FLOBOSS™ 503 AND 504 FLOW MANAGERS
Instruction Manual

EMERSON

Process Management

FloBoss 503 and 504 Instruction Manual

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This manual may be revised periodically to incorporate new or updated information. The date revision level of each page is indicated at the bottom of the page opposite the page number. A major change in the content of the manual also changes the date of the manual which appears on the front cover. Listed below is the date revision level of each page.

Page	Revision
Title page and page 4-6	11/11
All Pages	4/04
All Pages	9/03
All Pages	2/02

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FloBoss 503 and 504 Instruction Manual

SECTION 1 – GENERAL INFORMATION

This manual describes the FloBoss™ 503 and 504 Flow Managers, part of the family of FloBoss 500-series flow computers.

1.1 MANUAL OVERVIEW

This manual includes the following sections:

♦ **Section 2: Installation and Use** – provides information concerning the installation and use of the FloBoss.

♦ **Section 3: Power Connections** – describes the power connections of the FloBoss 503 and FloBoss 504 Flow Managers, focusing on calculating power and connecting wiring.

♦ **Section 4: Communications Installation and Wiring** – provides information and specifications for standard communications and the optional communications cards.

♦ **Section 5: Inputs and Outputs** – provides information and specifications for the standard inputs and outputs, plus the optional Input/Output (I/O) cards, which supplies additional inputs and outputs for expanded monitoring and control applications.

♦ **Section 6: Sensor for FloBoss 503** – describes the Sensors included with the FloBoss 503 for sensing static pressure and differential pressure.

♦ **Section 7: Sensor for FloBoss 504** – describes the Sensor Module included with the FloBoss 504 for sensing static pressure and counting pulse inputs.

♦ **Section 8: Calibration** – describes how to calibrate the FloBoss 503 and FloBoss 504 Flow Managers.

♦ **Section 9: Troubleshooting** – describes how to troubleshoot the FloBoss 503 and FloBoss 504 Flow Managers.

♦ **Glossary of Terms** – defines terms used in this manual.

♦ **Index** – alphabetically lists the items contained in this manual along with their page numbers.

1.2 ADDITIONAL INFORMATION

The following manuals may be used to acquire additional information not found in this manual:

📖 *ROCLINK for Windows Configuration Software User Manual* – Form A6091. Part Number D301138X12.

📖 *ROC/FloBoss Accessories Instruction Manual* – Form A4637. Part Number D301061X012.

📖 *ROC Protocol User Manual* – Form A4199. Part Number D301053X012.

1.3 PRODUCT OVERVIEW

The FloBoss 503 and FloBoss 504 are 32-bit microprocessor-based Electronic Flow Measurement (EFM) computers that provide functions required for measuring the flow at a single meter run. The FloBoss 503 provides functions required for orifice metering by measuring the differential pressure, static pressure, and temperature. The FloBoss 504 provides functions required for turbine metering by measuring the pulse counts, static pressure, and temperature.

The FloBoss computes gas flow for both volume and energy. The FloBoss provides on-site functionality and supports remote monitoring, measurement, data archival, communications, and control. The FloBoss design allows you to configure specific applications including those requiring gas flow calculations, data archival, remote communications, and logic and sequencing control using a Function Sequence Table (FST).

The FloBoss provides the following standard components and features:

♦ A 32-bit microprocessor, 512 KB of flash read-only memory (ROM), and 512 KB of static memory storage.

♦ Built-in Resistance Temperature Detector (RTD) Input.

♦ Built-in Discrete Output.

♦ Extensive applications firmware.

♦ Weather-tight enclosure with covered display.

♦ Space for up to four 7 Amp-hour batteries.

♦ Operator Interface (LOI) Local Port.

♦ Port for optional host communications card.

♦ Liquid Crystal Display (LCD).

♦ Optional Input/Output (I/O) card.

♦ Optional sensor for either orifice (FloBoss 503) or turbine (FloBoss 504) metering.

♦ Optional bracket for internally mounted radio.

♦ Optional Communications Cards.

♦ Optional AC Power Supply.

Physically, the FloBoss consists of a printed-circuit Main Electronics Board and a display housed in a compact, weather-tight case. The FloBoss is packaged in a National Electrical Manufacturer's Association (NEMA 4) windowed enclosure that can mount on a wall or a pipestand. A cover is provided for the display to protect it from adverse weather conditions. Refer to Figure 1-1 and Figure 1-2.

The steel enclosure protects the electronics from physical damage and harsh environments. The enclosure consists of two pieces: the body and the door. A foam-rubber gasket seals the unit when the hinged door is closed. The hinge, located on the left side, is stainless steel and fastened to the body with machine screws, allowing removal of the door. The door secures with a lockable hasp.

The enclosure is fabricated from carbon steel. Refer to the Specifications tables in Section 1.6, FloBoss 503 and FloBoss 504 Main Specifications, on page 1-20 for dimensional details.
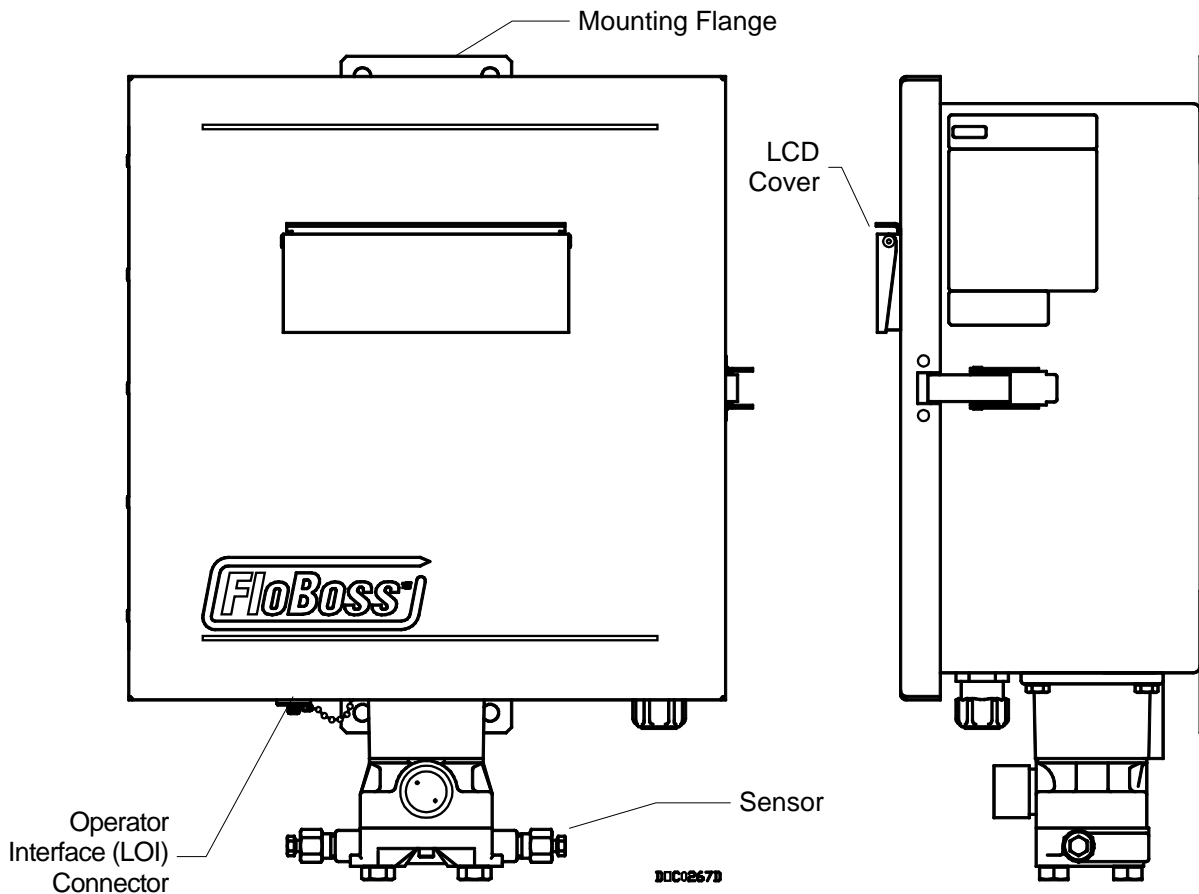
Figure 1-1. FloBoss 503 Flow Manager
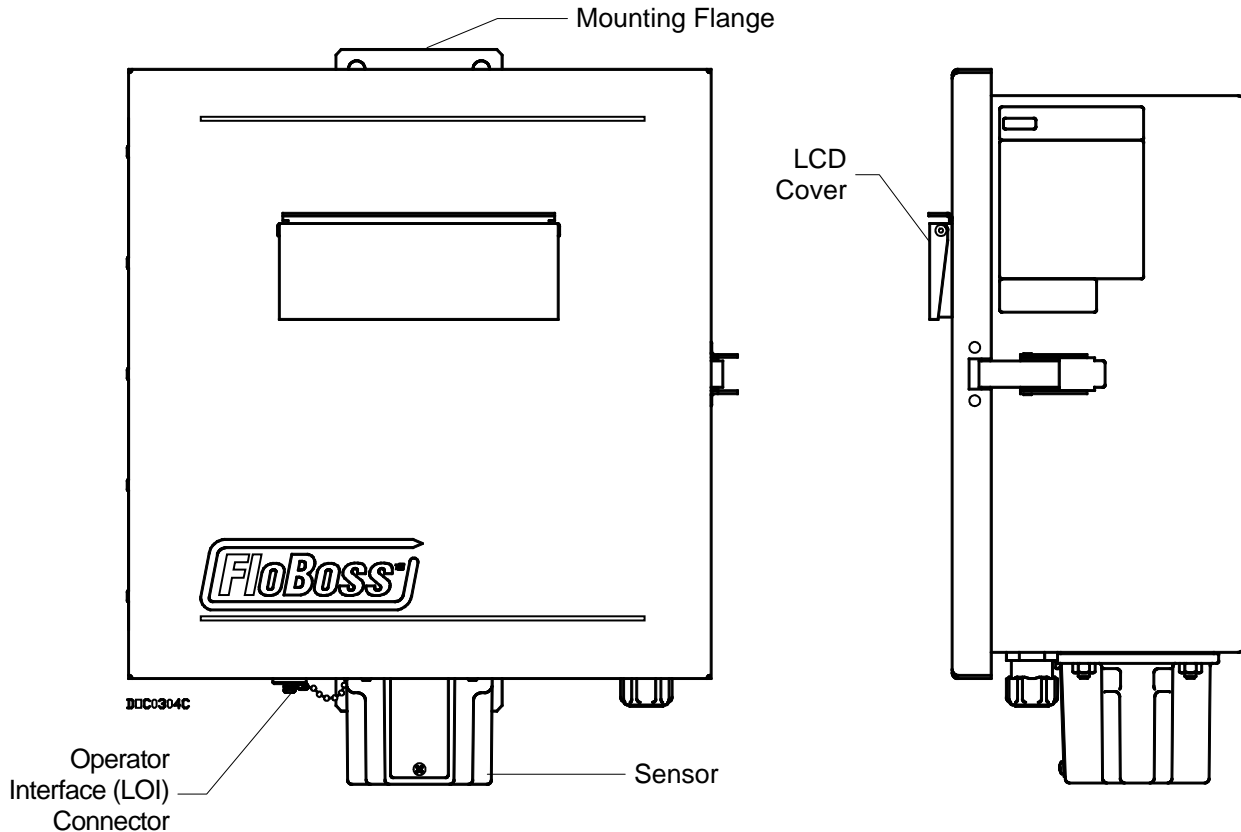
Figure 1-2. FloBoss 504 Flow Manager

1.3.1 Hardware

The Main Electronics Board mounts on quick-fastener stand-offs located on top of the swing-out panel. The majority of the components are surface-mounted with only the top side of the board used for components. The Main Electronics Board has built-in I/O capabilities, an LCD display, provisions for an optional communications card, and provisions for an optional I/O card. For more information on the Main Electronics Board, refer to Section 1.5.1, Main Electronics Board Overview, on page 1-13.

A Motorola 32-bit Complementary Metal-Oxide Semiconductor (CMOS) microprocessor runs at 14.7 MHz and has low-power operating modes, including inactivity and low battery conditions. The FloBoss comes standard with 512 KB of built-in, super capacitor-backed Static Random Access Memory (SRAM) for storing data and history. The FloBoss also has 512 KB of programmable Read-Only Memory (flash ROM) for storing operating system firmware, applications firmware, and configuration parameters.

The built-in inputs and outputs (I/O) on the FloBoss consist of a port for a Sensor, a 4-wire Resistance Temperature Detector (RTD) input interface, and a Discrete Output (DO). Three diagnostic Analog Inputs are dedicated to monitoring battery voltage, charger voltage, and enclosure/battery temperature. Refer to Section 1.5, Product Electronics, on page 1-13 for more information.

On the FloBoss 503, the orifice-metering Sensors measure differential pressure and static pressure (absolute or gauge) by converting the applied pressure to electrical signals and making the readings available to the Main Electronics Board. The Sensor housing fastens to a flanged adapter, which in turn mounts with four bolts to the bottom of the enclosure. The Sensor cable plugs directly into the Main Electronics Board. For more information on the Sensor for the FloBoss 503, refer to Section 6.

On the FloBoss 504, the turbine-metering Sensor Module (SM) measures pulses and static pressure by electronically counting pulses and converting the applied pressure to electrical signals. It makes the readings available to the Main Electronics Board. The Sensor Module housing mounts with four bolts to the bottom of the enclosure. The Sensor Module cable plugs directly into the Main Electronics Board. For more information on the Sensor Module for the FloBoss 504, refer to Section 7.

The I/O parameters, sensor inputs, flow calculations, power control, security, and FST programmability are configured and accessed using the ROCLINK for Windows software. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091), for details concerning software capabilities.

1.3.2 Options and Accessories

The FloBoss supports the following options and accessories:

- ♦ Communications Card for host communications (Comm1).
- ♦ Bracket for internally-mounted radio.
- ♦ I/O Card (10-channel or 24-channel).
- ♦ Internal AC Power Supply.
- ♦ Intrusion Switch.
- ♦ Local Operator Interface (LOI) cable.
- ♦ Batteries.
- ♦ Solar Panels.

A variety of plug-in communication cards are available that allow you to customize the FloBoss installation for most communications requirements. The communication cards provide an interface for the host communications port (Comm1). These cards permit serial communication protocols, as well as dial-up modem communications. Refer to Section 4, Communications Installation and wiring, for more information.

A radio with an integral modem can also be mounted inside the FloBoss enclosure using the optional radio bracket. Refer to Section 2, Installation and Use. The radio bracket allows a radio up to 57.15 mm (2.25 inches) high to be mounted securely in the battery compartment inside the FloBoss enclosure. Power for the radio can be controlled through the EIA-232 (RS-232) communications card. Clearance is provided for the radio antenna cable to exit through the bottom of the enclosure.

An optional FloBoss 500-series I/O Cards provide additional inputs and outputs for expanded monitoring and control applications. The I/O Card contains Analog Inputs (AI), an Analog Output (AO), Discrete Inputs (DI), Pulse Inputs (PI) and Discrete Outputs (DO). The DI, DO, and PI circuitry is optically coupled to help isolate the processor board from the input signal. Refer to Section 4, Communications Installation and Wiring, for more information.

An internal AC power supply is available as a factory-installed option. The AC power supply converts AC line power to DC power for use with the FloBoss and the associated accessories. The power supply typically is used in line-powered installations. If battery backup is used in the line-powered installation, the AC supply also functions as a battery charger. The unit provides a fully-regulated, temperature-compensated output that is protected from overcurrent conditions. The AC supply is factory-installed in the battery compartment of the FloBoss. Refer to Section 3, Power Connections, for details concerning the AC power supply.

The intrusion switch acts as a tamper detector for the FloBoss units. The intrusion switch is a momentary contact switch used to detect whether the door to the enclosure is open or closed. The switch, which has a normally-closed contact, is designed to be mounted in the FloBoss enclosure. Refer to the *ROC/FloBoss Accessories Instruction Manual* (Form A4637) for details. An I/O Card must be installed in order to use the intrusion switch. The status of the switch can be configured to generate an alarm when the door to the enclosure is open. Refer to Section 5, Inputs and Outputs, for details.

The FloBoss enclosure can hold up to four sealed lead-acid batteries. The 12-volt batteries provide approximately 7 Amp-hours each, resulting in up to 28 Amp-hours of backup capacity or up to 21 Amp-hours of backup capacity when used with an AC power supply. The batteries are mounted under the electronics swing-out panel and are retained by the panel when it is secured. The batteries are connected to a wiring harness that allows the batteries to be changed without removing power from the unit. Refer to Section 2, Power Connections, for further details.

A solar panel can be installed to recharge the backup batteries; it connects to the POWER charge inputs on the Main Electronics Board. Circuitry on the Main Electronics Board monitors and regulates the charge based on battery voltage, charging voltage, and temperature. The typical panels used are 12-volt panels with output ratings of 5 or 10 watts. The panels are typically bracket-mounted on a pole or pipe, and the wiring is brought into the bottom of the FloBoss enclosure through a liquid-tight fitting. Refer to Section 3, Power Connections, for further details.

1.4   PRODUCT FUNCTIONS

This section describes the functions of the FloBoss 503 and FloBoss 504, most of which is determined by firmware. The features and applications provided by the firmware must be configured with ROCLINK for Windows software.

1.4.1   Firmware

The firmware, contained in flash ROM on the electronics board, determines much of the functionality of the FloBoss, such as:

♦   Memory logging of 240 alarms and 240 events.

♦   Archival of data for up to 15 history points for up to 35 days.

♦   AGA flow calculations.

♦   Power cycling control.

♦   Flow calculations for a single meter run.

♦   Logic and sequencing control by means of two user-defined Function Sequence Tables (FST).

♦   Closed-loop (PID) control.

♦   Communications based on either ROC protocol or Modbus protocol (slave mode only).

♦   Spontaneous Report by Exception (SRBX) communication to a host computer.

♦   User level security.

1.4.2   Flow Measurement

The primary function of the **FloBoss 503** is to measure the flow of natural gas through an orifice in accordance with the 1992 American Petroleum Institute (API) and American Gas Association (AGA) standards.

The primary inputs used for the orifice metering flow measurement function are differential pressure, static pressure, and temperature. The differential and static pressure inputs, which are sampled once per second, come from a Dual-Variable Sensor (DVS) or a Multi-Variable Sensor (MVS). The temperature input, which is sampled and linearized once per second, comes from an Resistance Temperature Detector (RTD) probe.

The primary function of the **FloBoss 504** is to measure the flow of gas using a turbine meter (with a single or dual pulse train), in accordance with the American Gas Association (AGA), American Petroleum Institute (API), and International Standards Organization (ISO) standards.

The primary inputs used for turbine flow measurement are Pulse Input (PI) counts, static (line) pressure, and temperature. The PI counts are acquired from a turbine meter, the static pressure (including auxiliary pressure) input comes directly from the Sensor Module, and the temperature input is read directly by the FloBoss unit from an RTD probe.

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1.4.2.1   1992 Flow Calculations for Orifice Metering

The 1992 flow calculation is in accordance with ANSI/API 2530-92 (AGA Report No. 3 1992), API Chapter 14.2 (AGA Report No. 8 1992 2nd printing 1994), and API Chapter 21.1. The 1992 flow calculation may be configured for either Metric or US units.

Flow Time

The differential pressure stored for each second is compared to the configured low flow cutoff. If the differential pressure is less than or equal to the low flow cutoff or the converted static pressure is less than or equal to zero, flow is considered to be zero for that second. Flow time for a recalculation period is defined to be the number of seconds for which the differential pressure exceeded the low flow cutoff.

Input and Extension Calculation

Every second the FloBoss unit stores the measured input for differential pressure, static pressure, and temperature and calculates the flow extension (defined as the square root of the absolute upstream static pressure times the differential pressure).

Flow time averages of the inputs and the flow extension over the configured recalculation period are calculated, unless there is no flow for an entire recalculation period. Averages of the inputs are recorded to allow monitoring during no flow periods.

Instantaneous Rate Calculations

The instantaneous value of the flow extension is used with the previous recalculation period's Integral Multiplier Value (IMV), C Prime (C') for orifice, and Base Multiplier Value (BMV) for turbine metering, to compute the instantaneous flow rate. The IMV is defined as the value resulting from the calculation of all other factors of the flow rate equation not included in the Integral Value (IV). The IV is defined as the flow extension. The instantaneous flow rate is used with the volumetric heating value to compute the instantaneous energy rate.

Flow and Energy Accumulation

The averages of the differential and static pressure, temperature, and flow extension are used with the flow time to compute the flow and energy over the recalculation period. The flow and energy are then accumulated and stored at the top of every hour. At the configured contract hour, the flow and energy are then stored to the Daily Historical Log and zeroed for the start of a new day.

1.4.2.2 Flow Calculations for Turbine Metering

The turbine flow calculation is in accordance both with 1996 AGA Report No. 7 (1993 API Chapter 21.1) and with ISO 9951-1993(E). The FloBoss 504 performs 1992 AGA8 compressibility calculations in accordance with AGA Report No. 8 1992 (API Chapter 14.2); for ISO calculations, the FloBoss 504 performs ISO 12213-2 compressibility. The flow calculation may be configured to use either Metric or US units. Pulse fidelity/integrity checking at Level A through Level E is also performed according to AGA/API 5-5 and ISO 6551-1982(E). These integrity levels are summarized as follows:

♦ **Level A** – This is the highest level of integrity; it provides continuous protection against errors. Both verification and correction are performed by comparing two pulse streams from the turbine. The two pulse streams are checked against each other to produce a corrected pulse stream, which is then used in the flow calculation. Errors are indicated even when corrected. For Level A, the FloBoss 504 employs a patent-pending algorithm and requires a high-precision turbine with no more than 1% phase error between blades.

♦ **Level B** – This level provides continuous warning of errors by comparing two pulse streams from the turbine against each other. For Level B, the FloBoss 504 employs a patent-pending algorithm.

♦ **Level C** – This level provides automatic warning of errors at specified intervals by comparing two pulse streams from the turbine against each other and requires a turbine with no more than 15% phase error between blades.

♦ **Level D** – This level provides manual warning of errors at specified intervals by comparing the results of one pulse stream from the turbine visually against another means of measurement, such as a mechanical meter.

♦ **Level E** – This is the lowest level of integrity; it provides no detection of errors by comparison of the one pulse stream from the turbine to any other results, but instead depends entirely on the quality of the installed equipment.

After power-up, the Master Controller Unit (MCU) enters the normal operation mode. The Sensor Module (SM) then counts the pulses as they occur. Once every 992 ms, the SM reports to the MCU the number of pulses received by its pulse inputs, as well as the static and auxiliary pressures. The values are stored in temporary memory.

Once every Scan Period, the MCU processes the pulse counts, determines the number of pulse counts since the last reading, and calculates a rate. Next, the static pressure and auxiliary pressure values are read. Then the temperature is read and linearizing compensation is applied to the pressure readings if necessary. The RTD is internally re-calibrated for every 5°C (9°F) change as sensed by the enclosure temperature diagnostic input.

All resultant values are stored in the current value database. The values are taken from the current value database and used to calculate the Minute, Hour, and Daily historical values.

Finally, the MCU enters a low-power mode and waits for the beginning of the next cycle.

Once a minute and once an hour, the values are logged along with other configured values to the Historical Database. At the configured Contract Hour, the values are stored to the Daily Historical Log and zeroed for the start of a new day.

1.4.3 History Points

A total of fifteen history points may be logged and accessed in the FloBoss unit. The first eight are pre-configured for flow metering history and cannot be changed. Refer to Table 1-1.

Table 1-1. History Points

History Point Number	Value	Archive Type
1	Flowing Minutes Today	Accumulate
2	FloBoss 503 – Differential Pressure	Average
	FloBoss 504 – Raw pulse count from Pulse Input Primary Device	Totalize
3	Static or Line Pressure	Average
4	Temperature	Average
5	FloBoss 503 – IMV, Integral Multiplier Value, or C Prime	Average
	FloBoss 504 – BMV, Base Multiplier Value, or C Prime	Average
6	FloBoss 503 – Pressure Extension or IV, Integral Value	Average
	FloBoss 504 – Uncorrected Flow Today	Accumulate
7	Instantaneous Flow	Accumulate
8	Instantaneous Energy	Accumulate

The **Average Archive Type** employs one of the following techniques:

♦ Flow dependent time-weighted linear averaging (default).

♦ Flow dependent time-weighted formulaic averaging.

♦ Flow-weighted linear averaging.

♦ Flow-weighted formulaic averaging.

The seven user-configurable history points and Averaging Technique may be configured in ROCLINK for Windows software.

1.4.3.1 Minute Historical Log

The FloBoss unit has a 60-minute historical log for every history point. The Minute Historical Log stores the last 60 minutes of data from the current minute. Each history point has Minute Historical Log entries, unless the history point is configured for FST-controlled logging.

1.4.3.2 Hourly Historical Log

The FloBoss unit has a total of 840 hourly historical logs available for every history point. The Hourly Historical Log is also called the Periodic Log. Normally, the Hourly Log is recorded every hour at the top of the hour. The exceptions are FST Minute and FST Second logging.

The time stamp for periodic logging consists of the month, day, hour, and minute. The exception is for FST Second logging, for which the time stamp consists of the day, hour, minute, and second.

1.4.3.3 Daily Historical Log

The FloBoss unit has a total of 35 daily historical logs for every history point. The Daily Log is recorded at the configured contract hour every day with a time stamp that is the same as the Hourly Log. Each history point has daily historical log entries, unless the history point is configured for FST-controlled logging.

1.4.3.4 Alarm Log

The Alarm Log contains the change in the state of any alarm signal that has been enabled for alarms. The system Alarm Log has the capacity to maintain and store up to 240 alarms in a circular log. The Alarm Log has information fields which include time and date stamp, alarm clear or set indicator, and either the tag name of the point which was alarmed with the current value or a 14-character ASCII description.

In addition to providing functionality for appending new alarms to the Alarms Log, it allows host packages to request the index of the most recently logged alarm entry. Alarm logging is available internally to the system, to external host packages, and to FSTs. Alarm Logs are not stored to the flash ROM during the Save Configuration function in ROCLINK for Windows software.

The Alarm Log operates in a circular fashion with new entries overwriting the oldest entry when the buffer is full. The Alarm Log provides an audit history trail of past operation and changes. The Alarm Log is stored separately to prevent recurring alarms from overwriting configuration audit data.

1.4.3.5 Event Log

The Event Log contains changes to any parameter within the FloBoss unit made through the protocol. This Event Log also contains other FloBoss unit events, such as power cycles, cold starts, and disk configuration downloads.

The system Event Log has the capacity to maintain and store up to 240 events in a circular log. The Event Log has information fields, which include point type, parameter number, time and date stamp, Point Number (if applicable), the operator identification, and either the previous and current parameter values or a 14-byte detail string in ASCII format.

In addition to providing functionality for appending new events to the Events Log, it allows host packages to request the index of the most recently logged event entry. Event logging is available internally to the system, to external host packages, and to FSTs.

Event Logs are not stored to flash ROM when the Save Configuration function is issued in ROCLINK for Windows software. The Event Log operates in a circular fashion with new entries overwriting the oldest entry when the buffer is full. The Event Log provides an audit trail history of past operation and changes. The Event Log is stored separately to prevent recurring alarms from overwriting configuration audit data.

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1.4.4 Security

The FloBoss unit provides for security within the unit. A maximum of 16 log-on identifiers (Operator IDs) may be stored. In order for the unit to communicate, the log-on ID supplied to the ROCLINK for Windows software must match one of the IDs stored in the FloBoss unit. The Local Port (Security on LOI) has security Enabled by default. The Host Port (Comm1) can likewise be configured to have security protection, but is disabled by default. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) concerning security.

1.4.5 Function Sequence Tables (FST)

The FloBoss unit supports FST user programmability. The two FST programs can be up to 4000 bytes each (typically 200 or 300 lines of code). The FST code resides in static Random Access Memory (RAM) and is backed up to flash memory when the Save Configuration function is issued through ROCLINK for Windows software. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

1.4.6 Modbus

The Modbus Protocol Emulation Program is contained within the FloBoss firmware. The Modbus application is designed to allow the FloBoss unit to emulate on the Host Port (Comm1) the communications protocol used by Modbus devices. The Modbus communications protocol is fully described in the reference guide entitled "Modicon Modbus Protocol Reference Manual" publication PI-MBUS-300 (not available from Emerson Process Management).

The Modbus protocol supports two modes of transmission: American Standard Code for Information Interchange (ASCII) and Remote Terminal Unit (RTU), with RTU as the default. Both modes of transmission are supported by the FloBoss unit. In addition, a version of Modbus with EFM extensions can be emulated as a slave device. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) for details.

1.4.7 Power Control

The Power Control function is used with the EIA-232 (RS-232) communications card to provide power savings when using a radio or cell phone for communications. Two modes of Power Control are possible: Second and Minute. In Second mode, the time base for the timers is in 100 millisecond increments and is primarily used with radios. In Minute mode, the time base for the timers is in 1 minute increments that are kept in tune with the Real-Time Clock and is primarily used with cell phones. Three cycling zones are provided, but zones can be disabled as desired. The EIA-232 (RS-232) card provides the switching mechanism and is controlled by the Data Terminal Ready (DTR) signal.

The Power Control function calculates which zone should be currently active. In Second mode, the Power Control begins in the ON state and continues with a full On Time and then goes to the OFF state for the full Off Time. In Minute mode, the Power Control determines if it should be ON or OFF and how much time it needs until it switches. Refer to Section 3, Power Connections and Section 4, Communications Installation and Wiring.

1.4.8 PID Control

The Proportional, Integral, and Derivative (PID) Control functionality calculates both the Primary Control and Override Control change in output. It then selects which Control is to be used, based upon whether the High Override Type Select or Low Override Type Select is chosen and adjusts the Output control as necessary. PID Control can only be active if an I/O card is installed in the FloBoss unit. The Output of the PID functions can be implemented either through an Analog Output or through a pair of Discrete Outputs for open/close control.

1.4.9 Spontaneous Report By Exception (SRBX) Alarming

The SRBX functionality allows a communications port to be set up to enable the FloBoss unit to contact the host computer when specified alarm conditions exist. The host will be sent a message that an alarm condition exists.

1.5 PRODUCT ELECTRONICS

This section describes the FloBoss Main Electronics Board. For calculating power and connecting to wiring, refer to Section 3, Power Connections. For Communications Installation and Wiring, refer to Section 4. For I/O Cards, refer to Section 5, Inputs and Outputs. For the Flow Sensors, refer to Section 6 (FloBoss 503) or Section 7 (FloBoss 504).

1.5.1 Main Electronics Board Overview

The Main Electronics Board components support the functionality of the FloBoss. Refer to Figure 1-3. The board provides: 32-bit microprocessor; built-in static RAM; Flash ROM; Liquid Crystal Display (LCD) display; communications card Host Port; Local Port (LOI); built-in Discrete Output (DO); RTD input; diagnostic monitoring; Real-Time Clock and backup power; automatic self tests; and power regulation modes.

1.5.2 Microprocessor and Memory

The FloBoss unit derives processing power from a 32-bit microprocessor. The 32-bit CMOS microprocessor features dual 32-bit internal data buses and a single 8-bit external data bus. The unit can address up to 4 MB of memory including high-speed direct memory access.

The Main Electronics Board has 512 KB of static random access memory (SRAM) for storing interrupt vectors, Function Sequence Tables (FST), alarms, events, and history data.

The Main Electronics Board also has a 512 KB flash memory chip for storing the operating system factory code and configuration parameters. Two of the 64 KB blocks are reserved for internal usage.

1.5.3 Liquid Crystal Display (LCD)

A two-line Liquid Crystal Display (LCD) panel is factory-mounted directly to the Main Electronics Board and visible through the window on the front panel. The panel has automatic contrast adjustment, due to temperature sensing and bias adjustment circuitry on the Main Electronics Board. The LCD panel remains on at all times when the power applied is in the valid operating range.

The built-in LCD provides the ability to look at data and configuration parameters while on site without using the Local Port (LOI) and a PC. Through this display, you can view predetermined information stored in the FloBoss. Up to 16 items can be defined for display. The LCD automatically cycles through the configured list of items displaying a new value approximately every three seconds.

The first two displays, which cannot be configured by the user, show values for time and date, operating voltages, and battery condition. The next five displays are configured by the factory to show certain flow parameters, but you may change their configuration. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) for details on how to configure the list of values for the LCD panel.
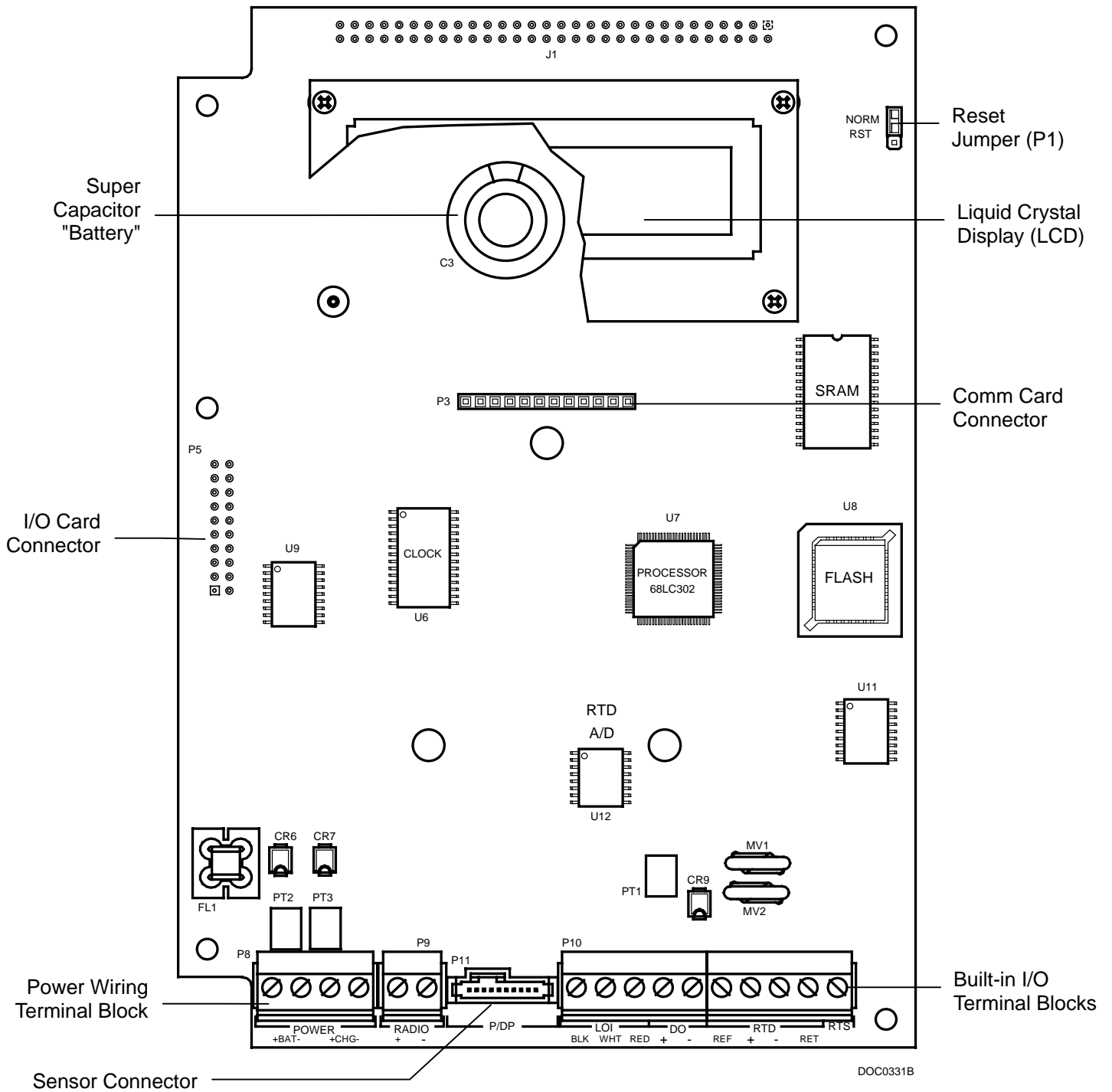
Figure 1-3. Main Electronics Board

1.5.4   Communications Ports

The FloBoss unit provides two communication ports:

♦ Local Operator Interface Port (LOI) – Local Port.

♦ Host Port for communication to a remote host – Comm1 Port.

1.5.4.1   Local Port – LOI

The Local Port (LOI) provides direct communications between the FloBoss unit and the serial port of an operator interface device, such as a PC. The interface allows you to access the FloBoss unit (using ROCLINK for Windows software) for configuration and transfer of stored data. The LOI terminal plus the Ready to Send (RTS) terminal on the Main Electronics Board provide wiring access to a built-in EIA-232 (RS-232) serial interface, which is capable of 19,200 bps operation. The Local Port supports only ROC protocol communications. The LOI also supports the log-on security feature of the FloBoss unit if the Security on LOI is Enabled in ROCLINK for Windows software.

❖ **NOTE:** The following installation should not be used in Class 1, Division 2 hazardous (C1D2) areas.

A cannon-type waterproof connector on the bottom of the enclosure provides connection through a prefabricated cable for a Local Port device, typically a personal computer (PC) running ROCLINK for Windows software. Inside the FloBoss enclosure, the cannon-type connector is wired to three terminals (LOI) on the Main Electronics Board.

1.5.4.2   Host Port – Comm1

The Host Port (Comm1) is activated by the installation of the optional communications card. The Host Port is used to monitor or alter the FloBoss unit from a remote site using a host or ROCLINK for Windows software. The Host Port automatically configures itself based upon the specific communications card installed. The Host Port supports rates up to 19,200 bps. Comm1 also supports the log-on security feature of the FloBoss unit if the Security on Comm1 is Enabled in ROCLINK for Windows software.

One of the following card types can be accommodated:

♦ EIA-232 (RS-232) for asynchronous serial communications.

♦ EIA-485 (RS-485) for asynchronous serial communications.

♦ Dial-up modem for communications over a telephone network.

The Host Port can receive messages in either ROC or Modbus protocol and responds using the same protocol in which the message was received. The Host Port is capable of initiating a message in support of Spontaneous Report by Exception (SRBX) and Store and Forward when using ROC protocol. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

For installations using radio communications, battery power can be conserved by cycling power to the radio or a cellular telephone. The power cycling control for a radio is acquired through the Data Terminal Ready (DTR) signal on the optional EIA-232 (RS-232) communications card. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) concerning radio power control. The radio is connected to the signal wiring terminals located on the EIA-232 (RS-232) communications card. Refer to Section 4, Communications Installation and Wiring.

The communications connectors on the Main Electronics Board provide the FloBoss unit with electrical access and mounting provisions for the optional communications cards. The communications cards mount directly on the connectors at P3 on the Main Electronics Board and are held in place with three compression stand-offs. The stand-offs on the Main Electronics Board pass through the communications card. The communications cards available for the FloBoss unit allow the options of serial data communications and modem communications. Refer to Section 4, Communications Installation and Wiring.

1.5.5   Built-In Discrete Output

The FloBoss unit provides a Discrete Output (DO) to provide control capabilities for a sampler or odorizer. The Discrete Output is capable of switching up to 0.3 Amp of current.

The built-in Discrete Output on the FloBoss unit is intended to perform sampler or odorizer functions, but may be used as a standard DO. This includes toggle mode, latched mode, and timed DO mode. The Discrete Output is accessed by ROCLINK for Windows software as DO Point Number A4.

When the Sampler function is enabled, the FloBoss unit provides a Time Duration Output (TDO) based on the volume. A control volume and a pulse duration must be specified with the Sampler function. After each flow calculation, an internal volume accumulator is compared to the control volume. If the accumulator exceeds the control volume, a pulse is output and the accumulator is reduced by the control volume. This output may be used to drive an external totalizer, odorizer, gas sampler, or similar device. Refer to Section 5, Inputs and Outputs.

1.5.6   RTD Input

The FloBoss unit supports a direct input from a Resistance Temperature Detector (RTD) sensor. An RTD temperature probe typically mounts in a thermowell on the metering pipe. The terminals for the RTD wires are located at the bottom right of the Main Electronics Board and labeled "RTD". The RTD input is converted through a 16-bit RTD converter chip.

During operation, the RTD is read once per second. The value from the RTD is linearized, and then it is sent to processing as Analog Input (AI) Point Number A3. The AI routine converts this value to engineering units, performs calibration corrections, and checks alarming. The board temperature is monitored by the RTD routine. If the temperature has changed by roughly 5°C (9°F), the RTD circuitry is sent a command to re-calibrate its reference. Refer to Section 5, Inputs and Outputs.

1.5.7   Real-Time Clock

The Real-Time Clock provides the FloBoss unit with the time of day, month, year, and day of the week. The time chip automatically switches to backup power when the Main Electronics board loses primary input power. Backup power for the Real-Time Clock comes from a super-capacitor (which also backs up the non-volatile RAM), and is adequate for at least three weeks with no power applied to the FloBoss unit.

1.5.8   Automatic Self Tests

The FloBoss unit performs the following self tests on a periodic basis:

- ♦ Battery low and battery high.
- ♦ Software and hardware watchdog.
- ♦ RTD automatic temperature compensation.
- ♦ Sensor operation.
- ♦ Charging voltage for the super-capacitor.
- ♦ Memory validity.

The FloBoss unit operates with 8 to 15 volts of dc power. The LCD becomes active when input power with the proper polarity and startup voltage (typically set at 10.6 volts or greater) is applied to the POWER terminal block (provided the power input fusing/protection is operational). The battery voltage tests ensure that the FloBoss unit is operating in the optimum mode.

The software watchdog is controlled by the Main Electronics Board. This watchdog checks the software for validity every 1.2 seconds. If necessary, the software automatically resets. The hardware watchdog is controlled by the Main Electronics Board and monitors the power to the hardware. If this voltage drops below 4.75 volts, the FloBoss unit automatically shuts down.

RTD automatic temperature compensation is tested at approximately every 5°C (9°F) temperature change of the board temperature.

The FloBoss 503 monitors its orifice-metering Sensor for accurate and continuous operation, while the FloBoss 504 similarly monitors its Sensor Module.

Voltage for charging the super-capacitor is checked to ensure that it is continuously applied when the FloBoss unit is powered. A memory validity self-test is performed to ensure the integrity of memory.

1.5.9   Diagnostic Monitoring

The electronics board has three diagnostic inputs incorporated into the circuitry for monitoring battery voltage, charging voltage, and board temperature. These inputs can be accessed by using the I/O function of ROCLINK for Windows software. The three values are available as the following Analog Input (AI) Point Numbers:

- ♦ E1– battery voltage.
- ♦ E2 – input charging voltage.
- ♦ E5 – board (battery) temperature.

1.5.10 Low Power Modes

The processor used in the FloBoss unit is capable of low power operation under predetermined conditions. This feature is available because the Phase Lock Loop (PLL) is used to control the speed of the system clock. The base crystal frequency is 3.6863 MHz and is raised by the PLL to 14.7 MHz for normal system operation. During the low power modes, the PLL and oscillator are in various states of shutdown. Two low power modes are supported: Standby and Sleep (also called Doze).

Standby – This mode is used during periods of inactivity. When the operating system cannot find a task to run, the FloBoss unit enters Standby mode. Processor loading is calculated by using the amount of time spent in Standby mode. This mode keeps the clocks running and communications active with baud clocks running. A Periodic Interrupt Timer (PITR) wakes up the FloBoss unit and starts the normal operating mode.

Wake-up from Standby occurs when the FloBoss unit receives a:
♦ Timed / Alarmed interrupt from the Real-Time Clock.
♦ Signal from the Local Port – LOI.
♦ Signal from connector P10 (built-in I/O, DO, RTD, or RTS).
♦ Signal from the I/O Card.
♦ Signal Carrier Detect (CD) from a communications card – Comm1.
♦ Signal Ring Indicator (RI) from a communications card – Comm1.

Sleep – This mode is used if a low battery voltage is detected. The battery voltage measured by diagnostic Analog Input Point Number E1 is compared to the LoLo alarm limit associated with this point. This limit value defaults to 10.6 volts.

Wake-up from Sleep occurs when the FloBoss unit receives a:
♦ Timed / Alarmed interrupt from the Real-Time Clock.
♦ Signal from the Local Port – LOI.

If the battery voltage is less than the LoLo Alarm configured for AI Point Number E1, the unit:

1. Sets the Real-Time Clock (RTC) alarm for 15 minutes from the present time if a charge voltage (AI Point Number E2) is greater than the battery voltage (AI Point Number E1), or for 55 minutes if the charge voltage is less than the battery voltage.
2. Writes the message "Low Battery, Sleep Mode" to the LCD.
3. Enters the Sleep mode.
4. Shuts down communications.
5. The unit wakes up from Sleep mode by the Real-Time Clock alarm (set in Step 1) and rechecks the voltage to see if operation is possible. If the voltage is greater than the LoLo Alarm limit for AI Point Number E1, a normal restart sequence initiates.

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1.6 FLOBOSS 503 AND FLOBOSS 504 MAIN SPECIFICATIONS

Refer to the following pages for specifications of the main electronics board and the optional AC power supply.

FloBoss 503 and FloBoss 504 Main Specifications	
PROCESSOR INFORMATION Motorola 32 bit, running at 14.7 MHz. **Program Memory:** 512 KB flash ROM (electrically programmable) for firmware and configuration. **Data Memory:** 512 KB SRAM, super-capacitor-backed for up to four weeks. **Memory Reset:** A reset jumper enables a cold start initialization when used during power-up. **TIME FUNCTIONS** **Clock Type:** 32 kHz crystal oscillator with regulated supply, super capacitor-backed. Year/Month/Day and Hour/Minute/Second, with Daylight Savings Time control. **Clock Accuracy:** 0.01%. **Watchdog Timer:** Hardware monitor expires after 1 second and resets the processor. **DIAGNOSTICS** These conditions are monitored and alarmed: **FloBoss 503:** SRAM validity/operation, Sensor and RTD point fail, battery and charging voltages, and internal temperature. **FloBoss 504:** SRAM validity/operation, pulse integrity, SM Analog Inputs, and RTD point fail, battery and charging voltages, and internal temperature. **COMMUNICATIONS** **Local Operator Interface:** EIA-232 (RS-232D) format. Software configured, 600 to 19,200 bps rate selectable. Screw-cap protected connector. **Host:** Serial or modem interface, with optional communications card is installed.	**POWER** **Battery Input:** 8 to 15 V dc (normally 10.8 V dc to start up). **FloBoss 503:** 0.2 W typical, including Sensor power, but excluding power for Discrete Output load, communications card, and I/O Card. **FloBoss 504:** 0.35 W typical, including Sensor power, but excluding power for Discrete Output load, communications card, and I/O Card. **Charging Input:** 14 to 22 V dc. Charge current internally limited to 1.0 Amp. **Power Supply (Optional):** 105-132 or 207-264 V ac, 47 to 63 Hz. Refer to the AC Power Supply Specifications table for additional information. **LOCAL DISPLAY** Two line by 16 character LCD. Continually updates approximately every 3 seconds. See Environmental specification for operating temperature. **RTD INPUT (BUILT-IN)** **Quantity/Type:** Single input for a 2, 3, or 4-wire RTD element with alpha of 0.00385. **Terminals:** "REF" current source, "+" signal positive input, "–" signal negative, and "RET" return (common). **Sensing Range:** –50 to 100°C (–58 to 212°F). **Accuracy:** ±0.56°C (1.0°F) over sensing range (includes linearity, hysteresis, repeatability). **Ambient Temperature Effects per 28°C (50°F):** ±0.50°C (90°F) for process temperatures from –40 to 100°C (–40 to 212°F). **Filter:** Band-pass hardware filter. **Resolution:** 16 bits. **Conversion Time:** 100 µsec. **Sample Period:** 1 second minimum.

Main Specifications (Continued)

DISCRETE OUTPUT (BUILT-IN)

   Quantity/Type: 1 sourced, high-side switched output.

   Terminals: "+" positive output, "–" negative (common).

   Voltage: Same as applied to Battery Input minus 0.7 volts.

   Frequency: 1.5 Hz maximum.

   Sample Period: 200 ms minimum.

   Current Limit: 300 mA, automatic reset.

ENVIRONMENTAL

   Operating Temperature: –40 to 75°C (–40 to 167°F), excluding LCD display, which is –25 to 70°C (–13 to 158°F). Refer to Section 7, for pressure accuracy in Operating Temperature for the SM.

   Storage Temperature: –50 to 85°C (–58 to 185°F).

   Operating Humidity: 5 to 95%, non-condensing.

   Vibration: FloBoss 503 – Tested to SAMA 31.1 Condition 3, with an abbreviated endurance dwell test.

   Radiated/Conducted Transmissions: Complies with requirements for Class A Information Technology Equipment per EN 55022 (1995) and CISPR 22 (1993). Also complies with FCC Part 15 Class A. FloBoss 504 also complies with ICES-003 of the Canadian Interference-Causing Equipment Regulations.

   Voltage Surge Immunity: FloBoss 503 – Designed to meet IEC 801-4 and IEC 801-5, as required by EN 50082-2.

   Electrostatic Discharge: FloBoss 504 – Complies with requirements in CENELEC document EN61000-4-2, Class A, withstanding 8 kV Air Discharge and 4 kV Contact Discharge.

   Radiated Immunity: FloBoss 504 – Complies with requirements in CENELEC document EN61000-4-3 and complies with FCC Part 15, Class.

   Conducted Emissions: FloBoss 504 – Complies with requirements in CENELEC document EN55011, Class A.

   Power Frequency Magnetic Field: FloBoss 504 – Complies with requirements in CENELEC document EN61000-4-8, Class A.

   Conducted Immunity: FloBoss 504 – Complies with requirements in CENELEC document EN61000-4-6, Class A.

ENCLOSURE

   Construction: Powder-coated (gray polyurethane) 14-gauge carbon steel with lockable hasp and gasketed door. Coating is gray polyurethane paint. All unpainted hardware is stainless steel. Meets CSA Type 4 rating (NEMA 4 equivalent).

   Wiring access: Three 0.88 in pre-punched holes in bottom.

DIMENSIONS

   Overall (Height includes top mounting flange and Sensor):

   FloBoss 503: 451 mm H by 350 mm W by 184 mm D (18.12 in H by 13.80 in W by 7.25 in D).

   FloBoss 504: 420 mm H by 350 mm W by 184 mm D (16.56 in H by 13.80 in W by 7.25 in D).

   Wall Mounting: 350 mm H by 72 mm W (13.80 in H by 2.81 in W) between mounting hole (0.38 in diameter) centers.

   Pipestand Mounting: Mounts on 2-inch pipe with U-bolt mounting kit (supplied).

WEIGHT

   Weight includes Sensor, but excludes batteries (not supplied). AC Power Supply adds 0.82 kg (1.8 lb).

   FloBoss 503: 13.0 kg (28.5 lb) nominal.

   FloBoss 504: 10.4 kg (23.0 lb) nominal.

INTRUSION SWITCH (OPTIONAL)

   SPST, normally-closed, hermetically-sealed. Uses Discrete Input on optional I/O Card.

APPROVALS

   Approved by CSA as Model W40079 for hazardous locations Class I, Division 2, Groups A, B, C, and D.

   FloBoss 503: Also includes C US.

SECTION 2 – INSTALLATION AND USE

This section describes the FloBoss 503 and FloBoss 504 Flow Managers, focusing on meeting requirements and startup.

This section contains the following information:

2.1 Installation Requirements

This section provides generalized guidelines for successful installation and operation of the FloBoss unit. Planning helps to ensure a smooth installation. Be sure to consider location, ground conditions, climate, and site accessibility as well as the suitability of the FloBoss application while planning an installation.

The versatility of the FloBoss unit allows it to be used in many types of installations. For additional information concerning a specific installation, contact your local sales representative.

❖ **NOTE:** The FloBoss unit has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the Federal Communications Commission (FCC) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy. If not installed and used in accordance with this instruction manual, the FloBoss unit may cause harmful interference to radio communications. Operation of the equipment in a residential area is likely to cause harmful interference, in which case you will be required to correct the interference at your own expense.

2.1.1 Environmental Requirements

The FloBoss case is classified as a NEMA 4 equivalent enclosure. This provides the level of protection required to keep the units operating under a variety of weather conditions.

The FloBoss unit is designed to operate over a wide range of temperatures. However, in extreme climates it may be necessary to moderate the temperature in which the unit must operate.

The FloBoss unit is designed to operate over a –40 to 75°C (–40 to 167°F) temperature range. The LCD temperature range is –25 to 70°C (–13 to 158°F). When mounting the unit, be aware of external devices that could have an effect on the operating temperature. Operation beyond the recommended temperature range could cause errors and erratic performance. Prolonged operation under extreme conditions could also result in failure of the unit.

Check the installation for mechanical vibration. The FloBoss unit should not be exposed to levels of vibration that exceed 2 g for 15 to 150 hertz and 1g for 150 to 2000 hertz.

2.1.2   Site Requirements

Careful consideration in locating the FloBoss unit on the site can help prevent future operational problems. The following items should be considered when choosing a location:

♦ Local, state, and federal codes often place restrictions on monitoring locations and dictate site requirements. Examples of these restrictions are fall distance from a meter run, distance from pipe flanges, and hazardous area classifications.

♦ Locate the FloBoss unit to minimize the length of signal and power wiring. By code, line power wiring must not cross meter runs.

♦ When using solar-powered FloBoss units, orient solar panels to face due South (not magnetic South) in the Northern Hemisphere and due North (not magnetic North) in the Southern Hemisphere. Make sure nothing blocks the sunlight from 9:00 AM to 4:00 PM.

♦ Antennas are equipped for radio communications and must be located with an unobstructed signal path. If possible, locate antennas at the highest point on the site and avoid aiming antennas into storage tanks, buildings, or other tall structures. Allow sufficient overhead clearance to raise the antenna.

♦ To minimize interference with radio communications, locate the FloBoss unit away from electrical noise sources such as engines, large electric motors, and utility line transformers.

♦ Locate the FloBoss unit away from heavy traffic areas to reduce the risk of being damaged by vehicles. However, provide adequate vehicle access to aid in monitoring and maintenance.

2.1.3   Compliance with Hazardous Area Standards

The FloBoss unit has hazardous location approval for Class I, Division 2, Groups A to D exposures. The Class, Division, and Group terms are defined as follows:

Class defines the general nature of the hazardous material in the surrounding atmosphere. Class I is for locations where flammable gases or vapors may be present in the air in quantities sufficient to produce explosive or ignitable mixtures.

Division defines the probability of hazardous material being present in an ignitable concentration in the surrounding atmosphere. Division 2 locations are presumed to be hazardous only in an abnormal situation.

Group defines the hazardous material in the surrounding atmosphere. Groups A to D are defined as follows:

♦ **Group A** – Atmosphere containing acetylene.

♦ **Group B** – Atmosphere containing hydrogen, gases, or vapors of equivalent nature.

♦ **Group C** – Atmosphere containing ethylene, gases, or vapors of equivalent hazards.

♦ **Group D** – Atmosphere containing propane, gases, or vapors of equivalent hazards.

For the FloBoss unit to be approved for hazardous locations, it must be installed according to the National Electrical Code (NEC) Article 501.

> ⚠ **CAUTION**
>
> **When installing units in a hazardous area, make sure all installation components selected are labeled for use in such areas. Installation and maintenance must be performed only when the area is known to be non-hazardous. Installation in a hazardous area could result in personal injury or property damage.**

2.1.4   Federal Communications Commission (FCC) Information

This equipment complies with Part 68 of the FCC rules. On the modem assembly is a label that contains, among other information, the FCC certification number and Ringer Equivalence Number (REN) for this equipment. If requested, this information must be provided to the telephone company.

A FCC compliant telephone modular plug is provided with this equipment. This equipment is designed to be connected to the telephone network or premises' wiring, using a compatible modular jack that is Part 68 compliant. Refer to Installation Instructions for details.

The REN is used to determine the quantity of devices that may be connected to the telephone line. Excessive RENs on the telephone line may result in the devices not ringing in response to an incoming call. Typically, the sum of the RENs should not exceed five (5.0). To be certain of the number of devices that may be connected to a line (as determined by the total RENs), contact the local telephone company.

If this equipment, dial-up modem, causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But if advance notice isn't practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it necessary.

The telephone company may make changes to its facilities, equipment, operations or procedures that could affect the operation of the equipment. If this happens the telephone company will provide advance notice so you can make the necessary modifications to maintain uninterrupted service.

If trouble is experienced with this equipment, dial-up modem, for repair or warranty information, please contact Emerson Process Management, Flow Computer Division (641) 754-3923. If the equipment is causing harm to the telephone network, the telephone company may request that you disconnect the equipment until the problem is resolved.

2.2   Mounting

When choosing an installation site, be sure to check all clearances. Provide adequate clearance for the enclosure door to be opened for wiring and service. The door is hinged on the left side. The LCD display should be visible and accessible for the on-site operator. When using a solar panel, allow adequate clearance. View of the sun should not be obstructed. Allow adequate clearance and an obstructed location for antennas, when using radios.

The Sensor is factory-mounted directly to the FloBoss enclosure with four bolts. On the FloBoss 503, this mounting uses a special coupler to join the Sensor to the four-bolt mounting pattern on the bottom of the FloBoss enclosure.

2.2.1 Mounting the FloBoss

Mounting of the FloBoss unit can be accomplished using either of the following methods:

♦   **Pipe mounted** – The enclosure provides top and bottom mounting flanges with holes for 2-inch pipe clamps (U-bolts and brackets supplied). The 2-inch pipe can be mounted to another pipe with a pipe saddle, or it can be cemented into the ground deep enough to support the weight and conform to local building codes.

♦   **Wall or panel mounted** – Fasten to the wall or panel using the mounting flanges on the enclosure. Use 5/16-inch bolts through all four holes. Mounting dimensions are given in Figure 2-1.

⚠ CAUTION

Do not mount the FloBoss unit with the Sensor supporting the entire weight of the unit (such as in Integral Orifice mounting for the FloBoss 503). Due to the weight of the unit with batteries and possibly a radio, the unit does not meet vibration requirements unless it is installed using its enclosure mounting flanges. This could result in damage to the FloBoss unit or enclosure.

With either mounting method, the pressure inputs must be piped to the process connections on the Sensor. For more information on process connections, refer to Section 6 for the FloBoss 503 or to Section 7 for the FloBoss 504.
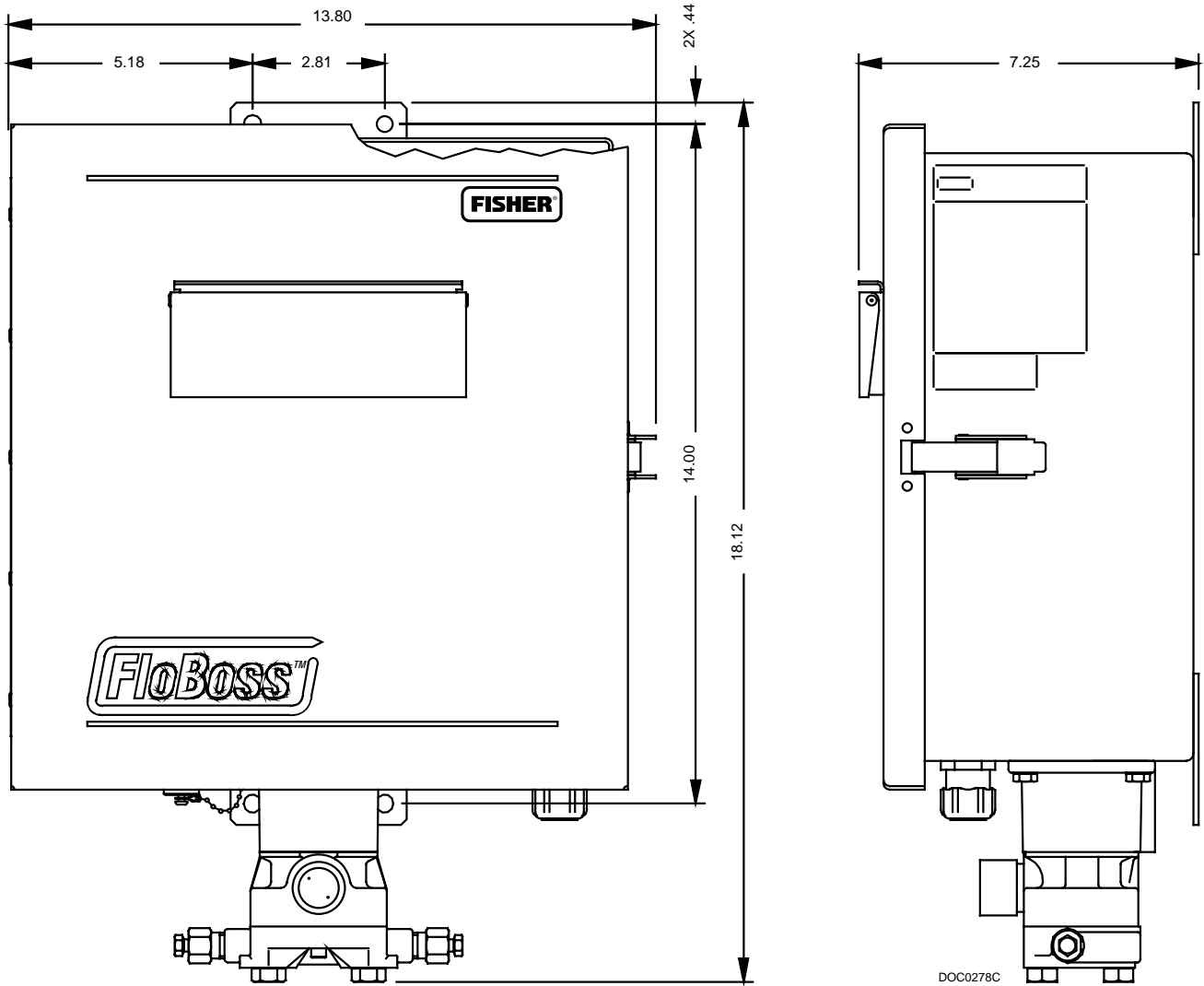
Note: All dimensions are in inches.

Figure 2-1. Outline and Mounting Dimensions – FloBoss 503

CAUTION

The FloBoss unit must be mounted vertically with the Sensor at its base. Refer to Figure 2-1 and Figure 2-2. Mounting in other orientations could result in damage to the FloBoss unit or enclosure.
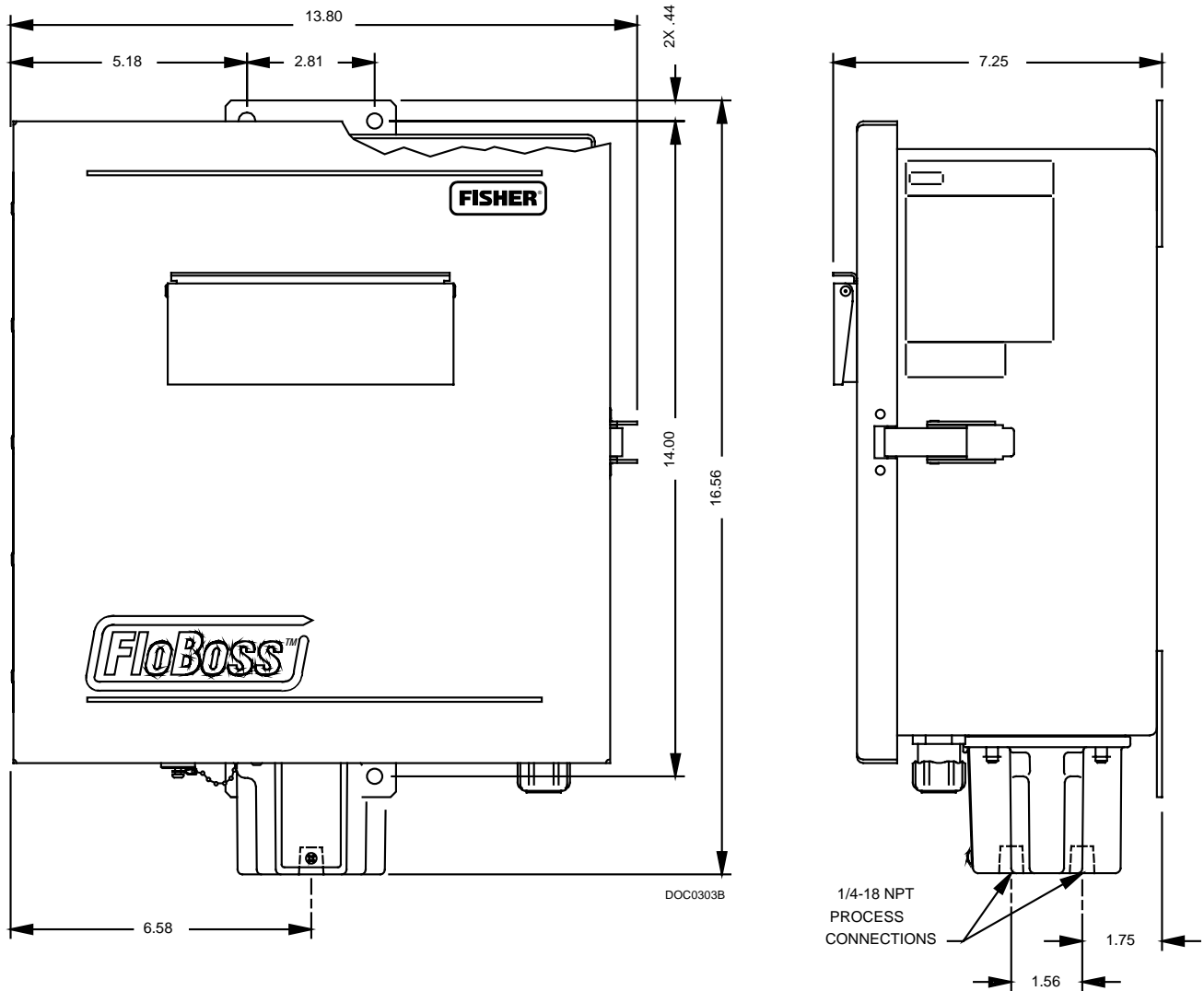
Note: All dimensions are in inches.

Figure 2-2. Outline and Mounting Dimensions – FloBoss 504

2.2.2   Mounting a Radio

A radio up to 57.15 mm (2.25 inches) high can be mounted inside the FloBoss enclosure using the optional radio bracket at the top of the enclosure. This bracket allows most radios to be secured in the compartment. Fasten the radio to the bracket using one of the pre-drilled mounting patterns and the four 6-32 × 0.25 pan-head screws (supplied).

1. Remove the winged brackets supplied with the radio.

2. Fasten the radio through the bottom of the radio bracket using the four 6-32 × 0.25 flat-head screws supplied.

3. Place the 6-32 × 0.50 screw in the threaded hole located in the upper left of the battery compartment.

4. Place the radio and bracket into the enclosure, aligning the assembly over the two studs on the back panel of the enclosure and position the bracket over the 6-32 × 0.50 screw.

5. Slide the bracket to the right to engage the slots, and tighten the screw.

6. Route the radio antenna either to the right or to the left and then out the bottom of the FloBoss enclosure.

2.2.3   Accessing the Battery Compartment

As many as four 7 Amp-hour batteries can be mounted inside the FloBoss enclosure. To access the battery compartment:

1. Unscrew the two captive screws on the left side of the swing-out mounting panel containing the Main Electronics Board.

2. Unplug the ribbon cable going to the Sensor by pressing down on the connector tab and pulling straight out.

3. Press down on the detent immediately below the Sensor (P/DP) connector and swing the mounting panel out. You now have full access to the battery compartment.

2.3   Configuration

The FloBoss 500-series Flow Managers have a number of software settings, called parameters, which must be configured before it is calibrated and placed into operation. Configuration must be performed using ROCLINK for Windows software, which runs on an personal computer. The PC is normally connected to the Local Port (LOI) of the flow computer to transfer configuration data into the FloBoss unit, although much of the configuration can be performed off-line and later downloaded into the unit.

The configuration data can be downloaded into the FloBoss while in the office or in the field. Although configuration changes can be made remotely via the Host Port (Comm1), it is not recommended except for minor changes, due to the possibility of data being corrupted during transmission.

Default values for all parameters exist in the firmware of the FloBoss. If the default firmware configuration is acceptable for your application, it can be left as is.

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2.4 Startup and Operation

Before starting the FloBoss unit, perform the following checks to ensure the unit is properly installed.

- ♦ Make sure the enclosure has a good earth ground connected to the earth ground bus inside the enclosure.

- ♦ Check the field wiring for proper installation. Refer to Section 3, Power Connections.

- ♦ Make sure the input power has the correct polarity.

- ♦ Make sure the input power is fused at the power source.

⚠ CAUTION

It is important to check the input power polarity before turning on the power. Incorrect polarity can damage the FloBoss unit.

When installing equipment in a hazardous area, ensure that all components are approved for use in such areas. Check the product labels. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.

2.4.1 Startup

Apply power to the FloBoss unit by plugging the input power terminal block into the connector labeled POWER located at the bottom left of the Main Electronics Board. After the FloBoss unit completes start-up diagnostics (RAM and other internal checks), the LCD displays the date and time to indicate that the FloBoss unit completed a valid reset sequence. If the LCD does not come on, refer to Section 9, Troubleshooting, for possible causes.

2.4.2 Operation

Once startup is successful, it is necessary to configure the FloBoss unit to meet the requirements of the application. ROCLINK *for Windows Configuration Software User Manual* (Form A6091) details the procedure for configuring the FloBoss unit and calibrating the I/O. Once the FloBoss unit is configured and calibrated, it can be placed into operation.

⚠ CAUTION

Local configuration or monitoring of the FloBoss unit through its Local Port (LOI) must be performed only in an area known to be non-hazardous. Performance of these procedures in a hazardous area could result in personal injury or property damage.

During operation, the FloBoss unit can be monitored (to view or retrieve current and historical data) either locally or remotely. Local monitoring is accomplished either by viewing the LCD panel by using ROCLINK for Windows software on a PC connected through the LOI Local Port. Remote monitoring is performed through the Host Port of the FloBoss unit, typically using host software. Remote monitoring can also be performed using ROCLINK for Windows software.

SECTION 3 – POWER CONNECTIONS

This section describes the power connections of the FloBoss 503 and FloBoss 504 Flow Managers, focusing on calculating power and connecting wiring.

This section contains the following information:

3.1 Calculating Power Consumption

A FloBoss system's power consumption determines power supply and battery sizing for both line and solar power. Table 3-1 provides information to assist in determining power requirements. The FloBoss unit has low power consumption, due to a typical Duty Cycle of 10 to 20% for its microprocessor. The other 80 to 90% of the time the microprocessor is shut off (with external wake-up signals reactivating it).

3.1.1 Determining I/O Channel Power Consumption

In estimating total I/O power requirements, the "Duty Cycle" of each I/O channel must be estimated. For example, if a Discrete Output is active for 15 seconds out of every 60 seconds, the Duty Cycle is:

Duty Cycle = Active time / (Active time + Inactive time) = 15 sec / 60 sec = 0.25

For an *analog I/O channel*, the Duty Cycle is approximated by estimating the percent of time that the channel spends in the upper half of its range (span) of operation. For example, if an Analog Input is wired as a current loop (4 to 20 milliAmp) device and operates in the upper half of its range 75% of the time, then 0.75 would be used as the Duty Cycle. If the Analog Input channel generally operates around the midpoint of its span, use 0.5 as the Duty Cycle.

To calculate the total power consumed by an I/O channel use Table 3-2 and read the minimum (P_{min}) and maximum (P_{max}) power consumption value from the table for the desired I/O channel. Use the following equation to calculate the power consumption for a channel with the Duty Cycle taken into account:

$$Power = (P_{max} \times Duty\ Cycle) + [P_{min} (1 - Duty\ Cycle)]$$

Multiply this value by the Quantity of I/O channels with the same Duty Cycle and enter the calculated value in the Subtotal column. Repeat the procedure for all other I/O channels used. Total the values in the Subtotal column in Table 3-2, and enter the value in the I/O Card row of Table 3-1.

Table 3-1. Power Consumption of the FloBoss and Powered Devices

Device	Power Consumption (mW) 12 V System		Quantity	Duty Cycle	Subtotal (mW)
	P_{min}	P_{max}			
FloBoss 503 Main Electronics Board; includes minimum built-in I/O power consumption, RTD, and DVS or MVS	200		1	N/A	
FloBoss 504 Main Electronics Board; includes minimum built-in I/O power consumption, RTD, and Sensor Module	500		1	N/A	
Built-in Discrete Output (load dependent with a maximum of 15 volts and 0.3 Amps)	0	4000	1		
Serial Communications Card	30			N/A	
Dial-up Modem Comm Card	250			N/A	
Radio	N/A		N/A	N/A	
I/O Card Total from Table 3-2					
				Total	

Table 3-2. Power Consumption of the I/O Cards (10 Channel)

Device	Power Consumption (mW) 12 V System		Quantity	Duty Cycle	Subtotal (mW)
	P_{min}	P_{max}			
I/O Card – base amount	210	210	1	N/A	
Analog Input	90	365			
Analog Output	130	650			
Discrete Input	0	110			
Discrete Output	0	30			
Pulse Input	0	70			
				Total	

Notes: 1. For analog I/O channels, the Duty Cycle is the percent of time spent in the upper half of the operating range.
 2. The P_{max} amount includes any power drawn by a FloBoss-powered field device, such as a transmitter.

Table 3-3. Power Consumption of the I/O Cards (24 Channel)

Device	Power Consumption (mW) 12V System		Quantity	Duty Cycle	Subtotal (mW)
	P_{min}	P_{max}			
I/O Card – base amount	1560	1560	1	N/A	
Analog Input	0	264			
Analog Output	0	264			
Discrete Input	0	14.4			
Discrete Output	0	28.8			
Discrete Output Relay	0	204			
Pulse Input	0	48			
Total (Pmax with all DO is 4930 mW)					

3.1.2   Determining Radio Power Consumption

In determining power requirements for radios, the Duty Cycle for the radio must be estimated. The Duty Cycle is the percentage of time the radio is transmitting (TX). For example, if a radio is transmitting 1 second out of every 60 seconds, and for the remaining 59 seconds the radio is drawing receive (RX) power, the Duty Cycle is:

Duty Cycle = TX time / (TX time + RX time) = 1 sec / 60 sec = 0.0167

To calculate the total power consumed by a radio, obtain the power (P) consumption values for transmit and receive from the radio manufacturer's literature. Use the following equation to calculate the power consumption for a particular Duty Cycle:

Power = (P_{TX} x Duty Cycle) + [P_{RX} (1 – Duty Cycle)]

Determine the power consumption for all radios that use power from the FloBoss unit, and enter the total calculated value in Table 3-1.

3.1.3   Totaling Power Requirements

To adequately meet the needs of the FloBoss system, it is important to determine the total power consumption, size of solar panel, and battery backup requirements accordingly. For total FloBoss power consumption, add the device values in Table 3-1. Although Table 3-1 takes into account the power supplied by the FloBoss unit to its connected devices, be sure to add the power consumption (in mW) of any other devices used with the FloBoss unit in the same power system, but not accounted for in the table.

Convert the total value (in mW) to watts by dividing it by 1000.

mW / 1000 = watts

For selecting an adequate power supply, use a safety factor (SF) of 1.25 to account for losses and other variables not factored into the power consumption calculations. To incorporate the safety factor, multiply the total power consumption (P) by 1.25.

P_{SF} = P x 1.25 = _____ watts

To convert P_{SF} to current consumption in Amps (I_{SF}), divide P_{SF} by the system voltage (V), typically 12 volts.

$$I_{SF} = P_{SF} / V = \_\_\_\_\_ \text{ Amps}$$

3.1.4 Power Installation Requirements

Typical sources of primary power for FloBoss installations are line power and solar power. Care must be taken to route line power away from hazardous areas, sensitive monitoring devices, and radio equipment. Local and company codes generally provide guidelines for line power installations. Adhere rigorously to all local and National Electrical Code (NEC) requirements for line power installations.

3.1.5 Grounding Installation Requirements

Grounding wiring requirements for line-powered equipment are governed by the National Electrical Code (NEC). When the equipment uses line power, the grounding system must terminate at the service disconnect. All equipment grounding conductors must provide an uninterrupted electrical path to the service disconnect.

- The National Electrical Code Article 250-83 (1993), paragraph c, defines the material and installation requirements for grounding electrodes.

- The National Electrical Code Article 250-91 (1993), paragraph a, defines the material requirements for grounding electrode conductors.

- The National Electrical Code Article 250-92 (1993), paragraph a, provides installation requirements for grounding electrode conductors.

- The National Electrical Code Article 250-95 (1993) defines the size requirements for equipment grounding conductors.

Proper grounding of the FloBoss unit helps to reduce the effects of electrical noise on the unit's operation and protects against lightning. Lightning protection is designed into the FloBoss unit, providing lightning protection for built-in field wiring inputs and outputs. A surge protection device installed at the service disconnect on line-powered systems offers lightning and power surge protection for the installed equipment. You may also consider a telephone surge protector for the dial-up modem communications card.

All earth grounds must have an earth to ground rod or grid impedance of 25 ohms or less as measured with a ground system tester. The grounding conductor should have a resistance of 1 ohm or less between the FloBoss case ground lug and the earth ground rod or grid.

The grounding installation method for the FloBoss unit depends on whether the pipeline has cathodic protection. On pipelines with cathodic protection, the FloBoss unit must be electrically isolated from the pipeline.

Electrical isolation can be accomplished by using insulating flanges upstream and downstream on the meter run. In this case, the FloBoss unit could be flange mounted or saddle-clamp mounted directly on the meter run and grounded with a ground rod or grid system.

On pipelines without cathodic protection, the pipeline itself may provide an adequate earth ground and the FloBoss unit could mount directly on the meter run. Test with a ground system tester to make sure the pipeline to earth impedance is less than 25 ohms. If an adequate ground is provided by the pipeline, do not install a separate ground rod or grid system. All grounding should terminate at a single point.

If the pipeline to earth impedance is greater than 25 ohms, the FloBoss installation should be electrically isolated and a ground rod or grid grounding system installed.

The recommended cable for I/O signal wiring is an insulated, shielded, twisted-pair. The twisted pair and the shielding minimize signal errors caused by ElectroMagnetic Interference (EMI), Radio Frequency Interference (RFI), and transients. A ground bar is provided for terminating shield wires and other connections that require earth ground.

CAUTION

> **Do not connect the earth ground to any wiring terminal on the Main Electronics Board. It could result in property damage.**

3.1.6   Solar Powered Installations

Solar power allows installation of the FloBoss unit in locations where line power is not available. The two important elements in a solar installation are solar panels and batteries. Solar panels and batteries must be properly sized for the application and geographic location to ensure continuous, reliable operation.

A 12-volt solar panel can be installed to provide charging power for the backup batteries. The panel can be rated at 5 or 10 watts and is sized depending upon the power requirements of the unit. This is within the Canadian Standards Association (CSA) rating of the FloBoss 500-series unit. The solar panel typically mounts to the same 2-inch pipe that supports the FloBoss unit. The panel wiring is brought into the FloBoss enclosure through the pre-punched holes in the bottom of the enclosure and is terminated at the charge (+CHG–) power terminals on the Main Electronics Board.

The panel must face due South (not magnetic South) in the Northern Hemisphere and due North (not magnetic North) in the Southern Hemisphere. The panel must also be tilted at an angle from horizontal dependent on latitude to maximize the energy output. The angles for different latitudes are normally included in the solar panel documentation. At most latitudes, the performance can be improved by less of an angle during the summer and more of an angle during the winter.

As a site may have additional power requirements for radios, repeaters, and other monitoring devices, power supply and converter accessories may be used to minimize the number of separate power sources required for an installation.

Solar arrays are used to generate electrical power for the FloBoss unit from solar radiation. The size and number of solar panels required for a particular installation depends on several factors, including the power consumption of all devices connected to the solar array and the geographic location of the installation.

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3.1.6.1 System Solar Panel Sizing

To determine solar panel output requirements, first determine the solar insolation for your geographic area. The map in Figure 3-1 shows solar insolation (in hours) for the United States during winter months. Call your local sales representative for a map detailing your specific geographic area.

Insolation (from map) = _____ hours

Next, calculate the amount of current required from the solar array per day using the following equation. I_{SF} is the system current requirement. Refer to Section 3.1.3, Totaling Power Requirements, on page 3-3.

$I_{array} = [I_{SF} \text{ (Amps)} \times 24 \text{ (hours)}] / \text{Insolation (hours)} = $ _____ Amps
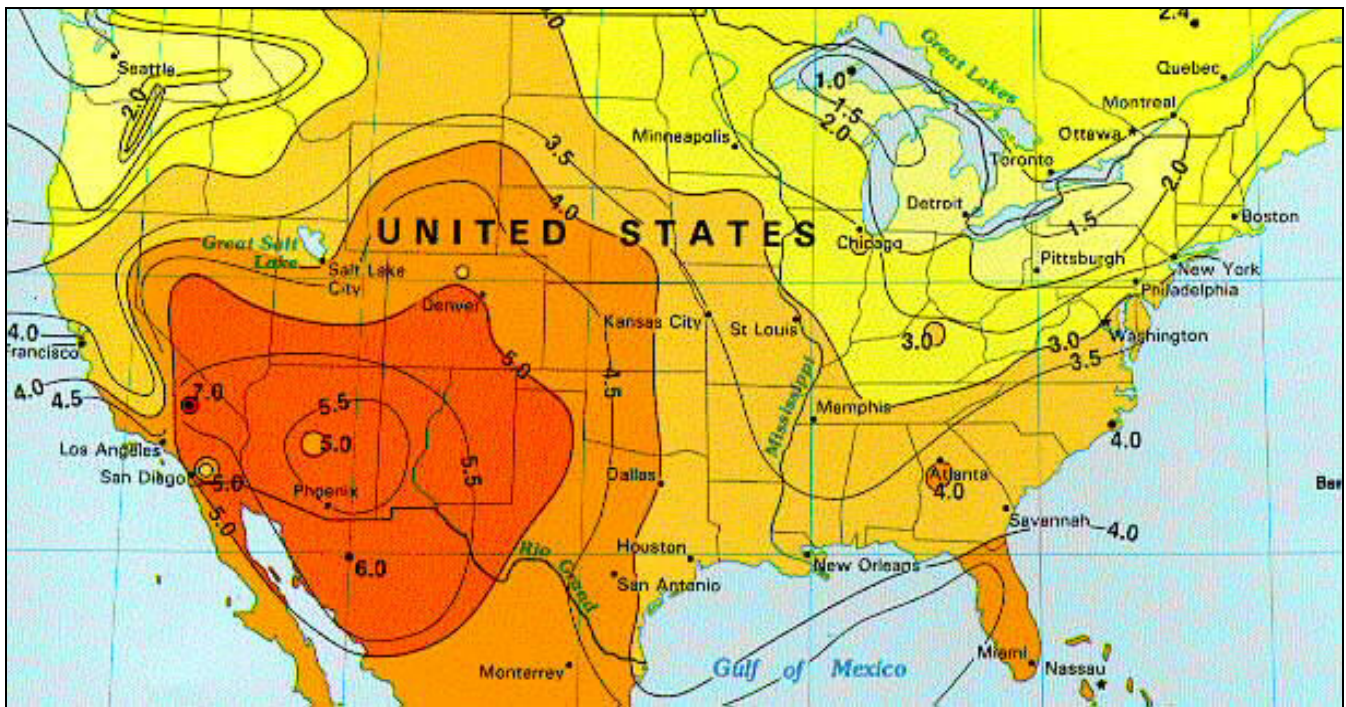
Figure 3-1. Solar Insolation in Hours for the United States

Finally, the number of solar panels can be determined using the following equation:

Number of Panels = I_{array} Amps / (I_{panel} Amps/panel) = _____ panels

For example, if I_{array} equals 0.54 Amps, and I_{panel} equals 0.29 Amps for a 5-watt panel, then the number of panels required equals 1.86, which would be rounded up to 2 (panels connected in parallel). Alternatively, the next larger solar panel can be used, which in this case would be a 10-watt panel. Table 3-4 gives recommended I_{panel} values for solar panels.

❖ **NOTE:** The I $_{panel}$ value varies depending on the type of solar panel installed. Refer to the vendor's specifications for the solar panel being used.

❖ **NOTE:** The current accepted by the FloBoss 500-series unit is limited by its charging circuit to around 1 Amp. Therefore, it is not practical to install a solar array that supplies significantly more than 1 Amp to the FloBoss unit.

Table 3-4. Solar Panel Sizing

Panel	I_{panel}
4.5 watt	0.27 Amps
5 watt	0.29 Amps
10 watt	0.58 Amps
11 watt	0.7 Amps

3.1.7 Batteries

Batteries are used to supplement both line-powered and solar-powered installations. When used in line-powered installations, the batteries serve as backup in case of line power failure. When used in solar installations, they provide power for the FloBoss unit when the solar panels are not generating sufficient output.

The standard battery configurations use a 12-volt, sealed, lead-acid battery (approximately 6.0 x 2.6 x 3.7 inches). These configurations can provide 7, 14, 21, or 28 Amp-hour capacities. Recommended 7 Amp-hour battery types (up to four batteries) for FloBoss 500-series units are listed below. If other batteries are used, rechargeable, sealed, gel-cell, lead-acid batteries are recommended.

  ♦ Powersonic PS-1270   7.0 Amp-Hour

  ♦ Panasonic LCR12V7.2P   7.2 Amp-Hour

  ♦ Yuasa NP7-12   7.0 Amp-Hour

The batteries are connected in parallel by a supplied wiring harness to achieve the required capacity. The amount of battery capacity required for a particular installation depends upon the power requirements of the equipment and days of reserve (autonomy) desired. Battery requirements are calculated based on power consumption of the FloBoss unit and all devices that will be powered by the batteries.

Battery reserve is the amount of time that the batteries can provide power without discharging below 20 percent of their total output capacity. For solar-powered units, a minimum reserve of five days is recommended, with ten days of reserve preferred. Add 24 hours of reserve capacity to allow for overnight discharge. Space limitations, cost, and solar panel output are all factors that affect the actual amount of battery capacity available.

To determine the system capacity requirements, multiply the system current load (I_{SF}) on the batteries by the amount of reserve time required. Compute "I_{SF}" as described in Section 3.1.3, Totaling Power Requirements, on page 3-3. The equation is as follows:

  System Requirement = I_{SF} Amps × Reserve hours = _____ Amp-hours

Finally, determine the number of batteries required for the calculated power consumption by rounding up to the nearest multiple of 7 Amps: 7, 14, 21, or 28 Amp-hour capacity. If more than 28 Amp-hours are required, an external battery enclosure with additional batteries may be used.

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3.2   Connecting the FloBoss to Wiring

The following paragraphs describe how to connect the FloBoss unit to power, ground, I/O devices, and communications devices. Use the recommendations and procedures described in the following paragraphs to avoid damage to equipment.

Open the front door to access the field wiring terminations. The wiring terminals are arranged on the lower edge of the Main Electronics Board. The terminal designations are printed on the circuit board.

⚠ CAUTION

Always turn off the power to the FloBoss unit before you attempt any type of wiring. Wiring of powered equipment could result in personal injury or property damage.

To avoid circuit damage when working with the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

3.2.1   Making Wiring Connections

The FloBoss Main Electronics Board connectors use compression terminals that accommodate wiring up to 16 AWG in size. The input power terminations use a removable connector and accommodate wiring up to 14 AWG in size. In all cases, connections are made by baring the end (¼ inch maximum) of the wire, inserting the bared end into the clamp beneath the termination screw, and then tightening the screw.

The inserted wires should have a minimum of bare wire exposed to prevent short circuits. Allow some slack when making connections to prevent strain on the circuit board and to provide enough clearance to allow the Main Electronics Board to swing out. This allows access to the batteries without removal of the field wiring.

The connectors are provided on the Main Electronics Board are defined in Table 3-5.

Table 3-5. Terminal Connectors

Definition	Connector
Battery Input	POWER (+BAT–)
Charge Input	POWER (+CHG–)
Auxiliary Radio Power	RADIO
Flow Sensor	P/DP
Discrete Output	DO
Resistance Temperature Detector	RTD
Local Port	LOI
Communications Card connector	P3
I/O Card connector	P5

The input terminal wiring is arranged on the lower edge of the Main Electronics Board. The terminal designations are printed along the bottom of the circuit board.

3.2.2   Connecting Ground Wiring

The FloBoss unit and related components must be connected to an earth ground. The National Electrical Code (NEC) governs the ground wiring requirements for all line-powered devices.

A ground bar is located inside the enclosure at the top right-hand side. This ground bus bar is electrically bonded to the enclosure and provides screw compression terminals to connect shields from I/O wiring, line-power earth ground, and other device earth grounds as required.

An external lug on the bottom outside of the enclosure (refer to Figure 3-2) provides a place to connect an earth ground to the enclosure. Although this ground lug is electrically connected to the ground bar through the enclosure, it is recommended that a ground wire also be connected between the ground lug and the ground bar.

It is recommended that 14 AWG wire be used for the ground wiring. Make sure the installation has only one ground point to prevent creation of a ground loop circuit. A ground loop circuit could cause erratic operation of the system.

The Main Electronics Board is electrically isolated from the enclosure; no earth ground connections to the board should be made. However, the drain shields of I/O signal wiring (such as the RTD cable) should be connected to earth ground at one end to minimize signal errors caused by ElectroMagnetic Interference (EMI), Radio Frequency Interference (RFI), and transients.

CAUTION

> **Do not connect the earth ground to any terminal on the Main Electronics Board. It could result in property damage.**

> **For line-powered installations, the grounding conductor must end at the service disconnect. The grounding conductor can be wire or metallic conduit, as long as the circuit provides a low-impedance ground path.**
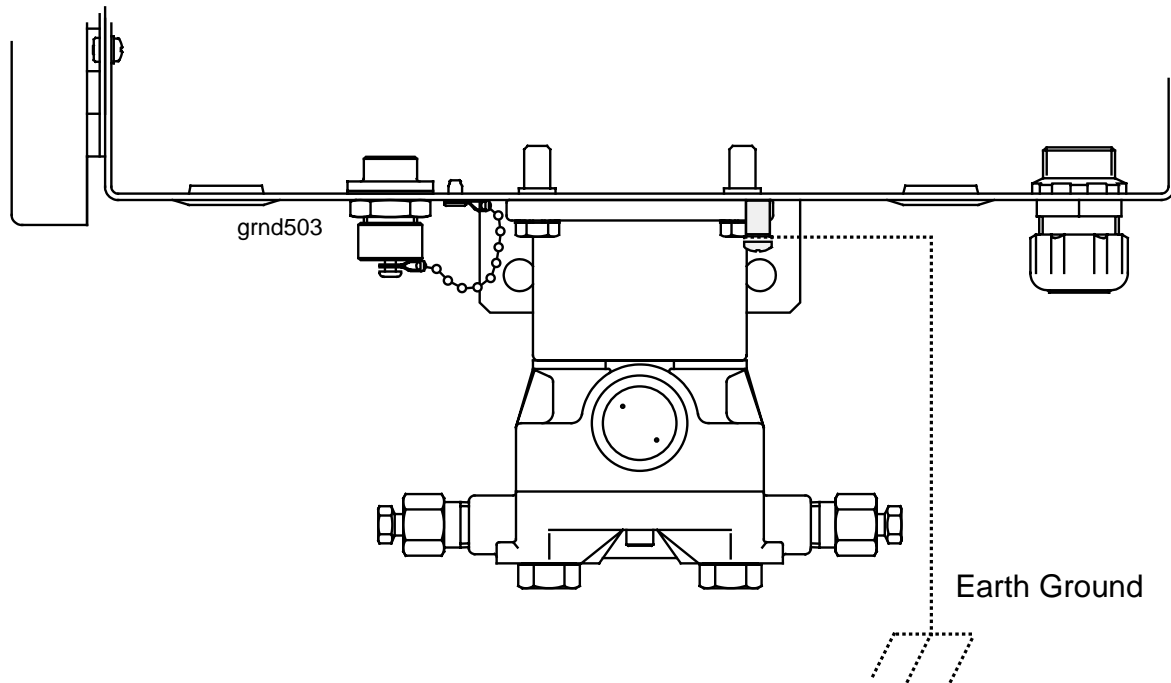
Figure 3-2. Earth Ground Connection (FloBoss 503 Shown)

3.2.3   Connecting Main Power Wiring

It is important that good wiring practices be used when sizing, routing, and connecting power wiring. All wiring must conform to state, local, and NEC codes. **The POWER terminal block can accommodate up to 14 AWG wire.** Refer to Figure 3-3.
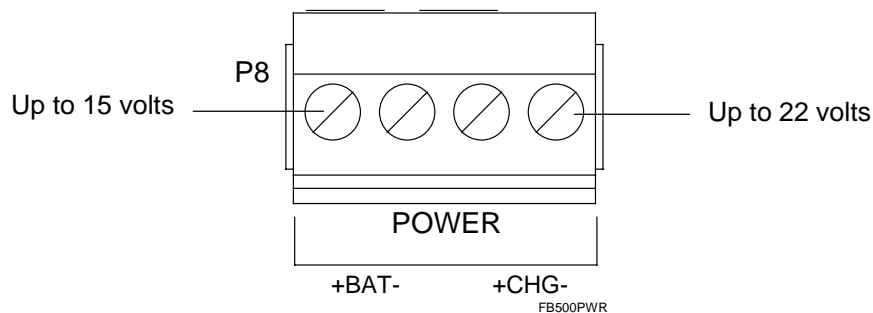
Figure 3-3. Power Input Terminal Connector

To make power connections:

1. Unplug the left-hand connector from its socket located at P8 on the Main Electronic Board.

2. Insert each bared wire end into the clamp beneath its termination screw.

3. Secure the screw.

4. Plug the connector back into the socket at P8.

As described in Sections 3.2.3.1, 3.2.3.2, and 3.2.3.3, connect the batteries (if used) to the "+BAT" and "BAT–" terminals. Connect the charging source (solar panels or AC power supply) to the "+CHG" and "CHG–" terminals. **Make sure the hook-up polarity is correct.**

> ❖ **NOTE:** If you are connecting a solar panel that has its own regulator, connect the panel instead to the +BAT– terminals.

3.2.3.1 Battery Connections

The battery connections are on the removable terminal block labeled POWER. Refer to Figure 3-4. These connections provide the input power, for the FloBoss electronics, and are the output of the charge regulation circuitry. A single 12-volt, sealed, lead-acid battery or multiple batteries wired in parallel are connected to these terminals, which are labeled "+BAT" for battery positive and "BAT–" for battery negative.

⚠ CAUTION

Remove the removable Power terminal block before removing the battery connections or the battery. Power being sent to the FloBoss unit without batteries in operation could damage the FloBoss unit.

The maximum voltage that can be applied to the "BAT" terminals without damage to the electronics is 15 volts dc. Excessive voltage could result in property damage.

The FloBoss enclosure can hold up to four sealed lead-acid batteries. Refer to Section 3.1.7, Batteries, for recommended battery types. The 12-volt batteries can be installed to provide 7, 14, 21, or 28 Amp-hours of backup capacity, or up to 21 Amp-hours of backup capacity when used with an AC power supply.

The batteries are mounted under the electronics swing-out mounting panel and are retained by the panel when it is secured. The AC Power Supply mounts in place of one of the batteries. The batteries are connected to a harness that allows the batteries to be changed without removing power from the unit. Make sure that the black wires of the harness are connected to the negative terminals of the batteries and the red wires are connected to the positive terminals. Input wiring is connected at the POWER wiring terminal connector.

DOC0361A
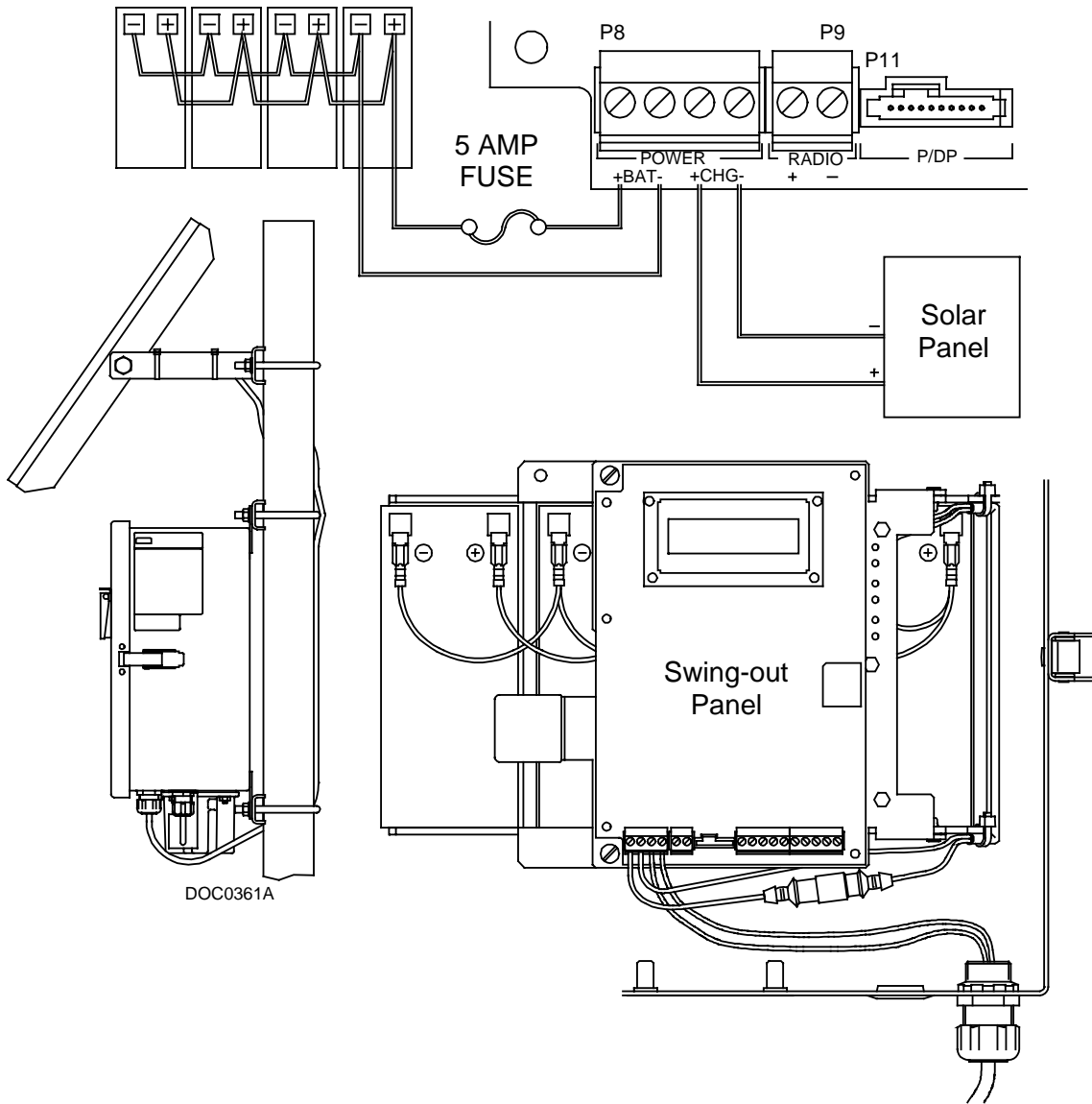
Figure 3-4. Battery and Solar Panel Connections

3.2.3.2 Solar Panel Charge Connections

The FloBoss unit contains an internal battery charger circuit for charge control of the 12-volt batteries. The charger monitors the battery voltage, charge voltage, and the battery temperature, which is actually the board enclosure temperature. Based on these three conditions, a charge rate is determined and applied to the battery. Refer to Figure 3-4 for the proper wiring connections.

CAUTION

Remove the removable Power terminal block before removing the battery connections or the battery. Power being sent to the FloBoss unit without batteries in operation could damage the FloBoss unit.

❖ **NOTE:** The internal battery charger limits the current input to 1 Amp, which is less than the output of a typical 22-watt solar panel. To use a solar panel with an output exceeding 1 Amp, ensure that the panel has its own regulator and is connected to the +BAT– terminals.

❖ **NOTE:** Keep in mind that a solar panel bigger than 11 watts may violate certain CSA Class I, Division 2 ratings. Be sure to use approved connectors on the bottom of the FloBoss enclosure for routing the power wiring. Refer to Figure 3-4.

❖ **NOTE:** If the solar panel contains its own regulator, connect it instead to the +BAT– terminals.

The charging source (solar panel) provides power for the charging of the backup batteries. Overcharging is prevented by comparing the battery cell voltage to a maximum limit. If this limit is exceeded, the battery charge cycle is immediately terminated and cannot be re-initiated until the cell voltage has dropped below the maximum limit.

The charge connections (+CHG–) are on the removable connector labeled POWER. These connections provide the input voltage and power for the battery charging circuitry. The charger circuitry provides reverse polarity protection and reverse discharge protection, so no external circuitry is required. The maximum voltage that can be applied to the terminals is 22 volts dc. The terminals are labeled CHG+ for charge input positive and CHG– for charge input negative.

A 12-volt solar panel with an output regulated to no more than 15 volts can be directly connected to the +BAT– terminals.

3.2.3.3 AC Power Supply Charge Connections

The optional internal AC Power Supply is used as the primary source of power for the FloBoss 500-series unit in line-powered installations. The AC Power Supply is used to convert AC line power to DC power for the FloBoss 500-series unit and its accessories. The supply is designed to be used either as a power supply only, or as a combination power supply and battery charger. Refer to Section 3.3, Optional AC Power Supply Specifications, on page 3-16.

The AC Power Supply is powered by 110 to 240 volts ac, 50 to 60 hertz and provides a regulated output of 14 volts dc at a maximum load of 1 Amp. The charger is installed by the factory in the left-most battery position (Figure 3-5). The installation and wiring of the ac voltages must meet local code and stated requirements for compliance to Class I, Division 2 hazardous requirements. When the power supply is installed, there is room for three batteries for providing up to 21 Amp-hours of battery backup capacity.

Figure 3-5. AC Power Supply Wiring

The AC Power Supply is shipped ready for 115 volt operation. It may be changed to 230 volt operation. To change the voltage input:

1. Loosen the four ¼-inch hex head screws (two above and two below).

2. Pull the AC Power Supply straight out to remove the AC Power Supply.

3. Move the Switch S1 on the back of the AC Power Supply to the desired position.

4. Re-install the AC Power Supply.

In installations where battery backup is used, the AC Power Supply also functions as a battery charger. When charging batteries, temperature compensation of the output voltage is provided. Battery temperature is sensed by a thermistor (supplied) connected to terminals T1 and T2 on the AC Power Supply For connection to the FloBoss when battery backup is being used, refer to Figure 3-6.

If battery backup is not used, ensure that the DC output of the AC Power Supply is connected to the +CHG– terminals.

Through its DC Monitor terminals, the AC Power Supply provides a means for monitoring its DC output remotely, allowing an alarm to be produced when power is interrupted. The DC Monitor terminals are typically connected to an unsourced Discrete Input (DI). To use a DI on the FloBoss 500-series I/O Card (which has sourced DIs), use a relay between the DI and the DC Monitor terminals. Refer to Figure 3-6.
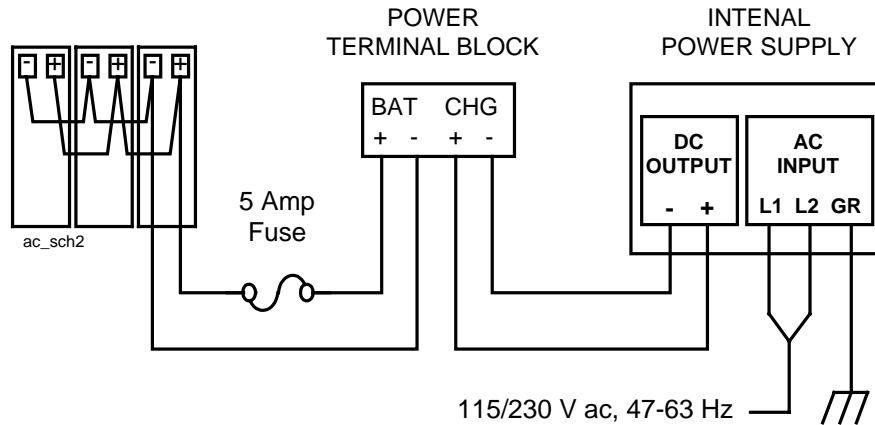
Figure 3-6. AC Power Supply Connections

3.2.4   Auxiliary Output Power

The auxiliary output power connections are on a fixed terminal block connector labeled RADIO. Refer to Figure 3-7. These terminals can supply power (pass-through) to external devices, such as a radio or cell phone. The power for this connector originates at the battery connection terminal and is not fused or controlled on the Main Electronics Board. Fusing should be installed in the auxiliary output wiring and should not exceed the size of the fuse in the battery harness wiring. The terminals are labeled "+" for positive voltage and "–" for common.
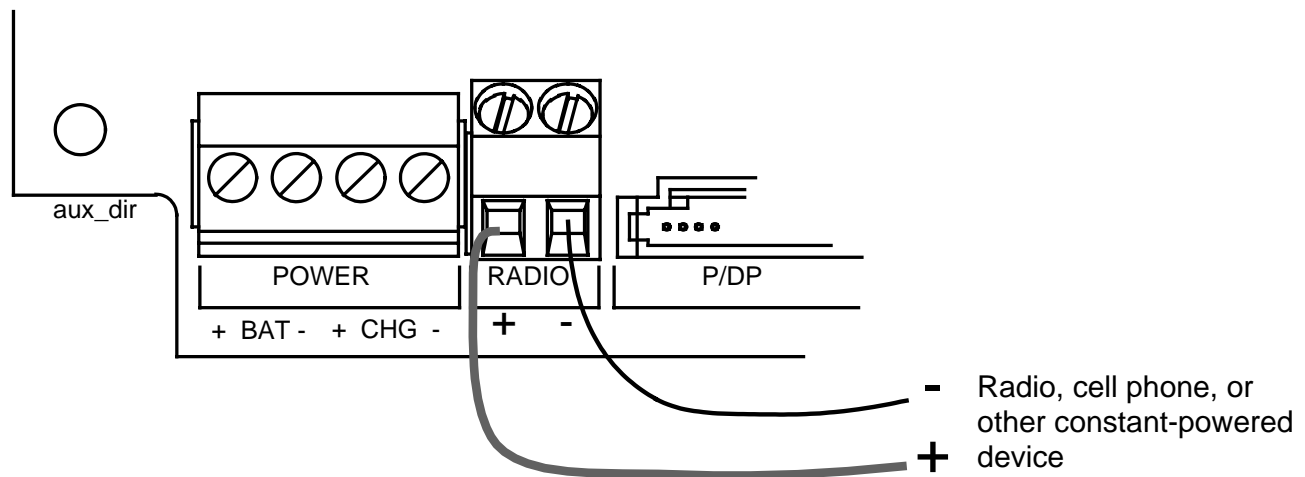
Figure 3-7. Auxiliary Power Terminals – Direct Connect to Power

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If power to the radio or other device needs to be cycled to conserve power (recommended when batteries are used), use an EIA-232 (RS-232) communications card and connect wiring for switched radio power as described in Section 4, Communications Cards. Configure radio power cycling / control as detailed in the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) and in Section 3, Communications Installation and Wiring.

3.3 Optional AC Power Supply Specifications

Optional AC Power Supply Specifications	
AC INPUT 105 to 132 V ac or 207 to 264 V ac, 47 to 63 Hz. Input ranges are switch-selectable. **REGULATION** Output voltage varies no more than ±0.05% for a 10% change in line voltage or for a 50% change in load current. **STABILITY** ±0.3% for 24 hours after warm-up. **AC INPUT FUSING** 1 A for either the 115 or 230 V ac range. **DC OUTPUT** 14 V dc no-load. Supplies 1.0 A maximum at 25°C (77°F). Derate DC output power 10% for 50 Hz operations.	**OUTPUT RIPPLE** 5.0 mV peak-to-peak, maximum. **EFFICIENCY** 55% typical. **ENVIRONMENTAL** **Operating:** –40 to 65°C (–40 to 149°F), fully rated. **Storage:** –40 to 85°C (–40 to 185°F). **EMI/RFI SUSCEPTIBILITY** Meets the requirements of FCC Docket 20780 for Class B equipment and VDE 0871 for Class B. **WEIGHT** 0.9 kg (2 lbs), including case. **APPROVALS** Approved by CSA for hazardous locations Class I, Division 2, Groups A, B, C, and D.

SECTION 4 – COMMUNICATIONS INSTALLATION AND WIRING

This section describes the built-in communications wiring and the communications cards used with the FloBoss 500-series Flow Managers.

The FloBoss unit communicates to external devices through either its Local Port (LOI) or its Host Port (Comm1). The Local Port uses a special 3-pin connector to connect a PC running ROCLINK for Windows software. The Comm1 Port has the flexibility to communicate to external devices using different protocols. Wiring connections for the Comm1 Host Port are made using screw terminals on the optional communications card.

This section contains the following information:

4.1 How to Wire the Local Port (LOI)

Figure 4-1 displays the Local Port (LOI) located at P10 on the Main Electronics Board. The Local Port (LOI) is intended for use with the ROCLINK for Windows software. The Local Port provides connections for a built-in EIA-232 (RS-232) communications interface to a configuration and monitoring device.

The port signals originate on the Main Electronics Board terminations and are wired to the three-terminal, cannon-style LOI connector located on the bottom of the enclosure. A prefabricated LOI cable is available as an accessory. A Ready to Send (RTS) terminal is provided on the Main Electronics Board (not routed to the cannon connector) and is intended for future applications, such as using the Local Port as a second Host Port.

Table 4-1 displays the signal routing of the Main Electronics Board terminations and the cannon-style connector:

Table 4-1. Local Port (LOI) Terminations

Board Label (P10)	Connector	Signal
BLK	1	Common
WHT	2	RXD
RED	3	TXD

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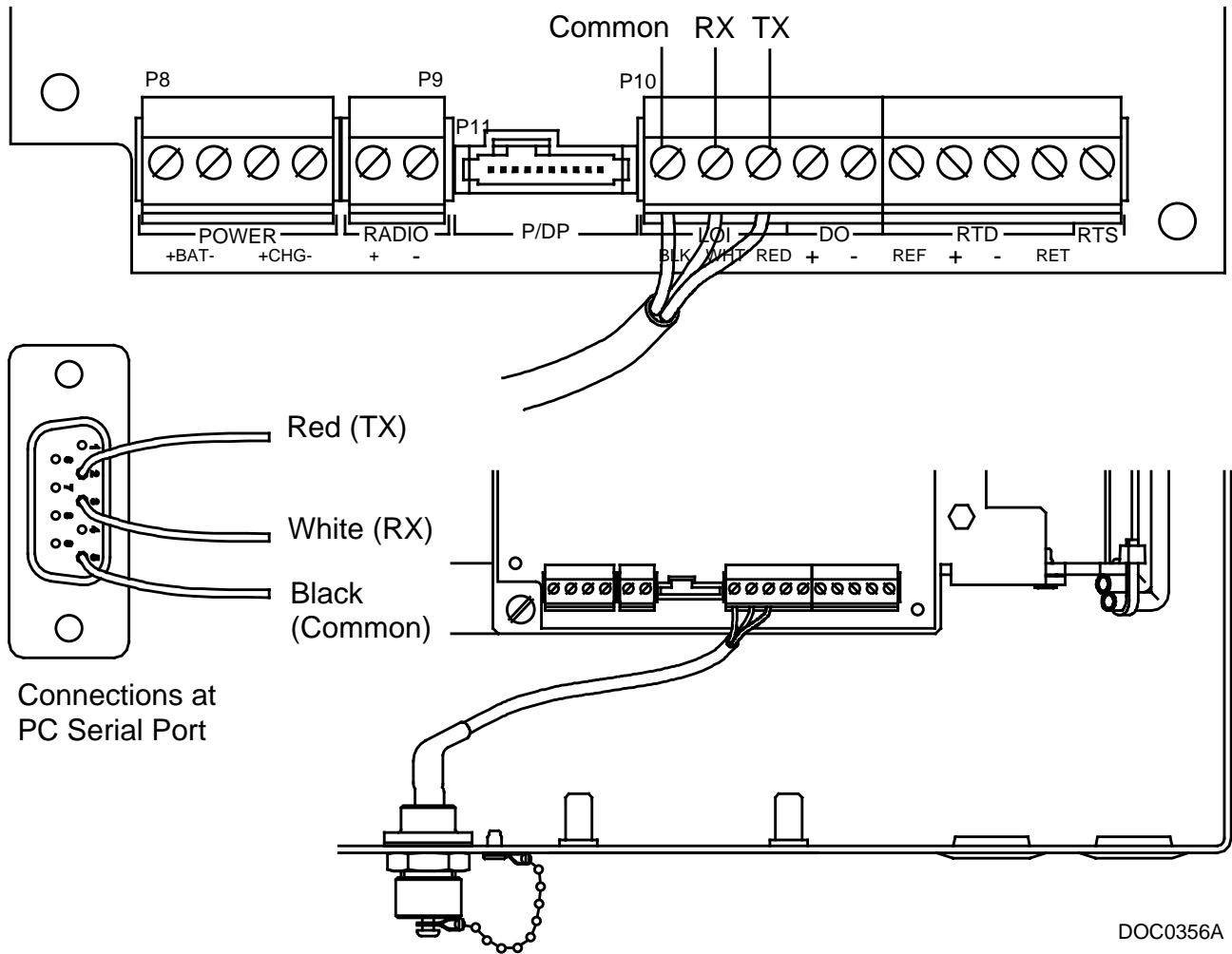
Figure 4-1. Local Port (LOI) Interface Wiring

4.2 Communications Cards Product Descriptions

The optional communications cards provide communications between the FloBoss and a host system or external devices. The communications cards install directly onto the Main Electronics Board at P3 and activate the Host Port (Comm1) when installed. The following cards are available:

♦ EIA-232 (RS-232) Serial Communications Card.

♦ EIA-485 (RS-485) Serial Communications Card.

♦ Dial-up Modem Communications Card.

4.2.1 EIA-232 (RS-232) Serial Communications Card

The EIA-232 (RS-232) communications card meets all EIA-232 specifications for single-ended, EIA-232 (RS-232) asynchronous data transmission over distances of up to 15 meters (50 feet). Refer to Figure 4-2. The EIA-232 (RS-232) communications card provides transmit, receive, and modem control signals. Normally, not all of the control signals are used for any single application.

The EIA-232 (RS-232) card is one of the optional interface cards for the Host Port of the FloBoss 500-series products. The EIA-232 (RS-232) communication card's P1 connector plugs into the Main Electronics Board at P3 and activates Comm1.

The RTS and DTR control lines are supported. The EIA-232 (RS-232) communications card defaults are: 9600 bps rate, 8 data bits, 1 stop bit, no parity, 10 millisecond Key On Delay, and 10 millisecond Key Off Delay. The maximum rate is 19,200 bps.

The EIA-232 (RS-232) communications card includes LED indicators that display the status of the RXD, TXD, DTR, DCD, and RTS signal/control lines. Refer to Figure 4-2 for LED indicators.

4.2.1.1 Power Cycling

This function is available with the EIA-232 (RS-232) communications card to provide power savings, when using a radio or cell phone for communications. Power cycling control is accomplished through Power Control Terminals or the DTR signal on the EIA-232 (RS-232) communications card. Connect wiring as described in Section 4.4.1. Configure the power cycling using the Radio Power Control feature as described in the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).
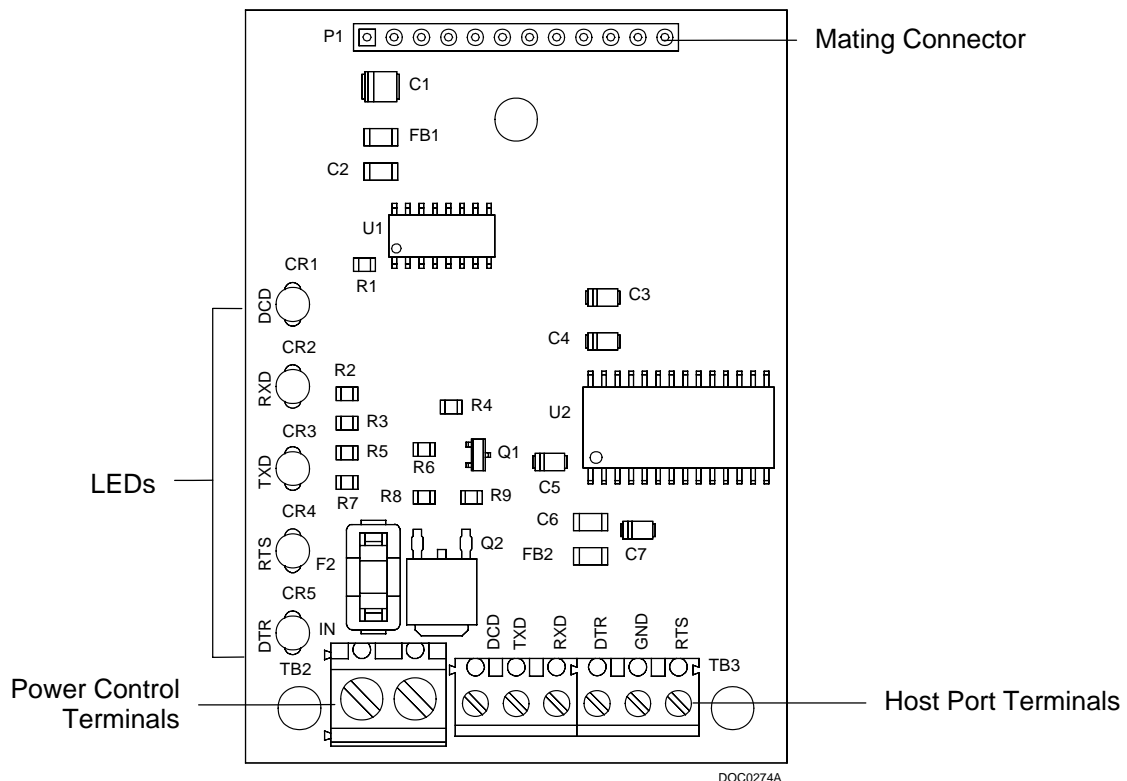
Figure 4-2. EIA-232 (RS-232) Serial Communications Card

Table 4-2. Communications Cards LED Indicators

LEDs	Status and Activity
DCD	The **data carrier detect** LED lights when a valid carrier tone is detected.
DTR	The **data terminal ready** LED lights when a signal from the processor indicates the modem is ready to answer an incoming call. When the DTR is triggered, a connected modem disconnects.
RTS	The **ready to send** LED lights when a signal from the processor specifies the modem is ready to transmit.
RXD	The **receive data** LED blinks when the receive signal is being received from the communications card. The LED is on for a space and off for a mark.
TXD	The **transmit data** LED blinks when transmit signal data is being received from the processor. The LED is on for a space and off for a mark.
RI	The **ring indicator** LED blinks when the modem rings and it glows when Power is on.

4.2.2 EIA-485 (RS-485) Serial Communications Card

The EIA-485 (RS-485) communications cards meet EIA-485 specifications for differential, EIA-485 (RS-485) asynchronous transmission of data over distances of up to 1220 meters (4000 feet). The EIA-485 (RS-485) drivers are designed for true multi-point applications with multiple devices on a single bus.

This optional interface communications card for the Host Port activates Comm1. The P1 connector on the EIA-485 (RS-485) communication card plugs into the Main Electronics Board at P3.

The interface lines of RTS are supported to control transmission. RTS must be active during TXD. The default values for the EIA-485 (RS-485) communications card are: 9600 bps Rate, 8 Data Bits, 1 Stop Bit, No Parity, 10 millisecond Key On Delay, and 10 millisecond Key Off Delay. The maximum rate is 19,200 bps.

The EIA-485 (RS-485) communications card includes LED indicators that display the status of the RXD, TXD, and RTS control lines. LED indicators are detailed in Table 4-2.
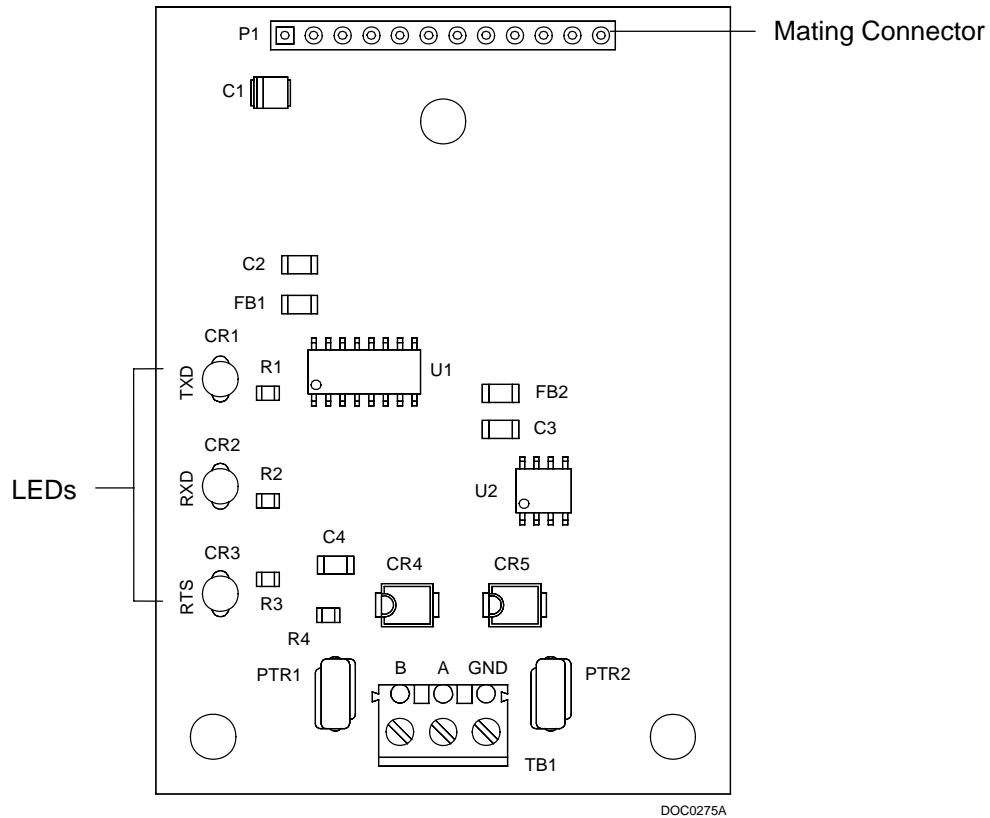
Figure 4-3. EIA-485 (RS-485) Serial Communications Card

4.2.3 Dial-up Modem Communications Card

The dial-up modem communications card supports 2400 baud communications (Bell 212A, Bell 103, V.22 bis, V.22, and V.21) with auto-answer/auto-dial features. Refer to Figure 4-4. The modem card is FCC part 68 approved for use with public-switched telephone networks (PSTNs). The FCC label on the card provides the FCC registration number and the ringer equivalent. The modem card has automatic adaptive and fixed compromise equalization.

This optional modem communications card for the Host Port activates Comm1. The dial-up modem communications card's P1 connector plugs into the Main Electronics Board at P3.

The defaults for the dial-up modem communications card are: 2400 bps rate, 8 data bits, 1 stop bit, no parity, 10 millisecond Key On Delay, and 10 millisecond Key Off Delay. On power up, the modem must be set up for Auto Answer. Periodic checks are made to ensure that the modem is still in Auto Answer or that it is not left off the hook after a certain period of non-communication.
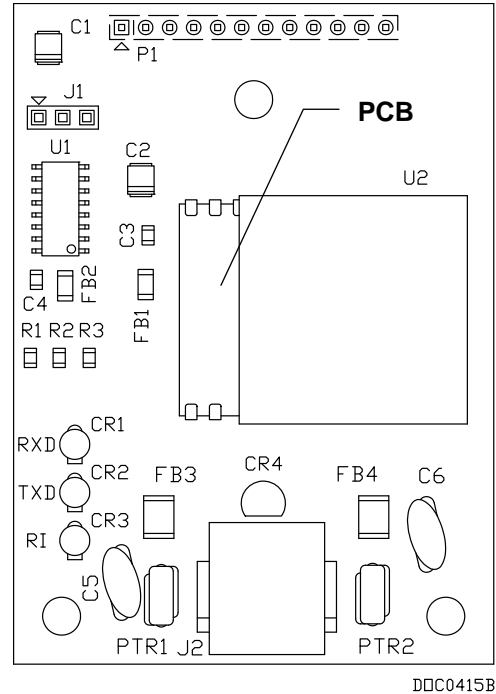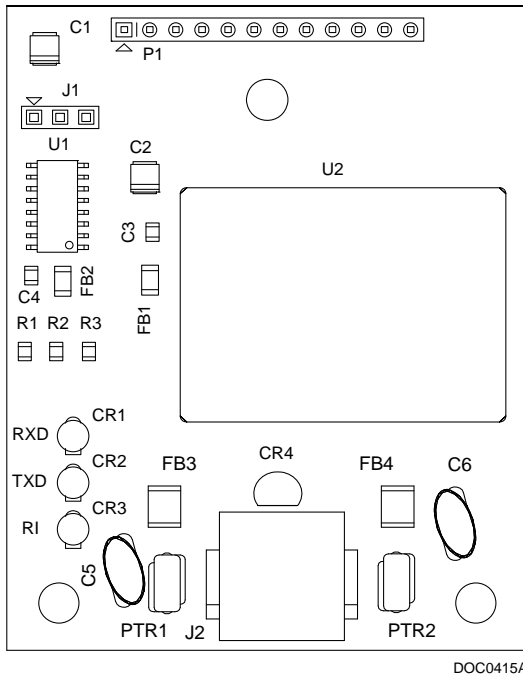
Figure 4-4. Dial-up Modem Communications Card
(Model W28146X0012 on left, Model W28146X0022 on right)

❖ **Note:** The communications modem module was upgraded in September of 2011 with a new modem component (U2), available in model W28146X0022. The new modem component is smaller and shows a portion of the printed circuit board (PCB) (see *Figure 4-4*).

The modem card interfaces to 2-wire, full-duplex telephone lines using asynchronous operation at data baud rates of 1200 and 2400. The card interfaces to a PSTN through an RJ11 jack located at the bottom of the communications card. Control the modem using industry-standard AT command software. A 40-character command line is provided for the AT command set.

❖ **Note:** Set the modem initialization strings with the appropriate AT command (Config Command) in the Modem screen within ROCLINK configuration software. The Config Command for the FloBoss 503 and 504 is:

♦ **ATEØHØVØX1QØ&C1&D2&SØ&LØSØ=1S7=60** (for modem model W28146X0012)

♦ **ATEØHØVØX1QØ&C1&D2&SØSØ=1S7=60** (for modem model W28146X0022)

LED indicators on the communications card show the status of the RXD, TXD, and RI control lines (see *Table 4-2*). The modem card also provides EIA-232 (RS-232) level output signals (RXD and TXD) for an analyzer.

4.3   Communications Card Installation and Setup

Communications card installation is normally performed at the factory when the FloBoss is ordered. However, the modular design of the FloBoss 500-series makes it easy to change hardware configurations in the field. The following procedures assume that this is a **first-time installation of a communications card in a FloBoss and that the unit is currently not in service.** For units currently in service, refer to the procedures in Section 9, Troubleshooting.

⚠ CAUTION

When installing units in a hazardous area, ensure that the components selected are labeled for use in such areas. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.

Be sure to use proper electrostatic handling, such as wearing a grounded wrist strap, or components on the circuit cards may be damaged.

4.3.1   How to Install a Communications Card

All communications cards install into the FloBoss in the same manner.

1. **Unplug** the **Power** terminal block at P8 to ensure power is removed.

2. **Plug in** the **communications card** connector P1 into connector P3 on the Main Electronics Board. Figure 4-5 shows the card location. Gently press the connectors together until the card contacts a stand-off.

3. Ensuring that the three stand-off holes in the communications card line up with the compression stand-offs on the Main Electronics Board, **install** by firmly pressing the **communications card** onto the stand-offs.

4. **Plug in** the **Power** terminal block at P8 to allow power to be applied.

5. With the FloBoss powered up, and a PC connected to the LOI port and running ROCLINK for Windows software, **verify** that the **configuration** associated with the communications card is correct. If not, change as needed.

6. Perform wiring as instructed in Section 4.4, How to Connect Communications Card Wiring.
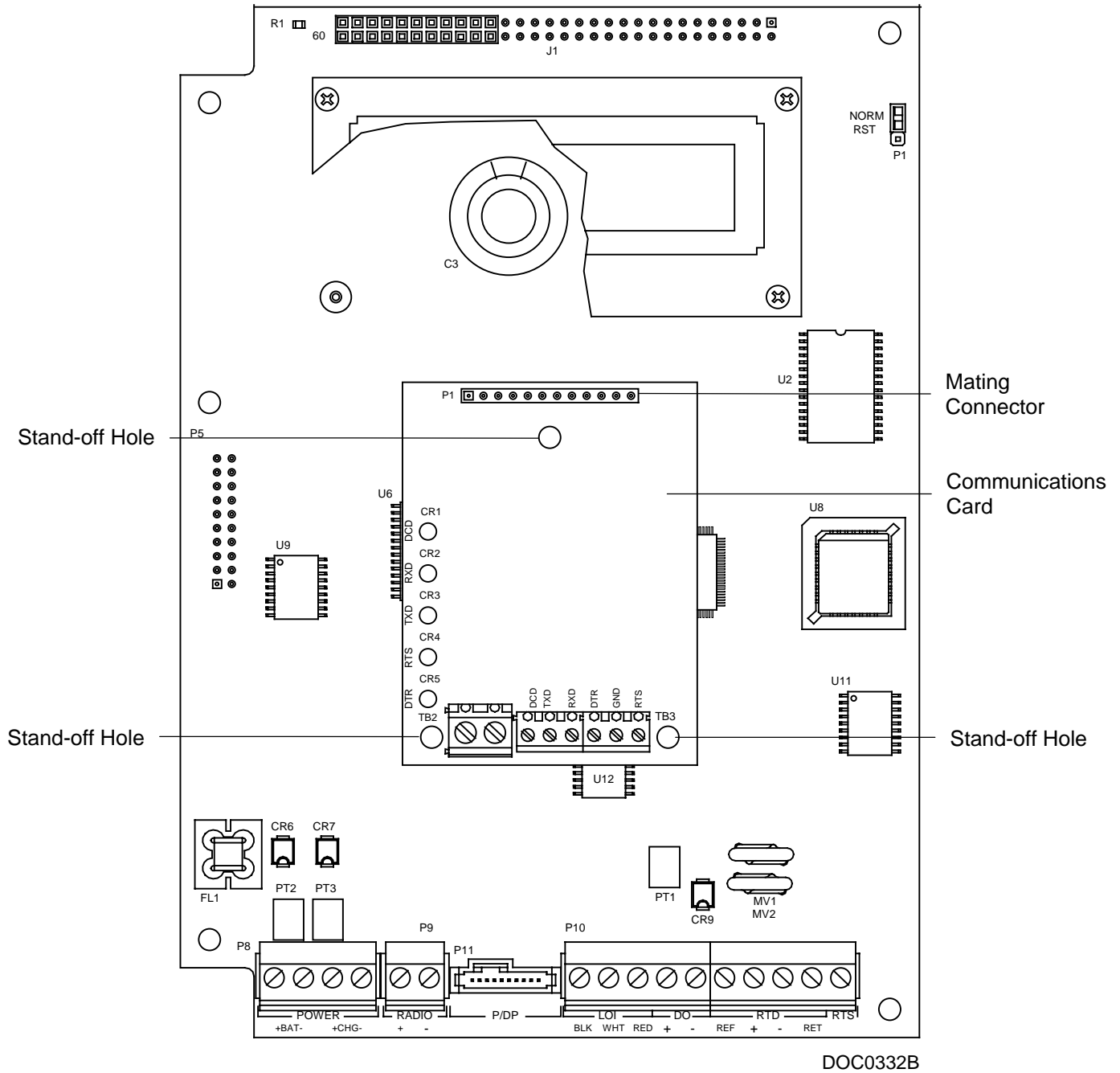
Figure 4-5. Communications Card Location

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4.4　How to Connect Communications Card Wiring

Signal wiring connections to the communications cards are made through the terminal block located on the serial communications cards, or through the RJ11 TELCO connector supplied on the modem card.

The FloBoss unit communicates to external devices through either its Local Port (LOI) or its Host Port (Comm1). The LOI Local Port uses a special 3-pin connector to connect a PC running ROCLINK for Windows software. The Host Port has the flexibility to communicate to external devices using different protocols. Wiring connections for the Host Port are made using screw terminals on the optional communications card.

4.4.1　EIA-232 (RS-232) Communications Card Wiring

The EIA-232 (RS-232) communications card provides for EIA-232 (RS-232) signals on the Host Port (Comm1). This communications card also provides a means to switch external power to communication devices to conserve power (for example, a radio). LEDs are provided for diagnostic functions. The screw terminals and their functions are defined in Table 4-3.

Table 4-3. EIA-232 (RS-232) Host Port Terminations

Terminal	Function
RXD	Receive data
TXD	Transmit data
DTR	Data Terminal Ready
RTS	Ready to Send
DCD	Data Carrier Detect
GND	Ground
IN	Switched Power Input
Out	Switched Power Output

4.4.1.1　Switched Auxiliary Power Wiring

Switched auxiliary power is used for radios or other devices that do not have a built-in sleep mode to automatically shut the radio off. Control of auxiliary power is set up by using the Radio Power Control function of the ROCLINK for Windows software to achieve the required power cycling. The switched method involves wiring the power through the EIA-232 (RS-232) communications card as shown in Figure 4-6.

If the auxiliary device already has a built-in sleep mode, or for some reason you do not need to cycle the auxiliary power, you can wire directly to the RADIO terminals for power.
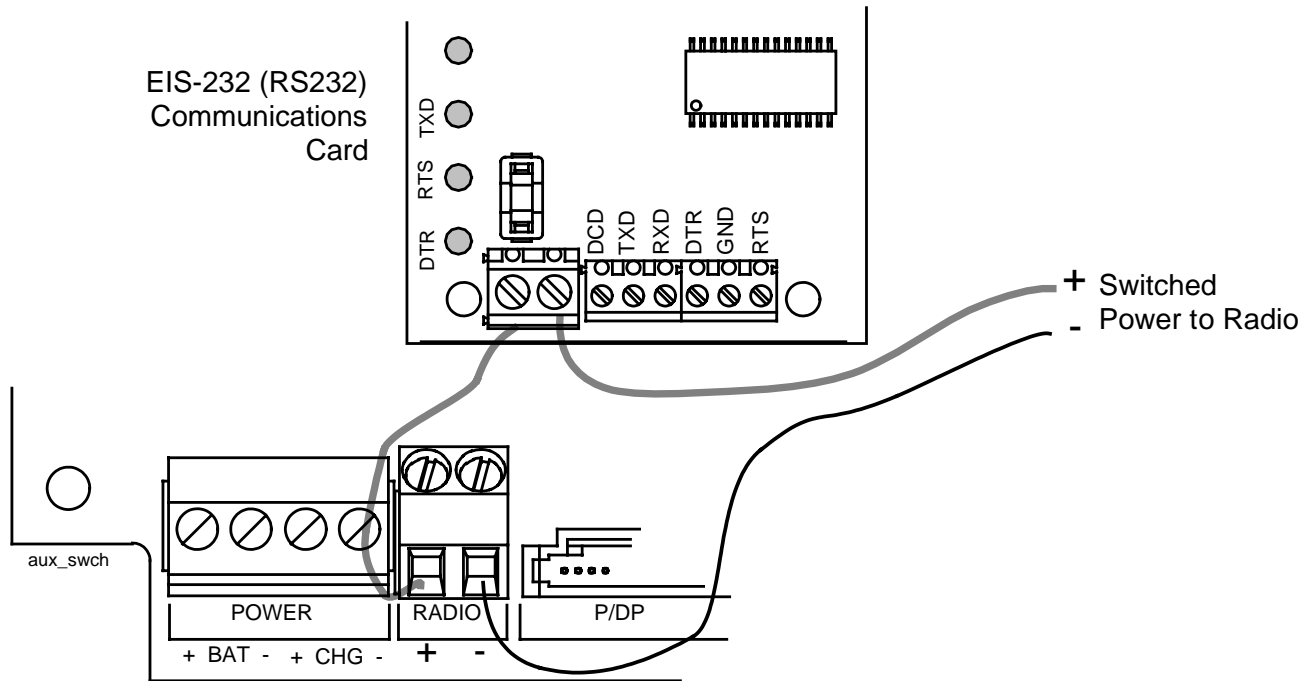
Figure 4-6. Wiring Switched Auxiliary Radio Power

Refer to Section 3, Power Connections, for additional information concerning auxiliary power.

4.4.2   EIA-485 (RS-485) Communications Card Wiring

The EIA-485 (RS-485) communications card provides for EIA-485 (RS-485) signals on the Host Port located at Comm1. Wiring should be twisted-pair cable. This board also provides additional protection for the external wiring and the board circuitry. LEDs are provided for diagnostic functions.

Table 4-4. EIA-485 (RS-485) Host Port Terminations

Terminal	Function
A	EIA-485 (RS-485) Positive
B	EIA-485 (RS-485) Negative
GND	Ground

Multiple units with communication cards installed may be daisy-chained together without exceeding 1220 m (4000 feet). When daisy-chaining communication cards, they should be connected in a sequential order. For example, comm card one should connect to comm card two and comm card two should connect to comm card three.

4.4.3 Dial-Up Modem Communications Card Wiring

The dial-up modem card interfaces to a PSTN line through the RJ11 jack located at J2 with two wires. The dial-up modem card provides for a telephone interface on the Host Port that is capable of both answering and originating phone calls. The dial-up modem card also provides electronics that conserve power when the phone line is not in use. The dial-up modem card provides some protection from transients on the phone lines; however, if the potential for lightning damage is high, additional surge protection for the phone lines should be installed outside the FloBoss 500-series enclosure.

LEDs are provided for diagnostic functions. The dial-up modem card provides a modular phone (RJ11) jack that directly interfaces to phone line connections. The RJ11 connector signals and their functions are diplayed in Table 4-5.

Table 4-5. Dial-up Modem Host Port Terminations

RJ11	Signal
1	–
2	–
3	Tip
4	Ring
5	–
6	–

4.5 How to Replace a Communications Card

If you are installing a communications card for the first time, refer to Section 4.3, Communications Card Installation and Setup. To remove and replace a communications card on an in-service FloBoss 500-series, perform the following procedure. Be sure to observe the cautions to avoid losing data and damaging equipment.

❖ **NOTE:** There is a possibility of losing the FloBoss 500-series configuration and historical data while performing the following procedure. As a precaution, save the current configuration and historical data to Config Memory on the ROC Flags screen of ROCLINK for Windows software.

⚠ CAUTION

When repairing units in a hazardous area, make sure that the components selected are labeled for use in such areas. Change components only in an area known to be non-hazardous. Performing these procedures in a hazardous area could result in personal injury or property damage.

Be sure to use proper electrostatic handling, such as wearing a grounded wrist strap, or components on the circuit cards may be damaged.

During this procedure, all power will be removed from the FloBoss and devices powered by the FloBoss. Make sure that all connected input devices, output devices, and processes will remain in a safe state, when power is removed from the FloBoss and when power is restored to the FloBoss. An unsafe state could result in property damage.

1. As a precaution, save the current configuration and historical data to Config Memory. Use **Write to Internal Config Memory** (ROC menu > ROC Flags) in ROCLINK for Windows software.

2. **Remove** the **Power** terminal block at P8 on the Main Electronics Board.

3. If the communications card is a modem card, **unplug** the **RJ11** phone jack cable from the communications card connector J2.

4. Using a rocking motion, gently **disengage** the **two stand-off connectors** located at the bottom of the communications card.

5. Using a rocking motion, gently **disengage** the **stand-off connector** located at the top, in the middle of the communications card.

6. Using a rocking motion to **disengage** the **connectors** at **P1**, pull the card free from the Main Electronic Board at P3.

7. To **reinstall** a **communications card**, orient the card with the P1 connectors on the communications card mating with the connectors at P3 on the Main Electronics Board. Plug the card into its stand-off connectors and gently press until the connectors firmly seat.

8. For a modem card, **connect** the **RJ11** phone jack cable to communications card connector J2.

9. **Reconnect** power by plugging in the **Power** terminal connector at P8 on the Main Electronic Board.

10. **Check** the **configuration** data and FSTs, and load or modify them as required.

11. Verify that the FloBoss 500-series performs, as required.

If you changed the configuration, save the configuration data to Flash ROM. If you changed the configuration, history database, or FSTs, save them to disk. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) for more information.

4.6 Communication Cards Specifications

The following tables list the specifications for each communications card.

Serial Card Specifications	
EIA-232D (RS-232D) CARD Meets EIA-232 (RS-232D) standard for single-ended data transmission over distances of up to 15 m (50 ft). **Data Rate:** Selectable from 1200 to 19,000 bps. **Format:** Asynchronous, 7 or 8-bit (software selectable) with full handshaking. **Parity:** None, odd, or even (software selectable). **EIA-485 (RS-485) CARD** Meets EIA-485 (RS-485) standard for differential data transmission over distances of up to 1220 m (4000 ft). **Data Rate:** Selectable from 1200 to 19,200 bps. **Format:** Asynchronous, 7 or 8-bit (software selectable). **Parity:** None, odd, or even (software selectable). **LED INDICATORS** Individual LEDs for RXD, TXD, and RTS signals. EIA-232D (RS-232D) card also has LEDs for DTR and DCD.	**POWER REQUIREMENTS** 4.75 to 5.25 V dc, 0.03 W maximum, supplied by processor board. **ENVIRONMENTAL** **Operating Temperature:** –40 to 75°C (–40 to 167°F). **Storage Temperature:** –50 to 85°C (–58 to 185°F). **Operating Humidity:** To 95% relative, non-condensing. **DIMENSIONS** 18 mm H by 51 mm W by 70 mm L (0.7 in H by 2.0 in W by 2.75 in L). **APPROVALS** Covered by the CSA approval for the FloBoss 503 or FloBoss 504 unit in which it is installed.

Dial-up Modem Card Specifications

OPERATION

Mode: Full-duplex 2-wire for dial-up PSTN (Bell 212 compatible).

Data Rate: 1200 or 2400 bps asynchronous (software selectable).

Parity: None, odd, or even (software selectable).

Format: 8, 9, 10, or 11 bits, including start, stop, and parity (software selectable).

Modem Protocols: Bell 212A, Bell 103, V.21, V.22 and, V.22 bis.

Transmit Carrier Frequencies: Originate, 1200 Hz $\pm$ 0.1%; Answer, 2400 Hz $\pm$ 0.1%.

Receive Carrier Frequencies: Originate, 2400 Hz $\pm$ 7 Hz; Answer, 1200 Hz $\pm$ 7 Hz.

Telephone Line Impedance: 600 ohm typical.

RTS to Transmission Delay: Configurable in 50 millisecond periods (software selectable).

Receiver Sensitivity: On hook, Type B ringer, 38 Vrms.

Maximum Output Level: 0 dBm nominal into 600 ohms.

LED Indicators: TXD, RXD, and RI.

Surge Protection: Conforms to FCC part 68 and DOC.

OPERATION (CONTINUED)

Surge Isolation: 1000 V ac and 1500 volt peak.

Certification: FCC Part 68 approved.

POWER REQUIREMENTS

4.75 to 5.25 V dc, 0.25 W maximum, supplied by processor board.

ENVIRONMENTAL

Operating Temperature: –35 to 70°C (–31 to 158°F).

Storage Temperature: –40 to 85°C (–40 to 185°F).

Operating Humidity: To 95% relative, non-condensing.

DIMENSIONS

18 mm H by 51 mm W by 70 mm L (0.7 in H by 2.0 in W by 2.75 in L).

APPROVALS

Covered by the CSA approval for the FloBoss 503 or FloBoss 504 unit in which it is installed.

This modem uses an FCC registered modem chip. Registration No. DWEUSA-21473-Md-E, REN 0.8B, Registration Holder: XECOM, INC.

SECTION 5 – INPUTS AND OUTPUTS

This section describes the built-in Inputs/Outputs (I/O) and the optional I/O Cards.

This section contains the following information:

5.1 Description

The FloBoss units have a built-in RTD Input, a Discrete Output (DO), and three diagnostic Analog Inputs.

The FloBoss 500-series Input/Output (I/O) cards, shown in Figure 5-1, Figure 5-2, and Figure 5-3, provide additional inputs and outputs for expanded monitoring and control applications. Table 5-1 displays the types of additional I/O channels for the FloBoss 500-series units that the I/O Cards provide. Two types of optional I/O Cards are available: 10-channel and 24-channel.

Table 5-1. I/O Card Channels

I/O Type	10-Channel	24-Channel
Analog Input – AI	3	8
Analog Output – AO	1	2
Discrete Input – DI	2	2
Discrete Output – DO	2	2 (Relay)
Pulse Input – PI	–	2
Selectable DI/PI	2	–
Selectable DI/DO	–	8

The I/O Cards use a microprocessor for monitoring, control, and acquisition of data from external devices connected to the I/O channels. The information is then relayed to the FloBoss 500-series unit. The I/O channels have removable plug-in terminal blocks for field wiring. In addition, the 10-channel card has six LEDs to indicate the state of the Discrete Inputs, Discrete Outputs, and Pulse Inputs. Refer to Section 5.4, I/O Card LEDs.
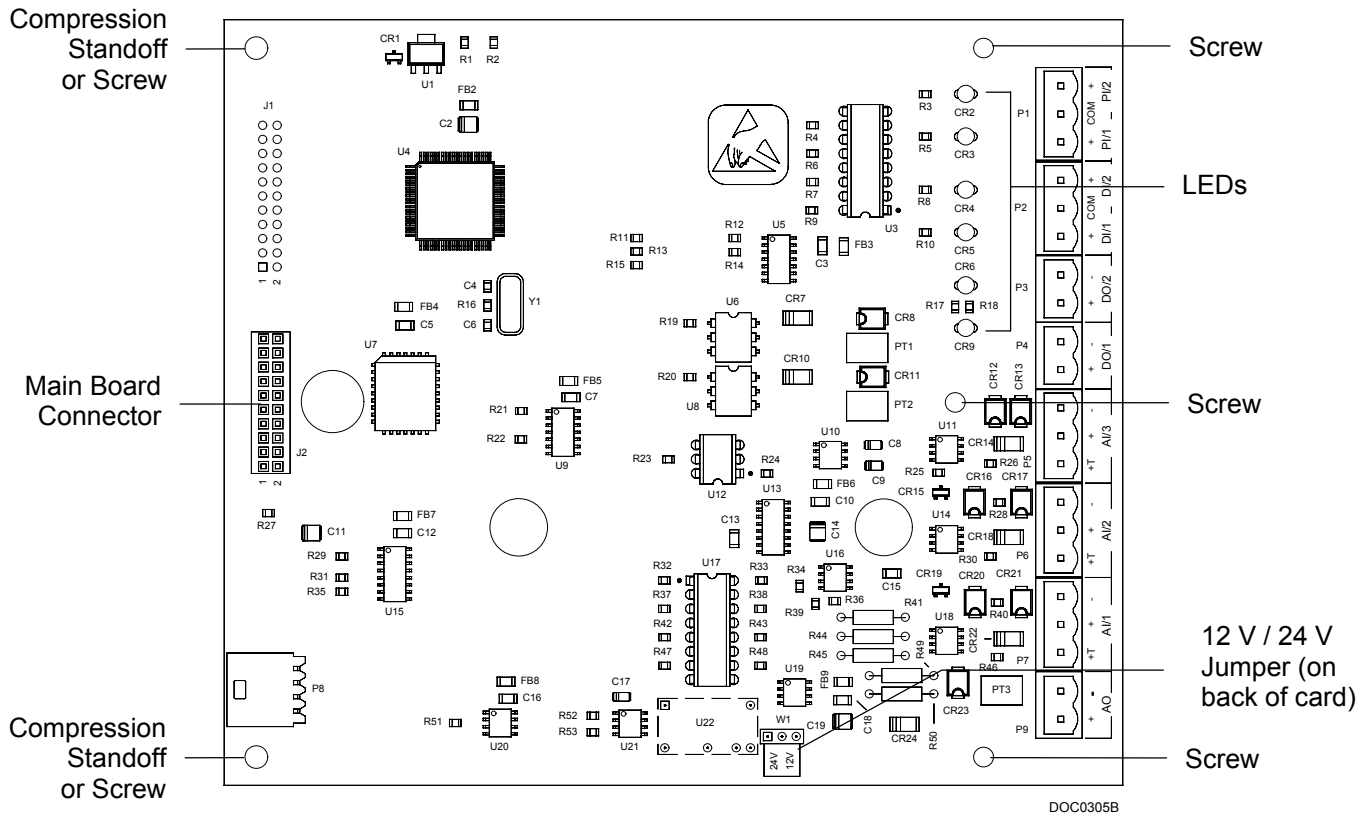
Figure 5-1. Input/Output Card – 10 Channel (Front)

A **10-channel I/O Card** has no physical switches for the DI/PI selections. The DI/PI are selected and the Point Numbers are configured in ROCLINK for Windows software.

The 10-channel I/O Card receives its power from the main processor card. The power converter produces enough current to support four current loops (three AIs and one AO) plus the power to run the analog-to-digital (A/D) and digital-to-analog (D/A) converters, as well as the Discrete Inputs. The power converter can turn off under processor control to reduce the load in low-battery conditions.

❖ **NOTE:** The Pulse Inputs can be wired as a FloBoss-powered pulse counters. The pulse circuitry is optically coupled to isolate the processor board from the input signal. The Pulse Inputs on the 10-channel card can also be configured as Discrete Inputs.
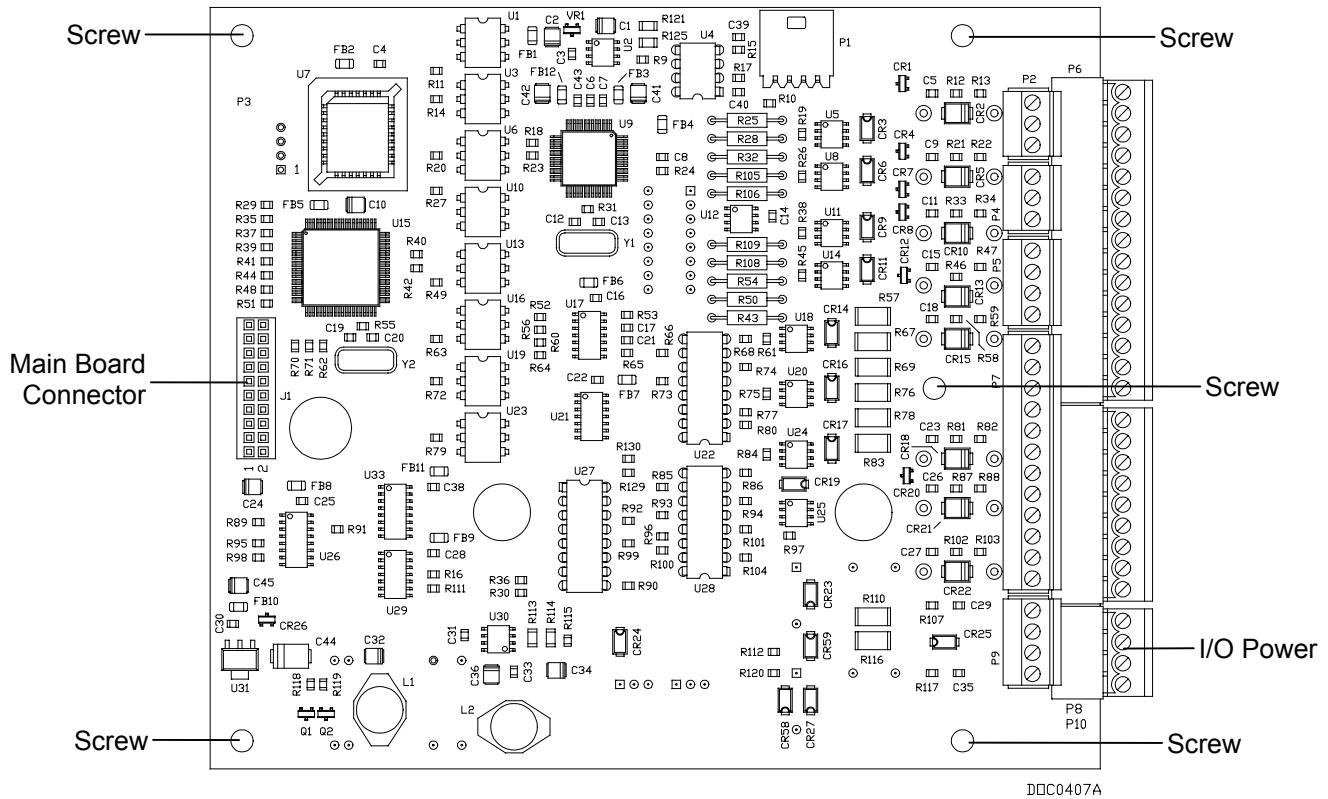
Figure 5-2. Input/Output Card – 24 Channel (Front)

A **24-channel I/O Card** has sockets for AI scaling resistors provided on the back of the I/O Card, along with switches for the selectable DI/DO channels. The DI/DO Point Numbers are configured using ROCLINK for Windows software.

The 24-channel I/O Card receives its power from the main processor card. The processor is isolated from noisy I/O circuits by optical coupling and a DC/DC power converter, which supplies power for most of the I/O circuits. This converter helps isolate the field I/O from the processor.

If you require additional **power** for the I/O, connect an external 24 V dc power source to the +T and –T on the I/O Power terminal block.

If you require additional **voltage** for the I/O, connect an external DC/DC to the +B, –B, +T, and –T on the I/O Power terminal block.

❖ **NOTE:** The isolation jumpers on the back of the 24-channel I/O Card (W1 and W2) should both be set at BATT when providing battery power to the Discrete Inputs. Refer to Figure 5-3.
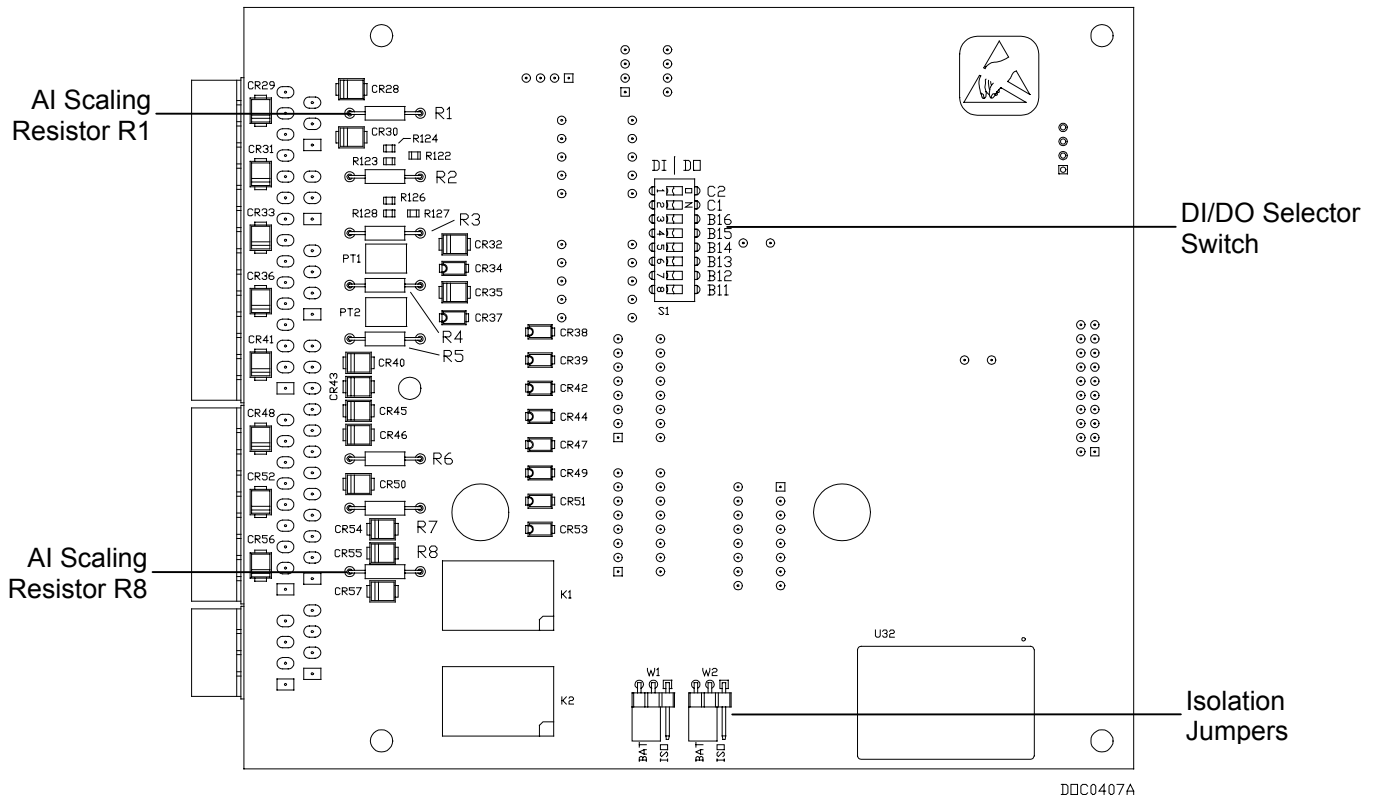
Figure 5-3. Input/Output Card – 24 Channel (Back)

5.2 How to Install an I/O Card

The I/O Card installs on the back of the swing-out mounting panel in the FloBoss enclosure. The I/O Card electrically connects to the Main Electronics Board with a mating connector. Earlier versions of the I/O Card (prior to January 2000) physically mount on two compression standoffs and secure with three #6-32 screws. Current versions mount and secure with five #6-32 screws. Refer to Figure 5-5 and Figure 5-6.

> ⚠ **CAUTION**
>
> **To avoid circuit damage when working with the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.**
>
> **Always turn the power to the FloBoss off before you attempt any type of wiring. Wiring of powered equipment could result in personal injury or property damage.**

1. As a precaution, save the current configuration and historical data to Config Memory (**Write to Internal Config Memory**) on the ROC > Flags screen of ROCLINK for Windows software.

2. **Unplug** the **Power** terminal block at P8 on the Main Electronics Board to remove power.

3. **Disconnect** the **ribbon cable** connected at **P11** and any wiring that would restrict the panel from opening. Press down on the detent and open the swing-out panel. Refer to Figure 5-5 and Figure 5-6.

4. **Mate** the 20-pin **connector J2** on the I/O Card with **connector P5** on the Main Electronics Board.

5. After mating the connectors, **press firmly to seat the board**. For earlier versions of the I/O Card, also ensure that the card seats on the two compression standoffs.

6. For earlier versions of the I/O Card, **install** three #6 – 32 **screws**. For the current version, install five #6 – 32 screws.

7. When using a **24-channel I/O Card**, **select** the necessary **DI/DO** selector switches and verify AI scaling resistors are installed as required. Refer to Section 5.3, I/O Wiring, on page 5-8.

8. **Close** the **swing-out panel**, and **reconnect** the **ribbon cable** and any other wiring removed in Step 3.

9. **Affix I/O label** to swing-out panel. The 24-channel card also has a label to be placed on the inside of the enclosure door. The two labels for the 24-channel card are shown in Figure 5-4.

10. **Apply power**:

    ♦ Plug in the Power terminal block at P8 on the Main Electronics Board to restore power to the FloBoss.

    ♦ When using a 24-volt optional transformer, plug it into P10 on the I/O board.

11. Refer to Section 9, How to Restart and Reconfigure.

When power is applied to the FloBoss, scanning of the I/O Card automatically activates. Use the ROCLINK for Windows software to configure the new I/O points, history database, and other aspects as desired. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).
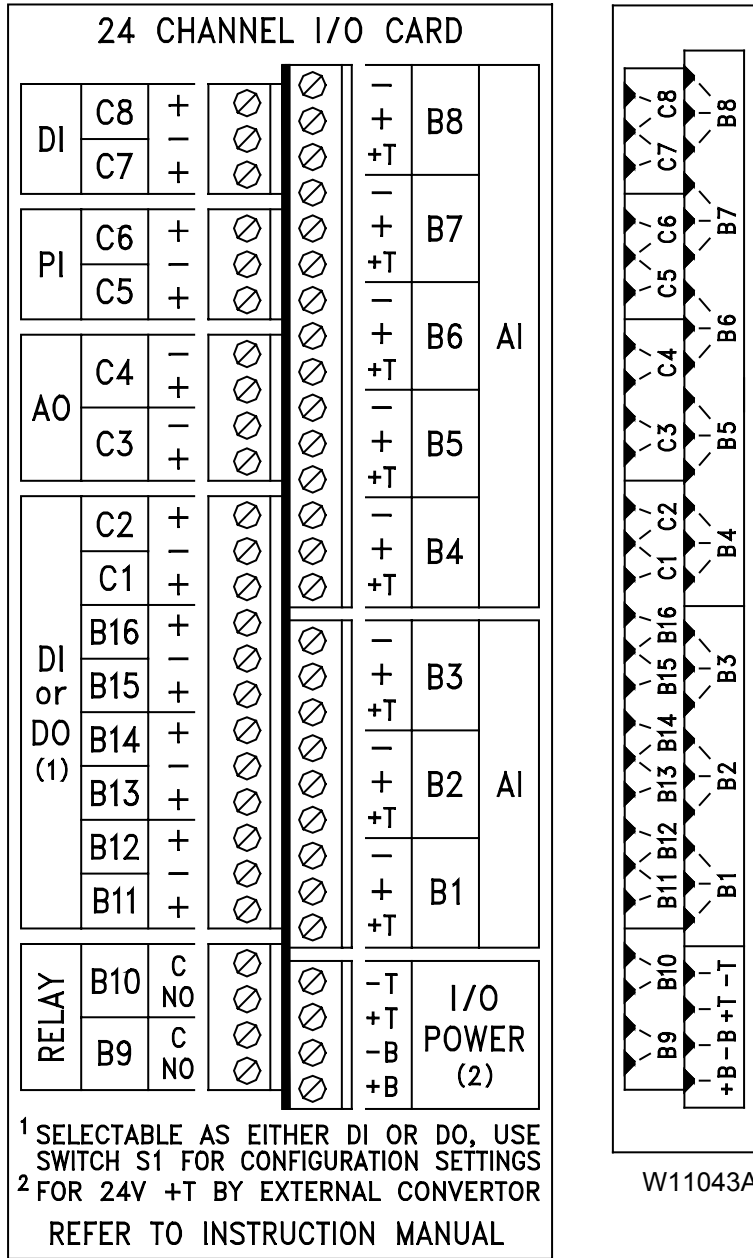
Figure 5-4. 24-Channel I/O Card Wiring Labels
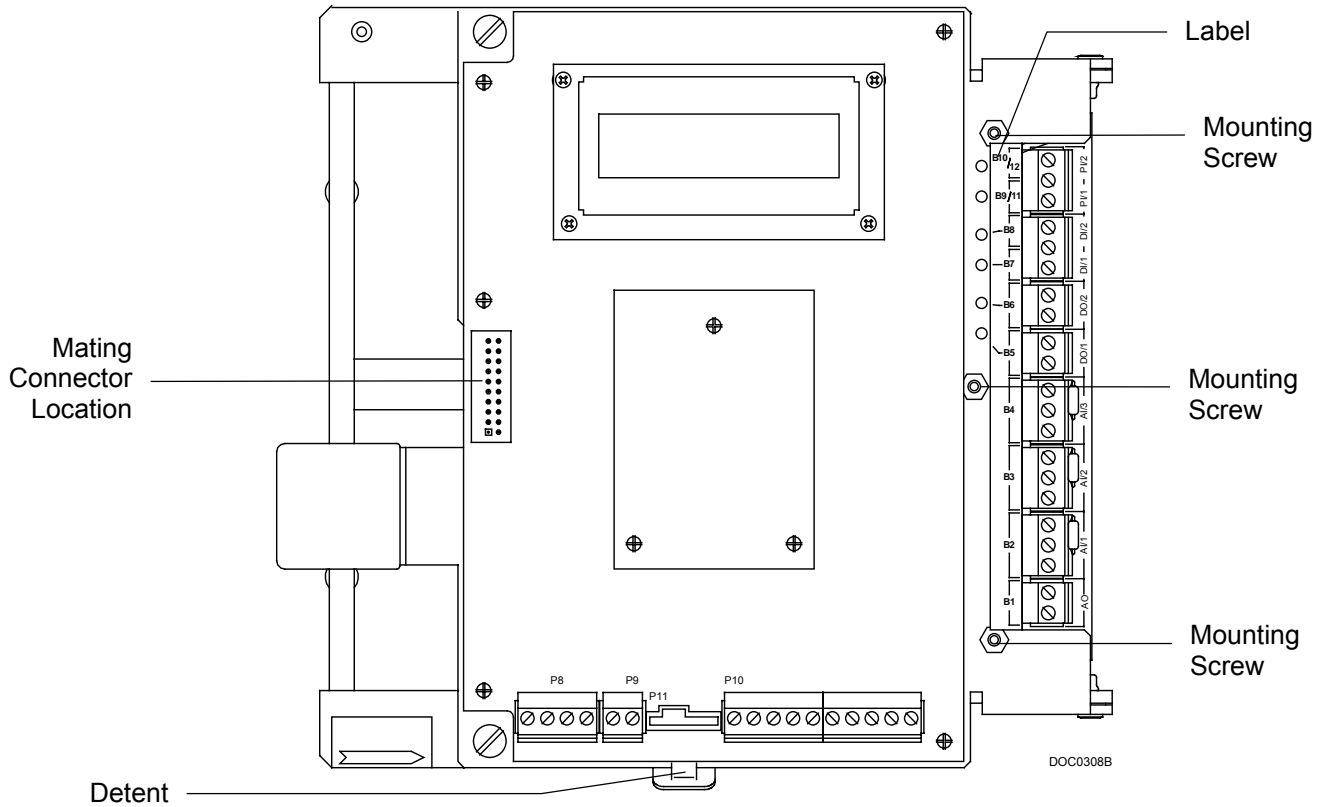
Figure 5-5. I/O Card Installation (10-channel Card Shown)
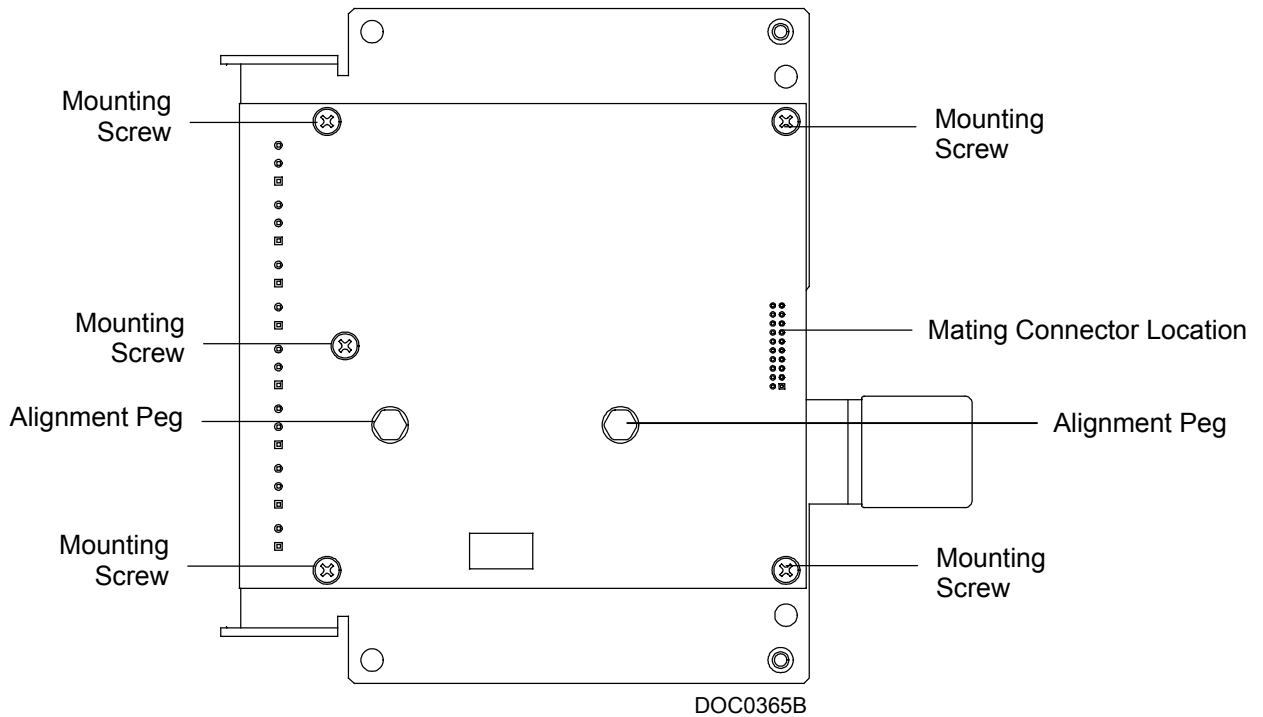
Figure 5-6. Back of Swing out Panel (10-channel Card Shown)

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5.3 I/O Wiring

The field terminals on the FloBoss 500-series I/O Card are connected as explained in the following sections. I/O wiring requirements are site and application dependent. Local, state, or NEC requirements determine the I/O wiring installation methods. Direct burial cable, conduit and cable, or overhead cables are options for I/O wiring installations.

The Main Electronics Board containing the field wiring terminal connections is accessed by opening the front door after removing the lock (if installed) and releasing the hasp on the right-hand side. The input terminal wiring is arranged on the lower edge of the Main Electronics Board. The terminal designations are printed on the circuit board.

5.3.1 Analog Inputs

Analog Inputs (AIs) monitor current loop and voltage input devices. The I/O Card's Analog Inputs each consist of a 12 V dc (+T), 22 mA current source, and a multiplexed A/D converter. The power for the A/D is from the isolated power supply. The A/D signal input range is from 1 to 5 volts with 12-bit resolution.

Table 5-2 and Table 5-3 display the Analog Input's number, the Point Number to which the AO is assigned in ROCLINK for Windows software, and the number printed on the I/O Card. In the case of the 24-channel card, the number in the software and on the label are the same.

Table 5-2. Analog Inputs – 10-Channel

Analog Input	Point Number	Label Number
4	B2	AI/1
5	B3	AI/2
6	B4	AI/3

Table 5-3. Analog Inputs – 24-Channel

Analog Input	Point / Label Number
4	B1
5	B2
6	B3
7	B4
8	B5
9	B6
10	B7
11	B8

Table 5-4. Analog Inputs Terminals

Terminal	Function
+T	Current-limited positive battery voltage for transmitter power
+	Positive Input
–T	Negative Input (Common)

The Analog Inputs have three field terminals per channel. Refer to Table 5-4. When using a 10-channel card, the "+T" terminal provides power for loop-powered devices at either 12 or 24 volts, depending on the position of jumper W1 (not included on some of the first I/O Cards manufactured). As in Figure 5-1, the jumper is actually found on the non-component side of the board. The "+T" terminal on the 24-channel I/O Card currently provides 12 volts.

Each channel has a current regulator in series with the "+T" terminal to provide short-circuit protection. A 250-ohm scaling resistor is supplied for use between the "+" and "–" Analog Input terminals.

The "+" terminal is the positive signal input and the "–" terminal is the signal common. These terminals accept a voltage signal in the 1 to 5 volt range. Because the "–" terminal is internally connected to common, the Analog Input channels function as single-ended inputs only.

Current inputs of 4-20 milliAmps can be used with the addition of a 250-ohm resistor across the input terminals. When wiring a 4-20 milliAmp current signal on the 10-channel I/O Card, leave the 250-ohm resistor installed between the "+" and "–" terminals. The 24-channel I/O Card has 250-ohm resistors in the sockets on the back of the card. Remove any resistors that will not be required. For both I/O Cards, wire the current loop device "+" lead to the "+T" terminal and the device "–" lead to the AI "+" terminal. Figure 5-7 shows the wiring for a typical current signal.

❖ **NOTE:** FloBoss-powered means power is received from the Input, Output, or Module shown. External or self-powered means power is received from the device, a battery, the FloBoss Main Electronics Board, or another source.
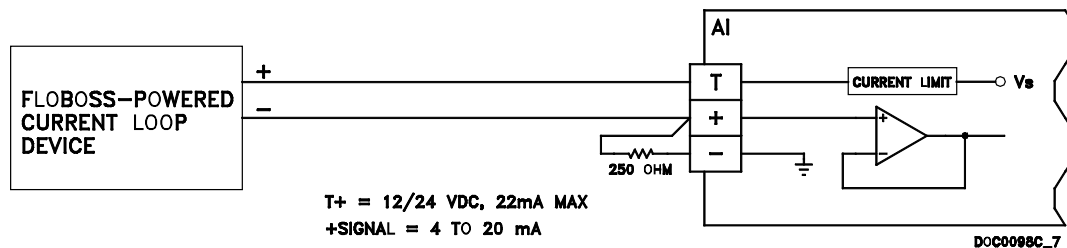
Figure 5-7. Current Signal on Analog Input

❖ **NOTE:** When **connecting the Analog Input channel to a voltage device**, be sure to **remove the 250-ohm resistor** from the Analog Input terminal block. Figure 5-9 shows wiring for a 3- or 4-wire voltage transmitter
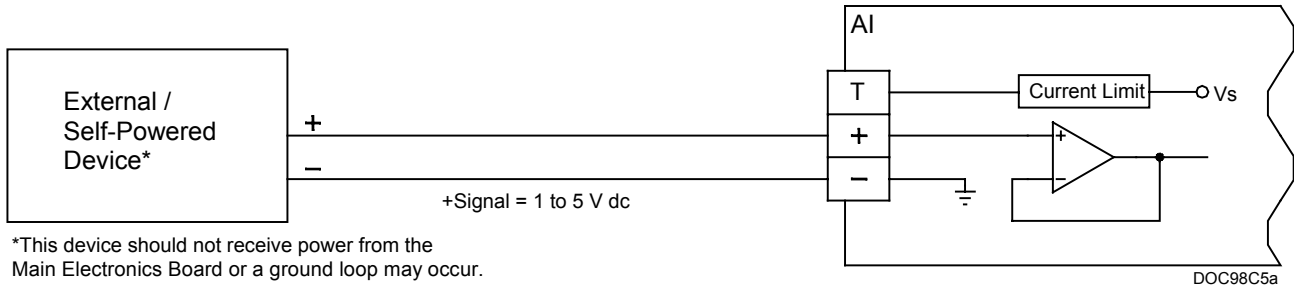
* Note: This device should not receive power from the Main Electronic Board or a ground loop may occur.

Figure 5-8. Voltage Signal (Self-Powered Device) on Analog Input
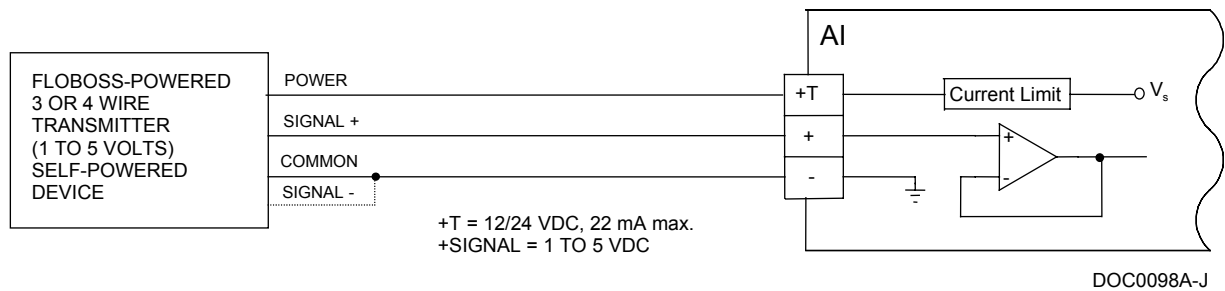
Figure 5-9. Voltage Transmitter on Analog Input

5.3.2 Analog Output

Analog Outputs (AOs) provide a current output for powering analog devices.

The I/O Card Analog Output is a 4-20 mA loop signal with a maximum voltage of 24 V dc from the isolated power supply. The Analog Output uses a 12 bit D/A converter and a voltage to current converter.

Table 5-5 and Table 5-6 display the Analog Output's number, the Point Number to which the AO is assigned in ROCLINK for Windows software, and the number printed on the I/O Card. In the case of the 24-channel card, the number in the software and on the label are the same.

Table 5-5. Analog Outputs – 10-Channel

Analog Output	Point Number	Label Number
1	B1	AO/1

Table 5-6. Analog Outputs – 24-Channel

Analog Output	Point / Label Number
1	C3
2	C4

Table 5-7. Analog Output Terminals

Terminal	Function
+	Positive load
–	Negative load

A schematic representation of the field wiring connections to the Analog Output channel is shown in Figure 5-10. The AO can provide loop current to non-powered field devices. The Analog Output provides a 0 to 22 milliAmp current source output at terminal "+". Terminal "–" is isolated from the FloBoss common. Refer to Table 5-7.

Figure 5-10 shows wiring for a FloBoss-powered current loop device.

❖ **NOTE:** FloBoss-powered means power is received from the Input, Output, or Module shown. External or self-powered means power is received from the device, a battery, the FloBoss Main Electronics Board, or another source.

DOC0311A
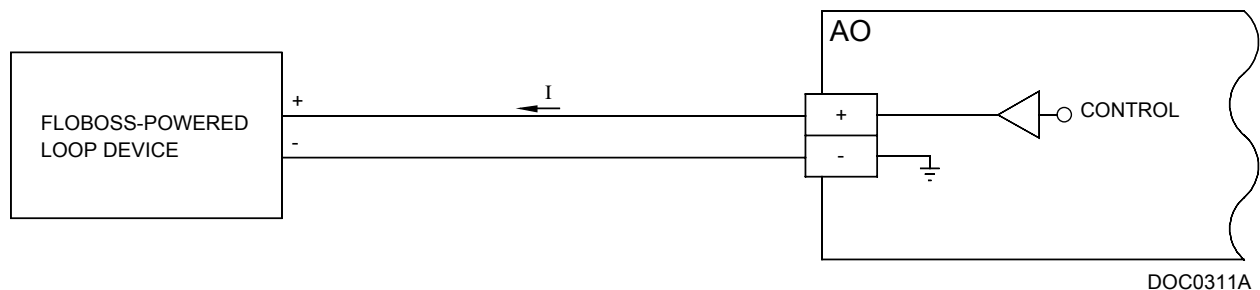
Figure 5-10. Analog Output Field Wiring for Current Loop Devices

5.3.3 Discrete Inputs

Discrete Inputs (DIs) monitor the status of relays, solid-state switches, the intrusion switch, or other two-state devices. DI functions support discrete latched inputs and discrete status inputs.

Table 5-8 and Table 5-9 display the Discrete Input's number, the Point Number to which the DI is assigned in ROCLINK for Windows software, and the number printed on the I/O Card. In the case of the 24-channel card, the number in the software and on the label are the same.

Table 5-8. Discrete Inputs – 10-Channel

Discrete Input	Point Number	Label Number
4	B7	DI/1
5	B8	DI/2
6	B9[1]	PI/1
7	B10[1]	PI/2
1. The Discrete Inputs located at Point Number B9 and Point Number B10 requires the use of the two Pulse Inputs on the I/O Card. Refer to How to Use Pulse Inputs as Discrete Inputs on page 5-20.		

Table 5-9. Default Discrete Inputs – 24-Channel

Discrete Input	Point / Label Number
4	B11
5	B12
6	B13
7	B14
8	B15
6	B16
7	C1
8	C2
9	C7
10	C8

Table 5-10. Discrete Inputs Terminals

Terminal	Function
+	Positive Discrete Input
COM	Common

When using a **10-channel I/O Card**, the I/O Card Discrete Inputs acquire power from the 24-volt power supply. An LED indicator is included for each point on the field side. The signal from the field is coupled through an optical isolator providing 2500 V dc isolation from the main FloBoss circuit board.

❖ **NOTE:** The 24-channel I/O Card does not have LEDs.

The Discrete Input operates by providing a voltage across terminals "+" and "COM" (Figure 5-11), which is derived from internal voltage source (Vs). When a field device, such as a relay contact is connected across "+" and "COM," the closing of the contacts completes the circuit which causes a flow of current between Vs and ground at terminal "COM." This current flow activates the LED and is sensed in the DI circuitry that, in turn, signals the FloBoss electronics indicating that the relay contacts have closed. When the contacts open, current flow is interrupted and the DI circuit signals to the FloBoss electronics that the relay contacts have opened.

CAUTION

The Discrete Input is designed to operate only with non-powered discrete devices, such as "dry" relay contacts or isolated solid state switches. Use of the DI channel with powered devices may cause improper operation or damage to occur.

❖ **NOTE:** FloBoss-powered means power is received from the Input, Output, or Module shown. External or self-powered means power is received from the device, a battery, the FloBoss Main Electronics Board, or another source.
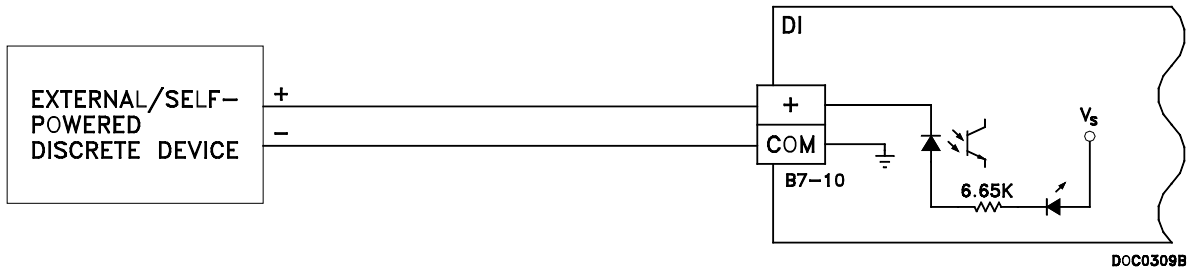
Figure 5-11. Discrete Input Wiring

5.3.3.1 Intrusion Switch Wiring

The intrusion switch acts as a tamper detector for the FloBoss units. The optional intrusion switch is a momentary contact switch used to detect whether the door to the enclosure is open or closed. The switch, which has a normally-closed contact, mounts in the enclosure. When the normally-closed contacts are wired to a Discrete Input (DI) on the I/O Card of the FloBoss (Figure 5-12), an "Off" status (contacts open) is detected when the door is closed and an "On" status (contacts closed) when the door is open. The status of the switch can be configured to generate an alarm when the door to the enclosure is open.

Using ROCLINK for Windows, the DI switch Status parameter can be configured to generate an alarm when the door is open. The SRBX feature can be enabled on the alarm to automatically notify the host computer.
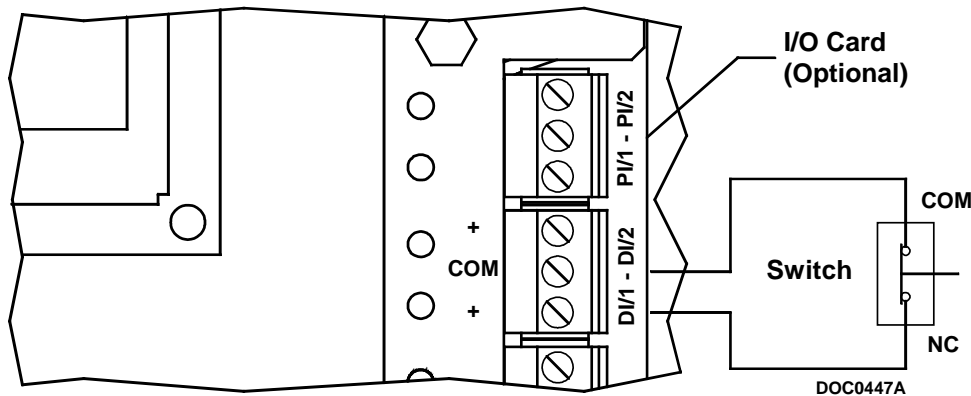
Figure 5-12. Intrusion Switch Wiring (10-channel Card Shown)

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5.3.4   Discrete Outputs

Discrete Outputs (DO) on the 10-channel I/O Card provide a solid-state switch to control relays and power small electrical loads. The 24-channel I/O Card Discrete Outputs (DO) control two-state devices, such as motor and pump relays. The built-in DO is detailed in Section 5.3.4.1, Built-In Discrete Output Wiring, on page 5-16.

DO functions supported are:

♦   Sustained Discrete Outputs.

♦   Momentary Discrete Outputs.

♦   Slow pulse-train outputs.

The 10-channel I/O Card provides two Discrete Output channels at B5 and B6. The Discrete Output channel is a normally-open, single-pole, single-throw switch. An LED turns on to show when the switch is closed. The Discrete Outputs are solid-state switches enabled by individual signals from the processor I/O lines. The solid-state switches are capable of handling 24 V dc at 300 mA.

The 24-channel I/O Card provides two dedicated Discrete Output mechanical relay channels at B9 and B10. The 24-channel I/O Card provides eight selectable DOs, which can also be configured as DIs. The DO relays provide normally-open contacts, while the selectable DOs are normally-open, solid-state switches that are used for activating externally-powered devices.

Table 5-11 and Table 5-12 display the Discrete Output's number, the Point Number to which the AO is assigned in ROCLINK for Windows software, and the number printed on the I/O Card. In the case of the 24-channel card, the number in the software and on the label are the same.

Table 5-11. Discrete Outputs – 10-Channel

Discrete Output	Point Number	Label Number
4	B5	DO/1
5	B6	DO/2

Table 5-12. Default Discrete Outputs – 24-Channel

Discrete Output	Point / Label Number
2	B9
3	B10
4	B11
5	B12
6	B13
7	B14
8	B15
9	B16
10	C1
11	C2

Table 5-13. Discrete Outputs Terminals

Terminal	Function
+	Positive load
–	Negative load

The Discrete Output on the I/O Card can be used in:

♦ Toggle mode.

♦ Latched mode.

♦ Time Duration Output (TDO) mode.

When using a 24-channel card, the external device must be powered directly from the battery or the + terminal of the Radio Power Control terminal block. When using a solid state selectable Discrete Output, the card must be placed in BATT mode (W1 and W2 jumpers located on the back of the board). The negative terminal is not applicable for the selectable DO because the + terminal is in one of two states: not connected or short to BATT ground (–).

Figure 5-13 shows a typical Discrete Output wiring diagram for solid-state relays.

❖ **NOTE:** FloBoss-powered means power is received from the Input, Output, or Module shown. External or self-powered means power is received from the device, a battery, the FloBoss Main Electronics Board, or another source.
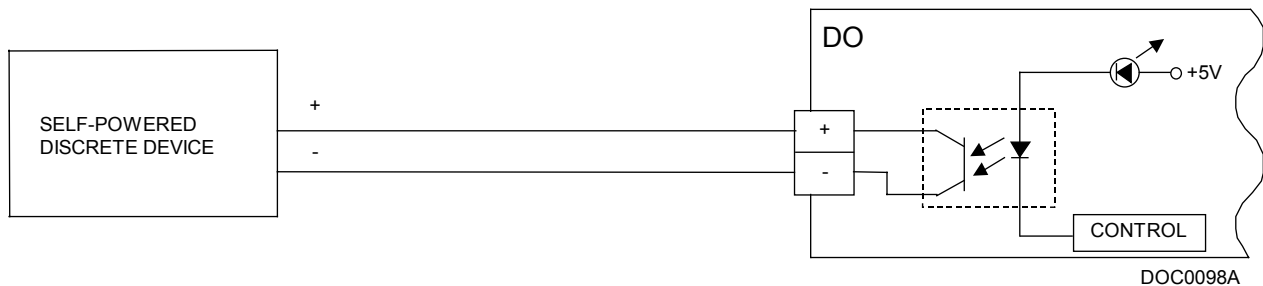
Figure 5-13. Solid State Relays – Discrete Outputs

Figure 5-14 shows a typical Discrete Output wiring diagram for mechanical relays.
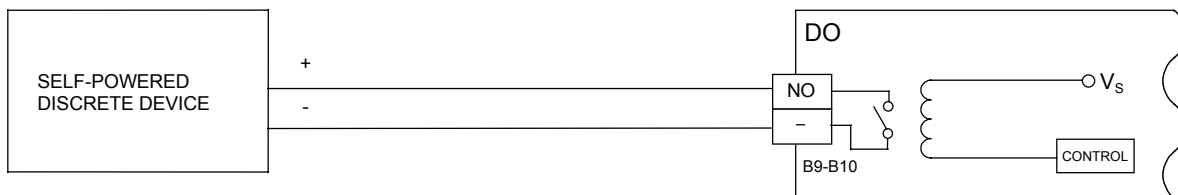
Figure 5-14. Relay Circuit – Discrete Outputs

Figure 5-15 shows a typical Discrete Output wiring diagram for selectable DOs.
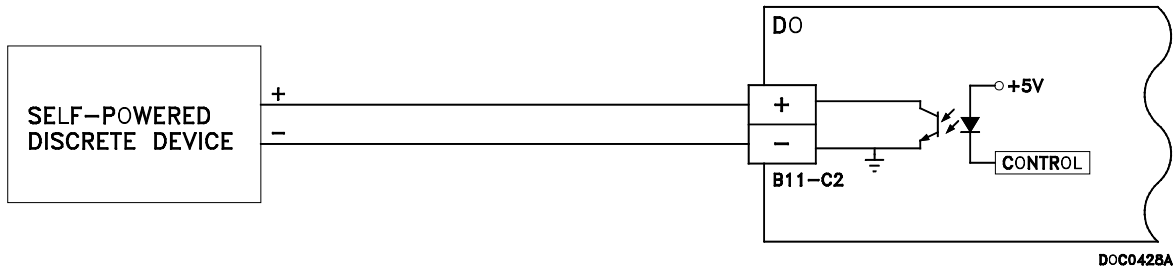
Figure 5-15. Selectable Circuit – Discrete Outputs

5.3.4.1 Built-In Discrete Output Wiring

A built-in Discrete Output is provided on the FloBoss Main Electronics Board in the P10 terminal block. Refer to Figure 5-16. The typical application for this output is a sampler or odorizer control, although it may be used for other purposes, such as a standard DO. This includes toggle mode, latched mode, and timed DO mode. The Discrete Output is accessed by the ROCLINK for Windows software as DO Point Number A4.

When the Sampler function is enabled, the FloBoss unit provides a Time Duration Output (TDO) based on the volume. A control volume and a pulse duration must be specified with the Sampler function. After each flow calculation, an internal volume accumulator is compared to the control volume. If the accumulator exceeds the control volume, a pulse is output and the accumulator is reduced by the control volume. This output may be used to drive an external totalizer, odorizer, gas sampler, or similar device.

The DO uses a P-channel Metal-Oxide-Semiconductor Field-Effect-Transistor (MOSFET) to switch current-limited (300 mAmp) battery power to the positive terminal. The negative terminal is internally connected to battery negative. A blocking diode, a 22-volt transorb, and a back-EMF diode protect the FloBoss electronics. Refer to Table 5-14.

Table 5-14. Discrete Output

Function	Output
Output Voltage during ON state	Battery voltage minus 0.7 volts
Output Voltage during OFF state	0 volts
Maximum Output Current	0.3 Amp
Maximum Voltage	22 volts (clamping occurs at this voltage)

Because the output is not isolated, care must be used to ensure that the operation of the load does not affect the operation of the FloBoss unit. This may include installation of back-EMF diodes and MOVs on the load. The load should be connected as in Table 5-15.

Table 5-15. Built-in Discrete Outputs Terminals

Terminal	Function
DO+	Positive load
DO–	Negative load
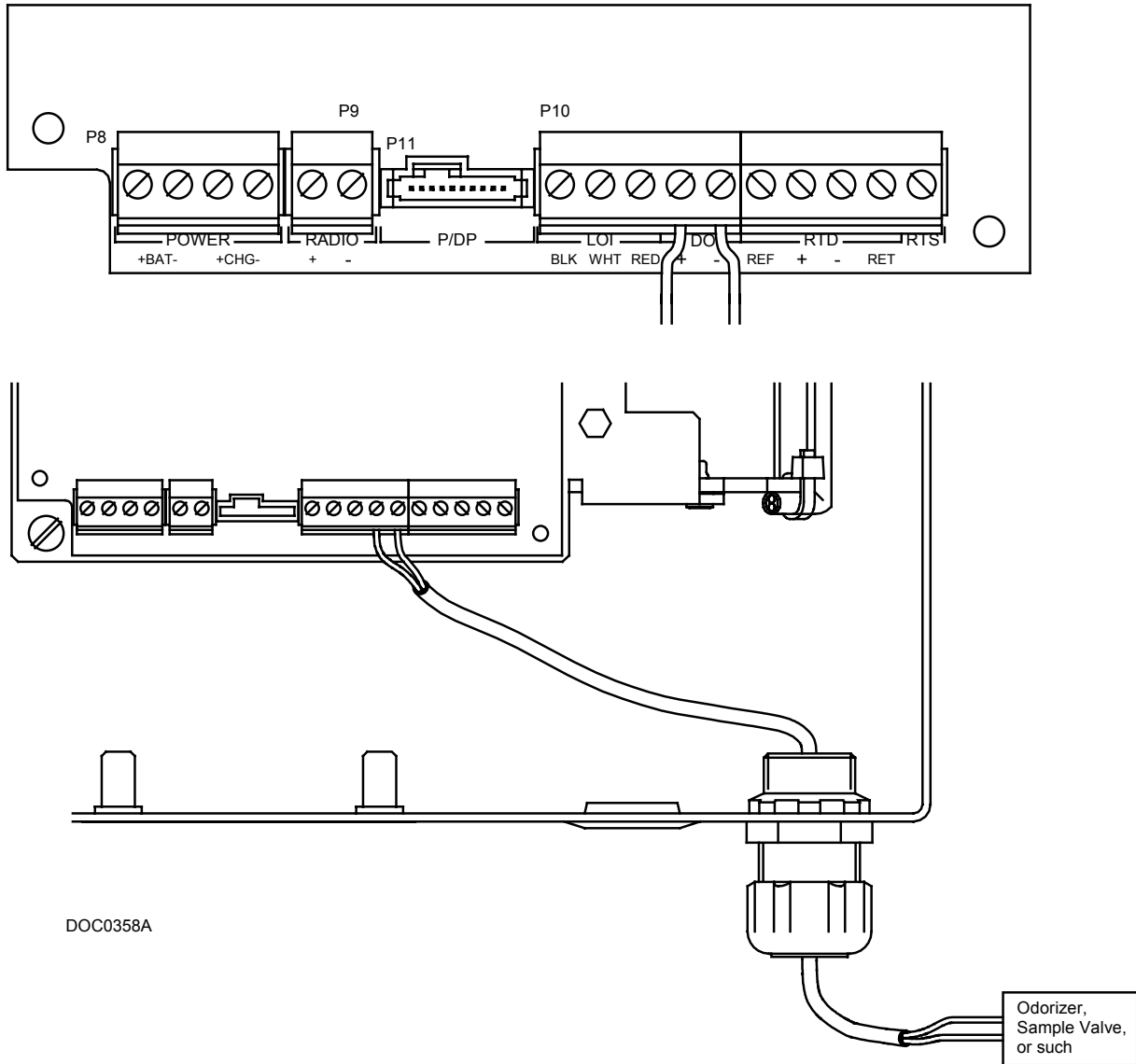
Figure 5-16. Built-in Discrete Output Terminal Wiring

5.3.5 Pulse Inputs

Pulse Inputs (PIs) count pulses from pulse-generating devices. The I/O Card Pulse Input circuits are physically the same as the Discrete Inputs. The Pulse Input, after the isolation, routes to a pulse accumulator, where the pulses are counted and accumulated.

Table 5-16 and Table 5-17 display the Pulse Input's number, the Point Number to which the AO is assigned in ROCLINK for Windows software, and the number printed on the I/O Card. In the case of the 24-channel card, the number in the software and on the label are the same.

Table 5-16. Pulse Inputs – 10-Channel

Pulse Input	Point Number	Label Number
4	B9	DI/1
5	B10	DI/2
6	B11	PI/1
7	B12	PI/2

The Pulse Inputs provided on the **10-channel I/O Card** are located at Point Number B11 and B12. The Pulse Input at Point Number B11 can operate at up to 50 Hz, with a maximum 50% duty cycle. The Pulse Input at Point Number B12 can operate at up to 10 kHz, with a maximum 50% duty cycle.

❖ **NOTE:** The Discrete Inputs located at Point Number B9 and Point Number B10 require the use of the two Pulse Inputs on the 10-channel I/O Card. Refer to Section 5.3.5.1, How to Use Pulse Inputs as Discrete Inputs, on page 5-20.

Table 5-17. Pulse Inputs – 24-Channel

Pulse Input	Point Number	Label Number
4	C5	PI/1
5	C6	PI/2

The PI channel has two field terminals. One terminal is a positive source voltage and the other is the signal return. The terminals are designated as in Table 5-18.

Table 5-18. Pulse Inputs Terminals

Terminal	Function
+	Positive Pulse Input (Sourced)
COMM	Common

To use the channel as a Pulse Input (shown in Figure 5-17), connect the "+" and "–" field wires to terminals "PI/1+" or "PI/2+" and "COM" on the FloBoss 500-series I/O Card Pulse Input channel. When the field device completes the circuit between "+" and "COM" terminals, the PI indicator LED on the termination board lights to show an active circuit, and the optical circuitry is triggered, producing a signal to the FloBoss 500-series unit.

❖ **NOTE:** FloBoss-powered means power is received from the Input, Output, or Module shown. External or self-powered means power is received from the device, a battery, the FloBoss Main Electronics Board, or another source.
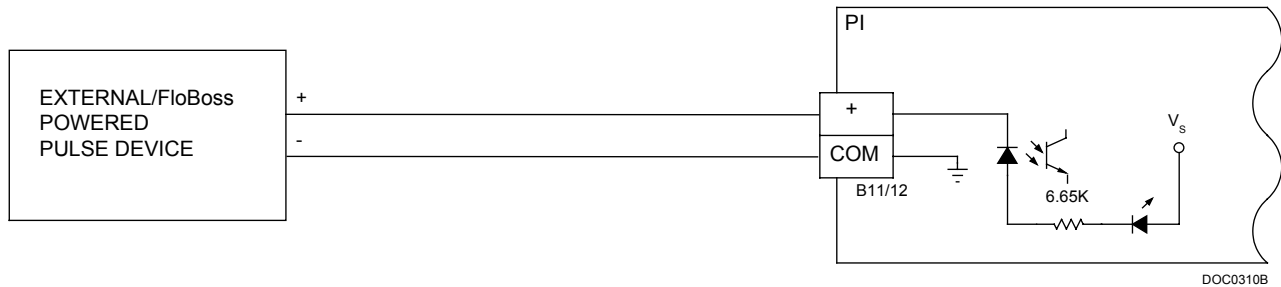
Figure 5-17. Pulse Input Wiring (10 Channel)
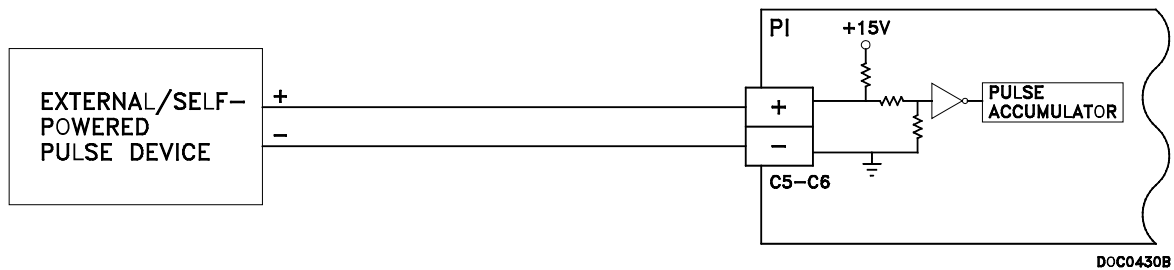
Figure 5-18. Pulse Input Wiring (24 Channel)

5.3.5.1 How to Use Pulse Inputs as Discrete Inputs

The two PI channels on the 10-channel card can be configured as both Pulse Inputs, both Discrete Inputs, or one of each in either order.

Table 5-19 displays the type of channels on the I/O Card and their respective Point Numbers.

Table 5-19. PI and DI Point Numbers – 10-Channel

Type	Point Number	I/O Card Location
Discrete Input	B7	DI/1
Discrete Input	B8	DI/2
Discrete Input	B9	PI/1
Discrete Input	B10	PI/2
Pulse Input	B11	PI/1
Pulse Input	B12	PI/2

The Point Number designation can be viewed when using ROCLINK for Windows software (Figure 5-19); in addition, these Point Numbers appear on a label to the left of the terminals on the I/O Card.

❖ **NOTE:** When using a PI as a DI, be careful to configure the correct Point Number. It may help to name the Pulse Input Tag field DISCRETE so you do not accidentally try to configure the Pulse Input when it is attached to a Discrete Input device.

To use a Pulse Input as a Discrete Input:

1. Make sure the I/O Card is installed correctly. Refer to Section 5.2, How to Install an I/O Card, on page 5-4.

2. Attach a PC to the LOI port on the FloBoss and launch ROCLINK for Windows software.

3. In ROCLINK for Windows, connect to the FloBoss 500-series unit.

4. Select Configure > I/O > **DI Points**.

5. Select:

   ♦ **Discrete Input 3** (Point Number **B9** to use PI/1 as a DI) in the Point Number field. Refer to Figure 5-19.

   ♦ **Discrete Input 4** (Point Number **B10** to use PI/2 as a DI) in the Point Number field. Refer to Figure 5-19.
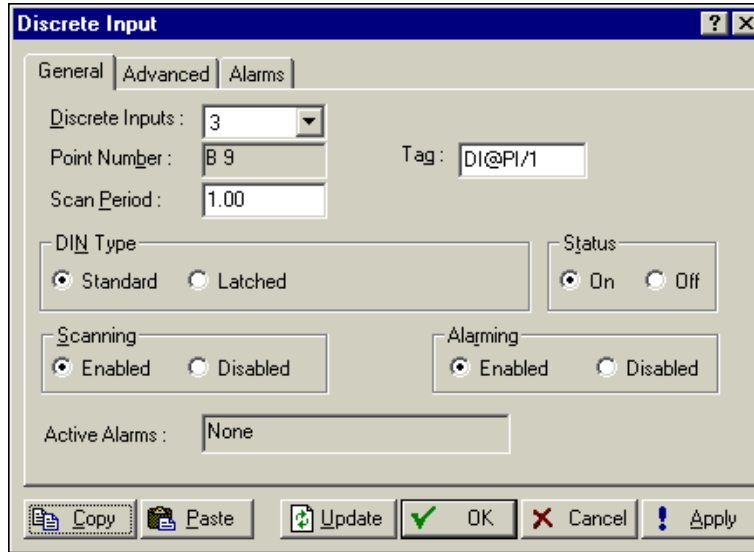
Figure 5-19. Pulse Input PI/1 used as a Discrete Input – 10-Channel

6. Type a name in the **Tag** field and configure the rest of the Discrete Input as detailed in the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

7. Wire the channel for the Discrete Input the same as described in Section 5.3.1, Discrete Inputs, on page 5-11.

❖ **NOTE:** There is no jumper or software switch to set to change a PI into a DI or back again Both software Point Numbers (such as B9 and B11) always exist for the same channel (in this case, PI/1). Make sure that the PI or DI point is configured for the channel's intended use.

5.4 I/O Card LEDs

Six LED indicators are located on the 10-channel I/O Card. When a specific PI, DI, or DO is active, then the corresponding LED lights. Refer to Table 5-20 and Figure 5-1.

Table 5-20. I/O Card LEDs – 10-Channel

Type	Point Number	I/O Card Location	LED
Discrete Output	B5	DO/1	CR6
Discrete Output	B6	DO/2	CR9
Discrete Input	B7	DI/1	CR4
Discrete Input	B8	DI/2	CR5
Discrete Input	B9	PI/1	CR2
Discrete Input	B10	PI/2	CR3
Pulse Input	B11	PI/1	CR2
Pulse Input	B12	PI/2	CR3

❖ **NOTE:** The 24-channel I/O Card does not have LEDs.

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5.5   RTD Wiring

The temperature is a direct input through the Resistance Temperature Detector (RTD) probe and circuitry. An RTD temperature probe mounts directly to the piping using a thermowell, outside the FloBoss enclosure. RTD wires should be protected either by a metal sheath or by conduit connected to a liquid-tight conduit fitting on the bottom of the enclosure. The RTD wires connect to the four screw terminals designated "RTD" on the Main Electronics Board. Refer to Figure 5-20.

The FloBoss unit provides terminations for a four-wire 100-ohm platinum RTD with a DIN 43760 curve. The RTD has an alpha equal to 0.00385. A three-wire or two-wire RTD probe can be used instead of a four-wire probe; however, they may produce measurement errors due to signal loss on the wiring.

Wiring between the RTD probe and the FloBoss unit must be shielded wire, with the shield grounded only at one end to prevent ground loops. Ground loops cause RTD input signal errors.

During operation, the RTD is read once per second. The value from the RTD is linearized, and then it is sent to processing as Analog Input (AI) Point Number A3. The AI routine converts this value to engineering units, performs calibration corrections, and checks alarming. The board temperature is monitored by the RTD routine. If the temperature has changed by roughly 5°C (9°F), the RTD circuitry is sent a command to re-calibrate its reference.

The RTD terminals on the Main Electronics Board are designated and defined in Table 5-21.

Table 5-21. RTD Terminals

Terminal	Function
REF	Current Source Reference
+	Signal Positive Input
–	Signal Negative Input
RET	Return (Common) Reference
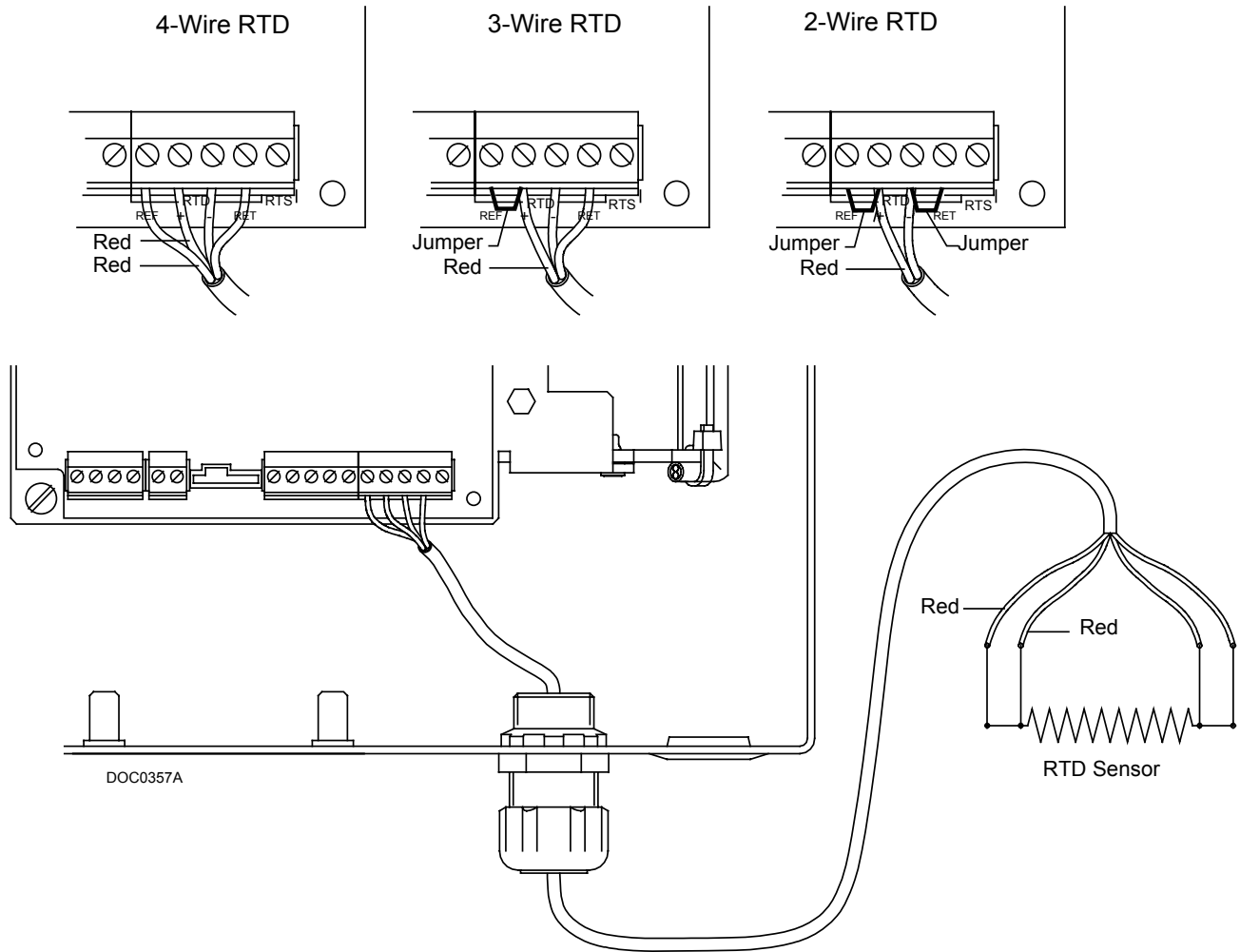
Figure 5-20. RTD Wiring Terminal Connections

As shown in Figure 5-20, the connections at the RTD terminals for the various RTD probes is defined as in Table 5-22.

Table 5-22. RTD Input Wiring

Terminal	4-Wire RTD	3-Wire RTD	2-Wire RTD
REF	Red	Jumper to +	Jumper to +
+	Red	Red, Jumper to REF	Red, Jumper to REF
–	White	White	White, Jumper to RET
RET	White	White	Jumper to –

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5.6 I/O Card Specifications

10-Channel I/O Card Specifications

DISCRETE INPUTS

Quantity/Type: Two contact-sense Discrete Inputs. Two additional DIs are available when Pulse Inputs are so configured (see Pulse Inputs below).

Terminals: "+" positive input; "COM" negative input (common).

Signal Current: 0.5 to 3.5 mA in the active (on) state, 0 to 0.2 mA in the inactive (off) state.

Isolation: 2500 V dc from processor.

Frequency: 50 Hz maximum.

Sample Period: 10 ms minimum.

DISCRETE OUTPUTS

Quantity/Type: Two dry-contact, solid-state relay outputs.

Terminals: "+" normally-open contact; "–" common.

Contact Rating: 24 V dc, 0.3 A maximum.

Isolation: 3000 V dc from processor.

Frequency: 5 Hz maximum.

PULSE INPUTS

Quantity/Type: Two sourced pulse counter inputs, one medium-speed and one high-speed. Both are also software-configurable as Discrete Inputs.

Terminals: "+" positive input, "COM" negative input (common).

Isolation: 2500 V dc from processor.

Frequency: Medium-speed input (B11) is 50 Hz maximum; high-speed input (B12) is 10 kHz maximum.

Signal Current: 0.5 to 3.5 mA in the active (on) state, 0 to 0.2 mA in the inactive (off) state.

ANALOG INPUTS

Quantity/Type: Three single-ended, voltage-sense Analog Inputs (current loop if scaling resistor is used).

Terminals: "+T" 12 or 24 V dc loop power, "+" positive input, "–" negative input (common).

Signal: 1 to 5 V dc, software configurable. 4 to 20 mA, with 250Ω resistor (supplied) installed across "+" and "–" terminals.

Accuracy: 0.1% over –40 to 65°C (–40 to 149°F) range.

Isolation: 2500 V dc from processor.

Input Impedance: 1 MΩ.

ANALOG INPUTS (CONTINUED)

Filter: Double-pole, low-pass.

Resolution: 12 bits.

Conversion Time: 200 µs.

Sample Period: 50 ms minimum.

ANALOG OUTPUT

Quantity/Type: One current loop signal output.

Terminals: "+" positive output and "–" common.

Range: 4-20 mA with 0 to 22 mA overranging.

Loop Resistance: 300 ohm maximum at 12 V dc. 600 ohm maximum at 24 V dc source voltage.

Resolution: 12 bits.

Accuracy: 0.1% of full-scale output.

Settling Time: 100 µs maximum.

Reset Action: Output goes to zero percent output or last value (software configurable) on power-up (warm start) or on watchdog timeout.

POWER

Input: 8 to 15 V dc (supplied by main processor card), 20 mA typical without I/O devices.

AI Loop: 12 or 24 V dc nominal provided for transmitter loop power from internal power converter. Available at "+T" terminal on each Analog Input channel.

FIELD I/O ISOLATION

1000 V minimum.

DIMENSIONS

21 mm by 137 mm by 160 mm (0.8 in H by 5.4 in W by 6.3 in L).

WEIGHT

0.4 kg (0.9 lb) nominal.

ENVIRONMENTAL

Meets the Environmental specifications of the FloBoss 500 unit in which the card is installed, including Temperature and Voltage Surge specifications.

APPROVALS

Covered by the CSA approval for the FloBoss 500-series unit in which it is installed.

24-Channel I/O Card Specifications

ANALOG INPUTS

Quantity/Type: Eight single-ended, voltage-sense Analog Inputs (current loop if scaling resistor is used).

Terminals: "+T" loop power, "+" positive input, "–" negative input (common).

Signal: 1 to 5 V dc, software configurable. 4 to 20 mA, with 250Ω resistor (supplied) installed in sockets on back of I/O Card.

Accuracy: 0.1% over –40 to 65°C (–40 to 149°F) range.

Isolation: 2500 V dc from processor.

Input Impedance: 1 MΩ.

Filter: Double-pole, low-pass.

Resolution: 12 bits.

Conversion Time: 200 µs.

Sample Period: 50 ms minimum.

ANALOG OUTPUT

Quantity/Type: Two current-loop signal outputs.

Terminals: "+" positive output and "–" common.

Range: 4-20 mA with 0 to 22 mA overranging.

Loop Resistance: 300 ohm maximum at 12 V dc source voltage.

Resolution: 12 bits.

Accuracy: 0.1% of full-scale output.

Settling Time: 100 µs maximum.

Reset Action: Output goes to zero percent output or last value (software configurable) on power-up (warm start) or on watchdog timeout.

DISCRETE INPUTS

Quantity/Type: Two contact-sense Discrete Inputs. Up to eight additional DIs available when Selectable DI/DO is so configured.

Terminals: "+" positive input; "–" negative input (common, shared between pair of DIs).

Signal Current: 0.5 to 3.5 mA in the active (on) state, 0 to 0.2 mA in the inactive (off) state.

Isolation: 2500 V dc from processor.

Frequency: 50 Hz maximum.

Sample Period: 10 ms minimum.

DISCRETE OUTPUTS

Quantity/Type: Two dry-contact relay outputs. Up to eight additional DOs available when Selectable DI/DO is so configured.

DISCRETE OUTPUTS (CONT'D)

Terminals: "NO" normally-open contact; "–" common.

Contact Rating: 30 V dc, 5 A maximum.

Isolation: 3000 V dc.

Frequency: 10 Hz maximum.

SELECTABLE DI/DO

Quantity/Type: Eight channels, individually switch-selectable as either a contact-sense DI or a solid-state relay DO.

Terminals: "+" positive input for DI or normally-open contact for DO; "–" common (shared between pairs of channels).

DI Signal Current: 0.5 to 3.5 mA in the active (on) state, group-sourced either from non-isolated or isolated on-board power (jumper selectable). 0 to 0.2 mA in the inactive (off) state.

DO Contact Rating: 120 V dc, 0.15 A maximum.

Isolation: 2500 V dc for DI; 3000 V dc for DO.

Frequency: 50 Hz maximum for DI; 5 Hz maximum for DO.

PULSE INPUTS

Quantity/Type: Two sourced, high-speed pulse counter inputs.

Terminals: "+" positive input, "–" negative input (common).

Isolation: 2500 V dc.

Frequency: 10 kHz maximum.

Signal Current: 0.5 to 3.5 mA in the active (on) state, 0 to 0.2 mA in the inactive (off) state.

POWER

Input: 8 to 15 V dc (supplied by main processor card), 40 mA typical without I/O devices.

AI Loop: 12 V dc nominal from internal power converter; 24 V dc can be supplied externally. Available at +T terminals of all AI channels.

FIELD I/O ISOLATION

1000 V dc minimum.

DIMENSIONS

21 mm H by 137 mm W by 160 mm L (0.8 in H by 5.4 in W by 6.3 in L).

WEIGHT

0.45 kg (1 lb) nominal.

24-Channel I/O Card Specifications (Continued)

ENVIRONMENTAL	APPROVALS
Meets the Environmental specifications of the FloBoss 503 or FloBoss 504 unit in which the card is installed, including Temperature and Voltage Surge specifications.	Covered by the CSA approval for the FloBoss 503 or FloBoss 504 unit in which it is installed.

SECTION 6 – SENSOR FOR FLOBOSS 503

This section describes the orifice-metering Dual-Variable Sensor (DVS), which provides differential pressure and static pressure inputs to the FloBoss 503 Flow Manager for orifice flow calculation.

The Multi-Variable Sensor (MVS) may also be used with the FloBoss 503. For information on installation of the MVS, refer to the *ROC/FloBoss Accessories Instruction Manual* (Form A4637). For information on configuration and calibration of the MVS, refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

❖ **NOTE:** The DVS Sensor is not equipped to provide a temperature input to the FloBoss. The DVS Sensor will only sense pressure and differential pressure when in use with a FloBoss 503. In both cases, temperature input comes into the FloBoss by means of the RTD input.

❖ **NOTE:** The FloBoss 503 firmware (must be version 2.30 or greater) allows the **RTD sensor either to be wired directly to the FloBoss 503 MCU** at the RTD input **or to be wired to the MVS sensor**. The firmware detects which method of wiring is in use at power-up. Refer to Section 5, Inputs and Outputs, of this manual for more information on the RTD input.

This section contains the following information:

6.1 Description of Sensor

The DVS Sensor, which uses Rosemount sensor technology, measures differential pressure and static pressure (absolute or gauge) by converting the applied pressure to electrical signals and making the readings available to the Main Electronics Board. The sensor housing screws into an adapter, and this, in turn, mounts with four bolts to the bottom of the FloBoss enclosure. The Sensor cable plugs directly into the Main Electronics Board at the P/DP connector.

The readings from the DVS Sensor are stored in Analog Inputs on the FloBoss 503. The differential pressure value uses the Analog Input (AI) Point Number A1, and the static pressure value uses the AI Point Number A2. If the alarm for either point is enabled, and the sensor fails to communicate during either initialization or operation, an alarm is entered in the Alarm Log.

The DVS Sensor uses an interrupt to inform the Main Electronics Board that it is ready for an update. This must occur at least once per second. The FloBoss 503 then converts this value and stores it in the proper analog input for access by other functions within the unit. If an update does not occur in the one second interval, the sensor is re-initialized. A point fail alarm is set if the sensor does not respond to the initialization.

6.2 Process Connections

Piping from the meter run connects to the DVS Sensor of the FloBoss 503 unit. Both the static and differential pressures pipe to female ¼-18 NPT connections on the bottom of the Sensor. The FloBoss 503 is an **upstream** device, meaning that the static pressure line normally connects to the high pressure side (labeled "H" on the sensor body) and the upstream values are normally calculated.

If you need to use the FloBoss 503 as a **downstream** device, refer to the *ROC/FloBoss Accessories Instruction Manual* (Form A4637).

6.3 Sensor Wiring

The FloBoss 503 and the Sensor ship from the factory with the wiring connected between them. This wiring consists solely of a ribbon cable from the Sensor, which plugs into the P/DP connector on the Main Electronics Board at P11. This ribbon cable fits into the P11 connector in only one direction.

⚠ CAUTION

Always turn off power to the FloBoss 503 before you connect or disconnect wiring. Wiring of powered equipment could result in personal injury or property damage.

6.4 Configuration

Use the ROCLINK for Windows configuration software to configure the DVS Sensor, meter run, and I/O. For more information, refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

6.4.1 Meter Run

To configure the meter run, select the Meter > Setup. This displays a screen that allows you to configure a flow calculation point. Figure 6-1 shows the Orifice Setup screen. For details concerning each parameter, refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

❖ **NOTE:** A FloBoss 503 supports 1992 AGA3 with AGA8 compressibility.

❖ **NOTE:** To select the API 5-5 Pulse Fidelity (Level A through Level E), use the Advanced tab Features pushbutton as described in the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).
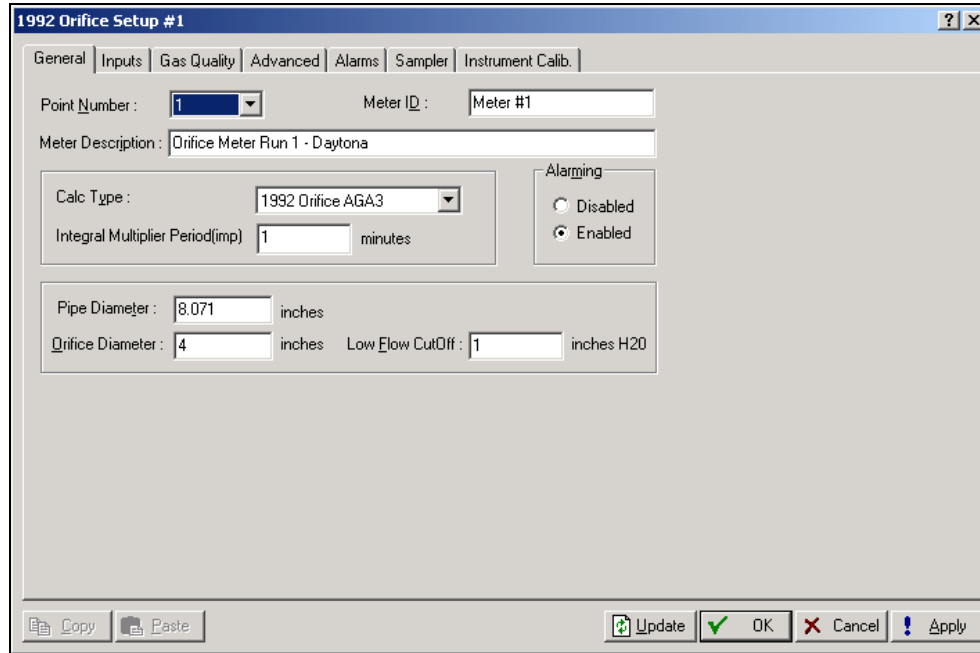
Figure 6-1. Orifice Meter Setup for FloBoss 503

6.4.2 Configuring Inputs

To configure parameters for the individual inputs associated with the Sensor and the flow calculation, use the ROCLINK for Windows Configure > I/O menu as described in the *ROCLINK for Windows Configuration Software User Manual* (Form A6091). The inputs and their Point Numbers are displayed in Table 6-1.

Table 6-1. Configuration Inputs

Input Type	Point Number	Reading
Analog Input	A1	Differential Pressure
Analog Input	A2	Static Pressure (Gauge or Absolute)
RTD	A3	Resistance Temperature Detector

The defaults contained within the Sensor are the initial pressures read. Refer to the Specifications table on page 6-4 or the lable for the initial ranges. You can change the ranges through the calibration routines. The turndown on the range should not be greater than the values in the Specifications table on page 6-4.

The Sensor also supports the conversion of values to metric units. To enter the metric mode, use ROCLINK for Windows software.

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The FloBoss automatically adjusts the units, ranges, alarm limits, and calibration factors of the differential pressure, static pressure, RTD, and enclosure/battery temperature to the Metric mode.

Points starting with "A" (such as A2) are associated with points either on the Main Electronics Board or on the Sensor that may be physically connected to external signals. Points starting with "B" or "C" are associated with the optional FloBoss 500-series I/O Cards.

The initial ranges are read from the defaults contained within the pressure sensor, such as 0 to 300 psig (depends on the sensor installed at the factory). The ranges can be changed through the calibration routines. Turndown is not recommended; however, if required the turndown on the ranges should not be greater than five.

6.5 DVS Specifications

Refer to the following pages for specifications of the DVS. For other specifications, see the Main Electronics Specifications in Section 1. MVS specifications are located in the *ROC/FloBoss Accessories Instruction Manual* (Form A4637).

Dual-Variable Sensor Specifications

DIFFERENTIAL PRESSURE INPUT

　Range: 0 to 62.2 kPa (0 to 250 in H_2O).

　Reference Accuracy: $\pm 0.075\%$ of span with a 10:1 of upper range limit turndown (includes linearity, hysteresis, and repeatability effects).

STATIC PRESSURE INPUT

　Range*: Either Absolute or Gauge:

　　0 to 5516 kPa (0 to 800 psia/psig).

　　0 to 25,000 kPa (0 to 3626 psia/psig).

　Reference Accuracy: $\pm 0.075\%$ of span with a 6:1 of upper range limit turndown (includes linearity, hysteresis, and repeatability effects). For spans with more than 6:1 turndown, contact factory.

　Stability: $\pm 0.1\%$ of upper range limit for 12 months.

PROCESS CONNECTIONS

　1/4-18 NPT on 2-1/8 in centers, located on bottom of Coplanar flange.

CONSTRUCTION

　316 SST*. Wetted O-rings are glass-filled TFE. Coupler is stainless steel (CF8M).

ENVIRONMENTAL AND OTHER SPECS

　Meets the Environmental specifications of the FloBoss 500-series unit, including Temperature and Voltage Surge specifications.

Note: *Consult factory for special ranges and materials that may be available.

SECTION 7 – SENSOR FOR FLOBOSS 504

This section describes the Sensor Module (SM), which provides pulse count and static pressure inputs to the FloBoss 504 Flow Manager for the turbine-metered flow calculation. Note that the SM is not equipped to provide a temperature input to the FloBoss; this input comes directly into the FloBoss from an RTD, by means of the built-in RTD input.

This section contains the following information:

7.1 Description of Sensor Module

The primary function of the FloBoss 504 is to measure the flow of natural gas using turbine metering in accordance with the American Gas Association (AGA), American Petroleum Institute (API), and International Standards Organization (ISO) standards. When performing AGA7 calculations, the FloBoss uses 1992 AGA8 compressibility. When performing ISO 9951 calculations, the FloBoss uses ISO 12213-2 compressibility. Five levels of pulse integrity checking (Level A through Level E) are available with either calculation scheme.

The Sensor Module provides volumetric flow measurement for a turbine meter used to measure the flow in a single meter run and can be configured for Metric or US units of measurement. The Sensor Module provides terminals for its pulse counter (PI) inputs from a turbine meter, and senses static (line) and auxiliary pressures from direct process connections.

The SM can count pulses acquired from a turbine meter, read and convert pressure, store the pulse count and the pressure values temporarily, and communicate the values to the FloBoss. The inputs are used to determine an instantaneous flow and energy rate. At the end of the Base Multiplier Period, the accumulated inputs are averaged or totalized and stored in history.

The primary inputs used for turbine flow measurement are Pulse Input (PI) counts, static pressure, and temperature. The Pulse Input counts are acquired from a turbine meter, the static pressure (including auxiliary pressure) inputs come from the Sensor Module, and the temperature input is read from an RTD probe. After the static pressure and auxiliary pressure values are read, the board temperature is read and compensation is applied to the pressure inputs if necessary. The inputs are read by the FloBoss processor at the following rates:

- Pulse counts are sampled once per second.
- Static pressure is sampled once per second.
- Temperature is sampled and linearized once per second. The RTD is internally re-calibrated for every 5°C (9°F) temperature change as sensed by enclosure (battery) temperature.

The Sensor Module measures static pressure by converting the applied pressure to electrical signals; in addition, it counts (and checks) pulses applied to its Pulse Input terminals. A factory-installed ribbon cable (see Figure 7-1) that plugs into the Main Electronics Board at P/DP enables all readings from the sensor to be available to the Main Electronics Board. The readings from the SM are configured as two Analog Input points and two Pulse Input points.

Table 7-1. Analog and Pulse Inputs

Input Type	Point Number	Reading
Analog Input	A1	Auxiliary Pressure
Analog Input	A2	Line (Static) Pressure
Pulse Input	A5	Pulse Count
Pulse Input	A6	Auxiliary Pulse Input

Standard PI and AI alarming are implemented, along with sensor and flow alarms. If the sensor fails to communicate, either during initialization or run time, the Failure bit in the Pulse Input and Analog Input alarm code is set. If alarms are enabled, an alarm is also entered in the Alarm Log.

The sensor measurement in the SM for the static and auxiliary pressure inputs can be any combination of these ranges listed in Section 7.5. Read the label on the SM to know the specific pressure ranges.

The SM informs the Main Electronics Board that it is ready for an update at least once per second. The FloBoss converts this value and stores it in the proper Pulse Input and Analog Input for access by other functions within the FloBoss. If an update does not occur in ten seconds, the sensor is re-initialized. A Point Fail alarm is set if the sensor does not respond to the initialization. Calibration is performed through the PI and AI routines.

As described in Section 7.4, use ROCLINK for Windows Configuration Software to configure all Analog Input and Pulse Input points required for turbine metering. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) for detailed information.
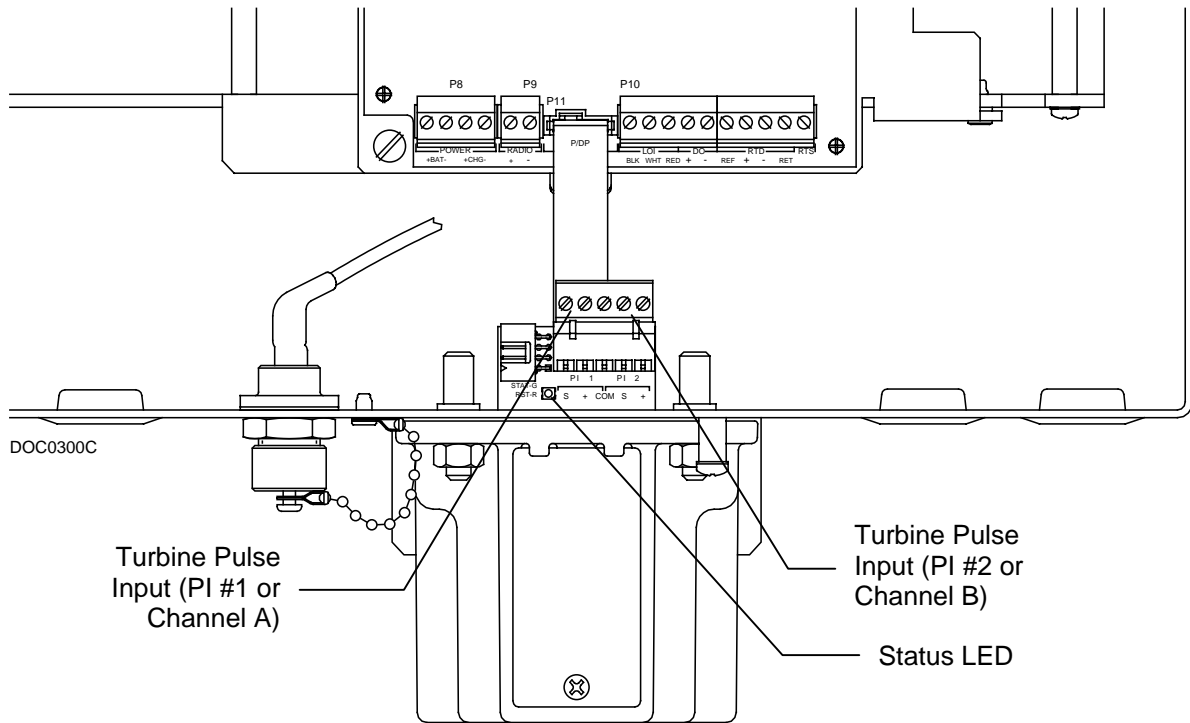
Figure 7-1. Sensor Module

7.1.1   Pulse Inputs

The SM is capable of handling two channels (points) for Pulse Inputs. The first Pulse Input (PI) is used to calculate the flow based on counts acquired from a turbine meter. This Pulse Input is located at P1 on the SM.

The second Pulse Input, called the auxiliary PI, is typically used to perform Level A, B, or C pulse integrity checking. When pulse integrity checking is not in use, you may use the auxiliary PI in other ways, such as calculating a correction value for a meter or calculating odor injection. This Pulse Input is located at P2 on the SM.

Table 7-2. Pulse Inputs

Input Type	Point Number	Reading
Pulse Input	A5	Pulse Count
Pulse Input	A6	Auxiliary Pulse Input

The Pulse Input circuitry is based upon a two-stage Schmidt trigger inverter. Also provided is a source voltage for open collector/drain turbines and for dry contacts. This source voltage is a nominal 12 volts open circuit; it provides approximately one milliAmp in shorted or closed contact positions. The source voltage is load dependent. **Note that the circuit does not supply sufficient power for a pre-amp.**

Connect an external amplifier (pre-amp) to the field terminations to provide gain for low-level turbine signals. The amplifier receives power through a source voltage (other than the SM) and the amplifier output connects to the "+" input signal. If the gain of the amplifier were 40, 100-millivolt signals are amplified to 4 volts, which is above the 3.5-volt active threshold.

The pulses accumulate in a 32-bit register that rolls over when the 25th bit is set. Only 24 bits are sent to the FloBoss for updates.

The inputs for the Pulse Inputs are acquired from devices, such as a turbine meter. Refer to the product specifications in Section 7.5 for details concerning pulse frequency and phase, which vary depending on the level of integrity checking you are performing. The SM accepts the signals, shapes and filters them, and sends the values to the MCU. The Pulse Input connectors consist of a 5-pin removable terminal block with screw-type compression connectors.

7.1.2   Analog Inputs

The static (line) pressure and auxiliary pressure readings from the SM sensors are configured as two Analog Input points in the FloBoss. The pressure circuitry uses a 16-bit A/D converter. The circuitry is designed to use as much range of the reference as possible. The sensors measurement ranges are listed in Section 7.5.

The 16-bit values are converted to 24-bit values (23 bits plus a sign bit) for transmitting to the MCU.

Table 7-3. Analog Inputs

Input Type	Point Number	Reading
Analog Input	A1	Auxiliary Pressure
Analog Input	A2	Line (Static) Pressure

7.1.3   Sensor Module Connection

The connection between the SM and the main electronics board is achieved entirely by means of a ribbon cable plugged in at the P/DP connector. In addition to all the signals, a 12 volt power supply from the FloBoss is made available to the SM through the P/DP interface cable. The voltage of this power follows the battery voltage of the unit. This supply operates under very low currents with an efficiency of 60 to 90 percent, depending upon the current draw.

7.2   Process Connections

The process inputs are the static and auxiliary pressure connections, which are located on the bottom of the SM housing. Refer to Figure 7-2.

The static pressure connection is made to the front tap (labeled "1"), and the auxiliary pressure connection is made to the rear tap (labeled "2"). The static pressure connection is required for the AGA7 flow calculation; the auxiliary pressure sensor can be used for measuring any other pressure within its specified range, or it may be left unused. Both pressure connections are ¼-18 NPT.

CAUTION

Be sure to use a pipe thread compound suitable for stainless steel, or galling may occur.
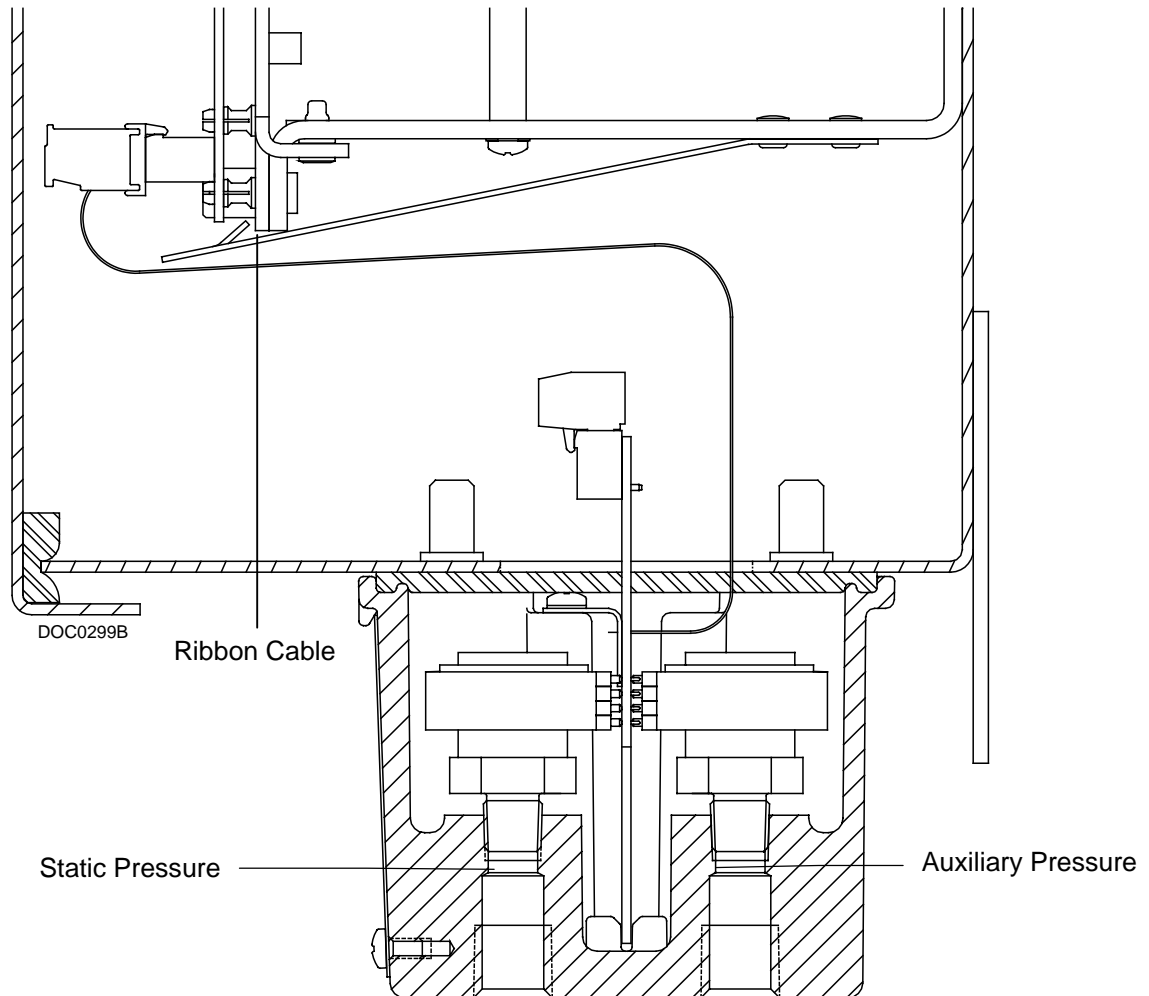
Figure 7-2. Side Cut-away View Showing Process Connections

7.3 Sensor Wiring

The only field wiring connections to the SM are for the two Pulse Input channels. Like the standard field wiring, the wiring terminals for these inputs are accessed by opening the door of the FloBoss 500 enclosure. The terminal designations (S, +, and COM) are printed on the circuit board directly below each terminal as shown in Figure 7-1. PI 1 (Channel A) is located at the left three terminals of the terminal block; PI 2 (Channel B) is located at the right three terminals. The Pulse Input (PI) terminals are detailed in Table 7-4.

When connecting the SM for Level A, B, or C pulse integrity checking, use both Pulse Inputs; the order does not matter. When connecting the SM for Level D or E pulse integrity, either channel may be used to acquire pulse counts (in fact, the pulse count could even come from an I/O card). The unused PI may be used in other ways, such as for calculating odor injection.

⚠ CAUTION

Always turn off the power to the FloBoss unit before you attempt any type of wiring. Wiring of powered equipment could result in personal injury or property damage.

To avoid circuit damage when working with the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

Table 7-4. PI Connections on the SM

Terminal	Primary Turbine Pulse Input #1 (P1 Left Position)
SOURCE 1 (S)	Pulse #1 source for open collector/drain or dry contacts only.
PULSE 1 (+)	The positive side of the first Pulse Input (Channel A). This PI is identified as Point Number A5 when configuring.
COMMON (COM)	Power supply and circuit common (shared with PI #2).
	Auxiliary Turbine Pulse Input #2 (P2 Right Position)
COMMON (COM)	Power supply and circuit common (shared with PI #1).
SOURCE 2 (S)	Pulse #2 source for open collector/drain or dry contacts only.
PULSE 2 (+)	The positive side of the second Pulse Input (Channel B). This PI is identified as Point Number A6 when configuring.

The actual wiring connections for the Pulse Input counter depend on the application. Refer to the following figures for typical hook-ups.

A FloBoss powered Pre-amp (such as an universal type) can be accommodated by wiring the device as shown in Figure 7-3. If a dual pulse train is required, wire the second PI channel in the same manner.

As shown in Figure 7-4, a FloBoss powered field device that uses a switch to ground (a "shorting" switch) can be accommodated by wiring the device between the "+" and COM terminals and also connecting the "S" and "+" terminals together. Note that although the power for the pulse device is shown coming from power terminals on the FloBoss, another suitable 12-volt source could be used (but **not** the "S" terminal on the SM Pulse Input).

The field device is assumed to be opening and closing an isolated switch of some type. The SM supplies the power to handle this wiring scheme.

The pulse device is typically a self-powered device with a built-in amplifier.

❖ **NOTE:** FloBoss-powered means power is received from the Input, Output or Module shown. External/Self-powered means power received from the device, a battery, the FloBoss main electronics board, or another source.
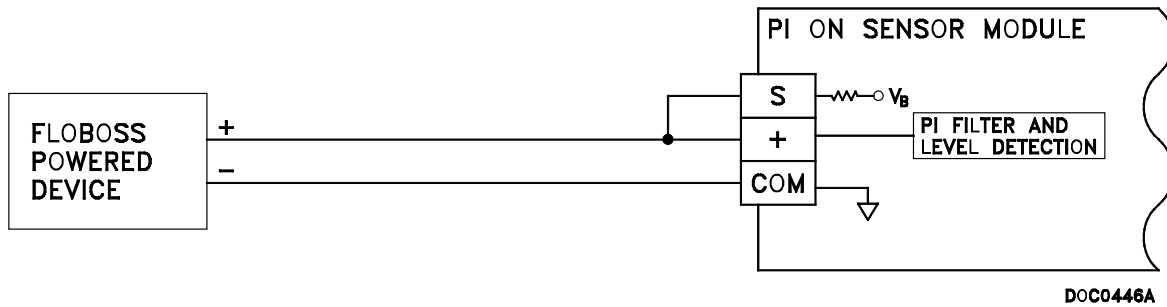
Figure 7-3. Pulse Input from FloBoss Powered Device
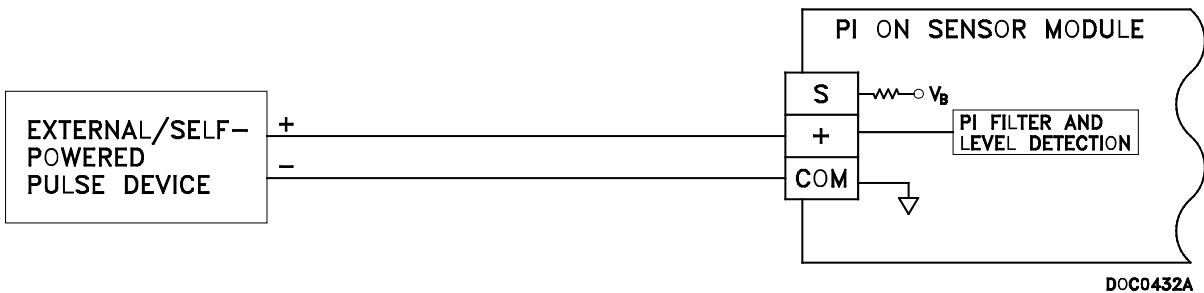
Figure 7-4. Pulse Input from FloBoss Powered Device

❖ **NOTE:** On External/Self-powered wiring, locate an external fuse close to the power connector on the battery, the FloBoss main electronics board, or another source.

7.4   Configuration

Use ROCLINK for Windows Configuration Software to configure the meter run and inputs associated with the SM. For configuration procedures, refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

7.4.1   Meter Run

To configure the meter run, select the Meter > Setup. This displays a screen that allows you to configure a flow calculation point. Figure 7-5 shows the Turbine Setup screen for an ISO 9951 flow point. The parameters shown in this screen are described following the figure. For details concerning each parameter, refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

❖ **NOTE:** A FloBoss 504 supports 1992 AGA8 compressibility (depending on which firmware Flash was installed). ISO 12213-2 compressibility is supported by all 504 firmware options.

❖ **NOTE:** To select the ISO 6551 / API 5-5 Pulse Fidelity (Level A through Level E), use the Advanced tab as described in the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).
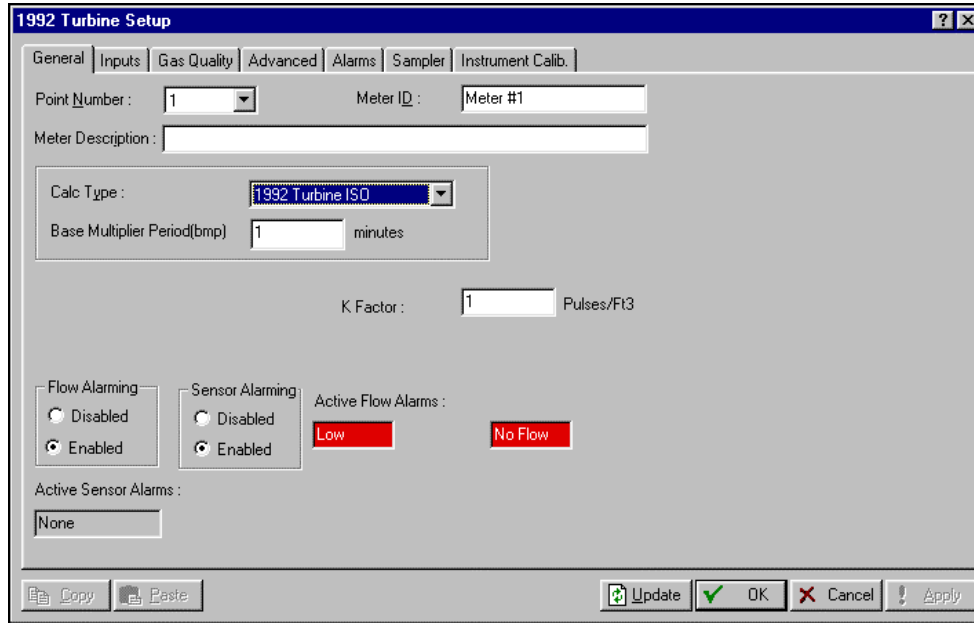
Figure 7-5. Turbine Meter Setup for FloBoss 504 (ISO 9951 shown)

7.4.2   Configuring Inputs

To configure parameters for the individual inputs associated with the SM and the flow calculation, use the ROCLINK for Windows Configure > I/O menu as described in the *ROCLINK for Windows Configuration Software User Manual* (Form A6091). The inputs and their Point Numbers are displayed in Table 7-5.

Table 7-5. Configuration Inputs

Input Type	Point Number	Reading
Analog Input	A1	Auxiliary Pressure
Analog Input	A2	Static Line Pressure
RTS	A3	Temperature on the FloBoss Main Electronics Board
Pulse Input #1 (Channel A)	A5	Pulse Count*
Pulse Input #2 (Channel B)	A6	Auxiliary Pulse Input*
"Pseudo" Pulse Input	A7	Corrected Pulse Count created by the firmware for Level A metering*

* NOTE: When configuring parameters for the Pulse Input identified in the Meter > Setup, be sure to setup the Conversion factor and Advanced parameters to match the flow calculation results (MCF/Day or 1000 m^3/Day). For example, if your turbine meter produces 100 pulses/ft^3, then enter 100,000 in the Conversion field of the Pulse Input screen and select Rate Period, EU/day, and Conversion Pulses/EU in the Pulse Input > Advanced parameters dialog. Otherwise, the calculation of Instantaneous Flow and Instantaneous Energy will not be performed correctly. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091).

Points starting with "A" (such as A2) are associated with points either on the Main Electronics Board or on the SM that may be physically connected to external signals. Points starting with "B" or "C" are associated with the optional FloBoss 500-series I/O Cards.

The initial ranges are read from the defaults contained within the pressure sensor, such as 0 to 300 psig (depends on the sensor installed at the factory). The ranges can be changed through the calibration routines. Turndown is not recommended; however, if required the turndown on the ranges should not be greater than five.

7.5 Sensor Module Specifications

For other specifications, refer to the Specifications tables in Section 1.

Sensor Module Specifications

PULSE COUNTER INPUTS

Quantity and Type: Two voltage-sensing inputs.

Field Wiring Terminals: S, +, COM.

Source Power: Voltage is 12 V dc maximum; current is 1 mA maximum (designed for contact closure device).

Range: Inactive, 0 to 1.0 V dc; active, 3.5 V dc minimum.

Minimum Pulse Width: 100 μsec under 1 kHz.

Frequency and Phase:

For Level A integrity, phase between pulse inputs must be between 45°C (315°F) and frequency between 101 and 2000 Hz, qualified as follows:

♦ 45°C (315°F), 1250 Hz maximum.
♦ 90°C (270°F), 1500 Hz maximum.
♦ 180°C (356°F), 2000 Hz maximum.

For Level B integrity, phase must be between 45°C (315°F) and frequency between 101 and 3000 Hz, with Level B phase error at 15% maximum. For Level C, D, or E integrity, frequency is 10 kHz maximum.

INTEGRATED PRESSURE INPUTS (OPTIONAL)

Quantity and Type: Up to two pressure sensors, selected from ranges in table below. All are gauge pressure inputs, except for the 0 to 1000 PSI sensor.

Accuracy (Typical)[2]: ±0.5% of span from –20 to 50°C (4 to 122°F).

CONSTRUCTION

Housing is 316 SST with Poron™ gasket between housing and controller enclosure.

PROCESS CONNECTIONS

1/4-18 NPT female on 1.56-inch center, located on bottom surface.

WEIGHT (FLOBOSS 504)

10.4 kg (23 lb) nominal, including SM, but excluding batteries (not supplied). AC Power Supply adds 0.82 kg (1.8 lb).

ENVIRONMENTAL

Meets Environmental Specifications for the FloBoss 504 main electronics.

APPROVALS

Approved by CSA as Model W40079 for hazardous locations Class I, Division 2, Groups A, B, C, and D.

Pressure Input Range	Accuracy (-20 to 50°C)[3] (-4 to 122°F)[3]	Proof Pressure	Burst Pressure
0 – 5 PSIG (0 – 35 kPa)	± 0.5%	15 PSIG (103 kPa)	25 PSIG (172 kPa)
0 – 30 PSIG (0 – 207 kPa)	± 0.5 %	90 PSIG (620 kPa)	150 PSIG (1034 kPa)
0 – 100 PSIG (0 – 689 kPa)	± 0.5 %	300 PSIG (2068 kPa)	500 PSIG (3447 kPa)
0 – 300 PSIG (0 – 2068 kPa)	± 0.5 %	900 PSIG (6205 kPa)	1500 PSIG (10340 kPa)
0 – 500 PSIG (0 – 3447 kPa)	± 0.5 %	1200 PSIG (8273 kPa)	2400 PSIG (16540 kPa)
0 – 1000 PSIA (0 – 6894 kPa)	± 0.5 %	3000 PSIA (20680 kPa)	5000 PSIA (34470 kPa)

1. Better accuracy is available using a FloBoss 500-series I/O Board with off-board transmitters.

2. See Pressure Input Accuracy spec above for full operating temperature ranges.

SECTION 8 – CALIBRATION

This section describes how to calibrate the FloBoss 503 and FloBoss 504 Flow Managers.

This section contains the following information:

8.1 Calibrating the FloBoss

Use ROCLINK for Windows software to perform initial calibration or re-calibration, such as after a change in an orifice plate in the meter run handled by the FloBoss. The calibration procedure allows you to perform a 5-point (minimum, maximum, and up to three intermediate points) calibration of the Analog Inputs associated with the flow calculation (static pressure and temperature).

Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) and *ROC/FloBoss Accessories Instruction Manual* (Form A4637) for details.

The Calibration routine provides Verify, Calibrate, and Zero Shift functions for each input of the meter run as applicable. You can calibrate Differential Pressure (orifice metering only; may be High or Low Differential Pressure, depending on the device), Static Pressure, or Temperature. Calibration parameters include Set Zero, Set Span, and Set Midpoint 1, 2, and 3. This allows you to specify the low calibration point between the Zero and Span endpoints. The Zero and Span endpoints are used in setting the Midpoints. Midpoints 1, 2, and 3 are values set between the Zero and Span values.

All new calibration values are automatically logged in the Event Log.

> ❖ **NOTE:** When calibrating Stacked Differential Pressure, you may calibrate either the low differential pressure (Low DP) input or the high differential pressure (Diff Pressure) input.

> ❖ **NOTE:** Click **Cancel** to exit the calibration without saving the changes. The previous calibration settings are retained.

> ❖ **NOTE:** During calibration, the FloBoss time-outs and disconnects if it is left idle for an extended period. You lose calibration values and must reconnect to start calibration from the beginning.

Perform the following steps:

1. Launch **ROCLINK for Windows** software and connect to the FloBoss 503 or FloBoss 504.

2. Perform one of the following:

   ♦ Select the **Meter Calibration** tab from Quick Setup.

   ♦ Select Meter > **Calibration**.

   ♦ Select Configuration > I/O > AI Points > **AI Calibration** tab in the Analog Inputs screen.

   This opens the Meter Calibration window as in Figure 8-1. The current reading displays under each meter input as the Freeze Value. The FloBoss uses these values in the flow calculations while calibrating the points.

   > ❖ **NOTE:** The Freeze Value function occurs automatically when using Quick Setup.

3. Click **Freeze** to stop the values of the Differential Pressure, Low Differential Pressure (labeled Low DP), Static Pressure, and Temperature from being updated during verification or calibration. This effectively "freezes" the values used in ongoing processing, such as history logging, while calibration is being performed. This effectively "freezes" the values (**Freeze Values**) used in ongoing processing, such as history logging, while calibration is being performed.
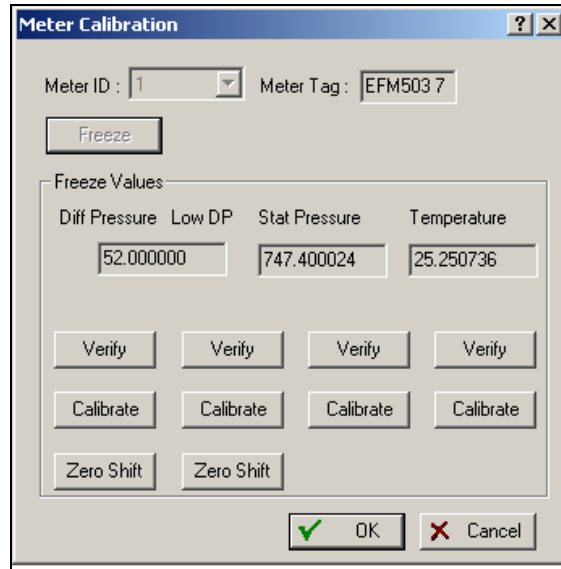
Figure 8-1. Meter Calibration

4. If desired, select and specify a **Calibration Report File**. Select **Yes** to create a report text file containing calibration and verification details. Select **No** to continue without creating a report. If you select Yes, another dialog box appears.

5. Type the name of the Calibration Report File in the **File name** field and use the extension `.cal` to represent calibration. The Calibration Report File is created in the default directory `C:/Program Files/ROCLINK for Windows/Data`, unless you specify otherwise another Directory/Drive before you click Save. The report can be viewed using a text editor.

6. Click **Save**.

If you are calibrating a pressure input, read the following Caution, and then isolate the Sensor from the process. If you are calibrating a temperature input, proceed to Step 8.

⚠ CAUTION

Open the by-pass valve on the valve manifold prior to isolating the sensor from the process, to protect the differential cell of the Sensor. This will keep one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. This should be done whether you are calibrating differential or static pressure. Refer to Figure 8-2 for the recommended sequence.
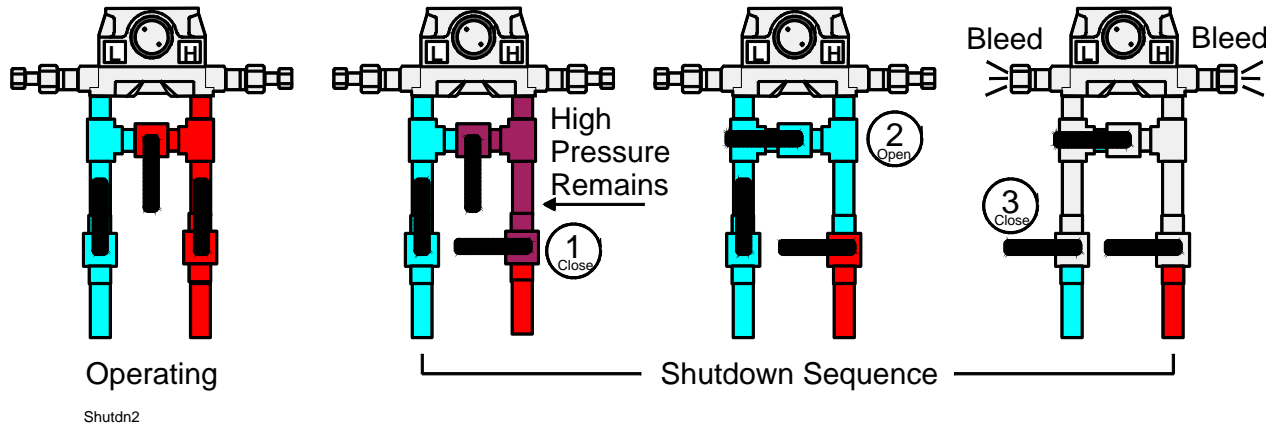
Figure 8-2. Removing the Sensor from Service

7. If you are calibrating a pressure input, **setup** the **pressure calibrator** and make the necessary connections to the Sensor.

8. If you are calibrating a temperature input, **disconnect** the **RTD** sensor and connect a decade box (or comparable equipment) to the RTD terminals of the FloBoss.

9. Click **Calibrate** under the desired input to calibrate Diff Press, Stat Press, or Temperature. This displays the Set Zero calibration window as in Figure 8-3.
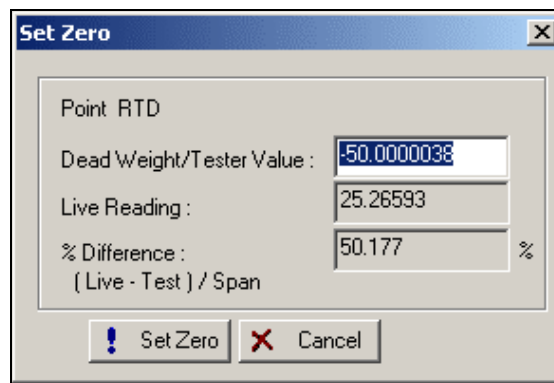
Figure 8-3. Set Zero Calibration for Differential Pressure

10. Calibrate the zero value (0% of range) for Differential Pressure (orifice only), Static Pressure, or Temperature. This should correspond with the 0% Count and is the low value for the meter run. Enter applied value in the **Dead Weight/Tester Value** (in engineering units) field of the Set Zero dialog. This should be a 0 (zero) value. For a pressure input, this would typically be open to atmosphere. For static pressure on an absolute-pressure device, remember to enter the actual current atmospheric pressure, such as 14.73 psi. Refer to Figure 8-3.

❖ **NOTE:** The **% Difference (Live - Test) / Span** is the percentage of difference of the Live Reading divided by the Span.

11. When the Live Reading is stable, click **Set Zero** to calibrate the zero reading. The Set Span window appears as in Figure 8-4.
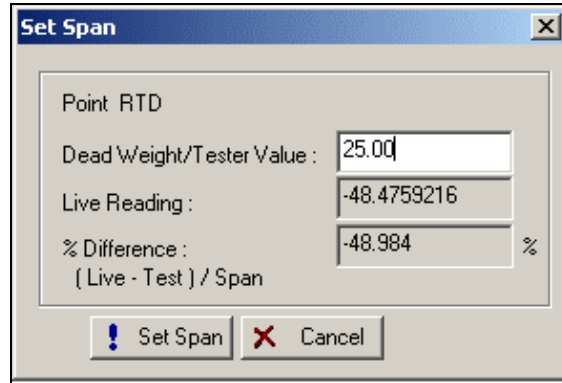
Figure 8-4. Set Span

12. Calibrate the span value (100% of range) for Differential Pressure (orifice only), Static Pressure, or Temperature. Enter the **Dead Weight/Tester Value** (in engineering units). This should correspond with the 100% Count and is the **high value** to the input (the top end of the expected operating range). To maintain rated accuracy, be sure to observe the turndown limits listed in the Sensor Specifications table.

♦ If you are calibrating the Diff Press input, and the Sensor is configured for Downstream operation, apply the calibrator pressure to the low (labeled "L") side of the sensor. Enter the value as positive and the Live Reading appears as a negative value. ROCLINK for Windows software automatically compensates.

♦ Static pressure for Downstream is calibrated the same as for Upstream.

♦ For static pressure on an absolute-pressure device, add the actual atmospheric pressure, such as 300 + 14.73.

13. When the Live Reading is stable, click **Set Span** to calibrate the high reading. The window advances to the Set Midpoint 1 window as in Figure 8-5.
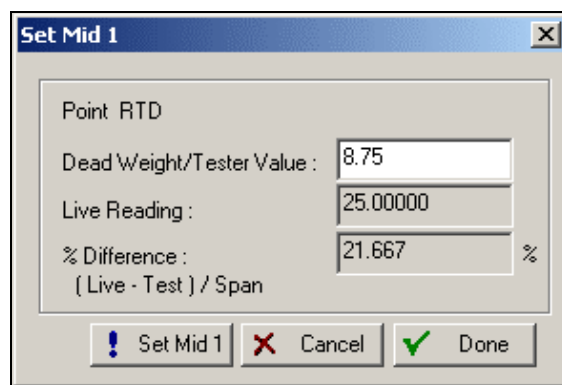
Figure 8-5. Set Midpoint 1
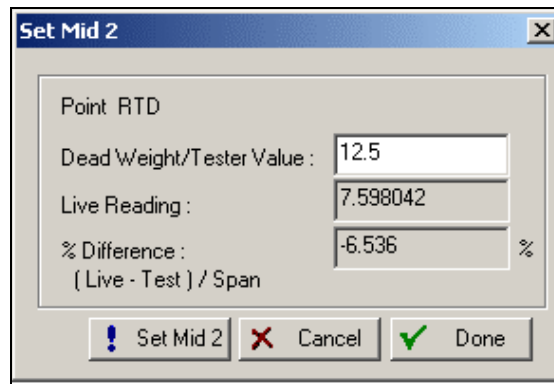
14. To perform a two-point calibration, click **Done**. Calibration for this input is complete.

15. If desired, calibrate Midpoint 1 (such as 25% of range) for the Differential Pressure (orifice only), Static Pressure, or Temperature. Enter the **Dead Weight/Tester Value** (in engineering units). Midpoint 1 allows you to specify the low calibration point between the Zero and Span endpoints. The Zero and Span endpoints you recently established are used in setting the Midpoints. **Midpoints 1, 2, and 3 are values set between the Zero and Span values**.

Midpoint 1 should have the lowest value of the three midpoints and should be between the Zero and Span values. **Midpoints should be entered in order from smallest to largest or vice versa**.
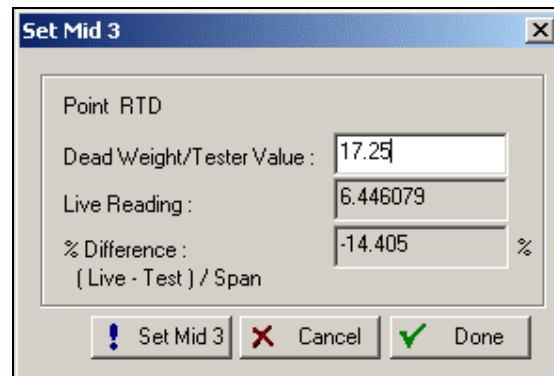
16. When the Live Reading is stable, click **Set Mid 1** to calibrate this reading. The display advances to the Set Midpoint 2 window as in Figure 8-6.

Figure 8-6. Set Midpoint 2

17. To perform a three-point calibration, click **Done**. Calibration for this input is complete.

18. To calibrate additional midpoints, apply the desired pressure or temperature and enter the applied value in the **Dead Weight / Tester Value** (such as 50% of range) field.

19. When the Live Reading is stable, click **Set Mid 2** to calibrate this reading. The display advances to the Set Midpoint 3 window as in Figure 8-7.

Figure 8-7. Set Midpoint 3

20. To perform a four-point calibration, click **Done**. Calibration for this input is complete.

21. To calibrate a third midpoint, apply the desired pressure or temperature and enter the applied value in the **Dead Weight / Tester Value** (such as 75% of range) field.

22. When the Live Reading is stable, click **Set Mid 3** to calibrate this reading. The display returns to the Meter Calibration window.

When the calibration for a selected point is complete, you have the choice to calibrate another input or to complete the calibration. If calibration is complete, and you calibrated pressure inputs, read the following Caution and then return the Dual-Variable Sensor to service.

⚠ CAUTION

Do NOT close the by-pass valve on the valve manifold until after process pressure has been reapplied, to protect the differential cell of the Sensor. This will keep one side of the differential sensor from being subjected to high pressure while the other side has no pressure applied. Refer to Figure 8-8.
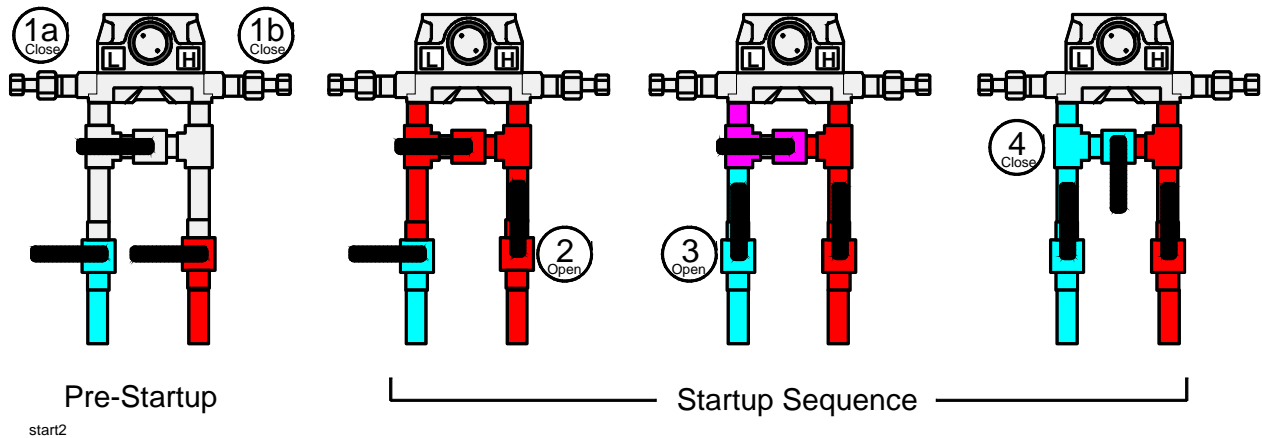
Figure 8-8. Returning the Sensor to Service

❖ **NOTE:** If you calibrated the Differential Pressure input, refer to Section 8.1.1, Zero Shift, before completing the last step.

23. Finally, click **Done** to cause the calibration window to close, cancel freeze values (unfrozen), and enable live readings for use in the flow calculations. The Event Log records all calibration settings that were changed.

8.1.1 Zero Shift

If desired, use the Zero Shift procedure after calibrating the pressure inputs. The Differential Pressure is calibrated without line pressure being applied to the Sensor. When the Sensor is connected back to the process after calibration, a shift in the differential pressure can occur due to the influence of the line pressure. This effect can be canceled out with a Zero Shift adjustment.

To check or adjust for Zero Shift, leave the sensor by-pass valve open (to simulate a no-flow condition), with either line pressure or a normal operating static pressure from the calibrator applied to the Sensor. This applies the same pressure to both sides of the differential pressure diaphragm to give a zero differential pressure reading.

Perform the Zero Shift procedure.

Once the Zero Shift window has closed, the Meter Calibration window displays. Refer to Figure 8-1. Click Done to close the calibration window, cancel the freeze values, and cause the FloBoss to begin using live readings for the flow calculations.

8.2 Calibrating I/O

The calibration routines support 5-point calibration, with the three mid-points calibrated in any order. The low-end or zero reading is calibrated first, followed by the high-end or full-scale reading. The three mid-points can be calibrated next, if desired. The diagnostic Analog Inputs—battery voltage (Point Number E1), charge voltage (Point Number E2), and board/battery temperature (Point Number E5)—are not designed to be calibrated.

If the FloBoss unit has an optional I/O Card installed, then the Analog Inputs supplied by the card can likewise be calibrated using the ROCLINK for Windows software.

For a FloBoss 503, the built-in inputs that are supported with the 5-point calibration are:

- ♦   Differential pressure = AI Point Number A1.
- ♦   Static pressure = AI Point Number A2.
- ♦   RTD temperature = AI Point A3.

For a FloBoss 504, the built-in inputs that are supported with the 5-point calibration are:

- ♦   Auxiliary pressure (optional) = AI Point Number A1.
- ♦   Static (line) pressure = AI Point Number A2.
- ♦   RTD temperature = AI Point Number A3.

These inputs are assigned to the first three Analog Input points. The calibration procedure for these inputs is described in Section 8.1, Calibrating the FloBoss, on page 8-1.

SECTION 9 – TROUBLESHOOTING

This section provides generalized guidelines for troubleshooting of the FloBoss 503 and FloBoss 504. The procedures in this chapter should be performed before removing power for any reason, after restoring power, and if the unit is disassembled.

The ROCLINK for Windows software runs on the personal computer and is required for a majority of the troubleshooting performed on the FloBoss unit. Refer to the *ROCLINK for Windows Configuration Software User Manual* (Form A6091) for additional information.

The following tools are required for troubleshooting:

♦ IBM-compatible personal computer.

♦ ROCLINK for Windows software.

♦ Flat-head and Philips screwdrivers.

This section contains the following information:

9.1 Troubleshooting Guidelines

When you are attempting to diagnose a problem with a FloBoss 503 or FloBoss 504 unit:

♦ Remember to write down what steps you have taken.
♦ Note the order in which you remove components.
♦ Note the orientation of the components before you alter or remove them.
♦ Save the configuration and log data (Section 9.3.2, How to Preserve Configuration and Log Data, on page 9-6).
♦ Read and follow all Cautions in this manual.

When you are done troubleshooting, perform the restart procedure in Section 9.3.4, How to Restart and Reconfigure, on page 9-7.

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9.2 Troubleshooting Checklists

9.2.1 Dial-up Modem

If you are experiencing troubles with an internal **dial-up modem**:

♦ Check to make sure power is applied to the FloBoss unit at terminal block P8.

♦ Check the wiring to the modem. Refer to Section 4, Communications Installation and Wiring.

♦ Check the communication port settings in ROCLINK for Windows software. Select ROC > Comm Ports.

♦ Check the modem INIT string refer to section 4.2.3. It displays in the Comm Port settings screen in ROCLINK for Windows software. Select ROC > Comm Ports > Modem tab.

The communications cards have no user-serviceable parts. If a card appears to be operating improperly, verify that the card is set up according to the information contained in Section 4, Communications Installation and Wiring. If it still fails to operate properly, the recommended repair procedure is to remove and replace the card. The faulty card should be returned to your local sales representative for repair or replacement.

9.2.2 Serial Communications

If you are experiencing troubles with a **serial communications** connection [LOI, EIA-232 (RS-232), or EIA-485 (RS-485)]:

♦ Check to make sure power is applied to the FloBoss unit. Check the wiring connections at the power source: Power, +CHG– and +BAT–.

♦ Check the wiring to the termination block or connector. Refer to Section 4, Communications Installation and Wiring.

The communications cards have no user-serviceable parts. If a card appears to be operating improperly, verify that the card is set up according to the information contained in Section 4, Communications Installation and Wiring. If it still fails to operate properly, the recommended repair procedure is to remove and replace the card. The faulty card should be returned to your local sales representative for repair or replacement.

9.2.3 Inputs and Outputs

If you are experiencing troubles with an **I/O point** (Analog Input, Analog Output, Discrete Input, Discrete Output, or Pulse Input):

♦ Check to see how the channel is configured using ROCLINK for Windows software.

♦ If the configuration looks correct, then simulate an input (within the range of the input) or force an output to be produced using ROCLINK for Windows software.

♦ If an input channel is in question, you may be able to use one of the outputs (known to be in working order) to simulate the required input. Likewise, if an output channel is in question, you may able to connect it to a working input channel and check the results.

No field repair or replacement parts are associated with the I/O Card. If a card appears to be operating improperly, verify that the card is set up according to the information contained in Section 5, Inputs and Outputs. The faulty card should be returned to your local sales representative for repair or replacement.

9.2.4 ROCLINK for Windows Software

If you are experiencing problems with the FloBoss 503 or FloBoss 504 that appear to be **software**-related, try resetting the FloBoss. To reset the FloBoss open ROCLINK for Windows software, connect to the FloBoss unit and select ROC > Flags. Refer to *ROCLINK for Windows Configuration Software User Manual (Form A6091)*.

♦ Use a **Warm Start** to restart without losing configuration or log data. If you are still experiencing problems then perform a Cold Start.

♦ Use a **Cold Start** to restart without a portion of the configuration, log data, or programming that may be the source of trouble. To perform a Cold Start, open ROCLINK for Windows software, connect to the FloBoss unit and select ROC > Flags.

♦ Use the **RST** (reset) jumper on the FloBoss unit to restore the unit to factory defaults without connecting to ROCLINK for Windows software. Refer to Section 9.3.3, How to Reset the FloBoss, on page 9-6.

If these methods do not resolve the problem, contact your local sales representative.

9.2.5 Power Issues

If you are experiencing trouble with **powering** up the FloBoss 503 or FloBoss 504:

♦ Check to make sure power is applied to the FloBoss unit.

♦ Check the wiring connections at the power source: Power, +CHG– and +BAT–.

♦ Check the batteries for voltage. If the batteries are below nominal voltage, replace them. Refer to Specifications in Section 1, General Information and section 3 Power connection.

9.2.6 FloBoss 503 DVS or MVS Sensors

If the **DVS** or **MVS** sensors are experiencing issues:

❖ **NOTE:** The DVS or MVS sensor should only be installed and removed at the factory.

If your sensor is not responding:

1. Ensure that the Sensor is plugged into the P/DP connector on the Main Electronics Board at P11. This ribbon cable fits into the P11 connector in only one direction.

2. Ensure that the connector and cable do not appear to be defective.

3. Ensure that the Sensor is not in manual mode by setting the Scanning field in Analog Input Point Number A1 to Enabled. Refer to Figure 9-1.
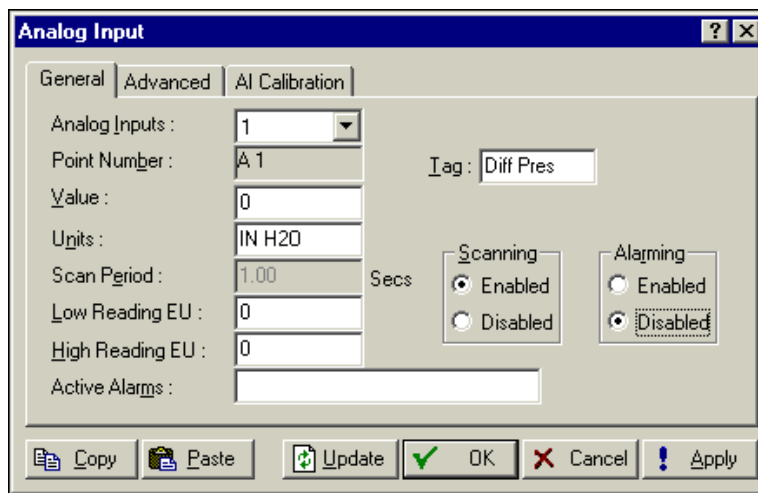
Figure 9-1. Analog Input – Scanning Enabled

4. Ensure all required inputs are Enabled.

If the DVS or MVS is still not responding, reset the DVS to factory defaults to clear invalid calibration data. Refer to Section 9.3.1, How to Reset the FloBoss 503 DVS to Factory Defaults, on page 9-5.

No field repair or replacement parts are associated with the DVS, DVS input, MVS, MVS input, or RTD input. Return the FloBoss to your local sales representative for repair or replacement.

9.2.7 FloBoss 504 Sensor Module

No field repair or replacement parts are associated with the Sensor Module or RTD input. Return the FloBoss 504 to your local sales representative for repair or replacement.

> ❖ **NOTE:** The SM sensor should only be installed and removed at the factory.

The SM contains an LED indicator viewable when the case is open. LED indicates the status of the SM. The Status LED indicator displays (after a power-up sequence):

♦ **Normal Operation** – Flashing green.

♦ **Communication Fail** – Solid green for 20 seconds, then alternating red (processor reset) and green.

♦ **Power Fail** – LED off.

If a failure is indicated, check the P/DP connector and restart the FloBoss. Refer to Section 9.3.3, How to Reset the FloBoss, on page 9-6.

9.3 Procedures

9.3.1 How to Reset the FloBoss 503 DVS to Factory Defaults

To reset the DVS back to the original factory defaults:

1. Launch ROCLINK for Windows software.

2. Select Configure > I/O > **AI Points**.

3. Select **Analog Inputs 1** (Point Number A1).

4. Select the **Advanced** tab.

5. Enter 32767 in the **Adjusted A/D 100%** field. Refer to Figure 9-2.
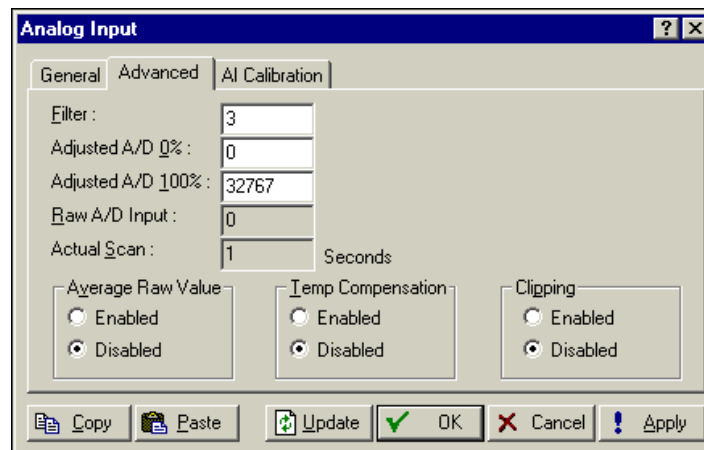
Figure 9-2. Analog Input – Advanced

6. Click **Apply**.

9.3.2 How to Preserve Configuration and Log Data

Perform this backup procedure, before removing power to the FloBoss unit for repairs, troubleshooting, removing or adding components, or upgrades. This procedure preserves the current flow computer configuration and log data held in RAM.

⚠ CAUTION

When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing these procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.

To avoid circuit damage when working inside the unit, use appropriate electrostatic discharge precautions, such as wearing a grounded wrist strap.

1. Launch ROCLINK for Windows software.

2. Ensure that the configuration is saved in flash memory by performing a **Write to Internal Config Memory** (ROC menu > Flags). This saves all configuration settings, including the current states of the ROC Flags and calibration values.

3. If you will be replacing the flash chip, save the current configuration data to disk by using File > **Save**. This action saves the configuration to an .fcf file (you can specify your own file name and path if desired).

4. Select ROC > **Collect Data**.

5. Select the **All** checkbox and click **OK**. This action saves event logs (.evt), alarm logs (.alm), report data (.det), hourly logs (.pdb), and daily (.day) logs. You can specify your own file name and path if desired.

9.3.3 How to Reset the FloBoss

The Main Electronics Board has a jumper located at P1 in the upper right-hand corner that can be used to perform a special type of Cold Start. Refer to Figure 9-3. This jumper permits a power-up reset to re-establish a known operating point. This includes reinitializing the Tasks, Databases, Sensors, Communication Ports, and I/O while restoring the factory default configuration. This Cold Start does not include any of the clearing options available in a Cold Start performed using ROCLINK for Windows software.
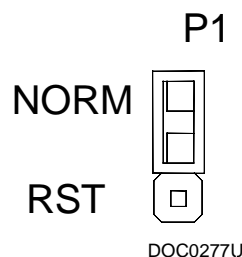
Figure 9-3. Reset Jumper Shown in Normal Position

❖ **NOTE:** This type of reset restores the factory configuration defaults. Some user-entered configuration parameters may be lost. Therefore, back up required data before performing this reset.

1. **Save** the FloBoss **Config** and **Data.** Refer to Section 9.3.2, How to Preserve Configuration and Log Data, on page 9-6 and perform the Backup Procedure.

2. **Disconnect** the **Power** terminal block to remove power.

3. **Install** the **P1** jumper in the reset (**RST**) position.

4. **Apply** power by plugging in the **Power** terminal block at P8.

5. **Remove** the **P1** jumper and install it in the normal (**NORM**) position.

This reset action loads the factory default values into all configurable parameters.

9.3.4 How to Restart and Reconfigure

After removing power to the FloBoss unit and installing components as required, perform the following steps to start your FloBoss unit and reconfigure your data. The procedure assumes you are using ROCLINK for Windows software.

⚠ **CAUTION**

Ensure all input devices, output devices, and processes remain in a safe state upon restoring power. An unsafe state could result in property damage.

When working on units located in a hazardous area (where explosive gases may be present), make sure the area is in a non-hazardous state before performing these procedures. Performing these procedures in a hazardous area could result in personal injury or property damage.

1. **Reconnect** power to the FloBoss unit by inserting the **Power** terminal plug into the **P8** Power connector.

2. **Launch** the **ROCLINK for Windows** software, log in, and connect to the FloBoss unit.

3. **Verify** that the **configuration** is correct. If it is not, continue by configuring the required items. If major portions or the entire configuration needs to be reloaded, perform the remaining steps.

4. Select File > **Download**.

5. Select the backup configuration file (has extension `*.FCF`). Refer to Figure 9-4.
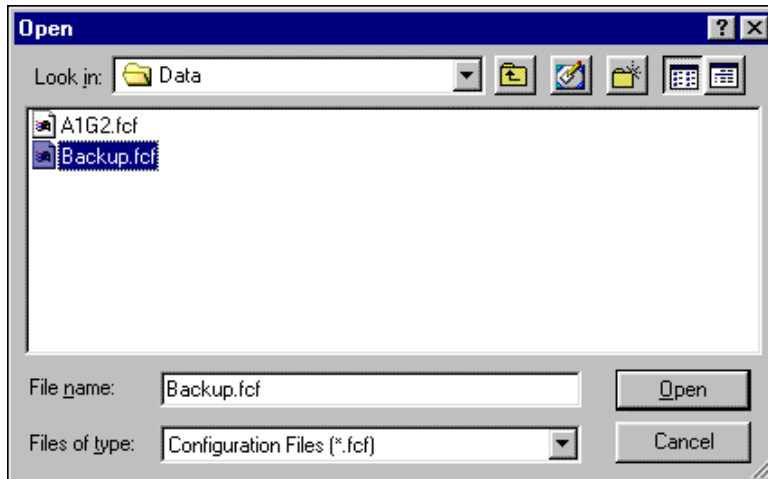
Figure 9-4. Open Configuration File

6. **Select** the **Configuration Points** checkboxes you desire to download (restore). Refer to Figure 9-5.
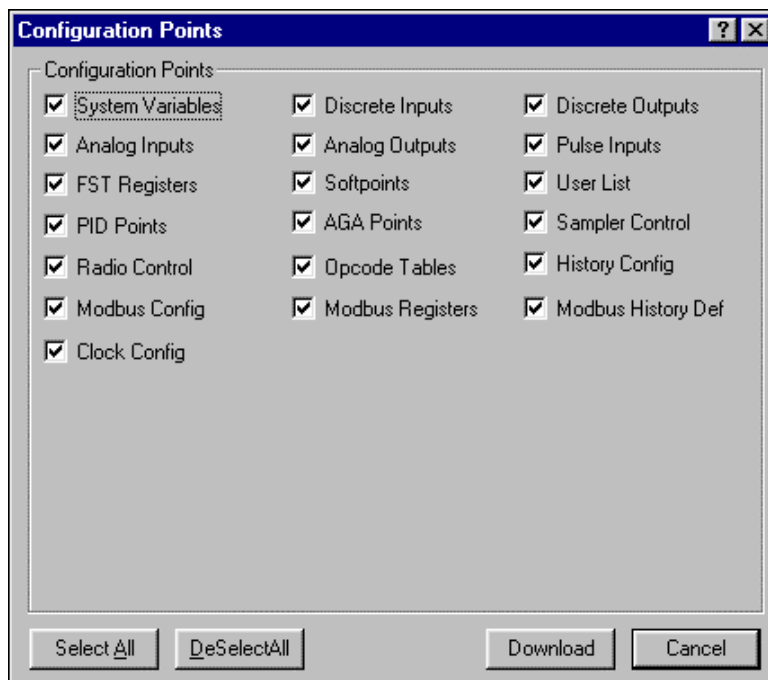
Figure 9-5. Download Configuration Points

7. Click **Download** to restore the configuration.

GLOSSARY OF TERMS

A

A/D – Analog to Digital.

AGA – American Gas Association.

AI – Analog Input.

AO – Analog Output.

Analog – Analog data is represented by a continuous variable, such as an electrical current signal.

AP – Absolute Pressure.

API – American Petroleum Institute.

ASCII – American Standard Code for Information Interchange.

AWG – American Wire Gauge.

B

BTU – British Thermal Unit, a measure of heat energy.

Built-in I/O – Input/Output channels that are fabricated into the ROC or FloBoss and do not require a separate module. Also called "on-board" I/O.

C

C1D2 – Class 1, Division 2 hazardous area.

COMM1 – Port on the FloBoss that may be used for host communications. This port is built-in for EIA-232 (RS-232) serial communications.

Configuration – Typically, the software setup of a device that can often be defined and changed by the user. Can also mean the hardware assembly scheme.

CRC – Cyclical Redundancy Check for communications integrity.

CSA – Canadian Standards Association.

CTS – Clear To Send modem communications signal.

D

D/A – Digital to Analog.

DB – Database.

dB – Decibel. A unit for expressing the ratio of the magnitudes of two electric signals on a logarithmic scale.

DCD – Data Carrier Detect modem communications signal.

Deadband – A value that is an inactive zone above the low limits and below the high limits. The purpose of the deadband is to prevent a value such as an alarm from being set and cleared continuously when the input value is oscillating around the specified limit. This also prevents the logs or data storage location from being over-filled with data.

DI – Discrete Input.

Discrete – Input or output that is non-continuous, typically representing two levels such as on/off.

DO – Discrete Output.

DP – Differential Pressure.

DSR – Data Set Ready modem communications signal.

DTR – Data Terminal Ready modem communications signal.

Duty Cycle – Proportion of time during a cycle that a device is activated. A short duty cycle conserves power for I/O channels, radios, and such.

DVM – Digital voltmeter.

DVS – Dual-Variable Sensor. Provides static and differential pressure inputs to a FloBoss 503 Flow Manager.

E

EEPROM – Electrically Erasable Programmable Read Only Memory, a form of permanent memory.

EFM – Electronic Flow Metering or Measurement.

EIA-232 – Serial Communications Protocol using three or more signal lines, intended for short distances. Also referred to as RS-232.

EIA-485 – Serial Communications Protocol requiring only two signal lines. Can allow up to 32 devices to be connected together in a daisy-chained fashion. Also referred to as RS-485.

EMF – Electro-motive force.

EMI – Electro-magnetic interference.

ESD – Electro-static discharge.

EU – Engineering Units. User-selected units of measure.

F

Firmware – Internal software that is factory-loaded into a form of ROM. In the ROC or FloBoss, the firmware supplies the software used for gathering input data, converting raw input data calculated values, storing values, and providing control signals.

Flash ROM – A type of read-only memory that can be electrically re-programmed. It is a form of permanent memory (needs no backup power).

FloBoss – A specialized Remote Operations Controller (ROC), microprocessor-based unit from the Flow Computer Division of Emerson Process Management that provides remote monitoring and control.

FSK – Frequency Shift Keyed.

FST – Function Sequence Table, a type of program that can be written by the user in a high-level language designed by Emerson Flow Computer Division. One or more FSTs can be set up in a ROC or FloBoss.

G

GFA – Ground Fault Analysis.

GND – Electrical ground, such as used by the ROC power supply.

GP – Gauge Pressure.

H

HART – Highway Addressable Remote Transducer.

hw – Differential pressure.

I, J

ID – Identification.

IEC – Industrial Electrical Code.

IMV – Integral Multiplier Value.

I/O – Input/Output.

IRQ – Interrupt Request. Hardware address oriented.

IV – Integral Value.

K

Kbytes – Kilobytes (KB).

kHz – Kilohertz.

L

LCD – Liquid Crystal Display. Display only device used for reading data.

LED – Light-emitting diode.

LOI – Local Operator Interface. Refers to the serial EIA-232 (RS-232) Local Port on the ROC or FloBoss through which local communications are established, typically for configuration software running on a PC. Also referred to as Local Port or Op Port.

LRC – Longitudinal Redundancy Checking, a type of error checking.

M

mA – Milliamps.

MCU – Master Controller Unit.

MEB – Main Electronics Board.

Modular I/O – I/O channels that are provided on a ROC or FloBoss by means of I/O modules. See I/O Module.

MPU – Micro-processor Unit.

MVS – Multi-Variable Sensor. The MVS provides differential pressure, static pressure, and temperature inputs to the FloBoss or Remote MVS interface for orifice flow calculation.

mV – Millivolts, or 0.001 volt.

mW – Milliwatts, or 0.001 watt.

N

NEC – National Electrical Code.

NEMA – National Electrical Manufacturer's Association.

O

OH – Off-Hook modem communications signal.

Off-line – Accomplished while the target device is not connected (by a communications link). For example, off-line configuration is configuring a ROC in a electronic file that is later loaded into the ROC.

Ohms – Units of electrical resistance.

On-line – Accomplished while connected (by a communications link) to the target device. For example, on-line configuration is configuring a ROC while connected to it, so that current parameter values are viewed and new values can be loaded immediately.

Opcode – Type of message protocol used by the ROC to communicate with the configuration software, as well as with host computers.

P, Q

Parameter – A property of a point that typically can be configured or set by the user. For example, the Point Tag ID is a parameter of an Analog Input point. Parameters are normally edited by using configuration software running on a PC.

Pf – Flowing pressure.

PC – Personal computer.

P/DP – Pressure/Differential Pressure.

PI – Pulse Input.

PID – Proportional, Integral, and Derivative control feedback action.

PLL – Phase Lock Loop.

Point – Software-oriented term for an I/O channel or some other function, such as a flow calculation. Points are defined by a collection of parameters.

Point Number – The rack and number of an I/O point as installed in the FloBoss system.

PRI – Primary PID control loop.

PSTN – Public switched telephone network.

PT – Process Temperature.

PTI – Periodic Timer Interrupt.

PTT – Push-to-talk signal.

Pulse – Transient variation of a signal whose value is normally constant.

PV – Process variable. Usually used in discussions of PID loops.

R

Rack – For a ROC, a rack is a row of slots into which I/O modules may be plugged. The rack is given a letter to physically identify an I/O channel location, such as "A" for the first rack. Built-in I/O channels are assigned a rack identifier of "A," while diagnostic I/O channels are considered to be in rack "E".

RAM – Random Access Memory. In a FloBoss, it is used to store history, data, most user programs, and additional configuration data.

RBX – Report-by-exception. In a FloBoss, it always refers to Spontaneous RBX in which the FloBoss contacts the host to report an alarm condition.

RFI – Radio frequency interference.

RI – Ring Indicator modem communications signal.

ROC – Remote Operations Controller, Emerson Process Management's microprocessor-based unit that provides remote monitoring and control.

ROCLINK for Windows – Configuration software used to configure ROC or FloBoss units to gather data, as well as most other functions.

ROM – Read-only memory. Typically used to store firmware. Flash memory.

RS-232 – Serial Communications Protocol using three or more signal lines, intended for short distances. Also referred to as EIA-232.

RS-485 – Serial Communications Protocol requiring only two signal lines. Can allow up to 32 devices to be connected together in a daisy-chained fashion. Also referred to as EIA-485.

RTC – Real-time clock.

RTD – Resistance Temperature Detector.

RTS – Ready to Send modem communications signal.

RTU – Remote Terminal Unit.

RX or RXD – Received Data communications signal.

S

SAMA – Scientific Apparatus Maker's Association.

Script – A uncompiled text file (such as keystrokes for a macro) that is interpreted by a program to perform certain functions. Typically, scripts can be easily created or edited by the end-user to customize the software.

Soft Points – A type of ROC point with generic parameters that can be configured to hold data as desired by the user.

SP – Setpoint (when used in discussions of PID loops), or Static Pressure (when used in discussions of flow parameters).

SPI – Slow Pulse Input.

SRAM – Static Random Access Memory. Stores data as long as power is applied; typically backed up by a lithium battery or supercapacitor.

SRBX – Spontaneous Report By Exception.

SVA – Signal Value Analog.

SVD – Signal Value Discrete.

T-Z

TDI – Timed Discrete Input, or Timed Duration Input.

TDO – Timed Discrete Output, or Timed Duration Output.

Tf – Flowing temperature.

TLP – Type (of point), Logical (or point) number, and Parameter number. For a list and explanation of the TLPs, refer to the *ROC Protocol Manual* (Form A4199).

TX or TXD – Transmitted Data communications signal.

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