2017282-002 (AC)

# Totalflow®

## Operations and Maintenance Manual

## for

## Pulse Input Flow Computers

TOTALFLOW
MEASUREMENT & CONTROL SYSTEMS

ABB

# Copyright Notice

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## Introduction

# About the Manual

## Audience & Purpose

This manual is written to provide an experienced flow meter technician with the requirements necessary to install, setup and operate a Totalflow Pulse Input Flow Computer System.

## Organization & Style

Each of the chapters in this manual presents labeled blocks (chunks) of information 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 | Description |
|---|---|
| 1. Knowing Your System | Provides a description of the Totalflow Pulse Input system components, specifications, and description of flow computer computation methods. |
| 2. Installation | Includes unpacking and detailed procedures for setup and installation. |
| 3. Portable Calibration & Collection Unit | Provides you with an overview of the PCCU, a description of the keyboard, and how to install and change batteries. |
| 4. FCU Operation | Provides you with a tutorial on how to get a newly installed FCU system up and running. |
| 5. Maintenance | Provides instructions on how to remove and replace major modules. |
| 6. Troubleshooting | Provides a description of the FCU front panel error messages and provides a troubleshooting chart on how to correct most problems. |
| 7. Plug-In RTU Option | Describes the Plug-In RTU interface board option available for the Model 6700 Unit |
| 8. Analog Output Options | Discusses the different analog output options available on the Model 6700 Unit. |
| 9. Valve Control | Describes the Valve Control Option available on the Model 6700 Unit. |
| 10. 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. When you purchase a product, you receive documentation which should answer your questions; however, your Totalflow technical support provides you an 800 number as an added source of information.

If your require assistance, call:

(800) 442-3097

## Before You Call

Know your Totalflow's serial number. Serial 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 front panel LCD.

## Safety Practices and Precautions

**Safety First**

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

## Safety Practices, Continued

**Grounding the Product**

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

**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**

To avoid fire hazard, use only a fuse of the correct type, voltage rating and current rating as specified in the parts list for your product. Use of repaired fuses or short circuiting of the fuse switch is not permitted.

**Safety Guidelines**

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

Only a properly trained technician should work on any equipment with power still applied.

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 1.0
# Knowing Your System

## Overview

### Introduction

This Chapter introduces you to the Totalflow® Pulse Input Series Flow Computer Units (FCU). The 6400 and 6700 series pulse input products are microprocessor based units designed for calculating and measuring gas flow. Two models of the 6400 FCU are available, a Model 6411 and a Model 6414. The model 6414 is packaged in an enclosure that can accommodate both the FCU, and a variety of remote communications devices. Additionally, the model 6714 is available for more advanced applications incorporating more I/O points and expandability utilizing our line of optional I/O cards.

When using the 6400 or 6700 series units in hazardous area installations, refer to drawing numbers 2015267-CD (Div 1) and 2015246-CD (Div 2) for information on approved installation and wiring methods.

### *What it Does*

The FCU maintains a log period history of average static pressure (SP), average flowing temperature (Tf), Extension, Flowtime, Energy, and maintains log period accumulated volumes. The FCU can be programmed to calculate flow rates and volumes in accordance with AGA 7. This includes calculating supercompressibility, in accordance with either NX-19 or AGA 8-92 Gross method or AGA 8-92 Detail.

The FCU defaults to 970 log period records (40 days) and 50 daily records (40 days plus 10 skip days). An FCU also maintains an event file that encompasses 200 FCU events, and a characteristic file of the current configuration set-up of the unit.

### Chapter Highlights

This chapter covers the following topics:



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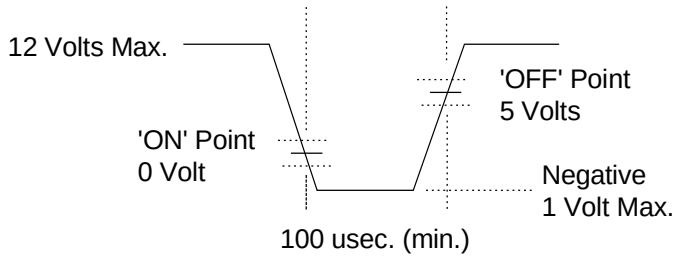
## **Chapter Highlights** (Continued)

# 6400/6700 General Specifications

| | |
|---|---|
| Certification | Designed to meet Class 1, Division 1, Groups C & D, FM and CSA hazardous area classifications. Meets FCC Part 15, Class A Certification. |
| Dimensions | **Model 6411** - 8.57 in. W x 10.19 in. H x 9.37 in. D ( 217.68mm W x 258.83 mm H x 238 mm D)<br><br>**Model 6414** - 11.52 in. W x 14.81 in. H x 10.27 in. D (292.61 mm W x 376.17 mm H x 260.86 mm D)<br><br>**Model 6714** – 13.70 in. W x 18.80 in. H x 13.69 in. D (347.98 mm W x 477.52 mm H x 347.73 mm D) |
| Weight | 6411 - 26.0 lbs. (12.02 kg) with 8AH Gates Battery<br><br>6414 - 28.0 lbs. (12.70 kg) with 8AH Gates Battery<br><br>6714 - 29.0 lbs. (13.4 kg) with 8AH Gates Battery |
| Mounting | Wall, pipe or direct |
| Analog Inputs | 2 (1-5 VDC) |
| Digital Inputs | 1 State Change |
| Digital Outputs | 2 FETs, sink = 100 ma |
| Pulse Counters | 2, (measurement range = 1 pulse per day up to 5 Khz), PI-1 dedicated to primary pulse meter measurement. Consult factory if higher frequency input required. |

PULSE INPUT SIGNAL REQUIREMENTS

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## 6400/6700 General Specifications, Continued

| | |
|---|---|
| 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. |
| Data Storage | Default allows for 970 log period records (40 days of 24 one hour records) and 50 daily records (40 days plus 10 skip day records). An FCU also maintains an event file that encompasses 200 FCU events, and a characteristic file of the current configuration set-up of the unit. Considerable more data can be stored if the optional 512K RAM is used. |
| Comm Ports | Model 6411 and 6414 = 4 Ports Available:<br>1 - dedicated - AMU<br>1 - dedicated - PCCU<br>2 - RS232 or RS485 Plug-In Modules<br><br>Model 6714 = 5 Ports Available:<br>1 - dedicated - AMU<br>1 - dedicated - PCCU<br>3 - RS232 or RS485 Plug-In Modules,<br>(one used as LocalBus in Multi-tube application) |
| Analog Measuring Unit(AMU) | Self contained, environmentally protected unit for measuring differential pressure, static pressure, flowing temperature, and 2 additional analog inputs. See page 5 for AMU Specifications. |
| Model 6714 Optional I/O | VCI Term Panel: 4 Digital Inputs, 4 Digital Outputs<br><br>Plug-in RTU: 7 Analog Inputs, 1-4 Analog Outputs, 8 Digital Inputs, 8 Digital Outputs, 2 Pulse Inputs<br><br>Single AO Card: 1 Analog Output<br><br>Quad AO Card: 4 Analog Outputs |

***Note:*** Only one of the Plug-in RTU, Single AO or Quad AO expansion cards can be used at a time and are only available as expansion options for the model 6714 Flow Computer Unit.

# Analog Measuring Unit (AMU) Specifications

| | |
|---|---|
| General | 18 bits of A/D Range.<br>Differential Inputs for Totalflow Smart transducer.<br>5:1 turn down capability on Totalflow Smart Differential pressure transducers.<br>5:1 turn down capability on Totalflow Smart Static pressure transducer.<br>$E^2$ Prom for holding factory calibration data.<br>Tested for EMI/RFI susceptibility from 30 to 1000 MHz and for field strengths to 32V/m, minimum (verified by independent lab).<br>Dedicated 100-ohm platinum RTD input ( measurement range = (-)96°F to (+)624°F (-69°C to +329°C) (RTD extension wire rated to 300°F)<br>Two 1 to 5 volt analog inputs<br>Temperature Limits<br>Compensated -20 to 140°F (-29 to 60°C)<br>Operational -40 to 200°F (-40 to 93°C)<br>Storage -60 to 225°F (-51 to 107°C) |
| Performance Specifications | Reference Conditions, zero-based spans at calibration temperature. |
| Accuracy | Includes the effects of linearity, hysterisis and repeatability.<br>(Standard Accuracy)<br><= ±0.2% of URL (Upper Range Limit)<br>Accuracy after turn down:<br><= ±100 * (0.2% of URL, +0.13% of Span) / Span<br>for spans 1:1 to 5:1<br>(Optional Accuracy)<br><= ±0.05% of factory calibrated span<br>(After calibration, NIST traceable, additional charge)<br>Accuracy after turn down:<br><= ±100 * (0.05% of URL, +0.13% of Span) / Span<br>for spans 1:1 to 5:1 |
| Stability | ±0.25% of URL for 6 months. |
| Static Pressure Effect (AP Units) | Zero Error<br>±0.1% of calibrated span.<br><br>Span Error<br>±0.15% per 1000 psi (6895 kPa) |
| Temperature Effect (AP Units) | ±0.25% Total temperature effect including zero and span errors |

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## Analog Measuring Unit Specifications, Continued

| | |
|---|---|
| Residual Thermal Effects | *Thermal Hysterisis*<br>Typically ±0.15% of URL for 200°F (93°C).<br>Temperature cycle without recalibration<br>Worst case ±0.3% of URL for 200°F (93°C).<br>Temperature cycle without recalibration<br><br>*Thermal Repeatability*<br>Typically ±0.15 of URL for 200°F (93°C)<br>temperature cycle without recalibration<br>Worst case ±0.3% of URL for 200°F (93°C)<br>temperature cycle without recalibration |
| Over Pressure Effects (Toggle) | ±0.6% of URL for < 1000 psi (6895 kPa).<br>±1.0% of URL for ≥ 1000 ≤ 2000 psi (13790 kPa) |
| Vibration Effect | The total effect (maximum effect at any point on scale) at frequencies up to 200 Hz and amplitude up to 0.25 in. Peak to peak, or for accelerations up to 1 “g” (10 $m/s^2$), which is smaller, is less than 0.25% of span. |
| 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. |

# Pulse Input Flow Computer Hardware

## Introduction, See Figure 1-1

The Totalflow® Pulse Input Flow Computer Units (FCU) are housed in a lightweight aluminum case. Components of the FCUs are:

- Enclosure
- 6400 or 6700 Digital Controller Board
- Analog Measuring Unit
- Battery & Comm Compartments
- Solar Panel
- Resistive Temperature Detector (RTD)

Additional items used for expansion:

- Communications mounting and equipment
- Valve Control Term Board
- Single and Quad Analog Output Board
- Plug-in RTU (Expanded I/O) and Term Board
- LocalBus for Multi-tube Measurement (future)

## Enclosure

The enclosure consists of hinged-lid box. The lid provides a watertight, corrosion resistant seal between the outside elements and the FCU components. It is designed to meet Class I, Division I, Groups C&D and is NEMA 4X rated. Single or dual clasps are used to secure the lid to the enclosure. Opening the lid's latch allows access to electronics, battery, options, and Analog Measurement Unit (AMU) components. Mounted to the bottom of the enclosure is the absolute pressure smart transducer (AMU) that provides the primary pressure measurement capability for the FCU. The absolute pressure sensor measures line pressure in the primary meter run. Output from the primary meter pulse transmitter is cabled through the bottom of the unit to the main electronics board or can optionally be wired externally using flexible conduit.

## Digital Circuit Board

The pulse input flow computer single electronics controller board is mounted on the inside of the lid. All FCU input and output connections are made on snap-in connector terminals mounted directly on the main board. The PC board uses a low power 18 - MHz microprocessor with 128K RAM and 256K EPROM (both expandable to 512K). A socket for installation of FLASH memory is available and can be added later or at time of ordering. Other circuitry processes the inputs from the Analog Measuring Unit and provides the interface to the LCD as well as the PCCU. Remote communications are handled by the RS232, RS485 and RS422 communication modules that plug directly into the main electronics board.

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## Pulse Input Flow Computer Hardware, Continued

**Analog Measurement Unit (AMU)**

The AMU contains circuitry for processing all analog measurements. The unit is designed to provide EMI/RFI protection of the low level signals, and to protect the circuitry from other environmental effects. The AMU contains a single circuit board with the A to D converter and other analog conditioning circuitry necessary for the transducers, RTD, and external analog measurement channels.

Because the AMU is characterized over temperature at the factory the unit is not field repairable. All repairs should be done at an authorized Totalflow service center or returned to the factory. The AMU is characterized over temperature so that any changes occurring in the transducers or in the electronics can be compensated for in real time. All factory characterization data is stored in EPROM in the AMU.

**Battery Compartment**

The battery compartment houses the various optional battery packs that are available for the FCU; the standard pack is a single lead acid 8-ampere hour battery pack. Installation of the battery requires only removing the battery plate, placing the battery in place, and connecting the battery cable to J1 on the Digital Circuit board. A legend for the field termination connector located on the main electronics board is located either on the battery cover plate (models 6411 and 6414) or silk screened to the electronics board shield/cover plate (model 6714).

**Comm Compartment**

Model 6414 and 6714 FCUs. Provides an enclosure to house a remote communication device; transceiver, cellular phone, modem, etc.

**Solar Panel**

The Pulse Input FCU comes standard with a 10-Watt solar panel. The panel is designed to be mounted on 2-inch extension pipe, or it can be mounted on top of or on the side of a meter house. Larger panels are available upon request for the model 6714.

**Resistive Temperature Detector (RTD)**

The RTD measures real-time flowing temperature of the measured gas stream. The pulse input FCU includes a 100-ohm Platinum RTD with 10-foot cable as standard equipment. Other lengths of cable are available upon request.

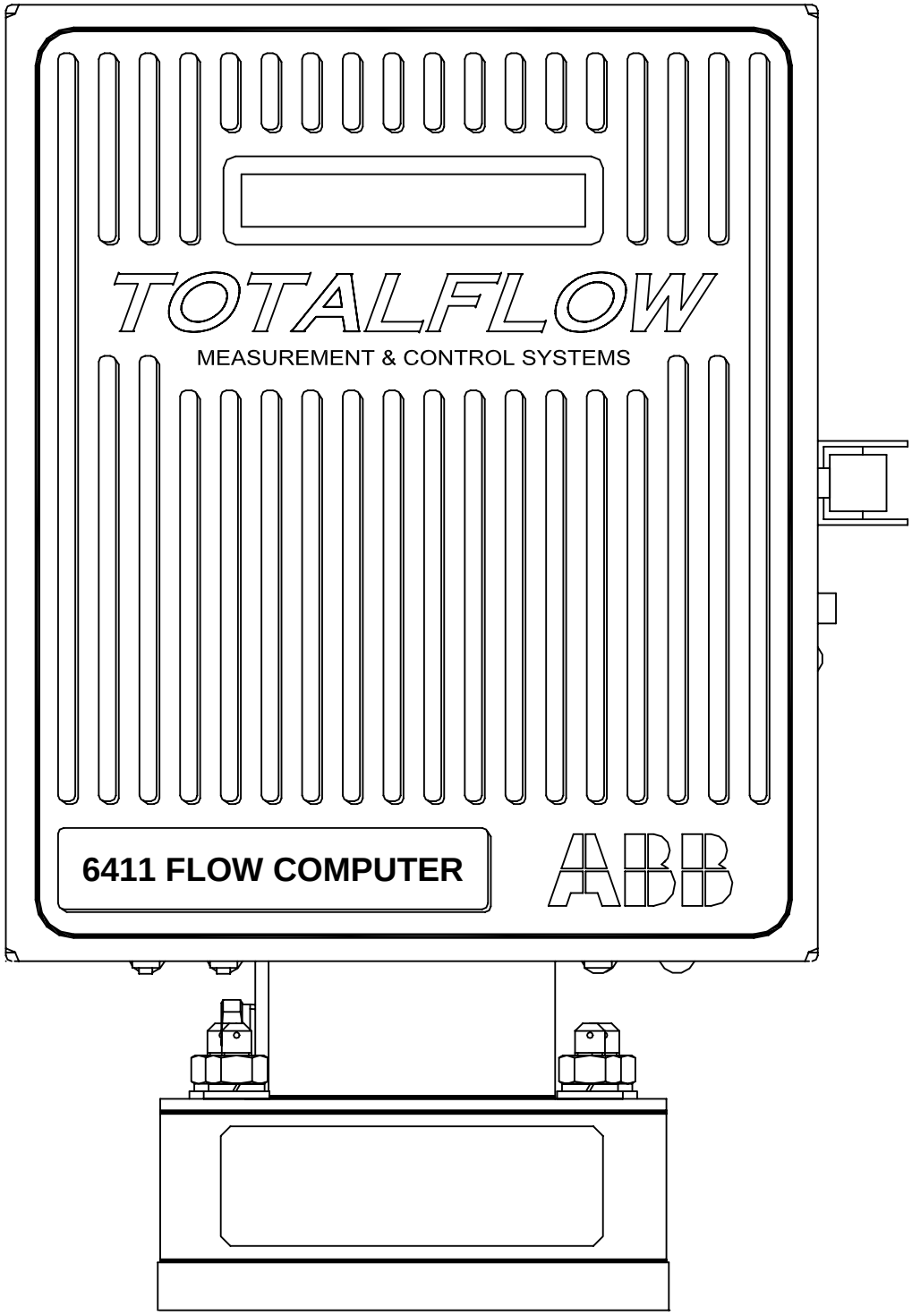


**Figure 1-1. Model 6411 Pulse Input Flow Computer Unit**

# Functions of the FCU

## Description

Primary functions of the FCU reflect an instrumental design that is practical and efficient. The FCU is simple to use and easy to use.
The FCU allows you to perform the following with minimum effort, maximum speed and greater accuracy.

Complete log period flow and operational records including -
- Average absolute pressure
- Average flowing temperature
- Uncorrected Volume
- Corrected volume
- Flow time
- Energy (MMBTU)
- Period BTU
- Operating status
- Alarms (up to 24 discrete)

Complete daily flow records including -
- Average absolute pressure
- Average flowing temperature
- Average C’
- Uncorrected Daily Volume
- Corrected Daily Volume
- Flow time
- Energy (MMBTU)

Complete daily operation statistics including -
- Percent flowing time
- AP Percent out of limits (programmable)
- Maximum Absolute Pressure
- Maximum Flowing Temperature
- Alarms (up to 24 discrete)

Adjustable Volume Calculation Periods
- Selectable 1, 2, 10, 20, & 60 second vol. Calc. periods

### FCU Capabilities

The records and statistics generated are due to the following capabilities of the FCU:

- Calculation of flow rates, volume and coefficients per AGA-7, and supercompressibility standards as per NX-19 and AGA-8-1992
- Extrapolation of flow accumulation during transducer calibration
- Check for flow/no-flow at completion of flow period
- Selection of all coefficients for log period calculation; calculation of dynamic factors (dependent upon AP and Tf) using log period averages based on one second samples
- Measurement of absolute pressure once per second; measurement of flowing temperature once per second.
- Production of sample set of all selected AGA-7 and supercompressibility calculations allowing subsequent verification of proper factor calculation and usage
- Monitoring of the operational limits to insure detection and reporting of malfunctions or abnormal site conditions
- Acceptance and storage of system constants from the hand held PCCU
- Default storage capacity for 970 Log Period records (40 days of 24 one hour records). 50 Daily records (40 days plus 10 skip days).
- Storage of a characteristic file of the current configuration settings in the FCU.
- Storage of up to 200 operational events (100 in old database).

### Additional Features

Additional features of the Totalflow® System enabling its flexibility include the following:

- Two Digital Outputs
- Programmable multi-level security codes to prevent unauthorized communication and configuration of the FCU
- One extra state input configurable as either digital inputs or high speed pulse accumulator.
- Automatic drift compensation of electronic measurement circuitry
- Automatic internal calibration of the RTD, with programmable bias adjustment
- Internal crystal controlled clock providing a highly stable time base for the system
- Normal battery operation for 10 days without charging source; optional battery packs to extend operation for longer periods are available
- Three available charging sources approved for operations in hazardous area:
  External solar panel (standard)
  External AC power
  External 24/12 VDC power
- LCD (liquid crystal display) to allow monitoring of the FCU operation (for example, displays voltage level of batteries in FCU)
- Rugged aluminum, powder coated, NEMA 4X enclosure, lockable to prevent internal access
- Optional ability to allow rapid data collection over several communication links.
- Additional I/O for advanced control, valve control (model 6714 only), pressure & level monitoring, etc..

# FCU Display Function

## Description

During the operation of the FCU the front panel LCD by default continuously scrolls through 9 operating parameters as shown below with an asterisk beside the DSP#. The duration that the parameter is displayed can vary from 1 to 255 seconds (default is 5 seconds); a setting of 0 seconds will set any function to off. See Program Display, page 4-27 for details on how to program the FCU. The Program Display selection in the PCCU or Laptop Software at present can only program a few of the 29 items listed in the following table. To display any of the items listed in the following table, see 'Programming the FCU Display' immediately following the table.

| DSP# | Display | Description |
|---|---|---|
| 1* | FLOW TEMP<br>NNN.N DEG F | Flowing Temperature<br>°F |
| 2* | PRESSURE<br>NNN.N PSIA | Static Pressure Absolute<br>PSIA |
| 3* | PERIOD VOL<br>NNNN.N ACF/PERIOD | Flow Window Period Volume<br>ACF/Period |
| 4* | BATTERY<br>NN.N VOLTS | Battery Voltage<br>Volts |
| 5* | ACCUM VOL<br>NNNNNN.NN ACF | Total Uncorrected Volume, Programmable<br>acf - cubic feet<br>dacf- 10 cubic feet<br>cacf - 100 cubic feet<br>macf - 1000 cubic feet<br>dmacf - 10 mcf<br>cmacf - 100 mcf<br>mmacf - 1000 mcf |
| 6* | ACCUM VOL<br>NNNNNN.NN SCF | Total Corrected Volume, Programmable<br>scf - cubic feet<br>dscf- 10 cubic feet<br>cscf - 100 cubic feet<br>mscf - 1000 cubic feet<br>dmscf - 10 mcf<br>cmscf - 100 mcf<br>mmscf - 1000 mcf |
| 7 | FLOWRATE<br>NNNNNN.N ACF/HR | Current Uncorrected Flow Rate, Programmable:<br>(Same units as DSP #5)<br>Rate/Day or Rate/Hour |
| 8* | FLOWRATE<br>NNNNNN.N SCF/HR | Current Corrected Flow Rate, Programmable:<br>(Same units as DSP #6)<br>Rate/Day or Rate/Hour |

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## FCU Display Function, Continued

| DSP# | Display | Description |
|---|---|---|
| 9 | YEST HI<br>NN.N PERCENT | Yesterday's Uncorrected Volume<br>Percent Above High Limit |
| 10 | YEST LO<br>NN.N PERCENT | Yesterday's Uncorrected Volume<br>Percent Below Low Limit |
| 11 | HOUR VOL<br>NNNNNN.N ACF | Last Log Period Uncorrected Volume, Programmable:<br>(Same units as DSP #5) |
| 12 | HOUR VOL<br>NNNNNN.N SCF | Last Log Period Corrected Volume, Programmable:<br>(Same units as DSP #6) |
| 13* | YEST VOL<br>NNNNNN.N ACF | Yesterday's Uncorrected Volume, Programmable:<br>(Same units as DSP #5) |
| 14 | YEST VOL<br>NNNNNN.N SCF | Yesterday's Corrected Volume, Programmable:<br>(Same units as DSP #6) |
| 15* | DATE/TIME<br>MM/DD/YY HH/MM/SS | Current Date and Time<br>24 hour clock |
| 16 | TOTALFLOW TM<br>FCU=6411 | Location and Device ID |
| 17 | VARIABLES | By default scrolls through 18 different variables. Variables displayed are selected using the 'Device Template Editor' of WinCCU. |
| 18 | CHARGER<br>NN.N VOLTS | Charger Voltage |
| 19 | Flow Window xx (yy)<br>68 Pulses | Flow Window ('xx' secs.), current time of Flow Window ('yy' secs.), and current pulse count ('zz' pulses). |
| 20 | BTU RATE<br>NNNNNN.N MMBTU/DAY | Current MMBTU rate<br>Per day or per hour (Log Period) |
| 21 | HOUR BTU<br>NNNNNN.N MMBTU | Last Log Period MMBTU |
| 22 | YEST BTU<br>NNNNNN.N MMBTU | Yesterday's MMBTU |
| 23 | ACCUM BTU<br>NNNNNN.N MMBTU | Total Accumulated MMBTU |
| 24 | ACC CDVOL<br>NNNNNN.N SCF | Accumulated Corrected Volume for Current Contract Day |

*Continued on next page*

## FCU Display Function, Continued

| DSP# | Display | Description |
|---|---|---|
| 25 | ACC CDBTU<br>NNNNNN.N MMBTU | Accumulated MMBTU for Current Contract Day |
| 26 | PREV CDVOL<br>NNNNNN.N SCF | Previous Contract Day's Corrected Volume |
| 27 | PREV CDBTU<br>NNNNNN.N MMBTU | Previous Contract Day's MMBTU |
| 28 | AI 1<br>NN.N PERCENT | Current value of calibrated range for Analog Input 1 |
| 29 | AI 2<br>NN.N PERCENT | Current value of calibrated range for Analog Input 2 |

### Configuring the FCU Display

Items listed in the above table are available for display on the FCU, but can only be configured through a Terminal Emulator such as Microsoft Windows® HyperTerm®, etc. using the procedures listed below. Please reference technical bulletin #44 for more information on the Terminal Interface Command Structures.

### Procedure

**1** Connect PCCU cable to the FCU local port. Set Terminal Emulator communications setup to 2400 bps, 8 data bits, 2 stop bits, no parity.

**2** Type *TERM* to activate FCU terminal emulation mode.

**3** Type *DSP* = ## ( where ## = item number ) to select the display item you wish to program.

**4** Type *DSI* = ## ( where ## = number of seconds ) item stays on the display

**5** Type DSAV to save the change

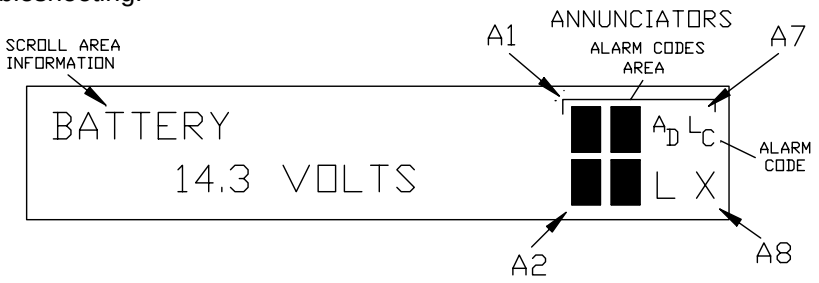
**6** Repeat steps 3 thru 5 for the items you wish to display

**7** Type *DSP*=0 to unlock the display

# FCU Alarms and Status Description

## Description

One of the primary functions of the FCU is the provision of complete log period flow and operational records; therefore, the FCU indicates when an unusual or “alarm” condition is occurring. For how to use the display to troubleshoot, refer to Chapter 6; Troubleshooting.




Whenever an alarm is indicated the FCU records it on log period flow records. The time and date of the occurrence and the type of alarm indicated are stored in the FCU and can be retrieved when desired.

### FCU Alarms and Status Codes

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A1 | LL | Battery Voltage: When LL (low lithium) is displayed, battery voltage is below 2.5 Vdc. If battery voltage is above 2.5VDC, LL appears shaded. |
| A1 | ↑/↓ | Differential Pressure: If differential pressure is above high limit, ↑ arrow is displayed. If pressure is below low limit, ↓ arrow is displayed. If pressure is within limits, ↑/↓ arrow keys are shaded. |
| A1 | ↑/↓ | Absolute Static Pressure: If absolute static pressure is above high limit, ↑ arrow is displayed. If pressure is below low limit, ↓ arrow is displayed. If pressure is within limits, ↑/↓ arrow keys are shaded. |

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## FCU Alarms and Status Description, Continued

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A2, A4, A8<br><br>A2=Comm3<br>A4=Comm2<br>A8=Comm1 | ǂ | *TOTALFLOW Listen Cycle*: ǂ 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. 3 remote communications ports are available (2 for 6400) and can be each programmed as described. When FCU remote port is not active, ǂ is shaded. In early versions of 6700s with EXIO, the A8 display will toggle between ǂ and V. Not toggling could indicate a bad board or PROMs mismatched. |
| See above | → | *Transmitting Data*: If remote port is active and Totalflow Remote Protocol is running, → is displayed. |
| See above | ← | *Receiving Data*: If remote port is active and Totalflow Remote Protocol is running, ←is displayed. |
| See above | **X** | *Remote Port Not Active*: This is the default state at cold start of the FCU for all remote communications ports. Baud rate must be toggled to activate each remote port. Also displayed when a communications card is missing or bad. |
| See above | **M** | *MODBUS ASCII*: Modbus ASCII protocol selected on this port. 3 remote communications ports are available for 6700s, 2 for 6400s which can be programmed with any of 5 resident remote protocols; Totalflow, Totalflow Packet, Modbus ASCII, Modbus RTU, or Square D. |
| See above | **m** | *MODBUS RTU*: Modbus RTU protocol selected on this port. Same options available as above. |
| See above | **1** | Read X-Frame. |
| See above | **2** | Process X-Request. |
| See above | **3** | Wait for Ack/Nak. |
| See above | **4** | Re-Send Packet. |
| See above | **5** | Direct Download. |
| See above | **6** | Positive Acknowledge. |
| See above | **7** | Nak w/packet list. |
| See above | **8** | Negative Acknowledge (Typically wrong Security Code). |
| See above | **9** | Single host write request – send data after ready. |

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## FCU Alarms and Status Description, Continued

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A3 | = | *Valve Control*: Valve Control option installed. Process Value (PV) is within the user set dead band. No control action required |
| A3 | V | *Valve Control*: Displayed when Valve Control option is on an Expanded I/O board (plug-in RTU). Other Valve Control symbols do not apply. |
| A3 | ⌈ | *Valve Control*: Valve Control option installed. Valve is in full open position. |
| A3 | ⌋ | *Valve Control*: Valve Control option installed. Valve is in full closed position. |
| A3 | ↑ | *Valve Control*: Valve Control option installed. Valve is opening (open signal is being sent to valve actuator). |
| A3 | ↓ | *Valve Control*: Valve Control option installed. Valve is closing. (close signal is being sent to valve actuator). |
| A3 | ö | *Valve Control*: Valve Control option installed. Valve controller override conditions met (DP/AP override set point or Low Battery). |
| A3 | L L | *Valve Control*: Valve Control option installed. Local Lock-out is initiated. |
| A3,A5 | A D | Displayed if A to D Converter Absolute Differential Pressure, Absolute Static Pressure or temperature readings exceed maximum counts or are less than minimum counts. If A to D Converter readings are within range, AD is shaded. A3 Location for 6400, A5 location for 6700. |
| A4,A7 | L C | *Low Charger.* Displayed if FCU battery charging voltage is (+)0.4 Vdc or is less than or equal to battery voltage. If (+)0.4 Vdc battery charging voltage is greater than battery voltage, LC is shaded. |
| A4,A6 | L | *Local Protocol.* Displayed when PCCU part is active and running TOTALFLOW Local Protocol. When PCCU port is not active, L is shaded. This will occur if PCCU is not connected to PCCU port. |
| A5 | H | *Hold.* Displayed when HOLD flag is active. When not active, H is shaded. Also displayed when HOLD flag is active for the following:<br>1. PCCU is being calibrated or<br>2. A to D Converter cannot be read. |

*Continued on next page*

## FCU Alarms and Status Description, Continued

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A2, A4, A8<br>A2=Comm3<br>A4=Comm2<br>A8=Comm1 | **¥** | *Totalflow Packet Protocol.* The Totalflow Packet Protocol selected on this port. 3 remote communications ports are available for 6700s, 2 for 6400s which can currently be programmed with any of 5 resident remote protocols; Totalflow, Totalflow Packet, Modbus ASCII, Modbus RTU, or Square D. |
| See above | **S** | *Square D Protocol*: Square D protocol is running on this port. Same options available as above. |
| See above | **r** | *Alarm Monitoring System.* Ring indicator for the alarm cryout option. |
| See above | **h** | *Alarm Monitoring System.* Hang up indicator for the alarm cryout option |
| See above | **i** | *Alarm Monitoring System.* Modem initialization indicator for the alarm cryout option. |
| See above | **R** | *LevelMaster*: LevelMaster tank gauging option installed. Tank level(s) and temperature are polled (user selectable intervals) by flow computer via RS485. |
| A6 | **C** | *Host Console.* Host Console connected and communicating. |
| A6 | **T** | *Terminal Mode.* Terminal is connected and communicating. See Technical Bulletin #44. |
| A8 | **L V** | *Low Voltage-Communications.* FCU battery voltage below 12 Vdc--too low to communicate. If FCU is below 11.5 Vdc, sleep mode will occur. |
| A8 | **+9** | *Alarm Monitoring System:* Successful download of alarm page. |
| A8 | **?** | *Alarm Monitoring System:* Received exception broadcast. |

# FCU Log Period Record Entries

## Description

Each Daily Log Period has a fixed length log period entries that contain the following information:

- average AP (absolute pressure)
- average T (flowing temperature)
- log period calculated volume and
- up to 16 individual alarm indicators

## Processing Load

Complete log period calculations require approximately 1 second to complete, depending on the calculation method selected. During this time period, the FCU maintains the following functions:

- continue to maintain the one (1) minute calculations,
- calculate log period AGA-7 corrected volume for log period,
- update log period and daily data,
- continue processing any I/O (input/output) requirements and
- Continue updating LCD display

## Communi-cations

Communications can be established with the 6400 and 6700 series FCU even while in the data processing mode.

Before completion of log period processing, gathered data does not effect any of that hour's calculations.

Updating log period data entries, begins at the start of log period and takes approximately 1second to complete.

EXAMPLE: Before collecting FCU data up to and including 7:00 a.m., user should wait until approximately 7:00:20 a.m. This allows sufficient processing time to insure completion of log period calculations and data accumulated at 7:00 a.m. has been updated.

## FCU Log Period Record Entries, Continued

### Making Log Period Data Entries

Log period data entries are made once per hour, on the hour immediately following completion of log period calculations.

When the FCU voltage drops below 11VDC the unit automatically records any data collected since the last calculation before entering a “Sleep” mode and turning power to remote device to off.

### Note

When FCU voltage drops below 11VDC, *SLEEP MODE* is entered. When this occurs, a Reset Volume command forces a log period data entry. Entry reflects information collected between last hour’s entry and time Reset Volume command was encountered.

---

### Changing FCU Clock

Changing FCU clock could affect time when next log period entry is made. Clock changes are handled as follows:

**Clock Change Not Crossing an Hour Boundary**

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

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

**Forward Clock Change Crossing an Hourly Boundary**

Forces an hourly data entry for part of hour that has accumulated since last hourly entry. FCU then advances to newly defined hourly boundary and begins maintaining balance of days' data in newly defined boundary.

**Backward Clock Change Crossing an Hourly Boundary**

To protect integrity of accounting audit trail, FCU handles this type of clock change as follows:

- Hourly entry is made for part of hour that has accumulated since making last hourly entry. This is same as for a Forward Clock Change Crossing an Hourly Boundary.

FCU advances to a new day’s data flow record and maintains balance of day’s data in new record.

### Notes:

1. A backward clock change uses two (2) daily records to maintain data integrity. This assures that previously recorded data is not overwritten.

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

## Remote Sense/Digital Output

## Description

The Totalflow FCU provides digital inputs (one designated as remote sense input for backward compatibility) and two digital (12V dc) outputs as a means to control external equipment with the FCU. Details on the control of external devices are given in Section 4 (FCU Operations). Additional information on selecting other commands can be found in Technical Bulletin #44.

## Remote Sense

The Remote Sense reads an external contact. This contact must be closed to be considered “ON” and must remain “ON” for 1 consecutive seconds to be recognized by the flow computer. The input is read once every second. The “ON” condition is recorded in the hourly alarms and can trigger the action of the flow computer’s digital voltage (12 vdc) output. “OFF” is defined as an open contact at the input for 2 consecutive seconds. The Reference Section describes the maximum voltage allowable on the remote sense input.

## Voltage Output

The output is primarily used to trip a sampler on a volume setpoint.
The output can also be set by the FCU when at least one of the following conditions occur:

- Absolute Pressure over high limit set point
- Absolute Pressure under low limit set point
- Flowing Temperature over high limit set point
- Flowing Temperature under low limit set point
- Flow Rate over high limit set point
- Flow Rate under low limit set point
- Accumulated volume set point
- Low Charger voltage
- Remote Sense (DI) is ON
- User programmable using GELLO® User Programming Tools ( ie; register value change, calculated variable, etc. ). See “Users Guide to TOTALFLOW RTU Programming and Customization Tools” for a more detailed explanation of this topic.

# Chapter 2.0

# 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 FCU 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 contained in this manual under the tab Wiring Diagrams.

Installation procedures, presented within this Chapter, are applicable to FCU Models 6411 and 6414 and 6714.

### 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. | 2-3 |
| Select placement of equipment on the meter run; consult AGA Report No. 3 for placement of the RTD probe. | 2-4 |
| Install the pipe saddle to the meter run in selected location. BE SURE TO LOCATE THE FCU CLOSE TO THE STATIC PRESSURE TAP TO KEEP LINES AS SHORT AS POSSIBLE. | 2-8 |
| If direct mounting FCU, skip the next 4 events. | 2-14 |
| Install the 40-inch pipe in the pipe saddle. | 2-8 |
| Mount the FCU on the 2-inch pipe. | 2-9 |
| Install static pressure impulse line. | 2-18 |

*Continued on next page*

**Sequence of Events Table (Continued)**

| Events | See Page |
|---|---|
| Install the RTD and connect the wiring to the connector block on the digital PC board. | 2-20 |
| Mount and connect the battery to J1, the primary battery connector on the digital PC board. | 2-24 |
| Mount the solar panel, do not connect solar panel wiring until battery pack(s) are connected. | 2-25 |
| Connect optional AC charger if using instead of solar charger | 2-29 |
| Connect the PCCU to FCU. | 3-3 |
| Set date and time; program ID and location | 4-12 |
| Calibrate the absolute pressure using a deadweight tester or acceptable standard. | 4-39 |
| Perform calibration check if desired. | 4-49 |
| Use the PCCU ENTRY and AGA-7 operation modes to enter all operational parameters. | Entry 4-10<br>AGA7 4-38 |
| Setup remaining Entry mode items. | |
| Setup and monitor the RTD measurement. | 4-51 |
| Place the FCU on line:<br><br>a. Open the static pressure isolation valve slowly .<br><br>b. Give the FCU a RESET VOLUME command with the PCCU to reset the total volume measured to zero.<br><br>c. Verify the FCU display is calculating volume correctly.<br><br>d. Collect data and printout to verify all data has been entered correctly. | <br><br>2-18<br><br>4-22<br><br><br><br>4-5 |

# Unpacking & Inspection

## Unpacking

The FCU and RTD are 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 Analog Module Unit 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 vi.

# FCU Meter Run Installation

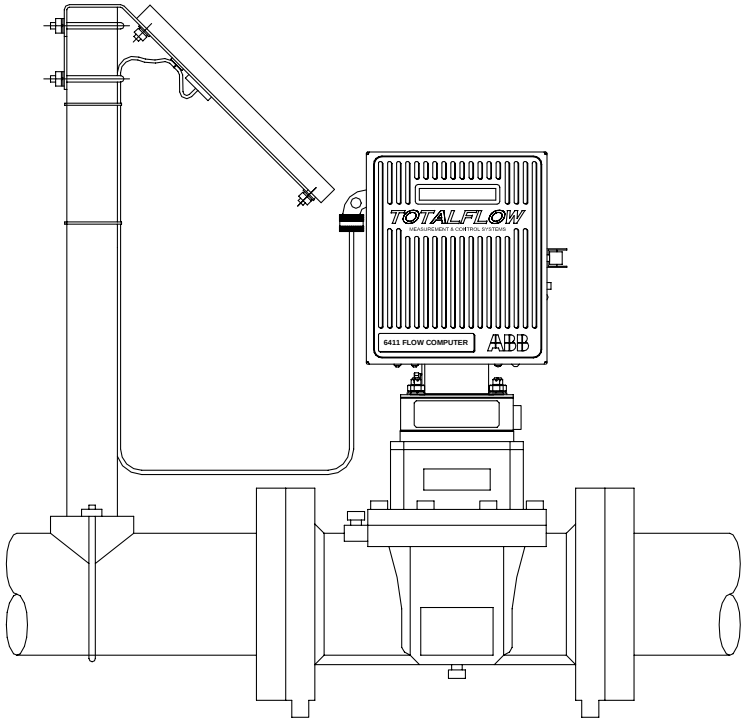
## Description

The following procedures unless otherwise stated are applicable for either the FCU Model 6411, 6414 or 6714. The FCU can either be pipe, direct or wall mounted, use the procedure that fits your installation. Figure 2-1 through Figure 2-3 shows the dimensions and outline for the models listed above.

## Important

The FCU should be located as close to the meter as possible on the meter run. This keeps the static pressure stainless steel tubing run as short as possible between the meter and pressure tap valve, reducing the possibility of freezing .

## Typical Pipe Installation




## Instructions

| If you want to... | THEN use... | For Procedure See Page |
|---|---|---|
| Install on meter run | Pipe Mounting Procedure | 2-8 |
| Install on wall | Wall Mounting Procedure | 2-10 |
| Direct Mount | Direct Mounting Procedures | 2-14 |

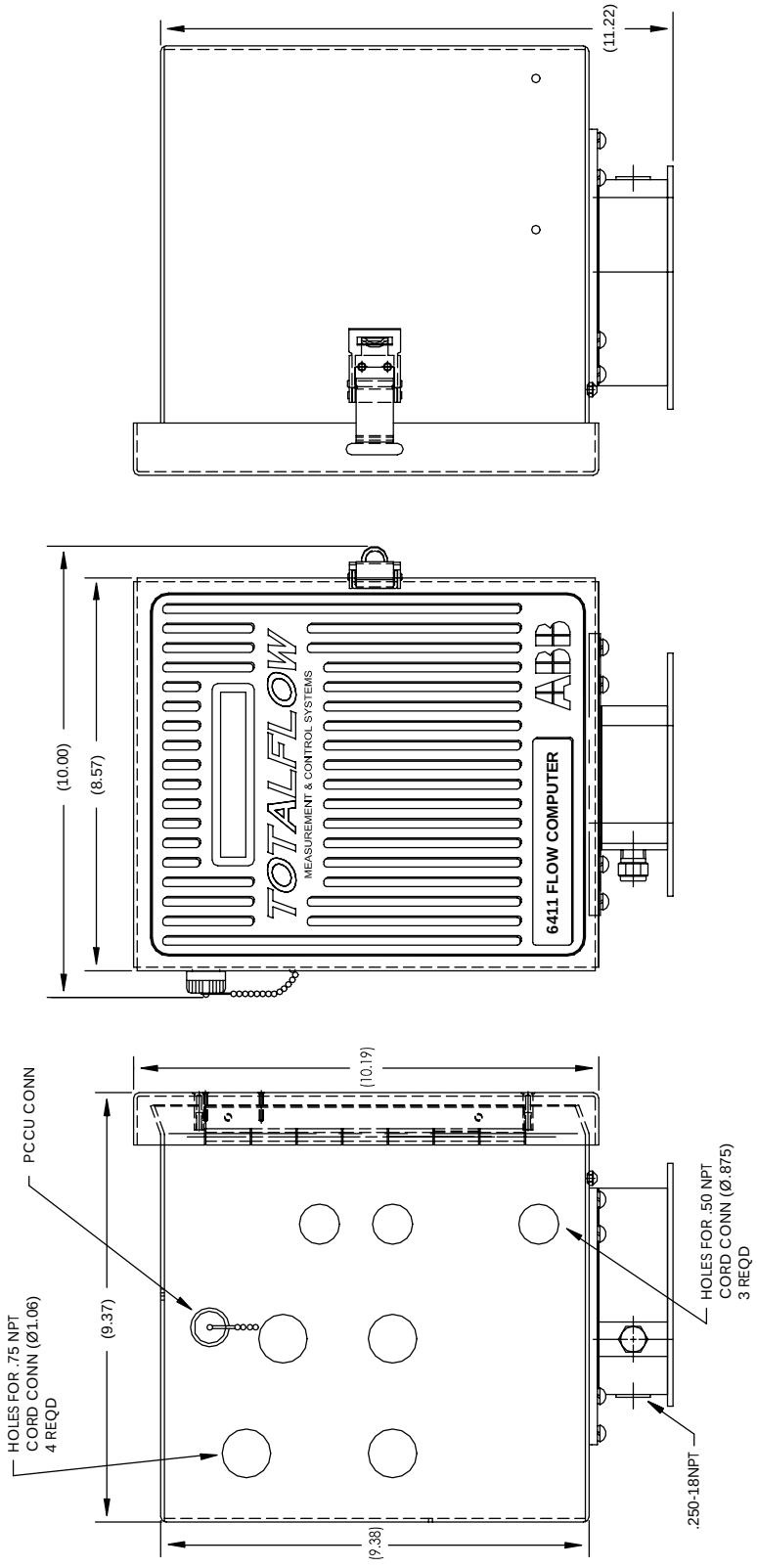



**Figure 2-1. Outline Drawing, Model 6411 FCU**

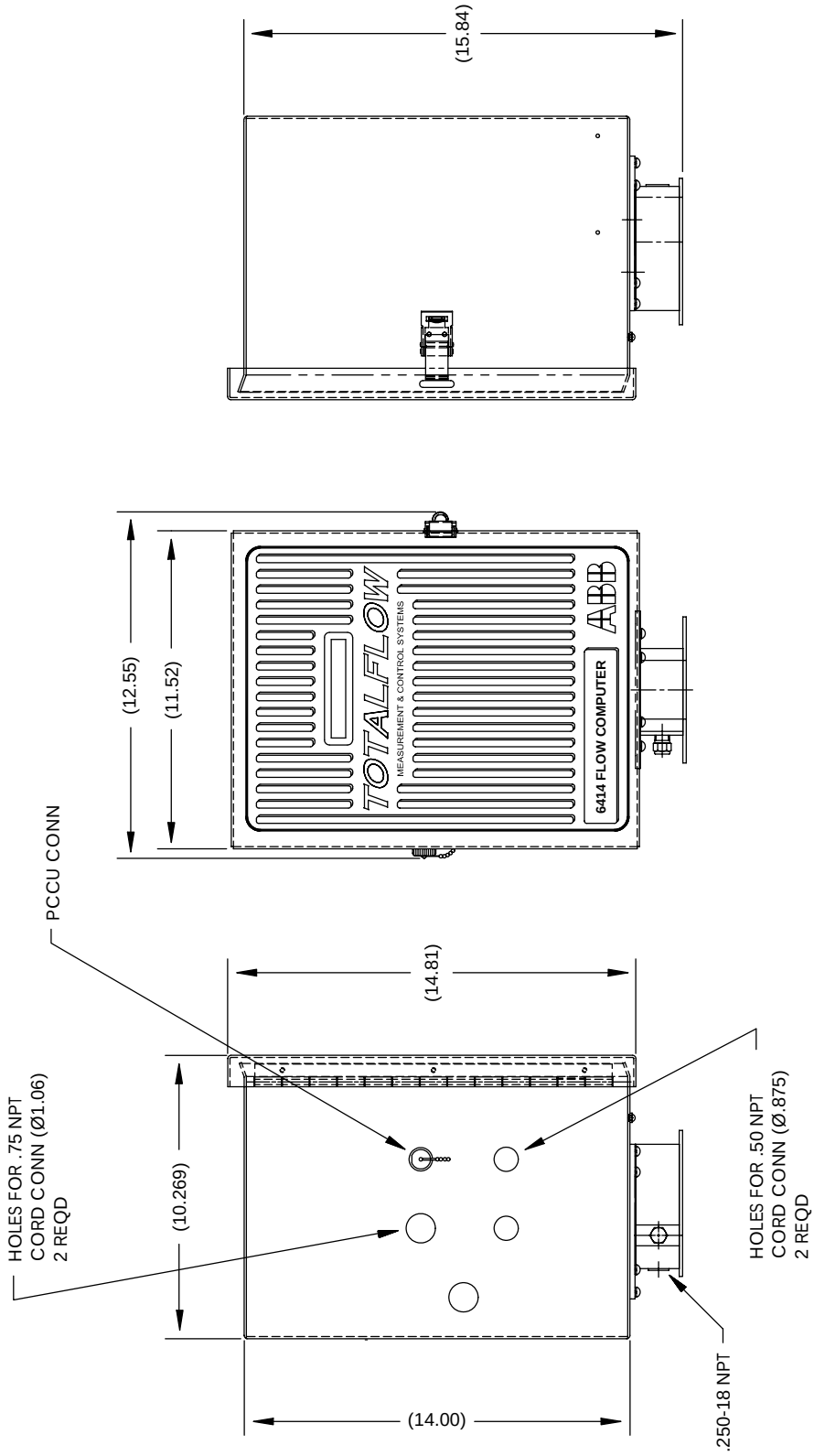



**Figure 2-2. Outline Drawing, Model 6414 FCU**

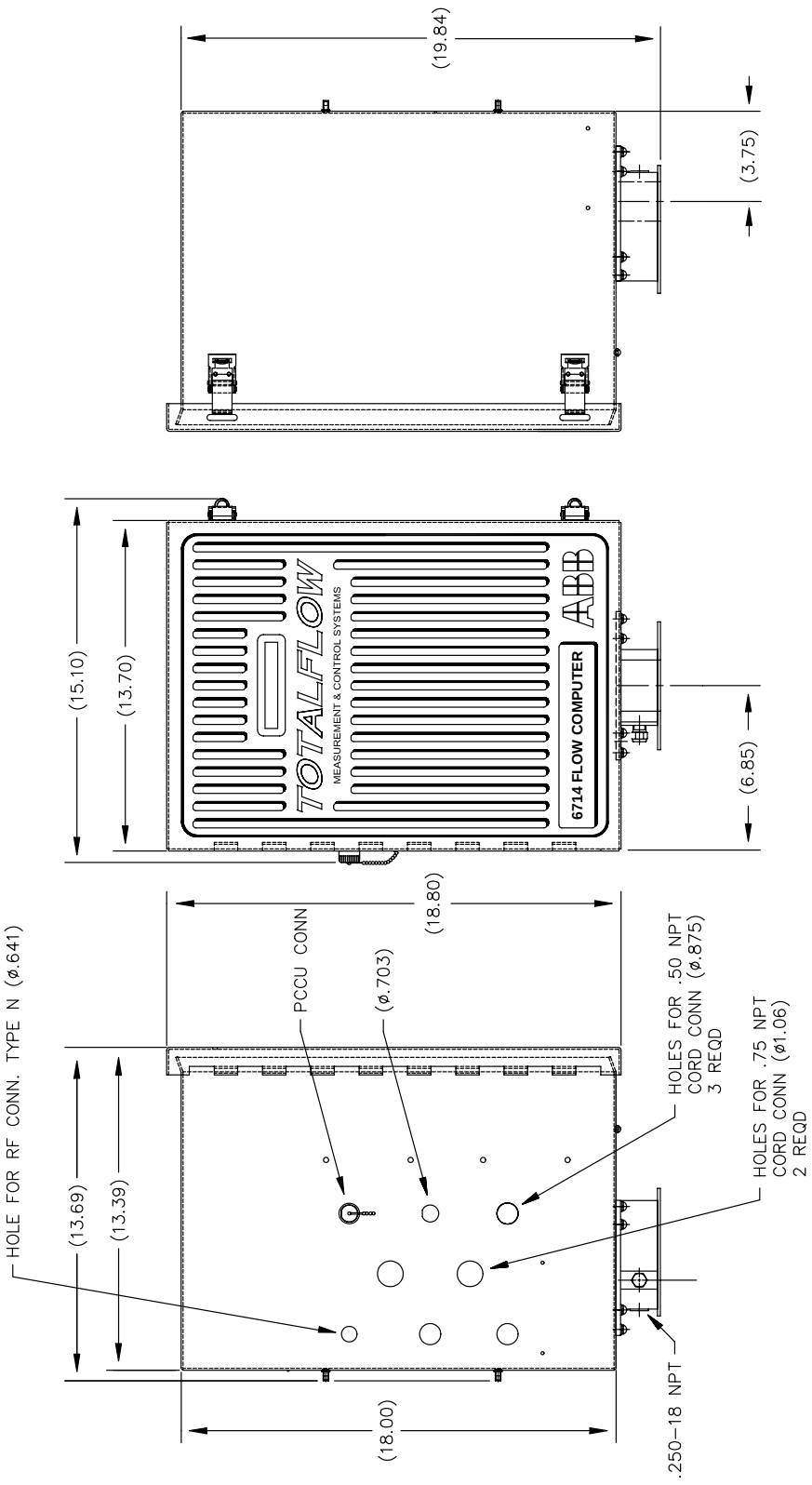



**Figure 2-3. Outline Drawing, Model 6714 FCU**

### Pipe Mounting Procedure

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

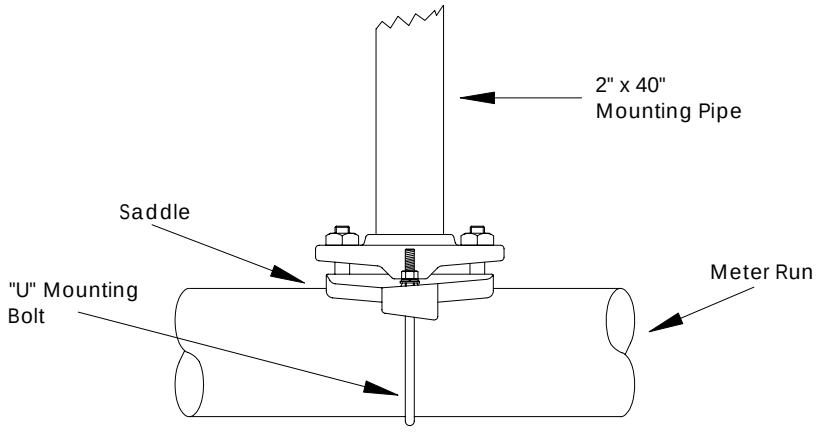
***Totalflow Supplied Materials***

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

***Material Not Supplied***

- One pipe Saddle
- One 40-inch, 2-inch pipe
- Static pressure tap valve
- Stainless steel tubing

### Instructions

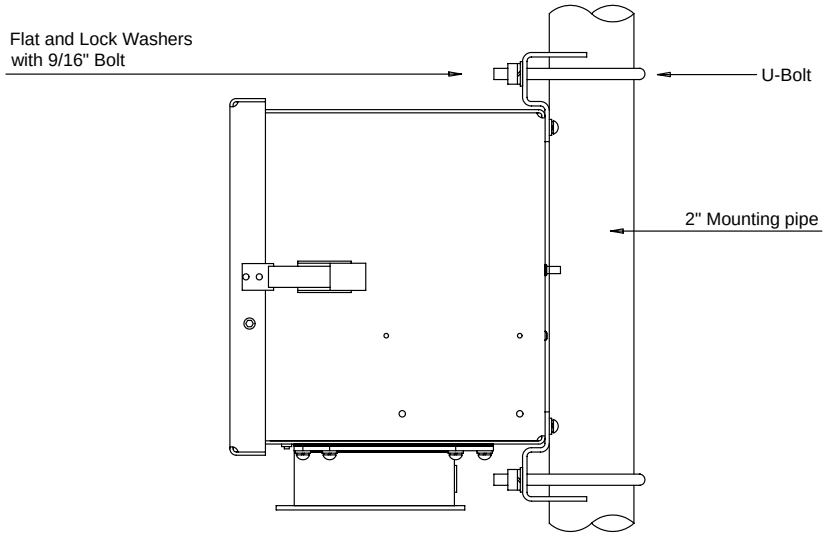
| Step | Procedure |
|---|---|
| 1. | Position pipe saddle on meter run. Select a location that allows easy user access and is close to static pressure tap. Static pressure input tubing should be as short as possible. See note page 2-9 regarding sloping tubing.   |
| 2. | Temporarily attach Saddle on 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. |

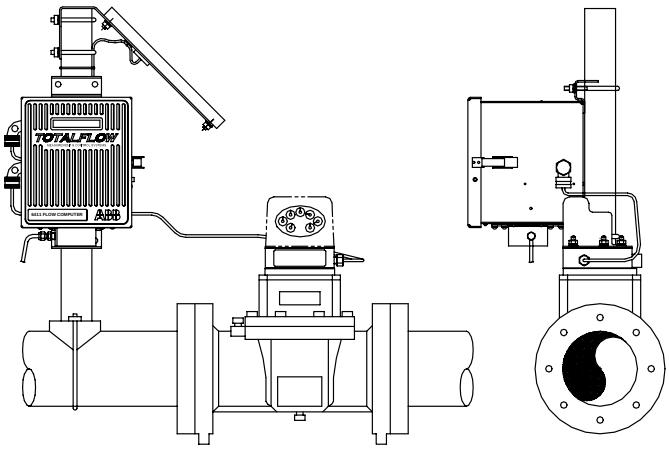
*Continued on next page*

**Pipe Mounting Procedures (Continued)**

**Note** The following procedures are to be followed when installing FCU unit on 2” mounting pipe. Method of installation must be consistent with customers company policy.

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




**Note** Position FCU unit high enough on pipe to allow slope from externally mounted static pressure tap valve.

### Wall Mounting Procedure

If you are installing to a wall near the meter run 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***

- FCU wall mounting brackets

***Material Not Supplied***

- Four 1/4” x 1/4” machine bolts
- Static pressure valve manifold
- 3/8-inch stainless steel tubing
- 3/8” x 1/4” tubing fittings

### Instructions

**CAUTION**

If FCU is to be wall mounted, the wall itself should be of sufficient strength to support the hanging weight of the unit.

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

| Step | Procedure |
|---|---|
| 1. | Referring to Figures 2-4 through 2-6 FCU wall mount Drawings, drill mounting holes in wall supports. |
| 2. | Remove 2” mounting post brackets, from back of FCU unit, and install supplied wall mounting brackets. |
| 3. | Lift and align FCU unit wall mounting brackets with mounting holes drilled in wall. |
| 4. | Insert 1/4” x 1/4” diameter machine bolts through FCU mounting brackets into wall. Securely tighten all bolts to secure unit to wall. |

### Note

Position FCU unit high enough on wall to allow slope from unit to static pressure tap valve.

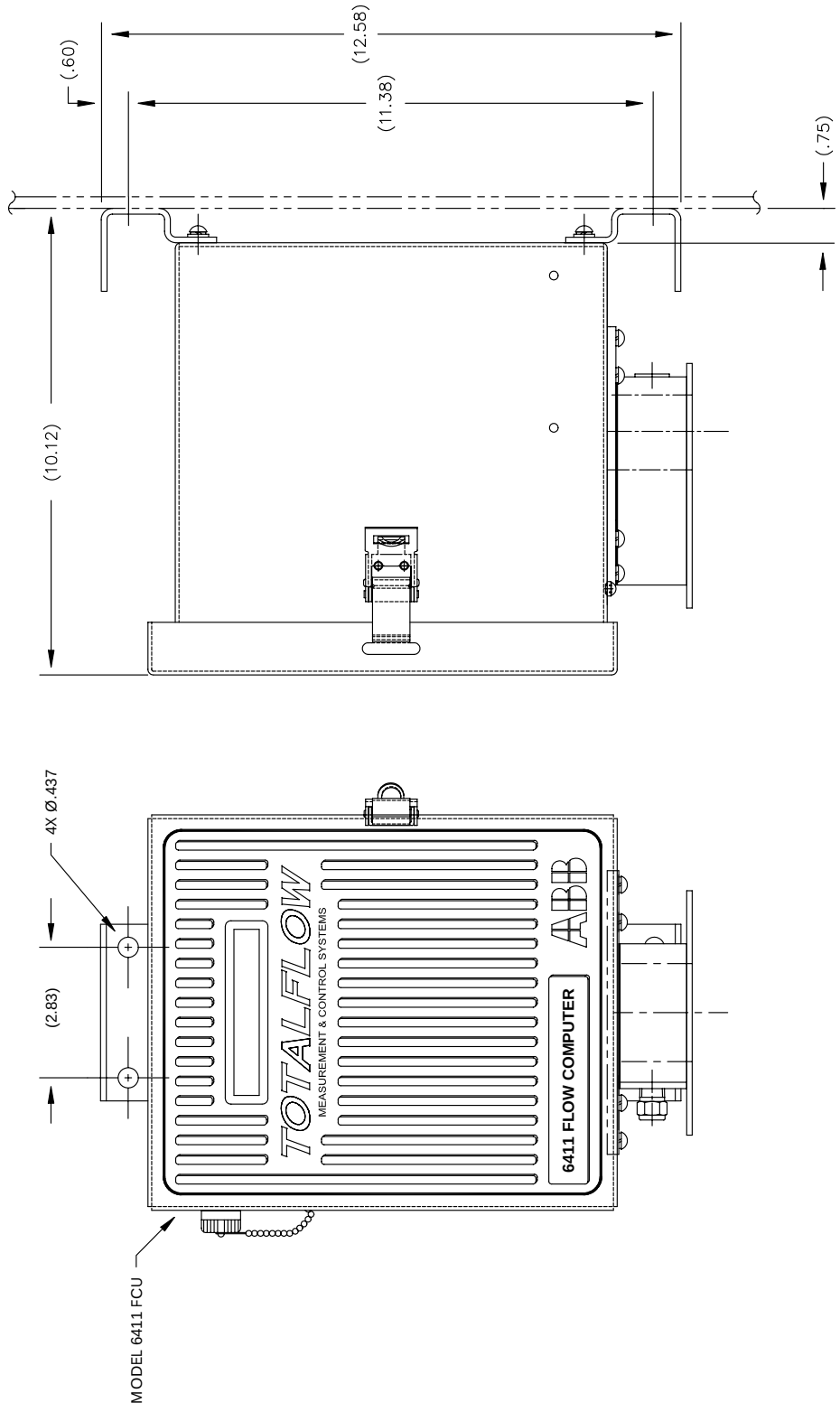



**Figure 2-4. Model 6411, Wall Mount**

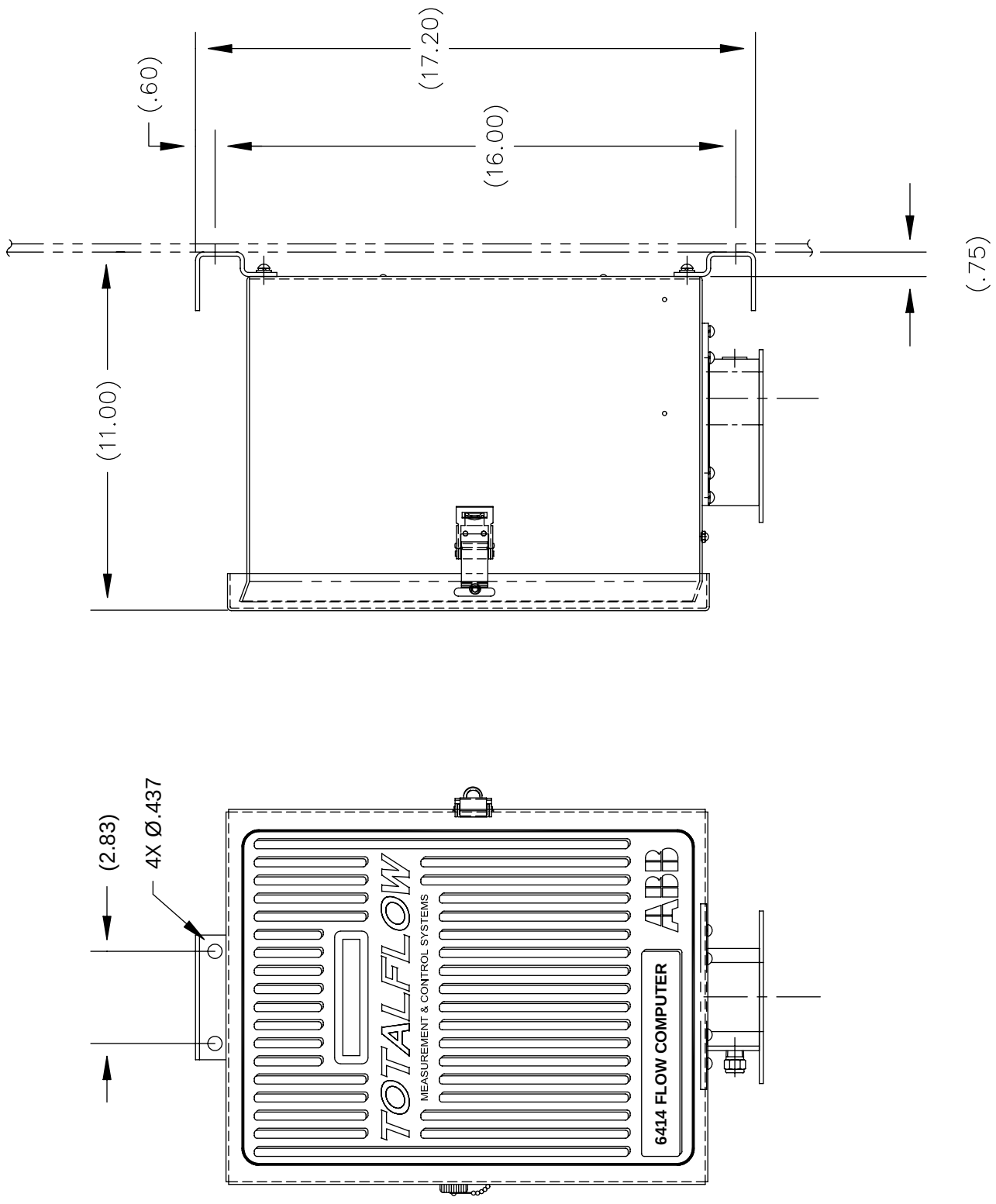



**Figure 2-5. Model 6414, Wall Mount**

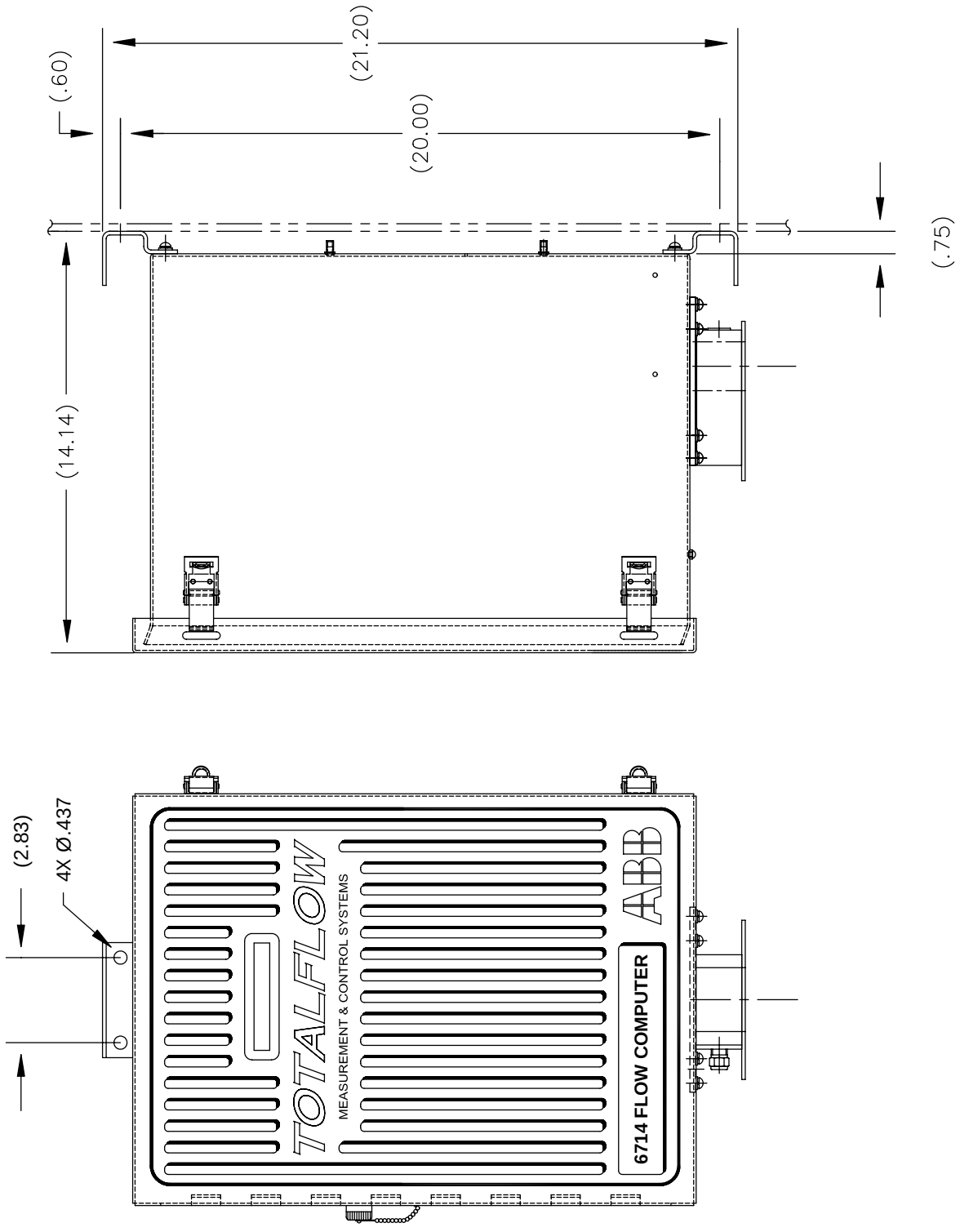



**Figure 2-6. Model 6714, Wall Mount**

### Direct Mounting Procedure

If you are installing the FCU directly to a meter use this procedure. Before you begin, review the procedure and the Direct Mount Outline Drawings; see Figures 2-7 through 2-9.

**Important**

All required hardware for mounting to the meter is supplied by Totalflow, as ordered.

### Instructions

| Step | Procedure |
|---|---|
| 1. | Referring to Figures 2-7 through 2-9 FCU Outline Drawings, attach the FCU to the meter. Before aligning with the meter, ensure that all seals are in place around the mounting hardware as per installation drawing # 2015374-AI. |
| 2. | Using the four 3/8-inch bolts supplied with the FCU secure the FCU to the meter. |
| 3. | Refer to Figure 2-7, 2-8 or 2-9 and complete installation. |

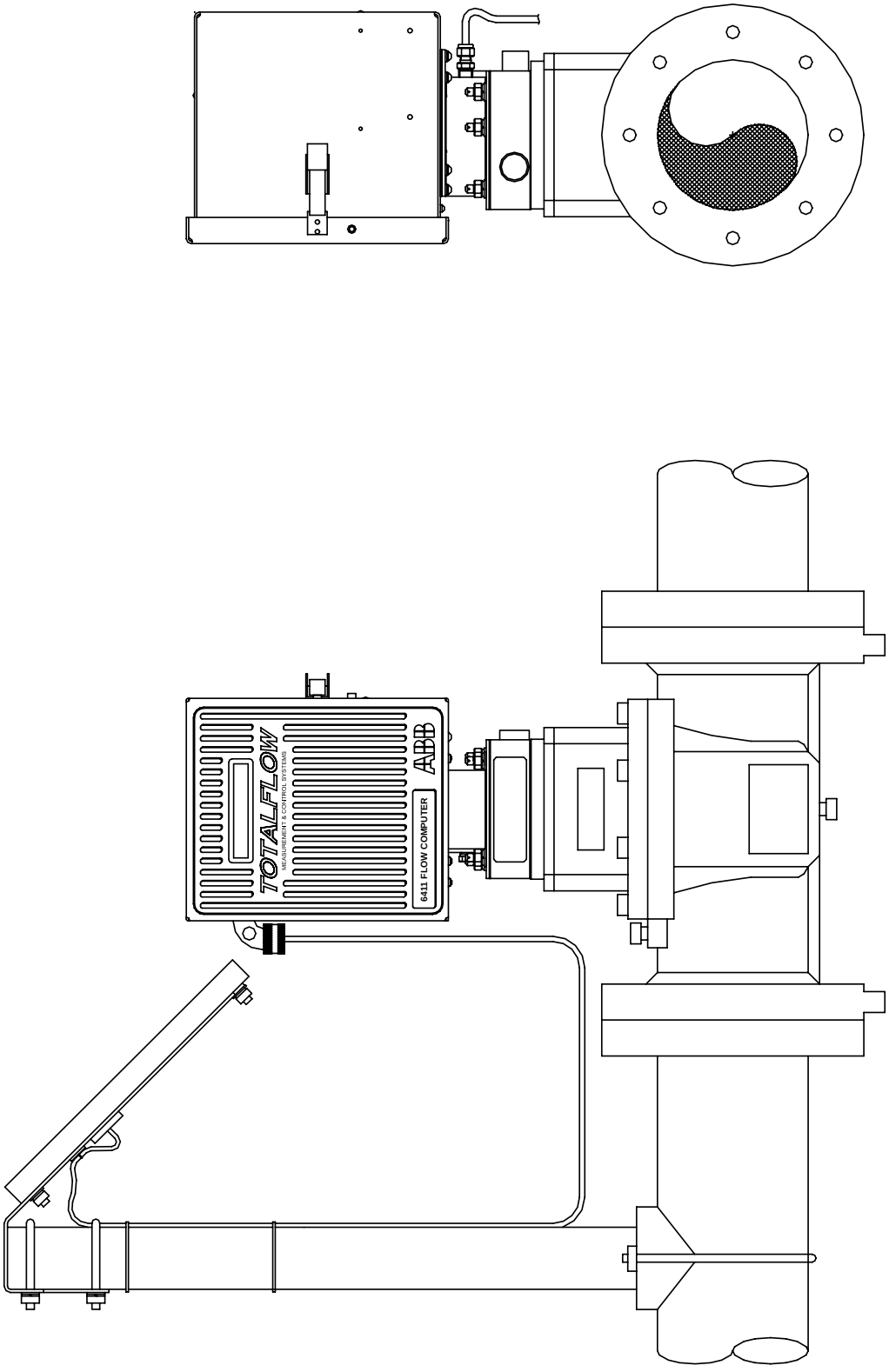



**Figure 2-7. Model 6411, Direct Mount**

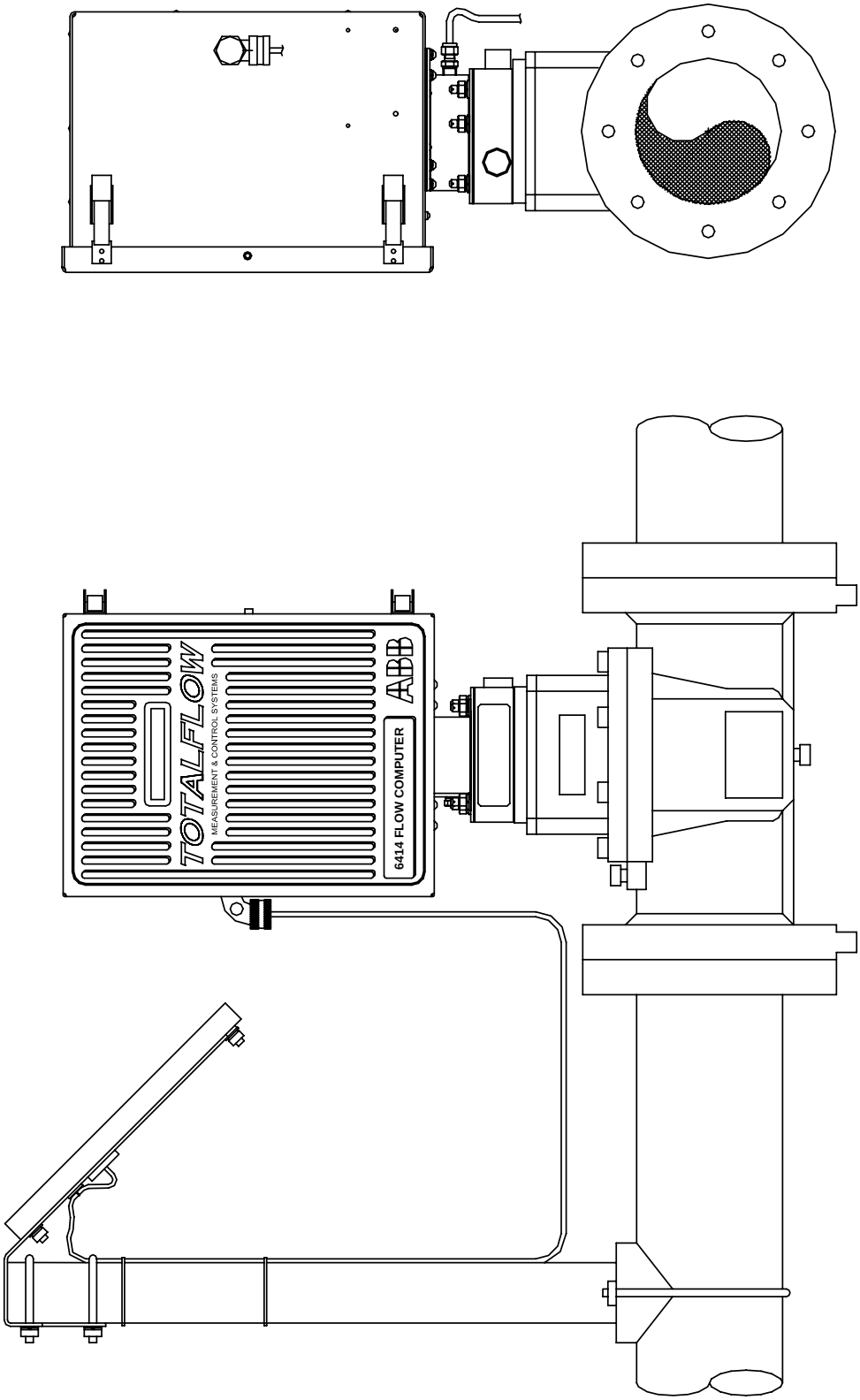



**Figure 2-8. Model 6414, Direct Mount**

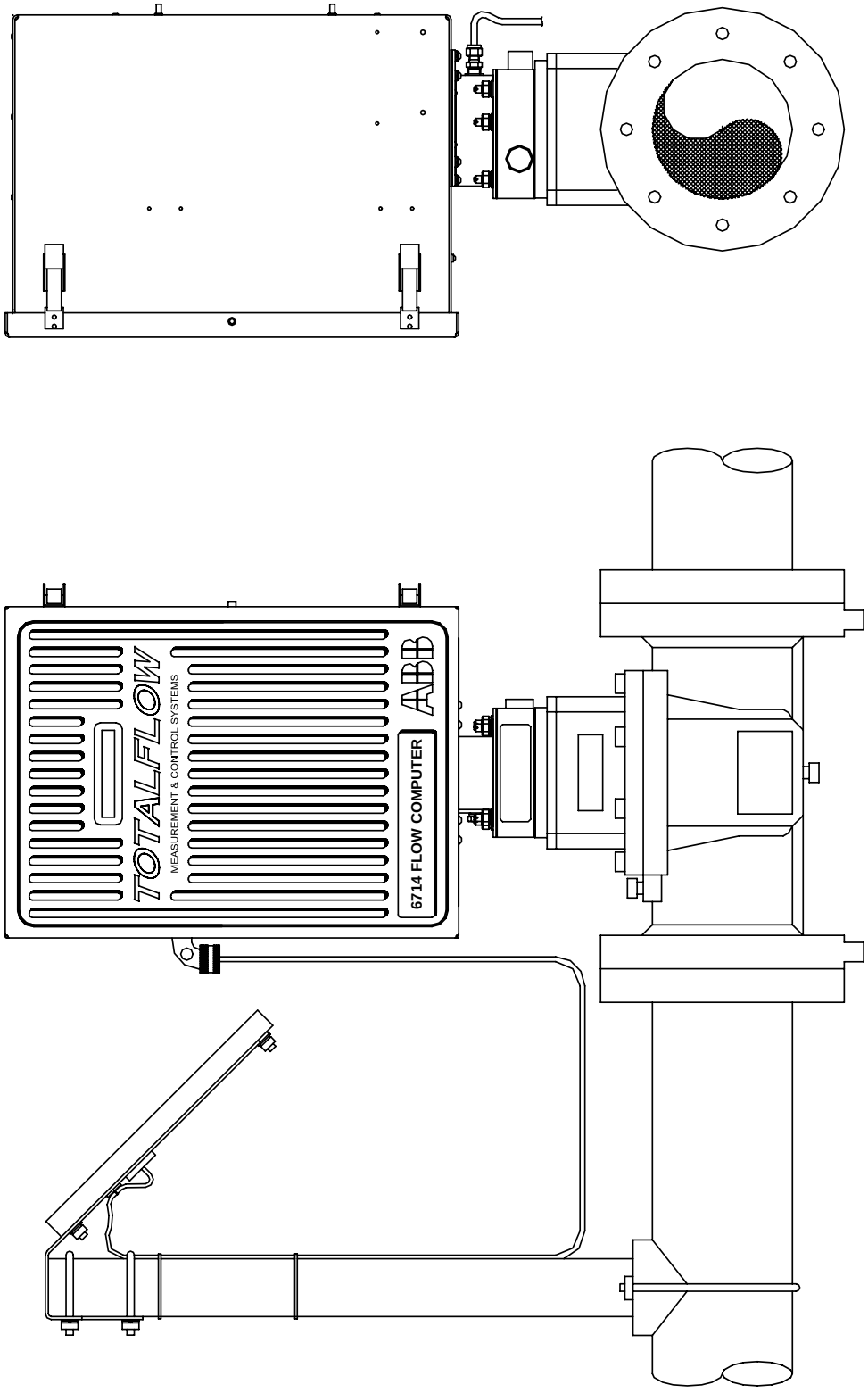
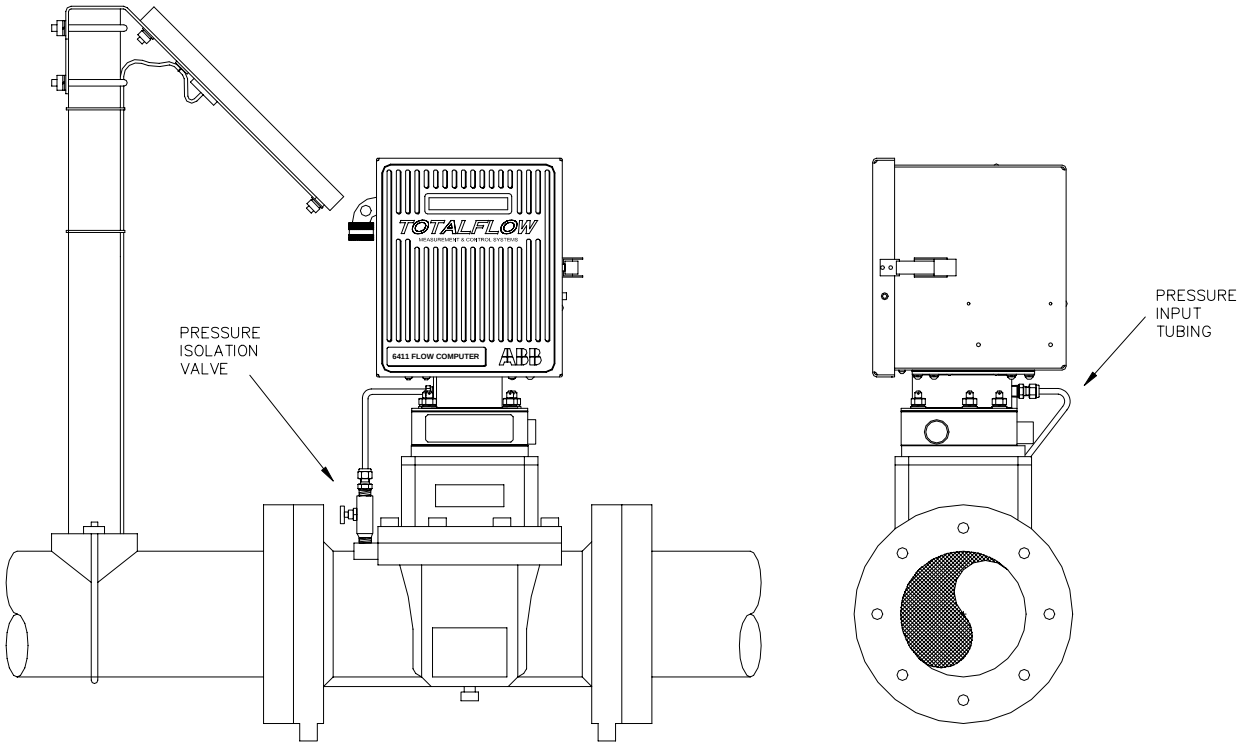



**Figure 2-9. Model 6714, Direct Mount**

# Static Pressure Input Line

## Description

The following instructions will provide procedural steps to install the static pressure input line. The static pressure input line terminates in either the rear or side pressure ports on the FCU mounting block located on the bottom of the FCU.




## Installation

The hardware required to connect the FCU static pressure line to the FCU static pressure port is as follows. Installation is customers responsibility.

***Customer Provided Materials***

- Stainless steel tubing
- Static pressure isolation/shut off valve
- Tubing fittings

---

**CAUTION**

A backup wrench should always be used when attaching stainless steel tubing to the static pressure isolation/shut off valve and to the FCU static pressure input port. This prevents fitting from turning and/or putting tension on stainless steel tubing.

---

*Continued on next page*

## Static Pressure Input Lines, Continued

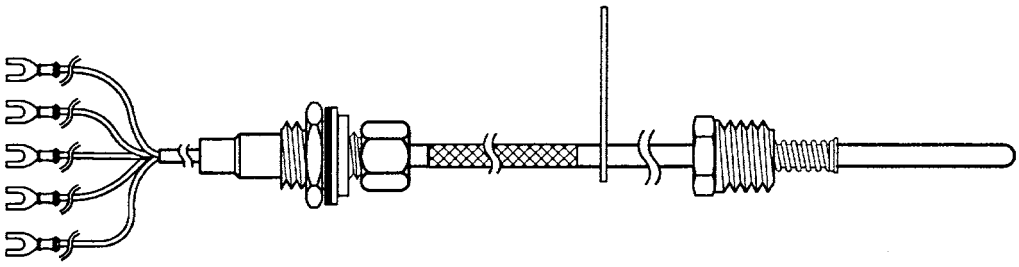
### Instructions

| Step | Procedure |
|---|---|
| 1. | Install static pressure isolation valve on meter run. |
| 2. | Install static pressure tubing to static pressure isolation valve and FCU static pressure input port connection. (Note: Valve to FCU fittings not supplied with FCU). |
| 3. | Leak check all connections. Leaks in the tubing or connections will introduce errors when calibrating transducers. |
| 4. | Mount FCU to direct mount manifold. |
| 5. | Leak check all tubing connections before calibrating. Leaks in static pressure connections will introduce errors in transducer readings. |

# RTD Probe Installation

## Description

The RTD measures flowing gas temperature. The standard length of RTD extension cable supplied is 10 feet; longer lengths are available. Procedures, presented in this section, enable the user to install the RTD into the meter run.



.

***Totalflow Materials Supplied***

- RTD probe with 10’ of cable. Optional lengths are 15’, 25’, 30’, 40’, and 50’.
- One (1) thermowell with 3/4” npt threads; optional threads are 1/2” and 1”.
- Nylon tie wraps.

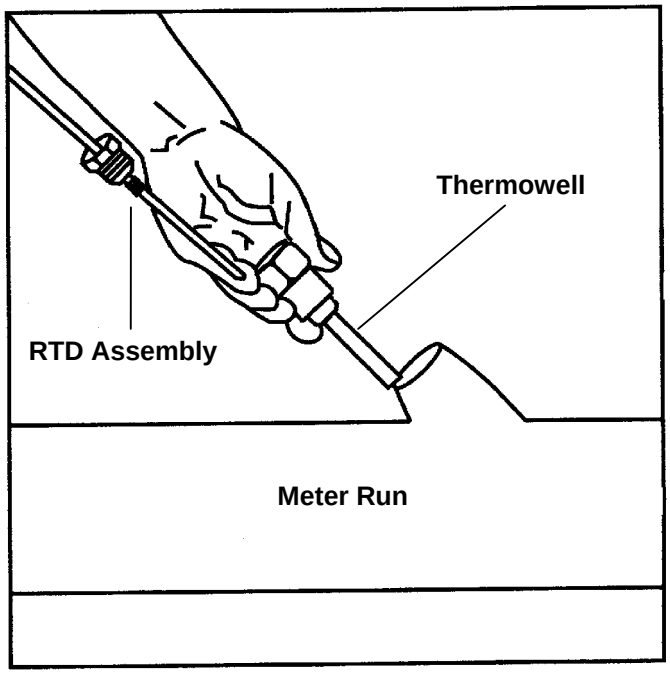
***Customer Provided Materials***

- Customer must specify Thermowell “U” length for factory adjustment (RTD u-length is user adjustable via outside snap ring).
- Teflon tape

*Continued on next page*

## RTD Probe Installation, Continued

### Instructions

| Step | Procedure |
|---|---|
| 1. | Install thermowell into meter run.<br>  <br> |
| 2. | Using outside snap ring pliers, adjust probe length so that it is spring loaded against bottom of thermowell. |
| 3. | Remove nut from water tight cord connector. On FCU unit, remove hole plug unit and insert wires through the hole. Allow enough RTD cable to extend into FCU for connecting wires to RTD termination's (Termination Block J7). |
| 4. | Secure RTD Probe cable using supplied sealing ring and nut. |

### Note

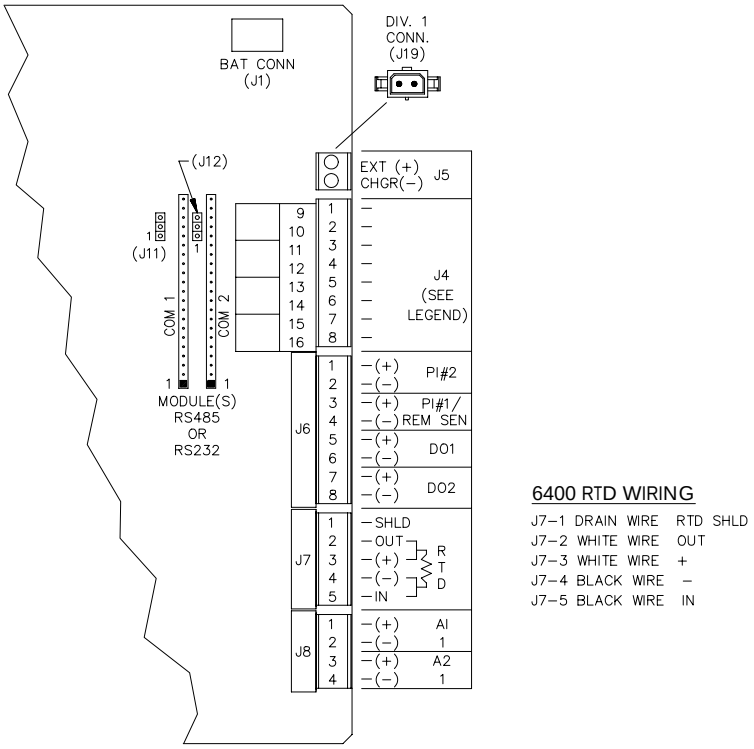
To prevent moisture from entering FCU unit after installing RTD cord connector, make sure the associated connector, at FCU unit, has a metal backed sealing "O" ring and metal locking nut attached.

*Continued on next page*

**Instructions (Continued)**

**Note** Power should be removed from FCU before performing any field wiring.

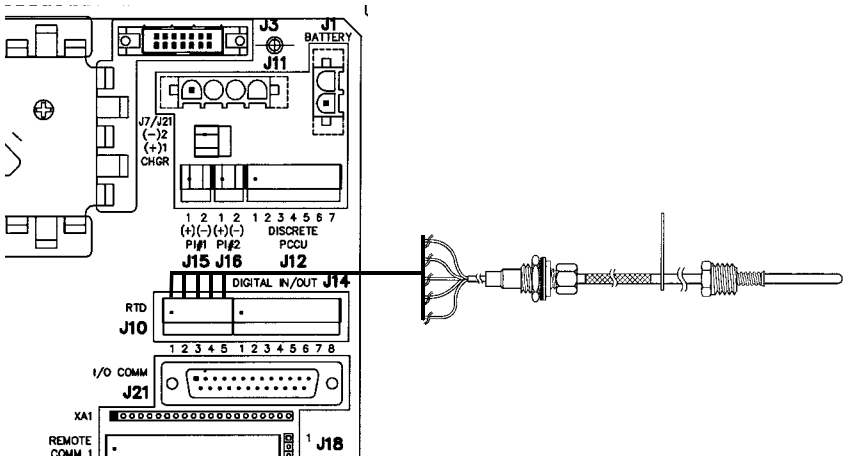
If wiring RTD to series 6400 products follow step 5 below, otherwise skip to step 7.

| Step | Procedure |
|---|---|
| 5. | Connect RTD probe to FCU RTD connector as follows. Before making connections to terminal block, remove spade lugs if attached and trim wire ends back 1/4" and remove associated terminal block from Digital Board. See overlay on battery plate.<br><br>Loosen terminal block securing screws, insert wire then re-tighten. Reinstall terminal block with wires attached. Connect wires as follows:<br><br>  <br><br>Model 6400 RTD connections. |
| 6. | Following connection of RTD thermowell, secure cable to meter run pipe with plastic tie wraps. |

*Continued on next page*

**Instructions (Continued)**

**Note** Power should be removed from FCU before performing any field wiring.

| Step | Procedure |
|---|---|
| 7. | Connect RTD probe to FCU RTD connector as follows. Before making connections to terminal block, remove spade lugs if attached and trim wire ends back 1/4" and remove associated terminal block from Digital Board. See overlay on battery plate.<br><br>Loosen terminal block securing screws, insert wire then re-tighten. Reinstall terminal block with wires attached. Connect wires as follows:<br><br>6700 RTD WIRING<br><br>J10-1 DRAIN WIRE RTD SHLD<br>J10-2 WHITE WIRE OUT<br>J10-3 WHITE WIRE +<br>J10-4 BLACK WIRE -<br>J10-5 BLACK WIRE IN<br><br>  <br><br>Model 6700 RTD connections. |
| 8. | Following connection of RTD thermowell, secure cable to meter run pipe with plastic tie wraps. |

# Battery Pack Installation

## Description

A battery pack provides the FCU with it's operating power. The battery is packed and shipped separately. The battery is not installed in FCU 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 FCU unit battery cover plate and insert battery pack into battery compartment. Insert battery pack with its long dimension facing outward.<br><br>When cover plate is reinstalled, it will fit snugly against some battery packs.<br><br>The screws can be loosened to accommodate larger battery. |
| 2. | Connect battery pack connector to Digital Board BATTERY CONNECTOR J1 (on both series 6400 and 6700 products) located in upper right hand corner of main electronics board. |
| 3. | Observe LCD, the display should be on and scrolling through the startup diagnostics sequence. |
| 4. | Remove paper tab from lithium battery bracket located on digital board. |

# Solar Panel Installation

**Description**

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

For wall mounted FCU unit it can be mounted on top or side of meter house.

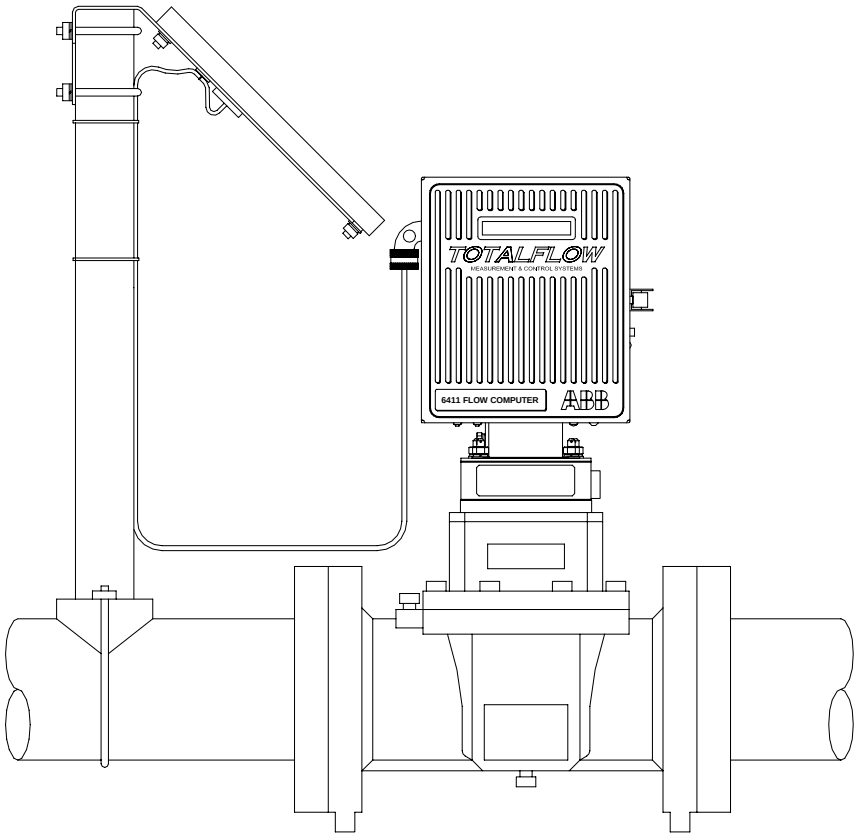
**CAUTION**

Do not connect solar panel power cable to the FCU unless main battery pack has been connected to J1. Refer to Section Battery Pack.

**Important**

If installation procedures are required for mounting Solar Panel on top or side of meter house, customer should contact Service Department, ABB Automation, Totalflow Division; see page vi.

**Typical Solar Panel Installation**



## Solar Panel Installation, Continued

### Procedure

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

***Totalflow 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 or other suitable length of pipe.

### Instructions

| Step | Procedure |
|---|---|
| 1. | Attach 2” pipe union to top end of FCU 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 removable termination block J5; see overlay on battery plate. DO NOT connect other end of cable to FCU unit 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 due south. |

### 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*

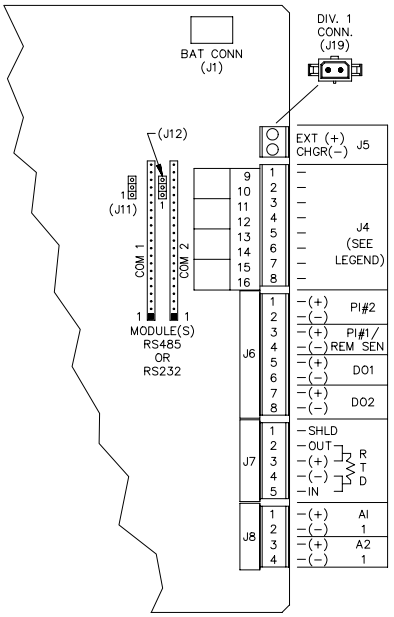
**Note**

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**

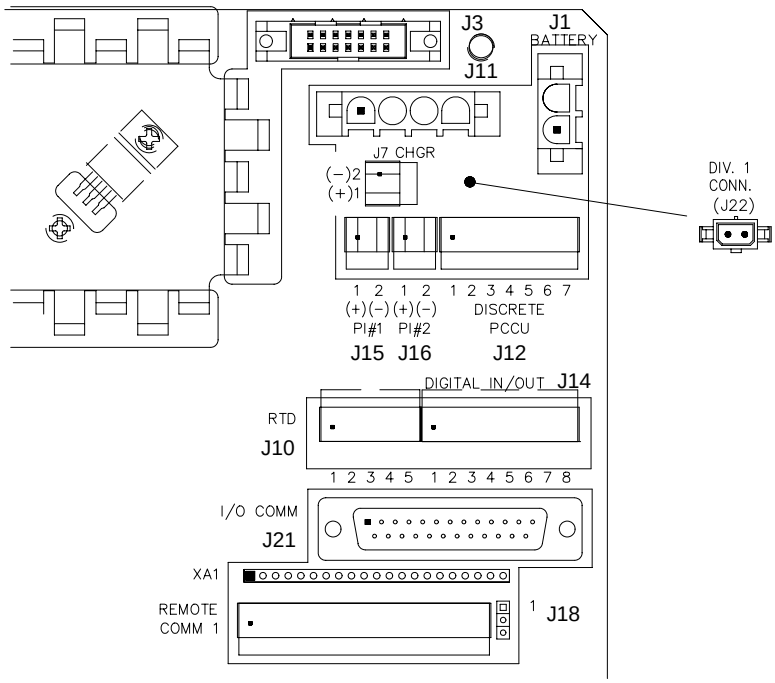
Do not connect solar panel power cable to the FCU unless main battery pack has been connected to battery connector J1. Refer to Section, Battery Pack.

***Model 6411, 6414***

| | |
|---|---|
| 7. | The series 6400 Solar Panel power cable is connected to FCU Digital Board EXT CHGR terminals. Refer to silk screen on electronics board 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 FCU unit for cable connection to EXT CHGR +/- termination's on J5. For Division 1 boards J5 is replaced by J19. Division 1 solar panels will have the mate to J19 already installed on its cable.<br>  <br> |
| 8. | Before making connections to terminal block, trim wire ends back 1/4" and remove associated terminal block from Digital Board.<br><br>Loosen terminal block securing screws, insert wire then re-tighten. Connect Solar Panel (+) lead to + terminal and (-) wire to - terminal. Connect cable shield to SHLD terminal. Reinstall terminal block with wires attached. |
| 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*

***Model 6714***

| | |
|---|---|
| 10. | The series 6700 solar panel power cable is connected to FCU Digital Board EXT CHGR terminals. Refer to silk screen on electronics board 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 FCU unit for cable connection to EXT CHGR +/- termination's on J7. For Division 1 boards J7 is replaced by J22. Division 1 solar panels will have the mate to J22 already installed on the its cable.<br>  <br> |
| 11. | Before making connections to terminal block, trim wire ends back 1/4" and remove associated terminal block from Digital Board.<br><br>Loosen terminal block securing screws, insert wire then re-tighten. Connect Solar Panel (+) lead to + terminal and (-) wire to - terminal. Connect cable shield to SHLD terminal. Reinstall terminal block with wires attached. |
| 12. | Following connection of Solar Panel power cable, secure cable to 2" extension and mounting pipe cable with plastic tie-wraps provided. |

# AC Charging Unit Installation

## Description

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

## Installation

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

***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 ABB Automation, Totalflow Division. |
| 2. | Remove one of the plugs from the side of FCU so that AC charging unit can be mounted without obstruction; see Figure 2-10 2-11 and 2-12. |
| 3. | Feed AC Charger DC power lines into FCU. Allow enough cable to extend into unit for connection to EXT CHGR +/- terminals. |
| 4. | Connect AC Battery Pack Charger to FCU unit using supplied sealing ring and nut. |

## Note

To prevent moisture from entering FCU 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 main board unless main battery pack has been connected to battery connector J1.

**Instructions** (Continued)

| Step | Procedure |
|---|---|
| 5. | Before connecting Charger wiring, trim wire ends back 1/4" and remove associated EXT CHGR terminal block from Digital Board.<br><br>Loosen terminal block securing screws, insert red wire into plus (+) terminal and black wire in negative (-) terminal. Retighten screws and reinstall terminal block with wires attached.<br><br>6411 & 6413: 6714:<br><br>+ = J5 Pin 1 (Top) + = J7 Pin 1 (Bottom)<br>- = J5 Pin 2 (Bottom) - = J7 Pin 2 (Top) |
| 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 neutral 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 flow computer cabinet and verify that the main battery pack is plugged into J1. Apply AC power to the AC Charger. |
| | Monitor DC charging voltage by connecting PCCU to associated FCU connector. Set PCCU to MONITOR mode. If proper connections have been made, LCD display should indicate BATTERY CHARGER 13.0 - 13.5 VOLTS. |

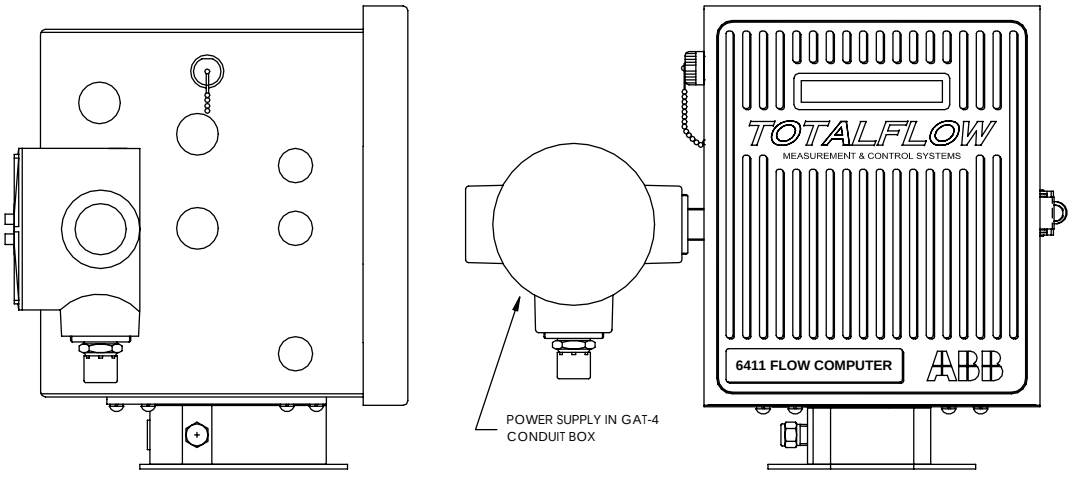



**Figure 2-10. AC Charger mounted on Model 6411 FCU**

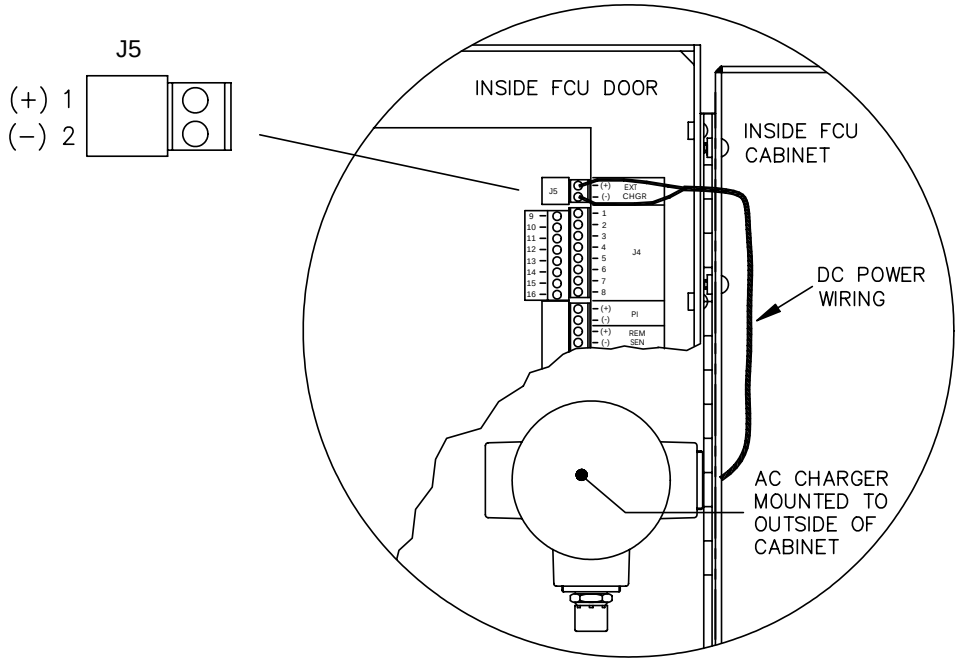



**Figure 2-11. Mounting AC Charger in Model 6411 & 6414**

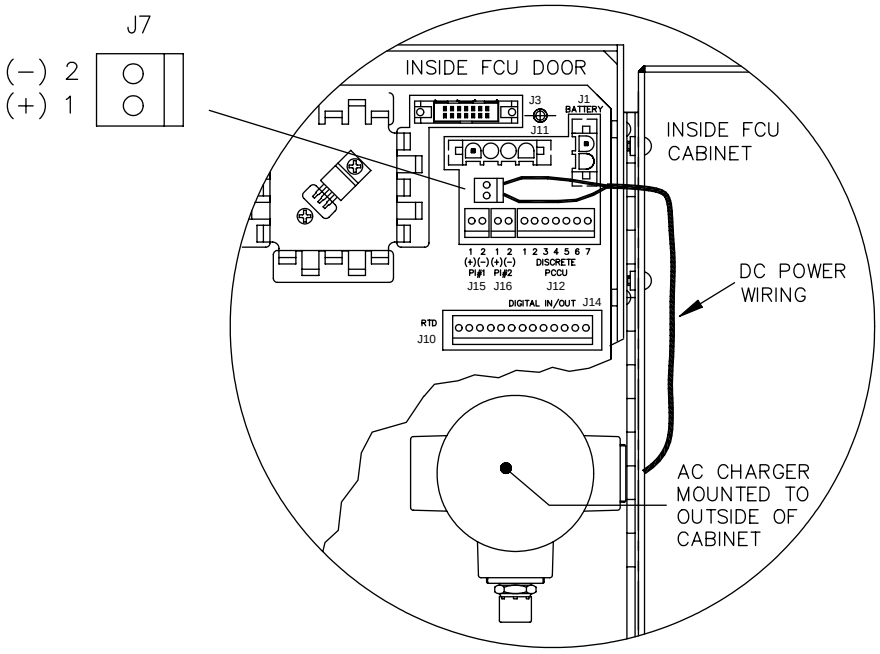



**Figure 2-12. Mounting AC Charger in Model 6714**

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# Chapter 3.0

# Portable Calibration & Collection Unit (FS/2)

## Overview

### Introduction

PCCU32 is the most recent release of Totalflow's Portable Calibration & Collection Unit (PCCU) software and is designed to be run on a Laptop computer. PCCU32 is required to setup many of the features on newer flow computers. PCCU32 users should use the online Help files for assistance. Many customers however, will still be using the FS/2 for sometime. Therefore, the information in this chapter pertains only to the FS/2.

The PCCU (FS/2) is factory programmed to communicate with the FCU. The battery powered PCCU allows you to enter gas calculation and site specific information, calibration and test parameters, answer displayed questions and make menu selections. User entries are made interactively through the PCCU keypad; see Figure 3-1.

### Chapter Highlights

This chapter covers the following topics.


**Figure 3-1 Totalflow Portable Calibration & Collection Unit (PCCU)**

# PCCU Highlights

## Functions

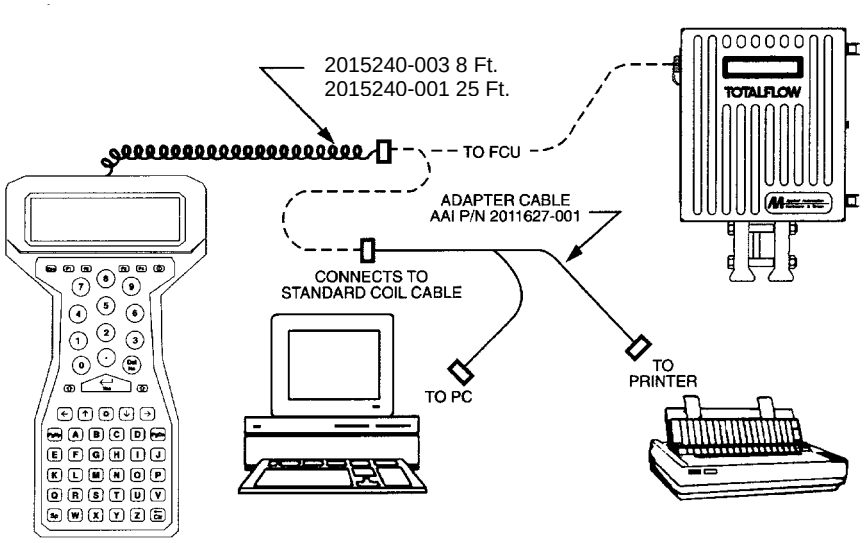
The PCCU display continuously shows user-defined site variables, and menus which present simple and easy to use options. In most cases, questions can usually be answered with a single key-stroke.

Displayed questions and menu selections are designed for easy understanding by field personnel familiar with natural gas measurement procedures and terminology.

## FCU Interface

The PCCU is interconnected to the FCU unit by a coiled interface cable. One end of the interface cable is connected to the PCCU D-Type 25 Pin Connector RS-232 Serial Port and the other end is connected to FCU local port input connector.

The PCCU has the capabilities for connecting to external peripheral devices such as Totalflow Flow Computer Units, printers or PC class computers running Totalflow's CCU software. Interconnecting the PCCU to a user's computer allows retrieved data to be downloaded for viewing, analyzing and storage.




## Collected Data

The PCCU allows user to graphically review natural gas flow collected data for any 24-hour or eight-day period up to 35 days. It is a primary collection device and allows the user to graphically review data either on-site or in a remotely located facility.

Collected PCCU data can be read by Totalflow central collection units for archiving, production of tabular or graphical hard copy, data analysis or transmitting to a central business computer system. Central business computer system can be a district or regional office that provides for local data collection, verification, and analysis.

## PCCU Highlights, Continued

### Modes of Operation

The PCCU standard modes of operation, which support FCU functions are as follows:

- Calibration
- Entry Mode
- Print Data
- Data Collection
- AGA Mode
- Download Data
- Monitor Mode
- On-Screen Data View
- Trend Data

### AGA-3 Flow Equations

TOTALFLOW calculation procedures are based on the AGA-7 flow equations including AGA-8 1992 [*Gross & Detailed*] and NX-19 supercompressibility calculation procedures and are user selectable via the PCCU menu system.

### Exchange of Data

Data and programs can easily be exchanged with other computers or devices using the built-in HCOM utility or IBM compatible 3.5” external disk drive options.

*Continued on next page*

# PCCU Components & Keypad

## Description

This Section describes functions of PCCU keypad keys, connectors and the functions they control. Keypad keys and interface connectors are described.

## Warning

User must never open the PCCU case. There are no serviceable parts inside. Opening case will destroy seal and void PCCU warranty.

## Keypad Table 3-1

The keypad layout includes all keys necessary for the versatile operation of the unit. The keyboard arrangement reflects user requirements of simple data entry and response.

## Special Keys

Reference is made in the various menu's to depress the EXIT, CONTINUE, YES, or NO key to perform desired operations. The following keys are assigned these functions. There are two ways to get each function.

| Method 1 | Method 2 | Function |
|---|---|---|
| Esc | E | Menu Exit to Previous Menu |
| "paw"+cont. | C | Continue to Next Menu |
| Yes | Y | YES |
| No | N | NO |

*Continued on next page*

### Arrow Keys

The arrow keys have two functions:

1. Selecting certain menu items. Sometimes, the PCCU will ask you to use the arrow keys to assist in selecting certain menu items. When the PCCU asks you to do this you would simply use the arrow keys directly.

2. The FS/2 screen behaves as a “window” onto a larger “virtual” screen, which provides 25 by 80 characters of information. To move the window a line or a column at a time hold down the “paw” key and press one of the arrow keys.

   When you are printing reports, you can use the arrows along with the “paw” key (“paw”+arrow keys), to move data into view of the display (should be used when the display is halted.)

   When you are in valve control, you can use the arrows (along the “paw” key) to view the controller indicator.

### Parts and Function

These are the parts and functions of the PCCU keypad and components:

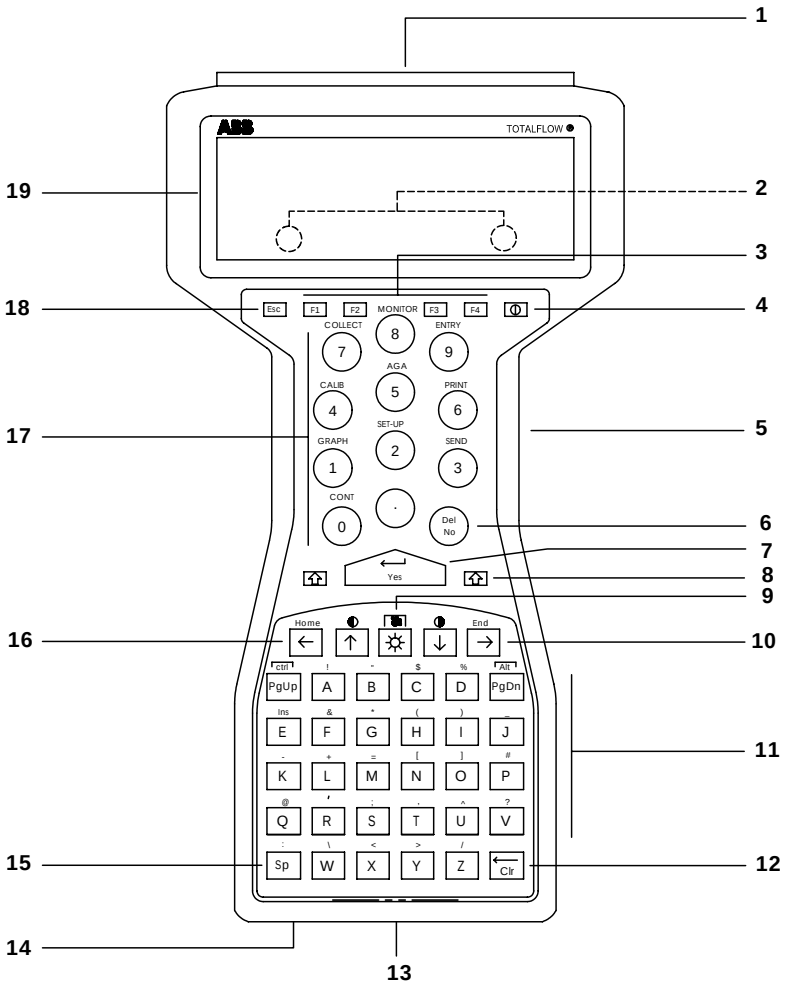



**Table 3-1. PCCU Components and Keypad**

| Key Ident. | PCCU Key | Description |
|---|---|---|
| 1. | 25 Pin “D”-TYPE CONNECTOR | This RS-232 serial port connector provides interface facility for connecting PCCU to TOTALFLOW interface cable. |
| 2. | COMMUNICATION and PCCU CHARGING CONTACTS | Charging contacts are located on backside of PCCU unit. They provide automatic connection to optional FS/2 Communication and Charging Rack. |

*Continued on next page*

**Table 3-1. PCCU Components and Keypad (Continued)**

| Key Ident. | PCCU Key | Description |
|---|---|---|
| 3. | FUNCTION Keys (6) | Pressing a required function key activates an application function. |
| 4. | POWER ⏻ | Pressing key turns battery power ON. Pressing key a second time turns power OFF. |
| 5. | BACKSTRAP | Connected to back of PCCU unit. Provides ease when carrying PCCU. |
| 6. | Del/No | To erase typing or an answer, press Del. In response to a question press No**.** |
| 7. | YES | In response to user typed data or an answer or a question. |
| 8. | SHIFT (⇑) | To type punctuation or other symbols, hold ⇑ key down. |
| 9. | PAW ✳ | When key is depressed it provides an extra shift key. This allows access to a wide range of special functions.<br>These functions are:<br>CONTINUE AGA<br>GRAPH PRINT<br>SET-UP COLLECT<br>SEND MONITOR<br>CALIB ENTRY |
| 10. | ARROW (↑ and ↓) | To use the function keys, hold down the “paw” key and press the desired function key. For example, if you want to collect you would hold “paw”+COLLECT. Arrow keys ↑ and ↓ move position of cursor. When used with SHIFT KEY ⇑ (7), arrow keys adjust LCD screen contrast. |

**Note**

When PCCU is first turned ON, PgUp key acts as Ctrl key and PgDn key acts as Alt key.

When PCCU is first issued to a user, application normally switches these keys to functions shown by their legends. For example, PgUp and PgDn.

| | | |
|---|---|---|
| 11. | TYPING (alpha keys) | When used with SHIFT (7) key, user can type alpha letters or symbols. |

*Continued on next page*

## PCCU Components and Keypad, Continued

| Key Ident. | PCCU Key | Description |
|---|---|---|
| 12. | Backspace/ Clr (←/Clr) | The **(←/**Clr**)** key erases user entered typing. |
| 13. | BATTERY CAP | Removing cap provides access to PCCU power source batteries. Removal of cap allows three (3) AA batteries to be removed or new batteries installed. |
| 14. | 5-WAY FISCHER CONNECTOR (PORT 3) | This is a circular serial logic level input port. Used to connect FS/2 AC Adapter, or Husky Oracle GT external disk drive, to PCCU. Disk drive is A or B. |
| 15. | Space (Sp) | Depressing this key enters a blank space between characters or words. |
| 16. | SHIFT (⇑) | To type punctuation or other symbols, hold ⇑ key down. |
| 17. | NUMERIC (0-9) | Depressing a 0-9 numeric key enters selected number. The SHIFT ⇑ (15) key has no effect on numeric keys. |
| 18. | ESCAPE (Esc) | To exit programs or return to a previous menu. |
| 19. | LCD Screen | Allows viewing of displayed or user entered data. Provides a window onto a full size external virtual monitor screen. LCD screen moves over virtual screen to keep cursor within user area of viewing.<br>Arrow keys ←,↑,→ and ↓ move Window. |

**If Keypad Locks Up**

If the PCCU locks up and does not respond to keypad entries, or cannot be turned off from PCCU keypad power key, the PCCU can be cold started. Hold down both PCCU ⇑ shift keys (located on either side of yes key) then press power key on-off until Husky reboots.

**NOTE**

If user continues to use PCCU with low battery power and does not replace them with new Alkaline or recharged NiCad batteries, the screen displays *Warning Batteries are Low*. The PCCU turns OFF automatically.

**CAUTION**


Although low power batteries can partially recover a portion of their lost power after being switched off, it is not recommended that PCCU be continually used. Continual use of PCCU with lower power NiCad batteries could totally exhaust their charged potential. This could lead to permanent damage to NiCad's.

## How to Adjust LCD Contrast

For most operating lighting conditions, the LCD screen will not need adjustment. If screen must be adjusted for maximum clarity and contrast, perform the following procedures.

**Procedure**

| Step | Procedure |
|---|---|
| 1. | Position PCCU at suitable working viewing angle. |
| 2. | Hold down PCCU ⇑ then press ↑ or ↓ arrow key. |
| 3. | When desired clarity and contract are achieved, release keys. |

## How to Adjust Backlight

To improve LCD screen viewing visibility under bad lighting conditions, turn back-lighting screen ON by performing the following procedures:

**Procedure**

| Step | Procedure |
|---|---|
| 1. | From PCCU keyboard, press the paw key and the “L” key. To turn back-lighting OFF, depress key sequence a second time. |

## Note

When backlighting is ON, an additional battery drain occurs. Backlighting should only be used when required.

## Battery Power Source and Installation

### Description

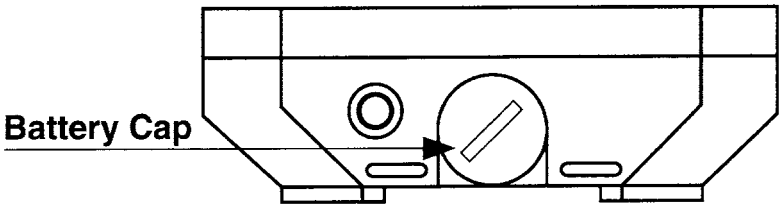
Power to operate PCCU is provided by three non-rechargeable A or AA size Alkaline or rechargeable Nickel Cadmium (NiCad) batteries.

### Caution

- It is NOT recommended that Zinc Carbon batteries be used as PCCU power source. Such batteries have short operational life and may leak. This can cause internal PCCU damage which would not be visible to user. Such damage could render the PCCU inoperable.
- Do not, under any conditions, install lithium batteries in PCCU.
- Do not mix batteries of different types, sizes or state of charge.

### Location of Batteries

Alkaline and NiCad batteries are located in the bottom of the PCCU. To gain access to batteries, remove the BATTERY CAP.




### Battery Operating Life

Operating lifetime of non-chargeable Alkaline batteries is up to 30 hours before having to replace batteries. Chargeable lifetime of NiCad batteries is 15 hours before recharging.

*Continued on next page*

### Recharging of *NiCad* Batteries

NiCad batteries can be recharged by an AC adapter or Husky FS/2 Communications and Charging Rack. Charging of batteries is under software control.

### Data Retention

Using NiCad chargeable batteries under normal operating conditions, data is retained for at least two (2) weeks when all other PCCU power is removed.

### Using *Alkaline* Batteries

Alkaline batteries can be used to power the PCCU. If such batteries are used as PCCU power source, operator must setup PCCU by performing the following procedures.

**Procedures**

| Step | Procedure |
|---|---|
| 1. | Use the HOT key power option to perform the following functions by pressing the Paw key and H key simultaneously. |
| 2. | Enable Advance Power Management. |
| 3. | If fresh Alkaline batteries are used, set remaining power to 100%. |
| 4. | Set Alkaline battery low power warning onset to 5%. |
| 5. | Set Alkaline battery chargeable to NO. |
| 6. | Set Alkaline battery capacity to 2250 mAh, or to value recommended by battery manufacturer. |

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### Using NiCad Batteries

The PCCU can be powered using rechargeable NiCad batteries. If such batteries are used as power source, operator must setup PCCU by performing the following procedures.

**Procedures**

| Step | Procedure |
|---|---|
| 1. | Before inserting NiCad batteries into PCCU, be certain they are fully charged. |
| 2. | Use HOT key power option to perform the following functions. Refer to Husky FS/2 System Developers Guide, Part 2. |
| 3. | Enable Advance Power Management. |
| 4. | Set remaining NiCad power to 100%. |
| 5. | Set onset of low NiCad power warning to 5%. |
| 6. | Set NiCad battery authorization to 3. |
| 7. | Set NiCad battery chargeable to YES. |
| 8. | Set NiCad battery capacity to 1200 mAh or to value recommended by battery manufacturer. |
| 9. | Press ESC and return to top menu. |

*Continued on next page*

### Installing and Removing Batteries

To install or remove Alkaline or NiCad batteries in PCCU, perform the following procedures.

**Procedures**

| Step | Procedure |
|---|---|
| 1. | Before removing Alkaline or NiCad batteries, PCCU MUST BE first turned OFF. Press function key O to turn power OFF. |
| 2. | Using a coin, turn the battery cap counterclockwise (CCW) to undo cap. |

**Note**

When removing battery cap, internal spring which securely holds batteries in PCCU battery compartment, may cause battery cap to spring outward.

| | |
|---|---|
| 3. | Insert three A or AA non-chargeable Alkaline or chargeable NiCad batteries into battery compartment. |

**Note**

Insert each battery into battery compartment, with their positive (+) end first.

| | |
|---|---|
| 4. | Using finger pressure on battery cap, press it into battery compartment and turn clockwise (CW) until thread catches. |
| 5. | Using coin, securely tighten battery cap. |

### Start-up After Installing Batteries

After Alkaline or NiCad batteries have been installed, turn PCCU ON by firmly pressing function key O.

## Low Battery Indications and Warnings

### Description

The following information is to acquaint you with the PCCU's visual and audio message used to indicate low PCCU battery status and warnings.

### Important

Before you use the PCCU, the PCCU batteries should be checked to be certain NiCads are fully charged to Alkaline manufacturer's voltage rating.

If Alkaline or NiCad battery power is low, PCCU issues a user warning. Low battery voltage can cause loss of data and programs, therefore, it is recommended that PCCU be switched OFF as soon as possible to prevent this from occurring.

If Alkaline batteries are the power source, they should be replaced. If NiCad batteries are the power source, they should be recharged or replaced with precharged NiCad's. Discharged NiCad's should be recharged.

### Indications and Warnings

- When PCCU is turned ON**.** Warning is repeated every five (5) seconds.
- If consecutive warnings are ignored, PCCU switches OFF automatically**.**

  Text Mode**:** For low battery power, top line on PCCU LCD screen displays *Warning Batteries are Low* in inverse video. PCCU beeps twice and original text is restored until next warning. Following power restoration, LCD screen is restored to pre-warning state.

  Graphics Mode*:* For low battery power, top line on LCD screen displays *Warning Batteries are Low* in inverse video**.** This message remains displayed on screen between battery warnings. PCCU also beeps twice.

  Warning message destructively overwrites top line on screen. Screen contents are lost.

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# Chapter 4.0
# FCU Operation

## Overview

### Introduction

This chapter describes how to get a newly installed FCU system up and running using the Portable Calibration/Collection Unit (PCCU). The chapter tells you how to select each of the PCCU operating modes and gives detailed instructions on the use of each mode.

### 6625L PCCU Emulation Software Users

If you are using a PC to run the PCCU software refer to Totalflow 6625L Emulation Software User's Manual in lieu of this Chapter.

### Before You Begin

Before you begin you should complete the task outlined in Chapter 2.0, Installation. Reference Chapter 3.0.

### Chapter Highlights

In this chapter you will learn How to:.

# Top Operational Menu

## Description

The PCCU Top Level Menu appears after you have properly connected to the FCU and the PCCU is turned on. From the Top Level menu you proceed through a series of menus and prompts related to your operational needs.

## Menu Chain

When the PCCU Top Level Menu is displayed, five user selectable modes are displayed on PCCU screen.

```
PCCU TOP LEVEL MENU -1
1) Connected to TOTALFLOW
2) Set-Up PCCU
3) Print or Clear FCU data
4) Send FCU data to CCU
5) Graph FCU data

CONTINUE for more
```

*Continued on next page*

## Top Operational Menu, Continued

**Learning Hint** Use the Chart below to learn about each of the operational modes. To access second screen when a 'CONTINUE for more' prompt is displayed on any screen simply press C, or while holding down the paw key press CONT.

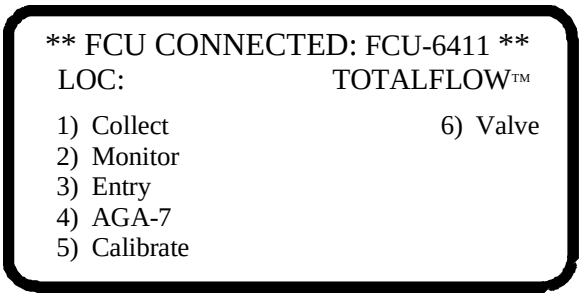
***Important*** Before any function can be entered from the Top Level menu you must enter a user security code. Security codes prevent unauthorized user access to data; see page 4-17 for information on setting security codes.

| IF you want to learn about... | THEN enter... | And see page... |
|---|---|---|
| Connect to Totalflow | 1 | 4-4 |
| Set Up PCCU | 2 | 4-77 |
| Print or Clear FCU Data | 3 | 4-87 |
| Send FCU Data to CCU | 4 | 4-104 |
| Graph FCU Data | 5 | 4-110 |
| Set Up ID List | 6 | 4-116 |

## Connected to Totalflow Mode

## Introduction

The Connected to Totalflow mode is accessed from the PCCU Top Level Menu by selecting item 1. This mode allows you access to the FCU data and calibration screens. After you selected item 1 from the main menu, access to the Connected to Totalflow main menu is prohibited unless you enter the correct security code from the prompt, or the security switch is set to OFF; see Programming Security Code, page 4-17.




## Preview

This section is divided into 5 parts as it relates to the FCU Connected Menu.

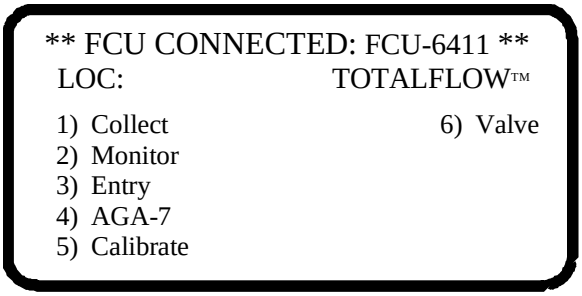
| Topic | See Page |
|---|---|
| Collect Data from the FCU | 4-5 |
| Monitor Operational Data | 4-7 |
| Enter or Change Operational Limits | 4-10 |
| Select or Enter AGA-7 Data | 4-41 |
| Calibrate AP, Set-Up Temperature Measurement, & Set 'K' factor | 4-55 |

# COLLECT Mode

## Overview

The Collect mode enables you to collect FCU stored data, verify collected data and display and record date and time data was collected. The PCCU can collect one (1) to five (5) meter weeks of data. Collection size is defined in setup PCCU MODE; see Set Up PCCU, Collection Size page 4-81. Number of meters which can be collected depends on Model purchased.

This mode is selected from **FCU CONNECTED: FCU-6411** menu.




### Procedure

| Step | Procedure |
|---|---|
| 1. | Select **1) Collect** from ****FCU CONNECTED: FCU-6411**** menu or by simultaneously pressing the paw and COLLECT keys. |

*Continued on next page*

**Procedure (Continued)**

| Step | Procedure |
|---|---|
| 2. | If the PCCU has collected data from the FCU it will display the last data collected.<br><br>Collection Size x Week(s) Room for x New FCUs<br><br>Checking FCU ID: FCU-6411<br>Last Collected on MMDDYY HH:MM.SS<br>Ready to Collect<br><br>Depress CONTINUE to proceed<br><br>Last data collection time period indicated by Last Collected on MM/DD/YY HH:MM:SS field. If data is collected again, new data replaces previously collected data.<br><br>Designator X in “Room For new FCU’s” field varies according to amount of PCCU memory and selected collection size. |
| 3. | To collect new FCU data, press PCCU **CONTINUE (C)** key. A “collecting FCU data” message will appear for several seconds. |

# MONITOR Mode

## Description

The Monitor mode enables you to display real-time operational FCU data on the PCCU display. This mode is selected from the **FCU CONNECTED: FCU-6411** menu.

```
** FCU CONNECTED: FCU-6411 **
 LOC:                    TOTALFLOW™

 1) Collect              6) Valve
 2) Monitor
 3) Entry
 4) AGA-7
 5) Calibrate
```

## Displayed Items

The PCCU can be programmed to display (see Entry Mode 3, page 129) the Items the FCU can display plus two additional items. However, only one to four of these items can be monitored at one time, and the PCCU cycles through the selected items once every 5 seconds. Numbers that exceed one million units, are displayed in scientific notation. For example, a unit of 5,070,000 would be displayed as 5.07 E06.

| Display | Description |
|---|---|
| DATE/TIME<br>MM/DD/YY HH:MM:SS | Current Date and Time<br>24 hour clock |
| YEST VOL<br>NNNN.N MCF | Yesterday's Volume<br>Programmable SCFM or MCF or MMCF |
| FLOWRATE<br>NNNNNN.N SCF/HR | Current Flow Rate<br>Programmable SCF or MCF or MMCF |
| ACCUM VOL<br>NNNNNN.NN MCF | Total Accumulated Volume<br>Programmable SCF or MCF or MMCF |
| BATTERY<br>NN.N VOLTS | Battery Voltage<br>Volts |
| PERIOD VOL<br>NNNN.N SCF | Previous Period Volume<br>Last volume calculation period volume |

*Continued on next page*

**Displayed Items (Continued)**

| Display | Function |
|---|---|
| PRESSURE<br>NNN.N PSIA | Static Pressure Absolute<br>PSIA |
| FLOW TEMP<br>NN.N DEG. F | Flowing Temperature<br>°F |

## Monitor Procedures

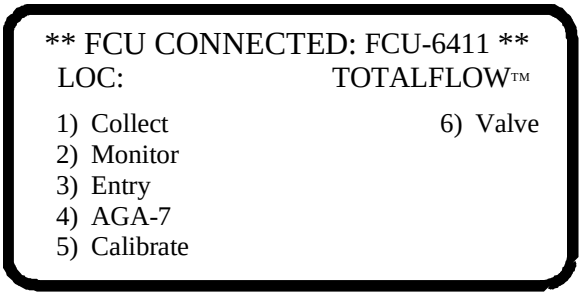
| Step | Procedure |
|---|---|
| 1. | Select **2) Monitor** from ****FCU CONNECTED: FCU-6411**** menu or simultaneously pressing PCCU paw and MONITOR keys<br><br>>TIME BATT AP TEMP T_VOL T_UVOL<br>D_CVOL D_UVOL H_CVOL H_UVOL C_CRATE<br>C_URATE C_UVOL LO_UVOL HI_UVOL CHRG<br><br>Use arrow keys to MOVE and CHANGE<br>Depress CONTINUE to proceed |
| 2. | Using PCCU keyboard left ← and right → arrow keys, move to item(s) needing selection. Using up ↑ or down ↓ arrow keys, change Yes and No status of selected item. |
| 3. | When selected item(s) are ready for display on PCCU screen, press PCCU keyboard **CONTINUE (C)** key. The items selected will be displayed. |

**Note** If more than four (4) items are selected, an error message is displayed on bottom of PCCU screen. You must then press PCCU keyboard **CONTINUE (C)** key. The Monitor menu is displayed to allow you to delete items.

# ENTRY Mode

## Description

The Entry mode enables user to setup FCU operating and identification parameters. This mode is selected from ****FCU CONNECTED: FCU-6411**** menu.




## Preview

Each of the following operating and identification parameters are user selectable and are available on three Entry Mode menus; MENU-1, MENU-2 and MENU-3 menu screens. Function of each parameter is discussed in this section.

| Preview Topic | Menu Number | See Page |
|---|---|---|
| Setting FCU Calendar/Clock | 1 | 4-12 |
| Setting FCU Identification | 1 | 4-13 |
| Setting FCU Location Designator | 1 | 4-14 |
| Entering BTU/SCF | 1 | 4-15 |
| Setting Flow Period | 1 | 4-16 |
| Setting Security Code in FCU | 1 | 4-17 |
| Contract Day Setup | 2 | 4-19 |
| Entering Operational Limits | 2 | 4-21 |

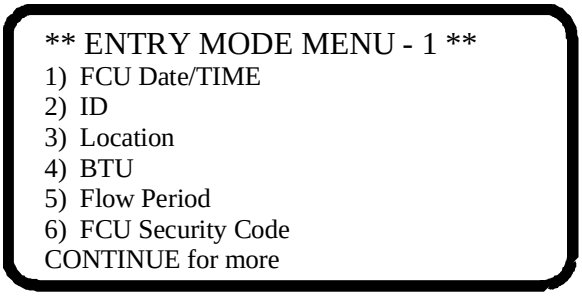
*Continued on next page*

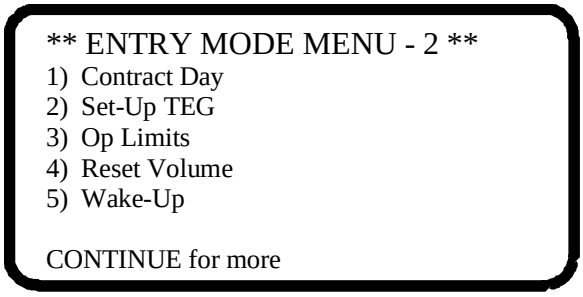
## **ENTRY Mode,** Continued

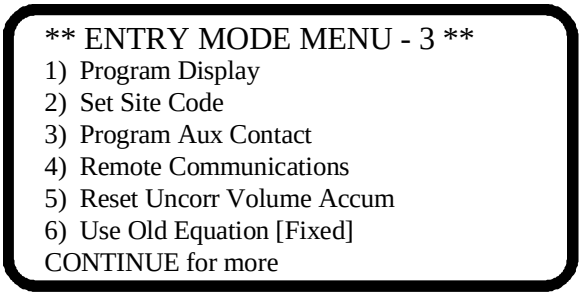
**Preview (Continued)**

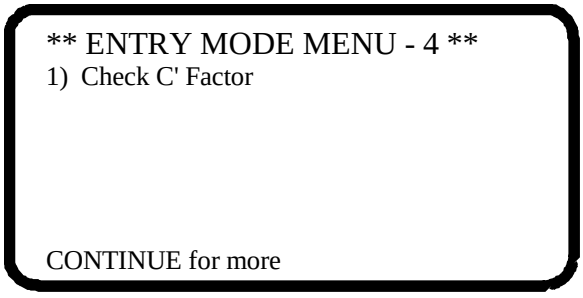
| Preview Topic | Menu Number | See Page |
|---|---|---|
| Resetting Volume Accumulator | 2 | 4-23 |
| Bringing FCU Up from SLEEP Mode | 2 | 4-25 |
| Setting FCU Display | 3 | 4-27 |
| Setting Site Code | 3 | 4-30 |
| Auxiliary Contact Setup | 3 | 4-32 |
| Set-up Remote Communications | 3 | 4-36 |
| Resetting Uncorrected Volume Accumulator | 3 | 4-38 |
| Selecting Characteristic File Type | 3 | 4-39 |

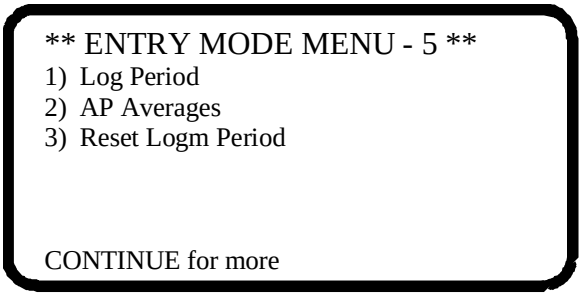
**Learning Hint** To move from Entry menus 1, 2 and 3 simply enter letter **(C),** or simultaneously push the **paw** and **CONT** keys. Continually holding the keys will cycle the menus.



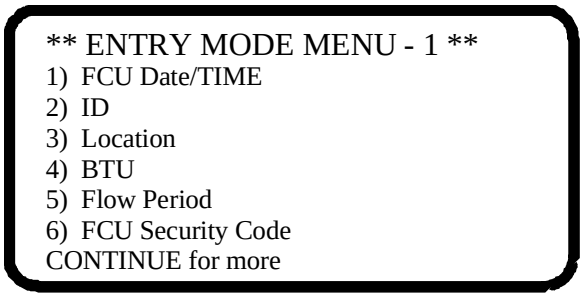



**Description** The FCU date and time must be set with the PCCU date and time. See Set Up PCCU for setting PCCU Time.

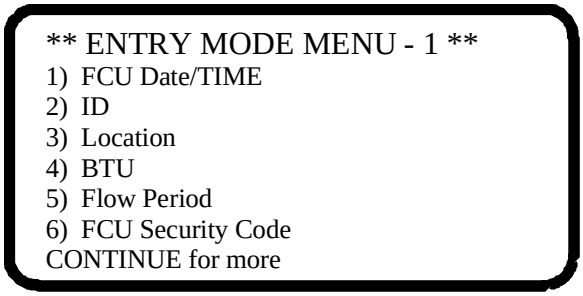
| Step | Procedure |
|---|---|
| 1. | To display FCU internal clock current date and time, select **1) FCU Date/Time** from *****ENTRY MODE MENU-1***** menu.<br><br>** ENTRY MODE MENU - 1 **<br>1) FCU Date/TIME<br>2) ID<br>3) Location<br>4) BTU<br>5) Flow Period<br>6) FCU Security Code<br>CONTINUE for more |
| 2. | When FCU Date/Time is selected, the display will show the FCU and PCCU date and time to set FCU with PCCU, enter YES. Date and time are automatically set at top of next minute.<br><br>FCU Date/Time is MM.DD.YY HH:MM.SS<br><br>PCCU Date/Time is MM.DD.YY HH:MM.SS<br><br>Set FCU with PCCU date/Time? |

| Step | Procedure |
|---|---|
| 1. | To display current FCU identification select **2) ID** from *****ENTRY MODE MENU-1***** menu.<br>  |
| 2. | When **2) ID** is selected, the following screen is displayed. Press No to change or enter a new ID or Y to accept.<br>  |
| 3. | For a new ID enter up to 10 alphanumeric characters than press Yes. PCCU repeats verification prompt allowing you to check new ID. |
| 4. | If new ID is approved, press Yes from PCCU keypad. If not approved, enter No and enter another alphanumeric code. |

**Note** The identifier code uniquely identifies one FCU from that of others connected in the system.

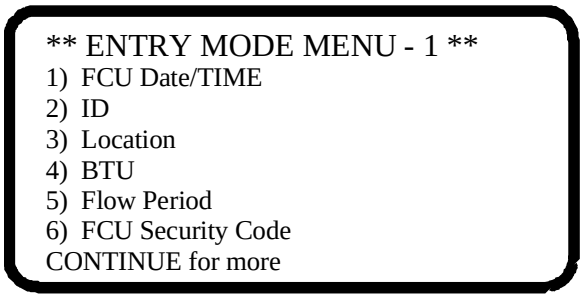
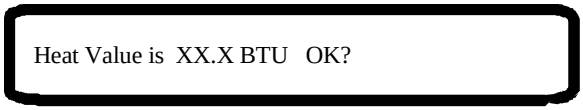
## Description

An FCU can hold up to 24 alphanumeric characters to describe its location. This description is called a location description. An example would be a lease name.

| Step | Procedure |
|---|---|
| 1. | To display current FCU location, select **3) Location** from *****ENTRY MODE MENU-1***** menu.<br>  |
| 2. | When **3) Location** is selected, the following screen is displayed. Press No to change or enter a new Location or Yes to accept.<br>  |
| 3. | Enter new FCU location identifier and press Yes key. PCCU repeats verification prompt allowing user to check new descriptor. |
| 4. | If new location identifier is correct, press Yes from PCCU keypad. If not, enter No and enter new identifier. |

## Description

The FCU gives you the option to display the BTU heat value or enter a new value. The BTU value is stored in FCU characteristics record with old and new values date/time stamped in events file.

| Step | Procedure |
|---|---|
| 1. | To display current FCU BTU heat value, select **4) BTU** from *****ENTRY MODE MENU-1***** menu.<br>  |
| 2. | When **4) BTU** is selected, the following screen is displayed. Press No to change or enter a new value or Yes to accept.<br>  |
| 3. | Enter desired BTU heat value and press Yes from PCCU keypad. |
| 4. | PCCU repeats BTU Heat Value Verification Prompt so user can verify newly entered heat value |
| 5. | If newly entered heat value is correct, press Yes from PCCU keypad. If not correct, enter No and enter another BTU heat value. |

## Note

If BTU heat value is not used in calculations, its value is logged in characteristics record.

## Description

Flow Period is a selectable time period used to establish whether flow or no flow conditions exist. If no pulses are received during a flow period, it is considered a period of no flow. Pressure and temperature data accumulated during that period are not included in the hourly averages.

| Step | Procedure |
|---|---|
| 1. | To display the current Flow Period, select **5) Flow Period** from *****ENTRY MODE MENU-1***** menu.<br><br>** ENTRY MODE MENU - 1 **<br>1) FCU Date/TIME<br>2) ID<br>3) Location<br>4) BTU<br>5) Flow Period<br>6) FCU Security Code<br>CONTINUE for more |
| 2. | When **5) Flow Period** is selected, the following screen is displayed.<br><br>Flow Period Selected<br><br>Flow Period = 60 seconds<br><br>Use UP/DOWN arrows to change<br>Depress CONTINUE when finished |
| 3. | The UP/DOWN arrows will provide the following flow period selections:<br><br>a. 1, 2, 5, 10, 15, 20, 30 & 60 seconds<br>b. each increment after 60 seconds will be 1 minute up to 1 hour |
| 4. | Select the desired flow period and depress the (C) or depress the paw key and the CONT key to transfer the new flow period to the flow computer. |

## Description

To protect unauthorized access to the FCU operating parameter screens a user selected security code must be entered after selecting a TOP Level Menu mode. In addition, all devices that communicate with the FCU must also have a matching security code to gain access.

## Code Levels

The FCU software supports two code levels of access. Both levels require a 4-digit entry. A Level 1 access code allows only reading of FCU data. The Level 2 access code allows both data reading from and data entry into the FCU.

## How to Set Code

The PCCU is used to program the FCU security code. In order to program a code into the FCU the Security Switch S1 on the digital board must be OFF.

## CAUTION


If the Security Switch S1 located on the digital board is in the OFF position, at any time, no security code has to be entered to access the operating parameters.

## Note

During remote communications the security code must match regardless of position of security code switch (S1).

### Procedure

| Step | Procedure |
|---|---|
| 1. | Open FCU access door and set digital board Security Switch (S1) to OFF. |
| 2. | Connect PCCU to FCU and turn-on PCCU. |
| 3. | From Top Level Menu select item **1) Connect to Totalflow**. The ***FCU Connected*** menu will appear.<br>** FCU CONNECTED: FCU-6411 **<br>LOC: TOTALFLOW™<br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-7<br>5) Calibrate |

*Continued on next page*

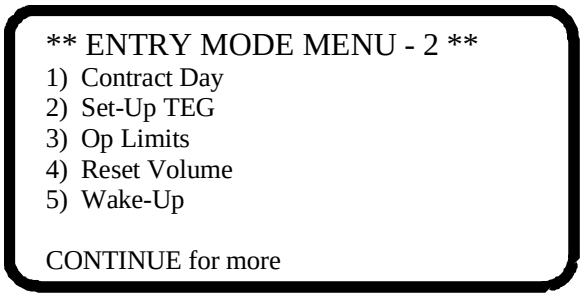
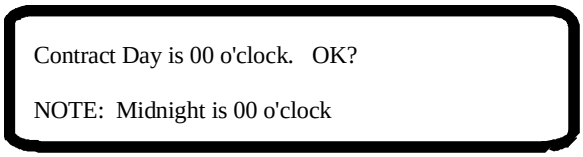
## Programming FCU Security Code, Continued

**Procedure (Continued)**

| Step | Procedure |
|---|---|
| 4. | Select item **3) Entry** from **Top Level Menu;** the Level 1 security screen will appear.<br><br>** ENTRY MODE MENU - 1 **<br>1) FCU Date/Time<br>2) ID<br>3) Location<br>4) BTU<br>5) Flow Period<br>6) FCU Security Code<br>CONTINUE for more |
| 5. | Enter **6** from Entry Mode Menu-1 to set the FCU Security Code. |
| 6. | Enter a 4-digit security code. The PCCU will prompt you to either accept the new code by entering a Y (yes) or let you enter an N (no) to change it. |
| 7. | If you enter a Y the next display will prompt you to enter a Level 2 code. |
| 8. | Repeat step 6. |
| 9. | Place Security Switch S1 to On, and secure FCU lid shut. |
| 10. | Return PCCU to Top Level Menu by continuing to press Esc key until the menu appears. Turn PCCU off. |
| 11. | Disconnect PCCU from FCU. |

## Description

You can program the FCU when to begin the hourly calculations for a contract day. When a FCU first powers up the contract day is preset to begin at midnight or (00).

| Step | Procedure |
|---|---|
| 1. | To display Contract Day, select **1) Contract Day** from *****ENTRY MODE MENU-2***** menu.<br>  |
| 2. | When **1) Contract Day** is selected, the following screen is displayed. Press No to change or enter a value or Yes to accept.<br>  |
| 3. | Enter first hour (24-hour clock) of contract day then press PCCU keypad Yes key. For example, if contract day begins at 7:00 AM, enter: 07. |

## Note

Any value greater than 23, FCU forces value to 00 (midnight).

*Continued on next page*

| Step | Procedure |
|---|---|
| 4. | PCCU repeats Contract Day prompts allowing user to check new contract day entry. |
| 5. | If new contract day is approved, press Yes from PCCU keypad. If not approved, enter No and enter another contract day. |

**Note** Following a Yes response, user is returned to *****ENTRY MODE MENU-2***** menu.

## Description

You can program in the FCU operational limits for the absolute pressure. These limits are maintained in the Characteristic File. Other limits can be set using the commands listed in Technical Bulletin #44.

| Step | Procedure |
|---|---|
| 1. | To set FCU absolute and differential pressure (AP and DP) operating limit values, select **3) Op-Limits** from *****ENTRY MODE MENU-2***** menu.<br><br>** ENTRY MODE MENU - 2 **<br>1) Contract Day<br>2) Set-Up TEG<br>3) Op Limits<br>4) Reset Volume<br>5) Wake-Up<br><br>CONTINUE for more |

## Note

Any violation of the AP operating limits will cause not only an alarm on the LCD, but an alarm will be recorded in the Historical File. The Alarm will appear in the hour that violation occurred.

Each limit is checked once per second. Even if the operational limit may be exceeded, the FCU continues to measure actual AP, and flow.

Also entered in the Historical File is the percent of time that each AP limit was violated during the current day.

*Continued on next page*

| Step | Procedure |
|---|---|
| 2. | Select **AP Lo Limit**. The following display is shown. The displayed value is current AP low operating pressure (psia).<br><br>AP Lo Limit is 0.00 psia. OK? |
| 3. | From PCCU keypad, enter No. The display will request a new AP Lo Limit be entered. After entering desired AP Lo Limit, enter Yes. The *****OPERATIONAL LIMITS MENU***** menu is displayed. |
| | Other AP limits can be changed in same manner as AP Lo Limit.<br><br>AP and DP Limit default values are as follows:<br><br>• **AP Lo Limit** (psia): Defaults to 0<br>• **AP Hi Limit** (psia): Defaults to 2500 |

**Note** To return to ***ENTRY MODE MENU-2***, press **Esc**. The PCCU automatically returns to this menu after AP Hi Limit has been entered.

# Reset Volume

## Entry Mode Menu-2

**Description**

When you Reset the volume accumulator the FCU will:

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

**Important**

Since the FCU volume calculations are made each vol calc period, any changes you make during the period would affect the volume calculations (such as changing the orifice plate size) and be introduced into the calculations. To avoid introduced errors, it is recommended that Reset Volume command be used. This command forces the FCU to perform volume calculations for the elapsed time since a previous volume calculation was made. A new partial period volume is added to the volume accumulator, which is logged as an event before it is reset to zero (0).

| Step | Procedure |
|---|---|
| 1. | To reset FCU volume accumulator to complete the following operational functions, select **4) Reset Volume** from *****ENTRY MODE MENU-2***** menu.<br><br>** ENTRY MODE MENU - 2 **<br>1) Contract Day<br>2) Set-Up TEG<br>3) Op Limits<br>4) Reset Volume<br>5) Wake-Up<br><br>CONTINUE for more |

*Continued on next page*

| Step | Procedure |
|---|---|
| 2. | When **Reset Volume** is selected, the following fail safe prompt screen is displayed. Since the reset volume command sets FCU total volume to zero, this fail safe user prompt is issued to notify you against making an error.<br><br>RESET VOL Selected<br><br>Are you sure? Last Chance |
| 3. | If volume accumulator command is correct, press Yes from PCCU key-pad. The following reset volume screen is displayed.<br><br>RESET VOL Selected<br><br>Are you sure? Last Chance<br><br>RESET Vol Complete<br><br>C to Proceed |

## Description

The SLEEP mode is a safety feature which maintains the flow records but discontinues flow measurement calculations. When the FCU is in the SLEEP mode the word SLEEP is displayed on the FCU. If FCU battery voltage falls below 11VDC, FCU enters SLEEP mode. The FCU can be restarted with PCCU WAKE-UP command. If battery voltage is still below 11VDC, FCU returns to SLEEP mode after approximately 2 minutes. If battery voltage is above 11VDC, FCU remains awake.

| Step | Procedure |
|---|---|
| 1. | To allow FCU to start measuring inputs, calc. and storing flow records, select **5**) **Wake -Up** from *****ENTRY MODE MENU-2***** menu.<br><br>The FCU performs the following functions:<br><br>• Store time, date and present calc periods accumulations in historical record,<br>• Zero present calc periods accumulations and<br>• End current daily record and start new daily record.<br><br>** ENTRY MODE MENU - 2 **<br>1) Contract Day<br>2) Set-Up TEG<br>3) Op Limits<br>4) Reset Volume<br>5) Wake-Up<br><br>CONTINUE for more |

*Continued on next page*

| Step | Procedure |
|---|---|
| 2. | When Wake-Up is selected, the following screen is displayed:<br><br>WAKE-UP Selected<br><br>WAKE-UP Complete<br><br>Depress CONTINUE to Proceed |
| 3. | Pressing PCCU keypad **C** key displays *****ENTRY MODE MENU-3***** menu and user selectable functions.<br><br>To return to ****FCU CONNECTED: FCU-6610 TOTALFLOW ™** menu, press PCCU keypad **Esc**. |

## Description

The FCU scrolls the parameters shown below continuously on the FCU LCD. The factory set default for the display cycle time is 5 second for each parameter. The previous day's volume defaults to a display cycle time of 0 seconds. The PCCU gives you the ability to change this default to zero or any value from 5 to 255 seconds. If you specify zero for an item, the FCU will stop displaying the item. If you specify a non-zero value less than 5 seconds, the FCU sets the cycle time for that item to 5 seconds. You are also able to change the engineering units on the volume and rate entries.

**FCU Displayed Items**

| Display | Description |
|---|---|
| DATE/TIME<br>MM/DD/YY HH:MM:SS | Current Date and Time<br>24 hour clock |
| BATTERY<br>NN.N VOLTS | Battery Voltage<br>Volts |
| PRESSURE<br>NNN.N PSIA | Static Pressure Absolute<br>PSIA |
| FLOW TEMP<br>NN.N DEG. F | Flowing Temperature<br>°F |
| | |
| CORRECTED VOL<br>NNNN.N MCF | Corrected TOTAL Volume<br>Corrected Volume accumulated since last RESET or Volume Accumulation Rollover |
| UNCORRECTED VOL<br>NNNN.N SCF | UnCorrected TOTAL Volume<br>UnCorrected Volume accumulated since last RESET or Volume Accumulation Rollover |

*Continued on next page*

**Setting FCU Display Cycle Time Procedures**

| Step | Procedure |
|---|---|
| 1. | To display Program Displayed cycle times, select **1) Program Display** from *****ENTRY MODE MENU-3***** menu**.**<br><br>** ENTRY MODE MENU - 3 **<br>1) Program Display<br>2) Set Site Code<br>3) Program Aux Contact<br>4) Remote Communications<br>5) Reset Volume Accum<br>6) Use Old Equation [Fixed]<br>CONTINUE for more |
| 2. | When **Program Display** is selected, the following Program FCU Display Menu is displayed:<br><br>** Program FCU Display MENU **<br>1) Select Display Times<br>2) Rate Units [Vol Units/hr] [1]<br>3) Corrected Vol Units [scf] [2]<br>4) Uncorrected Vol Units [scf] [3]<br><br>CONTINUE for more<br><br>NOTES: Selections can be made for the preceding display units as follows;<br><br>1. Rate Units - Hourly or Daily |
| 3. | Select **1) Select Display Times** from **Program FCU Display Menu.** The PCCU display shows following cycle time verification prompt screen for first FCU display.<br><br>CURRENT DISPLAY DURATION<br>for TIME is 5 seconds. OK? |

*Continued on next page*

**Setting FCU Display Cycle Time Procedures (Continued)**

| Step | Procedure |
|---|---|
| 4. | If cycle time verification is correct, press PCCU keypad Yes key. Cycle time for next display item is displayed.<br><br>To change displayed item cycle time, press PCCU keypad No key. The display screen asks that a new cycle time be entered. |
| 5. | Enter new cycle time. PCCU repeats verification prompt allowing user to check new entry. |

**Important**

To select a displayed item, page down the list by pressing PCCU keypad Yes key to each prompt until reaching item to be changed.

When bottom of displayed item list is reached, PCCU returns to Program FCU Display Menu.

| | |
|---|---|
| 6. | Select **2) RATE units [mcf/hr]** from **Program FCU Display Menu.** Rate units toggle between scf/hr, mmcf/day or mcf/day. Toggling between rate units is dependent on selected **VOLUME units [mcf].** |
| 7. | Select **3) CORRECTED VOLUME units [scf]** from **Program FCU Display Menu.** Volume units toggle between Corrected Vol Units - scf (standard cubic feet), dcf (tens standard cubic feet - cf*10), cscf (hundred standard cubic feet - cf*100), mscf ( thousand standard cubic feet - cf*1000), dmscf (ten thousand standard cubic feet - mcf*10), cmscf (hundred thousand standard cubic feet - mcf*100), mmscf (million standard cubic feet - mcf*1000).<br><br>To change units back to their original state, select "**2**" **CORRECTED VOLUME units [scf]** again. |
| 8. | Select **3) UNCORRECTED VOLUME units [acf]** from **Program FCU Display Menu.** Volume units toggle between UnCorrected Vol Units - acf (actual cubic feet), dcf (tens cubic feet), cscf (hundreds cubic feet), mscf (thousands cubic feet), dmscf (ten thousands cubic feet), cmscf (hundred thousands cubic feet), mmscf (million cubic feet).<br><br>To change units back to their original state, select "**2**" **UNCORRECTED VOLUME units [acf]** again. |

| | |
|---|---|
| 8. | To return to **ENTRY MODE MENU-3** menu**,** press PCCU keypad **Esc.** |

## Description

The FCU has a feature called a site code. The site code is a number from one to six digits which you can enter into the FCU that can represent predetermined information or notes about the site. It can include a decimal point, and the decimal point can be inserted anywhere among the digits.

The information or notes can represent any sequence of events that may have occurred at the meter site. For example, each site code number could be defined by the field people and by the office people to represent different site conditions or equipment failures. These site codes are intended to provide communication similar to writing notes on the back of circular charts.

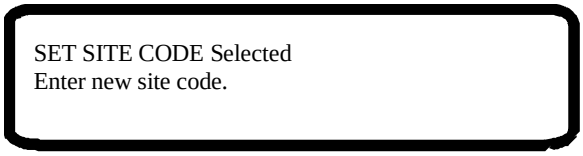
Date and time tagged Site Codes are recorded in the FCU EVENT FILE for future reference.

### Entering Site Code Procedures

| Step | Procedure |
|---|---|
| 1. | To display Set Site Code, select **2) Set Site Code** from *****ENTRY MODE MENU-3***** menu**.**<br><br>** ENTRY MODE MENU - 3 **<br>1) Program Display<br>2) Set Site Code<br>3) Program Aux Contact<br>4) Remote Communications<br>5) Reset Volume Accum<br>6) Use Old Equation [Fixed]<br>CONTINUE for more |

*Continued on next page*

**Entering Site Code Procedures (Continued)**

| Step | Procedure |
|---|---|
| 2. | Enter site code, one (1) to six (6) digits with or without decimal, then press Yes key.<br>  <br> |
| 3. | PCCU display's the entered site code and asks for verification. |
| 4. | From PCCU keypad, enter Yes if correct. Site code will be sent to FCU. If not correct, enter No**.** The message **Site code NOT sent to FCU** is displayed and *****ENTRY MODE MENU-3***** menu is displayed. |

## Additional Site Codes

Additional site codes can be entered if needed. The FCU can store up to 100 events in the FCU EVENT FILE. The last 100 events will be printed out at the end of the CHARACTERISTIC FILE report on the PCCU printout when it is transferred from the PCCU to a printer or screen.

Three predetermined site codes are recorded in the FCU EVENT FILE whenever their associated events occur. These are -3.0000 for a collection of the FCU data with a PCCU, -2.0000 for an AP LOW.

## Description

The FCU provides one remote input sense line and two 12 VDC digital outputs. The 12 volt output is referred to as the DO1 and DO2 Contacts. Refer to Technical Bulletin for additional items that can be selected as event triggers for DO1 and DO2.

## Definitions

The following definitions describe the functions of each of the I/O's:

***Remote Sense*** Contact closure on the line causes an alarm in the Flow File Report during the hour which it occurred.

***12 Volt Digital Output*** Can be set to trip a sampler on a volume setpoint, or provide 12 volts to an auxiliary device based on alarm conditions.

***Rating***

- 12 Volts Typical
- 2 Digital Outputs (open drain FET, can sink 100 mA)
- Time on with auto-reset enabled is approximately 5 seconds.

***Digital Output Volume*** A volume accumulator used in conjunction with the digital output control logic. (This is not the volume accumulator seen on the FCU display or in the FCU characteristic file.) It is a separate variable that is updated each minute and is based on last calc periods C' and last minute's extension.

***Digital Output Volume Set Point*** Value in MCF against which the Digital Output Volume may be compared for deciding whether to activate the output or not. The digital output volume set point is entered from the PCCU. Any time the set point is entered the FCU automatically resets the Digital Output Volume accumulator to zero and resets the digital output.

The set point is entered in MCF.

## Activating Digital Output

Connections for the D/O's are made on the FCU digital board; refer to overlay on battery plate for terminal location. After **Program Aux Contact** has been selected from *****Entry Mode Menu-3***** and 12 volt digital output has been setup**,** the following two methods can be used to activate 12 volt digital output auxiliary contact output.

- Operating Conditions method
- Calculated Volume method

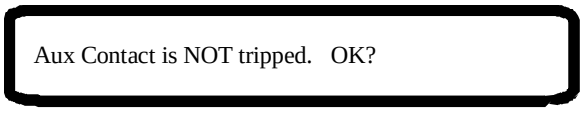
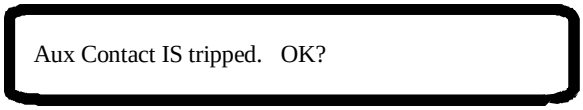
They are each described in the following Sections.

*Continued on next page*

### Setting Up Digital Output Procedures

| Step | Procedures |
|---|---|
| 1. | To display program auxiliary contact setup parameters, select **3) Program Aux Contact** from *****ENTRY MODE MENU-3***** menu.<br><br>** ENTRY MODE MENU - 3 **<br>1) Program Display<br>2) Set Site Code<br>3) Program Aux Contact<br>4) Remote Communications<br>5) Reset Volume Accum<br>6) Use Old Equation [Fixed]<br>CONTINUE for more |
| 2. | When **Program Aux Contact** is selected, the following user prompt is displayed.<br><br>>REMOTE SENSE LO CHG LO UVOL HI UVOL<br>LO AP HI AP AUTO RESET VOLUME S.P.<br><br>Use arrow keys to MOVE and CHANGE<br>Depress CONTINUE to proceed |

### Operating Condition Procedures

| Step | Procedures |
|---|---|
| 1. | Select one or more of Digital Output parameters to trigger an Aux Contact Output. Using PCCU keypad ← and → arrow keys to go to condition, and ↑ and ↓ to select the Yes and/or No condition.<br><br>• REMOTE SENSE = REMOTE SENSE<br>• LO CHG = Low Charger<br>• LO AP = Low Absolute Pressure<br>• HI AP = High Absolute Pressure |
| 2. | Entering Yes for any condition, the 12 volt output is energized if condition is encountered. |
| 3. | After all parameter conditions have been set, press PCCU keypad **C** key. The PCCU screen will display the following user prompt.<br><br>The prompt shows current state of 12 Volt Digital Output and manually changes condition.<br><br>**AUTO RESET** is used with digital output conditions. When selected parameter conditions clear, **AUTO RESET** returns digital output to untripped condition.<br><br>  <br><br><br>OR<br><br>  <br> |

*Continued on next page*

### Tripping a Sampler

When using Calculated Volume Method to trip sampler, **AUTO RESET** must be set to Yes.

**Calculated Volume Method Procedures**

| Step | Procedure |
|---|---|
| 1. | Set **VOLUME S.P.** and **AUTO RESET** to Yes. |
| 2. | After setting step 1 conditions to Yes, press PCCU keypad **C** key. The PCCU will display the following user prompt.<br><br>Volume Set Point is X.XXX SCF. OK? |
| 3. | If Volume Set Point is not correct, press PCCU keypad No key and enter new set point. When volume matches or exceeds Volume Set Point, output will be enabled. |

### Note

When set point volume is reached, output is enabled and accumulator resets to zero. Any residual volume above the setpoint volume is put back into accumulator so that no volume is lost.

Model 6400 and 6700 Flow Computers have two digital outputs. Either of the digital outputs can used to drive samplers. At the time of the printing of this manual, the Portable Collection & Calibration Unit (PCCU) and Laptop software would only support setting the Volume Set Point for the first digital output. However, WinCCU software can configure both digital outputs and utilizing Technical Bulletin #44 and a terminal emulator, both can be configured.

## Description

The Remote Communication mode is used to set up the correct baud rate and listen cycle time when the FCU is coupled to a remote communication device such as a modem or radio.

## Definitions

The following definitions describe the functions of each selection from the menu:

***Comm Rate*** Selected in bits per second from 1200 to 19,200 bps.

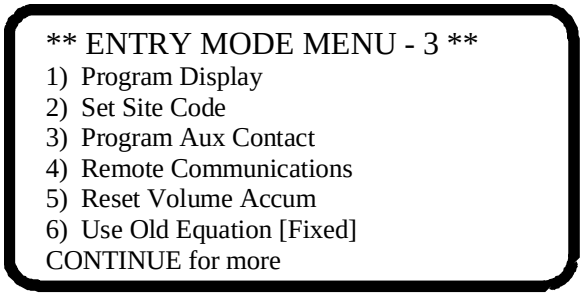
***Listen Cycle*** When the TOTALFLOW Protocol is utilized, a user selectable "Listen Cycle" is used for duty cycling the remote transceiver for an effective 10% duty cycle with a Listen Cycle of 4 seconds. Listen Cycle can be changed from 0, 1, 2, and 4 seconds (default).

***Receive Attack Delay*** This selects the time delay for the receiver to power up before receiving data.

***Transmit Key Delay*** This selects the delay time interval for the transmitter to "key" or transmit after receiving a signal from the FCU to transmit.

***Protocol*** Four protocols are available in the standard release EPROM firmware; 1) TOTALFLOW Low Power (old), TOTALFLOW Packet (new), TOTALFLOW Modbus ASCII, and TOTALFLOW RTU. Documentation on TOTALFLOW Modbus is available by contacting your local Sales Engineer, or from our BBS.

### Remote Communications Procedures

| Step | Procedures |
|---|---|
| 1. | To display communication parameters, select **4) Remote Communications** from *****ENTRY MODE MENU-3***** menu.<br>  |

*Continued on next page*

**Remote Communications Procedures (Continued)**

| Step | Procedures |
|---|---|
| 2. | When **Remote Communications** is selected, the following user prompt screen is displayed. Baud rate and listen cycle time can be set.<br><br>** Remote Communications MENU **<br>1) Comm Rate [1200] [1]<br>2) Listen Cycle [4] seconds [2]<br>3) Recieve Attach Delay [3]<br>4) Transmit Key Delay [4]<br>5) Protocol [TOTALFLOW] [5]<br>6) Modbus Address [1] [6]<br>CONTINUE for more |
| 3. | Enter **Comm Rate [1200] baud** and toggle between the following baud rates:<br><br>• 1,200<br>• 2,400<br>• 4,800<br>• 9,600<br>• 19,200 (only selectable on later versions of PCCU firmware) |
| 4. | Enter **Listen Cycle [4] sec.** and toggle between desired listen cycle time. Listen cycle time is between 1, 2 and 4 seconds. |

PCCU display options may vary depending on PCCU and FCU firmware revision.

**Note** Remote communications must be entered to activate the FCU's use of remote com. ports. This will be visually indicated by a blinking telephone pole symbol (‡) in the lower right hand corner of the local display.

**Description** Permits the setting of the Uncorrected Volume Accumulator. This accumulator is a running total of the Uncorrected Volume (acf) which is the pulse count times the Meter Factor (K). This does not affect the Corrected Volume Accumulator which shows up as 'Reset Volume' in Entry Mode Menu-2 (see earlier this chapter).

| Step | Procedure |
|---|---|
| 1. | To reset the Uncorrected Volume Accumulator, select **5) Reset Uncorr Volume Accum** from *****ENTRY MODE MENU-3***** menu.<br><br>** ENTRY MODE MENU - 3 **<br>1) Program Display<br>2) Set Site Code<br>3) Program Aux Contact<br>4) Remote Communications<br>5) Reset Uncorr Volume Accum<br>6) Use Old Equation [Fixed]<br>CONTINUE for more |
| 2. | After selecting **Reset Uncorr Volume Accum**, the following screen will be displayed showing the current value and asking if the value is ok.<br><br>Uncor Vol Acc is xxxxxxx acf. ok? |
| 3. | To change the value, enter 'N' for No and a new line will prompt you for a new value.<br><br>Uncor Vol Acc is xxxxxxx acf. ok?N<br>Enter new Uncor Vol Acc |
| 4. | Enter a new value and press the 'Enter' key and the new value will be shown.<br><br>Uncor Vol Acc is xxxxxxx acf. ok?<br><br>If the new value is correct, answer 'Y' for Yes and you will be returned to the Entry Mode Menu-3. |

## Description

The nomenclature **'Use Old Equation Fixed'** or **'Use Old/New Equation Selectable'** may be somewhat misleading since the only volume calculation equation available for Pulse Input Flow Computers is the AGA-7 Equation. This labeling is held over from the Gas Orifice Flow Computers in which you can select the Extended Characteristic File type which in turn gives you a choice of gas orifice volume equations to use (AGA-3 85 or 92). This option with Pulse Input Flow Computers still allows you to change the Characteristic File type. Changing the Characteristic File type from 'Standard' file to the 'Extended' allows some of the same benefits as a Gas Orifice Flow Computer.

Primary benefits of the 'Extended Characteristic File' are:

1. Selectable volume calculation periods.

2. Selectable 'Z' or F(pv) methods

## Important

The 'Extended Characteristic File' is larger than the 'Standard Characteristic File'. Any other files such as ASCII files generated from the Characteristic File will also be larger. Therefore, if you decide to use the 'Extended' file and have software that uses any of these files that are based on the 'Standard' file, you would need to modify the software to accept the larger file.

A Totalflow Flow Computer defaults to the 'Standard Characteristic File' when started the first time or when 'Cold' started. Once you have selected the 'Extended Characteristic File', you cannot return to using the 'Standard Characteristic File' without cold starting the Flow Computer.

| Step | Procedure |
|---|---|
| 1. | To display the current Characteristic File type, view item **6)** of *****Entry Mode Menu-3*****. Item **6)** will be displaying one of two choices:<br><br>**Use Old Equation Fixed** - Flow Computer is using 'Standard Characteristic File'.<br><br>**Use Old/New Equation Selectable** - Flow Computer is using 'Extended Characteristic File'. |

## Changing Characteristic File Type, Continued

| Step | Procedure |
|---|---|
| 2. | To change the current Characteristic File type from 'Standard' to 'Extended', view item **6)** of *****Entry Mode Menu-3*****.<br><br>Item **6)** will be displaying **'Use Old Equation Fixed'**. |
| 3. | Depress the **6** key and you get the following response:<br><br>This makes changes to the database<br>Are you Sure? Last Chance.<br><br>**Note:** *See 'Important' note on previous page.* |
| 4. | Depress 'Y' for yes and the Characteristic File type is now changed and item **6)** now reads like this:<br><br>6) Use Old/New Equation Selectable |

# AGA-7 Factor Mode

**Overview**

The Pulse Input FCU is programmed to calculate volumes by using only the AGA-7 Equation. This is unlike a gas orifice meter which has the option to use the AGA-3 1985 or AGA-3 1992 equation. To support the AGA-3 1992 equation, a larger Characteristic File was developed. Some additional benefits of the larger file known as the 'Extended' Characteristics File, is selectable volume calculation periods and selectable 'Z' or F(pv) methods. Even though the AGA-7 equation does not require the 'Extended' Characteristic File to run, you have the option of using this mode, thereby giving you access to these additional benefits. This is selectable by item 6 of menu-3 of the 'Entry' mode. See 'Changing Characteristic File Type' earlier in this chapter.

**Important**

The 'Extended Characteristic File' is larger than the 'Standard Characteristic File'. Any other files such as ASCII files generated from the Characteristic File will also be larger. Therefore, if you decide to use the 'Extended' file and have software that uses any of these files that are based on the 'Standard' file, you would need to modify the software to accept the larger file.

A Totalflow Flow Computer defaults to the 'Standard Characteristic File' when started the first time or when 'Cold' started. Once you have selected the 'Extended Characteristic File', you cannot return to using the 'Standard Characteristic File' without cold starting the Flow Computer.

**Learning Hint**

The following pages discuss the user changeable factors associated with the AGA-7 equation and will be divided up between those options available with the 'Standard' Characteristic File and the ones available when using the 'Extended' Characteristic File.

**Reminder**

By default from initial start-up or from a cold start, the Flow Computer will be using the 'Standard' Characteristic File. To verify which file is being used, select **3) Entry** from the above menu, **Continue** to ***** Entry Mode Menu-3 ***** and view item **6).** If item **6)** shows:

Use Old Equation Fixed - 'Standard' Characteristic File is selected.

Use Old/New Equation Selectable - 'Extended' Characteristic File is selected.

# AGA-7 (W/ Standard Characteristic File)

**Description** This procedure is for those users who have selected the 'Standard' Characteristic File.

**Procedures:**

| Step | Procedure |
|---|---|
| 1. | Connect and power-up PCCU to display Top Level Menu. |
| 2. | From the Top Level Menu select **1) Connected to Totalflow**, to display the Connected to Totalflow menu.<br>** FCU CONNECTED: FCU-6411 **<br>LOC: TOTALFLOW™<br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-7<br>5) Calibrate |
| 3. | Select **item 4) AGA-7** from the *****FCU CONNECTED: FCU-6411***** menu. The following message is displayed for approximately five (5) seconds. During this time, PCCU polls FCU for current AGA setup.<br>Reading AGA Data from FCU..... |
| 4. | When PCCU completes reading AGA data, the following user selectable option menu is displayed.<br>** AGA-7 1985 TOP MENU **<br>1) Select Factors<br>2) Enter Constants<br>3) Send AGA data to FCU<br>CONTINUE for more |

### Factor Selects

The following procedure enables you to select or de-select a AGA-7 computation factor. Factors available are shown below. All factors except F(AUX) take into account the AGA-7 requirements for correcting a gas volume back to base conditions. For a complete description of each of the factors, see AGA Report No. 7.

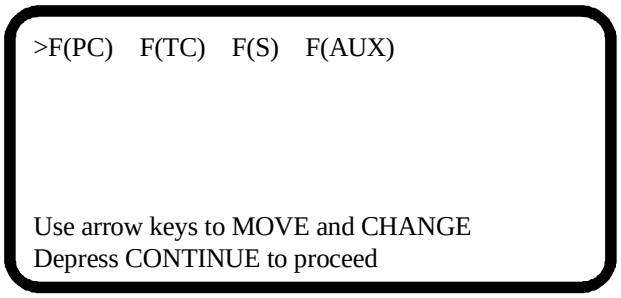
F(PC) Pressure Correction Factor - Equal to the Vol. Calc. Period average Ap divided by the Pressure Base.

F(TC) Temperature Correction Factor - Equal to the Temperature Base divided by the Vol. Calc. Period average temperature.

F(S) Compressibility Factor - Equal to $F(pv)^2$ . F(S) is calculated by the PCCU based on the composition data entered in the AGA mode.

F(AUX) Multiplication Factor - Can be set to any value to allow for static corrections for site conditions that are not handled by the fundamental equation. An example would be a linear meter calibration shift.

**Select Factors Procedure:**

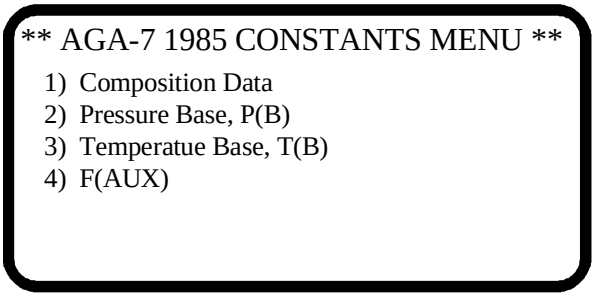
| | |
|---|---|
| 1. | To change or set selected factor(s), select item **1) Select Factors** from ****AGA-7 1985 TOP MENU****.<br>  |
| 2. | Move to a factor using the ← and → arrow keys. To change a factor selection state, use the ↑ and ↓ keys. |
| 3. | When finished moving to or changing factor(s), press C on PCCU keypad or ESC. The ***AGA-7 1985 TOP MENU*** is displayed. |
| 4. | Enter **3) Send AGA Data to FCU** from the AGA-7 Top Menu. The display will acknowledge that the data has been received by the FCU. |

# AGA-7 (W/ Standard Characteristic File), Continued

## Enter Constants

The following procedure enables you to change or enter a AGA-7 computation constants. Constants available are shown below. For a complete description of each of the constants see to AGA Report No. 7.

**Enter Constants Procedure:**

| Step | Procedure |
|---|---|
| 1. | To change constant(s), select item **2) Enter Constants** from ****AGA-7 1985 TOP MENU****. The *****AGA-7 1985 CONSTANTS MENU***** menu selection screen is displayed.<br>  <br><br>To change an entry press the appropriate number and then press the NO key and enter the desired value. The prompt will repeat to insure you entered the correct value. Press the Yes key to advance to the next item.<br><br>After you enter your choice the display will return to the AGA-7 CONSTANTS MENU. |

*Continued on next page*

**Enter Constants Procedures: (Continued)**

| Step | Procedure |
|---|---|
| 2. | Select 1 from the AGA-3 CONSTANTS MENU-1. You will step through the following items of the Composition Data.<br><br>1. Specific Gravity<br>2. % Nitrogen<br>3. % Carbon Dioxide<br>4. F(p)<br>5. F(t)<br><br>To change an entry press the NO key and enter the desired value. The prompt will repeat to insure you entered the correct value. Press the Yes key to advance to the next item.<br><br>Appearances of F(p) and F(t).<br><br>The queries for F(p) and F(t) will appear if:<br><br>ONE OF THE NX-19 METHODS SELECTED AND:<br><br>GRAVITY (G) IS GREATER THAN .75 AND/OR<br>CARBON DIOXIDE (CO2) IS GREATER THAN 15% AND/OR<br>NITROGEN (N2) IS GREATER THAN 15%<br><br>If any of these conditions exist F(p) and F(t) must be hand calculated and entered through the PCCU. Otherwise, the PCCU will use the gravity method for F(pv) and will do the F(P) and F(t) calculations internally.<br><br>After entering item 5 the display will return to the AGA-3 CONSTANTS MENU. |

*Continued on next page*

**Enter Constants Procedure: (Continued)**

| Step | Procedure |
|---|---|
| 3. | Select 2 from the AGA-7 CONSTANTS MENU-1 to enter the Pressure Base, P(B).<br><br>The Pressure Base defaults to 14.73 PSI.<br><br>After entering the Pressure Base, the display will return to the AGA-3 CONSTANTS MENU. |
| 4. | Select 3 from the AGA-3 CONSTANTS MENU-1 to enter the Temperature Base, T(B).<br><br>The Temperature Base defaults to 60º F.<br><br>After entering the Temperature Base, the display will return to the AGA-3 CONSTANTS MENU. |
| 5. | Select 4 from the AGA-7 CONSTANTS MENU to enter F(AUX)<br><br>F(AUX) defaults to 1.0<br><br>After entering F(AUX), the display will return to the AGA-3 CONSTANTS MENU. |

# AGA-7 (W/ Extended Characteristic File)

## Description

This procedure is for those users who have selected the 'Extended' Characteristic File.

## Reminder

By default from initial start-up or from a cold start, the Flow Computer will be using the 'Standard' Characteristic File. To verify which file is being used, select **3) Entry** from the **FCU CONNECTED:**, **Continue** to ***** Entry Mode Menu-3 ***** and view item **6).** If item **6)** shows:

Use Old Equation Fixed - 'Standard' Characteristic File is selected.

Use Old/New Equation Selectable - 'Extended' Characteristic File is selected.

## Learning Hint

Review the screens and menus associated with this process and have all input information ready to enter.

### Procedures

| Step | Procedure |
|---|---|
| 1. | Connect and power-up PCCU to display Top Level Menu. |
| 2. | From the Top Level Menu select **1) Connected to Totalflow**, to display the Connected to Totalflow menu.<br>** FCU CONNECTED: FCU-6411 **<br>LOC: TOTALFLOW™<br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-7<br>5) Calibrate |
| 3. | Select **item 4) AGA-7** from the *****FCU CONNECTED: FCU-6411***** menu. The following message is displayed for approximately five (5) seconds. During this time, PCCU polls FCU for current AGA setup.<br>Reading AGA Data from FCU..... |

| | |
|---|---|
| 1. | When PCCU completes reading AGA data, the following user selectable option menu is displayed.<br><br>** AGA-3 1985 TOP MENU **<br>1) Select Factors<br>2) Enter Constants<br>3) Send AGA data to FCU<br>4) Enter Fixed Analysis<br><br>CONTINUE for more |

*Continued on next page*

### Factor Selects

The following procedure enables you to select or de-select a AGA-7 computation factors. Factors available are shown below. All factors except F(AUX) take into account the AGA-7 requirements for correcting a gas volume back to base conditions. For a complete description of each of the factors, see AGA Report No. 7.

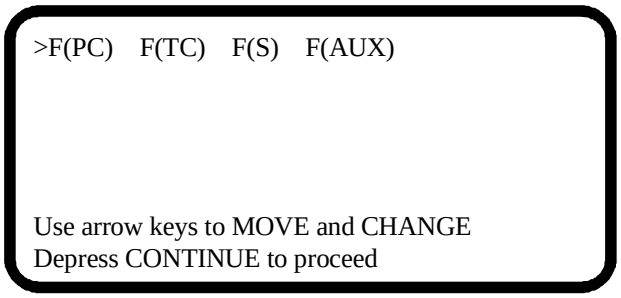
F(PC) Pressure Correction Factor - Equal to the Vol. Calc. Period average Ap divided by the Pressure Base.

F(TC) Temperature Correction Factor - Equal to the Temperature Base divided by the Vol. Calc. Period average temperature.

F(S) Compressibility Factor - Equal to $F(pv)^2$ . F(S) is calculated by the PCCU based on the composition data entered in the AGA mode.

F(AUX) Multiplication Factor - Can be set to any value to allow for static corrections for site conditions that are not handled by the fundamental equation. An example would be a linear meter calibration shift.

**Select Factors Procedure:**

| | |
|---|---|
| 1. | To change or set selected factor(s), select item **1) Select Factors** from ****AGA-7 1985 TOP MENU****.<br>  |
| 2. | Move to a factor using the ← and → arrow keys. To change a factor selection state, use the ↑ and ↓ keys. |
| 3. | When finished moving to or changing factor(s), press C on PCCU keypad or ESC. The ***AGA-7 1985 TOP MENU*** is displayed. |
| 4. | Enter **3) Send AGA Data to FCU** from the AGA-7 Top Menu. The display will acknowledge that the data has been received by the FCU. |

*Continued on next page*

## Enter Constants

The following procedure enables you to change or enter a AGA-7 computation constants. Constants available are shown below. For a complete description of each of the constants see to AGA Report No. 7.

**Enter Constants Procedure:**

| Step | Procedure |
|---|---|
| 1. | To change constant(s), select item **2) Enter Constants** from ****AGA-7 1985 TOP MENU****. The *****AGA-7 1985 CONSTANTS MENU***** menu selection screen is displayed.<br><br>** AGA-7 1985 CONSTANTS MENU **<br>1) Composition Data<br>2) Pressure Base, P(B)<br>3) Temperatue Base, T(B)<br>4) F(AUX)<br>5) Vol Calc Period 60<br>6) Z Method NX19 GCN or GCNM<br>7) Z of Air<br><br>To change an entry press the appropriate number and then press the NO key and enter the desired value. The prompt will repeat to insure you entered the correct value. Press the Yes key to advance to the next item.<br><br>After you enter your choice the display will return to the AGA-7 CONSTANTS MENU. |

*Continued on next page*

**Enter Constants Procedure,** Continued

| | |
|---|---|
| 2. | Select 1 from the AGA-3 CONSTANTS MENU-1. You will step through the following items of the Composition Data.<br><br>1. Specific Gravity<br>2. % Nitrogen<br>3. % Carbon Dioxide<br>4. % Methane<br>5. F(p)<br>6. F(t)<br><br>To change an entry press the NO key and enter the desired value. The prompt will repeat to insure you entered the correct value. Press the Yes key to advance to the next item.<br>Selection of 'Z' method "NX19 fixed Ft,Fp" can cause the appearances of F(p) and F(t).<br><br>The queries for F(p) and F(t) will appear if:<br><br>GRAVITY (G) IS GREATER THAN .75 AND/OR<br>CARBON DIOXIDE (CO2) IS GREATER THAN 15% AND/OR<br>NITROGEN (N2) IS GREATER THAN 15%<br><br>If any of these conditions exist F(p) and F(t) must be hand calculated and entered through the PCCU. Otherwise, the PCCU will use the gravity method for F(pv) and will do the F(P) and F(t) calculations internally.<br><br>After entering item 5 the display will return to the AGA-3 CONSTANTS MENU. |
| 3. | Select 2 from the AGA-7 CONSTANTS MENU-1 to enter the Pressure Base, P(B).<br><br>The Pressure Base defaults to 14.73 PSI.<br><br>After entering the Pressure Base, the display will return to the AGA-3 CONSTANTS MENU. |
| 4. | Select 3 from the AGA-3 CONSTANTS MENU-1 to enter the Temperature Base, T(B).<br><br>The Temperature Base defaults to 60º F.<br><br>After entering the Temperature Base, the display will return to the AGA-3 CONSTANTS MENU. |

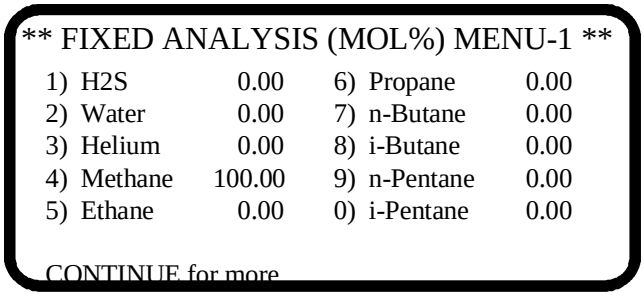
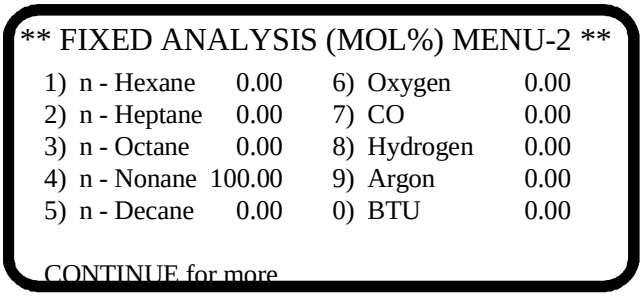
**Enter Constants Procedure,** Continued

| | |
|---|---|
| 5. | Select 4 from the AGA-7 CONSTANTS MENU to enter F(AUX)<br><br>F(AUX) defaults to 1.0<br><br>After entering F(AUX), the display will return to the AGA-3 CONSTANTS MENU. |
| 6. | Select 5 from the AGA-7 CONSTANTS MENU to enter the Volume Calculation Period.<br><br>Available selections are 1, 2, 5, 10, 20, 30 & 60 minutes.<br><br>Default is 60 minutes. |
| 7. | Item 6 lets you choose Z or F(pv) methods. Choices are:<br><br>AGA-8 Gross<br>*AGA-8 Detail<br>NX19 fixed Ft, Fp<br>NX19 GCN or GCNM — Automatically selects based on .75 gravity and/or 15% N2 or CO2<br><br>NX19 GCN — GCN = Gravity, CO2, Nitrogen<br>NX19 GCNM — GCNM = Gravity, CO2,N2,Methane<br><br>To select a factor continue to press 6 until your choice is displayed.<br><br>* If you are using the AGA-8 Detail option you need to go to the 'Enter Fixed Analysis' screen of the *** AGA-7 1985 TOP MENU *** and enter your analysis. (See later in this chapter) |
| 8. | Select item 7 to select the compressibility or Z of Air. Default value is zero. |

## Fixed Analysis

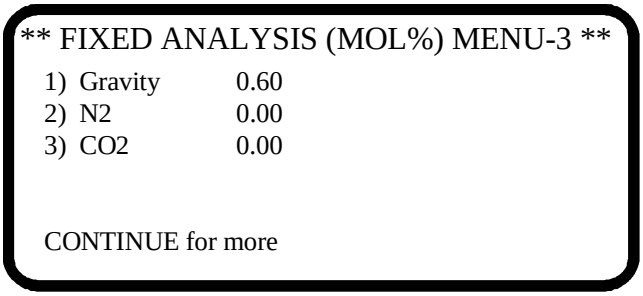
The Fixed Analysis mode is used only if you have selected the AGA-8 Detail Method for calculating F(pv). The AGA-8 Detail Method calculates super compressibility based on a total analysis consisting of 21 components. Three screens are used to allow you to do the component entries for the Detail method.

**Fixed Analysis Entry Procedures:**

| Step | Procedure |
|---|---|
| 1. | Select item **4) AGA-7** from the *****FCU CONNECTED: FCU-6411***** menu to display the AGA-7 1985 Top Menu. |
| 2. | Enter **4) Enter Fixed Analysis** from the AGA-7 Top Menu. After FCU reads the Analysis data the first of three Fixed Analysis menus will be displayed. Press the Continue key to scroll through each menu.<br>  <br>** FIXED ANALYSIS (MOL%) MENU-1 **<br>1) H2S 0.00 6) Propane 0.00<br>2) Water 0.00 7) n-Butane 0.00<br>3) Helium 0.00 8) i-Butane 0.00<br>4) Methane 100.00 9) n-Pentane 0.00<br>5) Ethane 0.00 0) i-Pentane 0.00<br>CONTINUE for more<br>To enter or change a value select the number corresponding to the component. Enter the value, then press Enter. |
| 3. |  <br>** FIXED ANALYSIS (MOL%) MENU-2 **<br>1) n - Hexane 0.00 6) Oxygen 0.00<br>2) n - Heptane 0.00 7) CO 0.00<br>3) n - Octane 0.00 8) Hydrogen 0.00<br>4) n - Nonane 100.00 9) Argon 0.00<br>5) n - Decane 0.00 0) BTU 0.00<br>CONTINUE for more |

*Continued on next page*

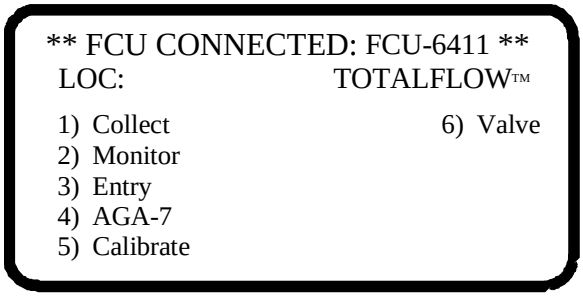
**Fixed Analysis Entry Procedures:,** Continued

| | |
|---|---|
| 4. |  |
| 5. | When finished moving to or changing factor(s), press C on PCCU keypad or ESC. The ***AGA-7 1985 TOP MENU*** is displayed. |
| 6. | Enter **3) Send AGA data to FCU** from the AGA-7 Top Menu. The display will acknowledge that the data has been received by the FCU. |

# Calibration Mode

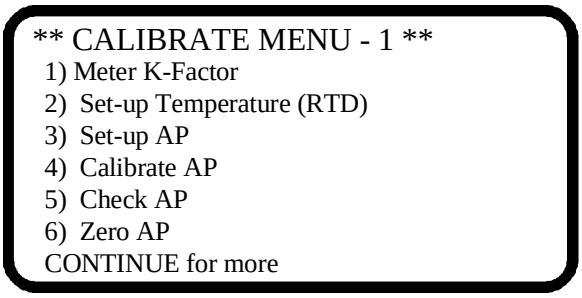
## Overview

To select Calibrate Mode you must select **5) Calibrate** from **FCU Connected Menu**.




## Calibrate Menu

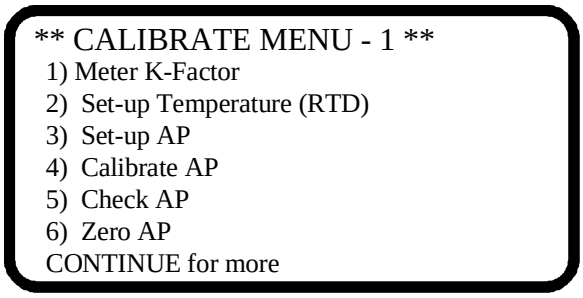
After entering 5, the Calibrate Menu is displayed.



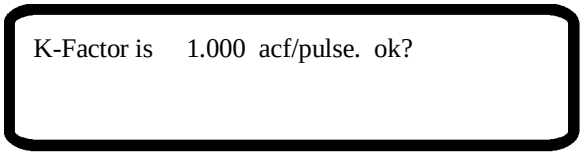
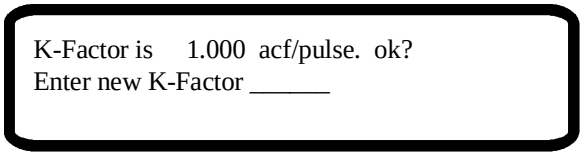

| Menu Choices | Menu Number | See Page |
|---|---|---|
| K - Factor | 1 | 4-56 |
| Set-up Temperature | 2 | 4-57 |
| Set-up AP | 3 | 4-63 |
| Calibrate AP | 4 | 4-65 |
| Check AP | 5 | 4-73 |
| Zero AP | 6 | 4-75 |

## Overview

Meter K-Factor specifies the volume of gas in actual cubic feet, represented by a single pulse from the measurement hardware. Therefore, the number of pulses are multiplied by the K-Factor to get the actual cubic feet which is the uncorrected volume. The uncorrected volume is then multiplied by C' to correct it to base conditions, thus corrected volume.




**Entering K-Factor:**

| Step | Procedure |
|---|---|
| 1. | Select item **1) Meter K-Factor** from the *****Calibrate Menu 1***** menu and the following window will be displayed.<br>  |
| 2. | If the value is not correct, answer No and you will be prompted for a new value.<br>  |
| 3. | Enter a new value and press the 'Yes (↵)' key. The new value will be displayed and you will be prompted for verification as in step 1. If the entered value is correct, press Yes and you will be returned to the *****Calibrate Menu 1***** menu. |

## Description

Volume calculations can be set to use either the 'Fixed' temperature or the 'RTD' temperature. Setting each condition is described in the following applicable Sections.

## Temperature Method Selection

If the Flow Computer is told that the RTD is not installed, It will display the 'Fixed' temperature as well as use the 'Fixed' temperature in it's volume calculations.

If the Flow Computer is told that the RTD is installed, the user then has the option of telling the Flow Computer to use either the 'Fixed' or the 'RTD' temperature in it's calculations. The Flow Computer will always display the 'RTD' temperature if it is told the RTD is installed, no matter which method is used in the calculations.

Although the RTD (Resistive Temperature Detector) temperature is accurately self-calibrating, you can match it to another reference source. This is accomplished by entering a temperature bias, which shifts the RTD probe curve either positive or negative.

## Important

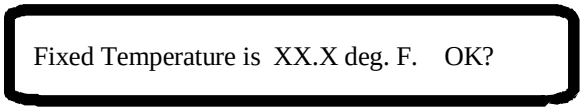
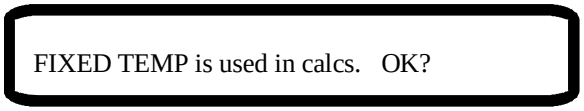
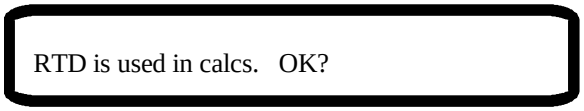
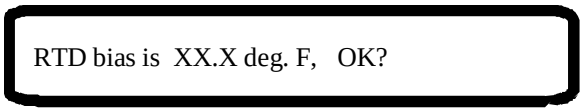
If RTD probe is used in calculations, and fails or over-ranges, the Flow Computer will use the 'Fixed' temperature for calculations.

**Procedures**

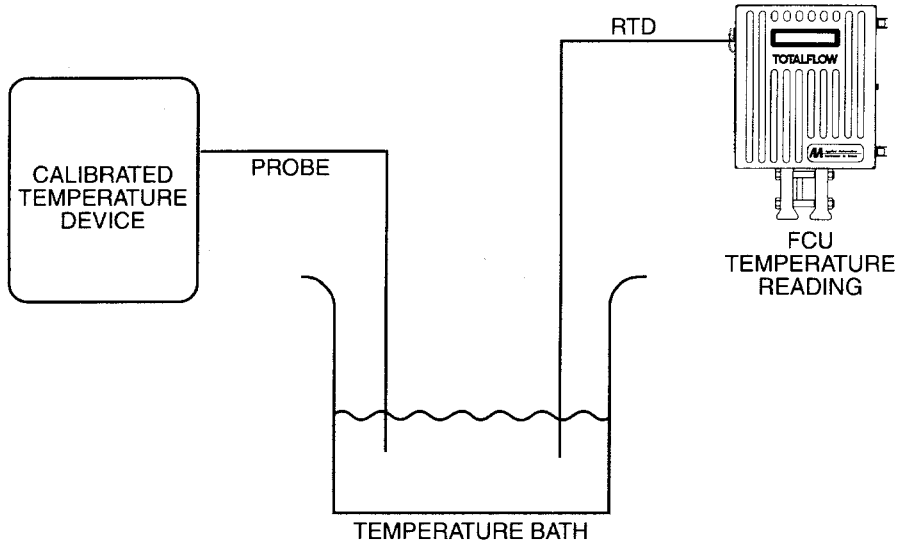
| Step | Procedure |
|---|---|
| 1. | Select **5) Calibrate** from **FCU CONNECTED** menu.<br><br>** FCU CONNECTED: FCU-6411 **<br>LOC: TOTALFLOW™<br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-7<br>5) Calibrate |
| 2. | When selected, the **CALIBRATE MENU-1** is displayed. From Calibrate Menu 1, select Set Up Temperature by entering 2.<br><br>** CALIBRATE MENU - 1 **<br>1) Meter K-Factor<br>2) Set-up Temperature (RTD)<br>3) Set-up AP<br>4) Calibrate AP<br>5) Check AP<br>6) Zero AP<br>CONTINUE for more |
| 3. | The first prompt will say that the RTD is installed or not installed according to how is currently set. The user needs to answer Yes or No according to how they want it set up.<br><br>RTD is installed ok?<br><br>RTD is not installed ok?<br><br>Answer No to either prompt and the other prompt will be displayed. |

*Continued on next page*

**Procedures (Continued)**

| Step | Procedure |
|---|---|
| 4. | Answer Yes to RTD not installed and a verification prompt will ask if the fixed temperature value is correct.<br><br>Answer Yes to RTD is installed - Go to Step 6<br><br>  <br><br>If displayed fixed temperature is correct, depress Yes. If not correct, press No and enter correct fixed temperature. |
| 5. | If the new temperature is correct, press Yes and the **CALIBRATE MENU-1** is displayed. |
| 6. | Answer Yes to RTD is installed and one of two prompts will ask if the Fixed temperature or RTD will be used in the calculations.<br><br>  <br><br>  <br><br>Answer No to either prompt and the other prompt will appear. |
| 7. | Answer Yes to either prompt and new prompt asking for the correct RTD bias will appear.<br><br>  |
| 8. | See following pages for setting RTD bias and Fixed temperature. |

**Important** To accurately setup the RTD temperature the following test setup or equivalent should be used for the following procedures.

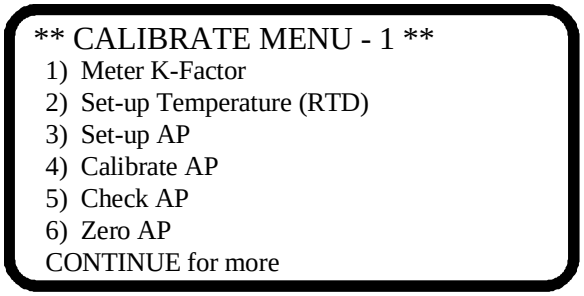
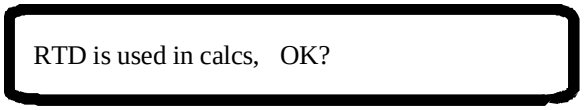



**Procedures**

| Step | Procedure |
|---|---|
| 1. | Select **5) Calibrate** from **FCU CONNECTED menu**.<br>** FCU CONNECTED: FCU-6411 **<br>LOC: TOTALFLOW™<br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-7<br>5) Calibrate |

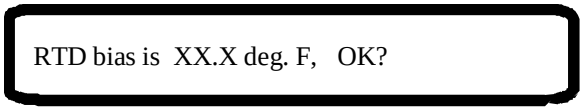
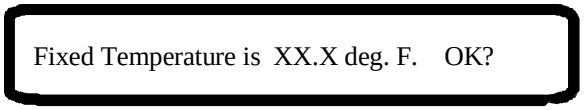
*Continued on next page*

**Procedures (Continued)**

| Step | Procedure |
|---|---|
| 2. | When selected, the **CALIBRATE MENU-1** is displayed. From **Calibrate Menu 1**, select Set Up Temperature by entering 2.<br>  <br>** CALIBRATE MENU - 1 **<br>1) Meter K-Factor<br>2) Set-up Temperature (RTD)<br>3) Set-up AP<br>4) Calibrate AP<br>5) Check AP<br>6) Zero AP<br>CONTINUE for more |
| 3. | Press No until the following screen is displayed.<br>  <br>RTD is installed OK? |
| 4. | Enter Yes, the following verification prompt will be displayed. If not, press No until the RTD is used in calcs. user verification prompt is displayed.<br>  <br>RTD is used in calcs, OK? |

*Continued on next page*

**Procedures (Continued)**

| Step | Procedure |
|---|---|
| 5. | Enter Yes, the following verification prompt will be displayed.<br>  <br>If the displayed RTD bias is correct, depress Yes. If not correct, press No and enter the correct bias. |
| 6. | If No was entered the PCCU screen displays the newly entered temperature bias. This allows you to change value. If new temperature bias is correct, press Yes. |
| 7. | After answering Yes to the correct RTD bias, the following screen will be displayed asking if the Fixed temperature is correct. The Fixed temperature will be used if an error occurs reading the RTD's temperature.<br>  <br>If the displayed Fixed temperature is correct, depress Yes. If not correct, press No and enter the correct Fixed temperature. Enter Yes to the correct Fixed temperature and the **Calibrate Menu-1** is displayed. |

## Overview

Set-up AP is used to direct the Flow Computer to either use the AP transducer's reading for the volume calculations or to use the Fixed AP value. After selecting the desired method, the user will enter a Fixed AP value. This value can also be used even if AP transducer is selected but Flow Computer sees an error in reading the AP transducer.

### Procedures

| Step | Procedure |
|---|---|
| 1. | Select **5) Calibrate** from **FCU CONNECTED** menu.<br><br>** FCU CONNECTED: FCU-6411 **<br>LOC: TOTALFLOW™<br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-7<br>5) Calibrate |
| 2. | When selected, the **CALIBRATE MENU-1** is displayed. From Calibrate Menu 1, select Set Up AP by entering 3.<br><br>** CALIBRATE MENU - 1 **<br>1) Meter K-Factor<br>2) Set-up Temperature (RTD)<br>3) Set-up AP<br>4) Calibrate AP<br>5) Check AP<br>6) Zero AP<br>CONTINUE for more |
| 3. | The first prompt will say that the 'AP transducer is used in calcs' or 'Fixed AP is used in calcs', based on how it is currently set. The user needs to answer Yes or No according to how they want it set up.<br><br>AP transducer is used in calcs. ok?<br><br>Fixed AP is used in calcs. ok?<br><br>Answer No to either prompt and the other prompt will be displayed. |

**Procedures (Continued)**

| Step | Procedure |
|---|---|
| 4. | Answer Yes to either prompt and the following prompt will appear asking you to verify the correct Fixed AP.<br><br>Fixed AP is xx.xx psia. ok?<br><br>If displayed AP is not correct, press No and enter correct AP. |

**Important** If AP from the AP transducer is used in calculations, and fails or over-ranges, the Flow Computer will use the 'Fixed' AP for calculations.

| | |
|---|---|
| 5. | If the new AP is correct, press Yes and the **CALIBRATE MENU-1** is displayed. |

## Required Test Equipment

The following test equipment is required to calibrate the FCU AP transducer:

- PCCU
- Deadweight tester or equivalent calibration standard
- Barometer or another means which can determine barometric pressure
- Nitrogen or compressed air source

## Hold Mode

When calibrating a transducer or setting up a temperature, the PCCU will instruct the FCU to ignore any changes to the flow calculations for the period of time the FCU is being calibrated. This prevents real time FCU flow calculations from being affected during the present calibration. During this time the FCU continues to use values from the last calibration period. (This is called the “HOLD” mode.)

Flow calculations, temporarily in hold mode, can be removed by the following methods:

- Unplug DATA cable at FCU connector.
- Exit Calibration mode using PCCU Esc. key

## Calibrate Absolute Pressure (AP), Continued

### Description

A three or five point pressure method is used to calibrate the FCU Absolute Pressure Transducer. These different pressures are applied to the transducer from a known traceable source with resultant pressure values entered into FCU using the PCCU.

**Note**

When doing the following procedures wait for the FCU display to stabilize. If the FCU is not in the calibration mode the display will not necessarily match applied transducer pressures.

### Before You Begin

The following information is important:

Because the FCU uses an Absolute Pressure (AP) Transducer, the initial calibration point is barometric pressure reading in psia. Measured pressure reflects changing barometric pressure.

When the Absolute Pressure Transducer is vented, it measures true barometric pressure.

To convert barometric pressure measured from inches of mercury to Barometric Pressure (psi), perform the following calculation:

- Barometric pressure, in inches of mercury x .4912 or ( ÷ 2.036) equals Barometric Pressure in psi.

**3-Point calibrate AP Procedures**

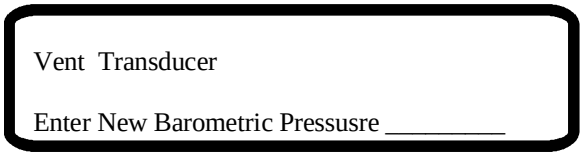
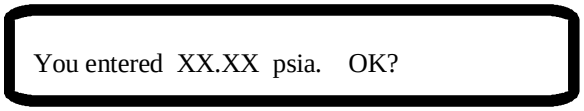
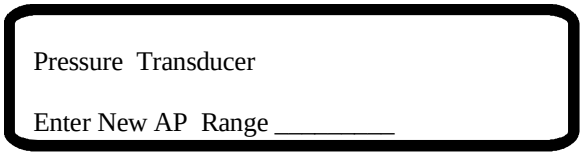
| Step | Procedure |
|---|---|
| 1. | Select item **4) Calibrate AP** from the *****Calibrate Menu 1***** menu. A prompt message will query you on the calibration method to be used. Enter a Yes to accept a 3 point or a No if you want to do a 5 point calibration. |

### Note

Capability of doing a 5-point calibration was not available at the time of the printing of this manual but was soon to be released.

*Continued on next page*

**3-Point Calibrate AP Procedures (Continued)**

| Step | Procedure |
|---|---|
| 2. | After you selected Yes to the 3-point calibration method a prompt message will ask you to vent, to atmosphere, both sides of AP Transducer and then enter a new barometric pressure.<br>  |
| 3. | Vent, to atmosphere, both sides of AP Transducer, and enter barometric pressure. A verification prompt asks if the correct barometric pressure was entered.<br>  |
| 4. | If the entered barometric pressure is correct and the FCU display is stable enter Yes to proceed or No to change entry. Answer Yes and a user prompt is displayed to enter new AP range.<br>  |

**Note:**

To calculate the actual absolute pressures for the pressure ranges, add the applied pressure transducer gauge reading to the barometric pressure.

Because a dead weight pressure source generates gauge pressure, barometric must be added to the output value for proper calibration of the AP transducer.

Absolute pressure (psia) = applied pressure (psi) + barometric pressure (psi).

| | |
|---|---|
| 5. | Apply upper range source pressure to the AP transducer in psia. |

*Continued on next page*

**3-Point Calibrate AP Procedures (Continued)**

**Important** Check FCU system for pressure leaks. No leaks should be present during the AP calibration sequence.

| Step | Procedure |
|---|---|
| . | Enter the new calculated AP range. A verification prompt will ask if the correct value was entered.<br><br>You entered XX.XX psia. OK?<br>. |
| 8. | If the entered AP range is correct and the FCU display is stable, enter Yes to proceed or No to change entry. Answer Yes and a user prompt is displayed to enter new expected AP.<br><br>Pressure Transducer<br><br>Enter New Expected AP _____ |
| 9. | Pressure up the calibration source to the AP transducer and apply the desired expected value in psia. Enter the new calculated Expected AP and a verification prompt will ask if the correct value was entered. This 3rd point can be and usually is the mid range value. Sometimes accuracy can be improved if 3rd point is a normal operating pressure. |
| 10. | If the entered Upper Range pressure is correct and the FCU display is stable, enter Yes to proceed or No to change entry. Answer Yes and a prompt message will be displayed that indicates the start of calibration.<br><br>CALIBRATING<br><br>and then,<br><br>CALIBRATING COMPLETE |

## Calibrate Absolute Pressure (AP), Continued

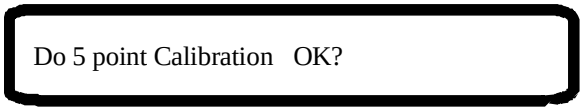
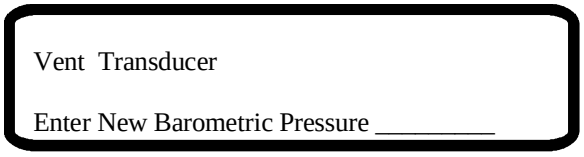
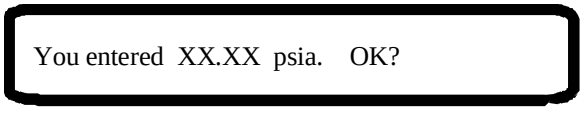
**3-Point Calibrate AP Procedures (Continued)**

**Note:** At this time the FCU display should be measuring the correct pressure.

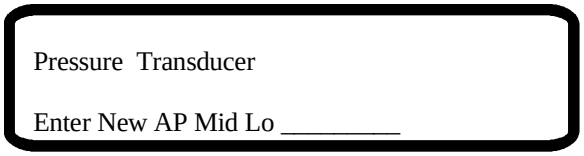
| | |
|---|---|
| 11. | Depressing **CONTINUE (C)** redisplays **CALIBRATE MENU-1** menu. |

**5- Point Calibrate AP Procedures**

**Note** Capability of doing a 5-point calibration was not available at the time of the printing of this manual but was soon to be released.

| Step | Procedure |
|---|---|
| 1. | Select item **4) Calibrate AP** from the **Calibrate Menu 1***** menu. A prompt message will query you on the calibration method to be used. Enter a No to reject the 3 point calibration. The following prompt screen will appear. Enter a Yes to accept a 5 point calibration.<br>  |
| 2. | After you selected Yes to the 5-point calibration method a prompt message will ask you to vent, to atmosphere, both sides of the AP Transducer and then enter a new barometric pressure.<br>  |
| 3. | Vent, to atmosphere, both sides of AP Transducer, and enter the barometric pressure. A verification prompt asked if correct barometric pressure was entered.<br>  |

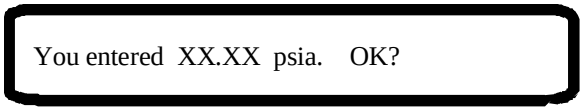
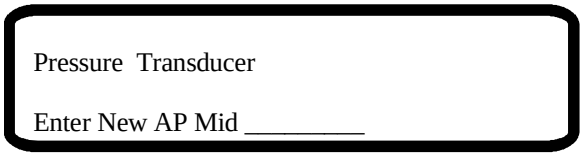
**5-Point Calibrate AP Procedures (Continued)**

| | |
|---|---|
| 4. | If the entered barometric pressure is correct and the FCU display is stable, enter Yes to proceed or No to change entry. Answer Yes and a user prompt is displayed to enter the AP Mid Lo Range.<br>  |

**Note:** To calculate the actual absolute pressures for the pressure ranges, add the applied pressure transducer gauge reading to the barometric pressure.

Because a dead weight pressure source generates gauge pressure, barometric must be added to the output value for proper calibration of the AP transducer.

Absolute pressure (psia) = applied pressure (psi) + barometric pressure (psi).

| | |
|---|---|
| 5. | Pressure up the calibration source to the AP transducer and apply the desired AP Mid Lo Range value in psia. |
| 6. | Enter the new calculated AP Mid Lo value. A verification prompt will ask if the correct value was entered.<br>  |
| 7. | If the entered AP Mid Lo value is correct and the FCU display is stable enter Yes to proceed or No to change entry. Answer Yes and a user prompt is displayed to enter new expected AP Mid range.<br>  |
| 8. | Pressure up the calibration source to the AP transducer and apply the desired AP Mid range value in psia. |

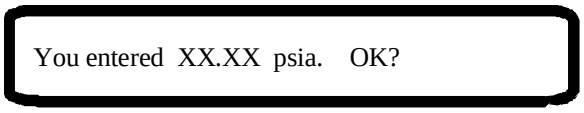
# Calibrate Absolute Pressure (AP), Continued

**5-Point Calibrate AP Procedure (Continued)**

| | |
|---|---|
| 9. | Enter the calculated absolute AP Mid range pressure. A verification prompt asks if the correct pressure was entered.<br><br>You entered XX.XX psia. OK? |
| 10. | If the entered Mid Range pressure is correct and the FCU display is stable, enter Yes to proceed or No to change entry. Answer Yes and a user prompt is displayed to enter new AP Mid Hi range.<br><br>Pressure Transducer<br><br>Enter New AP Mid Hi _____ |
| 11. | Pressure up the calibration source to the AP transducer and apply the desired Mid Hi Range value in psia. |
| 12. | Enter the new calculated AP Mid Hi range. A verification prompt will ask if correct value was entered.<br><br>You entered XX.XX psia. OK? |
| 13. | If the entered AP Mid Hi Range is correct and the FCU display is stable, enter Yes to proceed or No to change entry. Answer Yes and a user prompt is displayed to enter a new AP range.<br><br>Pressure Transducer<br><br>Enter AP Range _____ |

*Continued on next page*

**5-Point Calibrate AP Procedure (Continued)**

| Step | Procedure |
|---|---|
| 14. | Pressure up the calibration source to the AP transducer and apply the desired upper range value in psia. |
| 15. | Enter the calculated Upper Range pressure. A verification prompt asks if the correct pressure was entered.<br>  |
| 16. | If the entered Upper Range pressure is correct and the FCU display is stable, enter Yes to proceed or No to change entry. Answer Yes and a prompt message will be displayed that indicates the start of calibration.<br>  <br>and then,<br>  |
| 17. | Depressing **CONTINUE (C)** redisplays **CALIBRATE MENU-1** menu. |

## Description

The PCCU allows you to check the FCU Absolute Pressure Calibration and log the pressure marker check points into the FCU EVENTS file.

### Check AP Procedures

| Step | Procedure |
|---|---|
| 1. | From the **Calibrate Menu-1**, select Check AP (Absolute Pressure) by entering 5. When selected, the following user prompt is displayed.<br><br>Pressure Both Sides of Transducer<br>Enter New Expected AP ___<br><br>Pressure Marker no. < 1 > psia |

## Notes

1. The prompt in step 1 requests that the pressure be applied to both sides of the Transducer, but since this is AP only with no differential pressure, their will be only one point to apply pressure.

2. The FCU display provides continuous AP Transducer readouts; however during this procedure the FCU is placed in a temporary hold mode.

| | |
|---|---|
| 2. | Read barometric pressure and perform the following procedures:<br><br>• Apply a check pressure to the Absolute Pressure Transducer.<br><br>• Calculate the Absolute pressure by adding the applied check pressure to the barometric pressure.<br><br>(Applied Pressure + Barometric Pressure = Absolute Pressure) |
| 3. | Compare the calculated pressure values to the pressure shown on FCU display when display stabilizes. |

## Caution


The resulting comparison pressure must not be greater than absolute pressure transducer's maximum pressure**.**

*Continued on next page*

**Checking AP Procedures (Continued)**

| Step | Procedure |
|---|---|
| 4. | If the Applied Pressure markers are not desired, press 'Enter' without entering a value to return to the **CALIBRATE MENU-1**. |
| 6. | If the pressure markers are desired, enter the value and Yes.<br><br>You entered XX.XX psia. OK?<br><br>If the value is not correct, press No and enter correct value. Entering Yes, instructs the FCU to log the entered value along with the measured value into the FCU Event File as a pressure marker.<br><br>Once logged a prompt screen asks you to enter a new expected value.<br><br>Pressure Both Sides of Transducer<br>Enter New Expected AP ___<br><br>Pressure Marker no. < 2 > psia |
| 7. | If another AP pressure marker is desired, apply new pressure, calculate Absolute pressure, and enter the value. If correct, answer Yes to the prompt. If no further AP pressure markers are required, depress 'Enter' to return to **CALIBRATE MENU-1** menu. |

**Important**

The PCCU displayed PRESSURE MARKER no. <X> psia informs you of the pressure marker number you will currently be logging during this session.

**Caution**


You can enter as many AP pressure markers as you desire, however, do not log an excessive number. Central Collection Unit software (CCU) uses up to five pressure markers to do a 'Calibration Adjustment'.

Important additional events are recorded in the FCU events file. Recording to many markers causes FCU to overwrite existing older events.

## Zero Absolute Pressure (AP) Transducer Calibrate Mode Menu-2

**Description**

The Absolute Pressure (AP) can be zeroed without it having to be re-calibrated. If AP shifts, user can enter new barometric pressure value using PCCU. This shifts the AP Transducer curve. The re-zero function assumes that Transducer shift is linear. Transducer must have been previously calibrated.

**Procedure**

| Step | Procedure |
|---|---|
| 1. | From the **CALIBRATE MENU-1**, press **CONTINUE (C).** The following menu is displayed. This menu provides additional user selectable options.<br><br>** CALIBRATE MENU - 2 **<br>1) Zero AP transducer<br>CONTINUE for more |
| 2. | Enter 1 to select Zero AP Transducer. When selected, the following user prompt is displayed.<br><br>Vent Transducer<br>Enter New Absolute Pressure Zero _____<br><br>Before entering new barometric pressure wait for FCU LCD display to stabilize. Both sides of Absolute Pressure Transducer must be equalized and vented to atmosphere. |
| 3. | Enter a new barometric pressure reading then press Yes. User verification prompt is displayed to be certain entry is correct. |

*Continued on next page*

**Procedure (Continued)**

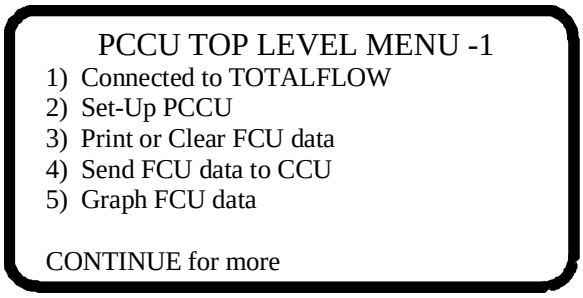
| Step | Procedure |
|---|---|
| 4. | If not correct, press No and enter new barometric pressure value. After entering barometric pressure, PCCU LCD screen displays user calibrating and calibrating complete screens. |
| 5. | Following calibration, pressing **CONTINUE (C)** redisplays **CALIBRATION MENU-2.** |

# Set Up PCCU

## Overview

This section provides you with instructions for setting up the PCCU.

To select PCCU setup instructions, you must select **2) Set Up PCCU** from **PCCU TOP LEVEL MENU-1**.




After entering 2**,** the SET-UP PCCU MENU is displayed presenting user selectable options.

## User Selectable Options

These sections provide you with instructions for each user selectable option.

# PCCU Security

## Description

The security code is a four digit code and can be entered to automatically match up with LEVEL 1 or Level 2 security code set in the FCU; see Programming Security Code, earlier in this chapter.

### Procedures

| Step | Procedure |
|---|---|
| 1. | To enter user security code, select **PCCU Security Code** by entering **1.** The display will prompt you if the Security Code is ok. |
| 2. | If new user security code is to be entered, press NO. The PCCU LCD screen will ask you to enter the new code. |
| 3. | If code is correct, enter Yes. If a new user security code is to be entered, press No. The PCCU LCD screen will ask you to enter a new four (4) digit security code. |

## Important

If a Level 1 code is entered into PCCU and code matches FCU, you can read data but no changes can be made to FCU set-up data. You must enter the correct Level 2 code to make changes.

# PCCU Communication Setup

## Description

The PCCU Communication Setup lets you enter the baud rates for the communication link as well specifying the CCU connection.

### Procedure

| Step | Procedure |
|---|---|
| 1. | To enter user PCCU Communication Setup functions, select PCCU Communication Setup by entering **2.**<br><br>** PCCU Communication Setup MENU **<br>1) Print Speed [9600]<br>2) CCU Speed [9600]<br>3) CCU Conection [Cable]<br>4) CCU Telephone No.<br><br>CONTINUE for more |
| 2. | Select baud rate of printer.<br><br>Entering 1 selects baud rate of printer connected to PCCU. Depressing PCCU keypad **1** key, toggles between 150, 300, 600, 1200, 2400, 4800 and 9600 baud rates. This matches PCCU baud rate with baud rate of receiving printer. |
| 3. | Select CCU baud rate.<br><br>Baud Rate of CCU: Entering **2** selects baud rate of CCU connected to PCCU. Depressing PCCU keypad **2** key, toggles between 150, 300, 600, 1200, 2400, 4800 and 9600 baud rates. This matches PCCU baud rate with baud rate of CCU. |

*Continued on next page*

**Procedure (Continued)**

| Step | Procedure |
|---|---|
| 4. | Toggle modem or cable.<br><br>Connection: Selects connection between PCCU and CCU. Connection can either be a cable or modem. |
| 5. | Enter CCU Telephone Number.<br><br>CCU Telephone Number**:** If a modem is selected by entering **3**, telephone number can be entered. The PCCU LCD screen displays the following menu.<br><br>** PCCU Communication Setup MENU **<br>1) Print Speed [9600]<br>2) CCU Speed [9600]<br>3) CCU Conection [Cable]<br>4) CCU Telephone No.<br><br>Enter CCU Telephone Number |
| 6. | Enter telephone number of receiving CCU and press **Yes**. PCCU LCD screen shows entered CCU telephone number.<br><br>Telephone number **must be** prefixed with a **T** (touch phones) or **P** (pulse or rotary phones). |
| 7. | To return to **SET-UP PCCU MENU,** press **Esc**. Another user option can be selected. |

# PCCU Collection Size

## Description

The data collection capacity is determined by amount of memory within PCCU. It is also determined by PCCU installed software updates, size of database and other programs.

## PCCU Meter Capacities

The FS/2 PCCU (see Chapter 2.0) has the following minimum meter capacities. Refer to the following Table.

FS/2 PCCU Meter Capacities

| Memory Capacity | # of Meters |
|---|---|
| 1.0 M | 13 |
| 1.5 M | 45 |
| 2.0 M | 77 |
| 3.0 M | 141 |

Referring to Table, the number of meters is based on collecting a maximum of five (5) weeks of data information for each meter.

To gain data storage capacity for more FCU units, collection capacity can be decreased below five (5) weeks. Valid collection capacities are one to five weeks. This is based on one week increments.

*Continued on next page*

**Procedure**

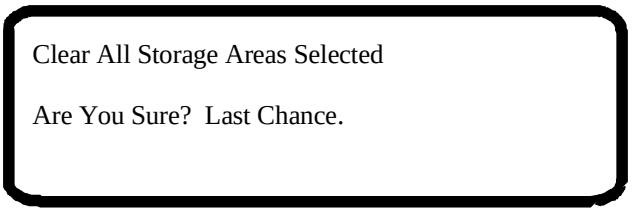
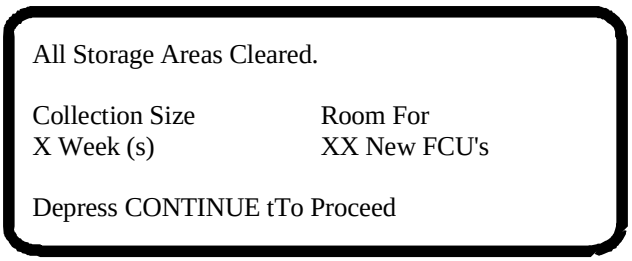
| Step | Procedure |
|---|---|
| 1. | To enter data Collection Size, select **3) Collection Size.**<br>  <br> |
| 2. | If data collection size is satisfactory, enter Yes**.** The SET-UP PCCU MENU is redisplayed. Another user selectable option can be selected. |
| 3. | To change data collection size, press No**.** The PCCU screen will ask you to enter new collection size. |
| 4. | Enter new data collection size. PCCU LCD screen shows new entry.<br><br>Keeping data collection size small allows additional memory storage capacity for more FCU's. |
| 5. | Depressing either Yes or Esc, redisplays SET-UP PCCU MENU. |

# Clear All FCU Storage Areas

## Description

All previously collected data can be cleared, from PCCU memory, using option Clear All FCU Storage Areas.

### Procedure

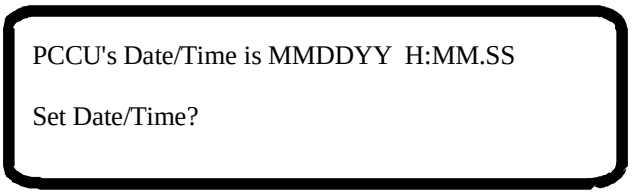
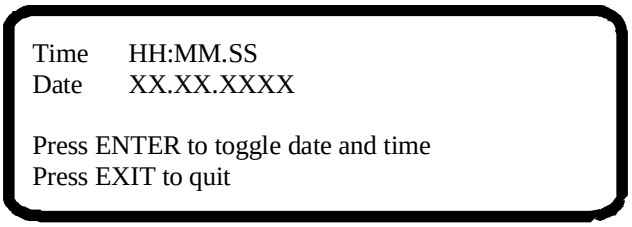
| Step | Procedure |
|---|---|
| 1. | To enter Clear All FCU Storage Area's option, select **4) Clear All FCU Storage Areas.**<br>  |
| 2. | For PCCU to clear FCU collected data, enter Yes. When cleared, the following screen is displayed.<br>  |
| 3. | Depressing **CONTINUE (C)** redisplays **SET-UP PCCU MENU.** |

# Set PCCU Calendar/Clock

## Description

The following procedure sets the calendar and clock in the PCCU.

### Procedure

| Step | Procedure |
|---|---|
| 1. | To enter Set PCCU Calendar/Clock option, select **5) Set PCCU Calendar/Clock.** The following screen is displayed.<br>  |
| 2. | If date and time *are not* to be set, press No**.** The SET-UP PCCU MENU is redisplayed. If date and time *are* to be set, press Yes. The following user prompt is displayed.<br>  |

*Continued on next page*

**Procedure (Continued)**

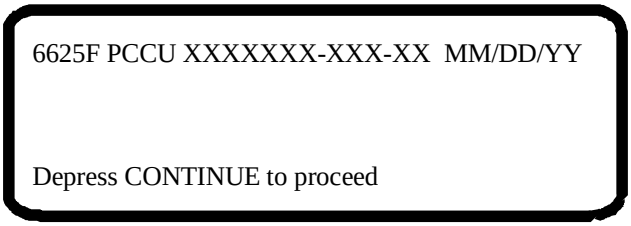
| Step | Procedure |
|---|---|
| 3. | Enter necessary time and date. To set time, the following user prompt is displayed.<br><br>Before entering minutes, hours MUST BE entered. Before seconds are entered, hours and minutes MUST BE entered. Set time ahead a few seconds or the succeeding minute.<br><br>Time HH:MM.SS<br>Press ENTER to set the time<br>Date XX.XX.XXXX<br><br>Press ENTER to toggle date and time<br>Press EXIT to quit |
| 4. | When entered time *equals* actual time, press YES**.** Clock is now running on new time and cursor moves down to Date**:** field.<br><br>Time displayed on PCCU LCD screen does not continually show actual time. Whenever **Yes** is pressed, time is updated. |
| 5. | When cursor is flashing in Date**:** field, new date can be entered. When entire data is entered, the following user prompt is displayed.<br><br>Enter entire date even if some data numbers are correct.<br><br>Time HH:MM.SS<br><br>Date XX.XX.XXXX<br>Press ENTER to set the date.<br><br>Press ENTER to toggle date and time<br>Press EXIT to quit |
| 6. | To return to SET-UP PCCU MENU**,** press Esc**.** Another user option can be selected. |

# PCCU Software Rev Level

## Description

The following procedure lets you see the revision of software being used.

### Procedure

| Step | Procedure |
|---|---|
| 1. | To enter PCCU Software Rev Level option, select PCCU Software Rev Level by entering 6**.** Displayed data, on screen, indicates which software is installed in PCCU.<br>  |
| 2. | To return to SET-UP PCCU MENU**,** press CONTINUE**.** The SET-UP PCCU MENU is redisplayed. Another user selectable option can be selected. |

## Description

The Print or Clear FCU Data mode allows you to perform the following functions from the PCCU.

- Display PCCU held collected data on PCCU LCD screen.
- Clears PCCU memory of individual meters.
- Provide a file report printout.

## Examples

Refer later in this chapter to examples of Meter File Reports collected and printed directly from the PCCU.

## Menu Description

The Print or Clear FCU Data mode function is selected from the **PCCU TOP LEVEL MENU-1** by entering **3.**

```
PCCU TOP LEVEL MENU -1
1) Connected to TOTALFLOW
2) Set-Up PCCU
3) Print or Clear FCU data
4) Send FCU data to CCU
5) Graph FCU data

CONTINUE for more
```

*Continued on next page*

**Procedure**

Read through the following procedural steps before you begin. The Print or Clear FCU Data function is selected from the PCCU TOP LEVEL MENU-1**.**

<table>
<tr><th>Step</th><th>Action</th></tr>
<tr><td>1.</td><td>Select 3) Print or Clear FCU Data from the PCCU TOP LEVEL MENU-1 to display ID Selection Menu.<br><br>** ID SELECTION MENU **<br><br>1) Print ID list to screen[1]<br>2) Print ID list to printer<br>3) Select ALL<br>4) Select by ID<br>5) Select by SEQ No.<br>6) Select by [FCU].</td></tr>
<tr><td>2.</td><td>If you are printing or clearing data from a FCU verify that item 6 on the ID Selection Menu is set to FCU; refer to Totalflow Analyzer Interface Unit User’s Manual 2012978-001 for information on the AIU setting.<br><br>Pressing the 6 key will toggle the field from FCU to AIU.</td></tr>
<tr><td>3.</td><td>Use the table below to determine your next step. Result: a new screen appears.<br><br>
<table>
<tr><th>IF you want to ...</th><th>THEN go to...</th></tr>
<tr><td>Print ID List to Screen</td><td>Step 4</td></tr>
<tr><td>Print ID List to Printer</td><td>Step 5</td></tr>
<tr><td>Print or Clear All FCUs</td><td>Step 6</td></tr>
<tr><td>Print or Clear by FCU ID</td><td>Step 7</td></tr>
<tr><td>Print or Clear By Seq. Number</td><td>Step 8</td></tr>
<tr><td>Print or Clear AIU</td><td>Step 9</td></tr>
</table>
</td></tr>
</table>

*Continued on next page*

**Step 4. Print ID List to Screen**

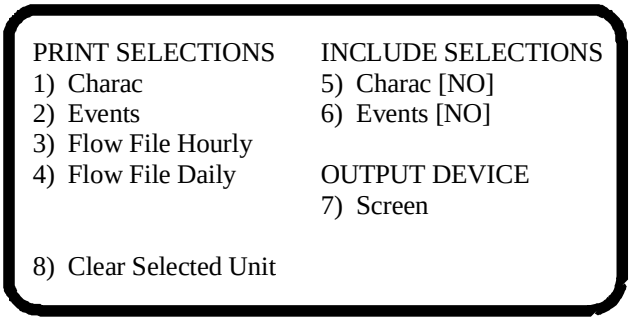
| Step | Procedure |
|---|---|
| 1. | To view a list of the collected FCUs by ID number, select **1) Printer ID List to Screen**. The following screen is displayed.<br><br>COLLECTED DATA MM/DD/YY HH:MM.SS<br><br>SEQ ID SIZE COLLECTION DATE<br>1 FCU-6411 5 wk MM/DD/YYHH:MM.SS<br>2 FCU-1234 5 wk MM/DD/YYHH:MM.SS<br><br>End of Collected FCU's List<br>Deprtess EXIT to quit. |

**Step 5. Print ID List to Printer**

| Step | Procedure |
|---|---|
| 1. | To print a list of the FCUs by Identifier, select **2) Printer ID List to Printer**. The PCCU **must be** connected to a serial printer to receive data output. The PCCU Communication Print Speed Set-Up, print speed, **must agree** with printer baud rate.<br><br>COLLECTED DATA MM/DD/YY HH:MM.SS<br><br>SEQ ID SIZE COLLECTION DATE<br>1 FCU-6411 5 wk MM/DD/YYHH:MM.SS<br>2 FCU-1234 5 wk MM/DD/YYHH:MM.SS<br><br>End of Collected FCU's List<br>Deprtess EXIT to quit. |

*Continued on next page*

**Step 6. Select All**

| Step | Procedure |
|---|---|
| 1. | To select data from all of the recorded FCUs choose **3) Select All.** The following screen is displayed. If screen does not appear check to see that ID Selection Menu, item 6 is not set to AIU.<br>  <br>PRINT SELECTIONS<br>1) Charac<br>2) Events<br>3) Flow File Hourly<br>4) Flow File Daily<br>8) Clear Selected Unit<br>INCLUDE SELECTIONS<br>5) Charac [NO]<br>6) Events [NO]<br>OUTPUT DEVICE<br>7) Screen |
| 2. | Select the options from the screen. Table below describes the options you can make. |

| Field | Description |
|---|---|
| 1) Charac | Prints a Characteristic Report for selected FCU's |
| 2) Events | Prints Events Report for selected FCU's |
| 3) Flow File Hourly | Prints Flow File Report with hourly numbers |
| 4) Flow File Daily | Prints Flow File Report with daily numbers |
| 5) Charac [NO] | Selects Characteristic Report to be included or not included with Daily or Hourly report files |

*Continued on next page*

**Step 6. Select All (Continued)**

<table>
<tr><th>Step</th><th>Procedure</th></tr>
<tr><td></td><td>
<table>
<tr><th>Field</th><th>Description</th></tr>
<tr><td>6) Events [NO]</td><td>Selects Events Report to be included or not included with Daily or Hourly report files.</td></tr>
<tr><td>7) [SCREEN]</td><td>Instructs PCCU to direct reports to connected serial printer or the PCCU display.</td></tr>
<tr><td>9) Clear Selected Unit</td><td>Displays prompt instructions</td></tr>
</table>
Results: Functions will be initiated.
</td></tr>
<tr><td>3.</td><td>To display ID SELECTION MENU, press CONTINUE (C). Pressing Esc, from PRINT SELECTIONS menu, displays ID SELECTION MENU</td></tr>
<tr><td>4.</td><td>The table below provides PCCU function keys that can control the display and printing.
<table>
<tr><th>Key</th><th>Function</th></tr>
<tr><td>+</td><td>Speeds up PCCU display</td></tr>
<tr><td>-</td><td>Slows down PCCU display</td></tr>
<tr><td>Yes (enter)</td><td>Starts and stops PCCU display</td></tr>
<tr><td>← →</td><td>Moves data into view on PCCU display. Should be used when display is not moving</td></tr>
<tr><td>↑ ↓</td><td>Scrolls PCCU display. Should be used when display is not moving</td></tr>
</table>
Results: Functions will occur.
</td></tr>
<tr><td>5.</td><td>Press Esc key for stop print, exit, or continue selections.</td></tr>
</table>

*Continued on next page*

**Step 7. Select FCU by ID**

| Step | Procedure |
|---|---|
| 1. | To select collected FCU by its identifier select, **4) Select FCU by ID**. The following screen is displayed.<br><br>Select SEQ No. 1 ID XXXXXXXXXX<br><br>Depress any of the keys listed below<br><br>YES Include FCU in selections<br>NO exclude FCU from selections<br>EXIT cancel selections<br>CONTINUE finished with selections |
| 2. | Use Yes and No keys to select from which collected FCU's you want to display data. When no other FCU's are available for selection an end of ID list message will appear on the LCD. |
| 3. | Depressing Esc displays ID SELECTION MENU**.** If *no selection* is made, pressing CONTINUE also redisplays ID SELECTION MENU**.** |
| 4. | After making selections, depress **CONTINUE (C),** the LCD displays the following screen. The function of each option is described in Step 6, Select All (For FCU)<br><br>Only selected FCU's, from previous display, are affected by your selections.<br><br>PRINT SELECTIONS / INCLUDE SELECTIONS<br>1) Charac / 5) Charac [NO]<br>2) Events / 6) Events [NO]<br>3) Flow File Hourly<br>4) Flow File Daily / OUTPUT DEVICE<br>7) Screen<br><br>8) Clear Selected Unit |

*Continued on next page*

**Step 7. Select FCU by ID (Continued)**

<table>
<tr><th>Step</th><th>Procedure</th></tr>
<tr><td>5.</td><td>The table below provides the PCCU function keys that can control the display and printing.
<table>
<tr><th>Key</th><th>Function</th></tr>
<tr><td>+</td><td>Speeds up PCCU display</td></tr>
<tr><td>-</td><td>Slows down PCCU display</td></tr>
<tr><td>Yes (enter)</td><td>Starts and stops PCCU display</td></tr>
<tr><td>← →</td><td>Moves data into view on PCCU display. Should be used when display is not moving</td></tr>
<tr><td>↑ ↓</td><td>Scrolls PCCU display. Should be used when display is not moving</td></tr>
</table></td></tr>
<tr><td>6.</td><td>Press Esc key for stop print, exit, or continue selections.</td></tr>
</table>

*Continued on next page*

**Step 8. Select FCU by Sequence Number**

| Step | Procedure |
|---|---|
| 1. | To select a collected FCU by its sequence number, select **5) Select by SEQ. No.** The screen will prompt you to enter the Sequence Number. Sequence numbers are found by entering one of the two of selections. These selections are found on the ID Selection MENU.<br><br>1) Print ID list to screen<br>or<br>2) Print ID list to printer |
| 2. | Enter FCU sequence number of the data to be displayed. |
| 3. | Enter a Yes to accept; Enter No, to change or enter another Sequence Number. After entering Yes to a newly entered number, the PCCU displays the following screen. The function of each option on this menu is described in Step 6, Select All (For FCU).<br><br>Only FCU's, whose sequence number was selected, are affected.<br><br>PRINT SELECTIONS<br>1) Charac<br>2) Events<br>3) Flow File Hourly<br>4) Flow File Daily<br><br>8) Clear Selected Unit<br><br>INCLUDE SELECTIONS<br>5) Charac [NO]<br>6) Events [NO]<br><br>OUTPUT DEVICE<br>7) Screen |

*Continued on next page*

**Step 8. Select FCU by Sequence Number (Continued)**

<table>
<tr><th>Step</th><th>Procedure</th></tr>
<tr><td>4.</td><td>The table below provides the PCCU function keys that can control the display and printing.
<table>
<tr><th>Key</th><th>Function</th></tr>
<tr><td>+</td><td>Speeds up PCCU display</td></tr>
<tr><td>-</td><td>Slows down PCCU display</td></tr>
<tr><td>Yes (enter)</td><td>Starts and stops PCCU display</td></tr>
<tr><td>← →</td><td>Moves data into view on PCCU display. Should be used when display is not moving</td></tr>
<tr><td>↑ ↓</td><td>Scrolls PCCU display. Should be used when display is not moving</td></tr>
</table></td></tr>
<tr><td>5.</td><td>Press Esc key for stop print, exit, or continue selections.</td></tr>
</table>

**Step 9. Print or Clear Data From Analyzer Interface Unit**

Step 9 is for users of the Totalflow Natural Gas Analyzer Interface Unit (AIU). For detailed information on how to use this mode refer to the Totalflow Analyzer Interface Unit User's Manual 2012978-001.

# Example Reports
# Characteristic File Report AGA-7 w/ Std. Characteristics

CHARACTERISTICS FILE REPORT Page #1
METER ID FCU-6411
METER LOC TOTALFLOW tm
COLLECT DATE 06/28/96 11:23:56
REPORT DATE 07/29/96 13:01:25
ERROR CHECK PASS

---------- MONITORED SITE CONDITIONS ----------

| | | |
|---|---|---|
| FCU Software Rev | MD | |
| Contract Hour | 00 | o'clock |
| Battery | 13.9 | volts |
| Sec. Code Switch is | OFF | |
| TEG Auto-Start is | DISABLED | |

---- Last Hour's Alarms ----

| | | | | | |
|---|---|---|---|---|---|
| AADD | ZB | RA | TAD | LL | AMC |
| HLHL | FF | SC | EEE | CL | NGE |
| ____ | __ | __ | ____ | __ | ____ |

| | | |
|---|---|---|
| Corr Rate | 67.8 | scf/hr |
| Uncorr Rate | 67.8 | acf/hr |
| Corr Vol Accum | 17.4 | mscf |
| Uncorr Vol Accum | 17.4 | macf |

--------- LAST HOUR'S CALCULATIONS ---------

| | | |
|---|---|---|
| Average AP | 114.74 | psia |
| Fixed AP | 115.00 | psia |
| AP used in calcs | MEASURED | |

| | | |
|---|---|---|
| Average TEMP | 60.00 | deg. F |
| Fixed TEMP | 60.00 | deg. F |
| RTD Installed? | NO | |
| TEMP Used in Calcs | is FIXED | |

| | | |
|---|---|---|
| Pulse Counts | 678 | |
| Corr Vol | 67.8 | scf |
| Uncorr Vol | 67.8 | acf |

| | | | |
|---|---|---|---|
| C' | 1.0000 | | |
| F(pc) | | 1.0000 | OFF |
| F(tc) | | 1.0000 | OFF |
| F(s) | | 1.0000 | OFF |
| F(aux) | | 1.0000 | OFF |

------- PREVIOUS DAY'S CALCULATIONS ----------

| | | |
|---|---|---|
| Corr Vol | 1627.2 | |
| Uncorr Vol | 1627.2 | |
| Under Uncorr Vol Lo | 0.0 | percent |
| Above Uncorr Vol Hi | 0.0 | percent |

## Characteristic File Report AGA-7 w/ Std. Characteristics, Continued

CHARACTERISTIC FILE REPORT Page #2
METER ID FCU-6411
METER LOC TOTALFLOW tm
COLLECT DATE 06/28/96 11:23:56
REPORT DATE 07/29/96 13:01:25
ERROR CHECK PASS

---------- ANALYTICAL DATA ----------

| | | |
|---|---|---|
| Heating Value | 1000.00 | BTU |
| Specific Gravity | 0.000 | |
| Nitrogen | 0.000 | mol % |
| Carbon Dioxide | 0.000 | mol % |
| F(t) | 1.000 | |
| F(p) | 1.000 | |

---------- OTHER AGA DATA ----------

| | | |
|---|---|---|
| Temperature Base | 60.00 | deg F |
| Pressure Base | 14.730 | psia |

---------- OPERATIONAL LIMITS ----------

| | | |
|---|---|---|
| Uncorr Lo Limit | 5.00 | in. H2O |
| Uncorr Hi Limit | 2047.00 | in. H2O |
| AP Lo Limit | 0.00 | psia |
| AP Hi Limit | 2047.00 | psia |

---------- CALIBRATION DATA ----------

| | | |
|---|---|---|
| Meter K-Factor | 1.000 | acf/pulse |
| Flow Period | 60 | seconds |
| AP LO Cal Point | 14.73 | psia |
| AP Mid Cal Point | 64.73 | psia |
| AP High Cal Point | 114.73 | psia |
| Temperature Bias | 0.00 | deg F |

---------- AUXILIARY CONTACT SELECTS ----------

| | |
|---|---|
| Use Low Charge? | NO |
| Use Uncorr Vol Lo? | NO |
| Use Uncorr Vol Hi? | NO |
| Use AP Lo? | NO |
| Use AP Hi? | NO |
| Use Remote Sense? | NO |
| Use Vol? | NO |
| Auto Reset? | NO |

End of CHARACTERISTICS FILE REPORT

# Example Reports
# Characteristic File Report AGA-7 W/ Ext. Characteristics

CHARACTERISTICS FILE REPORT Page #1
METER ID FCU-6411
METER LOC TOTALFLOW tm
COLLECT DATE 06/28/96 11:23:56
REPORT DATE 07/29/96 13:01:25
ERROR CHECK PASS

---------- MONITORED SITE CONDITIONS ----------

| | | |
|---|---|---|
| FCU Software Rev | MD | |
| Contract Hour | 00 | o'clock |
| Battery | 13.9 | volts |
| Sec. Code Switch is | OFF | |
| TEG Auto-Start is | DISABLED | |

---- Last Hour's Alarms ----

| | | | | | |
|---|---|---|---|---|---|
| AADD | ZB | RA | TAD | LL | AMC |
| HLHL | FF | SC | EEE | CL | NGE |
| ____ | __ | __ | ____ | __ | ____ |

| | | |
|---|---|---|
| Corr Rate | 67.8 | scf/hr |
| Uncorr Rate | 67.8 | acf/hr |
| Corr Vol Accum | 17.4 | mscf |
| Uncorr Vol Accum | 17.4 | macf |

--------- LAST HOUR'S CALCULATIONS ---------

| | | |
|---|---|---|
| Average AP | 114.74 | psia |
| Fixed AP | 115.00 | psia |
| AP used in calcs | MEASURED | |
| | | |
| Average TEMP | 60.00 | deg. F |
| Fixed TEMP | 60.00 | deg. F |
| RTD Installed? | | NO |
| TEMP Used in Calcs | | is FIXED |
| | | |
| Pulse Counts | 678 | |
| Corr Vol | 67.8 | scf |
| Uncorr Vol | 67.8 | acf |
| | | |
| C' | 1.0000 | |
| F(pc) | 1.0000 | OFF |
| F(tc) | 1.0000 | OFF |
| F(s) | 1.0000 | OFF |
| F(aux) | 1.0000 | OFF |

------- PREVIOUS DAY'S CALCULATIONS ----------

| | | |
|---|---|---|
| Corr Vol | 1627.2 | |
| Uncorr Vol | 1627.2 | |
| Under Uncorr Vol Lo | 0.0 | percent |
| Above Uncorr Vol Hi | 0.0 | percent |

CHARACTERISTIC FILE REPORT Page #2
METER ID FCU-6411
METER LOC TOTALFLOW tm
COLLECT DATE 06/28/96 11:23:56
REPORT DATE 07/29/96 13:01:25
ERROR CHECK PASS

---------- ANALYTICAL DATA ----------

| | | |
|---|---|---|
| Heating Value | 1000.00 | BTU |
| Specific Gravity | 0.000 | |
| Nitrogen | 0.000 | mol % |
| Carbon Dioxide | 0.000 | mol % |
| H2S | 0.000 | mol % |
| Helium | 0.000 | mol % |
| Methane | 100.000 | mol % |
| Ethane | 0.000 | mol % |
| Propane | 0.000 | mol % |
| n-Butane | 0.000 | mol % |
| i-Butane | 0.000 | mol % |
| n-Pentane | 0.000 | mol % |
| I Pentane | 0.000 | mol % |
| Hexane | 0.000 | mol % |
| Heptane | 0.000 | mol % |
| Octane | 0.000 | mol % |
| Nonane | 0.000 | mol % |
| Decane | 0.000 | mol % |
| O2 | 0.000 | mol % |
| CO | 0.000 | mol % |
| H2 | 0.000 | mol % |
| Argon | 0.000 | mol % |

---------- OTHER AGA DATA ----------

| | | |
|---|---|---|
| F(pv) Calc Method | AGA-8 | GROSS |
| Vol Calc Method | AGA-7 | 1992 |
| Primary Element | Pulse | |
| Vol Calc Period | 3600 | Secs |
| Log Period | 3600 | Secs |
| Z of Air | 0.9996 | |
| Temperature Base | 60.00 | deg F |
| Pressure Base | 14.730 | psia |

CHARACTERISTIC FILE REPORT Page #3
METER ID FCU-6411
METER LOC TOTALFLOW tm
COLLECT DATE 06/28/96 11:23:56
REPORT DATE 07/29/96 13:01:25
ERROR CHECK PASS

---------- OPERATIONAL LIMITS ----------

| | | |
|---|---|---|
| Uncorr Lo Limit | 5.00 | in. H2O |
| Uncorr Hi Limit | 2047.00 | in. H2O |
| AP Lo Limit | 0.00 | psia |
| AP Hi Limit | 2047.00 | psia |
| AP Max Value | 2048 | psia |

---------- CALIBRATION DATA ----------

| | | |
|---|---|---|
| Meter K-Factor | 1.000 | acf/pulse |
| Flow Period | 60 | seconds |
| AP LO Cal Point | 14.73 | psia |
| AP Mid Cal Point | 64.73 | psia |
| AP High Cal Point | 114.73 | psia |
| Temperature Bias | 0.00 | deg F |

---------- AUXILIARY CONTACT SELECTS ----------

| | |
|---|---|
| Use Low Charge? | NO |
| Use Uncorr Vol Lo? | NO |
| Use Uncorr Vol Hi? | NO |
| Use AP Lo? | NO |
| Use AP Hi? | NO |
| Use Remote Sense? | NO |
| Use Vol? | NO |
| Auto Reset? | NO |

End of CHARACTERISTICS FILE REPORT

# Example Reports
# Events File Report

EVENTS FILE REPORT Page # 1
METER ID FCU-6411
METER LOC totalflow tm
COLLECT DATE 07/01/96 08:12:33
REPORT DATE 07/01/96 08:15:55
ERROR CHECK PASS

| DATE | TIME | EVENT DESCRIPTION | OLD VALUE | NEW VALUE |
|---|---|---|---|---|
| 07/10/96 | 11:24 | Site Code | -3.000 | |
| 07/10/96 | 11:21 | AP Marker (psia) | 45.0 Std | 45.0 FCU |
| 07/09/96 | 07:18 | AP Mid Cal (psia) | 0.00 | 45.00 |
| 07/09/96 | 07:18 | AP Hi Cal (psia) | 0.00 | 115.00 |
| 07/09/96 | 07:18 | AP Lo Cal (psia) | 0.00 | 15.00 |
| 07/09/96 | 07:09 | Meter K-Factor (acf/pulse) | 100.000 | 100.000 |
| 07/09/96 | 06:46 | F(aux) | 1.0000 | 0.0000 |
| 07/07/96 | 13:04 | Temperature Base (deg. F) | 60.000 | 65.000 |
| 07/10/96 | 09:52 | Pressure Base (psia) | 14.730 | 14.650 |
| 07/10/96 | 09:37 | F(t) | 1.000 | 0.983 |
| 07/10/96 | 09:37 | F(p) | 1.000 | 0.977 |
| 07/10/96 | 09:37 | CO2 (mole %) | 0.000 | 4.560 |
| 07/10/96 | 09:37 | N2 (mole %) | 0.000 | 1.230 |
| 07/10/96 | 09:37 | Specific Gravity | 1.0000 | 0.6500 |
| 07/10/96 | 09:37 | AGA - 7 Factor Selects | | |
| | | F(pc) | OFF | ON |
| | | F(tc) | OFF | ON |
| | | F(pv) | OFF | ON |
| | | F(aux) | OFF | ON |
| 07/10/96 | 09:35 | Uncorrected Vol Accum changed to | 1001 | scf |
| 07/10/96 | 09:35 | Uncorrected Vol Accum changed from | 4104125 | scf |
| 07/10/96 | 09:34 | AP Hi Limit (psia) | 2500.00 | 85.00 |
| 07/10/96 | 09:34 | AP Lo Limit (psia) | 0.00 | 45.00 |
| 07/10/96 | 09:34 | ACF Hi Limit (acf/FlowPeriod) | 2500.00 | 95.0 |
| 07/10/96 | 09:34 | ACF Lo Limit (acf/FlowPeriod) | 5.0 | 10.0 |
| 07/10/96 | 09:34 | Security Code (2) changed | | |
| 07/10/96 | 09:33 | Security Code (1) changed | | |
| 07/10/96 | 09:31 | Heating Value (BTU) | 0.00 | 1043.60 |
| 07/10/96 | 09:30 | Site Code | -3.000 | |
| 07/10/96 | 09:28 | Date / Time Changed To | | 07/10/96 11:20 |
| 07/10/96 | 09:27 | Watchdog Timeout | | |

End of EVENTS FILE REPORT

## Site Code Descriptions

Site codes are intended for customer use to describe actions or conditions at meter sites. Negative site codes are reserved for TOTALFLOW use. The following codes are defined by TOTALFLOW.

| | |
|---|---|
| -1 | Re-zero DP |
| -2 | Re-zero AP |
| -3 | Local Data Collection |
| -99 | Analog to Digital Converter - OK |
| -100 | Analog to Digital Converter - Failure |

The following site codes may be reported from FCUs which support the new database. These are actually new event codes which are not defined in the old database format. In order to support come new features without impacting the old database, host reports in PCCU and DOSCCU, these events are reported as negative site code events from the FCU when it is collected in the old database format.

| | |
|---|---|
| -162 | Reset Log Periods |
| -163 | Log Period Changed |
| -164 | Linear/Square Root Averaging |
| -165 | Hold Last Read Analog Values |
| -166 | Maximum Number of Events |
| -167 | Maximum Number of Day Periods |
| -168 | Maximum Number of Log Periods |
| -169 | Size of Local Communications Buffer |
| -170 | Size of Remote Communications Buffer |
| -171 | Extended Memory Free Space |
| -172 | Use Fixed Water Content |
| -173 | Water Content (Lbs/MMSCF) |
| -174 | Water Content Bias |
| -175 | Use Fixed Test Mode Analogs |
| -176 | ROM CheckSum |
| -177 | AI1 External Analog Input Calibration Point #5 |
| -178 | AI1 External Analog Input Calibration Point #4 |
| -179 | AI1 External Analog Input Calibration Point #3 |
| -180 | AI1 External Analog Input Calibration Point #2 |
| -181 | AI1 External Analog Input Calibration Point #1 |
| -182 | AI2 External Analog Input Calibration Point #5 |
| -183 | AI2 External Analog Input Calibration Point #4 |
| -184 | AI2 External Analog Input Calibration Point #3 |
| -185 | AI2 External Analog Input Calibration Point #2 |
| -186 | AI2 External Analog Input Calibration Point #1 |
| -187 | AP Analog Input I/O Channel |
| -188 | DP Analog Input I/O Channel |
| -189 | Analysis Expected in this Period |
| -190 | ISO Tap Type |

# Example Reports
# Flow File Hourly Volume Report

FLOW FILE HOURLY REPORT Page # 1
METER ID FCU-6411
METER LOC totalflow tm
COLLECT DATE 07/01/96 08:12:33
REPORT DATE 07/01/96 08:15:55
ERROR CHECK PASS

| HOUR | AP psia | TEMP deg F | C' | UNCORR Vol acf | CORRECTED Vol scf | AADD HLHL | ZB FF | RA SC | TAD EEE | LL CL | AMC NGE |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | DATE | [ 07/10/97 ] | | _____ | __ | __ | ___ | __ | ___ |
| 01 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 02 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 03 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 04 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 05 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 06 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 07 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 08 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | ____x | x_ | __ | ___ | x_ | ___ |
| 09 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 10 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 11 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 12 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 13 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 14 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 15 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 16 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 17 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 18 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 19 | 83.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 20 | 80.1 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 21 | 43.4 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 22 | 45.0 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 23 | 45.3 | 60.00 | 1.0000 | 216006.1 | 216006.1 | _____ | __ | __ | ___ | __ | ___ |
| 00 | 14.7 | 60.00 | NoFlow | NoFlow | NoFlow | _____ | __ | __ | ___ | __ | ___ |
| DAILY | 75.3 | 60.00 | 1.0000 | 4104125 | 4104.1 mcf | ____x | x_ | __ | ___ | x_ | ___ |

| | | |
|---|---|---|
| UnCorrected Vol Lo Limit | 14.5 | percent of day |
| UnCorrected Volume Hi Limit | 85.5 | percent of day |
| Under AP Low Limit | 0.0 | percent of day |
| Above AP Hi Limit | 0.0 | percent of day |
| Daily Flow Time | 100.00 | percent of day |

End of FLOW FILE HOURLY REPORT

# Example Reports
# Flow File Daily Volume Report

FLOW FILE DAILY VOLUME REPORT Page # 1
METER ID FCU-6411
METER LOC totalflow tm
COLLECT DATE 07/01/96 08:12:33
REPORT DATE 07/01/96 08:15:55
ERROR CHECK PASS

| DATE | AP psia | TEMP deg F | C' | Uncorrected VOL acf | CORRECTED VOL mcf | ERROR CHECK |
|---|---|---|---|---|---|---|
| 07/27/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/26/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/25/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/24/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/23/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/22/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/21/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/20/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/19/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/18/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/17/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/16/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/15/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/14/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/13/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/12/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/11/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/10/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/09/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/08/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/07/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/06/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/05/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/04/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/03/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/02/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| 07/01/96 | 80.9 | 60.0 | 1.0000 | 4104125.0 | 4104.1 | PASS |
| TOTAL | VOLUME | | | | 73873.8 | mcf |
| 07/30/96 | 80.9 | 60.00 | 1.000 | 0.841 | | PASS |
| TOTAL | | | | | | |
| 07/29/96 | 80.9 | 60.00 | 1.000 | 4104125.0 | | PASS |
| 07/28/96 | 80.9 | 60.00 | 1.000 | 410125.0 | | PASS |
| TOTAL | VOLUME | | | | 12312.3 | mcf |

End of FLOW FILE DAILY VOLUME REPORT

# Send FCU Data to CCU

## Description

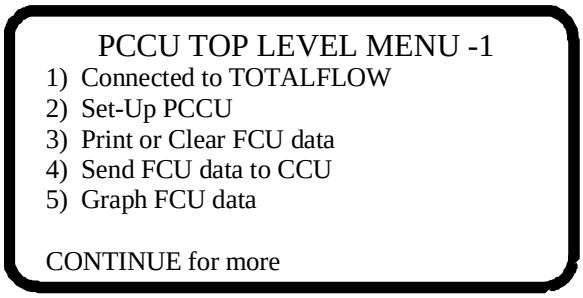
The Send FCU Data to the CCU (Central Collection Unit) lets you down load data collected by the PCCU to the Totalflow Central Collection Unit.

## Related Manual

Refer to Totalflow Central Collection Unit User's Manual, 2010135-001 for detailed information on the CCU.

## Menu Description

The Send FCU Data to CCU mode function is selected from the **PCCU TOP LEVEL MENU-1** by entering **4**.




## Important

The PCCU communications baud rate MUST AGREE with CCU set baud rate. Before transferring data, cable or modem connections with CCU telephone number, must be selected.

Using modem to transfer data, the PCCU must be set to the correct modem speed. If PCCU communication setup is not properly set, error messages are displayed.

Instructions for completing PCCU to CCU data transfer, are presented in CCU User Manual, Section: Data Collection. After selection of O(D)-Data Collection and 1(L)-Local to initiate data transfer, follow instructions on PC screen.

*Continued on next page*

| Step | Procedure |
|---|---|
| 1. | Select **1) Send FCU Data to CCU** from the **PCCU TOP LEVEL MENU-1** to display ID Selection Menu.<br><br>** ID SELECTION MENU **<br><br>1) Print ID list to screen[1]<br>2) Print ID list to printer<br>3) Select ALL<br>4) Select by ID<br>5) Select by SEQ No.<br>6) Select by [FCU]. |
| 2. | Verify that item 6 on the ID Selection Menu is set to FCU; refer to Totalflow Analyzer Interface Unit User's Manual 2012978-001 for information on the AIU setting.<br><br>Pressing the 6 key will toggle the field from AIU to FCU. |
| 3. | Use the table below to determine how you want to specify what data to send.<br><br>**IF you want to ... / THEN go to...**<br>Print ID List to Screen / Step 4<br>Print ID List to Printer / Step 5<br>Send All FCUs / Step 6<br>Send Data By FCU ID Number / Step 7<br>Send Data By Seq. Number / Step 8<br>Print or Clear AIU / Step 9<br><br>Result: a new screen appears. |

*Continued on next page*

**Step 4. Print ID List to Screen**

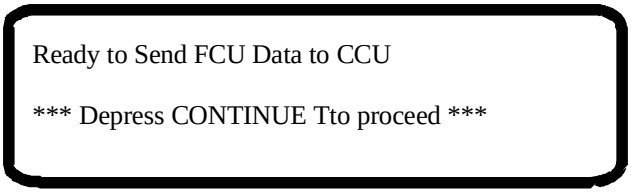
| Step | Procedure |
|---|---|
| 1. | To view a list of the collected FCUs by ID number, select **1) Print ID List to Screen**. The following screen is displayed.<br><br>COLLECTED DATA MM/DD/YY HH:MM.SS<br><br>SEQ ID SIZE COLLECTION DATE<br>1 FCU-6411 5 wk MM/DD/YYHH:MM.SS<br>2 FCU-1234 5 wk MM/DD/YYHH:MM.SS<br><br>End of Collected FCU's List<br>Deprtess EXIT to quit. |

**Step 5. Print ID List to Printer**

| Step | Procedure |
|---|---|
| 1. | To print a list of the collected FCUs by Identifier, select **2) Printer ID List to Printer**. The PCCU must be connected to a serial printer to receive data output. The PCCU Communication Print Baud Rate, print speed, must agree with printer baud rate.<br><br>COLLECTED DATA MM/DD/YY HH:MM.SS<br><br>SEQ ID SIZE COLLECTION DATE<br>1 FCU-6411 5 wk MM/DD/YYHH:MM.SS<br>2 FCU-1234 5 wk MM/DD/YYHH:MM.SS<br><br>End of Collected FCU's List<br>Deprtess EXIT to quit. |

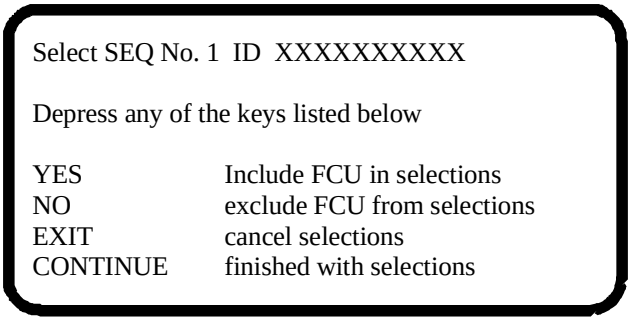
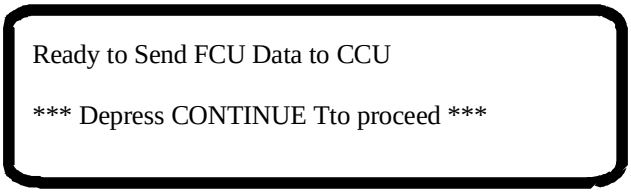
*Continued on next page*

**Step 6. Select All**

| Step | Procedure |
|---|---|
| 1. | To down load all of the collected FCUs choose **3) Select All**. The following screen is displayed.<br>  <br><br>Depressing CONTINUED initiates data transfer from PCCU to CCU.<br><br>PCCU selects all FCU's and automatically cycles, in sequence, to each FCU ID number. Data is sent from each PCCU to the central collection unit.<br><br>Depressing Esc returns user to ID Selection Menu. |

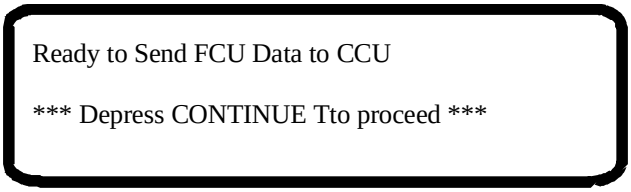
*Continued on next page*

**Step 7. Select FCU by ID**

| Step | Procedure |
|---|---|
| 1. | To select a collected FCU by its identifier select **4) Select FCU by ID**. The following screen is displayed.<br>  <br> |
| 2. | Use Yes and No keys to select which FCU's to display data. When no other FCU's are available for selection an end of ID list message will appear on the LCD. |
| 3. | Depressing EXIT redisplays ID SELECTION MENU. If no selection is made, pressing CONTINUE will cause the following prompt.<br>  <br> |
| 4. | Depressing **CONTINUE (C)** initiates data transfer from PCCU to CCU. |
| 5. | Depressing Esc returns user to ID Selection Menu. |

*Continued on next page*

**Step 8. Select FCU by Sequence Number**

| Step | Procedure |
|---|---|
| 1. | To select collected FCU by its sequence number, select **5) Select by SEQ No.** |
| 2. | Enter the FCU sequence number of the data to be transferred. |
| 3. | Enter a Yes to accept; Enter No, to change or enter another Sequence Number. |
| 4. | Depressing Esc redisplays ID SELECTION MENU. If no selection is made, pressing CONTINUE will cause the following prompt.<br>  |
| 5. | Depressing **CONTINUE (C)** initiates data transfer from PCCU to CCU. |
| 6. | Depressing Esc returns user to ID Selection Menu. |

**Step 9. Select Analog Input Device**

Step 9 is for users of the Totalflow Natural Gas Analyzer Interface Unit (AIU). For detailed information on how to use this mode refer to the Totalflow Analyzer Interface Unit User's Manual 2012978-001.

# Graph FCU Data

## Description

The Graph FCU data mode gives you the capability to display or print the collection data for each FCU the PCCU has collected from. In addition, you can graphically display, on the PCCU, the TEMP, AP, DP or VOLUME versus Time for a selected FCU. Only two of the parameters can be displayed for any 1 day (24 hr.) or 8 day time base.

## Menu Description

The Graph function is selected from the **PCCU TOP LEVEL MENU-1** by entering **5**.

```
PCCU TOP LEVEL MENU -1
1) Connected to TOTALFLOW
2) Set-Up PCCU
3) Print or Clear FCU data
4) Send FCU data to CCU
5) Graph FCU data

CONTINUE for more
```

After entering 5**,** the ID Selection Menu is displays user selectable options. This menu is similar to the menu used for the Print mode. The first two selections are identical and will initiate a display or printout listing the collection sequence, ID number, size and collection date of each FCU the PCCU has collected from.

```
** ID SELECTION MENU **

1) Print ID list to screen[1]
2) Print ID list to printer
3) Select ALL
4) Select by ID
5) Select by SEQ No.
6) Select by [FCU].
```

## Graph Parameters

Items 3, 4, and 5 initiates the graph mode by first letting you select which FCU you want to graph by specifying all FCUs, by its ID number or by its sequence number.

# How to Graph

## Procedure

Read through the following procedural steps before you graph. The Graph function mode is selected from the PCCU TOP LEVEL MENU-**1.**

| Step | Action |
|---|---|
| 1. | Select Graph from the PCCU TOP LEVEL MENU-1 by entering a 5. |
| 2. | If you are graphing from a FCU verify that item 6 on the ID Selection Menu is set to FCU; refer to Totalflow Analyzer Interface Unit User's Manual 2012978-001 for information on the AIU setting.<br><br>Pressing the 6 key will toggle the field from FCU to AIU |
| 3. | Use the table below to determine your next step. |

| IF you want to graph ... | THEN enter... |
|---|---|
| All the recorded FCUs | 3 and go to Step 6 |
| Select particular FCU ID's | 4 and go to Step 4 |
| Select particular Sequence numbers | 5 and go to Step 5 |

| | |
|---|---|
| | Result: a new screen appears. |

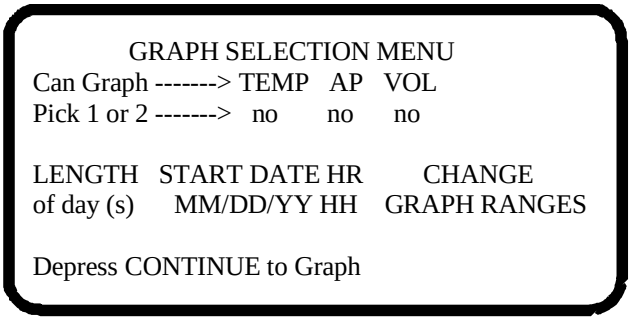
*Continued on next page*

**Procedure (Continued)**

| Step | Action |
|---|---|
| 4. | Selecting 4 from the ID Selection Menu and PCCU displays the following screen. Enter the ID of the FCU and use Yes and No keys to change other parameters.<br><br>Select SEQ No. 1 ID XXXXXXXXXX<br><br>Depress any of the keys listed below<br><br>YES Include FCU in selections<br>NO exclude FCU from selections<br>EXIT cancel selections<br>CONTINUE finished with selections<br><br>A message will tell you when no other FCUs are available for selection.<br><br>Press continue after you make your selections to display the Graph Selection Menu. Go to Step 6. |
| 5. | Enter the Sequence Number of the FCU you want to transfer data from. Depress Yes. A prompt will appear showing you what you have entered. Press No to enter another number. Press Yes to view the graph Selection Menu. |

*Continued on next page*

**Procedure** (continued)

| Step | Action |
|---|---|
| 6. | After a few seconds after selecting ALL, by ID or by Seq. No. the Graph Selection Menu will appear.<br>  <br>GRAPH SELECTION MENU<br>Can Graph -------> TEMP AP VOL<br>Pick 1 or 2 -------> no no no<br>LENGTH START DATE HR CHANGE<br>of day (s) MM/DD/YY HH GRAPH RANGES<br>Depress CONTINUE to Graph |
| 7. | Make appropriate changes to screen: |

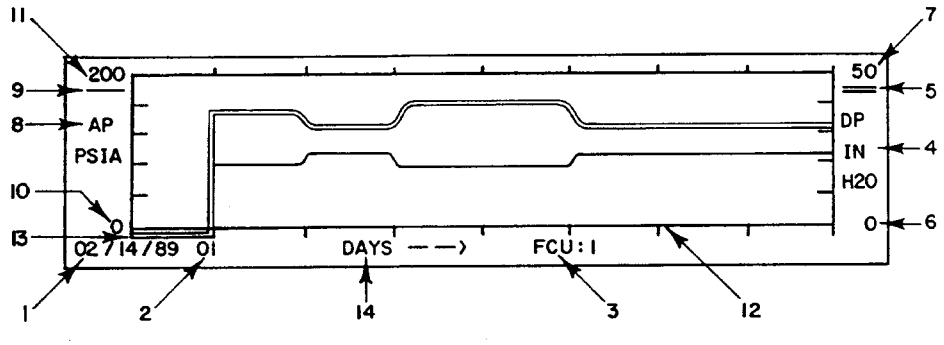
| Key or Field Name | Description |
|---|---|
| Up and Down Arrow Keys | Used to change all variables fields. Remember, only two parameters can be displayed on a graph |
| Left an Right Arrow Keys | Move Cursor to another field |
| Length Selection | selects 1 or 8 days of data to be graphed |
| Start Date Hr | Date when graph is made<br>The Hr is the contract hour in the FCU and cannot be changed |
| Change Graph Ranges | Calls up separate menu to sets up the scales of the graph to better analyze data |

| | |
|---|---|
| 8. | After completing all entries press **Continue (C)** to Graph; see next page for a description of a typical graph. |

# How to Read a Graph

## Graph

The graph shown is an example of an 8-day graph using Absolute Pressure and Differential Pressure as variables.




## Description

The Table describes the key components of the graph

| Item | Description |
|---|---|
| 1. | The date on the graph is the start day of the 8 day graph. In this example 2/14/89 to 2/21/89. |
| 2. | 01 is the contract hour set in the flow computer unit. The start of each day begins at 01:00 or 1 o'clock A.M. |
| 3. | FCU: Indicates the ID number of the FCU being graphed. |
| 4. | Denotes the variable being graphed and the engineering units represented by the graph. |
| 5. | Double line represents the variable whose scale is indicated. |
| 6. | Denotes the minimum scale for the variable indicated on the side of the graph. |
| 7. | Denotes the maximum scale for the variable indicated on this side of the graph. |
| 8. | Denotes the variable being graphed and engineering units represented by the graph. |

*Continued on next page*

### Description (continued)

| Item | Description |
|---|---|
| 9. | Single line represents the variable whose scale is indicated. |
| 10. | Denotes the minimum scale for the variable indicated on this side of the graph. |
| 11. | Denotes the maximum scale for the variable indicated on this side of the graph. |
| 12. | Denotes the start of a new day. Days start at the contract hour. |
| 13. | Double line below the bottom of the graph means that the flow computer unit does not have data available for that time period. |
| 14. | Denotes the unit of time measurement per increment on the graph. |

## Set-Up ID List

**Description**

The Set -Up ID List mode is for users of the Totalflow Natural Gas Analyzer Interface Unit (AIU). This mode lets you create a list of FCUs that are on the RS-485 Bus.

For detailed information on how to use this mode refer to the Totalflow Analyzer Interface Unit User's Manual 2012978-001.

## Valve

**Description**

The Valve mode is for users who have installed the valve control option on a flow computer. If you have this option please contact Applied Automation /Hartmann & Braun for detailed information; see Getting Help in the Introduction portion of this manual.

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# Chapter 5.0
# Maintenance

## Overview

### Introduction

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

### Chapter Highlights

In this chapter you will learn how to:



### Maintenance Support

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

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

*Continued on next page*

### How to Use This Chapter

We recommend that you develop regularly scheduled daily, weekly or monthly maintenance program. By establishing such a maintenance program FCU down-time can be at a minimum.

Record all items within this Chapter, in the maintenance practice procedures. Also include any other procedures found through experience.

Practical experience permits updating this schedule over a period of time. This results in many maintenance items being handled on a routine basis before potential problem(s) result in a failure.

### Maintaining Cleanliness of FCU

Because an FCU 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 FCU inoperable.

### Front Mounted LCD Display

The two lines by 24 alphanumeric character LCD display displays alarm codes on right side of display window. By observing this display, user is informed of operational problems or to flag operational limits. FCU alarm troubleshooting procedures are presented in Troubleshooting Section.

### PCCU Unit Maintenance

This PCCU is maintenance free except for the recharging of NiCad batteries or replacement of the non-rechargeable Alkaline batteries.

### Returning Part(s) for Repair

If a TOTALFLOW component is to be returned to Totalflow 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 return package and ship to:

ABB Automation Inc.
Totalflow Division
7051 Industrial Blvd.
Bartlesville, OK. 74006

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

# Replacing FCU Battery Pack

## Description

This section presents the procedures for removal and installation of FCU battery pack. To access battery pack, open FCU door. Battery pack is located behind front mounted keeper plate.

## Important

If the Totalflow Battery Charger is connected it MUST be disconnected from FCU Digital Circuit Board terminals EXT CHGR +/- prior to removal and installation of battery pack.

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

## See Figures 5-1 & 5-2

Refer to Figures 5-1 and 5-2 during the following procedure.

| Step | Procedure |
|---|---|
| 1. | Make sure paper tab has been removed from lithium battery (BT1). |
| 2. | Either make sure “LL” battery alarm is not being displayed on FCU or measure lithium battery and make sure it is > 3.0V. |
| 3. | Disconnect charging source wiring from charger connector (J5 or J7/J21) |
| 4. | Before removing battery pack, disconnect the Battery Cable from the FCU Digital Circuit Board connector J1. |
| 5. | Remove keeper plate which secures battery pack in its mounting location, by slightly 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. Refer to Application Instruction packaged in FCU shipping container.<br><br>Reinstall keeper plate and tighten three keeper plate mounting screws. |

*Continued on next page*

**Procedures (Continued)**

| Step | Procedure |
|---|---|
| 8. | Reconnect battery pack cable to FCU Digital Circuit Board connector J1. |
| 9. | Reconnect charging source wiring to FCU Digital Circuit Board (J5/J19 or J7/J21). |
| 10. | After closing FCU door, check door mounted LCD display for normal operational readings. |

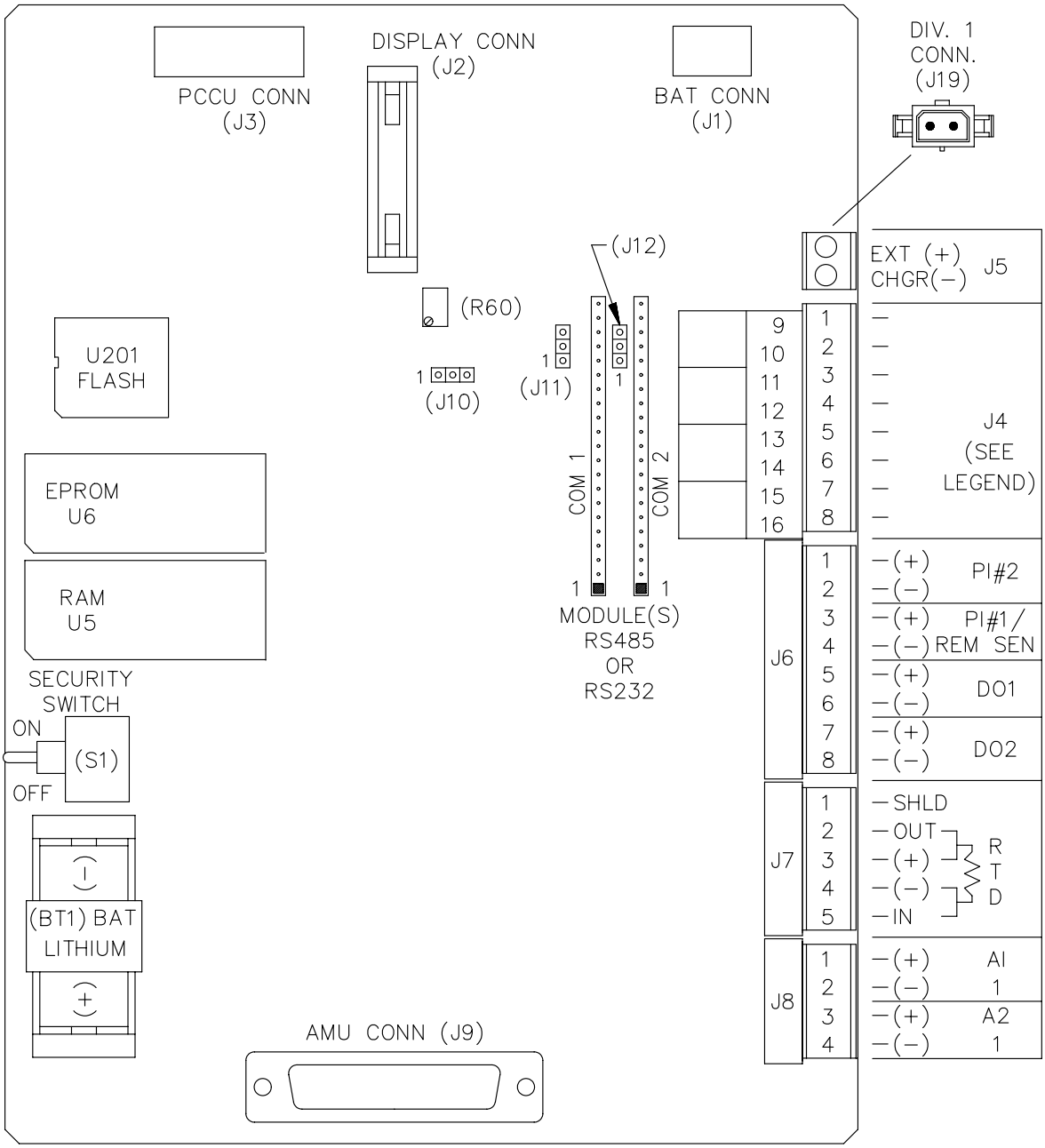



**Figure 5-1. 6400 Digital Circuit Board Parts Location**

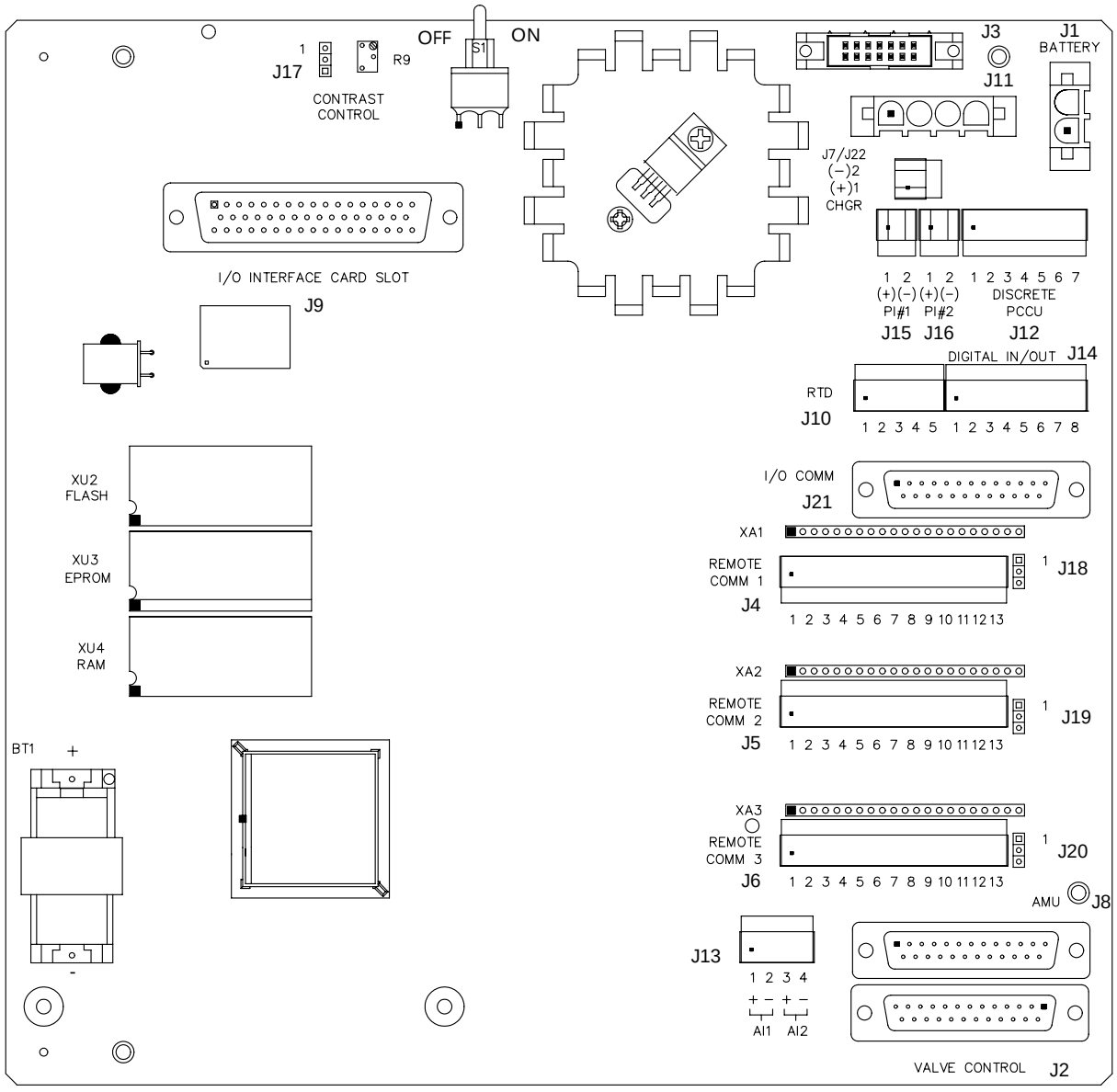



**Figure 5-2. 6700 Digital Circuit Board Parts Location**

# Replacing FCU Digital Circuit Board

## Description

The Digital Circuit Board is mounted to the backside of FCU access door. It is mounted, to the door, on standoffs.

## Caution

The digital circuit board is susceptible to damage by static electricity build-up or improper handling. To prevent this from occurring, user should use a grounding strap.

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

Before handling the board you should install the ground strap on the wrist and then connect it to ground potential. 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 Digital Circuit Board, be certain any RAM stored data has been downloaded to an external storage medium. Failure to do so will result in data loss when Circuit Board is removed.

## See Figures 5-1 & 5-2

Refer to Figures 5-1 and 5-2 during the following procedure.

| Step | Procedure |
|---|---|
| 1. | ***6400 Digital Board Procedure:*** Before Digital Board removal, disconnect the following associated connectors in this order.<br>• If used, disconnect external battery charging source.<br>• Disconnect battery pack connector J1.<br>• Slide, to the right; green terminal strips J4, J6, J8 and J19 from their associated circuit board connector. DO NOT lift connectors upward.<br>• Tape an identifier to each connector so it will be correctly reinserted into the same Board mounting connector during reinstallation of 6400 Digital Circuit Board.<br>• Disconnect PCCU Port connector J3.<br>• AMU Pressure Transducer Port connector J9.<br>• FCU LCD Display port connector J2. |

*Continued on next page*

## Replacing FCU Digital Circuit Board, Continued

**Procedure (Continued)**

| Step | Procedure |
|---|---|
| 2. | Remove four mounting screws and lock washers securing Digital Circuit Board to door mounted standoffs. |

**Note** When removing Digital Circuit Board, grasp its outer edges. This prevents damage to circuitry and components.

| | |
|---|---|
| 3. | Replace and secure 6400 Digital Circuit on four standoffs and secure in place using four screws and lock washers. DO NOT over tighten screws. Doing so could cause damage to Board or associated circuitry. |
| 4. | Reinstall connectors, previously removed, to their original associated board mounted connectors in the following order.<br><br>• AMU Connector<br>• LCD Connector<br>• Other I/O and Communications Connectors<br>• Battery Pack<br>• Charger Last |
| 5. | ***6700 Digital Board Procedure:*** Before Digital Board removal, disconnect the following associated connectors in this order.<br><br>• If used, disconnect external battery charging source.<br>• Disconnect battery pack connector J1.<br>• Remove all signal terminal strips (green terminal strips, and D-sub-miniature connectors) from the 6700 digital circuit board.<br>• Tape an identifier to each connector so it will be correctly reinserted into the same Board mounting connector during reinstallation of 6700 Digital Circuit Board.<br>• Disconnect PCCU Port connector.<br>• Disconnect AMU Pressure Transducer Port from 6700 circuit board.<br>• Disconnect FCU LCD Display port connector. |
| 6. | Replace and secure 6400 Digital Circuit on four standoffs and secure in place using four screws and lock washers. DO NOT over tighten screws. Doing so could cause damage to Board or associated circuitry. |
| 7. | Use step 4 above for 6700 Digital Board replacement |

# Replacing LCD Display Board

## Overview

The LCD Display Board is mounted on the backside of hinged doors behind Digital Circuit Board. To access and remove Display Board, perform the following procedures.

## See Figures 5-1 & 5-2

Refer to Figures 5-1 and 5-2 during the following procedure.

| Step | Procedure |
|---|---|
| 1. | To access the LCD Display Board, open the TOTALFLOW unit door. Board is located behind Digital Circuit Board. |

## Note

To prevent power damage to the Digital Circuit Board and Display Board, it is recommended that the battery pack connector be disconnected from Board mounted connector J1. If an external charging unit is connected to Digital Circuit Board, the applicable EXT CHGR +/- green terminal block must be disconnected.

| | |
|---|---|
| 2. | DO NOT remove Digital Board mounted Lithium battery since it provides power to RAM. This prevents loss of accumulated data.<br><br>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 Digital Circuit Board Display Port connector. To remove connector, extend connector hold down fingers outward. Connector will pop upward. |
| 4. | Remove four Digital Board mounting screws and lock washers. DO NOT let screws and lock washer fall onto Board circuitry.<br><br>Move Board away from door then support it so its circuitry does not come in contact with any metal surface. |

*Continued on next page*

## Replacing LCD Display Board, Continued

**Procedures (Continued)**

| Step | Procedure |
|---|---|
| 5. | Using a 3/16” nut driver, remove four Display Board hexagonal mounting standoffs. Lift Board from door mounted standoffs.<br><br>If Board is being returned to Totalflow for service, it is recommended that attached ribbon cable be left connected and returned with Display Board. |
| 6. | To reinstall Display Board, perform procedures 1 to 5 in reverse order. Once Display Board is reinstalled, apply power to FCU 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.

# Replacing FCU Pressure Transducer (AMU)

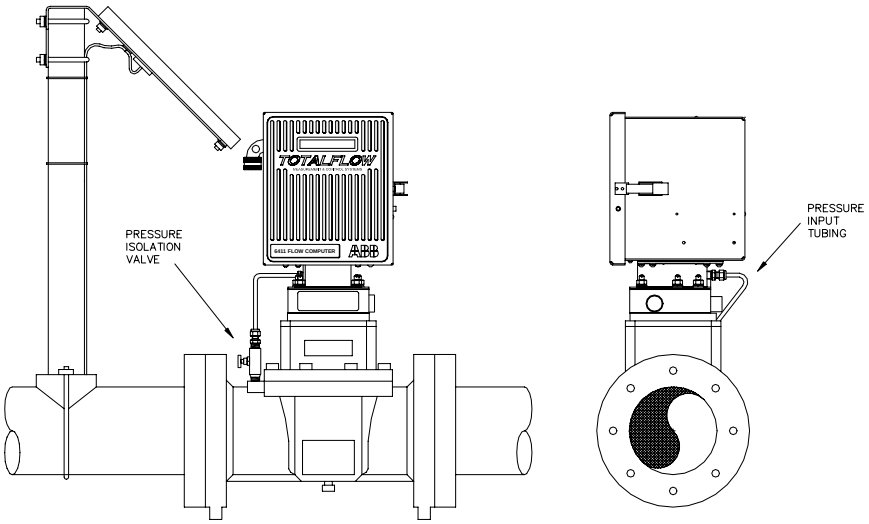
**Important**

Under no circumstances shall the FCU AMU pressure transducer cover be removed. Removal of this cover, and entry into interior of pressure transducer, voids transducer warranty.

If AMU pressure transducer requires servicing, the entire assembly must be removed from FCU, securely packaged for shipping and returned to Totalflow.

**See Figures 5-1 & 5-2**

Refer to Figures 5-1 and 5-2 during the following procedure.

| Step | Procedure |
|---|---|
| 1. | Using user installed AMU static pressure transducer impulse line isolation valve, close and isolate static pressure to AMU Transducer.   |
| 2. | Using user installed AMU static pressure transducer calibration three way valve, close and isolate static pressure to AMU Transducer and open test port to vent static pressure from AMU static pressure transducer. |
| 3. | Remove static pressure impulse line connections from AMU transducer. |

*Continued on next page*

**Procedures (Continued)**

| Step | Procedure |
|---|---|
| 4. | If used, disconnect external battery charging connection (Solar Panel). |
| 5. | Disconnect battery pack. |
| 6. | Disconnect FCU AMU Transducer cable from FCU Digital Circuit Board. Cable is secured to Digital Circuit Board with a Board mounting screw which must be removed.<br><br>***<u>Do not</u> disconnect AMU cable with power connected.*** |
| 7. | Remove cable from AMU Pressure Transducer connector. |
| 8. | Loosen FCU 2” mounting post clamps and rotate FCU a sufficient distance to allow removal of AMU Pressure Transducer. Clearance of approximately 7” is required for removal. After rotation, tighten clamps to hold FCU in place before removing Pressure Transducer. |

**Note** When rotating FCU, be careful not to place twisting stress on attached cables.

| | |
|---|---|
| 9. | Using a Phillips screwdriver, remove eight mounting screws, washers and lock washers securing AMU Pressure Transducer to FCU cabinet. Access mounting hardware from underside of FCU. |
| 10. | Tilt AMU Pressure Transducer slightly upwards then remove unit. A weather sealing gasket is affixed to top side of AMU Pressure Transducer mounting flange. |

**Note** During reinstallation of AMU Pressure Transducer, weather sealing gasket must be reinstalled between the AMU Transducer and bottom of FCU.

| | |
|---|---|
| 11. | To install AMU Pressure Transducer, perform steps 1 to 8 in reverse order. When installing AMU Transducer, the eight mounting screws should be securely tightened to keep external environmental elements from entering FCU interior. |

**Note** Before placing AMU Transducer back into operation, the FCU MUST be calibrated. Refer to Calibration Procedure; Chapter 4 for detailed instructions.

# Chapter 6.0

# Troubleshooting

## Overview

### Overview

This chapter contains troubleshooting tables to correct most FCU alarm code condition(s). The alarm codes flag you that an operational problem exists, and are visible on the FCU's front cover display.

The Troubleshooting Tables are designed to match an alarm code with its probable cause(s) and the corrective procedure(s). Besides these tables, this section contains procedures for setup and troubleshooting an FCUs with an installed radio communication unit.

### Repair Procedures

For instructions on how to remove modules refer to Chapter 5.0, Maintenance.

### Chapter Highlights

This chapter covers the following topics:



*Continued on the next page*

# FCU Reset Procedures

## Description

The FCU 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 FCU 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 FCU microprocessor and not disturb any data that has been stored in RAM. A warm start should be used when taking an FCU out service to perform maintenance or troubleshooting. A warm start can be used when a power or communication interruption caused the FCU 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. Slide external battery pack charger EXT CHGR +/- terminal block from the FCU digital circuit board green terminal block. |
| 2. | Disconnect battery pack connector from Digital Circuit Board BAT CONN connector J1. |
| 3. | Remove Lithium battery, from its Digital Circuit Board mount. The FCU 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 Digital Circuit Board BAT CONN connector J1 and observe LCD display. |
| 5. | If removed, reconnect external battery pack charging source to EXT CHGR connector. |
| 6. | Reinstall Lithium battery in its Digital Circuit Board mount. During installation of battery, observe correct polarity. |
| 8. | Enter all necessary parameters and calibrate FCU, Chapter 4.0, FCU Operation. |

**Note**

When FCU has been cold started, the military 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 FCU microprocessor and not disturb any data that has been stored in RAM.

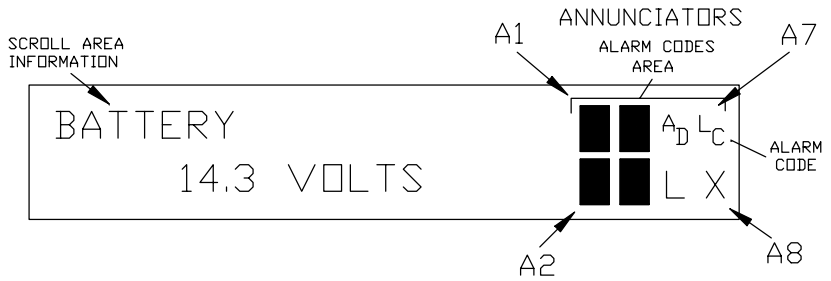
| Step | Procedure |
|---|---|
| 1. | If an external charging source is connected, it must be disconnected. Slide external battery pack charger EXT CHGR +/- terminal block J5 from the FCU digital circuit board green terminal block. |
| 2. | Disconnect battery pack connector from Digital Circuit Board BAT CONN connector J1. The FCU is now out of service. |
| 3. | To place FCU in service, connect EXT CHGR +/- terminal block and battery pack connector J1. |

# FCU LCD Visual Alarm and Status Codes

## Description

After the FCU completes recording hourly flow and operational records the LCD will show any alarm conditions that has occurred. Also, the date, hour and type of alarm conditions are stored in the FCU memory. An alarm can be a word, character, letter or symbol. The alarm character designators shown in Table 6-1 will appear on the right side of the FCU screen; see illustration below. A description of each FCU LCD alarm code, are described in Table 6-1.

For how to use the display to troubleshoot, refer to Chapter 6; Troubleshooting.




Whenever an alarm is indicated the FCU records it on log period flow records. The time and date of the occurrence and the type of alarm indicated are stored in the FCU and can be retrieved when desired.

**Table 6-1 Alarm and Status Code Descriptions**

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A1 | LL | Battery Voltage: When LL (low lithium) is displayed, battery voltage is below 2.5 Vdc. If battery voltage is above 2.5VDC, LL appears shaded. |
| A1 | ↑/↓ | Differential Pressure: If differential pressure is above high limit, ↑ arrow is displayed. If pressure is below low limit, ↓ arrow is displayed. If pressure is within limits, ↑/↓ arrow keys are shaded. |
| A1 | ↑/↓ | Absolute Static Pressure: If absolute static pressure is above high limit, ↑ arrow is displayed. If pressure is below low limit, ↓ arrow is displayed. If pressure is within limits, ↑/↓ arrow keys are shaded. |

*Continued on next page*

**Table 6-1 Alarm and Status Code Descriptions** (Continued)

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A2, A4, A8<br><br>A2=Comm3<br>A4=Comm2<br>A8=Comm1 | ǂ | *TotalFlow Listen Cycle*: ǂ 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. 3 remote communications ports are available (2 for 6400) and can be each programmed as described. When FCU remote port is not active, ǂ is shaded. In early versions of 6700s with EXIO, the A8 display will toggle between ǂ and V. Not toggling could indicate a bad board or PROMs mismatched. |
| See above | → | *Transmitting Data*: If remote port is active and Totalflow Remote Protocol is running, → is displayed. |
| See above | ← | *Receiving Data*: If remote port is active and Totalflow Remote Protocol is running, ←is displayed. |
| See above | **X** | *Remote Port Not Active*: This is the default state at cold start of the FCU for all remote communications ports. Baud rate must be toggled to activate each remote port. Also displayed when a communications card is missing or bad. |
| See above | **M** | *MODBUS ASCII*: Modbus ASCII protocol selected on this port. 3 remote communications ports are available for 6700s, 2 for 6400s which can be programmed with any of 5 resident remote protocols; Totalflow, Totalflow Packet, Modbus ASCII, Modbus RTU, or Square D. |
| See above | **m** | *MODBUS RTU*: Modbus RTU protocol selected on this port. Same options available as above. |
| See above | **1** | Read X-Frame. |
| See above | **2** | Process X-Request. |
| See above | **3** | Wait for Ack/Nak. |
| See above | **4** | Re-Send Packet. |
| See above | **5** | Direct Download. |
| See above | **6** | Positive Acknowledge. |
| See above | **7** | Nak w/packet list. |
| See above | **8** | Negative Acknowledge (Typically wrong Security Code). |
| See above | **9** | Single host write request – send data after ready. |

*Continued on next page*

**Table 6-1 Alarm and Status Code Descriptions** (Continued)

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A3 | = | *Valve Control*: Valve Control option installed. Process Value (PV) is within the user set dead band. No control action required |
| A3 | V | *Valve Control*: Displayed when Valve Control option is on an Expanded I/O board (plug-in RTU). Other Valve Control symbols do not apply. |
| A3 | ⌈ | *Valve Control*: Valve Control option installed. Valve is in full open position. |
| A3 | ⌋ | *Valve Control*: Valve Control option installed. Valve is in full closed position. |
| A3 | ↑ | *Valve Control*: Valve Control option installed. Valve is opening (open signal is being sent to valve actuator). |
| A3 | ↓ | *Valve Control*: Valve Control option installed. Valve is closing. (close signal is being sent to valve actuator). |
| A3 | ö | *Valve Control*: Valve Control option installed. Valve controller override conditions met (DP/AP override set point or Low Battery). |
| A3 | L L | *Valve Control*: Valve Control option installed. Local Lockout is initiated. |
| A3,A5 | A D | Displayed if A to D Converter Absolute Differential Pressure, Absolute Static Pressure or temperature readings exceed maximum counts or are less than minimum counts. If A to D Converter readings are within range, AD is shaded. A3 Location for 6400, A5 location for 6700. |
| A4,A7 | L C | *Low Charger.* Displayed if FCU battery charging voltage is (+)0.4 Vdc or is less than or equal to battery voltage. If (+)0.4 Vdc battery charging voltage is greater than battery voltage, LC is shaded. |
| A4,A6 | L | *Local Protocol.* Displayed when PCCU part is active and running TotalFlow Local Protocol. When PCCU port is not active, L is shaded. This will occur if PCCU is not connected to PCCU port. |
| A5 | H | *Hold.* Displayed when HOLD flag is active. When not active, H is shaded. Also displayed when HOLD flag is active for the following:<br>1. PCCU is being calibrated or<br>2. A to D Converter cannot be read. |

*Continued on next page*

**Table 6-1 Alarm and Status Code Descriptions** (Continued)

| Annunciator Location | Alarm/ Status Codes | Description |
|---|---|---|
| A2, A4, A8<br>A2=Comm3<br>A4=Comm2<br>A8=Comm1 | **¥** | *Totalflow Packet Protocol.* The Totalflow Packet Protocol selected on this port. 3 remote communications ports are available for 6700s, 2 for 6400s which can currently be programmed with any of 5 resident remote protocols; Totalflow, Totalflow Packet, Modbus ASCII, Modbus RTU, or Square D. |
| See above | **S** | *Square D Protocol*: Square D protocol is running on this port. Same options available as above. |
| See above | **r** | *Alarm Monitoring System.* Ring indicator for the alarm cryout option. |
| See above | **h** | *Alarm Monitoring System.* Hang up indicator for the alarm cryout option |
| See above | **i** | *Alarm Monitoring System.* Modem initialization indicator for the alarm cryout option. |
| See above | **R** | *LevelMaster*: LevelMaster tank gauging option installed. Tank level(s) and temperature are polled (user selectable intervals) by flow computer via RS485. |
| A6 | **C** | *Host Console.* Host Console connected and communicating. |
| A6 | **T** | *Terminal Mode.* Terminal is connected and communicating. See Technical Bulletin #44. |
| A8 | **L V** | *Low Voltage-Communications.* FCU battery voltage below 12 Vdc--too low to communicate. If FCU is below 11.5 Vdc, sleep mode will occur. |
| A8 | **+9** | *Alarm Monitoring System:* Successful download of alarm page. |
| A8 | **?** | *Alarm Monitoring System:* Received exception broadcast. |

# FCU Troubleshooting

## Overview

Alarm conditions and their probable cause, and procedure(s) for correcting the problem, are presented in Table 6-2.

**Table 6-2 Troubleshooting FCU**

| Alarm Condition | Probable Cause | Procedure |
|---|---|---|
| SLEEP | Battery Voltage Below 11 VDC | 1. Try to bring FCU out of SLEEP mode by giving it a WAKE-UP command using PCCU. This causes FCU to function normally for two (2) minutes. If battery pack voltage is still below 11 VDC, FCU returns to SLEEP mode. This allows enough time to check all alarm conditions.<br>2. Check battery pack cable. It must make a good secure electrical connection with Digital Circuit Board BAT CONN connector J1.<br>If battery pack cable is securely connected, check battery pack voltage. If voltage is low, replace with another battery pack. |
| LC | Charging Source Below 0.8 VDC Plus Battery Pack Voltage | Check battery pack charging source with PCCU. This is for either Solar or externally connected charging sources. |
| LC | Solar Power Charging Unit | 1. Check that the solar panel is positioned to receive direct sunlight. In low lighting conditions, normally display LC.<br>2. Check solar panel angle and direction. In northern hemisphere, panel should face due south and due north in southern hemisphere. |

*Continued on next page*

**Table 6-2** (Continued)

| Alarm Condition | Probable Cause | Procedure |
|---|---|---|
| LC | Solar Power Charging Unit Cont'd. | 3. Check solar panel for any physical damage or obstructions to sunlight. Sunlight obstruction prevents solar panel from receiving enough sunlight to charge installed battery pack.<br><br>Solar panel should be positioned so it receives the most sunlight. Do not place it in a shaded area.<br><br>4. Check solar panel wiring to be certain it is correctly connected to associated Digital Circuit Board green termination block. Refer to Figure 6-2.<br><br>5. If solar panel wiring is correct, sunlight is not obstructed and voltage does not increase above 0.8 VDC under bright sunlight, replace Solar Panel. |
| LC | AC Power Unit | 1. Check AC charger wiring to FCU green termination block connector J5. Be certain wiring is correct.<br><br>2. Check input AC voltage to external AC charging unit. Be certain primary AC voltage is correct.<br><br>3. If input primary AC voltage level is correct, wiring to FCU Digital Circuit Board green terminal is correct and there is no DC output from the charger, replace charger fuse.<br><br>4. If fuse is not faulty or there is no charger DC output voltage after replacing fuse, replace AC charging unit. |

*Continued on next page*

**Table 6-2** (Continued)

| Alarm Condition | Probable Cause | Procedure |
|---|---|---|
| AD | A/D Converter on Digital Electronics Board is Over or Under Range | This alarm condition can be caused by differential or absolute pressure being under or over measurement range and/or temperature is out of measurement range.<br><br>1. Check AP, DP and temperature with PCCU operating in Monitor mode. This determines which condition is causing alarm. |
| AD | Differential or Absolute Pressure Causing Alarm | 1. From PCCU enter CALIBRATION check mode. This forces FCU to monitor differential or absolute pressure.<br><br>2. Vent meter, run installed Manifold, to atmospheric pressure. Check to see if alarm code AD disappears. If it does, it is an indication transducer is being operated out of its pressure range.<br><br>3. If AD alarm code does not disappear, replace AMU. |

**Important** Do not remove cover from AMU transducer. Doing so voids warranty. Remove AMU as an entire assembly.

**Table 6-2** (Continued)

| Alarm Condition | Probable Cause | Procedure |
|---|---|---|
| AD | Temperature Measurement Causing Alarm | A faulty RTD Probe, or loose wiring connection(s), can cause an AD alarm code.<br><br>1. Check RTD wiring on FCU Digital Board green terminal connector J7.<br><br>2. To determine if problem is with the RTD Probe or FCU Digital Circuit Board, disconnect green RTD wiring connector from Digital Board connector.<br><br>3. Perform either of the following two procedures:<br><br>Substituting RTD Probe with Resistor: These procedures are performed on the Digital Circuit Board. .<br><br>1. Connect a 100-ohm resistor across connector RTD OUT and (+) terminals.<br><br>2. Connect a jumper wire from J7 terminals 2 and 3.<br><br>3. Connect a jumper wire from J7 terminals 4 and 5.<br><br>4. If FCU is setup with RTD connected to Digital Circuit Board green connector, FCU LCD display should read approximately 32°F.<br><br>If temperature is 32°F, RTD probe is faulty and should be replaced. If temperature is not 32°F, Digital Circuit Board or AMU is faulty and should be replaced. |

*Continued on next page*

**Table 6-2** (Continued)

| Alarm Condition | Probable Cause | Procedure |
|---|---|---|
| AD Cont'd. | Temperature Measurement Causing Alarm Cont'd. | RTD Probe Resistive Impedance Check:<br>1. Immerse RTD Probe in ice bath.<br>2. Perform a continuity check between any two similar colored wires. Measured resistance should be 1-ohm or less.<br>3. Perform a continuity check between any two dissimilarity colored wires. Measured resistance should be approximately 100 ohms.<br>4. Perform a continuity between RTD shield and any other wire. Measured resistance should be in the megaohm range. |
| ↑ | Indicates that DP or AP is OVER Operational Limit Set with PCCU. | 1. With PCCU operating in ENTRY mode, reset differential or absolute pressure operational limit to a higher value.<br>or<br>2. Change manifold orifice plate to bring pressure measurement below operational limit. |
| ↓ | Indicates that DP or AP is UNDER Operational Limit set with PCCU. | 1. With PCCU operating in ENTRY mode, reset differential or absolute pressure operational limit to a lower value.<br>or<br>2. Change manifold orifice plate to bring pressure measurement above operational limit. |

# FCU Communications

## Overview

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

## What is in This Section

This section contains the following Communication Troubleshooting procedures:

- Central Collection Unit (CCU)
- RS-232 Serial Communication
  - FCU Will Not Respond
  - Receiver Supply Voltage
  - Receive Data
  - Request to Send (RTS)
  - Transmit Data
  - Existing Communication Problems
- RS-485 Communications
  - FCU Will Not Respond
  - Transceiver Power Supply Switch
  - Transceiver Power Supply
  - Receive Data
  - Request to Send (RTS)

## Communication Configurations

The two basic types of radio communications that can be used between the FCU and a radio receiver, are:

RS-232 Communications: Communication is accomplished using an RS-232 Module (P/N-2015192-001), connected to the FCU Digital Electronics Board, through the associated RS-232 or RS-485 connector.

RS-485 Communications: Communication is accomplished using an RS-485 Module (P/N-2015193-002), connected to the FCU Digital Electronics board, through the associated RS-232 or RS-485 connector.

## Warning


Before removing or installation either of the above communication interface modules, it is important that you disconnect FCU external battery charger and main FCU installed battery pack cable connectors from Digital Circuit Board. Refer to Figure 6-1.

*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 following information:

- Verify RS-232 or RS485 Interface Modules, cables, associated FCU Digital Board MODULE RS-485 or RS-232 connector and radio are correctly installed.
- Check FCU identifier (ID) number. Log the ID for future reference.
- Log FCU 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, FCU displays the → after it recognizes the FCU identifier number.
- Check baud rate of FCU 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 listening time is 4 seconds.

# Central Collection Unit (CCU)

## Overview

The following CCU troubleshooting procedures will assist the user in determining the possible cause for an indicated error message. Refer to Table 6-3.

**Table 6-3 Central Collection Unit (CCU)**

| Error Message | Possible Cause |
|---|---|
| FCU Did Not Respond to Communication Message | • CCU transmitting from wrong serial port.<br>• In Meter ID Manager, FCU ID is incorrect.<br>• In Meter ID Manager, communication baud rate is incorrect.<br>• In Meter ID Manager link establishment time is incorrect.<br>• Bad communication link.<br>• More than one FCU has same ID.<br>• Problem(s) with installed hardware. |
| CRC Error Detected in FCU Data | • Bad communication link<br>• Installed hardware problems |
| FCU Error Detected in CCU Transmis-sion | • In Meter ID Manager, FCU security code is incorrect. |
| FCU Modem Did Not Answer | • In Meter ID Manager, FCU phone number is incorrect.<br>• In Meter ID Manager, communication BAUD rate is incorrect.<br>• Incorrect type of modem being used. |
| FCU Did Not Respond to Download Request | • CCU transmitting from incorrect serial port.<br>• In Meter ID Manager, FCU ID is incorrect.<br>• In Meter ID Manager, communication BAUD rate is incorrect.<br>• In Meter ID Manager, link establishment time is incorrect.<br>• Bad communication link.<br>• More than one FCU has same ID.<br>• Problem(s) with installed hardware.<br>• Wrong security code |

# RS-232 Serial Communications

## Overview

The following RS-232 Serial Communication troubleshooting procedures will assist the user in what may be the possible cause for indicated error message. Refer to Table 6-4.

**Table 6-4 RS-232 Serial Communication**

| Error Message | Possible Cause |
|---|---|
| FCU Will Not Respond to Communication Message | • Verify FCU Digital Circuit Board wiring to radio transceiver is correct.<br>• Verify battery pack voltage is greater than 11.5 VDC.<br>• Verify FCU identification number and access security code are correct.<br>• Check FCU transceiver SWVBATT supply voltage. Refer to the following Measuring SWVBATT Transceiver Supply voltage for procedures. |
| Measuring SWVBATT Transceiver Supply Voltage | • Using a digital voltmeter, measure transceiver SWVBATT DC supply voltage between the following Digital Circuit Board green connector terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-1 (GND [BLK]) and<br>J4-3 (SWVBATT [WHT])<br><br>*Series 6700*<br>J4-2, J5-2, or J6-2 (GND [BLK])<br>J4-3, J5-3, or J6-3 (SWVBAT [WHT])<br><br>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 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.

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**Table 6-4** (Continued)

| Error Message | Possible Cause |
|---|---|
| Measuring Receiving Data [RXD (+)] Voltage | • Using an oscilloscope or digital voltmeter, connect it to Digital Circuit Board J4 green connector across the following terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-1 (GND [BLK] and<br>J4-6 (RXD+ [BRN])<br><br>*Series 6700*<br>J4-2, J5-2, or J6-2 (GND [BLK])<br>J4-6, J5-6, or J6-6 (RXD [BRN])<br><br>When communication data is being transmitted from CCU to FCU, voltage should vary between +5 VDC and -5 VDC. |

**Note**

These voltages may be difficult to see using a digital voltmeter. They can be seen using an oscilloscope.

Verify voltage by continuously polling FCU from CCU.

| | |
|---|---|
| Measuring Request To Send (RTS) Voltage | • Using an oscilloscope or digital voltmeter, connect measuring device to Digital Circuit Board J4 green connector across the following terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-1 (GND [BLK]) and<br>J4-8 (RTS [Red])<br><br>*Series 6700*<br>J4-2, J5-2, or J6-2 (GND [BLK])<br>J4-8, J5-8, or J6-8 (RTS [RED])<br><br>When FCU is sending communication data to CCU, voltage should be +5 VDC. |

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**Table 6-4** (Continued)

| Error Message | Possible Cause |
|---|---|
| Measuring Transmitting Data (TXD+) Voltage | • Using an oscilloscope or digital voltmeter, connect measuring device to Digital Circuit Board J4 green connector across the following terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-1 (GND [BLK]) and<br>J4-4 (TXD+ [GRN])<br><br>*Series 6700*<br>J4-2, J5-2, or J6-2 (GND [BLK])<br>J4-4, J5-4, or J6-4 (TXD [GRN])<br><br>When communication data is being transmitted from FCU, voltage should be +5 VDC; when transmitting voltage should be -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 FCU from CCU.

| | |
|---|---|
| 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.<br>• Using a wattmeter, check transceiver output power. Refer to manufacturer's documentation for measuring instructions.<br>• Verify that transceiver is on correct frequency. Refer to manufacturer's documentation for checking frequency instructions. |

# RS-485 Communications

## Overview

The following RS-485 Communications troubleshooting procedures will assist the user in what may be the possible cause for indicated error message. Refer to Table 6-5.

**Table 6-5 RS-485 Communications**

| Error Message | Possible Cause |
|---|---|
| FCU Will Not Respond To Communication Message | • Verify that FCU Digital Circuit Board wiring, to optional universal Communications Interface (UCI) Board or Radio Modem Assembly, is correct.<br>• Verify wiring from UCI Board to Radio Transceiver Assembly is correct. Verify UCI Board jumper settings are correct.<br>• Verify wiring from Radio Modem Assembly to Radio Transceiver Assembly is correct.<br>• Verify FCU battery pack voltage is at least 11.5 VDC.<br>• Verify that FCU identifier 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 digital Circuit Board connector terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-1 (GND [BLK]) and<br>J4-3 (SWVBATT [WHT])<br><br>*Series 6700*<br>J4-2, J5-2, or J6-2 (GND [BLK])<br>J4-3, J5-3, or J6-3 (SWVBAT [WHT])<br><br>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.

*Continued on next page*

**Table 6-5** (Continued)

| Error Message | Possible Cause |
|---|---|
| Measuring Battery Pack Voltage (VBATT) | • Using a digital voltmeter, measure transceiver VBATT power supply voltage between the following Digital Circuit Board connector terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-1 (GND [BLK]) and<br>J4-2 (VBATT)<br><br>*Series 6700*<br>J4-2, J5-2, or J6-2 (GND [BLK])<br>J4-1, J5-1, or J6-1 (VBATT)<br><br>Battery voltage should be greater than 12.0 VDC. |

**Important**

Power to transceiver can be provided from an external power supply. This allows FCU to switch external power to transceiver. Switching is accomplished using a 12VDC switch line connected to J4-3 (WHT) for Series 6400 and J4-3, J5-3, or J6-3 for Series 6700. Refer to Measuring SWVBATT Transceiver Supply Switch Voltage.

If this option is used, (VBATT) is not used.

| | |
|---|---|
| Measuring RS-485 Line Driver voltage | • Using an oscilloscope or digital voltmeter, connect leads to the following Digital Circuit Board terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-4 (BUS-[RED]) and<br>J4-6 (BUS+[BRN])<br><br>*Series 6700*<br>J4-6, J5-6, or J6-6 (BUS- [RED])<br>J4-4, J5-4, or J6-4 (BUS+ [BRN])<br><br>If a RS-485 I/O board is plugged into the 6700 digital board, BUS+ is on J4-8. J5-4 and J6-4 don't change.<br><br>Voltage should vary between +5 VDC and 0 VDC when communication data is being transmitted from CCU to FCU. |

*Continued on next page*

**Table 6-5** (Continued)

| Error Message | Possible Cause |
|---|---|
| Measuring Request to Send (RRTS) Voltage | • Using an oscilloscope or digital voltmeter, connect leads to the following Digital Circuit Board terminals. Refer to Figures 5-1 and 5-2.<br><br>*Series 6400*<br>J4-1 (GND [BLK]) and<br>J4-8 (RRTS [VIO])<br><br>*Series 6700*<br>J4-2, J5-2, or J6-2 ( GND [BLK])<br>J4-8, J5-8, or J6-8 (RRTS [VIO])<br><br>If a RS-485 I/O board is plugged into the 6700 digital board, RRTS is on J4-10. J5-8 and J6-8 don't change.<br><br>Voltage should be +5 VDC when sending data to CCU. 0 V 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 FCU from CCU.

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

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

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# Chapter 7.0

# Plug-in RTU (Expanded I/O) Operation

## Overview

### Overview

This chapter provides you with an explanation of the operation of the Plug-in RTU (PIRTU or Expanded I/O) system.

The PIRTU feature is a method to provide inputs and outputs at a meter site for control or monitoring purposes. Please consult with Project Engineering for custom applications programming.

The PIRTU feature allows the model 6714 I/O to be expanded to the following additional I/O points:

- 7 analog inputs
- 4 analog outputs
- 8 digital inputs
- 8 digital outputs
- 2 high speed pulse accumulators (10 kHz)

### Chapter Highlights

This chapter covers the following topics

## Introduction

### What is a Plug-in RTU

The PIRTU is a system that expands the I/O capabilities of the model 6714 FCU. This system is made up of a main electronics board (PIRTU), two 25 pin interconnect cables and a I/O field termination board.

The PIRTU is inserted into the 50 pin expansion connector of the 6714 main electronics system board and is powered by the 6714 battery system.

Because the PIRTU is connected to the host 6714 FCU, items being measured such as; Differential Pressure, Static Pressure, Temperature, and Flow Rate can be used by the PIRTU for control feedback purposes.

### What is a Stand-Alone RTU

The SARTU is a system similar to the PIRTU with identical I/O capabilities with the exception that it does not plug into the model 6714 FCU. This system is made up of a main electronics board (SARTU), two 25 pin interconnect cables and a I/O field termination board. The SARTU requires it's own power supply and charging source.

The SARTU can of course be multi-dropped using the RS485/RS422 communications capabilities.

Please see the "6790 Installation Operations and Maintenance Manual" for more information on this system.

## Equipment Layout

## Component Locations

The following system components layout drawing shows all the major functional parts and their locations when mounted in a model 6714 FCU system.

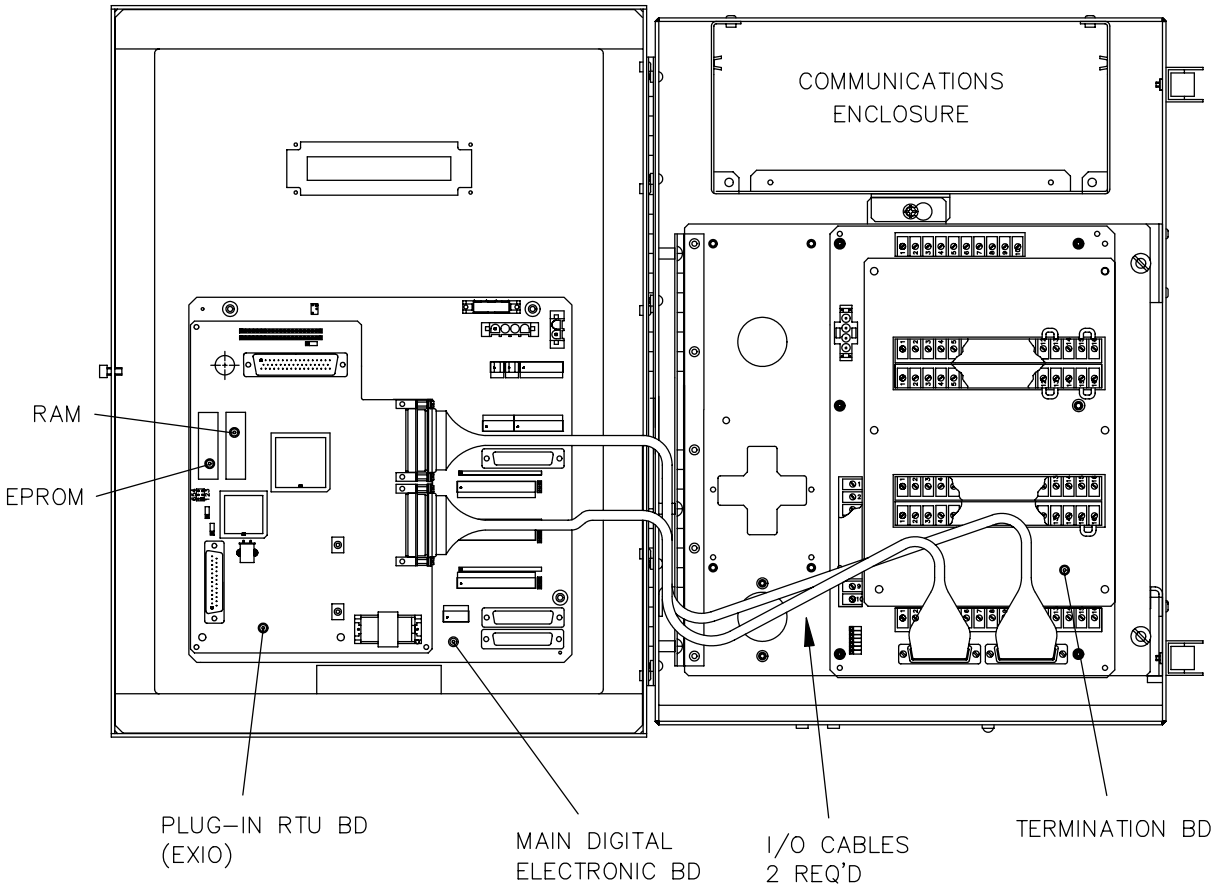



**Figure 7-1 Plug-in RTU system layout drawing.**

# PIRTU Operational Programming and Calibration using the PCCU

## Section Highlights

This section covers the following topics.

# Top Level Menu

## How to Connect PCCU to the PIRTU

Only the PCCU operation that pertains to the Expanded I/O and RTU will be covered in this section. If using PCCU32, a Windows version of PCCU, use the online Help files for assistance. Refer to the Model 6625 Portable Calibration and Collection Unit section of the 6713 Flow Computer Manual for full details about the use of the 6625 PCCU including use with Flow Computer functions.

The PCCU is used with the PIRTU feature to name the available channels with names that apply to the measurement being taken. 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 can be named "Feet", "Inches", or "Barrels".

The PCCU is also used to calibrate the Analog Input, Analog Output 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. Currently only 6 of the measurement channels can be collected by the host CCU software at a time. Up to 16 items can be stored in the trend data base. The PCCU is used to select which channels "trend".

While connected to the I/O device, the PCCU can be used to Monitor the inputs and outputs being measured by the PIRTU.

## Connect PCCU to PIRTU

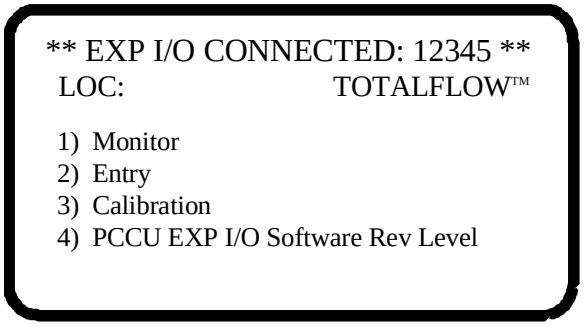
Follow the steps outlined below to connect the PCCU to the PIRTU for purposes of programming, calibrating and general set-up requirements.

| Step | Procedure |
|---|---|
| 1. | Connect the PCCU to the correct military connector on the left side of the model 6714 FCU described in the previous section (see detail drawing figure 2-2). |
| 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:<br><br>PCCU TOP LEVEL MENU -1<br>1) Connected to TOTALFLOW<br>2) Set-Up PCCU<br>3) Print or Clear FCU data<br>4) Send FCU data to CCU<br>5) Graph FCU data<br><br>CONTINUE for more |

*Continued on next page*

| Step | Procedure |
|---|---|
| 3. | Respond to the initial prompt from the PCCU as follows: |
| 4. | Enter 1 if the PCCU is connected to any TotalFlow field device. The initial communication between the device and the PCCU indicates to the PCCU the type of device attached. The PCCU then initiates the proper configuration displays.<br><br>For any of the other items displayed on the PCCU TOP LEVEL MENU, please refer to the MODEL 6625 PCCU User's Manual.<br><br>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.<br><br>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:<br><br>Please Wait. Reading EXP I/O Data.<br><br>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.<br><br>The next screen displayed is:<br><br>  <br><br><br>Depress the corresponding number key to select the desired operational mode.<br><br>• *Monitor Mode:*<br>This mode enables the display of up to six operating conditions of the measured I/O points at a time.<br><br>• *Entry Mode:*<br>This mode enables the entry of setup information the PIRTU needs for proper operation.<br><br>• *Calibration Mode:*<br>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

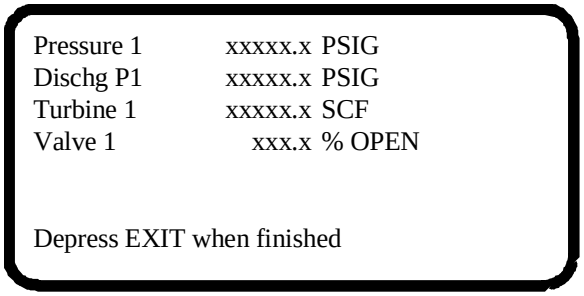
Follow the steps outlined below to enter into the MONITOR Mode of operation.

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

## Entry Mode Operation

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 Expanded I/O Date/Time
- Set the Expanded I/O Identification
- Set the Expanded I/O Location Description
- Set EXP I/O 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:<br><br>** ENTRY MODE MENU **<br>1) EXP I/O Date / Time<br>2) ID<br>3) Location<br>4) EXP I/O Security Code<br>5) Trend Channel<br>6) Channel Tags<br>7) Set Digital Outputs<br><br>Items 1 thru 4 are similar to the Entry Mode items of an FCU. |

| Step | Procedure |
|---|---|
| 2. | Select 1, EXP I/O Date/Time, and the following screen is displayed:<br><br>EXP I/O Date/Time is MM.DD.YY HH:MM.SS<br><br>PCCU Date/Time is MM.DD.YY HH:MM.SS<br><br>Set EXP I/O with PCCU date/Time?<br><br>The display shows the clock of the I/O 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 I/O time with the PCCU time. Answer No to not change the I/O 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.<br><br>The clock of the I/O is separate from the clock of the Flow Computer. The 2 clocks should be set to agree with each other. |

*Continued on next page*

## **Entry Mode** - Continued

| Step | Procedure |
|---|---|
| 3. | Select 2, ID, to enter the ID of the I/O. In the FCU - I/O configuration, the I/O operation and data base are separate from the operation and data base of the FCU. Each must have unique IDs.<br><br>When 2 is selected, the following appears:<br><br>ID is 12345 . OK?<br><br>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 characters, either alpha, numeric or a combination of the two can be used in the ID. Spaces and hyphens are allowed. |
| 4. | Press 3, Location, to enter a location description of the I/O. 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, EXP I/O 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.<br><br>When selected, the following appears:<br><br>EXP I/O SECURITY CODE<br>Enter new LEVEL 1 code: _____<br><br>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 EIO - RTU requires that the Level 2 code for the device be entered at the Meter ID Manager. |

*Continued on next page*

| Step | Procedure |
|---|---|
| Step 6 continued | After entering the numbers, place the Security Code Switch in the ON position.<br><br>NOTE: In the configuration where the I/O is used with an FCU (plug in RTU), the Security Code Switch on the FCU electronics board serves as the security switch for the I/O also. The switch is ON when it is in the Down position.<br><br>In the stand alone RTU configuration, the Security Switch is located on the electronics board. The switch is ON when it is in the Up position.<br><br>Remote communications with the PIRTU 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. |

# Setting Channel Tags

## Set Channel Tags Mode

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

The naming of the channels is usually the first step in setting up the PIRTU 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.

## Setting 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:<br><br>** CHANNEL TAGS MENU **<br><br>1) Analog Inputs<br>2) Analog Outputs<br>3) Pulse Inputs<br>4) Digital Inputs<br>5) Digital Outputs<br><br>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:<br><br>*** Analog Input Tags ***<br><br>1) Channel Tag [1]<br>2) Tag Tank Lvl 1<br>3) Units BARRELS |

*Continued on next page*

## **Setting Channel Tags** - Continued

| 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.<br><br>The following is displayed:<br><br>*** Analog Input Tags ***<br><br>1) Channel Tag [3]<br>2) Tag Pressure 1<br>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 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

## Trend Channels

The PIRTU feature has the capability of storing information such as digital input and output status, analog input and outputs, and pulse accumulations, etc., up to sixteen (16) channels of information in a trend database. Six channels can then be collected and displayed by the host application (CCU) per collection. The information shows the "trend" of the channel and is referred to as “Trend Information” or “Trend Channel Data”. The PCCU is used to select which analog or pulse input channels of the PIRTU to collect.

## Setting 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:<br><br>** ENTRY MODE MENU **<br>1) EXP I/O Date / Time<br>2) ID<br>3) Location<br>4) EXP I/O Security Code<br>5) Trend Channel<br>6) Channel Tags<br>7) Set Digital Outputs |
| 2. | The Trend Channel assignment screen will be displayed:<br><br>Select Trend Channel<br>1) Trend Channel 1 trend off<br>2) Trend Channel 2 trend off<br>3) Trend Channel 3 trend off<br>4) Trend Channel 4 trend off<br>5) Trend Channel 5 trend off<br>6) Trend Channel 6 trend off<br><br>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. |

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| Step | Procedure |
|---|---|
| | Perform the following steps to assign analog or pulse input channels to be trended.<br><br>Select Trend Channel<br><br>1) Trend Channel 1 trend off<br>2) Trend Channel 2 trend off<br>3) Trend Channel 3 trend off<br>4) Trend Channel 4 trend off<br>5) Trend Channel 5 trend off<br>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. Additionally Absolute Pressure, Differential Pressure, and Flow Rate are active and are derived directly from the model 6714 FCU that the PIRTU is plugged into.<br><br>Select ONE item to assign to the Trend Channel.<br><br>>Tank Lvl 1 Tank Lvl 2 Pressure 1<br>Pressure 2 Comp Tmp 1 Dischg P1<br>Dischg P2 Turbine 1 Turbine 2<br>Valve 1 Valve 2 Valve 3<br>Valve 4 ABS.PRES DIFF.PRES<br>FLOWRATE Trend Off<br>Use ARROW keys to MOVE and CHANGE<br>Depress CONTINUE when finished<br><br>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. |

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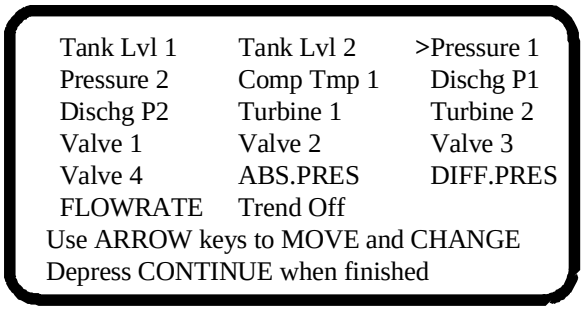
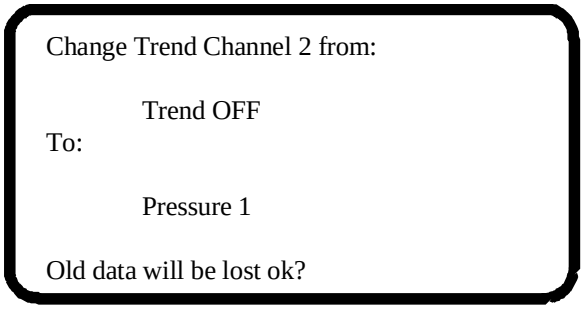
## **Trend Channels** - Continued

| Step | Procedure |
|---|---|
| 5. | As an example, select Pressure 1 (Analog Input 3) using the arrow keys.<br>  |
| 6. | Then press CONTINUE. The following display appears:<br>  |
| 7. | Respond YES if this is correct. The prompt "Old data will be lost" means that anything that was previously trended on this channel will be lost. The data base for this channel will be cleared to start over with new information. Since this Trend Channel was previously off, the prompt does not apply. No information would previously be stored. However, if changing from 1 analog or pulse channel to another, the previously stored data would be lost. Answer NO to cancel the change and save the existing data.<br><br>NOTE: Of the 16 data channels available for trending, only 6 can be collected at one time. The CCU can poll the I/O and report the condition of all channels at the time the poll request was made, but this information is not being stored in the data base at the I/O device unless the channel has been selected for trending. |

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# Setting Digital Outputs

## Digital Outputs

The PIRTU feature has the capability of initiating digital outputs directly from the PCCU or CCU. The PCCU is used to select which Digital Output channel of the PIRTU 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.<br><br>** ENTRY MODE MENU **<br>1) EXP I/O Date / Time<br>2) ID<br>3) Location<br>4) EXP I/O Security Code<br>5) Trend Channel<br>6) Channel Tags<br>7) Set Digital Outputs<br><br>The following screen is then displayed:<br><br>**>Dig. Out 1 Dig. Out 2 Dig. Out 3**<br>**Dig. Out 4 Dig. Out 5 Dig. Out 6**<br>**Dig. Out 7 Dig. Out 8**<br><br>Use ARROW keys to MOVE and CHANGE<br>Depress CONTINUE when finished |
| 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.<br><br>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. |

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## **Setting Digital Outputs** - Continued

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

# Calibration Mode

## Calibration Mode

The calibration mode enables the calibration of the Analog Inputs, Analog Outputs, and Pulse Inputs of the PIRTU. 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 commands the I/O to ignore new readings from its measurement inputs. Instead the I/O uses readings just before receiving the command from the PCCU. This prevents the I/O data base from being affected by value changes during calibration.<br><br>There are two ways to remove this temporary hold:<br><br>1. Unplug the DATA cable at the EXP I/O connector.<br><br>2. Exit the calibration mode with the MENU EXIT key.<br><br>Select 3 or Calibrate and the following appears:<br><br>** CALIBRATE MENU **<br><br>1) Calibrate AIs<br>2) Calibrate AOs<br>3) Calibrate PIs |

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## 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 Totalflow devices 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. These resistors are provided on the termination board.

| Step | Procedure |
|---|---|
| 1. | To calibrate AIs, enter 1 on the Calibrate Menu and the following appears:<br><br>** CALIBRATE AI MENU **<br>1) Tank Lvl 1 5) Comp Tmp 1<br>2) Tanl Lvl 2 6) Dischg P1<br>3) Pressure 1 6) Dischg P2<br>4) Pressure 2<br><br>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:<br><br>Dischg P1<br>1) Calibrate<br>2) Lo Limit xxxxx.x LO xxxxx.x<br>3) Hi Limit xxxxx.x HI xxxxx.x<br>4) Test Val xxxxx.x HI xxxxx.x<br>5) Channel [Active]<br>6) Number of cal points [3]<br>7)Begin calibration at [LO] point |

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## 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.

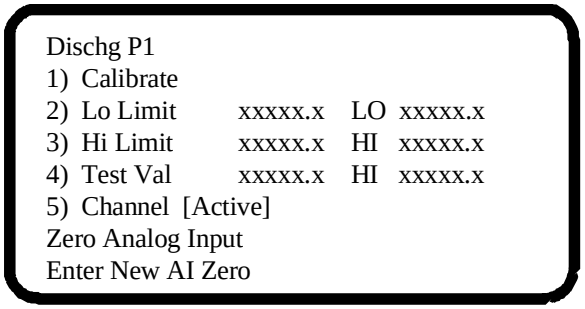
5. Channel Active/Inactive  Entering 5 toggles between setting the channel Active or Inactive.  When set to Active the channel  is reading the live measurement. A channel set to Inactive is reading the Test Value.

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

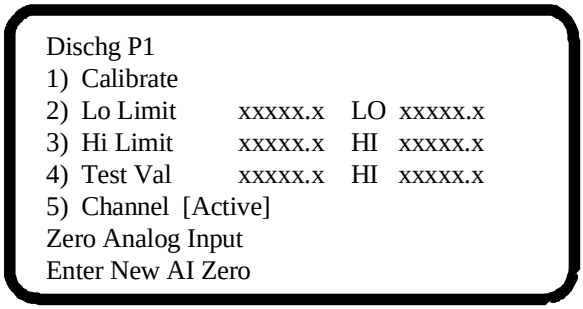
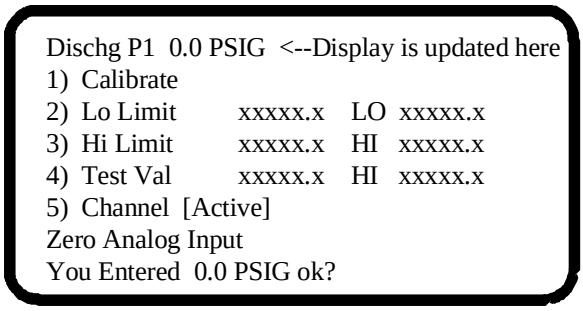
7. Begin Calibration at [LO/HI] point.  Entering 7 toggles between beginning the calibration procedure at the LO point or HI point.

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

*Continued on next page*

| 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 to begin calibration at the low point means that the calibration direction will be LO, MID, HI. By instructing the PCCU 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.<br><br>  <br><br><br>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.<br><br>The Calibrate routine is not entered until 1) Calibrate is selected. |

## Analog Input Calibration Steps

| Step | Procedure |
|---|---|
| 1. | Enter 1) Calibrate from the menu. Set the device providing the input to the I/O to reading of zero. Follow the calibration prompts shown on the last two lines of the display:<br>  <br> |
| 1a. | Enter 0 and press ENTER. The verification prompt appears:<br>  <br> |
| 1b. | 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. |

*Continued on next page*

| Step | Procedure |
|---|---|
| 2. | Set the output of the device providing the input to the expected operating point.<br><br>Dischg P1 0.0 PSIG<br>1) Calibrate<br>2) Lo Limit xxxxx.x LO xxxxx.x<br>3) Hi Limit xxxxx.x HI xxxxx.x<br>4) Test Val xxxxx.x HI xxxxx.x<br>5) Channel [Active]<br>Set Analog Input Operating Point<br>Enter New Operating Point |
| 2a. | Enter the value and press ENTER:<br><br>Dischg P1 50.0 PSIG <--Display is updated here<br>1) Calibrate<br>2) Lo Limit xxxxx.x LO xxxxx.x<br>3) Hi Limit xxxxx.x HI xxxxx.x<br>4) Test Val xxxxx.x HI xxxxx.x<br>5) Channel [Active]<br>Set Analog Input Operating Point<br>You Entered 50.0 PSIG ok? |
| 2b. | Here again, when the verification prompt is on the screen, the measurement is being updated. When the measurement settles, answer YES. |

*Continued on next page*

| Step | Procedure |
|---|---|
| 3. | Set the output of the device providing the input to the maximum operating value or range.<br><br>Dischg P1 50.0 PSIG<br>1) Calibrate<br>2) Lo Limit xxxxx.x LO xxxxx.x<br>3) Hi Limit xxxxx.x HI xxxxx.x<br>4) Test Val xxxxx.x HI xxxxx.x<br>5) Channel [Active]<br>Set Up Analog Input to Full Scale<br>Enter new AI Range |
| 3a | Enter the range and press ENTER.<br><br>Dischg P1 100.0 PSIG <--Display is updated here<br>1) Calibrate<br>2) Lo Limit xxxxx.x LO xxxxx.x<br>3) Hi Limit xxxxx.x HI xxxxx.x<br>4) Test Val xxxxx.x HI xxxxx.x<br>5) Channel [Active]<br>Set Up Analog Input to Full Scale<br>You entered 100.0 PSIG ok? |
| 3b | When the measurement settles, answer YES. The following is shown:<br><br>Dischg P1 100.0 PSIG <--Display is updated here<br>1) Calibrate<br>2) Lo Limit xxxxx.x LO xxxxx.x<br>3) Hi Limit xxxxx.x HI xxxxx.x<br>4) Test Val xxxxx.x HI xxxxx.x<br>5) Channel [Active]<br>Calibration is complete<br>.... Depress CONTINUE to Proceed ....<br><br>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. |

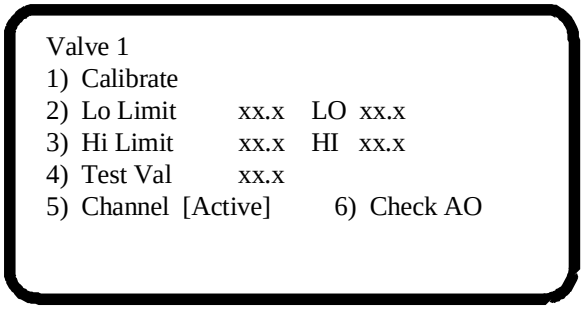
## Calibrating Analog Outputs

The Analog Output function of the PIRTU is capable of supplying up to four (4) outputs. These outputs can be individually addressed from internal 6714 measured points such as Differential Pressure, Static Pressure, Flowing Temperature and Flow Rate. 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:<br><br>** CALIBRATE MENU **<br>1) Calibrate AIs<br>2) Calibrate AOs<br>3) Calibrate PIs<br><br>A display such as the example below is shown:<br><br>** CALIBRATE AO MENU **<br>1) Valve 1<br>2) Valve 2<br>3) Valve 3<br>4) Valve 4 |

*Continued on next page*

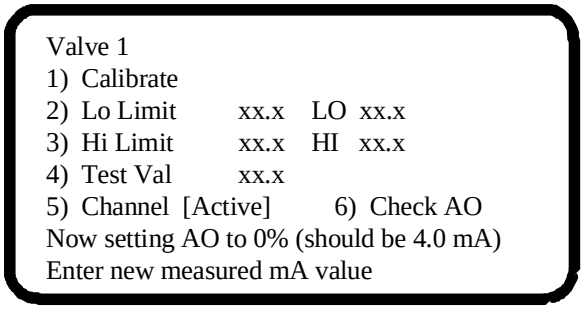
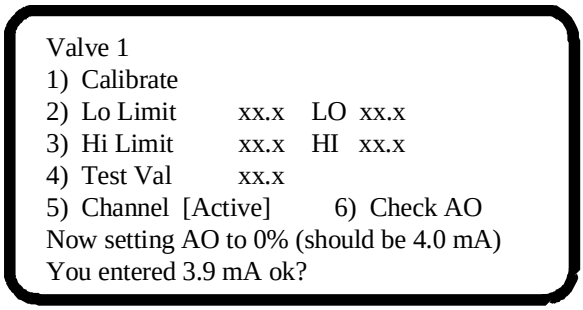
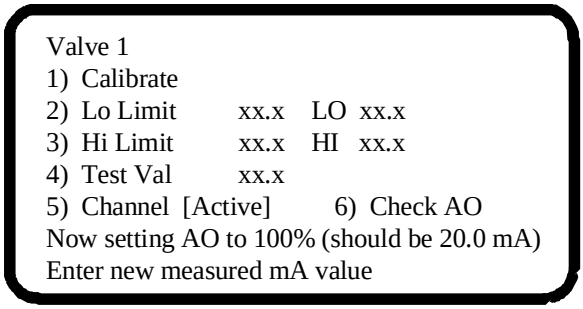
| Step | Procedure |
|---|---|
| 2. | In this example the AOs have been tagged or named Valve 1 thru 4. Up to four analog outputs are displayed. Only 1 AO is provided on the basic I/O device. An expanded AO board is necessary to provide AO 2 through 4. Choose the Analog Output to calibrate. For this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

## 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*

| Step | Procedure |
|---|---|
| 3. | Enter 1) Calibrate and the calibration prompts will appear on the last two lines of the display.<br>  <br> |
| 3a. | The PCCU instructs the I/O 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:<br>  <br><br>If satisfied, answer YES. If a change is necessary answer NO and enter the correct value. |
| 3b. | The PCCU then instructs the I/O to set the Analog Output to 100%.<br>  <br> |

*Continued on next page*

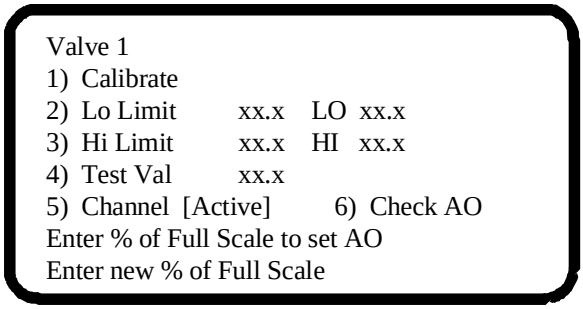
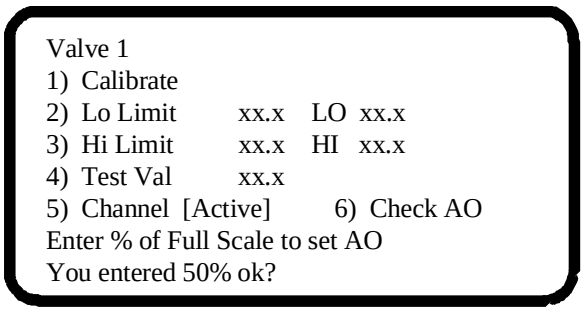
| Step | Procedure |
|---|---|
| 3c. | Check the analog output value on the termination panel with a meter. When it settles, it should read close to 20.0 mA (milliamps). Enter the value measured in milliamps (mA). For example, if the meter read 19.9, enter 19.9. A verification prompt will appear:<br>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

# Checking and Setting Analog Outputs

## Checking and Setting Analog Outputs

After calibration has been completed on the PIRTU 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:<br>  |
| 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:<br>  <br>Once the verification prompt is answered with YES the PCCU 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.

# Calibration of Pulse Inputs

## Calibrating Pulse Inputs

Two additional high speed pulse inputs are provided on the PIRTU.

To calibrate the pulse inputs use the following procedures:

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

*Continued on next page*

## Calibration of Pulse Inputs, Continued

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

Two types of pulse information are available with the PIRTU; Pulse Frequency and Pulse Accumulation. 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.

After all entries have been made to the PIRTU with the PCCU, the PCCU can be used to monitor the operation of the device. When the operation has been verified, disconnect the PCCU. In the FCU - PIRTU configuration, the PCCU must be removed before remote communications can take place.

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

# PIRTU Appendix - A

**PIRTU I/O Description**

4 Analog outputs: 4 to 20 ma (1 standard, 3 optional) (optional AO's require external power)

7 Analog inputs: 1 to 5 v (EXP I/O-non-differential) (RTU -differential)

2 Pulse inputs: 0 - 5v to 0 - 12v input range

1 Absolute Pressure (1 minute average) from FCU (I/O - FCU configuration)

1 Differential Pressure (1 minute average) from FCU (I/O - FCU configuration)

1 Flow Rate (1 minute average) from FCU (I/O - FCU configuration)

8 Digital outputs (dc switched)

8 Digital inputs (dry contact)

**Specifications**

*Analog Output*

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

*Analog Input*

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

*Pulse Input* - Active Input

- 0 - 20000 Hz frequency input
- 0 - 5 volt minimum pulse voltage input
- 0 - 12 volt maximum pulse voltage input

*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)

# PIRTU Appendix - B

**Monitoring and Data base Information**

The current value for all PIRTU I/O points is available using the Monitor Mode of the PCCU.

Minute, Hourly, or Daily resolution of inputs and outputs is available with the CCU I/O Control program.

Up to 16 channels are recorded, with only 6 of the AO, AI, and PI channels that can be collected at a time.

- Minute resolution - 60 one minute averages
- Hourly resolution - 72 one hour averages
- Daily resolution - 35 daily averages

Pulse Input can be either pulse frequency (Hz) or pulse accumulation (total pulses) for resolution selected. Pulse frequency or accumulation is controlled by firmware version.

The data base will contain the average value in the 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 base 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. Exceptions are the AP, DP, and Flow Rate being supplied by an FCU. These values will be the last minute's average value. The Pulse Input value read by a poll will be the frequency of the pulse input, regardless of firmware version installed.

# PIRTU Appendix - C

**Power Considerations**

The FCU - I/O configuration and RTU are designed for 1 watt continuous operation from internal batteries in the following configuration:

- 10 watt solar charging source
- 1 - 26 amphour battery
- 6714 FCU w/AMU (smart transducer) and RTD probe (FCU - I/O configuration only)
- Communications interface and approved radio

Expanded termination board with the following I/O:

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

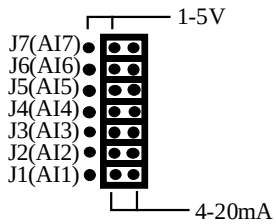
To prevent excessive power drain of the internal batteries, it is recommended to use an external power supply whenever the Digital Outputs and more than 1 Analog Output are used.

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

- Part No. 2017220-001 Uses screw type terminals for field wiring
- Part No. 2017220-002 Uses Phoenix type terminals for field wiring
- Part No. 2012511-001 Replaced by the above termination boards

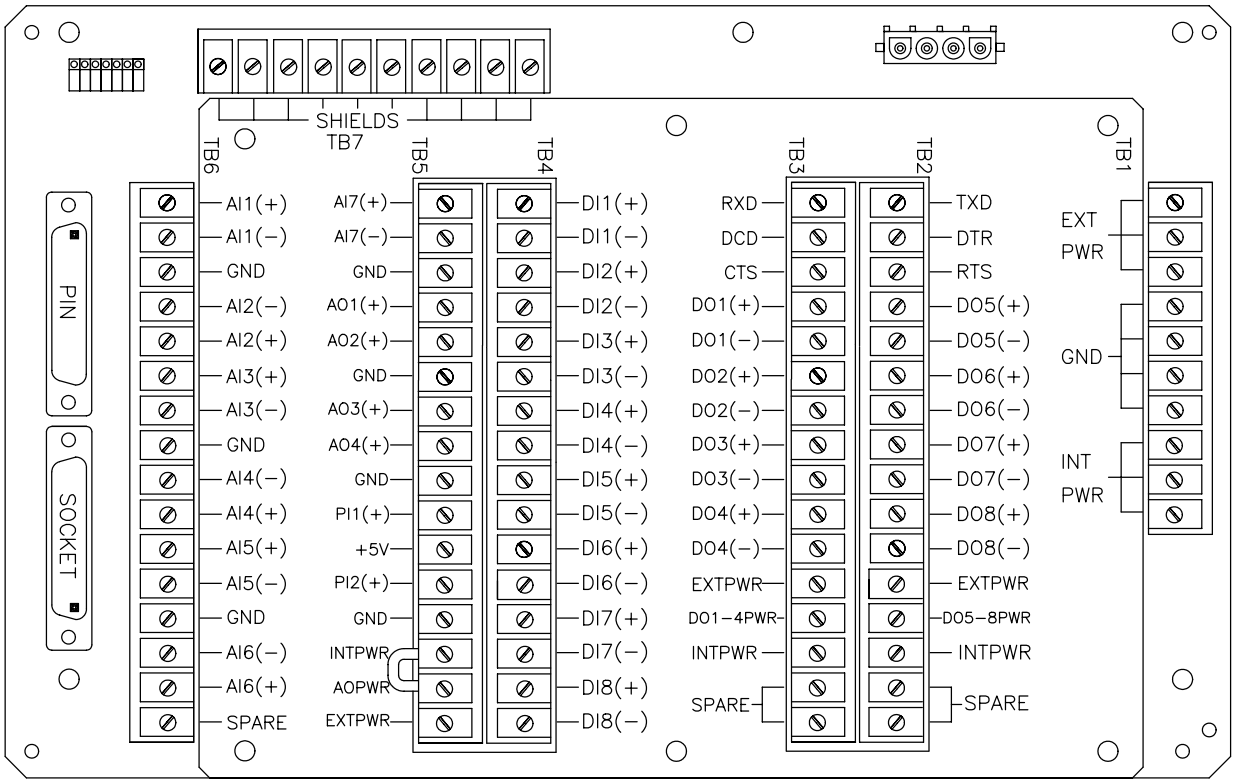
NOTE: 250 ohm load resistors are provided for all Analog Inputs and are mounted on termination board. The load resistors should be connected across the Analog Input connections for any input that is a 4 to 20 milliamp signal.

The connection of the resistors across the Analog Input is controlled with jumper blocks. 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.



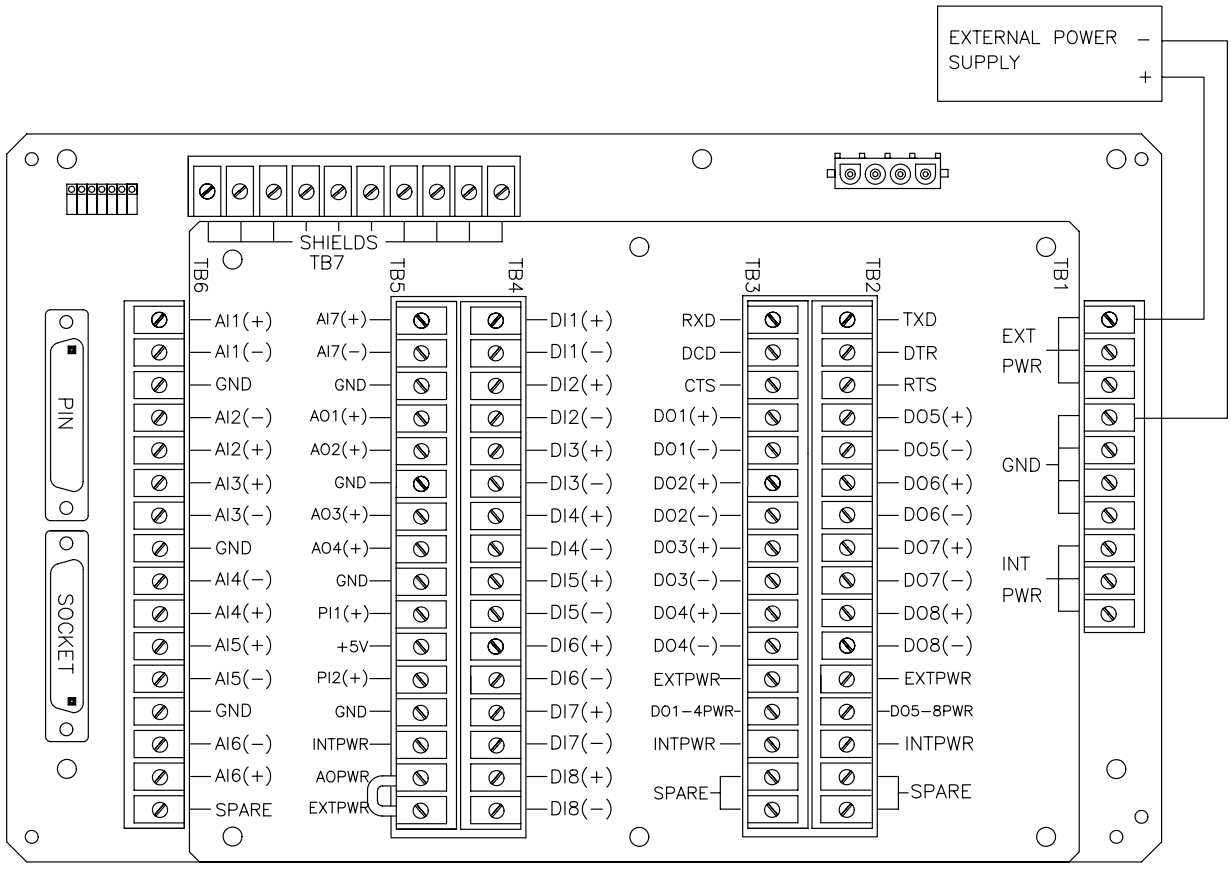
# PIRTU Appendix - D

The following drawings show the power connections necessary for termination boards. Although the drawing shows the screw terminal type terminations, the layout is the same for the Phoenix type (Part # 2017220-002.



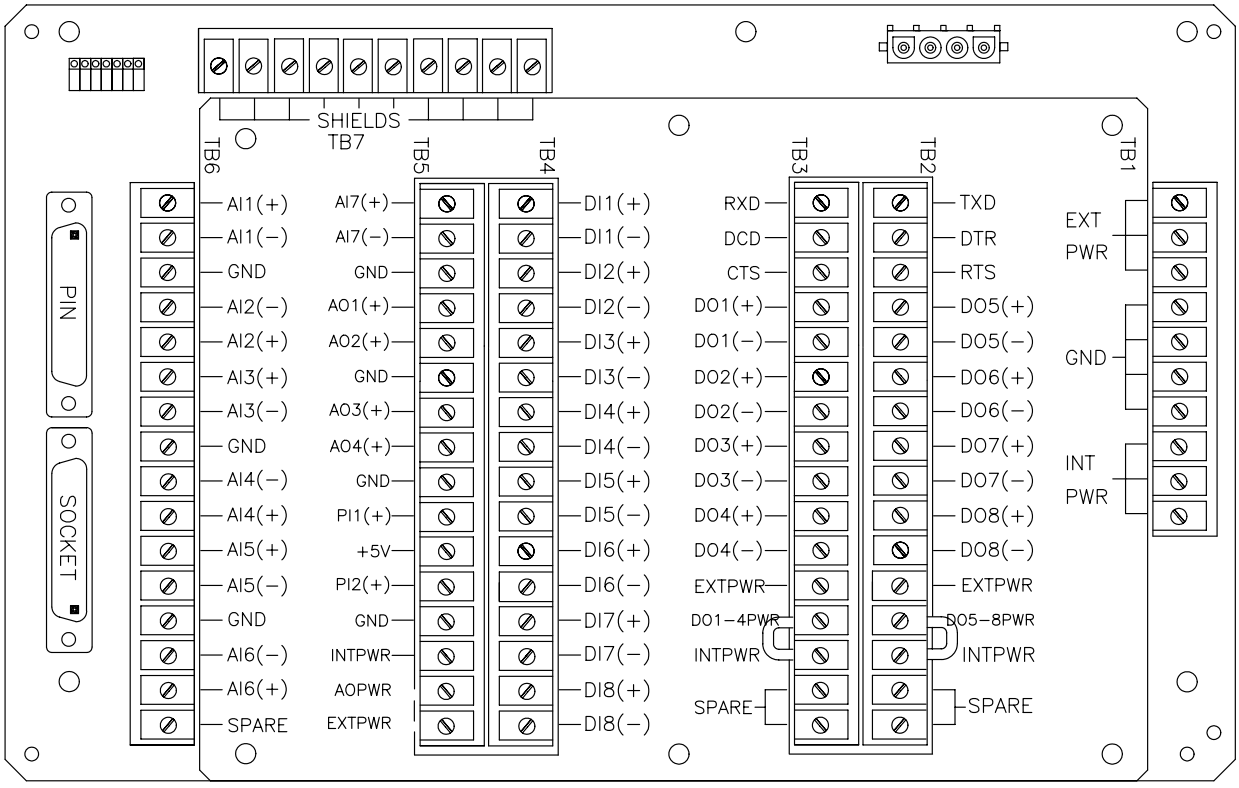

**Connections to power Analog Outputs with Internal Power**

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



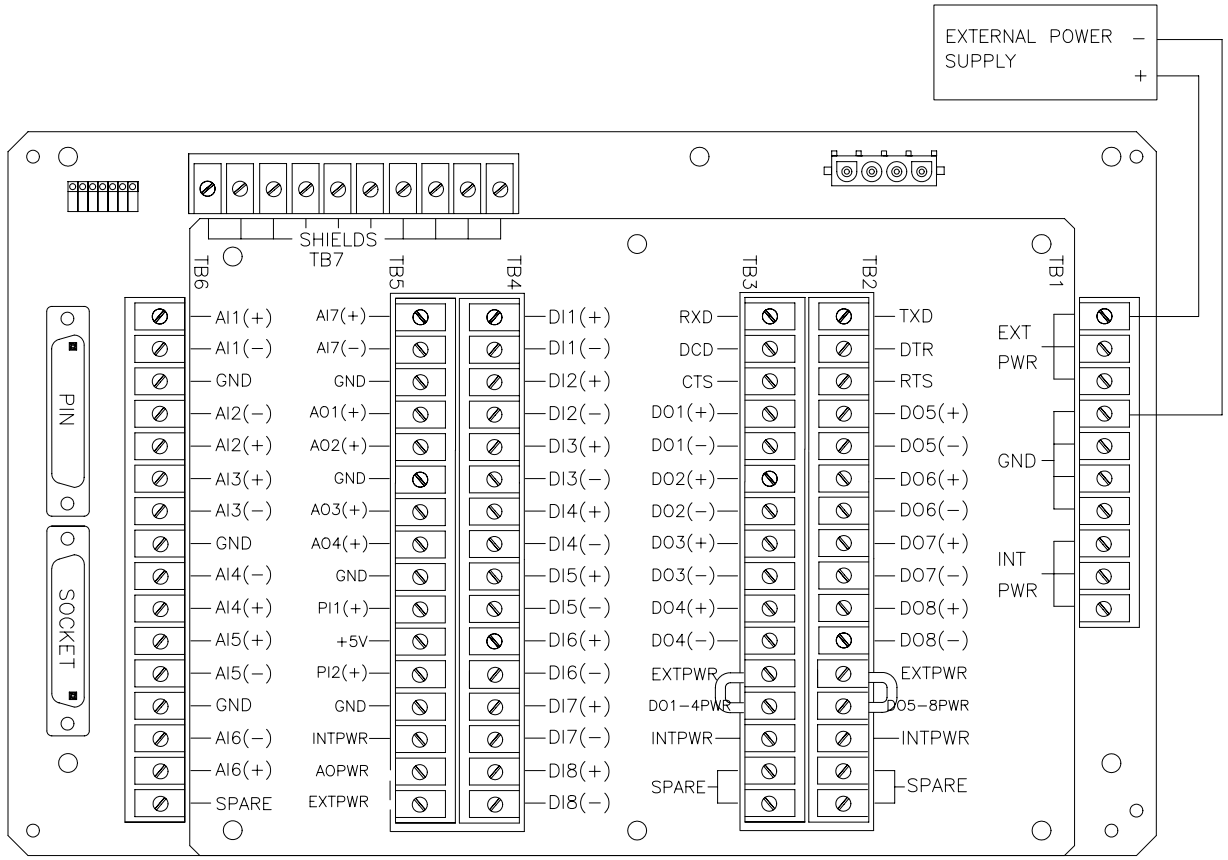

**Connections to power Analog Outputs with External Power**

The External Power Source is attached to EXTPWR and GND at TB1 as shown. Jumper EXTPWR to AOPWR at TB5.




**Connections to power Digital Outputs with Internal Power**

INTPWR is the internal power connection at TB2 and TB3. Jumper INTPWR to DO5-8 PWR on TB2 and INTPWR 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.




**Connections to power Digital Outputs with External Power**

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

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# Chapter 8.0
# Analog Output Expansion Options

## Overview

### Overview

This Chapter provides you with information on the Analog Output expansion options.

When using the 6700 series in hazardous area installations, refer to drawing numbers 2015267-CD (Div 1) and 2015246-CD (Div 2) for information on the approved installation and wiring required.

***What it Does***

The Analog Output (AO) option is available for TOTALFLOW model 6713 (Orifice) and 6714 (Pulse Input) Flow Computer Units with the RS-485/Single AO, RS-485/Quad AO and RS232/Quad AO Communication Interface boards. Also required is the correct FCU and PCCU firmware which support the AO options.

The AO feature provides the user with a proportional output (4-20 mA or 1-5 Vdc) at the termination board which tracks one (single AO option) or all (quad AO option) of the following measured variables:

- Flow Rate
- Absolute (Static) Pressure
- Differential Pressure
- Temperature

In addition, the AO can be set to "manual" to provide a fixed output (user selectable).

The Single Analog Output option is powered by the Flow Computer battery. Due to the power required by this option, a minimum 26 amp-hour battery and a 10 watt solar panel are recommended.

The Analog Output is updated once per second.

The PCCU is used to select the measured variable and calibrate the AO to represent the variable selected. The PCCU is also used to set or change the range of the AO if tracking a variable, and to manually set the output if the "Manual AO" option is selected. Once the AO is calibrated, the variable selected for output can be changed without having to re-calibrate. The calibration or set-up of the AO is not possible via the remote communication option. Only the PCCU can calibrate and set-up the AO. If using PCCU32, the Windows version of PCCU, use the online Help files for assistance.

The connections for the AO signal are on the termination board of the 6713 FCU (See recommended procedures in *Field Wiring* section).

## Chapter Highlights

This chapter covers the following topics:

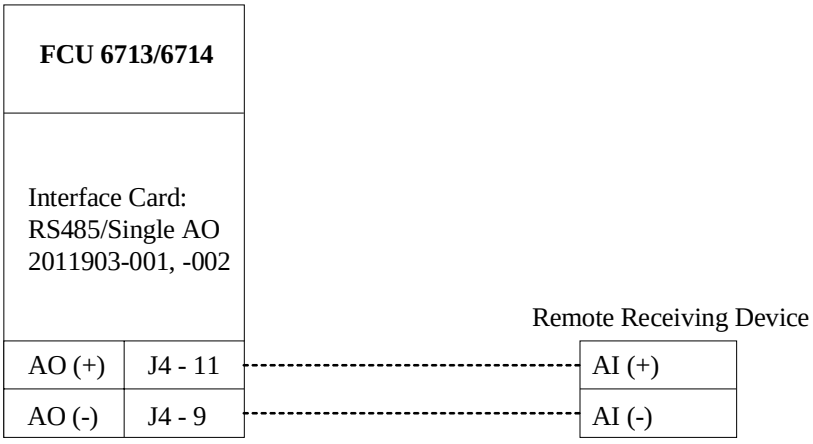
# Field Wiring

## How to connect Field Wiring

This section details procedures for connecting field wiring to the Analog Output expansion options.

**Note:** Do not connect and or disconnect field wiring and or the Analog Output expansion board with FCU power connected. Main battery and solar power must be disconnected before servicing FCU.

| Step | Procedure |
|---|---|
| 1. | Disconnect solar panel wiring from FCU main electronics board. |
| 2. | Disconnect main battery wiring from main FCU electronics board. |
| 3. | Disconnect field analog output device power. |
| 3. | For the ***Single Analog Output*** expansion card part number 2011903-001 or -002, connect field wiring to terminals as shown below. Connect cable shield wire at only one end of cable. |

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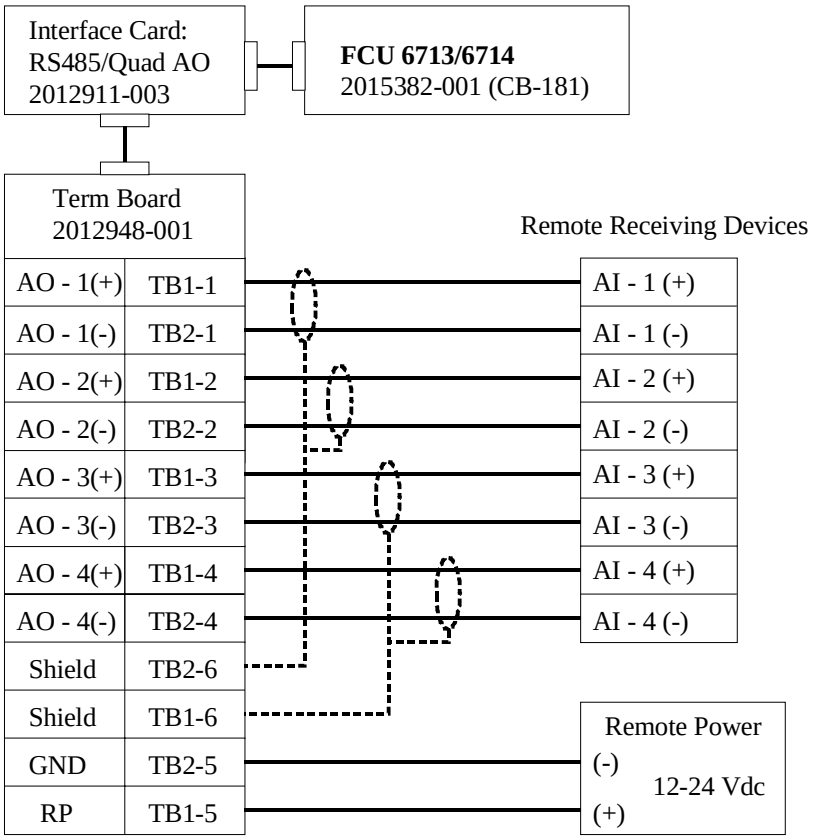
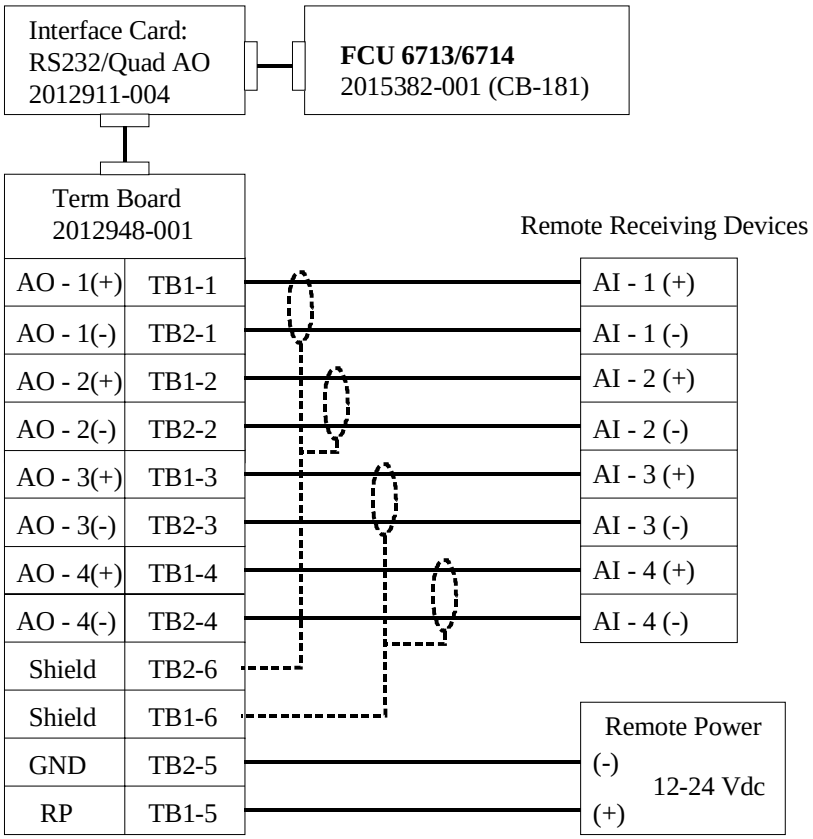
| Step | Procedure |
|---|---|
| 3. | For the ***RS485 Quad Analog Output*** expansion card part 2012911-003, connect field wiring to terminals as shown below. Connect cable shield wire at only one end of cable. |




**NOTE:** When using the Quad Analog Output option, AO power must be supplied externally as shown. Four analog loops require at least 80 mA of current supply capability.

*Continued on next page*

| Step | Procedure |
|---|---|
| 3. | For the ***RS232 Quad Analog Output*** expansion card part 2012911-004, connect field wiring to terminals as shown below. Connect cable shield wire at only one end of cable. |




**NOTE:** When using the Quad Analog Output option, AO power must be supplied externally as shown. Four analog loops require at least 80 mA of current supply capability.

## Set-up Operation

| Step | Procedure |
|---|---|
| 1. | To set up the Analog Output connect the PCCU to the FCU and select **"1" Connected to TOTALFLOW** from the PCCU Top Level Menu.<br><br>NOTE: The proper firmware must be installed in the FCU and PCCU and the RS-485/AO board must be installed for the following displays to appear on the PCCU. If any of the 3 requirements are missing the FCU and PCCU will appear as standard units.<br><br>** PCCU TOP LEVEL MENU -1 **<br>1) Connected to TOTALFLOW™<br>2) Set-Up PCCU<br>3) Print or Clear FCU Data<br>4) Send FCU Data to CCU<br>5) Graph FCU Data<br><br>CONTINUE for more |
| 2. | Enter 5 to select the calibration mode from the FCU CONNECTED menu:<br><br>** FCU CONNECTED: FCU-6713 **<br>LOC: TOTALFLOW™<br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-3 1985<br>5) Calibrate |

*Continued on next page*

| Step | Procedure |
|---|---|
| 3. | To set up the Analog Output enter “6”.<br><br>** CALIBRATE MENU - 1 **<br>1) Calibrate AP<br>2) Calibrate DP<br>3) Check AP<br>4) Check DP<br>5) Set Up Temperature<br>6) Set Up Ananlog Output<br><br>CONTINUE for more<br><br>And you should see the following display:<br><br>Reading Calibration Data. |
| 3.1 | When using the Quad Analog Output options, the following screen will be displayed with an additional menu item # 7 “*Select AO*”. Selecting this menu item repeatedly selects which AO to program.<br><br>** CALIBRATE MENU - 1 **<br>1) Calibrate AP<br>2) Calibrate DP<br>3) Check AP<br>4) Check DP<br>5) Set Up Temperature<br>6) Set Up Ananlog Output<br>**7) Select AO: [ AO1 ]**<br><br>CONTINUE for more |

*Continued on next page*

| Step | Procedure |
|---|---|
| 4. | The following Analog Output Setup Menu should now be displayed.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x scf/hr LO xx.xxx<br>4) Hi Val xxxxx.x scf/hr HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units scf/hr<br><br>CONTINUE for more |

## AO Setup Menu Definitions

- *Calibrate* - Selects the AO Calibration procedure. The prompts for calibration are shown on the bottom two lines of the display.
- *Check AO* - Entering "2" allows you to check calibration of the Analog Output.
- *Lo Val* - Entering "3" allows you to set the LO Range value in the units of the variable you are tracking.
- *Hi Val* - Entering "4" allows you to set the HI Range value in the units of the variable you are tracking.
- *Proportional to Flow/AP/DP/Temp or AO Manual* - Entering "5", over and over, causes the PCCU to select which Process Variable to track. The choices are Flow, AP, DP, Temperature, or AO Manual.
- *Rate Units* scf/hr - Section "6" lets the PCCU set the rate units that flow is measured in. Entering 6, over and over again selects scf/hr, mcf/day, or mmcf/day.
- *LO, HI* - are the low and high calibration points entered during calibration. Values are in whatever units have been selected to track.
- *Select AO* - Entering 7, over and over, causes the PCCU to select which analog output to use. This is how you select which of the four AO's to calibrate, or check. You can set up ranges and also attach which process variable you are interested in tracking to the selected analog output.

# Selecting The Process Variable

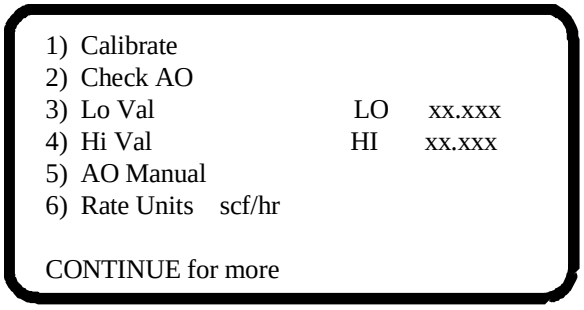
## Selecting the process variable

The analog output can be set up to track any one of the Process Variables that the FCU measures. It can track:

- Flow Rate
- Flowing Temperature
- Differential Pressure
- Absolute Pressure

  or

- Manual Output Operation.

| Step | Procedure |
|---|---|
| 1. | When you first enter the Analog Output Set-up Menu, a process variable is not selected. You will see:<br>  <br> |

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## Selecting The Process Variable, Continued

| Step | Procedure |
|---|---|
| 2. | To select the Process Variable, Enter "5" over and over you will see the following screens with item 5 different for each screen: |

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x **scf/hr** LO xx.xxx
4) Hi Val xxxxx.x **scf/hr** HI xx.xxx
5) Proportional to **Flow**
6) Rate Units scf/hr

CONTINUE for more

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x **in. H2O** LO xx.xxx
4) Hi Val xxxxx.x **in. H2O** HI xx.xxx
5) **Proportional to DP**
6) Rate Units scf/hr

CONTINUE for more

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x **PSIA** LO xx.xxx
4) Hi Val xxxxx.x **PSIA** HI xx.xxx
5) **Proportional to AP**
6) Rate Units scf/hr

CONTINUE for more

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x **deg. F** LO xx.xxx
4) Hi Val xxxxx.x **deg. F** HI xx.xxx
5) **Proportional to deg. F**
6) Rate Units scf/hr

CONTINUE for more

**NOTE:** Each time a new process variable is selected, the HI Val and LO Val that "belong" to that variable are displayed as well. Leave item 5 set to the variable that you want the AO to track.

# Entering AO Ranges

## Entering AO Ranges

The 4 to 20 mA analog output signal represents a percentage between 0 and 100% of the entered Lo and Hi Values of the variable selected. To assign value to this percentage, you must enter the AO Ranges. (Lo and Hi Val) the FCU stores separate ranges (Hi Val and Lo Val) for each of the four process variables (Flow, DP, AP, and Temp).

| Step | Procedure |
|---|---|
| 1. | Depress "3" then enter the value in the units displayed that you want a 4 mA output to represent.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x mcf/D LO xx.xxx<br>4) Hi Val xxxxx.x mcf/D HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units **mcf/D**<br><br>CONTINUE for more |
| 2. | Depress "4" then enter the value in the units displayed that you want 20 mA output to represent. |

# Setting Flow Rate Ranges

## Setting Flow Rate Units

If flow rate is selected as the Process Variable, the ranges (Lo Val and Hi Val) for flow rate can be made to read in various flow rate units. These are: scf/hr, mcf/day, or mmcf/day. These are the same selections that are used for flow rates in Setting FCU Display. When changing these selections the FCU display flow rate units for current flow also changes. This selection is here as a convenience so you can enter the range in units that you commonly use.

| Step | Procedure |
|---|---|
| 1. | To select the desired flow rate units, Enter "6" over and over you will see the following screens: |

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x scf/hr LO xx.xxx
4) Hi Val xxxxx.x scf/hr HI xx.xxx
5) Proportional to deg. F
6) Rate Units **scf/hr**

CONTINUE for more

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x mcf/D LO xx.xxx
4) Hi Val xxxxx.x mcf/D HI xx.xxx
5) Proportional to flow
6) Rate Units **mcf/D**

CONTINUE for more

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x mmcf/D LO xx.xxx
4) Hi Val xxxxx.x mmcf/D HI xx.xxx
5) Proportional to flow
6) Rate Units **mmcf/D**

CONTINUE for more

*Continued on next page*

| Step | Procedure |
|---|---|
| 2. | Once the rate units have been selected, enter the flow rate range )LO Val and HI Val). Changing the rate units after entering the range will change the range values displayed to agree with the rate selected. |

**NOTE:** The Rate Units selection is here as a convenience and it does change the FCU Display settings for flow rate units. Therefore, if changed, it is necessary to set the units back to what you want the FCU display to read.

# Calibrating Analog Outputs

## AO Calibration Procedures

The following procedures should be used to calibrate the Analog Output functions.

| Step | Procedure |
|---|---|
| 1. | Enter "1" Calibrate and you will see the calibration prompts on the last two lines.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x scf/hr LO xx.xxx<br>4) Hi Val xxxxx.x scf/hr HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units scf/hr<br>Now seting AO to 0% (should be 4.0 mA)<br>Enter new measured mA value |
| 2. | The PCCU instructs the FCU to set the Analog Output to 0%. Check the analog output value on the termination panel with a meter (insure that the meter used is set to milliamps before making connection to AO terminals). When it settles, it should read close to 4.0 mA (milliamps). Enter the value you measure in milliamps (mA). For example, if you read 3.9 enter 3.9. You will now get a verification prompt.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x scf/hr LO xx.xxx<br>4) Hi Val xxxxx.x scf/hr HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units scf/hr<br>Now seting AO to 0% (should be 4.0 mA)<br>You entered 3.9 mA OK?<br><br>This sets the mA value entered to equal the Lo Val entered. If you are satisfied, answer YES. |

*Continued on next page*

| Step | Procedure |
|---|---|
| 3. | The PCCU then instructs the FCU to set the Analog Output to 100%.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x scf/hr LO xx.xxx<br>4) Hi Val xxxxx.x scf/hr HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units scf/hr<br>Now seting AO to 100% (should be 20.0 mA)<br>Enter new measured mA value<br><br>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 you measure in milliamps (mA). For example, if you read 19.9, enter 19.9. You will now get a verification prompt.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x scf/hr LO xx.xxx<br>4) Hi Val xxxxx.x scf/hr HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units scf/hr<br>Now seting AO to 100% (should be 20.0 mA)<br>You entered 19.9 mA OK? |

*Continued on next page*

| Step | Procedure |
|---|---|
| 4. | This sets the mA value entered to equal the Hi Val entered. If you are satisfied, answer YES. |

1) Calibrate
2) Check AO
3) Lo Val xxxxx.x scf/hr LO 3.900
4) Hi Val xxxxx.x scf/hr HI 19.900
5) Proportional to flow
6) Rate Units scf/hr

**NOTE: 1** Unless instructed by "1" Calibrate or "2" Check AO the output will not change while the PCCU is in Calibrate option. After exiting the AO set-up Menu when a calibrate was requested, the selected variable changed, or a range value changed, 1 minute is necessary to insure that the AO output has reached its correct value.

**NOTE: 2** Always exit to the FCU Connected Menu before selecting the Monitor option on the PCCU. Use of the Monitor Key from the Calibrate routine maintains the Calibration "hold" of the FCU which will not allow the AO output to change.

**NOTE: 3** The FCU display of Flow Rate is calculated from the previous hour's C' number and the previous one second extension and extrapolated for an hour or day depending on the flow rate units selected. The AO output represents the flow rate calculated the same as the display. This value is filtered and provided at the output. For this reason, under varying flow conditions, the displayed flow rate will not agree with the AO value.

**CAUTION** If Calibrate AO is selected and the user exits calibration mode the previous calibration factors will be lost. Once in calibration mode the process must be completed.

# Analog Output Manual Operation

## Manual AO Operation

If AO Manual is selected instead of a process variable no Hi or Lo Values can be assigned. The output range is automatically set to 4 and 20 milliamps. The output is calibrated the same way as if a variable was selected. The output is then "set" with the "Check AO" option.

| Step | Procedure |
|---|---|
| 1. | Depress "2" Check AO and the last line on the display prompts you to enter the new % of full scale to set the AO.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x mmcf/D LO xx.xxx<br>4) Hi Val xxxxx.x mmcf/D HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units mmcf/D<br>Enter new % full scale to set AO |
| 2. | Enter the % amount desired, 0% to 100%, with 0% being 4 mA and 100% being 20 mA.<br><br>Let's say 50% is entered. This means that you desire the output to be 50% of the 16 mA range or 8 mA. This added to the 4 mA 0% value gives a 12 mA output.<br><br>After entering the desired percentage, the display shows the amount entered and asks if it is "ok?". Answer "yes" to continue or "no" to enter a new value. The AO output will automatically reflect the percentage chosen and will maintain this value after the calibrate routine is exited.<br><br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x mmcf/D LO xx.xxx<br>4) Hi Val xxxxx.x mmcf/D HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units mmcf/D<br>Enter new % full scale to set AO<br>You entered 50% OK? |

# Checking Analog Output Operation

## Checking AO Operation

Using the Monitor Mode of the PCCU or the FCU display to view the selected variable, compute the % of range the variable represents. For example say the AO was calibrated with 100 mcf/day as the Lo Value and 1100 mcf/day as the Hi Value. If the display shows the flow rate as 600 mcf/day this would represent 50% of the selected range. The AO therefore should be 50% of its range or 12 mA. Measure the AO at the termination board to confirm.

Another method to verify the AO calibration follows:

| Step | Procedure |
|---|---|
| 1. | Enter "2" Check AO and you will see the Check AO prompts on the last two lines.<br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x mmcf/D LO xx.xxx<br>4) Hi Val xxxxx.x mmcf/D HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units mmcf/D<br>Enter new % full scale to set AO |
| 2. | You are instructed to enter a percent of full scale to set the Analog Output. You enter the desired percent value. Let's say you entered 50:<br>1) Calibrate<br>2) Check AO<br>3) Lo Val xxxxx.x mmcf/D LO xx.xxx<br>4) Hi Val xxxxx.x mmcf/D HI xx.xxx<br>5) Proportional to flow<br>6) Rate Units mmcf/D<br>Enter new % full scale to set AO<br>You entered 50% OK? |
| 3. | Once you answer the verification prompt, the PCCU will instruct the FCU to set the AO and you can read the analog output (4-20 mA signal) with a meter. In this case, you should read 12 mA on your meter. |

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## Checking Analog Output Operation, Continued

| Step | Procedure |
|---|---|
| 4. | You can check the Analog Output at different percentages by following steps 1 through 3 and entering different % values. When finished press MENU EXIT 3 times to return to the FCU CONNECTED MENU. The AO will then begin to track the variable selected. |

**NOTE: 1** If flow rate is selected as the process variable and an orifice plate size change is entered at the FCU, the resulting change in flow will be reflected by the AO output. Insure that the new flow rate falls within the range (Lo Val and Hi Val) set for the variable.

**NOTE: 2** If the Flow Computer battery voltage falls below 11 volts the Flow Computer goes into the -SLEEP- mode to conserve power. During SLEEP mode the AO output falls to 0 mA and stays there until a Wake-up Command is issued by the PCCU. At Wake-Up, if the FCU battery power is above 11 volts, the AO will resume tracking the selected variable.

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# Chapter 9

# Valve Control

## Overview

### Introduction

Valve Control is an application specific Input / Output option feature available with the Model 6700 Totalflow Flow Computer Unit (FCU). The feature provides automatic feedback control of Differential Pressure (DP), Absolute Pressure (AP), and Flow Rate for the purpose of positioning a flow valve to maintain a desired value of DP, AP, or Flow Rate.

### Note

**For Valve Control on Pulse Input Flow Computers, any reference to Differential Pressure (DP) can be replaced by Actual Cubic Feet (ACF).**

The Model 6700 Flow Computer has on-board Valve Control capability and only requires a Termination Board necessary for connecting the Valve Actuator, the Actuator, the Valve, and the necessary cabling. Valve Control can also be achieved utilizing the Plug-in RTU (PIRTU) interface board which uses a larger Termination Board and provides more I/O capability.

A Controller is a device that regulates or controls its output based on inputs received. With the Totalflow Valve Control System, the Controller on the Model 6700 Flow Computer is part of the main digital board or is located on the Plug-In RTU interface board. The output of the Controller is a time period. Voltage is applied to the valve actuator for the amount of time computed. This output results in valve movement. The inputs to the Controller are the DP and AP values measured by the Flow Computer Unit and the Flow Rate which is computed by the FCU using the measured DP and AP values. One of these inputs is selectable as the Process Variable or parameter to be controlled by the action of the valve. The output voltage duration and resulting valve movement are such that the Process Variable is maintained at a pre-determined user defined value.

In addition to automatic feedback control of Flow Rate, Absolute Pressure or Differential Pressure, the following features are provided with the Totalflow Valve Control System:

- Manual control of valve
- No external power requirements. Appropriate valves and communication options can be powered with battery packs. Solar charging, AC or 24 VDC power charging is required and is a part of the standard Valve Control Package. Power requirements for additional features and options must be evaluated for specific application.
- All control features can be accessed either locally with a Portable Calibration and Collection Unit or remotely using the Totalflow Central Collection Unit software and communication option.

*Continued on next page*

**Introduction,** Continued

The maintaining of the valve in a position to keep the selected input Process Variable constant is the job of the Controller. Parameter values and limits for the Controller to use in determining its output must be entered. These values and limits can be entered using the menu entry display screens of the Portable Calibration and Collection Unit (PCCU) or Central Collection Unit (CCU).

**Chapter Highlights**

This chapter covers the following topics:

# Terms and Definitions

## Terms and Definitions

The following is a list of terms and definitions necessary for understanding and setting up the controller operation.

**PROCESS VARIABLE (PV):** The parameter being controlled. Three process variables are supported:

Absolute Pressure in PSIA (AP)
Differential Pressure in IN. H2O (DP)
Flow Rate in MCF/DAY (Flow Rate)

Each process variable has its own unique controller with its own tuning parameters.

**MODE:** Specifies whether a controller is turned off or on for automatic control operation. There are three modes of operation:

| | |
|---|---|
| OFF | Controller is turned off, no control action results. |
| AUTO | Controller is turned on, automatic feedback control action is in progress. |
| SHUT IN | Controller is in auto, but will also check for DP override SHUT IN conditions. (Conditions defined later) |
| TMR | Controller is in auto, but will open and close the control valve based on the intervals set by the OPEN and CLOSE time specified in the utilities menu number three. |
| NOM | Controller is in auto, but will nominate the flow based on a volume set point, start date/time and stop date/time. The nominations controller must be on before the nomination screen can be displayed. (Nominations is only available on Plug-In RTU) |

**SET POINT (SP)** : The set value at which the process variable is to be maintained by the controller. SET POINT has the same engineering units as the process variable.

**HIGH LIMIT (HiLm)** : The process variable's upper limit for control. The highest value at which the process variable can be controlled. HIGH LIMIT has the same engineering units as the process variable. (See SPAN)

*Continued on next page*

**Note**

Suggestions for picking proper HIGH and LOW LIMITS are covered later.

**Terms and Definitions,** Continued

**LOW LIMIT (LoLm)** : The process variable's lower limit for control. The lowest value at which the process variable can be controlled. LOW LIMIT has the same engineering units as the process variable. (See SPAN)

**DEAD BAND (DB)** : Specifies a range around the SET POINT within which the controller will take no action. DEAD BAND has the same engineering units as the process variable.

Example If the SET POINT is 50 and the DEAD BAND is 5, the controller will take no action when the PROCESS VARIABLE is between 45 and 55. A proper DEAD BAND is important for maintaining the integrity of the system's battery capacity.

**GAIN** : The maximum allowable CONTROLLER OUTPUT for any one control action. A good rule of thumb is to use 1/2 the control valve's travel time from a full open to a full closed state. GAIN has engineering units of milliseconds.

**CONTROLLER OUTPUT (CO)** : The output of the control algorithm or equation. The output is a time period for either opening or closing the valve. The system voltage will be applied to the valve actuator for the time period calculated by the controller. CONTROLLER OUTPUT has engineering units of milliseconds. (.001 second = 1 millisecond)

**ERROR**: The difference between the PROCESS VARIABLE and the SET POINT.

**SPAN**: HIGH LIMIT value minus LOW LIMIT value. The process variable's range of control. SPAN has the same engineering units as the process variable.

**DIRECTION** : Specifies whether the valve needs to be closed or opened to achieve the desired SET POINT. The control algorithm shown below is for control valves located on the downstream side of the Flow Computer Unit.

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**AP Bias**

The term used to describe the pressure drop between the well head and the metering point. The well head pressure can then be determined for use by the AP controller. The WELL HEAD PRESSURE = AP at METER + AP_BIAS.

When the AP controller is being viewed on the PCCU or CCU, both the PROCESS VARIABLE (well head pressure) and the AP at METER (APM) are displayed.

**Note:** If using upstream control valve, an external pressure can be installed upstream of control valve for the process variable. (Wellhead Pressure)

The Weymouth formula is used to determine the AP_BIAS.

$$AP\_BIAS = \left[ L \times \left[ Qs / 871 \times d^{2.667} \right]^2 + P_2^{\,2} \right]^{\frac{1}{2}} - P_2$$

which was derived from:

$$\mathrm{Qs} = 871 \times \mathrm{d}^{2.667} \times \left[ P_1^{\,2} - P_2^{\,2} \; / \; L \right]^{\frac{1}{2}}$$

where:

| | | | |
|---|---|---|---|
| Qs | = | rate of gas flow, cu ft/24 hr. | (calculated by FCU) |
| d | = | internal diameter of pipe, in. | |
| $P_1$ | = | initial pressure, psia. | (pressure at wellhead) |
| $P_2$ | = | terminal pressure, psia. | (pressure measured by FCU) |
| L | = | length of line in miles. | |

## Override Conditions

### DP Override

There are times during operation when system pressure transitions may cause the DP to go through radical changes that may push the DP reading outside the transducer's range. With the controller in operation, the calculated CONTROLLER OUTPUT PERIOD and DIRECTION are compared to a period calculated based on the Differential Pressure value and desired operating range. The controller decides which output period to use for the purpose of keeping the DP within a range that can be measured. If the controller output is overridden by the DP calculated output, the operation is called DP OVERRIDE. It can occur for either high DP or low DP conditions and is indicated on the PCCU or CCU display.

### AP Override

AP override allows the controller to monitor and override on pressure while controlling on Flow rate or Differential pressure. The override condition is checked if AP high or low override is enabled in the utility menu. If the control valve is unable to maintain the pressure set point the valve will fail closed. (See AP override section for details)

The calculation and use of the DP and AP OVERRIDE output period are explained below.

### Note

The computation of the OVERRIDE output by the controller **requires** that the DP and AP operating limits be entered on the DP and AP control screens of the PCCU or CCU. This is necessary even though the process variable selected is AP or Flow Rate.

### Override Periods

The following explanation is for valves located downstream from the FCU.

**If the current DP reading is between its HIGH and LOW LIMITS,** override periods are determined for each of the limits of the DP by substituting the limits for the SET POINT and other input parameters from DP controller screen in the algorithm. The resulting values are compared against the CONTROLLER OUTPUT PERIOD from the control algorithm for the Process Variable. If an override period is less than the control algorithm CONTROLLER OUTPUT PERIOD, the override period is used and the controller indicates an override condition. If DIRECTION = CLOSING, then the LOW LIMIT period is used. If DIRECTION = OPENING, then the HI LIMIT period is used.

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## Override Conditions, Continued

**Override Periods,** Continued

**If the current DP reading is less than the LOW LIMIT**, an override period is calculated for the DP LOW LIMIT by substituting the LOW LIMIT for the SET POINT and other input parameters from DP controller screen in the algorithm. If DIRECTION = CLOSING, the valve is OPENED for the override period. If DIRECTION = OPENING, the override period is compared to the control algorithm CONTROLLER OUTPUT PERIOD and the larger of the two is used. In either case a LOW LIMIT override condition occurs and a LOW DP OVERRIDE status is set.

**If the current DP reading is greater than the HIGH LIMIT,** an override period is calculated for the DP HI LIMIT by substituting the HIGH LIMIT for the SET POINT and other input parameters from DP controller screen in the algorithm. If DIRECTION = OPENING, the valve is CLOSED for the override period. If DIRECTION = CLOSING, the override period is compared to the control algorithm CONTROLLER OUTPUT PERIOD and the larger of the two is used. In either case a HI LIMIT override condition occurs and a HIGH DP OVERRIDE status is set.

**Note**

If the DEAD BAND of the DP LIMIT includes the current DP value, the Controller output is set equal to zero.

**If AP ENABLE HI is selected and the current AP reading is greater than the AP OVERRIDE,** an override period is calculated by substituting the AP OVERRIDE for the SET POINT and other input parameters from AP controller screen in the algorithm. If DIRECTION = OPENING, the valve is CLOSED for the override period. If DIRECTION = CLOSING, the override period is compared to the control algorithm controller output period and the larger of the two is used. In either case, an AP OVERRIDE condition exists and an AP OVERRIDE status is set.

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**Override Periods,** Continued

**If AP ENABLE LO is selected and the current AP reading is less than the AP OVERRIDE,**
an override period is calculated by substituting the AP OVERRIDE for the SET POINT and other input parameters from AP controller screen in the algorithm. If DIRECTION = OPENING, the valve is CLOSED for the override period. If DIRECTION = CLOSING, the override period is compared to the control algorithm controller output period and the larger of the two is used. In either case, an AP OVERRIDE condition exists and an AP OVERRIDE status is set.

**Note**

If the DEAD BAND of the AP OVERRIDE includes the current AP value, the Controller output is set equal to zero.

## Flow Computer Interface

All pertinent control data is kept in the FCU's memory. This allows the data to be backed up with the FCU's board mounted lithium battery. When controller data is modified by the user (e.g. GAIN, LIMITS, etc.) the data is stored in the FCU's memory. The FCU measures the variables and stores them in it's memory. All the data is available to the controller whenever required. The controller transfers data to the FCU's memory whenever it finishes a control action. The updated status information in the FCU's memory is made available to both the PCCU and the CCU.

The controller's algorithm and data conversion programs take approximately ten seconds to execute. Therefore, assuming no valve movement is required, the controller requests data from the FCU and executes the control algorithm once every ten seconds. In the event a valve movement is required, the controller waits for the valve movement to finish before requesting new data from the FCU. The minimum controller output period is set to 80 milliseconds. The maximum output period possible would be the time necessary to ramp the valve full open or closed from the opposite condition.

## Control Algorithm

The system has three controllers, only one of which can be active at any given time. The control equation is best described as a "Single Speed Floating Algorithm". This algorithm provides integral action based on :

- The process variable's difference from set point (ERROR)
- The process variable's range of control (SPAN)
- The total possible valve travel time (GAIN)

The Control algorithm is as follows:

ERROR = PROCESS VARIABLE - SET POINT

If ERROR is greater than the DEAD BAND then:
CONTROLLER OUTPUT = (ERROR / SPAN) * GAIN

If ERROR is less than or equal to the DEAD BAND then:
CONTROLLER OUTPUT = 0

DIRECTION of valve movement

| | |
|---|---|
| AP MODE | If AP is less than the AP SET POINT, close valve. |
| FLOW MODE | If FLOW is less than the FLOW SET POINT, open valve. |
| DP MODE | If DP is less than the DP SET POINT, open valve. |

The output and direction computed above are for control valve location downstream from the metering point.

See definition of DIRECTION.

### Selecting Control Parameters

Setting of the control parameters varies with each well site control point. Careful analysis of the control point characteristics is required before entry of the necessary parameters. General guidelines are given below.

### AP Controller Settings

The AP HIGH LIMIT should be set to the maximum AP pressure the well achieves after an extended SHUT IN period. This value is used to restart the controller if DP LO SI = Reactivate on AP HI. The AP LOW LIMIT should be set to the minimum well head pressure the well achieves after an extended full open period. These values are used when calculating an output if AP OVERRIDE is Enabled, and must be entered even if the active controller is using either DP or Flowrate as the process variable.

When using automatic AP control after an extended shut in period, the set point should initially be set to a value close to the HIGH LIMIT and gradually dropped (i.e. several hour intervals) until the desired operating point is achieved. This allows the well head pressure to drop slow enough to keep the DP reading from going off scale and to keep from toggling the DP transducer. This procedure should be followed **before** using the FLOW controller.

### DP Controller Settings

The DP HIGH LIMIT should be set to the maximum controllable DP. This would be slightly less than the range of the DP transducer. The DP LOW LIMIT should be set to a value just above zero DP. These values are used for the DP override checks and must be entered even if using AP or Flow Rate as the Process Variable.

DP controllability improves as the DP SET POINT moves higher on the DP control range scale. This is due to a square root relationship which makes small valve movements create large DP changes on the low end of the DP control range. For this reason, when using the DP controller after an extended shut in period, it is advisable that a small gain value be used (i.e. less than 1/8 the valve total travel time), until the system has stabilized.

### Flow Controller Settings

The Flow Rate HIGH LIMIT should be set to the maximum controllable Flow Rate (i.e. after AP pressure is down from shut in levels). The Flow Rate LOW LIMIT should be set to the minimum controllable flow.

### Dead Band Selection

The selection of the DEAD BAND setting is a compromise between the desired control and the amount of valve movement. A process variable exhibiting little change can be assigned a small DEAD BAND and will operate with little valve movement. A selected process variable that changes frequently may need a large DEAD BAND to prevent continuous valve movement.

### Note

**When activating any automatic mode, insure that the step time in the PCCU utilities menu is set to a value between 1000 - 1500 msec. This value is used when initially opening the valve from a full closed position.**

## Low DP Override

**Auto Mode**

If the set DP LOW LIMIT is **greater than 0** and the measured DP remains below the LOW LIMIT, the override condition exists and the override period used will open the valve in an attempt to increase the DP. If the DP remains below its LOW LIMIT, even with the valve full open, the valve will remain open waiting for flow conditions to change.

**Auto, Shut In or Timer Mode**

If the set DP LOW LIMIT is **greater than 0** and the measured DP remains below the LOW LIMIT, the override condition exists and the override period used will open the valve in an attempt to increase the DP. If the DP remains below its LOW LIMIT with the valve full open, the controller will wait until the DP LOW TIME has expired then ramp the valve closed.

**Auto or Auto Shut In Mode**

If the set DP LOW LIMIT is **exactly 0**, the DP low limit override condition will be ignored. This allows the controller to operate with either the DP high override or the CONTROLLER OUTPUT PERIOD computed for the Process Variable selected.

## High AP Override

**Auto, Shut In or Timer Mode**

Set AP OVERRIDE to "Enable Hi".

Downstream valve location:
The external pressure transmitter must be installed downstream of the control valve. Connect the external transmitter to the analog input on the plug-in RTU. Select AI [1-7] on the valve control utility menu. If Select AI = NONE, AP OVERRIDE will be ignored. When AP exceeds the AP OV value set in utility menu, the controller will close the valve in an attempt to decrease the AP. If the valve travels to full closed, the active controller is set to FAIL and SHUT IN if Auto Shut In Mode is selected. When the AP falls below the APRSTRT value, the selected process variable's output will be used and the controller is restarted.

Upstream valve location:
FCU's AP pressure (downstream of control valve) is used for AP OVERRIDE. No external pressure transmitter is required. When AP exceeds the AP OV value set in utility menu, the controller will close the valve in an attempt to decrease the AP. If the valve travels to full closed, the active controller is set to FAIL and SHUT IN if Auto Shut In Mode is selected. When the AP falls below the APRSTRT value, the selected process variable's output will be used and the controller is restarted.

## Low AP Override

**Auto, Shut In or Timer Mode**

Set AP OVERRIDE to "Enable Lo".

Downstream valve location:
The external pressure transmitter must be installed downstream of the control valve. Connect the external transmitter to the analog input on the plug-in RTU. Select AI [1-7] on the valve control utility menu. If Select AI = NONE, AP OVERRIDE will be ignored. When AP falls below the AP OV value set in utility menu, the controller will close the valve in an attempt to increase the AP. If the valve travels to full closed, the active controller is set to FAIL and SHUT IN if Auto Shut In Mode is selected. When the AP exceeds the APRSTRT value, the selected process variable's output will be used and the controller is restarted.

Upstream valve location:
FCU's AP pressure (downstream of control valve) is used for AP OVERRIDE. No external pressure transmitter is required. When AP falls below the AP OV value set in utility menu, the controller will close the valve in an attempt to increase the AP. If the valve travels to full closed, the active controller is set to FAIL and SHUT IN if Auto Shut In Mode is selected. When the AP exceeds the APRSTRT value, the selected process variable's output will be used and the controller is restarted.

## Auto Shut In Operation

The purpose of the AUTO SHUT IN Mode is to shut in the well by closing the valve if the DP measurement cannot be kept high enough to provide accurate measurement and control. If the control mode selected is AUTO/SHUT IN, the SHUT IN check is activated.

The SHUT IN Mode checks for continuous minutes of the condition where the valve is FULL OPEN and DP is below its LOW LIMIT. If this condition persists for the specified time (DP LOW TIME), the valve is ramped closed. The FAIL CLOSED status, the LOW DP OVERRIDE (LDPO) status, the SHUT IN (SHUT) status, and the FULL CLOSED (FCL) status are all set.

Once the SHUT IN status is set, automatic control is terminated until the RESTART CONTROLLER command is received by the controller. This command can be sent manually using the PCCU. The controller can also be instructed to restart automatically by one of the following:

1. At the end of a specified time period (shut-in time)

2. In response to an external contact closure signal (DI4 on VCI termination board and DI8 on plug-in RTU). External event mode = RESTART CONTROLLER.

3. When the AP reaches its operational HI LIMIT (DP LOW Shut-in = Reactivate on AP HIGH)

**Low Battery Fail Closed Condition**

If the battery voltage is less than the specified LOW BATTERY VOLTAGE, the valve is ramped closed. The FAIL CLOSED status and the LOW BATTERY status are both indicated and only a manual RESTART CONTROLLER command from the PCCU will restart the controller.

**Timer Mode**

This mode will allow the controller to open and close the valve based on the open and close time specified in the utility menu. During open time the active controller will adjust the valve. All other controller modes and overrides can be selected and active during the open time. When open time remaining elapses the valve will close for the close time period. No other controller or overrides can manipulate valve during close time.

## Utility Commands and Parameter Definitions

**Note**

The following Utility Commands and Parameter definitions are necessary for understanding and setting up the controller for operation:

**Commands & Parameters**

**BATTERY VOLTAGE LOW LIMIT (LO BATT)** : A low voltage threshold used by the controller's logic to detect a LOW BATTERY condition. The default value is 11.5 Vdc.

**DP LOW TIME** : A duration, in minutes, used by the controller logic to determine if a DP SHUT IN condition exists. If the DP is below its set LOW LIMIT for the specified time, the DP SHUT IN condition exists and the valve is ramped closed. The controller checks for this condition when in the AUTO / SHUT IN mode. The default value is 0 minutes. The range is 65535 minutes.

**STEP TIME** : A period, in milliseconds, used when a STEP OPEN or STEP CLOSED command is processed. This period is also used when a valve is initially opened from a full closed position. The default is 0. The range is 65535 milliseconds.

**PIPE ID** : The internal diameter, in inches, of the pipe run between the well head and the metering point.

**PIPE LENGTH** : The distance, in feet, between the wellhead and the metering point.

**STEP OPEN / CLOSED** : These commands will move the control valve in the desired direction for the specified STEP TIME period. Only one VALVE STEP is made for each STEP COMMAND.

**RAMP OPEN / CLOSED** : These commands will move the control valve continuously in the desired direction until the control valve trips the respective open or closed limit switch.

**VALVE LOCATION** : The UP STREAM or DOWN STREAM location of the valve with respect to the flow computer.

**EXTERNAL EVENT MODE** : The selection of an externally applied signal to cause the valve to FAIL CLOSED or to RESTART if in a FAIL CLOSED SHUT IN condition. DI4 on VCI termination board and DI8 on plug-in RTU termination board.

**DP LOW SHUT IN MODE** : The selection of the method to generate a restart command if the controller is in a FAIL CLOSED SHUT IN condition. Selection of NORMAL allows a timer to be used to restart the controller. Selection of REACTIVATE ON AP HI allows the restart command to occur when the AP reaches its Hi Limit, timer or external event.

**SHUT IN TIME** : The timer setting used with the DP LOW SHUT IN mode. Can be set from 0-255 minutes or hours selectable using the timer units, minutes or hours.

*Continued on next page*

**Commands & Parameters,** Continued

**TIME REMAINING (TR)** : Once the timer is activated by a DP LOW SHUT IN condition, the display will show the time remaining on the timer before the restart command is issued.

**RESTART CONTROLLER** : When a SHUT IN condition exists, no further automatic control action takes place. The RESTART CONTROLLER command is used to restart the controller that was active at the time the SHUT IN condition occurred. The command can be issued manually with the PCCU or automatically using one of the conditions discussed above. A manual restart is necessary for control after a LOW BATTERY FAIL CLOSED condition has occurred or after a External Event FAIL CLOSED condition has occurred.

**AP OVERRIDE** : AP override has three modes, Off, Enable High or Enable Low. The pressure override mode allows the AP controller to take over either the Differential pressure or Flow rate controller. If set to Enable High the AP controller will override when the pressure exceeds the AP OV (Override) value. If set to Enable Low the AP controller will override when the pressure drops below the AP OV (Override) value.

**Note**

If valve location is downstream an external transmitter must be installed downstream of control valve to override. If valve location is upstream the Flow Computers pressure is used to override.

**Select AI []** : An external analog input can be used as a pressure input to the controller. This transmitter if upstream of valve will be used to as AP process variable to control or restart controller after shut-in due to low DP. If transmitter located downstream of valve it will be used as AP override process variable.

**Timer Units** : Programs shut-in units to either minutes or hours. Used to determine the amount of time to leave the controller off after shut-in due to low DP.

**AP OV and APRstrt** : Setup parameters for pressure override. AP OV value determines when AP controller will override. APRstrt value determines what pressure to restart previous controller after shut-in. AP restart will only be used by the controller when 1) SI (Shut-in) is set in controller and 2) AP override value has been reached and valve has been closed by AP controller.

**On LoBatt** : Determines the valve action after low battery value is reached. Close will force the valve closed and Freeze will hold the valve in last position.

**OPEN and CLOSE Time** : Setup parameters for the timer function. These parameters are observed by the controller when the TMR (Timer) controller mode is activated. The valve will open and close as determined by the associated times. During the open time the active controller will be determining valve position. During the close time the valve will be closed until either the close timer has elapsed or the controller is turned off.

## Status Conditions

**Description**

Eight status conditions are maintained by the controller. These status conditions are displayed by the PCCU and the CCU and show the current state of the control system. The items highlighted on the screen indicate that the condition is active or true. If true the meaning is:

**VALVE FULL OPEN (FOP)** The valve's full open switch is tripped.

**VALVE FULL CLOSED (FCL)** The valve's full closed switch is tripped.

**HIGH DP OVERRIDE (HDPO)** DP has exceeded the specified high limit during AP or FLOW control. Valve control is maintained at the high DP limit until the condition clears after which normal control is resumed.
*or if AP OVERRIDE = ENABLE HI or ENABLE LO*

**AP OVERRIDE (APO)** AP has exceeded or fallen below AP Override Value. AP OVERRIDE annunciator is displayed instead of HIGH DP OVERRIDE.

**LOW DP OVERRIDE (LDPO)** DP has dropped below the specified low limit during AP or FLOW control. Valve control is maintained at the DP LOW LIMIT until the condition clears after which normal control is resumed. If SHUT IN is enabled and the LOW LIMIT violation persists with the valve FULL OPEN for the DP LO TIME the valve is ramped closed and valve control ceases until a restart command occurs.

*or if AP OVERRIDE = ENABLE HI or ENABLE LO*

**DP OVERRIDE (DPO)** DP has exceeded DP LOW or HIGH LIMIT. DP OVERRIDE annunciator is displayed instead of LOW DP OVERRIDE.

**FAIL CLOSED (FAIL)** The FCU battery voltage has dropped below the specified low limit, a LOW DP OVERRIDE SHUT IN condition has occurred, an External FAIL CLOSED Event has occurred, or an internal VCI error has occurred. The valve is ramped closed and valve control ceases until a restart command occurs.

**LOW BATTERY (LBAT)** The FCU battery voltage has dropped below the specified BATTERY VOLTAGE LOW LIMIT.

**LOCAL-LOCKOUT (LCLL)** The cable between the control valve and the termination box is disconnected. If the valve used does not support the local lockout feature, the jumpers at the termination board are not installed. Local-Lockout indication is not available with actuators providing a torque switch output.

**SHUT IN (SHUT)** The controller has ramped the valve closed because a SHUT IN condition has occurred. SHUT IN indicates that the valve was closed because of operation in the AUTO SHUT IN mode and the DP could not be maintained above its Low Limit.

# Setting Up Valve Control with the PCCU

## Introduction

After determining the type of control operation to apply to the valve, the necessary parameters and limits must be defined and entered. The Portable Calibration and Control Unit is used to enter the parameter values and to select the operating conditions.

## Procedure

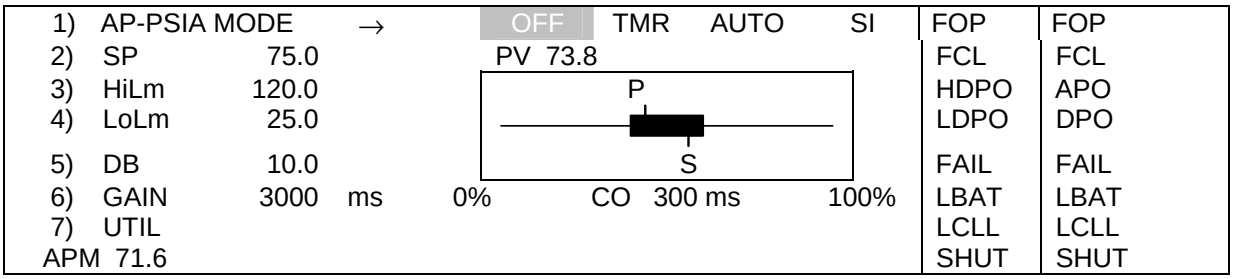
| Step | Procedure |
|---|---|
| 1. | With the PCCU connected to the Flow Computer Unit, select 1) Connected to Totalflow from the Top Level Menu<br><br>*** PCCU TOP LEVEL MENU ***<br>1) Connected to Totalflow<br>2) Set Up PCCU<br>3) Print or Clear FCU Data<br>4) Send FCU data to CCU<br>5) Graph FCU data<br><br>CONTINUE for more.<br><br>The following screen will be displayed:<br><br>** FCU CONNECTED: 376385<br>LOC: Johnson Crossing<br><br>1) Collect 6) Valve<br>2) Monitor<br>3) Entry<br>4) AGA-7<br>5) Calibrate |
| 2. | Select 6) Valve to enter the valve control setup screen and the following message will be displayed:<br><br>Please wait.<br>Reading Controller Data. |

## Setting Up Valve Control with the PCCU, Continued

**Note**

After initially applying power to the FCU, wait until it has gone through it's startup cycle before attaching the PCCU.

| Step | Procedure |
|---|---|
| 3. | Once the controller data is read by the PCCU, the following menu will be displayed: |




A menu of this format is used for each of the AP, DP and FLOW RATE controllers. The controller status data read by the PCCU determines which of the three menus to display first. If a controller is "active" or turned on, it is automatically displayed first. If no controller is turned on, the DP controller menu is displayed first. **To access the other controller menus depress the CONTINUE (CONT.) key.** Pressing the CONTINUE key causes the PCCU display to cycle through the three controller menus.

The PCCU updates the Process Variable (PV) display information on the screen once every five seconds. The Status Information and Controller Output (CO) is updated once every 15 seconds.

**Changing Menu Parameters**

Six parameters are capable of being entered or selected from the Controller Menu. These are items 1 through 6 on the display. Item 7 selects a UTILITY Menu which also requires parameter entry.

Item 1 shows the selected controller and the engineering units of the selected controller. Press item 1 to choose the operational mode of the controller displayed. When 1 is pressed, OFF, AUTO, or AUTO SI is highlighted by the moving cursor. Leave the cursor on the desired operational mode to activate that mode. When a controller is made active by selecting AUTO or AUTO SI, any other controller which was active becomes inactive. Items 2 through 5 have the same engineering units as the displayed controllers engineering units.

**Reminder**

**Press CONTINUE to choose another controller. Only 1 controller can be active at a time.**

### Changing Menu Parameters, Continued

To change the parameters associated with the displayed controller select the parameters corresponding number. The PCCU will quit polling the FCU for display update information and the cursor will move to the selected item. Enter the necessary value for the item selected. If the wrong key is pressed or an incorrect entry made, press the Menu Exit key and the original value will be retained.

Select items 2 through 6 and enter the necessary values. Refer to the term definitions and the section on selecting the control parameters for more information on the entry requirements.

User selections for changing controller data:

2) SP SET POINT
3) HiLm HI LIMIT
4) LoLm LO LIMIT
5) DB DEAD BAND
6) GAIN GAIN

When the AP controller is selected, the PV value displayed is the well head pressure and APM is the pressure measured by the FCU. Well head pressure is equal to APM + AP_BIAS. AP_BIAS is calculated dynamically by the controller.

PV Current controllers PROCESS VARIABLE
CO Current controller's most recent OUTPUT PERIOD in milliseconds
TR Time Remaining before the Automatic Restart of the controller takes place. This feature is selected in the Utility Menu.

The PV value is updated on the PCCU display every 5 seconds, the CO and TR values are updated every 15 seconds.

### Graph

At the center of the display screen is a graph of the current controllers PROCESS VARIABLE (P), SET POINT (S), and DEAD BAND in percent of SPAN. The graph shows the relationship of PROCESS VARIABLE to the SET POINT and the DEAD BAND around the SET POINT. The left limit of the display is 0% of SPAN and the right limit is 100% of SPAN. The graphic display is updated every 5 seconds by the PCCU.

*Continued on next page*

### Status Flags

The right edge of the display shows the controller STATUS FLAGS. Any indication that is highlighted is active or true. The STATUS FLAGS are updated by PCCU every 15 seconds. Refer to the definitions for more information on the STATUS FLAGS.

| | | |
|---|---|---|
| | FOP | Valve Full Open |
| | FCL | Valve Full Closed |
| | HDPO | High DP override condition exists |
| or | APO | High or Low AP override condition exists |
| | LDPO | Low DP override condition exists |
| or | DPO | High or Low DP override condition exists |
| | FAIL | Fail Closed condition exists |
| | LBAT | Low Battery voltage condition exists |
| * | LCLL | Local Lock-Out condition exists |
| | SHUT | Shut In condition exists |

* Local Lock-out indication not available with all actuators

### Utility Menu

Select item 7, UTIL to access the Utility Menu. The following will be displayed:

| | STEP | | MISC | | | or FOP | FOP |
|---|---|---|---|---|---|---|---|
| 1) | Open | 5) | LO BATT | 11.5 | Vdc | FCL | FCL |
| 2) | Close | 6) | DP LO TIME | 1 | min | HDPO | APO |
| | | 7) | STEP TIME | 500 | ms | LDPO | DPO |
| | RAMP | 8) | PIPE ID | 4.5 | in | FAIL | FAIL |
| 3) | Open | 9) | PIPE LEN | 345 | ft | LBAT | LBAT |
| 4) | Close | 0) | Restart Controller | | | LCLL | LCLL |
| | | Cont for More | | TR 0 Min | | SHUT | SHUT |

Three screens make up the Utility Menu. Press Continue from the above screen to view the second screen.

### Note

The capabilities of the Utility Menu second screen became available with firmware revisions released June 1993. The screen will be different if the unit does not have this firmware installed. PCCU firmware revisions released the same date are required to access the capabilities. Additional changes in the Plug-In RTU and PCCU firmware has added a third utility menu. These options were released in October 1994.

*Continued on next page*

### Utility Menu, Continued

The Utility Menu requires entry of various operating parameters for the Valve Control System to work properly.

**Items 1, 2, 3, and 4** are selections for manual operation of the valve. STEP refers to incremental movement of the valve. The increment of movement is defined in item 7, STEP TIME and is a time duration in milliseconds. Each time 1 or 2 is selected a prompt appears at the bottom of the display asking if a STEP is desired. Answer Yes or No to the prompt. Only 1 STEP or increment is performed each time 1 or 2 is selected. No movement of the valve will take place if the valve is against the limit switch of the direction selected.

RAMP refers to the movement of the valve to its full open or closed position. The time duration of the ramp is whatever is necessary to move the valve to the selected position, 3 to Open, 4 to Close. Movement stops when the limit switch is activated.

### Important

**The selection of STEP or RAMP turns any active controller OFF.**

**Item 5, LO BATT**, is selected to enter the battery voltage value where control will cease. If the system battery supply voltage drops to the entered value control ceases and a Low Battery (LBAT) FAIL CLOSED condition is indicated. The purpose of the condition is to reserve battery power for FCU operation. **A manual restart is required to remove the LBAT FAIL CLOSED condition.**

---

**Item 6, DP LO TIME**, is selected to enter the time, in minutes, that the Low DP Override condition will be allowed to exist with the valve full open before the Low DP Override condition forces the valve closed. DP LO TIME is active only when operating in the AUTO SHUT IN mode with DP Low Limit greater than 0. For example, if operating in AP AUTO SHUT IN mode and the flow quits, the Low DP Override output period will force the valve open in an attempt to increase DP.(Down stream valve location) The opening to the full open position will be in steps. Once full open, the controller will count the time that the Low DP Override condition exists. At the end of the time period, the valve will ramp closed.

### Important

**The setting of the DP Low Limit to 0 will allow the controller to operate on the AP controller output period which will force the valve closed when flow stops. SHUT IN will not occur if the DP Low Limit is set to 0.**

---

**Items 8 and 9** are selected to enter the Pipe Inside Diameter and Length between the well head and the metering point or Flow Computer Unit. The controller computes the AP BIAS, or difference between the AP measured at the Flow Computer and the well head. The bias value is added to the AP measured by the FCU to determine the AP Process Variable value. The computed well head AP value is the control value. Both AP values are shown on the AP control display. If an external transmitter is installed (upstream valve control), the AP process variable is equal to the external transmitter pressure.

### Utility Menu, Continued

**Item 0** is used to restart the controller from a FAIL CLOSED condition. When selected, a prompt will appear at the bottom of the screen asking if a Restart is desired. Answer Yes or No. Item 0 is the Manual Restart operation necessary if a LOW BATTERY FAIL CLOSED or an External Event FAIL CLOSED condition occurs.

To exit the Utility Menu depress the MENU EXIT key. The PCCU will return to the Controller Menu that was active before the Utility Menu was requested. To view the continuation of the Utility Menu, press the Continue (CONT) key. The second of three menu screens is displayed:

| | | | | ***or*** |
|---|---|---|---|---|
| 1) | VALVE LOC → | DN STREAM | FOP | FOP |
| 2) | EXT EVT MODE: | FAIL CLOSE | FCL | FCL |
| 3) | DP LO SI: | NORMAL | HDPO | APO |
| 4) | SI TIME: | 0 min TR 0 Min | LDPO | DPO |
| 5) | AP OVERRIDE | ENABLE HI | FAIL | FAIL |
| 6) | SELECT AI [1] | 7) Timer Units Min | LBAT | LBAT |
| | | | LCLL | LCLL |
| | Continue for More | | SHUT | SHUT |

**Item 1** of the second display of the Utility Menu is used to enter the Valve Location with respect to the Flow Computer. The two selections are **DOWN (DN) STREAM and UP STREAM**. Select 1 and a prompt will appear at the bottom of the display asking if the parameter is to be changed. Answer Yes to change the item to the other possible setting or answer No to leave it as indicated on the screen.

**The Valve Location selection is very important to the proper operation of the Valve Control System**.

Some conditions that require the valve to move in the open direction if the valve is Down Stream require the valve to move in the opposite direction if the valve is Up Stream.

**Items 2, 3, 4, 5 ,6 and 7** enhance the operation of the Valve Control System.

**Item 2** allows an External Event (Digital Input) to either cause a FAIL CLOSED condition or restart the controller after a SHUT IN condition has occurred. (RESTART CONTROLLER). The External Event must be a contact closure signal applied to the Digital Input (DI4) contacts of the valve control termination board or the Digital Input (DI8) contacts of the plug-in RTU termination board.

Only 1 set of contacts is available for the External Event on each type of termination board. Therefore, no External Restart is possible if the External Event created the FAIL CLOSED condition.

### Utility Menu, Continued

**Important**

**A Manual Restart is required to restart the controller if the External Event caused the FAIL CLOSED condition.**

If RESTART CONTROLLER is selected as the External Event Mode, the required contact closure signal will restart the controller from a FAIL CLOSED SHUT IN condition. A Low Battery (LBAT) FAIL CLOSED or FREEZE VALVE condition requires a Manual restart of the controller.

**Item 3** of the menu, DP LO SI (DP LOW SHUT IN), can be set to either NORMAL or REACT. ON AP HI. If NORMAL is selected, the controller can be restarted from a FAIL CLOSED SHUT IN condition by a Timer. **FAIL CLOSED SHUT IN conditions are created by operating in the AUTO SHUT IN mode when the DP drops below its Low Limit.** The amount of time between the FAIL CLOSED SHUT IN condition and the restart command is set by selecting item 4, SI TIME (SHUT IN TIME). The timer can be set from 1 to 255 minutes or hours, depending on setting of Item 7 (TIMER UNITS). An entry of 0 minutes in item 4 cancels the timer and no Restart occurs. A read only TR (Time Remaining) will be displayed next to SI TIME to indicate the remaining time before the controller restarts.

If REACT. ON AP HI is selected for item 3, the controller can be restarted from a FAIL CLOSED SHUT IN condition by the pressure increasing to its High Limit (Hi Lim) value as set on the AP controller display, timer (if shut-in time is greater than 0) or external event (if external event is = restart controller). **FAIL CLOSED SHUT IN conditions are created by operating in the AUTO SHUT IN mode when the DP drops below its Low Limit**. When either the AP reaches the value set as its Hi Limit, the timer elapses or the external event trips, the restart command will automatically occur.

**Important**

**In upstream valve control, an external pressure transmitter must be installed upstream of the control valve for the Reactivate on AP High Limit to work.**

If item 4, SI TIME (SHUT IN TIME) is set to 0, the timer function to restart the controller is disabled.

**If item 4 is set to some value greater than 0, the restart command will occur when the set time elapses or when the AP has reached its Hi Limit, whichever occurs first.**

*Continued on next page*

**Utility Menu,** Continued

**Item 5: AP OVERRIDE**

Upstream valve location:

When enabled the controller uses the FCU's absolute pressure (APM) to override the active controller. AP OVERRIDE will attempt to close the control valve to control system pressure.

Downstream valve location:
An external transmitter must be installed downstream of the control valve to use AP OVERRIDE. In Item 6, Select AI [1-7].

When AP OVERRIDE is enabled, the controller uses the external transmitter's pressure to override the active controller. AP OVERRIDE will attempt to close the control valve to control system pressure.

**Important** **AP OVERRIDE using downstream valve location will not work without an external transmitter installed.**

**Item 6: SELECT AI**

Allows an external pressure transmitter to be connected to an analog input on the plug-in RTU's termination board. Any analog input can be selected (1-7) or (none) if no external transmitter is being used.

With upstream valve control, the input is used as the process variable on the AP controller and to restart the controller on AP HIGH LIMIT.

While making entries at the Utility Menu, if an incorrect item is inadvertently selected or a wrong parameter entered, depress the Menu Exit key. The original value will be retained.

**Item 7: TIMER UNITS**

Units can be toggled between minutes and hours. Shut-in time can be programmed from 0 (disable timer) to 255 minutes or hours.

**Important** **Any change in item 1, 2, or 3 causes a restart of the controller.**

**Note** While viewing the Utility Menu the PCCU updates the STATUS information every fifteen seconds. The display is refreshed to reflect any new status from the controller.

**Utility Menu,** Continued

Press the CONTINUE (CONT) key while in the second Utility menu and the last Utility screen will appear.

| | | | | **or** |
|---|---|---|---|---|
| 1) | AP OV | 95.0 | FOP | FOP |
| 2) | AP Rstrt | 20.0 | FCL | FCL |
| 3) | On LoBatt | [CLOSE] | HDPO | APO |
| 4) | Open TIME | 000:00 | LDPO | DPO |
| 5) | Close TIME | 000:00 | FAIL | FAIL |
| | | | LBAT | LBAT |
| | | | LCLL | LCLL |
| | Continue for More | | SHUT | SHUT |

**Item 1: AP OV**
AP override set point. If AP Override = Enable Hi, when the pressure downstream of control valve exceeds this value the valve will close attempting to reduce the system pressure. If AP Override = Enable Lo, when the pressure downstream of control valve falls below this value the valve will close attempting to increase the system pressure.

**Item 2: APRSTRT**
AP restart value. Restarts controller after shut-in caused by AP override. If AP Override = Enable Hi, when downstream pressure drops below APRSTRT the controller will restart based on the active controller before the override condition occurred. If AP Override = Enable Lo, when downstream pressure exceeds APRSTRT the controller will restart based on the active controller before the override condition occurred.

With downstream valve control, the external analog input is used as the AP OVERRIDE variable. The AI value is compared to the AP OV LIMIT to determine if AP OVERRIDE has occurred.

**Item 3: OPEN TIME**
The active controller must have TMR (Timer mode) enabled before open time and close time periods are valid. If enabled the Open Time will set the active controllers on time programmed in hours and minutes (000:00). At the end of this period the controller will close valve for the Close Time period. During the open time all other modes can be activated including Shut-in, Nominations and AP override.

*Continued on next page*

### Utility Menu, Continued

**Item 4: CLOSE TIME**
The active controller must have TMR (Timer mode) enabled before close time and open time periods are valid. If enabled the Close Time will set the active controllers off time programmed in hours and minutes (000:00). At the end of this period the controller will open the valve for the Open Time period. During the close time all other modes will be deactivated.

### Turning Control On

After all entries are made, manually step the valve to the position where the desired parameter is near the control Set Point. If a large step time was used to manually open the valve, enter a smaller step time before turning the controller on. The entered step time value is the period used by the controller initially opening the valve from a full closed position. Select the desired control mode and the valve should position itself to maintain the Process Variable at the selected Set Point.

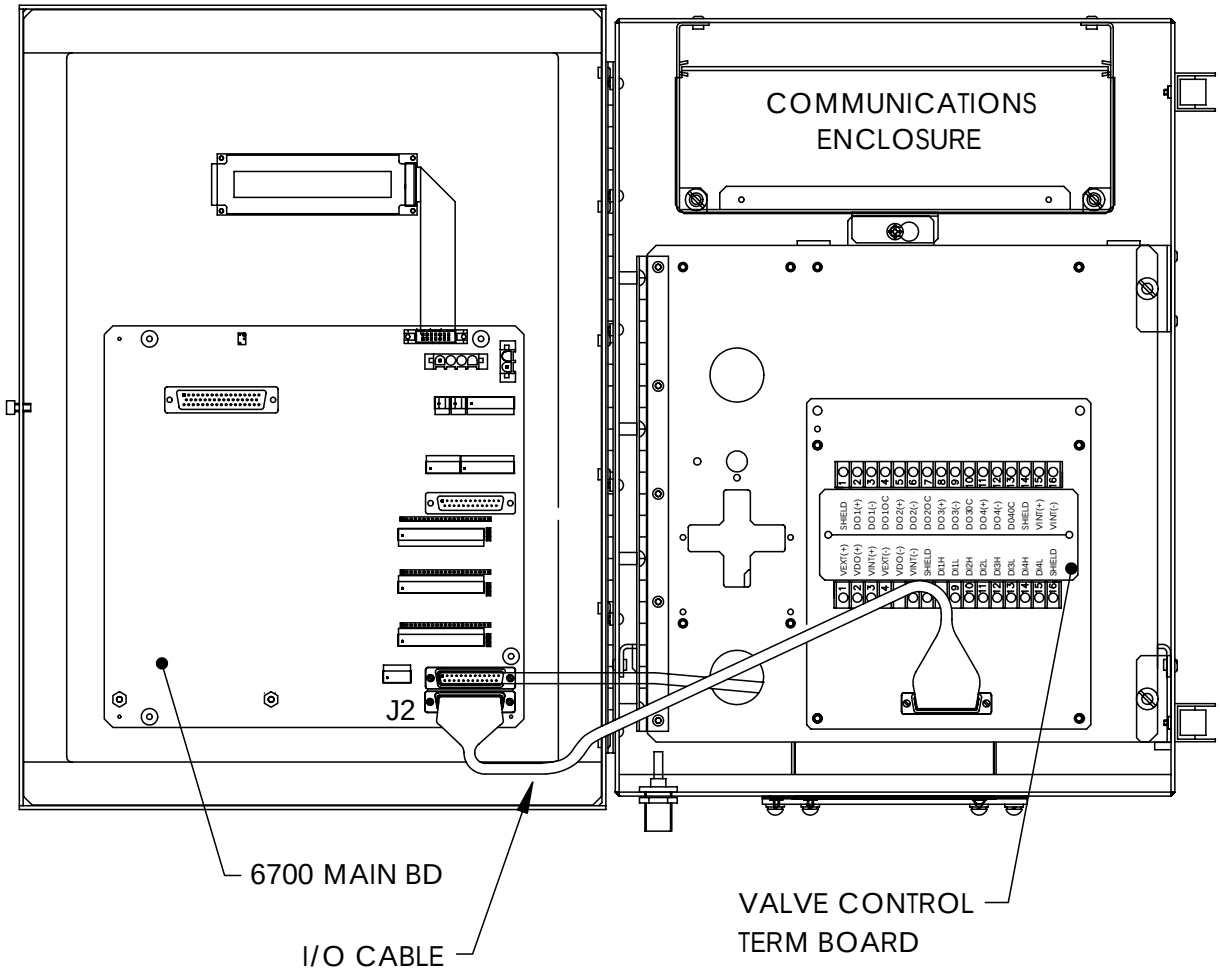
As flow conditions change and the controlled parameter goes outside the boundaries of the Dead Band, the controller output will move the valve in steps as determined by the algorithm to bring the parameter back to within the Dead Band. Often times only one movement of the valve will accomplish this. Other times, as determined by the changing parameters, many small steps of the valve may be necessary.

# Control Valve Actuator Compatibility Specification

The actuator motor must be a nominal 12Vdc bi-directional motor with a maximum inrush current of 800 milli-amps and a nominal holding current of 200 milli-amps. The actuator must provide two dry contact switches. One switch for indicating valve FULL OPEN the other for FULL CLOSED.
Valve/Actuator manufacturers known to provide compatible configurations are:

- Jamesbury
- Keystone
- Ledeen (Local Lock-out indication not available)
- Foxboro Jordon
- Valvcon
- Worchester

## System Configuration




The valve option uses 2 Digital Outputs and 4 Digital Inputs

| Digital Outputs | Digital Inputs |
|---|---|
| 2 used for actuator motor power | 2 used to detect limit switches |
| | 1 used to detect Local Lockout/Torque |
| | 1 used to detect External Event |

Valve option is also available with the Plug-in RTU (PIRTU).

## Valve Control Setup Checklist

| Set-up Parameters | DP Auto | DP Auto/ Tmr | DP Auto/Tmr /SI | DP Auto/SI | AP Auto | AP Auto/ Tmr | AP Auto/Tmr /SI | AP Auto /SI |
|---|---|---|---|---|---|---|---|---|
| **DP Low Limit** | 4 | 4 | 4(3) | 4(3) | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP High Limit** | 4 | 4 | 4 | 4 | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP Setpoint** | 4 | 4 | 4 | 4 | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP Deadband** | 4 | 4 | 4 | 4 | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP Gain** | 4 | 4 | 4 | 4 | 4(4) | 4(4) | 4(4) | 4(4) |
| | | | | | | | | |
| **AP Low Limit** | O(2) | O(2) | 4(2) | 4(2) | 4 | 4 | 4 | 4 |
| **AP High Limit** | O(2) | O(2) | 4(1)(2) | 4(1)(2) | 4 | 4 | 4(1) | 4(1) |
| **AP Setpoint** | O(2) | O(2) | 4(2) | 4(2) | 4 | 4 | 4 | 4 |
| **AP Deadband** | O(2) | O(2) | 4(2) | 4(2) | 4 | 4 | 4 | 4 |
| **AP Gain** | O(2) | O(2) | 4(2) | 4(2) | 4 | 4 | 4 | 4 |
| | | | | | | | | |
| **Flow Rate Low Limit** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Flow Rate High Limit** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Flow Rate Setpoint** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Flow Rate Deadband** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Flow Rate Gain** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| | | | | | | | | |
| **Low Battery** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **DP Low Time** | N/A | N/A | 4(3) | 4(3) | N/A | N/A | 4(3) | 4(3) |
| **DP Shut-In Time** | N/A | N/A | 4(3) | 4(3) | N/A | N/A | 4(3) | 4(3) |
| **DP Low Shut-In Mode** | N/A | N/A | 4(1)(3) | 4(1)(3) | N/A | N/A | 4(1)(3) | 4(1)(3) |
| **AI** | O(5) | O(5) | O(5) | O(5) | O(5) | O(5) | O(5) | O(5) |
| **Low Bat. Valve Action** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Step Time** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Valve Location** | 4(6) | 4(6) | 4(6) | 4(6) | 4(6) | 4(6) | 4(6) | 4(6) |
| **Timer Units** | N/A | N/A | 4 | 4 | N/A | N/A | 4 | 4 |
| **External Event Mode** | O | O | O | O | O | O | O | O |
| **Battery Low Limit** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Pipe ID** | O | O | O | O | O | O | O | O |
| **Pipe Length** | O | O | O | O | O | O | O | O |
| **AP Override Limit** | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) |
| **AP Restart** | N/A | N/A | O(2) | O(2) | N/A | N/A | O(2) | O(2) |
| **Timer Open Time** | N/A | 4 | 4 | N/A | N/A | 4 | 4 | N/A |
| **Timer Close Time** | N/A | 4 | 4 | N/A | N/A | 4 | 4 | N/A |
| **AP Override Mode** | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) |
| **On Low Battery** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Nom. Start Time** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Nom. Stop Time** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Nom. Term. Mode** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |
| **Nom. Target Volume** | N/A | N/A | N/A | N/A | N/A | N/A | N/A | N/A |

**Note** See checklist notes on page 9-31.

*Continued on next page*

## Valve Control Setup Checklist, Continued

| Set-up Parameters | Flow Rate Auto | Flow Rate Auto/ Tmr | Flow Rate Auto/ Tmr/ SI | Flow Rate Auto/ Nom/ Tmr | Flow Rate Auto/ Nom/ SI/Tmr | Flow Rate Auto/ Nom | Flow Rate Auto/ Nom/ SI | Flow Rate Auto/ SI |
|---|---|---|---|---|---|---|---|---|
| **DP Low Limit** | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP High Limit** | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP Setpoint** | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP Deadband** | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) |
| **DP Gain** | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) | 4(4) |
| | | | | | | | | |
| **AP Low Limit** | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) |
| **AP High Limit** | 4(2) | 4(2)(1) | 4(2)(1) | 4(2) | 4(2)(1) | 4(2) | 4(2)(1) | 4(2)(1) |
| **AP Setpoint** | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) |
| **AP Deadband** | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) |
| **AP Gain** | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) | 4(2) |
| | | | | | | | | |
| **Flow Rate Low Limit** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Flow Rate High Limit** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Flow Rate Setpoint** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Flow Rate Deadband** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Flow Rate Gain** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| | | | | | | | | |
| **Low Battery** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **DP Low Time** | N/A | 4N/A | 4(3) | N/A | 4(3) | N/A | 4(3) | 4(3) |
| **DP Shut-In Time** | N/A | 4N/A | 4(3) | N/A | 4(3) | N/A | 4(3) | 4(3) |
| **DP Low Shut-In Mode** | N/A | 4N/A | 4(1)(3) | N/A | 4(1)(3) | N/A | 4(1)(3) | 4(1)(3) |
| **AI** | O(5) | O(5) | O(5) | O(5) | O(5) | O(5) | O(5) | O(5) |
| **Low Bat. Valve Action** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Step Time** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Valve Location** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Timer Units** | N/A | N/A | 4 | N/A | 4 | N/A | 4 | 4 |
| **External Event Mode** | O | O | O | O | O | O | O | O |
| **Battery Low Limit** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Pipe ID** | O | O | O | O | O | O | O | O |
| **Pipe Length** | O | O | O | O | O | O | O | O |
| **AP Override Limit** | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) |
| **AP Restart** | N/A | N/A | O(2) | N/A | O(2) | N/A | O(2) | O(2) |
| **Timer Open Time** | N/A | 4 | 4 | 4 | 4 | N/A | N/A | N/A |
| **Timer Close Time** | N/A | 4 | 4 | 4 | 4 | N/A | N/A | N/A |
| **AP Override Mode** | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) | O(2)(6) |
| **On Low Battery** | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| **Nom. Start Time** | N/A | N/A | N/A | 4 | 4 | 4 | 4 | N/A |
| **Nom. Stop Time** | N/A | N/A | N/A | 4 | 4 | 4 | 4 | N/A |
| **Nom. Term. Mode** | N/A | N/A | N/A | 4 | 4 | 4 | 4 | N/A |
| **Nom. Target Volume** | N/A | N/A | N/A | 4 | 4 | 4 | 4 | N/A |

**Note** See checklist notes on following page.

## Valve Control Setup Checklist, Continued

**Checklist Notes**

(N/A)- Not Applicable

(4) - Required settings

( 1) - Required to reactivate controller on pressure (AP high) when "DP LO SI" = "React. on AP HI".

(2) - Required for calculating AP override limits and/or to shut-in valve

(3) - Used to activate and control on Low DP shut-in (DP Low Limit must be > 0 to activate) Select "Normal" or "React. on AP HI" mode settings to intermit on Low DP and restart on timer

(4) - Required for calculating DP override limits

(5) - Optional pressure input.

If Valve selection = Upstream - External pressure used to control and restart controller after shut-in caused by low DP.

If Valve selection = Downstream - External pressure transmitter located downstream of control valve used to override.

(6) - Pressure override settings:

If valve location = Downstream an external transmitter must be connected and will be used to override.

If valve location = Upstream the Flow Computer's pressure is used as the process variable.

(O) - Optional Parameters

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# Chapter 10

## 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 Pulse Input Flow Computer 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.