2017285-001 (AB)

TOTALFLOW®

6790 Remote Terminal Unit

Installation - Operations - Maintenance

Manual

TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

Copyright Notice

Table of Contents

Table of Contents, Continued

About the Manual

Audience & Purpose

This manual is written to provide an experienced RTU technician with the requirements necessary to install, setup and operate a RTU System.

Organization & Style

Each of the chapters in this manual is written in an organized and concise manner. Readers are able to look at the headings and get a broad picture of the content without reading every word. Also, there are overviews at the beginning of each chapter that provides you with an idea of what is in the chapter, and how it fits into the overall manual.

Chapter Contents

This manual provides the following information.

Chapter	Title	Description
1	System Description	Provides a description of the RTU system components, specifications, and description of RTU operational methods.
2	Installation	Includes unpacking and detailed procedures for setup and installation.
3	RTU Operation	Provides you with a tutorial on how to get a newly installed RTU system up and running using both PCCU32 and DOS PCCU.
4	Maintenance & Troubleshooting	Instructions on replacing major parts and troubleshooting techniques.
5	Customization	Describes the user tools available to customize the RTU and their operation.
6	Drawings	This section provided for the user to insert drawings that accompany new units.

Getting Help

Technical Support

At Totalflow, we take pride in the on going support we provide our customers. We try to put enough information in our manuals to answer your questions; however, our customer service group provides you with a special 800 phone number as an added source of information.

If your require assistance, call:

(800) 442-3097

Before You Call

Know your unit's model number. Model numbers can be found on the escutcheon plate located on the side of each unit.

Prepare a written description of the problem.

How to Describe Your Problem

Be prepared to give the customer service representative a detailed description of the problem.

Note the alarms or messages as they appear on the PCCU or the device's display.

Safety Practices and Precautions

Safety First

This product has been designed and tested in accordance with IEC Publication 1010-1, Safety Requirements for Electronic Measuring Apparatus, and has been supplied in a safe condition. This manual contains information and warnings which have to be followed by the user to ensure safe operation and to retain the product in a safe condition.

Terms in This Manual

WARNING statements identify conditions or practices that could result in personal injury or loss of life.

CAUTION statements identify conditions or practices that could result in damage to the equipment or other property.

Terms as Marked on Equipment

DANGER indicates a personal injury hazard immediately accessible as one reads the markings.

CAUTION indicates a personal injury hazard not immediately accessible as one reads the markings, or a hazard to property, including the equipment itself.

Symbols in This Manual

This system indicates where applicable cautionary or other information is to be found.

Symbols Marked on Equipment

DANGER - High voltage

Protective ground (earth) terminal

ATTENTION - Refer to Manual

Grounding the Product

A grounding conductor if required should be connected to the grounding terminal before any other connections are made.

Safety Practices, Continued

Correct Operating Voltage

Before switching on the power, check that the operating voltage listed on the equipment agrees with the available line voltage.

Danger Arising From Loss of Ground

Any interruption of the grounding conductor inside or outside the equipment or loose connection of the grounding conductor can result in a dangerous unit. Intentional interruption of the grounding conductor is not permitted.

Safe Equipment

If it is determined that the equipment cannot be operated safety, it should be taken out of operation and secured against unintentional usage.

Use the Proper Fuse

None of the fuses on the model 6790 RTU are user replaceable. Consult the factory for service instructions if you have determined that a fuse is blown. Use of repaired fuses or short circuiting of the fuse switch is not permitted.

Safety Guidelines

DO NOT perform any adjustments, measurements, maintenance, parts replacement or repairs until all power supplies have been disconnected.

When opening covers or removing parts, exercise extreme care "live parts or connections can be exposed".

Capacitors in the equipment can still be charged even after the unit has been disconnected from all power supplies.

Chapter 1

System Description

Overview

Introduction

The Model 6790 RTU is a system that offers Inputs and outputs for measurement and control of process variables.

The Model 6790 RTU offers the following Input and output points:

- 7 analog inputs
- 1 to 4 analog outputs
  (1 on base board, 3 additional using plug-in expander board)
- 8 digital inputs
- 8 digital outputs
- 2 high speed pulse accumulators (20 kHz)

This system is made up of a NEMA 4X enclosure which can house remote communications equipment, a main electronics board and Liquid Crystal Display, two 25 pin interconnect cables and an input/output field termination board.

Continued on next page

Chapter Highlights

This chapter covers the following topics

Introduction, Continued

The RTU is powered by a primary 12 VDC battery system which can be charged using either solar panel, 24Vdc or 120/240 VAC chargers.

The Model 6790 is optimized for extremely low power consumption and is primarily designed for remote operation in harsh environments.

The Model 6790 RTU has four communications ports (3 remote and 1 local) and can be multi-dropped using the RS485 communications capabilities.

The RTU system has built-in, pre-engineered applications for data collection, trending and long term data storage (35 daily averages, last 72 one hour averages, and last 60 minutes of 1 minute averages)

This system can be used for oil and gas production, transmission and distribution site monitoring and control, water and waste system monitoring and control, etc.

The model 6790 RTU system can be programmed for advanced control or shutdown logic using a control language called GELLO (graphically enhanced ladder logic). An extensive applications library is available from Totalflow Projects Engineering as needed, or we can program the application for you.

Monitoring and Data Logging Information

The current value for all RTU I/O points is available using the Monitor Mode of the PCCU handheld programmer. Data that could be collected at one time has changed with the evolution of RTU firmware. Minute, Hourly, or Daily resolution of inputs and outputs is available with the WinCCU32 I/O Control program.

In early firmware, 6 channels of AO, AI, and PI data are logged and could be collected at one time. Later firmware allowed 16 channels to be recorded, but 6 could only be collected at one time. The latest RTU firmware as gone to completely new Trending system which is only limited by the amount of memory on the RTU.

Logged data can be averages, totals or snap shot values. The logged data will contain data in engineering units defined at calibration, the percent of time the value was above the set high limit and the percent of time the value was below the set low limit. The Digital I/O data contains the percent of time the channel was ON during the resolution period.

Polling the I/O using the Remote Communication routine normally returns the value present at the input or output at the time of the poll. Polling using templates however provides a lot more versatility.

Modbus protocol is available for use to communicate with the RTU as a Modbus Slave device. Modbus register information will be provided in the custom documentation generated for each RTU project.

Continued on next page

Power Consider-ations

The RTU is designed for <1 watt continuous operation from internal batteries in the following

configuration:

- 10 watt solar charging source
- 1 - 26 amp hour battery
- Communications interface and approved radio

Field I/O termination board with the following I/O:

- 7 Analog Inputs active
- 1 Analog Output active
- 8 Digital Inputs active
- Digital Outputs inactive

To prevent excessive power drain of the internal batteries, it is recommended to use an external power supply whenever the Digital Outputs and more than 1 Analog Output are used.

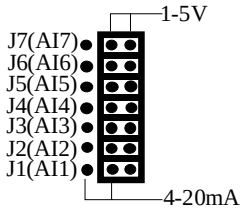
Two types of termination boards are available for the I/O:

- Part No. 2011697-001
- Part No. 2012511-001 Normally installed in Model 6790 RTU enclosure

Power Consider-ations, Continued

NOTE: 250 ohm load resistors are provided for all Analog Inputs and are mounted on termination board part no. 2011697-001. The load resistors should be connected across the Analog Input connections for any input that is a 4 to 20 milliamp signal.

Termination board part no. 2012511-001 has the 250 ohm load resistors soldered on the board. The connection of the resistors across the Analog Input is controlled with jumper blocks located on the termination board next to TB7, the terminal block marked "SHIELDS". Jumper the blocks as indicated for 1 to 5 volt inputs or 4 to 20 milliamp inputs. Any unused channels should have the jumper in the 4 to 20 milliamp input position.



Jumper blocks on termination board 2012511-001 (or latest revision)

Specifications

Certification	Designed to meet Class 1, Division 2, NRTL/C hazardous area classifications. Meets FCC Part 15, Class A Certification.
Dimensions	15.1 in. W x 18.00 in. H x 13.69 in. D (383.54 mm W x 457.20 mm H x 347.73 mm D)
Weight	29.3 lbs. (13.29 kg) with 12AH Battery
Mounting	Wall, pipe or direct
Power	Battery 12 VDC
Charger	Solar or 13-26 VDC
Memory	Data stored in 128K CMOS RAM. RAM memory has lithium backup battery. Applications programs stored in 256K ROM. RAM and ROM expandable to 512K.
Comm Ports	1 - RS-232 or RS-485 (Board dependent) 1 - RS-232 only 1 - RS-485 only 1 - Local Port (dedicated)
Shock	Maximum of 25G's in any axis, 11 ms duration.
Humidity	0-95% R.H. 12 hours exposure non-condensing over compensated temperature range.
Temperature Limits	Operational -40 to 200°F (-40 to 93°C) Storage -60 to 225°F (-51 to 107°C)
I/O Description	4 Analog outputs: 4 to 20 ma (1 standard, 3 optional) 7 Analog inputs: 1 to 5 v (RTU-non-differential) (RTU -differential) 2 Pulse inputs: 0 - 5v to 0 - 12v input range 8 Digital outputs (dc switched) 8 Digital inputs (dry contact)

Analog Output

- 4 - 20 ma output
- 12 bit resolution
- +/- 5.127 microamps accuracy
- 250 ohm minimum load

Analog Input

- 0 - 5v (4-20 ma with built-in 250 ohm resistor)
- 13 bit resolution
- +/- 640.87 microvolts (+/-2.57 microamps) accuracy
- Non-differential inputs (common ground)

Continued on next page

I/O Description Continued

Pulse Input - Active Input

- 0 - 20000 Hz frequency input
- 0 - 5 volt minimum pulse voltage input
- 0 - 12 volt maximum pulse voltage input
- 0 VDC must be less than .8 volts

Pulse Input - Contact Closure Input

- 0 - 100 Hz frequency input

Digital Output

When active or set, DC voltage is supplied across DO+ and DO-.

The DC voltage available on the outputs is determined from the power source and the total combined current available (sum of all active outputs)

- Internally powered: Battery voltage @ 2 amps
- Externally powered: External power supply @ 4 amps

Digital Input

- Input sensed by dry contact input (0 ohms) between DI+ and DI-
- Input status read once per second
- Not operational with non-dry contact input (active input)

Equipment Layout

Stand-alone Enclosure

The following system components layout drawing shows all the major functional parts and their locations when mounted in a model 6790 RTU stand-alone system. This system houses an internal main battery located behind the swing out plate shown with field termination's panels.

A removable communications enclosure can be provided that has been pre-drilled for mounting of many popular communications devices such as radios, cellular phones, modems, etc.

This enclosure meets NEMA 4X ratings and is designed for mounting in harsh environments (cold, hot, wet and salty).

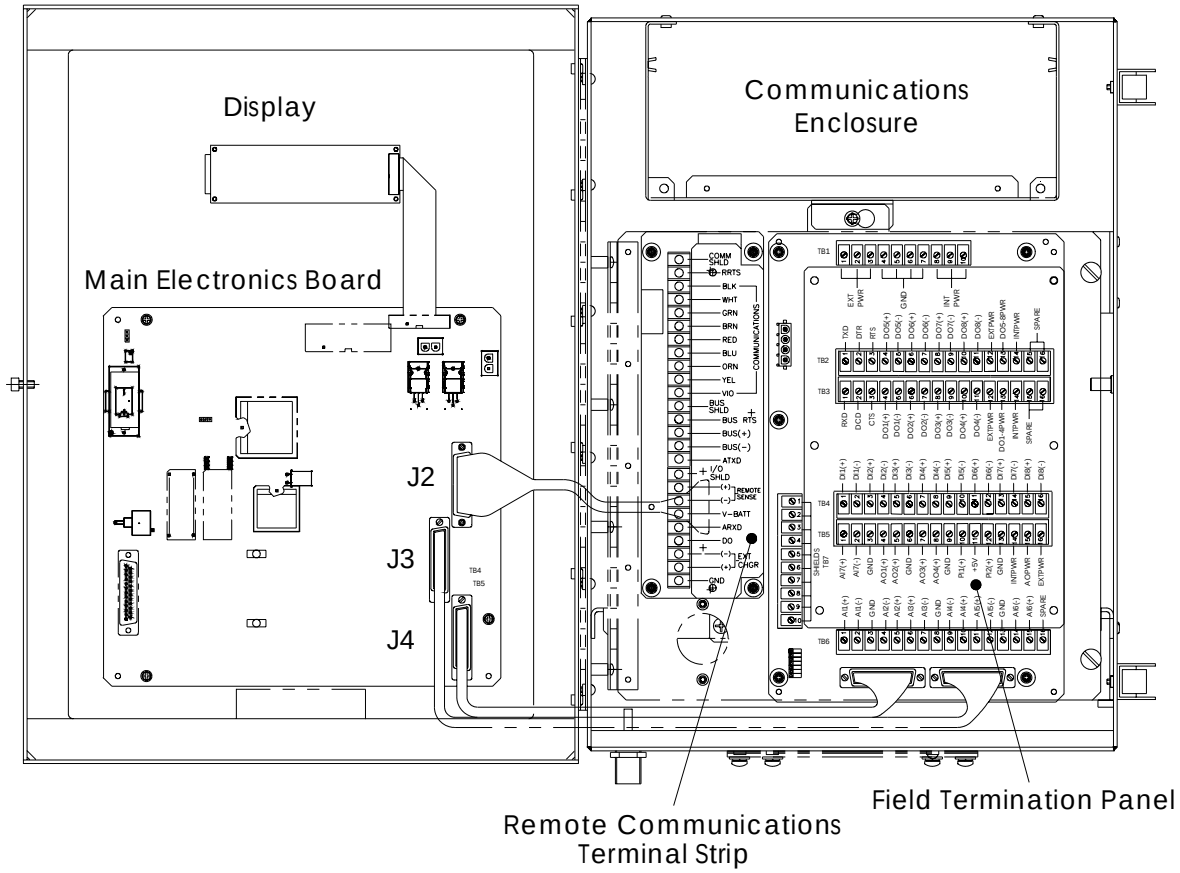


Figure 1 - 1 6790 RTU Stand-alone Enclosure Layout.

Wall-mount Enclosure

The following views show the major functional parts and their locations when mounted in a model 6790 RTU wall mount system. This system is designed for mounting in customer supplied environmental enclosures, or for wall mounting in a building. Slotted pre-drilled mounting holes are provided for ease of installation.

Main battery power, charging power, and remote communications equipment must be mounted remotely from the enclosure shown.

Please consult with Custom Projects Engineering or your local system integrator for help in mounting of this enclosure.

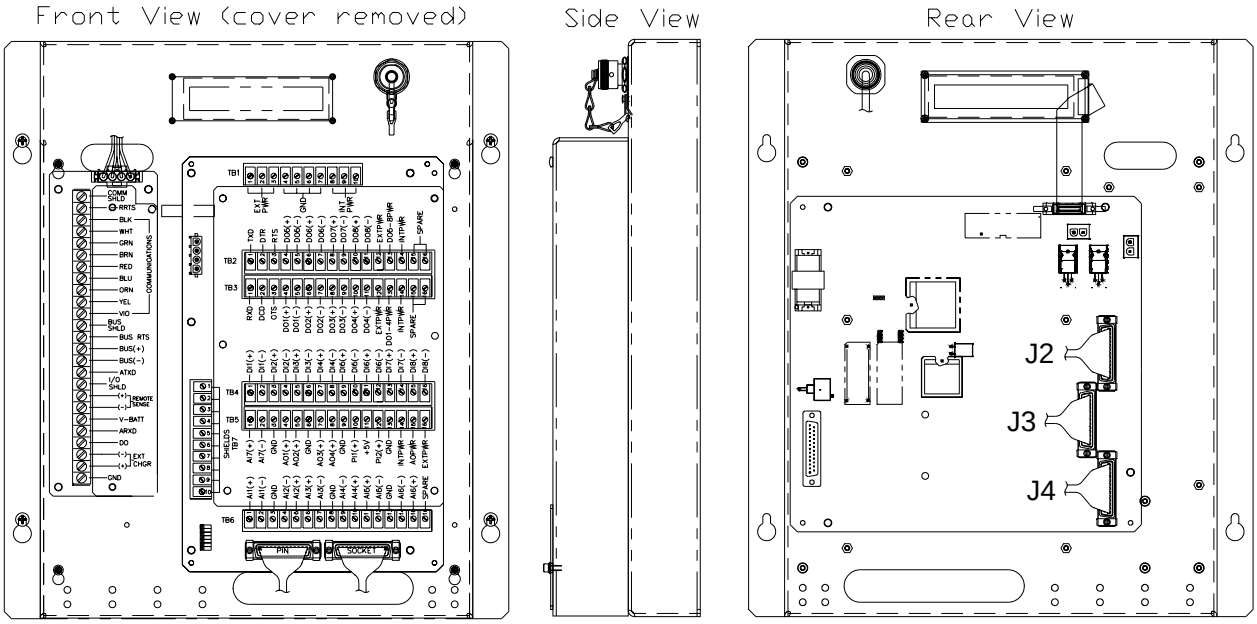


Figure 1 - 2 6790 RTU Wall-mount Enclosure Layout.

Component Locations

The following system components layout drawing of the electronics board shows all the major functional parts and their locations when mounted in a model 6790 RTU system.

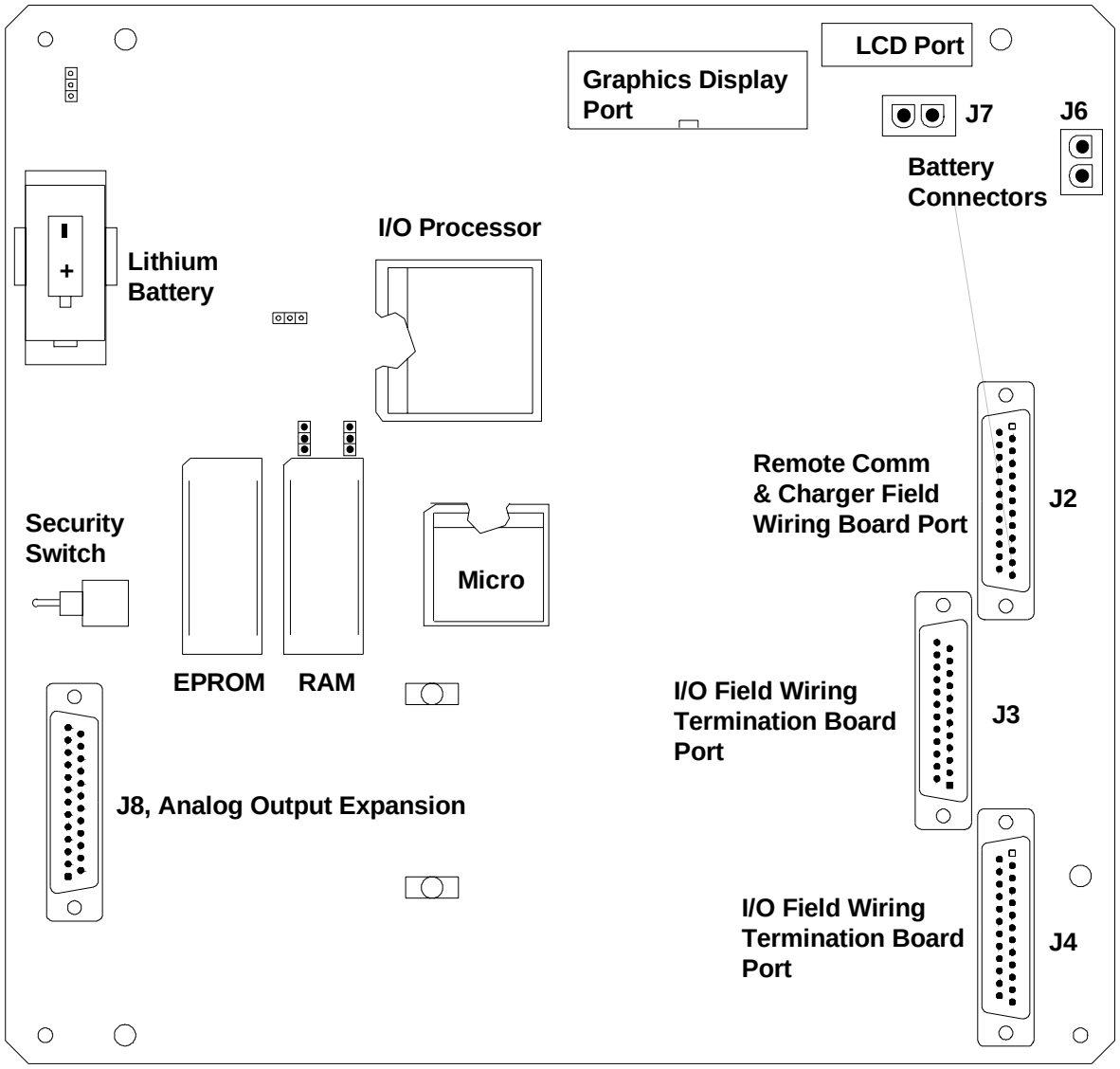


Figure 1 - 3 6790 RTU Main Electronics Board Component Layout

Powering Field Terminations

Connections to power Analog Outputs with Internal Power

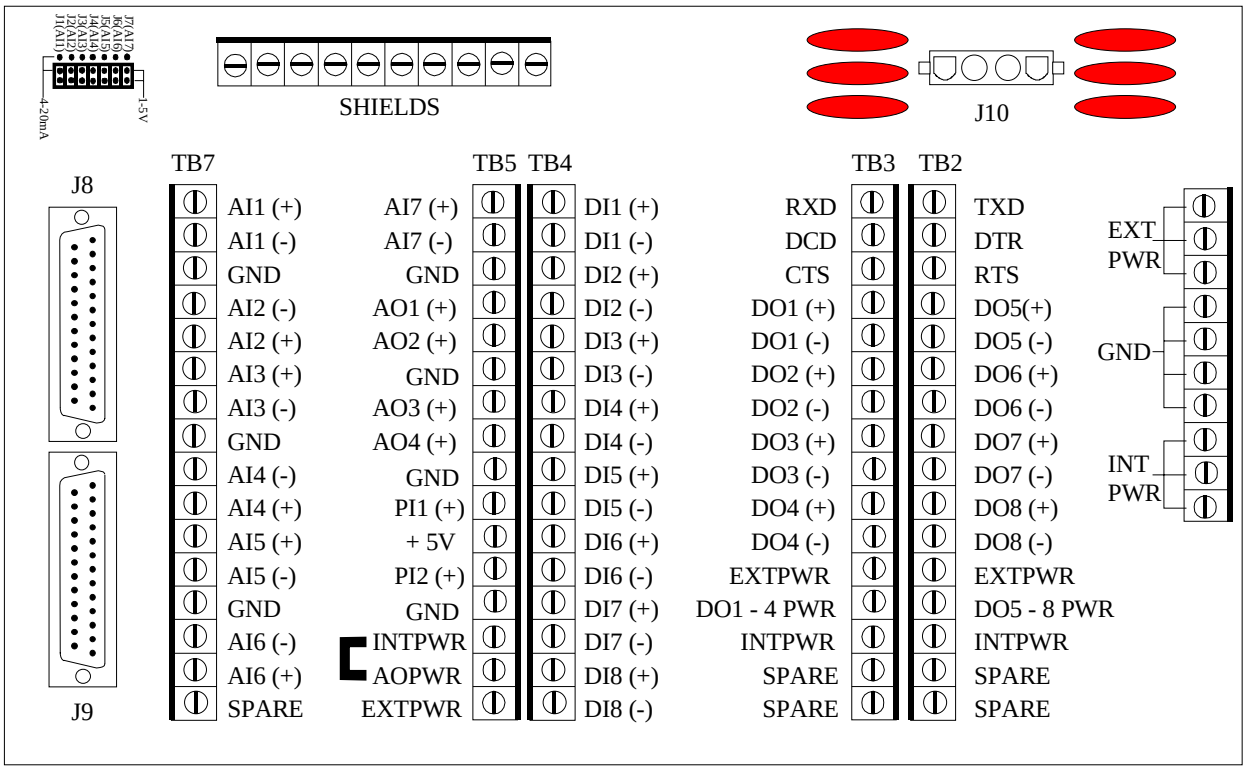


Figure 1 - 4 Termination Board Part No. 2012511-001

Int Pwr is the Internal Power connection on the Termination Board. Jumper Int Pwr to AO Pwr as shown to power the AO with Internal Power.

Powering Field Terminations, Continued

Connections to power Analog Outputs with External Power

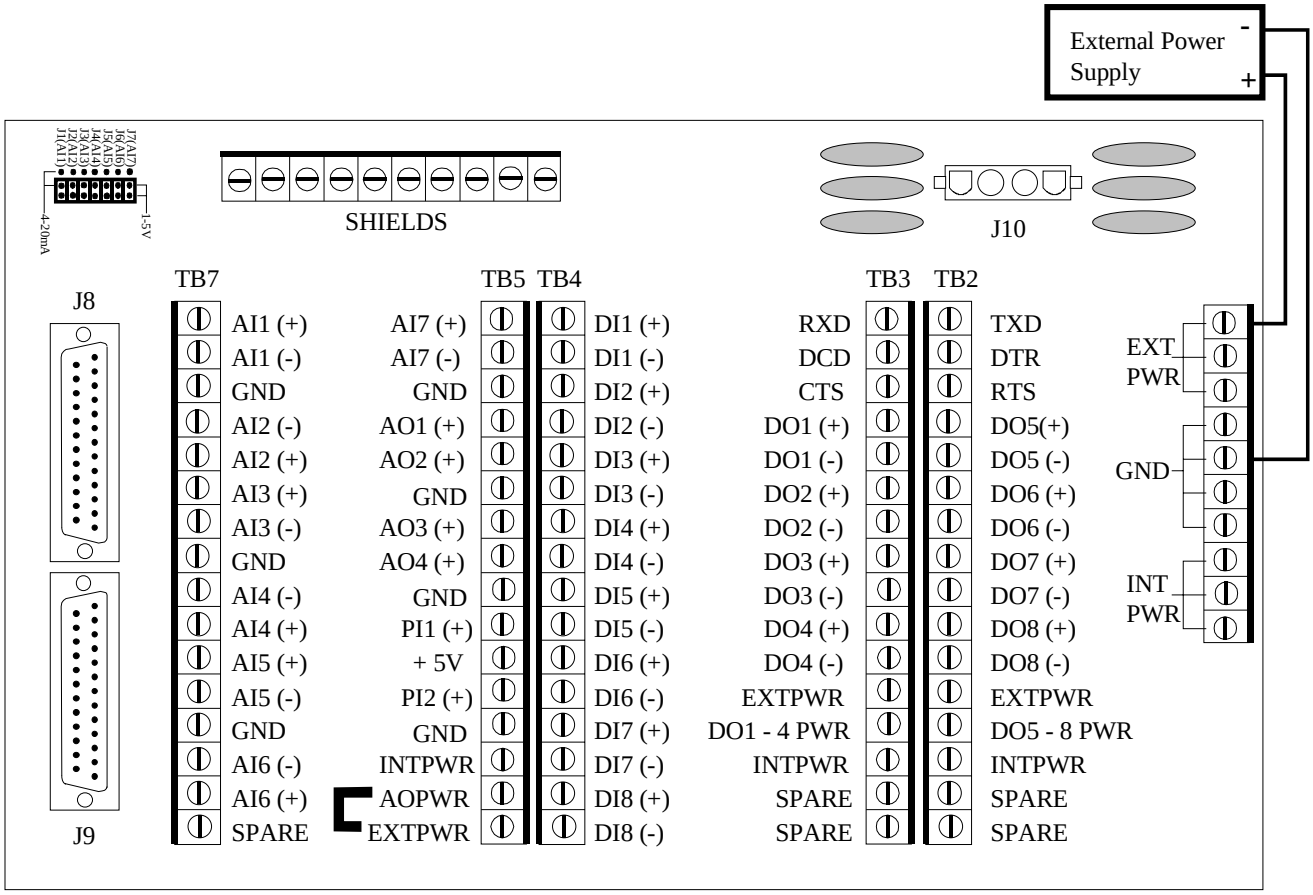


Figure 1 - 5 Termination Board Part No. 2012511-001

The External Power Source is attached to Ext Pwr and Gnd at TB1 and GND as shown. Jumper Ext Pwr to AO Pwr at TB5.

Powering Field Terminations, Continued

Connections to power Digital Outputs with Internal Power

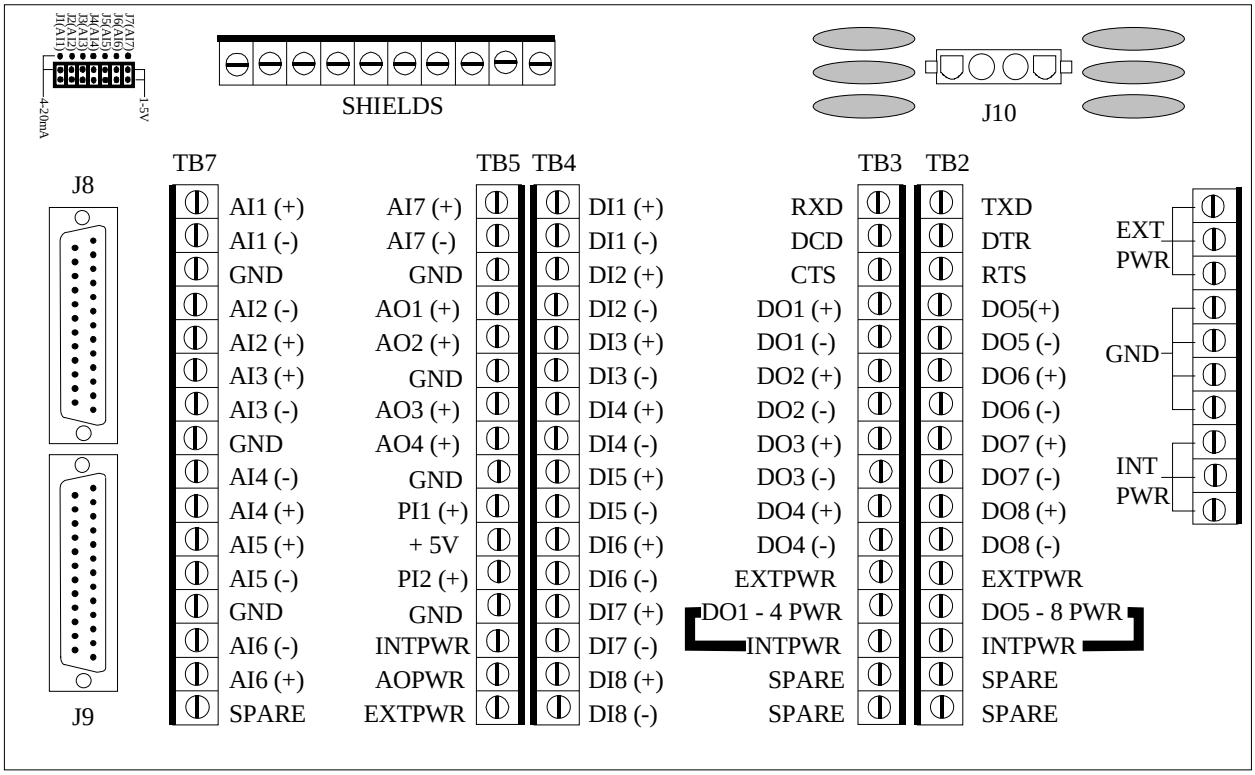


Figure 1 - 6 Termination Board Part No. 2012511-001

Int Pwr is the internal power connection at TB2 and TB3. Jumper Int Pwr to DO5-8 Pwr on TB2 and Int Pwr to DO1-4 Pwr on TB3 to power all 8 DOs with internal battery power. Each group of DOs can be powered either with internal power or with external power.

Powering Field Terminations, Continued

Connections to power Digital Outputs with External Power

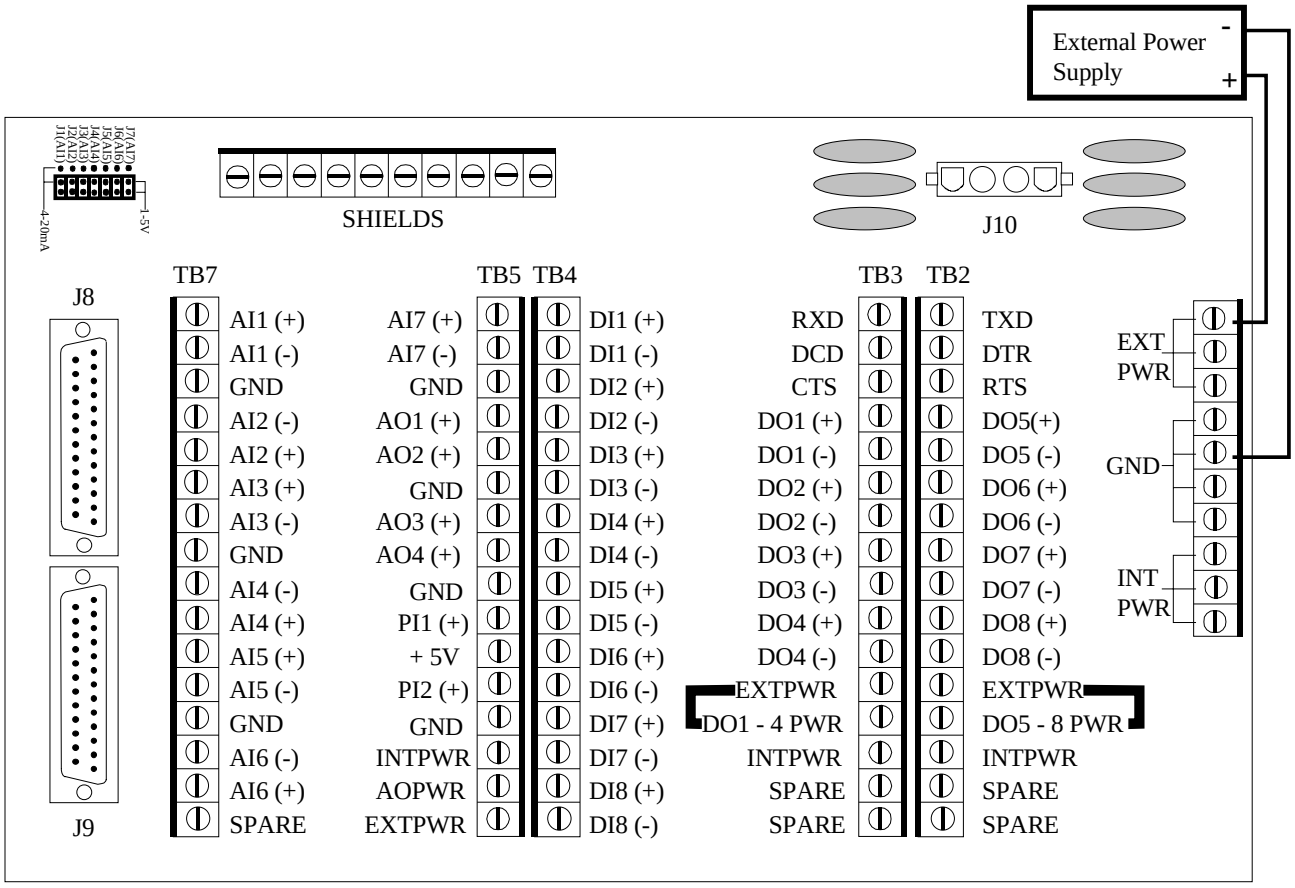


Figure 1 - 7 Termination Board Part No. 2012511-001

The External Power Source is attached to Ext Pwr and Gnd at TB1. DO5-8 is jumpered to Ext Pwr on TB2 and DO1-4 is jumpered to Ext Pwr to power all 8 DOs with External Power. Each group of DOs can either be powered internally or with external power.

Chapter 2

Installation

Overview

Introduction

This Chapter provides you with the information for installation and setup. By the time you finish this chapter you will have the RTU unpacked, installed, field wired and ready for operation. For safe and trouble free installation follow all instructions and advisories.

Installation Hint

Read through this chapter before you begin the installation to plan your installation requirements. Also before you begin, refer to the wiring diagrams that accompanied the RTU.

Installation procedures, presented within this Chapter, are applicable to Model 6790 RTU and AIU systems.

Sequence of Events Table

The table provides you a recommended sequence of events to be followed for the installation process. Before you begin the installation familiarize yourself with the process; detail procedures are given on the pages referenced.

Events	See Page
Unpack the equipment and inspect for damage.	2 - 2
Mount Unit	2 - 8
Connect Main Battery(s)	2 - 11
Connect Solar Charging Source	2 - 12
Connect AC Charging Source	2 - 15

Unpacking & Inspection

Unpacking

The RTU is shipped in a specially designed shipping carton which contains the unit, mounting brackets, parts list and wiring and interconnect diagrams. The Solar Panel and the Battery Pack with applicable hardware are shipped in a separate carton.

Carefully remove the items from each carton.

Initial Inspection

Inspect the shipping carton for 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 releasing the set screw and releasing the latch/latches.
- Visually inspect the Digital PC Board, cables, and connectors for damage.

Damaged Components

If any components has been damaged or if there are noticeable defects, notify your Totalflow representative. Keep all shipping materials for the carrier's inspection. Totalflow will arrange for immediate repair or replacement; see 'Getting Help', page iv.

Dimensional Drawings

The following pages contain dimensional drawings that will aid in the installation process.

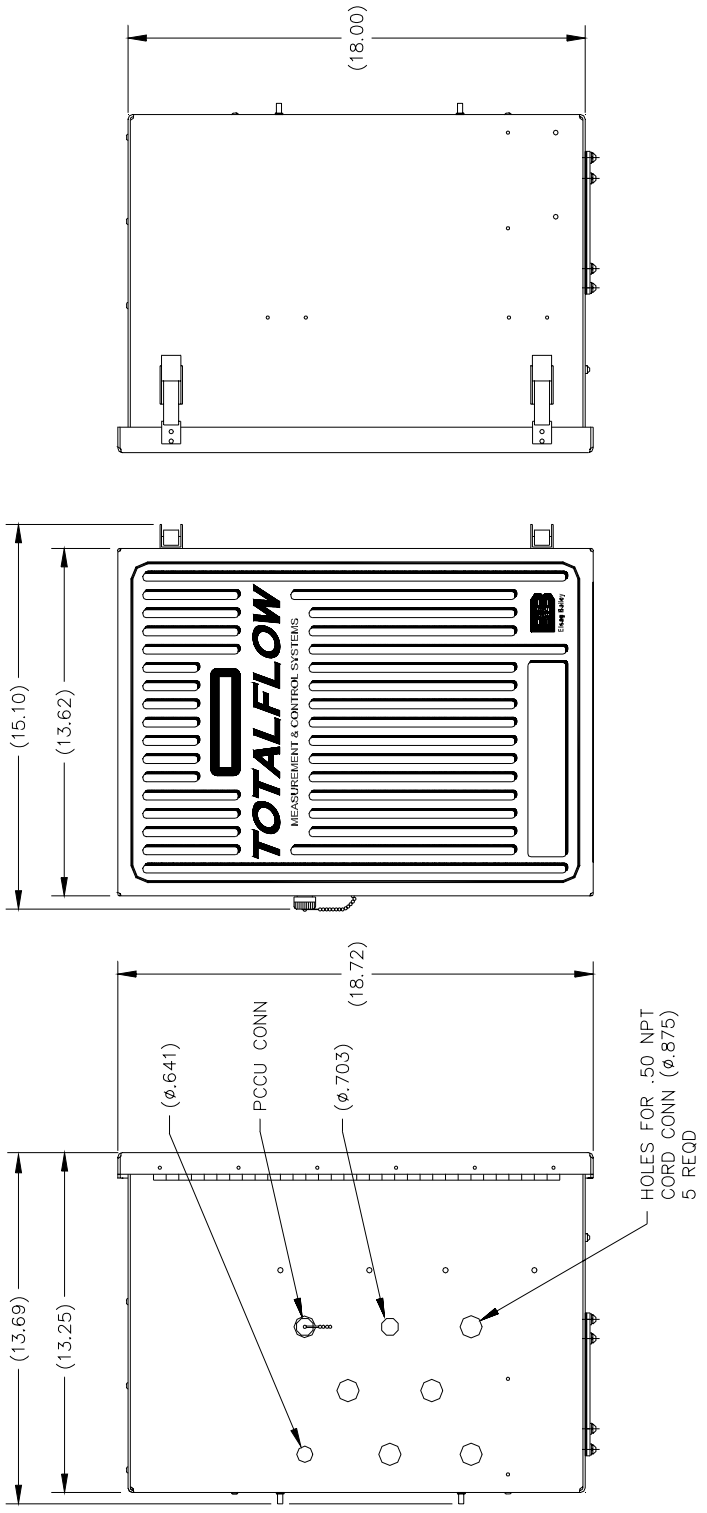


Figure 2 - 1 Side & Front Dimension Drawing, Model 6790 RTU

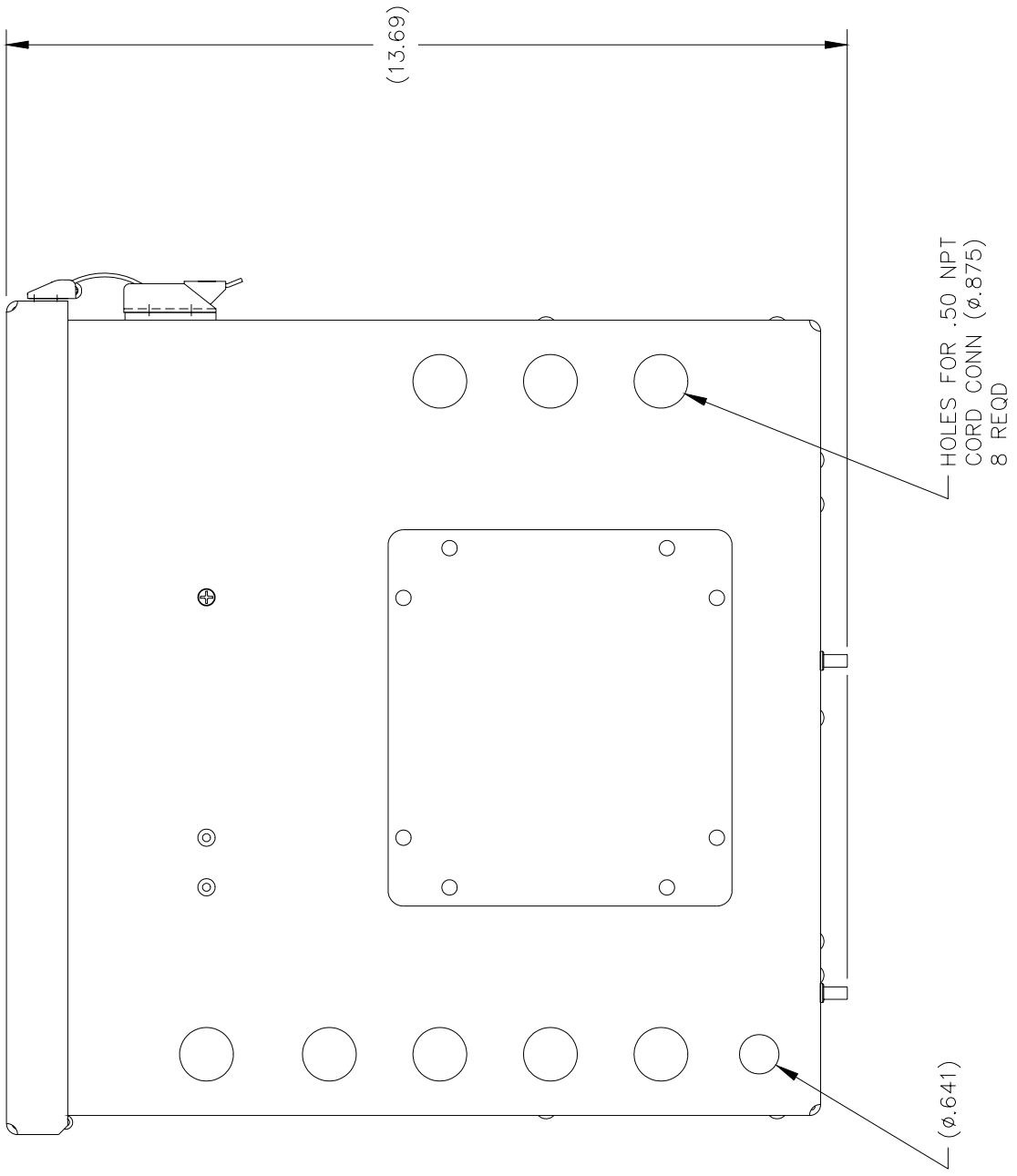


Figure 2 - 2 Bottom Dimension Drawing, Model 6790 RTU

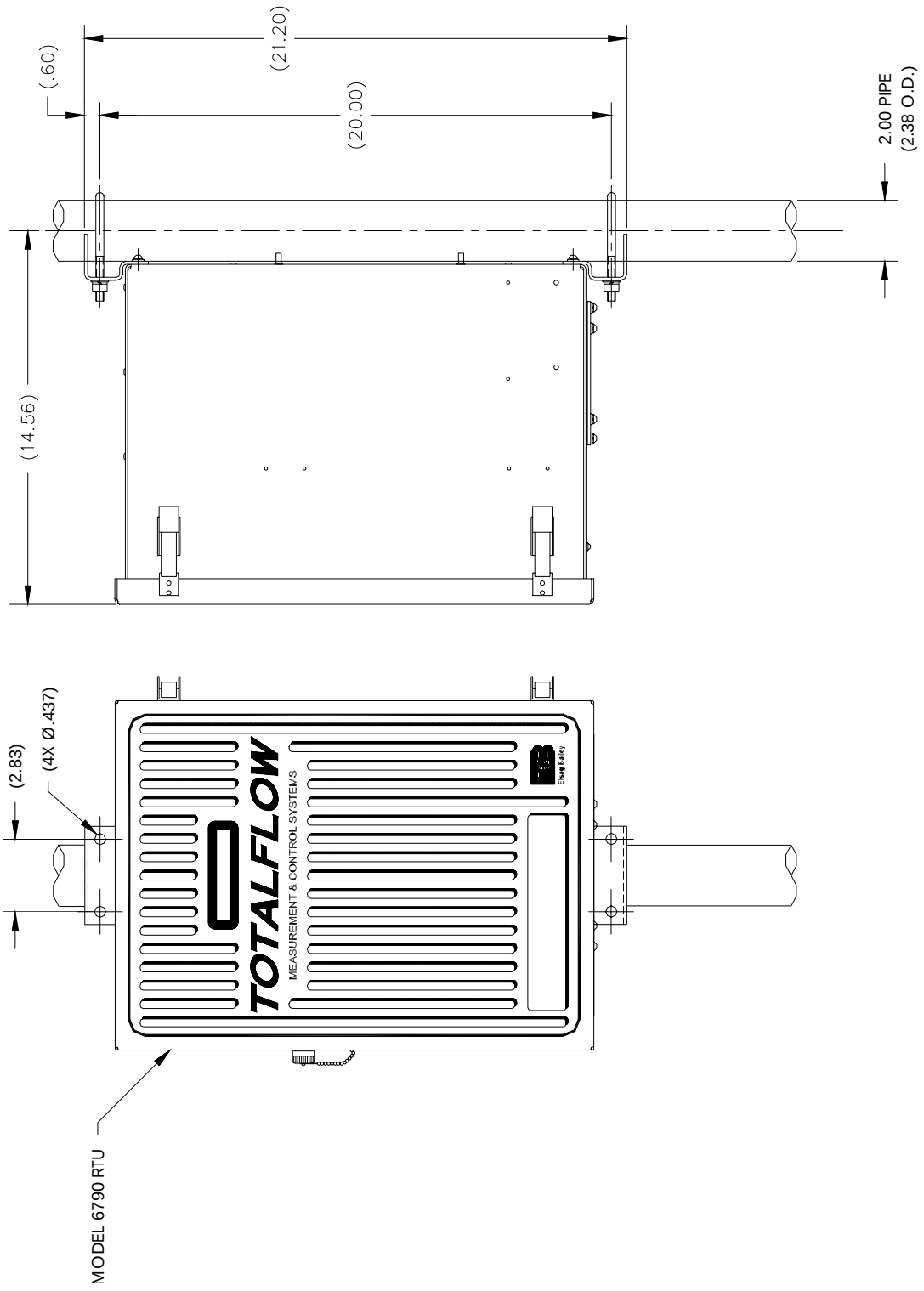


Figure 2 - 3 Pole Mounting Dimension Drawing, Model 6790 RTU

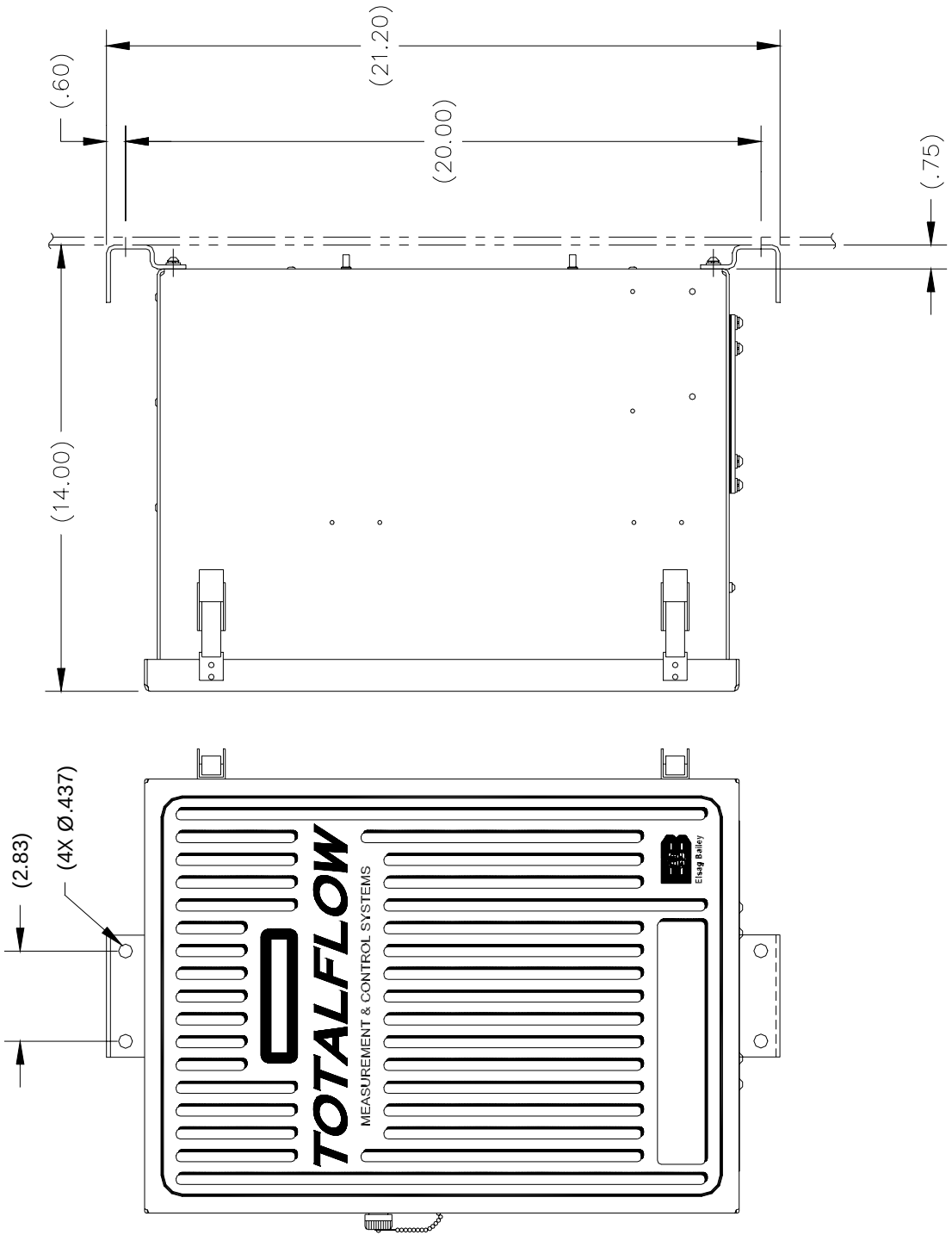


Figure 2 - 4 Wall-mount Dimension Drawing, Model 6790 RTU

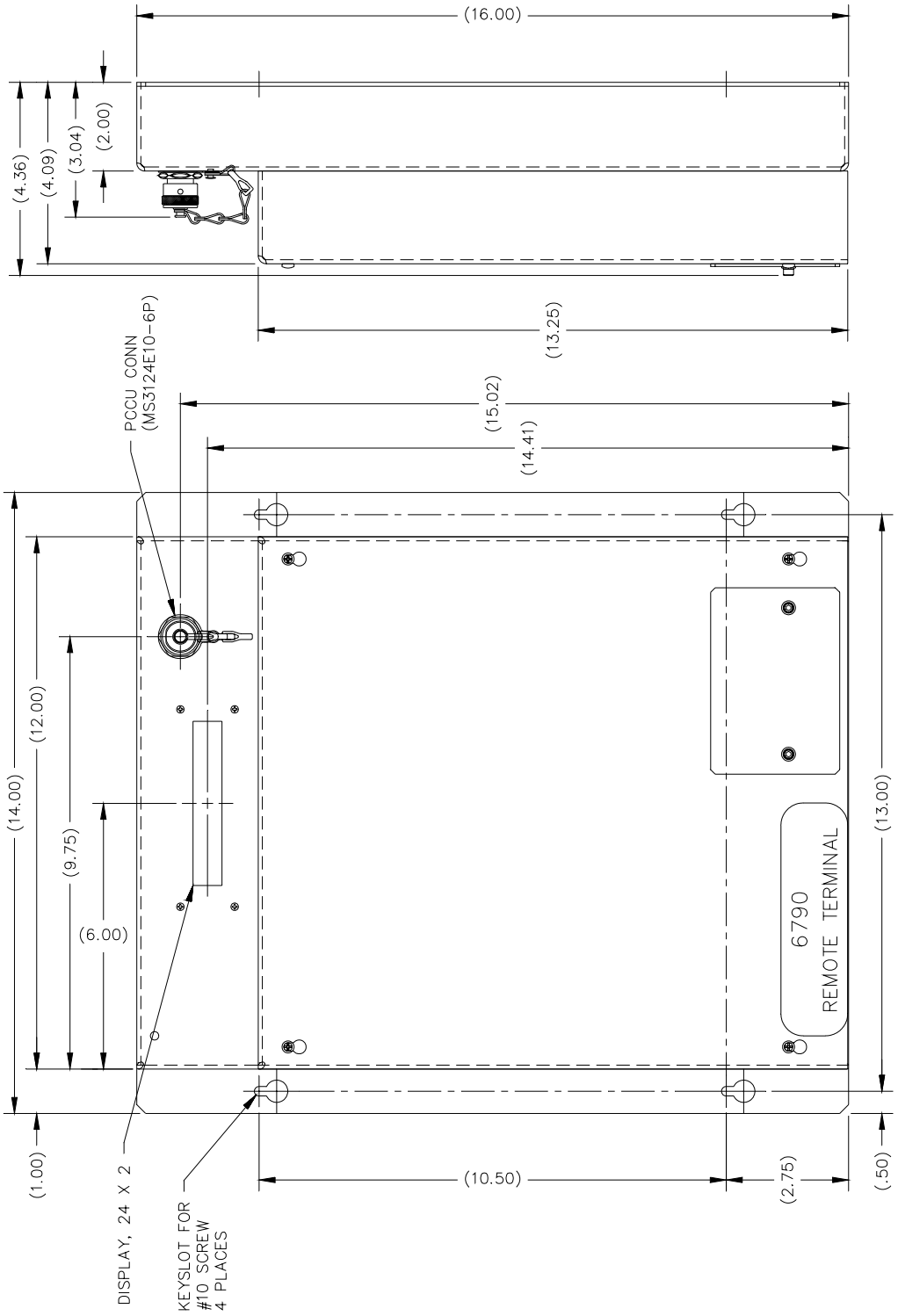


Figure 2 - 5 Wall-Mount Enclosure Outline Drawing, Model 6790A RTU

RTU Installation

Pipe Mounting Procedure

If you are installing RTU directly to a meter run or pipeline use this procedure. Before you begin, review the procedure and the materials required for installation.

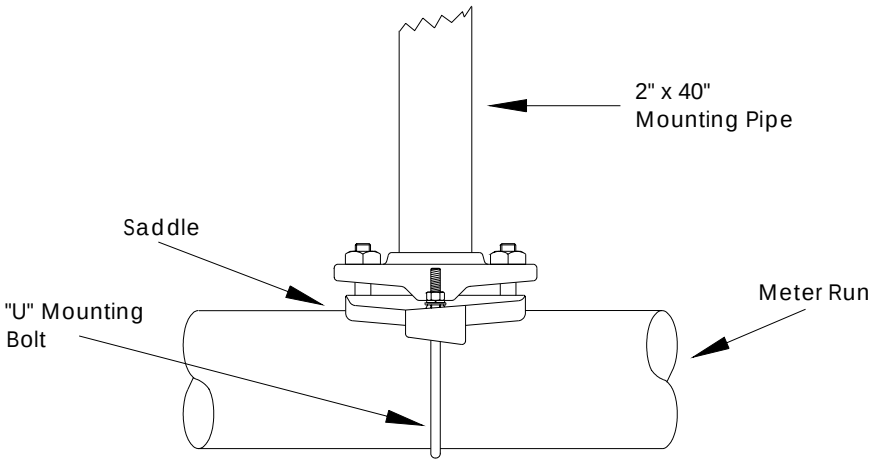
Totalflow Supplied Materials

- Two U-bolts plus fastening hardware
- RTU mounting brackets

Material Not Supplied

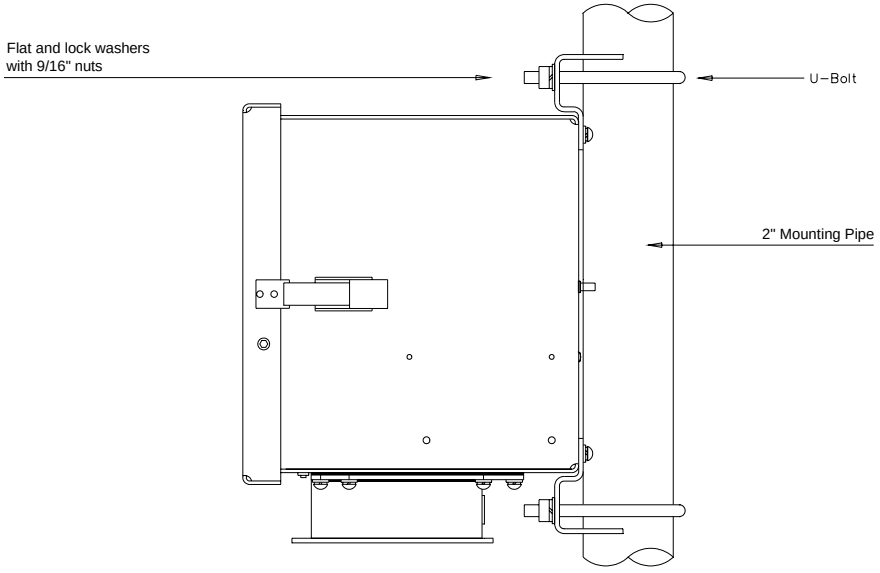
- One pipe Saddle
- One 40-inch long by 2-inch O.D. pipe

Instructions

Step	Procedure
1.	Position pipe saddle on meter run or pipeline. Select a location that allows easy user access to I/O wiring holes in enclosure. 
2.	Temporarily attach Saddle on meter run pipe using U-bolt and associated hardware.
3.	Screw 2” by 40” mounting pipe into Saddle. Place level against pipe and vertically align. Adjust pipe, mounted in saddle, until vertical alignment is achieved.
4.	After vertical alignment, securely tighten 2” by 40” pipe in Saddle then securely tighten Saddle mounting bolts. Be certain pipe is securely installed in Saddle.

Continued on next page

Pipe Mounting Procedures (Continued)

Step	Procedure
5.	Position RTU unit in position on 2” mounting pipe and secure in place with two U-bolts, flat washers, lock washers and two 9/16” nuts. 

Wall Mounting Procedure

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

Totalflow Optionally Supplied Materials

- Two U-bolts w/ fastening hardware
- Enclosure mounting brackets

Material Not Supplied

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

Instructions

CAUTION

The wall itself should be of sufficient strength to support the hanging weight of the unit including internal backup battery. This would not apply to the 6790A wall mount version in which the battery is external to the enclosure.

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

Step	Procedure
1.	Referring to Figures 2-4 and 2-5, RTU wall mount Drawings, and drill mounting holes in wall supports. Figure 2-4 is the standard 6790 enclosure as opposed to the 6790A wall mount version shown in figure 2-5.
2.	For standard 6790 enclosure, install mounting brackets on back of enclosure as shown in figure 2-4. Use screws supplied with kit. For the 6790A wall mount enclosure, the mounting holes are designed into the enclosure. (see figure 2-5)
3.	Lift and align RTU unit wall mounting brackets with mounting holes drilled in wall.
4.	For the standard enclosure with brackets, insert 1/4" diameter machine bolts and capture with nuts or use lag screws in the case of wood. For the 6790A wall mount version, use #10 machine screws with nuts or wood screws in the case of wood. Securely tighten all bolts or screws to secure unit to wall.

Battery Pack Installation

Description

A battery pack provides the RTU with it's operating power. The battery is packed and shipped separately. The battery is not installed in RTU unit when shipped. Before installation, inspect power cables, where they terminate on battery pack, and connector for breakage.

Installation

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

Instructions

Step	Description
1.	Remove RTU battery cover plate and insert battery pack into battery compartment. Insert battery pack with its long dimension facing outward. When cover plate is reinstalled, it will fit snugly against some battery packs. The screws can be loosened to accommodate larger battery.
2.	Connect battery pack connector to main electronics board BATTERY CONNECTOR J6 or J7 located in upper right hand corner of the board.
3.	Observe LCD, the display should be on and scrolling through the startup diagnostics sequence.
4.	Plug-in lithium battery located on left side of main electronics board (see figure 1 - 3).

Solar Panel Installation

Description

The Solar Panel is designed for outdoor mounting on a 2” extension pipe installed on upper end of RTU unit 40” mounting pipe. Solar panel must be mounted within 15 feet of RTU unit (other lengths available).

For wall mounted RTU it can be mounted on top or side of meter house or building (see comments below).

CAUTION

Do not connect solar panel power cable to the RTU unless main battery pack has been connected to J6 or J7. Refer to section *Battery Pack*.

Important

If installation requires the Solar Panel to be mounted on top or side of a meter house or building, customer should contact the Totalflow Service Department; see page iv.

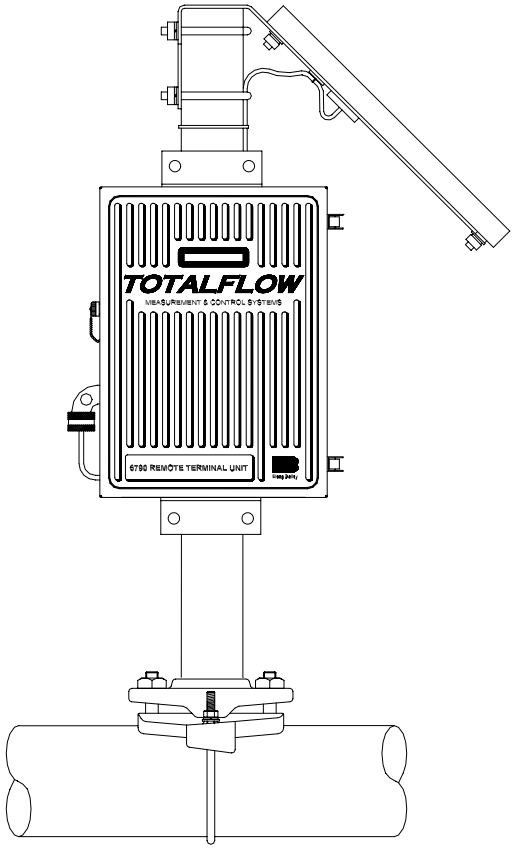


Figure 2 - 6 Typical Solar Panel Installation

Solar Panel Installation, Continued

Procedure

Solar panel must be mounted within 15 feet of RTU. For Solar Panel mounting, the following materials are required.

AA/H&B Supplied Materials

- One Solar Panel
- Two U-Bolts and fastening hardware
- Solar panel cable

Customer Provided Materials

- Cable ties
- One 9-inch extension of 2-inch pipe or other suitable length of pipe.
- One 2-inch union

Instructions

Step	Procedure
1.	Attach 2” pipe union to top end of 40” mounting pipe. Securely tighten.
2.	Install 2” pipe extension into union and securely tighten.
3.	Attach Solar Panel mounting plate to top end of 2” extension pipe with U-bolts and associated mounting hardware. Do not tighten U-bolts until Solar Panel has been correctly orientated.
4.	Connect Solar Panel power cable to EXT CHGR +/- termination’s on field wiring board TB1 terminals 23 (external charger -) and 24 (external charger +). DO NOT connect other end of cable to RTU until instructed to do so. Check solar panel polarity using digital voltmeter to insure proper connection is made.
5.	Install Solar Panel on mounting bracket with provided hardware
6.	Position Solar Panel so it is facing in the correct orientation based on your location in relation to the equator.

Note: Exercise caution when installing Solar Panel, so as not to damage it. When mounted, Solar Panel will face up from horizon at 50° angle.

Continued on next page

Solar Panel Installation, Continued

Note

Solar Panel installation is the same for northern and southern hemispheres. For northern hemispheres, Solar Panel must face south. For southern hemispheres, Solar Panel must face north.

CAUTION

Do not connect solar panel power cable to the RTU unless main battery pack has been connected to battery connector J6 or J7. Refer to Section, Battery Pack.

7.	The Solar Panel power cable is connected to RTU Field Termination Board TB1, EXT CHGR terminals. Refer to silk screen on the TB1 shield plate for proper terminal designations. Insert Solar Panel power cable through an access hole on side of case. Allow enough power cable to extend into RTU for cable connection to EXT CHGR +/- termination's on TB1.
8.	User has the choice of trimming insulation and putting wire under screw head or using a crimp-on spade lug. Connect Solar Panel (+) lead to + terminal (TB1-24)and (-) wire to – terminal (TB1-23). Connect cable shield to SHLD terminal.
9.	Following connection of Solar Panel power cable, secure cable to 2" extension and mounting pipe cable with plastic tie-wraps provided.

Continued on next page

AC Charging Unit Installation

Description

The AC Power Charging Unit maintains a constant voltage charge on installed battery pack(s).

Installation

The following hardware is required to mount the AC power charging unit to RTU.

Totalflow Materials Supplied

- AC Charging Unit
- Coupling nipple

Customer Supplied Materials

- Plastic cable ties
- AC wiring, conduit (rigid or flexible)

Warning

To prevent injury only a licensed electrician should install AC power wiring to customer supplied primary AC power source.

Instructions

Step	Procedure
1.	The AC Charging Unit is shipped separately. When unit is received, unpack and inspect all components for evidence of damage. Report damage to shipping carrier and to Totalflow.
2.	Remove one of the plugs from the side of RTU so that AC charging unit can be mounted without obstruction; see Figure 2 - 10.
3.	Feed AC Charger DC power lines into RTU. Allow enough cable to extend into unit for connection to TB1 EXT CHGR +/- terminals 23 and 24.
4.	Connect AC Battery Pack Charger to RTU unit using supplied sealing ring and nut.

Note

To prevent moisture from entering RTU unit after installing AC Battery Pack Charger, be certain associated connector, at Charger has a metal backed sealing “O” ring and metal locking nut attached.

Continued on next page

CAUTION

Do not connect AC Charger DC power wires to the RTU unless main battery pack has been connected to battery connector J6 or J7. Refer to Section, Battery Pack.

Instructions (Continued)

Step	Procedure
5.	(See Caution above) Connect AC Charger DC power wires (+) lead to + terminal (TB1-24)and (-) wire to – terminal (TB1-23). Connect ground wire to terminal 25.
6.	Plumb the conduit and associated AC wiring into the AC Charger conduit box. The AC Charger is rated at either 120 VAC 60 Hz or 240 VAC 50 Hz. Connect the 120 V hot and nuetral or possibly the two hot wires for 240 V to TB1 of the AC Charger. Connect the ground wire to the green screw T1.
7.	Verify that the DC power wires are terminated properly inside the RTU and apply AC power to the AC Charger.
8.	Monitor DC charging voltage by connecting PCCU to associated RTU connector. Set PCCU to MONITOR mode. If proper connections have been made, LCD display should indicate BATTERY CHARGER 13.0 - 13.5 VOLTS.

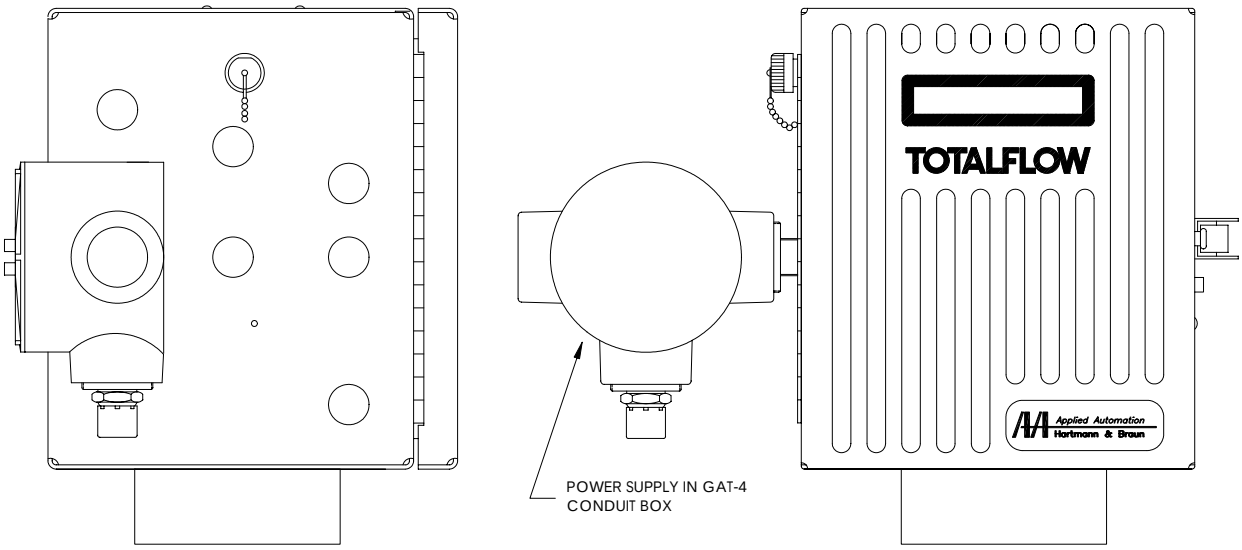


Figure 2 - 10 AC Charger mounted on RTU

Chapter 3

RTU Operation w/ PCCU32

Overview

Introduction

This chapter provides you with an explanation of the operational setup programming and calibration of I/O of the Totalflow Model 6790 RTU system using PCCU32 software.

Please consult with Project Engineering for additional custom applications programming assistance (see Chapter 5 for a general customization overview).

Chapter Highlights

This chapter covers the following topics

Connecting to an RTU

Startup Introduction

Only the PCCU32 operation that pertains to the RTU will be covered in this section.

The PCCU is used with the RTU to name the available channels with names that apply to the measurement being performed. An example is "Tank Level" for one of the Analog Input channels being used to monitor the fluid level in a storage tank. Engineering Units can also be assigned. In the above example, the units could be named "Feet", "Inches", or "Barrels".

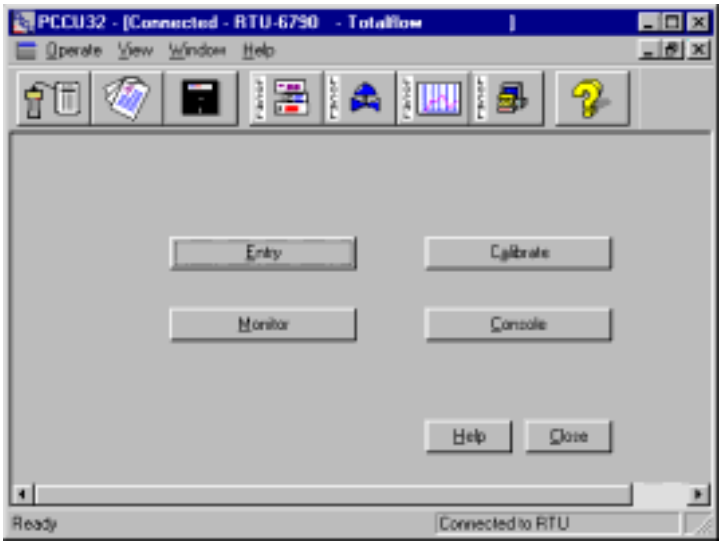
The PCCU is also used to calibrate the Analog Inputs, Analog Outputs and Pulse Input signals. The ID and Location of the device are entered in the Entry Mode, as are the Security Code and Date and Time for the data base to be built on. Up to 16 measurement channels can be trended and stored in the trend data base. The PCCU is used to select which channels are assigned in the database as "trend" channels. Currently only 6 of the measurement channels at a time can be collected by the host WINCCU32 software.

While connected to the RTU, the PCCU can be used to monitor inputs and outputs being measured by the RTU.

Connect PCCU to RTU

Follow the steps outlined below to connect the PCCU to the RTU for purposes of programming, calibrating and general set-up requirements.

Step	Procedure
1	Connect the PCCU to the green military connector on the left side of the model 6790 RTU enclosure or in front on the panel mount version.
2	From the Windows desk top click the "Start" button, select "Programs", "Totalflow PCCU32", and click on "PCCU32". This will launch PCCU32's startup screen or shell.
3	Click the Connect Icon button  to start the communications between the PCCU and the RTU. The PCCU checks the security code assigned to the RTU. Dual level codes are used and are activated by the Security Switch located on the electronics board. Level 1 code permits reading of the data, but no entry or change is allowed. Level 2 code permits reading and changing of the data If the code in PCCU32's System Setup matches the Level 1 or Level 2 code of the RTU, connection is allowed or you will be alerted if they do not match. If no match, you are given the opportunity to enter a new security code and make it the default PCCU security code. If the new code matches, connection is allowed. However, to make changes, the code needs to match the Level 2 code.

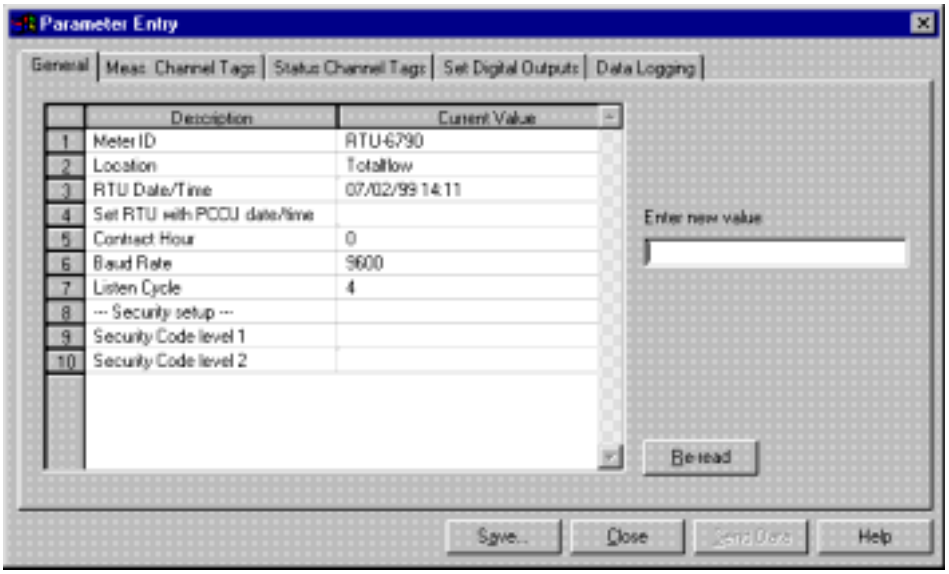
3 (Cont)	If the codes match, the Names and Units are read from the RTU followed by the following "Connected" screen. 
4	From this point, four buttons allow entry into the different modes of operation which are: **Entry:** • Date/Time • RTU's ID • Location • Contract Hour • Communication's Parameters • Security Codes • Measurement Channel Tags • Status Channel Tags • Setting Digital Outputs • Data Logging Channels **Monitor:** • Up to three lists of items can be constructed for data monitoring **Calibration:** • Analog Input Calibration • Pulse Input Calibration • Analog Output Calibration **Console:** • Permits viewing and editing of items created by custom firmware

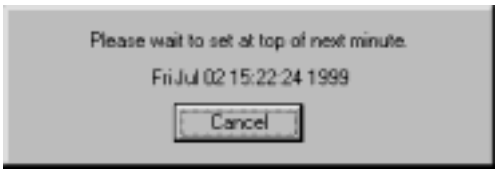
Entry Mode

Introduction

Clicking the "Entry" button from the "Connected" screen brings you to a tabbed dialog screen as shown below. Entry items are grouped in the five different tabs. Clicking on a tab will display it's associated items. Select a tab, make any necessary changes and then click the "Send Data" button to send the changes to the RTU. Either click on another row or press the "Enter" key after each row change and especially after the last change. Send any changes made on a tab before going to another tab.

"General" Tab



	Step	Procedure
Entering "ID"	**1**	Click on the "Meter ID" row. Click in the "Enter new value" window and enter up to 10 alpha-Numeric characters for the ID.
Entering "Location"	**2**	Click on the "Location" row. Click in the "Enter new value" window and enter up to 24 alpha-Numeric characters for the Location.
Setting "Date/Time"	**3**	Click on the "Set RTU with PCCU date/time" row. Click on the down arrow of the "Make Selection" window and select "Yes". When the "Send Data" button is clicked, any other changes will be sent, but when it comes to setting the time, a dialog box will be displayed as follows:  The dialog box contains a clock which will display the time until the top of the next minute, at which time the PCCU's time will be downloaded to the RTU. After initiating a "Re-read", the current date and time will be displayed in the "RTU Date/Time" row.

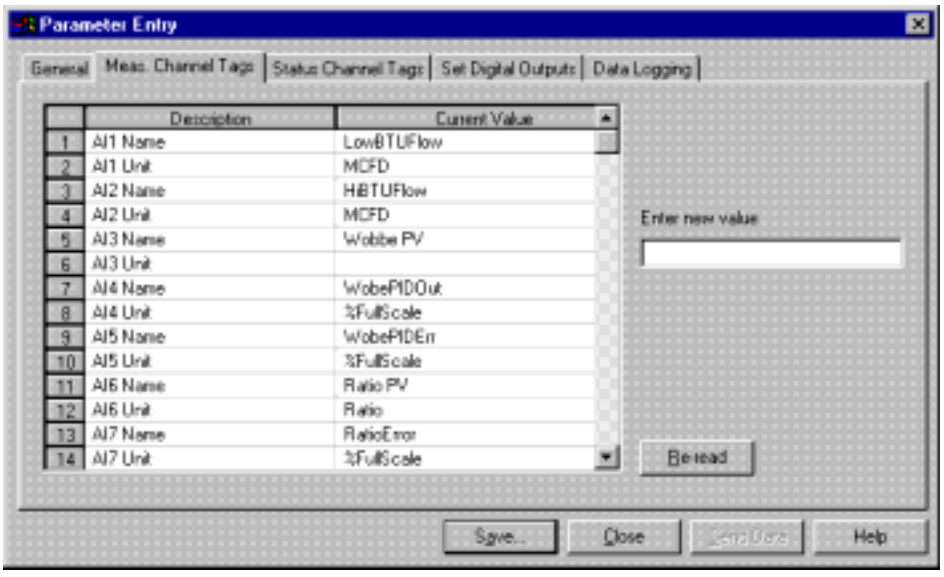
"General" Tab
Continued

	Step	Procedure
Setting "Baud Rate"	**4**	Click on the "Baud Rate" row and then click on the "Make Selection" down arrow. Select the baud rate from the list. This baud rate applies to the Remote Communications port and the Satellite Port.
Setting "Listen Cycle"	**5**	Click on the "Listen Cycle" row and then click on the "Make Selection" down arrow. Select 1, 2 or 4 seconds from the list. Listen Cycle time applies to the Remote Communications port and the Satellite Port.
Setting "Security Codes"	**6**	Select the "Security Code Level 1" row and enter a four digit alpha-numeric code which represents the Read Only code of the RTU.
Setting "Security Codes"	**7**	Select the "Security Code Level 2" row and enter a four digit alpha-numeric code which represents the Read/Write code of the RTU.

"Measurement Channel Tags" Tab

This tab permits the user to assign names and engineering units to the Analog Inputs, Analog Outputs, Pulse Inputs and three user channels. To change an entry, click on the row of the Name or Unit and enter up to 10 alpha-numeric characters in the "Enter new value" window. Make as many changes on the tab as necessary then click the "Send Data" button. Click the "Re-read" button any time to refresh the display for verification of changes.

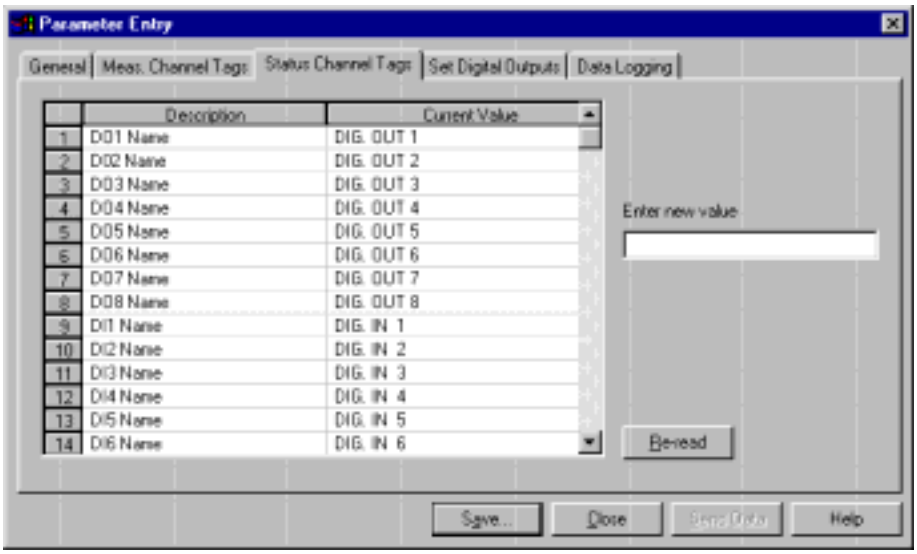
If the RTU was supplied with custom firmware, the Names and Units will most likely already be assigned as shown below and no changes will be required. RTUs with generic firmware will have default Names and Units that the user will typically rename.



"Status Channel" Tab

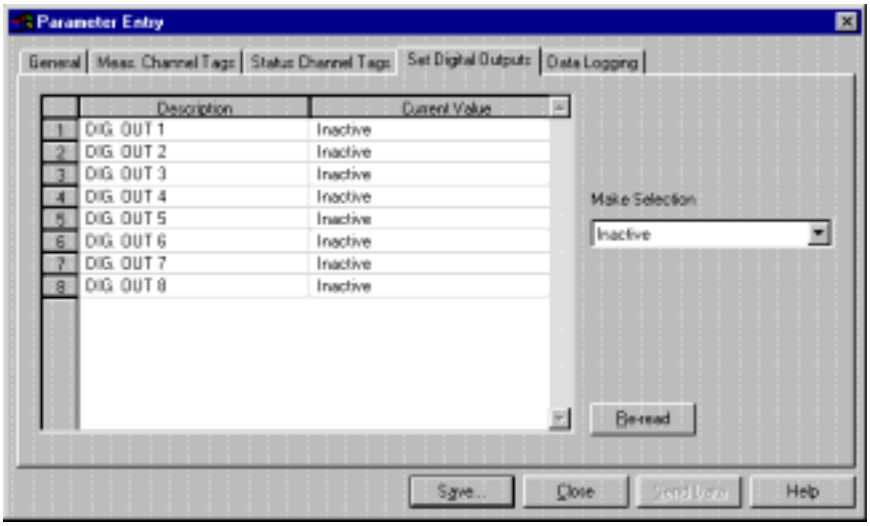
This tab permits the user to assign names to Digital Inputs and Digital Outputs. To change an entry, click on the row of the Name and enter up to 10 alpha-numeric characters in the "Enter new value" window. Make as many changes on the tab as necessary then click the "Send Data" button. Click the "Re-read" button any time to refresh the display for verification of changes.

RTUs delivered with custom firmware may have custom names already assigned to some or all of the DIs and DOS. In this case, changes are typically no required. RTU's without custom firmware will typical have default names similar to the following table, which of course can be edited to suit the user.



"Set Digital Outputs" Tab

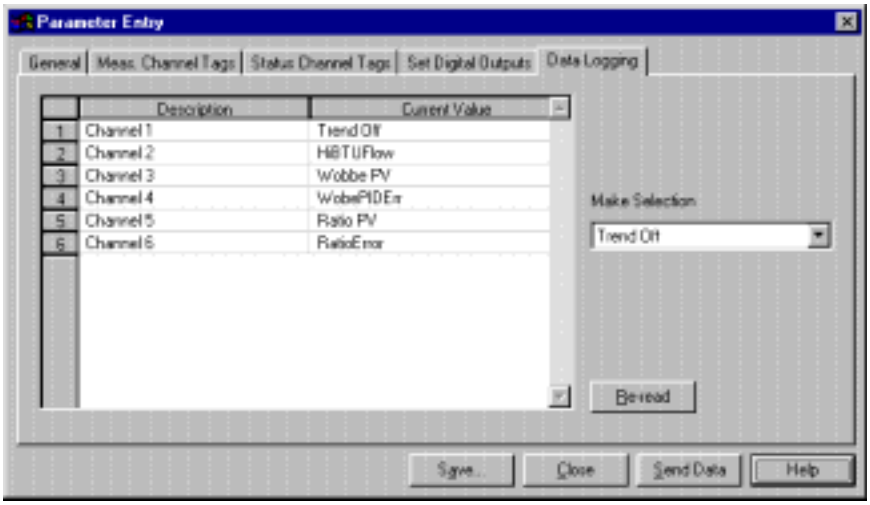
This tab permits the user to manually open or close the digital outputs. The "Current Value" column displays the current status of the DOs on entry into the screen. To open or close a DO, click on the appropriate row, select "Active" to close the DO or "Inactive" to open the DO from the Make Selection window and click the "Send Data" button. Click the "Re-read" button at any time to get the current status.



"Data Logging" Tab

The Data Logging Tab permits the user to set up to 6 channels of user selectable data sources for Logging. The RTU will log and maintain the last 3 days of hourly data which then can be collected via the Central Collection Unit (WinCCU). The data will commence logging at the time the channel assignments are made. A channel can be re-assigned at any time, however, the existing data for that channel will be lost.

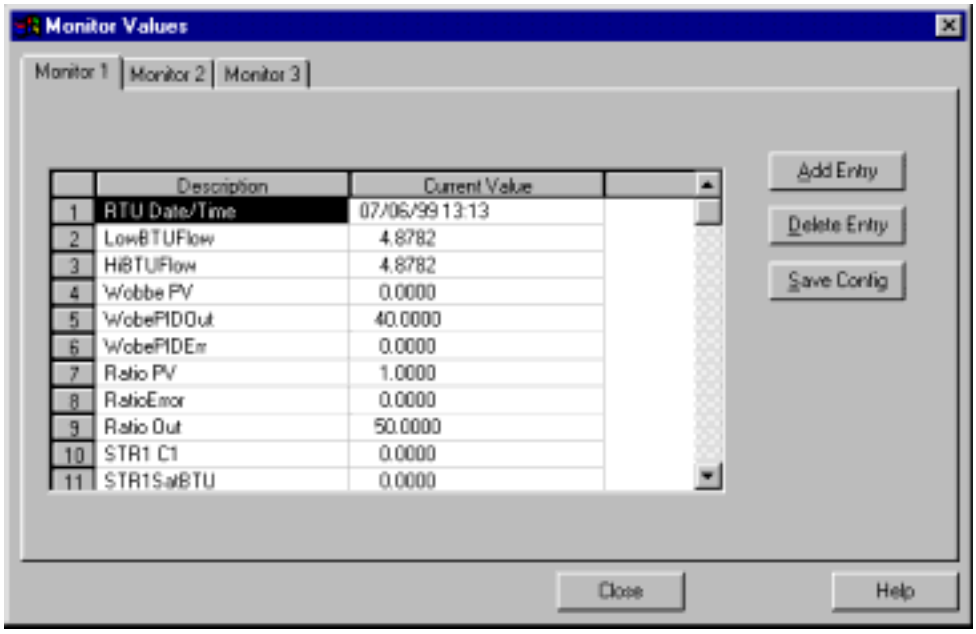
To set up a channel, click on the channel's row, click on the down arrow of the "Make Selection" window and select a data source. Setup one or all six channels and then click the "Send Data" button.



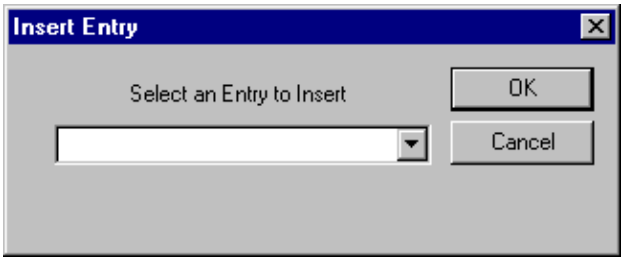
Monitor Mode

Monitor Mode Operation

Clicking the "Monitor" button from the "Connected" screen will display the following screen. The Monitor Mode allows the user to select items to monitor on a continual basis while connected to the device. The user can configure up to three different screens (Monitor 1, 2 & 3) with different items to view.



If the RTU was delivered with custom firmware, some or all the items may already set up for monitoring. Entries can added or deleted at any time. To keep a configuration, click the "Save Config" button before clicking the "Close" button.

Add Entry	Step	Procedure
	1	Select the list to modify (Monitor 1, 2 or 3) by clicking on the appropriate tab.
	2	Click the "Add Entry" button to see the Insert Entry window. 
	3	Click the down arrow of the Insert Entry window to see the available selections.
	4	Select an option and click the "OK" button. This will add the item to list.
	5	Repeat steps 2 - 4 to add additional items to the list.
	6	To save for subsequent Monitor Mode entries, click the "Save Config" button.

Delete Entry	Step	Procedure
	1	Select the list to modify (Monitor 1, 2 or 3) by clicking on the appropriate tab.
	2	Select the item to delete by clicking in the appropriate row. You may need to scroll down the list to find the item.
	3	Click the "Delete Entry" button.
	4	For the deletion to be permanent, click the "Save Config" button.

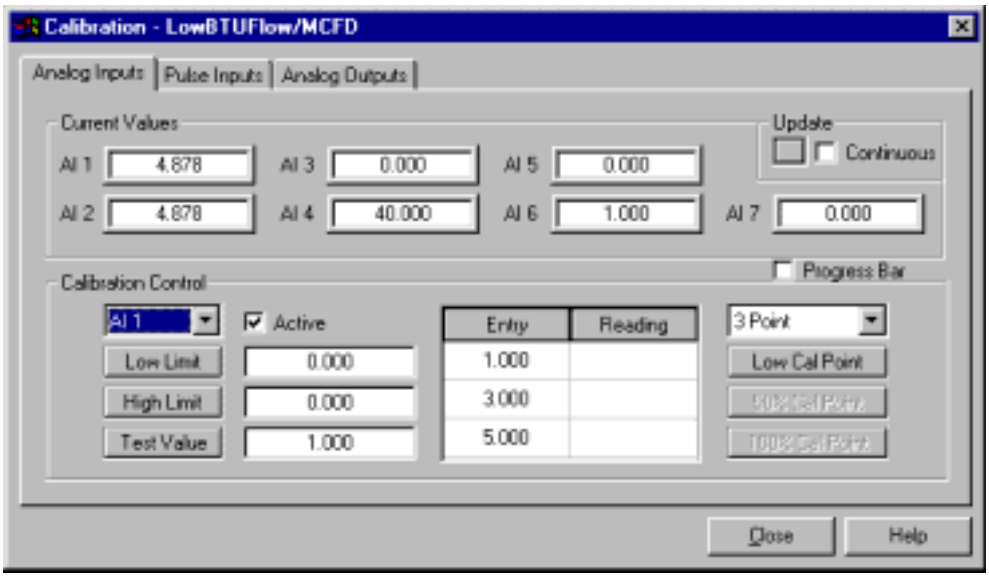
Calibration Mode

Introduction

The calibration mode enables the calibration of the Analog Inputs, Analog Outputs and Pulse Inputs of the RTU. Follow the steps outlined below to calibrate the Analog Input, Analog Output and Pulse Input channels.

Calibrating Analog Inputs

Totalflow RTU's typically have 7 analog inputs. From the "Connected" screen, click on the "Calibrate" button and then select the Analog Inputs tab to see the following screen.



The Current Values section will display the current values continuously by checking the "Continuous" box or on demand by clicking the "Update" button. It is recommended that the "Continuous" box not be checked during a calibration. The Progress Bar if checked, will show any communication between the PCCU and the flow computer.

When different analog inputs are selected, their assigned names are displayed across the top of the screen.

Step	Procedure
1	Connect an accurate power source capable of 1 - 5 volts or 4 - 20 ma to the AI terminals to be calibrated. Make sure the J1 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.
2	Under Calibration Control select the AI from the drop down dialog box. The Name and Units of the AI will be displayed in the banner at the top of the screen as shown above. The Name and Units are assigned in the Meas. Channel Tags tab of the Entry mode and are not required to be assigned prior to this calibration.

Continued on next page

Calibrating Analog Inputs, Continued	**Step**	**Procedure**
	3	Check the Active box if not already checked. This causes the AI to look for it's source at the terminals instead of a Test Value.
	4	Under Calibration Control select either 2 Point or 3 Point for number of calibration points. 2 Point for a low and high value and 3 Point for a low, high and mid-range values.
	5	Apply 1 volt or 4 ma to the AI terminals.
	6	Click on the Low Cal Point button and verify that the Current Reading is stabilized.
	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.
	7	Enter a value (typically zero) representing the Low Cal Point and representing the desired engineering units. Click the OK button.
	8	Apply 5 volts or 20 ma to the AI terminals.
	9	Click on the 100% Cal Point button and verify that the Current Reading is stabilized.
	10	Enter a value representing full range and representing the desired engineering units. Click the OK button.
	11	If 3 Point calibration was selected, apply 3 volts or 12 ma to the AI terminals.
	12	Click on the 50% Cal Point button and verify that the Current Reading is stabilized.
	13	Enter a value representing mid range and representing the desired engineering units. Click the OK button.
	Notes:	As a calibration check, check the Continuous box and watch the appropriate AI Current Values window while varying the voltage or current source. If not satisfied, re-calibrate. A Test Value can be used in place of the live signal by un-checking the Active box, clicking on the Test Value button and entering a value in the same engineering units.

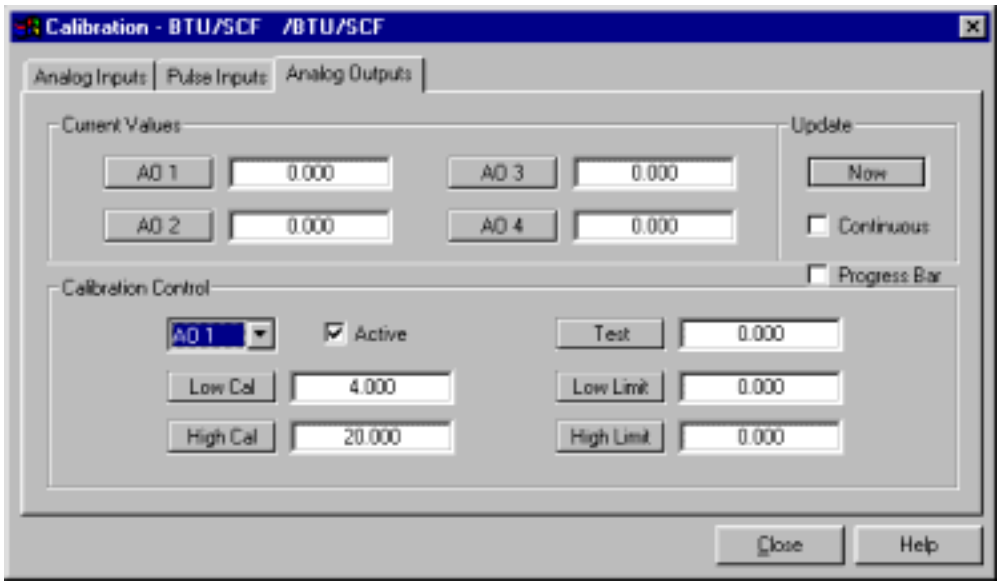
Continued on next page

Calibrating RTU Analog Inputs, Continued

Entering Limits	Low and High limits can be entered and the RTU will calculate the percent of time the AI value is below the Low limit or above the High limit. Limits do no affect the calibration of the AI.	
	Step	**Procedure**
	1	Click on the Low Limit button, enter a value in the same engineering units that the AI was calibrated in and click the OK button.
	2	Click on the High Limit button, enter a value in the same engineering units that the AI was calibrated in and click the OK button.

Calibrating Analog Outputs

The following procedure is for calibrating Analog Outputs contained on the RTU. From the Connected screen, click on the Calibrate button and then select the Analog Outputs tab to see the following screen.



The Current Values section will display the current values as percentage continuously by checking the Continuous box or on demand by clicking the Now button. It is recommended that the Continuous box not be checked during a calibration.

Continued on Next Page

Calibrating Analog Outputs, Continued

The Progress Bar if checked, will show any communication between the PCCU and the flow computer.

The following procedure is for the calibration and setup of one analog output. The procedure will be the same for any additional analog outputs.

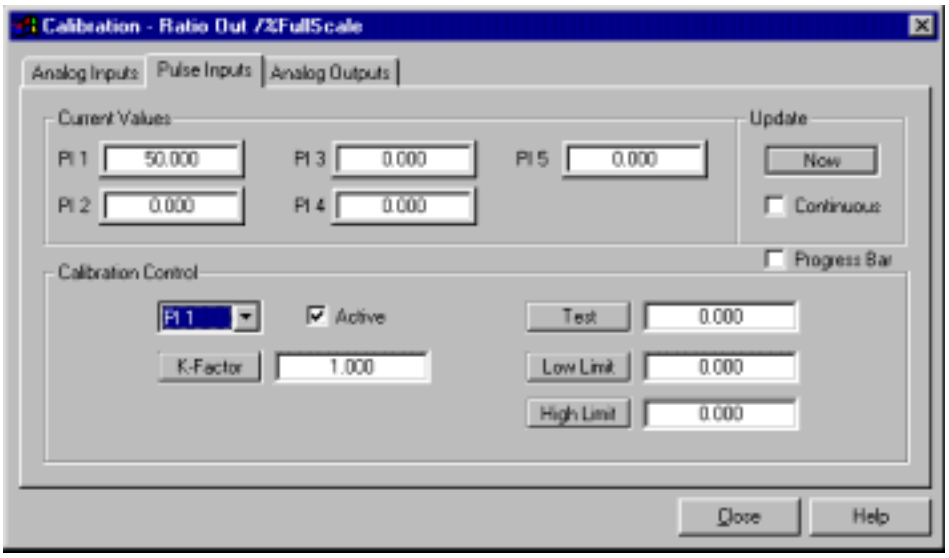
Step	Procedure
1	Connect a meter capable of reading 4 - 20 ma signal to the analog output terminals to be calibrated.
2	Under Calibration Control select the appropriate analog output from the AO drop down dialog box.
3	Check the Active box. This box should always be checked unless a Test value is to be used (see below).
4	Click on the Low Cal button and verify that the meter's reading has stabilized at approximately 4 ma.
5	Enter the meter's reading in the Enter Measured Value window and click the OK button.
6	Click on the High Cal button and verify that the meter's reading has stabilized at approximately 20 ma.
7	Enter the meter's reading in the Enter Measured Value window and click the OK button.
8	To test the calibration, click on the appropriate AO button in the Current Values section and enter a value 0 - 100% and note the reading on the meter. (25% = 8 ma, 50% = 12ma, 75% = 16 ma, 100% = 20 ma)
9	If the calibration is not satisfactory, repeat steps 4 thru 7.

Entering a Test Value	A Test value can be entered for an analog output which will be used internally by the firmware instead of using the actual analog output value. This test value will not be seen at the analog output's terminals but will be seen in the Current Values section.	
	1	Uncheck the Active box.
	2	Click on the Test button, enter a value in percent and click the OK button.
Entering Limits	Low and High Limits can be entered for an analog output. The I/O control routine calculates the percent of time the value is below the Low Limit or above the High Limit. This information is typically used internally and not provided in any host software.	
	1	Click on the Low Limit button, enter a value in percent and click the OK button.
	2	Click on the High Limit button, enter a value in percent and click the OK button.

Calibrating RTU Pulse Inputs

Totalflow RTUs typically have 2 high speed pulse inputs, however DI 1, DI 2 and DI 3 can be used as slow speed pulse inputs. Therefore the calibration screen will show five pulse inputs.

From the Connected screen, click on the Calibrate button and then select the Pulse Inputs tab to see the following screen.



The Current Values section will display the current values continuously by checking the Continuous box or on demand by clicking the Now button.

The Progress Bar if checked, will show any communication between the PCCU and the flow computer.

	Step	Procedure
	1	Under Calibration Control select the appropriate pulse input from the drop down dialog box.
	2	Click on the K-Factor button, enter a value and click the OK button. Input pulses are multiplied by the K-Factor. To have a one to one pulse count, use a factor of 1.
Limits	Low and High limits can be entered and the RTU will calculate the percent of time the PI value is below the Low limit or above the High limit. Limits do no affect the calibration of the PI.	
	1	Click on the Low Limit button, enter a value in the same engineering units that the AI was calibrated in and click the OK button.
	2	Click on the High Limit button, enter a value in the same engineering units that the AI was calibrated in and click the OK button.
Test Value	A test value can be used in stead of the live inputs. To use a test value do the following:	
	1	Uncheck the Active box.
	2	Click on the Test button and enter a value representing pulses and click OK. The value in the Current Values should be incrementing.

Console Mode

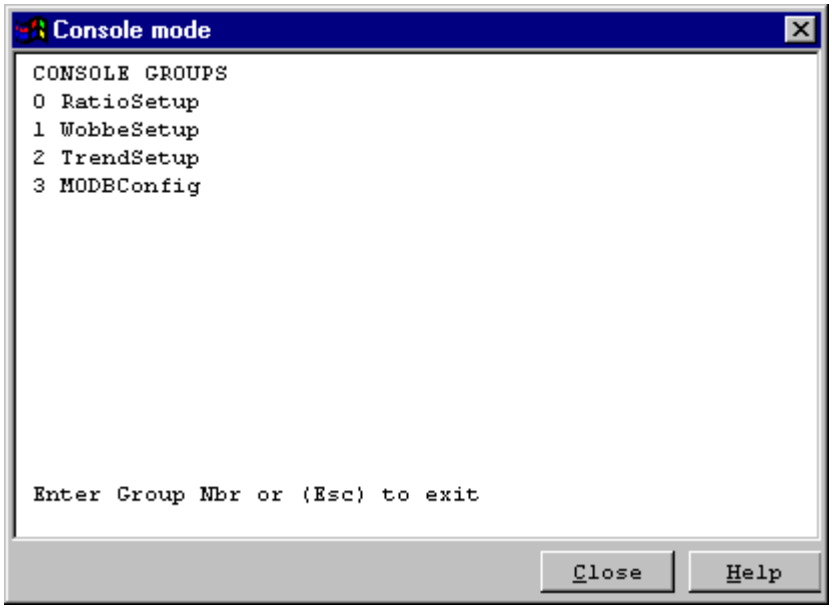
Introduction

Console mode when connected to an RTU makes use of the "Local User Interface" designed into the RTU. Console mode is a terminal emulator which has all the appropriate communication's parameters already setup and ready to communicate with the RTU.

Using Console Mode

When starting PCCU32's "Console" mode, the "CONSOLE" command is automatically sent to the RTU. This tells the RTU to begin controlling the "Local User Interface".

Once the "Console" mode is invoked, the first display that comes up is the "Console Groups" display. This tells the user what groupings of data can be displayed or modified. The Groups list is displayed as a virtual list. For example on a 8x40 display, 10 items could be displayed by scrolling the display as necessary to display those items that won't fit because there are not enough lines on the physical display. An example GROUPS display is shown below:

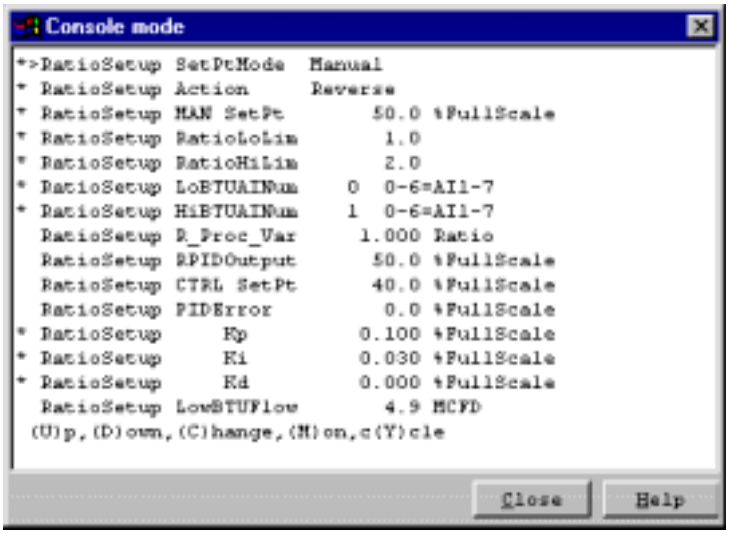


In the case shown above, all of the groups fit on the display. If there were more groups than display lines, the group list could be scrolled on the display with the '*U*' *key*, and the '*D*' *key*. The '*ESC*' *key* can be used at this point to exit the handheld interface.

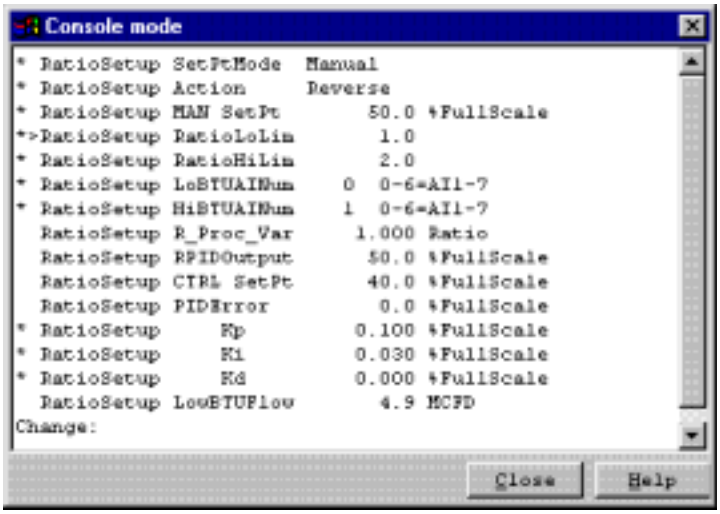
To select a group, depress the numeric selection key for that group. For example, to select the RatioSetup group depress 0. The initial data screen for that group would be displayed as shown below:

Continued on Next Page

Using Console Mode, Continued



Each '✶' indicates that the item next to it can be modified. The '**>**' indicates that the item next to it is currently selected for editing. In the following screen, the *'D'* key was used to move down to item "RatioLoLim" and then to edit that item the *'C'* key is depressed.



Note that the help prompt has been cleared and is now a *Change Area* titled 'Change:' If the 'ENTER' key is pressed now, the original value will be restored.

If a number is entered now followed by 'ENTER' key, that number will become the new "RatioLoLimit". 'BACKSPACE' key can be used to correct errors before depressing the 'ENTER' key. After making a change, the cursor '**>**' can be moved to another item if needed for editing.

Continued on Next Page

Using Console Mode, Continued

Pressing the 'D' key causes the cursor to move Down through the list, one item at a time and pressing the 'U' key causes the cursor to move up through the list. In like manner, pressing the ‘P’ key causes the cursor to move Down through the list a page at a time. Pressing the ‘B’ key causes the cursor to move up through the list a page at a time.

Refreshing and Monitoring the Display

Pressing 'R' will refresh the display with current values. By pressing 'M', you can monitor the variables on the screen. When monitoring data , the display will refresh with current data on a periodic basis (currently 5 seconds). During this time, the data pointer will disappear. Press any key to stop monitoring the data.

Cycling the Display

Cycling the display supports automatically sequencing through all of the data in a group. When cycle mode is entered, the data pointer will disappear and the display will be refreshed on the same period used by the Monitor function. Every refresh period (currently 5 seconds), the display will automatically scroll up and refresh. When the display gets to the last item in the group, it will begin scrolling again with the first data item in the group. Press any key to stop cycling the display.

Returning to the Group Display

Any one of three different keys will return you to the group display. They are either the ‘✶‘ key, the ’e’ key or the ‘E’ key. Upon returning to the group display, another group may be selected, or the Local Console may be exited by pressing ESC.

Exiting the LOCAL CONSOLE

The Local Console may be exited directly at any time by pressing ESC.

Commands

Below is a summarization of the Local Console Terminal commands:

Command	**Description**
'CONSOLE'	RTU starts up it's Local Console Task and begins controlling the Local Console Display
'D'	Move Cursor Down one item
'U'	Move Cursor Up one item
'P'	Move Cursor Down one page
'B'	Move cursor (Back) up one page
'R'	Refresh the display
'M'	(M)onitor mode: the display updates every 5 seconds. Note: Once begun, Depressing any key will exit (M)onitor mode.
'Y'	c(Y)cle display: the display will scroll and update every 5 seconds. Note: Once begun, Depressing any key will exit c(Y)cle mode.
'✶' or 'e' or 'E'	Exit and Return to top level 'Group Display'
'ESC'	RTU exits it's Local Console Task and returns to it's Local Protocol Task, thus reverting control back to PCCU32.
'C'	Change selected value. When **Changing Numeric Values** the RTU clears the *help prompt area* of the screen to create a *change area* which is titled with the word *Change:* Entry of the new value is terminated by depressing the [ENTER] key. If the [ENTER] key is depressed before any other keys, the change process is terminated and the old value retained. When **Changing Boolean (coil or state) Values** the RTU first creates a *Change* area that shows the current state of the coil. Depressing the 'C' key a second time toggles the coil's state and displays the new state. Subsequent depressions of the 'C' key will continue to toggle to coil's state. When the [ENTER] key is depressed the last state of the coil is retained. ***Note:*** *Some coil states are designed to used as a command to the RTU. Upon detection of the command the RTU then automatically switches the coil back to the neutral state. This automatic switch will not be reflected on the Console's screen unless you depress the 'R' (refresh) key.*

RTU Operation w/ DOS PCCU

Overview

Introduction

This section provides you with an explanation of the operational setup programming and calibration of I/O of the Totalflow model 6790 RTU system using the DOS version of PCCU as opposed the first part of this chapter which dealt with PCCU32, a Windows version of PCCU software.

Please consult with Project Engineering for additional custom applications programming assistance (see Chapter 5 for a general customization overview).

Section Highlights

This section covers the following topics

Connect PCCU to RTU

Only the PCCU operation that pertains to the RTU will be covered in this section.

The PCCU is used with the RTU to name the available channels with names that apply to the measurement being performed. An example is "Tank Level" for one of the Analog Input channels being used to monitor the fluid level in a storage tank. Engineering Units can also be assigned. In the above example, the units could be named "Feet", "Inches", or "Barrels".

The PCCU is also used to calibrate the Analog Inputs, Analog Outputs and Pulse Input signals. The ID and Location of the device are entered in the Entry Mode, as are the Security Code and Date and Time for the data base to be built on. Up to 16 measurement channels can be trended and stored in the trend data base. The PCCU is used to select which channels are assigned in the database as "trend" channels. Currently only 6 of the measurement channels at a time can be collected by the host WINCCU32 software.

While connected to the RTU, the PCCU can be used to monitor inputs and outputs being measured by the RTU.

Note: Just prior to the release of this manual a Window's version of PCCU know as PCCU32 was released. Due to the newness of PCCU32, the DOS version of PCCU will be used in the following explanations.

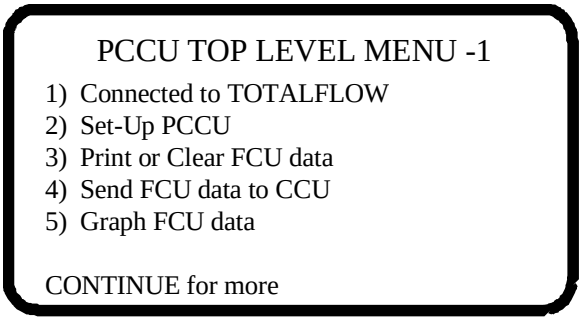
Connect PCCU to RTU

Follow the steps outlined below to connect the PCCU to the RTU for purposes of programming, calibrating and general set-up requirements.

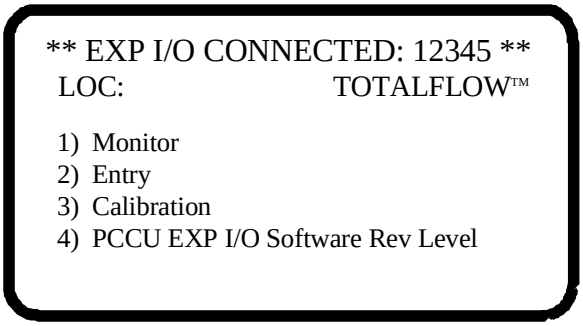
Step	Procedure
1	Connect the PCCU to the green military connector on the left side of the model 6790 RTU enclosure or in front on the panel mount version.

Continued on next page

Top Level Menu - Continued

Step	Procedure
2	Depress the ON/OFF key on the PCCU to turn the unit ON. The PCCU displays the same information that existed before it was turned off. If the Top Level Menu screen is not displayed, depress the Menu Exit key until the following screen is displayed: 
3	Respond to the initial prompt from the PCCU as follows:
4	Enter 1 if the PCCU is connected to model 6790 RTU. The initial communication between the RTU and the PCCU indicates to the PCCU the type of device attached. The PCCU then initiates the proper configuration displays. For any of the other items displayed on the PCCU TOP LEVEL MENU, please refer to the MODEL 6625 PCCU User's Manual. After entering 1, Connected to TOTALFLOW, on the PCCU Top level Menu, the PCCU checks the security code assigned to the I/O. Dual level codes are used by the I/O, and are activated by the Security Switch located on the electronics board. Level 1 code permits reading of the data at the I/O, but no entry or change is allowed. Level 2 code permits reading and changing of the data. The I/O must be entered using the Level 2 code for calibration purposes. If the code of the I/O agrees with the code set in the PCCU or if the Security Switch is off, the following is displayed:  If the code set in the PCCU does not agree with the I/O code, the message: "Invalid Security Code--Access Denied - Enter new Security Code" is displayed.

Continued on next page

Step	Procedure
5	The PCCU will read the I/O channel tags and assigned engineering units. It takes about 20 seconds to do this. The next screen displayed is:  Depress the corresponding number key to select the desired operational mode. • *Monitor Mode:* This mode enables the display of up to six operating conditions of the measured I/O points at a time. • *Entry Mode:* This mode enables the entry of setup information the RTU needs for proper operation. • *Calibration Mode:* This mode enables the calibration of Analog Inputs, Analog Outputs, and Pulse Inputs.

Monitor Mode

Monitor Mode Operation

This mode enables the display of operational I/O data on the PCCU. The Entry Mode setup functions of assigning channel tags and selecting trend channels is usually performed before monitoring any data. Up to six items can be displayed at any one time. Any combination of items may be displayed.

Monitor Mode

Follow the steps outlined below to enter into the Monitor Mode of operation.

Step	Procedure
1	Upon selecting monitor, a screen will appear showing the types of information available for monitoring. ** MONITOR MODE MENU ** 1) Analog Inputs 2) Analog Outputs 3) Pulse Inputs 4) Digital Inputs 5) Digital Outputs 6) Begin Monitor
2	Up to six total items can be selected to monitor. For example, select: 1) Analog Inputs A list of the analog inputs that may be selected for monitoring will appear. >Tank Lvl 1 Tank Lvl 2 Pressure 1 Pressure 2 Comp Tmp 1 Dischg P1 Dischg P2 Use ARROW keys to MOVE and CHANGE Depress CONTINUE when finished

Continued on next page

Step	Procedure
3	Each analog input channel is identified by a unique "channel tag" (name). The "channel tags" are entered or changed in the ENTRY MODE. In this example, the channels have been named as: **Channel — Channel Tag** Analog Input 1 — Tank Lvl 1 Analog Input 2 — Tank Lvl 2 Analog Input 3 — Pressure 1 Analog Input 4 — Pressure 2 Analog Input 5 — Comp Tmp 1 Analog Input 6 — Dischg P1 Analog Input 7 — Dischg P2
4	Move the cursor to the items that need to be selected using the LEFT/RIGHT arrow keys. Select the item with either the YES/NO keys or the UP/DOWN arrow keys. When selected, the items will be displayed on a black background.
5	When finished selecting items to be monitored, press CONTINUE. The Monitor Mode Menu appears: ** MONITOR MODE MENU ** 1) Analog Inputs 2) Analog Outputs 3) Pulse Inputs 4) Digital Inputs 5) Digital Outputs 6) Begin Monitor
6	Select other items to monitor from the remaining inputs and outputs. Remember, up to six total items can be selected for each viewing.

Continued on next page

Step	Procedure
7	Once the items to monitor have been selected, enter 6) Begin Monitor. The following is displayed: Pressure 1 xxxxx.x PSIG Dischg P1 xxxxx.x PSIG Turbine 1 xxxxx.x SCF Valve 1 xxx.x % OPEN Depress EXIT when finished In this example, two Analog Inputs (Pressure 1, Dischg P1), one Pulse Input (Turbine 1), and an Analog Output (Valve 1) were selected for monitor. If more than six items are selected, an error message is displayed on the bottom of the screen. Depress CONTINUE and make the necessary changes so that only six items are selected.

Entry Mode

Introduction

This mode enables the entry of operational set-up using the PCCU. The Entry Mode setup functions of assigning channel tags and selecting trend channels is usually performed before monitoring any data.

Below is a list of tasks that can be performed in the ENTRY mode:

- Set the RTU Date/Time
- Set the RTU Identification
- Set the RTU Location Description
- Set the RTU Security Code
- Select Channels to Be Trended
- Assign Channel Tags and Engineering Units
- Set the Digital Outputs

Entry Mode

Follow the steps outlined below to enter into the Entry Mode of operation.

Step	Procedure
1	Select the ENTRY MODE and the following menu is displayed: ** ENTRY MODE MENU ** 1) EXP I/O Date / Time 2) ID 3) Location 4) EXP I/O Security Code 5) Trend Channel 6) Channel Tags 7) Set Digital Outputs
2	Select 1, RTU Date/Time, and the following screen is displayed: EXP I/O Date/Time is MM.DD.YY HH:MM.SS PCCU Date/Time is MM.DD.YY HH:MM.SS Set EXP I/O with PCCU date/Time?

Step	Procedure
2 (Cont)	The display shows the clock of the RTU and the PCCU. The option is to set the I/O clock with the PCCU clock. The PCCU clock is set in the PCCU Setup routine. Refer to the PCCU section of the Installation, Operation and Maintenance Manual for instructions on setting the PCCU time. Answer Yes by pressing the YES key on the PCCU to set the RTU time with the PCCU time. Answer No to not change the RTU time. If Yes is selected the display will show the PCCU time and indicate that the change will occur at the top of the next minute.
3	Select 2, ID, to enter the ID of the RTU. When 2 is selected, the following appears: ID is 12345 . OK? The display shows the current ID of the I/O and asks if the ID is correct. Answer Yes by pressing the YES key to leave the ID as indicated. Press the NO key to change the ID. Up to 10 alphanumeric can be used in the ID. Spaces and hyphens are allowed.
4	Press 3, Location, to enter a location description of the RTU. The current location entered will be displayed on the screen and again the option is Yes or No, leave as indicated or enter in a new description. Up to 24 characters can be used in the location description.
5	Press 4, RTU Security Code, to enter the 2 security codes. With security codes entered in the system, access to the data and access to control functions is limited to those individuals who know the codes. Level 1 code permits reading the data, level 2 code permits reading the data and the making of changes to the setup. The Security Code Switch, located on the main electronics board, must be off to enter new security code numbers. When selected, the following appears: EXP I/O SECURITY CODE Enter new LEVEL 1 code: _____

Continued on next page

Step	Procedure
5 (Cont)	The code must be a 4 digit number. The default code is 0000. After entering the Level 1 code, the display asks for the Level 2 code. It also must be a 4 digit number. The default code for Level 2 is also 0000. The numbers that were entered for the security codes are not available for viewing. The downloading of information remotely to the RTU requires that the Level 2 code for the device be entered at the Meter ID Manager in the WinCCU32 host application.
6	After entering the numbers, place the Security Code Switch in the ON position. The Security Switch is located on the main electronics board. The switch is ON when it is in the Up position.

Note: Remote communications with the RTU using the Central Collection Unit software requires a security code entry in the Meter ID Manager. The security code number entered in the Meter ID Manager must agree with the code entered at the remote device regardless of the Security Code Switch position.

Assigning Channel Tags

Introduction

This mode enables the entry of I/O channel tag names and engineering units using the PCCU handheld programmer.

The naming of the channels is usually the first step in setting up the RTU I/O. Each of the I/O channels can be identified with its own unique name or tag. Each tag can be up to 10 characters long. In addition, engineering units can be assigned to the Analog Inputs, Analog Outputs, and Pulse Inputs.

Assigning Channel Tags

Follow the steps outlined below to channel tags and engineering units.

Step	Procedure
1	Select 6, Channel Tags, and the following is displayed: ** CHANNEL TAGS MENU ** 1) Analog Inputs 2) Analog Outputs 3) Pulse Inputs 4) Digital Inputs 5) Digital Outputs To name an input or output channel and to assign engineering units to the channel, select the channel type from the display.
2	Select 1) Analog Inputs and the following is displayed: *** Analog Input Tags *** 1) Channel Tag [1] 2) Tag Tank Lvl 1 3) Units BARRELS

Continued on next page

Step	Procedure
3	The channel number is selected by pressing 1. Each time 1 is pressed the channel number indication [ ] changes. At the same time, the Tag and Units for the channel selected are displayed. To change the Tag or Units, enter 2,or 3. For example, to change the tag and unit selection on Analog Input channel 3, press 1 until [3] is indicated. The following is displayed: *** Analog Input Tags *** 1) Channel Tag [3] 2) Tag Pressure 1 3) Units PSIG
4	Change the Tag and Units by pressing either 2 or 3 and entering up to 10 characters for either one. To enter alpha characters, first press the Shift Lock key on the PCCU handheld programmer keyboard. Press Shift Lock again after entering alpha characters.
5	Press Menu Exit to return to the Channel Tags Menu to select the Analog Output, Pulse Input, Digital Input or Output channels. The process for assigning names and units is the same as the above example except that no engineering units can be assigned to the Digital Inputs or Outputs.

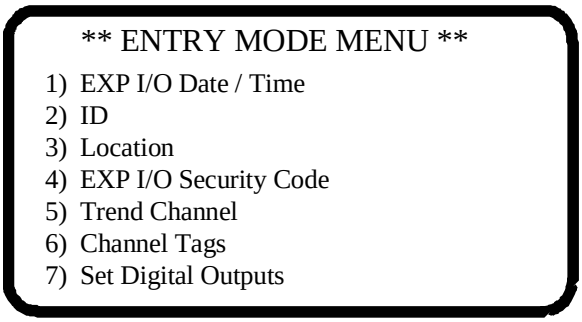
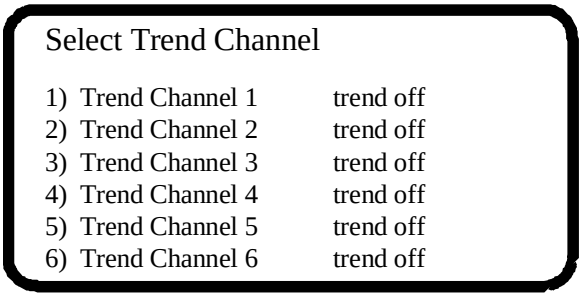
Trend Channels

Introduction

The RTU has the capability of logging information such as digital input and output status, analog input and outputs, and pulse accumulations. Up to sixteen (16) channels can be logged. Six of these channels can then be collected and displayed by the host application (WinCCU32) per collection. The information shows the logged data of the channel and is referred to as “Trend Information” or “Trend Channel Data”. The PCCU handheld programmer is used to select which analog or pulse input channels of the RTU to trend. In the new PCCU32 software, this same information is referred to as "Data Logging".

Assigning Trend Channels

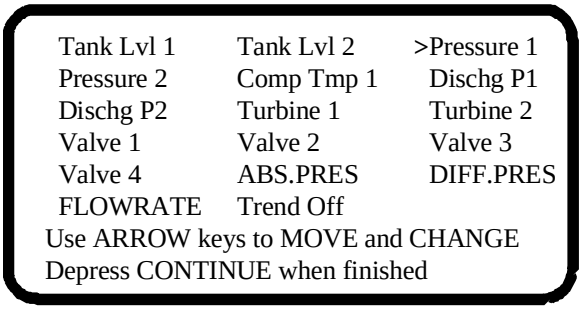
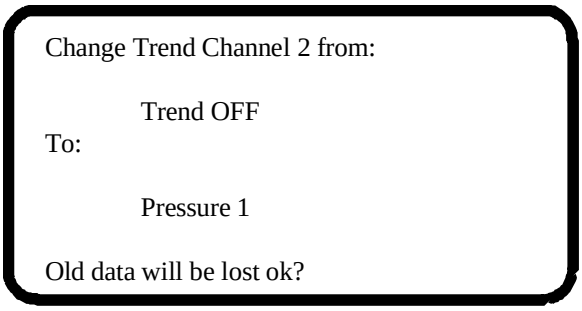
Follow the steps outlined below to select trend channel assignments.

Step	Procedure
1	Select option 5) Trend Channel on the Entry Mode Menu: 
2	The Trend Channel assignment screen will be displayed:  Each of the 6 Trend Channels can be assigned to 1 of the analog or pulse input channels or not used. If not being used, the Trend Channel will indicate "trend off". When initially setup, all Trend Channels will be turned off.

Continued on next page

Step	Procedure
2 (Cont)	Perform the following steps to assign analog or pulse input channels to be trended. Select Trend Channel 1) Trend Channel 1 trend off 2) Trend Channel 2 trend off 3) Trend Channel 3 trend off 4) Trend Channel 4 trend off 5) Trend Channel 5 trend off 6) Trend Channel 6 trend off
3	Enter the number of the Trend Channel to set up from the above display. For example, to set up Trend Channel 2, enter 2.
4	A selections menu appears showing all analog and pulse input channels with the name or tag that has been assigned to the channel. The channels appear in order from left to right: Analog Input (7), Pulse Input (2), Analog Output (4), *Absolute Pressure, *Differential Pressure and *Flow Rate. Select ONE item to assign to the Trend Channel. >Tank Lvl 1 Tank Lvl 2 Pressure 1 Pressure 2 Comp Tmp 1 Dischg P1 Dischg P2 Turbine 1 Turbine 2 Valve 1 Valve 2 Valve 3 Valve 4 ABS.PRES DIFF.PRES FLOWRATE Trend Off Use ARROW keys to MOVE and CHANGE Depress CONTINUE when finished To select the item to trend, move the cursor to the item using the LEFT/RIGHT arrow keys. Select the item with either the YES/NO keys or the UP/DOWN arrow keys. When selected, the item will "light up" or appear on a black background. To remove a selection, position the cursor on the Trend Off selection and select it.

Continued on next page

Step	Procedure
5	As an example, select Pressure 1 (Analog Input 3) using the arrow keys. 
6	Then press CONTINUE. The following display appears: 
7	Respond YES if this is correct. The prompt "Old data will be lost" means that any data that was previously logged on this channel will be lost. This is true in older standard RTU firmware, but is not true for later custom firmware. The data base for this channel in the older firmware would be cleared to start over with new information. Answer NO to cancel the change. Sixteen data channels are available for logging of data. In older RTU firmware only 6 channels could be set up for logging and collected at one time by host software such as WinCCU32. In later firmware, all 16 channels could be set up for logging but only 6 could still be collected at one time by the host software.

Note: The newest RTU firmware uses a completely new trending system that can only be setup by PCCU32 or WinCCU32. The only limitation for trending of data is limited by the amount of memory on the RTU.

Continued on next page

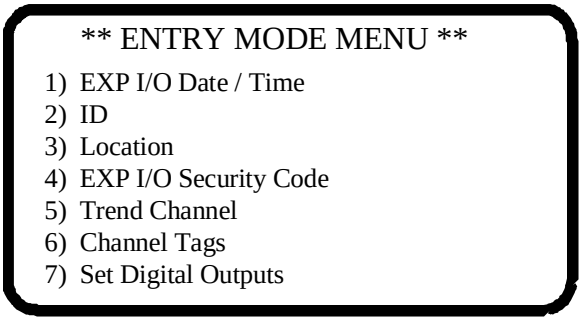
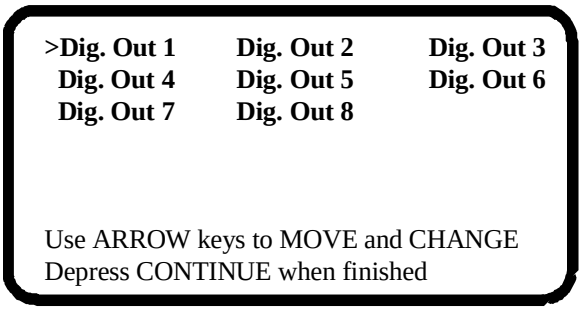
Setting Digital Outputs

Introduction

The RTU has the capability of initiating digital outputs directly from the PCCU handheld programmer or WinCCU32 host application. The PCCU is used to select which Digital Output channel of the RTU to change.

Setting Digital Outputs

Follow the steps outlined below to select Digital Output channel status changes.

Step	Procedure
1	To set/reset the digital outputs, enter 7 on the Entry Mode Menu.  The following screen is then displayed: 
2	Set/reset refers to voltage level at the digital output connection. Set is the active state with the battery voltage present at output. Reset is the inactive state with 0 volts at the output. The digital outputs are set or active if they are shown on the display with the black background or appear as "lit up". Move to the outputs that need to be set/reset with the LEFT/RIGHT arrow keys. Set/reset the output with either the YES/NO keys or the UP/DOWN arrow keys.

Continued on next page

Step	Procedure
3	When all the digital outputs have been set/reset as needed, press CONTINUE. The PCCU handheld programmer will then command the RTU to set/reset the Digital Outputs. **Setting Digital Outputs**
4	Once the communication between the PCCU handheld programmer and the RTU is complete, the display returns, showing the current state of the digital outputs: **>Dig. Out 1 Dig. Out 2 Dig. Out 3** **Dig. Out 4 Dig. Out 5 Dig. Out 6** **Dig. Out 7 Dig. Out 8** Use ARROW keys to MOVE and CHANGE Depress CONTINUE when finished At this point changes can be made which would require pressing Continue again, or if the settings are correct, press MENU EXIT.

Calibration Mode

Introduction

The calibration mode enables the calibration of the Analog Inputs, Analog Outputs, and Pulse Inputs of the RTU. Before entering the Calibrate Mode, set up the Channel Tags and Units with the necessary names and engineering units. See the section on the ENTRY MODE for the correct procedures.

Calibration Procedures

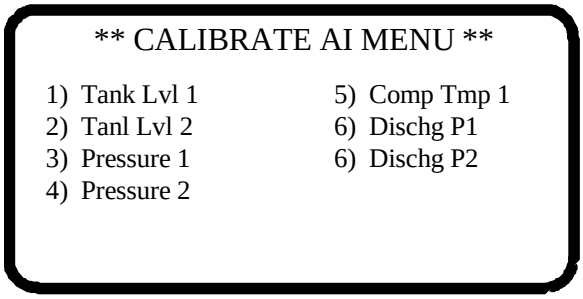
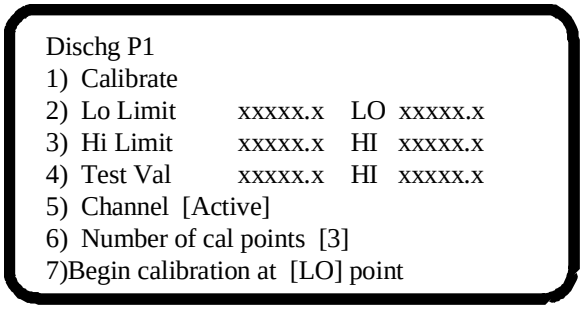
Follow the steps outlined below to calibrate the Analog Input, Analog Output and Pulse Input channels.

Step	Procedure
1	After selecting 3 or Calibration from the Connected Menu, the PCCU handheld programmer commands the RTU to ignore new readings from its measurement inputs. Instead the RTU uses readings just before receiving the command from the PCCU handheld programmer. This prevents the RTU data base from being affected by value changes during calibration. There are two ways to remove this temporary hold: 1. Unplug the DATA cable at the RTU connector. 2. Exit the calibration mode with the MENU EXIT key. Select 3 or Calibrate and the following appears: ** CALIBRATE MENU ** 1) Calibrate AIs 2) Calibrate AOs 3) Calibrate PIs

Continued on next page

Calibrating Analog Inputs

The Analog Input measurement is often referred to as the measurement of the variation in a 4 to 20 milliamp signal provided by an external transducer. Normally the low value represents the lowest unit to be measured and the high value represents the highest value to be measured. The I/O of the RTU senses and measures voltage. Certain low power transducers provide the necessary 1 to 5 volt variation. Transducers providing a 4 to 20 milliamp signal must have a 250 ohm resistor jumpered across the input connection at the termination board. High precision resistors are provided on the termination board for this use.

Step	Procedure
1	To calibrate AIs, enter 1 on the Calibrate Menu and the following appears:  ** CALIBRATE AI MENU ** 1) Tank Lvl 1 5) Comp Tmp 1 2) Tanl Lvl 2 6) Dischg P1 3) Pressure 1 6) Dischg P2 4) Pressure 2 In this example display, the channels are identified by the tags or names entered in the Entry Mode. Select the Analog Input to calibrate. In this example, assume Dischg P1 (Analog Input 6) was selected. Enter 6 and the display for the calibration of Analog Input 6 is shown:  Dischg P1 1) Calibrate 2) Lo Limit xxxxx.x LO xxxxx.x 3) Hi Limit xxxxx.x HI xxxxx.x 4) Test Val xxxxx.x HI xxxxx.x 5) Channel [Active] 6) Number of cal points [3] 7)Begin calibration at [LO] point

Continued on next page

Calibrating Analog Inputs, Continued

Calibrating Analog Inputs Menu Items

The items of the Analog Input Calibration Menu are:

1. **Calibrate** Selects the calibration procedure. The prompts for calibration will be shown on the bottom two lines of the display.

2. **Lo Limit** Entering 2 permits the entry of the LO Limit in the engineering units selected. The I/O Control routine calculates percent of time that the value was below the entered low limit.

3. **Hi Limit** Entering 3 permits the entry of the High Limit in the engineering units selected. The I/O Control routine calculates percent of time that the value was above the entered high limit.

4. **Test Value** Entering 4 permits the entry of a test value to use in verifying the operation of the Analog Input. The value entered should be in the engineering units selected. This value is used by the I/O when a channel is Inactive.

5. **Channel Active/Inactive** Entering 5 toggles between setting the channel Active or Inactive. When set to Active the channel is reading the live measurement. A channel set to Inactive is reading the Test Value.

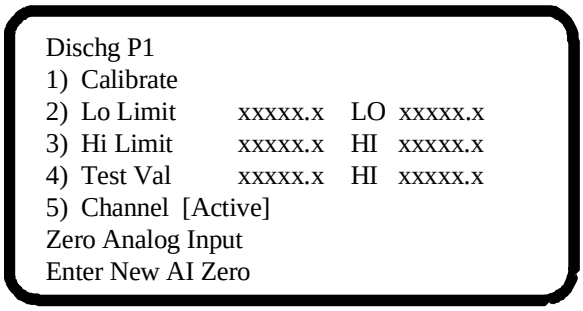
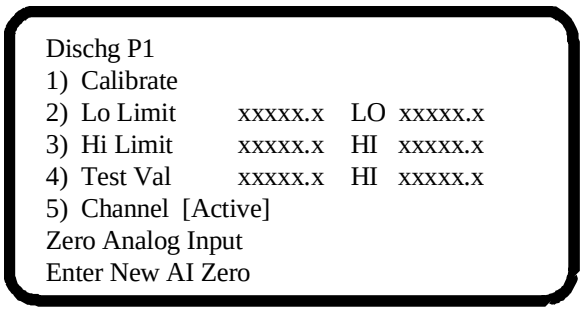
6. **Number of Cal. Points [3/2]** Entering 6 toggles between setting the number of calibration points to 2 or 3.

7. **Begin Calibration at [LO/HI] point** Entering 7 toggles between beginning the calibration procedure at the LO point or HI point.

LO, MID, HI are the low, mid, and high calibration points entered during calibration. These values are shown in milliamps.

Continued on next page

Calibrating Analog Inputs, Continued

Step	Procedure
2	Before beginning, select either 2 or 3 point calibration and the calibration direction. These selections are items 6 and 7 from the calibrate display. Instructing the PCCU handheld programmer to begin calibration at the low point means that the calibration direction will be LO, MID, HI. By instructing the PCCU handheld programmer to begin calibration at the HI point the direction is reversed. If the two point calibration is selected, the direction is HI, LO or LO, HI.  Enter 6 to select the number of calibration points. Entering 6 will toggle between 2 or 3 points.
3	Enter 7 to select whether to begin calibration at the LO point or the HI point. The Calibrate routine is not entered until 1) Calibrate is selected.
4	Enter 1) Calibrate from the menu. Set the device providing the input to the RTU to reading of zero. Follow the calibration prompts shown on the last two lines of the display: 

Continued on next page

Calibrating Analog Inputs, Continued

Step	Procedure
4a	Enter 0 and press ENTER. The verification prompt appears: Dischg P1 0.0 PSIG <--Display is updated here 1) Calibrate 2) Lo Limit xxxxx.x LO xxxxx.x 3) Hi Limit xxxxx.x HI xxxxx.x 4) Test Val xxxxx.x HI xxxxx.x 5) Channel [Active] Zero Analog Input You Entered 0.0 PSIG ok?
4b	When the verification prompt is on the screen, the measurement is being updated. When the measurement settles, answer YES to proceed or NO and re-enter the correct value.
5	Set the output of the device providing the input to the expected operating point. Dischg P1 0.0 PSIG 1) Calibrate 2) Lo Limit xxxxx.x LO xxxxx.x 3) Hi Limit xxxxx.x HI xxxxx.x 4) Test Val xxxxx.x HI xxxxx.x 5) Channel [Active] Set Analog Input Operating Point Enter New Operating Point
5a	Enter the value and press ENTER: Dischg P1 50.0 PSIG <--Display is updated here 1) Calibrate 2) Lo Limit xxxxx.x LO xxxxx.x 3) Hi Limit xxxxx.x HI xxxxx.x 4) Test Val xxxxx.x HI xxxxx.x 5) Channel [Active] Set Analog Input Operating Point You Entered 50.0 PSIG ok?

Continued on next page

Calibrating Analog Inputs, Continued

Step	Procedure
5b	Here again, when the verification prompt is on the screen, the measurement is being updated. When the measurement settles, answer YES.
6	Set the output of the device providing the input to the maximum operating value or range. Dischg P1 50.0 PSIG 1) Calibrate 2) Lo Limit xxxxx.x LO xxxxx.x 3) Hi Limit xxxxx.x HI xxxxx.x 4) Test Val xxxxx.x HI xxxxx.x 5) Channel [Active] Set Up Analog Input to Full Scale Enter new AI Range
7	Enter the range and press ENTER. Dischg P1 100.0 PSIG <--Display is updated here 1) Calibrate 2) Lo Limit xxxxx.x LO xxxxx.x 3) Hi Limit xxxxx.x HI xxxxx.x 4) Test Val xxxxx.x HI xxxxx.x 5) Channel [Active] Set Up Analog Input to Full Scale You entered 100.0 PSIG ok?
7a	When the measurement settles, answer YES. The following is shown: Dischg P1 100.0 PSIG <--Display is updated here 1) Calibrate 2) Lo Limit xxxxx.x LO xxxxx.x 3) Hi Limit xxxxx.x HI xxxxx.x 4) Test Val xxxxx.x HI xxxxx.x 5) Channel [Active] Calibration is complete .... Depress CONTINUE to Proceed .... The display continues to update until Continue or Exit is selected. Since the display continues to update, verification of the calibration is possible at this point.

Calibrating Analog Outputs

The Analog Output function of the RTU is capable of supplying up to four (4) outputs. These outputs can be individually addressed from internal measured points. Additionally, these outputs can be controlled using our graphically enhanced ladder logic (GELLO).

To program and set-up the Analog Outputs use the following procedures:

Step	Procedure
1	To calibrate an Analog Output, enter 2 on the Calibrate Menu: ** CALIBRATE MENU ** 1) Calibrate AIs 2) Calibrate AOs 3) Calibrate PIs A display such as the example below is shown: ** CALIBRATE AO MENU ** 1) Valve 1 2) Valve 2 3) Valve 3 4) Valve 4

Continued on next page

Calibrating Analog Outputs, Continued

The Analog Output function of the RTU is capable of supplying up to four (4) outputs. These outputs can be individually addressed from internal measured points. Additionally, these outputs can be controlled using our graphically enhanced ladder logic (GELLO).

To program and set-up the Analog Outputs use the following procedures:

Step	Procedure
2	In this example the AOs have been tagged or named Valve 1 thru 4. Up to four analog outputs are displayed. Only 1 AO is provided on the basic RTU. An expanded AO board is necessary to provide AO 2 through 4. Choose the Analog Output to calibrate. For this example Valve 1 (AO 1) is chosen.

```
Valve 1
1) Calibrate
2) Lo Limit      xx.x   LO  xx.x
3) Hi Limit      xx.x   HI  xx.x
4) Test Val      xx.x
5) Channel  [Active]      6) Check AO
```

Calibrating Analog Outputs Menu Items

The items of the menu are:

- *Calibrate* – Selects the calibration procedure. The prompts for calibration will be shown on the bottom two lines of the display.
- *Lo Limit* – Entering 2 permits the entry of the LO Limit in Percent. The I/O Control routine calculates the percent of time that the value was below the entered low limit.
- *Hi Limit* - Entering 3 permits the entry of the High Limit in Percent. The I/O Control routine calculates the percent of time that the value was above the entered high limit.
- *Test Value* – Entering 4 the entry of a test value in Percent. The test value is used by the I/O when a channel is Inactive.
- *Channel Active/Inactive* - Entering 5 toggles between setting the channel Active or Inactive. When set to Active the channel is outputting the set value. A channel set to Inactive is outputting the Test Value.
- *Check AO* – Entering 6 permits the setting of the AO for test or operational purposes.
- *LO, HI* - are the low and high calibration points entered during calibration. These are in ma (milliamps).

Continued on next page

Calibrating Analog Outputs, Continued

Step	Procedure
3	Enter 1) Calibrate and the calibration prompts will appear on the last two lines of the display. Valve 1 1) Calibrate 2) Lo Limit xx.x LO xx.x 3) Hi Limit xx.x HI xx.x 4) Test Val xx.x 5) Channel [Active] 6) Check AO Now setting AO to 0% (should be 4.0 mA) Enter new measured mA value
3a	The PCCU handheld programmer instructs the RTU to set the Analog Output to 0%. Check the analog output value on the termination panel with a meter. When it settles, it should read close to 4.0 ma (milliamps). Enter the value measured in milliamps (ma). For example, if the meter indicated 3.9, enter 3.9. A verification prompt then appears: Valve 1 1) Calibrate 2) Lo Limit xx.x LO xx.x 3) Hi Limit xx.x HI xx.x 4) Test Val xx.x 5) Channel [Active] 6) Check AO Now setting AO to 0% (should be 4.0 mA) You entered 3.9 mA ok? If satisfied, answer YES. If a change is necessary answer NO and enter the correct value.
3b	The PCCU handheld programmer then instructs the I/O to set the Analog Output to 100%. Valve 1 1) Calibrate 2) Lo Limit xx.x LO xx.x 3) Hi Limit xx.x HI xx.x 4) Test Val xx.x 5) Channel [Active] 6) Check AO Now setting AO to 100% (should be 20.0 mA) Enter new measured mA value

Continued on next page

Calibrating Analog Outputs, Continued

Step	Procedure
3c	Check the analog output value on the termination panel with a meter. When it settles, it should read close to 20.0 ma (milliamps). Enter the value measured in milliamps (ma). For example, if the meter read 19.9, enter 19.9. A verification prompt will appear: Valve 1 1) Calibrate 2) Lo Limit xx.x LO xx.x 3) Hi Limit xx.x HI xx.x 4) Test Val xx.x 5) Channel [Active] 6) Check AO Now setting AO to 100% (should be 20.0 mA) You entered 19.9 mA ok?
4.	If satisfied, answer Yes. Valve 1 1) Calibrate 2) Lo Limit xx.x LO xx.x 3) Hi Limit xx.x HI xx.x 4) Test Val xx.x 5) Channel [Active] 6) Check AO Calibration Complete .... Depress CONTINUE to proceed ....

Checking and Setting Analog Outputs

After calibration has been completed on the RTU Analog Outputs it is recommended to check or verify that the calibration is valid. You can also manually set the analog outputs to a user determined value.

To check and manually set the Analog Outputs use the following procedures:

Step	Procedure
1	Enter 6) Check AO and the last two lines on the display prompts for the percent value to enter: Valve 1 1) Calibrate 2) Lo Limit xx.x LO xx.x 3) Hi Limit xx.x HI xx.x 4) Test Val xx.x 5) Channel [Active] 6) Check AO Enter % of Full Scale to set AO Enter new % of Full Scale
2	Enter a percent of full scale of the Analog Output. 0 to 100% is the scale of the AO, 100% being full scale. 0% represents 4 milliamps, 100% represents 20 milliamps. Half scale or 50% would represent 12 milliamps: Valve 1 1) Calibrate 2) Lo Limit xx.x LO xx.x 3) Hi Limit xx.x HI xx.x 4) Test Val xx.x 5) Channel [Active] 6) Check AO Enter % of Full Scale to set AO You entered 50% ok? Once the verification prompt is answered with YES the PCCU handheld programmer will instruct the I/O to set the AO with the value. The analog output (4-20 ma signal) will appear at the output terminals and can be read with a meter. In this example, 12 ma on should be indicated by the ampmeter.
3	Check the Analog Output for any scale percentage setting by following steps 1 through 3. When finished, press MENU EXIT.

Note: The analog output is a fixed value, a percentage of the calibrated range, and set by the "Check AO" routine.

Calibrating Pulse Inputs

Two high speed pulse inputs are provided on the RTU. To calibrate the pulse inputs use the following procedures:

Step	Procedure
1	To calibrate a Pulse Input, enter 3 on the Calibrate Menu: ** CALIBRATE MENU ** 1) Calibrate AIs 2) Calibrate AOs 3) Calibrate PIs
2	The display for the two Pulse Input channels will appear: ** CALIBRATE PI MENU ** 1) Turbine 1 2) Turbine 2 In this example Turbine 1 (Pulse Input 1) is chosen: Turbine 1 1) K Factor xxxxx.x 2) Lo Limit xxxxx.x 3) Hi Limit xxxxx.x 4) Test Val xxxxx.x 5) Channel [Active]

Continued on next page

Calibrating Pulse Inputs, Continued

The calibration for the Pulse Input channels consists of entering the K-factor. The RTU will read pulses at the channel inputs and multiply them by the factor entered.

Two types of pulse information are available with the RTU; Pulse Frequency and Pulse Averaging. The selection is controlled by firmware version. Insure that the firmware version ordered will support the pulse information desired.

Calibrating Pulse Inputs Menu Items

The items of the Pulse Input Calibration Menu are:

- *K-Factor* - Enter 1 to enter the pulse multiplier or K-factor.
- *Lo Limit* - Entering 2 permits the setting of the LO Limit. Units for the Pulse Inputs are usually in pulses. The I/O Control routine calculates the percent of time the pulses were below the set value.
- *Hi Limit* - Entering 3 permits the setting of the High Limit pulse value. The I/O Control routine calculates the percent of time the pulses were above the set value.
- *Test Value* - Entering 4 permits the entry of a test value to use in checking the Pulse Input operation. The test value is used by the I/O when a channel is Inactive.
- *Channel Active/Inactive* - Entering 5 toggles between setting the channel Active or Inactive. An Active channel is reading the live pulse inputs. An Inactive channel is reading the Test Value.

Note:

When connected to a radio or modem, the RTU's operation can be monitored or controlled remotely using the Central Collection Unit (WinCCU32) software package. Please reference the latest revision of the Central Collection Unit (WinCCU32) software help files for more information on this topic.

Chapter 4

Maintenance & Troubleshooting

Overview

Introduction

This chapter provides you with standard Maintenance information and instructions on how to remove and install components of the RTU.

Chapter Highlights

In this chapter you will learn how to:

Maintenance Support

If installation, calibration and maintenance assistance is required, user can contact the Totalflow Service Department.

Inside or Outside Oklahoma 1-(800)-442-3097

Continued on next page

How to Use This Chapter

Totalflow recommends that you develop regularly scheduled daily, weekly or monthly maintenance program. By establishing such a maintenance program, downtime can be at a minimum. The majority of maintenance is simply cleanliness and detecting any failures as soon as possible.

This chapter is broken down into the replacement of major parts. As part of the maintenance program, keep a log of any replaced parts. Log the date when a part was replaced, it's part number and symptom or reason for replacing.

Maintaining Cleanliness of RTU

Because a 6790 RTU 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 RTU inoperable.

Front Mounted LCD Display

The two lines by 24 alphanumeric character LCD, displays alarm codes on the right side of the display window. By observing this display, you are informed of operational information or alarm conditions that may be present. RTU alarm troubleshooting procedures are presented in the Troubleshooting Section.

Returning Part(s) for Repair

If a Totalflow component is to be returned for repair, securely wrap it in protective anti-static packaging. Before returning a component, call us for a Return Authorization Number (RA). Affix this number to the outside of your return package.

Part shipments must be prepaid by customer. Any part, not covered by original SYSTEM WARRANTY, will be shipped to customer, F.O.B.

Replacing RTU Battery Pack

Introduction

This section presents the procedures for removal and installation of the RTU battery pack. To access the battery pack, open RTU front door. Battery pack is located behind internal access plate (behind field termination panel).

Important

If the Totalflow Battery Charger is connected it *MUST* be disconnected from the termination board (TB1) terminals EXT CHGR +/- prior to removal and installation of battery pack.

When removing battery pack, *DO NOT* remove Lithium battery from 6790 Digital Circuit Board. This prevents any data stored in RAM, from being lost.

Procedures See Figures 4-1 & 4-2

Refer to Figure 4-2 for location of Digital Circuit Board connections.

Step	Procedure
1.	Make sure the lithium battery is plugged into it's socket.
2.	Disconnect the charging source by removing wires at TB1-23 and TB1-24 (page 73). Be careful to tape ends of wires during maintenance to alleviate shorting of solar panel wires to other system components.
3.	Measure the lithium battery and make sure it is > 3.0V.
4.	Before removing battery pack(s), disconnect the Battery Cable from the 6790 Main Circuit Board connector J6 and J7.
5.	Remove keeper plate, which secures battery pack in its mounting location, by loosening the three mounting screws. It is not necessary to remove screws.
6.	Remove battery pack from battery compartment.
7.	Insert new battery pack into battery compartment. Battery pack must be positioned so its longest dimension fits snugly against keeper plate when plate is installed. Reinstall keeper plate and tighten three keeper plate mounting screws.

Continued on next page

Procedures (Continued)

Step	Procedure
8.	Connect battery(s) cable to 6790 Digital Circuit Board connector(s) J6 and J7.
9.	Connect the charging source input wires at TB1-23 and TB1-24.
10.	After closing RTU door, check door mounted LCD display for normal operational readings.

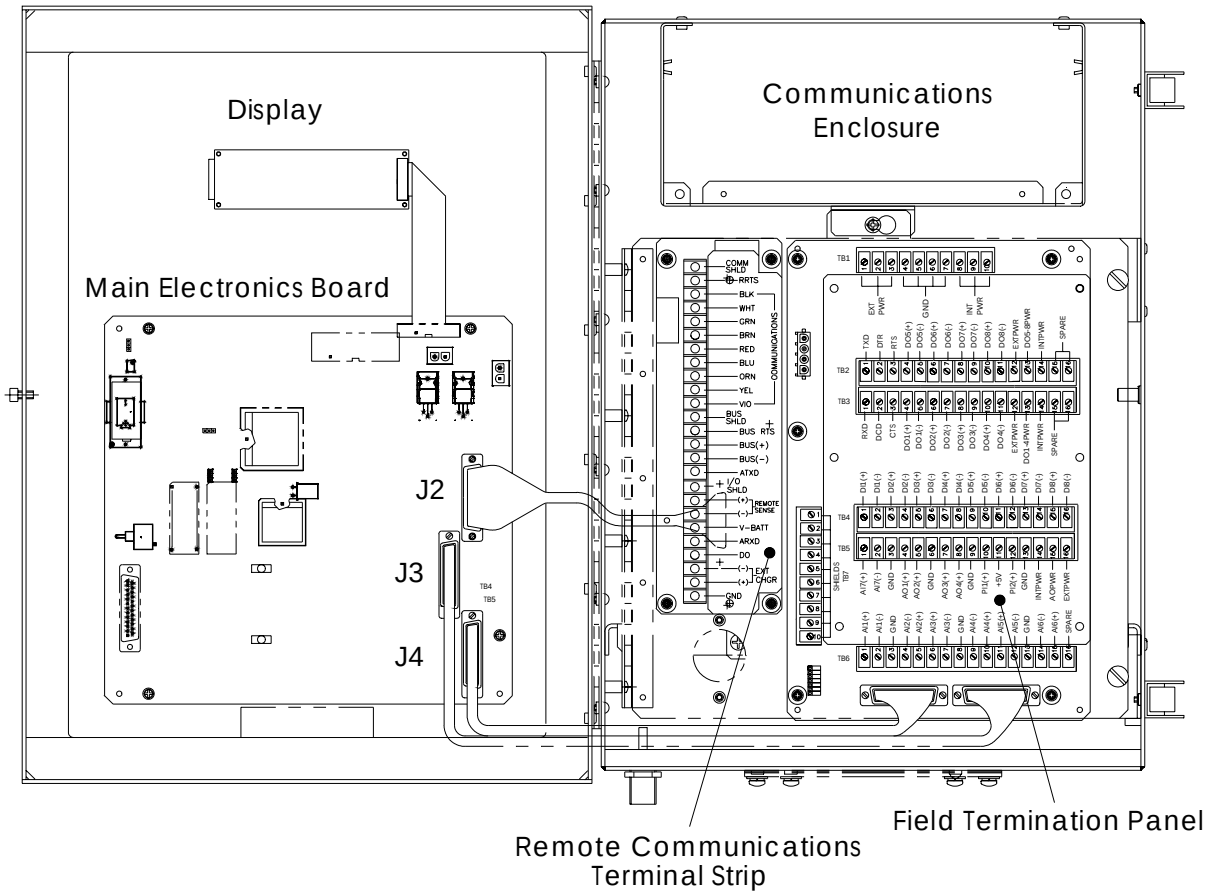


Figure 4 - 1 Model 6790 RTU System Components Layout Drawing.

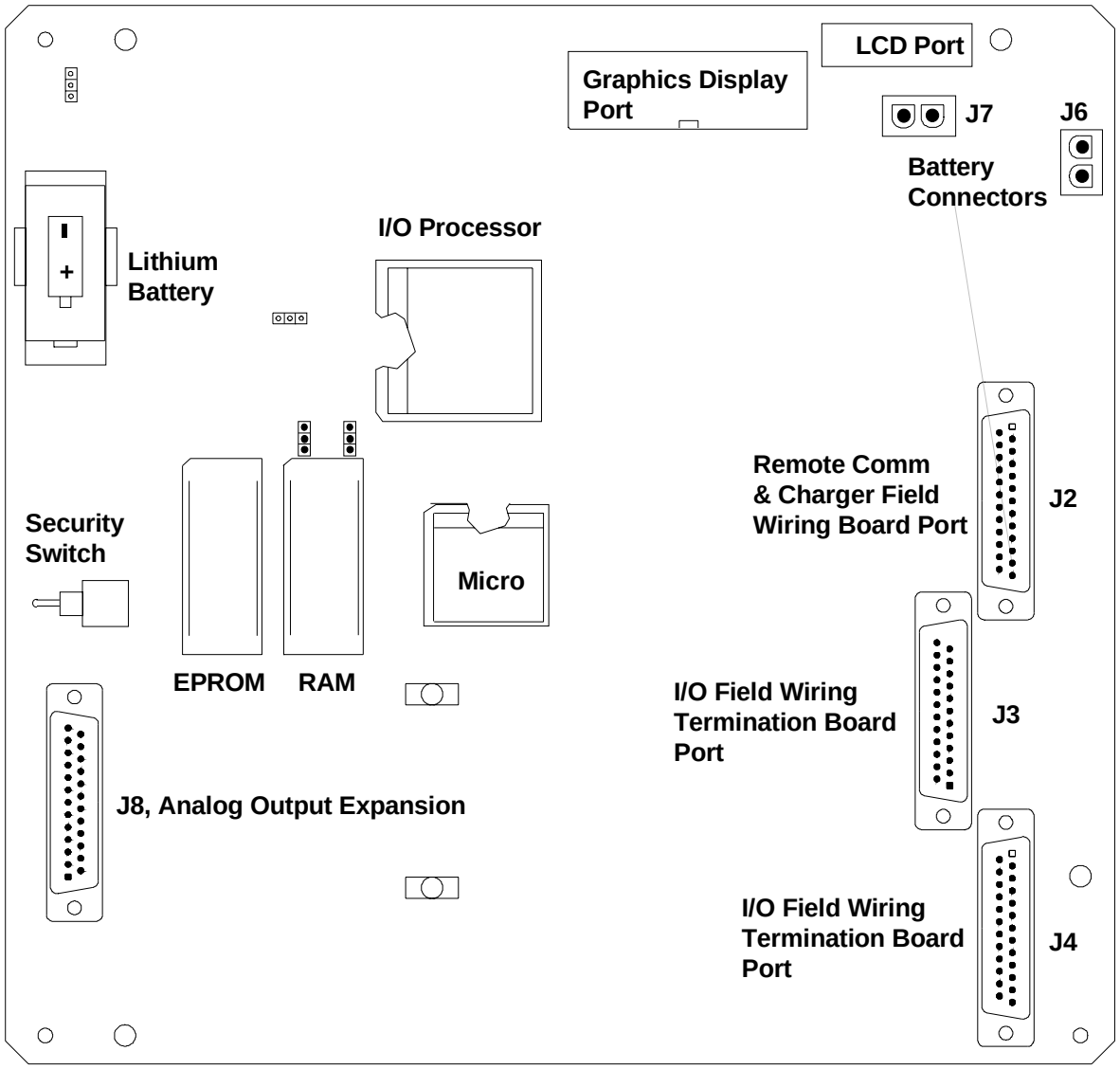


Figure 4 - 2 6790 Main Electronics Circuit Board Parts Locations.

Replacing 6790 Main Electronics Circuit Board

Introduction

The 6790 Main Electronics Circuit Board is mounted to the front side of the battery access door. It is mounted, to the door, on standoffs. Refer to Figure 4-1.

Caution

The 6790 Main Electronics Circuit Board is susceptible to damage by static electricity or improper handling. To prevent this from occurring, user should install an approved personal grounding strap.

A grounding strap is a conductive device used to make connection between the person handling the board, and a high quality ground potential.

Before handling the board you must install ground strap on a conductive part of your body, preferably your wrist, then connect it to the ground connection located on the bottom left corner of the RTU. This discharges electrical static buildup from the persons body to ground. This prevents any electrical static buildup from discharging to the board.

Important

Before removal of 6790 Main Electronics Circuit Board, be certain any RAM stored data has been downloaded to an external storage medium. Failure to do so could result in data loss when the Circuit Board is removed.

Procedures See Figures 4-1 & 4-2

When performing these procedures, please refer to Figure 4-1 and 4-2 for locations of Main Electronics Circuit Board connections.

Step	Procedure
1.	Before Main Electronics Circuit Board removal, disconnect the following associated connectors in this order. • If used, disconnect external batter charging source (Solar Panel or AC charger) connector at TB1- 23 and TB1-24 (page 73). • Disconnect battery pack(s) connector J6 and J7. • Tape an identifier to each connector so it will be correctly reinserted into the same Board mounting connector during reinstallation of 6790 Main Electronics Circuit Board. • Disconnect external field wiring panel connectors at J2, J3 and J4. • Disconnect RTU LCD port connector J1.

Continued on next page

Replacing 6790 Main Electronics Circuit Board, Continued

Procedure (Continued)

Step	Procedure
2.	Remove four mounting screws and lock washers securing Main Electronics Circuit Board to door mounted standoffs.

Note: When removing Main Electronics Circuit Board, grasp its outer edges. This prevents damage to circuitry and components.

3.	Replace and secure 6790 Main Electronics Circuit Board on four standoffs and secure in place using four hex nuts. DO NOT over tighten hex nuts. Doing so could cause damage to the digital circuit board or associated circuitry.
4.	Reinstall connectors, removed in Step 1, to their associated Board mounted connections in the following order. • J3 LCD Connector • J2 Communication and Charging Wiring Termination Panel (TB1) • J3 Field I/O Wiring Termination's Panel • J4 Field I/O Wiring Termination's Panel • J6 and J7 Battery Pack • TB1- 23 and TB1-24 (external charger wires) • Any additional connections that were previously disconnected

Replacing LCD Display Board

Introduction

The LCD Display Board is mounted on the backside of the front enclosure hinged door above the 6790 Main Electronics Circuit Board. To access and remove the Display Board, perform the following procedures.

Procedures See Figures 4-1 & 4-2

When performing these procedures, please refer to Figure 4-1 and 4-2 for locations of the Main Electronics Circuit Board connections.

Step	Procedure
1.	To access the LCD Display Board, open the 6790 RTU front door. The LCD board is located above the 6790 Digital Circuit Board.

Note: To prevent power damage to the 6790 Main Electronics Circuit Board and Display Board, the battery pack connector must be disconnected from Board mounted connector J6 and J7. If an external charging unit is connected to TB1-23 and TB1-24, these connections must be disconnected before disconnecting the battery.

2.	DO NOT remove Main Electronics Circuit Board mounted Lithium battery since it provides power to RAM. This prevents loss of accumulated data. It is recommended that RAM data be downloaded before accessing and removing LCD Display Board to prevent potential loss of stored data.
3.	Disconnect LCD Display Board cable connector from the Main Electronics Circuit Board Display Port connector J1. To remove connector, extend connector hold down fingers outward. Connector will pop upward.
4.	Using a 3/16” nut driver, remove the four plastic Display Board hexagonal mounting standoffs. Lift the LCD Board from the door mounted standoffs. If LCD Board is being returned to Totalflow for service, it is recommended that attached ribbon cable be left connected and returned with Display Board.
5	To reinstall Display Board, perform procedures 1 to 4 in reverse order. Once Display Board is reinstalled, apply power to RTU and verify information displayed on LCD display is correct. Adjust contrast potentiometer for optimum display.

Note: When reinstalling mounting hardware, DO NOT over tighten screws.

(This page intentionally left blank)

Troubleshooting

Overview

Introduction

This section contains troubleshooting techniques to hopefully correct most RTU problems. How to Warm start or Cold start a unit and the ramifications of each. A table explaining the annunciator status codes is provided. A section is provided for setup and troubleshooting an RTU with an installed radio communication unit.

Repair Procedures

For instructions on how to remove modules refer to the Maintenance Section.

Chapter Highlights

This chapter covers the following topics:

	REMOTE COMM 1		REMOTE COMM 2 (Satellite Bus)	AUX PORT (Analyzer Port)
	RS232	***RS485***	***RS485***	***RS232***
1	COMM SHLD	COMM SHLD	COMM SHLD	
2	RRTS	RRTS	RRTS	
3	GND	GND	GND	
4	SWVBATT	SWVBATT	SWVBATT	
5	TXD	TERMINATION		
6	RXD	BUS -		
7	RTS	BUS +		
8	DSR			
9	CD			
10	CTS			
11	DTR	RTS		
12			BUS SHLD	
13			BUS RTS	
14			BUS (+)	
15			BUS (-)	
16				ATXD
18				ARTS
19				ADCD
20	V-BATT	V-BATT	V-BATT	V-BATT
21				ARXD
22				ACTS
25	GND	GND	GND	GND

Figure 4 - 3 Communication's Ports (TB1) functional descriptions

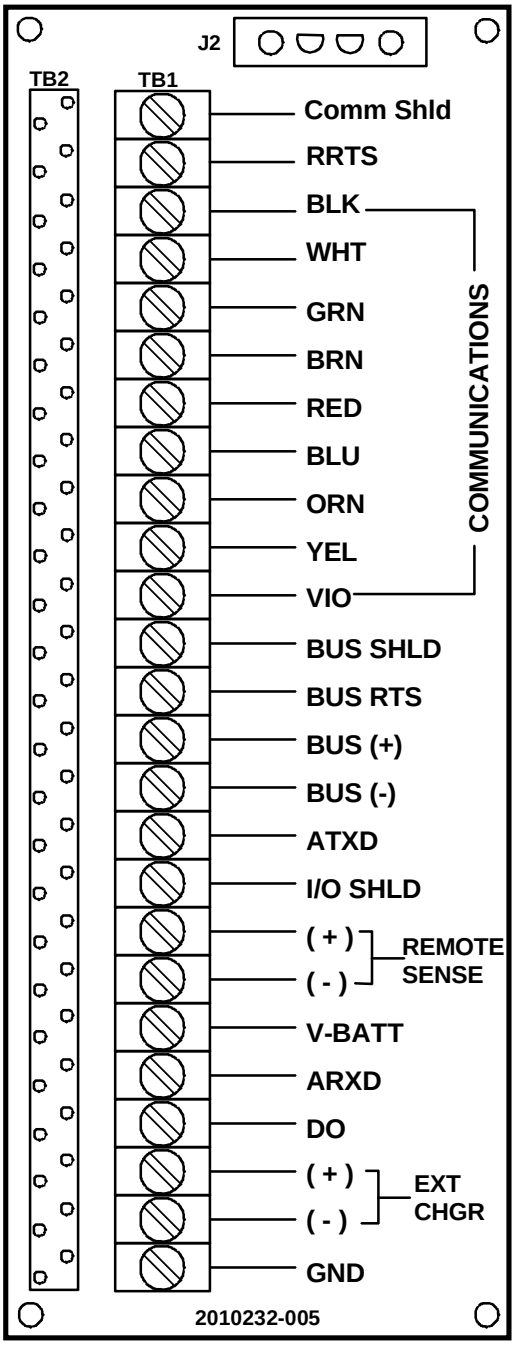


Figure 4 - 4 Communications and Charger Wiring Panel (TB1)

RTU Reset Procedures

Description

The RTU 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.

Cold Start

A cold start clears all the data that is stored in RAM as well as resetting all entered variables to their factory default values. A cold start should be used for new RTU 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.

Warm Start

A warm start does not clear the data stored in RAM since the lithium battery is not removed. The warm start will only reset the RTU microprocessor and not disturb any data that has been stored in RAM. A warm start should be used when taking an RTU out of service to perform maintenance or troubleshooting. A warm start can be used when a power or communication interruption caused the RTU microprocessor to lock-up.

Cold Start Procedures

A cold start clears all the data that is stored in RAM as well as resetting all entered variables to their factory default values. Discretionary use of this procedure is advised.

Step	Procedure
1.	If an external charging source is connected, it must be disconnected. Remove external charger EXT CHGR +/- wires from the RTU TB1-23 and TB-24 terminals.
2.	Disconnect battery connector(s) from the RTU Main Electronics Circuit Board BATTERY connector J6 and J7.
3.	Remove Lithium battery from the Electronics Circuit Board. The RTU is now out of service.

Continued on next page

Cold Start Procedures (Continued)

Step	Procedure
4.	To return to service reconnect 12 Vdc battery pack connector to Main Electronic Circuit Board BATTERY connector(s) J6 and J7 and observe LCD display.
5.	Reconnect external charging source to EXT CHGR, TB1-23 and TB1-24 terminals.
6.	Reinstall Lithium battery on Main Electronic Circuit Board.
7.	Enter all necessary operational parameters and calibrate RTU I/O using procedures in the Operations chapter.

Note

When RTU has been cold started, the system clock will be reset to 00:00:00.

Warm Start Procedures

A warm start does not clear the data stored in RAM since the lithium battery is not removed. The warm start will only reset the RTU microprocessor and not disturb any data that has been stored in RAM.

Step	Procedure
1.	If an external charging source is connected, it must be disconnected. Remove external charger EXT CHGR +/- terminals at TB1-23 and TB-24.
2.	Disconnect battery pack connector from Digital Circuit Board BATTTERY connector J6 and J7. The RTU is now out of service.
3.	To place RTU in service, perform the following steps in order: • Connect battery pack connector(s) J6 and J7 • Connect external charger wires to EXT CHGR +/- terminals located on TB1-23 and TB1-24

RTU LCD Visual Status Codes

Description

The LCD display contains six annunciators located on the right hand side of the display. Each annunciator typically represents the status of some function such as a communication's channel. A status code can be a word, character, letter or symbol. The table below lists the codes available; see illustration below.

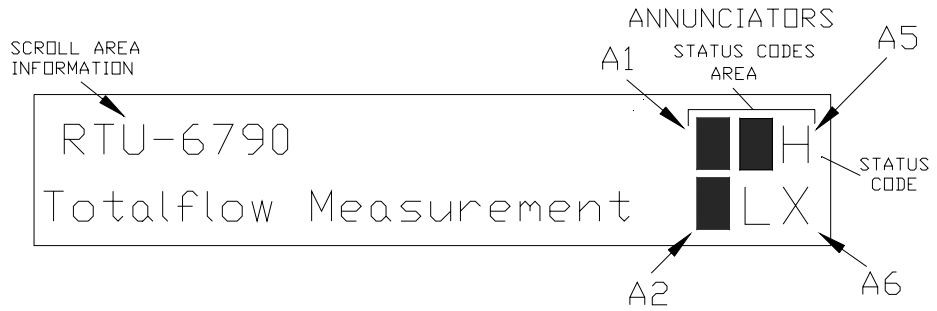


Table 4-1 Annunciator Status Codes and Description

Annunciator Location	Status Codes	Description
A4	**L**	*Local PCCU Connected*: Displayed when PCCU port is active and running TOTALFLOW Local Protocol. When PCCU port is not active, L is shaded. For example, this would occur if PCCU was not connected to PCCU port.
A1, A2, A6 A1 = Satellite Port A2 = Aux Port A6 = Remote Port	‡	*TOTALFLOW Listen Cycle*: Listening symbol. 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. Three remote communications ports are available. When RTU remote port is not active, ‡ is shaded.
A1, A2, A6 (See above)	→	*Transmitting Data*: If remote port is active and TOTALFLOW Remote Protocol is running, → arrow is displayed.
A1, A2, A6 (See above)	←	*Receiving Data*: If remote port is active and TOTALFLOW Remote Protocol is running, < arrow is displayed.
A1, A2, A6 (See above)	**X**	*X Frame Protocol*: The remote port is using X Frame protocol.
A1, A2, A6 (See above)	**M**	*MODBUS ASCII*: Modbus ASCII protocol selected on this port.
A1, A2, A6 (See above)	**m**	*MODBUS RTU*: Modbus RTU protocol selected on this port.

RTU Model 6790 Communications

Overview

These troubleshooting procedures are applicable to an RTU with an installed radio communication unit.

What is in This Section

This section contains the following Communication Troubleshooting procedures:

- Using the Host Application WinCCU32 for Troubleshooting
- RS-232 Serial Communication
  - RTU Will Not Respond
  - Receiver Supply Voltage
  - Receive Data (RXD)
  - Request to Send (RTS)
  - Transmit Data (TXD)
  - Existing Communication Problems
- RS-485 Communications
  - RTU Will Not Respond
  - Transceiver Power Supply Switch
  - Transceiver Power Supply
  - Receive Data (RXD)
  - Request to Send (RTS)

Communication Configurations

The two basic types of communications that can be used between the RTU and a remote communications device, are:

RS-232 Communications: Communication is accomplished using an RS-232 configured 6790 RTU board, through the associated RS-232 connector.

RS-485 Communications: Communication is accomplished using an RS-485 configured 6790 RTU board, through the associated RS-485 connector.

Warning

Before removing or installation any of the above communication wiring, it is important that you disconnect the RTU external charger and main RTU battery pack cable connector(s) from the RTU system wiring and field connector panels. Please refer to Figures 4-2 and 4-4.

Continued on next page

Setting Up Communications

After installation of communication equipment and before placing the communication system into operation, the user should adhere to the suggestions:

- Verify RS-232 or RS485 cables, and associated remote communications equipment connectors are correctly installed.
- Check RTU identification number (ID). Log the ID for future reference.
- Log RTU access security code for future reference.

Helpful Hints

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

- When communication equipment is powered on, the RTU displays the → after it recognizes the RTU identification number being transmitted from the host application (WinCCU32).
- Check baud rate of RTU transmission and LISTEN time settings. The baud rate and time settings can be changed when PCCU is in ENTRY mode. Default settings are 1200 baud and listen cycle is 4 seconds.

Central Collection Unit (CCU)

Introduction

Central Collection Unit software provides error messages when a communication's error exists. The following table will assist the user in determining the possible cause for an indicated error message.

Table 4-2 Host Application (CCU)

Problem	Possible Cause
RTU Did Not Respond to Communication Message	• CCU transmitting from wrong serial port. • In Meter ID Manager, RTU ID is incorrect. • In Meter ID Manager, communication baud rate is incorrect. • In Meter ID Manager link establishment time is incorrect. • Bad communication link. • More than one RTU has same ID. • Problem(s) with installed hardware.
CRC Error Detected in RTU Data	• Bad communication link • Installed hardware problems • RTU is responding with errors in data
FCS Error Detected in CCU Transmission	• In Meter ID Manager, RTU security code is incorrect.
RTU Modem Did Not Answer	• In Meter ID Manager, RTU phone number is incorrect. • Problem with modem at RTU or Host PC. • Incorrect type of modem being used.
RTU Did Not Respond to Download Request	• CCU transmitting from incorrect serial port. • In Meter ID Manager, RTU ID is incorrect. • In Meter ID Manager, communication BAUD rate is incorrect. • In Meter ID Manager, link establishment time is incorrect. • Bad communication link. • More than one RTU has same ID. • Problem(s) with installed hardware. • Wrong security code

RS-232 Serial Communications

Introduction

The following RS-232 Serial Communication troubleshooting procedures will assist the user in what may be the possible cause for indicated error messages.

Table 4-3 RS-232 Serial Communication

Problem	Possible Cause
RTU Will Not Respond to Communication Message	• Verify RTU Digital Circuit Board wiring to radio transceiver is correct. • Verify battery pack voltage is greater than 11.5 Vdc. • Verify RTU identification number and access security code are correct. • Check RTU transceiver SWVBATT supply voltage. Refer to the following Measuring SWVBATT Transceiver Supply voltage for procedures.
	• Using a digital voltmeter, measure transceiver SWVBATT DC supply voltage between the following TB1 terminals: TB1-3 (GND) and TB1-4(SWVBATT) Refer to Figure 4-4. TB1-3 (GND [BLK]) and TB1-4 (SWVBATT [WHT]) Voltage should be greater than 11.5 Vdc.

Important

The transceiver measured DC voltage should pulse every four (4) seconds for a time duration of approximately 350 milliseconds (Baud rate dependent 350 ms max = 1200 Baud). Voltage must be at least 11.5 Vdc.

Voltage may be difficult to measure because of the short 350 millisecond time duration. A multi-meter with a peak hold feature is recommended for proper testing.

Continued on next page

Table 4-3 (Continued)

Problem	Possible Cause
Measuring Receiving Data [RXD (+)] Voltage	• Using an oscilloscope or digital voltmeter, connect to TB1 Wiring Panel across the following terminals. Refer to Figure 4-4. TB1-3 (GND [BLK]) and TB1-6 (RXD+ [BRN]) When communication data is being transmitted from CCU to RTU, voltage should vary between +5 Vdc and -5 Vdc.

Note: Voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.

Verify voltage by continuously polling RTU from Host application (CCU).

Measuring Request To Send (RTS) Voltage	• Using an oscilloscope or digital voltmeter, connect measuring device to TB1 Wiring Panel connector across the following terminals. Refer to Figure 4-4. TB1-3 (GND [BLK]) and TB1-7(RTS [Red]) When RTU is sending communication data to Host application (CCU), voltage should be +5 Vdc.

Important Voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.

Verify voltage by continuously polling RTU from CCU.

Continued on next page

Table 4 (Continued)

Problem	Possible Cause
Measuring Transmitting Data (TXD+) Voltage	• Using an oscilloscope or digital voltmeter, connect measuring device to TB1 Wiring Panel connector across the following terminals. Refer to Figure 4-4. TB1-3 (GND [BLK]) and TB1-5 (TXD+ [GRN]) When communication data is being transmitted from the RTU, voltage should vary between +5 Vdc and -5 Vdc.

Note This voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.

Verify voltage by continuously polling RTU from CCU.

Problem	Possible Cause
Communication Problem(s) Still Exists	• Using two (2) hand-held transceivers, check communication path between Master and Remote sites. If available, voice activated interface can be used. • Using a wattmeter, check transceiver output power. Refer to manufacturer's documentation for measuring instructions. • Verify that transceiver is on correct frequency. Refer to manufacturer's documentation for checking frequency instructions.

RS-485 Communications

Introduction

The following RS-485 Communications troubleshooting procedures will assist the user in what may be the possible cause for indicated error messages relating to RS485 remote communications failures.

Table 4-4 RS-485 Communications

Error Message	Possible Cause
RTU Will Not Respond To Communication Request	• Verify that RTU TB1 Wiring Panel connections, to optional universal Communications Interface (UCI) Board, RS485/RS232 Converter Barrier or Radio Modem Assembly, is correct or • Verify wiring from UCI Board to Radio Transceiver Assembly is correct. Verify UCI Board jumper settings are correct or • Verify wiring from , RS485/RS232 Converter Barrier to Radio Transceiver Assembly is correct or • Verify wiring from Radio Modem Assembly to Radio Transceiver Assembly is correct. • Verify RTU battery pack voltage is at least 11.5 Vdc. • Verify that RTU identification number and access security code are correct.
Measuring SWVBATT Transceiver Supply Switch Voltage	• Using a digital voltmeter, measure transceiver SWVBATT DC supply voltage between the following TB1 Wiring Panel terminals. Refer to Figure 4-4. TB1-3 (GND [BLK]) and TB1-4 (SWVBATT [WHT]) Switched voltage should be greater than 11.5 Vdc.

Note: The transceiver SWVBATT measured DC voltage should pulse every four (4) seconds for a time duration of approximately 350 milliseconds. Voltage must be at least 11.5 Vdc. (Baud rate dependent 350 max = 1200 Baud.)

Voltage may be difficult to measure because of the short 350 millisecond time duration. Use of a digital multi-meter with a peak hold function is recommended.

Continued on next page

Table 5 (Continued)

Error Message	Possible Cause
Measuring Battery Pack Voltage (V-BATT)	• Using a digital voltmeter, measure transceiver V-BATT power supply voltage between the following TB-1 connector terminals. Refer to Figure 4-4. TB1-3 (GND [BLK]) and TB1-20 (VBATT) Switched voltage should be greater than 11.5 Vdc.

Important Power to transceiver can be provided from an external power supply. This allows RTU to switch external power to transceiver. Switching is accomplished using a 12VDC switch line connected to TB1-4 (WHT). Refer to Measuring SWVBATT Transceiver Supply Switch Voltage.

If this option is used, TB1-20 (VBATT) is not used.

Measuring RS-485 Line Driver voltage	• Disconnect all communications wires from other units, to isolate the unit being tested. • Using an oscilloscope or digital voltmeter, connect it to TB1 Wiring Panel connectors across the following terminals. Refer to Figure 4-4. TB1-7 (BUS+ [RED]) and TB1-6 (BUS- [BRN]) Voltage should vary between +5 Vdc and 0 Vdc when communication data is being transmitted from Host Application (CCU) to RTU.

Important Voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.

Verify voltage by continuously polling RTU from CCU.

Continued on next page

Table 5 (Continued)

Problem	Possible Cause
Measuring Request to Send (RRTS) Voltage	• Using an oscilloscope or digital voltmeter, connect it TB1 Wiring Panel connector across the following terminals. Refer to Figure 4-4. TB1-3 (GRD [BLK]) and TB1-11 (RTS [VIO]) Voltage should be +5 Vdc when sending data to Host Application (CCU). Zero Volts when not transmitting.

Note Voltage may be difficult to see using a digital voltmeter. It can be seen using an oscilloscope.

Verify voltage by continuously polling RTU from Host Application (CCU).

When RRTS is high, transmitter should be keyed and transmitting data.

Communication Problem(s) Still Exist	Using two hand-held transceivers, check communication path between Master and Remote sites. If available, voice activated interface can be used. Using a wattmeter, check transceiver output power. Refer to wattmeter manufacturers documentation for operating instructions. Verify that transceiver is on correct frequency. Refer to transceiver manufacturer's documentation for procedures to check frequency.

Chapter 5

Customization

Overview

Introduction

The RTU is synonymous with customization. Typically, RTU user's have a specific or unique application to do which normally requires some custom programming. The software programming is typically done by Totalflow's Custom Project's group. However, if the user has the personnel, tools are available from Totalflow to permit them to do their own programming. In general, the user would use these tools to generate files on a PC and then down load them to the RTU. The program the user would write is referred to as a GELLO program which stands for **G**raphically **E**nhanced **L**adder **Lo**gic. See page 5-4 for more information on GELLO.

Other tools available when working with the customized programs in an RTU are PCCU32 and WinCCU32. PCCU32 is Totalflow's Windows® based "Portable Calibration and Collection Unit" software designed to be used at the site. PCCU32 has a mode called "Console" which allows the user to edit the data made available by the custom software. See page 5-6 for more information on PCCU32's "Console" mode.

WinCCU32 is Totalflow's Windows® based "Central Collection Unit" software designed to do setup, data collection, data processing and reporting. WinCCU32 has a mode called "Host Console" which allows the user to remotely view and/or edit the data made available by the RTU's custom programs. See page 5-10 for more information on WinCCU's "Host Console".

Chapter Highlights

This chapter covers the following topics

Custom Projects

Custom Applications List

Below is short list of some applications previously provided by Totalflow's Custom Project's group.

Emergency Well Shutdown

Logic is provided to handle Emergency Shutdown of wells. Basically the Emergency Shutdown program builds a daily Flowrate average which is then used as a baseline for comparing to the current Flowrate. If the current Flowrate is below the baseline by a certain value over a certain time period, the well is shut down.

Flare Gas Shut Down

Based on air quality regulations, this application requires that a pre-determined hourly quantity of flare exhaust gas must not be exceeded. This application totals volume each hour and compares the volume to a user specified set point. If the volume exceeds the set point then digital outputs are tripped to activate alarms and shutdown equipment. The application also supports Auto/Manual modes.

Gravity Corrected Oil Tank Level

This application is useful when using a static pressure transducer for measuring tank level. The pressure transducer is usually mounted toward the bottom of the tank, say a foot above grade. As the level rises in the tank, the pressure (relative to atmospheric pressure) increases, which increases the transducer output. As the level falls the transducer output falls.

Suppose you calibrate the level transmitter and RTU analog input system using dead weights so that 4 ma represents 0 feet and 20 ma represents 16 feet. We know that the transducer will output 4ma when the tank is empty and exerting 0 psig on the transducer. But the question is, what pressure will be on the transducer when the tank is full? The answer depends on the density of the fluid. The more dense the fluid the more pressure.

By doing a gravity correction on the tank level transmitter input the fluid density effects are accounted for and a correct tank level results.

Level Alarms / Shutdowns

Various kinds of levels and shutdowns have been provided. For example, on one site where our Valve Control was doing production flowrate control, when the production tank level exceeded a limit, the RTU shut in the production valve. On another example, the customer used level switches to detect when tank fluid overflowed onto the ground. In this instance, an alarm was transmitted over radio to the host system. The host system was equipped with Totalflow's Voice Alarm System (VAS) which was programmed to call an operator to report the spill.

Continued on next page

Custom Applications List, Continued

Liquid Volume Correction Factor

This application supports the computation of a liquid volume with a VCF derived from a Ctl and Cpl. Inputs to the Ctl factor are taken from a live temperature transmitter and user input of Specific Gravity at base conditions (60 Deg F). Inputs to the Cpl factor are taken from a live pressure transmitter. Meter Factor and K Factor are both supported as well as a user specified liquid measurement type selected from the following list: Crude Oil, Lube Oil, Nap Gas (Napthenes/Gasoline), Jet Gas (Jet Fuel/Gasoline) ,Jet Kero (Jet Fuel/Kerosene), and Fuel Oil (Diesel Fuel/Heating Oil/Fuel Oil)

Net Oil Calculation

This application generally involves computing gross and net oil volume totals. Measured inputs include a linear meter pulse input, a fluid temperature transmitter and a fluid BS&W transmitter. User entered inputs include transducer calibration ranges, linear meter K factor and Meter Factor, fluid gravity at base conditions and temperature base. From these inputs the RTU counts pulses, applies K factor and meter factor, computes and applies a Ctl volume correction factor (VCF), and applies BS&W correction which results in a net oil volume. Optionally a fluid static pressure can be used as input to allow Cpl to be computed as part of the Volume Correction Factor.

Net Water Calculation

This application works like the Net Oil Calculation, except that no BS&W is applied.

Oil Tank Sales Accumulator

On this application the user produces oil into a series of oil tanks. When one tank fills up, production is diverted to another tank. Before all the tanks fill up trucks are called out to transfer the oil to the purchaser.

The user wanted to totalize the off loaded oil volume for information purposes back at a host computer. Since this was only for indication and not custody transfer, the user did not want to invest in PD meters for these sites. So, an RTU algorithm was implemented that converts a change in tank level to a volume which is then accumulated. Digital inputs are used to tell the RTU when truck loading valves are opened and closed. The RTU monitors these digital inputs and computes the change in tank level during the time a valve is open. This tank level change is then converted to a volume by applying a multiplier factor that the user can set.

Production Volume Based On Tank Level

This is a variation of the *Oil Tank Sales Accumulator* above. However, no truck loading valves are involved. In this system, the delivery volume is being metered by the RTU using a PD meter. However, the user wanted not only the delivery volume from the tank outlet but also the production volume into the tank. But, the user did not want to purchase and install another PD meter on the tank inlet. So, an RTU algorithm was implemented that on a daily basis, converts the change in tank level to a volume which is then summed with the delivery PD meter to derive a daily production volume.

Continued on next page

Custom Applications List, Continued

Station Totals to Analog Outputs

The stand-alone RTU communicates via Modbus protocol to 6411 Flow Computers on 4 meter runs. The RTU reads several data values from each FCU. The current flow rates are summed by the RTU to provide 4-20 ma outputs proportional to station flow rate (MCF/Hr) and run flow rates. The analog outputs can be scaled by the user by modifying high and low limit values.

Water Analyzer Alarming

This program monitors a Water analyzer for a high level. If the signal from the analyzer exceeds a user definable high limit the application trips a digital output. The digital output will remain high until the H2O value falls below the high limit. The program also sets a flag which is available for alarming. The user can enable or disable the program to allow for calibration of the water analyzer and/or manually trip the digital output.

Water Injection Data

This application meters the water volume and computes daily average injection pump discharge pressures. The pump on/off status is used by the RTU to construct discharge pressure averages reflecting pressures during pump on times only. This average and pump on/off status is also brought into a host computer via radio communications.

Gello

Introduction

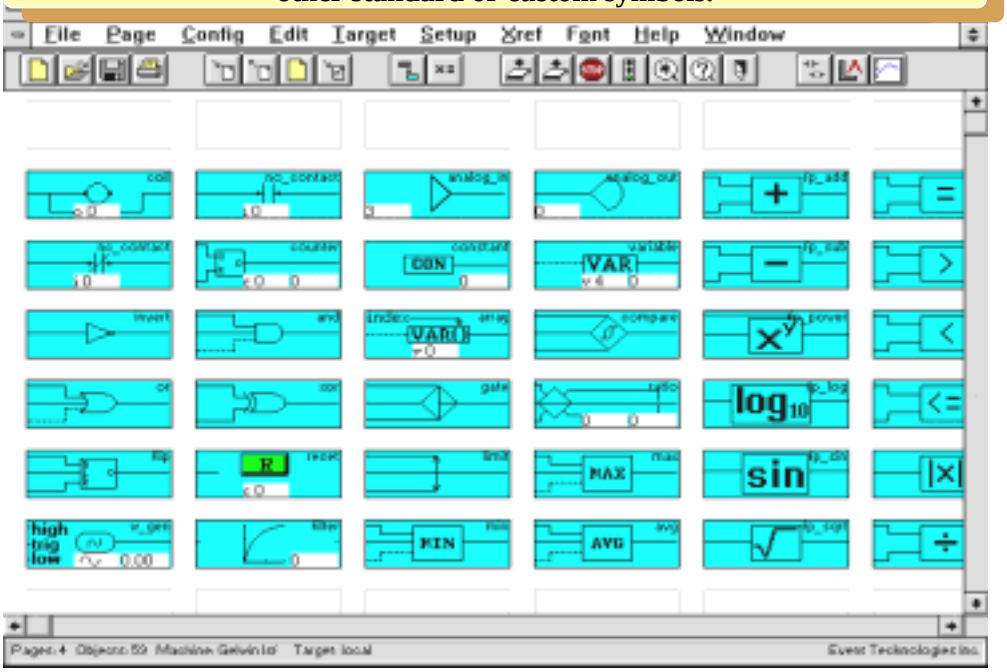
To program or customize a TOTALFLOW RTU you need not be a C language programmer familiar with multi-tasking, real-time embedded microprocessor environments. Totalflow provides tools that help project engineers, control engineers, technicians or programmers design and implement all that is necessary to perform typical control and math functions. In general, you will use these tools to produce files on a PC compatible computer. These files are then downloaded to the RTU that interprets these files and performs the functions you specify.

The tools provided by Totalflow are designed to assist and simplify the user's efforts in two main areas. They are (1) Writing the Application Program and (2) Specifying the User Interfaces associated with the application program.

GELLO Programming

The GELLO Application Program is written using a Windows® based program editor named GELLIX. Using GELLIX you construct a program that the RTU can execute. The program you write is referred to as a GELLO program. GELLO is an acronym for **G**raphically **E**nhanced **L**adder **Lo**gic. GELLO is a new generation Ladder Logic Language that is superior to its predecessors. Using GELLIX you write a GELLO program by arranging well defined graphic *objects* on *pages*.

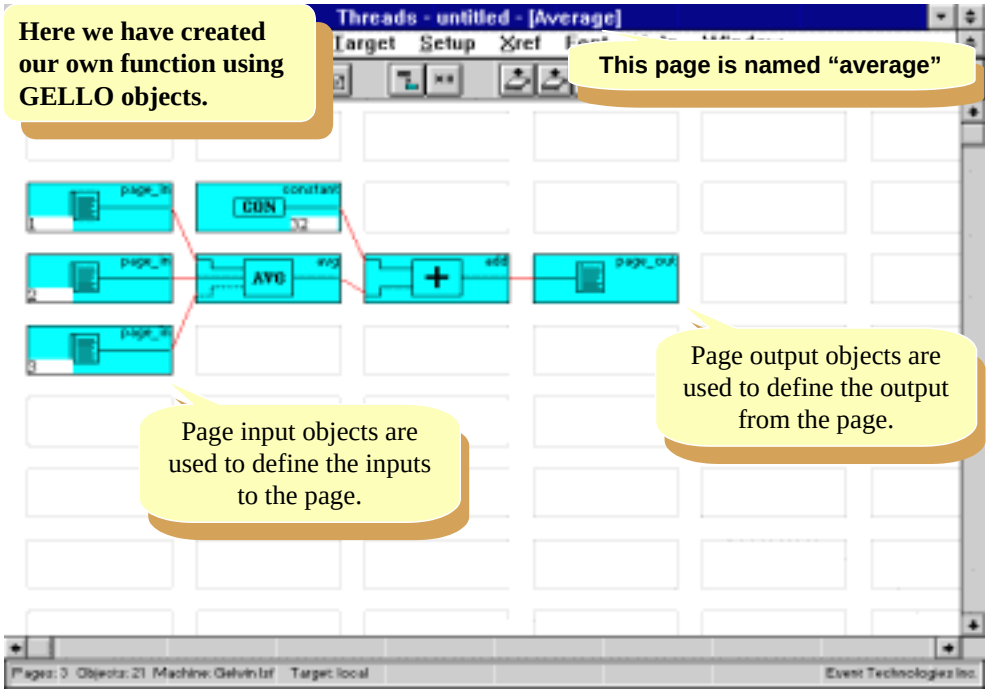
Objects represent ladder logic, gates, pneumatic, math, conversions, and other standard or custom symbols.



Continued on next page

GELLO Programming
Continued

A *page* is capable of holding a 16 X 16 grid of *objects*. You can have many *pages* in a GELLO program. The GELLO *objects* you place on a *page* are connected to each other with lines you draw using a mouse. These connections represent information (data) flowing from one object to another. In this way you construct a GELLO program that the RTU can execute. It is almost like drawing a picture of your program.



PCCU32

Introduction

PCCU32 is Totalflow's Windows® based "Portable Calibration and Collection Unit" software typically installed on a laptop and is designed to be used at the site. PCCU32 has a "Console" mode when connected to an RTU which makes use of the "Local User Interface" designed into the RTU. Console mode is a terminal emulator which has all the appropriate communication's parameters already setup and ready to communicate with the RTU.

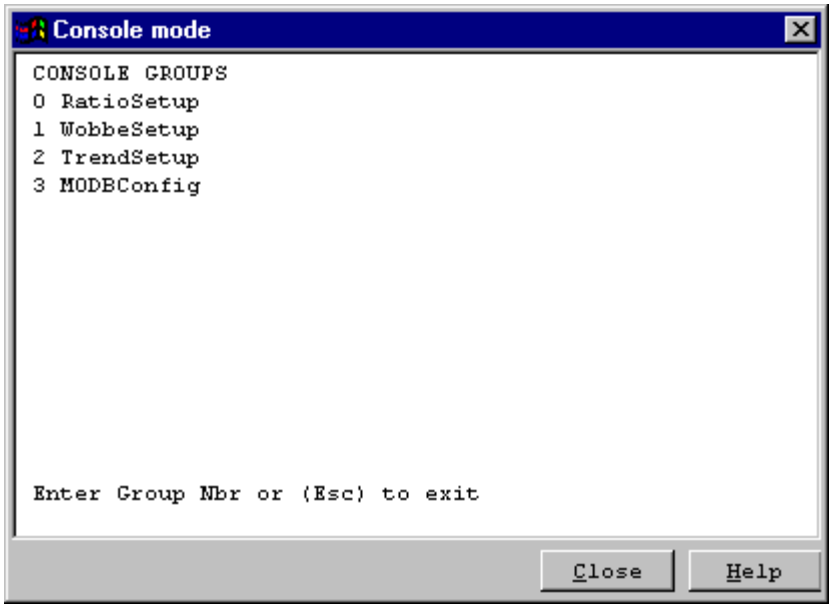
If you do not have PCCU32 software, you can use any terminal emulator that is VT-52 compatible (Windows® "HyperTerminal" program for example). To use a non-Totalflow VT-52 emulator, you must set up the appropriate communication's options and then type the "CONSOLE" command.

Another option to PCCU32's Advanced version is "Host Console". Host Console is typically used in WinCCU to allow the user to view and/or edit data remotely. Host Console requires a "Device Configuration Template" be associated with the RTU's ID. The template is designed to provide data that the user would typically want to see remotely as opposed to the setup data viewed at the site. See WinCCU32 on page 5-10 for more information on "Host Console".

Console Mode

When starting PCCU32's "Console" mode, the "CONSOLE" command is automatically sent to the RTU. This tells the RTU to begin controlling the "Local User Interface".

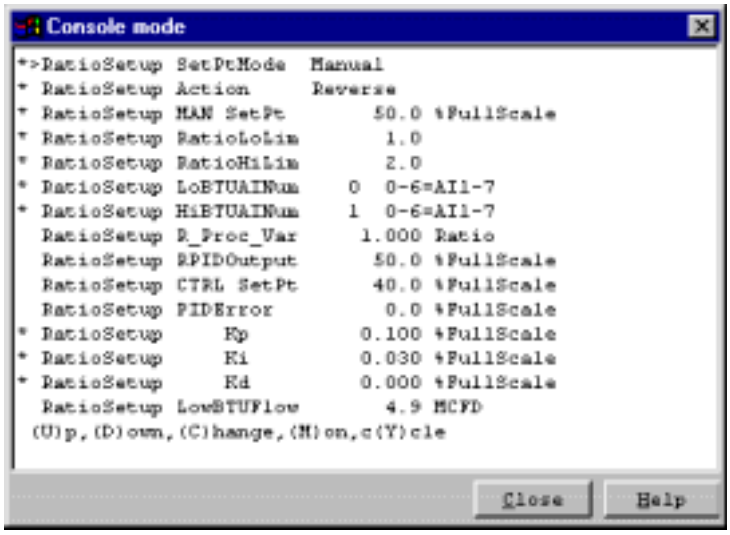
Once the CONSOLE mode is invoked, the first display that comes up is the CONSOLE GROUPS display. This tells the user what groupings of data can be displayed or modified. The GROUPS list is displayed as a virtual list. For example on a 8x40 display, 10 items could be displayed by scrolling the display as necessary to display those items that won't fit because there are not enough lines on the physical display. An example GROUPS display is shown below:



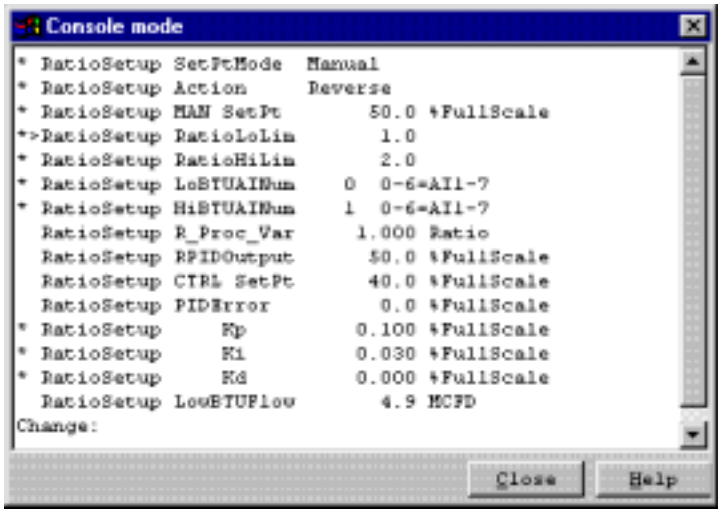
Console Mode, Continued

In the case shown above, all of the groups fit on the display. If there were more groups than display lines, the group list could be scrolled on the display with the '*U*' *key*, and the '*D*' *key*. The '*ESC*' *key* can be used at this point to exit the handheld interface.

To select a group, depress the numeric selection key for that group. For example, to select the RatioSetup group depress 0. The initial data screen for that group would be displayed as shown below:



Each '✶' indicates that the item next to it can be modified. The '**>**' indicates that the item next to it is currently selected for editing. In the following screen, the *'D'* key was used to move down to item "RatioLoLim" and then to edit that item the *'C'* key is depressed.



Note that the help prompt has been cleared and is now a *Change Area* titled 'Change:' If the 'ENTER' key is pressed now, the original value will be restored.

Console Mode, Continued

If a number is entered now followed by 'ENTER' key, that number will become the new "RatioLoLimit". 'BACKSPACE' key can be used to correct errors before depressing the 'ENTER' key. After making a change, the cursor '**>**' can be moved to another item if needed for editing.

Pressing the 'D' key causes the cursor to move Down through the list, one item at a time and pressing the 'U' key causes the cursor to move up through the list. In like manner, pressing the 'P' key causes the cursor to move Down through the list a page at a time. Pressing the 'B' key causes the cursor to move up through the list a page at a time.

Refreshing and Monitoring the Display

Pressing 'R' will refresh the display with current values. By pressing 'M', you can monitor the variables on the screen. When monitoring data , the display will refresh with current data on a periodic basis (currently 5 seconds). During this time, the data pointer will disappear. Press any key to stop monitoring the data.

Cycling the Display

Cycling the display supports automatically sequencing through all of the data in a group. When cycle mode is entered, the data pointer will disappear and the display will be refreshed on the same period used by the Monitor function. Every refresh period (currently 5 seconds), the display will automatically scroll up and refresh. When the display gets to the last item in the group, it will begin scrolling again with the first data item in the group. Press any key to stop cycling the display.

Returning to the Group Display

Any one of three different keys will return you to the group display. They are either the '✶' key, the 'e' key or the 'E' key. Upon returning to the group display, another group may be selected, or the Local Console may be exited by pressing ESC.

Exiting the LOCAL CONSOLE

The Local Console may be exited directly at any time by pressing ESC.

Commands

Below is a summarization of the Local Console Terminal commands:

Command	Description
'CONSOLE'	RTU starts up it's Local Console Task and begins controlling the Local Console Display
'D'	Move Cursor Down one item
'U'	Move Cursor Up one item
'P'	Move Cursor Down one page
'B'	Move cursor (Back) up one page
'R'	Refresh the display
'M'	(M)onitor mode: the display updates every 5 seconds. Note: Once begun, Depressing any key will exit (M)onitor mode.
'Y'	c(Y)cle display: the display will scroll and update every 5 seconds. Note: Once begun, Depressing any key will exit c(Y)cle mode.
'✶' or 'e' or 'E'	Exit and Return to top level 'Group Display'
'ESC'	RTU exits it's Local Console Task and returns to it's Local Protocol Task, thus reverting control back to PCCU32.
'C'	Change selected value. When **Changing Numeric Values** the RTU clears the *help prompt area* of the screen to create a *change area* which is titled with the word *Change:* Entry of the new value is terminated by depressing the [ENTER] key. If the [ENTER] key is depressed before any other keys, the change process is terminated and the old value retained. When **Changing Boolean (coil or state) Values** the RTU first creates a *Change* area that shows the current state of the coil. Depressing the 'C' key a second time toggles the coil's state and displays the new state. Subsequent depressions of the 'C' key will continue to toggle to coil's state. When the [ENTER] key is depressed the last state of the coil is retained. ***Note:*** *Some coil states are designed to used as a command to the RTU. Upon detection of the command the RTU then automatically switches the coil back to the neutral state. This automatic switch will not be reflected on the Console's screen unless you depress the 'R' (refresh) key.*

WinCCU32

Introduction

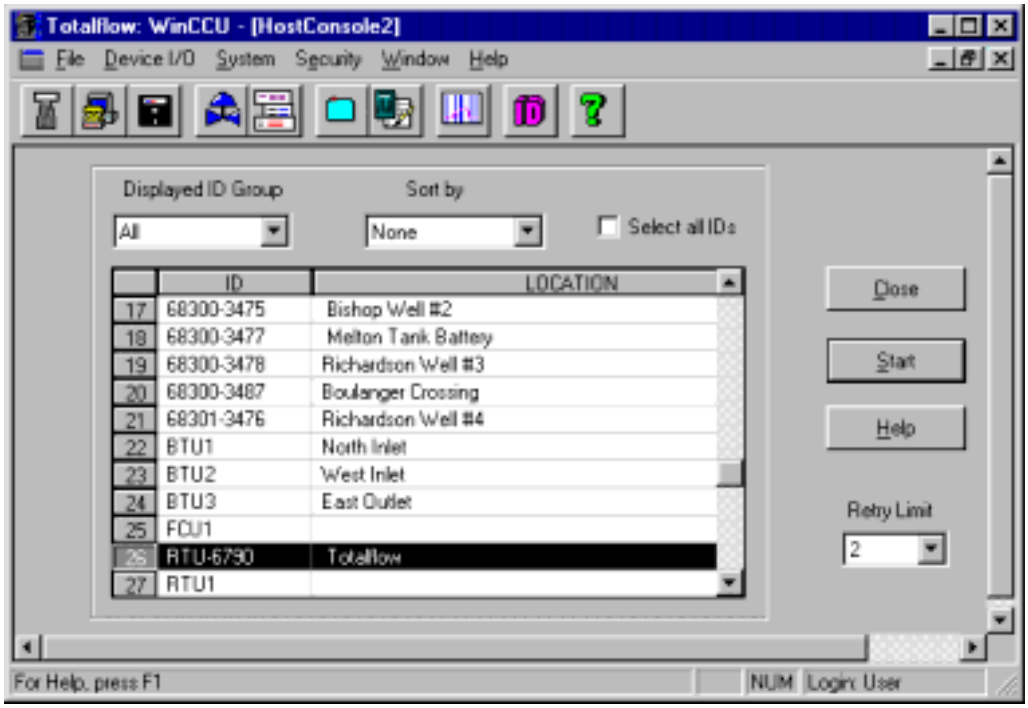
WinCCU32 is Totalflow's Windows® based "Central Collection Unit" software designed to do setup, data collection, data processing and reporting. WinCCU32 has a mode called "Host Console".

Host Console is designed to provide users a tool to step through multiple groups of variables of the remote devices. These groups, the variables associated with them and their names, units and read/write status are all part of the User Interface Program that is constructed using WinCCU's "Device Template Editor". The users can read variables, view , change and send those edited values to the remote devices.

For the WinCCU to recognize that the Host Console is applicable for a particular device, the proper "Device Configuration Template" must be attached to the device's ID. This is accomplished in WinCCU's "Meter ID Manager". If the Device Configuration Template includes a RTU Console application, then the CCU assumes the Host Console is applicable. The WinCCU Host Console will also look for a User Interface Program file (*.uil) which is associated with that Device Configuration Template. If the RTU firmware was supplied by Totalflow, the user will receive a Device Configuration Template which will need to be imported by the Meter ID Manager. The template will then be attached to the RTU's ID as mentioned above.

Starting Host Console

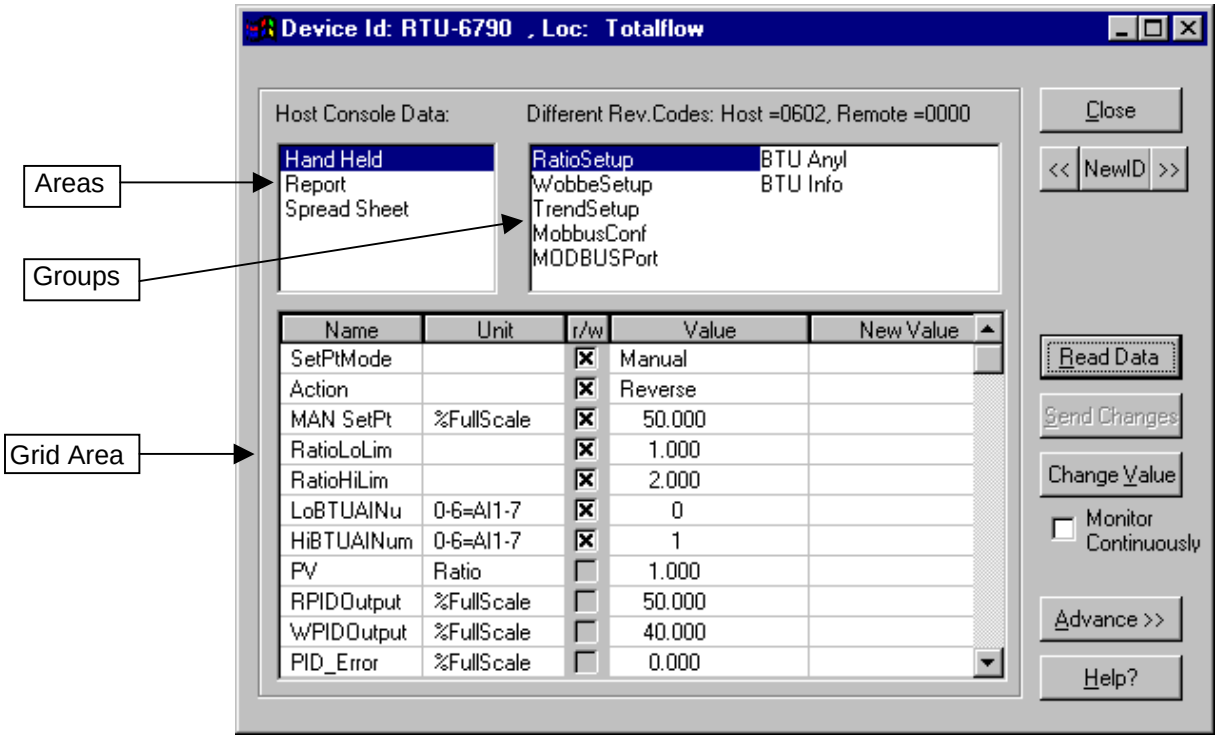
To start Host Console, select Host Console under "Device I/O" menu or select the "Host Console Icon" from the tool bar. The first user screen displays a table of IDs as shown below. The IDs displayed depends on the group shown in the 'Displayed ID Group' window. Therefore, select the group and then assuming we are only after the RTU-6790 ID, click on it's row as shown below.



Running Host Console

After selecting devices, click the "Start" button to run Host Console. A dialog will appear. The current Device's ID and Location are shown on the title bar of the dialog. The initial information that appears is configured by the Device Configuration Template that is attached to the device. The Areas section shows all the defined areas in the UI program, the Group section shows all the groups belong to the highlighted area, and the grid shows variables that are in the highlighted group. In the grid, the Name and Unit columns refer to names and units of the variables, R/W column specifies the variables are read-only or editable. The Value column will show the variable's value after initiating a "Read Data" from the device. If the variables are editable, you can edit their values in the Value column.

Clicking on a different "Area" displays that Area's groups in the "Group" section. Clicking on a 'Group" will display that group's information in the grid area.



Device Template Editor

As previously mentioned, a "Device Configuration Template" must be attached to the RTU's ID in the Meter ID Manager for the above information to be viewed. The Template is either configured by the user or supplied by Totalflow if the application software was supplied. The information displayed by the template is typically grouped according to the user's input. This information can be rearranged if desired by using the WinCCU32's "Device Template Editor". We will not get into the Device Template Editor since it is a topic of it's own. The user with the aid of the Editor's help files, should be able to edit or build a new template if needed. A hint when modifying an existing template, is to duplicate it and edit the duplicate. This keeps the original in tact.

Chapter 6

Drawings Section

This section of the manual has been provided as a location for the user to place drawings that accompanies their new Totalflow units.

Totalflow recommends that a complete set of all drawings that accompany a 6790 RTU be placed in this section. This would ensure that the user have only drawings applicable to their units and drawings that are at the latest revision level.