FLOWSTAR 2000™

USER'S MANUAL
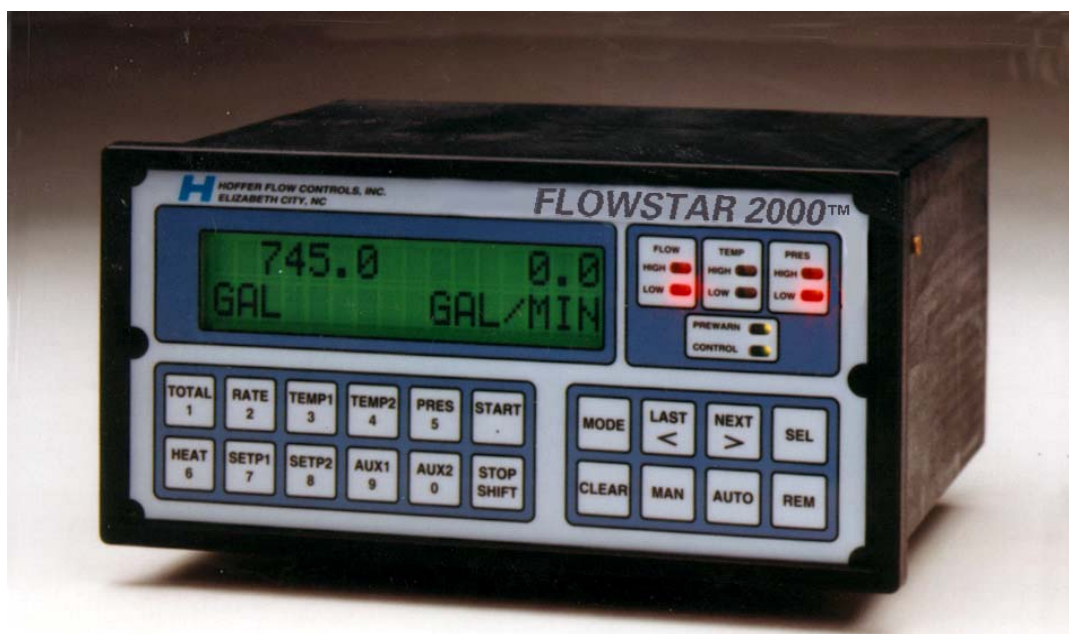
HP-221
December 2015

FLOWSTAR^{TM} 2000
User's Manual

DocNo HP221

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Notice

RETURN REQUESTS/INQUIRIES

Direct all warranty and repair requests/inquiries to the Hoffer Flow Controls Customer Service Department, telephone number (252) 331-1997 or 1-800-628-4584. BEFORE RETURNING ANY PRODUCT(S) TO HOFFER FLOW CONTROLS, PURCHASER MUST OBTAIN A RETURNED MATERIAL AUTHORIZATION (RMS) NUMBER FROM HOFFER FLOW CONTROLS' CUSTOMER SERVICE DEPARTMENT (IN ORDER TO AVOID PROCESSING DELAYS). The assigned RMA number should then be marked on the outside of the return package and on any correspondence.

FOR **WARRANTY** RETURNS, please have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number under which the product was PURCHASED,
2. Model and serial number of the product under warranty, and
3. Repair instructions and/or specific problems relative to the product.

FOR **NON-WARRANTY** REPAIRS OR **CALIBRATIONS**, consult HOFFER FLOW CONTROLS for current repair/calibration charges. Have the following information available BEFORE contacting HOFFER FLOW CONTROLS:

1. P.O. number to cover the COST of the repair/calibration,
2. Model and serial number of the product, and
3. Repair instructions and/or specific problems relative to the product.

HFC 9708

LIMITED WARRANTY

HOFFER FLOW CONTROLS, INC. ("HFC") warrants HFC's products ("goods") described in the specifications incorporated in this manual to be free from defects in material and workmanship under normal use and service, but only if such goods have been properly selected for the service intended, properly installed and properly operated and maintained. This warranty shall extend for a period of (1) year from the date of delivery to the original purchaser (or eighteen (18) months if the delivery to the original purchaser occurred outside the continental United States). This warranty is extended only to the original purchaser ("Purchaser"). *Purchaser's sole and exclusive remedy is the repair and/or replacement of nonconforming goods as provided in the following paragraphs.*

In the event Purchaser believes the goods are defective, the goods must be returned to HFC, transportation prepaid by Purchaser, within twelve (12) months after delivery of goods (or eighteen (18) months for goods delivered outside the continental United States) for inspection by HFC. If HFC's inspection determines that the workmanship or materials are defective, the goods will be either repaired or replaced, at HFC's sole determination, free of additional charge, and the goods will be returned, transportation paid by HFC, using the lowest cost transportation available.

Prior to returning the goods to HFC, Purchaser must obtain a Returned Material Authorization (RMA) Number from HFC's Customer Service Department within 30 days after discovery of a purported breach of warranty, but no later than the warranty period; otherwise, such claims shall be deemed waived. See the Return Requests/Inquiries Section of this manual.

If HFC's inspection reveals the goods are free of defects in material and workmanship or such inspection reveals the goods were improperly used, improperly installed, and/or improperly selected for service intended, HFC will notify the purchaser in writing and will deliver the goods back to purchaser upon (i) receipt of Purchaser's written instructions and (ii) the cost of transportation. If Purchaser does not respond within 30 days after notice from HFC, the goods will be disposed of in HFC's discretion.

HFC does not warrant these goods to meet the requirements of any safety code of any state, municipality, or any other jurisdiction, and purchaser assumes all risk and liability whatsoever resulting from the use thereof, whether used singly or in combination with other machines or apparatus.

This warranty shall not apply to any HFC goods or parts thereof, which have bee repaired outside HFC's factory or altered in any way, or have been subject to misuse, negligence, or accident, or have not been operated in accordance with HFC's printed instructions or have been operated under conditions more severe than, or otherwise exceeding, those set forth in the specifications for such goods.

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Disclaimer

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FIGURES

RELATED DRAWINGS

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1   INTRODUCTION

1.1   INTRODUCTION

The FLOWSTAR Series is a cost effective family of flow products designed to accept inputs from pulse producing or analog producing flowmeters such as turbine, vortex, magnetic, differential pressure, positive displacement, coriollis, ultrasonic and thermal flowmeters. The basic series consists of the following functions:

- Model 2000 Cenauri (B) - Volumetric flowrate indicator/totalizer for liquids and gases.

Performance enhancement features such as flowmeter linearization, are available. Such performance enhancement techniques greatly improve the accuracy of the flow measurement system by correcting for known sources of measurement error.

The front membrane panel features a two line 16 character alpha numeric display that indicates function and unit of measure in English or metric units. The display is a backlit LED type with .32" (8.13 mm) character height. The keypad is a bubble switch membrane type and sealed to NEMA 4X rating.

The unit is factory programmed when purchased with a Hoffer turbine flowmeter. This feature should save the user numerous hours of set up time that is associated with other microprocessor based units available in the marketplace. Programming is done through the front panel keyboard, as well as via a two way RS-232 or RS-422/RS-485 multi-drop communication port.

Three analog input channels are available. This allows for multiple flowmeter input capability. Two analog output signals are available for transmission of process variables to remote data acquisition systems or chart recorders.

Four scaled pulse outputs are provided for such applications as driving a remote flow totalizer or computer pulse input card. High and low alarms are available in either an open collector pulse form or OPTO-22 rely form.

1.2   PERFORMANCE CHARACTERISTICS

DISPLAY
- Two line, 16 char Alpha numeric, LCD, LED backlit
- Character height 0.32", super-twist +/- 20 degree viewing angle, industrial grade, 0 to 70° C.
- Options: Front display heater, less LED backlight for battery supplied operations

ANNUNCIATORS
- 6 LED indicators for high/low flow and flow only alarms.
- 1 piezeo electric sonic alarm.

OUTPUTS(4):
Output features are designed to meet as wide a variety of user applications as possible. In addition, output module changes can be performed by the end user. Each output will be software selectable from a list of available outputs. **All units will come standard with active low NPN open collector outputs**. For applications requiring additional output capabilities, a selection of on board modular relays will be provided for each output.

OPTIONAL OPTO-22 MODULE SELECTION

AC MODULE FEATURES

- Built in LED status indicator.
- Removable fuse.
- 4000 VAC optical isolation.
- Withstands one second surge @ 5 amps.
- Current rating of 3 Amps at 45°C.
- Line voltage 24 to 280 Vac.
- Operating temperature: -30 to 70°C.

DRY CONTACT MODULE FEATURES

- 100 VDC/130 VAC switching volts.
- 0.5 amps switching current.
- 1.5 amps carry current.
- 5,000,000 cycle life.
- 1500 VDC isolation voltage.
- Operating temperature: 0 to 70°C.

SOFTWARE SELECTABLE OUTPUT CHOICES (select any 4)

FLOW RELATED

- SCALED PULSE OUT.

ALARM RELATED

- ALARM (High and Low setpoints for process control).

AUXILIARY VOLTAGE OUTPUT

- 15 VDC, 60ma, if 12 vdc battery is used this option is not possible.

KEYPAD

- 12 key numeric, 8 key mode control keypad, bubble switch membrane.

INPUT

- Single channel, pulse input, 10 mVrms to 5 Vrms, 10 to 3500 Hz, 50 Kohm input impedance.
- Quadrature detection, pulse input, 10 mVrms to 5 Vrms, 10 to 3500 Hz, 50 Kohm input impedance.
- Optional: MCP pickup.

PROCESS INPUTS (3)

- 1-5Vdc(STD).
- 4-20mA current loop, (Optional). Input impedance: 250 ohms.

ANALOG OUTPUTS (2)

- Standard 0-5Vdc.
- 0-10Vdc.
- 4-20mA current loop, meets and exceeds ISA-S50.1 specifications for TYPE 3, Class L and U. Maximum Load Impedance: 350 ohms.

SERIAL COMMUNICATION

- RS-422\RS-485 multi-drop.
- RS-232C, plug in sockets standard.

DIP SWITCH PROGRAMMABLE FEATURES (7)

- Program lockout.
- Remote/Local.
- Input Channel 2.
- Input Channel 3.
- Input Channel 4.
- Output Channel 1.
- Output Channel 2.

SELF DIAGNOSTIC

- Unit checks computer hardware for proper operation (RAM, ROM chksum, RTC test only).
- Unit checks for transmitter signal loss and over-range conditions.

INPUT POWER

- 110/220 VAC 50-60hz selectable on board or 12-24 VDC with external battery.

ENVIRONMENTAL

- 0 to 70°C Operating Temperature, -20 to 80° C Storage Temperature.

ENCLOSURE

- DIN Standard 43700, flame retardant, glass filled Noryl case, Dimensions: 7.4 x 3.6 x 7.25.

1.3   ORDERING INFORMATION

MODEL 2000-A FLOWSTAR
VOLUMETRIC FLOW COMPUTER FOR SINGLE CHANNELS ONLY

MODEL **2000-A-(A)-(B)-(C)-(D)-(E)-(F)-(G)-(H)-(I)-(J)**

ANALOG OUTPUT
COMMUNICATION PORT
SCALED PULSE OUTPUT
SINGLE CHANNEL
FLOWMETER INPUT
POWER INPUT
ALARMS
ENCLOSURE STYLE
ACCESSORIES/OPTIONS
SPECIAL FEATURES
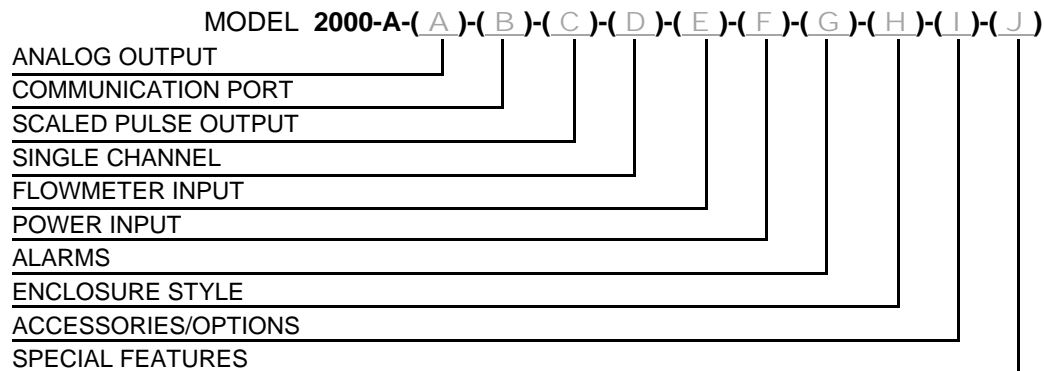
ANALOG OUTPUT (TWO MAY BE SELECTED)
MODEL **2000-A-(A)-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )**

> OPTION **(A)**
> (3)   0-5 VDC
> (D3)   DUAL 0-5 VDC
> (4)   0-10 VDC
> (D4)   DUAL 0-10 VDC
> (7)   4-20 MA
> (D7)   DUAL 4-20 MA
> (D3/4)   ONE 0-5 VDC AND ONE 0-10 VDC
> (D3/7)   ONE 0-5 VDC AND ONE 4-20 MA
> (D4/7)   ONE 0-10 VDC AND ONE 4-20 MA

COMMUNICATION PORT (SELECT ONE)
MODEL **2000-A-(   )-(B)-(   )-(   )-(   )-(   )-(   )-(   )-(   )-(   )**

> OPTION **(B)**
> (R2)   RS-232
> (R4)   RS-485 HALF DUPLEX

SCALED OUTPUT (FOUR MAY BE SELECTED INCLUDING ALARM OPTIONS)
MODEL **2000-A-(   )-(   )-(C)-(   )-(   )-(   )-(   )-(   )-(   )-(   )**

> OPTION **(C)**
> (1)   OPEN COLLECTOR (STANDARD)
> (2)   TTL/CMOS
> (3)   DRY CONTACT

SINGLE CHANNEL ONLY (SEE NOVA-FLOW FOR MULTIPLE CHANNELS)
MODEL **2000-A-(   )-(   )-(   )-(D)-(   )-(   )-(   )-(   )-(   )-(   )**

> OPTION **(D)**
> (1)   SINGLE CHANNEL

FLOWMETER INPUT
> MODEL **2000-A-(   )-(   )-(   )-(   )-(E)-(   )-(   )-(   )-(   )-(   )**
>
> OPTION **(E)**
> (M)   MAGNETIC COIL
> (MC3PA)   RF COIL
> (RPM)   MAGNETIC REDI-PULSE COIL
> (RPR)   RF REDI-PULSE COIL
> (DMX)   MAGNETIC REDI-PULSE I.S. COIL
> (DRX)   RF REDI-PULSE I.S. COIL
> (DC)   DRY CONTACT

MODEL 2000-A (CONTINUED)

POWER INPUT
MODEL **2000-A-(**)-( )-( )-( )-( )-(F)-( )-( )-( )-( )
      OPTION **(F)**
      (1)   115 VAC 50/60 HZ
      (2)   220 VAC 50/60 HZ
      (*)   10.5 VDC TO 24 VDC - INSERT ACTUAL VOLTAGE
                    (FOR ANALOG OUTPUT 0-10 VDC & 4-20 MA, THE DC VOLTAGE REQUIRED IS 18-24 VDC)

ALARMS
MODEL **2000-A-(**)-( )-( )-( )-( )-( )-(G)-( )-( )-( )
      OPTION **(G)**
      (HI/LO)   HIGH/LOW - OPEN COLLECTOR
      (L)   LOW - SOLID STATE RELAY 24-240 VAC @ 3 AMPS SPST N/O
      (H)   HIGH - SOLID STATE RELAY 24-240 VAC @ 3 AMPS SPST N/O
      (H/L)   HIGH/LOW - SOLID STATE RELAY 24-240 VAC @ 3 AMPS SPST N/O
      (L3)   LOW DRY CONTACT
      (H3)   HIGH DRY CONTACT
      (H/L3)   HIGH/LOW DRY CONTACT

ENCLOSURE STYLE
MODEL **2000-A-(**)-( )-( )-( )-( )-( )-( )-(H)-( )-( )
      OPTION **(H)**
      (P)   PANEL MOUNT - SEALED TO NEMA 4X
      (ND)   MOUNTED ON DOOR
                    SUPPLIED STANDARD WITH THREE ENTRANCE HOLES.
                    IF MORE OR LESS ARE REQUIRED USER MUST SPECIFY.

ACCESSORIES/OPTIONS
MODEL **2000-A-(**)-( )-( )-( )-( )-( )-( )-( )-(I)-( )
      OPTION **(I)**
      (F)   MOUNTED ON FLOW METER OPTIONS (ND) & (E) ONLY
                    IF MOUNTED, 'X' RISER ON FLOWMETER IS REQUIRED
      (H)   HEATERS FOR OPTIONS (ND) & (E) ONLY
      (MS)   CONNECTORS FOR (ND), INCLUDES MATING CONNECTORS
      (RTC)   REAL TIME CLOCK
                    RTC DISPLAYS AND PRINTS OUT THE DATE, TIME AND DAY. IF NOT EQUIPPED, DATE AND TIME
                    WILL NOT BE MAINTAINED AND A DEFAULT DATE AND TIME WILL BE DISPLAYED AND PRINTED.

SPECIAL FEATURES
MODEL **2000-A-(**)-( )-( )-( )-( )-( )-( )-( )-( )-(J)
      OPTION **(J)**

      (SP)   ANY SPECIAL FEATURES THAT ARE NOT COVERED IN THE
                 MODEL NUMBER, USE A WRITTEN DESCRIPTION OF THE -SP.

      NOTE: **INSERT (X) IN MODEL NUMBER FOR EVERY OPTION NOT SPECIFIED.**

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1.4   WARRANTY

Hoffer Flow Controls warrants that all equipment will be free from defects in workmanship and material provided that such equipment was properly selected for the service intended, properly installed, and not misused. Equipment which is returned transportation prepaid to Hoffer Flow Controls within 12 months after delivery of goods, or 18 months from date of shipment on equipment for destination outside the United States, and is found by Hoffer Flow Controls inspection to be defective in workmanship or material, will be repaired or replaced at Hoffer Flow Controls' sole option, free of charge and returned shipped using the lowest cost transportation prepaid.

In the event of product failure contact:

> Hoffer Flow Controls at 252-331-1997 or 800-628-4584 for
> issuance of a **Returned Material Authorization (RMA)** number.

1.5   ENCLOSURE DETAIL

Figure 1.1 Standard Panel Mount Enclosure
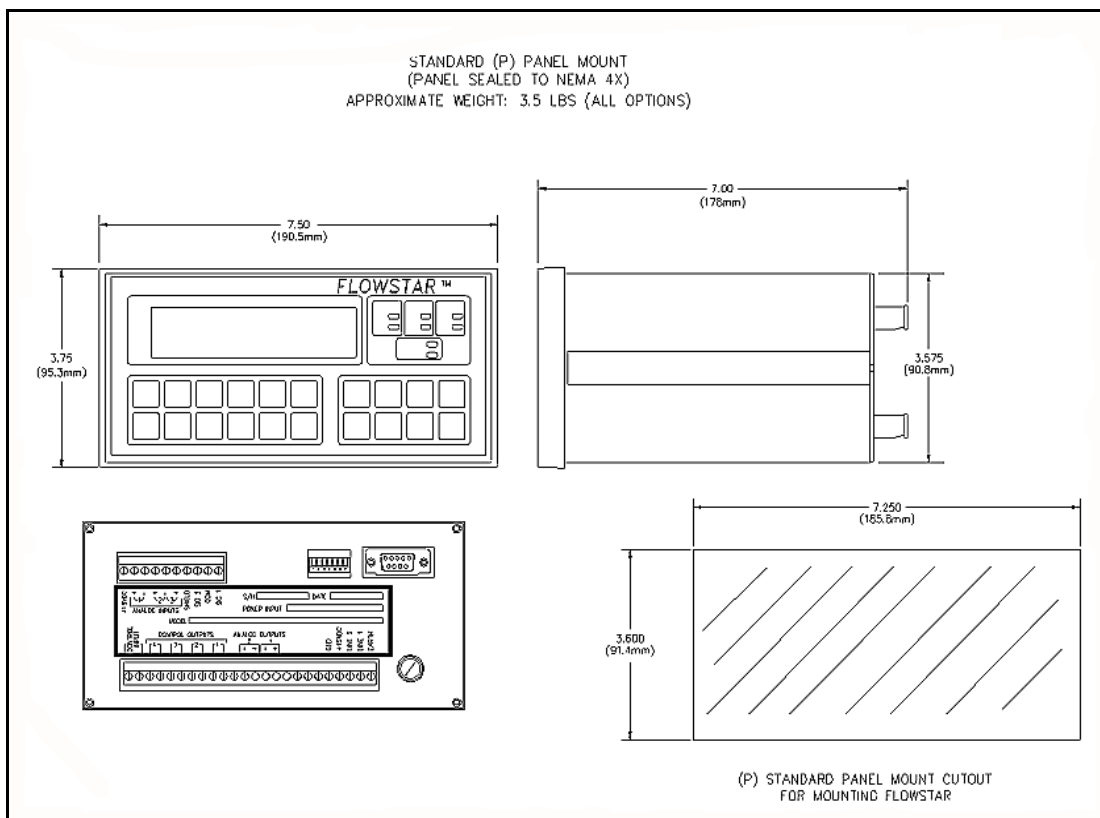
Figure 1.2 NEMA Enclosure
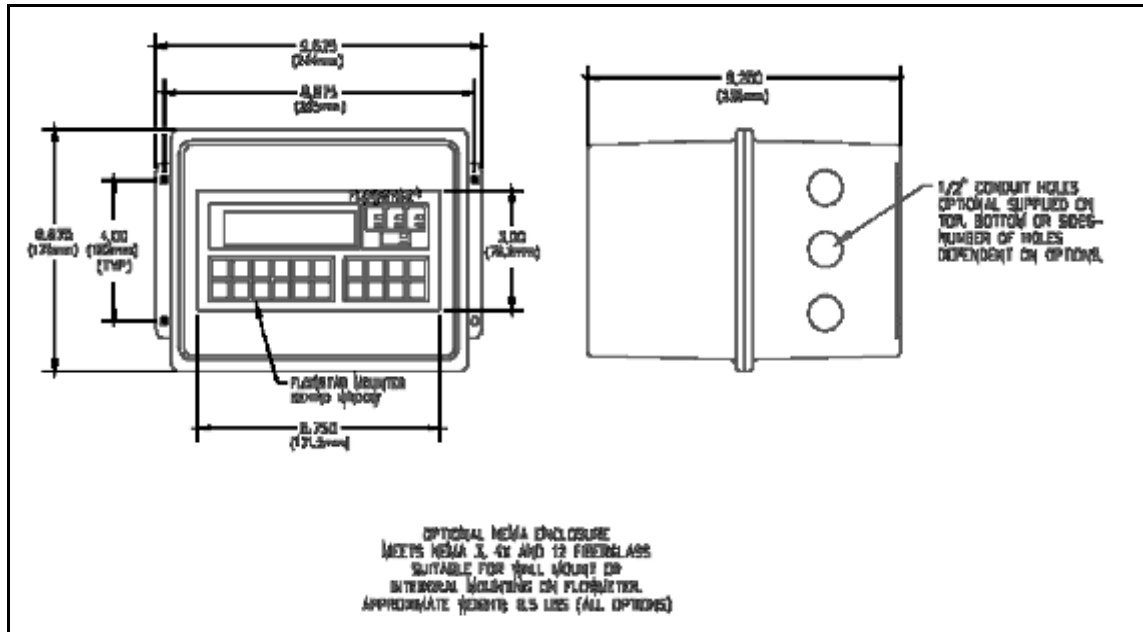
Figure 1.3 Explosion Proof Enclosure
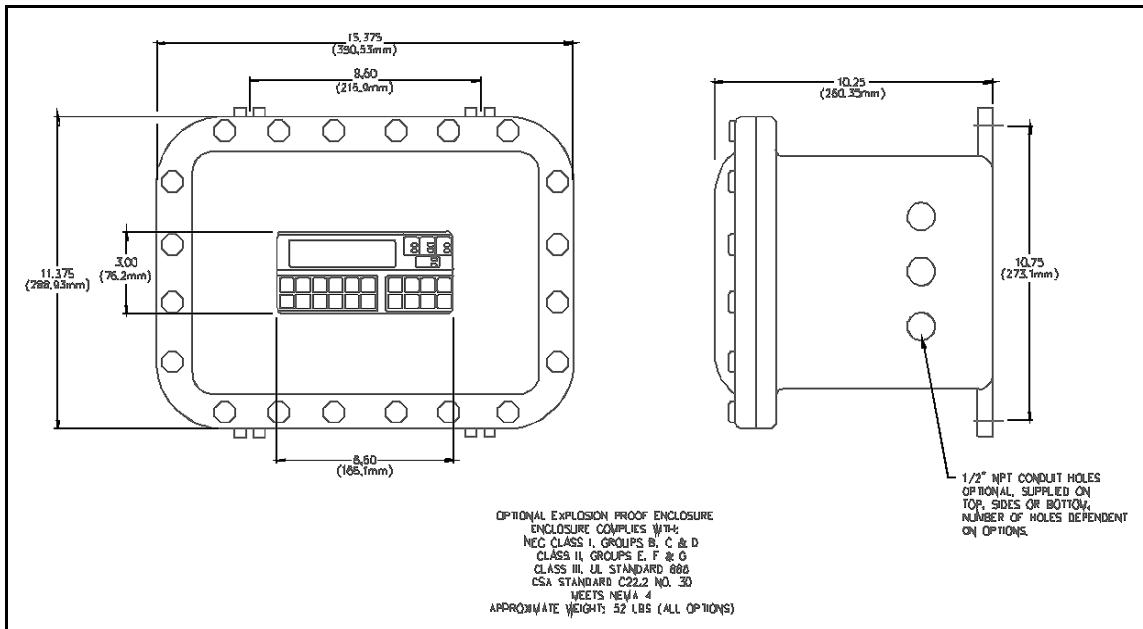
1.6   SHIPPING AND HANDLING

> CAUTION -   *The FLOWSTAR is a static-sensitive device and standard*
> *practice for static sensitive parts should be observed.*

In the event of malfunctioning equipment the following guidelines should be observed for the preparation and shipment of the equipment. Failure to do so may result in the material reaching its destination damaged.

The electronic unit due to its **STATIC SENSITIVE** nature should be wrapped in a material conforming to MIL-B-81705 , Type II, and packaged in a heat sealable bag conforming to MIL-P-81997. These steps are necessary to protect the equipment from electrostatic charge(s) that may occur during handling.

The package should then be marked with a sensitive electronic device caution label conforming to MIL-STD-129, Appendix C. The equipment should then be wrapped in cushioning material, and placed into a close fitting box conforming to PPP-B-636 Domestic class.

The exterior shipping container should be marked with a sensitive electronic device caution label conforming to MIL-STD-129, Appendix C.

Clearly mark the factory provided RMA number on all paperwork and shipping packaging.

1.7   ENHANCEMENT FEATURES AND OPTIONS

Many instruments may be used with turbine flowmeters. Few offer the following enhancements for increasing the accuracy of the measurement system.

1.7.1   LINEARIZATION

Many flowmeters are much more repeatable than they are linear. When this is true, as it is in turbine flowmeters, higher measurement accuracy can be achieved by a linearization routine.

Most commonly, higher precision is achieved with the FLOWSTAR by exploiting the repeatability of +/-.05 to +/-.1% over the repeatable flow range.   The FLOWSTAR improves linear turbine flow measurement accuracies to +/-0.1% over 20:1 to 100:1 repeatable flow ranges.

FLOWSTAR can store up to 20 calibration points, for channel 1, up to 5 points for the remaining channels.   The unit continuously samples the flowmeter frequency averaged over a 1 second period. Stored calibration points are then accessed to determine the closest available calibration information. Using a curve-fitting routine the actual calibration factor is determined and used in the instrument calculations to achieve the highest possible accuracy.

1.72   INSTRUMENTATION OPTIONS

The RS-232 communication port permits many of the desirable, commonly required interface connections to user supplied printers, modems, terminals, and for some computers interfaces. The signals of this port meet or exceed the requirements of RS-232. The 9-pin connector supports the most commonly required handshaking signals. When used with remote computer interface or terminal, the port may be used to request information or to command the FLOWSTAR unit. Most of the capabilities can be controlled from the remote device in a manner similar to the operator panel.

Many requirements arise from the RS422/RS-485 communication option. With this port, several instruments may be connected together over greater distances and communicate to a central computer over higher speeds than is possible with the RS-232 communication port. In a multi-drop configuration, the port has a unique feature which permits it to only become active when its corresponding instrument identifier is called.

2   OPERATIONS OVERVIEW

2.1   INTRODUCTION

The FLOWSTAR 2000 (FS) has two modes of operation, the OPERATING mode and the SETUP mode. The OPERATING mode displays keyboard selected values. This is the mode used during normal operations. The SETUP mode is used during factory and on site customization. This mode can be accessed by proper entry of a password.

Normal operator input to the FLOWSTAR is through the keyboard interface. The serial port also allows the FLOWSTAR to be controlled by electronic means. User output from the FLOWSTAR is in the form of a 16 character, 2 line LCD display, LED indicator lamps and a sonic alarm.

2.2   HARDWARE CONFIGURATION OF SOFTWARE OPTIONS

Several fields in both the OPERATION and SETUP modes are optionally dependent on the switch selection of S1 located at the back of the FLOWSTAR. This switch determines which channels are selected and is only used during power up. Changes after power up to the S1 selector switch have no effect on program operation until a subsequent power up. If a channel is not selected there is no need to set that channel's option. Non-switch selected channels will not have their related fields displayed during setup.

S1 at the back of the PCA-138, PCB sets the selected channels for the FLOWSTAR. The following table details its use:

```
S1  1  2  3  4  5  6  7
    |  |  |  |  |  |  |  |_ _ _ _ON PROGRAM LOCKOUT
    |  |  |  |  |  |  |_ _ _ _ _ ON LOCAL CONTROL ENABLE
    |  |  |  |  |  |_ _ _ _ _ _ _ON INPUT CHANNEL 2 ON
    |  |  |  |  |_ _ _ _ _ _ _ _ ON INPUT CHANNEL 3 ON
    |  |  |  |_ _ _ _ _ _ _ _ _ ON INPUT CHANNEL 4 ON
    |  |_ _ _ _ _ _ _ _ _ _ _ _ON OUTPUT CHANNEL 1 ON
    |_ _ _ _ _ _ _ _ _ _ _ _ _ON OUTPUT CHANNEL 2 ON
```

- S1-7: The program lockout option determines whether the setup mode is selectable. Turning this switch on disables the MODE key. This prevents an operator from having access to the SETUP mode.

- S1-6: When switch is turned ON, the front panel CLEAR key is disable. This prevents an operator from clearing the totalizer.

- S1-3,4,5: This switch enables or disables their respective analog to digital input channels. If an input channel is turned off, none of its respective configuration fields will be available in the SETUP mode.

- S1-1,2: This switch enables or disables their respective digital to analog output channels. If an output channel is turned off, none of its respective configuration fields will be available in the SETUP mode.

3   OPERATING MODE

3.1   INTRODUCTION

The OPERATING mode is where all measured values are displayed and batch controls are performed. Displaying a measured value is as simple as pressing a key. In this mode continuous monitoring of all channels is performed. The following display fields are available in the operating mode:

CH1 TOTAL	Direct Key Selectable
CH1 RATE	Direct Key Selectable
CH2	Direct Key Selectable
CH3	Direct Key Selectable
CH4	Direct Key Selectable
AUX 1	Direct Key Selectable
AUX 2	Direct Key Selectable
TIME	Accessible By LAST and NEXT Keys Only
DATE	Accessible By LAST and NEXT Keys Only
CH1 ACCUM	Accessible By LAST and NEXT Keys Only
CH2 ACCUM	Accessible By LAST and NEXT Keys Only
CH3 ACCUM	Accessible By LAST and NEXT Keys Only
CH4 ACCUM	Accessible By LAST and NEXT Keys Only
CH1 DUAL DISPLAY	Accessible By LAST and NEXT Keys Only
DENSITY LBS/FT^3	Accessible By LAST and NEXT Keys Only

NOTE: CH1 DUAL DISPLAY will display the flowrate and total for channel 1 only.

NOTE: AUX1 and AUX2 can display totalization values of the other channels even if they are setup to display rate. This allows channels 2, 3 and 4 to display rates when their totalization values are displayed on the AUX1 or AUX2 display.

3.2 OPERATING MODE KEYBOARD OPERATION

This section details each keys function and response when pressed in the OPERATING mode.

- **TOTAL, RATE:** Selects the display values for the pulsed flow channel 1. Actual display values are dependent on the SETUP configuration for that channel.

- **TEMP1, TEMP2, PRES:** Select the display values for input channels 2, 3 and 4 respectively. Actual display values are dependent on the SETUP configuration for that channel.

- **SETP1, SETP2:** If the RATE, TEMP1, TEMP2, or PRES were the previously selected display fields, then their respective alarm setpoints will be displayed. If no alarm related displays are previously selected, pressing SEPT1 or SETUP2 display the batch pre-warn and control setpoints.

- **AUX1, AUX2:** Displays the SETUP selected values. Refer to the SETUP section for the possible selections.

- **CLEAR:** The CLEAR key resets the previously selected totalizer to zero.

- **LAST, NEXT:** These keys allow the operator to scroll through the display fields individually. In addition to the key selected fields, there are several miscellaneous fields which can only be viewed by scrolling past the original fields. I.E. TIME, DATE, CH 1, 2, 3, 4, and ACCUMULATED TOTALS.

- **SEL:** This key acknowledges an alarm condition. It sets blinking LED'S to solid. It will also silence the sonic alarm.

- **MODE:** Prompts you for a password. This occurs only if the S1-7 switch is set to OFF position during power up. Password entry is facilitated by using the numeric keys. Entry of a proper password will shift the unit into the SETUP mode. Pressing the MODE key in the SETUP mode will return you to the OPERATING mode.

3.3 OPERATING MODE LED AND SONIC ALARM OPERATIONS

During normal operating conditions in which none of the alarm conditions are met, the LED and SONIC ALARM are in the off state. If an alarm condition is met, then the associated LED will blink and the sonic alarm will sound. This is considered an alarming condition. To silence the alarm, the SEL key must be pressed. This will cause the sonic alarm to be silenced and the LED will stop blinking and remain in the on condition. This will indicate that an alarming condition is met and that it has been acknowledged. This is the alarm acknowledged state. If the alarming condition subsides, the LED and sonic alarm (if still on) will de-energize. This is the cleared state. If another alarm condition is met then the same sequence of events will occur. The steady LED on state of a

previously acknowledged alarm will remain the same. The alarm conditions are fully configurable in the SETUP mode. When in the SETUP mode all alarm conditions are held in the cleared state. Even though the TEMP2, channel 3 does not have an associated alarm LED, it still has all of the above alarm functionality. It is possible depending on the channel 3 setup and the alarm 3 setpoints to get a channel 3 audible alarm. If this feature is used it must be noted that you will have an audible alarm with no blinking LED's. Silence this alarm using the SEL key.

4 SETUP MODE OPERATIONS

After the MODE key is pressed in the OPERATING mode, a password entry screen is displayed. If the proper password is entered, and the MODE key pressed, then the FLOWSTAR will enter the SETUP mode. After configuration parameters have been entered or viewed, press the MODE key once more to return to the OPERATING mode. If the SETUP mode is re-entered, the last SETUP selected field will be displayed again. This enhances corrections to specific fields when the OPERATING values are needed to fine tune the unit. The default password is 2001.

4.1 KEYBOARD OPERATION

- The FLOWSTAR uses an alternate key functionality when in the SETUP mode.

- 1, 2, 3, 4, 5, 6, 7, 8, 9, 0: These keys facilitate numeric entry in selected SETUP fields.

- SEL, REM: Scrolls forward and backward to select a field's discrete selection.

- LAST, NEXT: Scrolls forward and backward through the SETUP fields.

- STOP, CLEAR, AUTO, MAN: Perform no functions in this mode.

- MODE: Causes the program to exit the SETUP mode. Any altered values are stored in non-volatile memory (eeprom).

4.2 SETUP MODE FIELD TYPES

SETUP mode control keys consist of the MODE, LAST, and NEXT keys. Field data entry and option selection is facilitated by the NUMERIC, SEL and REM keys. Field parameters are presented in two basic forms. These are either English-like label fields (discrete) or numeric entry fields. Numeric fields require the entry of numbers using the NUMERIC keys for a particular parameter. Label fields display English messages showing what option is currently chosen for a particular setup option or parameter. Label type field alternate selections may be selected by pressing the SEL or REM key. The field selections wrap around once the last selection is passed.

4.3   SETUP MODE FIELD DESCRIPTIONS

Many of the field selections in the setup mode are optional and are dependent on the S1 setup switch. If the specific channel selector switch is not enabled then all of the setup fields for that channel will not be displayed.

NOTE: FOR BEST ACCURACY OF CHANNEL 2, 3 AND 4 IT IS RECOMMENDED THAT ALL POINTS BE ENTERED.

WARNING: TABLE DATA POINTS FOR ANALOG INPUT CHANNELS MUST BE ENTERED. IN A LINEAR MANNER.   FAILURE TO DO SO WILL RESULT IN MEASUREMENT ERROR.

4.3.1   CH1 TOT CONFIG

This field is used to assign display measured values in the TOTAL display for the pulsed flow input channel. The following units and options are available.

ENGLISH		METRIC	
LIQUID	**GAS**	**LIQUID**	**GAS**
LBS	LBS	KG	KG
FT^3	ACF	M^3	SM^3
GAL	SCF	LIT	AM^3
OZ	UDEF	MLIT	NM^3
FLOZ		CC	SCC
PINTS		MTON	ACC
BBL		UDEF	NCC
TON			LIT
			NLIT
USERDEF			SLIT
			UDEF

4.3.2 CH1 RATE CONFIG

This field is used to assign display measured values in the RATE display based off the pulsed flow input channel. The following units and options are available.

ENGLISH		METRIC	
LIQUID	GAS	LIQUID	GAS
LBS/MIN	LBS/MIN	KG/MIN	KG/MIN
LBS/HR	LBS/HR	KG/HR	KG/HR
LBS/SEC	LBS/SEC	KG/SEC	KG/SEC
FT^3/MIN	ACF/MIN	M^3/MIN	SM^3/MIN
FT^3/HR	ACF/HR	M^3/HR	SM^3/HR
FT^3/SEC	ACF/SEC	M^3/SEC	SM^3/SEC
GAL/MIN	SCF/MIN	LIT/MIN	AM^3/MIN
GAL/HR	UDEF/MIN	LIT/HR	AM^3/HR
GAL/SEC	UDEF/HR	LIT/SEC	AM^3/SEC
OZ/MIN	UDEF/SEC	MLIT/MIN	SCC/MIN
OZ/HR		MLIT/HR	SCC/HR
OZ/SEC		MLIT/SEC	SCC/SEC
FLOZ/MIN		CC/MIN	ACC/MIN
FLOZ/HR		CC/HR	ACC/HR
FLOZ/SEC		CC/SEC	ACC/SEC
PNTS/MIN		MTON/MIN	NCC/MIN
PNTS/HR		MTON/HR	NCC/HR
PNTS/SEC		MTON/SEC	NCC/SEC
BBL/MIN		UDEF/MIN	LIT/MIN
BBL/HR		UDEF/HR	LIT/HR
BBL/SEC		UDEF/SEC	LIT/SEC
TON/MIN			NLIT/MIN
TON/HR			NLIT/HR
TON/SEC			NLIT/SEC
UDEF/MIN			SLIT/MIN
			SLIT/HR
UDEF/HR			SLIT/SEC
			UDEF/MIN
UDEF/SEC			UDEF/HR
			UDEF/SEC

4.3.3   CH1 SMOOTHING

This field is used to filter the channel 1 rate display. A value of 0.0 means no filtering will occur. A maximum value of 1.00 filters the signal 100 percent. Select a value somewhere between 0 and 1.0 if smoothing is desired. Factory default is set to 0.500.

4.3.4   CH1 POINT NUMBER

This integer field determines how many points will be used in a linearization look-up table. Allowed values are from 0 to 20.

4.3.5   FLOW CALC METHOD

Select from the following based on the type of measurement calculation desired.
- KFACTOR
- SINGLE KFACTOR uses the default K-FACTOR of the selected table.

4.3.6   CH1 TABLE SELECT

Select from the following based on which table will be used in the linearization calculation. Channel 1 will accept a maximum of 4 tables each containing 20 point tables of both frequencies and K-factors.

- TABLE 1
- TABLE 2
- TABLE 3
- TABLE 4

4.3.7   DEF DENS LBS/FT³ (LIQUID VERSION ONLY)

This is the default density used when MASS FLOW METHOD is set to the MANUAL DENSITY. Enter a numeric value that corresponds to the density of the fluid being measured. Factory default is 62.32 #/FT^3 or 998.30 KG/M^3.

4.3.7.1   DENS @ STP LBS/FT (GAS VERSION ONLY)

Enter a value that corresponds to the gas density at S.T.P.

4.3.8   BASE DENS LBS/FT³ (LIQUID VERSION ONLY)

This is the base density used to compensate for specific fluids. Enter a number value that corresponds to the density of the fluid being measured, at the base conditions. Factory default is 62.32 LBS/FT³ or 998.30 KG/M³.

In order to achieve a readout of equivalent gas (SCF) at STP for cryogenic liquids, the following values must be used:

LIN: 0.0724655 #/ft³.
LOX: 0.0828092 #/ft³.
LAR: 0.103381 #/ft³.
LH²: 0.00521868 #/ft³.

4.3.9   DEF TEMP DEG R (FOR GAS VERSION ONLY)

This entry allows for the programming of the typical line operating temperature.

4.3.10   BASE TEMP DEG R (FOR GAS VERSION ONLY)

This entry allows for the programming of the desired base temperature. This value is initially set to 519.67°R (60°F).

FLOWSTAR performs measurement of gas based off of the following equation:

$$SCF = ACF \; X \; (\frac{P_{FLOW}}{P_{BASE}}) \; X \; (\frac{T_{BASE}}{T_{FLOW}}) \; X \; (\frac{1}{Z})$$

Use the following chart as default values:

UNITS	T_{BASE}	P_{BASE}
SCF	519.67°R	14.7 PSIA
SM³, SL	518.67°R	14.7 PSIA
NM³, NL	491.67°R	14.7 PSIA

4.3.11   DEF PRES PSIA (FOR GAS VERSION ONLY)

This is the pressure used to compensate gases to standard conditions when pressure is being regulated.

4.3.12   BASE PRES PSIA (FOR GAS VERSION ONLY)

This is the base pressure that corrections are made to.

4.3.13   DEF K P/UNIT

This is the default K Factor which will be use when the FLOW CALC METHOD is selected to SINGLE KFACTOR. Entry will be either P/GAL, P/LIT, P/ACF or P/AM³ depending on the version.

4.3.14   DEFAULT Z FACTOR (FOR GAS VERSION ONLY)

This is the compressibility factor used to compensate gases to standard conditions.

4.3.15   USER GAS TO UDEF

This field is used when the channel 1 total or rate are configured for a user's defined units. Enter a value that when multiplied by gallons will give the user the proper units.

4.3.16   FREQ HZ 1-20

Frequencies 1 through 20 are the flowmeter's characteristics used for the flow input channel when the KFACTOR method is selected for the FLOW CALC METHOD. Enter in a floating point value.

4.3.17   KFAC P/GAL 1-20

KFACTORS 1 through 20 are the flowmeter's characteristics used for the flow input channel when the KFACTOR method is selected for the FLOW CALC METHOD. Enter in a floating point value.

4.3.18 CH2 UNITS

NOTE: **If channel 2 is disabled by S1-5 being turned OFF, then the settings from 4.3.18 to 4.3.24 will not be displayed.**

WARNING: If UNITS are changed, then reprogram Channel 2 measurement points.

This selection determines the units of the generic analog to digital input channel's number 2. Since either a 1-5 volt or 4-20ma signal is used, the value chosen is not unique in the sense of measurability by the FLOWSTAR. Select from the following:

ENGLISH		METRIC	
LIQUID	**GAS**	**LIQUID**	**GAS**
LBS	LBS	KG	KG
LBS/MIN	LBS/MIN	KG/MIN	KG/MIN
LBS/HR	LBS/HR	KG/HR	KG/HR
LBS/SEC	LBS/SEC	KG/SEC	KG/SEC
FT^3	ACF	M^3	SM^3
FT^3/MIN	ACF/MIN	M^3/MIN	SM^3/MIN
FT^3/HR	ACF/HR	M^3/HR	SM^3/HR
FT^3/SEC	ACF/SEC	M^3/SEC	SM^3/SEC
GAL	SCF	LIT	AM^3
GAL/MIN	SCF/MIN	LIT/MIN	AM^3/MIN
GAL/HR	SDF/HR	LIT/HR	AM^3/HR
GAL/SEC	SCF/SEC	LIT/SEC	AM^3/SEC
OZ	UDEF	MLIT	NM^3
OZ/MIN	UDEF/MIN	MLIT/MIN	NM^3/MIN
OZ/HR	UDEF/HR	MLIT/HR	NM^3/HR
OZ/SEC	UDEF/SEC	MLIT/SEC	NM^3/SEC
FLOZ		CC	SCC
FLOZ/MIN		CC/MIN	SCC/MIN
FLOZ/HR		CC/HR	SCC/HR
FLOZ/SEC		CC/SEC	SCC/SEC
PNTS		MTONS	ACC
PNTS/MIN		MTONS/MIN	ACC/MIN
PNTS/HR		MTONS/HR	ACC/HR
PNTS/SEC		MTONS/SEC	ACC/SEC
BBL		UDEF	NCC
BBL/MIN		UDEF/MIN	NCC/MIN
BBL/HR		UDEF/HR	NCC/HR

ENGLISH		METRIC	
LIQUID	GAS	LIQUID	GAS
BBL/SEC		UDEF/SEC	NCC/SEC
TONS			LIT
TONS/MIN			LIT/MIN
TONS/HR			LIT/HR
TONS/SEC			LIT/SEC
UDEF			NLIT
UDEF/MIN			NLIT/MIN
UDEF/HR			NLIT/HR
UDEF/SEC			NLIT/SEC
			SLIT
			SLIT/MIN
			SLIT/HR
			SLIT/SEC
			UDEF
			UDEF/MIN
			UDEF/HR
			UDEF/SEC

4.3.19   CH2 LOW CAL

This field is used to calibrate the low end of the channel. Set the channel input to its lowest value and then, (i.e., 1VDC) press the select button. This locks in the low point corresponding to the lowest selected table entry.

4.3.20   CH2 HIGH CAL

This field is used to calibrate the channel's high end. Set the channel's input to its highest value and then, (i.e., 5VDC) press the select button. This locks in the high point corresponding to the highest selected table entry.

4.3.21   CH2 SMOOTHING

This field is used to filter the channel 2 temperature display. A value of 0.0 means no filtering will occur. A maximum value of 1.00 filters the signal 100 percent. Select a value somewhere between 0 and 1.0 if smoothing is desired. Factory default is 0.50.

4.3.22 CH2 POINT NUMBER

This numeric field determines how many points will be used in a linearization look-up table. Allowed values are from 0 to 10.

4.3.23 CH2 TABLE SELECT

Select from the following based on which table will be used in the linearization calculation. Channel 2 will accept a maximum of 2 tables containing up to 10 point tables each.

- TABLE 1
- TABLE 2

4.3.24 CH2 MEA PNT 1-10

These values are used to determine the measured value used in channel 2. The entries would consist of the temperature range corresponding to the 1-5 VDC or 4-20 mA input. If the channel is set up to totalize, then the measuring point data must be expressed as the configured unit per minute. For example, channel units equals pounds, the measurement entered will be represented as pounds per minute.

4.3.25 CH3 UNITS

> **NOTE: If channel 3 is disable by S1-4 being turned OFF, then the settings from 4.3.25 to 4.3.31 will not be displayed.**

> *WARNING: If UNITS are changed, then reprogram Channel 3 measurement points.*

This selection determines the units of the generic analog to digital input channel number 3. Since either a 1-5 volt or 4-20ma signal is used, the value chosen is not unique in the sense of measurability by the FLOWSTAR. The units for channel 3 are the same as those that are available for channel 2.

4.3.26 CH3 LOW CAL

This field is used to calibrate the low end of the channels. Set the channel input to its lowest value and then, (i.e., 1VDC) press the select button. This locks in the low point corresponding to the lowest selected table entry.

4.3.27 CH3 HIGH CAL

This field is used to calibrate the channel's high end. Set the channel's input to its highest value and then, (i.e., 5VDC) press the select button. This locks in the high point corresponding to the highest selected table entry.

4.3.28 CH3 SMOOTHING

This field is used to filter the channel 3 rate display. A value of 0.0 means no filtering will occur. A maximum value of 1.00 filters the signal 100 percent. Select a value somewhere between 0 and 1.0 if smoothing is desired. Factory default is 0.50.

4.3.29 CH3 POINT NUMBER

This numeric field determines how many points will be used in a linearization look-up table. Allowed values are from 0 to 5.

4.3.30 CH3 TABLE SELECT

Select from the following based on which table will be used in the linearization calculation. Channel 3 will accept a maximum of 4, 5 point tables.

- TABLE 1
- TABLE 2
- TABLE 3
- TABLE 4

4.3.31 CH3 MEA PNT 1-5

These values are used to determine the measured value used in channel 3. The entries would consist of the flow range corresponding to the 1-5 VDC or 4-20 mA input. If the channel is set up to totalize, then the measuring point data must be expressed as the configured unit per minute. For example, channel units equals pounds, the measurement entered will be represented as pounds per minute.

4.3.32 CH4 UNITS

NOTE: **If channel 4 is disable by S1-3 being turned OFF, then the settings from 4.3.32 to 4.3.48 will not be displayed.**

WARNING: If UNITS are changed, then reprogram Channel 4 measurement points.

This selection determines the units of the generic analog to digital input channel number 4. Since either a 1-5 volt or 4-20ma signal is used, the value chosen is not unique in the sense of measurability by the FLOWSTAR. The units for channel 4 are the same as those that are available for channel 2.

4.3.33 CH4 LOW CAL

This field is used to calibrate the low end of the channels. Set the channel input to its lowest value and then, (i.e., 1VDC) press the select button. This locks in the low point corresponding to the lowest selected table entry.

4.3.34 CH4 HIGH CAL

This field is used to calibrate the channel's high end. Set the channel's input to its highest value and then, (i.e., 5VDC) press the select button. This locks in the high point corresponding to the highest selected table entry.

4.3.35 CH4 SMOOTHING

This field is used to filter the channel 4 temperature display. A value of 0.0 means no filtering will occur. A maximum value of 1.00 filters the signal 100 percent. Select a value somewhere between 0 and 1.0 if smoothing is desired. Factory default is 0.50.

4.3.36 CH4 POINT NUMBER

This integer field determines how many points will be used in a linearization look-up table. Allowed values are from 0 to 5.

4.3.37 CH4 TABLE SELECT

Select from the following based on which table will be used in the linearization calculation. Channel 4 will accept a maximum of 4, 5 point tables.

- TABLE 1
- TABLE 2
- TABLE 3
- TABLE 4

4.3.38 CH4 MEA PNT 1-5

These values are used to determine the measured value used in channel 3. The entries would consist of the temperature range corresponding to the 1-5 VDC or 4-20 mA input. If the channel is set up to totalize, then the measuring point data must be expressed as the config. unit per minute. For example, channel units equals pounds, the measurement entered will be represented as pounds per minute.

4.3.39 AUX 1 UNITS AND AUX 2 UNITS

This selection sets the units to be used when the AUX 1 key is depressed in the OPERATING mode. These units should match the units of the channel being measured.

NOTE: **AUX1 and AUX2 can display totalization values of the other channels even if they are setup to display rate. This allows channels 2, 3 and 4 to display rates while their totalization values are displayed on the AUX1 or AUX2 display. Also the clear key will clear the original totaled values if depressed while viewing the AUX channels.**

ENGLISH	METRIC
LBS	KG
LBS/MIN	KG/MIN
LBS/HR	KG/HR
LBS/SEC	KG/SEC
FT^3	M^3
FT^3/MIN	M^3/MIN
FT^3/HR	M^3/HR
FT^3/SEC	M^3/SEC
GAL	LIT
GAL/MIN	LIT/MIN
GAL/HR	LIT/HR
GAL/SEC	LIT/SEC
SCF	MLIT

ENGLISH	METRIC
SCF/MIN	MLIT/MIN
SCF/HR	MLIT/HR
SCF/SEC	MLIT/SEC
ACF	ACM^3
ACF/MIN	ACM^3/MIN
ACF/HR	ACM^3/HR
ACF/SEC	ACM^3/MIN
OZ	SCM^3
OZ/MIN	SCM^3/MIN
OZ/HR	SCM^3/HR
OZ/SEC	SCM^3/SEC
PINTS	AM^3
PNTS/MIN	AM^3/MIN
PNTS/HR	AM^3/HR
PNTS/SEC	AM^3/SEC
BBL	SM^3
BBL/MIN	SM^3/MIN
BBL/HR	SM^3/HR
BBL/SEC	SM^3/SEC
UDEF	UDEF
UDEF/MIN	UDEF/MIN
UDEF/HR	UDEF/HR
UDEF/SEC	UDEF/SEC
DEG F	DEG F
DEG C	DEG C
DEG K	DEG K
KG channel must be lbs for this to work	LBS channel must be in KG
KG/MIN	LBS/MIN
M^3 channel must be ft^3 for this to work	FT^3 channel must be in M^3
M^3/MIN	FT^3/MIN
L channel must be gal for this to work	GAL channel must be in Lit
L/MIN	GAL/MIN

4.3.40 AUX1 CONFIG AND AUX2 CONFIG

This selection sets the value to be displayed when the AUX 1 key is pressed in the
OPERATING mode. Select from the following channel selections. The pluses and
minuses mean the channel values are added or subtracted.

C1
C2
C3
C4
C1+C2
C1+C2+C3
C1+C2+C3+C4
C1-C2
C2-C3
C3-C4
C1-C3

4.3.41 CH1 AUTO SWITCH

This feature is used to implement the auto ranging of flow inputs on channel 1 and
channel 2. The combined value is displayed on channel 1 total display. Both channel
1 and 2 rate displays will still have their associated flowmeters input displayed.

- OFF
- C1 LOW - C2 HIGH} Auto switching will occur to channel 2 when low setpoint
  for channel 1 is reached.

4.3.42 ALARM X SET HIGH

NOTE: **If the corresponding channel of an alarm is turned OFF by the S1
switch block, then the settings for that alarm will not be displayed.**

This field sets the high alarm setpoint for CHANNEL 1, 2, 3, or 4. If a high alarm is
not desired, set it to a known condition well above the operating range of the
measured value.

4.3.43 ALARM X SET LOW

This field sets the low alarm setpoint for CHANNEL 1, 2, 3, or 4.

4.3.44 ALARM X DEADBAND

This field sets the deadband for alarms. Once the alarm setpoint is reached, the alarm will be locked in. For high alarms, the measured values must fall below the high alarm setpoint minus the deadband value. For low alarms, the measured values must rise above the low alarm setpoint plus the deadband value. The deadband reduces spurious alarms when close to the set points.

4.3.45 ALARM X AUDIBLE

This selects the conditions for the audible sonic alarm. Select from the following:

- YES
- NO

4.3.46 DA1 CONFIG AND DA2 CONFIG

NOTE: **If the corresponding OUTPUT CHANNEL is turned OFF by the S1 switch block, then the SETUP settings for that output channel will not be displayed.**

T
his field selects the mode of operation for the digital to analog output channel. After making a selection, only the applicable settings will be displayed that are related to this channel.

- MIMIC   AUX2
- MIMIC   AUX1
- MIMIC   C1 FWD/REV: used to configure output for quadrature detection.
- MIMIC   C1: used to configure analog output to mimic CH1.
- MIMIC   C2: used to configure analog output to mimic CH2.
- MIMIC   C3: used to configure analog output to mimic CH3.
- MIMIC   C4: used to configure analog output to mimic CH4.

4.3.47 DAX MAX RANGE

When the output channel mode is selected to mimic, the maximum value of the measured variable must be entered. This value will correlate to the +5 volts output or the 20ma output depending on the hardware selected.

4.3.48 CX PULSE WEIGHT

When the relay configuration is set for FLOW C1, 2, 3 or 4 enter a value which corresponds to the pulses per unit of measure selected on the channels display field. For example, 1.00 will represent 1 pulse/volume, 10 will equal 10 pulses/volume and 0.1 will equal 10 times unit volume of units * 10.

4.3.49 RELAY X CONFIG

Each relay can have the following selections for the value to be sensed:

ALARM1	HIGH
ALARM1	LOW
ALARM2	HIGH
ALARM2	LOW
ALARM3	HIGH
ALARM3	LOW
ALARM4	HIGH
ALARM4	LOW
ALARM AUDIBLE	This will occur based on the conditions that the audible alarm is set to.
PRE-WARN	Not available for Flowstar 2000.
CONTROL	Not available for Flowstar 2000.
C1	Select, if a scaled pulsed output is desired.
C2	
C3	
C4	

Alarm 1, 2, 3, or 4 corresponds to channel 1, 2, 3, or 4 alarm setpoints.

4.3.50 SERIAL MODE

Selection of communication protocol. Communication options are RS-232, RS-422/RS-485.

> NOTE: This is a hardware option at the time of order. User cannot change from RS-232 to RS-422 by simply changing this label.

4.3.51 SERIAL MODE NUM

RS-422/RS-485 multi-drop communications requires a unique identifier for the unit. Enter in an integer for this field in the range of 0 to 31.

4.3.52 BAUD RATE

Select one of the following to determine the serial baud rate.

- 9600
- 4800
- 2400
- 1200
- 600
- 300
- 150
- 75

4.3.53 HANDSHAKE

Select one of the following to set the serial handshake method.

- NONE
- HARDWARE DTR
- XON/XOFF

4.3.54 SERIAL PROTOCOL

Determine the communication mode based on the hardware. Select one of the following.

- REMOTE KEYBOARD
- HOFFER INTERFACE

4.3.55 PASSWORD

This field allows the password to be changed from the factory default of 2001.

4.3.56 DATE

Enter the date using the numeric keys.

4.3.57 DAY OF THE WEEK

Select from one of the following fields.

- MON
- TUE
- WEN
- THU
- FRI
- SAT
- SUN

4.3.58 TIME 24-HOUR CLOCK

Set the time of day in 24 hour mode.

4.3.59 RESTORE NEW UNIT

To restore the unit to factory defaults, perform the following steps:

- Press the SEL key, the unit will display PASSWORD entry field.
- Enter password.
- Press MODE key, if correct password is entered then the unit will display RESTORING TO FACTORY DEFAULTS. If the incorrect password is entered, then display will return to RESTORE NEW UNIT.

> *WARNING:* **If the password is changed to "0000" then pressing the MODE key in the above step will cause the unit to RESTORE FACTORY DEFAULTS. To prevent restoring factory defaults by accident, do not assign the PASSWORD to "0000".**

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5   INSTALLATION

5.1   INSTALLATION WIRING LAYOUT FOR INTERCONNECTIONS

In considering the interconnections between the flowmeter and the flow measurement system some attention must be given to anticipated noise sources and to the coupling of these noise sources to the interconnecting wiring.

Noise signals may be coupled inductively or capacitively into the wiring between the sensor and the electronic measuring systems. In general, utilizing a shielded, twisted pair for the interconnection greatly reduces this coupling. The shield should be grounded on one end of the cable only. In general, grounding only on the electronic measuring system is best.

However, even with proper interconnecting cabling cross talk with other signal lines or power lines may still occur and should be avoided. Physical isolation of the wiring reduces the chance of potential problems.

5.2   INSTALLATION OF THE FLOWSTAR

FLOWSTAR should be placed in a convenient location which maintains access to the unit should repairs or readjustment be required.

Refer to following installation diagrams for proper connections of input power, process sensors, process output and control outputs.

Figure 5.1   RS-232/RS-422/RS-485 Wiring Detail

Figure 5.2   AC Power Input

AC POWER INPUT

EARTH GROUND
LINE 1 (HOT)
LINE 2 (NEUTRAL)
CASE GROUND
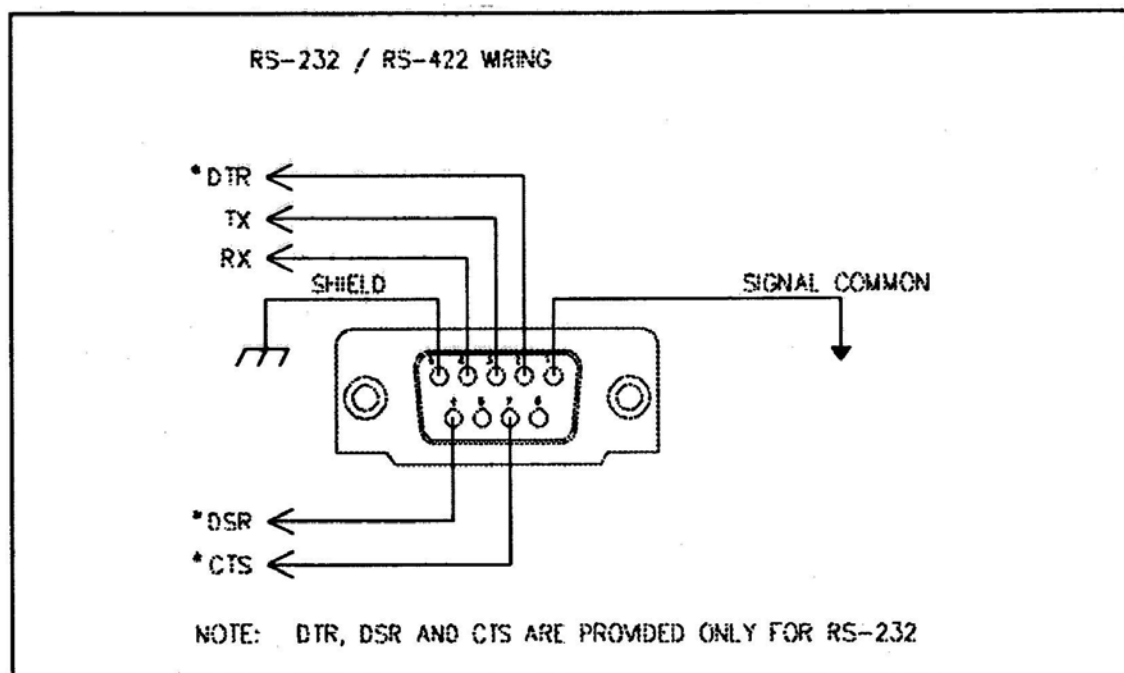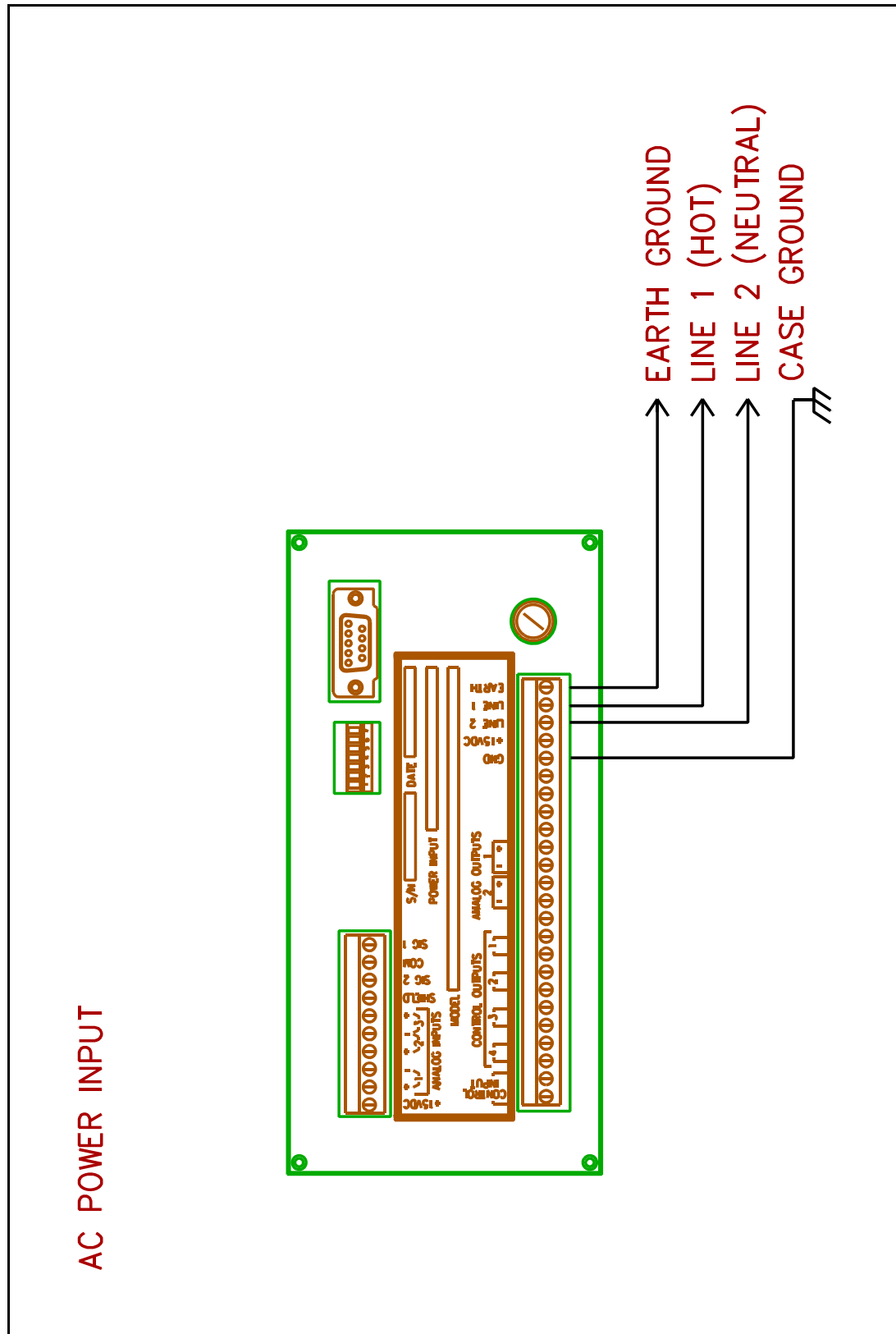
Figure 5.3　DC Power Input
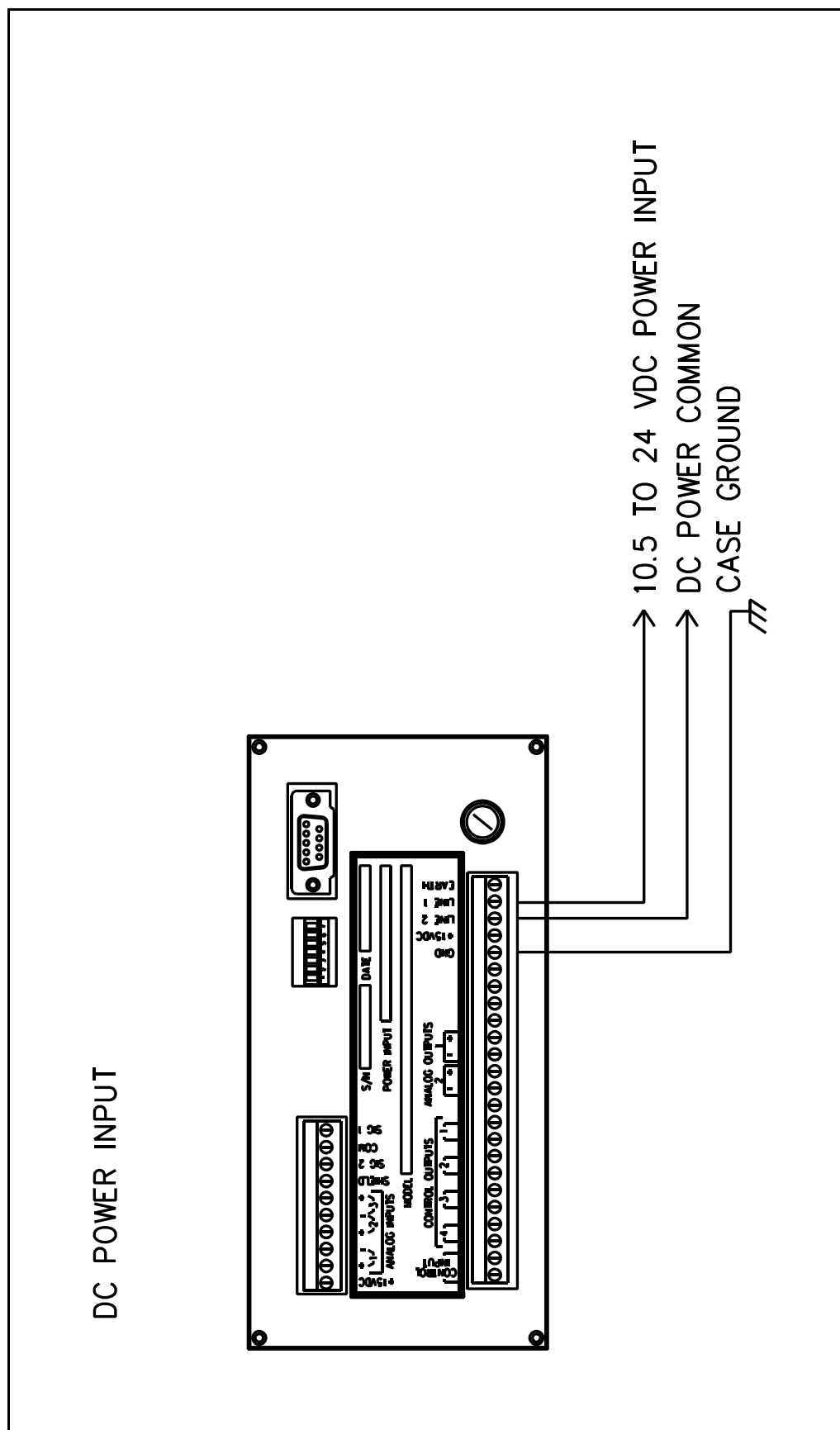
Figure 5.4   Single Magnetic Pickup Input

FLOW METER INPUT VIA MAGNETIC PICKUP

SCA-(__)CT2-S

MS3106A-10SL-4S

TO FLOW SENSOR MAGNETIC PICKUP COIL
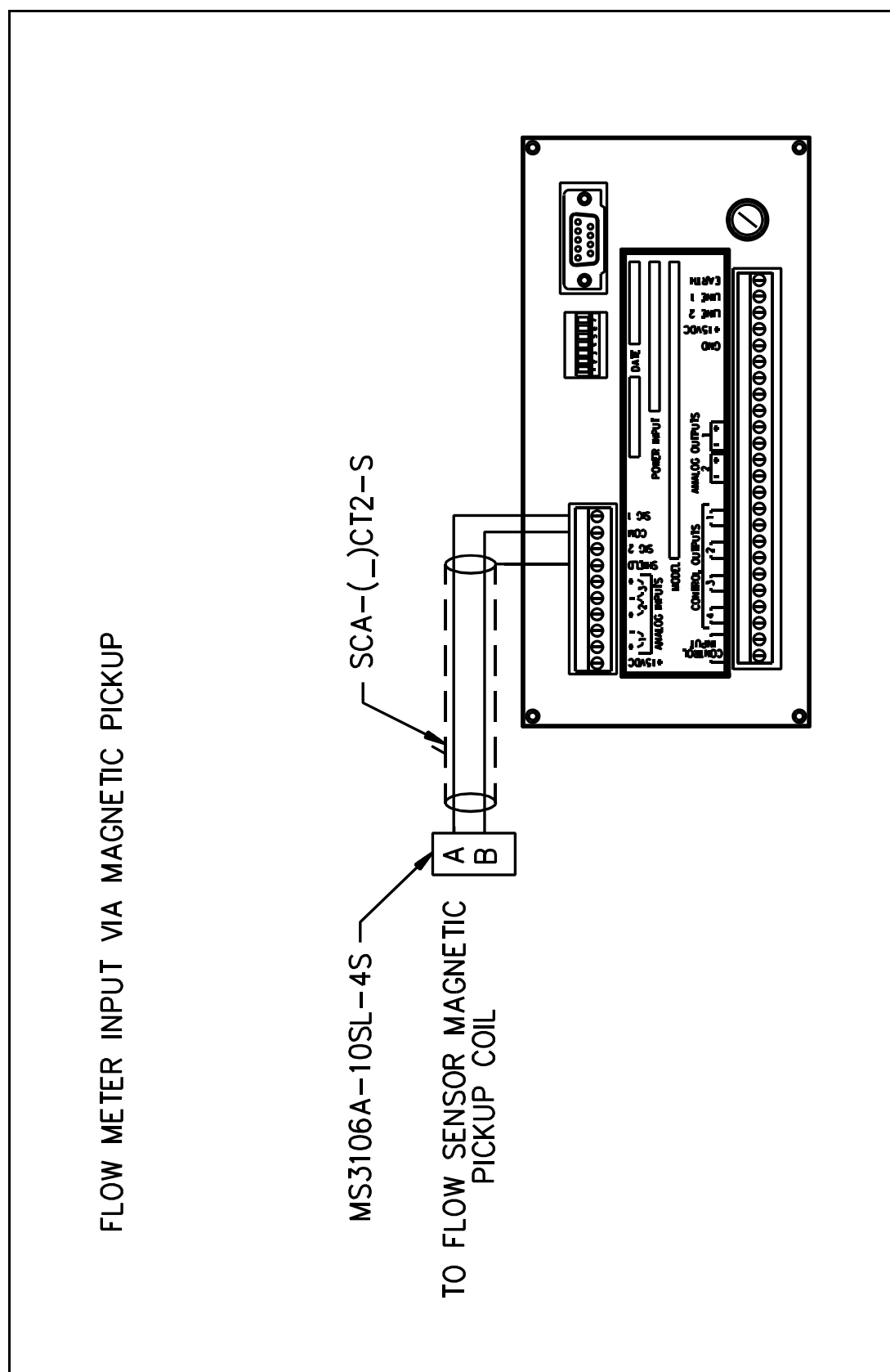
Figure 5.5   Quadrature Magnetic Pickup Input
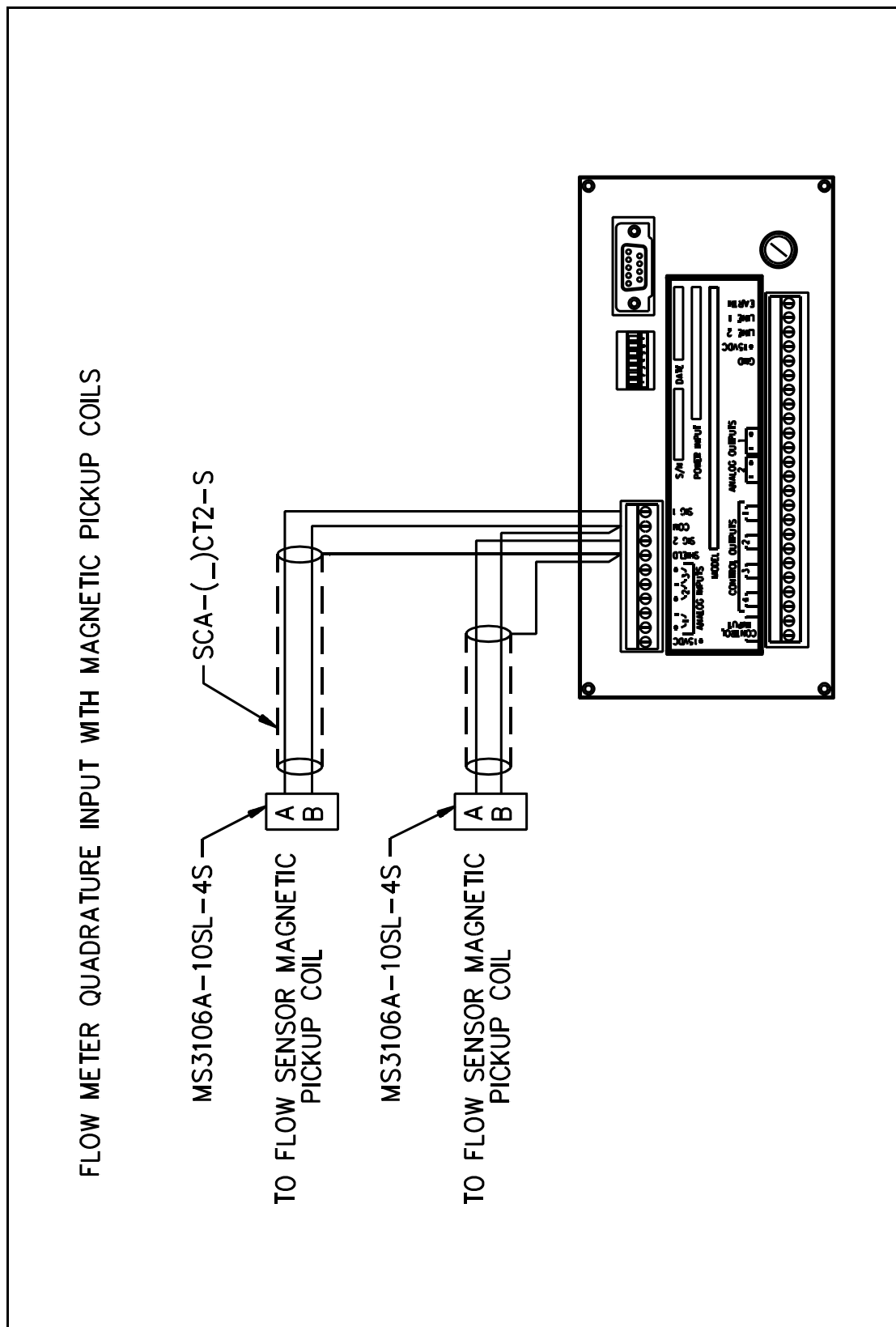
Figure 5.6　MCP Pickup Coil Input
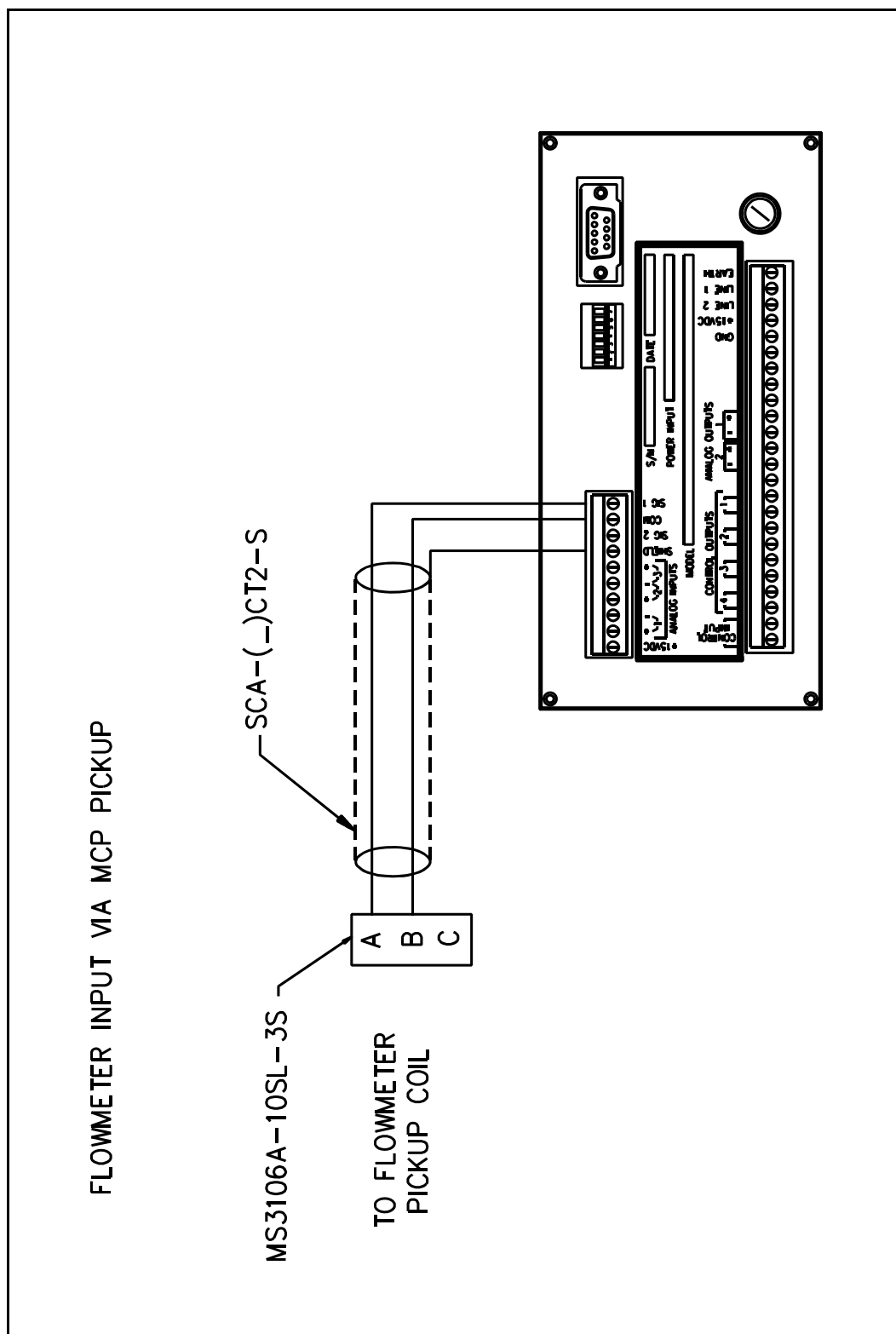
Figure 5.7   Remote Signal Conditioner Interface
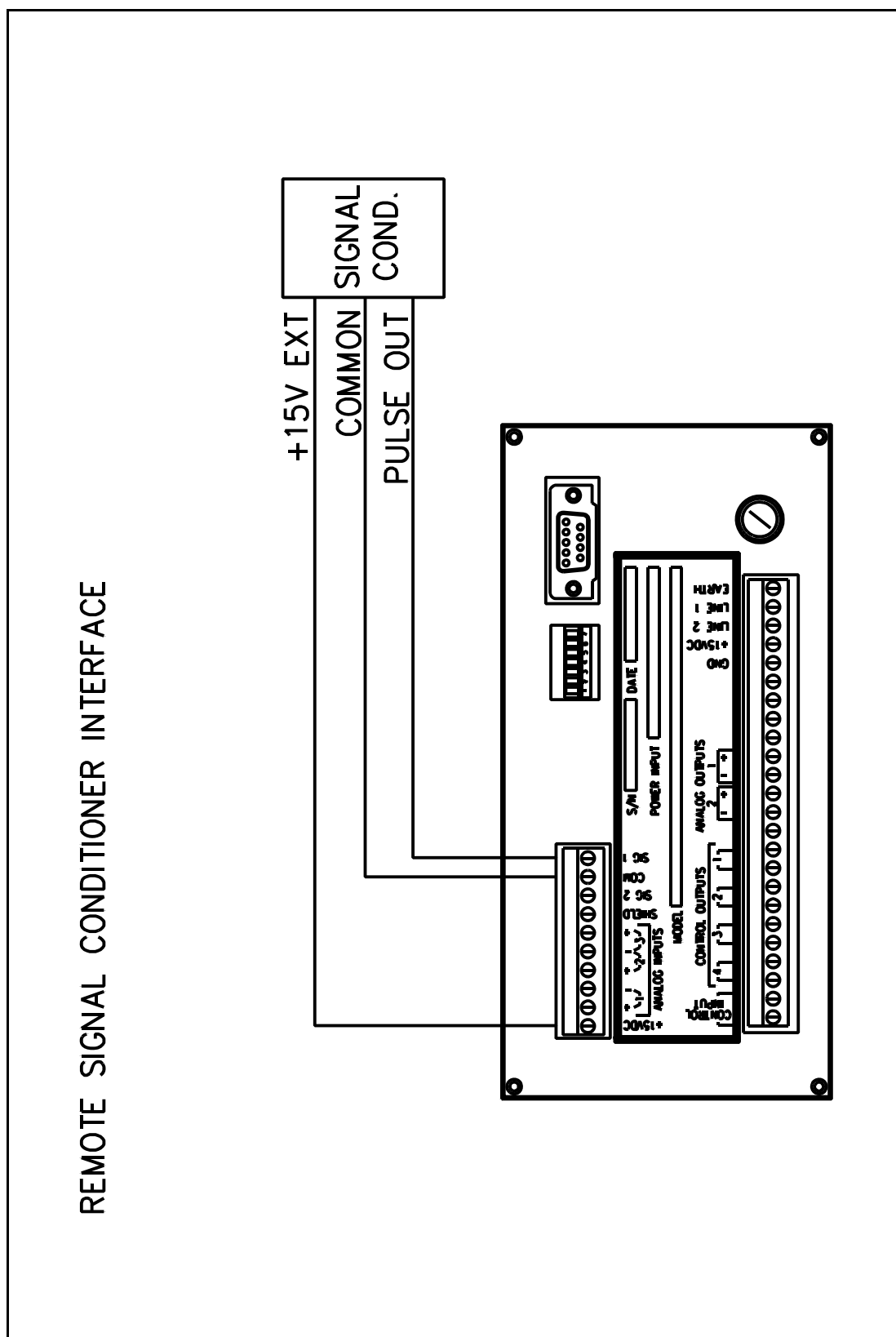
Figure 5.8 Analog Output Connections
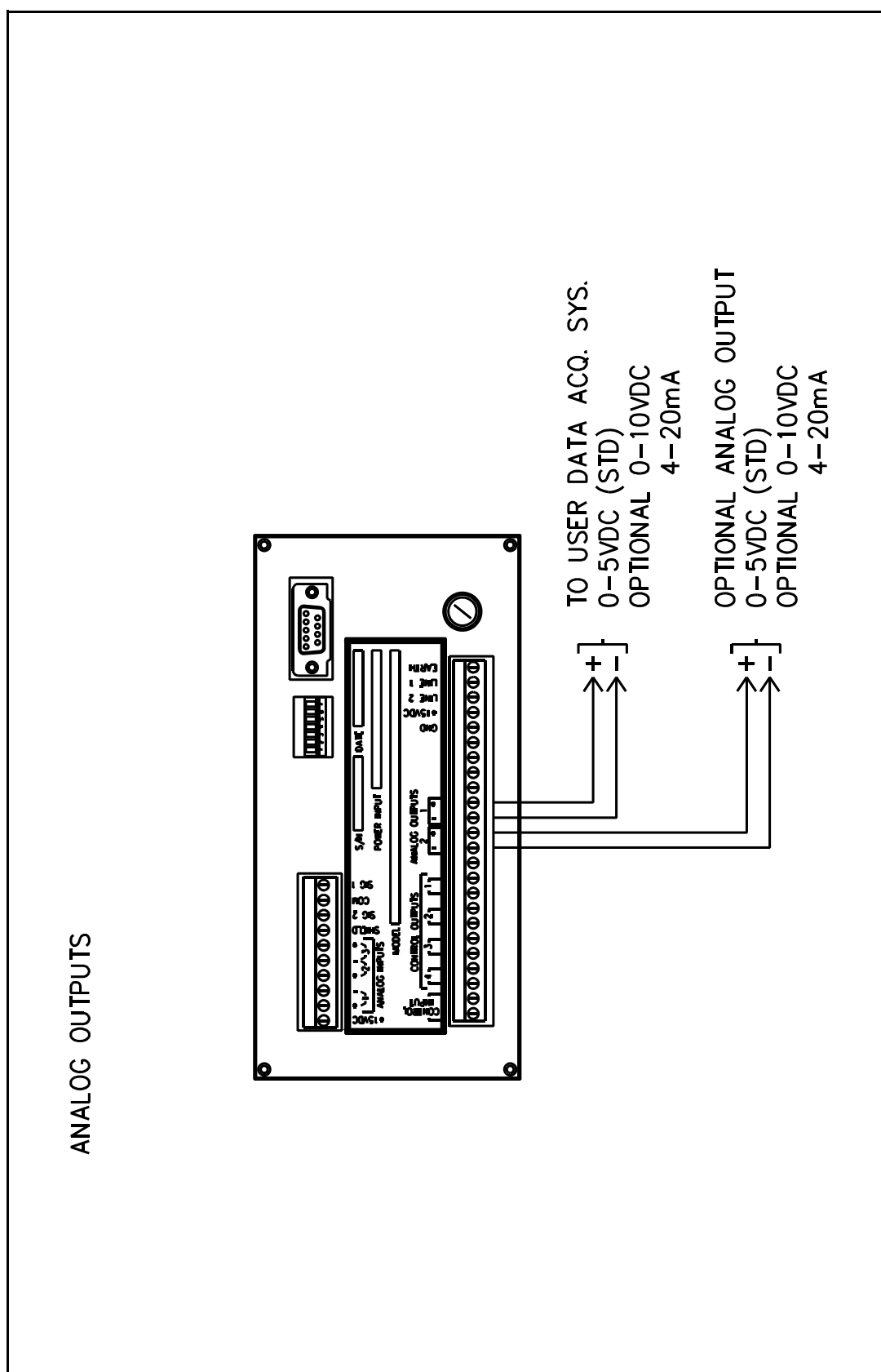
Figure 5.9   Two Wire Process Transmitter Input Connections
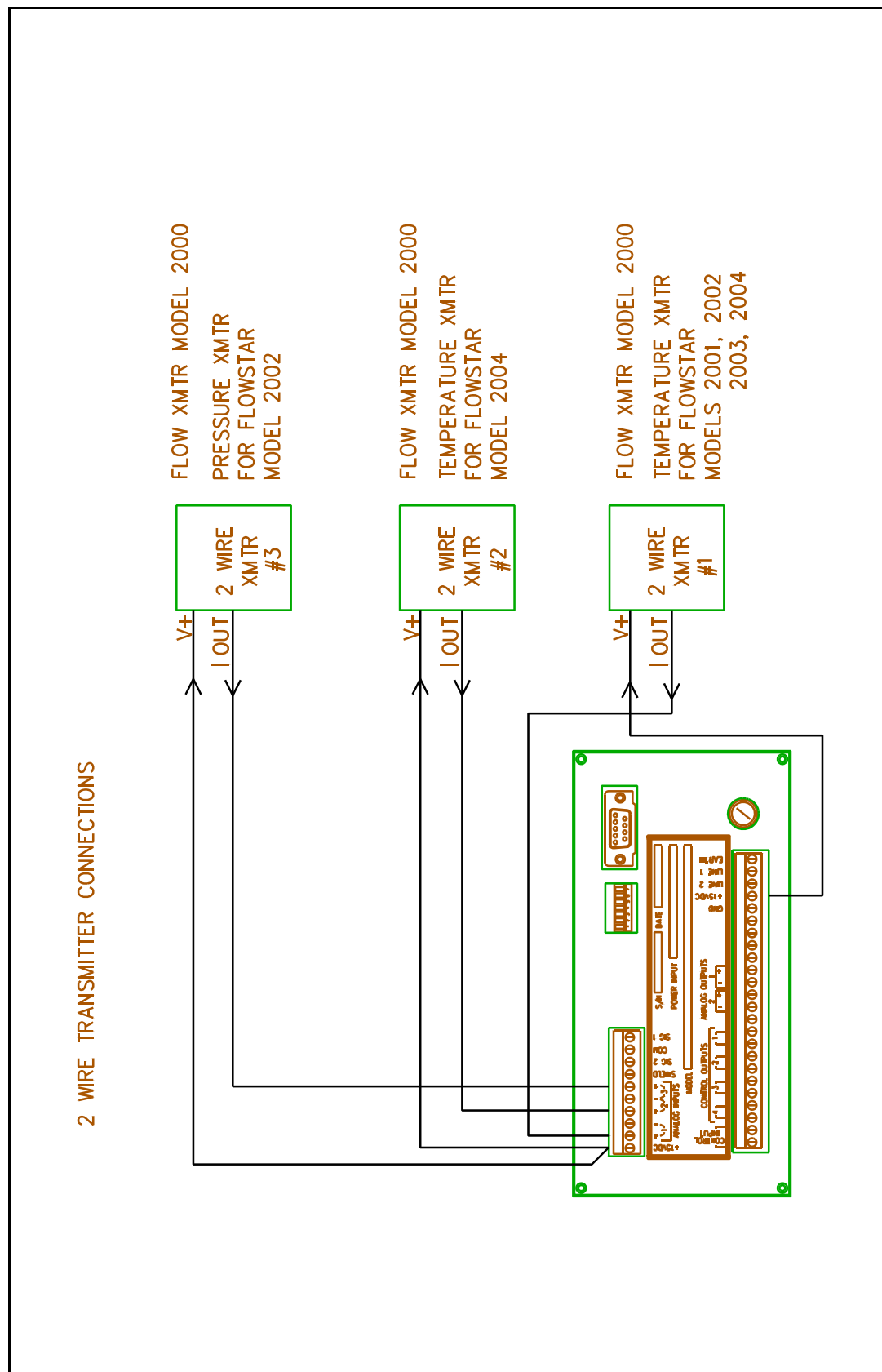
Figure 5.10 Three Wire Process Transmitter Input Connections
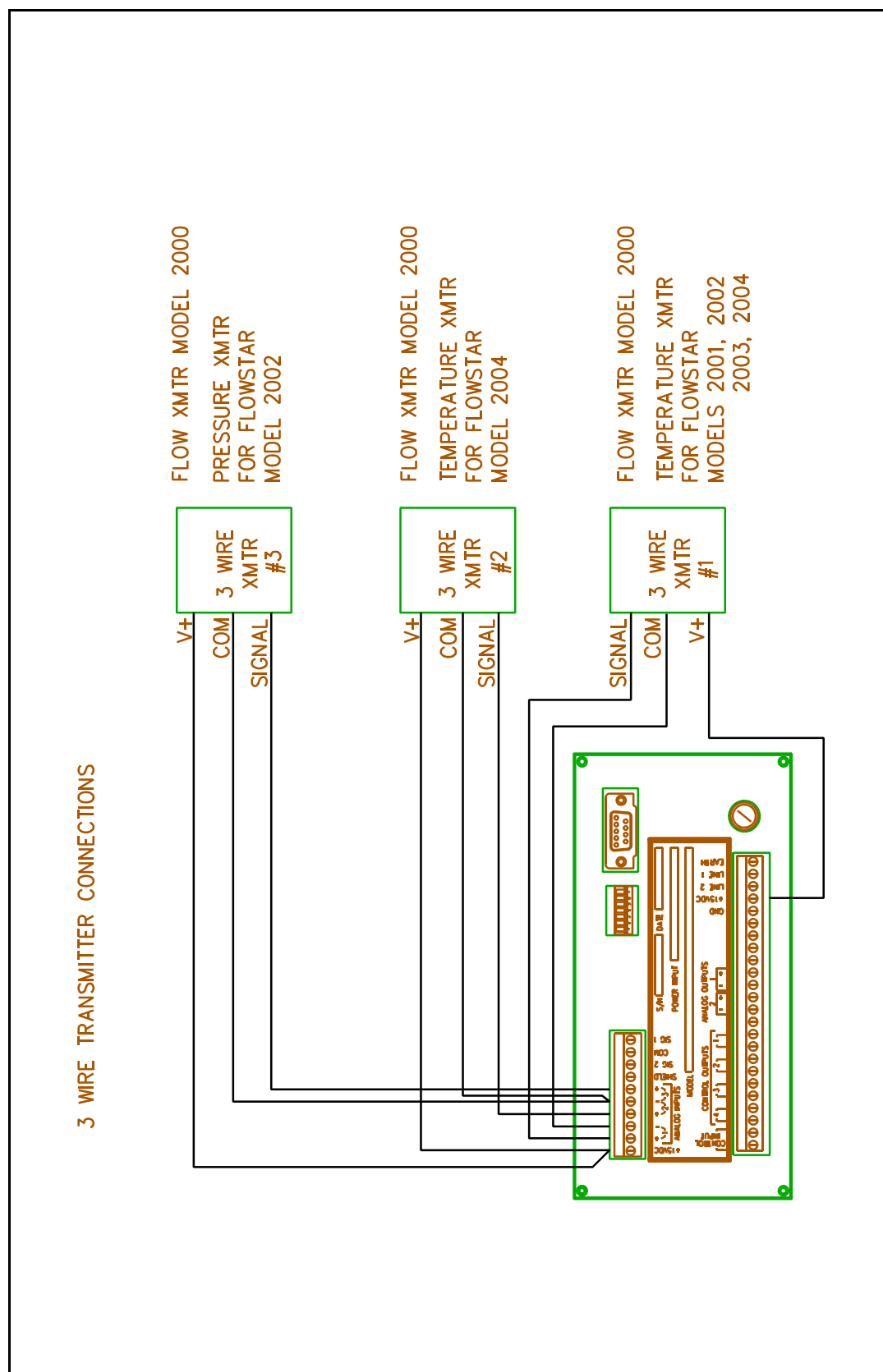
Figure 5.11   Pulse/Alarm Output Wiring
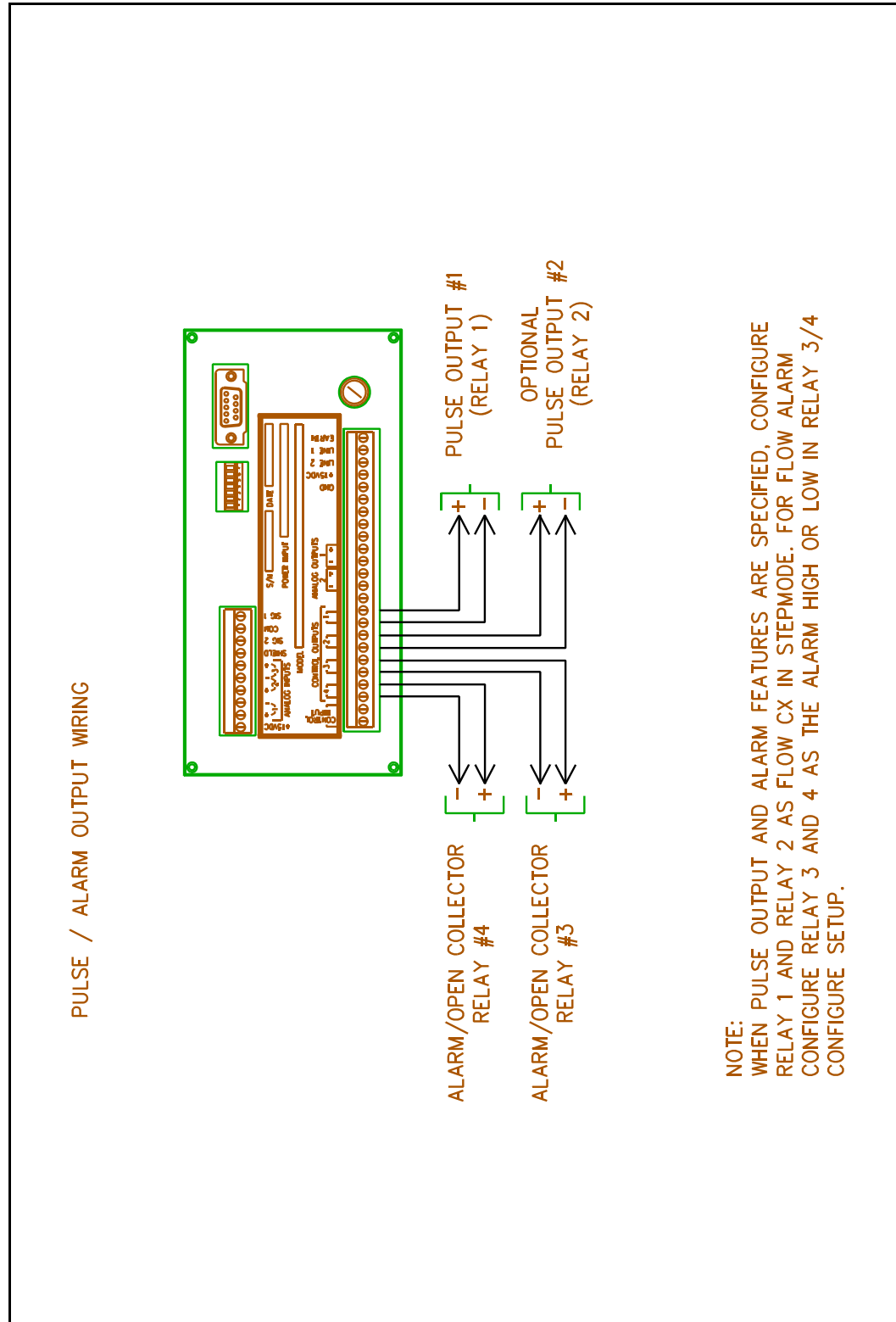
Figure 5.12   Pulse/Control Output Wiring

PULSE / CONTROL OUTPUT

PULSE OUT #1

PULSE OUT #2
(OPTIONAL)

PULSE OUT #3
(OPTIONAL)

PULSE OUT #4
(OPTIONAL)

NOTE:
PULSE OUTPUTS MAY BE CONFIGURED TO PULSE OR CONTROL
FUNCTIONS AS CONFIGURED IN THE SETUP MODE, IN THE
RELAY CONFIGURE FIELD.
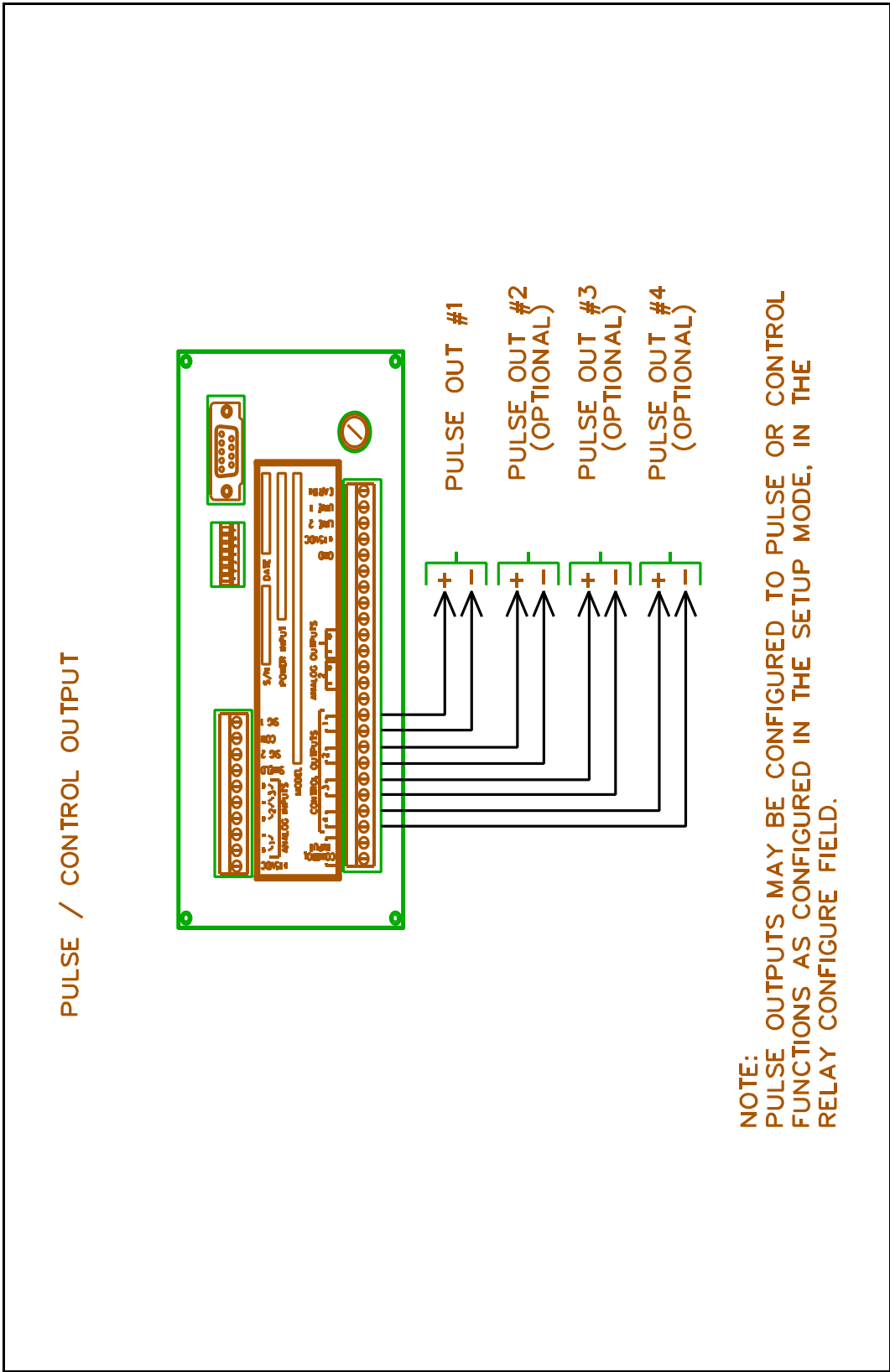
6   SERIAL COMMUNICATIONS

6.1   INTRODUCTION

FLOWSTAR's communication port may be either RS-232 or RS-422/RS-485, and has several uses. The port may be configured as REMOTE KEYBOARD or HOFFER INTERFACE.

- REMOTE KEYBOARD this is a special configuration which allows FLOWSTAR to be connected to a remote keyboard or personnel computer, via the RS-232. Flowstar may be directly connected to a remote pc via Windows compatible software.

- HOFFER INTERFACE allows for the two way communication between a host system and FLOWSTAR.

6.2   REMOTE KEYBOARD

In this configuration FLOWSTAR may be connected to a personnel computer, via the RS-232 communication option only. Control is possible by using Windows compatible communication software.

Hoffer Flow has written drivers that allow for Flowstar to be connecter to a host personal computer via Cross Talk for Windows. Windows is a registered trademark of Microsoft and Crosstalk is a registered trademark of Digital Communication Associates, Inc..

Installation is as follows:

Install CrossTalk for window as per manufacture's instructions. Copy the files copy the files FSREMOTE.XWS and FSREMOTE.XWC into the Crosstalk subdirectory XWS. Also copy the file FLOWSTAR.XWP into the Crosstalk directory XWP.

- Run Windows and click the mouse on the Crosstalk icon.

- Get into the Program Items Properties and modify as shown in figure 6.1, and as follows. Note this example assumes that your path is c:\window\xtalk, modify as your system requires.

Description:	Flowstar
Command line:	c:\windows\xtalk\xtalk.exe flowstar.xwp
Working directory:	c:\windows\xtalk
Shortcut Key:	None

Figure 6.1 Program Item Properties
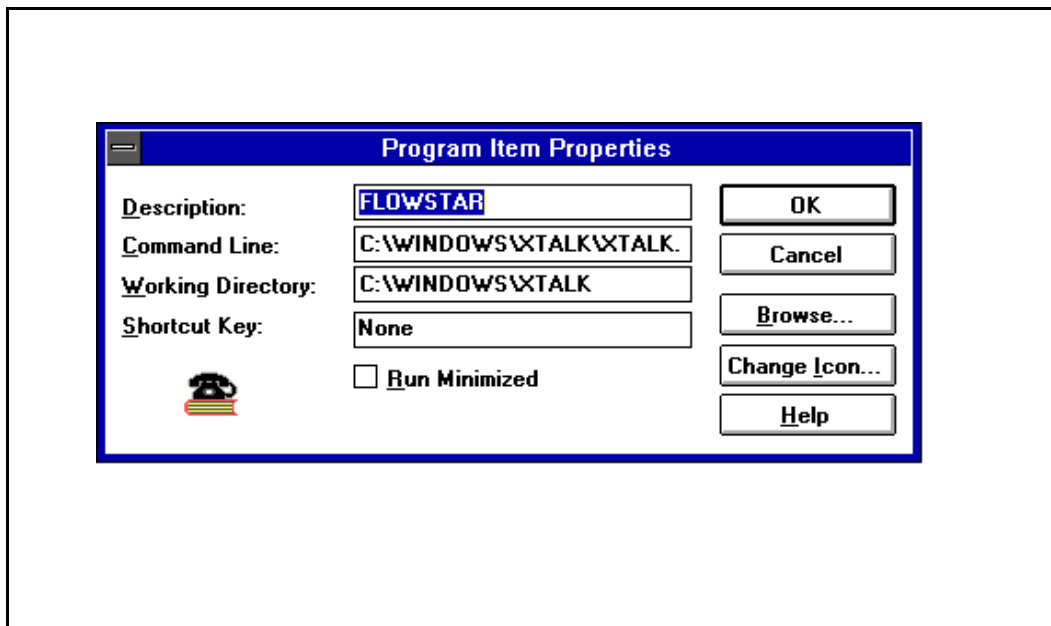
- Select the desired icon to represent FLOWSTAR, and exit Program Item Properties.

- Click the mouse on the FLOWSTAR icon. The computer will now establish an initial link to FLOWSTAR as shown in figure 6.2.

Figure 6.2 Flowstar Crosstalk Window
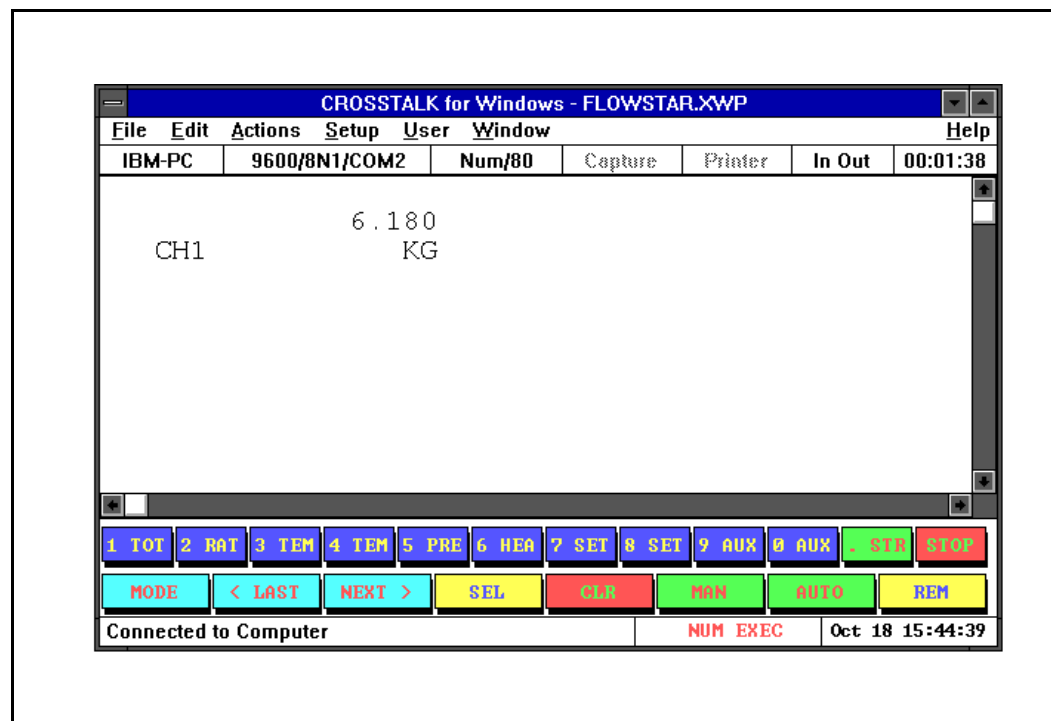
● Click the mouse on Setup and select System. Verify and modify as required. Refer to figure 6.3 for detail.

Figure 6.3 System Settings

● Click the mouse on Setup and select Terminal. Verify setup and modify as required as per figure 6.4.

Figure 6.4 Terminal Emulation Settings

- Click the mouse on Setup and select Fonts. Is should be noted that true type fonts are not recommended as system response will be slowed. Recommended selection is given in figure 6.5.

Figure 6.5 Font Selection
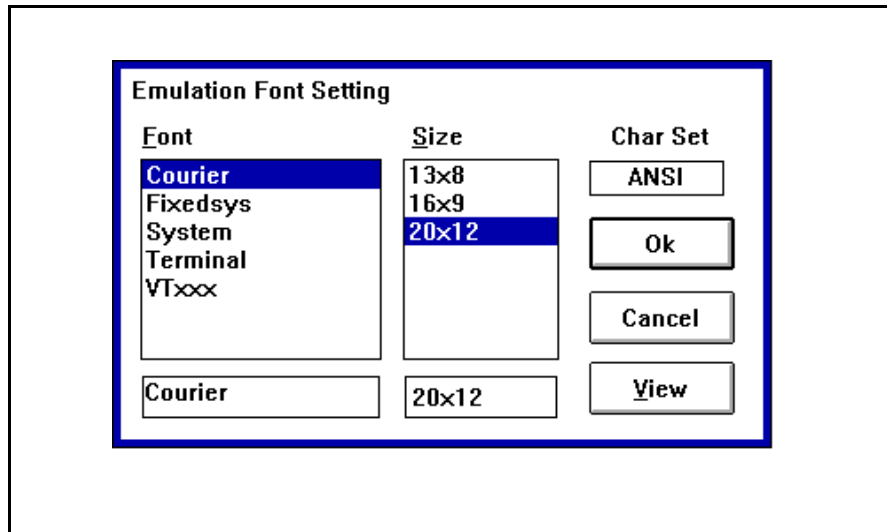
- FLOWSTAR is initially shipped from Hoffer Flow configured as a Remote Terminal, baud rate equal to 9600, and no handshaking. Crosstalk is also initially configured for 9600 baud, 8 data bits, no parity, one stop bit, and set for COM2. Should these settings require change, click the mouse on Actions and then Disconnect. Then click the mouse on Setup then Device and modify as required. All that may be required for change would be the COM port use.

6.3   HOFFER PROTOCOL

The Hoffer protocol allows for two way serial communications between the RS-232 or RS-422/RS-485 port to a host computer. The communication string consists of a start transmission code, unit ID number, a command code, specific data requested, data sent, end of transmission and checksum.

6.3.1   CONTROL COMMAND CALLER MESSAGE FORMAT

The following command format is used to perform remote operation of the Flowstar keypad. Execution of these commands will change the displayed information on the unit. The executed command will simply function as if the key were pressed on the actual unit. Flowstar will not respond back to the host with the new displayed data until a read data transmission is generated.

STX | nn | CT | sss | ETX | CKS

STX = 0x02
nn - unit id, 00 - 31
CT - control command
sss - keyboard input key number, ie., { 000 }
ETX - 0x03
CKS - exclusive or of each byte of data between the STX and ETX

Upon completion of the requested command, Flowstar will return an error code for the control command using the following:

STX | ee | ETX | CKS

STX = 0x02
ee - error codes:
00=no errors
01=invalid command
02=data out of range
03=access denied
Access is denied under the following conditions:
- A "FLOW" condition exist.
- Unit is in the SETUP mode.
ETX - 0x03
CKS - exclusive or of each byte of data between the STX and ETX

6.3.2   READ DATA COMMAND CALLER MESSAGE FORMAT

This group of commands allows the host computer system to read process conditions, and unit calibration data. To access data from Flowstar the read request must use the following command format.

STX | nn | RD | sss | ETX | CKS

STX = 0x02
nn - unit id, 00 - 31 for RS485. This value will be 00 for RS232.
RD - Read command.
sss - 3 characters specifying the specific field (000 - 421), as outlined in
     the Field Format Table.
ETX - 0x03
CKS - exclusive or of each byte of data between the STX and ETX

After receiving a read command from the host Flowstar will respond with the read response command. This response will be in the following format:

STX | ee | ddd | ETX | CKS

STX = 0x02
ee - error codes:
00=no errors
01=invalid command
02=data out of range
ddd=Value=char; response 3 digit numeric from Field Format Table column DDD.
Value= flt; response may consist of 16 numeric characters with decimal point.
        Leading zeros are not required. ie. 123456.789.
Value= int; response may consist of 16 numeric characters. Leading zeros are not
required. ie. 123456789.
ETX - 0x03
CKS - exclusive or of each byte of data between the STX and ETX

6.3.3   WRITE DATA COMMAND CALLER MESSAGE FORMAT

This command format allows the host computer system to write directly to the internal microprocessor registers of Flowstar. To write data to Flowstar the read request must use the following command format.

STX | nn | WR | sss | ddd | ETX | CKS

STX = 0x02
nn - unit id, 00 - 31
WR - Write command
sss - specific data, 3 characters specifying the specific field (000 - 421)
ddd - Value=char; response 3 digit numeric from Field Format Table column.
Value= flt; response may consist of 16 numeric characters with decimal point.
　　　　Leading zeros are not required. ie. 123456.789.
Value= int; response may consist of 16 numeric characters. Leading zeros are not required. ie. 123456789.
ETX - 0x03
CKS - exclusive or of each byte of data between the STX and ETX

After receiving a write command from the host Flowstar will respond with the read response command. This response will be in the following format:

STX | ee | ETX | CKS

STX = 0x02
ee - error codes:
00=no errors
01=invalid command
02=data out of range
ETX - 0x03
CKS - exclusive or of each byte of data between the STX and ETX

6.3.4   DATA FORMAT DESCRIPTIONS

Data may be transmitted to Flowstar using data formatted as either a character(char), floating(flt) numeric or an integer(int) numeric value.

Refer to the FIELD DATA TABLE for specific field formats.

For all char fields, 3 digit numeric entries are required corresponding to the specific field as listed in the FIELD DATA TABLE.

Floating fields may consist of up to 16 numeric characters with a decimal point. ie., {293.034}. Leading zeroes is not required here.

Integer values may also consist of up to 16 characters. Leading zeroes is not required here.

All characters between the STX and ETX must be ASCII alpha/numeric characters. In addition all alphabetic characters must be in upper case.

6.3.5   CHECKSUM DETERMINATION

The following routine used in the serial protocol calculates a checksum of all data bytes between the STX and ETX character. It takes as input a pointer to a string and the length of the string to calculate the checksum on. Its output is an unsigned character containing the checksum. The checksum itself is an exclusive or of all the bytes of data.

From Boolean algebra:

EXCLUSIVE OR = EOR = xy' + x'y

(chksum & ~*in_buff_ptr) | (~chksum & *in_buff_ptr)

Notice the similarity in the code to perform the EXCLUSIVE OR function. The rest of the code in the routine will perform the EOR the correct number of times on the input data string.
The format (ASCII, EBCDII, GRAY CODE, or what ever) of the bytes forming the string is completely irrelevant.

The following is a sample C program which may be used for the determination of the correct checksum.

```
/*****************************************************************/

unsigned char check_sum( unsigned char *in_buff_ptr, unsigned int abslen )

{
unsigned short int i;
unsigned char chksum;

  chksum = *in_buff_ptr++;
  for (i = 1; i < abslen; in_buff_ptr++, i++)
     chksum = (chksum & ~*in_buff_ptr) | (~chksum & *in_buff_ptr);
return( chksum );
}

/*****************************************************************/
```

6.3.6 TABLES

The following table indicated the equivalent code values for the specific keypad keys.

SSS	KEY EQUIVALENT
000	STOP
001	START
002	TOTAL
003	HEAT
004	CLEAR
005	MODE
006	RATE
007	SETP1
008	MAN
009	LAST
010	TEMP1
011	SETP2
012	AUTO
013	NEXT
014	TEMP2
015	AUX1
016	REM
017	SEL
018	PRES
019	AUX2

The following table is the Field Data Table. This information will be used to read all displayed data.

COMMAND	nnn	DESCRIPTION	VALUES
RD	000	AUX 2 TOTAL	flt
RD	001	CHANNEL 1	flt
RD	002	CHANNEL 1 RATE	flt
RD	003	CHANNEL 2	flt
RD	004	CHANNEL 3	flt
RD	005	CHANNEL 4	flt
RD	008	AUX 1 TOTAL	flt
RD	011	CHANNEL 1	flt
RD	012	CHANNEL 2	flt
RD	013	CHANNEL 3	flt
RD	014	CHANNEL 4	flt

CHI RATE

The following table is the Field Data Table. This information will be used to read and write to the internal registers of Flowstar.

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	020	CH1 TOTAL * SEE TABLE 6.1 FOR DEFINITION	char	UNIT 1 UNIT 2 UNIT 3 UNIT 4 UNIT 5 UNIT 6 UNIT 7 UNIT 8 UNIT 9 UNIT 10 UNIT 11	/* 000 */ /* 001 */ /* 002 */ /* 003 */ /* 004 */ /* 005 */ /* 006 */ /* 007 */ /* 008 */ /* 009 */ /* 010 */
RD/WR	021	CH1 RATE * SEE TABLE 6.1 FOR DEFINITION.	char	UNIT 1/MIN UNIT 1/HR UNIT 1/SEC UNIT 2/MIN UNIT 2/HR UNIT 2/SEC UNIT 3/MIN UNIT 3/HR UNIT 3/SEC UNIT 4/MIN UNIT 4/HR UNIT 4/SEC UNIT 5/MIN UNIT 5/HR UNIT 5/SEC UNIT 6/MIN UNIT 6/HR UNIT 6/SEC UNIT 7/MIN UNIT 7/HR UNIT 7/SEC UNIT 8/MIN UNIT 8/HR UNIT 8/SEC UNIT 9/MIN UNIT 9/HR UNIT 9/SEC UNIT 10/MIN UNIT 10/HR UNIT 10/SEC UNIT 11/MIN UNIT 11/HR UNIT 11/SEC	/* 011 */ /* 012 */ /* 013 */ /* 014 */ /* 015 */ /* 016 */ /* 017 */ /* 018 */ /* 019 */ /* 020 */ /* 021 */ /* 022 */ /* 023 */ /* 024 */ /* 025 */ /* 026 */ /* 027 */ /* 028 */ /* 029 */ /* 030 */ /* 031 */ /* 032 */ /* 033 */ /* 034 */ /* 035 */ /* 036 */ /* 037 */ /* 038 */ /* 039 */ /* 040 */ /* 041 */ /* 042 */ /* 043 */
RD/WR	021	CH1 SMOOTHING	flt	0.0 - 1.0	
RD/WR	023	CH1 POINT NUMBER	int	00 - 20	
RD/WR	024	FLOW CALC METHOD	char	KFACTOR SINGLE KFACTOR TEMP VS VISCOSITY	/* 044 */ /* 045 */ /* 046 */

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	025	MASS FLOW METHOD	char	MANUAL DENSITY TEMP VS DENSITY	/* 047 */ /* 048 */
RD/WR	026 267 302	CH1 TABLE SELECT CH3 TABLE SELECT CH4 TABLE SELECT	char	TABLE1 TABLE2 TABLE3 TABLE4	/* 049 */ /* 050 */ /* 051 */ /* 052 */
RD/WR	027	DEF DENS (CH1)	flt		
RD/WR	028	BASE DENS (CH1)	flt		
RD/WR	029	DEF TEMP (CH1)	flt		
RD/WR	030	BASE TEMP (CH1)	flt		
RD/WR	031	DEF PRES (CH1)	flt		
RD/WR	032	BASE PRES (CH1)	flt		
RD/WR	033	DEF KFACTOR	flt		
RD/WR	034	DEFAULT Z FACTOR	flt		
RD/WR	035	USER DEFINE (CH1)	flt		
RD/WR	036 thru 055	FREQ1_1 thru FREQ1_20	flt		
RD/WR	056 thru 075	FREQ2_1 thru FREQ2_20	flt		
RD/WR	076 thru 095	FREQ3_1 thru FREQ3_20	flt		
RD/WR	096 thru 115	FREQ4_1 thru FREQ4_20	flt		
RD/WR	116 thru 135	KFAC1_1 thru KFAC1_20	flt		
RD/WR	136 thru 155	KFAC2_1 thru KFAC2_20	flt		
RD/WR	156 thru 175	KFAC3_1 thru KFAC3_20	flt		
RD/WR	176 thru 195	KFAC4_1 thru KFAC4_20	flt		

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION		DDD
RD/WR	196 263 298	CH2 UNITS CH3 UNITS CH4 UNITS **NOTE:** **THESE OPTIONS ARE** **AVAILABLE** **AS FOLLOWS:** **MODEL CH#** **2000...............ALL** **2001...............CH3** **2002................CH3** **2003............NONE**	char	UNIT 1 UNIT 1/MIN UNIT 1/HR UNIT 1/SEC UNIT 2 UNIT 2/MIN UNIT 2/HR UNIT 2/SEC UNIT 3 UNIT 3/MIN UNIT 3/HR UNIT 3/SEC UNIT 4 UNIT 4/MIN UNIT 4/HR UNIT 4/SEC UNIT 5 UNIT 5/MIN UNIT 5/HR UNIT 5/SEC UNIT 6 UNIT 6/MIN UNIT 6/HR UNIT 6/SEC UNIT 7 UNIT 7/MIN UNIT 7/HR UNIT 7/SEC UNIT 8 UNIT 8/MIN UNIT 8/HR UNIT 8/SEC UNIT 9 UNIT 9/MIN UNIT 9/HR UNIT 9/SEC UNIT 10 UNIT 10/MIN UNIT 10/HR UNIT 10/SEC UNIT 11 UNIT 11/MIN UNIT 11/HR UNIT 11/SEC		/* 068 */ /* 069 */ /* 070 */ /* 071 */ /* 072 */ /* 073 */ /* 074 */ /* 075 */ /* 076 */ /* 077 */ /* 078 */ /* 079 */ /* 080 */ /* 081 */ /* 082 */ /* 083 */ /* 084 */ /* 085 */ /* 086 */ /* 087 */ /* 088 */ /* 089 */ /* 090 */ /* 091 */ /* 092 */ /* 093 */ /* 094 */ /* 095 */ /* 096 */ /* 097 */ /* 098 */ /* 099 */ /* 100 */ /* 101 */ /* 102 */ /* 103 */ /* 104 */ /* 105 */ /* 106 */ /* 107 */ /* 108 */ /* 109 */ /* 110 */ /* 111 */
		NOTE: **THESE OPTIONS ARE** **AVAILABLE AS FOLLOWS:** **MODEL CH#** **2000..........NONE** **2001..........CH2** **2002..........CH2, CH4** **2003..........CH2**		PSIG PSIA AJM BAR KPAS	* CH4 DISPLAYED VALUES	/* 053 */ /* 054 */ /* 055 */ /* 056 */ /* 057 */
				DEG F DEG R DEG C DEG K	* CH2 DISPLAYED VALUES	/* 058 */ /* 059 */ /* 060 */ /* 061 */

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION		DDD
RD/WR **MODEL 2001 & 2003 ONLY**	199	CH2 GAS INHIBIT	CHAR	ON OFF		/* 125 */ /* 126 */
RD/WR	200	CH2 SMOOTHING	flt	0.0 - 1.0		
RD/WR	201	CH2 POINT NUMBER	int	00 - 10		
RD/WR	202	CH2 TABLE	int	1 - 4	TABLE 1	/* 49 */
					TABLE 2	/* 50 */
RD/WR	203 thru 212	CH2 MEASURE PNT 1_1 thru 1_10	flt			
RD/WR	213 thru 222	CH2 MEASURE PNT 2_1 thru 2_10	flt			
RD/WR **MODEL 2001 & 2003 ONLY**	223 thru 232 233 thru 242	CH2 VISCOSITY PNT 1_1 thru 1_10 2_1 thru 2_10	flt			
RD/WR **MODEL 2001 & 2003 ONLY**	243 thru 252 253 thru 262	CH2 DENSITY PNT 1_1 thru 1_10 2_1 thru 2_10	flt			
RD/WR	266	CH3 SMOOTHING	flt	0.0 - 1.0		
RD/WR	267	CH3 POINT NUMBER	int	00 - 5		
RD/WR	268	MASS FLOW METHOD	char			
RD/WR	269	CH3 TABLE	int	1 - 4	TABLE 1	/* 49 */
					TABLE 2	/* 50 */
					TABLE 3	/* 51 */
					TABLE 4	/* 52 */
RD/WR	270	DEFAULT DENS CH3	flt			
RD/WR	271	BASE DENS CH3	flt			
RD/WR	272	DEFAULT TEMP OR CH3	flt			
RD/WR	273	BASE TEMP CH3	flt			
RD/WR	274	DEFAULT PRES CH3	flt			
RD/WR	275	BASE PRES CH3	flt			
RD/WR	278 thru 282	CH3 MEASURE PNT 1_1 thru 1_5	flt			
RD/WR	283 thru 287	CH3 MEASURE PNT 2_1 thru 2_5	flt			
RD/WR	288 thru 292	CH3 MEASURE PNT 3_1 thru 3_5	flt			
RD/WR	293 thru 297	CH3 MEASURE PNT 4_1 thru 4_5	flt			
RD/WR **MODEL 2001 & 2003 ONLY**	301	CH4 GAS INHIBIT	char	ON OFF		/* 125 */ /* 126 */
RD/WR	302	SCH4_SMOOTH	flt	0.0 - 1.0		
RD/WR	303	CH4 POINT NUMBER	int	00 - 5		
RD/WR	304	CH4 TABLE	int	1 - 4	TABLE 1	/* 49 */
					TABLE 2	/* 50 */
					TABLE 3	/* 51 */
					TABLE 4	/* 52 */

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	305 thru 309	CH4 MEASURE PNT 1_1 thru 1_5	flt		
RD/WR	310 thru 314	CH4 MEASURE PNT 2_1 thru 2_5	flt		
RD/WR	315 thru 319	CH4 MEASURE PNT 3_1 thru 3_5	flt		
RD/WR	320 thru 324	CH4 MEASURE PNT 4_1 thru 4_5	flt		
RD/WR *MODEL 2001 ONLY*	325 thru 329	CH4 DENSITY PNT 1_1 thru 1_5	flt		
RD/WR *MODEL 2001 ONLY*	330 thru 334	CH4 DENSITY PNT 2_1 thru 2_5	flt		
RD/WR *MODEL 2001 ONLY*	335 thru 339	CH4 MEASURE PNT 3_1 thru 3_5	flt		
RD/WR *MODEL 2001 ONLY*	340 thru 344	CH4 MEASURE PNT 4_1 thru 4_5	flt		

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	345 347	AUX1 UNITS AUX2 UNITS	char	KG	/* 062 */
				KG/MIN	/* 063 */
				M^3	/* 064 */
				M^3/MIN	/* 065 */
				LIT	/* 066 */
				LIT/MIN	/* 067 */
				UNIT 1	/* 068 */
				UNIT 1/MIN	/* 069 */
				UNIT 1/HR	/* 070 */
				UNIT 1/SEC	/* 071 */
				UNIT 2	/* 072 */
				UNIT 2/MIN	/* 073 */
				UNIT 2/HR	/* 074 */
				UNIT 2/SEC	/* 075 */
				UNIT 3	/* 076 */
				UNIT 3/MIN	/* 077 */
				UNIT 3/HR	/* 078 */
				UNIT 3/SEC	/* 079 */
				UNIT 4	/* 080 */
				UNIT 4/MIN	/* 081 */
				UNIT 4/HR	/* 082 */
				UNIT 4/SEC	/* 083 */
				UNIT 5	/* 084 */
				UNIT 5/MIN	/* 085 */
				UNIT 5/HR	/* 086 */
				UNIT 5/SEC	/* 087 */
				UNIT 6	/* 088 */
				UNIT 6/MIN	/* 089 */
				UNIT 6/HR	/* 090 */
				UNIT 6/SEC	/* 091 */
				UNIT 7	/* 092 */
				UNIT 7/MIN	/* 093 */
				UNIT 7/HR	/* 094 */
				UNIT 7/SEC	/* 095 */
				UNIT 8	/* 096 */
				UNIT 8/MIN	/* 097 */
				UNIT 8/HR	/* 098 */
				UNIT 8/SEC	/* 099 */
				UNIT 9	/* 100 */
				UNIT 9/MIN	/* 101 */
				UNIT 9/HR	/* 102 */
				UNIT 9/SEC	/* 103 */
				UNIT 10	/* 104 */
				UNIT 10/MIN	/* 105 */
				UNIT 10/HR	/* 106 */
				UNIT 10/SEC	/* 107 */
				UNIT 11	/* 108 */
				UNIT 11/MIN	/* 109 */
				UNIT 11/HR	/* 110 */
				UNIT 11/SEC	/* 111 */

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	346 348	AUX1 CONFIG AUX2 CONFIG	char	C1 C2 C3 C4 C1+C2 C1+C2+C3 C1+C2+C3+C4 C1-C2 C2-C3 C3-C4 C1-C3	/* 112 */ /* 113 */ /* 114 */ /* 115 */ /* 116 */ /* 117 */ /* 118 */ /* 119 */ /* 120 */ /* 121 */ /* 122 */
RD/WR	349	CH1 AUTO SWITCH	char	OFF CH1 LOW - CH2 HIGH	/* 123 */ /* 124 */
RD/WR	350	ALARM1 SET HIGH	flt		
RD/WR	351	ALARM1 SET LOW	flt		
RD/WR	352	ALARM1 DEADBAND	flt		
RD/WR	353	ALARM1 AUDIBLE	char	YES NO	/* 125 */ /* 126 */
RD/WR	354	ALARM2 SET HIGH	flt		
RD/WR	355	ALARM2 SET LOW	flt		
RD/WR	356	ALARM2 DEADBAND	flt		
RD/WR	357	ALARM2 AUDIBLE	char	YES NO	/* 125 */ /* 126 */
RD/WR	358	ALARM3 SET HIGH	flt		
RD/WR	359	ALARM3 SET LOW	flt		
RD/WR	360	ALARM3 DEADBAND	flt		
RD/WR	361	ALARM3 AUDIBLE (ALL OTHERS) CONT1 BATCH FOR MODEL 2003	char	YES NO	/* 125 */ /* 126 */
RD/WR	362	ALARM4 SET HIGH	flt		
RD/WR	363	ALARM4 SET LOW	flt		
RD/WR	364	ALARM4 DEADBAND	flt		
RD/WR	365	ALARM4 AUDIBLE	char	YES NO	/* 125 */ /* 126 */
RD/WR *MODEL 2003 ONLY*	366	PREWARN SETPOINT MODEL 2003	flt		
RD/WR *MODEL 2003 ONLY*	367	CONTROL SETPOINT MODEL 2003	flt		
RD/WR	368 370	DA1 CONFIG DA2 CONFIG	char	MIMIC AUX1 MIMIC AUX2 MIMIC CH1 FWD/REV MIMIC CH1 MIMIC CH2 MIMIC CH3 MIMIC CH4	/* 127 */ /* 128 */ /* 129 */ /* 130 */ /* 131 */ /* 132 */ /* 133 */
RD/WR	369	DA1 MAX RANGE	flt		
RD/WR	371	DA2 MAX RANGE	flt		
RD/WR	372	CH1 PULSE WEIGHT	flt		
RD/WR	373	CH2 PULSE WEIGHT	flt		

COMMAND	SSS	SPECIFIC FIELD	VALUES	FIELD SELECTION	DDD
RD/WR	374	CH3 PULSE WEIGHT	flt		
RD/WR	375	CH4 PULSE WEIGHT	flt		
RD/WR	376 377 378 379	RELAY1 CONFIG RELAY2 CONFIG RELAY3 CONFIG RELAY4 CONFIG	char	ALARM1 HIGH ALARM1 LOW ALARM2 HIGH ALARM2 LOW ALARM3 HIGH ALARM3 LOW ALARM4 HIGH ALARM4 LOW ALARM AUDIBLE PREWARN CONTROL FLOW CH1 FLOW CH2 FLOW CH3 FLOW CH4	/* 134 */ /* 135 */ /* 136 */ /* 137 */ /* 138 */ /* 139 */ /* 140 */ /* 141 */ /* 142 */ /* 143 */ /* 144 */ /* 145 */ /* 146 */ /* 147 */ /* 148 */
RD/WR	380	SERIAL MODE	char	RS232 RS422 RS485	/* 156 */ /* 157 */ /* 158 */
RD/WR	381	SERIAL MODE NUM	int	00 - 31	
RD/WR	382	SERIAL BAUD RATE	char	9600 4800 2400 1200 600 300 150 75	/* 159 */ /* 160 */ /* 161 */ /* 162 */ /* 163 */ /* 164 */ /* 165 */ /* 166 */
RD/WR	383	SERIAL HANDSHAKE	char	NONE HARDWARE DTR XON/XOFF	/* 167 */ /* 168 */ /* 169 */
RD/WR	384	SERIAL PROTOCOL	char	REMOTE KEYBOARD HOFFER INTERFACE	/* 170 */ /* 171 */
RD/WR	385	PASSWORD	int	0000-9999	
RD/WR	386	DATE	tim	mmddyy	
RD/WR	387	DAY OF WEEK	char	MON TUE WEN THU FRI SAT SUN	/* 149 */ /* 150 */ /* 151 */ /* 152 */ /* 153 */ /* 154 */ /* 155 */
RD/WR	388	TIME 24 HOUR CLK	tim	hhmmss	

Table 6.1   Unit Definitions

UNIT #	ENGLISH		METRIC	
	LIQUID	GAS	LIQUID	GAS
UNIT 1	LBS	LBS	KG	KG
UNIT 2	FT^3	ACF	M^3	SM^3
UNIT 3	GAL	SCF	LIT	AM^3
UNIT 4	OZ	UDEF	MLIT	NM^3
UNIT 5	FLOZ		CC	SCC
UNIT 6	PNTS		MTON	ACC
UNIT 7	BBL		UDEF	NCC
UNIT 8	TONS			LIT
UNIT 9	UDEF			NLIT
UNIT 10				SLIT
UNIT 11				UDEF

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Related Drawings

FLOWSTAR 2000 FLOWCHART

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

DWG NO. 500-0009
CAGE CODE 33321
SIZE C
SCALE NONE
SHEET 1 OF 1
REV —

DWG NO. 500-0009   SH 1   REV –

REVISIONS
ZONE | REV | DESCRIPTION | DATE | APP

Operating / Setup Mode

PASSWORD → PASSWORD

OPERATING MODE:
CH1 TOTAL
CH1 RATE
*CH2
*CH3
*CH4
AUX1
TIME
DATE
*CH1 ACCUM
*CH2 ACCUM
*CH3 ACCUM
*CH4 ACCUM
CH1 DUAL DISPLAY
DENSITY LBS/FT
AUX2

SETUP MODE:
CH1 TOT CONFIG
CH1 RATE CONFIGURE
CH1 SMOOTHING
CH1 POINT NUMBER
FLOW CALC METHOD
CH1 TABLE SELECT
DEF DENS LBS/FT
BASE DENS LBS/FT3
DEF TEMP DEG R
BASE TEMP DEG R
DEF PRES PSIA
BASE PRES PSIA
DEF K Z/UNIT
DEFAULT Z FACTOR
USER GAL TO UDEF
FREQ HZ 1-20
KFAC P/GAL 1-20

Channel Configuration

CH2 == ON (YES / NO):
CH2 UNITS
CH2 LOW CAL
CH2 HIGH CAL
CH2 SMOOTHING
CH2 POINT NUMBER
CH2 TABLE SELECT
CH2 MEA PNT 1-10

CH3 == ON (YES / NO):
CH3 UNITS
CH3 LOW CAL
CH3 HIGH CAL
CH3 SMOOTHING
CH3 POINT NUMBER
CH3 TABLE SELECT
CH3 MEA PNT 1-5

CH4 == ON (YES / NO):
CH4 UNITS
CH4 LOW CAL
CH4 HIGH CAL
CH4 SMOOTHING
CH4 POINT NUMBER
CH4 TABLE SELECT
CH4 MEA PNT 1-5

AUX 1 UNITS
AUX 1 CONFIG
AUX 2 UNITS
AUX 2 CONFIG
CH1 AUTO SWITCH

Alarm Configuration

ALARM 1 SET HIGH
ALARM 1 SET LOW
ALARM 1 DEADBAND
ALARM 1 AUDIBLE

CH2 == ON (YES / NO):
ALARM 2 SET HIGH
ALARM 2 SET LOW
ALARM 2 DEADBAND
ALARM 2 AUDIBLE

CH3 == ON (YES / NO):
ALARM 3 SET HIGH
ALARM 3 SET LOW
ALARM 3 DEADBAND
ALARM 3 AUDIBLE

CH4 == ON (YES / NO):
ALARM 4 SET HIGH
ALARM 4 SET LOW
ALARM 4 DEADBAND
ALARM 4 AUDIBLE

Pulse Weight

C1 PULSE WEIGHT

CH2 == ON (YES / NO):
C2 PULSE WEIGHT

CH3 == ON (YES / NO):
C3 PULSE WEIGHT

CH4 == ON (YES / NO):
C4 PULSE WEIGHT

Analog Output

ANALOG OUTPUT 1 (YES / NO):
DA1 CONFIG
DA1 MAX RANGE

ANALOG OUTPUT 2 (YES / NO):
DA2 CONFIG
DA2 MAX RANGE

Relay / Serial

RELAY 1 CONFIG
RELAY 2 CONFIG
RELAY 3 CONFIG
RELAY 4 CONFIG
SERIAL MODE
SERIAL NODE NUM
BAUD RATE
HANDSHAKE
SERIAL PROTOCOL
PASSWORD
DATE
DAY OF THE WEEK
TIME 24 HOUR CLOCK
RESTORE NEW UNIT
RETURN TO CH1 TOT CONFIG

CONTRACT/PR
DRAWN
CHECK
QA
PROD ENG

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES, TOLERANCES OTHER THAN THE SIZE OF PART MATERIALS SHALL BE HELD AS FOLLOWS:
3 PLACE DECIMALS ±.005
3 PLACE DECIMALS ±.005
FRACTIONAL ±1/64
ANGULAR ±1/2°

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MATERIAL
FINISH
NEXT ASSY
USED ON
APPLICATION

DWG NO. 500-0037   SH 1   REV B

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APP
	A	ZN B1, PIN 9 WAS PIN 5, ADDED TX DATA + AND RX DATA -. (CS)	941102	JD
	B	PER ECP 500-107, ZN 3D WAS FEMALE DB25 CONNECTOR	151201	V.K.

DB9 MALE CONNECTOR TO COMPUTER BOARD'S C10-CONN 485

SIGNAL COM — BLK 22AWG
TX — RED 22AWG
RX — WHT 22AWG

FLOWSTAR DB9 MALE CONNECTOR

RS-485

130Ω   130Ω

TXRX +
TXRX −

DB9 MALE CONNECTOR TO COMPUTER BOARD'S C10-DUAL 422

BLACK 22 AWG
RED 22 AWG
WHT 22 AWG

FLOWSTAR DB9 MALE CONNECTOR

RS-422

TX DATA +
RX DATA −

DB25 MALE CONNECTOR

SIGNAL COM — BLACK 22 AWG
TX — RED 22 AWG
RX — WHT 22 AWG
SHIELD — #22 BUS

TX
RX
CTS
DSR
DCD, DCE
DTE

FLOWSTAR DB9 MALE CONNECTOR

RS-232

RS-232 FEMALE CONNECTOR

SIGNAL COM — BLACK 22 AWG
TX — RED 22 AWG
RX — WHT 22 AWG

RX
TX
DTR
DSR
DTE
CTS
DCE

FLOWSTAR DB9 MALE CONNECTOR

RS-232

HOFFER FLOW CONTROLS, INC
ELIZABETH CITY, NC 27909

TITLE
FLOWSTAR
COMMUNICATIONS CABLES

DRAWN SWEET   DATE 941018
CHECK BRE   941024
PRODUCTION
PROJ ENG J.DEFEO   941024
MACH SHOP

MATERIAL

FINISH

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES. TOLERANCES OTHER THAN THE SIZE OF RAW MATERIAL SHALL BE HELD AS FOLLOWS:
2 PLACE DECIMALS ± .01
3 PLACE DECIMALS ± .005
FRACTIONAL ± 1/64
ANGULAR ± 1/2°

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NEXT ASSY   USED ON
APPLICATION

SIZE C   CAGE CODE 33321   DWG NO 500-0037   REV B

SCALE NONE   SHEET 1 OF 1

NOTES:

1. FOR 110VAC EQUIP JP8, JP9 AND
   U4 (OPTIONAL)

   FOR 220VAC EQUIP JP7, REMOVE U4
   IF EQUIPPED.

	REVISIONS		
REV	DESCRIPTION	DATE	APP

		MATERIAL	DRAWN	DATE 951214		HOFFER FLOW CONTROLS, INC. ELIZABETH CITY, NC 27909
			CHECK	951214		
			PRODUCTION	9512H		
		FINISH	PROJ ENG	95124	TITLE	AC POWER CONVERSION INSTRUCTIONS PCA-139

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UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES OTHER THAN RAW MATERIAL SHALL BE HELD AS FOLLOWS:

2 PLACE DECIMAL ±.01
3 PLACE DECIMAL ±.005
FRACTIONAL ±1/64
ANGULAR ±1/2°

NEXT ASSY	USED ON		SIZE A	CAGE CODE 33321	DWG NO 700−0136	REV −
APPLICATION			SCALE NONE			SHEET 1 OF 1