

INSTRUCTIONS-PARTS LIST



308-242

Rev A

This manual contains IMPORTANT
WARNINGS AND INSTRUCTIONS
READ AND RETAIN FOR REFERENCE

PPD 200 Remote

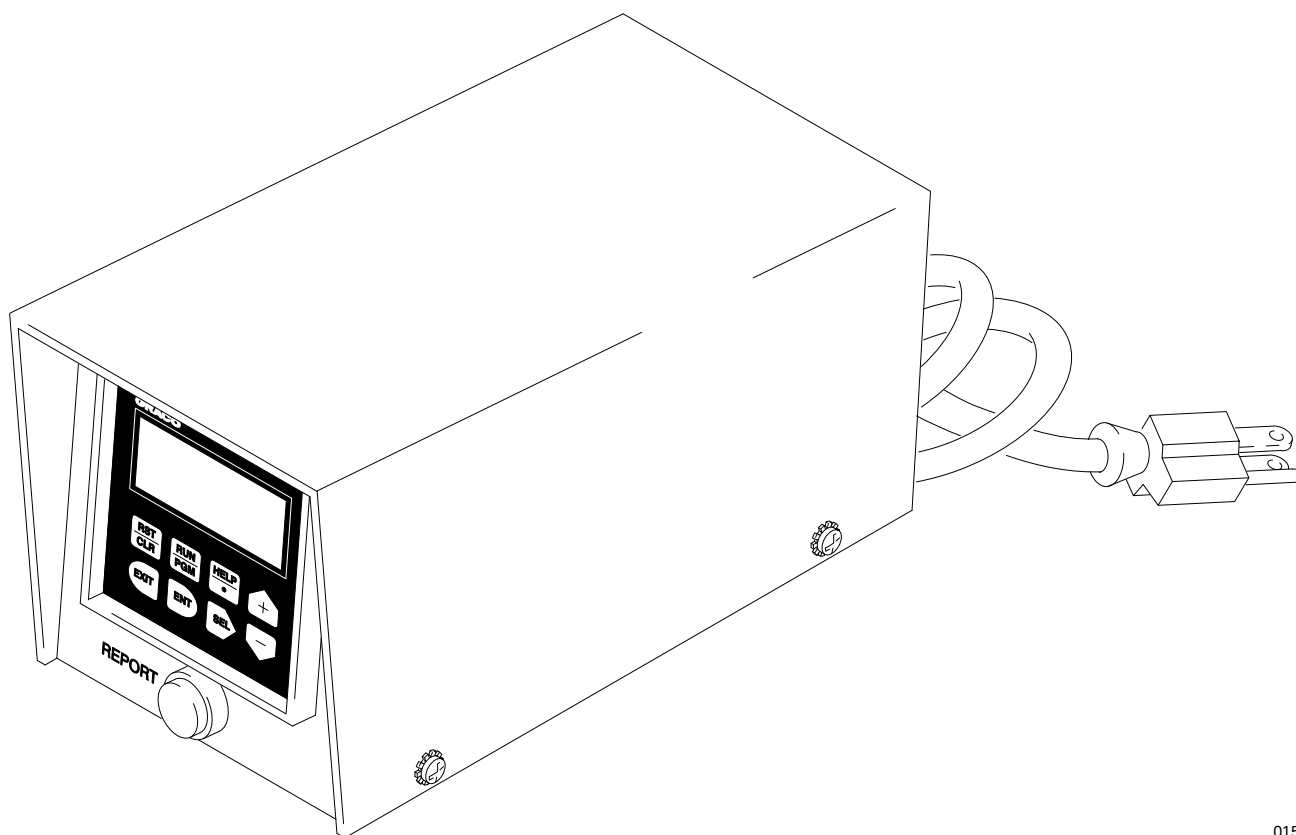
PRECISION PULSE DISPLAY

For use with Flow Meters Located in Class I,
Division 2 Hazardous Locations

PPD 200 PART NO.	FOR USE WITH METER MODEL NO.
235-610	PPM 3050
235-611	PPM 3100
235-612	PPM 3550

For use with Flow Meters Located in Class I,
Division 1 Hazardous Locations

PPD 200 PART NO.	FOR USE WITH METER MODEL NO.
235-613	PPM 3050H
235-614	PPM 3100H
235-615	PPM 3550H
235-616	PPM 100



01568

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WARNINGS

**SERIOUS BODILY INJURY, EXPLOSION, FIRE, OR ELECTRIC SHOCK
CAN OCCUR IF THE PRECAUTIONS BELOW ARE NOT FOLLOWED.**

**ELECTRICAL EQUIPMENT SHALL ONLY BE INSTALLED, OPERATED, AND SERVICED BY
TRAINED, QUALIFIED PERSONNEL WHO SHALL BE FULLY CONVERSANT WITH THE
REQUIREMENTS STATED WITHIN THIS INSTRUCTION MANUAL.**

**Read and understand all instruction manuals and
warning labels before operating the equipment.**

FIRE, EXPLOSION, OR ELECTRIC SHOCK HAZARD

All parts of the fluid system must be properly grounded to reduce the risk of static electricity discharge. Sparks can ignite fumes from solvents and the fluid being dispensed, dust particles and other flammable substances and can cause a fire or explosion and serious bodily injury and property damage.

If you experience any static sparking or feel even a slight shock, turn off the power to the remote display **IMMEDIATELY**. Check the entire system for proper grounding. DO NOT use the system again until the problem has been identified and corrected.

The PPD 200 Remote Displays 235–613, 235–614, 235–615, and 235–616 include a barrier module and are for use with Flow Meter Models PPM 3050H, 3100H, 3550H, and the PPM 100. These meters are for intrinsically safe operation in Class I, Division 1, Group D hazardous indoor (NEMA 1) locations. ALWAYS ensure proper grounding of the barrier module to a true earth ground.

The PPD 200 Remote Displays 235–610, 235–611, and 235–612 are for use with Flow Meter Models PPM 3050, 3100, and 3550, which are suitable for use in Class I, Division 2, Group D hazardous indoor (NEMA 1) locations.

To reduce the risk of fire or explosion and serious bodily injury, including electric shock:

- The remote display **MUST** be installed in a non-hazardous location.
- The display's electrical cord **MUST** be connected to a grounded outlet.
- ALWAYS ensure proper grounding of the barrier module to a true earth ground (*Displays 235–613, 235–614, 235–615, and 235–616 only*).
- Disconnect all power before wiring the terminals.
- Be sure to understand and follow **Hazardous Location Wiring of Intrinsically Safe Circuits** instructions in this manual. Also refer to ANSI standards ISA-RP12.6 *Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations*, NEC Article 504, and the Canadian Electrical Code Appendix F.
- Use shielded cables for count signals, control input and communications signals. See ACCESSORIES to order cable.
- Treat all control and count inputs as hazardous since they may carry line voltage.
- DO NOT spill water or other liquids on the PPD 200 Remote Display.

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TYPICAL INSTALLATION

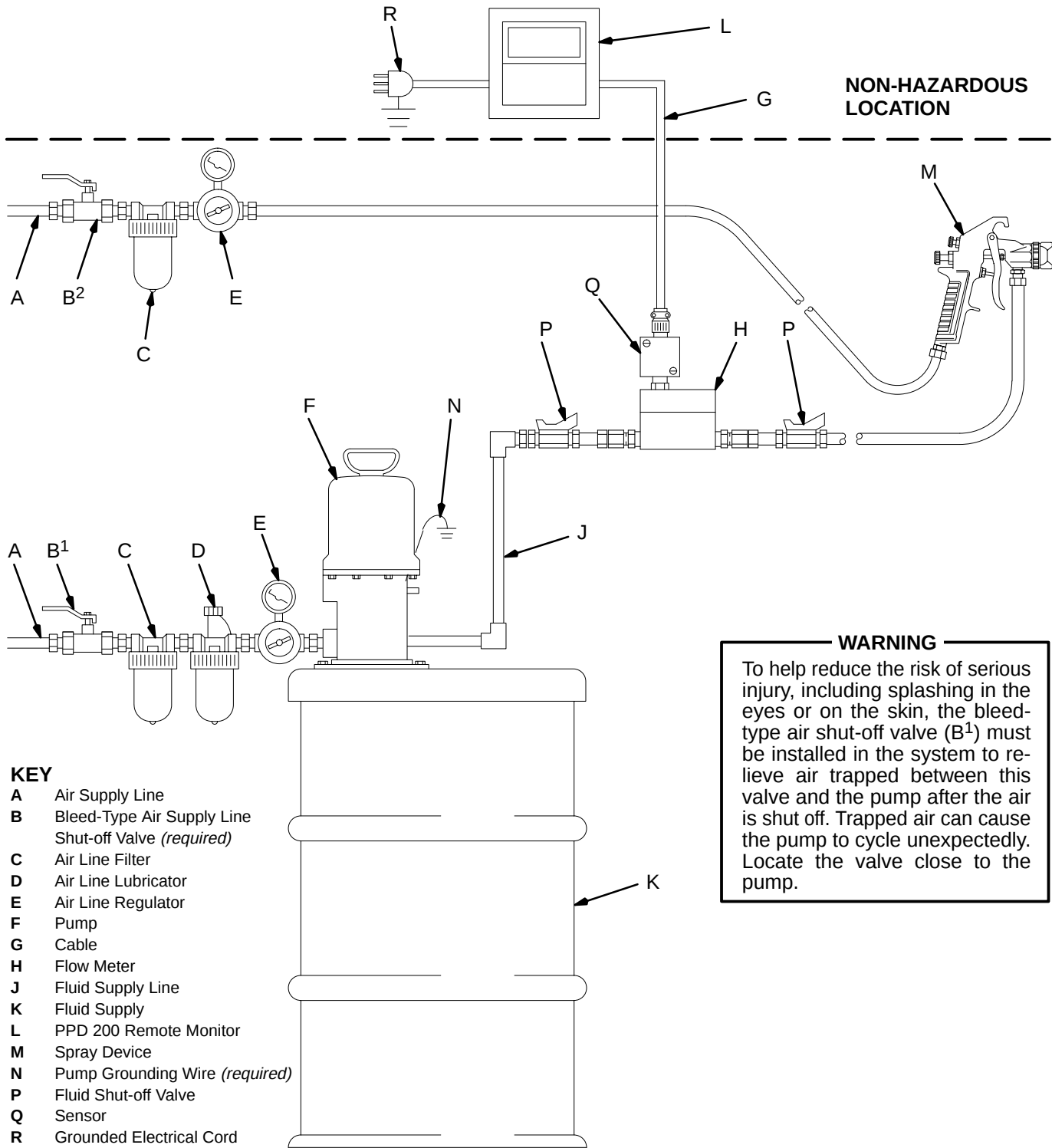


Fig 1

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Installing the System

The Typical Installation shown above is only a guide for selecting and installing the Precision Pulse Display and Meter System. The particular type and size system for your application must be custom designed for your

needs. For assistance in designing a system, contact your Graco representative.

Install the air line accessories in the order shown in Fig 1, using adapters as necessary.

General Wiring Practices

WARNING

To reduce the risk of fire or explosion and serious bodily injury, including electric shock, BE SURE to follow the **Warnings** on page 2.

1. Keep all signal lines as short as possible. Do not use more than 165 ft. (50.3 m) of cable to connect the meter to the remote display. See *ACCESSORIES* to order various cable lengths.
2. Do not bundle or route signal lines with power or machine control wiring. Use separate conduit for power and signal wires.
3. Provide “clean” power to the counter. In severe cases, power may have to be filtered or a separate power source used. Do not use the same power source that is supplying other loads.

Hazardous (classified) Location Wiring of Intrinsically Safe Circuits

PPD 200 Remote Display 235–613, 235–614, 235–615, and 235–616 ONLY

WARNING

To reduce the risk of fire and explosion and serious bodily injury, be sure to understand and follow **Hazardous Location Wiring of Intrinsically Safe Circuits** instructions.

The PPD 200 Remote Displays 235–613, 235–614, 235–615, and 235–616 have a barrier module installed. See the *SAFETY BARRIER SPECIFICATIONS*.

The PPD 200 Remote Display barrier module has 6 terminals. Terminals 1 and 2 are for the non-hazardous side connections. Terminals 3 and 4 are the intrinsically safe connections to the hazardous location.

Wiring beyond terminals 3 and 4 should maintain at least a 2 inch (50 mm) separation from any non-intrinsically safe wiring and must be marked as Intrinsically Safe Wiring at the required intervals. Field junction boxes may be used as long as this separation is maintained.

WARNING

The transmitting of flammable atmosphere from one area to another through a multi-conductor cable can cause fire or explosion and result in serious injury and property damage. Follow the instructions below and refer also to NEC Article 504 and 4.3 of ANSI standards ISA-RP12.6.

The cable must be sealed or vented at the point where the cable enters and leaves the non-hazardous area. (See *ACCESSORIES* for Graco cable seal, part no. 110–458.)

The purpose of such sealing or venting is to prevent the cable from transmitting the flammable atmosphere from one area of a hazardous location to another or from a hazardous location to a non-hazardous location at a rate of more than 198 cm³ of air per hour (h) at a pressure of 1493 Pa (0.007 ft³/h of air at a pressure of 6 in. of water), with both ends of the cable at atmospheric pressure.

Along with terminals 1, 2, 3, and 4, two extra screw terminals are provided, one on each side of the barrier. They are conductively connected to the mounting rail, once they are properly installed.

Without grounding, Intrinsic Safety Barriers will not provide voltage protection. Therefore, they must be grounded to a designated grounding electrode. This electrode should be the same potential as that used for the non-hazardous location side instrumentation. The ground conductor must be insulated from adjacent grounded metal objects and no smaller than a #12 AWG. The grounding path resistance from the barrier to this ground point must not exceed 1 ohm.

For further information on installation and wiring, refer to ANSI standards ISA-RP12.6 Installation of Intrinsically Safe Systems for Hazardous (Classified) Locations, NEC Article 504, and the Canadian Electrical Code Appendix F.

Cable Strain Relief

Place the cable through the display's strain relief as shown in Fig 2. Tighten the strain relief nut to secure the cable.

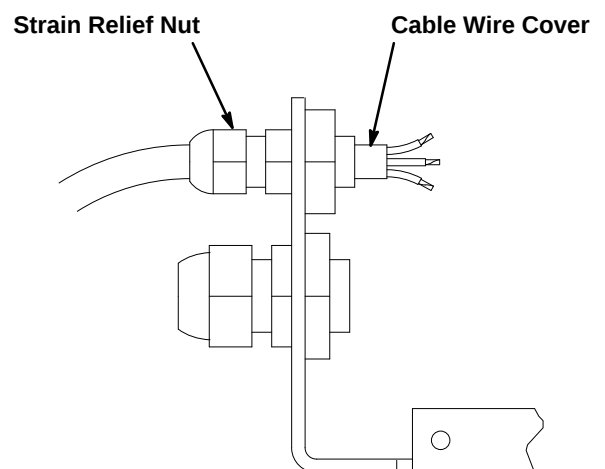


Fig 2

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Remote Displays 235–610, 235–611, and 235–612 (Meter used in Class I, Division 2 Hazardous Location)

Cable Wiring to Remote Display

WARNING

To reduce the risk of electric shock, always disconnect the display power cord before removing the display cover. Never plug in the power cord while the cover is removed.

Connections to remote displays 235–610, 235–611, and 235–612 are made through depluggable, screw terminal blocks. To remove the terminal block, disconnect the AC power and pry gently underneath each end of the terminal block with a small screwdriver. See Fig 3 for the terminal block location. Press the terminal block straight on to re-install it.

To connect the cable wires to the proper terminals, see the Fig 4 wiring diagram.

Place the exposed cable wire into the terminal as shown in Fig 3. Tighten the terminal screw to secure the wire.

Connect the Cable to the Meter Sensor

After aligning and pressing the cable connector onto the sensor's pin connector, be sure to secure the cable by tightening the cable connector nut.

Check the Electrical Grounding

WARNING

Proper electrical grounding of your system is essential. For your safety, the display's electrical cord **MUST** be connected to a grounded outlet. **BE SURE** to ground the other equipment in your system as instructed in their separate instruction manuals and according to all Local, State and National codes.

Have a qualified electrician check the electrical grounding continuity between the remote display and a true earth ground. If the resistance is greater than 25 ohms, check the display's electrical cord. **DO NOT** operate the system until the problem is corrected.

Install the Display Cover

WARNING

To reduce the risk of electric shock, always install the display cover before plugging in the display power cord.

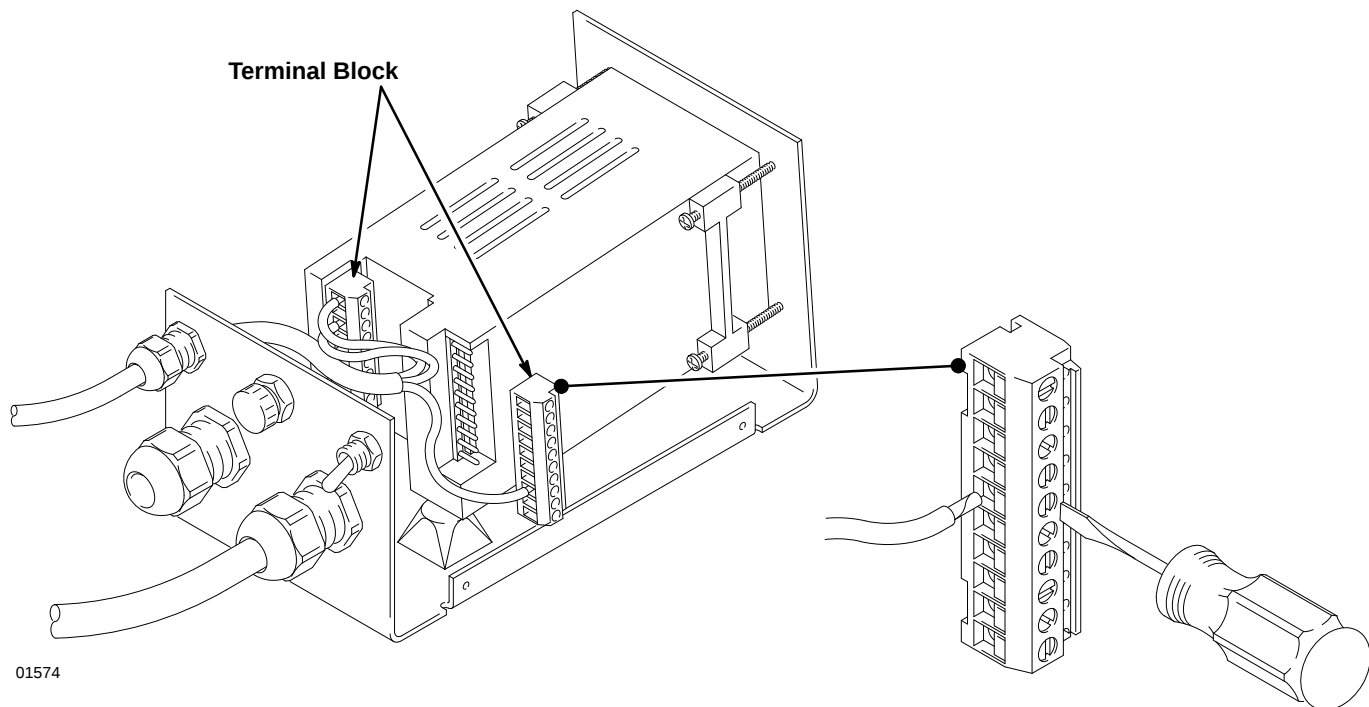


Fig 3

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CABLE WIRING & DIP SWITCH SETTINGS

Remote Displays 235-610, 235-611, and 235-612 Wiring Diagram (Meter used in Class I, Division 2 Hazardous Location)

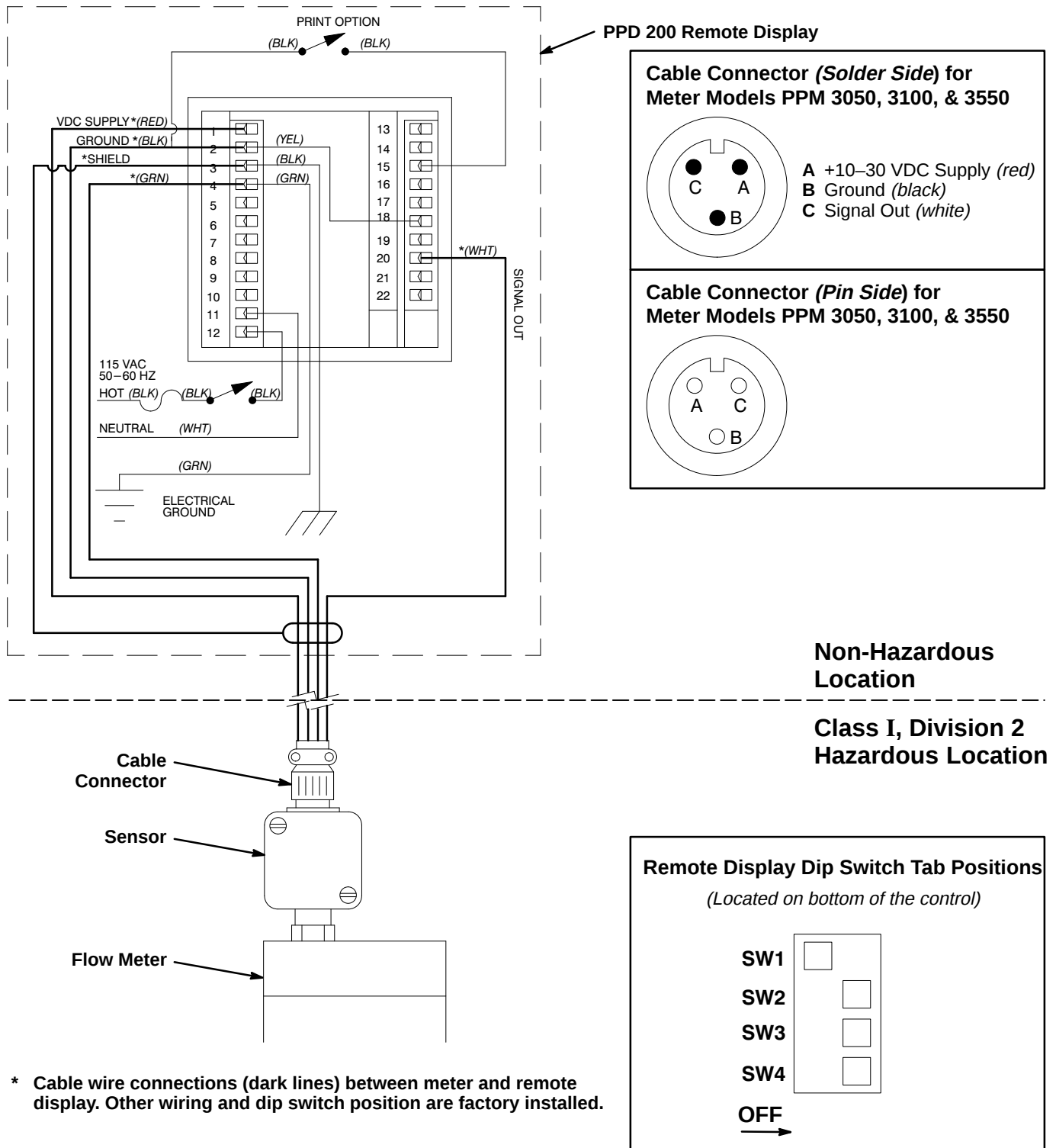


Fig 4

Remote Displays 235–613, 235–614, 235–615 and 235–616 (Meter used in Class I, Division 1 Hazardous Location)

Cable Wiring to Remote Display

WARNING

To reduce the risk of electric shock, always disconnect the display power cord before removing the display cover. Never plug in the power cord while the cover is removed.

Connections to remote displays 235–613, 235–614, 235–615, and 235–616 are made to the barrier module. See Fig 5 for the barrier module location.

To connect the cable wires to the proper terminals, see the Fig 6 wiring diagram (*for Meter Models PPM 3050H, 3100H, & 3550H*) or the Fig 7 wiring diagram (*for Meter Model PPM 100*).

Place the exposed cable wires into the barrier module terminals. Tighten the terminal screws to secure the wires.

Connect the Cable to the Meter Sensor

After aligning and pressing the cable connector onto the sensor's pin connector, be sure to secure the cable by tightening the cable connector nut.

Check the Electrical Grounding

WARNING

Proper electrical grounding of your system is essential. For your safety, the display's electrical cord **MUST** be connected to a grounded outlet. **BE SURE** to ground the other equipment in your system as instructed in their separate instruction manuals and according to all Local, State and National codes.

Have a qualified electrician check the electrical grounding continuity between the remote display and a true earth ground. If the resistance is greater than 25 ohms, check the display's electrical cord.

Check the ground continuity between the barrier ground lug and true earth ground. The resistance must be less than 10 ohms. See page 5 for general wiring practices.

DO NOT operate the system until the grounding problem is corrected.

Install the Display Cover

WARNING

To reduce the risk of electric shock, always install the display cover before plugging in the display power cord.

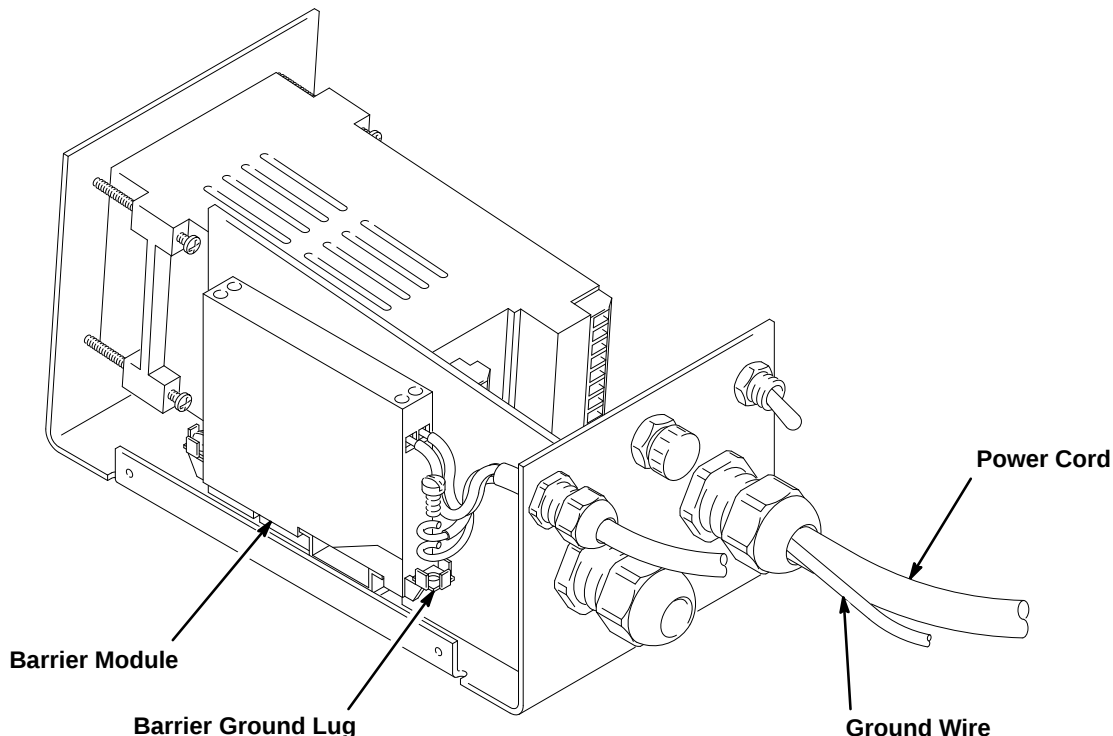
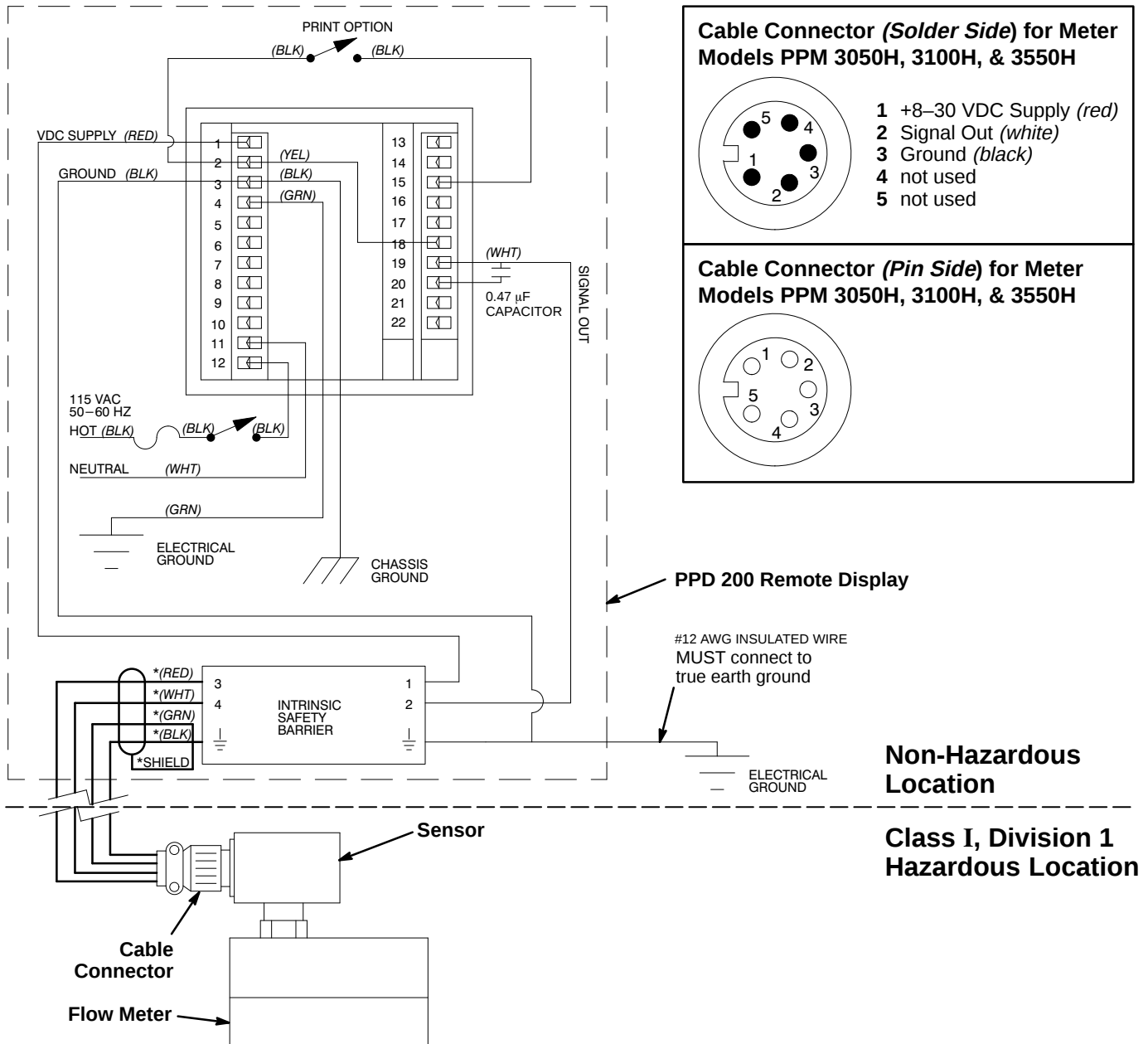


Fig 5

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CABLE WIRING & DIP SWITCH SETTINGS

Remote Displays 235–613, 235–614, and 235–615 Wiring Diagram (Meter used in Class I, Division 1 Hazardous Location)



* Cable wire connections (dark lines) between meter and remote display. Other wiring and dip switch position are factory installed.

Remote Display Dip Switch Tab Positions (Located on bottom of the control)

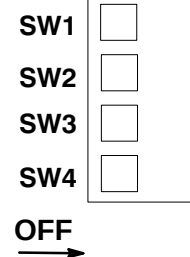
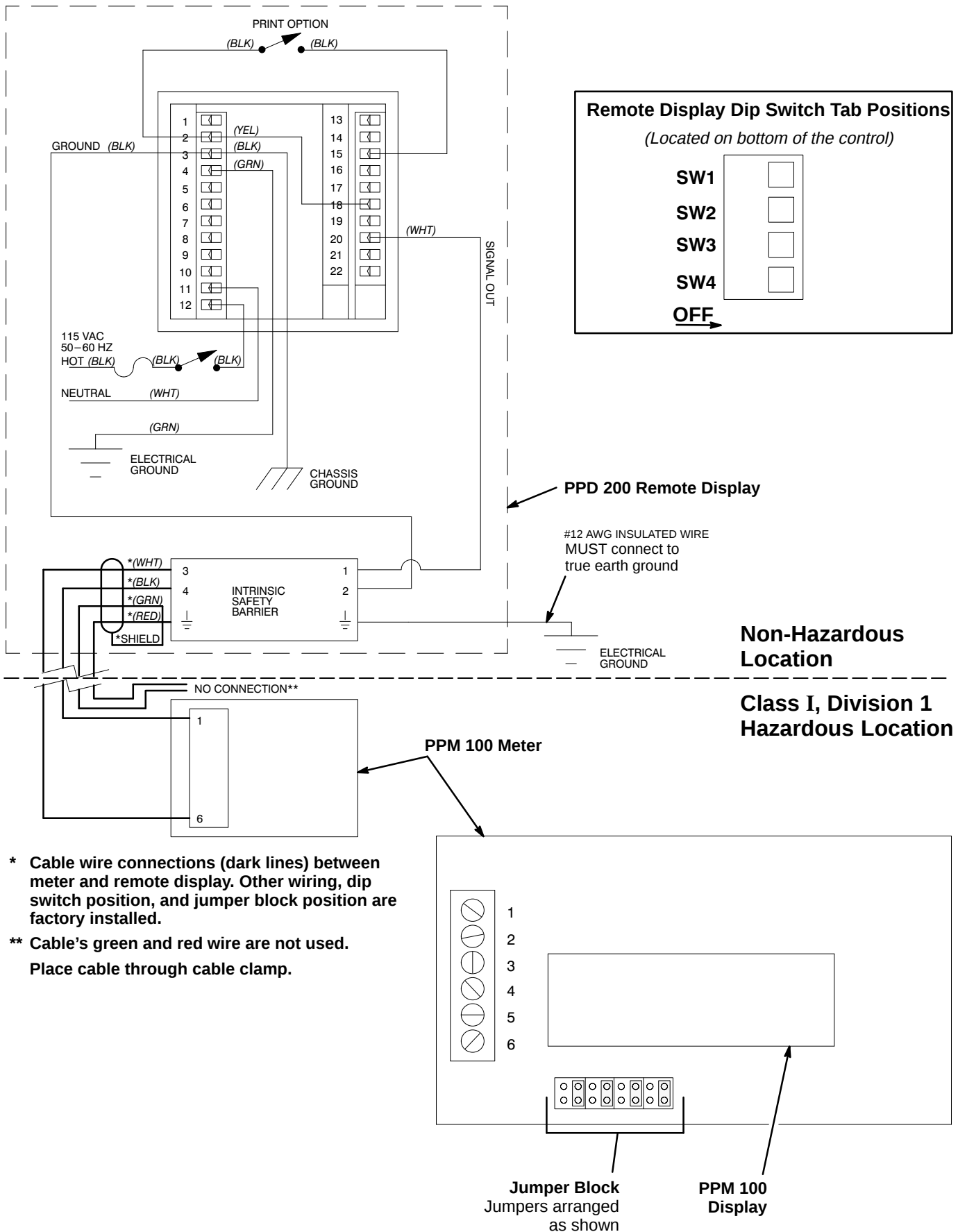


Fig 6

CABLE WIRING & DIP SWITCH SETTINGS

Remote Display 235–616 Wiring Diagram (PPM 100 Meter used in Class I, Division 1 Hazardous Location)



REAR TERMINAL DESCRIPTION

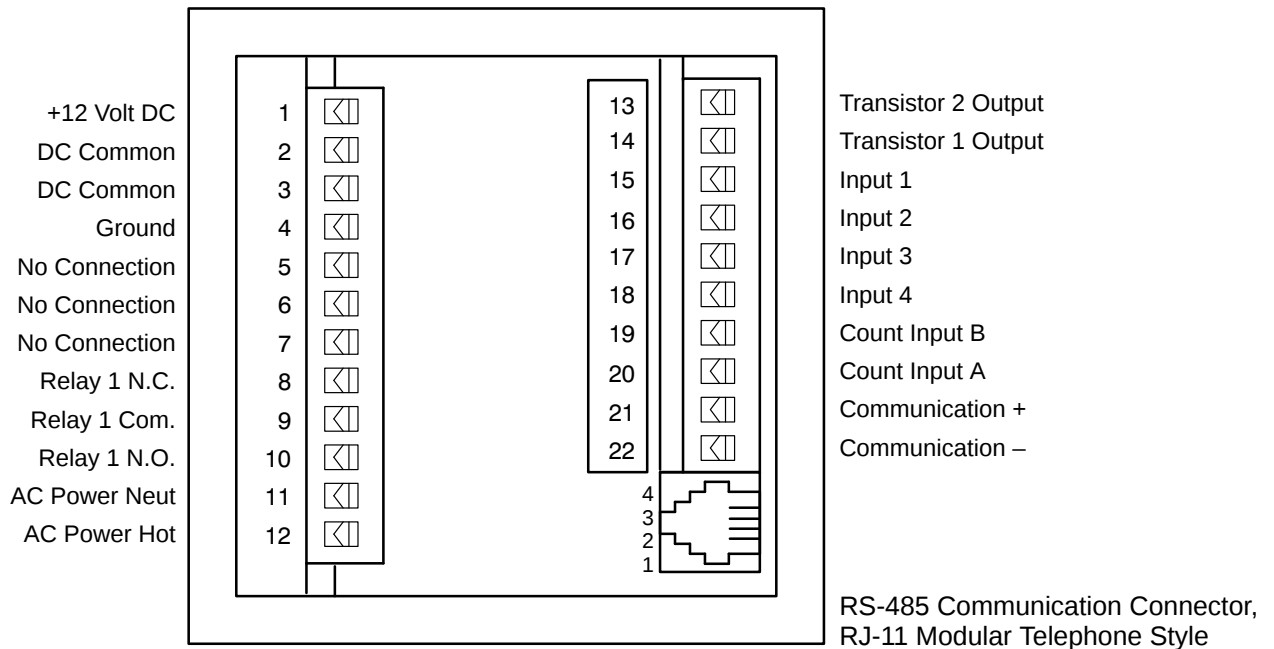


Fig 8

NOTE: The wiring diagram for your display model is shown in Fig 4, 6, or 7. Wire the terminals as shown there.

Terminal Descriptions

- 1** *+12 VDC Power Output* – Used to supply 12 VDC (+/- 25% 100 mA max) flow meters. DC Common is the negative side of this supply.
- 2, 3, and 4** *DC Common* – These terminals are connected to the negative side of the counter's internal DC power supply. Count inputs must be referenced to DC Common. Control inputs are on when connected to DC Common. Transistor outputs conduct to DC Common when picked up. For maximum noise immunity, the ground terminal must be connected to a true earth ground. Connect all shielded signal cables to true earth ground or ground the cable on the counter.
- 5, 6, and 7** – Not used
- 8, 9, and 10** *Relay 1 Contacts* – The relay output consists of one electrically isolated form C set of contacts. The user must supply power through a contact to the external load. The contacts remain in the normal state until a pick-up signal occurs. The relay remains picked up (on) until a drop out signal occurs. See the block diagram on page 28.
- 11 and 12** *AC Power Inputs* – 115 VAC
- 13 and 14** *Transistor Outputs 2 and 1* – These terminals are separate open collector NPN transistor outputs. Each output conducts to DC Common when picked up. See the block diagram on page 28.

15, 16, 17, and 18 *Inputs 1, 2, 3, and 4* – Programmable inputs. The user can assign one of eight functions to each individual input. The inputs require a current sinking signal (contact or solid state) to DC Common. See the block diagram on page 27.

19 and 20 *Count Inputs B and A* – Connect the count input signal(s) to these terminals. The count input can operate with either a current sinking signal (contact or solid state) to DC Common or a current sourcing signal. See the block diagram on page 26. Rate calculations are made from count pulses into Input A, terminal 20, only.

21 and 22 *RS-485 Serial I/O Port* – Connect terminal 21 to the positive lead of the communications bus. Connect terminal 22 to the negative lead of the communications bus.

Modular Communication Jack

The modular phone jack is an alternate connection to the RS-485 communications port. Pin 2 is positive and is the same as terminal 21. Pin 3 is negative and is the same as terminal 22. Pins 1 and 4 are connected to DC Common; use them for any shield connections.

To connect a printer, see page 12.

WARNING

DO NOT connect the modular phone jack to any telephone system -- equipment damage or hazardous conditions could result.

NOTE: The remote display will send a formatted RS-485 signal to a thermal printer. See *ACCESSORIES* for the recommended printer and cable. Other printers may not work with this display.

Connecting the Printer

WARNING

To reduce the risk of fire, explosion, or electric shock:

- The printer must be located in a non-hazardous location.
- Always disconnect the display power cord before removing the display cover. Never plug in the power cord while the cover is removed.

1. Unplug the remote display.
2. Remove the display cover.
3. Place the cable through the strain relief.
4. Connect the printer to the display's modular communication jack as shown in Fig 10. Refer to page 11 also.
5. Secure the cable with the strain relief nut.
6. Re-install the display cover.
7. Plug in the monitor and printer.

Operating the Printer

To print, press the display's REPORT button. The batch count total will automatically reset to zero each time the REPORT button is pressed. See Fig 9 for an example of printer output.

NOTE: The date and time stamp in Fig 9 are produced by Printer 235-599. See *ACCESSORIES*. Another printer may not have this feature.

Time	9:23:08 AM	11-02-92	Date
Serial ID #	ID #: 0		
	FLOW RATE (cc/min)	100000	Rate
	RESETTABLE TOTAL (cc)	123456	Count
	PRESET 1 (cc)	600000	P ₁
	NON-RESETTABLE TOTAL (cc)	123456	Total
PPD 200 MONITOR GRACO, INC			

Fig 9

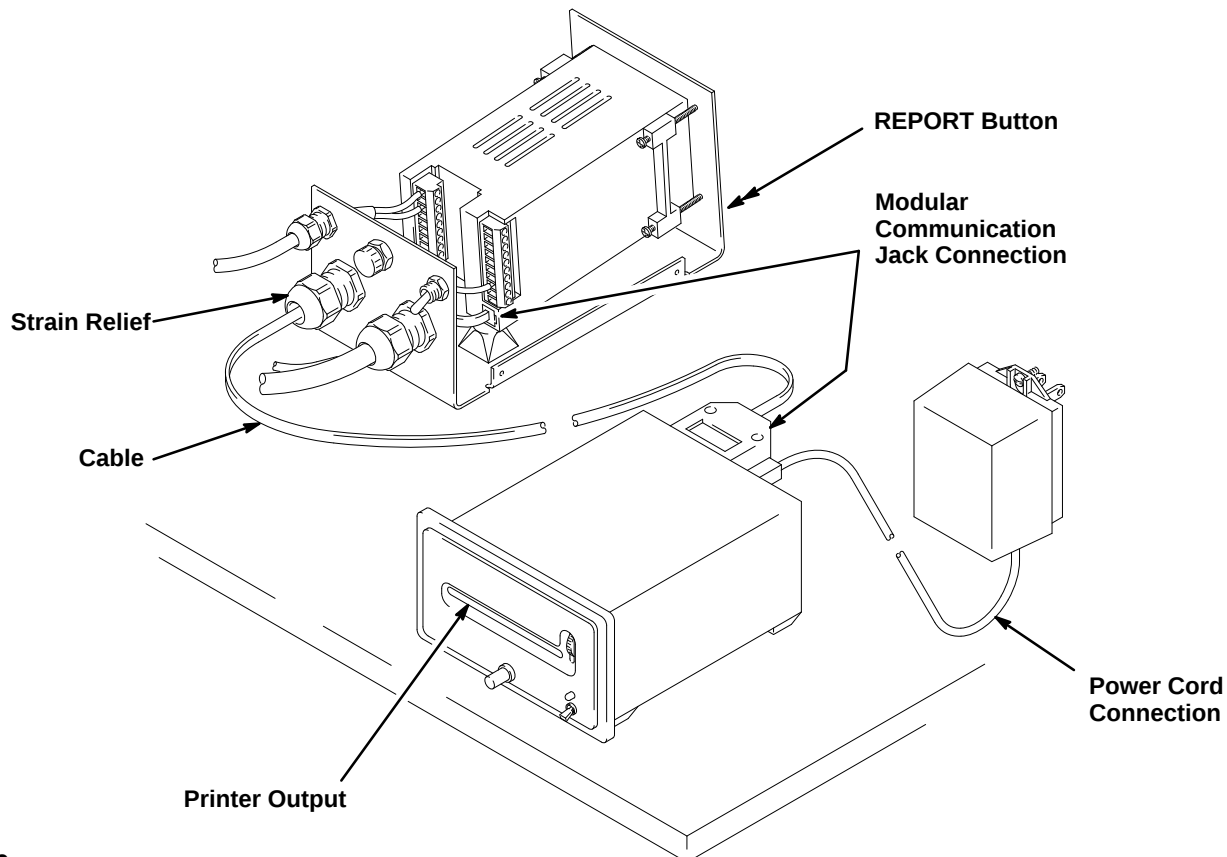


Fig 10

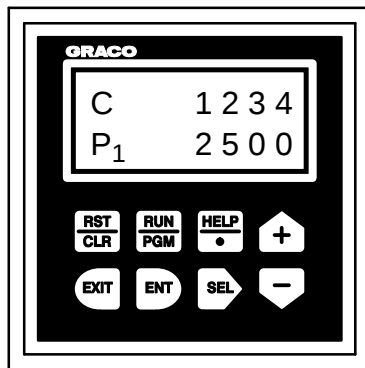
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RUN MODE OPERATION

1. Plug in the remote display.
2. Move the toggle switch up to the "ON" position. The display will illuminate.

NOTE: The count control is pre-programmed to measure in cubic centimeters (cc). To change from cubic centimeters to ounces (oz), liters (l), or gallons (gal), see page 23.

DISPLAY:

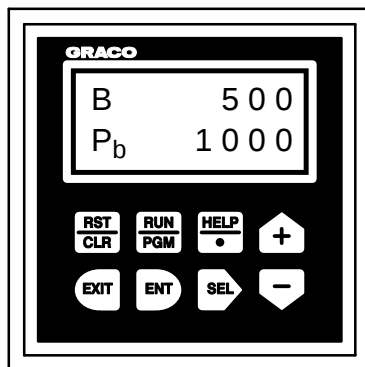


C is a batch count total. It displays a running total of the volume of the batch being filled.

P₁ is a preset limit value for the batch count total (C). It can be used to signal or stop the metering process when the desired amount of material is dispensed.

To change P₁, see page 16.

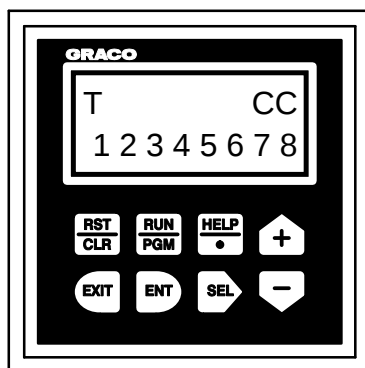
3. Press 



B is the number of batches. It displays the number of containers filled (or the number of times C has reached P₁).

P_b is a preset limit value for the batch (B). It is used to signal or stop the metering process when the desired number of batches are dispensed.

4. Press 



T is a non-resettable volume total. The value displayed represents the total amount of fluid dispensed by the metering process.

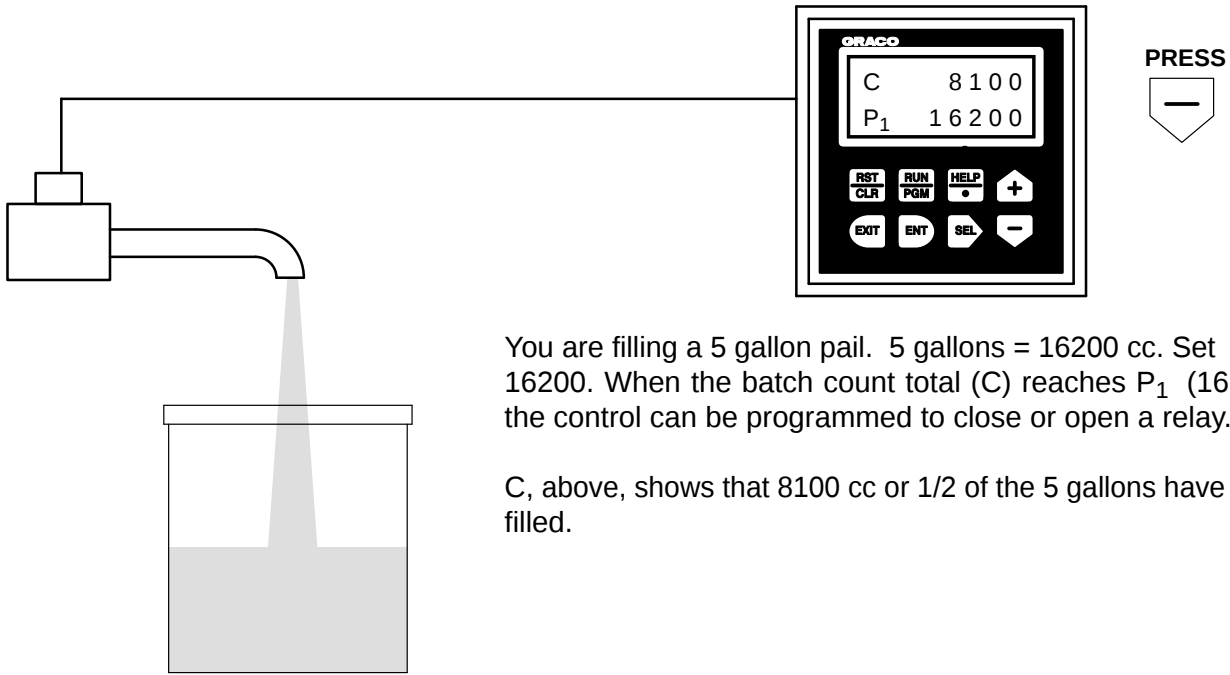
The top line of the display will show which unit of measure (R UNITS) the PPD 200 has been pre-programmed to meter. At left, the total is being measured in cubic centimeters (**CC**).

To change the R UNITS value, see page 23.

*See the following example.
RUN MODE OPERATION continued on page 15.*

EXAMPLE

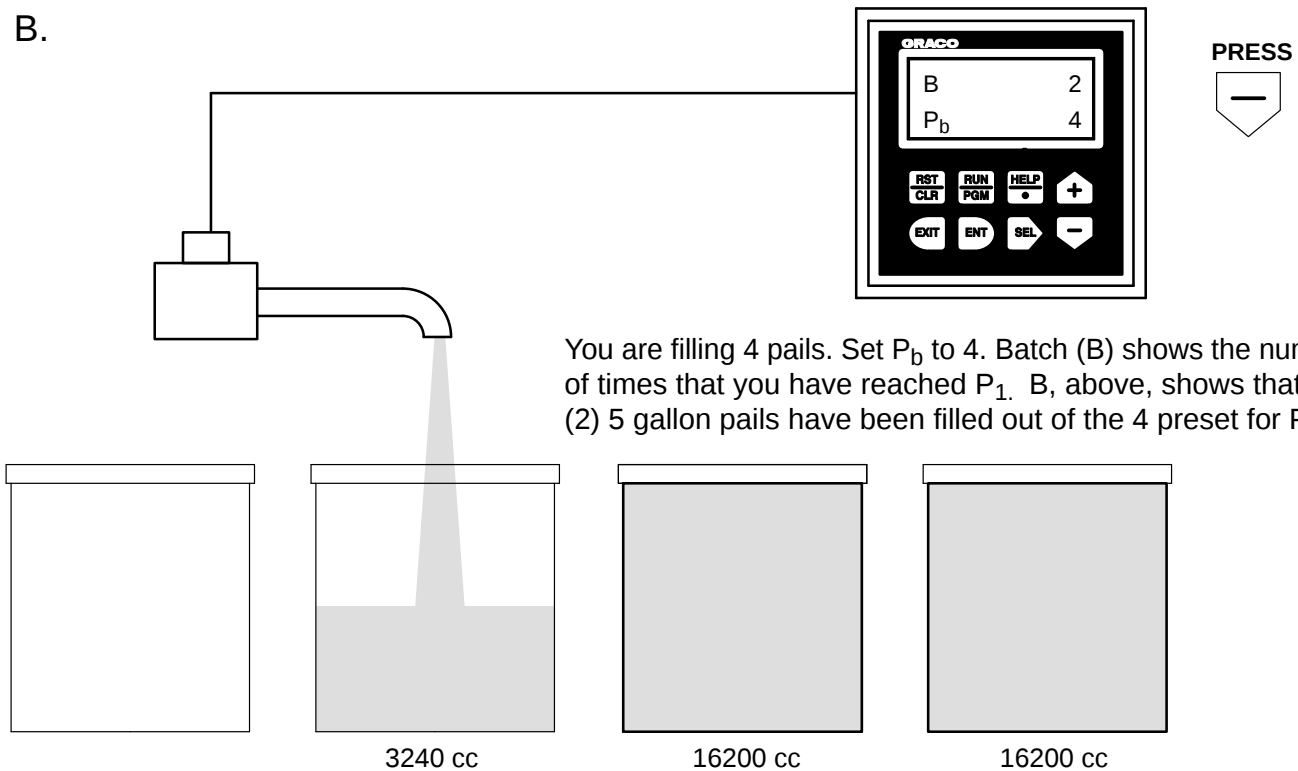
A.



You are filling a 5 gallon pail. 5 gallons = 16200 cc. Set P₁ to 16200. When the batch count total (C) reaches P₁ (16200), the control can be programmed to close or open a relay.

C, above, shows that 8100 cc or 1/2 of the 5 gallons have been filled.

B.



You are filling 4 pails. Set P_b to 4. Batch (B) shows the number of times that you have reached P₁. B, above, shows that two (2) 5 gallon pails have been filled out of the 4 preset for P_b.

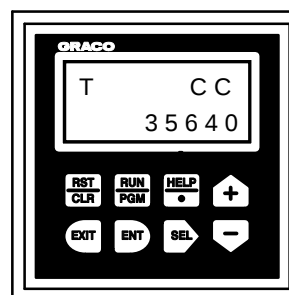
3240 cc

16200 cc

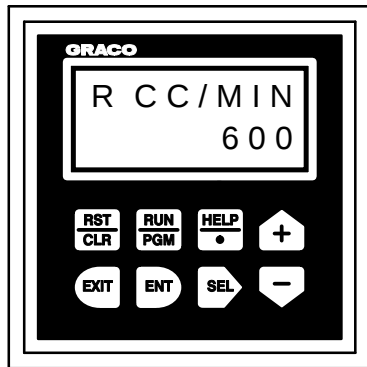
16200 cc

C.

Total (T) shows the total volume dispensed in cubic centimeters (CC) or as shown in the above example: $[16200 \text{ cc} \times 2 \text{ (pails)}] + 3240 \text{ cc} = 35640 \text{ cc}$



5. Press 

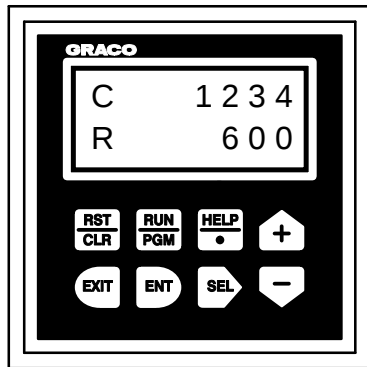


R is the instantaneous flow rate, which updates every 1 second.

The top line of the display will show which unit of measure (**R UNITS**) the PPD 200 has been pre-programmed to meter. At left, the rate is being measured in cubic centimeters/minute (**CC/MIN**).

To change the **R UNITS** value, see page 23.

6. Press 



This screen displays the batch count total (**C**) and the rate (**R**) simultaneously.

NOTE:

The  and  keys are used to scroll through the displays.

The selected display will remain on until one of the arrow keys is pressed to cause a change.

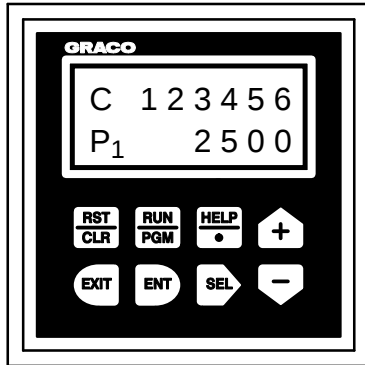
The screen selected for display during run-mode only provides information to the operator and does not affect the operation of the control.

If power is removed and restored, the unit will power-up with the display that was last selected.

PRESET EDIT MODE – SETTING P₁

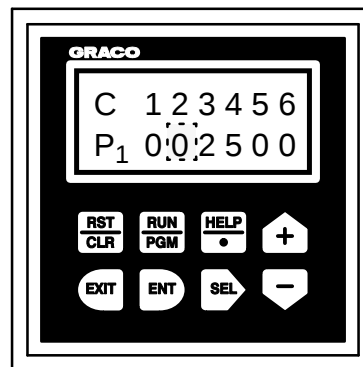
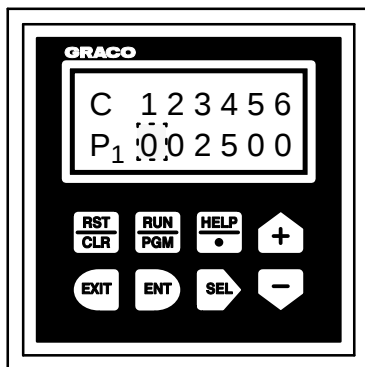
1. To set P₁, press  until this display appears:

DISPLAY:



NOTE: All count and control functions continue to operate while preset values are being changed.

2. Press . The first digit will blink. Use  and  keys to change to the desired digit.



3. Press . The second digit will blink. Use  and  keys to change to the desired digit. Continue until P₁ is set to the desired number.

NOTE: The  key will zero-out P₁ automatically.

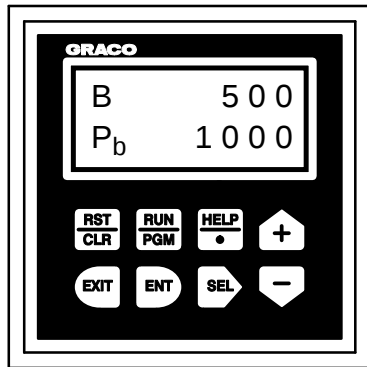
4. Press  to save the preset value and return one menu level.

OR

Press  at any time to exit without saving the preset changes and return one menu level.

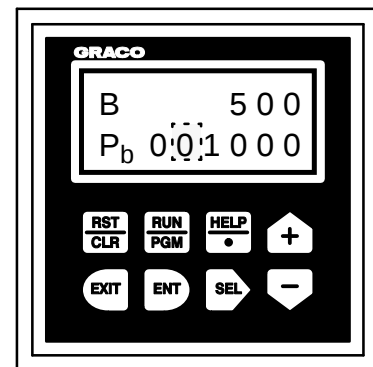
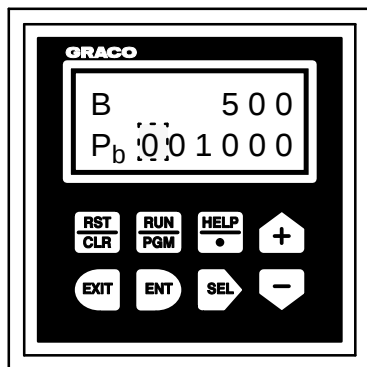
1. To set P_b, press  until this display appears:

DISPLAY:



NOTE: All count and control functions continue to operate while preset values are being changed.

2. Press . The first digit will blink. Use  and  keys to change to the desired digit.



3. Press . The second digit will blink. Use  and  keys to change to the desired digit. Continue until P_b is set to the desired number.

NOTE: The  key will zero-out P_b automatically.

4. Press  to save the preset value and return one menu level.

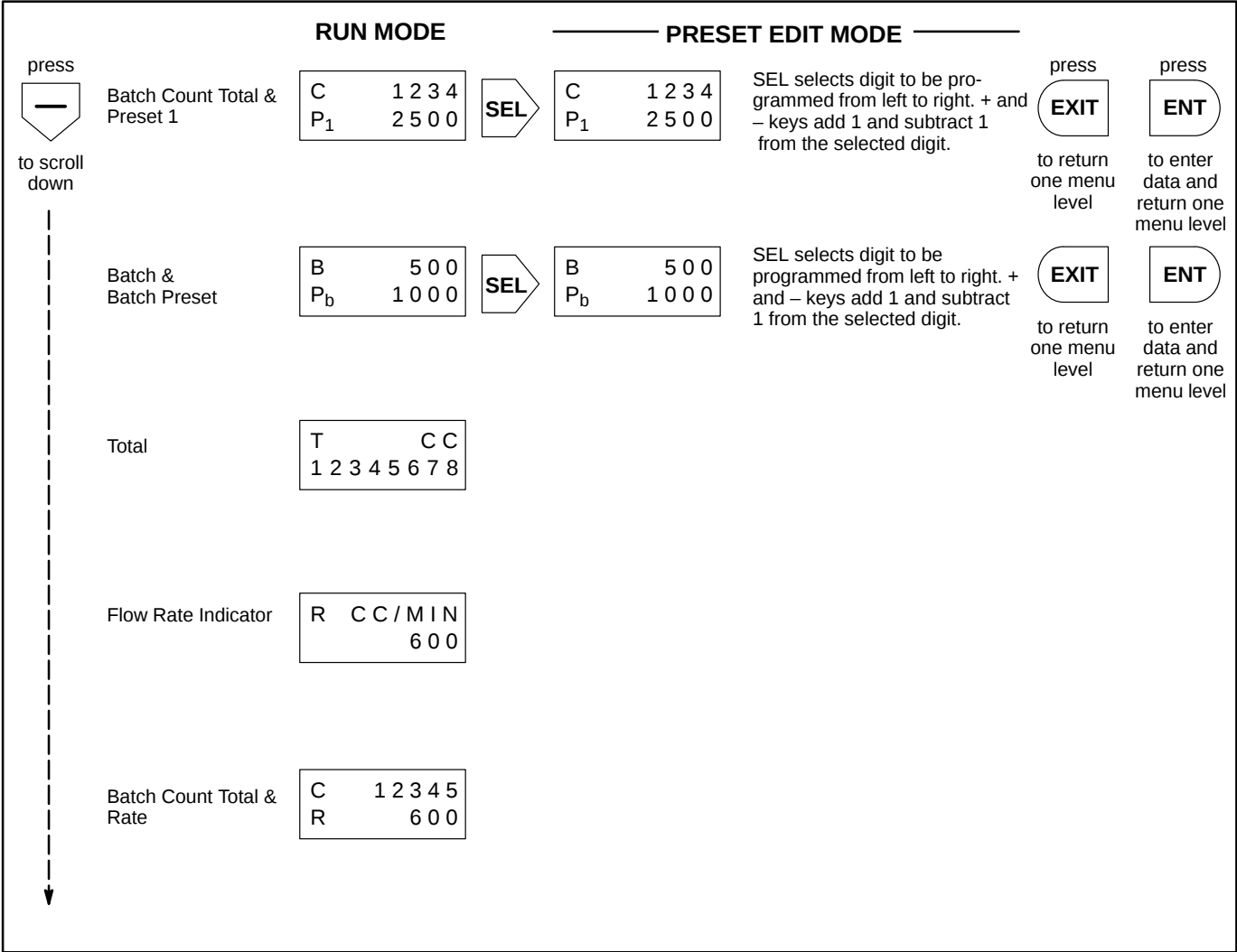
OR

Press  at any time to exit without saving the preset changes and return one menu level.

RUN MODE & PRESET EDIT MODE MENU

QUICK REFERENCE

The keystroke sequence used to access all of the available run mode displays and change preset values is shown in a menu format below.



KEY FUNCTIONS

Key Functions in Run Mode



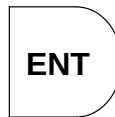
Reset/Clear Key This key can be programmed to reset count values.



Not used in run mode



Run/Program Key Press this key followed by the Enter key (ENT) to enter the program mode.



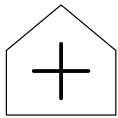
Enter Key Pressed after Run/Program key to enter the program mode.



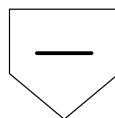
Help/Key Press this key to display the Help Screens.



Not used in run mode



Up Arrow/Plus (+) Key Press this key to scroll up through the five different run mode displays.



Down Arrow/Minus (-) Key Press this key to scroll down through the five different run mode displays.

Key Functions in Preset Edit Mode



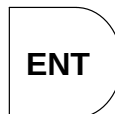
Reset/Clear Key This key zeros presets that are being changed.



Exit Key Press this key to exit the preset editing process without altering the previous preset value.



Run/Program Key Press this key followed by the Enter key (ENT) to enter the program mode.



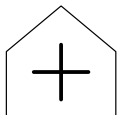
Enter Key Press this key to put the preset changes into effect.



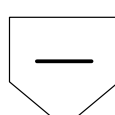
Help/Key Press this key to display the Help Screens.



Select Key This key allows the editing of presets and selects individual digits of the preset.



Up Arrow/Plus (+) Key This key adds 1 (increments) to the value of the selected digit each time it is pressed.



Down Arrow/Minus (-) Key This key subtracts 1 (decrements) from the value of the selected digit each time it is pressed.

SAMPLE: PPM 3000 FAMILY FLOW METER CALIBRATION DATA SHEET

Calibration Date : MM-DD-1992
Serial Number : 12345
Model Number : PPM 3550
Range in GPM : 0.1 to 5.0
Viscosity in CP : 30
Calibrated by : XX

Frequency	GPM	cc/min	Imp/gal	Imp/gal	Imp/oz	Deviation
12	0.112	424.5	6420.5	1.696	50.19	+0.21
18	0.169	640.9	6378.0	1.685	49.85	+0.05
39	0.368	1393.3	6356.9	1.680	49.69	-0.10
79	0.746	2832.4	6354.3	1.679	49.67	-0.26
145	1.368	5178.0	6359.5	1.680	49.71	-0.42
247	2.326	8802.3	6372.7	1.684	49.81	-0.35
389	3.641	13782.4	6409.8	1.693	50.10	-0.17
571	5.329	20171.8	6428.5	1.698	50.25	+0.49

Average k-factor in Imp/gal = 6391.4

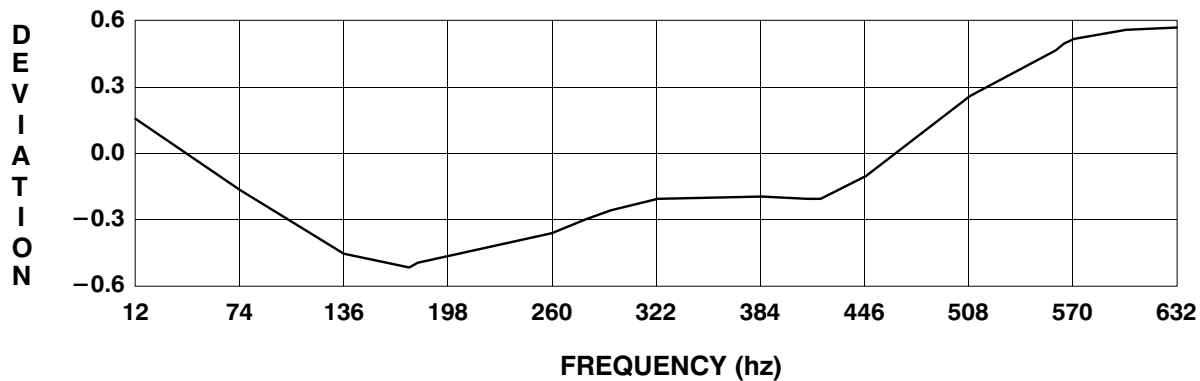
Average k-factor in Imp/oz = 49.96

Average k-factor in Imp/cc = 1.689

PPD 200 Scale Factor

CC/PULSE: 0.59207

Below is the Graph for the Table of Values:



Graco, Inc. Minneapolis, MN

Scale Factor

The Remote Display's scale factor has been programmed at the factory for the k-factor of your flow meter. This may introduce 1.0% error in the PPM 100 Meter and 0.5% error in the PPM 3000 Meters in addition to the accuracy factor of your meter.

Positive displacement flow meters each have a unique scale factor due to variability of machining tolerances. The scale factor for your meter can be found inside the cover of the PPM 100 Meter and on the Calibration Data Sheet of the PPM 3000 Meter. See page 20 for an example of a Calibration Data Sheet. The scale factor (CC/PULSE) value is highlighted.

If the additional error is unacceptable in your application, follow the procedure on page 22 to change the Remote Display's scale factor.

NOTE: The values of the scale factor and rate units (page 23) must both be changed, separately.

Entering the Programming Mode

WARNING

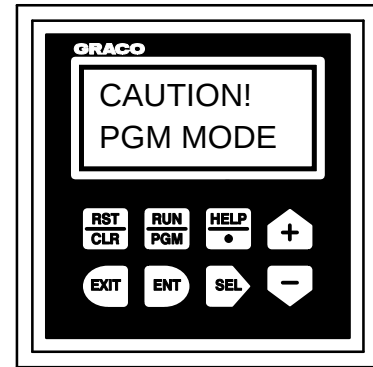
To reduce the risk of electric shock, always disconnect the display power cord before removing the display cover. Never plug in the power cord while the cover is removed.

1. Unplug the PPD 200 Remote Display.
2. Remove the display cover.
3. A yellow jumper is placed between pin 2 and 18 to prevent changes to the display's programming. Disconnect this wire from pin 18.
4. Re-install the display cover.

5. Plug-in the display and press the toggle to the "ON" position.

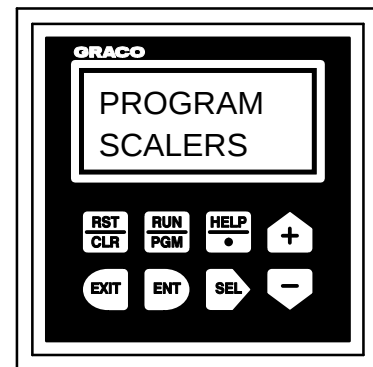
6. Press .

DISPLAY:



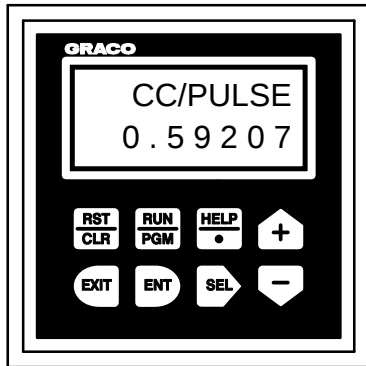
7. Press .

NOTE: The ENT key must be pressed within five seconds, otherwise the display will return to the last run mode menu.



CHANGING THE CC/PULSE VALUE

1. Press 

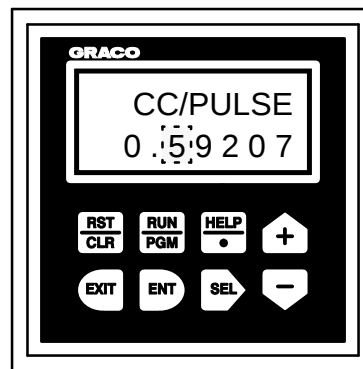
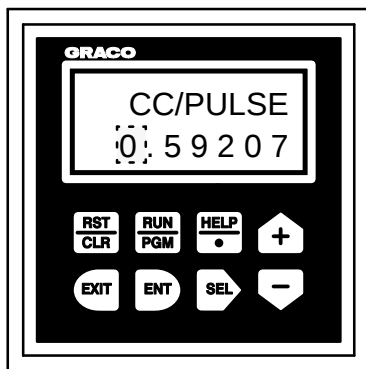


CC/PULSE defines the cubic centimeters for each input pulse.

At left is a typical CC/PULSE value for the PPM 3550 Meter. Your Remote Display is preset to an average for your flow meter. The actual value is found on your Calibration Data Sheet (see the example on page 20) or is the k-factor shown on the inside cover of the PPM 100 Flow Meter.

NOTE: The values of the scale factor and rate units (page 23) must both be changed, separately.

2. Press . The first digit will blink. Use  and  keys to change to the desired digit.



3. Press . The second digit will blink. Use  and  keys to change to the desired digit. Continue until the CC/PULSE is set to your meter scaler.

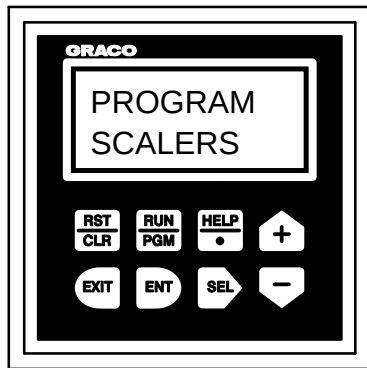
If you pass a digit, press  until you return to the digit.

4. Press  to save the CC/PULSE value and return one menu level.

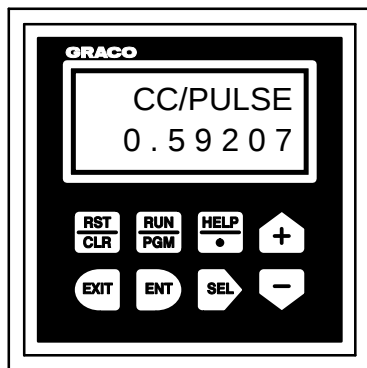
OR

Press  at any time to exit without saving the CC/PULSE changes and return one menu level.

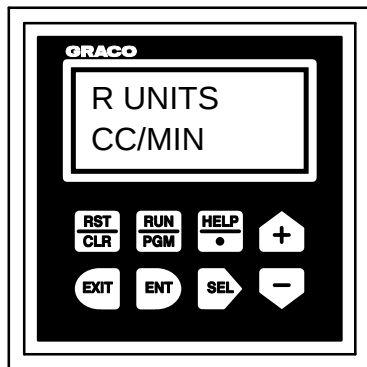
5. Press  to return to the RUN mode.



1. Press 



2. Press 



R UNITS set the units of volume for the Main Counter, Totalizer and Rate. The PPD 200 is programmed to count in cubic centimeters per minute (**CC/MIN**). The units can be changed to fluid ounces (OZ/MIN), liters (L/MIN), and gallons (GAL/MIN).

3. Press  and  and  keys to change to the desired units.

4. Press  to save the R UNITS value and return one menu level

OR

Press  at any time to exit without saving the R UNITS changes and return one menu level.

5. Press  to return to the RUN mode.

PREVENT PROGRAMMING CHANGES

WARNING

To reduce the risk of electric shock, always disconnect the display power cord before removing the display cover. Never plug in the power cord while the cover is removed.

1. Unplug the PPD 200 Remote Display.
2. Remove the display cover.
3. Re-connect the yellow jumper between pin 2 and 18 to prevent changes to the display's programming.
4. Re-install the display cover.
5. Plug-in the display and press the toggle to the "ON" position.

KEY FUNCTIONS

Key Functions in Program Mode



**RST
CLR**

Reset/Clear Key This key zeros numeric data that is selected for editing.



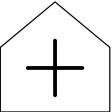
**RUN
PGM**

Run/Program Key Press this key to return to the run mode.



HELP

Help/Key Press this key to set the decimal point positions for count and rate scaler displays.



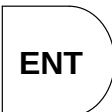
+

Up Arrow/Plus (+) Key This key is used to step vertically up through the menus and increment the value of selected digits when changing numeric values.



EXIT

Exit Key Press this key to exit program changes that have been selected but not yet entered.



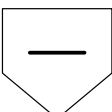
ENT

Enter Key Press this key to enter the displayed program changes.



SEL

Select Key Press this key to move into more detailed menus and to select the digits of numeric values needed for programming.



—

Down Arrow/Minus (-) Key This key is used to step vertically down through the menus and decrement the value of selected digits when changing numeric values.

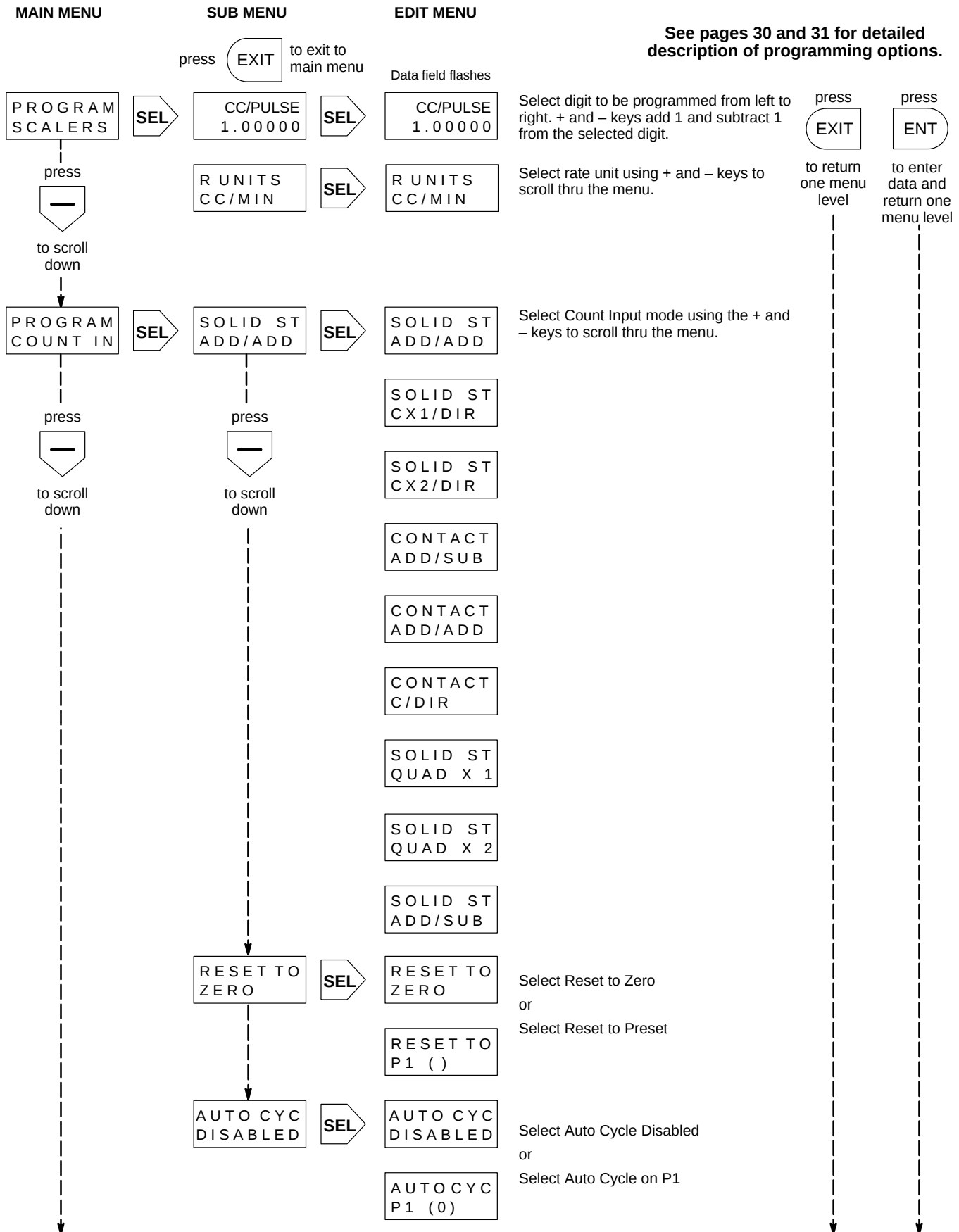
The keystroke sequences to select all of the programmable options are shown in the programming charts on pages 26 to 29.

The seven main menus are shown below.

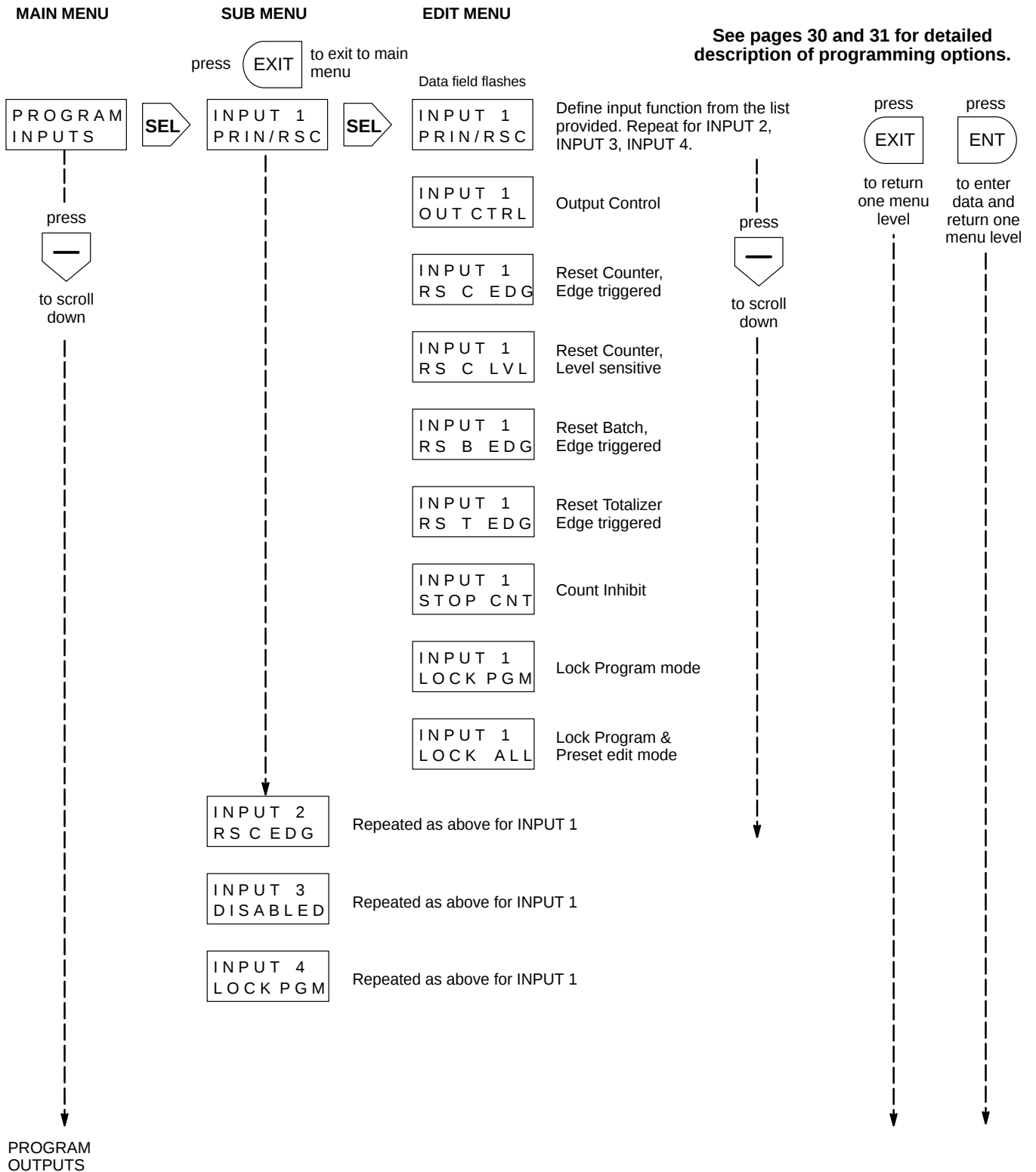
Overview of Seven Main Menus

press  to scroll down	
PROGRAM SCALERS	Enter count scale factor and rate units.
PROGRAM COUNT IN	Select count mode, reset to zero or reset to preset and auto-recycle operations.
PROGRAM INPUTS	Select the input function to be performed by each of the four programmable inputs.
PROGRAM OUT MODE	Select normal or reserve logic, latched or pulsed, pick-up or drop-out events.
PROGRAM SER PORT	Select the unit ID number, baud rate, parity, and transmission delay.
PROGRAM SER OUT	Select the data items to be transmitted when a serial group print command (RCD7) is received.
PROGRAM OPTIONS	Select the run mode function of the front panel RST/CLR key. Restore factory programming.
press  to scroll up	

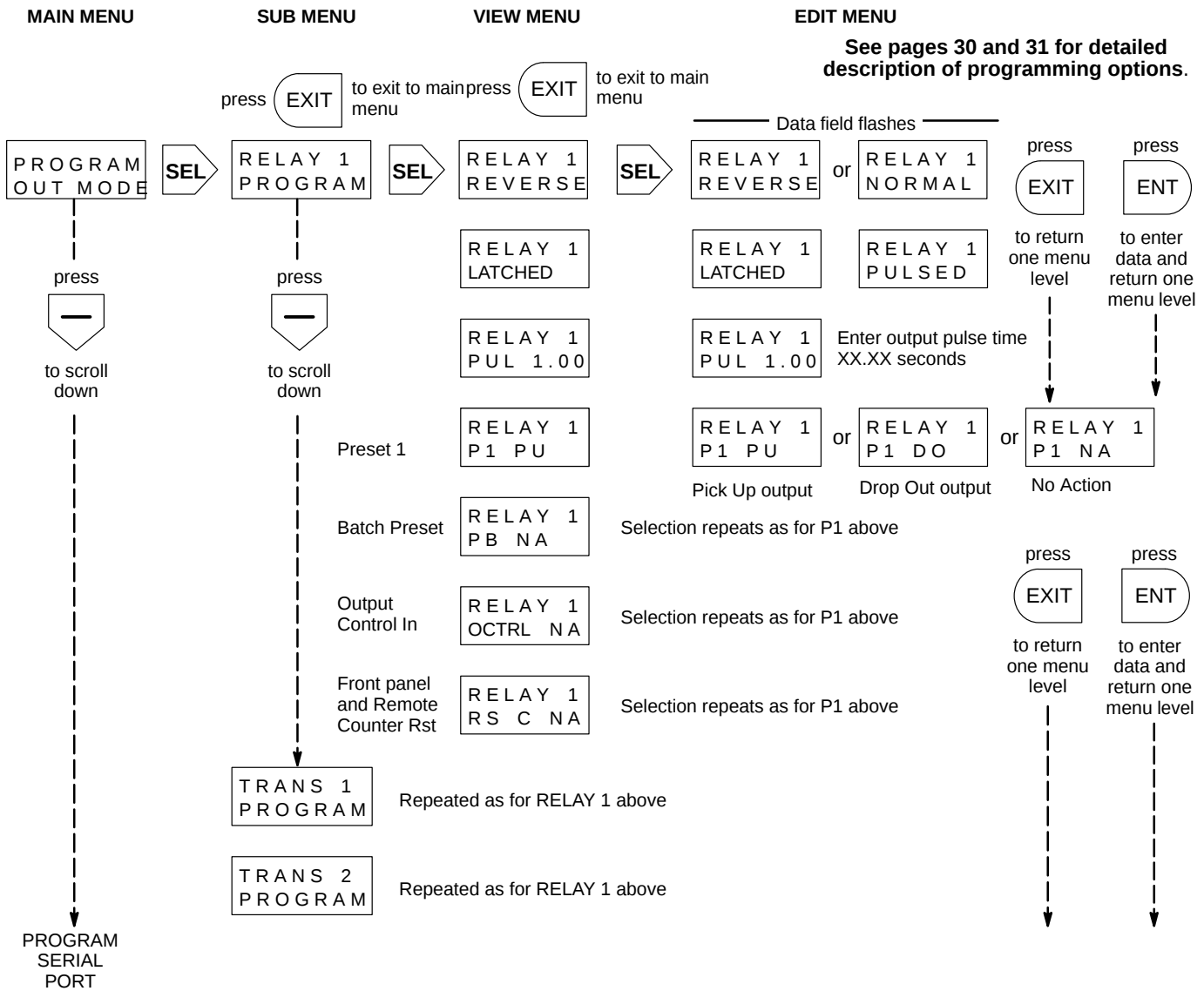
PROGRAMMING SCALERS AND COUNT INPUTS



PROGRAMMING CONTROL INPUTS



PROGRAMMING OUTPUTS



Relay Output Application Option

The count control has one relay output that may be used to switch signal a solenoid valve. The relay is programmed from the factory as follows:

RELAY 1	REVERSE
RELAY 1	LATCHED
RELAY 1	P1 PU
RELAY 1	RS C DO

Since the relay is reversed, the relay will drop out (DO) when the count reaches the preset 1 (P1). The relay will pull up (PU) when the count is reset by the RST/CLR key.

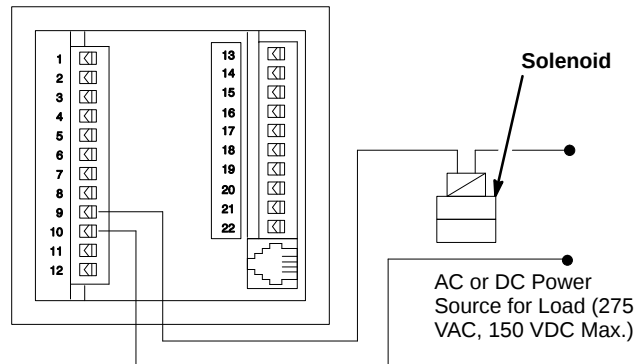
NOTE: See the menu above for other programming options. Call Graco Technical Assistance (phone no. on page 42) for further help with programming.

Relay Contact Output Wiring

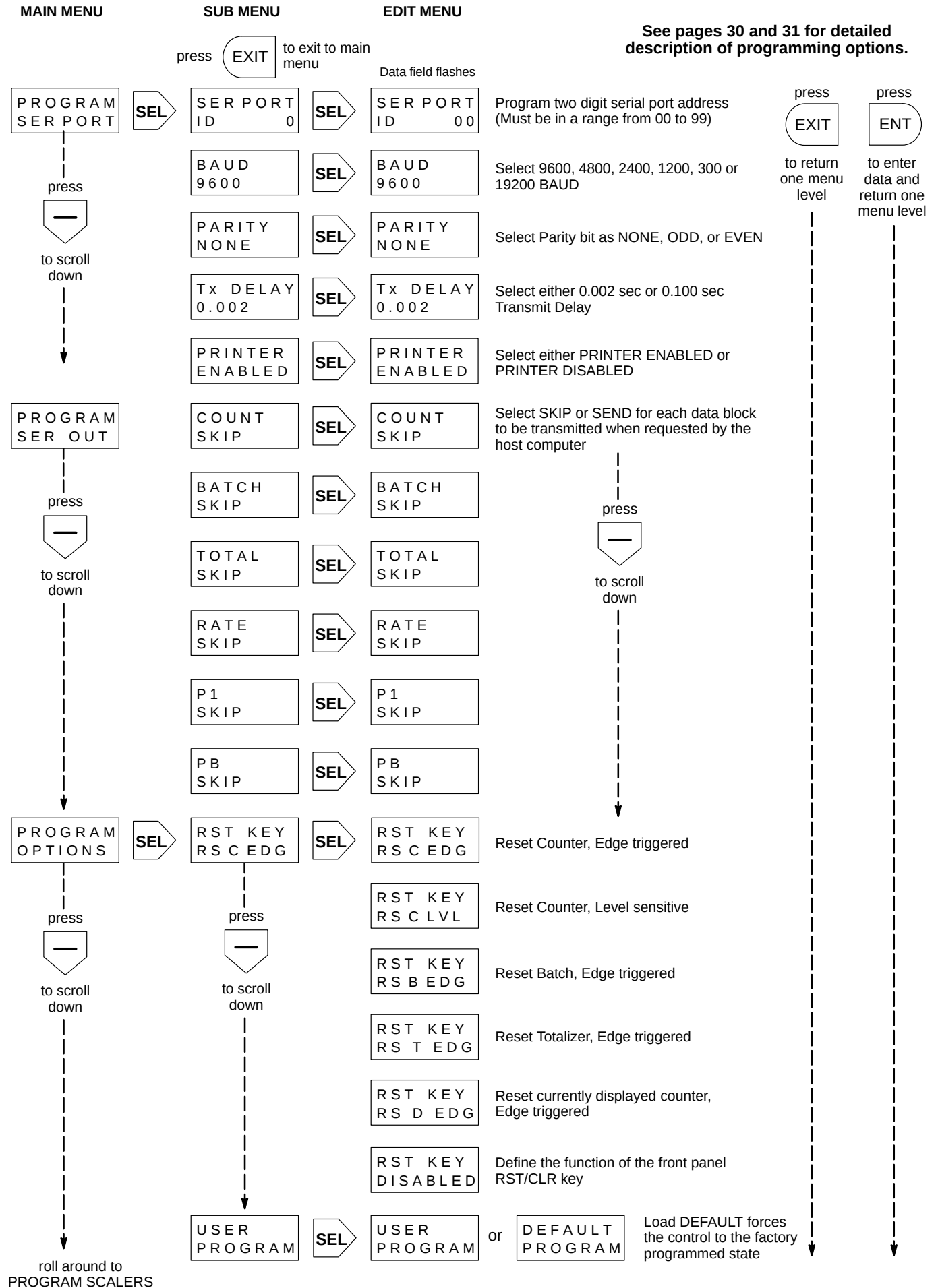
The following wiring example shows a solenoid being controlled from the normally open contact of Relay 1. Wiring for the normally closed contact (8, 9) would be done in the same way.

WARNING

To reduce the risk of fire and explosion and serious bodily injury, always install a barrier module when using a solenoid in a hazardous location. See page 5 for hazardous location wiring information. Consult your solenoid or barrier manufacturer to properly size your safety barrier.



PROGRAMMING SERIAL PORT AND OPTIONS



DESCRIPTION OF PROGRAM OPTIONS

SCALERS

CC/PULSE cc/pulse is the volume of fluid in cubic centimeters for each input pulse.

R UNITS – the rate units set the units of volume for the Main Counter, Totalizer, and Rate. The PPD 200 is programmed to count in cubic centimeters. The units can be change to fluid ounces, liters, and gallons. Rates are calculated per minute.

COUNT Input

SOLID ST ADD/ADD – same as contact add/add mode but can be used with high speed count signals.

SOLID ST C x1/DIR – same as the contact count/direction but can be used with high speed count signals.

SOLID ST C x2/DIR – same as above except counts occur on both edges of input signal for increased resolution.

CONTACT ADD/SUB – input A adds counts and input B subtracts counts. This mode includes input filtering to debounce mechanical contacts.

CONTACT ADD/ADD – inputs A and B both add counts. This mode includes filtering to debounce mechanical contacts.

CONTACT C/DIR – count with direction control. Input A adds counts when the B input is high. Input A subtracts counts when the B input is high. Input A subtracts counts when the B input is low.

SOLID ST QUAD x1 – requires a quadrature signal input. This mode provides direction control and is used to eliminate false counts due to jitter or vibration. The count direction depends on the phase relationship of inputs A and B.

SOLID ST QUAD x2 – same as the quadrature x1 mode above except that counts occur on both edges of input signal. This allows increased resolution from the same pulse source.

SOLID ST ADD/SUB – same as the contact add/subtract mode but can be used with high speed count signals.

RESET TO ZERO – the main counter resets to zero when a main counter reset occurs. The normal count direction is up and the main counter outputs respond only when counting up.

RESET TO P1() – the main counter resets to the preset value when a main counter reset occurs. Preset coincidence occurs when the main counter reaches zero. The normal count direction is down and the main counter output responds only when counting down.

AUTO CYC DISABLED – the main counter does not automatically reset when it reaches the preset value.

AUTO CYC P1(0) – the main counter automatically resets as programmed when it reaches the preset 1 coincidence value. The preset 1 coincidence value is zero when in the reset to preset mode.

INPUTS

INPUT 1 PRIN/RSC – when input 1 is turned on, the main counter automatically resets to 0 and the print format is sent out through the serial port.

INPUT 1 OUT CTRL – when input 1 is turned on, an output control signal occurs (edge sensitive). While more than one input may be programmed for output control, only one output control channel is available in the unit.

INPUT 1 RS C EDG – the main counter resets when input 1 is turned on (edge sensitive). If input 1 remains on, the main counter can still count.

INPUT 1 RS C LVL – the main counter is held at the reset value while input 1 is on (level sensitive).

INPUT 1 RS B EDG – the batch counter resets when input 1 is turned on (edge sensitive). If input 1 remains on, the batch counter can still count.

INPUT 1 RS T EDG – the totalizer resets when input 1 is turned on (edge sensitive). If input 1 remains on, the totalizer can still count.

INPUT 1 STOP CNT – all count functions stop (inhibited) while input 1 is on (level sensitive).

INPUT LOCK PGM – all program editing is disabled (keyboard and serial) while input 1 is on (level sensitive). Preset values can still be changed serially or from the keyboard.

INPUT 1 LOCK ALL – all programming and preset editing functions (keyboard and serial) are disabled while input 1 is on (level sensitive). The user can still select different run mode displays from the keyboard.

INPUT 1 DISABLED – input 1 does not perform any function when turned on.

Each of the above functions is repeated for inputs 2, 3 and 4, respectively.

OUTput MODE

RELAY 1 REVERSE – relay 1 turns on when it receives a drop-out signal and turns off when it receives a pick-up signal. The relay always powers-up in the off state.

RELAY 1 NORMAL – relay 1 turns on when it receives a pick-up signal and turns off when it receives a drop-out signal.

RELAY 1 LATCHED – relay 1 turns on (off if reversed) when it receives a pick-up signal and stays on (off if reversed) until it receives a drop-put signal.

RELAY 1 PULSED – relay 1 turns on (off if reversed) when it receives a pick-up signal and automatically turns off (on if reversed) after the time specified below.

RELAY 1 PUL – enter the desired time for relay 1 to stay on (00.01 to 99.99 seconds). This screen is not displayed unless pulsed is selected in the menu above.

RELAY 1 P1 – relay 1 can be programmed for no action, pick-up or drop-out when the main counter reaches the preset.

RELAY 1 PB – relay 1 can be programmed for no action, pick-up or drop-out when the batch counter reaches the batch preset.

RELAY 1 OCTRL – relay 1 can be programmed for no action, pick-up or drop-out when an output signal occurs. One of the inputs must be programmed for output control before RELAY 1 OCTRL can occur.

RELAY 1 RS C – relay 1 can be programmed for no action, pick-up or drop-out when a reset main counter signal occurs. The reset key or one of the inputs must be programmed to reset the main counter before a RELAY 1 RS C can occur.

Each of these functions is repeated for transistor output 1 and transistor output 2 sub-menus.

SERial PORT

SER PORT ID – enter the desired two digit serial ID number (00 to 99 decimal). All communications to the control must contain this number (in hexadecimal). Each unit must have a unique ID#.

BAUD – selects the serial port transmit and receive baud rate. Allowable rates are 9600, 4800, 2400, 1200 300 and 19200.

PARITY – the user may select none, odd, or even parity. If none (no parity) is selected, the counter transmits space parity and does not check received parity.

Tx DELAY – the user may select a transmission delay of either 2 or 100 milliseconds. The counter waits for this time period before responding to any serial commands. This delay is provided to allow a host of computer time to switch from the transmit to receive mode.

PRINTER – the user may select either printer enabled in order to send data to a printer or printer disabled.

SERial OUT

These options determine which items are sent when the counter receives the RCD7 command.

OPTIONS

RST KEY RS C EDG – the main counter resets when the RST/KEY is pressed (edge sensitive). If the RST/KEY is held on, the main counter can still count.

RST KEY RS C LVL – the main counter is held at the reset value while the RST/KEY is pressed (level sensitive).

RST KEY RS B EDG – the batch counter resets when the RST/CLR key is pressed (edge sensitive). If the RST/CLR key is held on, the batch counter can still count.

RST KEY RS T EDG – the totalizer resets when the RST/CLR key is pressed (edge sensitive). If the RST/CLR key is held on, the totalizer can still count.

RST KEY D EDG – any counter value being displayed is reset when the RST/CLR key is pressed (edge sensitive). If the RST/CLR key is held on, the displayed counter can still count.

RST KEY DISABLED – the RST/CLR key does not perform any function.

USER/DEFAULT PROGRAM – if the user selects default, the counter returns all program mode options to the factory set values (first choice shown in menus). Counter and preset values are not affected. This screen shows USER PROGRAM if any options have been changed from the default settings.

The advanced communication capability of the PPD 200 remote display allows a host computer to read and reset counters, read and write presets, inhibit and enable counts, turn outputs on and off, lock and unlock the keyboards, and read and program all setup parameters.

The PPD 200 uses ASCII code with the RS-485 serial specification and Opto-22 compatible protocol. This allows bi-directional communications and addressing of multiple controls on a single two-wire communication bus. Each unit is individually addressed via a user programmable ID number. Up to 100 counters can be connected directly to the bus.

Serial Command Summary

ESP: Enter Serial programming

LAL: Lock All

LPG: Lock Program

OCL: Output Control

RCD: Read Counter Data

RDV: Read Device Value

RPI: Read Program Item

UAL: Unlock All

RSB: Reset Batch Counter

RSC: Reset Counter

RST: Reset Totalizer

STP: Stop Count

WP1: Write Preset 1

WPB: Write Batch Preset

WPI: Write Program Item

UPG: Unlock Program

XSP: Exit Serial Programming

Serial Command Format

The general command format is shown below.

>ID#COMMAND[numeric data]CHECKSUM(cr)

Example:

To cause unit #10 to transmit the value of the main counter, send the RCD command as follows:

>	OA	RCD	0	7A	(CR)
1	2	3	4	5	6

- 1** *Message start character (ASCII 62)* – Required for all transmissions to the display.
- 2** *Two digit serial port ID# in hexadecimal* – Required for all transmissions to the display. Unit ID# 10 (decimal) is unit ID# OA (hexadecimal). Capital letters must be used.
- 3** *RCD (Read Counter Data) command* – All serial commands consist of three characters. Letters may be upper or lower case. See pages 34 to 36 for description of all commands.
- 4** *Numeric data required with the RCD command to specify counter or preset to be read* – Up to eight numeric characters are required for some commands. Most commands do not require any numeric characters. See pages 34 to 36 for list of all commands.
- 5** *Two digit hexadecimal checksum of the ASCII values of the ID number, command, and any required numeric characters* – Required for all transmissions to the control.

Checksum Calculation:

0	A	R	C	D	0
---	---	---	---	---	---

$$48 + 65 + 82 + 67 + 68 + 48 = 378 \text{ (dec.)}$$

$$= 17A \text{ (hex.)}$$

The checksum is the last two hexadecimal characters – 7A. Upper or lower case letters may be used. The > start character and carriage return are not used in calculation.

- 6** *ASCII carriage return (13 decimal)* – Required at the end of all commands.

Serial Response Format

The counter does not respond to a command unless the transmitted ID number matches its programmed ID number.

If the ID numbers match and the command and checksum are valid, the control executes the command and transmits a response as shown below:

A [data] [checksum] (cr)

Where:

A is the acknowledge character (ASCII 65) sent when any valid command is received and executed.

[data] is sent in response to the RCD, RDV, or RPI commands that request data. Data is not transmitted for other commands.

[checksum] is sent only when data is requested (RCD, RDV, or RPI commands). The checksum is calculated by adding the ASCII values of all preceding characters (including the A and spaces). The checksum is the two least significant digits of this sum in hexadecimal.

(cr) is the ASCII carriage return (13 decimal). Transmitted at the end of all responses.

Examples:

A(cr)	No Data requested
ACT 337914 93(cr)	Count data requested

If the ID numbers match, but the command is not valid or cannot be executed, the counter ignores the command and responds by sending an ASCII "N" (not acknowledged), followed by a one character error code and a carriage return.

Error Codes:

- 9** *Lock input is on* – Cannot change preset values or enter serial program mode until lock input is removed.
- A** *Checksum error* – Received checksum does not match calculated checksum.
- B** *Command not found in table or invalid command* – WPI, RPI, XSP received when not in serial program mode.
- C** *Invalid data* – Incorrect number of digits or illegal character received in data field.
- D** *Preset edit in progress on keyboard* – Serial preset cannot be sent if preset is being changed on the keyboard.
- E** *Command is valid for this family but not this counter or command is not valid with this program configuration* – Cannot change output time if output is set to latch.
- F** *Keyboard programming mode is active* – Cannot enter serial program mode is in keyboard program mode.

Examples:

NC(cr)	Invalid data
N9(cr)	Lock input is on

Serial Run-Mode Commands

RCD(n) – Read Counter Data

This command must be followed by a number (n) from 0 to 7. The number determines which value the counter sends. The requested value is preceded by a two character counter or preset abbreviation. The counter formats its response in a 12 character field. The counter sends any programmed decimal points in the correct location. Leading zeros are sent as spaces.

Example Command:

>1BRCD37F(cr) Reads rate indicator from unit 27

Example Response:

(n)	Value Sent	Response Formats with Different Decimal Points
-----	------------	--

		123456789012
0	Main Counter	ACT 123456 8D(cr)
1	Batch Counter	ABT 123456 8C(cr)
2	Totalizer	AT 12345678 99(cr)
3	Rate	ART 123456 9C(cr)
4	Preset 1	AP1 123456 77(cr)
6	Batch Preset	APB 123456 88(cr)

		123456789012
0	Main Counter	ACT 123.456 9B(cr)
1	Batch Counter	ABT 123456 8C(cr)
2	Totalizer	AT 12345.678 A7(cr)
3	Rate	ART 123.456 AA(cr)
4	Preset 1	AP1 123.456 85(cr)
6	Batch Preset	APB 123456 88(cr)

RCD7 is a special command that sends all of the values that have been specified in the SERIAL OUTPUT menu. The counter sends values in the order shown above. If the counter is programmed to send the main count, batch count, and preset 1, the response might look like this:

ACT 123.456 BT 0 P1 123.456 C5(cr)

RCD8 command returns an acknowledge with data response containing the RPI01 index of scaling units. Responses are as follows:

A030<cr>cc/min
A131<cr>oz/min
A232<cr>l/min
A333<cr>gal/min

WP1(nnnnnn) – Write Preset 1

WPB (nnnnnn) – Write Batch Preset

The write preset commands allow a host computer to enter new preset values. The commands must be followed by a six digit number (000000 to 999999). All leading zeros must be supplied. As with keyboard entry, decimal points cannot be sent to the counter. The counter always displays any decimal point in the programmed position.

Example:

>10WP10005005E(cr) Sets preset 1 to a value of 500 on unit 16

RSC – Reset Counter

RSB – Reset Batch Counter

RST – Reset Totalizer

The serial reset commands work the same as the reset key (edge) and reset input (edge) functions. Any outputs which are programmed to pick-up or drop-out with a counter reset signal will also respond to the RSC command.

Example:

>00RSC48(cr) Resets the main counter on unit 00

LAL – Lock All

LPG – Lock Program

UAL – Unlock All

UPG – Unlock Program

The lock and unlock commands allow a host computer to lock or unlock keyboard programming. The commands are similar to a lock input function except serial write and programming commands (WP1, WPB, and ESP) are still allowed.

The counter does not store lock commands when power is removed. The host must re-issue the desired lock command after power is re-applied.

Lock inputs are not affected by serial lock commands. If both a lock input and a serial lock command are in effect, the user must remove both locks before programming from the keyboard. The user only needs to remove the lock input for serial programming.

Example:

>5AUPG62(cr) Cancels a previously issued Lock Program command to unit 90

Serial Run-Mode Commands (continued)

STP – Stop Count
RSM – Resume Count

These commands mimic the stop count input function. When the counter receives an STP commands, all count input pulses are ignored until the counter receives an RSM command. These commands are useful when synchronizing serial counter reset commands.

The counter does not store the serial stop command when power is removed. The unit will count input pulses when power is re-applied.

Example:

>00STP57(cr)	Inhibit counts on unit 00
>00RSC48(cr)	Reset main counter on unit 00
>00RST59(cr)	Reset totalizer on unit 00
>00RSM52(cr)	Resume counting on unit 00

OCL – Output Control

Any outputs programmed to pick-up or drop-out with an output control signal will respond. This command is a one-shot or edge command. It is the same as turning on an input that has been programmed for output control.

Example:

>01OCL3F(cr)	Sends an output control signal to unit 01
--------------	---

RDV – Read Device Value

This command causes the counter to respond with the product family number the software version number, the hardware configuration byte, and the serial ID number.

Example Command:

>00RDV4C(cr)	Send RDV command to unit 00
--------------	-----------------------------

For this counter the family number is “1”, the software version is “1”, and the hardware configuration byte is “5D”. If the serial ID is set to 00 (00 hexadecimal), the response to the RDV command will be:

Example Response:

A115D007C(cr)

Serial Program-Mode Commands

ESP – Enter Serial Programming

This command causes the counter to enter the serial programming mode. The host must send this command before the unit will respond to serial programming commands (WPI, RPI, and XSP). The counter displays the message “LOADING PROGRAM” when it receives a valid ESP command. The counter and preset values are saved and the outputs dropout as when entering the keyboard programming mode.

If the counter is in the serial programming mode and power is removed, it will enter the keyboards programming mode when power is reapplied.

Example:

>00ESP48(cr)	Causes unit 00 to enter the serial programming mode
--------------	---

XSP – Exit Serial Programming

This command causes the counter to store any new program data and exit the serial programming mode. It is similar to exiting the keyboard programming mode.

Example:

>00XSP5B(cr)	Causes unit 00 to exit the serial programming mode
--------------	--

WPI(nnn - nnnnnnnn) – Write Program Item

This command allows a host computer to remotely program a PPD 200 remote display. The PPD 200 must be in the serial programming mode (ESP command). The host must send the WPI command followed by the two to four digit edit menu number of the desired function. A one to six digit data value is required with some edit menus. See diagram on pages 38 and 39 for edit menu item numbers.

Example:

>00WPI02360000DB(cr)	Sets the rate scaler to 60.000 on unit 00.
----------------------	--

Serial Program-Mode Commands (continued)

RPI(nn - nnn) – Read Program Item

This command allows a host computer to determine the programming of a PPD 200 remote display. The PPD 200 must be in the serial programming mode (ESP command). The host must send the PRI command followed by a two or three digit number representing the desired sub-menu. See diagram on pages 38 and 39 for sub-menu numbers. The counter responds by transmitting a

number representing the current option selected for a sub-menu.

Example Command:

>00RPI20AD(cr) Read input 1 selection

Example Response:

A200D3(cr) Input 1 is disabled

Sample Communications Program

The following BASIC program can be used to demonstrate the serial communications capability of the PPD 200 Remote Display. The program requires the user to enter a command with the correct unit ID# and format (example: 00WPI123456). The program will calculate

the checksum and include it in the command string along with the preceding ">" character. The command string will then be printed to the screen and sent to the PPD 200 unit (example: >00WPI123456E). The program then prints the PPD 200 response to the screen (example: A).

```

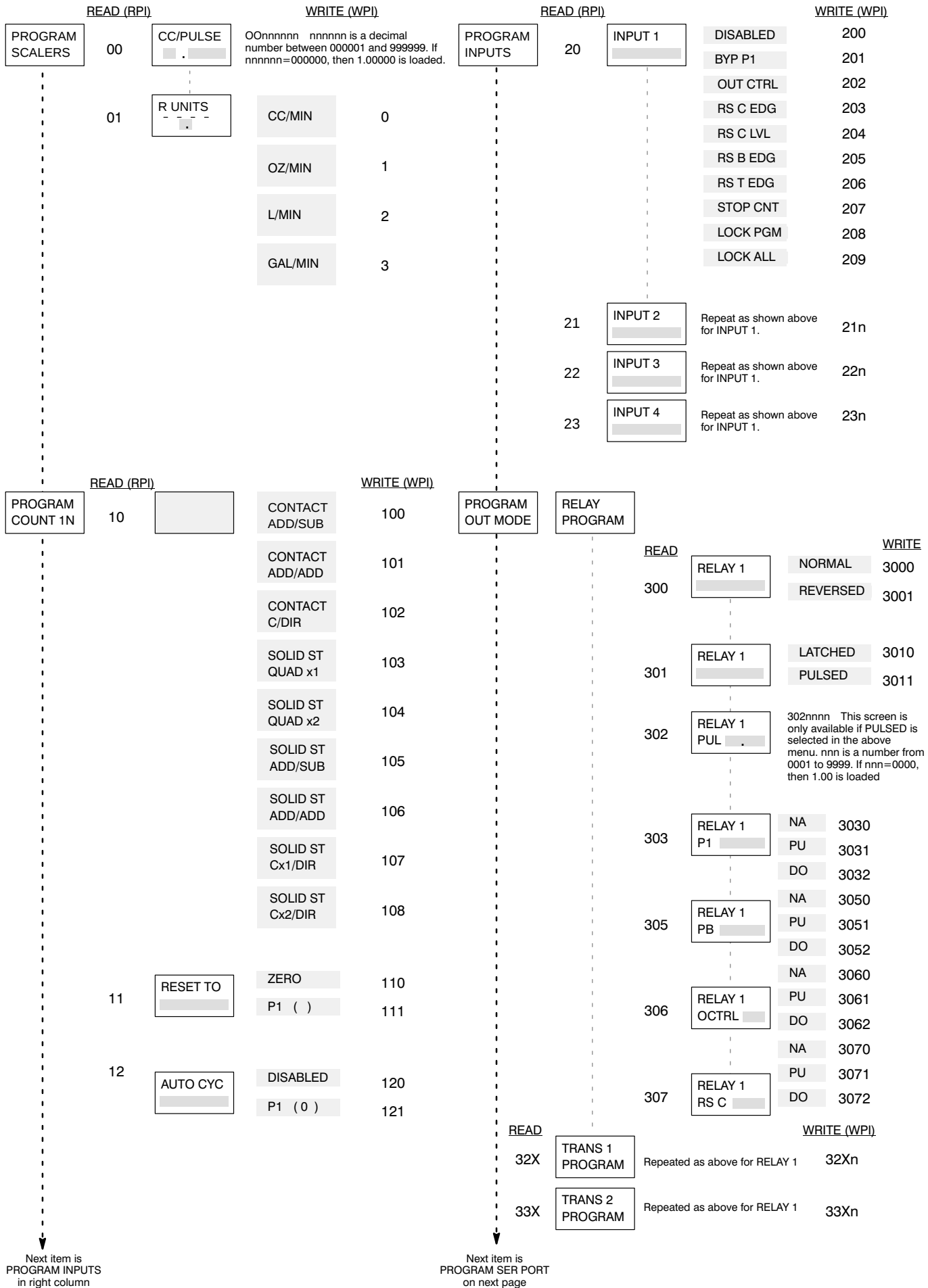
10 REM **** INITIALIZE AND INPUT ****
20 DEFINT A - Z : DEF SEG = &H40 : CB = PEEK(1)*&H100 + PEEK(0) : DEF SEG
30 MSR = CB + 6 : LSR = CB + 5 : MCR = CB + 4 : RTSON = 8+2+1 : RTSOFF = 8+1
40 OPEN = "COM1 : 9600,N,8,1,RS" FOR RANDOM AS #1 : ON TIMER(3) GOSUB 230
50 GOTO 250
60 REM ***** HEX CONVERSION *****
70 CMD$ = ID$ + CMD$ : CS = 0 : OUTPUT$ = " "
80 FOR X = 1 TO LEN(CMD$) : CS = CS + ASC(MID$(CMD$,X,1)) : NEXT X
90 CS = CS AND 255 : CS$ = HEX$(CS) : IF CS < 16 THEN CS$
100 T$ = ">" + CMD$ + CS$
110 REM **** TRS CONTROL AND SEND ****
120 OUT MCR, RTSON : PRINT #1, T$
130 IF INP(LSR) <> &H60 THEN 130
140 OUT MCR, RTSOFF
150 REM ***** GET RESPONSE *****
160 TIMER ON
170 IF LOC(1) = 0 THEN 170
180 OUTPUT$ = OUTPUT$ + INPUT$(LOC(1), #1)
190 TIMER OFF
200 IF RIGHT$(OUTPUT$,1) <> CHR$(13) THEN GOTO 160
210 RETURN
220 REM ***** NO RESPONSE ROUTINE *****
230 PRINT "NO RESPONSE" : PRINT : TIMER OFF : RETURN 60
240 REM *****
250 REM ***** BEGIN USER PROGRAM *****
260 REM *****
270 INPUT "ID #: ";ID
280 PRINT : PRINT
290 ID$ = HEX$(ID)
300 IF ID < 10 THEN ID$ = "0" + ID$
310 CMD$ = "RCD0" : GOSUB 60 : MAIN$ = MID$(OUTPUT$, 5, 8)
320 CMD$ = "RCD1" : GOSUB 60 : BATCH$ = MID$(OUTPUT$, 5, 8)
330 CMD$ = "RCD2" : GOSUB 60 : TOTAL$ = MID$(OUTPUT$, 4, 9)

```

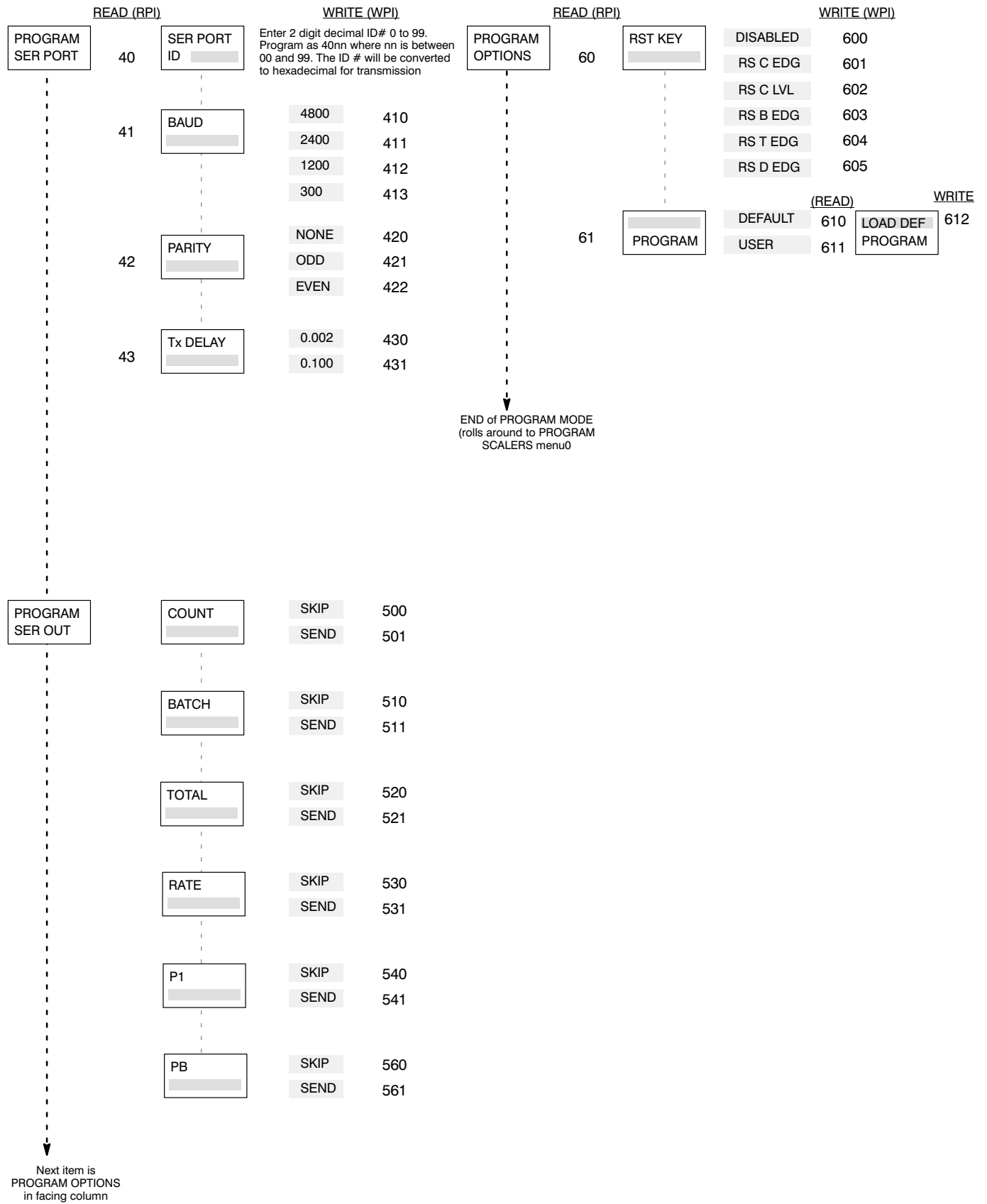
Sample Communications Program (continued)

```
340 CMD$= "RCD3" : GOSUB 60 : RATE$ = MID$(OUTPUT$, 5, 8)
350 CMD$= "RCD4" : GOSUB 60 : PRSET$ = MID$(OUTPUT$, 5, 8)
360 CMD$= "RCD8" : GOSUB 60 : UNIT$ = MID$(OUTPUT$, 1, 2)
370 IF UNIT$="A0" THEN UNIT$= "CC"
380 IF UNIT$="A1" THEN UNIT$= "OZ"
390 IF UNIT$="A2" THEN UNIT$= "L"
400 IF UNIT$="A3" THEN UNIT$= "GAL"
410 PRINT "ID#: ";ID$
420 PRINT "FLOW RATE (":PRINT UNIT$;PRINT "/MIN)";PRINT RATE$
430 PRINT "RESETTABLE TOTAL (":PRINT UNIT$;PRINT ")";PRINT MAIN$
440 PRINT "PRESET 1 (":PRINT UNIT$;PRINT ")";PRINT PRSET$
450 PRINT "NON-RESETTABLE TOTAL (":PRINT UNIT$;PRINT ")";PRINT TOTAL$
460 PRINT "MORE DATA? (YES/NO)";INPUT C$
470 IF C$="YES" THEN GOTO 310
480 CMD$="XSP" : GOSUB 60
490 CLOSE #1
500 END
```

SERIAL PROGRAMMING



SERIAL PROGRAMMING



Self-test Routines

The PPD 200 has several built in self-test routines. The counter performs these tests each time power is applied.

If a problem occurs, run the self-test routines by removing and re-applying power to the unit.

If one of the internal test routines discovers a problem, the counter displays the message "ERROR X" where X is a single digit test number. The counter will not operate when displaying an error code. All outputs will remain in the off (dropped-out) state. In the error mode, the counter responds to all serial commands with a "N" followed by the failed test number.

Description of Tests

- #0 ROM (Read Only Memory) Test** – This routine checks that the ROM, which holds the counter's operating program, is not corrupted.
- #1 RAM (Random Access Memory) Test** – This routine checks the read / write memory used by the counter for normal operation and communication.
- #2 Display Test** – This routine checks the operation of the display driver.
- #3 Non-Volatile RAM Test #1** – This routine checks the run data section of NOVRAM. This NOVRAM section retains all count and preset values while power is removed.
- #4 Non-Volatile RAM Test #2** – This routine checks the user program section of the NOVRAM. This section retains all programmable options and parameters while power is removed.
- #5 Non-Volatile RAM Test #3** – This routine checks the factory set hardware configuration.

What To Do When A Test Fails

1. Immediately halt the equipment being controlled by the counter.
2. Record the displayed error number.
3. *If the counter shows ERROR 0, 1, 2, or 5* – run the self-tests again by removing and re-applying power to the counter.

If the counter shows ERROR 3 – press the front panel reset key. This will set all counters and preset values to zero and rerun all tests.

If the counter shows ERROR 4 – press the front panel reset key. This will reset all user programmable options to the factory default settings and rerun all tests.

4. If the same error occurs again, there is a malfunction within the counter. Return it to your nearest Graco representative for repair.

If the counter does not display an error, the unit is okay.

WARNING

Before operating the system again, check all pre-set values and user programmable options to ensure that these parameters have not changed. Property damage and a serious safety hazard could result if the operating characteristics of the counter have changed.

Troubleshooting

Some of the troubleshooting steps that follow require the user to change the programming of the unit. **BE SURE to restore all programmable options to their required settings before running any equipment with the counter.**

WARNING

To reduce the risk of fire or explosion and serious bodily injury, including electric shock, troubleshooting must be done by a qualified electrician.

I. PROBLEM: Error Message on Display

The message "ERROR" followed by a single digit number on the display indicates that the counter's internal self-tests have detected a problem. See *Self-test Routines*, page 40, to determine what caused the problem and how to solve it.

II. PROBLEM: Display is Blank

- A. Check that incoming power is wired correctly. Connect a voltmeter to the power input terminals and verify that the correct voltage is being supplied to the counter.
- B. Remove and restore power to the counter. If this corrects the problem, investigate the following causes:
 1. *Counter not properly grounded* – Check that terminal 4 is connected to a true earth ground.
 2. *Electrical noise spike from inductive loads* – Install R-C suppressors in parallel with any external solenoid or relay coils that the counter controls.
 3. *Electrical noise spikes in power supplied to the counter* – Run power to the counter from another source or install a power line filter.

III. PROBLEM: Counter Will Not Count

- A. Check the count scale factor and verify that it is set to the correct value. Set the scale factor to 1.00000 and try counting again before proceeding any further with troubleshooting.

- B. Test the counter, using a manual count source, by following this procedure:

1. Remove any wires connected to terminals 19 and 20.
2. Turn all the dip switches off.
3. Reset all program parameters to the factory default. (Enter the program mode and select the PROGRAM OPTIONS menu, select the USER PROGRAM sub-menu, select the LOAD DEF program selection and press ENT.)
4. Make and break a connection between terminals 4 and 20, using a jumper wire. The main counter and totalizer should count up each time the connection is made. If the counters do not count, send the unit to your nearest Graco representative for repair.
5. Make and break a connection between terminals 4 and 19 using a jumper wire. The main counter and totalizer should count down each time the connection is made. If the counters do not count, sent the unit to your nearest Graco representative for repair.
- C. If the counter counted from the manual count source in steps 1 to 5, above, reconnect the sensor and select the correct dip switch setting.
 1. With the sensor output in the high state, measure the voltage between DC common and the count input. The voltage must be greater than 3.5 VDC. If it is lower, the sensor is defective or leaky.
 2. With the sensor output in the low state, measure the voltage between DC common and the count input. The voltage must be less than 1.9 VDC. If it is higher, the sensor is defective or leaky.

TROUBLESHOOTING continued on next page

TROUBLESHOOTING

IV. Other Problems

Other problems are usually caused by programming and/or wiring errors. Because of the versatility of this counter, it is impossible to include troubleshooting instructions for every situation that could occur. The following are general troubleshooting steps.

1. In detail, define exactly what the problem is and when it occurs.
2. Use the block diagram and/or the menu programming diagram to determine which program options or parameters are related to the problem. Check their setting.

3. Determine which I/O circuits are related to the problem and check their operation with a voltmeter at the counter's terminal strips.

If going through the above three steps did not lead you to a solution, perform the following steps.

1. Record the wiring connections to each terminal on the unit.
2. Place the unit in the run mode and press the HELP key. Write down the four lines of data. Use the up and down arrow keys to scroll between the two screens.
3. Call the Technical Assistance phone number, below, for help with troubleshooting.

GRACO PHONE NUMBERS

TO PLACE AN ORDER, contact your Graco distributor, or call Graco: **1-800-328-0211 Toll Free**

FOR TECHNICAL ASSISTANCE, service repair information or answers about the application of Graco equipment, call: **1-800-543-0339 Toll Free**

TECHNICAL DATA

Power Input:

115 VAC (+/-15% std., 50 to 60 HZ, 7 W

Power Output:

12 VDC (+/-25%), 100 mA maximum (includes all line and load variations)

Environment:

Operating Temperature: 32 to 131° F (0 to 55° C)
Storage Temperature: -4 to 158° F (-20 to 70° C)
Operating Humidity: 85% relative, non-condensing
 NEMA 4 rating when mounted with gasket provided

Main Counter:

Type: Bi-directional
Digits: 6
Presets: 1
Reset Modes: Auto or manual reset to zero or preset
Scaler Range: 0.00001 to 9.99999
Decimal Point: 5 positions, programmable
Output Latency: 0.7 to 2.7 mS

Main Counter:

Type: Increment with main counter preset signal
Digits: 6
Presets: 1
Output Latency: 0.7 to 2.7 mS

Totalizer:

Type: Bi-directional, same or opposite of main counter
Digits: 8
Scaler: Shared with main counter
Decimal Point: Tracks main counter

Count Speeds:

The maximum count speed depends on the selected count mode. All maximum speeds are shown with square wave (50% duty cycle) input.

Mode (Inp A/Inp B)	Maximum Speed	
	Solid State (high speed)	Contact (low speed)
Add/Sub	20 kHz	40 Hz
Add/Add	20 kHz	40 Hz
Count/Direction	15 kHz	40 Hz
Count x 2/Direction	7.5 kHz	N/A
Quadrature	6.5 kHz	N/A
Quadrature x 2	6.5 kHz	N/A

Count Speeds:

Sink: *Impedance:* 4.6k ohms to +5 VDC
Voltage: High: 3.5 to 34.0 VDC
 Low: 0.0 to 1.9 VDC
Source (high) Impedance: 2.3k ohms to common

Voltage: High: 3.5 to 17.0 VDC (100% duty cycle)
 Low: 0.0 to 1.9 VDC
Source (low) Impedance: 2.3k ohms to common
DC Voltage: High: 0.6 to 17.0 VDC
 Low: -17.0 to -0.6 VDC
AC Voltage: 17 VAC (48 V Peak -Peak) maximum

Control Inputs:

Impedance: 4.7 k ohms to +5 VDC
Voltage: High: +3.7 to +24 VDC
 Low: 0.0 to 0.9 VDC
Response: Min Low: 15 mS,
 Min High: 15 mS

Relay Output:

Type: SPDT contacts with transient protection
Max. Switched Power: 170 W and 1650 VA
Max. Switched Voltage: 150 VDC or 275 VAC
 120 VDC @ 0.6 A
 50 VDC @ 1.3 A
 28 VDC @ 6.0 A
Max. Switched Current: 6 amps
U.L. Ratings: 6 A @ 28 VDC or 120/275 VAC
 1/8 HP @ 120/240 VAC (100,000 cycles)
 1.5/0.8 A @ 120/240 VAC (30,000 cycles)

Transistor Outputs (2):

Type: NPN open collector with transient protection
Max. Voltage (off state): 30 VDC
Nax. Current (on state): 200 mA @ 1.3 VDC

Communication:

Type: RS-485
Format: 1 start bit, 7 data bits (ASCII),
 1 parity bit, 1 stop bit
Protocol: Opto-22 compatible
Speed: 300, 1200, 2400, 4800, 9600 or 29300 baud
Parity: Odd, Even, None (space transmitted, ignore received)

Count Accuracy:

99.95% when counter is operated within the specified count speeds and count signal high and low times.

Rate Indicator

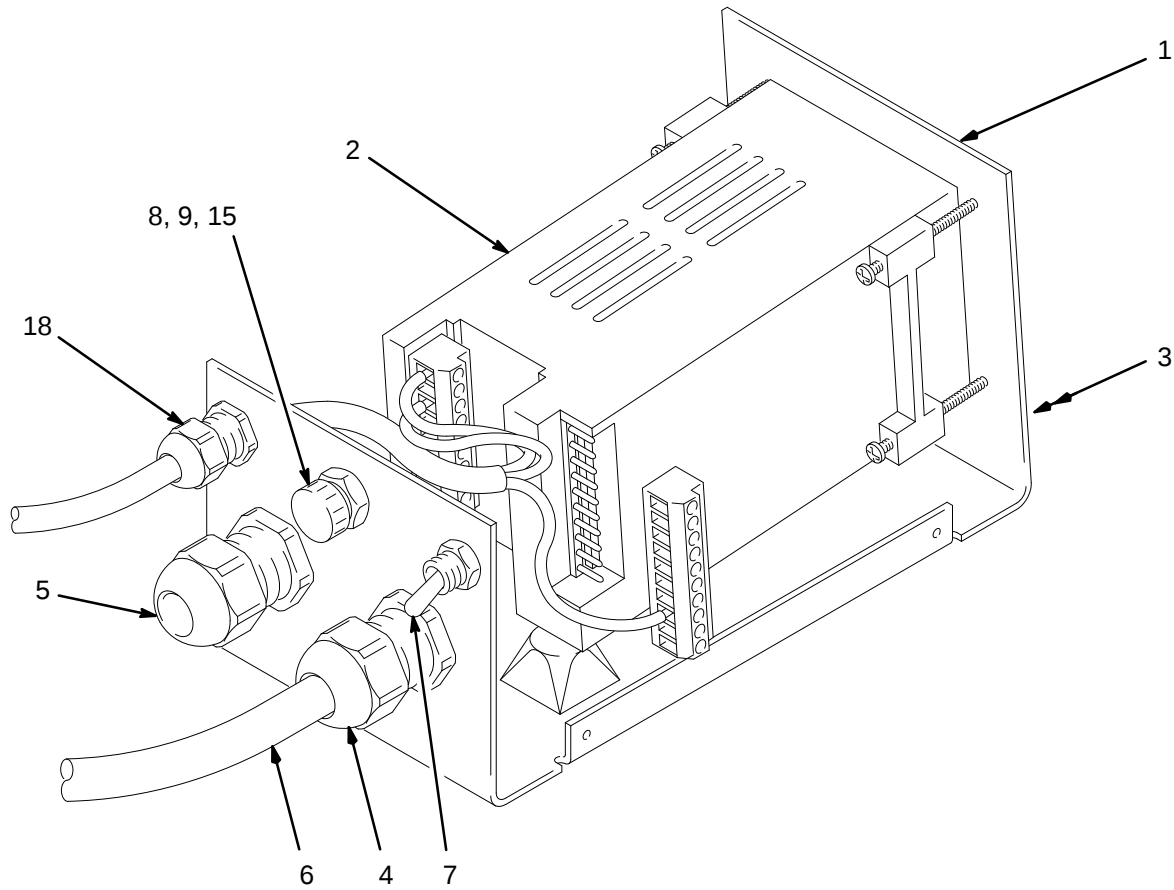
Type: 1/Tau
Digits: 6
Scaler Range: 0.00001 to 99999
Decimal Point: 5 posions, programmable
Accuracy: +/-0.015% of reading
Update Time: 1 second, fixed
Zero Time: 10 seconds, fixed

Connections:

Type: Dual depluggable screw terminal strips
Conductor Size: #14-22 AWG solid, stranded, or fused (preferred)

PARTS DRAWING

Part No. 235-610, 235-611, & 235-612 PPD 200 Remote Display



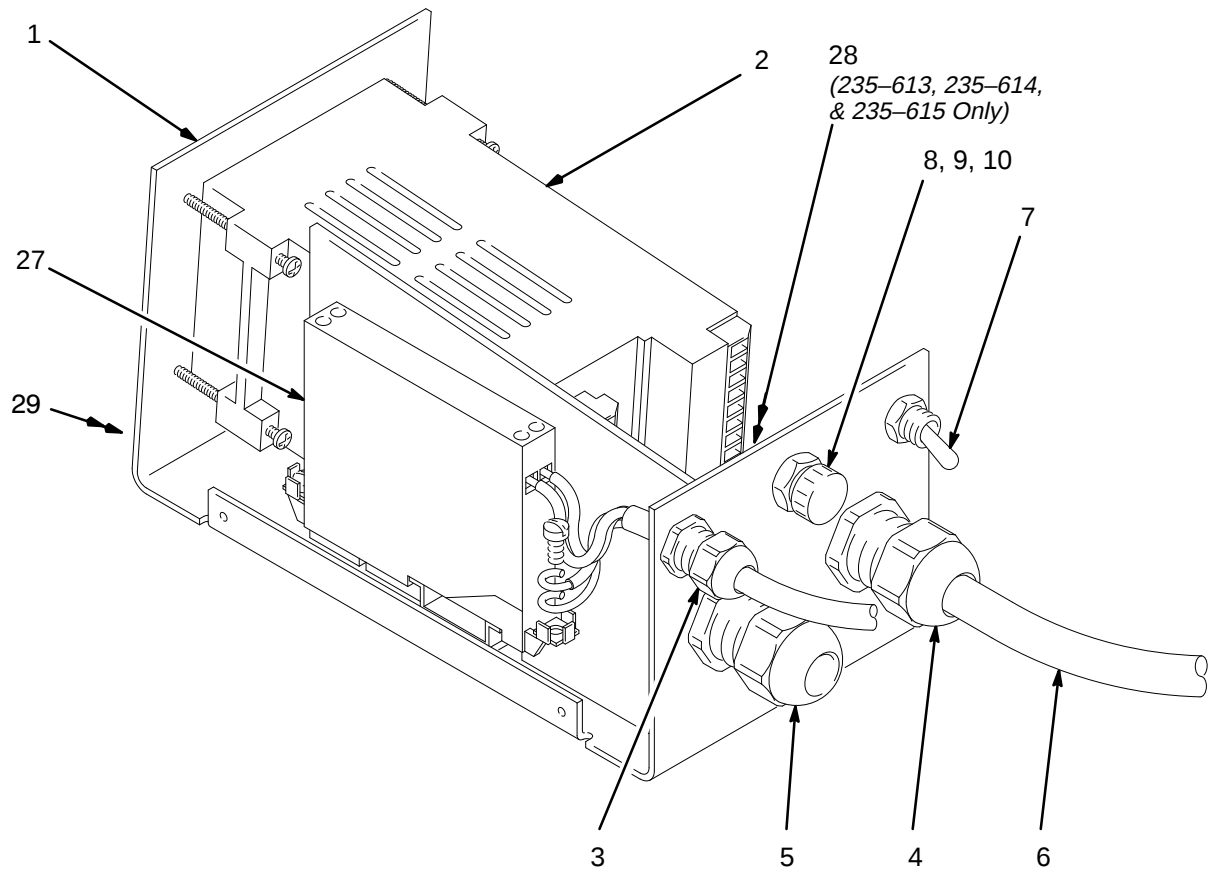
01574

PARTS LIST

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
1	185-880	CASE, remote display (cover not shown)	1	6	102-518	POWER CORD	1
2	110-491	COUNT CONTROL	1	7	105-679	ON/OFF TOGGLE SWITCH	1
3	110-592	PRINT BUTTON	1	8	106-487	FUSE HOLDER	1
4	110-514	CONNECTOR, cord strain relief	1	9	111-973	FUSE, time lag, 125 amp	1
5	110-515	CONNECTOR, cord strain relief	1	15	105-881	FUSE HOLDER	1
				18	111-987	CONNECTOR, cord strain relief	1

PARTS DRAWING

Part No. 235-613, 235-614, 235-615, & 235-616
PPD 200 Remote Display



01573

PARTS LIST

REF NO.	PART NO.	DESCRIPTION	QTY	REF NO.	PART NO.	DESCRIPTION	QTY
1	185-880	CASE, remote display (cover not shown)	1	10	111-973	FUSE, time lag, 125 amp	1
2	110-491	COUNT CONTROL	1	27	111-985	BARRIER, intrinsic safety (235-613, 235-614, & 235-615 Only)	1
3	111-987	CONNECTOR, cord strain relief	1		112-048	BARRIER, intrinsic safety (235-616 Only)	1
4	110-514	CONNECTOR, cord strain relief	1	28	111-988	CAPACITOR, ceramic, Z5U, between pin 19 & 20 (235-613, 235-614, & 235-615 Only)	1
5	110-515	CONNECTOR, cord strain relief	1	29	110-592	PRINT SWITCH	1
6	102-518	POWER CORD	1				
7	105-679	ON/OFF TOGGLE SWITCH	1				
8	106-487	FUSE HOLDER	1				
9	105-881	FUSE HOLDER	1				

SAFETY BARRIER SPECIFICATIONS & ORDERING INFORMATION

For Graco PPD 200 Displays 235–613, 235–614, and 235–615

Intrinsic Safety Barrier

Graco, Inc. Part No: 111–985

R. Stahl, Inc. Part No: 9002/13-280-110-00

This barrier is included with Graco PPD 200 Remote Displays 235–613, 235–614, and 235–615.

Outputs are Intrinsically Safe for Class I, Division 1, Groups A, B, C, D at 40° C.

Terminal Connections

Terminal 1: Non-hazardous connection for supply voltage

Terminal 2: Non-hazardous connection for signal

Terminal 3: Hazardous connection for supply voltage

Terminal 4: Hazardous connection for signal

Channel I Operational Data

Rated Voltage: 24 VDC

Maximum Voltage: 26 VDC

Fuse Current (I): 160 mA

End-to-End Resistance (R): 280 Ω

Safety Description in accordance to standards issued by Factory Mutual–Class No. 3610–October 1988 (entity concept parameters) for Channel I, terminal 3, supply voltage to ground

Open Circuit Voltage (V oc): 28 VDC

Short Circuit Current (I sc): 109.1 mA

Allowed External Capacitance (Ca): 0.39 μF

Allowed External Inductance (La): 11.6 mH

Safety Description in accordance to standards issued by CSA–22.2 No. 157

Open Circuit Voltage (V oc): 28.4 VDC

Minimum Resistance (R): 257 Ω

Channel II Operational Data

Rated Voltage: 24 VDC

Maximum Voltage: 26 VDC

Fuse Current (I): 160 mA

End-to-End Resistance (R): 1 V ≤ 22 mA
2 V > 22 mA

Safety Description in accordance to standards issued by Factory Mutual–Class No. 3610–October 1988 (entity concept parameters) for Channel II, terminal 4, signal to ground

Open Circuit Voltage (V oc): 28 VDC

Short Circuit Current (I sc): 0.0 mA

Allowed External Capacitance (Ca): 0.39 μF

Allowed External Inductance (La): 1000 mH

Safety Description in accordance to standards issued by CSA–22.2 No. 157

Open Circuit Voltage (V oc): 28.4 V

Minimum Resistance (R): diode

WARNING

To maintain intrinsic safety of your installation, only replace the Stahl barrier fuse with 160 mA replacement fuse, Stahl Part No. 011239.

For Graco PPD 200 Display 235–616

Intrinsic Safety Barrier

Graco, Inc. Part No: 112–048

R. Stahl, Inc. Part No: 9001/01-137-065-10

This barrier is included with Graco PPD 200 Remote Display 235–616.

Outputs are Intrinsically Safe for Class I, II, III, Division 1 and 2, Groups A–G.

Operational Data

Nominal Voltage: 12 VDC ± 10%

Maximum Voltage: 13.6 VDC

Fuse Current (I): 65.3 mA

End-to-End Resistance (R): 208 Ω

Safety Description in accordance to standards issued by Factory Mutual–Class No. 3610–1979 (entity concept parameters)

Open Circuit Voltage (V oc): 13.6 VDC

Short Circuit Current (I sc): 65.3 mA

Allowed External Capacitance (Ca):

A, B: 1.1 μF

C, E: 3.2 μF

D, F, G: 8.5 μF

Allowed External Inductance (La): 11.6 mH

A, B: 8.1 μF

C, E: 31.2 μF

D, F, G: 66.5 μF

Safety Description in accordance to standards issued by CSA–22.2 No. 157/79

Open Circuit Voltage (V oc): 13.9 VDC

End-to-End Resistance (R): 208 Ω

ACCESSORIES

*Accessories must be purchased separately.
Use only GENUINE GRACO PARTS AND ACCESSORIES.*

Remote Display, Flow Meter, and Cable Packages

**For use with Flow Meters Located in Class I,
Division 2 Hazardous Locations**

Package Part No.	Includes:		
	Meter Model	Display Part No.	Cable Length ft (m)
235-750	PPM 3050	235-610	25 (7.63)
235-751	PPM 3050	235-610	50 (15.25)
235-752	PPM 3050	235-610	100 (30.5)
235-753	PPM 3100	235-611	25 (7.63)
235-754	PPM 3100	235-611	50 (15.25)
235-755	PPM 3100	235-611	100 (30.5)
235-756	PPM 3550	235-612	25 (7.63)
235-757	PPM 3550	235-612	50 (15.25)
235-728	PPM 3550	235-612	100 (30.5)

**For use with Flow Meters Located in Class I,
Division 1 Hazardous Locations**

Package Part No.	Includes:		
	Meter Model	Display Part No.	Cable Length ft (m)
235-770	PPM 3050H	235-613	25 (7.63)
235-771	PPM 3050H	235-613	50 (15.25)
235-772	PPM 3050H	235-613	100 (30.5)
235-773	PPM 3100H	235-614	25 (7.63)
235-774	PPM 3100H	235-614	50 (15.25)
235-775	PPM 3100H	235-614	100 (30.5)
235-776	PPM 3550H	235-615	25 (7.63)
235-777	PPM 3550H	235-615	50 (15.25)
235-778	PPM 3550H	235-615	100 (30.5)

Package Part No.	Includes:		
	Meter Model	Display Part No.	Cable Length ft (m)
235-790	PPM 100	235-616	25 (7.63)
235-791	PPM 100	235-616	50 (15.25)
235-792	PPM 100	235-616	100 (30.5)

Electrical Cables

For connecting remote display to meter sensor

<i>For Displays 235-610, 235-611, & 235-612</i>	<i>For Displays 235-613, 235-614, 235-615, & 235-616</i>	
Cable Part No.	Cable Part No.	Cable Length
948-920	235-600	6 ft (1.83 m)
948-921	235-601	15 ft (4.58 m)
948-922	235-602	25 ft (7.63 m)
948-923	235-603	36 ft (10.98 m)
948-924	235-604	50 ft (15.25 m)
948-925	235-605	75 ft (22.88 m)
948-926	235-606	100 ft (30.5 m)
948-927	235-607	125 ft (38.13 m)
948-928	235-608	150 ft (45.75 m)
948-929	235-609	200 ft (61 m)

Cable Seal 110-458

For intrinsically safe electrical cable. Provides a sealed passageway for the cable from the Hazardous to the Non-hazardous Locations. See page 6.

Rack Mounting Kit 235-590

For mounting the PPD 200 in a rack. Includes a face-plate for the monitor and instructions on how to install it in the rack.

Printer 235-599

For printed output of display information.
RS485 Interface

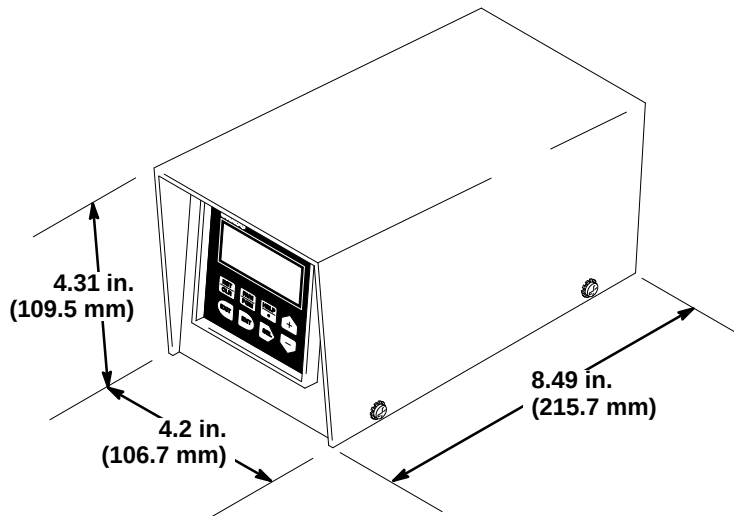
Cable 235-597

For connecting the remote display to the printer.

RS485 to RS232 Converter 235-598

For converting the RS485 interface to the RS232 for an RS232 serial printer or a PLC or PC.

DIMENSIONAL DRAWING



01568

THE GRACO WARRANTY AND DISCLAIMERS

WARRANTY

Graco warrants all equipment manufactured by it and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. As purchaser's sole remedy for breach of this warranty, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment proven defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

This warranty does not cover, and Graco shall not be liable for, any malfunction, damage or wear caused by faulty installation, misapplication, abrasion, corrosion, inadequate or improper maintenance, negligence, accident, tampering, or substitution of non-Graco component parts. Nor shall Graco be liable for malfunction, damage or wear caused by the incompatibility with Graco equipment of structures, accessories, equipment or materials not supplied by Graco, or the improper design, manufacture, installation, operation or maintenance of structures, accessories, equipment or materials not supplied by Graco.

This warranty is conditioned upon the prepaid return of the equipment claimed to be defective to an authorized Graco distributor for verification of the claimed defect. If the claimed defect is verified, Graco will repair or replace free of charge any defective parts. The equipment will be returned to the original purchaser transportation prepaid. If inspection of the equipment does not disclose any defect in material or workmanship, repairs will be made at a reasonable charge, which charges may include the costs of parts, labor and transportation.

DISCLAIMERS AND LIMITATIONS

THE TERMS OF THIS WARRANTY CONSTITUTE PURCHASER'S SOLE AND EXCLUSIVE REMEDY AND ARE IN LIEU OF ANY OTHER WARRANTIES (EXPRESS OR IMPLIED), INCLUDING WARRANTY OF MERCHANTABILITY OR WARRANTY OF FITNESS FOR A PARTICULAR PURPOSE, AND OF ANY NON-CONTRACTUAL LIABILITIES, INCLUDING PRODUCT LIABILITIES, BASED ON NEGLIGENCE OR STRICT LIABILITY. EVERY FORM OF LIABILITY FOR DIRECT, SPECIAL OR CONSEQUENTIAL DAMAGES OR LOSS IS EXPRESSLY EXCLUDED AND DENIED. IN NO CASE SHALL GRACO'S LIABILITY EXCEED THE AMOUNT OF THE PURCHASE PRICE. ANY ACTION FOR BREACH OF WARRANTY MUST BE BROUGHT WITHIN TWO (2) YEARS OF THE DATE OF SALE.

EQUIPMENT NOT COVERED BY GRACO WARRANTY

GRACO MAKES NO WARRANTY, AND DISCLAIMS ALL IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, WITH RESPECT TO ACCESSORIES, EQUIPMENT, MATERIALS, OR COMPONENTS SOLD BUT NOT MANUFACTURED BY GRACO. These items sold, but not manufactured by Graco (such as electric motor, switches, hose, etc.) are subject to the warranty, if any, of their manufacturer. Graco will provide purchaser with reasonable assistance in making any claim for breach of these warranties.

Factory Branches: Atlanta, Chicago, Dallas, Detroit, Los Angeles, Mt. Arlington (N.J.)
Subsidiary and Affiliate Companies: Canada; England; Switzerland; France; Germany; Hong Kong; Japan; Korea

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