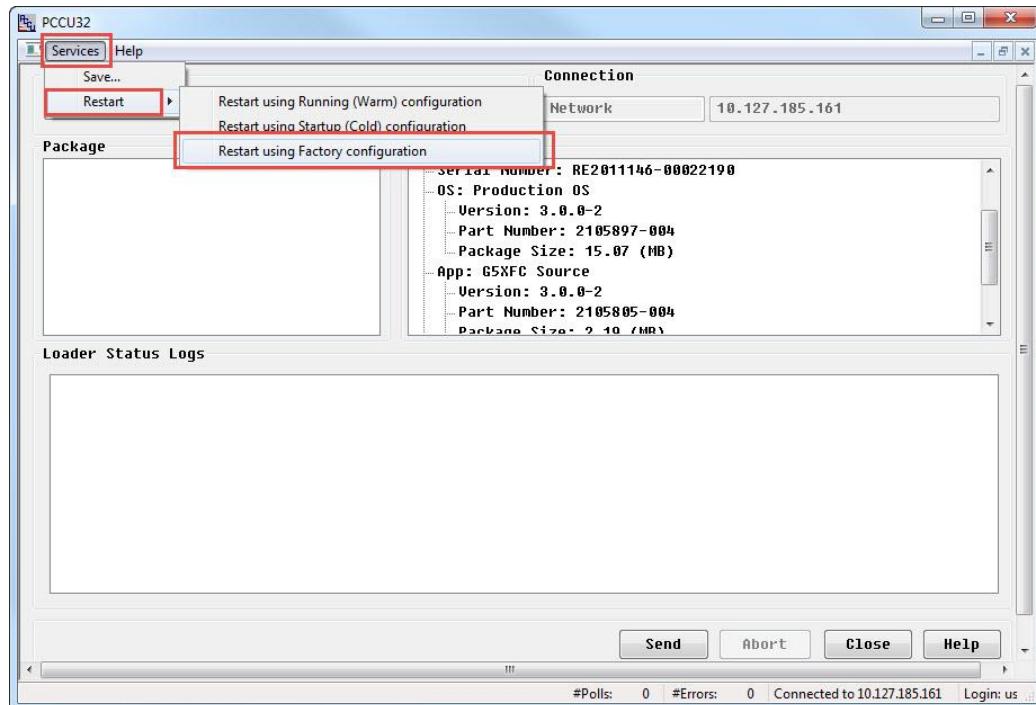


**NOTICE – Equipment damage or loss of data:** A restart with factory defaults deletes all data and previous configurations; both current startup and running configurations are lost. Perform the procedures in section [10.1 Preserve data and configuration](#) before restoring factory defaults. Network communication parameters will be overwritten with factory defaults as well. If this restart is triggered remotely on a network connection (not recommended), you will lose connectivity with the device. You will need to have physical access to the device to reconfigure.

To restore factory configuration:

1. Launch PCCU.
2. Click the 32-Bit Loader icon in the toolbar. A message box displays.
3. Click **Yes**.
4. Verify the connection setup information and click **Connect**. The Loader screen displays.
5. Click **Services>Restart** in the menu bar, and select **Restart using Factory configuration** from the drop-down list.

Figure 10-18: Restart using factory configuration



## 10.5 Remove and restore power

It might be necessary to remove power from an XSeries<sup>G5</sup> for maintenance. This procedure describes the removal and reconnection of power. For terminal block connectors, you do not need to remove individual wires. Remove the connector block to avoid rewiring.

Figure 10-19: XFC<sup>G5</sup>

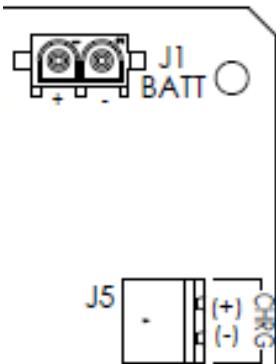
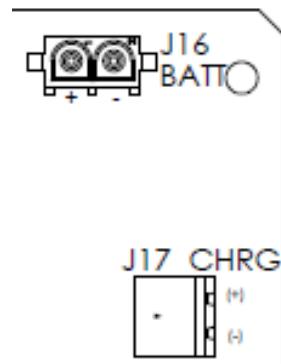


Figure 10-20: XRC<sup>G5</sup>



**IMPORTANT NOTE:** Do not remove power if the device does not have the lithium battery enabled or in place. If the lithium battery is not enabled, has failed, or was removed, the clock resets to factory defaults. See section [10.7.2 Replace the lithium battery](#).



**IMPORTANT NOTE:** This procedure requires physical access to the device, to open the enclosure door for access to the electronic board.

### 10.5.1 Remove power from the electronic board

The primary power source connecting to the board can be the battery in the enclosure or an outside power source. Disconnect power accordingly:

1. If battery powered:

- a. Disconnect the charging source by removing the terminal connector from the CHRG terminal (J5 on the XFC<sup>G5</sup>, or J17 on the XRC<sup>G5</sup>).
- b. Disconnect the battery from the BATT connector (J1 on the XFC<sup>G5</sup>, or J16 on the XRC<sup>G5</sup>).
2. If externally powered, disconnect the outside power source from the BATT connector (J1 on the XFC<sup>G5</sup>, or J16 on the XRC<sup>G5</sup>)

### 10.5.2 Reconnect power to the electronic board



**CAUTION – Equipment/Property damage:** Power 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.

Reconnect power:

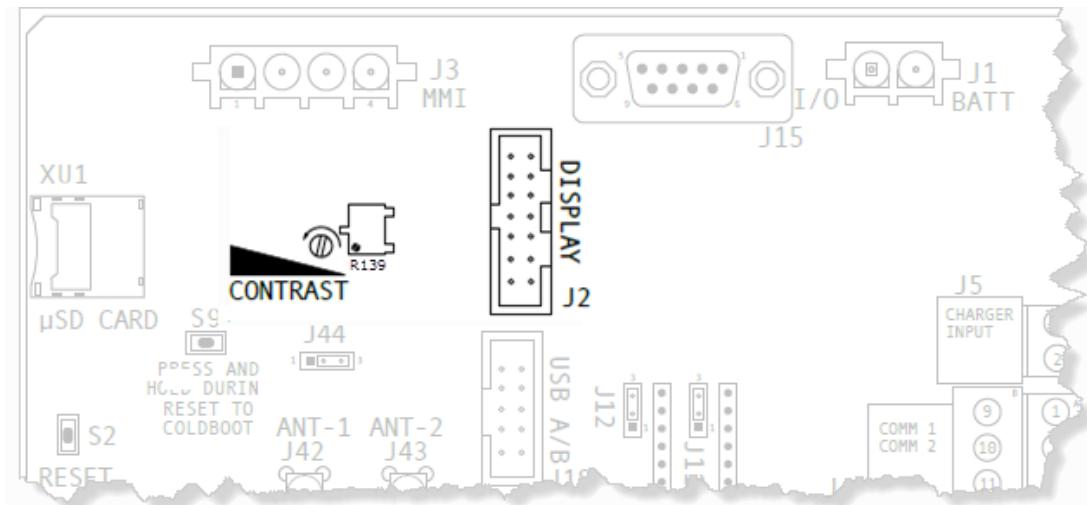
1. If battery powered:
  - a. Connect the battery to the BATT connector (J1 on the XFC<sup>G5</sup>, or J16 on the XRC<sup>G5</sup>).
  - b. Connect the charging source connector to the CHRG terminal (J5 on the XFC<sup>G5</sup>, or J17 on the XRC<sup>G5</sup>).
2. If externally powered, connect the outside power source to the BATT connector (J1 on the XFC<sup>G5</sup>, or J16 on the XRC<sup>G5</sup>).

## 10.6 Adjust the LCD contrast

The LCD contrast is controlled by the onboard potentiometer (R139). To adjust the contrast:

1. Locate the small onboard potentiometer (R139) on the top of the electronic board.
2. Using an extra small slotted screwdriver, turn the potentiometer screw clockwise as far as possible (see figure below).
3. Turn the potentiometer screw counter-clockwise until the LCD screen is readable.
4. If information does not display after contrast adjustment, check the LCD ribbon cable connection. Ensure the connector is securely plugged into the onboard DISPLAY connector.
5. If unable to see any information displayed after checking connection, call ABB technical support.

Figure 10-21: LCD contrast adjustment



## 10.7 XSeries<sup>G5</sup> replacement parts and procedures

The following is a list of the XSeries<sup>G5</sup> replaceable parts. Part removal method depends on the part location and connections and enclosure type.

- Electronic board
- LCD assembly
- Lithium battery
- 12 V battery
- Complete XIMV assembly (Transducer)
- Serial communication modules (RS-232 and RS-485)

[Figure 10-22: Exploded view of an XSeriesG5 enclosure](#) shows an exploded view of the XSeries<sup>G5</sup> flow computer, which will assist with disassembly and reassembly.

Figure 10-22: Exploded view of an XSeries<sup>G5</sup> enclosure

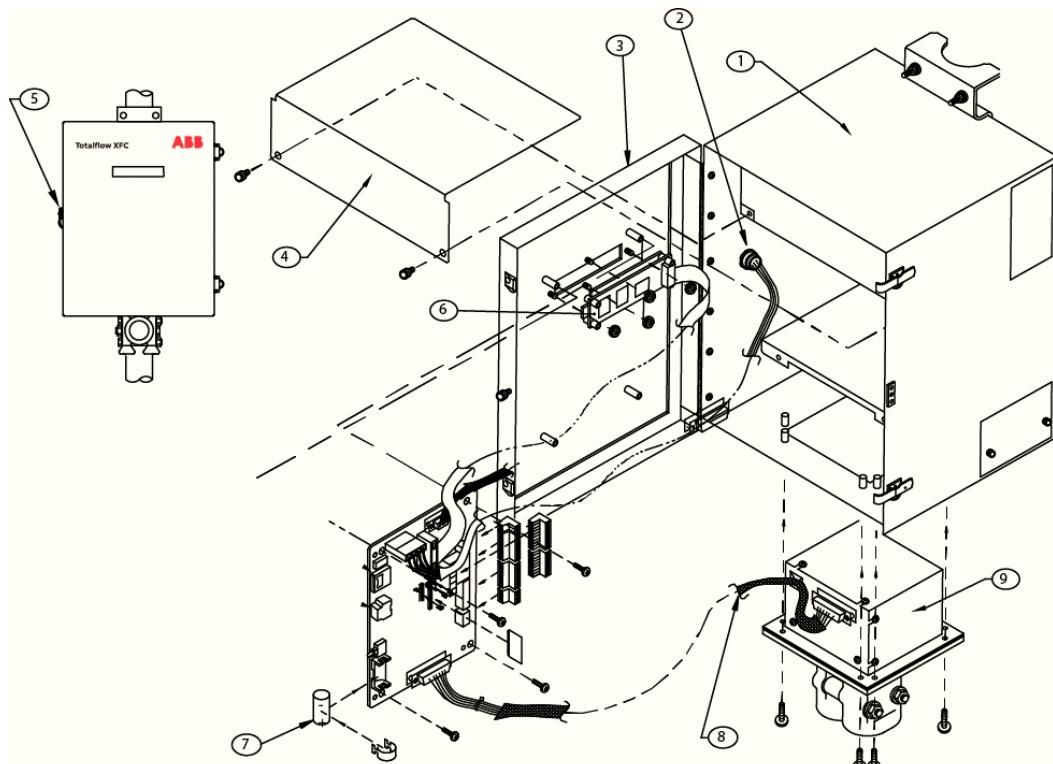


Table 10-2: Exploded view Legend

Number	Part name	Number	Part Name	Number	Part Name
1	Enclosure	4	Battery tray	7	Lithium battery
2	MMI connector	5	Door latch	8	Electronic board to transducer cable
3	Door	6	LCD	9	Transducer housing

### 10.7.1 Replace the 12 Vdc battery

These instructions describe the removal and replacement of the 12 Vdc battery.



**NOTICE – Loss of data:** Do not remove the lithium battery from the electronic board when removing the 12 Vdc battery. The lithium battery keeps the real-time clock running.

**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.

To replace the 12 Vdc battery:

1. Follow the procedures to backup device data and configuration as described in section [10.1 Preserve data and configuration](#).
2. Verify that the lithium battery backup is enabled, and that the lithium battery voltage level is OK:
  - a. View the scrolling parameters on the LCD. Verify that the Lithium Backup? parameter displays **Yes**. If it displays **No**, enable the Lithium backup. See [7.5 Enable real time clock backup](#).
  - b. Verify that the LL battery alarm does not display on the LCD. Or, measure the lithium battery to verify that it registers more than 3.0 V. If the lithium battery is low, see section [10.7.2 Replace the lithium battery](#).
3. Open the enclosure door.
4. Remove battery compartment plate.
5. Disconnect charger and battery following the steps for battery mode in section [10.5.1 Remove power from the electronic board](#).
6. Remove the battery and battery cable from the battery compartment.
7. Put the new battery in place. Ensure that the battery terminals do not touch the metal surfaces inside of the enclosure.
8. Connect battery cable to the new battery terminals (observing polarity).
9. Reconnect battery and charger following the steps for battery mode in section [10.5.2 Reconnect power to the electronic board](#).
10. Verify on the LCD that the controller's power-on sequence completes.
11. Reattach battery compartment plate.

## 10.7.2 Replace the lithium battery

The lithium battery maintains the operation of the real-time clock. It is important to monitor the state of the battery to avoid interruption to the clock backup.



**IMPORTANT NOTE:** In contrast with previous device generations, the real-time clock backup does not stop immediately after the battery stops working. The clock continues to operate for 24 to 36 hours. Do not remove power when replacing the battery.

To replace the battery:

1. Open the enclosure door.
2. Locate the lithium battery on the bottom left-hand corner of the electronic board.
3. Remove the lithium battery cover from the battery bracket by inserting the blade of a slotted screwdriver between the cover and the side of the bracket.
4. Grasp the battery on each side and pull from the bracket. The positive end of the battery is at the bottom end of the bracket.
5. Insert the new lithium battery into the bracket with the positive end of the battery down.
6. Reinsert the battery cover.

## 10.7.3 Replace the XSeries<sup>G5</sup> electronic board

To replace the electronic board on an XSeries<sup>G5</sup> device or to upgrade an XSeries<sup>G4</sup> device with a G5 board, refer to the XSeries<sup>G5</sup> Board Replacement Guide. When replacing boards on devices that are in

service, plan the replacement carefully and follow your company policies. See [Additional information](#). Please review the following admonitions in this section before replacement.

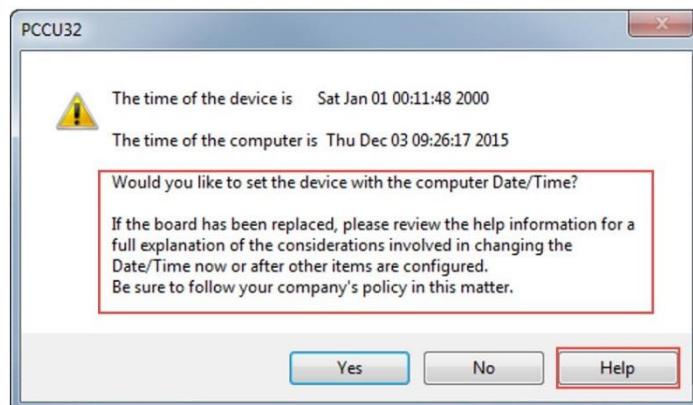
**NOTICE – Equipment damage:** The electronic board inside the XSeries<sup>G5</sup> housing is susceptible to damage by static electricity or improper handling. To prevent this, wear a grounding strap when handling the board.



A grounding strap is a conductive device that makes a connection between the person handling the board and a high-quality ground point. Before handling the board, install a ground strap on your body. Then connect it to a grounded point. This discharges electrical static buildup from the body to the ground and prevents static from discharging to the board.

**IMPORTANT NOTE:** The new board may require calibration and the setting of the clock to the correct date time/time. All device events including calibration are time stamped. You will be prompted to change the time/date settings at startup to match those of the connecting laptop or PC (figure below). Before you change the factory default, determine if your company's policies specify when, during the new board setup, the date/time should be updated. Click **Help** at the prompt for more details.

Figure 10-23: Change time/date factory defaults on a new board



#### 10.7.4 Replace the LCD assembly

In some XSeries<sup>G5</sup> models, the LCD assembly is installed behind of the electronic board on the enclosure door. To replace it, board removal is required.



**IMPORTANT NOTE:** If replacing a board in a device that is in service, follow your company policies and procedures to place the unit offline prior to removal.



**WARNING – Bodily injury.** Attach a ground strap to your body and connect it to a good earth ground before handling any electronic boards. This discharges any electrical static buildup in your body to the ground, instead of to the electronic board.

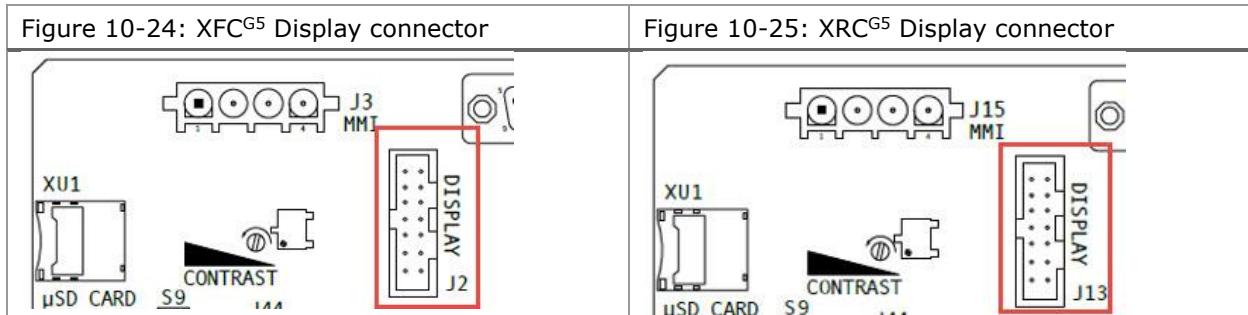
Tools needed:

- Phillips head screwdriver
- 3/16" nut driver

To replace LCD:

1. Connect with the device using PCCU entry mode.
2. Follow the procedures to backup device data and configuration as described in section [10.1 Preserve data and configuration](#).
3. Verify that the lithium battery backup is enabled, and that the lithium battery voltage level is OK:

- a. View the scrolling parameters on the LCD. Verify that the Lithium Backup parameter displays **Yes**. If it displays **No**, enable the Lithium backup.
- b. Verify that the LL battery alarm does not display on the LCD. Or, measure the lithium battery to verify that it registers more than 3.0 V. If the lithium battery is low, replace the lithium battery first according to section [10.7.2 Replace the lithium battery](#).
4. Open the enclosure door.
5. Disconnect power source as described in section [10.5.1 Remove power from the electronic board](#).
6. Locate the DISPLAY connector (J2 on the XFC<sup>G5</sup> and J13 on the XRC<sup>G5</sup>) on the top of the electronic board. The LCD attaches to the connector with a multi-color ribbon cable.



7. Remove the LCD ribbon-cable connector from the DISPLAY connector. Gently rotate the connector securing latches to the left and pull cable away.
8. If there is enough slack in connection cables those connections may be left intact as board is pulled away from door. If required remove other connections from the board.



**IMPORTANT NOTE:** For XFC<sup>G5</sup> models 6713 or a 6714, removal of the electronic board is not required, skip the board removal steps below for those models.

9. Remove the electronic board, being careful not to drop the mounting screws and washers:
  - a. Remove the mounting screw holding the ground wire at the bottom right corner of the board. Then remove the hex standoff that held the screw.
  - b. Remove the three remaining screws from the three remaining corners and remove the board.
  - c. Place the board on a safe, clean, non-metal surface.
10. Remove the four LCD hexagon mounting standoffs, using a 3/16" nut driver.
11. Lift the LCD from the door-mounted standoffs.
12. Install the replacement LCD and secure with standoffs.
13. Reinstall the electronic board. Do not tighten the screws until you have had time to verify that the new LCD works properly.
14. Reinsert all removed connectors.
15. Connect the LCD ribbon cable and connector to the DISPLAY connector on the board.
16. Reconnect the power source as described in section [10.5.2 Reconnect power to the electronic board](#).
17. Ensure that the LCD displays the startup sequence and the devices restarts. If unable to see parameters displayed, adjust the LCD contrast. (See section [10.6, Adjust the LCD contrast](#).)
18. If the LCD does not display parameters after contrast adjustment and checking that the ribbon connector is firmly attached to the electronic board, call ABB technical support.
19. If the LCD had displayed the startup sequence properly and begins to scroll parameters as programmed, tighten electronic board screws and close the enclosure door.

## 10.7.5 Replace or add communication modules (COMM modules)

The XSeries<sup>G5</sup> devices support two serial communication interfaces. Communication modules are required to activate those interfaces. Each can be configured as either RS-232 or RS-485. Standard configuration may ship with a COMM1 module already installed. Use this procedure to replace or add new communication modules. When adding new modules, make sure you order the type required by the external equipment you plan to connect to the COMM terminals.



**WARNING – Bodily injury.** Attach a ground strap to your body and connect it to a good earth ground before handling any electronic boards. This discharges any electrical static buildup in your body to the ground, instead of to the electronic board.



**IMPORTANT NOTE:** If replacing a module with a module of a different type, rewiring will be required. For RS-485 communication, set the termination jumper based on the number of external devices you plan to connect.

### 10.7.5.1 Before you replace or add modules

To prepare to replace/add modules:

1. Connect with the device using PCCU entry mode.
2. Follow the procedures to backup device data and configuration as described in section [10.1 Preserve data and configuration](#).
3. Verify that the lithium battery backup is enabled, and that the lithium battery voltage level is OK:
  - a. View the scrolling parameters on the LCD. Verify that the Lithium Backup parameter displays Yes. If it displays No, enable the lithium battery backup.
  - b. Verify that the LL battery alarm does not display on the LCD. Or, measure the lithium battery to verify that it registers more than 3.0 V. If the lithium battery is low, replace the lithium battery first according to section [10.7.2 Replace the lithium battery](#).
4. Open the enclosure door.
5. Disconnect the power source as described in section [10.5.1 Remove power from the electronic board](#).
6. Locate the COMM modules or slots [COMM1 (XA1) and COMM2 (XA2)] located left of the COMM terminal ports on the right side of the electronic board.

Figure 10-26: XFC<sup>G5</sup> COMM ports

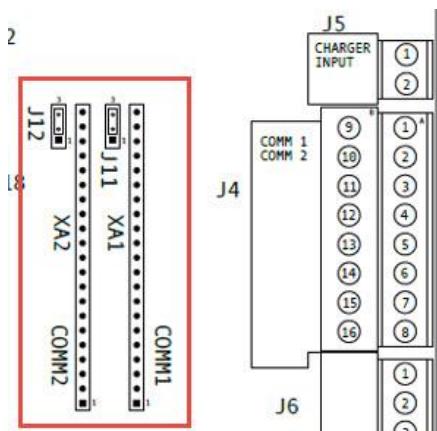
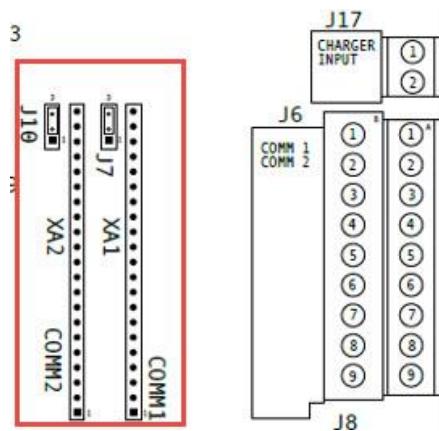


Figure 10-27: XRC<sup>G5</sup> COMM ports



### 10.7.5.2 Remove modules

Remove the communication modules from the COMM1 (XA1) and COMM2 (XA2) slots.

1. Identify the module to be replaced.
2. Grasp firmly in the middle of the module and gently pull straight out to avoid bending or breaking the module pins.

### **10.7.5.3 Insert modules**

Insert the communication modules into the COMM1 (XA1) and COMM2 (XA2) slots:

1. Remove modules from their package.
2. Grasp each new module in the middle and align the pins with the slot. Module pin 1 (indicated by a dot mark on the flat side of the module) must connect to slot pin 1 indicated on the board.
3. Gently insert the module straight into the slot to avoid bending or breaking the module pins.
4. For RS-485, set the termination jump correctly.
5. Wire the COMM port based on the COMM module type. If a module has been replaced with a module of a different type, make sure to rewire the terminal connector to the match the type.

### **10.7.5.4 Restore power to the board**

After module insertion is complete:

1. Restore power to the board as described in section [10.5.2 Reconnect power to the electronic board](#).
2. Verify startup sequence is completed.
3. Close the enclosure door.
4. Verify COMM connections. If new equipment has been added. Review the wiring and startup procedures in this manual.

## **10.7.6 Replace the transducer (XFC<sup>G5</sup> only)**



**NOTICE – 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.

# 11 Calibration

## 11.1 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 the following table will need to be configured.

Table 11-1: 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 XSeries<sup>G5</sup> XIMV:

- PCCU32, version 7.65 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, can recalculate 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.

### 11.1.1 Static pressure 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 5 values.



**IMPORTANT NOTE:** 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.



**WARNING – Property damage, bodily injury:** 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.

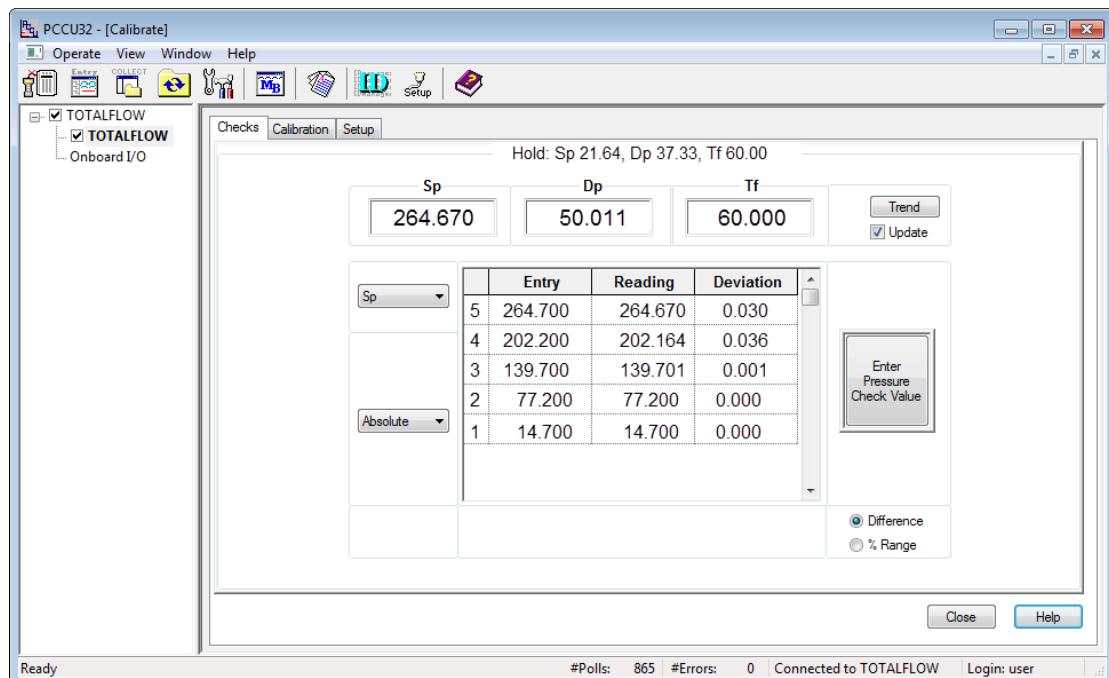
1. Select **Calibration** on the tool bar to place the flow computer in Hold mode.
2. Select the measurement tube in the navigation tree.

3. On the Checks tab, select **SP** from the Calibration drop-down menu.
4. Define the SP display value: Absolute or Gauge ([Figure 11-1: SP calibration pressure checks](#)).

**IMPORTANT NOTE:** Selecting Absolute will display the value with the barometric pressure added. 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 11-1: SP calibration pressure checks



5. Click Enter Pressure Check Value.
6. In the Enter Pressure dialog box, select **Continuous** 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. Add the barometric pressure if the pressure type is Absolute. Click **OK**.
18. Repeat steps 16 through 17 for each pressure check value.

After all the static pressure markers have been set, determine if calibration is required. Return the manifold to service before exiting Calibration mode if more calibration is not required.

## 11.1.2 Differential pressure 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 5 values.



**IMPORTANT NOTE:** 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.

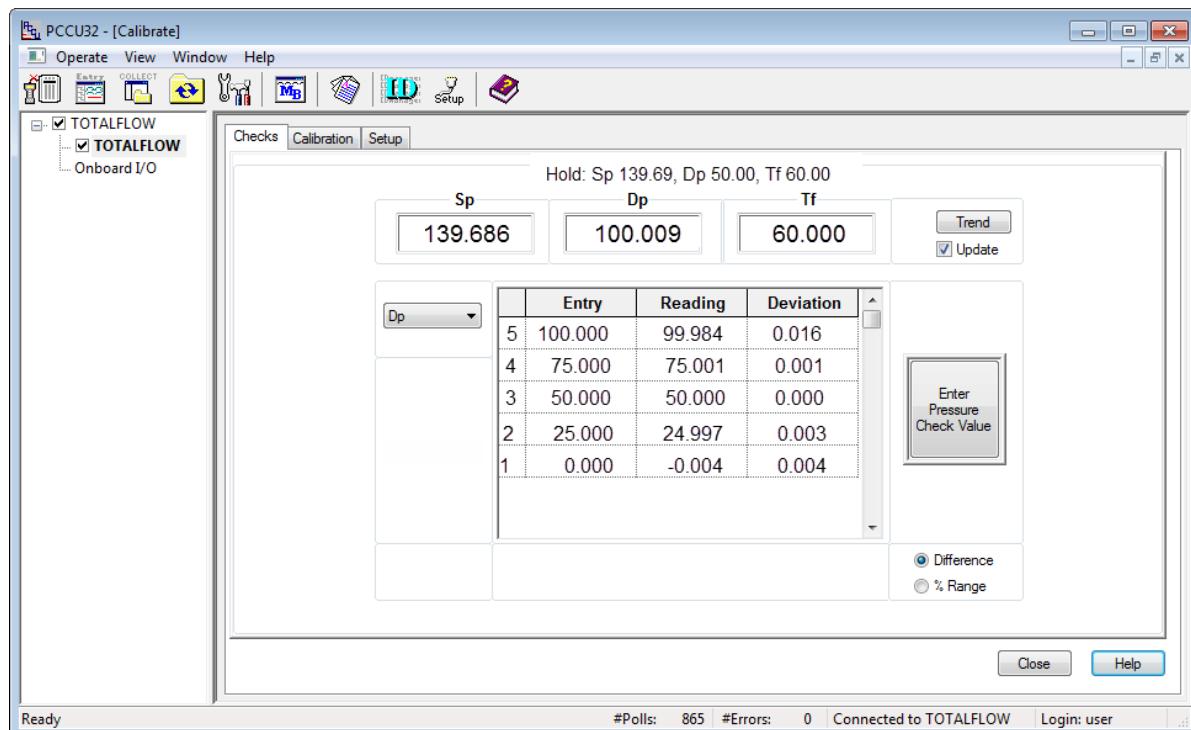
Refer to API 21.1 and company procedures for additional guidance on performing pressure checks.



**WARNING – Property damage, bodily injury:** 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. Select **Calibration** on the tool bar to place the flow computer in hold mode.
2. Select the measurement tube in the navigation tree.
3. On the Checks tab, select **DP** from the Calibration drop-down menu ([Figure 11-2](#)).

Figure 11-2: 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. After the current reading stabilizes, enter the pressure value from the calibration source, and click **OK**.

After all the static pressure markers have been set, determine if calibration is required. Return the manifold to service before exiting Calibration mode if more calibration is not required.

### **11.1.3 Calibrating static pressure**

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.



**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.

#### **11.1.3.1 Absolute vs. Gauge**

The initial calibration point should be completed under 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. Enter this reading.

Operating in PCCU32 Gauge mode, the readings may be entered as read. Upon completion, a barometric pressure reading is entered.

#### **11.1.3.2 Calculating PSI**

To convert barometric pressure measured in inches of mercury to PSI, perform the following calculation:

Barometric Pressure (inHg inches of mercury) \* 0.49115 = Barometric Pressure in PSI

#### **11.1.3.3 Calibration**

While 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. Select **Calibration** on the tool bar to place the flow computer in Hold mode.
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 NOTE:** Selecting Absolute will display the value with the barometric pressure 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, for a five (5) point calibration, enter 5 values.

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.

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. A 5 Point calibration requires two more points to be calibrated: 50% and 25%.

22. Repeat steps 19 through 21 until all calibration points have been pressured.

#### 11.1.4 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. Select **Calibration** on the tool bar to place the flow computer in Hold mode.
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.

**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.

 These instructions are specific to a three (3) point calibration. For a five (5) point calibration, enter 5 values.

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.

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.

19. 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%.

20. Repeat steps 17 through 19 until all calibration points have been pressured.

Return the manifold to service before exiting Calibration mode.

## 11.2 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.

Use Zero transducer to adjust pressures during regular maintenance. Pressures that are out of alignment by the same amount, could be the result of a linear shift.



**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 sections [11.1.1 Static pressure checks](#) and [11.1.2 Differential pressure checks](#).

### 11.2.1 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. Select **Calibration** on the tool bar to place the flow computer in Hold mode.
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.



**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. Check 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**.

### 11.2.2 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. Select **Calibration** on the tool bar to place the flow computer in Hold mode.
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. Check Continuous Update.
7. When the current reading stabilizes, enter a zero (0) and click **OK**.

## 11.3 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. Select **Calibration** on the tool bar to place the flow computer in Hold mode.
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 J7 on the XFC<sup>G5</sup> and J20 on the XRC<sup>G5</sup> electronic board.



**IMPORTANT NOTE:** Using a 100  $\Omega$  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 11-2: RTD wiring pinouts

XFC <sup>G5</sup>		XRC <sup>G5</sup>	
Terminal	J7	Terminal	J20
1	SHLD	1	VBAT
2	OUT	2	GND
3	(+)	3	SWVBAT
4	(-)	4	GND
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.

**IMPORTANT NOTE:** If the 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 the 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.

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**.



**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.

## 11.4 Resistance temperature detectors (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.



**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.



**IMPORTANT NOTE:** The current temperature value (T<sub>f</sub>) 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**.

## 11.5 Analog input calibration

The calibration for analog input (AI) can be a 3-point or 5-point calibration ([Table 11-3](#)).

Table 11-3: AI calibration points

Type of calibration	Points
<b>3-point</b>	Low, 50%, and 100%
<b>5-point</b>	Low, 25%, 50%, 75% and 100%

Typical external devices include 4-20 mA or 1-5 V transmitters. Use the values in [Table 11-4](#) for the calibration points for these types of devices.

Table 11-4: Typical calibration point values

Available calibration points	Current (in mA) for 4-20 mA range	Voltage (in volts) for 1-5 V range
<b>Low</b>	4	1
<b>25%</b>	8	2
<b>50%</b>	12	3
<b>75%</b>	16	4
<b>100%</b>	20	5



**IMPORTANT NOTE:** To properly calibrate the AI, you must determine the measurement range and signal type of the external device.



**IMPORTANT NOTE:** For I/O calibration on TFIO modules refer to PCCU32 online help topics. Topics for calibration of each module type are available when you click **Help** on the applicable screens.

### 11.5.1 Connect calibration equipment

A calibrator simulates the external device attached to the controller AI during analog input calibration. The calibrator applies the signal (voltage or current) values that would otherwise come from the external device.



**IMPORTANT NOTE:** Verify that the voltage or current values from the calibrator do not exceed the acceptable analog input ranges. Verify that the signal is the same type as the AI configuration. Do not turn the calibrator on until the AI is configured for the correct input signal type.

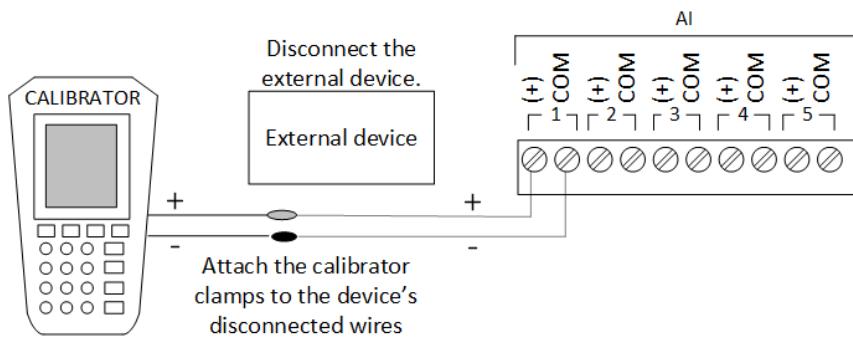


**NOTICE – Tainted results:** The wire length from the external device to the AI affects the calibration. Only use wires of the correct length from the XSeries<sup>G5</sup> to the external device when you connect the calibrator. Or, place the calibrator at the location where the external device is installed.

To prepare and connect the calibration equipment:

1. Power off the XSeries<sup>G5</sup>.
2. Disconnect the wires from the external device.
3. Set the calibrator to the same signal type (voltage or current) as the AI mode setting.
4. Connect the calibrator to the external device's wire ends. Observe the polarity and connect to the correct wire: positive probe to the signal wire, and negative probe to the negative or ground wire.
5. Keep the XSeries<sup>G5</sup> powered off to set the correct AI mode in the next section.

Figure 11-3: Calibration equipment connection to XRC<sup>G5</sup> AI



### 11.5.2 Set the AI to the correct input signal mode

XSeries<sup>G5</sup> devices support voltage or current input signals from external devices. Before proceeding with the calibration or restoring power to the device, make sure you set the correct AI mode.

To set the AI input signal mode:

1. Locate the AIs (XFC: J8, XRC: J23).

Figure 11-4: XRC<sup>G5</sup> AIs

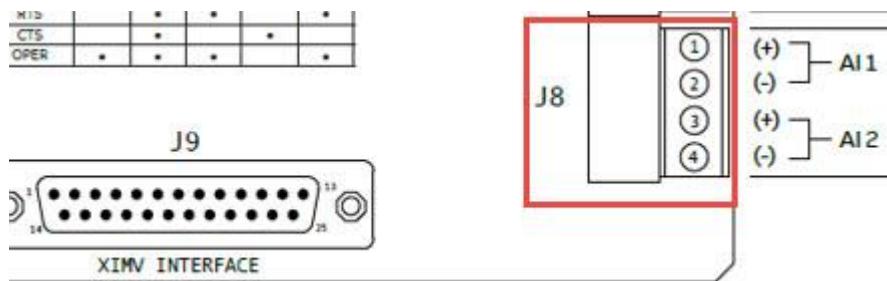
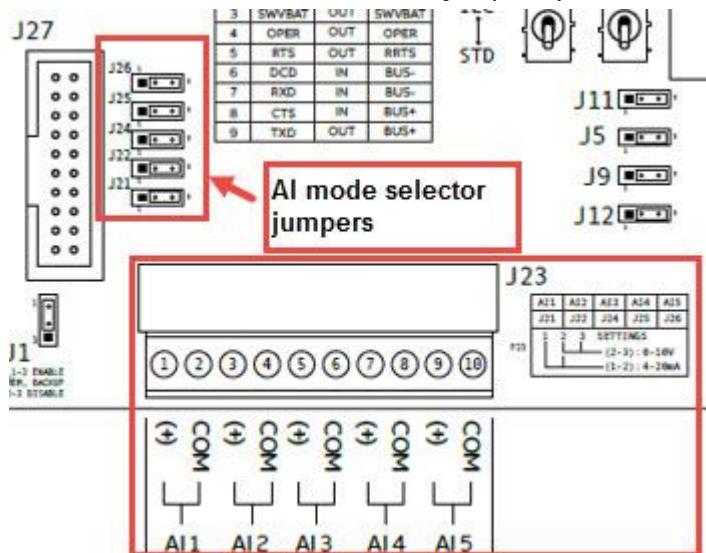


Figure 11-5: XRC<sup>G5</sup> AIs and mode selector jumpers (default setting)



To set the AI to voltage mode:

1. If calibrating on the XFC: AIs support voltage mode by default. Ensure that there are no external resistors connected across the AI pins.
2. If calibrating on the XRC: Verify that the mode selector jumper (J21, J22, J24, J25 or J26) is across pins 2 and 3 for the selected AI.

To set the AI to current mode:

1. If calibrating on the XFC: Insert a precision resistor across the selected AI pins.
2. If calibrating on the XRC: Place the mode selector jumper (J21, J22, J24, J25 or J26) across pins 1 and 2 for the selected AI.

### 11.5.3 Analog input calibration (voltage mode)

This procedure describes a three (3) point calibration. Available target values for this option display in the calibration window and become active in calibration order:

- Low Cal Point
- 100% Cal Point
- 50% Cal Point

These instructions can be adapted for a five (5) point calibration. The five pressure points display in calibration order:

- Low Cal Point
- 100% Cal Point
- 75% Cal Point
- 50% Cal Point
- 25% Cal Point

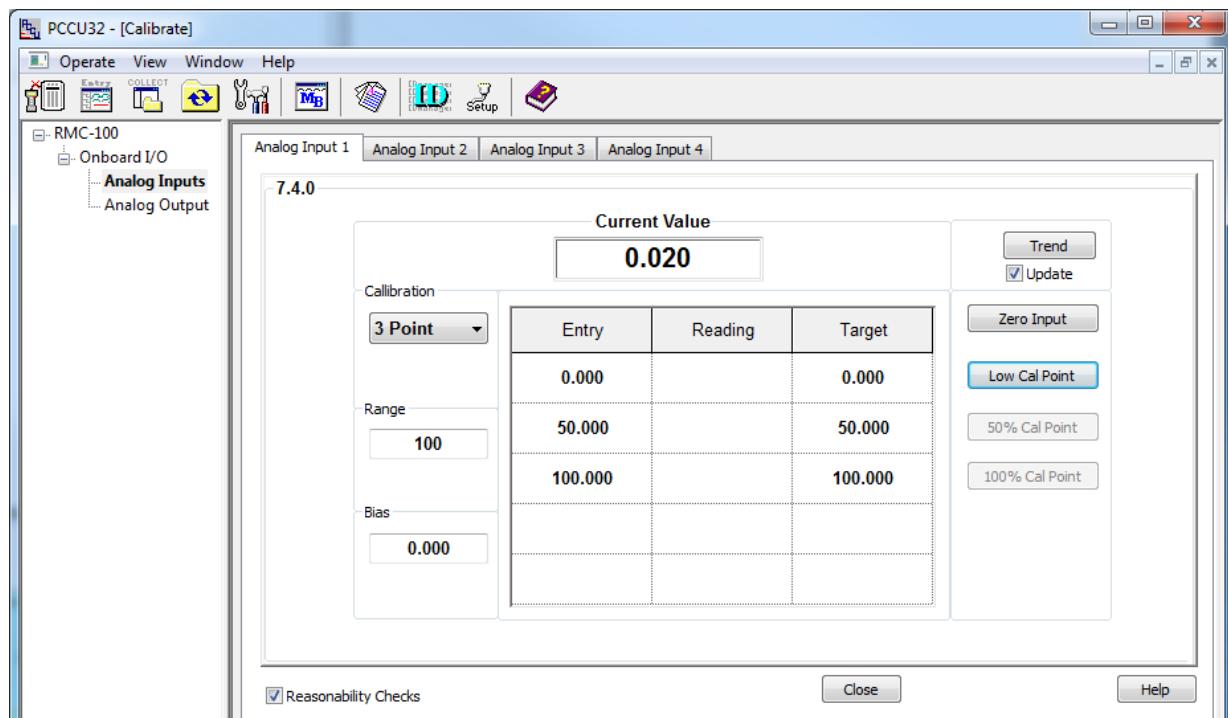


**IMPORTANT NOTE:** For illustrative purposes, the AI 1 is calibrated for an external device with a measurement range value of 100.

To calibrate the analog input:

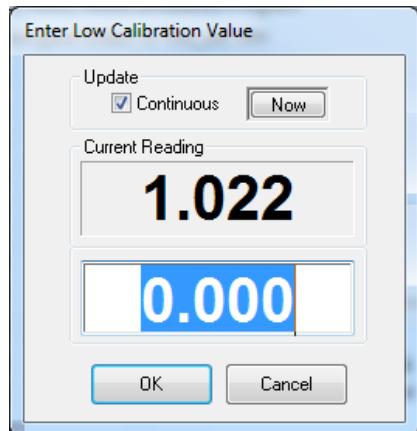
1. Make sure the AI is set to voltage mode.
2. Restore power to the XSeries<sup>G5</sup>.
3. Make sure that the calibrator is set to the voltage signal type.
4. Connect the PC or laptop running PCCU32 to the XSeries<sup>G5</sup> and connect using Entry mode.
5. Turn the calibrator on to supply the signal.
6. Click the **Calibrate** icon on the PCCU toolbar to display the Calibration screen.
7. Click the **Onboard I/O** folder on the navigation tree to expand it. Then, click **Analog Inputs**. The Analog Input 1-tab displays.
8. Click another **AI** tab, if necessary, to calibrate. This example displays AI 1 (the Analog Input 1 tab is the default displayed).

Figure 11-6: AI voltage default calibration values



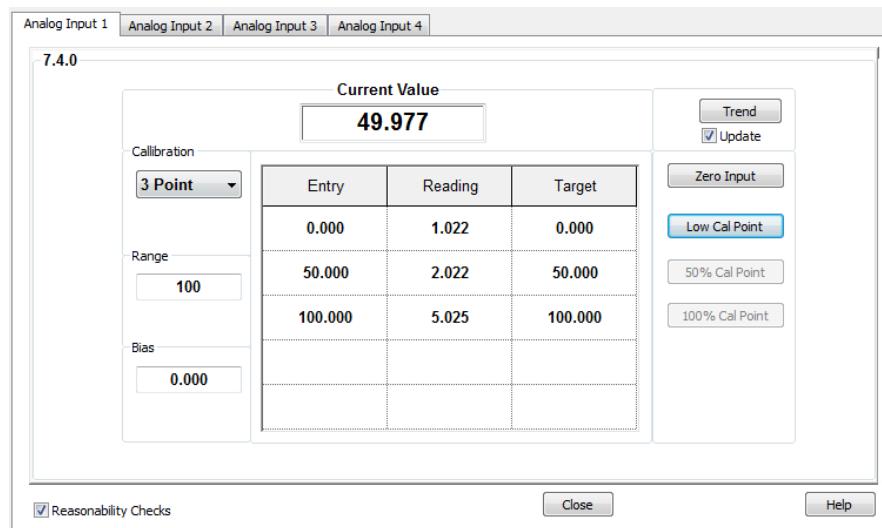
9. Select either the **3 Point** or **5 Point** calibration from the **Calibration** drop-down list.
10. Verify that only the **Zero Input** and **Low-Cal Point** buttons are enabled and highlighted. The system enables the buttons in the order required for the calibration.
11. Click the **Range** field. The Analog Input Range dialog box displays.
12. Type the external device measurement range into the entry field and click **OK**. The values in the Target column of the table update to reflect this range.
13. Click **Low Cal Point**. The Enter Low Calibration Value dialog box displays with the target low value automatically calculated. For example, for the range value of 100, the value is 0.000.
14. 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.
15. Observe the value in the Current Reading field. When the value stabilizes, click **OK**.

Figure 11-7: Low calibration value for voltage



16. Click **100% Cal Point**. The Enter 100% Calibration Value dialog box displays with the target high value automatically calculated. For example, the value is 100.000 for the range value of 100.
17. Adjust the calibrator to apply the high value (100%) of the signal range. For example, if the signal range of the external device is 1-5 Vdc, apply 5 Vdc.
18. Observe the value in the Current Reading field. When the value stabilizes, click **OK**.
19. If the high range value in the field is accepted, click **OK**.
20. Click **50% Cal Point**. The Enter 50% Calibration Value dialog box displays with the target mid value automatically calculated. For example, the value is 50.000 for the range value of 100.
21. Adjust the calibrator to apply the 50% value of the external device signal range. For example, if the signal range of the external device is 1-5 Vdc, apply 3 Vdc.
22. Observe the value in the Current Reading field. When the value stabilizes, click **OK**.
23. When the Calibration Complete message displays, click **OK**.
24. Verify that the Entry values are updated, and that the Current Value field displays the calibrated value based on the defined range.

Figure 11-8: Calibrated AI example (voltage mode)



Remain in the calibration screen and keep the calibrator connected to the AI. To verify the calibration, proceed to section [11.5.5 Verify analog input calibration](#).

#### 11.5.4 Analog input calibration (current mode)

This procedure describes a three (3) point calibration. Available target values for this option display in the calibration window and become active in calibration order:

- Low Cal Point
- 100% Cal Point
- 50% Cal Point

These instructions can be adapted for a five (5) point calibration. The five pressure points display in calibration order:

- Low Cal Point
- 100% Cal Point
- 75% Cal Point
- 50% Cal Point
- 25% Cal Point

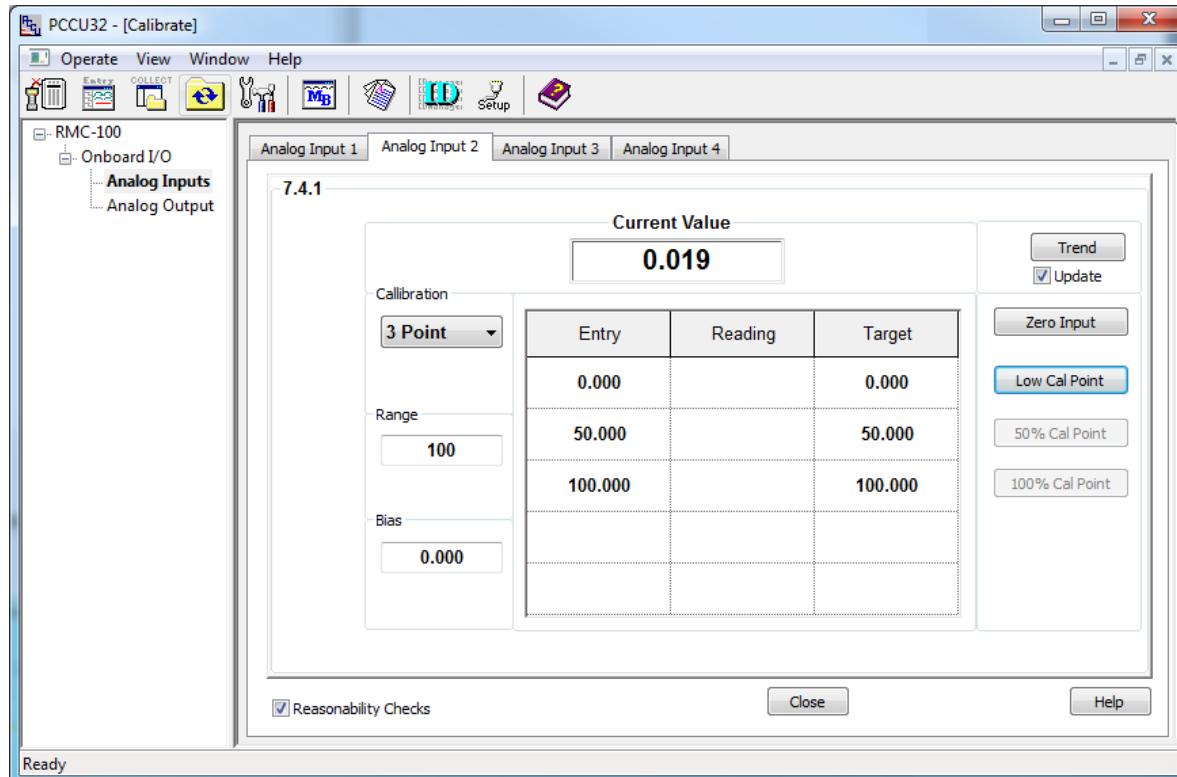


**IMPORTANT NOTE:** For illustrative purposes, the AI 2 is calibrated for an external device with a measurement range value of 100.

To calibrate the analog input:

1. Make sure the AI is set to current mode.
2. Restore power to the XSeries<sup>G5</sup>.
3. Verify that the calibrator is set to the current signal type.
4. Turn on the calibrator to supply the signal.
5. Click the **Calibrate** icon on the PCCU toolbar (the Calibrate icon shows tools). The Analog Input 1-tab displays.
6. Click another **AI** tab, if necessary, to calibrate. In this example, AI 2 displays. (Analog Input 2 tab).

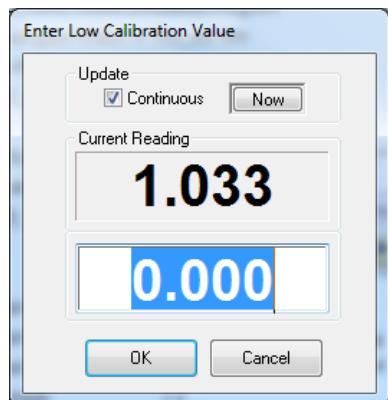
Figure 11-9: AI current default calibration values



7. Click **Calibration** and select **3-point** or **5-point** from the drop-down list.
8. Verify that only the **Zero Input** and **Low-Cal Point** buttons are enabled and highlighted. The system enables the buttons in the order required for the calibration.
9. Click **Range**. The Analog Input Range dialog displays.

10. Type the external device measurement range into the entry field and click **OK**. The values in the Target column of the table update to reflect the new range.
11. Click **Low Cal Point**. The Enter Low Calibration Value dialog displays with the target low value automatically calculated. For example, the value display is 0.000 if the range defined is 0-100.
12. 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.
13. Observe the value in the Current Reading field. When the value stabilizes, click **OK**.

Figure 11-10: Low calibration value for current



14. Click **100% Cal Point**. The Enter 100% Calibration Value box displays with the target high value automatically calculated. For example, the value display is 100.000 for the range value of 100.
15. Adjust the calibrator to apply the high value (100%) of the signal range. For example, if the signal range of the external device is 4 to 20 mA, apply 20 mA.
16. Observe the value in the Current Reading field. When the value stabilizes, click **OK**.
17. Click **50% Cal Point**. The Enter 50% Calibration Value dialog displays with the target mid value automatically calculated. For example, the value display is 50.000 for the range value of 100.
18. Adjust the calibrator to apply the mid-range value (50%) of the signal range. For example, if the signal range of the external device is 4 to 20 mA, apply 12 mA.
19. Observe the value in the Current Reading field. When the value stabilizes, click **OK**.
20. When the Calibration Complete message displays, click **OK**.
21. Verify that the Entry values updated, and the Current Value field displays the calibrated value based on the defined range.
22. Remain on the Calibration screen and keep the calibrator connected to the AI.

### 11.5.5 Verify analog input calibration

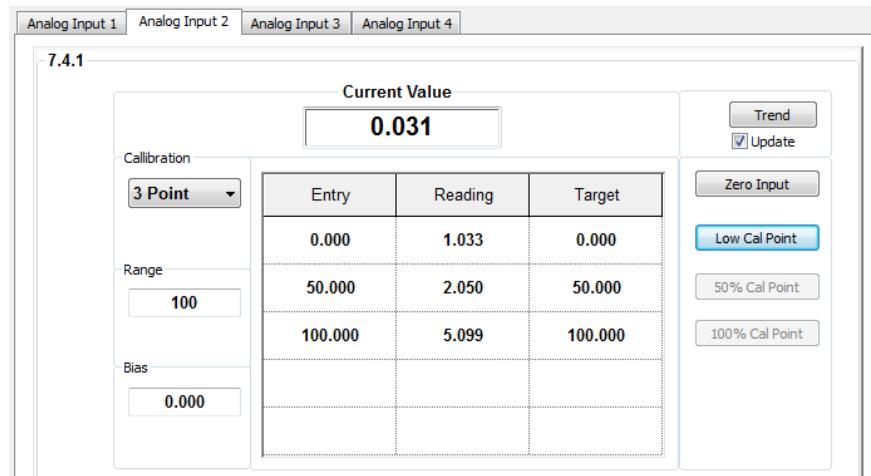
After calibration completes, the Current Value field displays the calibrated values based on the defined range. Continue to use the calibrator to apply different input signal values to the AI and verify that the value in the Current Value field reflects the expected calibration range values.

The instructions in this procedure apply to both current and voltage modes. The example used in these instructions is current mode.

To verify the analog input calibration:

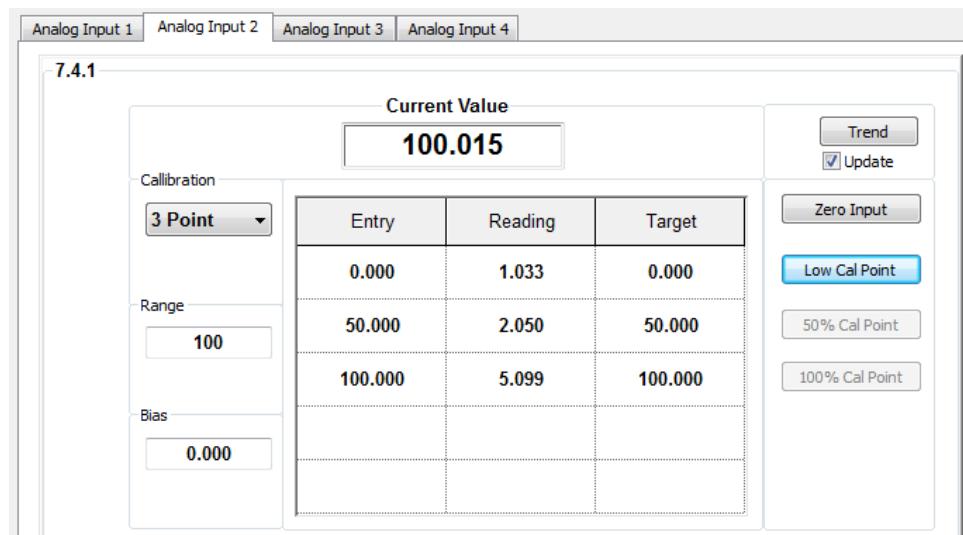
1. Adjust the calibrator to apply the minimum (low) value of the signal range.
2. Wait for the value in the Current Value field to stabilize.
3. Verify that Current Value displays a value equal or close to the target range low (0%) value.

Figure 11-11: Low range value verification



4. Adjust the calibrator to apply the high (100%) value of the signal range.
5. Wait for the value in Current Value to stabilize.
6. Verify that Current Value displays a value equal or close to the target range high (100%) value.

Figure 11-12: High range value verification



7. If all values are correct, calibrate the next AI or click **Close** to exit the Calibration screen.
8. When calibration for all required AIs successfully completes, remove power from the controller, remove the calibrator, and reconnect the external device.
9. If there are errors, proceed to section [11.5.6 Repeat calibration in case of errors](#).

## 11.5.6 Repeat calibration in case of errors

If the displayed input values are not valid or do not stabilize, the calibration might not be correct. In Entry mode, the calibrated AI indicates it has been **Field** calibrated regardless of whether the calibration was successful or not. This procedure sets the AI calibration status back to **Factory** as required before repeating the calibration procedures.

To set the AI before repeating the calibration:

1. Click **Close** to exit calibration.
2. Click the Entry icon on the PCCU toolbar.
3. Click **I/O Interface** on the navigation tree. The Analog Inputs tab displays. The calibrated AI displays Field in the calibration column.
4. Select **Factory** from the Calibration drop-down list for the appropriate AI.

5. Click **Send**.
6. Click the Calibrate icon on the PCCU toolbar (the Calibrate icon shows tools).
7. Click **I/O Interface** on the navigation tree.
8. Repeat the calibration procedure in section [11.5.2 Set the AI to the correct input signal mode](#)
9. XSeriesG5 [devices support voltage or current input signals from external devices. Before proceeding with the calibration or restoring power to the device, make sure you set the correct AI mode](#).

To set the AI input signal mode:

10. Locate the AIs (XFC: J8, XRC: J23).

Figure 11-4: XRCG5 AIs

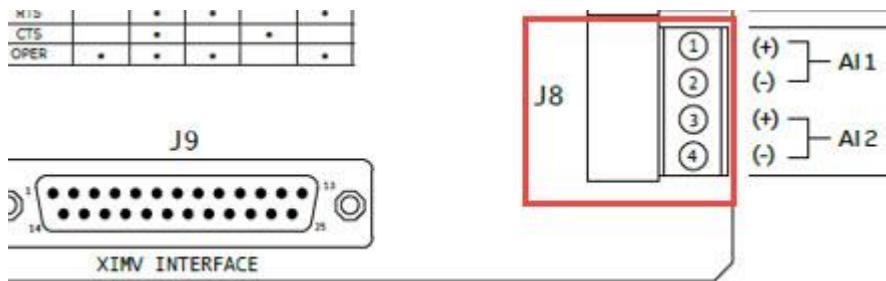
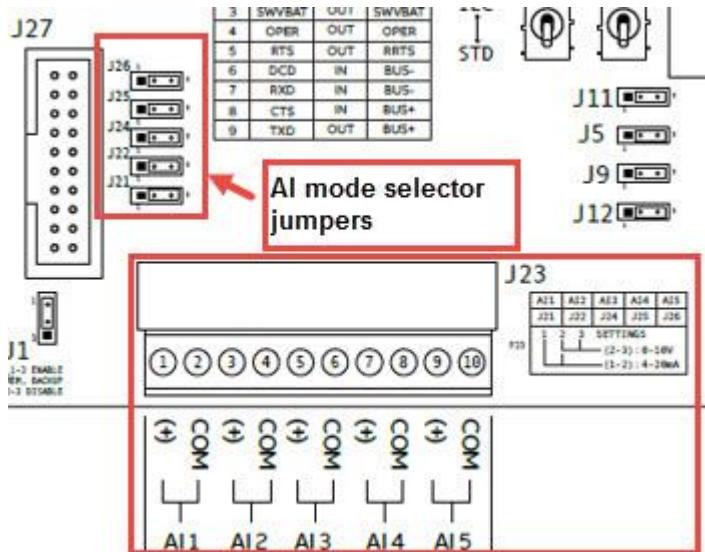


Figure 11-5: XRCG5 AIs and mode selector jumpers (default setting)



To set the AI to voltage mode:

11. If calibrating on the XFC: AIs support voltage mode by default. Ensure that there are no external resistors connected across the AI pins.
12. If calibrating on the XRC: Verify that the mode selector jumper (J21, J22, J24, J25 or J26) is across pins 2 and 3 for the selected AI.

To set the AI to current mode:

13. If calibrating on the XFC: Insert a precision resistor across the selected AI pins.
14. If calibrating on the XRC: Place the mode selector jumper (J21, J22, J24, J25 or J26) across pins 1 and 2 for the selected AI.
15. Analog input calibration (voltage mode), and section [11.5.4 Analog input calibration \(current mode\)](#).
16. Repeat the steps in section [11.5.5 Verify analog input calibration](#).

## 12 Troubleshooting

This section discusses a few potential issues during the initial startup of the flow computer.

### 12.1 LCD visual alarm and status codes

The LCD displays alarm conditions and status codes in the Annunciator area, see [Figure 12-1: XSeriesG5 annunciators](#).

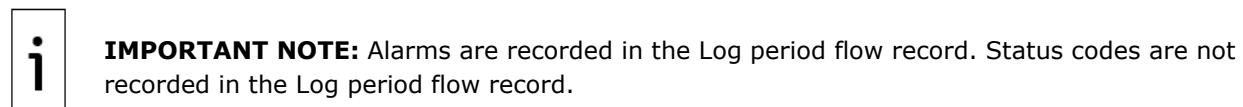
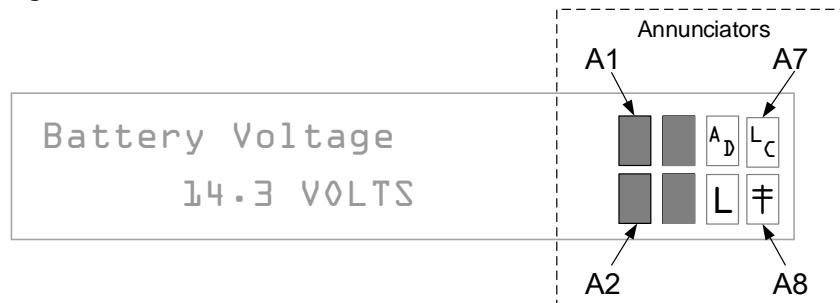


Figure 12-1: XSeries<sup>G5</sup> annunciators



The following table lists the indicator symbol and description of the status and alarm codes.

Table 12-1: XSeries<sup>G5</sup> status and alarm codes

Indicator	Description
System	
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 XSeries <sup>G5</sup> battery charging voltage is (+) 0.4 Vdc, or is less than or equal to the battery voltage.
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 recognized ID 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.

Indicator	Description
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
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 displayed.
↑	The displayed item's value is above the Data High Limit value on the display Item Setup screen.
↓	The displayed item's value is below the Data Low Limit value specified on the display Item Setup screen.



**IMPORTANT NOTE:** The status and alarm code area is customizable. Each of the 8 annunciator display fields, shown in [Figure 12-1: XSeriesG5 annunciators](#), may be programmed to display any of the available indicators, in any of the 8 locations.

## 12.2 Failure to start

The LCD displays the startup sequence after power up. See details in section [7.1 Super capacitor charging at boot time](#). The display should begin cycling through the pre-programmed items. If it fails to cycle and locks up, follow the procedure below.



**IMPORTANT NOTE:** Display time for screens 1 through 4 will vary. If the startup cycle stops, record the details on the screen. Provide the screen details to technical support to help them resolve the issue.

## 12.3 Screen locked-up

Follow this procedure to correct a locked-up screen:

1. Attach the lithium battery to the board.

Perform a warm boot:

1. Locate **RESET** (XFC<sup>G5</sup> S2 and XRC<sup>G5</sup> S6) on the electronic board, press and hold for 10 seconds.
2. View the screen during startup to verify that the unit warm-starts and begins cycling.
3. If the display moves through the startup screens and begins cycling correctly, the reset was successful, and it is not necessary to continue this procedure.
4. If the display does not begin cycling correctly or locks up on one of the startup screens, continue to perform a cold boot.

Perform a cold boot:

1. Locate the **COLDBOOT** button (S9) and the **RESET** button (XFC<sup>G5</sup> S2 and XRC<sup>G5</sup> S6) on the electronic board.
2. Press and hold the **COLDBOOT** button and at the same time press and hold the **RESET** button for 10 seconds.
3. The LCD displays Loading Boot Loader.
4. Verify the Power On sequence is completed.
5. If the display moves through the startup screens and begins cycling correctly, the COLDBOOT was successful.

6. If the display does not begin cycling correctly or locks up on one of the startup screens, contact technical support for additional instructions.



**IMPORTANT NOTE:** To reach technical support, call the ABB Totalflow main office, listed under [Contact us](#) and select technical support from the menu options.

## 12.4 Remote communication failure



**IMPORTANT NOTE:** Use COMM1 for remote communication.

Use the following list to eliminate possible remote communications issues (in any order):

1. Verify that the  $\ddagger$  symbol flashes in the A8 display position, see [Figure 12-1: XSeriesG5 annunciators](#). This indicates that the port is actively running Totalflow Remote Protocol. Each flash identifies the listen cycle time.

If the  $\ddagger$  symbol is not flashing:

2. Set the port Listen Cycle to zero. The symbol should display continuously.
  - Select Totalflow Remote Protocol in the configuration of the port, see section [8.7.1: Configure COM1](#).
  - Increase the cutoff voltage value specified in Station Setup > Remote Comm Cutoff Voltage. This helps determine if COMM1 is deactivated due to a drop in the voltage to the device. The default is 11.9 Vdc. Use voltage values based on the power mode used. Click **Help** in the Station Setup screen for more details.
3. Verify that these are correct:
  - The communication port wiring on the flow computer
  - The communication port wiring on the radio
  - All communication cables are intact and undamaged
4. Verify that the antenna is properly installed:
  - Wiring to the radio is correct
  - Frequency range is correct
  - Directional antenna is pointed toward the base radio ( $\pm 6^\circ$ )
  - Vanes are mounted vertically and are perpendicular to the ground
5. Verify that the base radio (host device, typically running WinCCU) is working at other locations, using the same frequencies as the remote radio.
6. Verify the configuration of the host communication application (typically WinCCU):
  - The Station ID and the Device ID match the host settings.
  - No other device is using the same Station ID or Device ID.
  - The baud rate, stop bits, security code, and listen cycle time agree between the host (WinCCU) device and flow computer.
  - The host (WinCCU) is using packet protocol.

For troubleshooting other communication equipment, including modems, cellular equipment, or telephone line, contact the ABB Totalflow main office, listed under [Contact us](#) and select technical support from the menu options.

## Appendix A Typographical conventions

Table 12-2: Typographical of conventions

Element	Convention	Example
<b>Cross-reference to a figure or table in the document</b>	Hyperlink to the figure or table	See <a href="#">Figure 2</a> .
<b>Cross-reference to a specific section in the document</b>	Hyperlinks to sections referenced throughout the document appear in blue, with underline.	See section <a href="#">1 System Description</a> .
<b>Cross-reference to another document or website</b>	Hyperlink to the website in blue, with underline	Go to the XSeries <sup>G5</sup> User Manual at <a href="http://abb.com">abb.com</a> .
<b>Greater-than character (&gt;)</b>	Indicates that the following item is an additional menu selection	From the menu, locate and select <b>Calibrate &gt; Diff. Press. Sensor &gt; Calibration Units &gt; Edit</b> .
<b>Name of selection buttons, menus, or navigation tree items in instructions that the user will locate and click</b>	Bold text, and the capitalization agrees with the name as displayed on the user interface	Click the <b>Monitor</b> tab and select the <b>Add Advanced Setup</b> tab.
<b>Programs, including utility and accessory programs</b>	Title capitalization	Microsoft Word
<b>URL</b>	All lowercase for a fully specified URL	<a href="http://www.abb.com/totalflow">www.abb.com/totalflow</a>
<b>User input</b>	Bold and lowercase, unless case sensitive. If the user-input string contains placeholder text, that text is in small caps.	Type <b>config</b> SMALL CAPS FOR PLACE HOLDERS.

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## **Appendix B 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.

Ensure compliance with the regulations applicable in the country of use when working with transmitters.

## Appendix C Compliance

### EU Directive 2012/19/EU – WEEE



Waste Electrical and Electronic Equipment (WEEE) 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 WEEE Directive.

### FCC RF Compliance

CONTAINS FCC CERTIFIED TRANSMITTER MODULE(S).

THIS PRODUCT CONTAINS FCC ID: Z64-WL18DBMOD.

THIS DEVICE COMPLIES WITH PART 15 OF THE FCC RULES.

THIS PRODUCT CONTAINS IC: 5530C-WL1837MOD. THIS DEVICE COMPLIES WITH RSS-GEN OF THE IC RULES

OPERATION IS SUBJECT TO THE FOLLOWING 2 CONDITIONS:

THIS DEVICE MAY NOT CAUSE HARMFUL INTERFERENCE.

THIS DEVICE MUST ACCEPT ANY INTERFERENCE RECEIVED, INCLUDING ANY INTERFERENCE THAT MAY CAUSE UNDESIRED OPERATION.



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[XFC<sup>G5</sup>](#)



[XRC<sup>G5</sup>](#)

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