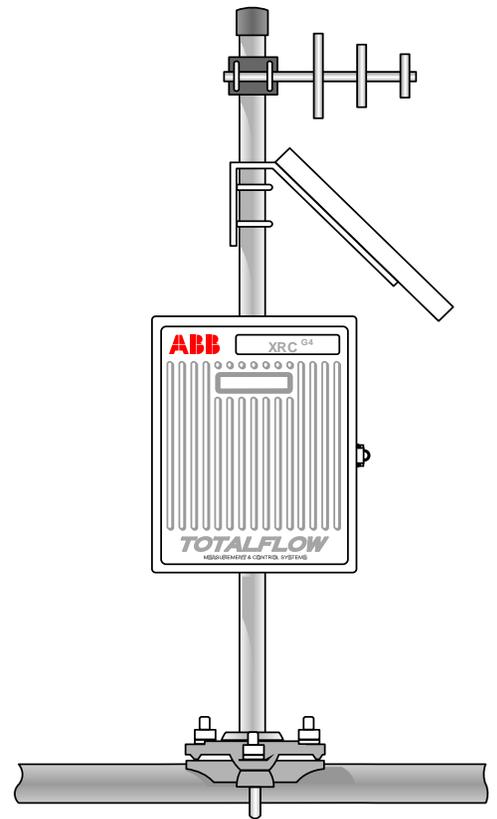


XSeriesG4 Remote Controller

An engineering milestone in the development of remote, low power, powerful control and measurement devices



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Health and safety

General information and notes

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

Observe warning labels on the packaging, on the device, and in this manual.

Safety, warning, and note symbols



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



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



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



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



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



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



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

Only qualified and authorized specialists are to be employed for the assembly, electrical connection, commissioning, and maintenance of the transmitter. Specific training and skills required include:

- The relevant sections of these instructions must be read carefully before starting work.
- Training, instruction, and authorization to operate and maintain devices or systems according to safety engineering standards for electrical circuits, high pressures, and corrosive media. Noncompliance with these instructions will transfer full liability to the user.
- Training or instruction in accordance with safety engineering standards regarding maintenance and use of adequate safety systems.



WARNING – Bodily injury. For electrical connections, the user must use sufficiently insulated tools according to the EN 60 900 standard.

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

- The construction and operation of electrical installations. For example, follow the regulation for technical working materials (safety guidelines for tools).
- Explosion protection, if transmitters with explosion protection are installed.

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

Additional safety advice concerning the operation of the equipment described in this manual or relevant safety data sheets (where applicable), along with information about spare parts and customer service, can be obtained by contacting the manufacturer at the address indicated on the back cover of this manual.

Storage

The device does not require any special treatment if stored as dispatched and within the specified ambient conditions. Although there is no limit to the storage period, the warranty conditions as agreed with the Company and as specified in the order acknowledgment remain unaffected.

Compliance

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

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



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

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

Additional publications

Additional free publications for the XRC^{G4} are available for download from the [ABB Library Download Center](#):

XSeries TFIO module user manual	2101226
XSeriesG4 (XFC/XRC) start up guide	2103333
XRCG4 enclosure measurements	2103677
XRCG4 (2103329 BD) pinouts	2104123
XRCG4 (2103329 BD) COMM1 to external multivariable w/RTD probe	2104127
XRCG4 (2103329 BD) COMM2 to external multivariable w/RTD probe	2104140
XRCG4 (2103329 BD) COMM1 to Airlink Raven XT radio (RS-232)	2104141
XRCG4 (2103329 BD) COMM2 to Airlink Raven XT radio (RS-232)	2104142
XRCG4 (2103329 BD) COMM2 (RS-485) to wireless I/O host (2102412 BD)	2104220
XRCG4 (2103329 BD) COMM1 to Micro Motion 1700/2700 Coriolis (RS-485)	2104233
XRCG4 (2103329 BD) COMM2 to Micro Motion 1700/2700 Coriolis (RS-485)	2104234
XRCG4 (2103329 BD) COMM1 to IMV25 multivariable (1641200) w/RTD probe	2104276
XRCG4 (2103329 BD) COMM2 to IMV25 multivariable (1641200) w/RTD probe	2104277
XRCG4 (2103329 BD) COMM2 (RS-485) to uFLO w/ RS-485 COMM Term BD	2104278
XRCG4 (2103329 BD) COMM2 (RS-485) w/power to uFLO w/ RS-485 COMM Term BD	2104279
XRCG4 (2103329 BD) AI to 2-wire XMV (analog input)	2104336
XRCG4 (2103329 BD) AI to 2-wire XMV (analog input) w/external 12/24 Vdc power	2104337
XRCG4 (2103329 BD) to power-one power supply	2104365
XRCG4 (2103329 BD) AI to SeniorSonic 3400	2104388
XRCG4 (2103329 BD) COMM1 (RS-485) w/FCU power & UCI2 (RS-485) to Airlink Raven XT radio (RS-232)	2104551
XRCG4 (2103329 BD) COMM2 (RS-485) w/FCU power & UCI2 (RS-485) to Airlink Raven XT radio (RS-232)	2104552
XRCG4 (2103329 BD) or ABB FCB Coriolis meter using Hart to Modbus converter	2104922
XRCG4 (2103329 BD) to ABB FCB Coriolis meter ABB FCB Coriolis meter	2104923
XRCG4 (2103329 BD) AI to ABB 266 Pressure Transmitter	2104925
XRCG4 (2103329 BD) to ABB Vortex and Swirl	2104951
XRCG4 (2103329 BD) AI to ABB TTH300 Temperature Transmitter using 12 V Aux Power	2104954
XRCG4 (2103329 BD) COMM2 to K-TEK for Modbus/RS485	2104955
XRCG4 (2103329 BD) TFIO AI Module to K-TEK MT5000 with COMM2 12V Power	2104957
XRCG4 (2103329 BD) AI to TTH300 temperature transmitter with COMM1 power	2105038
XRCG4 (2103329 BD) AI to TTH300 temperature transmitter 24 Vdc power	2105068
XRCG4 (2103329 BD) TFIO AI module to TTH300 temperature transmitter	2105069
XRCG4 (2103329 BD) to TZIDC-200 electro-pneumatic positioner	2105070
XRCG4 (2103329 BD) TFIO AI module to TTH300 temperature transmitter with 24v power	2105072
XRCG4 (2103329 BD) COMM2 (RS-485) to ABB 267/269CS & 266J w/RTD	2105113
XRCG4 (2103329 BD) COMM2 (RS-485) to ABB 266J & IMV25 w/RTD	2105116
XRCG4 (2103329 BD) to Tropos bridge 1410 or router via Ethernet w/POE injector	2105141
XRCG4 (2103329 BD) to Tropos bridge 1410-HAZ or router via Ethernet w/POE injector	2105142

Typographical conventions

Table-1: Typographical conventions

Element	Convention	Example
Cross-reference a figure or table	Hyperlink to figure or table	See Figure 2 or See Table 3.
Cross-reference to a section	Hyperlink with name in Italic	Go to section 2.1, <i>Device setup</i> .
Greater than character (>)	Indicates that the following item is an additional menu selection.	Use the key pad to locate and select Calibrate > Diff. Press. Sensor > Calibration Units > Edit .
Menu item names in instructions	Bold text and the capitalization of names agrees with the names as displayed on the HMI menu.	Use the right soft key to enter the Main Menu .
Programs, including utility and accessory programs	Title capitalization	Microsoft Word
URL	All lowercase for a fully specified URL.	http://www.microsoft.com/seattle.sidewalk.com
User input	Lowercase, unless case sensitive. Bold or italic, depending on element. If the user input string contains placeholder text, use italic for that text.	Type Name tag

1 System overview

1.1 Overview

This section introduces the Totalflow® Fourth Generation XSeries Remote Controllers (XRC^{G4}). The XSeries are low power, microprocessor-based units designed to meet a wide range of automation, monitor, control, alarming and measurement applications. Four models are available: Models XRC^{G4} 6490, 6790, 6890 and 6990.

For those users familiar with the Totalflow XSeries flow computers, the XRC^{G4} will be like meeting an old friend in a new suit. All the connectors, pin outs and displays are the same. The feature set is also very similar. The main difference is the new CPU Engine card, which is a 32-bit machine with more speed and more memory. The XRC^{G4} will be able to run more applications than the previous XSeries units, more AGA tube applications and more Plunger Lift applications. For connectivity, the XRC^{G4} supports the familiar military connector (serial communication) and PCCU cable. Additional USB and Ethernet support is also available. The only visual difference is the addition of an SD Card slot. Support is provided for 128M, 512M and 1G SD Cards.

1.1.1 Hardware

Each model is packaged in an enclosure that can accommodate the main electronic board (2102840-xxx), a variety of batteries and remote communications devices and additional I/O modules. The XRC^{G4} 6490 can accommodate up to three I/O modules, the XRC^{G4} 6790 can accommodate up to 6 I/O modules and the XRC^{G4} 6890 can accommodate up to 14 I/O modules.

The XRC^{G4} is powered by a battery system, which can be charged using solar panel, 24 Vdc or 120/240 Vac chargers. It is optimized for extremely low power consumption and is primarily designed for remote operation in harsh environments.

This system is made up of a NEMA 4X enclosure, which can house battery, power supply, remote communications equipment, an XRC^{G4} board and Liquid Crystal Display (LCD).

1.1.2 Functionality

The XRC^{G4} system has built-in, pre-engineered applications for data collection, trending and long term data storage. The XRC^{G4} can be used for oil and gas production, transmission and distribution site monitoring and control, water and waste system monitoring and control, etc.

This system can be programmed for advanced control or shutdown logic using the IEC 61131 Control Language. An extensive applications library is available from Totalflow Projects Engineering as needed, or new application programs can be developed for a specific need by Totalflow.

It is also possible for experienced IEC 61131 programmers in other companies to design application programs for any XRC^{G4} device.

1.1.3 XRC^{G4}

Table 2: General specifications

Description	Model	Width	Height	Depth
Dimensions	6490	11.52" (292.61 mm)	14.81" (376.17 mm)	10.27" (260.83 mm)
	6790	15.10" (383.54 mm)	18.80" (477.52 mm)	13.38" (339.85 mm)
	6890	20.09" (510.29 mm)	28.91" (734.31 mm)	15.52" (394.21 mm)
	6895	24" (609.6 mm)	30" (762 mm)	13.5" (342.9 mm)
	6990	16.91" (429.51 mm)	10.47" (265.93 mm)	10.21" (259.33 mm)
Installed Depth		Pipe Mounted	Direct Mounted	
	6490	12.75" (323.85 mm)	11.00" (279.40 mm)	
	6790	15.75" (400.05 mm)	14.00" (355.60 mm)	
	6890	18.01" (457.45 mm)	16.26" (413.00 mm)	
	6895	N/A	N/A	

Description	Model	Width	Height	Depth
Enclosure Specs	6990	19" (482.6 mm) ¹	10.47" (265.93 mm)	14.72" (373.89 mm) ²
		Weight (w/o battery)	Max I/O Modules	Max Battery Capacity
	6490	8.86 lbs. (3.31 k)	3	26 Ah
	6790	29.0 lbs. (13.17 k)	6	42 Ah
	6890	45.5 lbs. (16.98 k)	14	140 Ah
	6895	60 lbs. (27.2 kg)	22	N/A
	6990	12.0 lbs. (5.44 k)	12	30 Ah
Humidity	0–95% Non-Condensing			
Mounting	Wall, Pipe or Rack Mount			
Operating Temp.	-40° F to 140° F (-40° to 60°C)			
Certification (all but 6990)	CSA/NRTL Class 1, Division 2, Groups C and D hazardous area classification. (ATEX Zone 2 pending). XRC ^{G4} 6990 is General Purpose.			
EMC Requirements	EMISSIONS:	European Regions: EN55022 Class A Emissions (Radiated & Conducted) North America Regions: CFR 47, Part 15, Subpart B, Class A, FCC Emissions ICES-003 Issue 2, Rev. 1, Class A ITE Emissions		
	IMMUNITY:	European Regions: EN50082-1:98 Immunity EN61000-4-2:95, ESD, ± 8 kV Air, ± 4 kV Contact EN61000-4-3:95 RF Immunity, 10 V/m EN61000-4-4:95 EFT, 1 kV EN61000-5-5:95 Surge; 1 kV line to line, 2 kV line to earth EN61000-4-6:95 Conducted Susceptibility, 3 Vrms EN610004-8:93 Power Frequency Magnetic Field 3 A/m EN610004-11:94 Voltage DIP and interrupt		

1.2 XSeries remote controller hardware

The Totalflow XRC^{G4} models are each housed in an aluminum case. With the exception of the size of the cases, all models use identical components. Components of the XRC^{G4} are:

- Enclosure
- XRC^{G4} board (2102840-xxx) (Model 6990 may have up to two)
- Battery compartment
- Communication compartments
- Liquid Crystal Display (LCD) (Model 6990 may have up to two)
- Charger or solar panel
- Optional modular input / output
- Optional keypad (Model 6990 may have up to two)

1.2.1 XRC^{G4} board

The XRC^{G4} board (2102840-xxx) is mounted on the inside of the door. All XRC^{G4} on-board input and output connections are made with snap-in connector terminals mounted directly on the board. Other circuitry processes the inputs from the on-board I/O and provides the interface to the LCD as well as the PCCU and optional key pad. Remote communications are handled by the

¹ Width with Din rail.

² Depth with Modules.

RS-232 and RS-485 communication modules that plug directly into the board. The XRC^{G4} board offers the following input and output points:

- 5 analog inputs
- 4 DI/PI inputs can be used as high-speed (20KHz) counters, or as status indicators (Selectable Debounce enable/disable)
- 4 digital outputs
- 2 Remote Communication Ports (RS-232 or 485)
- I/O interface for TFIO interface modules

1.2.2 CPU engine card

The CPU engine card (2102427-xxx) plugs into the XRC^{G4} board.

All processor and memory components reside on the CPU engine card. The engine card uses a low power processor running at 192 MHz with 16M SRAM, 32M Flash and 256 bytes of serial E2PROM. A lithium backup battery is located on the main XRC^{G4} board. Unplugging the engine card disconnects it from the lithium cell backup and SRAM (historical flow data) is cleared. Application programs and configuration files are stored in non-volatile Flash.

1.2.3 Communication enclosure

A removable communications enclosure can be provided that has been pre-drilled for mounting many popular communications devices such as radios, cellular phones, modems, etc. This feature is not available in the XRC^{G4} 6990.

1.2.4 Battery compartment

The XRC^{G4} system houses an internal main battery.

- XRC^{G4} 6490: The battery sets in a central compartment directly behind the battery plate.
- XRC^{G4} 6790: The battery sets in a central compartment directly behind a hinged cover plate holding the DIN rail and installed modular components.
- XRC^{G4} 6890: The battery sets on the floor of the main compartment and houses the various optional battery packs that are available for the XRC^{G4}, from one 8 ampere hour battery up to two 70 ampere hour batteries.

1.2.5 Solar panel

The XRC^{G4} is configurable for a 10-Watt, 20-Watt or 30-Watt solar panel. The panel is designed for mounting on a 2-inch extension pipe above the XRC^{G4}, on top of or to the side of a meter house. As the XRC^{G4} 6990 is not designed for outside installations, solar panel chargers must be configured to mount outside of the building.

1.2.6 Additional features

Additional features of the Totalflow System include the following:

- A Programmable bi-level security system prevents unauthorized communication and configuration of the XRC^{G4}. Go to section 3.5.6, *Bi-Level security system* for more information.
- An internal crystal controlled clock provides a highly stable time base for the system.
- Optional battery packs extend operation for longer periods without power.
- Three available charging sources include:
 - External solar panel (standard)
 - External AC power
 - External 24/12 Vdc power
- The LCD (Liquid Crystal Display) is programmable to allow the monitoring of operations (displays flow rate, volumes, etc.)
- The rugged, aluminum, powder-coated NEMA 4X enclosure is lockable to prevent internal access.
- An optional ability allows rapid data collection over several communication links.
- Additional I/O for valve control, pressure, level monitoring, remote communication, etc. are available.
- An optional keypad is available.

1.3 Standard enclosure

The standard enclosure consists of a hinged-door box in varying sizes for the XRC^{G4} 6490, 6790 and 6890 (Figure 1, Figure 2 and Figure 3). The door provides a watertight, corrosion resistant seal between the outside elements and the XRC^{G4} components. It is designed to meet Class I, Division 2, Groups C and D and is NEMA 4X rated. It is designed for mounting in harsh environments (cold, hot, wet and salty). Opening the door's latch(s) allows access to electronics, battery, radio and modular components. This door may be locked for security purposes.

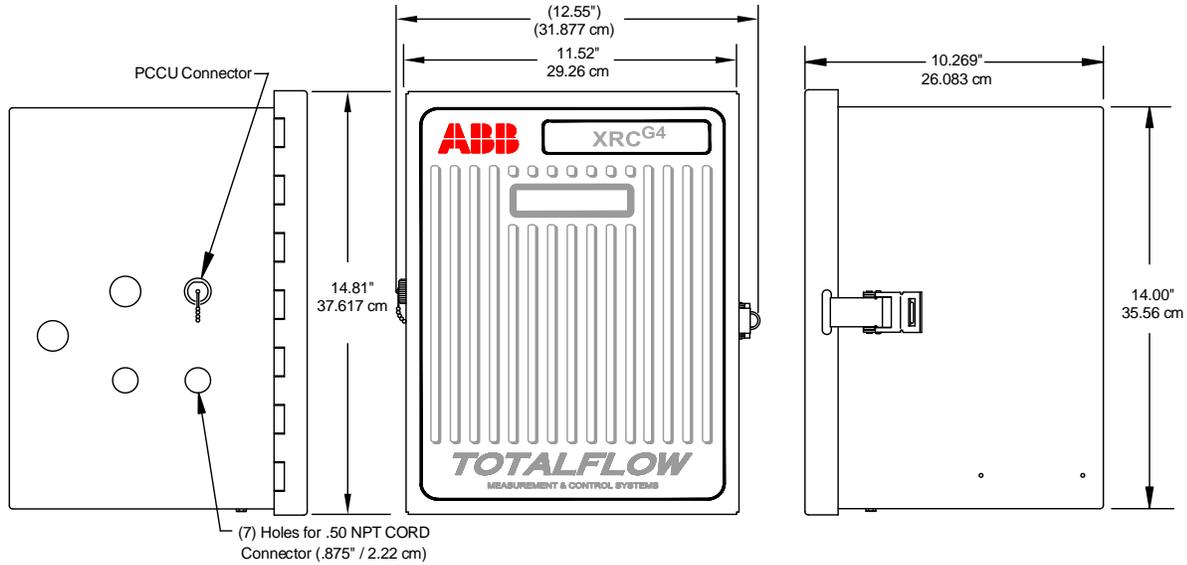


Figure 1: XRC^{G4} 6490

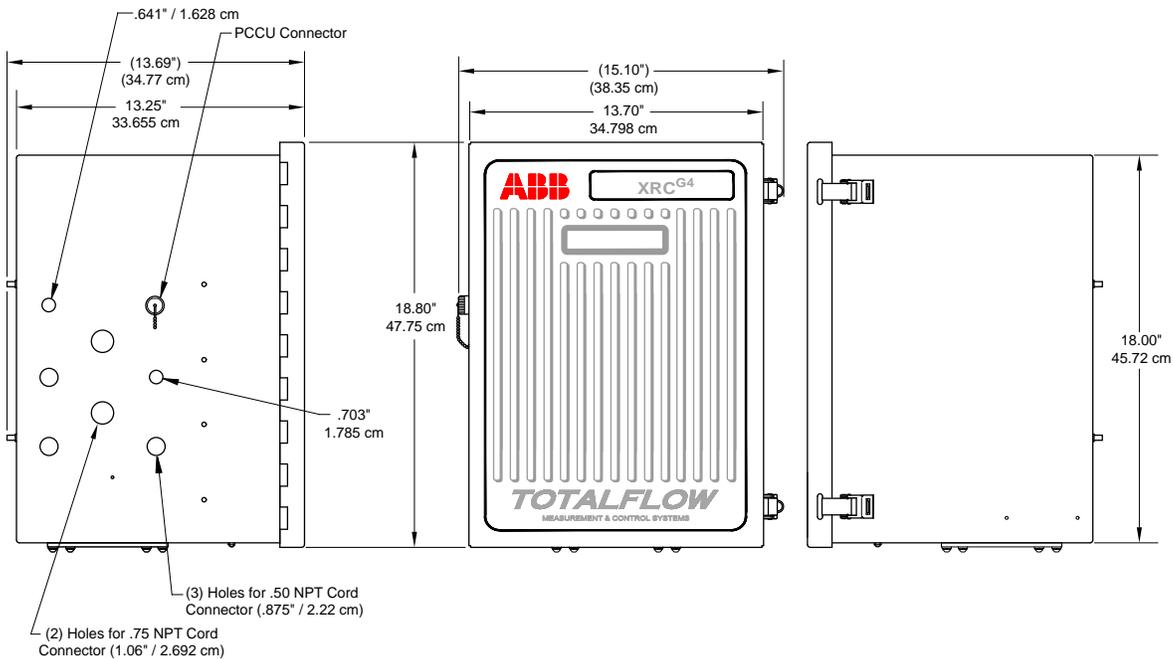


Figure 2: XRC^{G4} 6790

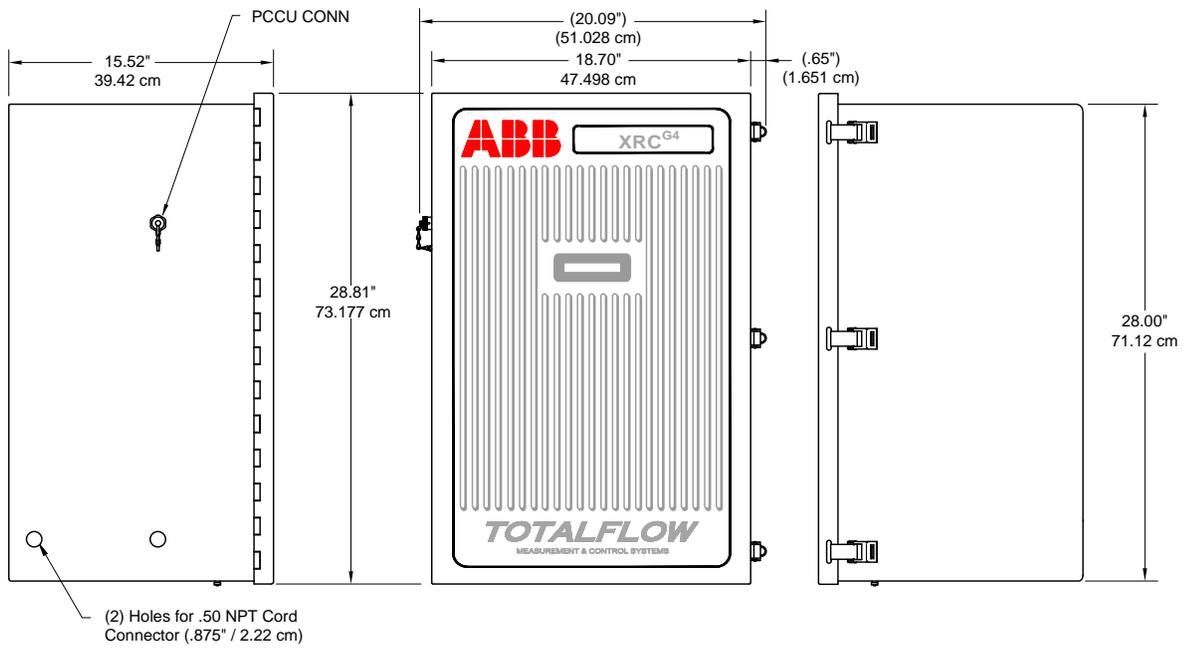


Figure 3: XRC^{G4} 6890

1.4 Rack mount enclosure

The XRC^{G4} 6990 enclosure is designed for 19" rack mount (see Figure 4). This enclosure may be configured to house up to two XRC^{G4} boards, up to two LCD displays and up to two optional key pads. This unit is not designed for exposure to the elements. With the exception of the local PCCU connector, all terminals are located on the back panel of the enclosure.

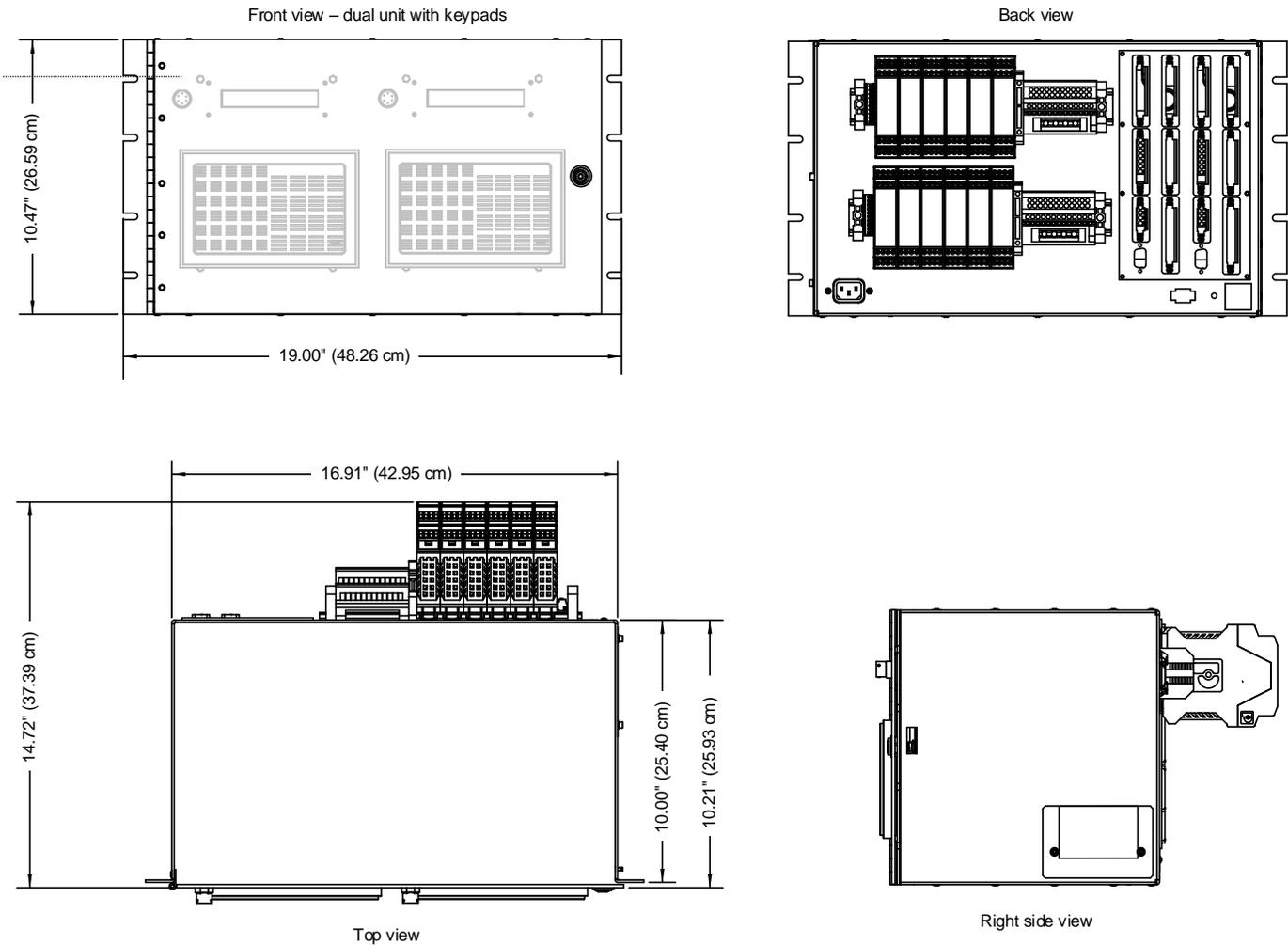


Figure 4: XRC^{G4} 6990 rack mount

1.5 XRC^{G4} board specifications

The XRCG4 board is designed as a general purpose RTU motherboard that mounts in all XSeries enclosures. It has the same footprint as its counterpart, the XFC board (extendable flow computer motherboard). The specifications for the XFC board are given in Table 3. Figure 5 identifies the parts of the board and Table 4 provides the descriptions.

Table 5: 2103329-xxx board specifications

Component	Description
Power	Nominal 12 Vdc Battery
Charger	Solar or 15 Vdc (30 Watts Max.)
Memory	Application (Totalflow.exe) runs out on 16M SRAM. RAM memory has lithium backup battery. Application and configuration files permanently stored in 32M Flash. All processor and memory functionality resides on the CPU engine card. Registry (MAC address, etc.) is stored in 256 byte E ² PROM SD Card optional (128M/512M/1G)

Component	Description
Comm. ports	6 Ports Available: Dedicated PCCU/MMI RS-232 or RS-485 via Plug-In Modules USB (Host & Client) NOTE: A special cable is required. Check with Totalflow for a list of drivers to support client peripherals. Ethernet
LCD interface	Dedicated Interface for 2 X 24 liquid crystal display (LCD)
Keypad interface	Dedicated Interface for optional ABB-supplied keypad equipment
I/O expansion	Dedicated I ² C serial I/O bus for TFIO module expansion
Security switch	On/Off bi-level on-board security (see section 3: <i>XRC^{G4} Startup</i>)
Time base stability	± 7.5 ppm (parts per million)
I/O scan rate	1 time per second
Analog inputs	5 Single-ended channels, 0–10 Vdc or 0–20 mA loop
Analog to digital resolution	18-bit maximum resolution (0.00038% FS) 18-bit nominal resolution (0.0015% FS)
Digital inputs	4 inputs, configurable as active or passive (selectable de-bounce enable/disable)
Pulse inputs	2 of the above listed 4 DIs can be used as pulse inputs (DI1 and DI2) (up to 20 KHz)
Digital outputs	4 outputs, open channel FET transistor switches

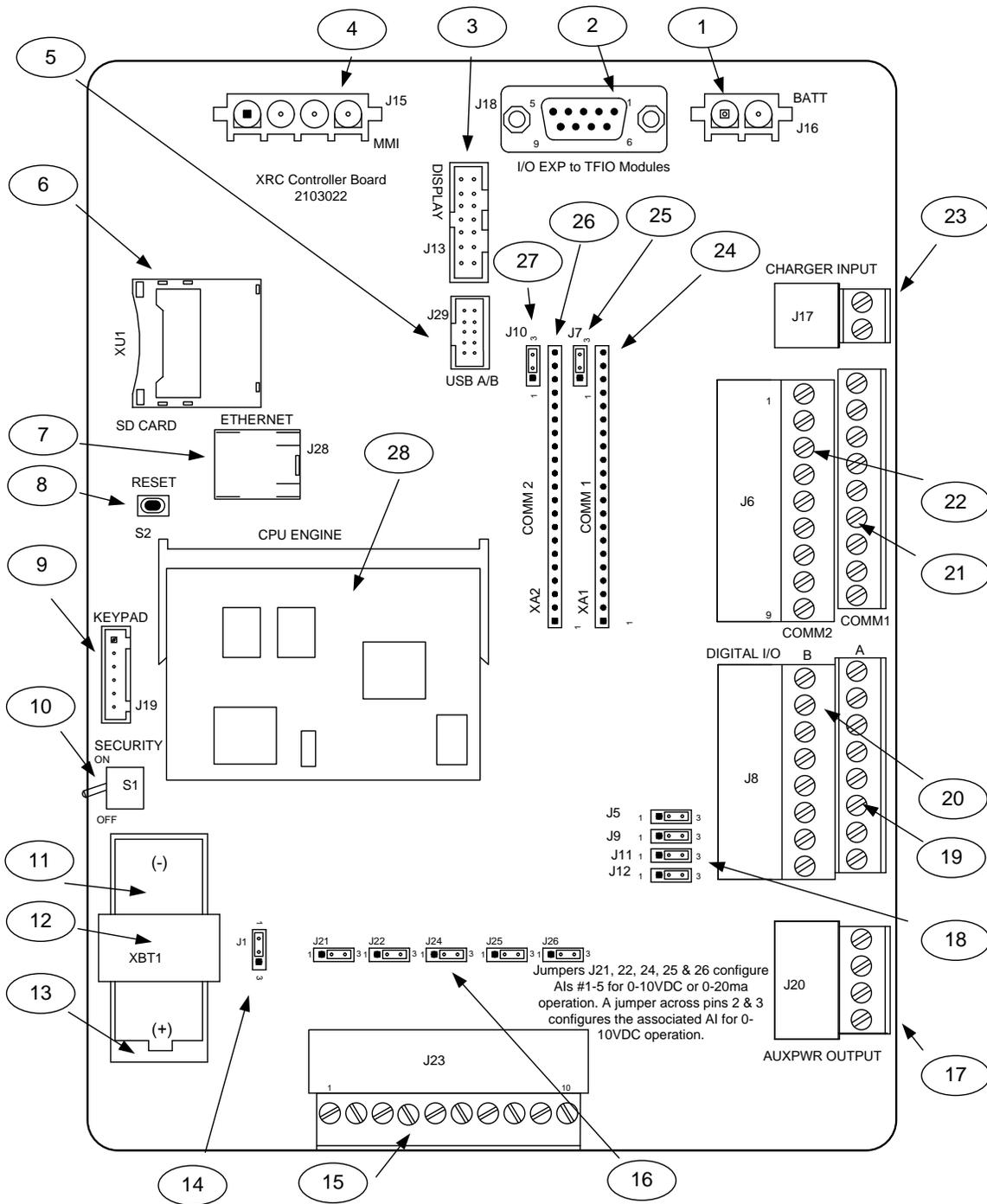


Figure 5: XRC board

Table 6: XRC board identification

ID number	Description	ID number	Description
1	Battery Connection	15	Analog Input Connectors
2	I/O Module Interface	16	Analog Input Type Selection Jumper Pins
3	LCD Display Interface	17	Auxiliary Power Output Connectors
4	PCCU Interface	18	DeBounce Enable/Disable
5	USB Extension Port	19	A Pulse Inputs/Digital Outputs Connectors
6	SD Card	20	B Pulse Inputs/Digital Outputs Connectors
7	Ethernet Connector	21	A Remote COMM1 Connectors
8	Reset Button (WARM Start)	22	B Remote COMM2 Connectors
9	Keypad Connector	23	External Charger (Solar Panel) Connectors
10	Security Switch	24	Remote COMM1: Module Plug-in
11	Lithium Battery	25	Remote COMM1: RS-485 Termination Jumper
12	Battery Cover	26	Remote COMM2: Module Plug-in
13	Battery Mounting Bracket	27	Remote COMM2: RS-485 Termination Jumper
14	Memory Backup Enable/Disable	28	CPU Engine Card

1.6 XSeries on-board input/output

Totalflow's XRC^{G4} features the base I/O listed below:

- 5 User A/I
- User D/O
- User D/I (2 may be used as High Speed P/Is (DI1 and DI2))
- Up to 6 communication ports
- Interface for TFIO modules

The main electronic board (XRC^{G4} board) is an enhanced replacement for previous versions of the RTU main electronic board. Specifications for digital/pulse input, digital output and analog input follow in the next few pages. For a complete overview of the XRC^{G4} board, see Figure 5.

1.6.1 Communication ports

Up to two on-board communication ports can be programmed on the main electronic board. Normally, COMM 0 is the local port required for reading the XRC with a laptop computer running PCCU32. COMM 1 and COMM 2 can be configured for any combination of RS-232 or RS-485. See Figure 5 for on-board Communication Ports. Six ports are available:

- Dedicated PCCU/MMI (COMM 0)
- 2 RS-232 or RS-485 via plug-in modules (COMM 1 and 2)
- TFIO I/O connection for use with the TFIO Communication Module
- Ethernet
- USB (host and client)
 - Special USB cable required.
 - Check with Totalflow for a list of drivers to support client peripherals.

1.6.2 Digital input

The Totalflow XRC^{G4} provides four digital inputs, or two digital and two high speed pulse inputs, as means to control external equipment with the XRC^{G4} (See Figure 5: *XRC board*, items 19 and 20).



DANGER – Serious damage to health / risk to life. When connecting or disconnecting any wires to the XRC^{G4} board, remove all power sources and make sure to be grounded properly.

The digital input reads an external contact. Figure 6 is a typical point schematic for the digital input. Figure 7 shows an example of point connections for the DI and the typical input voltage.

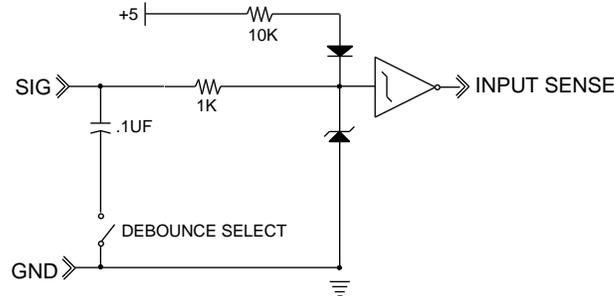


Figure 6: Typical DI point schematic

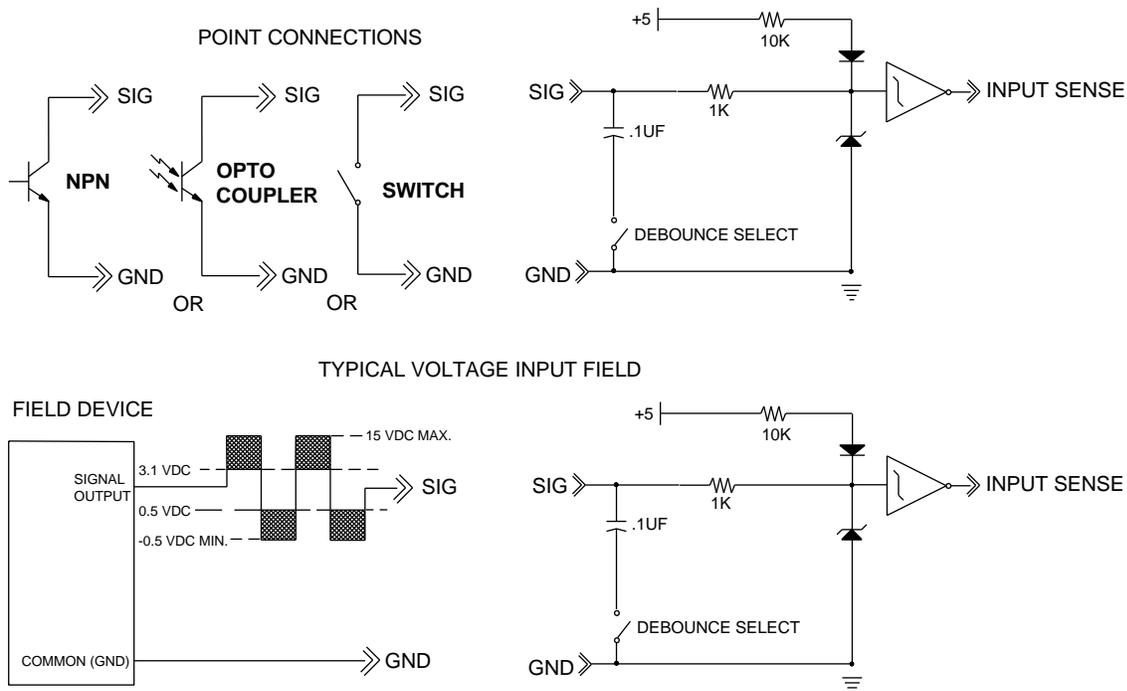


Figure 7: DI connection examples

1.6.2.1 Electrical specification (each point):

- Open circuit voltage, 5 Vdc (internally pulled up to 5 Vdc Nom.)
- Short circuit leakage current, -395 μ A typical
- Input capacitance, 0.1 μ fd typical
- Maximum allowable voltage range on input -0.5 Vdc to 15 Vdc
- Maximum frequency input 100Hz at 50% duty cycle with debounce enabled
- Maximum frequency input 20KHz at 50% duty cycle with debounce disabled

1.6.2.2 Input specification

- Dry contact (form A), open collector or active voltage
- Minimum contact resistance to activate input 1000 Ω

- Voltage threshold to deactivate the input, 3.1 V (referenced to GND terminal)
- Voltage threshold to activate the input, 0.5 V (referenced to GND terminal)
- Conductor pairs must be shielded to prevent spurious signals

1.6.2.3 Debounce

The XRC^{G4} board includes jumper pins to enable or disable debounce. See Figure 5: *XRC board*, item 18 for the jumpers. The inclusion of the debounce capacitor, when enabled, allows the unit to ignore noise when manual switches are set. When disabled, the high speed pulses are received exactly as sent. If input is received as a solid state, then debounce is not needed and it should be disabled.

1.6.3 Digital output

The Totalflow XRC^{G4} provides four digital (12 Vdc) outputs as means to control external equipment with the XRC^{G4} (Figure 5: *XRC board*, items 19 and 20.)

Digital outputs can be programmed to trigger, or activate, on any of several AGA3, AGA7 or Liquid Measurement limits or thresholds. The following are just a few of those conditions that can trigger one of the digital outputs:

- Differential pressure over high limit
- Volume set point
- Differential pressure under low limit
- Flowing temperature low
- Static pressure over high limit
- Flowing temperature high
- Static pressure under low limit
- Flow rate low
- Low charger voltage
- Flow rate high
- Remote sense is ON
- Trip on digital input

Other applications are custom-programmable by Totalflow or user-programmable with IEC 61131 programming language.



DANGER – Serious damage to health / risk to life. When connecting or disconnecting any wires to the XRC^{G4} board, remove all power sources and make sure to be grounded properly.

Figure 8 is a typical point schematic for the digital output. Figure 9 shows an example of point connections for the DO.

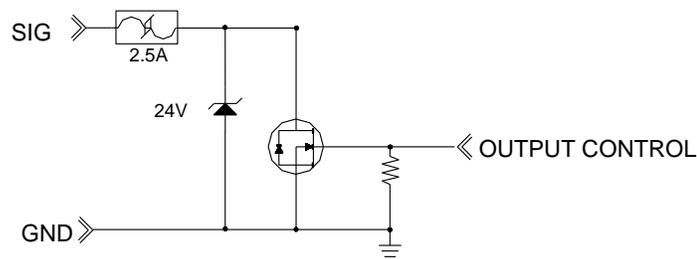


Figure 8: Typical DO point schematic

TYPICAL SINK OUTPUT FIELD WIRING

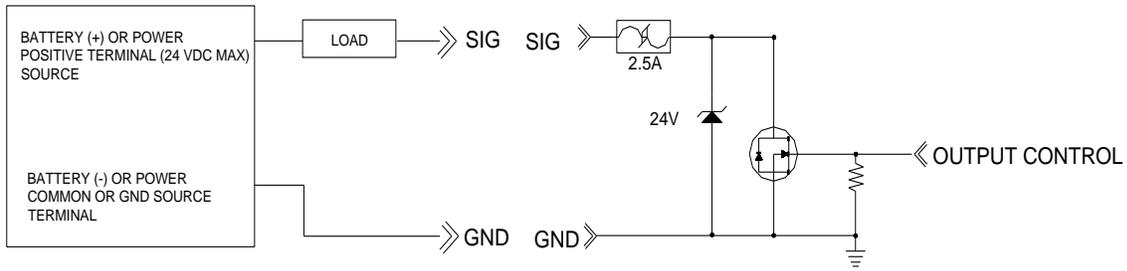


Figure 9: DO connection example

1.6.3.1 Electrical specification (each point):

- Open circuit voltage, 0 Vdc
- Short circuit leakage current, 0 uA typical
- Output capacitance, 1000 pF typical
- Maximum allowable voltage range on output, -0.5 Vdc to 26.5 Vdc

1.6.3.2 Input specification

- Open Drain FET type
- ON Resistance, 0.1 Ω Typical (including PTC fuse resistance)
- Maximum pulse current, 3 A for 5 seconds
- Maximum continuous sink current, 2 A

1.6.4 Analog inputs

Figure 10 is a typical point schematic for the analog input. Figure 11 shows an example of point connections for the AI and a typical 2-wire 4–20 mA field device.

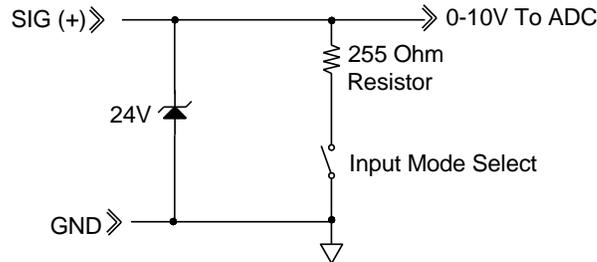


Figure 10: Typical AI point schematic

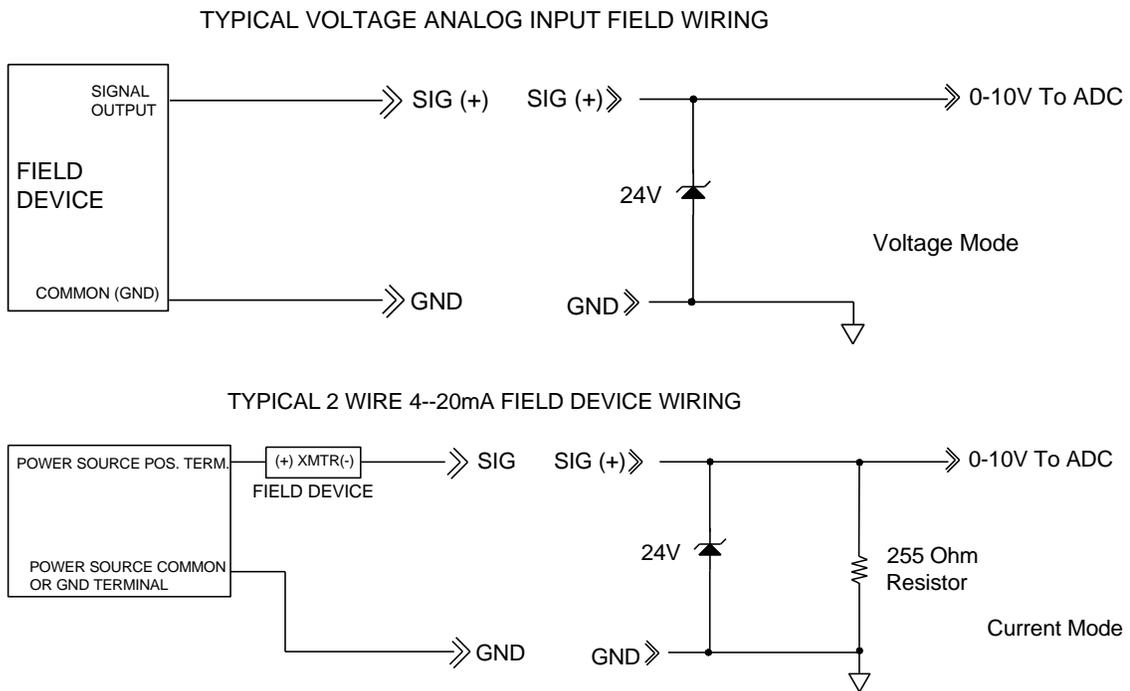


Figure 11: AI connection examples

1.6.4.1 Electrical specification (each point):

- Voltage mode, 0-10V
- Current mode, 0-20 mA
- Maximum voltage mode input before soft over-range, 10.7 V
- Maximum allowable continuous input current, 22.8 mA
- Typical input impedance voltage mode, 91.24 K Ohms
- Typical input impedance current mode, 249.3 Ohms

1.6.4.2 4-20 mA transmitter

When using a 4-20 mA transmitter on the analog input, refer to Appendix A, *4–20 mA transmitters* for more details. Manufacturer's instructions and specifications may not be applicable or accurate when used with Totalflow equipment.

For example: The manufacturer's specification claims to operate from 10 to 30 Vdc. It is not always clear that this 10-30 Vdc must be applied across the 4-20 mA transmitter only (and not across the transmitter/load resistor series combination).

1.7 Display function

During the operation of the XRC^{G4}, the front panel LCD continuously scrolls through the operating parameters. The system will come with a group of standard system displays. Table 7 shows typical display parameters; however any parameter with a register address can be displayed.

The duration that the parameter is displayed can vary from 1 to 255 seconds (default is 5 seconds); a setting of zero seconds will set any display to off. Go to section 3.5.5, *Program display* (and PCCU32 help files) for more details.

Table 7: Typical XRC^{G4} display options

Display	Description
DATE/TIME MM/DD/YY HH:MM:SS	Current Date and Time 24 hour clock

Display	Description
YEST DP LO NN PERCENT	Yesterday's Percent DP Low Limit Percent time below DP Low Set Point
YEST DP HI NN PERCENT	Yesterday's Percent DP High Limit Percent time below DP High Set Point
FLOWRATE NNNNNN.N SCF/HR	Current Flow Rate Programmable SCF, MCF, MMCF
ACCUM VOL NNNNNN.NN MCF	Total Accumulated Volume Programmable SCF, MCF, MMCF
BATTERY NN.N VOLTS	Battery Voltage Volts
DIFF PRESS NNN.N IN. H2O	Differential Pressure Inches H2O
PRESSURE NNN.N PSIA	Static Pressure Absolute PSIA
FLOW TEMP NN.N DEG. F	Flowing Temperature °F
YEST VOL NNNN.N MCF	Yesterday's Volume Programmable SCFM, MCF, MMCF
PERIOD VOL NNNN.N SCF	Previous Period Volume Last volume calc. period volume
CHARGER NN.N VOLTS	Charger Voltage Volts
ORIFICE DIA. NNNN.NNNN INCHES	Orifice Diameter Inches

1.8 Functions of the XRC^{G4}

The primary functions of the XRC^{G4} reflect a design that is practical and efficient. The XRC^{G4} is simple to use and easy to learn. It performs the following with minimum effort, maximum speed and greater accuracy.

1.8.1 Capabilities

- Monitoring the operational limits to insure detection and reporting of malfunctions or abnormal site conditions
- Remote communications
- Real-time measurement and control
- Acceptance and storage of system parameters from PCCU32 7.05.5 or greater
- Storage of data records
- Storage of operational events
- Extendable I/O count to support most customer applications
- Multiple enclosure sizes provided to fit specific I/O requirements
- Custom IEC 61131 applications to fit specific customer requirements

1.8.2 Applications

- AGA3 orifice meter run (an external transducer required)
- ISO 5167 orifice meter run (an external transducer required)
- V-cone meter run (an external transducer required)
- AGA7 rotary/turbine meter run
- Wedge meter, liquid and gas (an external transducer required)
- CO2, NIST 14 (an external transducer required)
- Real-time data logger (trending)
- Valve control (feedback controller)

- RAMS (alarming, exception reporting)
- Operators (simple math/logic functions)
- IEC 61131 (complex math/logic)
- Selectable units (user selectable engineering units)
- Display/keypad handler
- I/O subsystem
- Tank level application
- Therms master application
- Therms slave application
- Multiple protocols (Totalflow proprietary low power, MODBUS® slave (RTU/ASCII), MODBUS® master (RTU/ASCII), LevelMaster, Btu 8000/8001, Enron MODBUS®, MotorSaver®, ABB XMV multivariable, Altronics and others)

1.9 XRC^{G4} application licensing

The G4 (fourth generation) flow computers offer the user unrivaled power and flexibility. The G4 units can support far more applications than the G3 (third generation) devices. Some of these applications require that Totalflow pay a royalty to a third party vendor. For this reason, Totalflow has developed a credit system for handling application loads beyond what would be required for a typical G3 meter run. Application credits are required to instantiate many of the applications. From the factory, the G4 unit has four general credits installed. Several system configurations are possible with those four general credits, for example:

- AGA-3 (1 credit) with Valve Control (1 credit) and Trending (1 credit) using 3 general credits total
- Two AGA-3 (or AGA-7) tubes (1 credit each tube) with Trending (1 credit) using 3 general credits total
- AGA-3 (1 credit) with Valve Control (1 credit) and Plunger Lift (1 credit) using 3 general credits total

Applications have been divided into categories: Standard, general, IEC, CO2 and HCDP (hydrocarbon dew point). Other application categories may be created in the future.

Standard applications typically support general applications, as well as the basic operation of the G4 units. Standard applications do not require any credits to be instantiated.

Standard applications include:

- System application
- Communications
- I/O subsystem
- Therms Master
- Therms Slave
- Analysis Trend System
- LevelMaster
- Operations
- XMV interface
- Holding registers
- Units conversion
- Host interface
- Displays

General applications typically provide some type of measurement, control, logging or archival function.

General applications include:

- LMV interface (future)
- NGC client
- AGA-3 measurement

- AGA-7 measurement
- Trend system
- Alarm system
- Pulse accumulator
- Valve control
- Safety
- Plunger
- Oil custody transfer measurement

IEC applications are generally custom applications provided by Totalflow at the customer's request. They might include special control and/or measurement algorithms required by the customer. Multiple IEC applications can be instantiated with a single IEC credit.

- CO2 (NIST) applications will each require a CO2 (NIST) credit.
- Hydrocarbon Dew Point (HCDP) applications will each require an HCDP credit.

1.9.1 Credit key (USB)

The G4 comes with four general credits installed in the unit. If the system configuration requires more application credits, they can be purchased from Totalflow's Order Entry (1-800-442-3097).

Credits (standard, general, IEC, CO2 and HCDP) are maintained on the credit key. Credits can be purchased and kept on the USB credit key. The credit key is a secure USB flash drive. It cannot be written to or read by any program other than PCCU32 7.0 or later. Credits can be added to your credit key via phone call to Technical Support or through email. Again, these credits are used to run the various applications available in the G4 product line.

Credits can be transferred between the laptop and the G4 unit. If a G4 has extra credits (more than required to be fully licensed), the extra credits can be downloaded to the credit key to be used on other G4 units.



NOTE: If the G4 controller is running an unlicensed application, that fact will be reflected in any reports generated from that unlicensed meter. The meter will also log the fact that it is unlicensed in the Event Log at the top of each contract day. Unlicensed applications will cause the meter to connect more slowly than normal.

1.10 Display annunciators

One of the primary functions of the XRC^{G4} is monitoring operational conditions; therefore, the XRC indicates when an unusual or alarm condition is occurring. The alarm indication shows on the right side of the LCD display, see Figure 12. For instructions about how to use the display to troubleshoot, go to Section 5, *Troubleshooting*.

The status and alarm code locations are programmable with technology adaptable for multi-tube devices. This allows the user to program each annunciator to reflect different applications or tube types. The single tube device will come with a standard LCD display pre-programmed, but configurable (see Table 8).

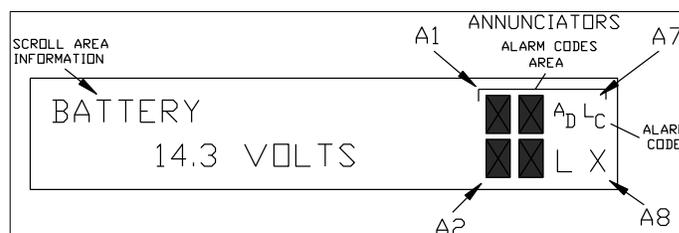


Figure 12: Liquid crystal display and indicators

Table 8: Status and alarm description

Indicator	Description
I/O Sub-System	
Ⓛ	<i>Low Lithium Battery Alarm:</i> When LL (low lithium) is displayed, lithium battery voltage is below 2.5 Vdc. A new lithium battery measures approximately 3.6 Vdc.
ⓁC	<i>Low Charger.</i> LC is displayed if the XRC ^{G4} battery charging voltage is (+) 0.4 Vdc or is less than or equal to battery voltage.
Display Application	
1	A number represents the Display Group number currently being displayed.
↑	The displayed item's value is above the Data High Limit value specified 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.
Communications Protocols	
→	Transmitting Data
←	Receiving Data
!	<i>Nak:</i> Negative Acknowledgement with packet list
+	<i>Ack:</i> Positive Acknowledge of receipt of request
⚡	<i>Waiting for Ack:</i> Waiting for response after transmission
⚡	ID Recognized
⚡	<i>Listen Cycle:</i> Flashes if this remote port is active and running Totalflow Remote Protocol. Flashes in sync with a listening cycle that occurs at 1, 2 or 4 second intervals.
M	<i>MODBUS® ASCII:</i> Modbus® ASCII protocol is selected for the port assigned to this annunciator.
m	<i>MODBUS® RTU:</i> Modbus® RTU protocol is selected for the port assigned to this annunciator.
R	<i>LevelMaster Protocol:</i> LevelMaster protocol is selected for the port assigned to this annunciator.
L	<i>Local Protocol:</i> Displayed when PCCU part is active and running TOTALFLOW Local Protocol.
¥	<i>Packet Protocol:</i> The Totalflow Packet Protocol is selected on this port.
Valve Control	
V	Displayed when Valve Control option is on an Expanded I/O board (plug-in RTU). Other Valve Control symbols do not apply.
┌	Valve Control option is installed. Valve is in full open position.
┐	Valve Control option is installed. Valve is in full closed position.
↑	Valve Control option installed. Valve is opening (open signal is being sent to the valve actuator).
↓	Valve Control option installed. Valve is closing (close signal is being sent to the valve actuator).
⓪	Valve Control option installed. Valve controller override conditions met (DP/SP override set point or Low Battery).
Ⓛ	Valve Control option installed. Local Lock-out is initiated.
Measurement Application	
BF	<i>Back Flow Condition:</i> Visible only when DP variable is displayed.
Z	<i>Zero Flow Condition:</i> Visible only when Flow Rate is displayed.
H	<i>Hold:</i> Displayed when HOLD flag is active. Also displayed when HOLD flag is active for the following: PCCU is being calibrated A to D Converter cannot be read
A	<i>Alarm Condition:</i> Need to view alarm. You may need to compare application limits to current values to determine where the alarm condition is present.
AD	<i>A to D Failure:</i> Displayed if A to D Converter Absolute Differential Pressure, Absolute Static Pressure or temperature readings exceed maximum counts or are less than minimum counts.

1.11 Laptop computer running PCCU32

PCCU32 software running in a laptop Windows environment offers the most capabilities for programming the XRC^{G4}. The Windows environment features user-friendly help files and easy to follow menus. Easy to follow menus and icons step the user through many required choices.

The laptop computer connects via the cable directly to the connector on the side of the XRC^{G4}. Once this physical connection has been made, the laptop may begin communicating through the software.



NOTE: Connecting to the G4 meters with PCCU32 will require version 7.05.5 or later.

Making a local connection to the meter may be accomplished one of two ways:

- Local connections are made using the RS-232 PCCU cable with the round military connector on one end, and a serial port connector on the other.
- The local connection may be made using a USB cable.

1.12 Local PCCU connections

1.12.1 RS-232 serial cable

The local connection (serial military connector) requires an RS-232 serial port on the host computer (generally a laptop). A PCCU cable (2015240-xxx) is required to connect the host computer to the meter's round military connector, see Figure 13. Connecting the PCCU cable to the meter will cause an annunciator in the LCD to display an upper case letter L for local connect.



NOTE: The G4 meter must be ordered to include USB communication capability. A change over kit may be purchased to adapt the G4 for serial communication capability.

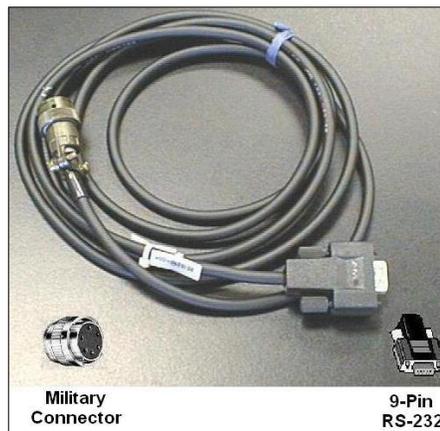


Figure 13: RS-232 local communication cable

1.12.2 USB connection cable

The local USB connection requires the use of a USB cable (see Figure 14) connected to the host computer, generally a laptop. A USB PCCU cable (1801800-xxx) is required to connect the host computer to the meter's client connector. Connecting the PCCU cable to the meter will cause an annunciator in the LCD to display an upper case letter L for local connect.

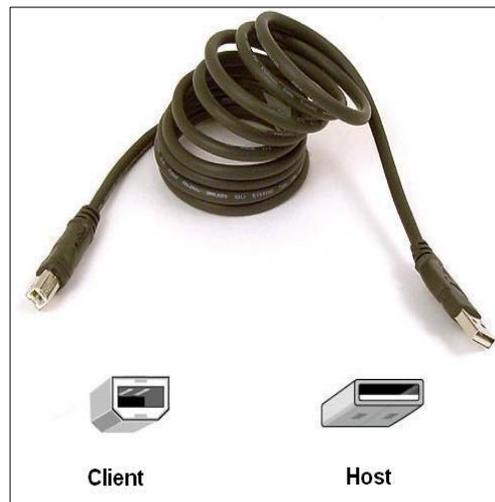


Figure 14: USB local communication cable

1.13 Network connectivity (dynamic IP with router)

When operating the XRC^{G4} in a network environment, using Ethernet is an excellent and practical solution. PCCU32 communication with the meter over an Ethernet connection (TCP/IP) requires the use of a hub, switch or router, along with appropriate cabling (see Figure 15). Ethernet (local) communication in a remote area may also be utilized.



Figure 15: Ethernet communication cable

1.14 Optional keypad

The XSeries models may be configured to include the optional keypad (see Figure 16) located on the front cover of the unit. Keypad entry allows the user to monitor programmed display items without using additional equipment. See Figure 17 through Figure 20 for outline dimensions.



NOTE: To be able to view various display items, those items must be pre-programmed for keypad entry. All the display items for an application may be programmed, or display items may be individually programmed within the application using PCCU32.

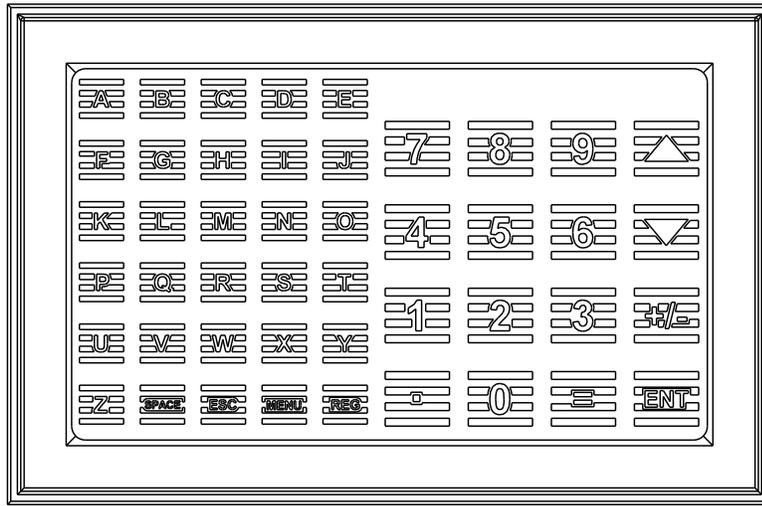
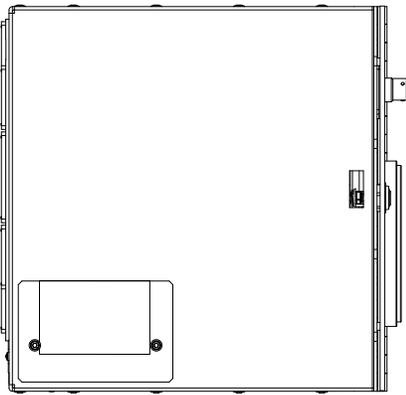
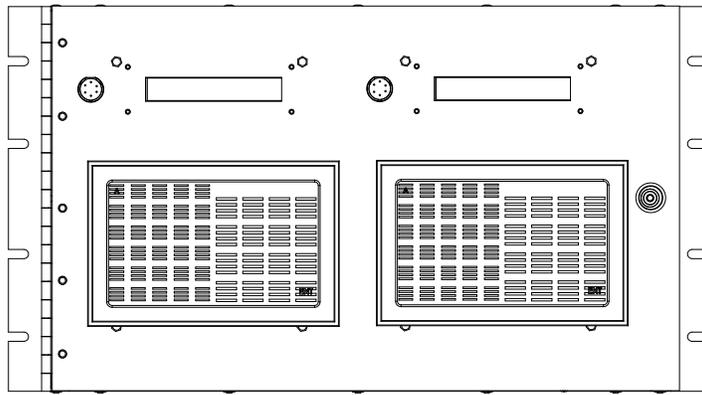


Figure 16: Optional keypad



SIDE VIEW WITH KEYPAD



FRONT VIEW WITH KEYPAD

Figure 17: XRC^{G4} 6990 with dual keypads

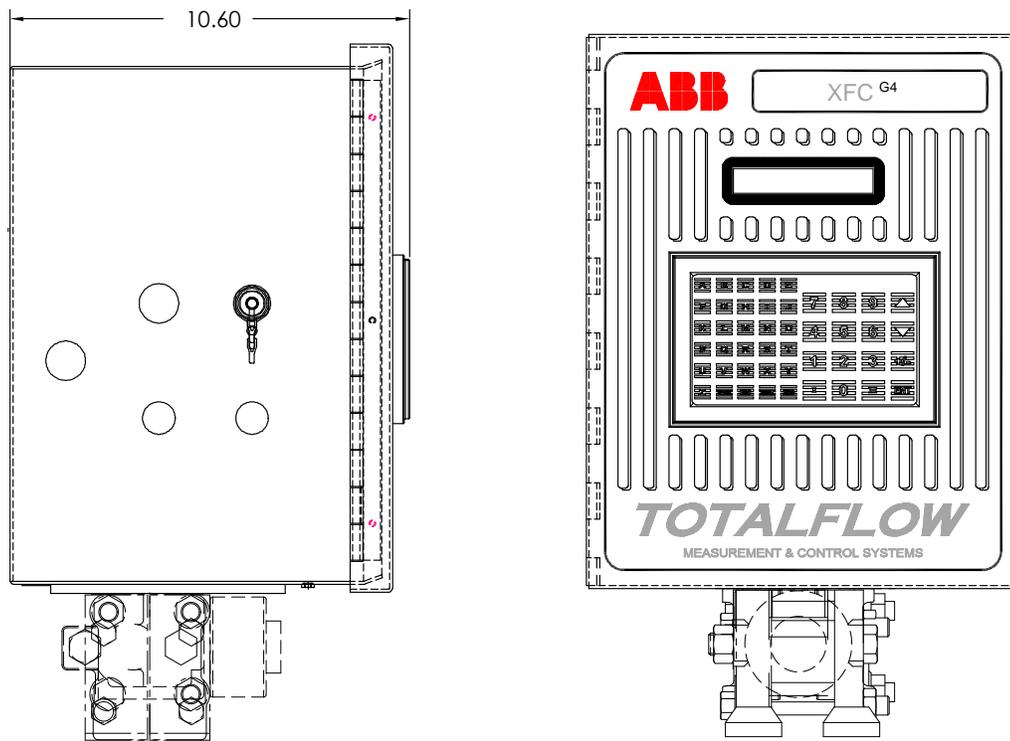
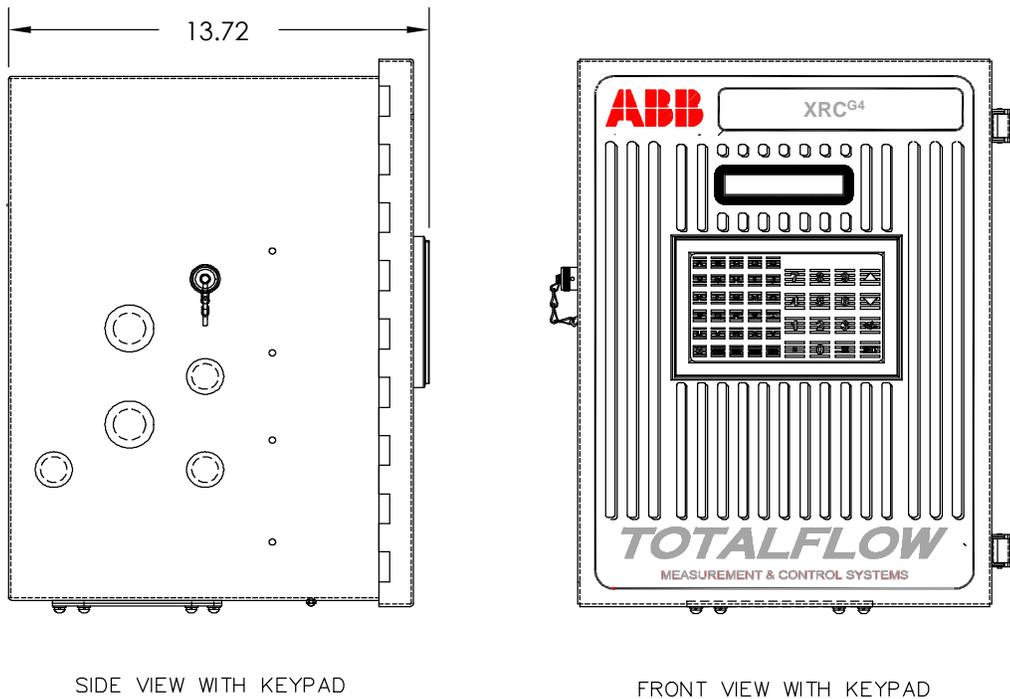


Figure 18: XRC^{G4} 6490 with optional keypad



SIDE VIEW WITH KEYPAD

FRONT VIEW WITH KEYPAD

Figure 19: XRC^{G4} 6790 with optional keypad

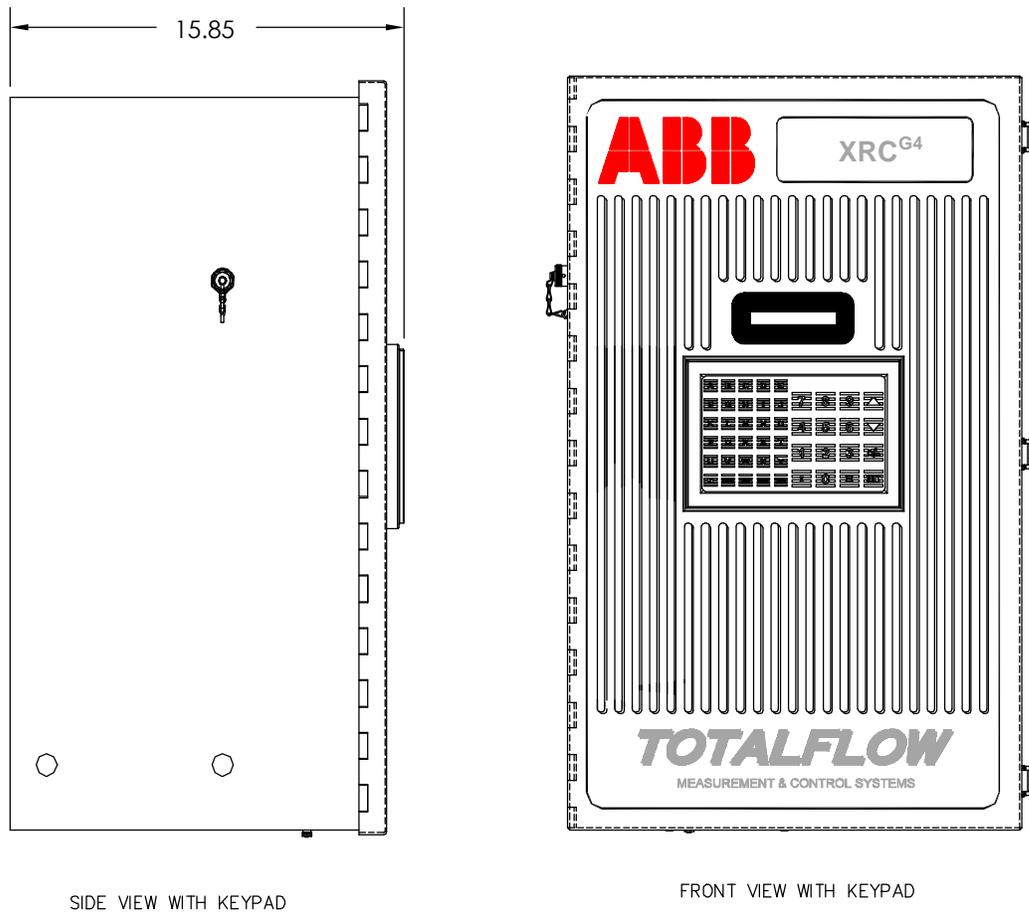


Figure 20: XRC^{G4} 6890 with optional keypad

1.15 Optional Totalflow input/output modules

In addition to Totalflow's enhanced on-board I/O capabilities, the hardware functionality of the XSeries can be extended in a flexible and friendly way by adding modular I/O as needed (see Figure 21). Totalflow I/O (TFIO) modules are designed to accommodate low power, harsh environments and economical cost requirements. The system automatically recognizes the module types and configures the I/O Scanner subsystem accordingly.

The modules are interfaced to the XRC^{G4} board by an I²C bus. On top of this bus, Totalflow has implemented an efficient I/O protocol to exchange information between the modules and the XRC^{G4} board. The bus operates in a master/slave mode, with the main board acting as master.

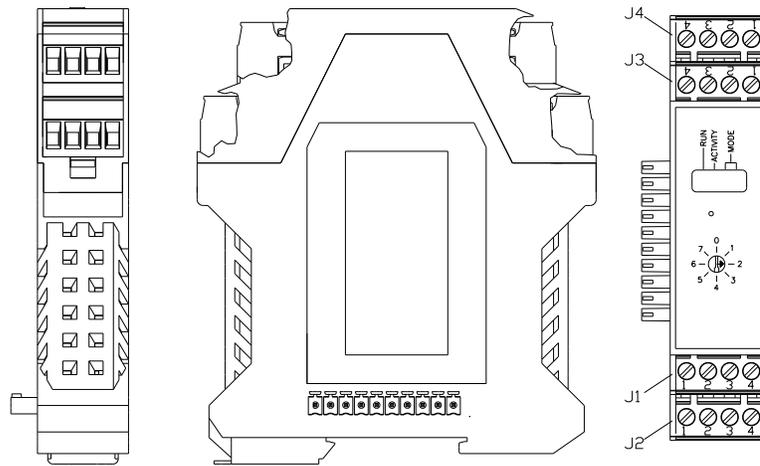


Figure 21: TFIO module housing

1.15.1 TFIO module specifications

The XRC^{G4} 6490 supports up to three modules (see Table 9). The XRC^{G4} 6790 supports up to six modules. The XRC^{G4} 6890 supports up to 14 modules. The XRC^{G4} 6990 supports up to 6 modules per board. For example, three analog input modules can be connected to the I²C bus. Since each module supports eight analog inputs, a total of 24 analog inputs can be added to the I²C bus. Each module has capacity for up to 16 field terminations. Thus, for many modules eight points are supported, since two terminations are generally required for each point.

Current design criteria dictates that module capacity must also be limited by the board's ability to provide power to the modules. The following table indicates the maximum load capabilities.

Table 9: TFIO module loading

	XFC (G3)	XRC (G3)	XFC ^{G4}	XRC ^{G4}
# of Modules	9	22	9	22

All modules are designed to meet Class 1, Division 2, Group C and D Certification.

1.15.2 TFIO module hardware

The I/O module hardware is packaged in DIN mount enclosures that employ Phoenix contact technology for field wiring. The modules also interconnect with each other to provide the necessary power and interface signals along their bus. Installation consists of snapping the Phoenix connector onto the DIN rail and moving the module into position directly beside and snapped to the next module. Likewise, in removing a module, it must first be separated from the module on either side then it can be removed from the DIN rail.

All modules have four LED lights, a manual reset button, and a selectable address from zero through seven. On the face plate of each module you will see:

- Type of module (name and color coded)
- LED light panel
- Reset button switch
- Module address selector

For additional information, please refer to the TFIO Module User's Manual (Part No.2101226-001).

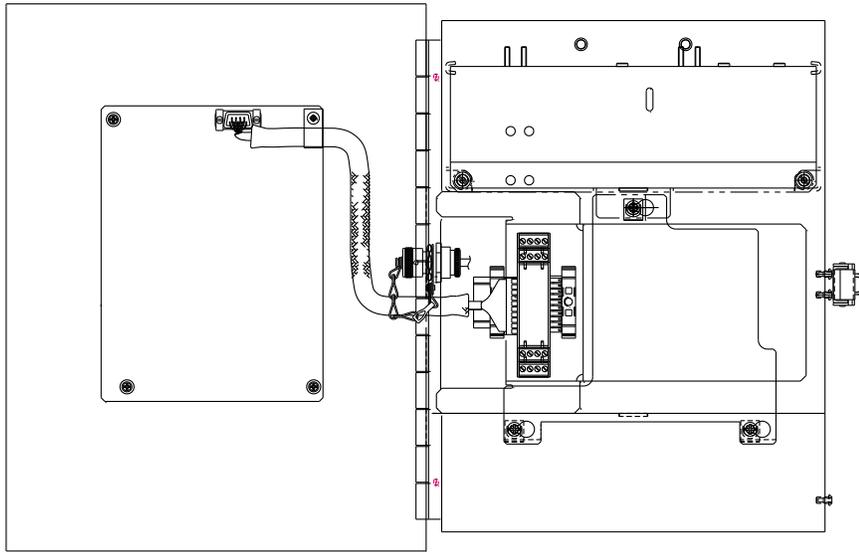


Figure 22: XRC^{G4} 6490 inside view

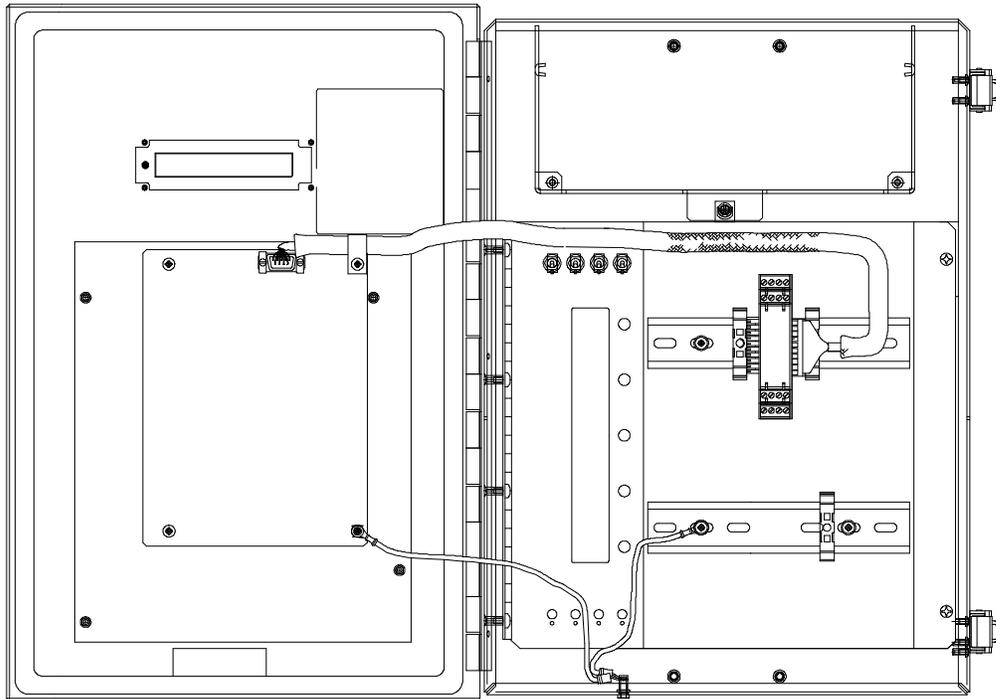


Figure 23: XRC^{G4} 6790 inside view

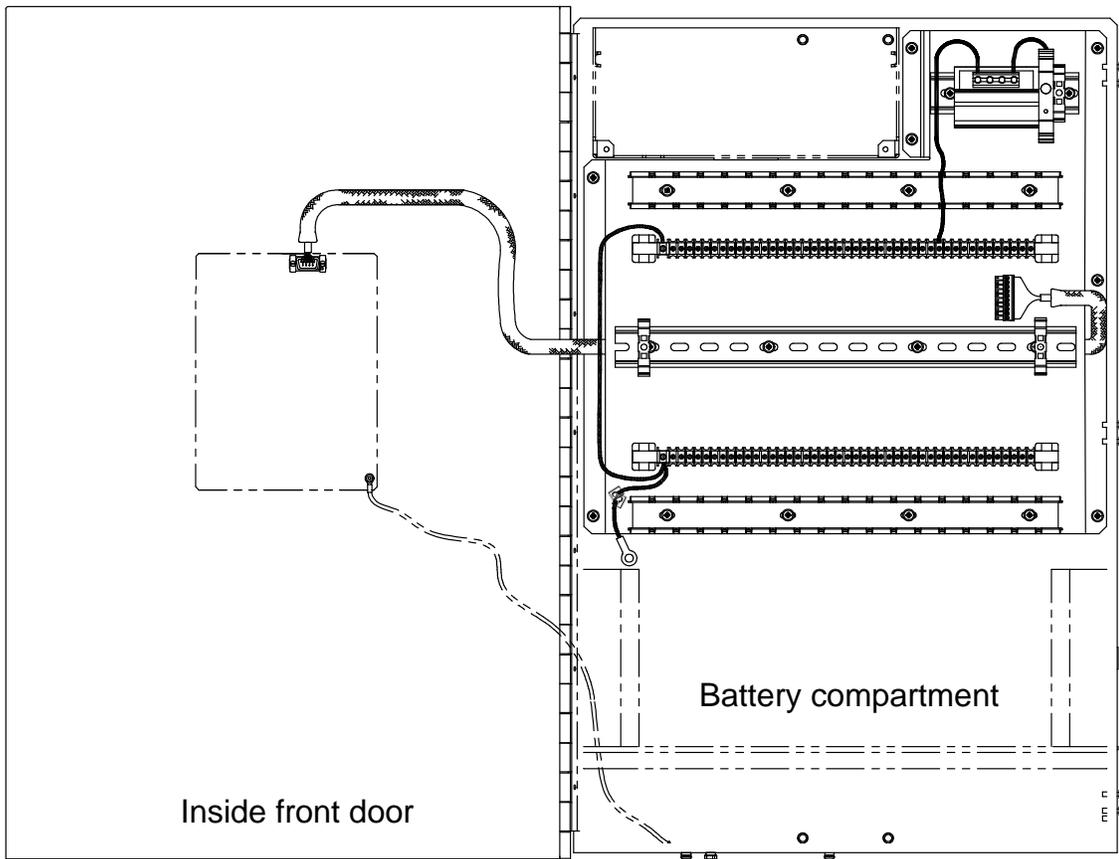


Figure 24: XRC^{G4} 6890 inside view

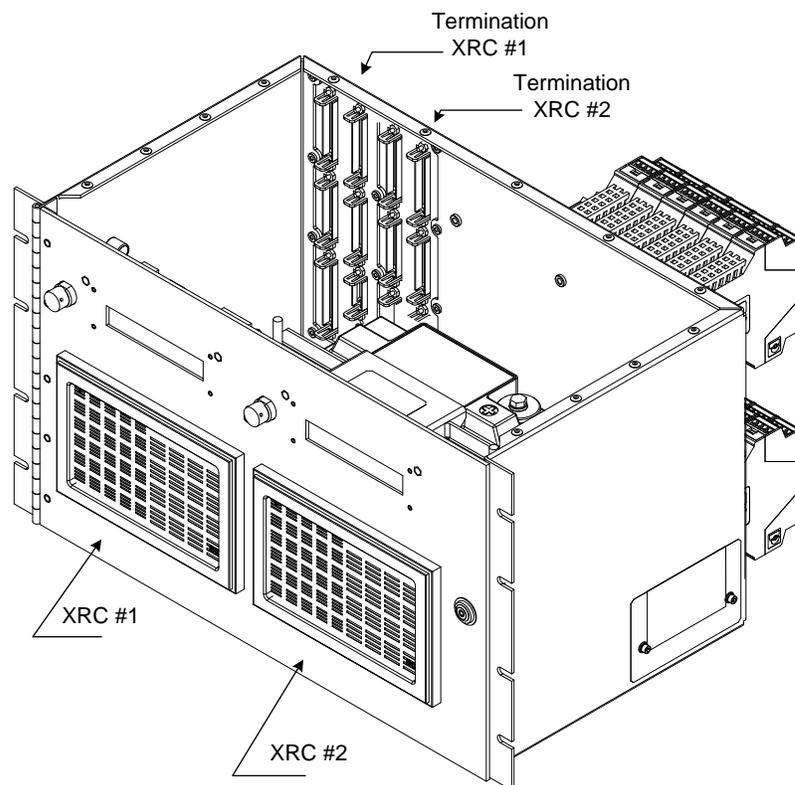


Figure 25: XRC^{G4} 6990 inside view

2 Installation

2.1 Overview

This section provides the information for installation and setup. For safe and trouble-free installation, follow all instructions and advisories. Due to its unique configuration, the XRC^{G4} 6990 installation instructions, and its optional equipment, are grouped together near the end of this section.

To plan the installation, read through this section before beginning the installation. Also before beginning, refer to the wiring diagrams delivered with the new XRC^{G4}. These may be stored in the back of this manual under the tab: *Wiring Diagrams*.

Installation procedures presented within this section are applicable to all XRC^{G4} models.

2.2 Unpacking and inspection

2.2.1 Unpacking

The XRC^{G4} is shipped in a specially designed shipping carton which contains the unit, mounting brackets, parts list and wiring and interconnect diagrams. The solar panel, mounting brackets and the battery pack with applicable hardware are shipped in a separate carton.

Carefully remove the items from each carton.

2.2.2 Inspection

- Inspect the shipping carton for any damage. If the shipping carton is damaged, keep it until the contents have been inspected for damage.
- Inspect the unit exterior for dents, chipped paint, etc.
- Inspect the LCD window for breakage.
- Open the housing by first removing the bolt and releasing the latch or latches.
- Visually inspect the Digital PC board, cables and connectors for damage.

2.2.3 Damaged components

If any components have been damaged or if there are noticeable defects, notify a Totalflow representative. Keep all shipping materials for the carrier's inspection. Totalflow will arrange for immediate repair or replacement; go to section 5.5, *Getting technical* support help.

2.3 Pipe saddle mount installation

Use this procedure to install the unit directly to the meter run. Before beginning, review the procedure and the materials required for installation.

2.3.1 Materials supplied

- XRC^{G4} mounting bracket and hardware

2.3.2 Customer-supplied materials

Optional equipment may be provided by the customer or ordered from Totalflow:

- One pipe saddle
- One 2" pipe of suitable length

2.3.3 Step-by-step instructions

- 1) Position the pipe saddle on meter run (see Figure 26). Select a location that allows easy user access and is close to equipment.

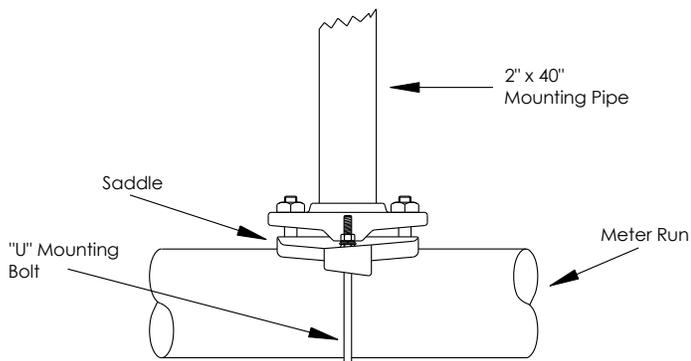


Figure 26: Typical pipe saddle installation

- 2) Temporarily attach the saddle on the meter run pipe using the U-bolt and associated hardware; do not tighten.
- 3) Screw the 2" mounting pipe into saddle. Place level against pipe and vertically align. Adjust the pipe, mounted in saddle, until vertical alignment is achieved.
- 4) After vertical alignment, securely tighten 2" pipe in saddle and then securely tighten saddle mounting bolts. Be certain pipe is securely installed in saddle.



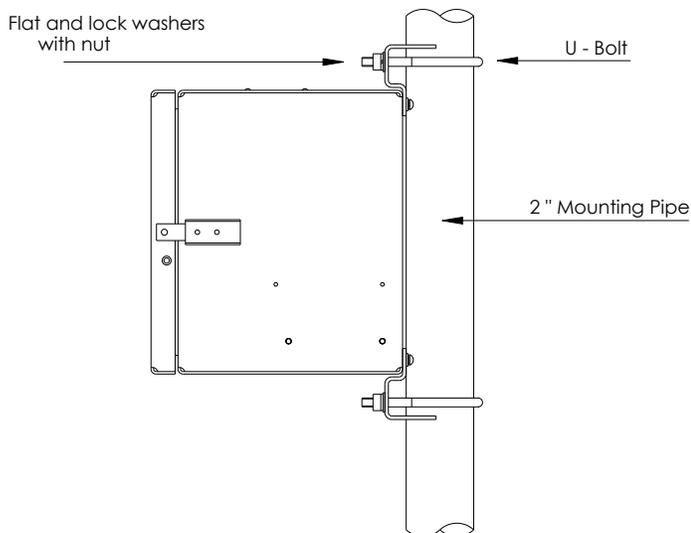
NOTE: To install the XRC^{G4}, it is recommended that two people perform the installation: One to hold the unit in position and the other to install and tighten the mounting brackets.

The method of installation must be consistent with customer's company policy.

Position the XRC^{G4} on the 2" mounting pipe and secure in place with two U-bolts, flat washers, lock washers and two 9/16" bolts as shown in

- 5) Figure 27: XRC^{G4} pipe mounting.

See Figure 28 through Figure 30 for final installation dimensions.

Figure 27: XRC^{G4} pipe-mounting

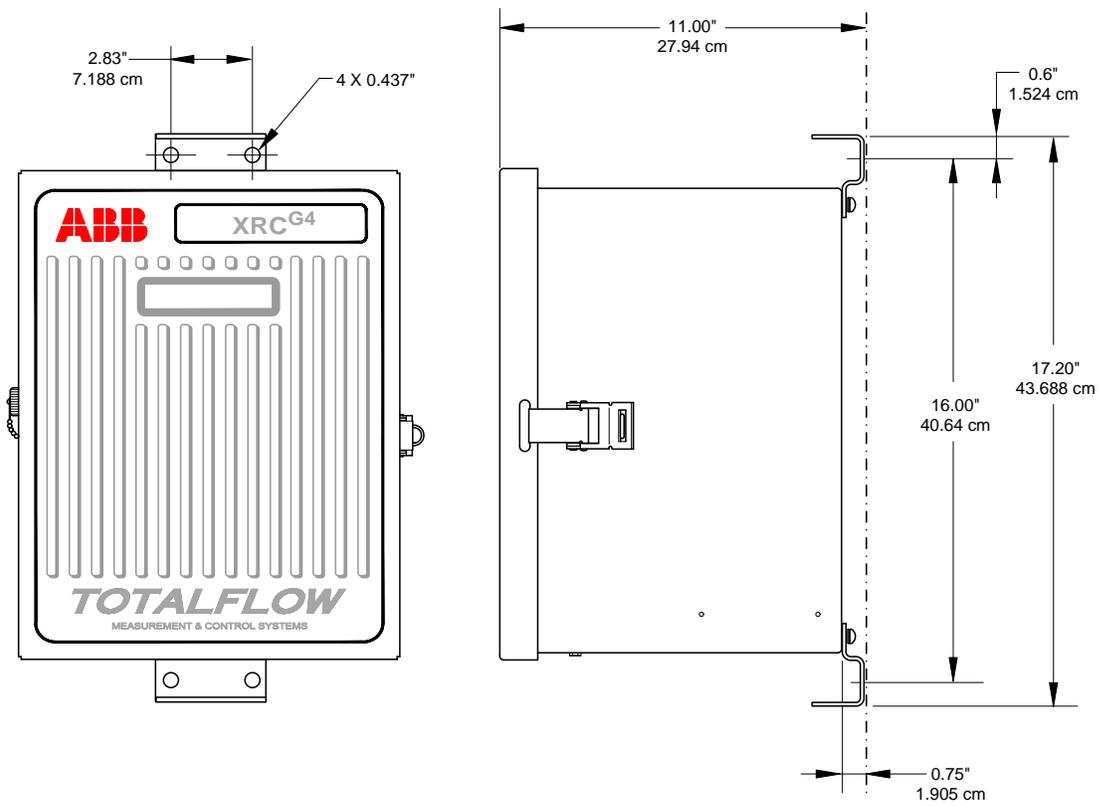


Figure 28: Model XRC^{G4} 6490, pipe-mounted

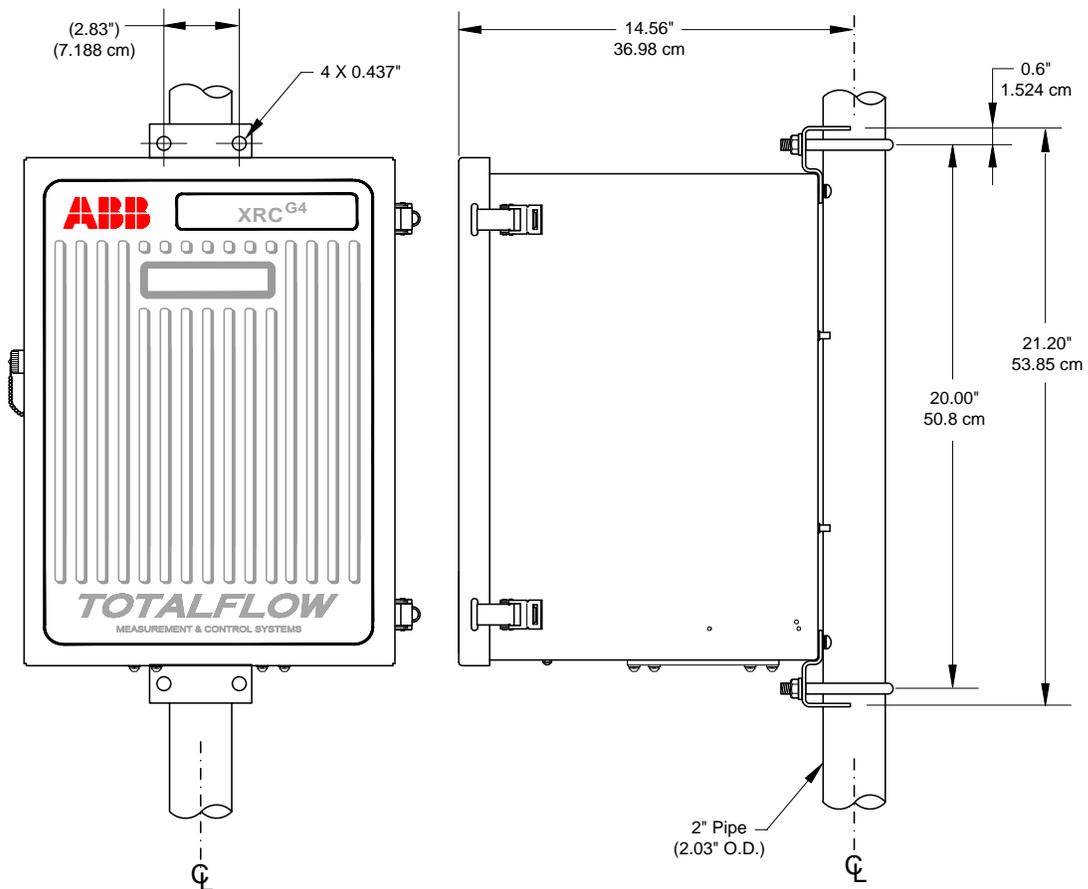
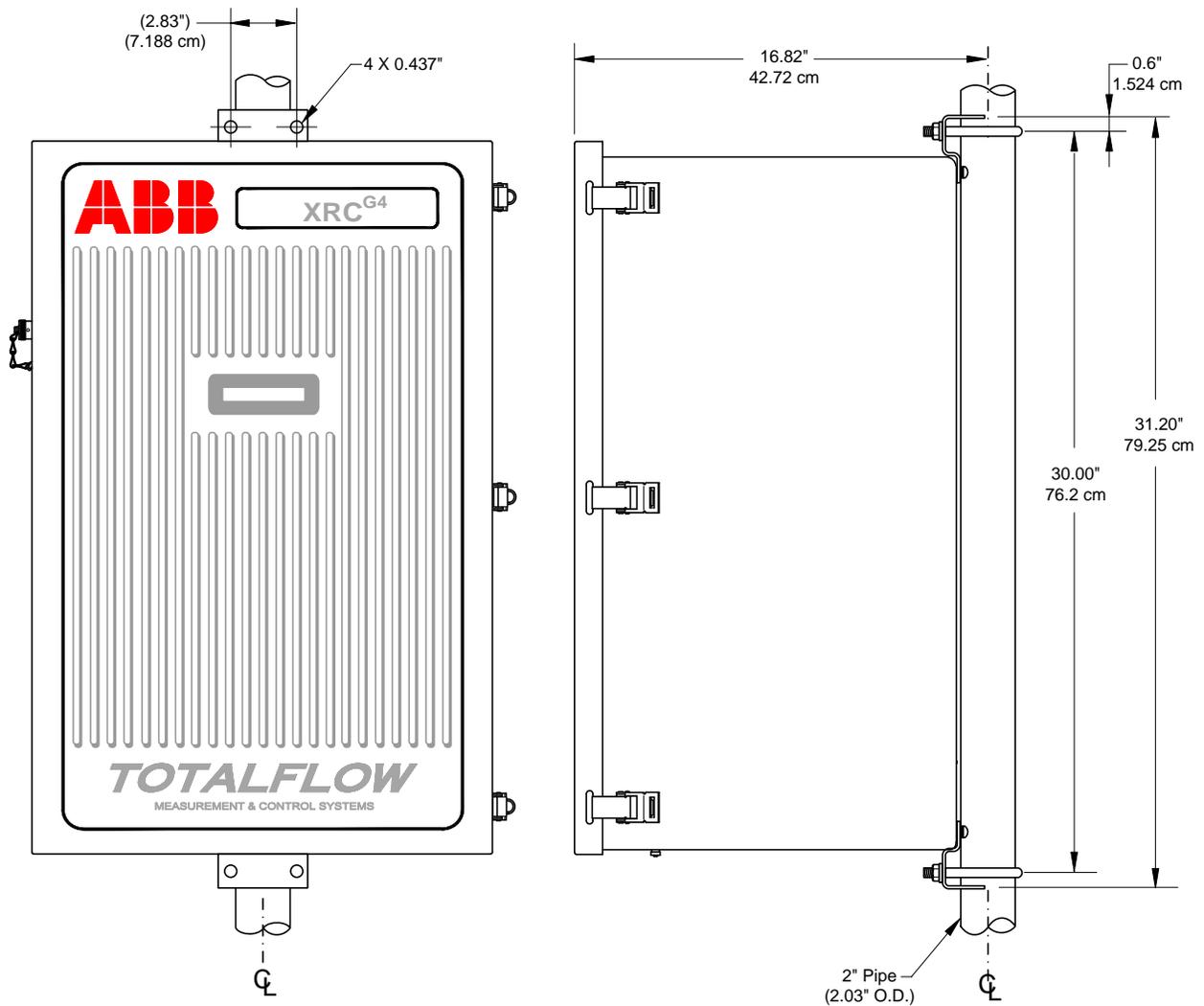


Figure 29: Model XRC^{G4} 6790, pipe-mounted

Figure 30: Model XRC^{G4} 6890, pipe-mounted

2.4 Wall mount installation

If installing to a wall near the meter run or inside a meter shed, use this procedure. Before beginning, review the procedure and the materials required for installation. Refer to the outline drawing for mounting dimension requirements.

2.4.1 Optionally supplied materials

- Two U-bolts with fastening hardware
- Enclosure mounting brackets

2.4.2 Customer-supplied materials

- Four 1/4" machine bolts
- #10 screws



NOTE: If the XRC^{G4} is to be wall-mounted, the wall itself should have sufficient strength to support the hanging weight of the unit.

There should be no obstruction(s) that would prevent the XRC^{G4} door from being opened to access interior installed components or to interfere with installation of the solar panel or other charging power sources.

2.4.3 Step-by-step instructions

See Figure 31 through Figure 33 Outline Drawings.

1. Install mounting brackets on the back of the XRC^{G4}, as shown.
2. Drill mounting holes in wall supports.
3. Lift and align XRC^{G4} wall-mounting brackets with the mounting holes drilled in the wall.
4. Insert 1/4" diameter machine bolts through the XRC^{G4} mounting brackets into the wall. Securely tighten all bolts to secure unit to the wall.

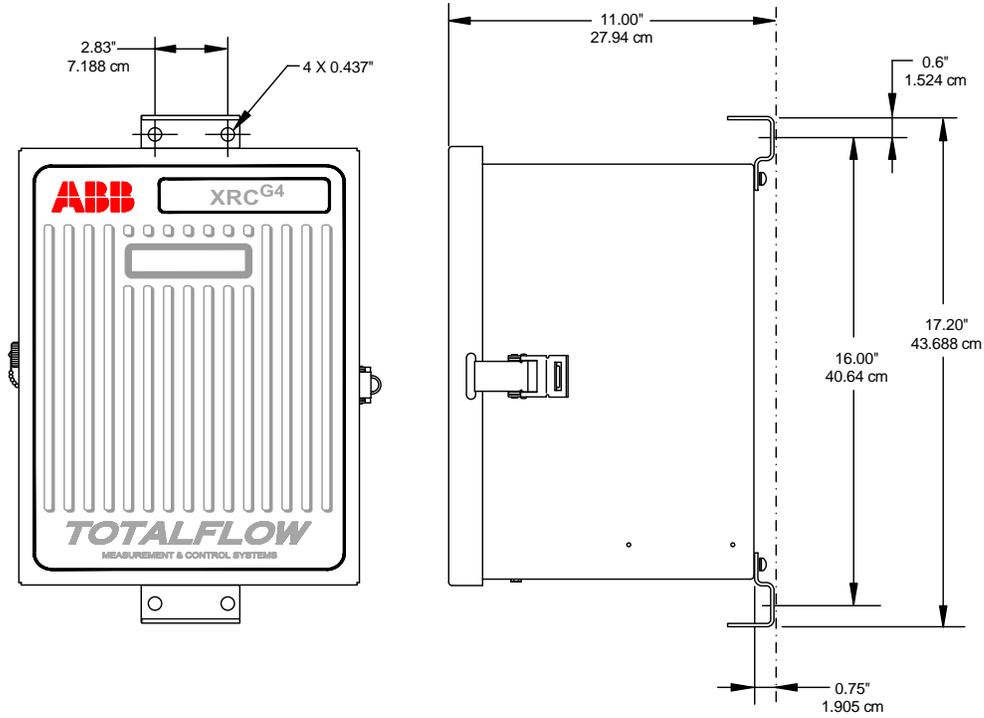


Figure 31: Model XRC^{G4} 6490, wall-mounted

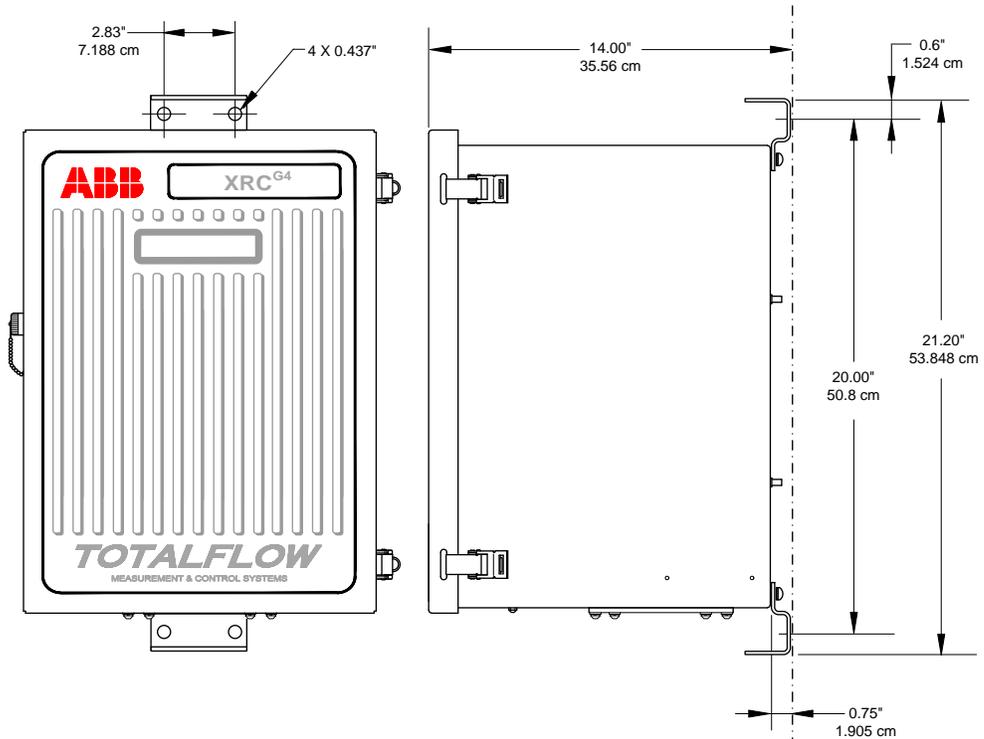
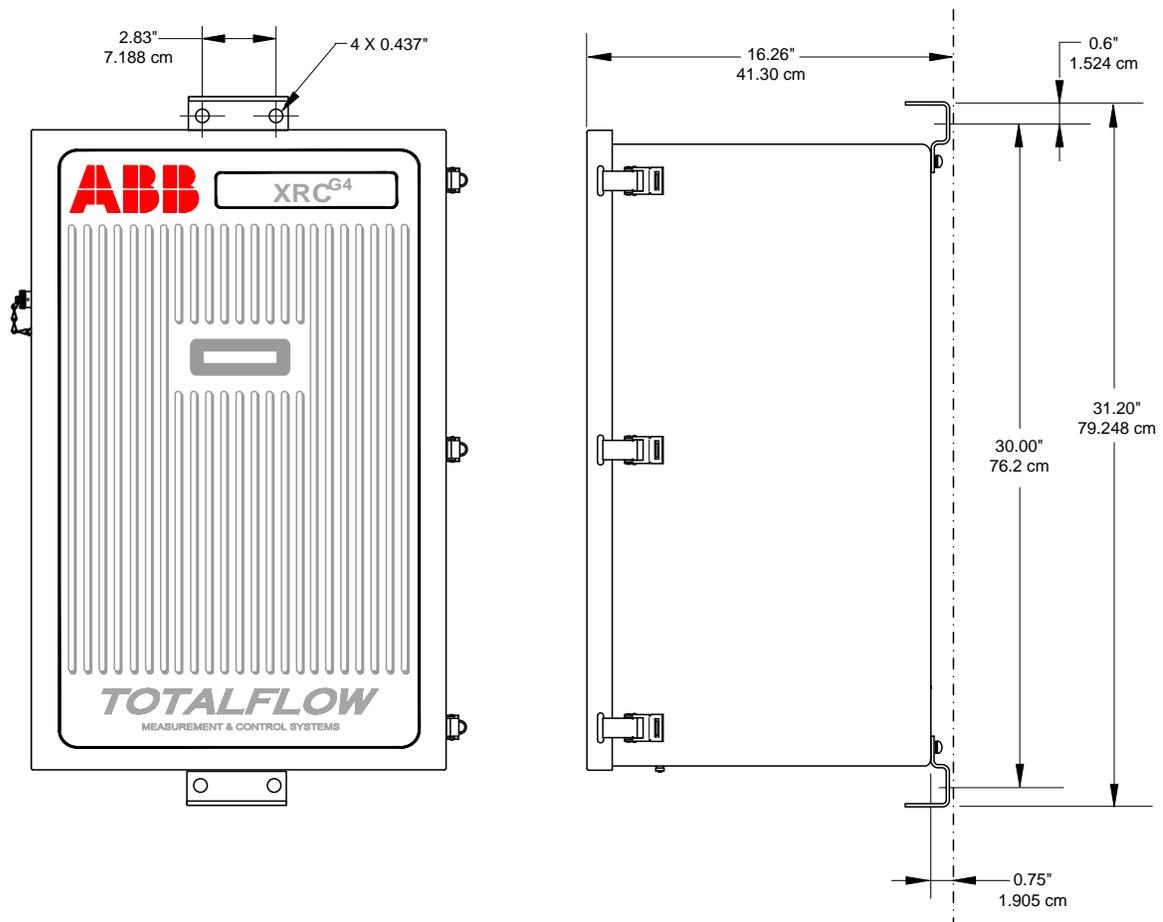


Figure 32: Model XRC^{G4} 6790 wall-mounted

Figure 33: Model XRC^{G4} 6890 wall-mounted

2.5 Battery pack installation

A battery pack provides the XRC^{G4} with its operating power. The battery is packed and shipped separately. Before installation, inspect power cables where they terminate on the battery pack and the connectors for breakage.

The battery pack is mounted behind the removable metal battery plate cover. The plate is adjustable for various sized batteries.

2.5.1 Step-by-step instructions

1. Insert the battery pack into the battery compartment with its long dimension facing outward.
2. Connect the battery pack connector to the digital board battery connection J16 connector (Figure 34), located in upper right corner of the board.
3. Observe the LCD; the display should be on and scrolling through the startup diagnostics sequence.

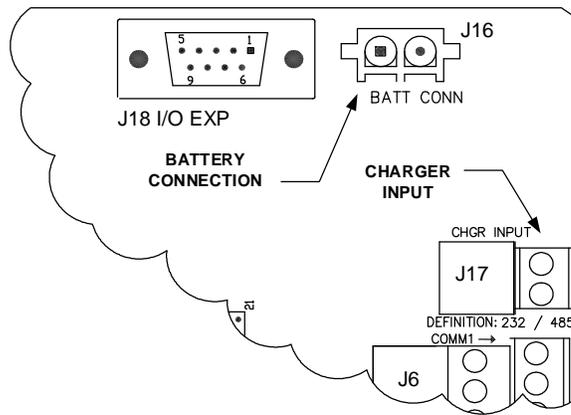


Figure 34: Battery and charger input connections

2.6 Solar panel installation

The solar panel is designed for outdoor mounting on a 2" extension pipe installed on the upper end of the XRC^{G4} 40" mounting pipe. The Solar panel must be mounted within 12 feet of the XRC^{G4} (other cable lengths are available). For wall-mounted XRCG4, it can be mounted on the top or side of the meter house.



NOTICE – Property damage. Do not connect solar panel power cable to the XRC^{G4} unless the main battery pack has been connected to J16.

If installation procedures are required for mounting the solar panel on the top or side of the meter house, the user should contact Totalflow's Service Department; go to section 5.5, *Getting technical* support help for additional information.

2.6.1 Materials supplied

- One solar panel
- Two U-Bolts and fastening hardware
- Solar panel cable (standard is 12', other lengths are available)
- Solar panel mounting bracket (if not already attached to solar panel)

2.6.2 Customer-supplied materials

- Cable ties
- One 9-inch extension of 2-inch pipe or other suitable length of pipe, threaded on one end.
- One 2-inch coupling.



NOTICE – Property damage. Exercise caution when installing the solar panel, so as not to damage it. When mounted, the solar panel will face up from the horizon at a 50° angle.

2.6.3 Step-by-step instructions

1. Attach 2" pipe coupling to the top end of the XRC^{G4} 40" mounting pipe (Figure 35). Securely tighten.

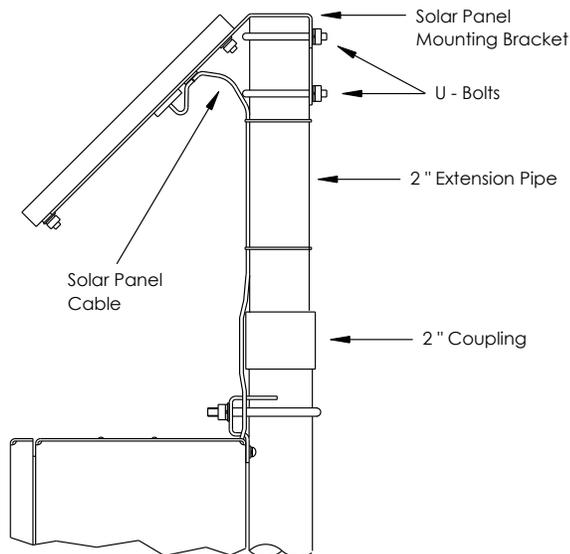


Figure 35: Typical solar panel installation

2. Install the 2" pipe extension into the coupling and securely tighten.
3. Check solar panel using digital voltmeter to verify polarity and output voltage. Voltage will vary depending on amount of sun, angle to sun, etc.
4. Install solar panel on mounting bracket, with provided hardware, if required.



NOTE: Do not connect the other end of the solar panel cable to the XRC^{G4} until instructed to do so.

5. Attach the solar panel mounting plate to the top end of the 2" extension pipe with U-bolts and associated mounting hardware. Do not tighten U-bolts until the solar panel has been correctly positioned.
6. For northern hemispheres, position the solar panel facing south. For southern hemispheres, position the solar panel facing north. For optimum charging, the solar panel should not be in shadows for the majority of the day. The Panel should be kept clean for maximum charging.
7. Remove CHGR Input terminal block (J17) from digital board (Figure 34: Battery and charger input connections). Insert solar panel power cable through an access hole on the side of case. Allow enough power cable for field wiring to CHGR Input +/- terminations on J17.
8. Before making connections to the terminal block, trim wire ends back 1/4". Loosen the terminal block securing screws, insert wire then retighten. Connect the solar panel (+) lead to (+) terminal and (-) wire to (-) terminal. Verify that the main battery pack is connected and then reinstall the terminal block with wires attached.
9. Following connection of the solar panel power cable, secure the cable to the 2' extension pipe and mounting pipe cable with the plastic tie-wraps provided.

3. Connect the AC battery pack charger to the XRC^{G4} using the supplied sealing ring and nut (see Figure 37).

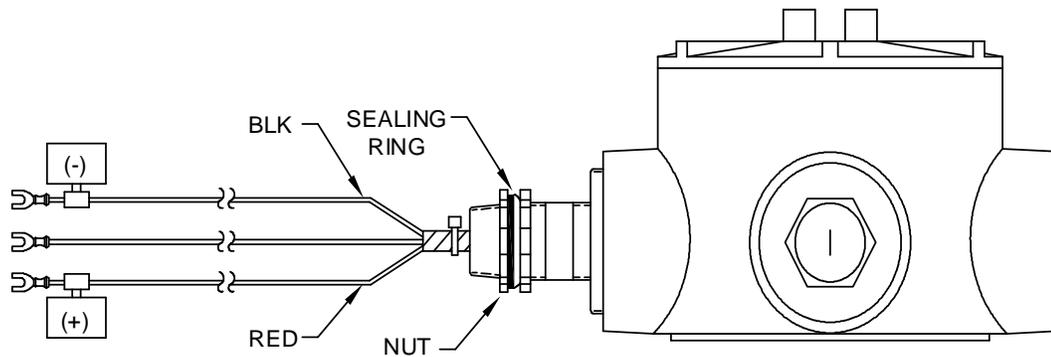


Figure 37: DC wiring instructions

4. To prevent moisture from entering the XRC^{G4} after installing the AC battery pack charger, be certain that the associated connector at the charger has a metal-backed sealing o-ring and metal-locking nut attached.
5. Before connecting the charger wiring, trim wire ends back 1/4" and remove associated CHGR Input J17 terminal block from the digital board (see Figure 36).
6. Loosen the terminal block securing screws, and insert the black wire into plus (+) terminal (top) and white wire in negative (-) terminal (bottom). Retighten screws and reinstall the terminal block with wires attached.
7. Plumb the conduit and associated AC wiring into the AC charger conduit box (see Figure 38). The AC charger is rated at either 120 Vac 60 Hz or 240 Vac 50 Hz. Connect the 120 V hot and neutral or the two hot wires for 240 V to the AC charger. Connect the ground wire to the green screw.

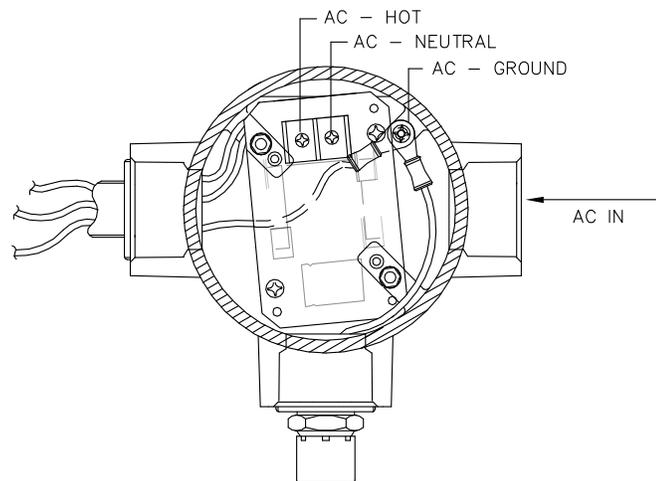


Figure 38: AC wiring instructions

8. Verify that the DC power wires are terminated properly inside the cabinet and verify that the main battery pack is plugged into J16. Apply AC power to the AC charger.
9. Monitor DC charging voltage by observing the XRC^{G4} display. The LCD should indicate: CHARGER 13.0 - 13.5 VOLTS.

2.8 XRC^{G4} 6990 rack mount installation

2.8.1 Overview

The XRC^{G4} 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 (see Figure 39).

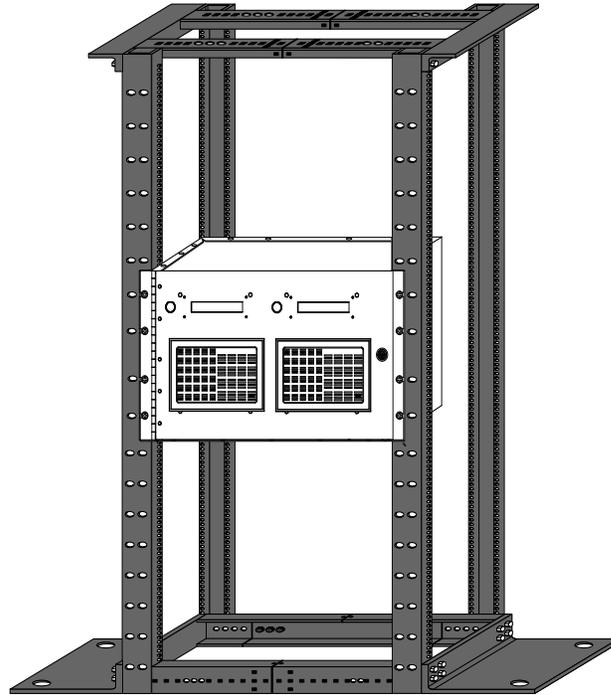


Figure 39: XRC^{G4} 6990 rack mount

2.8.2 Termination panel

User connections to the XRC^{G4} 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^{G4} 6990 or a Dual Unit with two XRC^{G4} controller boards.

Terminal designations on the back panel are identical to designated pin outs on the XRC^{G4} main electronic board(s). Any wiring instruction (WI) or User Drawing (UD) applicable to the XRC^{G4} will be applicable to the XRC^{G4} 6990, but wired to the corresponding plug on the rear of the enclosure. Table 10 shows XRC^{G4} jumper/termination panel correlation.

Table 10: XRC^{G4} Main Electronic Board to Termination Panel Correlation Chart

XRC ^{G4} main electronic board	XRC ^{G4} 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

2.8.3 Dual unit

Wiring to a XRC^{G4} 6990 dual unit is reflected by two termination panels on the rear of the enclosure, two XRC^{G4} boards in the interior and two display and local communication ports on the front. Likewise, if units are configured for the optional keypad, there will be two separate keypads on the front.

Since wiring for the dual unit configuration is identical for each unit, all discussions will focus on the single unit configuration. Figure 40 shows the single and dual unit termination panel.

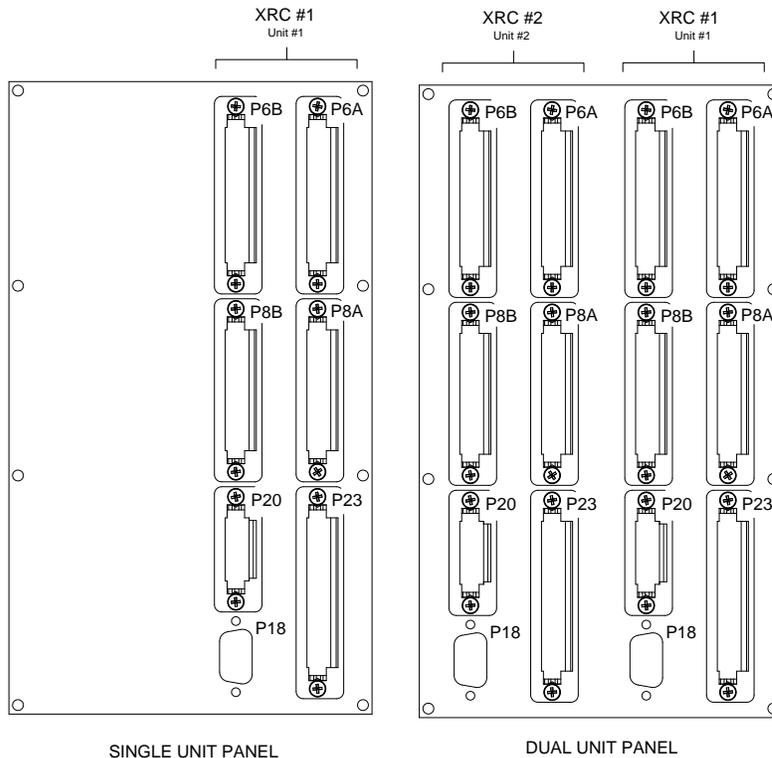


Figure 40: Single and dual unit termination panels

2.9 XRC^{G4} communication field-wiring

The XRC^{G4} main electronic board may require some basic setup and wiring.

The standard XRC^{G4} enclosure allows the user access to the main electronic board for configuration of jumpers, communication modules and switches. All user wiring is wired directly to this board.

While the XRC^{G4} panel-mount main electronic board(s) are pre-wired inside of the rack mount enclosure to the termination panel on the rear of the enclosure, it may be necessary to configure some of the jumpers, communication modules and switches that are located inside of the enclosure on the main electronic board(s).

2.9.1 Communication wiring

Up to two communication ports can be programmed on the XRCG4 board. COMM 0 is the local port required for reading the XRCG4 with a laptop computer running PCCU32. COMM 1 and COMM 2 can be configured for any combination of RS-232 or RS-485. See Figure 41 for on-board communications wiring inside the standard XRCG4 enclosure. See

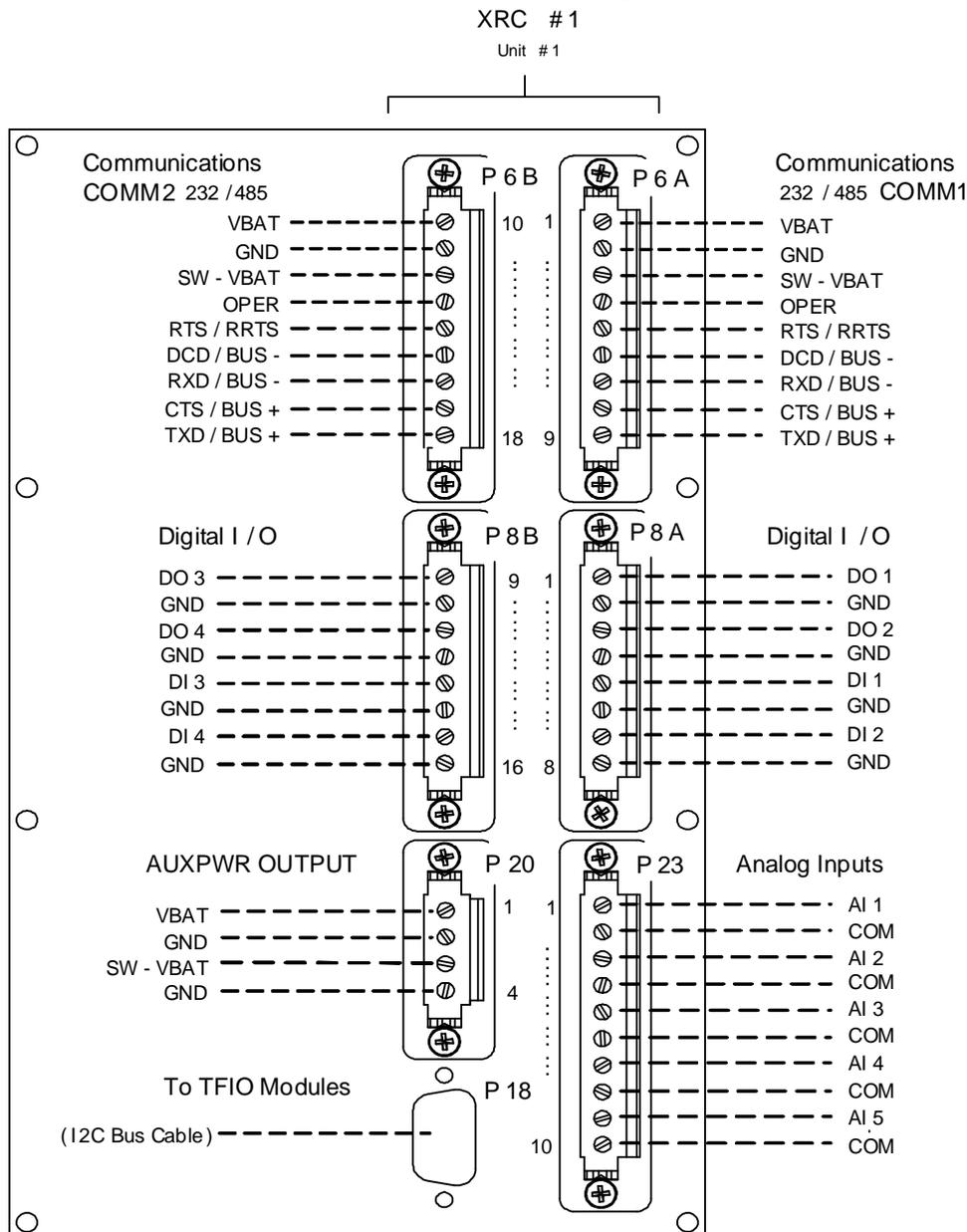


Figure 42: XRCG4 panel-mount field-wiring diagram, for communication wiring on the rear termination panel of the XRCG4 6990 panel mount enclosure.



NOTICE – Property damage. The XRC^{G4} board, as with any electronic board, is susceptible to damage by static electricity or improper handling. To prevent this from occurring, the user should wear a grounding strap.

Remove power to the unit prior to changing jumper settings or field-wiring to on-board I/O.

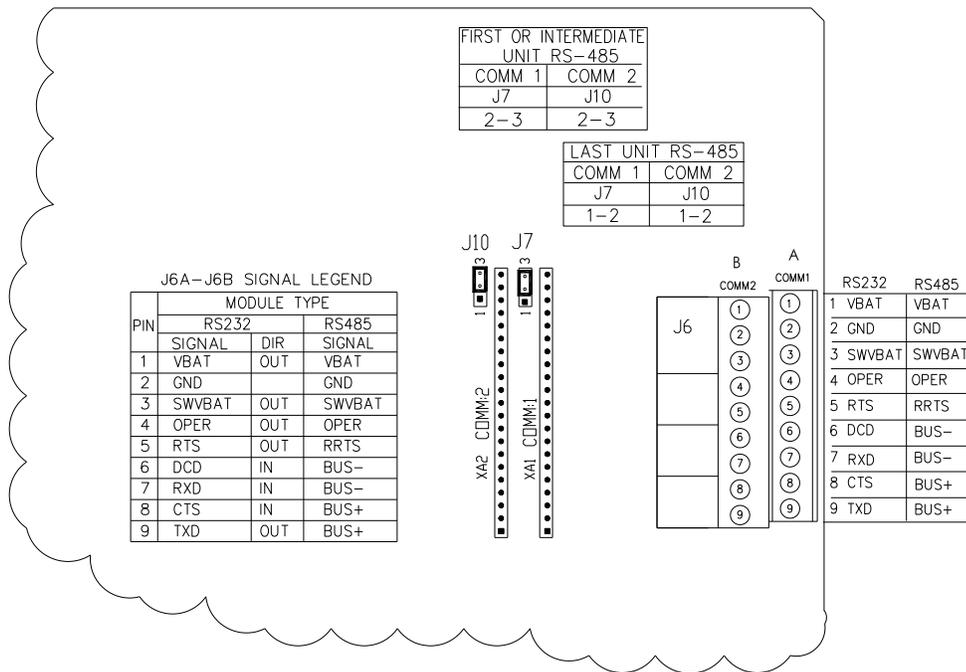


Figure 41: XRC^{G4} standard communication wiring

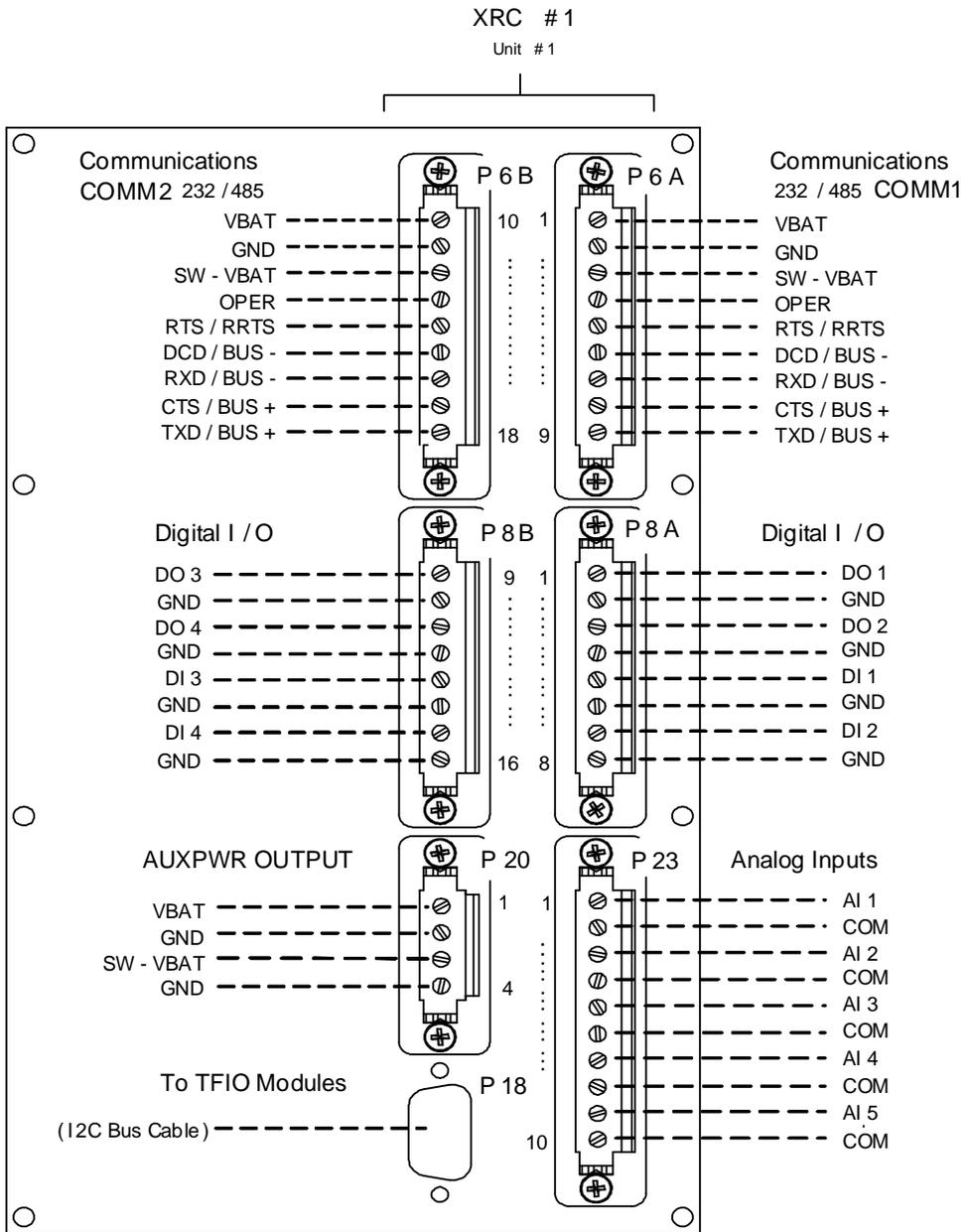


Figure 42: XRC^{G4} panel-mount field-wiring diagram

2.9.2 Communication modules

If the unit is configured for remote communications, XA1 and/or XA2 will contain a 21 pin communication module specific to either RS-232, RS-422 or RS-485. If using the RS-485 communication module, J7 and/or J10 jumpers will require termination on the last or only unit (Figure 41: XRC^{G4} standard communication wiring).

2.9.3 Board configuration

Table 11 is a brief description of each configurable point on the XRC^{G4} main electronic board and its function. The board diagram shows the location of these items (Figure 43).

Table 11: XRC^{G4} on-board jumper settings

Jumper No.	Description
J7 and J10	<i>RS-485 Termination:</i> When there are multiple XRC ^{G4} daisy-chained together on a single RS-485 bus, the bus must be properly terminated. When the XRC ^{G4} is the <i>last</i> or <i>only</i> unit on the bus, the jumper should be across pins 1 and 2. If the unit is <i>first</i> or <i>intermediate</i> , the jumper should be across pins 2 and 3.
J5, J9, J11 and J12	<i>Pulse Input (PI) Debounce:</i> When using any of the digital inputs as pulse inputs you may want to enable debounce for that input. Debounce enables an RC Time Constant that will tend to debounce noisy relay or switch closures. However, if the PI is monitoring a fairly high-speed input, enabling debounce could cause a loss of some of the pulses. To enable debounce jumper across pins 2 and 3.
J21, J22, J24, J25 and J26	<i>Analog Input (AI) Configuration:</i> The XRC ^{G4} controller board supports both voltage input and current loop input AI. A jumper across pins 2 and 3 establishes the associated AI as a 0-10 Vdc voltage input. A jumper across pins 1 and 2 establishes the associated AI as a 0-20 mA Current Loop Input.
J1	<i>Lithium Battery Backup:</i> J1 enables or disables memory backup via the lithium cell battery. A jumper across pins 1 and 2 enables RAM memory backup. If the jumper is removed (or across pins 2 and 3) the lithium cell is not enabled for memory backup. Should power be lost or disconnected while the lithium cell is not enabled, the XRC ^{G4} main processor board will execute a <i>COLD Boot</i> and all historical data will be lost.
S1	<i>Security Switch:</i> If the security switch is on and a local connection is made to the unit via PCCU, the proper security code must be entered. If the proper security code is not setup in PCCU, the operator will be unable to configure the XRC ^{G4} . If the security switch is turned <i>off</i> , the user will be able to configure the XRC ^{G4} without secure access.

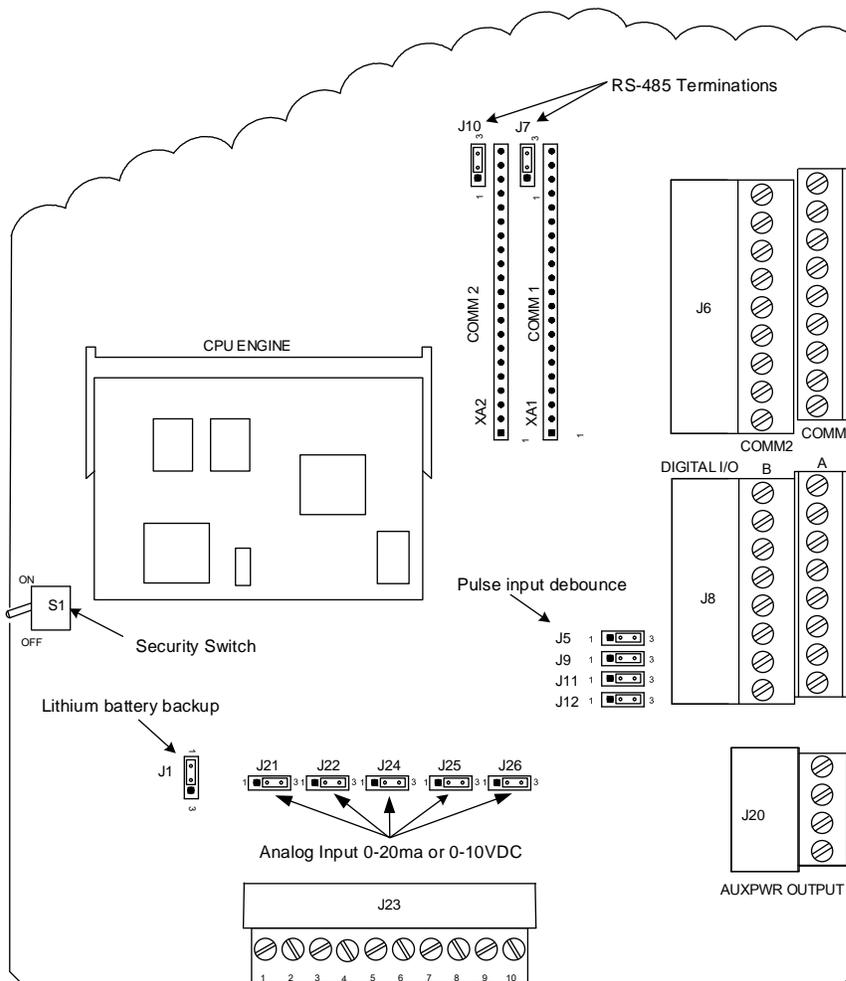


Figure 43: XRC^{G4} main electronic board jumper configuration

2.9.4 Other field wiring

For other wiring connections directly on the XRC^{G4} main electronic board, use Figure 43: *XRC^{G4} main electronic board jumper configuration*, and Figure 44: *Other field-wiring I/O connections*. When wiring to the termination panel on the back of the panel

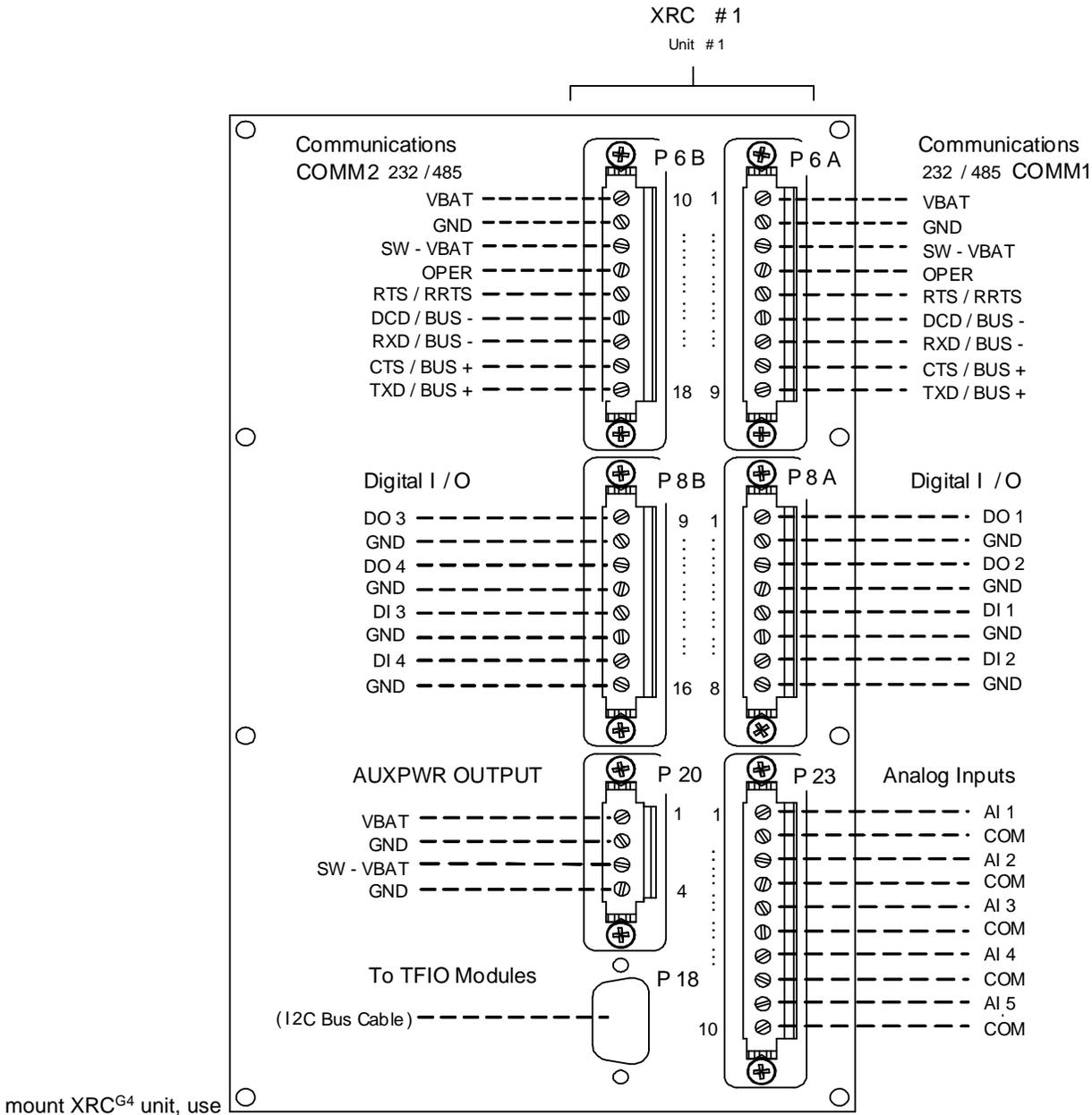


Figure 42: *XRC^{G4} panel-mount field-wiring diagram* and Figure 43: *XRC^{G4} main electronic board jumper configuration*.

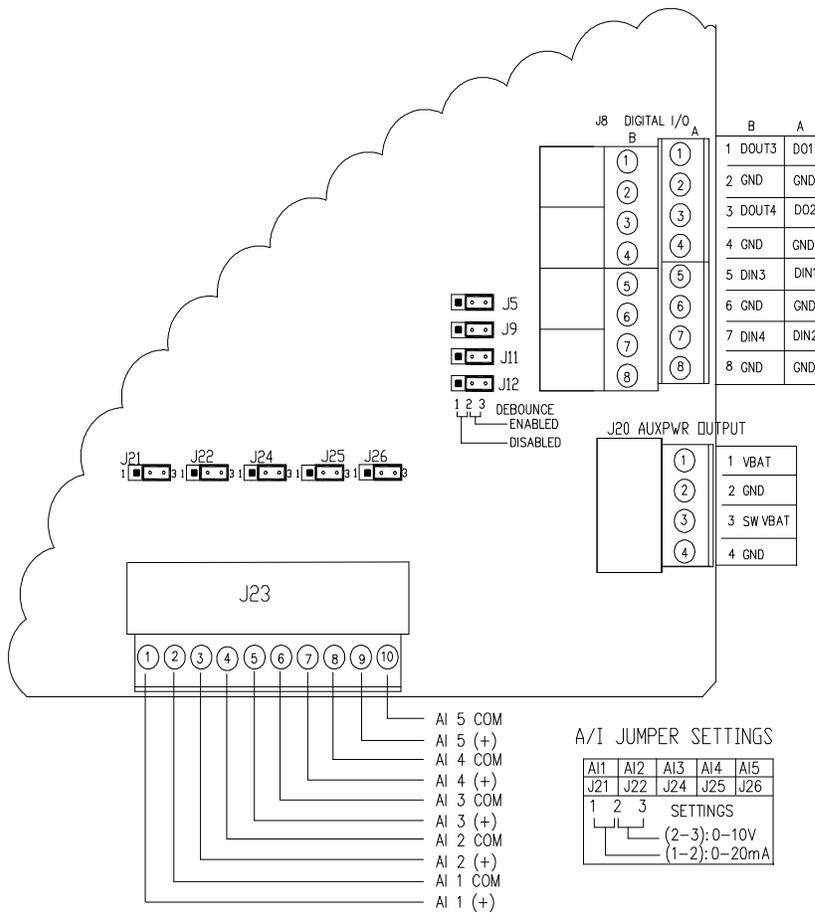


Figure 44: Other field-wiring I/O connections

3 XRC^{G4} startup

3.1 Overview

This section generally describes the steps required to get a newly installed XRC^{G4} system up and running. Specific information required to complete each step (depending on the specific equipment chosen) is discussed in the PCCU32 help files.

Programming of the XRC^{G4} is accomplished through the Windows-based PCCU32 software.



NOTE: Before beginning, complete the tasks outlined in Section 2, *INSTALLATION*.

3.2 PCCU32 installation and setup

Totalflow's PCCU32 7.05.5 (or later) software is required to communicate with XSeries G4 equipment. Previous versions of PCCU32 are not compatible.

PCCU32 software running in a laptop Windows environment offers the most capabilities for programming. The Windows environment features user-friendly help files and easy-to-follow menus. Easy-to-follow menus and icons step the user through many required choices.

3.2.1 Step-by-step instructions

1. Insert the PCCU32 disk into CD drive. If CD drive is set to AutoPlay, the installation program should begin. Otherwise, go to **Start, Run** and type **D:\Disk1\setup.exe**. *D* is the CD drive designation.
2. Follow screen prompts during installation.
3. Another screen prompt will ask for user information. Complete the information and enter the serial number in the appropriate space, carefully entering both numbers and dashes. Click **Next** to continue.
4. When installation is complete, click **Finish**. A new Totalflow PCCU32 window will appear. This contains the shortcuts created in the start menu. Copy the PCCU32 shortcut to the desktop if desired.

3.3 Establishing initial local communication

As discussed previously, local communication may be established in different ways: RS-232 MMI cable or USB cable. The unit may be configured for one or the other or both. TCP/IP is available but is designed for use over a network setup.

3.3.1 Connecting to local port via RS-232 cable

If the unit is configured to include the local RS-232 communication port, the connection is made using the RS-232 cable, connecting the laptop computer to the local port on the meter. This port is located on the side of a standard enclosure, or on the front panel of the panel-mount enclosure.



NOTE: If using a PC or laptop without RS-232 interfaces (serial ports), use a serial-to-USB converter on 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.

To connect to the local port using an RS-232 cable:

1. Connect the MMI cable to a serial port on your PC and to the RS-232 local port located on the unit.
2. Click on the Windows **Start** button.
3. Select **Programs>Totalflow PCCU32** (or correct program folder if changed during installation) and then select PCCU32. The PCCU32 initial screen displays.
4. Click **Setup** on the top menu bar. The System Setup window displays the **Setup** tab (Figure 45).

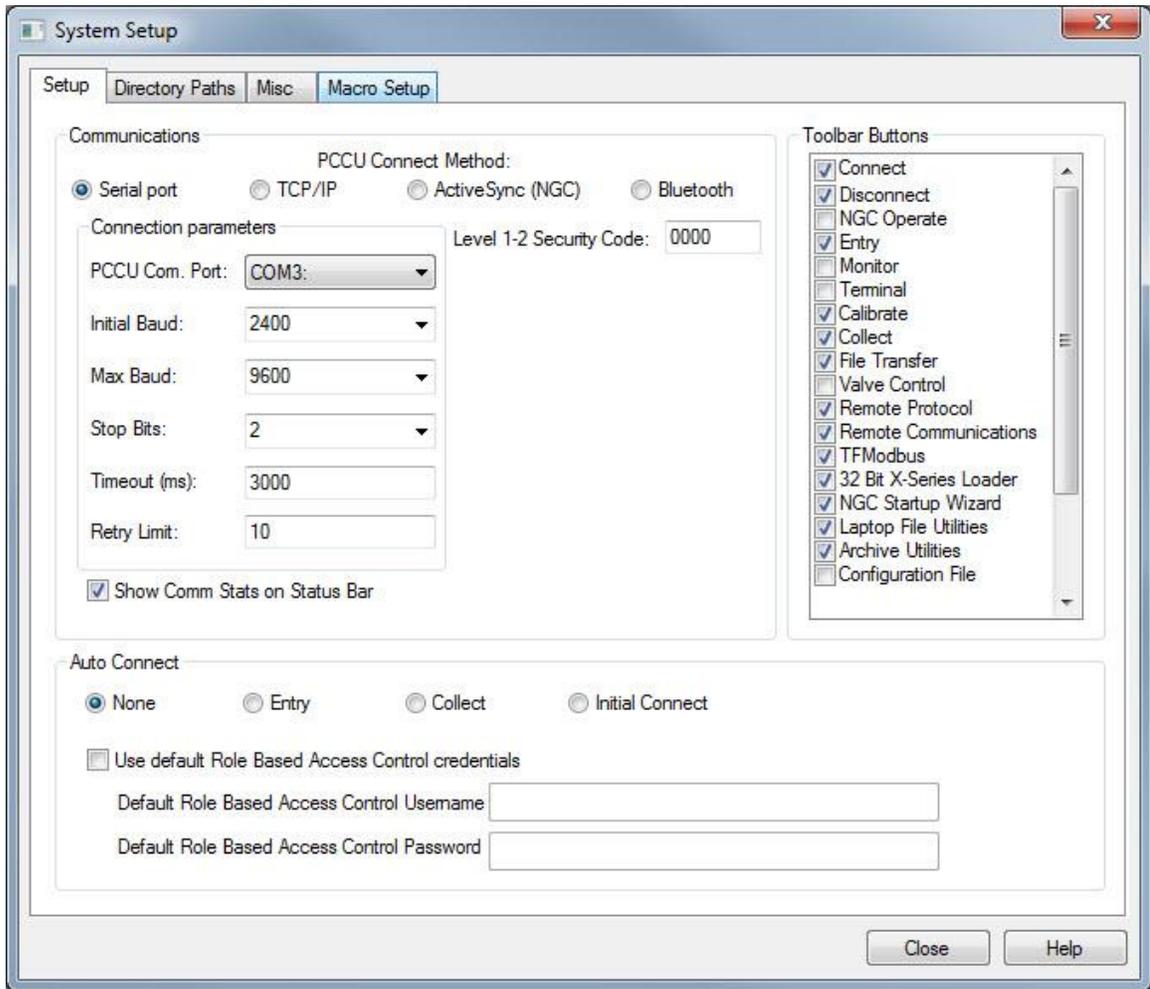


Figure 45: Setup for local communication

5. Under **Communications**, select **Serial port**.
6. Under Connection parameters, expand the **PCCU Com. Port** drop down list to select the Com port designated for the RS-232 communication on the PC.
7. Click **Close** to exit setup and return to the PCCU main screen.
8. Click the **Entry** icon on the top menu bar. For other screen options, click on the **Connect** Icon instead (left-most icon at the top of the screen). The Local Connect screen displays other screen options in addition to the **Entry** screen. When the selected screen displays, you have connected successfully to the device



NOTE: If the *Invalid Security Code* screen should appear, enter four zeros (0000) for the new code and click **OK**. The XRC^{G4} should have defaulted to 0000 on startup.

If the meter has been given a security code, enter that code in the *PCCU32 System Setup* screen (see Figure 45). However, if the meter has been COLD-started, the security code will be reset to factory default and historical data will be lost.

3.3.2 Connecting to local USB port

If the unit is configured to include the local USB communication port, the connection is made using the USB cable. This connects the laptop computer to the Local port on the meter. This port is located on the side of a standard enclosure, or on the front panel of the panel mount enclosure.

To connect to the USB port:

1. Connect the USB cable to a USB port on your PC and to the USB port on the unit.



IMPORTANT NOTE: If connecting directly to the USB port on the board, you need to purchase the Y adapter cable (part number 1803009-001). To order contact ABB.

2. Click on the Windows **Start** button.
3. Select **Programs>Totalflow PCCU32** (or correct program folder if changed during installation) and then select *PCCU32*. This will display PCCU32s initial screen.
4. Click **Setup** on the top menu bar. The System Setup window displays the **Setup** tab (Figure 45), *Setup for local communication*).
5. Under Communications, select **Serial port**.
6. Under Connection parameters, expand the **PCCU Com. Port** drop down list to select the Com port designated for the USB port on the PC.
7. Click **Close** to exit setup and return to the PCCU main screen.
8. Click the **Entry** icon on the top menu bar. For other screen options, click on the **Connect** Icon instead (left-most icon at the top of the screen). The *Local Connect* screen displays other screen options in addition to the **Entry** screen. When the selected screen displays, you have connected successfully to the device.

3.4 Set up the XRC^{G4} for Ethernet communication

The XRC's factory configuration has the Ethernet port disabled. To setup the XRC for Ethernet connection, you must first connect locally using either the RS-232 or USB cable as described in section 3.3, *Establishing initial local communication*. Using this local connection, enable and setup Ethernet based on the required scenario:

- Connection of the XRC to a host (PC or laptop) for local communication for configuration or monitoring purposes
- Connection of the XRC to a network for remote communication and management. Connections are established using the default factory- defined TCP port (9999). The XRC factory configuration comes with the communication instance for this type of connection already instantiated.
- Connection to the XRC to a network for remote communication and management. Connections are established using a user-defined TCP port (not the default 9999). The XRC factory configuration does not come with the communication instance for this type of connection. The instance must be added, enabled, and configured with user preferences.



IMPORTANT NOTE: A TCP port is a logical port defined by the TCP/IP protocol to support several connections on a single physical Ethernet port. Customers can add additional communication instances to handle non-default ports and other protocols over the Ethernet port.

3.4.1 Enable Ethernet for local point-to-point connection with a host

This procedure assumes the following:

- The local connection to the XRC through the Ethernet port is temporary and for monitoring or configuration purposes.
- The XRC has its default factory Network configuration intact.
- The PC or laptop has Windows 7 as its operating system.

i

IMPORTANT NOTE: The local connection can use private IP addressing for the point-to-point communication between the XRC and the PC or laptop. The XRC has a default private network IP address already assigned from the factory (169.254.0.11). The PC or laptop must be configured to obtain its own IP address automatically. When setup for automatic addressing, when the laptop connects to the enabled XRC Ethernet port, it automatically configures a compatible IP address.

For additional details on the IP addressing setup for the PC or laptop click **Help** from the **Network** screen.

To enable and setup the Ethernet port:

1. Establish a local connection to the **Entry** screen as described in section 3.3, *Establishing initial local communication*.
2. Connect the XRC Ethernet port to the PC or laptop Ethernet port with a crossover Ethernet cable
3. Select **Communications**> **Network** tab from the navigation tree. The Network screen displays with options to configure the Ethernet port or Network Adaptor (Figure 46).
4. In the Network ID value field type the Network ID.
5. Set **Network Adaptor** to **Enable**.

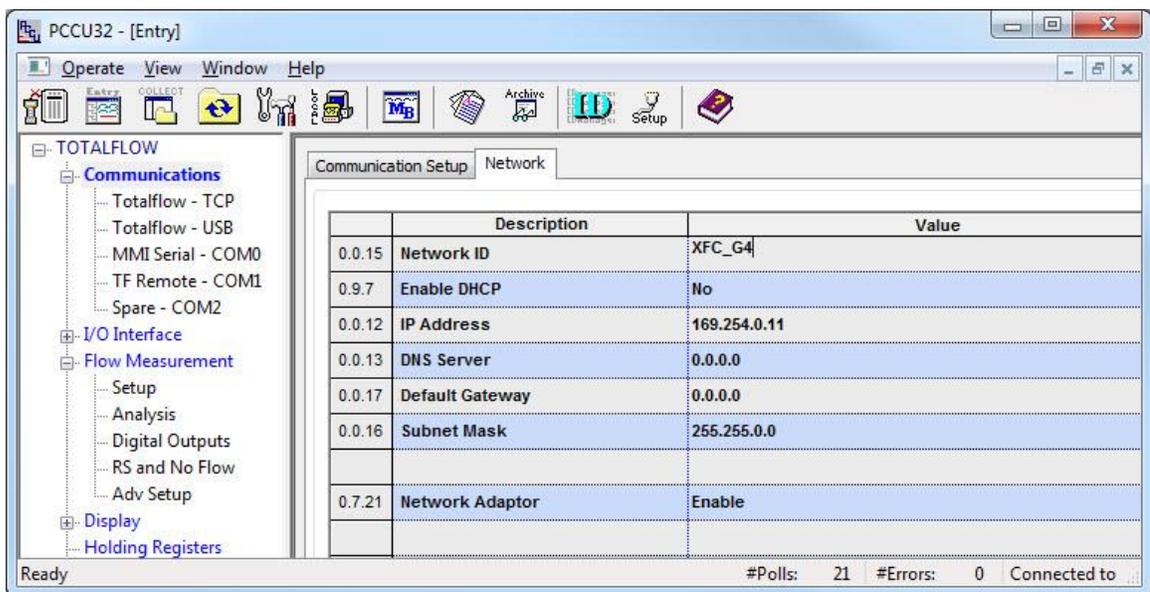


Figure 46: Network ID setup

6. Click **Send**.
7. Click **OK** to confirm changes.
8. On the navigation tree, select **Communications** > **Totalflow/TCP**>**Setup** tab to view or change additional port parameters (Figure 47). The default protocol enabled on the port is **Totalflow/TCP**.

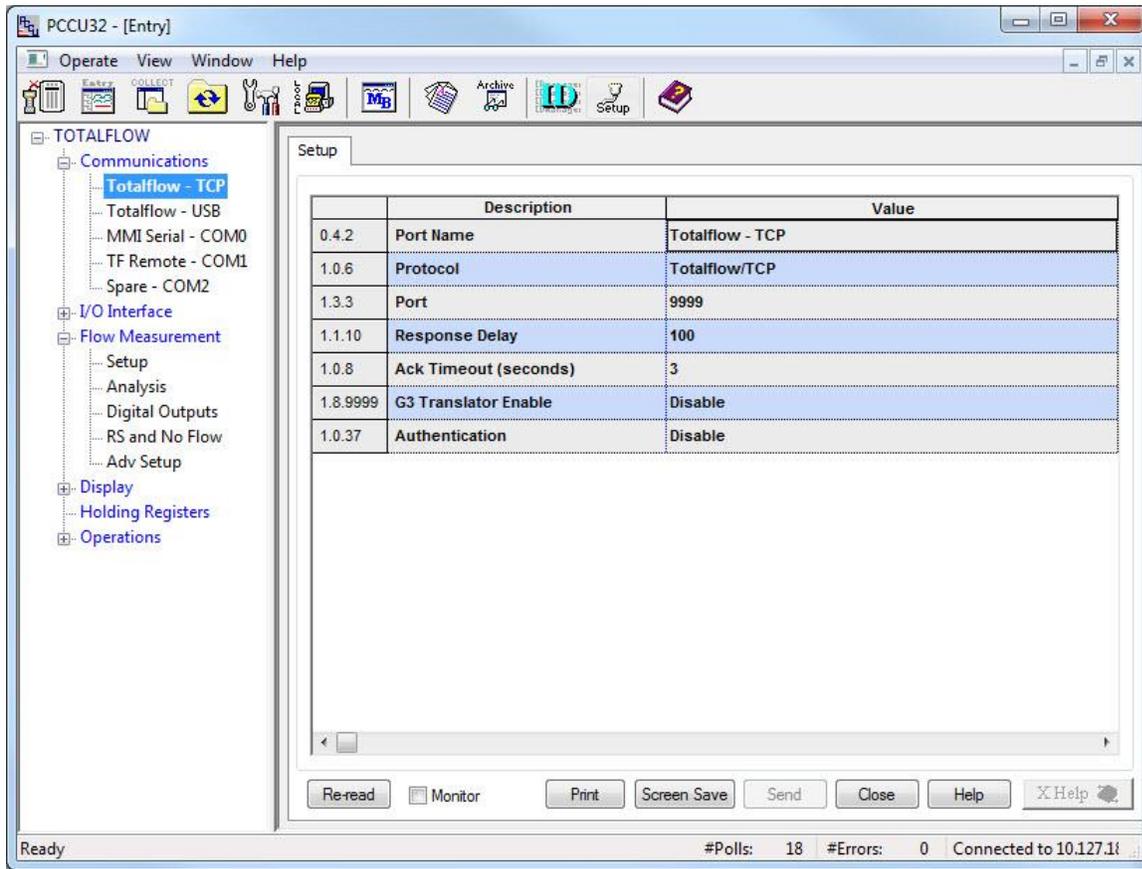


Figure 47: Communication setup for Totalflow /TCP protocol (default TCP port)

9. Click **Send** to save changes.
10. Open the door to the flow computer.
11. Press the Reset button on the board. This restarts the XRC with the Ethernet port enabled. The current PCCU connection to the XRC over the serial or USB port may terminate as the XRC resets.
12. When the XRC completes its startup sequence, connect to the XRC using Ethernet as described in section 3.4.2, *Establish local point-to-point connection over Ethernet*.

3.4.2 Establish local point-to-point connection over Ethernet

To establish an Ethernet connection:

1. Make sure the Ethernet cable is connected to both the XFC and laptop Ethernet ports.
2. Restart PCCU.
3. Click **Setup** from the toolbar. The **Setup** screen for communication displays (Figure 48).

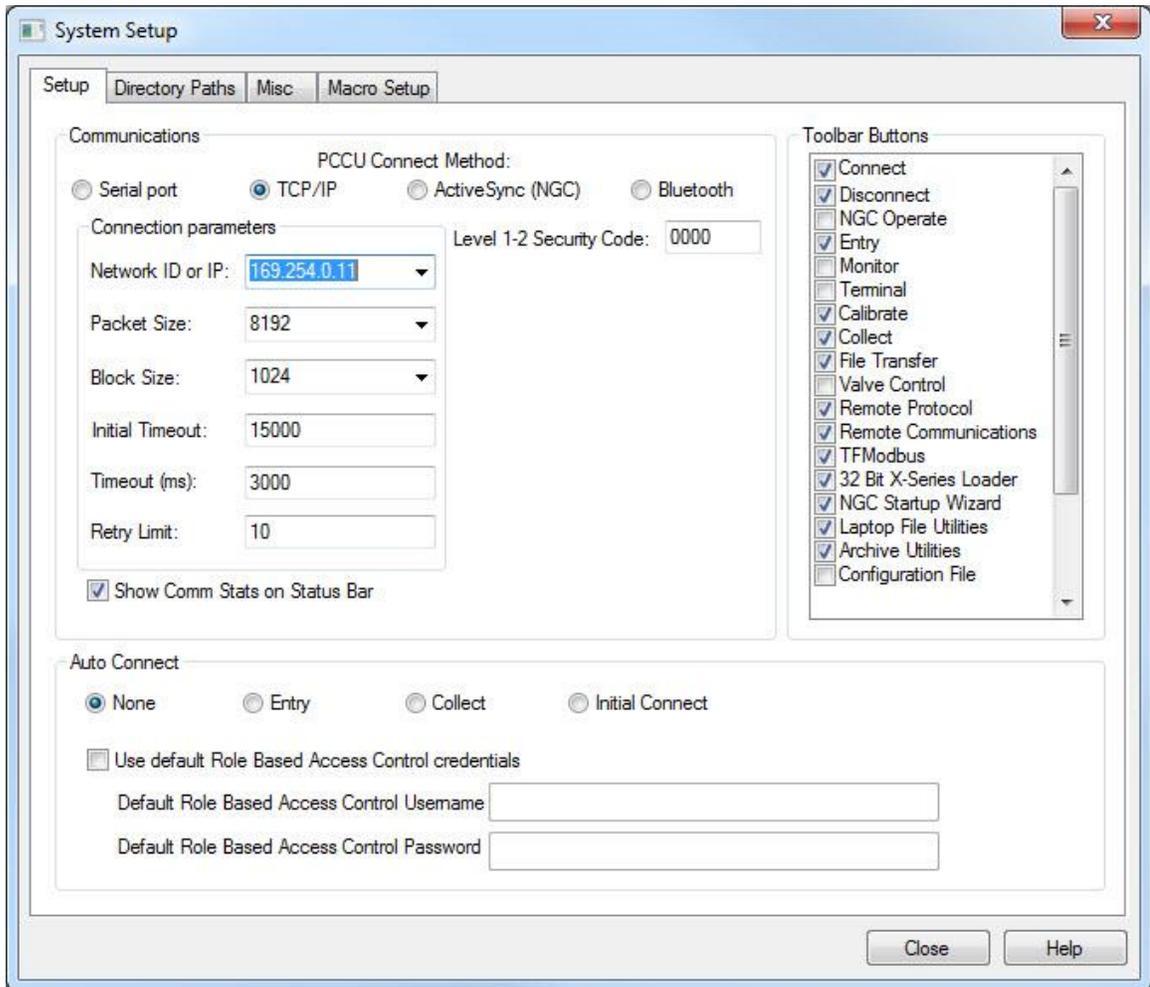


Figure 48: Set up TP/IP communication over Ethernet

4. Under Communications, select **TCP/IP** as the PCCU connect method.
5. In the Network ID field type either the Network ID or the IP address of the device (169.254.0.11).
6. Click **Close** to exit setup and return to the PCCU main screen.
7. Click **Entry** from the toolbar. When the Entry screen displays, the connection over Ethernet is successful.
8. Click **Close** to exit connection or continue to use the Ethernet connection for further configuration of the XRC.

3.4.3 Enable and configure Ethernet for network connection with hosts

Connecting the XRC to a network requires the configuration of valid IP parameters, such as the IP address, gateway and subnet mask. IP parameter configuration is either manual (static addressing) or automatic (dynamic addressing):

- For manual configuration, obtain IP parameters (static addresses) from your IT administrator and type the values in the required fields. Static addresses are permanent and remain in the device unless configuration is changed. The IP address must be unique (reserved for the device).
- For automatic configuration, enable DHCP. The XRC auto-populates the values in the required fields. This addressing mechanism requires that the network connection is active and that a DHCP server on the corporate network is active. If the flow computer is unable to connect to a DHCP server, it will not be able to configure its IP address and hosts will not be able to connect to the XRC.

To enable and configure Ethernet:

1. Establish a local connection to the Entry screen as described in section
2. Connect the XRC Ethernet port to the network equipment (switch) with the Ethernet cable.

3. Select **Communications> Network** tab from the navigation tree. The Network screen displays with options to configure the Ethernet port or Network Adaptor (Figure 49).
4. In the Network ID field, type a name that helps to identify the device uniquely.
5. Set **Network Adaptor** to **Enable**.
6. Configure the IP parameters. Select one of the options based on your addressing method.
 - a. If using DHCP for dynamic addressing, set **Enable DHCP** to Yes (Figure 49). Leave the additional default IP configuration intact as it will auto-configure after Ethernet is activated.

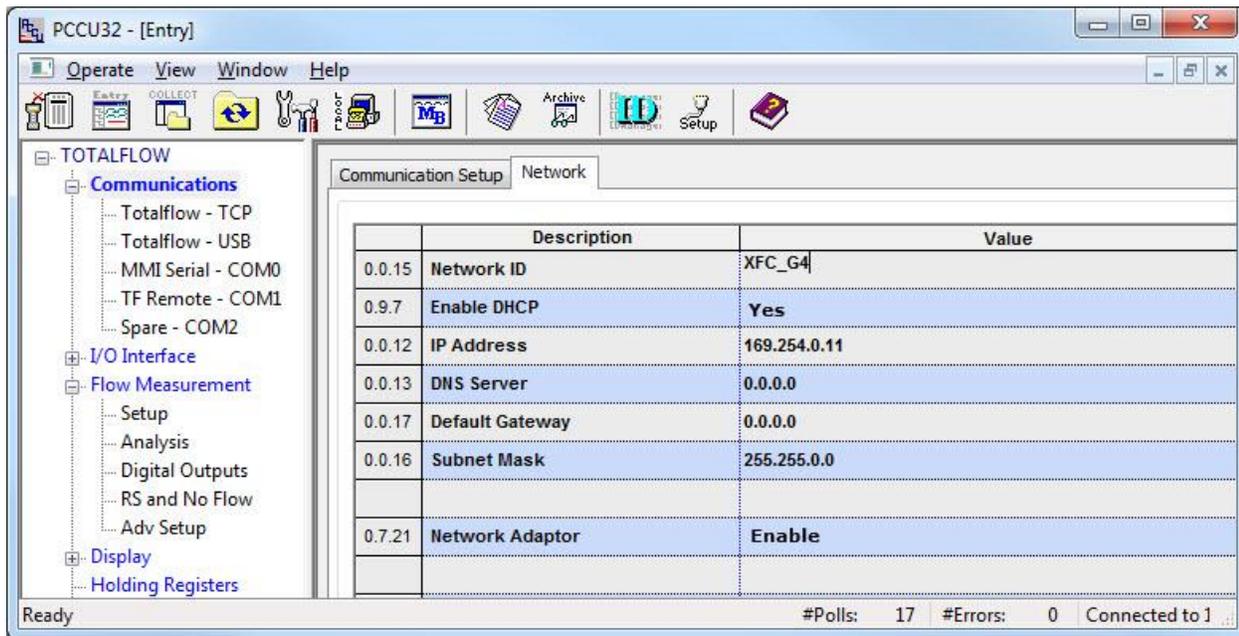


Figure 49: Network tab: Enable DHCP for dynamic addressing

- b. If using static addresses, make sure to set **Enable DHCP** to **No** (Figure 50). Type the IP Address, Subnet Mask, and Default Gateway, provided by the IT administrator.

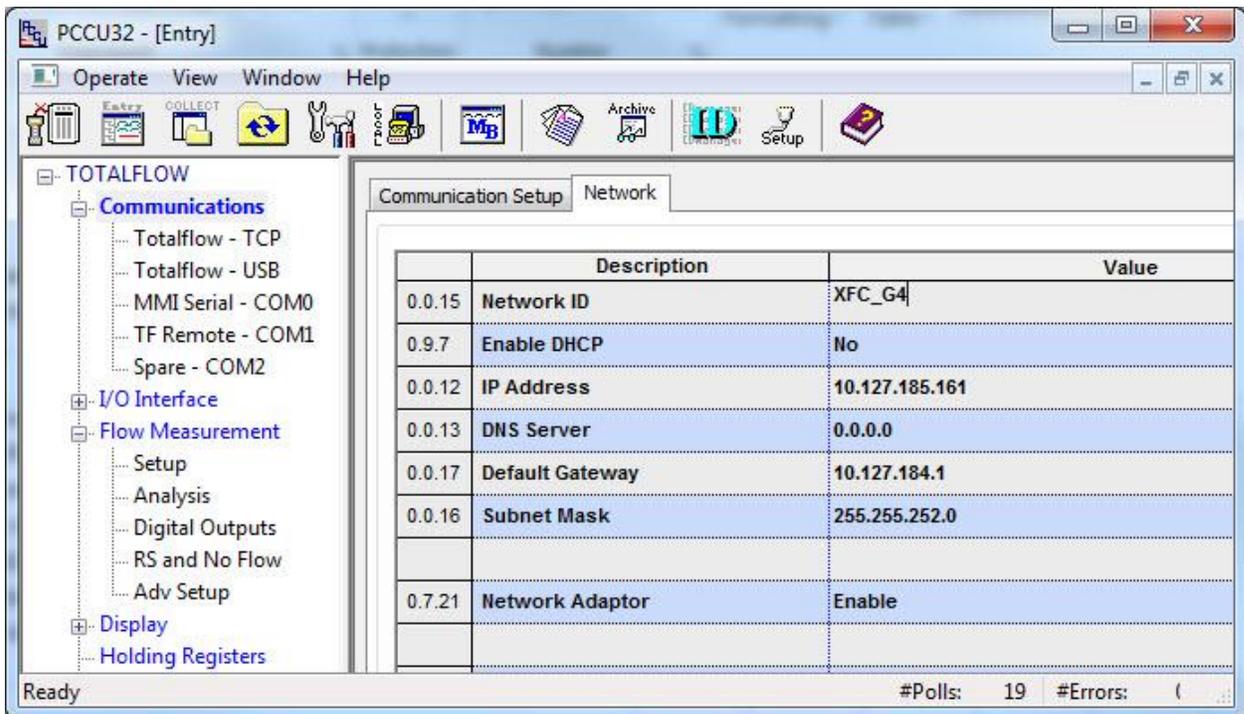


Figure 50: Network tab: Configure static IP addresses

7. Click **Send** to save configuration.
8. Click **OK** to confirm the changes.
9. Open the door to the flow computer.
10. Press the Reset button on the board. This restarts the XRC with the Ethernet port enabled. The current PCCU connection to the device will terminate as the XRC restarts.
11. When the XRC completes its startup sequence, restart PCCU and select the **Entry** icon to connect again.
12. If DHCP is enabled verify that the IP parameters display (the fields should have auto-populated). Take note of the IP address assigned to the XRC.
13. If the parameters do not display, the XRC was not able to obtain the parameters from the DHCP server:
 - a. Verify that the Ethernet cable is plugged correctly to the network equipment.
 - b. Ensure that the connection to the corporate network is active.
 - c. Contact the IT administrator to verify that the DHCP server on the corporate network is running and available.
 - d. If unable to use DHCP, obtain IP addresses and configure the XRC manually.
14. Click **Close** to terminate the connection over the serial or USB port.
15. Connect to the XRC over the network as described next in section 0,

17. Establish network connection over Ethernet (using default TCP port).

3.4.4 Establish network connection over Ethernet (using default TCP port)

This procedure assumes that the host (PC or laptop) has a valid IP configuration, is connected to the corporate network, and the connection is established remotely.



NOTE: If establishing this connection on site (able to connect both the XFC and the PC to a local Ethernet switch), make sure that the laptop has a compatible IP configuration. Both, the IP address of the PC and the XFC must be on the same IP subnet for communication to work.

For additional details on the IP addressing setup for the PC or laptop, click **Help** from the **Network** screen.

To establish a network connection:

1. Make sure the XFC is connected to the network equipment (switch).
2. Start PCCU.
3. Click **Setup** from the toolbar. The **Setup** screen for communication displays (Figure 51).
4. Under Communications, select **TCP/IP** as the PCCU connect method.
5. In the Network ID field type either the Network ID or the IP address of the device. Use the static address manually configured or the address obtained by DHCP.
6. Click **Close** to exit setup and return to the PCCU main screen
7. Click **Entry** from the toolbar. When the Entry screen displays, the Ethernet connection over the network is successful.

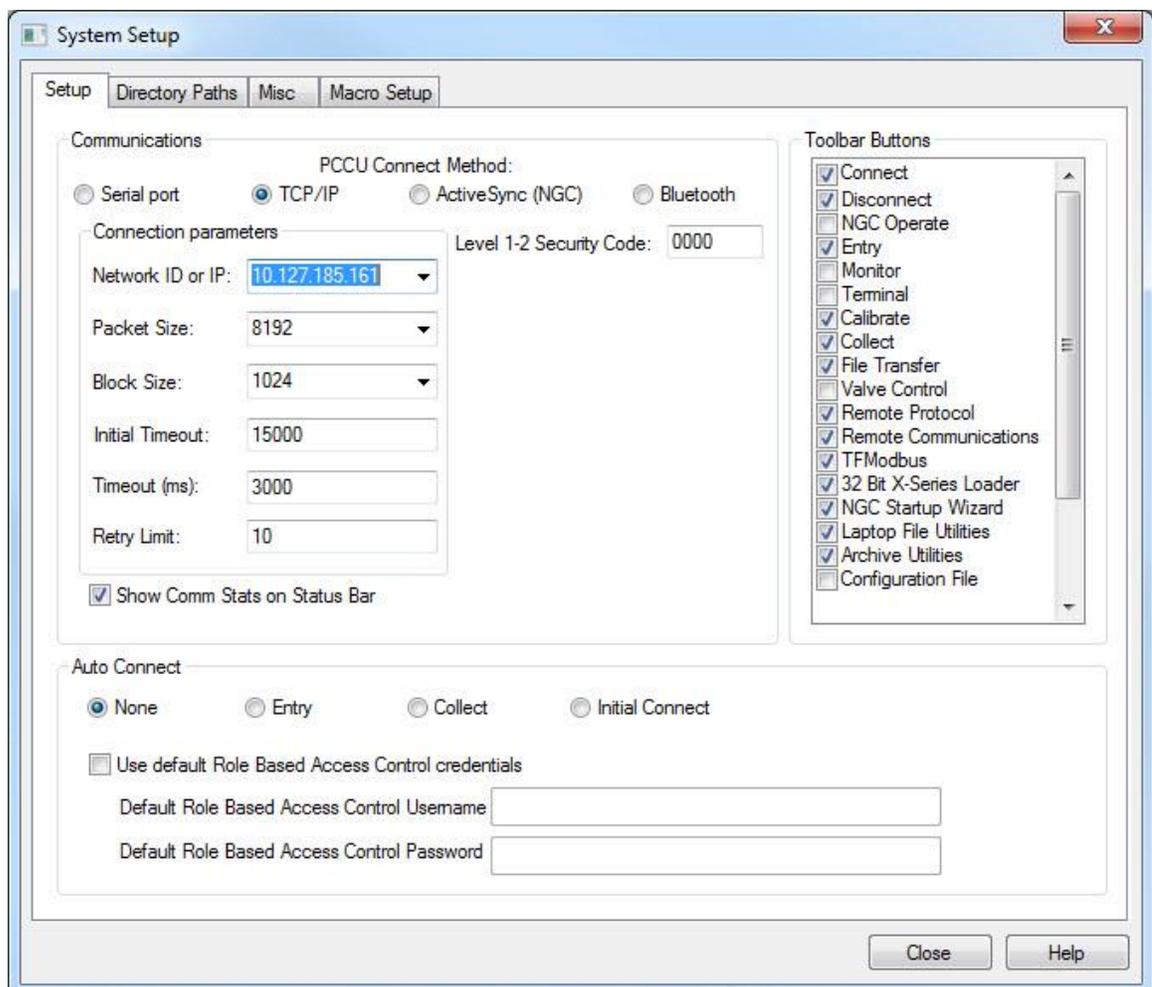


Figure 51: Setup of the network connection over Ethernet

3.4.5 Add and configure additional communication instances for Ethernet

The default Ethernet port configuration supports connections on TCP port 9999. This port value is read-only. To support connections using another TCP port, add a new communication instance for Ethernet and configure the desired port number.

3.4.5.1 Add communication instance

1. Establish local communication as described in section 3.3, *Establishing initial local communication*.
2. On the navigation tree, select the station name (top node on the tree, default name TOTALFLOW).
3. Click the **Application and Licensing** tab.
4. Click **Add App**. The Add New Application dialog box displays.
5. In the **Applications to add** drop down list, select **Communications**.
6. Click **OK**.
7. Verify that Communications show in the application list.
8. Click **Send**.
9. Verify that that the communication application displays in the navigation tree. The communication application instance displays a generic name and it displays at the bottom of the communication applications. Configure the protocol, change the name and configure the TCP port next.

3.4.5.2 Configure the new communication instance

1. On the navigation tree, select the new communication instance. The **Setup** tab displays.
2. Select the **Protocol** value field and select **Totalflow/TCP** from the drop down list.
3. Click **Send**.
4. On the navigation tree verify that the communication instance name changes to **Totalflow/TCP**.
5. Select the instance, the lower **Totalflow/TCP**. The **Setup** tab displays.
6. In the Port Name value field, type a name to uniquely identify the port or communication instance. For example to identify the TPC port, use TCP 9998. The port will not be confused with the default Totalflow/TCP
7. Click **Send**.
8. At the warning, click **Yes** to confirm and save changes
9. Click **Re-read** to verify that the user-defined name of the communication instance displays on the navigation tree (in this example the instance displays as TCP 9998). Make sure the configuration on the setup tab is correct.

3.4.6 Establish a network connection over Ethernet (using non-default TCP port)

This procedure assumes that the host (PC or laptop) has a valid IP configuration, is connected to the corporate network, and the connection is established remotely.



NOTE: If establishing this connection on site (able to connect both the XRC and the PC to a local Ethernet switch), make sure that the laptop has a compatible IP configuration. Both, the IP address of the PC and the XR must be on the same IP subnet for communication to work.

For additional details on the IP addressing setup for the PC or laptop, click **Help** from the **Network** screen.



NOTE: If the XRC is connected to a router or cell modem at the site, enable port forwarding on the router/cell modem. Ensure that the TCP port number configured in the XRC is also configured in the router. The connection will be established through the router/modem. Contact technical support for more details.

To establish a network connection:

1. Make sure the XRC is connected to the network equipment (switch).

2. Start PCCU.
3. Click **Setup** from the toolbar. The **Setup** screen for communication displays (Figure 52).
4. Under Communications, select **TCP/IP** as the PCCU connect method.
5. In the Network ID field type configure one of the following:
 - a. The address of the XRC and the TCP port for the connection (in the following format: xxx.xxx.xxx.xxx/TCP port number).
 - b. The IP address of the onsite router/cell modem and the TCP port for the connection (in the following format: xxx.xxx.xxx.xxx/TCP port number).

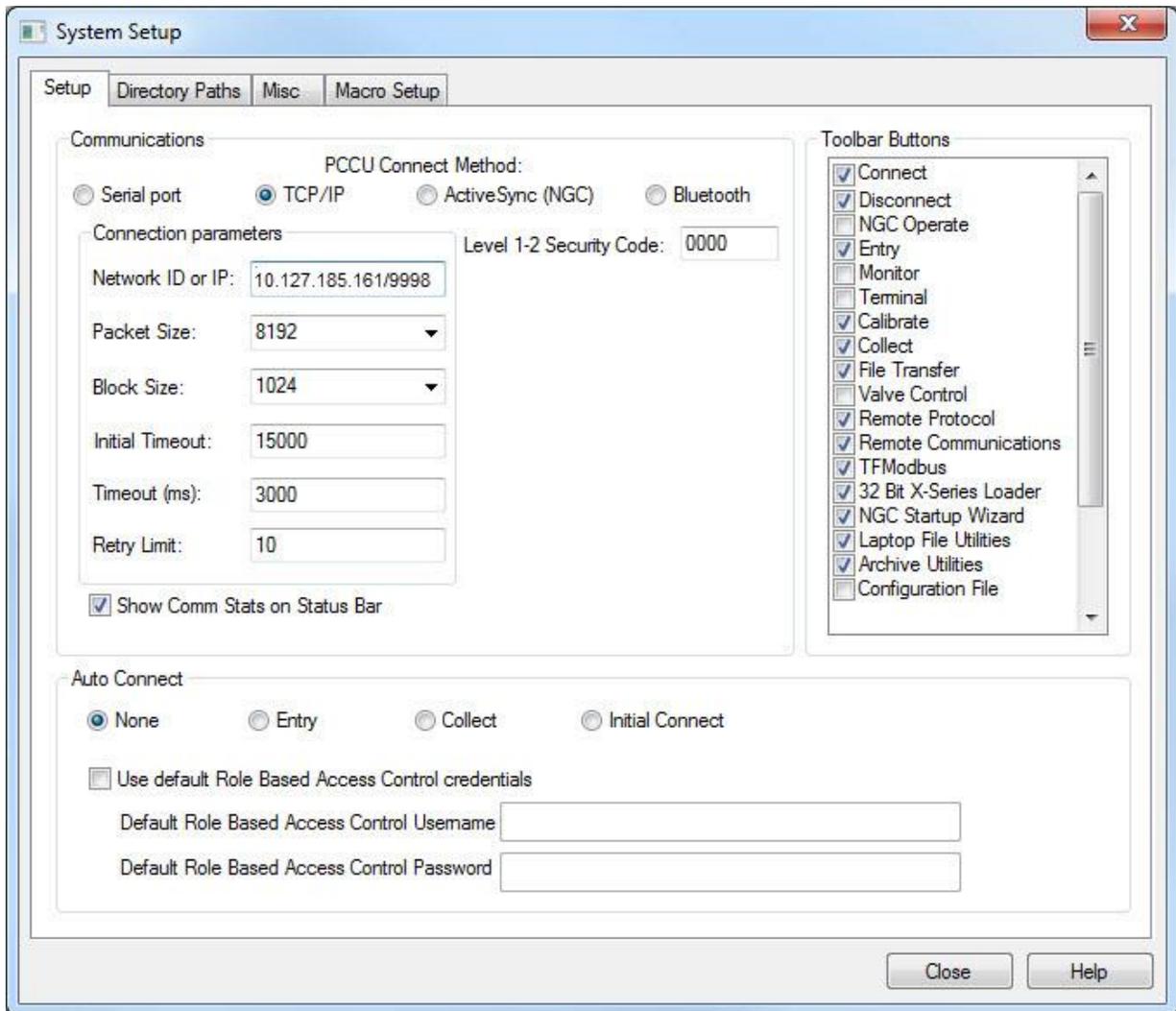


Figure 52: Connection setup over Ethernet using non-default TCP port

6. Click **Close** to exit setup and return to the PCCU main screen
7. Click **Entry** from the toolbar. When the Entry screen displays, the Ethernet connection over the network is successful.

3.5 Setting up the XRC^{G4}

As previously instructed, once physically connected to the XRC^{G4}, the user instructs the host software to connect to the device. At this time, the software will actually read the device default values programmed at the factory. These preset values are based on the type of product ordered and are programmed for the most widely used configuration.

Depending on the programming device used, the following are the minimum required entries. Specific information required to complete each step (depending on the equipment choice) is discussed in the PCCU32 help files.

3.5.1 Station ID

The station identifier code should uniquely identify one station from that of others. If running a multiple tube station, the station ID is the same for all tubes on that XRC^{G4}. If left blank on a single tube device, it will be the same as the device ID.

Description	Format	Note
Station ID	XXXXXXXXXX	10-digit alphanumeric

3.5.2 Device ID / Application ID

The device identifier should uniquely identify each application or tube on a multi-tube device. On a single tube installation, the identifier code should uniquely identify one XRC^{G4} from that of others and will be the same as the station ID.

Description	Format	Note
Device/ Application ID	XXXXXXXXXX	10-digit alphanumeric

3.5.3 Location

In WinCCU, the host software, the location field can hold up to 24 alphanumeric characters to describe its location. An example could be the county name or road number.

Description	Format	Note
Location	XXXXXXXXXX	24-digit alphanumeric



NOTE: There are additional fields stored in WinCCU for uniquely identifying the meter, including fields for entering the lease holder, producer, operator and buyer. These fields reside on the host computer in the ID manager, not in the XRC^{G4}.

3.5.4 Date/Time

The XRC^{G4} date and time must be set correctly and should agree with the collection equipment, if measurement tubes are instantiated. Selecting to update the unit with the PCCU date and time will update those fields. They are not editable.

Description	Format	Note
Date	MM/DD/YYYY	2-digit Month and Day, 4 digit year
Time	HH:MM:SS	24 hour clock

3.5.5 Program display

The XRC^{G4} comes from the factory with a set of default displays as shown below in Table 12. By default, each display item remains on the display for 5 seconds. This default can be changed to zero (item not displayed) or any value from 1 to 255 seconds. Engineering units can also be changed, as well as the data format for display purposes.

If the station is configured for measurement tubes or other applications, additional items will be scrolled.

Table 12: XRC^{G4} displayed items

Description	Format	Note
DATE/TIME	MM/DD/YY HH:MM:SS	24 hour clock
BATTERY	NN.N VOLTS	Battery Voltage Volts
CHARGER	NN.N VOLTS	Charger Voltage
STATION ID	XXXXXXXXXX	10 Character alphanumeric identifier
DEVICE ID	XXXXXXXXXX	10 Character alphanumeric application or tube identifier

3.5.6 Bi-Level security system

Data and configuration security in the XRC is spread across two elements: the hardware (XRC^{G4}) and the software (PCCU32 and WinCCU32).

The meters (XFC, XRC, or μ Flo) have a security switch (S1) on the electronic boards. Password security is bi-level: read only (security code level 1), or read/write (security code level 2). The security switch (S1) only controls security through the local PCCU connection. If the security switch is on, PCCU32 will be required to have the proper level of access. If the security switch is turned off, PCCU32 will have full access to the meter (even to change the security codes).

3.5.6.1 Meter security

To establish meter security:

1. Have the security switch in the OFF position.
2. Connect locally with PCCU32.
3. Enter a four digit number for level 1 and level 2 security codes (see Figure 54).

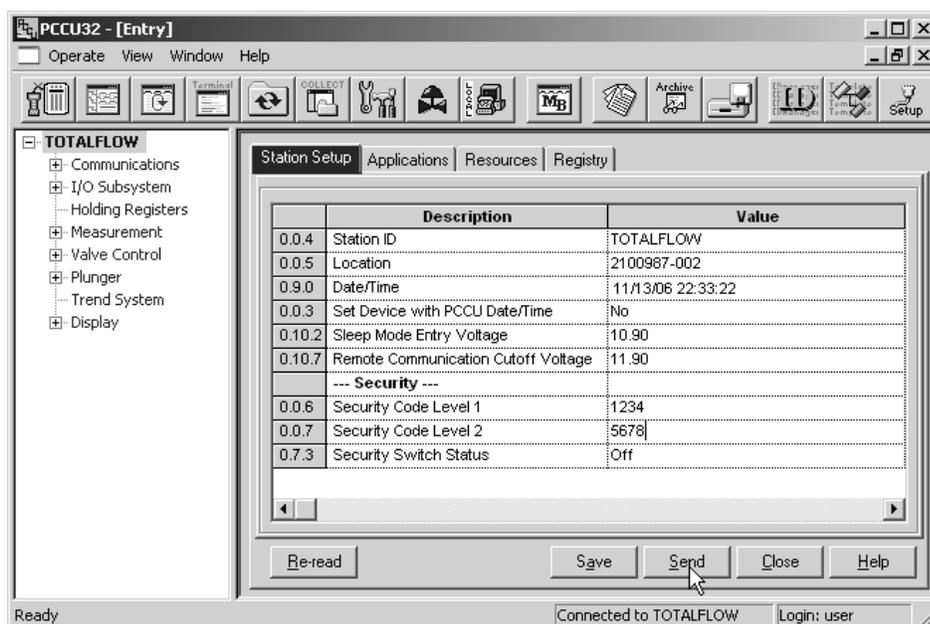


Figure 53: Meter setup and security screen

4. Click **Send**.

Turning the security switch (S1) on will activate the security codes. The level 1 code (example above: '1234') will allow data and configuration values to be read, but not altered. The level 2 code (example above: '5678') will allow full access to read and to write.

These security codes must be entered into PCCU32 and WinCCU32 to provide appropriate access to the meters. However, WinCCU32 will always need the proper security code, regardless of the position of the security switch (S1). Turning the security switch off does not allow unprotected access by a WinCCU32 operator.



NOTES: If the security level is breached, the meter will give no indication. Any data the operator attempted to change will simply remain unchanged.

There are additional fields stored in WinCCU for uniquely identifying the meter, including fields for entering the lease holder, producer, operator and buyer. These fields reside on the host computer in the ID manager, not in the XRC^{G4}.

3.5.6.2 PCCU32 security

Accessing the meter with PCCU32, when the security switch (S1) is activated, requires the appropriate security code be entered.

1. To enter the security code, go to the System Setup menu in PCCU32. In the example (Figure 54), the operator has read-only access to the meter.

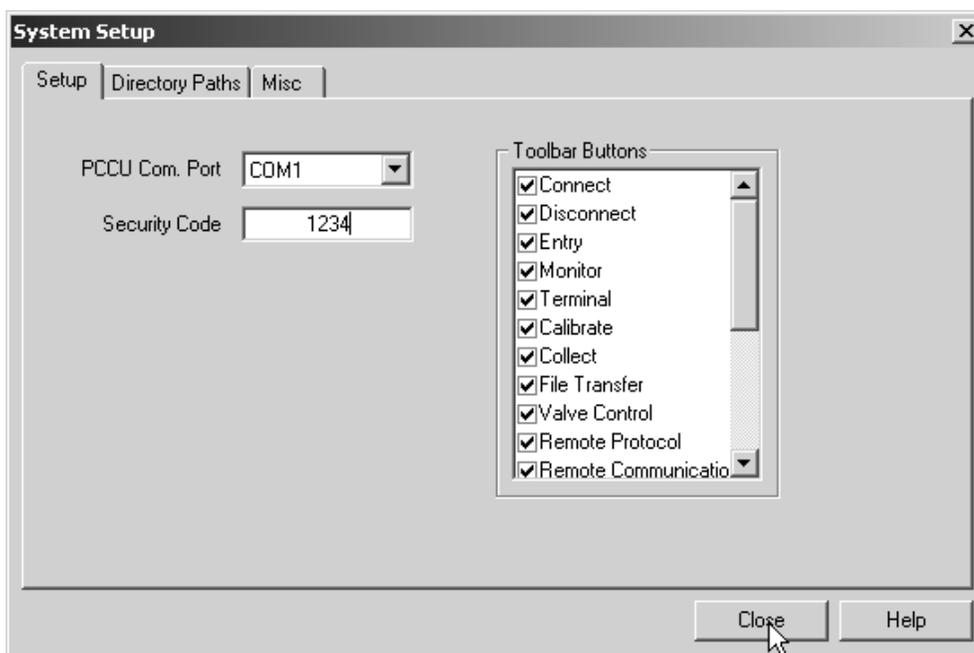


Figure 54: PCCU32 Security Code setup

A security code level 1 (below example) of '1234' will provide read only access to the meter. A security code of '5678' would give the operator full read and write access to the meter.



NOTE: If the security level is breached, the meter will give no indication. Any data the operator attempted to change will simply remain unchanged.

3.5.6.3 WinCCU32 security

Accessing the meter with WinCCU32, regardless of the device security switch (S1) setting, requires the appropriate security code.

1. Highlight the appropriate meter, and click **Edit ID**.
2. Enter the four-digit Security Code (Figure 55) for that meter.



NOTES: Entering a security code level 2 (previous example) of '5678' gives the WinCCU32 operator full read and write access to the meter.

There are additional fields stored in WinCCU for uniquely identifying the meter, including fields for entering the lease holder, producer, operator and buyer. These fields reside on the host computer in the ID manager not in the XRC^{G4}.

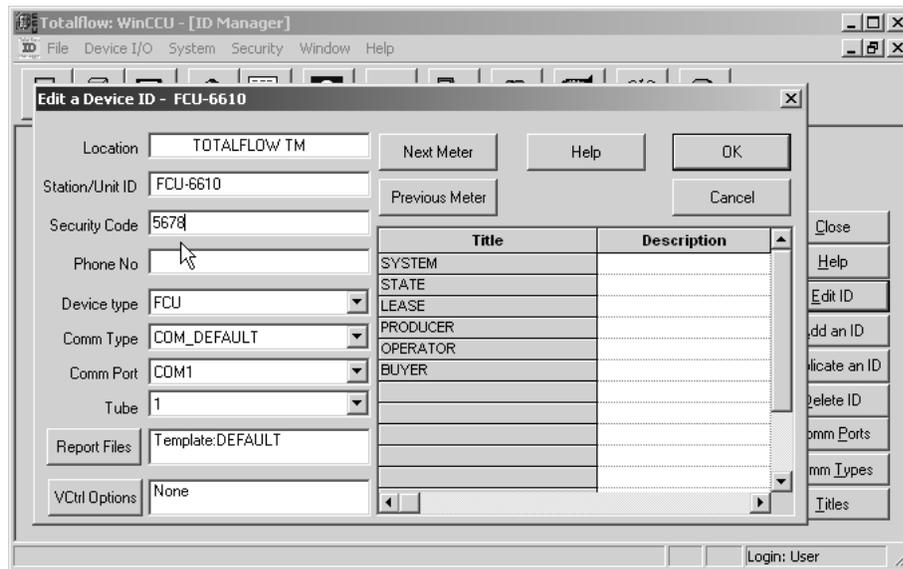


Figure 55: WinCCU32 Security Code entry in meter ID



NOTE: MODBUS[®] access to the meters is not protected by the security codes.

3.6 Application licensing credit key

3.6.1 Credit key driver installation

3.6.1.1 Step-by-step instructions

1. The credit key is very easy to install on a computer. Simply plug the USB credit key into an available USB port.
2. The Windows[®] operating system will recognize the credit key as new hardware and attempt to install the appropriate driver with the *Found New Hardware Wizard*.
3. Click **Next**.
4. It may be necessary to point the wizard to the PCCU32 directory. In the *Files Needed* screen, select **Browse** and locate the driver (*usbkey.sys*) in the PCCU32 directory.
5. Once located, click **OK**.
6. Software driver installation will commence.

7. When installation is complete, click **Finish**.



NOTE: If the user inserts the credit key in a different USB port on the computer, it will need to be installed for that new USB port. In other words, the credit key must be installed on each available USB port if not using the same USB port each time.

3.6.2 Access and view the credit key

To access and view the credit key use PCCU32 7.0 (or later). The credit key is a secure device only accessible through PCCU32.

3.6.2.1 Step-by-step instructions

1. Install the credit key in an available USB port.
2. Open PCCU32 and disconnect from the unit, if connected.
3. Go to the Credit Key License Utility (**Operate > File Utilities > Credit Key License Utility**).



NOTE: To go to the *Credit Key License Utility*, the computer cannot be connected to the G4 meter or controller. Simply have PCCU32 running and the initial Totalflow screen displayed.

4. When the *Credit Key Status and Update Utility* screen opens, click **Load** to view available credits on the USB Key (Figure 56).

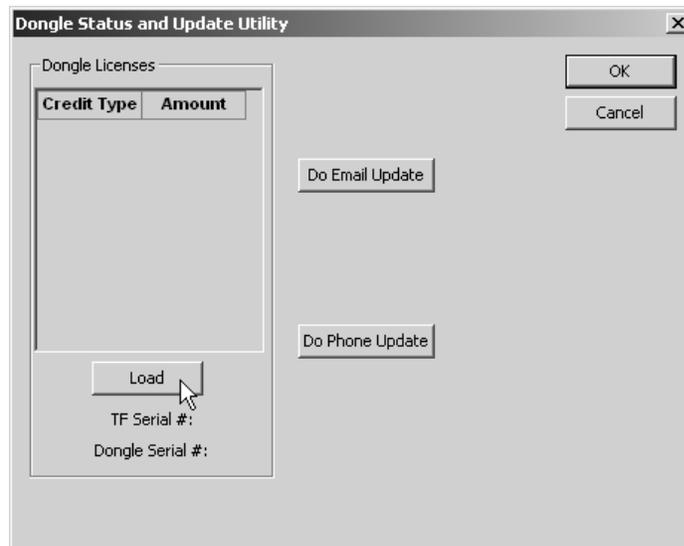


Figure 56: Loading credit key status

In this instance (Figure 57), the credit key has 30 general credits, 3 IEC credits, 3 CO2 credits and 2 HCDP credits.

Use this same dialog box to add more credits to the credit key.

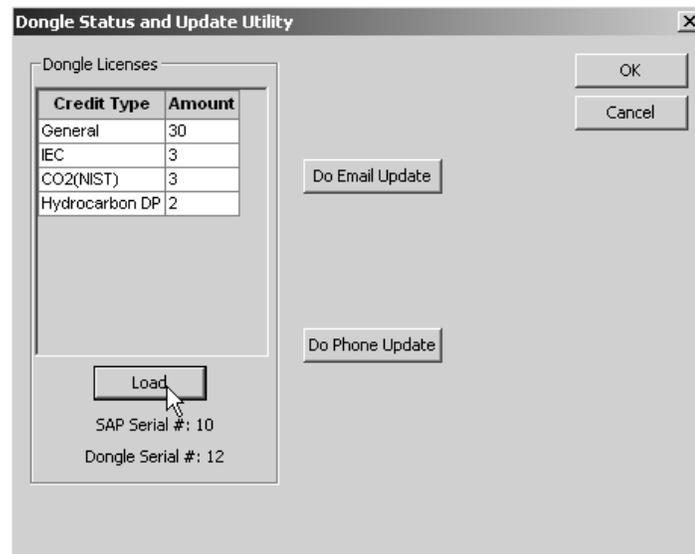


Figure 57: Loaded credit key status

3.6.3 Adding credits to the credit key by telephone

Credit keys ordered from Totalflow come with a specified number of the various credits; however, more or different credits may be needed in the future.

1. Open PCCU32 7.0 (or later), but do not connect to the unit.
2. Go to the credit key License Utility (**Operate > File Utilities > Credit Key License Utility**).
3. Insert the credit key into an available USB port.
4. Select **Do Phone Update** (Figure 58).

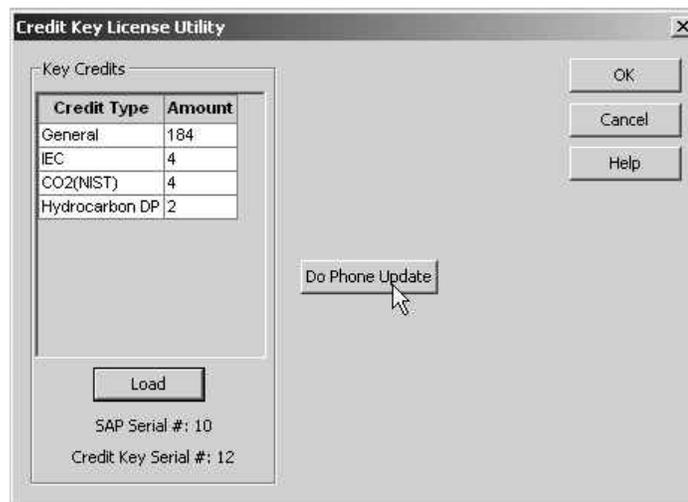


Figure 58: Credit key telephone update

5. The user will be asked to call Totalflow Order Entry, and insure that the credit key is plugged in.



NOTE: If the user inserts the credit key in a different USB port on the computer, it will need to be installed for that new USB port. In other words, the credit key must be installed on each available USB port if not using the same USB port each time.

6. Click **OK** when connected with an Order Entry clerk.

- The clerk will ask for the five (5) encrypted codes that appear directly beneath *Do Phone Update*. Read them from top to bottom (Figure 59).

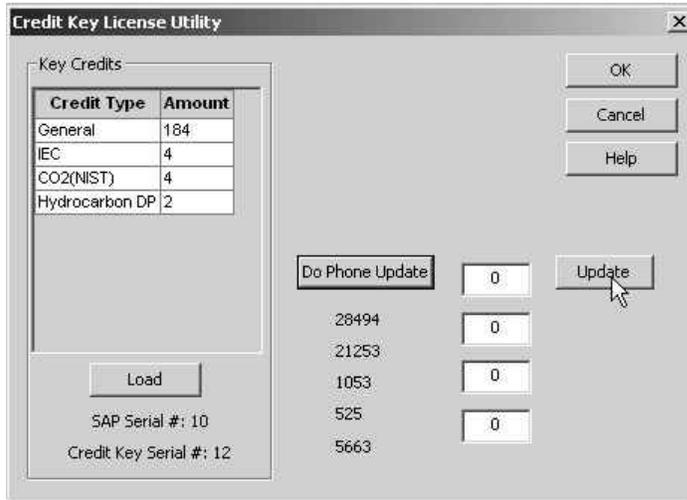


Figure 59: Application credit entry screen

- The clerk will give four codes to enter in the fields to the immediate right.
- After the proper codes have been entered (from top to bottom), click **Update**.
- Upon clicking **Update**, three more codes will be displayed directly beneath *Do Phone Update* (Figure 60).

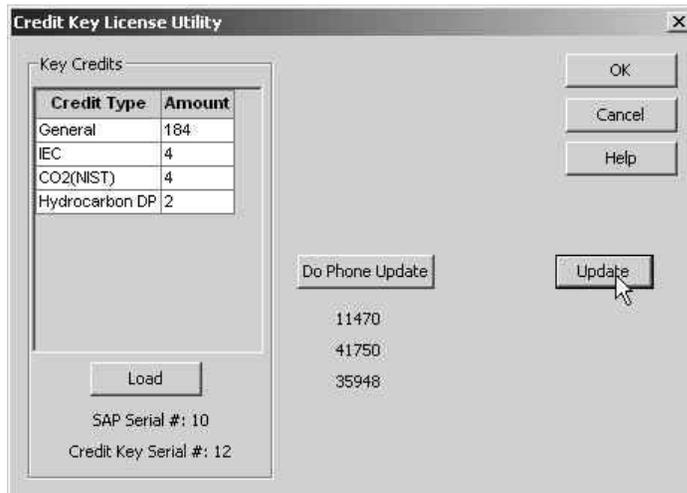


Figure 60: Application Credit Verification Codes

- The Totalflow representative will ask for the three codes to verify that the credits have been properly written to the credit key.
- When finished, click **Update**.

3.6.4 Transferring credits from credit key to device

Credits can be transferred to the XRC^{G4} device. The user selects the type of credit and the amount of those credits to be transferred.



NOTE: If XRC^{G4} has a surplus of credits, these credits can be transferred to the credit key to be used on other meters. See section 3.6.5, *Transferring credits from device to credit key* later in this section.

To transfer application credits to the G4 device, connect to the G4 unit with PCCU32 7.0 (or later).

1. Go to the **Application Licensing** tab.
2. Install the credit key in an available USB port.
3. Click **Load** to view available credits.



NOTE: This screen shows the licensing status of the G4 meter/controller as well as the available credits on the credit key. The left pane shows the type and amount of the available credits on the credit key. The upper-right pane is for information only. It shows the various applications available and the type and amount of credit necessary to run the application. The standard credits (and four general credits) come with the purchase of the G4 unit. The lower-right pane displays the licensing status of the G4 unit. It shows what credits are in the machine, what credits are being used, and any surplus or deficit of credits. A surplus of credits is highlighted in green. A deficit of credits is highlighted in red.

4. Select **Transfer to Device**, located in the center of the screen (Figure 61).
5. Directly below, select the type of credit using the drop down menu.
6. Below that, select the number of credits to transfer.
7. Click **Transfer**.

Transferred credits should now appear on the lower right-hand side (Figure 62).

The screenshot displays the 'Application Licensing' interface. It is divided into three main sections:

- Key Credits:** Shows SAP Serial #: 10 and Credit Key Serial #: 12. A table lists available credits:

Credit Type	Amount
General	184
IEC	4
CO2(NIST)	4
Hydrocarbon DP	2
- Supported Applications:** A table listing applications and their required credit types:

Application	Credit Type
XMV Interface	1-General
LMV Interface	1-General
NGC Client	1-General
AGA-3 Measurement	1-General
AGA-7 Measurement	1-General
Trend System	1-General
Alarm System	1-General
Pulse Accumulator	1-General
Valve Control	1-General
Safety	1-General
- Device Credits:** A table showing the current state of credits on the device:

Credit Type	Used	Surplus	Deficit
General(non-removable)	2	2	
General(removable)	0	0	
IEC	0	0	
CO2(NIST)	0	0	
Hydrocarbon DP	0	0	

In the center, there are two radio buttons: **Transfer to Device** (selected) and **Transfer to Key**. Below them is a 'Type' dropdown menu set to 'General' and an 'Amount' dropdown menu set to '4'. A red circle highlights the 'Transfer' button.

Figure 61: Transfer to Device: type and amount

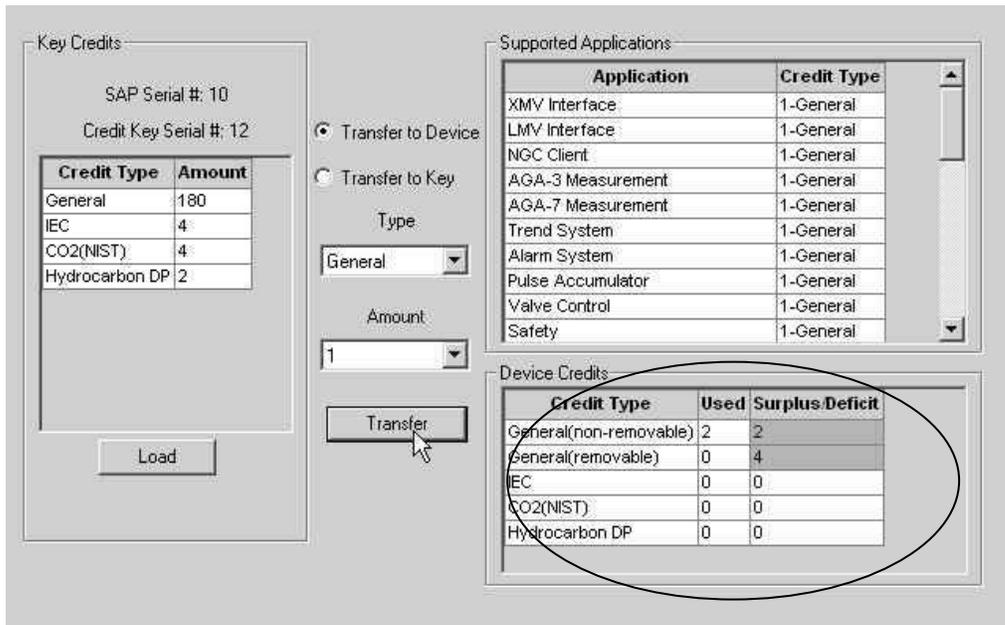


Figure 62: Transferred to Device application credits

3.6.5 Transferring credits from device to credit key

As has been mentioned before, excess credits (credits beyond what would be required to be fully licensed) can be taken from the G4 device and returned to the credit key to be used on other G4 meters.

Credits can be transferred from the device (G4). The user selects the type of credit and the amount of those credits to be transferred.



NOTES: If the XRC^{G4} has a surplus of credits, these credits can be transferred to the credit key to be used on other meters.

If the XRC^{G4} requires additional credits, these credits can be transferred from the credit key. See section 3.6.4, *Transferring credits from credit key to device* previously in this section.

To transfer application credits to the G4 device, connect to the G4 unit with PCCU32 7.0 (or later).

1. Go to the **Application Licensing** tab.
2. Install the credit key in an available USB port.
3. Click **Load** to view available credits.



NOTE: This screen shows the licensing status of the G4 meter/controller as well as the available credits on the credit key. The left pane shows the type and amount of the available credits on the credit key. The upper-right pane is for information only. It shows the various applications available and the type and amount of credit necessary to run the application. The standard credits (and four general credits) come with the purchase of the G4 unit. The lower-right pane displays the licensing status of the G4 unit. It shows what credits are in the machine, what credits are being used and any surplus or deficit of credits. A surplus of credits is highlighted in green. A deficit of credits is highlighted in red.

4. Select **Transfer to Key**, located in the center of the screen (Figure 63).
5. Directly below, select the type of credit using the drop down menu.
6. Below that, select the amount of credits to transfer.
7. Click **Transfer**.

The transferred credits should now appear on the left side of the screen (see Figure 64).

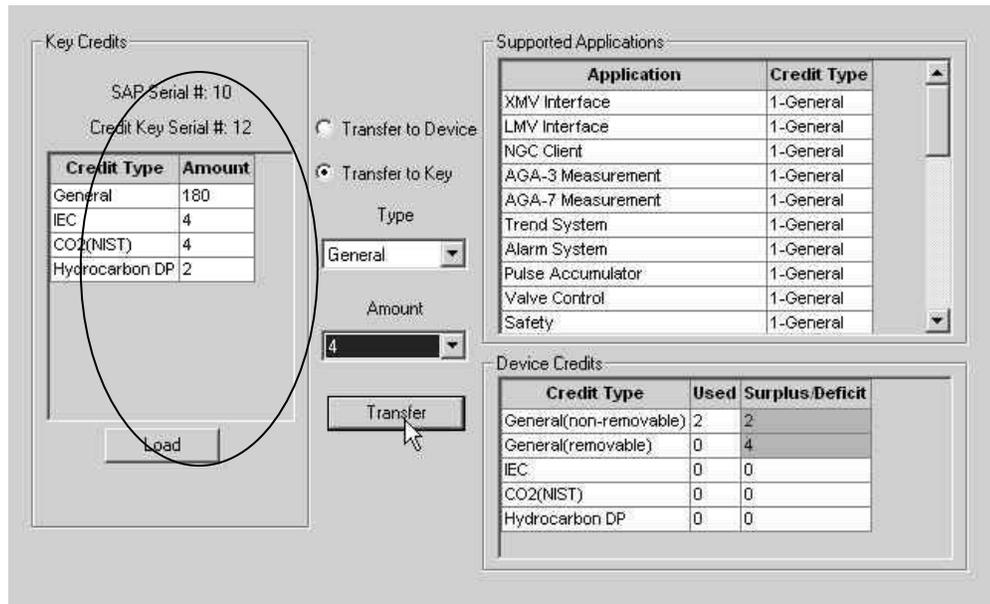


Figure 63: Transfer to credit key application credit selections

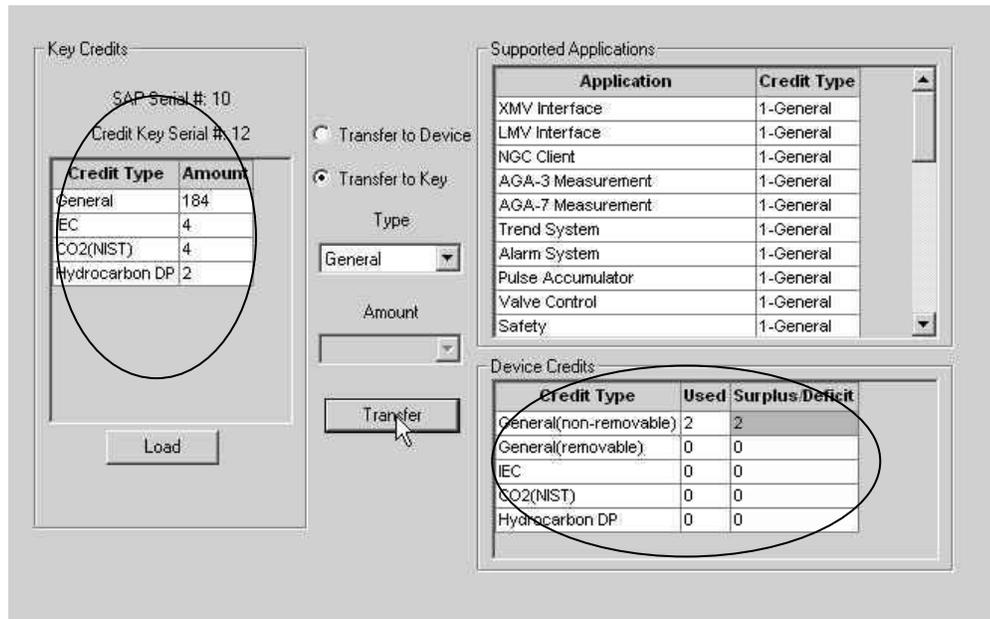


Figure 64: Transferred to credit key application credits

3.7 On-board I/O calibration

The calibration mode enables the calibration of the analog inputs, analog outputs and pulse inputs.

3.7.1 Hold mode

When calibrating, PCCU will instruct the XRC^{G4} to ignore live values for the period of time the XRC^{G4} is being calibrated. This prevents real-time XRC^{G4} calculations from being affected during the calibration. During this time, the XRC^{G4} uses the last known value at the time calibration mode was entered (This is called the *HOLD* mode). To exit the hold mode, perform any of the following:

- Unplug the DATA cable at the XRC^{G4} connector
- Exit Calibration mode

3.7.2 Analog input calibration

The Totalflow XRC^{G4} comes standard with five analog inputs on the XRC^{G4} board (see Figure 65: *XRC^{G4} board- analog input calibration points*). As the user enters calibration, the XRC^{G4} enters the hold mode and displays the current values.

The *Current Values* section will display the current values continuously by checking the *Update* box. When different analog inputs are selected, their assigned register numbers are displayed on the top of the screen.

Follow the instructions in the PCCU32 Help files for specific software steps. Generally, the user needs to complete the following procedures.

3.7.2.1 Step-by-step instructions

1. From the Local Connect screen in PCCU32, select **Calibrate**.
2. Connect an accurate power source capable of 1 - 5 Volts or 4 – 20 mA to the AI terminals to be calibrated (see Figure 65). Make sure the jumpers on the termination panel are in the 4 – 20 mA position, if a 4 -20 mA source is used. This puts a 250 Ohm resistor across the terminals to convert the 4 – 20 mA to 1 - 5 Volts.

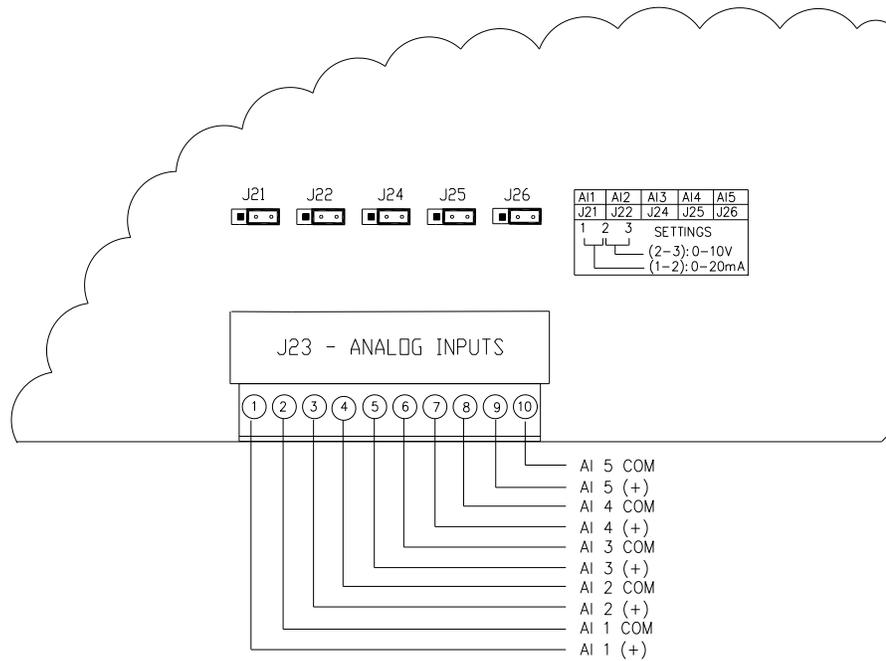


Figure 65: XRC^{G4} board- analog input calibration points

3. When calibrating an analog input, select either 3 Point or 5 Point for number of calibration points: 3 Point for low, 50% and 100% values, and 5 Point for low, 25%, 50%, 75% and 100% values.
4. In the *Current Value* box, check **Update**. This causes the AI to look for its source at the terminals instead of a test value.
5. Begin the calibration starting with the first selection, *Low Calculation Point*.
6. Apply an appropriate input, such as 1 Volt or 4 mA to the AI terminals.
7. Enter a value (typically zero) representing the *Low Cal Point* and representing the desired engineering units. Click **OK**.



NOTE: The current reading value on the pop-up entry screens will be placed in the *Reading* column and represent values from the previous calibration. User-entered values will be displayed in the *Entry* column.

8. Move to the 100% Calibration Value.
9. Apply 5 Volts or 20 mA to the AI terminals (depending on jumper setting).
10. Enter a value representing the full range and representing the desired engineering units. Click **OK**.
11. If 3 point calibration was selected, move to the 50% Calibration Value.

12. Apply 3 Volts or 12 mA to the AI terminals (depending on jumper setting).

3.7.3 Pulse and digital input calibration

Totaflo XRC^{G4} comes standard with two high-speed pulse inputs (PI) on-board. These may also be used as digital inputs. The following procedure is for calibrating PIs. Enter the calibration screen and select the PI to calibrate. The XRC^{G4} then enters the hold mode and displays the current values and their register number.

The *Current Values* section will display the current values continuously by checking the *Update* box. When different pulse inputs are selected, their assigned register numbers are displayed on the top of the screen.

Follow the instructions in the PCCU32 Help files for specific software steps. Generally, complete the following procedure.

3.7.3.1 Step-by-step instructions

1. Click **K-Factor**, enter a value, and click **OK**. Input pulses are multiplied by the K-Factor. To have a one to one pulse count, use a factor of 1.



NOTE: Take into consideration that these inputs may have the debounce enabled or disabled. This feature is discussed in detail in Section 1.6, *XSeries on-board input/output*. Look at jumpers J5, J11, J9 and J12 on the XRC^{G4} board.

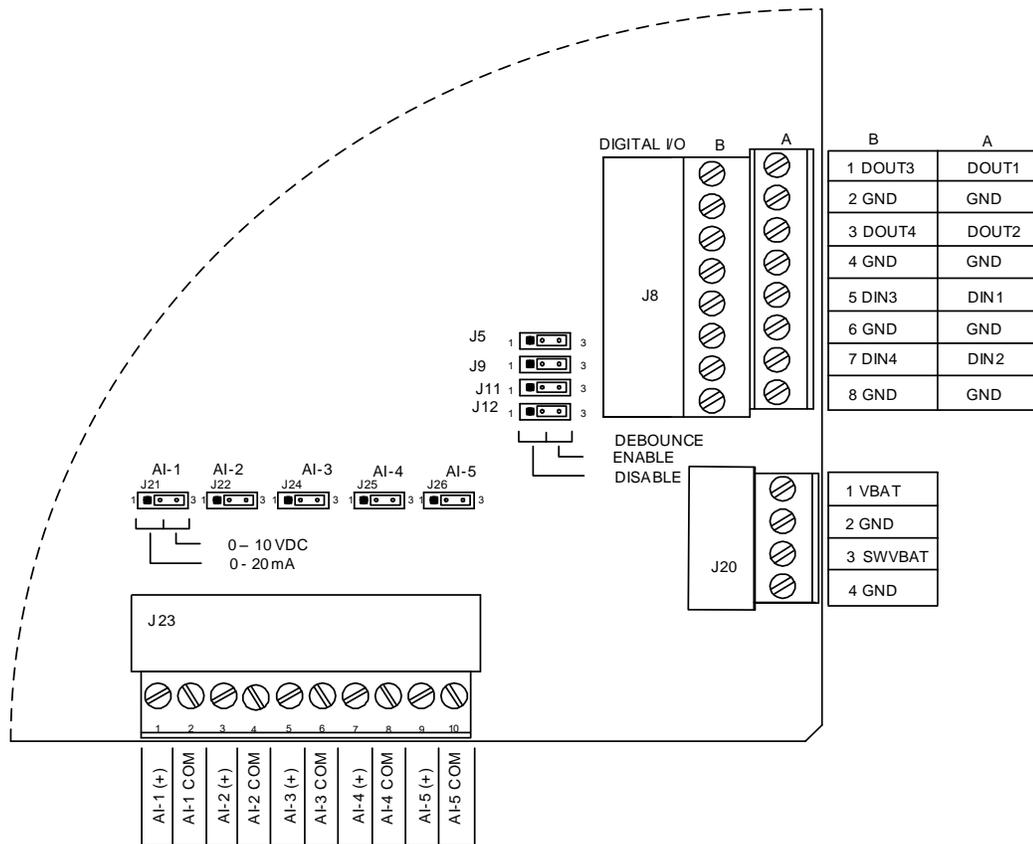


Figure 66: XRC^{G4} board- pulse/digital input calibration points

3.8 Keypad

The XSeries models may be configured to include the optional keypad (see Figure 67) located on the front cover of the unit. Keypad entry allows the user to monitor programmed display items without using additional equipment. See Table 13.



NOTE: To view various display items, those items must be pre-programmed for keypad entry. Either program all the display items for an application or individual display items within the application using PCCU32.

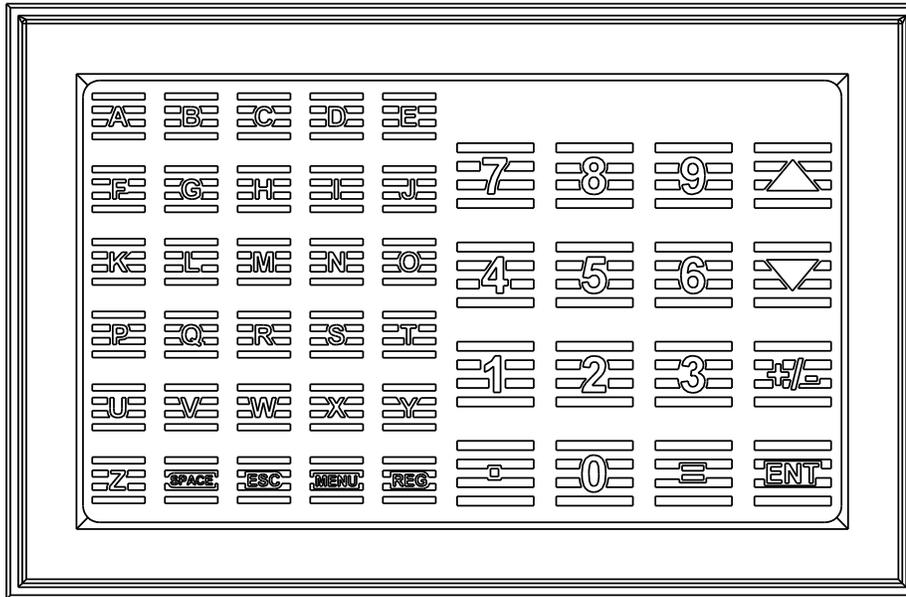


Figure 67: Optional Keypad (P/N 2100652-xxx)

Table 13: Optional Keypad Commands

Command	Description
Log On	Press the ENT key in the lower right corner of the keypad.
Security	When prompted, enter the 4-digit security code.
Viewing	Use the up and down arrow keys located in the upper right corner to scroll through the various instantiated applications (Multiple Tube Device).
Selection	After locating the item to change or display, press ENT .
Changing	After viewing the item for change, press the = key located in the lower right corner of the keypad. If entering a negative figure, press the ± key to toggle the minus sign on or off. Enter the new figure. Press Enter . NOTE: Only those values that are not live can be changed from this screen.
Validate	When setting up the XRC ^{G4} display items, the user may also set data limits so that when a programmed value is changed, it must be valid between the high and low limit; otherwise it will return an <i>invalid</i> code. This is called Validate Keypad Entry and must be set to <i>yes</i> to be active.
Time Out	Depending on how the display setup is programmed, the <i>Scroll Lock Timeout</i> may be set. After the programmed time has elapsed, it will return to regular operation. This includes exiting the security system. To re-enter the keypad program, the user will need to re-enter the security code.
SPACE	Pressing the SPACE key will have the effect of leaving a blank space(s) between characters during data entry.
MENU	Pressing the MENU key and then the group number and item number will take the user directly to the specified screen.
REG	Pressing the REG key and then entering the <i>application.array.index</i> of a register will take the user directly to the specified register.
ESC	To exit the program, press the ESC key in the lower left corner once for each level. When the screen begins to scroll again, the user has completely exited the program.

4 Maintenance

This section provides standard maintenance information and instructions about how to remove and install components of the XRC^{G4}.

4.1 Overview

We recommend that the user develop regularly scheduled maintenance programs. By establishing such a maintenance program, XRC^{G4} downtime can be minimized.

Record all items within this section in the maintenance practice procedures and update this schedule as needed. This provides for many maintenance items to be handled on a routine basis before potential problems result in a failure.

4.1.1 Maintenance support

If installation, calibration and maintenance assistance is required, the user can contact the Totalflow Service Department. See *Returning devices* in the front matter of this document.

4.1.2 Maintaining cleanliness of the XRC^{G4}

Because an XRC^{G4} installation is primarily exposed to external environmental conditions, it is important that it be regularly inspected for cleanliness, both externally and internally. Foreign contaminants can cause damage to interior mounted components, rendering the XRC^{G4} inoperable.

4.1.3 Front-mounted LCD

The user is informed of operational problems and operational limit violations by observing the alarm codes on the right side of the LCD display. XRC^{G4} alarm troubleshooting procedures are presented in Section 5, *Troubleshooting*.

4.2 Backing up configuration files

Before beginning any maintenance on the XRC^{G4}, collect the data and back up all configuration files to a laptop's hard drive or other external storage device. This safeguards the data and allows the user to re-start the unit without the need to re-configure the XRC^{G4}, should any problem arise.

4.2.1 Using the Save and Restore utility

The Save and Restore utility provides the ability to back up the configuration files on the Totalflow devices. The procedures in these sections show how to save the files from the device to a host (laptop or PC) and how to restore the backup file from the host to a device.

4.2.1.1 Save configuration files



IMPORTANT NOTE: Backup configuration files include both configuration and calibration data.

Although there are multiple reasons to backup station configuration files, this procedure will focus on preserving the configuration files and calibration data for the purpose of restoring the flow computer following maintenance and troubleshooting procedures.

There are several methods for file backup. This section describes the configuration file backup and the update of the startup (cold) configuration from the **Save and restore** utility.

To backup configuration files:

1. Start PCCU. The main PCCU screen displays.
2. On the main PCCU screen, on the top menu, select **Operate > File Utilities> Save and Restore Utility** or click the **Save and Restore Utility** icon on the toolbar.
3. Click **Save Station Files** at the bottom of the screen. The Save Station files dialog box displays.
4. In the Save to field, verify or define the location (path) to save the backup file. Take note of the file location for later retrieval. The default path stores the backup files in the StationFiles directory under the PCCU installation directory. The backup file default name is the station ID with the .xfc extension.
5. Click **OK**.

6. Wait for the backup to complete. Progress status messages display at the bottom of the screen.
7. When the upload complete message displays, select **Yes** to restore (copy) the warm configuration to tfCold
8. Wait for the tfCold update to complete. Progress status messages display at the bottom of the screen.
9. Verify that the update is complete by expanding tfCold on the navigation tree. Compare the contents of tfCold with tfData and ensure the configuration files now show in tfCold

4.2.1.2 Restore configuration files

The Restore function sends the backup file from its location on a host to the remote controller to restore operation, if the configuration is lost or corrupted. This procedure assumes that a configuration file backup already exists (If not, backup the file before attempting to restore the file, see section 4.2.1.1, *Save configuration files*).

To restore configuration and calibration data files:

1. Start PCCU. The main PCCU screen displays.
2. On the main PCCU screen, on the top menu, select **Operate > File Utilities> Save and Restore Utility** or click the **Save and Restore Utility** icon on the toolbar. The Save and Restore screen displays.
3. Click **Restore Station Files** at the bottom of the screen. The Restore Station Files dialog box displays.
4. Define or verify the file path where the backup file is located. If there are several backup files, make sure to select the desired one.
5. Click **OK**.
6. Wait for the restore to complete. Progress status messages display at the bottom of the screen.
7. Perform a cold-start (cold boot) to load the restored data. Select the cold start method in section 5.3.8, *Reset procedures*.
8. When the XRC completes its boot sequence, verify the unit is functioning properly.

4.3 Changing the XRC^{G4} clock

When any AGA applications are instantiated on the XRC^{G4}, changing the clock could affect the time when log period entries are made. To protect the integrity of accounting audit trails, the XRC^{G4} handles these types of clock changes as follows:

4.3.1 Clock change not crossing an hour boundary

When the next log period entry is made, the clock is not altered.

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

4.3.2 Forward clock change crossing an hourly boundary

This forces a log period entry for part of an hour that has accumulated since the last hourly entry. XRC^{G4} then advances to the newly defined data flow record boundary and begins maintaining balance of the days' data in the newly defined boundary.

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

4.3.3 Backward clock change crossing an hourly boundary

Hourly entry is made for the part of the hour that has accumulated since making the last hourly entry. This is the same as for a Forward Clock Change Crossing an Hourly Boundary. XRC^{G4} advances to a new day's data flow record and maintains balance of the day's data in a new record.

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



NOTE: A backward clock change uses two (2) records to maintain data integrity. This assures that previously recorded data is not overwritten. If it is necessary to make small backward time changes, less than one (1) hour, the user should wait until the current hour has progressed far enough to make a change that does not cross an hour boundary.

4.4 Components and spare parts

The XRC^{G4} components are identified in Figure 68 and Figure 69. Component details and Spare part list are available in Table 14 and Table 15 respectively.

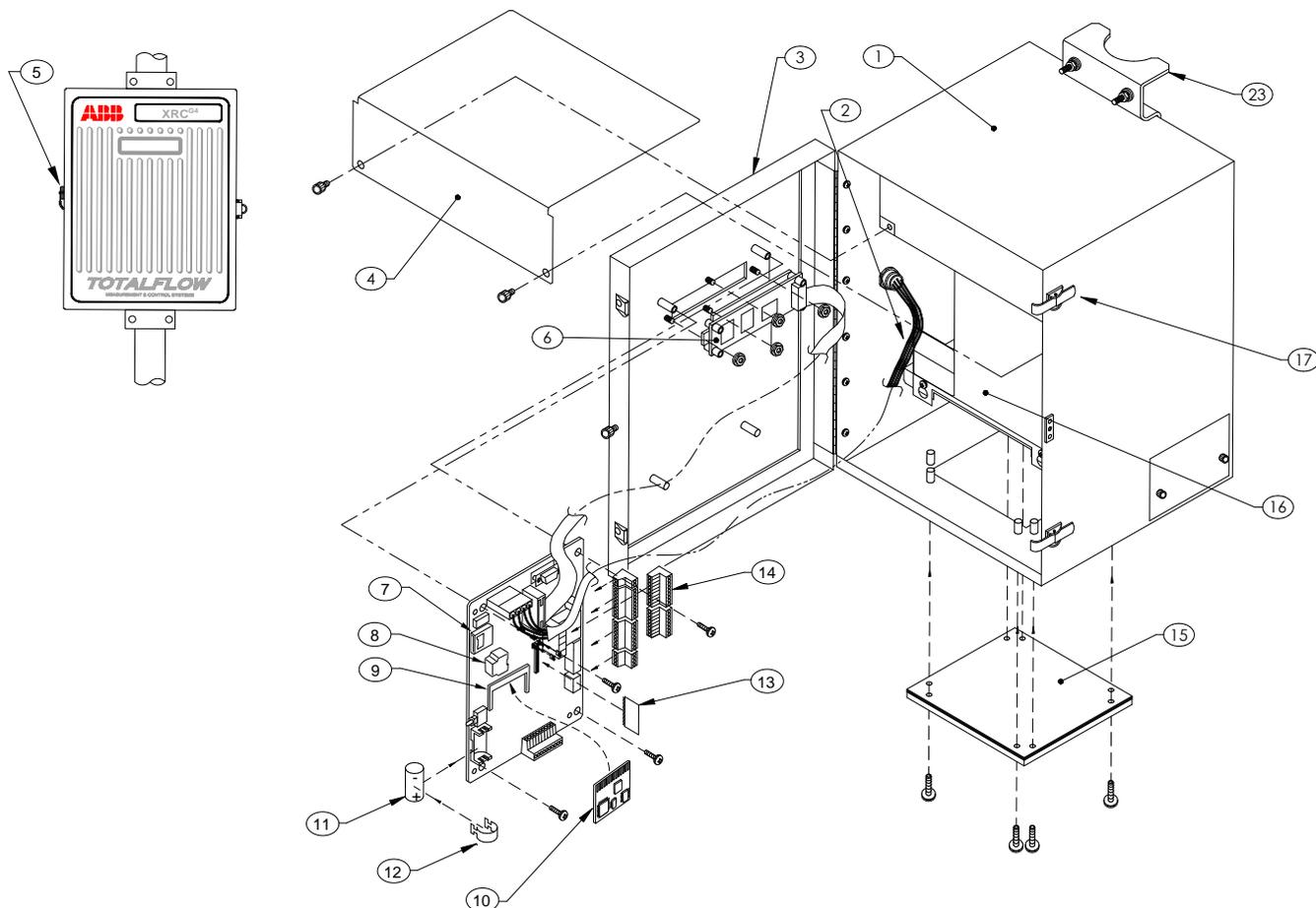


Figure 68: XRC^{G4} 6490 component/cable locations

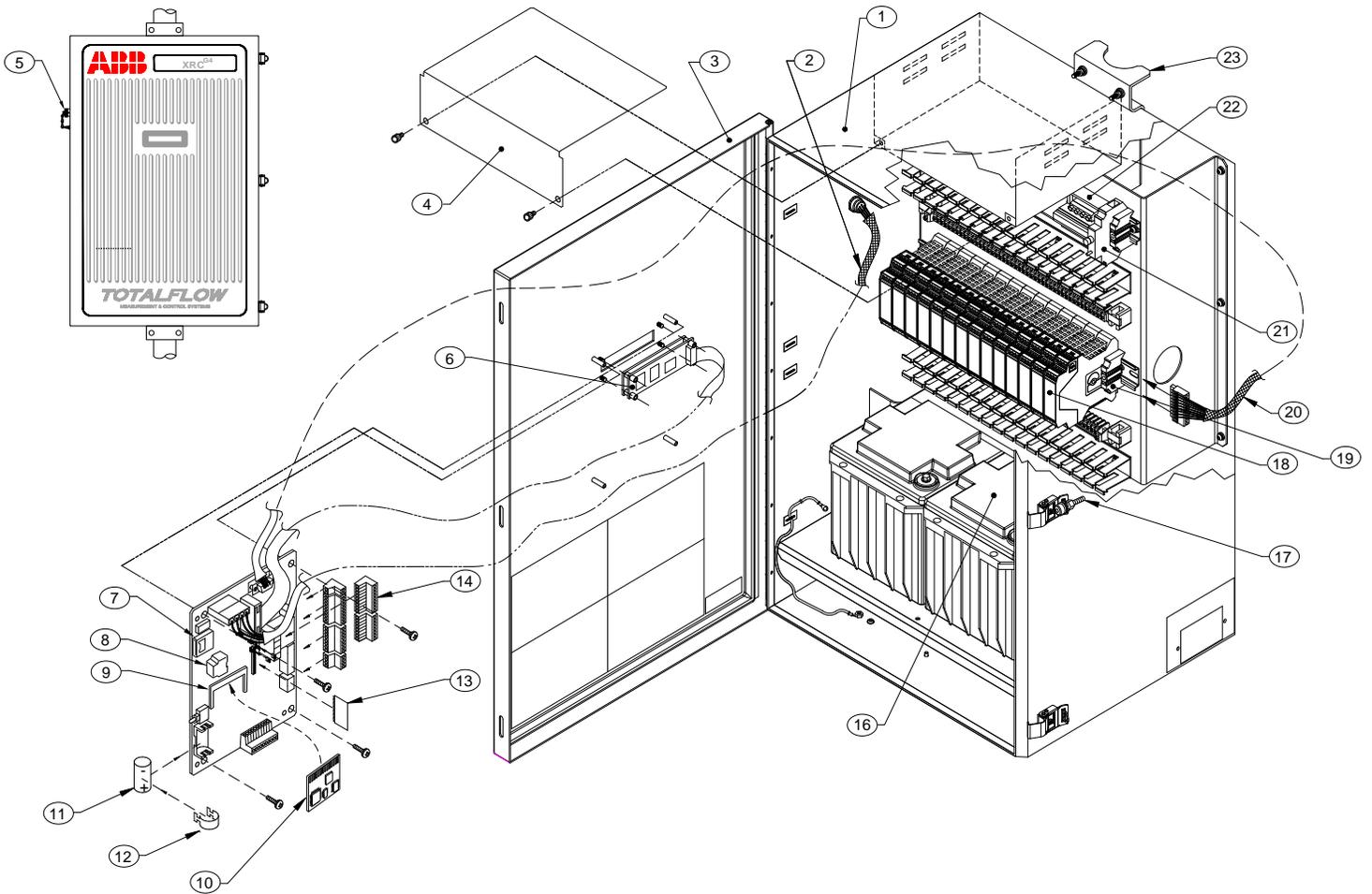


Figure 69: XRC^{G4} 6890 component/cable locations

Table 14: XRC^{G4} 6490 and 6890 component identifications

ID No.	Description	Spare Part Number
1	Enclosure	N/A
2	PCCU Internal Cable	2000073-xxx
3	Door (6490)	1800308-xxx
3	Door (6790)	1800309-xxx
3	Door w/keypad (6490)	2100548-xxx
3	Door w/keypad (6790)	2100924-xxx
4	Communication Bracket	2015260-xxx
5	External PCCU Connector Cap	1215000-xxx
6	LCD Display	2012804-xxx
7	SD Card	1801747-xxx
	128 MB	1801749-xxx
	512 MB	1801750-xxx
8	1 GB	
8	Ethernet Connector	N/A
9	CPU Engine Card Connector	N/A

ID No.	Description	Spare Part Number
10	CPU Engine Card	2102427-xxx
11	Lithium Battery	1487010-xxx
12	Battery Keeper	2100856-xxx
13	Communication Module RS-232	2015192-xxx
	RS-485	2015193-xxx
14	Phoenix Connector (10 pin)	1800389-xxx
	(4 pin)	1220017-002
	(8 pin)	1220017-005
	(9 pin)	1800388-xxx
	(2 pin)	1220017-001
15	Conversion Plate (6490 only)	2015353-xxx
16	Battery/Compartment Cover (6490 only)	N/A
17	Door Latch	1800423-XXX
18	I/O Module Assembly (shown 6890 only)	N/A
19	I/O Module End Cap (shown 6890 only)	N/A
20	TFIO Interface Module Cable (shown 6890 only)	2100391-xxx

Table 15: Additional spare parts

Description	Spare Part Number
Pipe Saddle Mounting Kit (12")	1310000-012x
Pipe Saddle Mounting Kit (10")	1310000-010x
Pipe Saddle Mounting Kit (8")	S00515
Pipe Saddle Mounting Kit (6")	S00510
Pipe Saddle Mounting Kit (4")	S00505
Pipe Saddle Mounting Kit (3")	S00500
Pipe Saddle Mounting Kit (2")	S00495
Key Pad Kit	2100652
PCCU Collection Cable to Laptop	2015240-xxx
Solar Panel Charger (10 Watt)	1488010-xxx
Solar Panel Charger (30 Watt)	1488010-xxx
Solar Panel Charger (20 Watt)	2015095-xxx
Hole Plug ½"	1800408-xxx
Hole Plug ¾"	1800407-xxx
LCD Nylon Standoff	1800536-xxx
FCU Diagnostic Test Kit	2017373-005
FCU Diagnostic Test Kit w/ Multi-Meter	2017373-004
LCD Window w/Adhesive (Hoffman)	1800553-xxx
Battery, 8 Ah	2015113-xxx
Battery, 26/30 Ah	2015052-001
Battery, 38/42 Ah	2015052-004
Battery, 16 Ah	2015052-003
Battery, 13 Ah	2015052-002
Battery, 70 Ah	2015052-010

Description	Spare Part Number
Battery Charger 115 Vac/12 Vdc	2011720-007
Battery Charger 230 Vac/12 Vdc	2011720-008
Power Supply Converter 120 Vac/Vdc	2018200-004
Power Supply Converter 240 Vac/Vdc	2018200-005
Battery Charger 115 Vac/12 Vdc	2100269-001
Battery Charger 230 Vac/12 Vdc	2100269-002
Communication Mounting Bracket	2015260-005

4.5 Replacing the lithium battery

This section presents the procedures for replacing the onboard lithium battery which maintains the SRAM memory. Replacing the lithium battery should only be done while the flow computer is fully powered by the battery pack or charging system. SRAM memory stores historical flow data.

4.5.1 Step-by-step instructions



NOTICE – Property damage. Loss of power to the unit will perform a COLD start when lithium battery is removed. All data and configuration files will be destroyed.

1. Collect data from the unit.
2. Back up configuration files following the instructions listed in section 4.2, *Backing up configuration files*.
3. Gain access to the Main Processor Board by unlatching the enclosure door (see Figure 68: *XRC^{G4} 6490 component/cable locations* and Figure 69: *XRC^{G4} 6890 component/cable locations*).
4. Remove the lithium battery cover from the battery bracket by inserting the flat blade of a small screwdriver between the cover and the side of the bracket. This should free the cover from the bracket allowing access to the battery.
5. Grasp the battery on each side and pull from the bracket. Note the positive end of the battery is at the bottom end of the bracket.
6. Insert a new lithium battery into the bracket with the positive end of the battery down.
7. Replace the battery cover.

4.6 Replacing the XRC^{G4} battery pack

This section presents the procedures for removal and installation of the XRC^{G4} battery pack. To access the battery pack, open the XRC^{G4} door. The battery pack is located behind the front-mounted keeper plate (model 6490 only).



NOTICE – Property damage. When removing the battery pack, do not remove the lithium battery from the main electronic board (XRC^{G4} board). This prevents any data stored in board RAM, from being lost. Removing the CPU engine card will also result in a COLD boot (loss of data stored in RAM).

4.6.1 Step-by-step instructions

1. Make sure the J1 (Figure 70) memory backup jumper covers the top two pins to enable the memory backup.

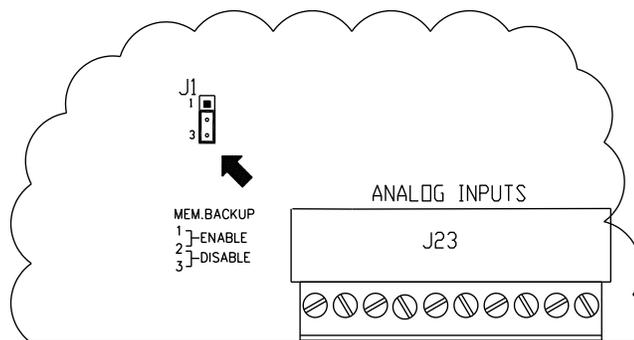
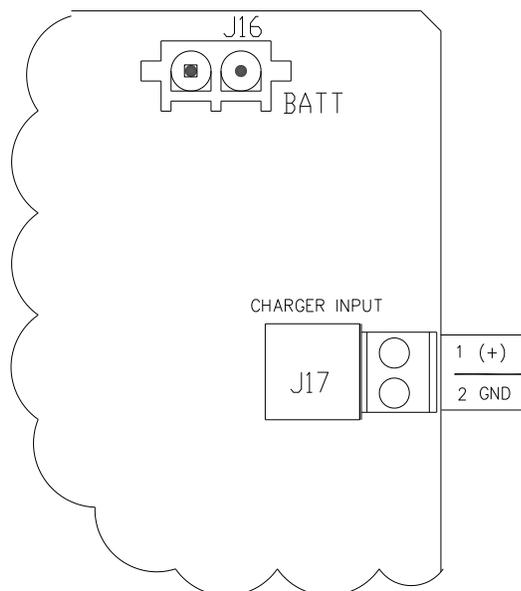


Figure 70: memory backup enable jumper

2. Either make sure LL battery alarm is not being displayed on the XRC^{G4} LCD, or measure lithium battery and make sure it is greater than 3.0V.
3. Disconnect the battery charger from the XRC^{G4} board terminals CHGR INPUT +/- J17 (Figure 71).
4. Before removing the battery pack, disconnect the battery cable from the XRC^{G4} board connector J16.
5. Remove the keeper plate (Figure 68: XRC^{G4} 6490 component/cable locations, Item 16-6490 only) which secures the battery pack in its mounting location by slightly loosening the three mounting screws. It is not necessary to remove the screws.
6. Remove the battery pack from the battery compartment.
7. Insert a new battery pack into the battery compartment. The battery pack must be positioned so that its longest dimension fits snugly against the keeper plate when the plate is installed.

Figure 71: XRC^{G4} battery and charger connections

8. Reinstall the keeper plate and tighten the keeper plate mounting screws.
9. Reconnect the battery pack cable to the XRC^{G4} (see Figure 71) connector J16.
10. Reconnect the battery charger to the XRC^{G4} board terminals CHGR INPUT +/- terminals J17.
11. After closing the XRC^{G4} door, check the door-mounted LCD for normal operational readings.

4.7 Replacing the main electronic board (XRC^{G4})

The XRC^{G4} board is mounted to the backside of the access door. It is mounted to the door on standoffs. See Figure 68: *XRC^{G4} 6490 component/cable locations* or Figure 69: *XRC^{G4} 6890 component/cable locations*.



NOTICE – Property damage. The XRC^{G4} board, as with any electronic board, is susceptible to damage by static electricity or improper handling. To prevent this from occurring, the user should wear a grounding strap.

A grounding strap is a conductive device used to make connection between the person handling the board and a high quality ground point. Before handling the board, wear a ground strap on the body then connect it to a grounded point. This discharges electrical static buildup from the body to ground, preventing static from discharging to the board.

4.7.1 Step-by-step instructions



NOTE: Before removal of the XRC^{G4} board, be certain any data has been saved to an external storage medium. Failure to do so could result in data loss when the XRC^{G4} board is removed.

1. Collect data from the unit.
2. Back up configuration files following the instructions in section 4.2, *Backing up configuration files*.
3. Verify “L_L” battery alarm is not being displayed on the XFC^{G4} or measure the lithium battery to make sure it is greater than 3.0V.
4. Before XRC^{G4} board removal, disconnect the following associated connectors in this order:
 - If used, disconnect the external charging source, J17 (Figure 72: *XRC^{G4} board connections*, Item 21).
 - Disconnect battery pack connector, J16 (Item 22).
 - Slide out to the right, the following green terminal strips from its associated XRC^{G4} board connector. Do not lift the connectors upward. Tape an identifier to each connector so it will be correctly reinserted into the same board mounting connector during reinstallation of the XRC^{G4} board:
 - J6-COMM 2 (Item 18)
 - J6-COMM 1 (Item 17)
 - J8-B (Item 16)
 - J8-A (Item 15)
 - J20 (Item 13)
 - J23 (Item 11)



NOTICE – Property damage. Pull all green terminal strips straight out. Rocking them back and forth may severely bend the end pins. A small screw driver can help pry them straight out.

- Disconnect PCCU port connector J15 (Item 25).
 - LCD interface connector J13 (Item 24).
 - Remove cable from J18 (Item 23) if external I/O modules are installed.
5. Remove the four mounting screws and lock washers securing the XRC^{G4} board to door mounted standoffs (Figure 68: *XRC^{G4} 6490 component/cable locations* or Figure 69: *XRC^{G4} 6890 component/cable locations*).



NOTICE – Property damage. When removing the XRC^{G4} board, grasp its outer edges. This prevents damage to circuitry and components.

6. Replace and secure the XRC^{G4} board on four standoffs and secure in place using four screws and lock washers. Do not over tighten screws. Doing so could cause damage to the board or associated circuitry.
7. Reinstall connectors, removed in Step 4, to their associated board mounted connectors in the following order.
 - J13 LCD Connector (Figure 72: *XRC^{G4} board connections*, Item 24)

- J15 PCCU connector (Item 25)
 - J18 I/O module cable (Item 23)
 - Communications:
 - J6-COMM 2 (Item 18)
 - J6-COMM 1 (Item 17)
 - On-board I/O:
 - J8-B (Item 16)
 - J8-A (Item 15)
 - J23 Analog Input (Item 11)
 - J20 Auxiliary Power (Item 13)
 - J16 Battery Pack (Item 22)
 - J17 Charger (Item 21)
8. If the replacement board does not include a new engine card, follow the instructions in section 4.8, *Replacing the CPU engine card* in this section.

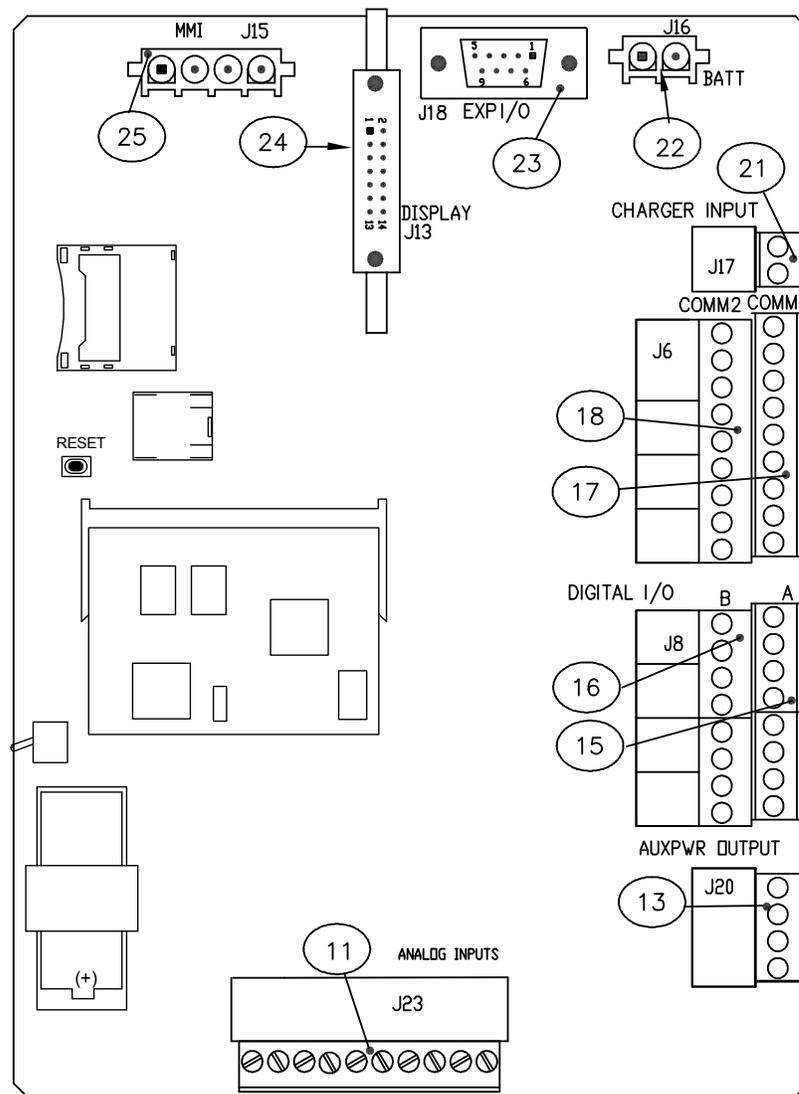


Figure 72: XRC^{G4} board connections

4.8 Replacing the CPU engine card

One of the major differences in the XRC^{G4} is the incorporation of a 32-bit CPU engine card. This engine card holds the main processor, as well as the Flash, RAM and serial E²PROM. Should the engine card require replacing, perform the following procedure.



NOTE: The engine card holds the machine's configuration. The configuration is in non-volatile Flash, but it is always a good idea to keep a copy of the configuration files on a laptop. The *Save and Restore Utility* will save the configuration to a laptop.

4.8.1 Step-by-step instructions

1. Collect data from unit.
2. If possible, back up configuration files following the instructions listed previously in section 4.2, *Backing up configuration files*.
3. Make sure the J1 memory backup jumper covers the top two pins to enable the memory backup. (Figure 70: *memory backup enable jumper*.)
4. Verify "L" battery alarm is not being displayed on the XFC^{G4} or measure the lithium battery to make sure it is greater than 3.0V.
5. Disconnect power from the XRC^{G4} board. First remove J17, charger input (Figure 71: XRC^{G4} battery and charger connections). Second, remove J16, the main battery pack.
6. With power removed, gently (with fingertips) spread the connector fingers extending down from the CPU engine card connector (Figure 73). These fingers extend down to the semi-circular notches on the engine card. When gently spread, these fingers will release the engine card and it will spring up at a 30-degree angle from the main board.
7. Gently pull the engine card out at this 30-degree angle. It should require very little force. Be gentle.

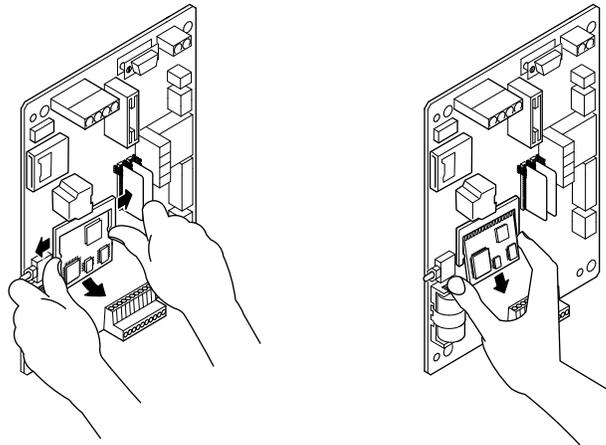


Figure 73: Engine Card Removal

8. To replace the engine card, simply reverse the process. Insert the new engine card at the same 30-degree angle (Figure 74: *Engine card replacement*). Gently press the engine card in until the gold-plated edge connector pins at the top of the engine card are no longer visible.
9. When fully inserted, gently press the engine card down toward the main board. It should snap into the connector fingers mentioned in the previous step.
10. If possible, restore station files using the instructions listed in section 2, *On the main PCCU screen, on the top menu, select Operate > File Utilities> Save and Restore Utility* or click the **Save and Restore Utility** icon on the toolbar.
11. Click **Save Station Files** at the bottom of the screen. The Save Station files dialog box displays.

12. In the Save to field, verify or define the location (path) to save the backup file. Take note of the file location for later retrieval. The default path stores the backup files in the StationFiles directory under the PCCU installation directory. The backup file default name is the station ID with the .xfc extension.
13. Click **OK**.
14. Wait for the backup to complete. Progress status messages display at the bottom of the screen.
15. When the upload complete message displays, select **Yes** to restore (copy) the warm configuration to tfCold
16. Wait for the tfCold update to complete. Progress status messages display at the bottom of the screen.
17. Verify that the update is complete by expanding tfCold on the navigation tree. Compare the contents of tfCold with tfData and ensure the configuration files now show in tfCold
18. previously in this section.
19. Perform a COLD start following the instructions listed in section 5.3.8, *Reset procedures*.

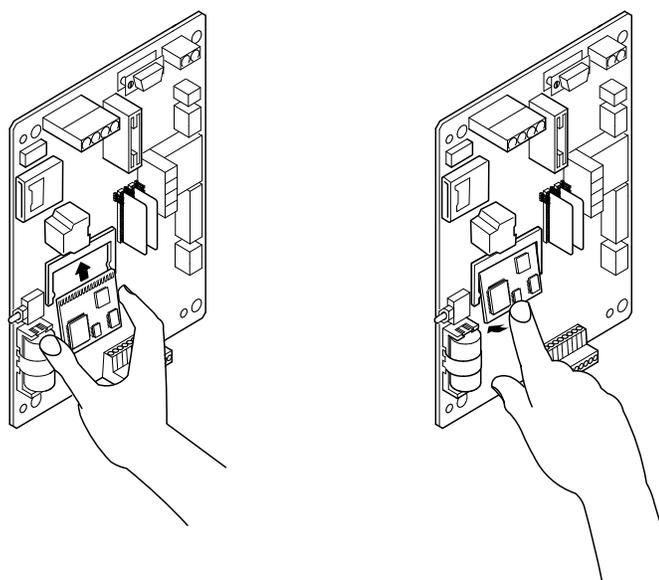


Figure 74: Engine card replacement

4.9 Replacing the Liquid Crystal Display (LCD) board

The LCD board is mounted on the backside of hinged doors behind the XRC^{G4} board. To access and remove the display board, perform the following procedures.

4.9.1 Step-by-step instructions

Most of the procedural steps involve connecting and disconnecting connectors or moving and removing jumpers. All of the connectors and jumpers are identified with a J-prefix (for example, J16 is the main battery connector). For a complete overview of the XRC^{G4} board and its jumpers and connectors, see Figure 5: *XRC board*.

1. Collect data from the unit.
2. If possible, back up configuration files following the instructions listed previously in section 4.2, *Backing up configuration files*.
3. To access the LCD board, open the TOTALFLOW unit door. The LCD board is located behind the XRC^{G4} board.



NOTICE – Property damage. Do not remove the board-mounted lithium battery since it provides power to RAM.

4. Disconnect the external charging unit J17 from the XRC^{G4} board.
5. Disconnect the battery pack connector, J16, from the board mounted connector.
6. Disconnect the LCD board cable connector from the XRC^{G4} board display interface connector J13.
7. Remove four XRC^{G4} board mounting screws and lock washers. Do not let the screws and lock washer fall onto the board circuitry.
8. Move the board away from the door then support it so its circuitry does not come in contact with any metal surface.
9. Using a 3/16" nut driver, remove the four display board hexagonal mounting standoffs. Lift the board from the door-mounted standoffs.



NOTE: If the LCD board is being returned to Totalflow for service, it is recommended that the attached ribbon cable be left connected and returned with the display board.

10. To reinstall the display board, perform procedures 4 to 9 in reverse order. Do not over tighten screws. Once the display board is reinstalled, apply power to the XRC^{G4}, adjust contrast potentiometer R32 for optimum display, and verify that the information displayed on the LCD is correct.

5 Troubleshooting

5.1 Overview

As an aid to troubleshooting the XRC^{G4}, this section will provide troubleshooting guidelines for the various subsystems.

This section contains a troubleshooting flowchart (see Figure 75: *Troubleshooting flowchart*.) Follow the logic in this flowchart to be directed to specific test instructions in this section. Other flow charts in this section further direct troubleshooting for power and communication problems. In addition to these flowcharts, this section contains step-by-step instructions for troubleshooting an XRC^{G4} with or without an installed radio communication unit.

5.1.1 Troubleshooting support

If troubleshooting instructions do not lead to a resolution and assistance is required, the user can contact the Totalflow Service Department.

USA: (800) 442-3097 or International: 001-918-338-4880

5.1.2 Visual alarm codes

As noted in Section 1, *System overview*, the LCD annunciator area shows many different status indicators related to device operations. This section contains information about those codes that reflect errors or provide information useful to troubleshooting. Alarm codes indicate that an operational problem exists.

The user is informed of operational problems and operational limit violations by observing the alarm codes on the right side of the LCD display.

5.1.3 SLEEP mode

Totalflow units are designed to go into a low power, SLEEP mode, when an insufficient supply voltage is present for a period of time. At issue here is locating the reason for the SLEEP alarm, so simply waking up the unit will not suffice. Therefore, issues relating to the system's power supply should be investigated.

5.1.4 Solar panel

When a solar panel is attached to the XRC^{G4} to provide a charging source for the battery, cleanliness and positioning play an important role, as do proper electrical and cabling techniques. More detailed information about power consumption may be found at www.abb.com/totalflow.

5.1.5 Communication

Troubleshooting the communications for this unit requires that both pieces of equipment be tested: the XRC^{G4} Comm ports and the communication device. This is discussed in more detail in section 5.4.1, *Communications overview*.

Other communication troubleshooting information is shared in the following categories:

- RS-232 Communications
- RS-485 Communications
- RS-422 Communications

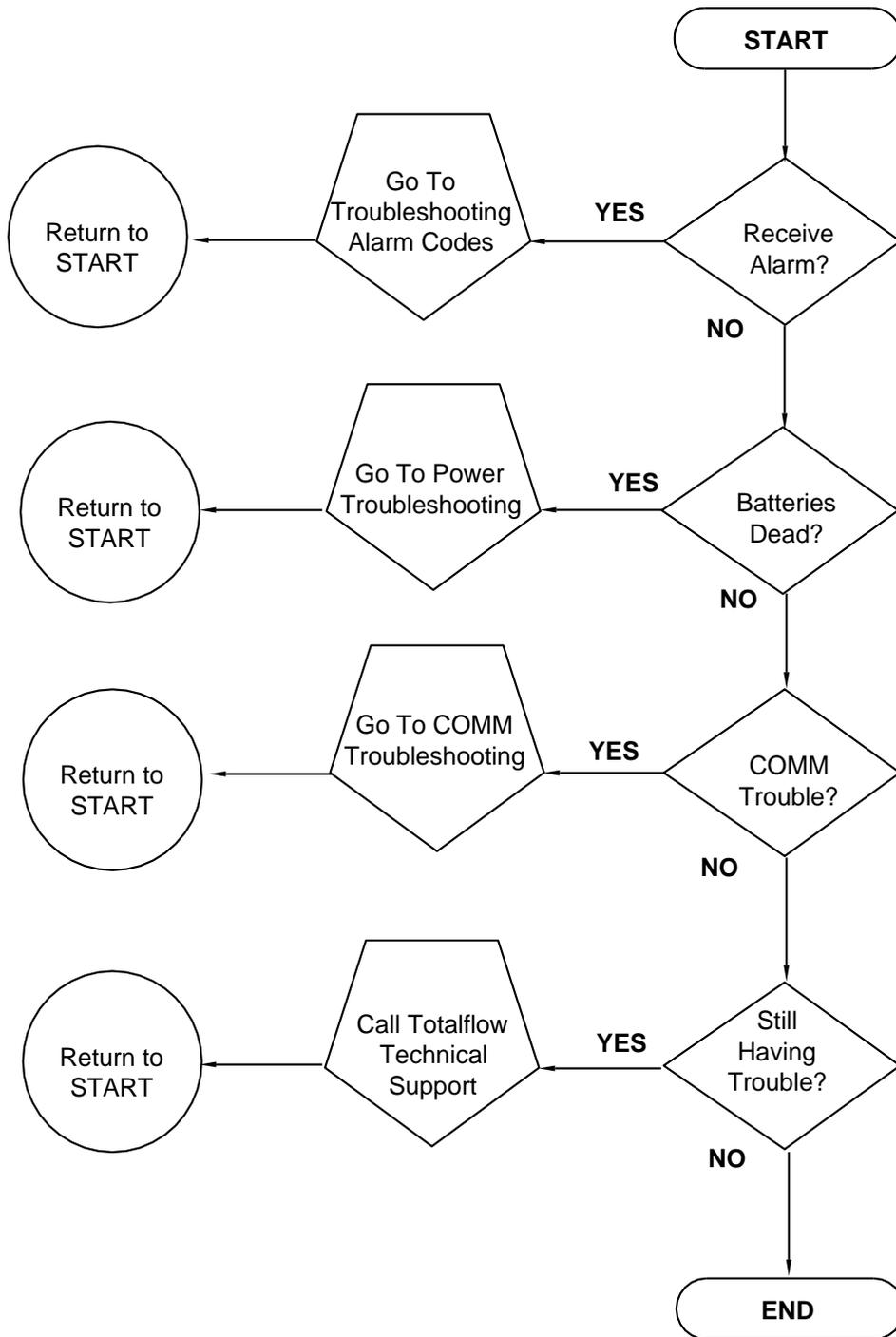


Figure 75: Troubleshooting flowchart

5.2 Troubleshooting visual alarm codes

5.2.1 Overview

When a visual indicator is present (see Figure 76), the following section will assist in determining the probable cause and the steps required to correct the condition.

For the purpose of troubleshooting, only those codes considered alarms or codes used to assist troubleshooting are discussed here. The entire list of status and alarm codes may be found in Section 1, *System overview*. Table 16 contains a description of each XRC^{G4} alarm code. An alarm can be a word, character, letter or symbol.

An application can be assigned to an annunciator and any alarms or status codes associated with that application will be displayed.

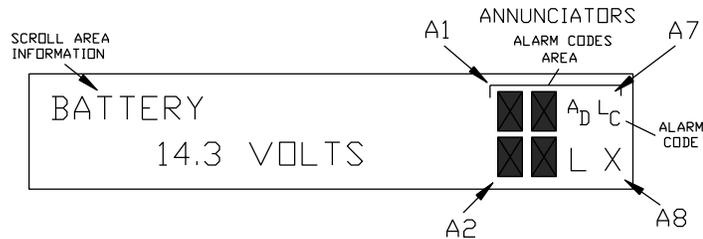


Figure 76: Liquid Crystal Display and indicators

Table 16: Visual alarm codes

Indicator	Description	Alarm
I/O Sub-System		
LL	Low Lithium Battery Alarm: When LL (low lithium) is displayed, the lithium battery voltage is below 2.5 Vdc. If battery voltage is above 2.5 Vdc, A1 appears shaded. A new lithium battery measures approximately 3.6 Vdc.	Y
LC	Low Charger: Displayed if the XRC ^{G4} battery charging voltage is less than (+) 0.4 Vdc higher than the battery voltage. If charging voltage is (+) 0.4 Vdc greater than the battery voltage, then the annunciator is shaded.	Y
Measurement Application		
AD	A to D Failure: Displayed if A to D Converter absolute differential pressure, absolute static pressure or temperature readings exceed maximum counts or are less than minimum counts. If A to D Converter readings are within range, AD is shaded.	Y
Communication Protocols		
→	Transmitting Data: Sending a response	N
←	Receiving Data: Processing request.	N
!	Nak: Negative acknowledgement with packet list.	N
+	Ack: Positive acknowledge of receipt of request.	N
‡	Waiting for Ack: Waiting for response after transmission.	N
?	Exception Alarm Processing.	N
¥	ID Recognized: Recognized and receiving request.	N
‡	Listen Cycle: Flashes if this remote port is active and running Totalflow Remote Protocol. Flashes in sync with listening cycle that occurs at 1, 2 or 4 second intervals.	N
M	MODBUS [®] ASCII: MODBUS [®] ASCII protocol is selected for the port assigned to this annunciator.	N
m	MODBUS [®] RTU: MODBUS [®] RTU protocol is selected for the port assigned to this annunciator.	N
L	Local Protocol: Displayed when PCCU port is active and running Totalflow Local Protocol.	N
¥	ID Recognized: The ID has been recognized but is waiting for Sync.	N

5.2.2 Troubleshooting a blank LCD screen

When the LCD is blank, this means that the unit has entered SLEEP mode. This generally indicates the battery voltage has dropped below 10.9 Vdc.

5.2.2.1 Step-by-step instructions

1. Make a local connection with the XRC^{G4}. This wakes up the unit so that the user may check all alarm conditions and determine the problem.
2. Check the battery pack cable. It must make a good secure electrical connection with the main electronic board BATT CONN connector J16 (see Figure 77).
3. Check that the battery pack cable is securely connected.
4. Check the battery pack voltage. If the voltage is low, replace with another battery pack.
5. If voltage is still low, investigate power issues following Figure 80: *Power troubleshooting flowchart*.

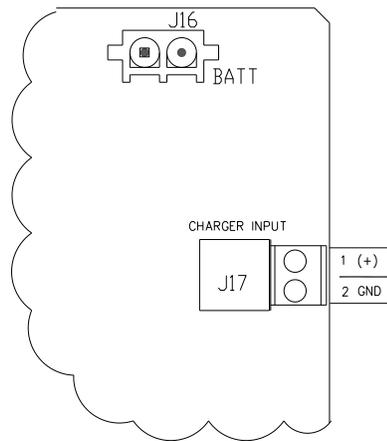


Figure 77: Battery charger and battery pack connections

5.2.3 Troubleshooting a low lithium alarm (LL)

When the Low Lithium alarm appears, the lithium battery should be replaced immediately. Failure to replace the lithium battery could result in loss of data following a power loss. Instructions for replacing the lithium battery may be found in Section 4, *Maintenance*.

5.2.4 Troubleshooting a low charger alarm (LC)

The Low Charger alarm is typically displayed if battery charging voltage is less than (+) 0.4 Vdc higher than battery voltage, or low light conditions exist and the system is charged using a solar power charger.

5.2.4.1 Step-by-step instructions

1. Check the battery pack cable. It must make a good secure electrical connection with the main electronic board BATT CONN connector J16 (see Figure 77).
2. Check that the battery pack cable is securely connected.
3. Check the battery pack charging source in PCCU. Under **I/O Subsystem** in the tree view, open **ON-BOARD** and select **Auxiliary I/O**. Charger voltage and battery voltage are displayed here. If the charger is less than +0.4 Vdc, proceed to section 5.3, *Power troubleshooting*.

5.2.5 Troubleshooting an Analog to Digital Failure alarm (AD)

The XRC^{G4} must have a *Measurement Tube Application* running to receive this error. If the A to D Failure alarm code is present, or if the device is in SLEEP mode but is still receiving minimum voltage, it may be necessary to test the data link between the main electronic board and the transducer. Follow the instructions below to check transducer.

Probable causes of receiving the A to D Failure include:

- AD converter is over or under range (DP, SP or Tf)
- Loose wiring connections
- Faulty RTD probe

If A to D converter readings are within range, AD is shaded.

5.2.5.1 Step-by-step instructions

1. Begin by collecting data from the unit.
2. View the event log in PCCU for codes (see PCCU Help Files for more information):
 - 99 AD converter could not be read
 - 100 AD converter could be read again.
3. If an event code is found, follow the guidelines for returning the transducer to Totalflow for repair or replacement. If an event code is not found, continue to the next step.
4. In the PCCU *Entry* screen, monitor the readings by clicking **I/O Subsystem, On-board** and **Analog Inputs**. Check SP, DP and temperature to determine which measurement channel is causing the alarm.
 - If the alarm is caused by the SP or DP channel, equalize and vent the manifold.
 - If the alarm disappears: SP or DP cell is not ranged properly or the manifold may have a blockage.
 - If the alarm is still present, replace the transducer.
 - If alarm is caused by the temperature channel, skip to Step 9. Otherwise, go to the next step.
5. Set the XMV back to *Factory* calibration. If this corrects the alarm, recalibrate the XMV to the correct field calibration. If the alarm is not corrected, continue to the next step.
6. Perform a WARM start on the unit. Verify that unit is not displaying a *LL* (Low Lithium) alarm, then remove power from the unit. Restore power to the unit. If the AD Failure alarm is not corrected, continue to the next step.
7. Perform the *Save and Restore* function. Follow the procedure in section 4.2.1, *Using the Save and Restore* utility. Be sure to restore these files to the tfCold Drive.
8. Perform a COLD start on the unit following reset procedures covered in this section. If the problem is not corrected, continue to the next step.
9. Check RTD wiring at XMV.
10. Perform the following three procedures found next in this section:
 - RTD continuity test (section 5.2.6)
 - RTD current source resistive test (section 5.2.7)
 - RTD impedance test (section 5.2.8)
11. Contact Totalflow to repair or replace the XMV.

5.2.6 RTD continuity test

Should the readings from the RTD be suspect, follow the instructions below to test the RTD probe.

5.2.6.1 Required equipment

- Digital MultiMeter (DMM) with alligator clip leads

5.2.6.2 Step-by-step instructions

1. Begin by disconnecting power and communications from the XMV.
2. Disconnect the RTD from the XMV.
3. Perform continuity test on wires leading to the probe. Set DMM to 200 Ohm or Continuity Audio.
4. Check continuity of the first wire pair (typically red or black) by connecting one lead to each wire. The meter should read zero or close to zero.

5. If there is continuity, skip to step 7. If there is no continuity, verify that the wiring at the RTD head is correct.
6. If wiring at the connection head is correct, the RTD is defective. Replace the probe. Otherwise continue to the next step.
7. Check continuity of the second wire pair (typically white) by connecting one lead to each wire. The meter should read zero or close to zero.
8. Check continuity of each wire (first pair either red or black as identified in step 4) to the probe or shield. If there is continuity, the RTD is defective. Replace the probe. If there is no continuity, continue to the next step.
9. Check continuity of each second wire pair (white or as identified in step 7) to the probe or shield. If there is continuity, the RTD is defective. Replace the probe. If there is no continuity, continue to the next step.
10. Check continuity of each first wire pair (as identified in step 4) to each second wire pair (as identified in step 7). The meter should read approximately 100 to 140 Ohms. If this is the case, continue to next step. If not, the RTD is defective and should be replaced.
11. If the probe is still not functioning correctly, re-check wiring using the supplied diagram (Figure 78). If no wiring error was found, perform the RTD current source troubleshooting test in section 5.2.7, *RTD current source (resistive) test*.

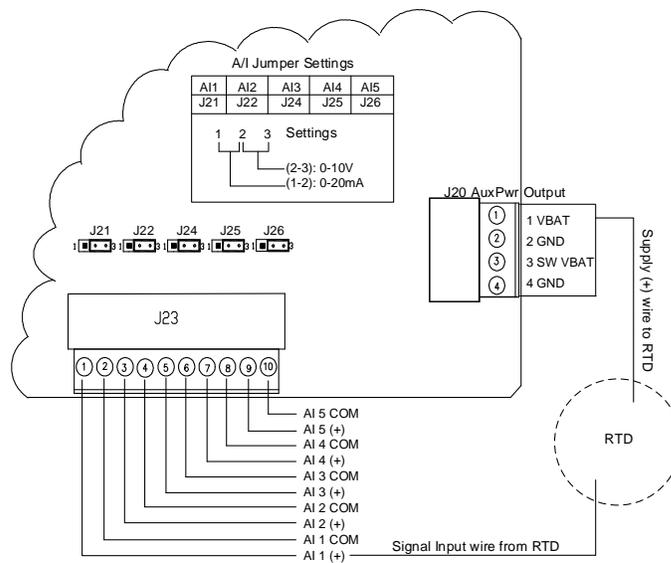


Figure 78: RTD wiring diagram

5.2.7 RTD current source (resistive) test

If readings from the RTD are still suspect following the RTD probe continuity test, follow the instructions below to test the current source on the termination board to verify it is receiving power.

5.2.7.1 Required equipment

- Totalflow Diagnostics Kit 2017373
- Digital multimeter with alligator clip leads

5.2.7.2 Step-by-step instructions

1. Begin by disconnecting power and communications from the XMV, if not already done.
2. Disconnect the RTD from the XMV, if not already done.
3. Set DMM to 200 mVdc.
4. Select the RTD test resistance value by selecting the resistor test connector from the FCU Diagnostic Kit, or make one using a resistor appropriate for the unit:
 - Substitute the RTD probe wiring by connecting either a 100 Ohm or 123 Ohm resistor across connector terminals 3 and 4.
 - Connect a jumper wire between terminals 2 and 3.

- Connect a jumper wire between terminals 4 and 5.
- 5. Clip the positive lead of the DMM to the upper side of the RTD test resistor.
- 6. Clip the negative lead of the DMM to the lower side of the RTD test resistor.
- 7. Supply power to the unit.
- 8. Once running, the measured value across the RTD test resistor should be either:
 - 100 Ohm Resistor – Min. of 100mv to a maximum of 125mv
 - 123 Ohm Resistor – Min. of 123mv to a maximum of 155mv
- 9. The RTD measurement temperature on the FCU display should read either:
 - 100 Ohm Resistor – 31.0°F to 33.0°F
 - 123 Ohm Resistor – 140.8°F to 142.8°F
- 10. If either of the measured values are outside of range, remove power and replace the termination board connector cable (1801415-xxx).
- 11. Return power and perform steps 9 and 10. If either of the measured values are outside of range, remove power and replace the termination board (2101873-xxx).
- 12. Return power and perform steps 9 and 10. If either of the measured values are outside of the range, remove power and replace main electronic board (2101471-xxx) and XIMV (2101465-xxx).

5.2.8 RTD impedance test

If readings from the RTD are still suspect following the RTD probe test, follow the instructions below to test the current source on the termination board to verify it is receiving power.

5.2.8.1 Required equipment

- Ice bath
- Digital multimeter

5.2.8.2 Step-by-step instructions

1. Immerse the RTD Probe in an ice bath.
2. Perform a continuity check between any two similarly colored wires. Measured resistance should be 1 Ohm or less.
3. Perform a continuity check between any two dissimilar colored wires. Measured resistance should be approximately 100 Ohms.
4. Perform a continuity check between shield wire and any other wires. Measured resistance should be in the Mega Ohm range.
5. If any values are returned out of range, the RTD probe is defective. Replace the RTD.

5.3 Power troubleshooting

5.3.1 Overview

This section focuses on determining what has caused the XRC^{G4} to lose power. Generally, loss of power can be attributed only to the power supply system. However, if the power supply system is used for powering a transceiver, or other peripheral equipment, a problem with that equipment may drain the battery and cause the XRC^{G4} to lose power. Notice that the *Power troubleshooting flowchart* (Figure 80) goes through several tests but also directs the user to Figure 79: *Communication troubleshooting flowchart* located later in this section.

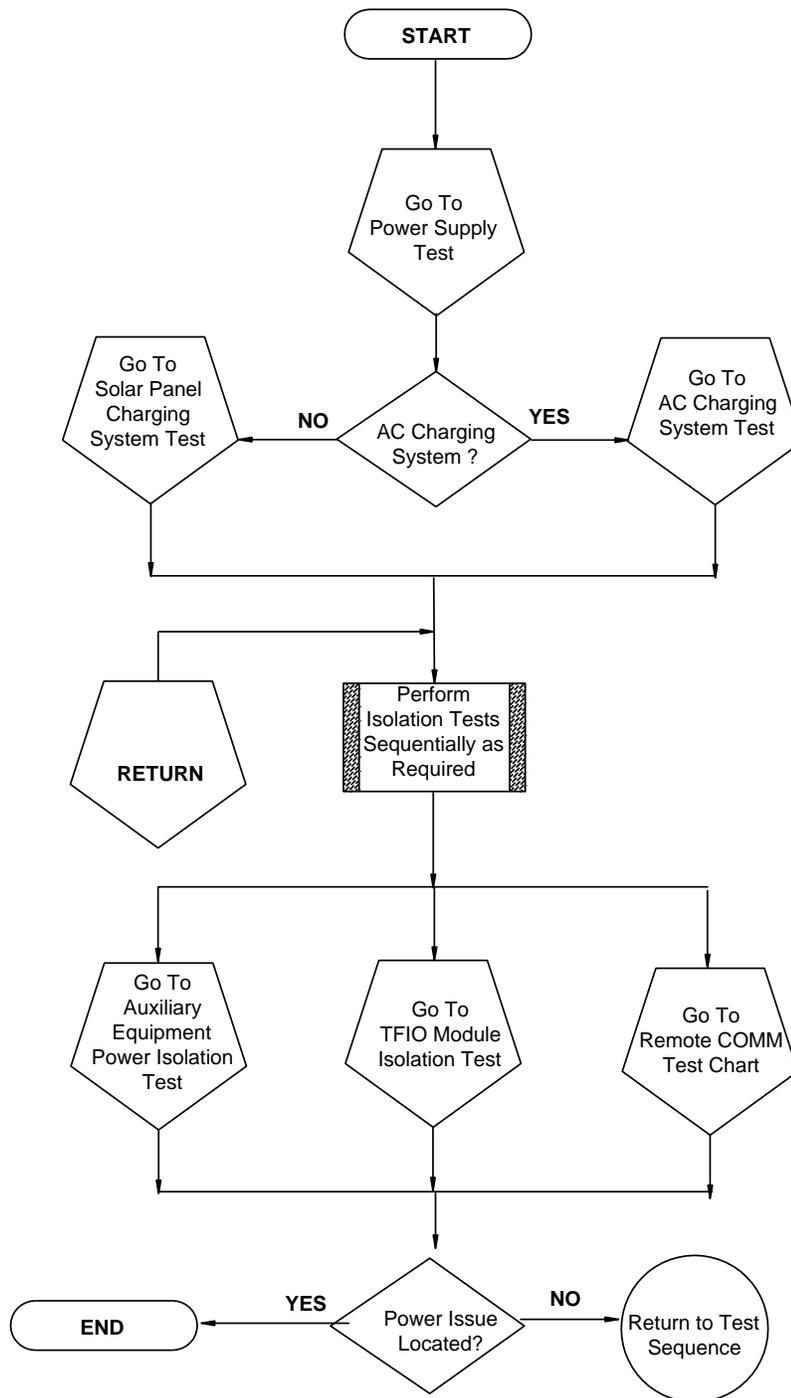


Figure 80: Power troubleshooting flowchart

5.3.2 Power supply test

Various equipment configurations will necessitate moving to one or more additional tests from this location.

5.3.2.1 Step-by-step instructions

1. Check that the power supply voltage setting, the power supply current rating, and the cables used for the installation meet the recommended requirements.
2. If this is a new installation and external equipment is being powered from the XRC^{G4}, call Totalflow Technical Support for help in evaluating the cable and power supply installation requirements.
3. Correct and retest as necessary.

4. Check for a poor cable connection in the cable between the XRC^{G4} and the battery pack (J16) and charging source (J17). Verify that all field wiring screw terminals are tight.
5. Correct and retest, as necessary.
6. Verify that there are no other devices that may drop an excessive voltage across them in the power supply circuit (to the XRC^{G4}).
7. Correct and retest, as necessary.
8. Disconnect the charging source cable at the XRC^{G4} board J17.
9. Replace the battery with a known good battery, using the procedure in section 4.6, *Replacing the XRCG4 battery pack*.
10. Reconnect the charging source cable to the XRC^{G4} board J17.
11. Measure the voltage at the charging source cable. Measure the voltage at battery pack. Compare voltages. If the charging source voltage is less than (+) 0.4 Vdc higher than the battery voltage, return to Figure 80: *Power troubleshooting flowchart* and continue.

5.3.3 Solar panel charging system test

If the system setup includes a solar panel charger connected to the XRC^{G4} board, and it is not supplying the required voltage to the XRC^{G4} unit, test the solar panel. The following instructions contain the steps required to do so.

5.3.3.1 Step-by-step instructions

1. Check the solar panel angle and direction. In the northern hemisphere, the panel should face due south and in the southern hemisphere, it should face due north.
2. Correct and retest, as necessary.
3. Check the solar panel for any physical damage or obstructions to sunlight. Sunlight obstruction prevents the solar panel from receiving enough sunlight to charge the installed battery pack.
4. Clean, correct and retest, as necessary.
5. The solar panel should be positioned so that it receives the most sunlight. Do not place it in a shaded area.
6. Correct and retest, as necessary.
7. Check the solar panel wiring to be certain it is correctly connected to the associated XRC^{G4} board termination block J17.
8. Correct and retest, as necessary.
9. Measure the solar panel voltage at the connector using a DMM connecting the (+) and (-) leads to the (+) and (-) solar panel wires. Loaded voltage should be greater than or equal to the specification listed in Table 17.

Panel	Max	Volts at P _{Max}	Open Circuit	Load Resistance	Loaded Voltage
10	10 W	16.8 V	21 V	30 Ω 25 W	16–18 Vdc
20	20 W	16.8 V	21 V	15 Ω 25 W	16–18 Vdc
30	30 W	16.8 V	21 V	10 Ω 40 W	16–18 Vdc

Table 17: Specifications for solar panels

Panel	Max	Volts at P _{Max}	Open Circuit	Load Resistance	Loaded Voltage
10	10 W	16.8 V	21 V	30 Ω 25 W	16–18 Vdc
20	20 W	16.8 V	21 V	15 Ω 25 W	16–18 Vdc
30	30 W	16.8 V	21 V	10 Ω 40 W	16–18 Vdc

10. If the solar panel is not above minimum, replace the solar panel. Return to step 1.
11. Disconnect the solar panel from the XRC^{G4} board.
12. Set the DMM range to read over 20 Vdc.

13. Determine if the Open Circuit voltage is greater than or equal to specification listed in Table 17 by clipping the positive lead of the DMM to the positive wire and clipping the negative lead of the DMM to the negative wire. If the solar panel is not above minimum, continue to the next step.
14. Using the selected resistor from Table 17 for the solar panel wattage, attach the selected resistor between the two solar panel wires.
15. Clip the positive lead of the DMM to the one side of the test resistor.
16. Clip the negative lead of the DMM to the other side of the test resistor.
17. Determine if the loaded voltage is greater than or equal to the specification listed.

Panel	Max	Volts at PMax	Open Circuit	Load Resistance	Loaded Voltage
10	10 W	16.8 V	21 V	30 Ω 25 W	16–18 Vdc
20	20 W	16.8 V	21 V	15 Ω 25 W	16–18 Vdc
30	30 W	16.8 V	21 V	10 Ω 40 W	16–18 Vdc

18. If the solar panel is not above minimum, replace the solar panel and retest.
19. If an issue still exists, return to Figure 79: *Power Troubleshooting flowchart* and continue testing.

5.3.4 AC charging system test

If the system setup includes an AC charger connected to the XRC^{G4} board, and it is not supplying the required voltage to the unit, test the AC charger. The following instructions contain the steps required to do so.

5.3.4.1 Step-by-step instructions

1. Check the DC wiring to the XRC^{G4} termination block connector J17 (see Figure 80). Be certain wiring is correct.
2. Check the input AC wiring from the source to the AC charging unit. Be certain the primary AC voltage is correct.
3. If the AC voltage at source is not correct, correct the source issue and retest as necessary.
4. If the primary AC voltage input level is correct, the wiring to the XRC^{G4} board terminal is correct, and there is no DC output from the charger, replace the charger fuse (Figure 82: *Current measurement troubleshooting cable*).
5. Retest the DC output voltage. If the fuse replacement does not correct the DC output voltage, replace the AC charging unit.
6. Retest the DC output voltage.
7. If the DC output voltage is correct and a power issue still exists, return to Figure 79: *Power troubleshooting flowchart* and continue testing.

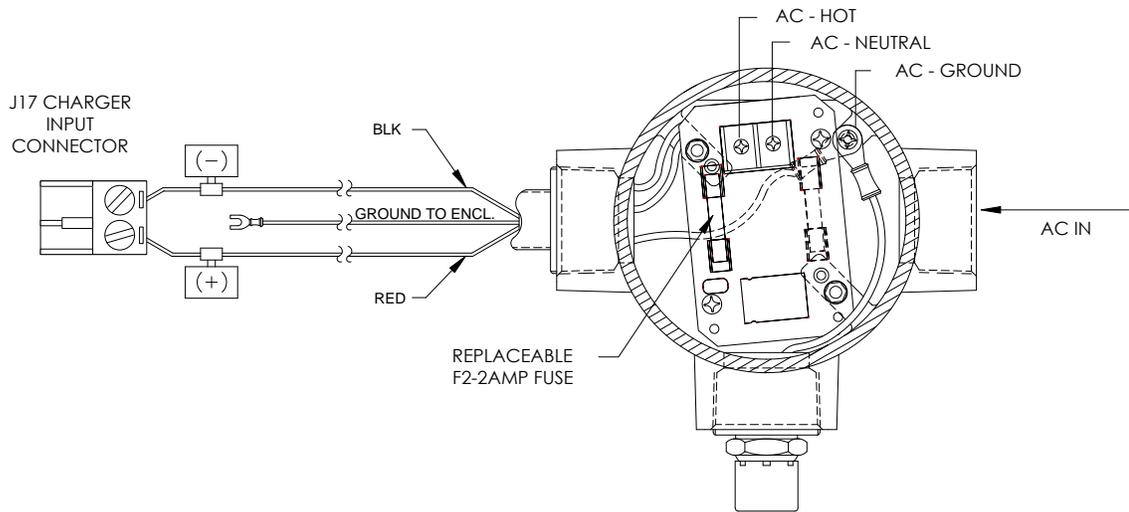


Figure 81: AC-DC charger wiring instructions

5.3.5 Auxiliary equipment isolation test

This test will need to be performed if the battery pack output voltage is not remaining consistent and no errors were found during the previous power supply, solar panel charging system or AC charging circuit troubleshooting tests.

5.3.5.1 Step-by-step instructions

1. Disconnect the solar panel charger or AC charger.
2. Disconnect the battery pack cable from the XRC^{G4} board and substitute a known good battery, if not already done.
3. Disconnect any auxiliary equipment that draws power from the XRC^{G4} or battery pack. This is not limited to, but should include, removing the J20 auxiliary power output connector if used.
4. Connect the current measurement troubleshooting cable (Part No. 2017350-xxx, see Figure 82), to a known good battery and re-connect to XRC^{G4} board.
5. Using DMM, connect to the troubleshooting cable and measure the average current. If equal to or greater than 80 mA at 12 Vdc, disconnect the battery pack and reconnect one auxiliary item. Continue to next step.
6. If the average current is less than specification, replace the main electronic board following the instructions in Section 4, *Maintenance*.
7. Re-connect the battery pack and measure the average current. If the average current is less than or equal to the equipment specification, disconnect the battery pack, and reconnect the next auxiliary item. Continue to next step.
8. Repeat step 6 until all auxiliary items have been tested and/or the equipment causing the power drain has been located.
9. If the power drain has not been located, return to Figure 80: *Power troubleshooting flow chart*.

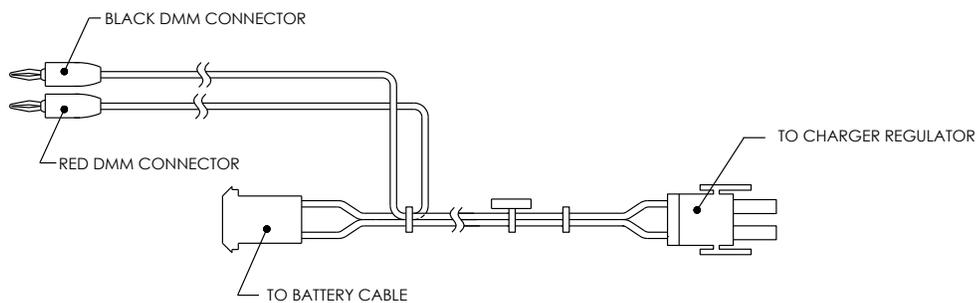


Figure 82: Current measurement troubleshooting cable

5.3.6 TFIO module isolation test

This test will need to be performed if the unit is configured to include TFIO modules, the unit's battery pack output voltage is not remaining consistent and no errors were found during the previous auxiliary equipment isolation test.

5.3.6.1 Step-by-step instructions

1. Disconnect the solar panel charger or AC charger.
2. Disconnect the battery pack cable from the XRC^{G4} board, and substitute a known good battery, if not already done.
3. Disconnect the TFIO module cable from the J18 I/O expansion connector, remote communications equipment and auxiliary equipment.
4. Connect the current measurement troubleshooting cable (Part No. 2017350-xxx, see Figure 82) to a known good battery, and connect to the XRC^{G4} board.
5. Using the DMM, measure the average current. If equal to or greater than 80 mA at 12 Vdc, disconnect the battery pack, reconnect TFIO module cable with one module connected, and continue to next step.
6. Using the DMM, measure the average current. Low power TFIO modules generally do not draw over 0.30 mA at 12 Vdc. If the average current drops less than or equal to 0.30 mA, disconnect the battery pack and connect one additional module. Repeat this step for additional modules until all have been connected or equipment fault has been located.
7. If a power drain has not been located, return to the *Power troubleshooting flow chart* (see Figure 80).

5.3.7 SLEEP mode

The SLEEP mode is a safety feature which maintains the RAM but discontinues data measurement calculations and control functions. When the XRC^{G4} is in the SLEEP mode, the word SLEEP is displayed on the LCD. If XRC^{G4} battery voltage falls below 11 Vdc, the XRC^{G4} enters SLEEP mode.

If battery voltage is still below 10.9 Vdc, when disconnected locally, the XRC^{G4} returns to SLEEP mode. If battery voltage is above 11 Vdc, the XRC^{G4} remains awake.

The XRC^{G4} has a real-time clock which maintains time and date during SLEEP mode and writes an event record when entering and leaving the SLEEP mode.

Upon wake-up, the XRC^{G4} performs the following functions:

- Stores present calculation period accumulations in historical record.
- Zeros present calculation period accumulations.
- Ends current daily record and starts a new daily record.

5.3.7.1 Step-by-step instructions

1. Connect locally to the XRC^{G4}. This should wake up the unit to then be able to determine the cause of SLEEP mode.
2. Check the battery pack cable. It must make a good secure electrical connection with XRC^{G4} board BATT connector J16 (see Figure 77: *Battery charger and battery pack connections*).
3. If the battery pack cable is securely connected, check the battery pack voltage. If voltage is low, replace with another battery pack.

5.3.8 Reset procedures

The XRC^{G4} operating system can be reset through either a COLD or WARM start procedure. The decision to use these procedures should only be made by an experienced technician.

5.3.8.1 COLD start overview

A COLD start clears all the data that is stored in RAM as well as resetting all entered variables to their factory default values or to the values last written to the tfCold drive by the Save and Restore utility. A COLD start should be used for new XRC^{G4} installations. This will ensure that all memory is clear and the operating program is at its default settings. Discretionary use of this procedure is advised.

5.3.8.2 COLD start procedure (hardware)



NOTE: Pressing the Reset button with the Memory Backup Enable jumper pulled performs a COLD Start.

1. If an external charging source is connected, it must be disconnected. Slide the external battery pack charger, CHGR INPUT +/- terminal block J17 (see Figure 77: *Battery charger and battery pack connections* on page 84), from the XRC^{G4} board green terminal block.
2. Disconnect the battery pack connector from the XRC^{G4} board BAT CONN connector J16 (see Figure 77.)
3. Disable memory backup, J1 (see Figure 83) by moving the pin jumper to pins 2 and 3.

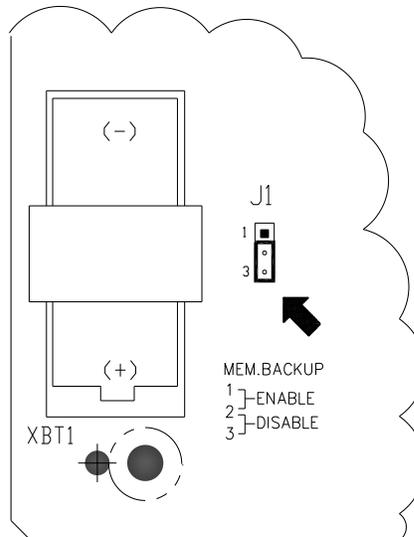


Figure 83: Lithium Battery Backup Enable/Disable

4. To return to service, reconnect the 12 Vdc battery pack connector to the XRC^{G4} board BAT CONN connector J16 (see Figure 77), and observe the LCD.
5. If removed, reconnect the external battery pack charging source to CHGR INPUT connector J17 (see Figure 77.)
6. Enter all necessary parameters (go to Section 3.5, *Setting up the XRCG4*) or send a saved station file (go to Section 2, **On the** main PCCU screen, on the top menu, select **Operate > File Utilities > Save and Restore Utility** or click the **Save and Restore Utility** icon on the toolbar.
7. Click **Save Station Files** at the bottom of the screen. The Save Station files dialog box displays.
8. In the Save to field, verify or define the location (path) to save the backup file. Take note of the file location for later retrieval. The default path stores the backup files in the StationFiles directory under the PCCU installation directory. The backup file default name is the station ID with the .xfc extension.
9. Click **OK**.
10. Wait for the backup to complete. Progress status messages display at the bottom of the screen.
11. When the upload complete message displays, select **Yes** to restore (copy) the warm configuration to tfCold
12. Wait for the tfCold update to complete. Progress status messages display at the bottom of the screen.
13. Verify that the update is complete by expanding tfCold on the navigation tree. Compare the contents of tfCold with tfData and ensure the configuration files now show in tfCold
14.).
15. When the XRC^{G4} has been COLD-started, the 24-hour clock will reset to 00:00:00.
16. Enable the memory backup J1 (see Figure 83), by moving the pin jumper to pins 1 and 2.

5.3.8.3 COLD start procedure (software)

While the hardware restart requires physically disconnecting and reconnecting jumpers from the main electronic board, performing a software restart involves typing in a command in PCCU. If an error was made while typing, begin the procedure again.

1. Using PCCU in the terminal mode, type this command exactly as shown: `boot=COLD`.

5.3.8.4 WARM start overview

A WARM start does not clear the data stored in RAM. The WARM start will only reset the XRC^{G4} microprocessor and not disturb any data that has been stored in RAM. A WARM start should be used when taking an XRC^{G4} out of service to perform maintenance or troubleshooting. A WARM start can be used when a power or communication interruption caused the XRC^{G4} microprocessor to lock-up.

5.3.8.5 WARM start procedure (Hardware)



NOTE: Pressing the Reset button with the Memory Backup Enable jumper in the enabled position performs a WARM Start.

1. Enable memory backup J1 (see Figure 83, *Lithium Battery Backup Enable/Disable* on page 93), by moving the pin jumper to pins 1 and 2.
2. If an external charging source is connected, it must be disconnected. Slide the external battery pack charger, CHGR INPUT +/- terminal block J17 (see Figure 77: *Battery charger and battery pack connections* on page 84), from the XRCG4 board green terminal block.
3. Disconnect the battery pack connector from the XRC^{G4} board BATT CONN connector J16 (see Figure 77). The XRC^{G4} is now out of service.
4. To place the XRC^{G4} back in service, connect the battery pack connector J16 (see Figure 77).
5. Connect the CHGR INPUT +/- terminal block J17 (see Figure 77).

5.3.8.6 WARM start procedure (software)

1. Move into Entry mode within PCCU.
2. Once this has been completed, click the Terminal icon on the PCCU toolbar.
3. Once the user is in Terminal mode, move to the terminal prompt (->) and type in the following: `BOOT=WARM`. Press Enter on the keyboard to initiate the WARM boot.

5.4 Troubleshooting communications

5.4.1 Communications overview

These troubleshooting procedures are applicable to all XSeries Remote Controllers with an installed radio. Use Figure 84: *Communication troubleshooting flow chart* as an aid for troubleshooting communication problems.

The three basic types of radio communications that can be used between the XRC^{G4} and a radio receiver are:

- RS-232 Communications, using a RS-232 module
- RS-485 Communications, using a RS-485 module
- RS-422 Communications (available, but not detailed)

The radio/modem may be powered one of two ways: always on or switched. The specific system setup will determine what steps are needed to power the radio/modem.

When switching power to a radio with Inhibit (SLEEP) mode, the communication 1 port or 2 switched power line will go to the radio's inhibit (SLEEP) mode input. Power out will go to the radios.

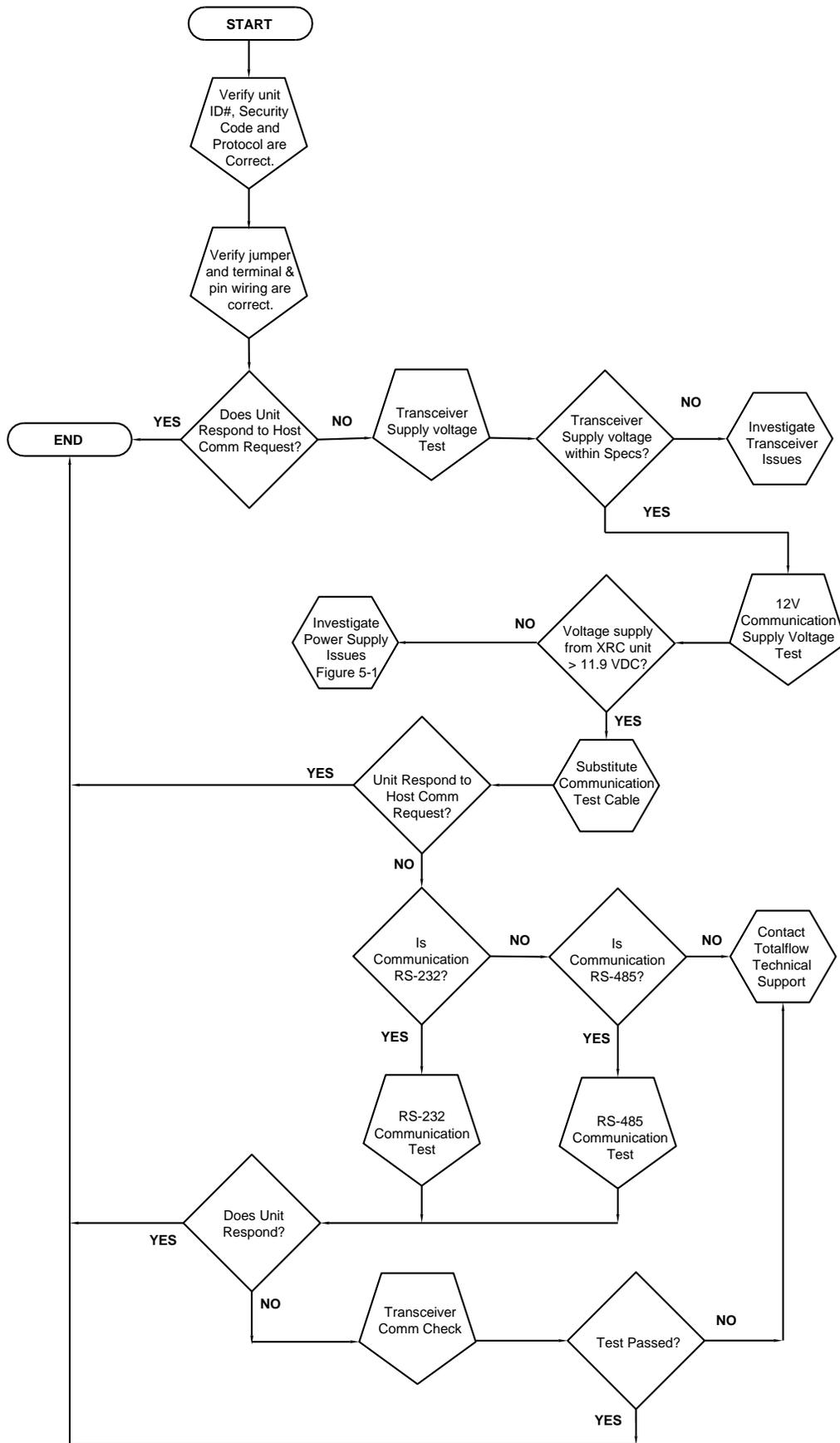


Figure 84: Communication troubleshooting flow chart

5.4.2 Verify communication set up

Verify the following items were correctly set up during the initial installation. If communications were previously operational, verify that no changes have altered the correct settings:

- Verify RS-232 or RS-485 interface modules and jumpers are installed or set correctly.
- Verify that radio cable or wiring is correctly installed at the radio.
- Verify field wiring terminations on the XRC^{G4} board.
- Check the XRC^{G4} identifier (ID). Log the ID for future reference.
- Log the XRC^{G4} access security code, baud rate, listen cycle, protocol and interface for future reference.



NOTE: The following helpful hints aid the user after communication equipment has been installed and setup:

- If the comm port is assigned to an annunciator, the XRCG4 displays the → after it recognizes the XRCG4 ID.
- Check the baud rate of the XRC^{G4} transmission and timing. The baud rate and timing settings can be changed when PCCU is in Entry mode. Default settings are 1200 baud, listening time is 4 seconds, and communications interface is turned off.
- Minimum power required for operating remote communications is 11.9 Vdc (default) or as set by user. Should the power fall below this level, remote communications will be terminated.
- Test remote communications using RS-232 troubleshooting cable (2011781-xxx). Use RS-232 to RS-485 communication converter (1800255-xxx) in conjunction with RS-232 troubleshooting cable to test RS-485 remote communications.

5.4.3 Transceiver supply voltage test

Using wiring information and guidelines supplied by the transceiver manufacturer, verify that the transceiver is receiving the manufacturer's suggested voltage. If the unit is receiving sufficient voltage, continue to the 12 V Communication supply voltage test.



NOTE: If the transceiver is not receiving sufficient voltage, investigate power supply issues. These may involve wiring irregularities at either the AC charger / power supply system or the XRC^{G4} board.

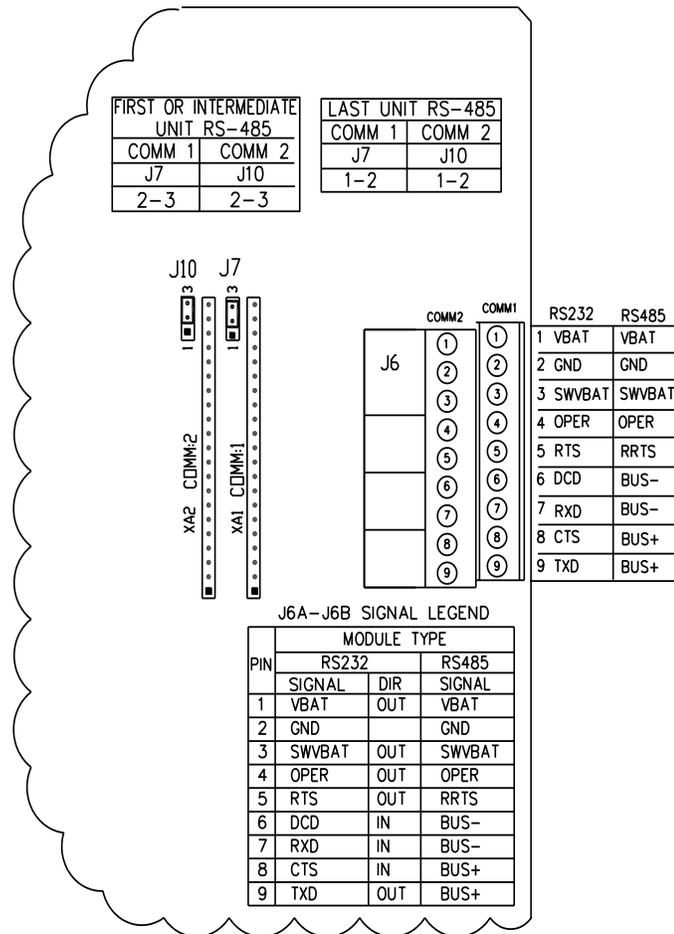
5.4.4 12V Communication supply voltage test

5.4.4.1 Step-by-step instructions

If the transceiver does not feature a SLEEP mode and power is supplied through an optional relay, perform Step 1, *Switched Power Supply Voltage Test*.

If the transceiver features a SLEEP mode, or is continuously powered, perform Step 2.

1. If the transceiver does not feature a SLEEP mode and receives power through the XRC^{G4} Switched Power, activate Serial Port 1 or 2 Switched Power Out (pin 3) and, using a digital multimeter (DMM) set to Volts DC, measure the voltage at J6 between: J6-2 (GND) and J6-3 (SWVBAT). Voltage should be greater than 11.9 Vdc for this unit. If the voltage is equal to or less than 11.9 Vdc, return to the test sequence outlined in the *Power Troubleshooting Flowchart* (see Figure 80).
2. If the transceiver features a SLEEP mode or is continuously powered, using a DMM set to Volts DC, measure the voltage at J6 between: J6-2 (GND) and J6-1 (VBAT). Voltage should be greater than 11.9 Vdc for this unit. If the voltage is equal to or less than 11.9 Vdc, return to the test sequence outlined in the *Power Troubleshooting Flowchart* (see Figure 80).

Figure 85: XRC^{G4} Communication Wiring

5.4.5 Transceiver check

5.4.5.1 Step-by-step instructions

1. If available, use a wattmeter to check the transceiver output power. Refer to the manufacturer's documentation for measuring instructions.
2. If available, use two hand-held transceivers, and verify the communication path between master and remote sites. Voice-activated interface can be used, if available.
3. Verify that the transceiver is set to the correct frequency. Refer to the manufacturer's documentation for checking frequency instructions.
4. If a directional antenna is used, verify the orientation to the antenna to the master site.



NOTE: If a communication problem still exists and the unit has passed the transceiver check test, contact Totalflow Technical Support for additional help.

5.4.6 RS-232 communication test

The following RS-232 Serial Communication Test procedure is directed from Figure 84: *Communication troubleshooting flow chart*, and will assist the user with what may be the possible cause for an indicated error message.

Before performing this test, please verify that the field wiring is correct (see Table 18).

Table 18: RS-232 field wiring on XRC^{G4} electronic board

PIN	Description
	J6–COMM 1 and 2
1	V Battery
2	Ground
3	Switched V Battery
4	Operate
5	Request to Send
6	DCD
7	RXD Receive Data
8	CTS Clear to Send
9	TXD Transmit Data



NOTE: When troubleshooting RS-232 mode, verify the termination settings of COMM1-J17 and COMM2-J10 on XRC^{G4} have pins 2 and 3 jumpered.

5.4.6.1 Step-by-step instructions



NOTE: Voltage on the following steps may be hard to see using a digital multimeter. If available, an oscilloscope will provide a more accurate reading. To verify, the host software must be continuously polling the XRC^{G4}.

Generally speaking, these tests performed on the termination board will only verify incorrect or damaged wiring. If all previous testing passed, and all wiring, jumpers and terminations have been verified correct, the board will need to be replaced. Contact Totalflow Technical Support. See *Getting Help* in the introduction of this manual for instructions.

1. Using an oscilloscope, measure Receiving Data voltage on the electronic board J8 or J10 between: *COMM 1 or 2, pin 2 (Ground) and pin 7 (Receive Data)*. When the unit is receiving data from the host, the voltage should vary between -5 Vdc and +5 Vdc. This would indicate that the unit is receiving data. Continue to Step 2. If the unit is not receiving data, investigate wiring issues (see Table 18).
2. Using an oscilloscope, measure Request to Send voltage on electronic board J6 between: *COMM 1 or 2, pin 2 (Ground) and pin 5 (Request to Send)*. When unit is communicating to the host, voltage should be +5 Vdc and remain +5 Vdc until XRC^{G4} transmit stops. This would indicate that the unit is transmitting data. Continue to Step 3. If unit is not receiving data, investigate wiring issues (see Table 18).
3. Using an oscilloscope, measure transmit data voltage on the electronic board J8 or J10 between: *COMM 1 or 2, pin 2 (Ground) and pin 9 (Transmit Data)*. When the unit is transmitting to the host, voltage should vary between -5 Vdc and +5 Vdc. This would indicate that the unit is transmitting data. If unit is still not responding, continue to next test as directed in Figure 84: *Communication troubleshooting flow chart*.

5.4.7 RS-485 communication test

The following RS-485 Serial Communication Test procedure is directed from Figure 84: *Communication troubleshooting flow chart* and will assist the user with what may be the possible cause for an indicated error message.

Before performing this test, please verify that the field wiring (see Table 19) is correct and that RS-485 terminations are pinned correctly (Table 20).

Table 19: RS-485 field wiring on XRC^{G4} board

PIN	Description
	J6–COMM 1 and 2
1	V Battery
2	Ground
3	Switched V Battery
4	Operate
5	RRTS Remote Request to Send
6	Bus (-)
7	Bus (-)
8	Bus (+)
9	Bus (+)

Table 20: RS-485 terminations

Serial Comm Port	1	2
Jumper	J7	J10
First or Intermediate Unit	pins 2–3	pins 2–3
Last or Only Unit	pins 1–2	pins 1–2



NOTE: Voltage on the following steps may be hard to see using a digital multimeter. If available, an oscilloscope will provide a more accurate reading. To verify, the host software must be continuously polling the XRC^{G4}.

5.4.7.1 Step-by-step instructions

1. Using an oscilloscope, measure line driver voltage on the XRC^{G4} board J6 between: *COMM 1 or 2, pin 6 or 7 (BUS-) and pin 8 or 9 (BUS+)*. When the unit is receiving data from the host, the voltage should vary between +5 Vdc and 0 Vdc. This would indicate that the unit is receiving data.
2. Using an oscilloscope, measure remote request to send (RRTS) voltage on the XRC^{G4} board J6 between: *COMM 1 or 2, pin 2 (Ground) and pin 5 (RRTS)*. When the unit is transmitting data, voltage should vary between +5 Vdc and 0 Vdc. This would indicate that the RRTS is working correctly.
3. If any inaccuracy exists, investigate wiring errors or damaged wires.



NOTE: If a communication problem still exists, and the unit has passed the tests in steps 1 and 2, additional testing will be required. Call Totalflow Technical Support for additional help.

5.5 Getting technical support help

5.5.1 Technical support

Totalflow takes pride in providing on-going support to customers. Purchased products come with documentation which should answer most questions; however, Totalflow Technical Support provides an 800 number as an added source of information.

For assistance, call: USA: (800) 442-3097 International: 001-918-338-4880

5.5.2 Before calling

- Know the Totalflow device's model and serial number. Serial numbers can be found on a plate located on each unit.
- Be prepared to give the Technical Support representative a detailed description of the problem.
- Note any alarms or messages as they appear.
- Prepare a written description of problem.
- Know the software version, board and optional part numbers.

5.6 Returning devices

If a Totalflow component needs to be returned to Totalflow for warranty replacement or repair, call for a Return for Authorization Number. See *Contact us* on the back cover of this manual. Follow all instructions provided and

5.6.1 Returning part(s) for repair

If a Totalflow component needs to be returned to Totalflow for replacement or repair:

- Affix the Return for Authorization number to the outside of the return package.
- Use the original packaging or a secure transport container of an appropriate type to return the device for repair or recalibration purposes.
- When returning electronic devices, securely wrap in protective anti-static packaging.
- All devices delivered to Totalflow must be free from any hazardous materials (acids, alkalis, solvents, etc.).

Appendix A 4–20 mA transmitters

A.1 Powering 4–20 milliamp transmitters

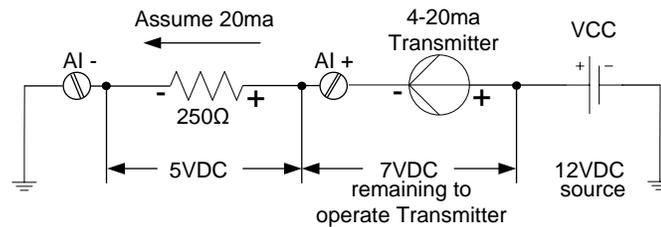
4-20 milliamp (mA) transmitters are essentially variable constant current sources. They need to have sufficient voltage applied to them to ensure that they will be able to drive 20 mA into a 250 Ohm load. Different transmitter technologies will have different powering requirements.

Many 4-20 mA transmitters claim to be operational between 10 and 30 Vdc. This can be somewhat misleading. If it is a two-wire (line powered) transmitter and it is sourcing the maximum loop current of 20 mA, 5 Vdc is dropped across the 250 Ohm resistor. Dropping 5 Vdc across the load resistor leaves only 5 to 25 Vdc (of the before mentioned 10 to 30 Vdc) to operate the transmitter. There is a good chance that 5 Vdc will not be enough to properly operate the transmitter at its maximum output of 20 mA.

Example: Voltage dropped across the load resistor at maximum loop current:

$$E = I \times R = 20 \text{ mA} \times 250 \text{ Ohm} = 5 \text{ Vdc}$$

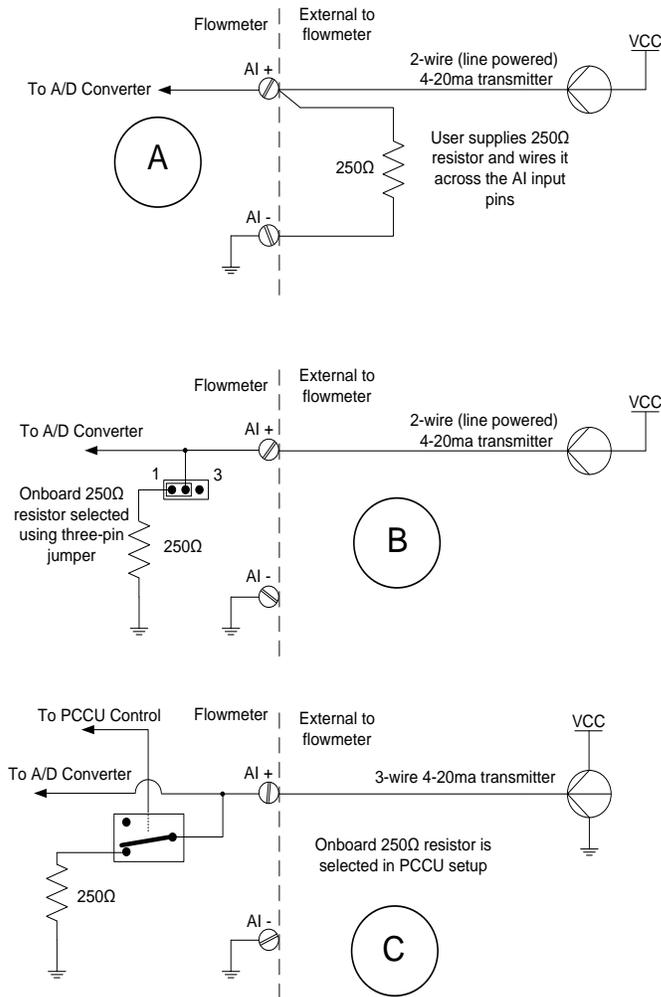
The figure below shows a 4-20 mA loop being powered by a 12 Vdc source, possibly a solar panel with battery backup. If the battery has been discharged to 12 Volts, then only 7 Volts would remain to operate the transmitter. This may not be enough to fully operate the transmitter at higher loop currents.



NOTE: The following discussion does not pertain to 1-5 Vdc transmitters.

Totalflow flow meters employ a 250 Ohm resistor to convert the 4-20 mA transmitter current loop to a 1-5 Vdc signal. In some meters this conversion is made by attaching a 250 Ohm resistor across the 4-20 mA input pins (see next figure, schematic A). Some meters use a small three-pin jumper to select an onboard 250 Ohm resistor (see next figure, schematic B). Still other meters employ an electronic switch to select the 250 Ohm resistor (see next figure, schematic C). In the schematics, VCC represents the voltage source used to power the transmitter. In many instances, VCC would be tied to the meter's VBATT.

With a solar-powered system, common for Totalflow installations, available voltage to power the 4-20 transmitter can become an issue. Batteries in a battery-backed solar installation can drop to 12 Vdc or less. Some transmitters may not be able to drive 20 mA into a 250 Ohm load with only 12 Vdc applied to them. Fully charged batteries, connected to an operational battery charger, may be sitting at about 13.5-14 Vdc.



Again, the 4-20 ma transmitter must be fully operational at voltages as low as $VCC - 5$ Vdc. VCC is the source voltage available at the site and 5 Vdc represents the voltage dropped across the meter's 250 Ohm resistor at maximum loop current (20 mA).

Totalflow can provide a 12 to 24 Vdc converter (part # 2100358-001). This converter can be powered from the meter's VBATT. The converter's 24 Vdc output can then be used to power the 4-2 mA transmitter loop. In other words; VCC (Figure 1-1) would now be 24 Vdc. Subtracting the 5 Volts dropped across the 250 Ohm resistor would leave 19 Vdc to power the transmitter.



NOTE: Another possible solution would be to reduce the 250 Ohm resistor to a smaller value, possibly 125 Ohms. An under-powered transmitter could more easily drive 20 mA into the lesser resistance. Field calibrating the AI would negate any differences between the 250 Ohm and the 125 Ohm resistors. However, as the size of the resistor is reduced, the overall resolution is diminished.

A.2 Example 1

If the 4-20 mA transmitter can drive full range (20 mA through the 250 Ohm resistor) a 4-20 mA current range has been converted into a 1-5 Vdc voltage range. The analog to digital (AD) converter used in Totalflow equipment expects a 1-5 Vdc signal. During field calibration, we might have the 4 mA of loop current represent 10 bbls. of fluid per hour and 20 mA represent 100 bbls. The conversion to voltage (using the 250 Ohm resistor) would be as follows:

$$1 \text{ Vdc} = 10 \text{ bbls/hour}$$

$$5 \text{ Vdc} = 100 \text{ bbls/hour}$$

Assuming that the AD converter is ranged between 0 and 5 Vdc, and that the converter is resolving 15 bits, expect to resolve about 150 μ Vdc (or .0006 mA). These numbers translate to about .003 bbl (3 thousandths of a barrel, or about one half fluid ounce).

A.3 Example 2

If the 4-20 mA transmitter cannot drive full range (20 mA through the 250 Ohm resistor), reduce the value of the resistor. For example drop it to 125 Ohm (or half). A 4-20 mA current would now be converted to a .5 - 2.5 Vdc voltage range. Again, during field calibration, have the 4 mA current represent 10 bbls per hour and the 20 mA signal represent 100 bbls per hour. The voltage conversion (using the 125 Ohm resistor) would be as follows:

$$.5 \text{ Vdc} = 10 \text{ bbls/hour}$$

$$2.5 \text{ Vdc} = 1000 \text{ bbls/hour}$$

The AD full range is still 0-5 Vdc, but using only about half of its range capability. Just like the resistor value, the ability to resolve barrels of fluid per hour has been cut in half. Overall accuracy remains unchanged, but only about .006 bbl (6 thousandths of a barrel, or about one fluid ounce) can be resolved.

A.4 Conclusion

If the 4-20 mA transmitter cannot drive a full 20 mA through the 250 Ohm resistor, one option is to reduce the resistive value. However, as the resistive value is reduced, resolution (not overall accuracy) will be reduced proportionately. Dropping the resistive value by half (250 Ohms to 125 Ohms), reduces the resolution also by half.

To reduce the resistive value of an onboard resistor another option is to add an external resistor across the analog input pins. This places the two resistors in parallel with one another. The parallel combination produces an equivalent resistance that is less than either of the two resistors alone. The value of this equivalent resistance is calculated as shown in the figure.

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