INSTRUCTIONS-PARTS LIST

310531

This manual contains important warnings and information.
READ AND KEEP FOR REFERENCE.

INSTRUCTIONS

GRACO

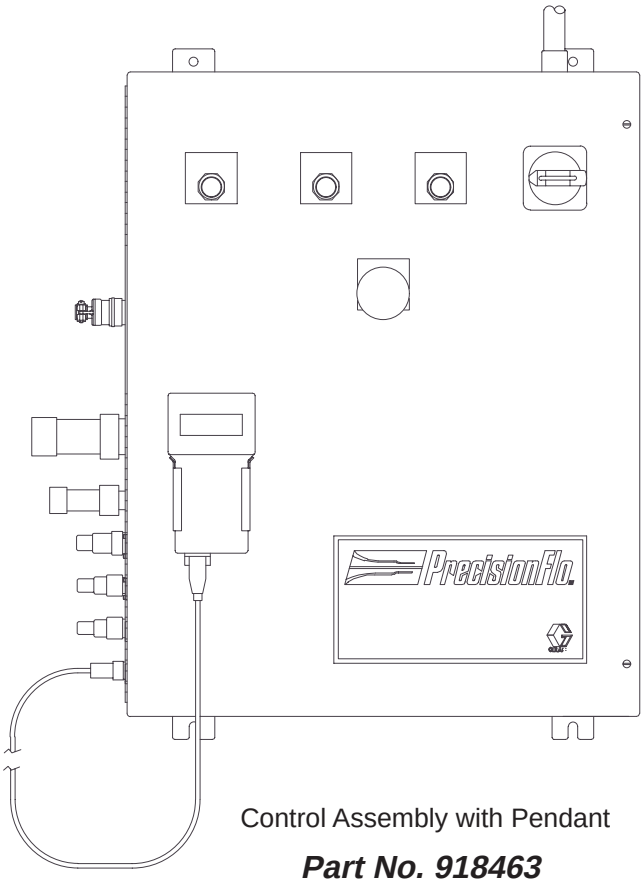
First choice when quality counts.™

Rev. C
Supersedes B

PrecisionFlo™ Control Assembly

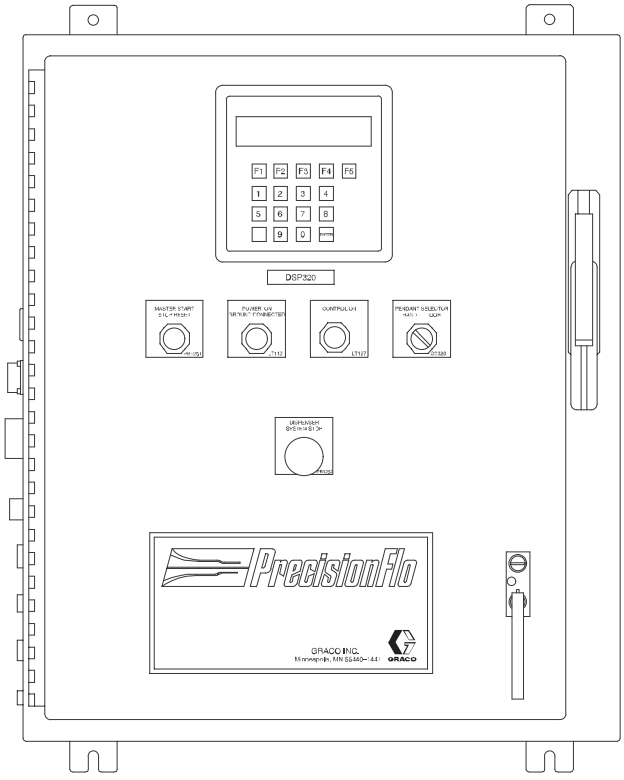
For use when dispensing fluids that meet at least one of the following conditions for non-flammability:

- The fluid has a flash point above 140°F (60°C) and a maximum organic solvent concentration of 20%, by weight, per ASTM Standard D93.
- The fluid does not sustain burning when tested per ASTM Standard D4206 Sustained Burn Test.



Control Assembly with Pendant

Part No. 918463



8646A

Control Assembly with Keypad

Part No. 918644

GRACO INC. P.O. BOX 1441 MINNEAPOLIS, MN 55440–1441
http://www.graco.com

Graco Inc. is registered to I.S. EN ISO 9001

Table of Contents

Warnings

Warning Symbol

⚠ WARNING

This symbol alerts you to the possibility of serious injury or death if you do not follow the instructions.

Caution Symbol

⚠ CAUTION

This symbol alerts you to the possibility of damage to or destruction of equipment if you do not follow the instructions.

⚠ WARNING

INJECTION HAZARD

Spray from the dispensing device, hose leaks, or ruptured components can inject fluid into your body and cause extremely serious injury, including the need for amputation. Fluid splashed in the eyes or on the skin can also cause serious injury.

- Fluid injected into the skin might look like just a cut, but it is a serious injury. **Get immediate medical attention.**
- Do not point the dispensing device at anyone or at any part of the body.
- Do not put hand or fingers over the front of the dispensing device.
- Do not stop or deflect fluid leaks with your hand, body, glove, or rag.
- Follow the **Pressure Relief Procedure** on page 42 whenever you are instructed to: relieve pressure; stop dispensing; clean, check, or service the equipment; or install or clean a spray tip or nozzle.
- Tighten all the fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.
- Always wear eye protection and protective clothing when installing, operating, or servicing this dispensing equipment.

TOXIC FLUID HAZARD

Hazardous fluids or toxic fumes can cause serious injury or death if splashed in the eyes or on the skin, swallowed, or inhaled.

- Know the specific hazards of the fluid you are using. Read the fluid manufacturer’s warnings. Follow the fluid manufacturer’s recommendations.
- Provide fresh air ventilation to avoid the buildup of vapors from the fluid being dispensed.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Wear the appropriate protective clothing, gloves, eyewear, and respirator.

⚠ WARNING

INSTRUCTIONS

EQUIPMENT MISUSE HAZARD

Equipment misuse can cause the equipment to rupture, malfunction, or start unexpectedly and result in serious injury.

- This equipment is for professional use only.
- Read all instruction manuals, warnings, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are uncertain about usage, call your Graco distributor.
- Only use the PrecisionFlo metering valve with the PrecisionFlo Control Assembly.
- Only use a dispensing device appropriate for the fluid and application method, and capable of operating at the highest possible fluid supply pressure the module may experience.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check the equipment daily. Repair or replace worn or damaged parts immediately.
- Do not disassemble the PrecisionFlo metering valve motor. The motor contains powerful magnets, which could attract metal objects and create a hazardous condition if the motor end plates are removed. Contact your Graco representative for motor service.
- Do not exceed the maximum working pressure of the lowest rated system component. The maximum working pressure of the PrecisionFlo metering valve is shown on the fluid head. **Other components may have lower working pressure ratings.**
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 180°F (82°C) or below –40°F (–40°C).
- Do not use the hoses to pull the equipment.
- Use only fluids that are compatible with the equipment wetted parts. See the **Technical Data** sections of all the equipment manuals. Read the fluid manufacturer's warnings.
- Comply with all applicable local, state and national fire, electrical and other safety regulations.
- Do not touch the metal heat sink on the metering valve when the surface is hot.
- Do not cover the PrecisionFlo metering valve; the motor needs air ventilation for cooling.
- Do not attempt to modify the programming of the module. Any modification of the programming could result in serious injury or damage to the module.

MOVING PARTS HAZARD

Moving parts, such as the fluid needle, can pinch fingers.

- Do not operate the equipment with the guard removed.
- Keep clear of any moving parts when starting or operating the equipment.

⚠ WARNING

FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

Improper grounding, poor air ventilation, open flames, or sparks can cause a hazardous condition and result in fire or explosion and serious injury.

- Ground the equipment and the object being sprayed. The PrecisionFlo metering valve is grounded through proper connection of the two electrical cables. See **Ground the Control Assembly** on page 13.
- If there is any static sparking or you feel an electric shock while using the equipment, **stop dispensing immediately**. Do not use the equipment until you have identified and corrected the problem.
- Make sure all electrical work is performed by a qualified electrician only.
- Have any checks, installation, or service to electrical equipment performed by a qualified electrician only.
- Make sure all electrical equipment is installed and operated in compliance with applicable codes.
- Do not install the PrecisionFlo module in a hazardous area, as defined in Article 500 of the National Electrical Code (USA).
- Make sure power is disconnected when servicing and repairing equipment.
- Keep the dispensing area free of debris, including solvent, rags, and gasoline.
- Before operating the equipment, extinguish all open flames or pilot lights in the dispense area.
- Do not smoke in the dispensing area.
- Disconnect the two electrical cables from the PrecisionFlo metering valve before servicing the valve.
- Keep liquids away from the electrical components
- Turn off power to the PrecisionFlo module before disconnecting **any** cables connected to the control assembly or fluid metering assembly.
- Disconnect electrical power at the main switch before servicing the equipment.

PrecisionFlo Module Overview

What This Manual Includes

This manual provides detailed information on the PrecisionFlo control assembly and operation of the PrecisionFlo module only. Specific information on metering valves or material conditioning systems, for example, is contained in other instruction forms supplied with each component, as part of the PrecisionFlo system.

PrecisionFlo Module Description

The PrecisionFlo module is a precision fluid dispensing mechanism designed to apply a variety of industrial sealants and adhesives as part of a robot-equipped production line or workcell. It is especially well-suited to applications requiring fast response times, and precise flow control.

The PrecisionFlo module is comprised of (Fig. 1):

- PrecisionFlo control assembly (1)
- pendant (2)
- fluid metering assembly (3)
- cables and hoses

PrecisionFlo options include:

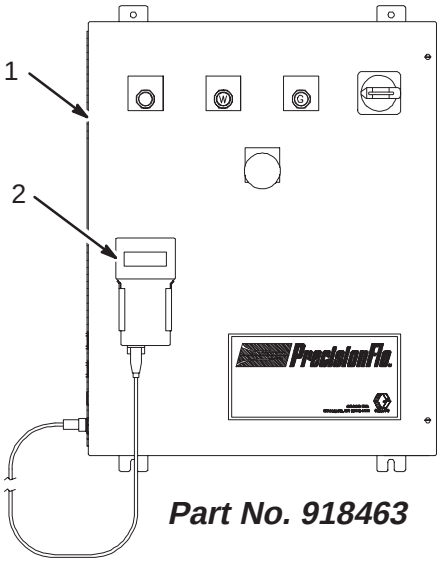
- inlet and dispense device pressure sensors to monitor inlet and dispense device pressures, and also to report faults
- air spray package to provide shaping air to the fluid spray.
- a variety of dispense devices to handle specific fluid characteristics and application requirements

PrecisionFlo Control Assembly

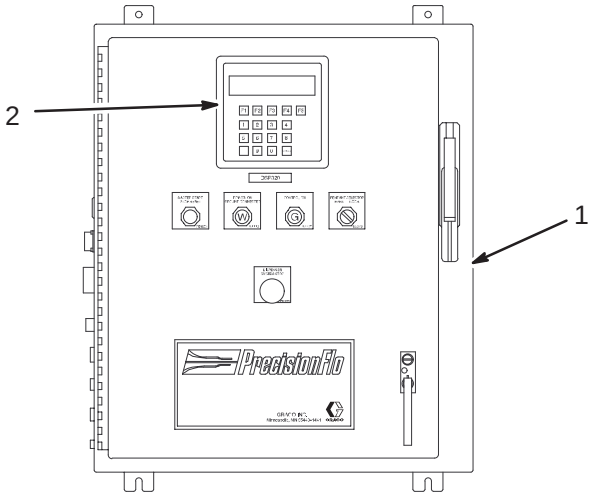
The PrecisionFlo control assembly includes the enclosure containing controlling, sensing, and power electronics for the metering valve, and an operator control pendant which is used for the operator to easily monitor, configure, and test the module.

The PrecisionFlo control assembly (1) houses a microprocessor, which gives electronic commands to the PrecisionFlo metering valve and collects Statistical Process Control information about your application.

You program the PrecisionFlo module using the control assembly's pendant (2). Additional buttons on the control assembly start and stop the PrecisionFlo module.



Part No. 918463



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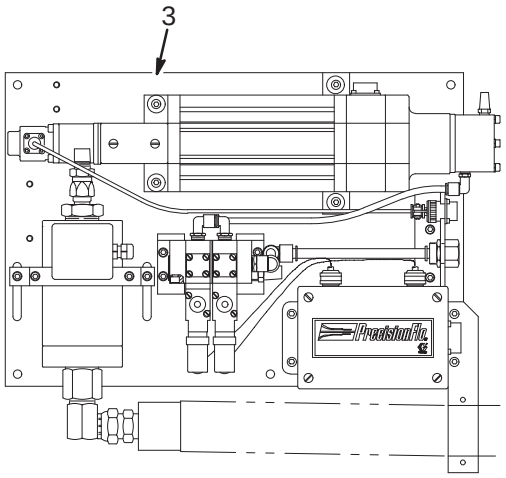


Fig. 1

PrecisionFlo Module Overview

Fluid Metering Assembly

The fluid metering assembly (Fig. 2) can be attached to a robot's arm, or mounted on a pedestal. Main components of the fluid metering assembly are:

- PrecisionFlo metering valve (A)
- flow meter to precisely measure the amount of fluid dispensed (B)
- solenoid air valve that controls a dispense device (C)
- metering valve closer (D)
- solenoid air valve (E) that controls the metering valve's closer

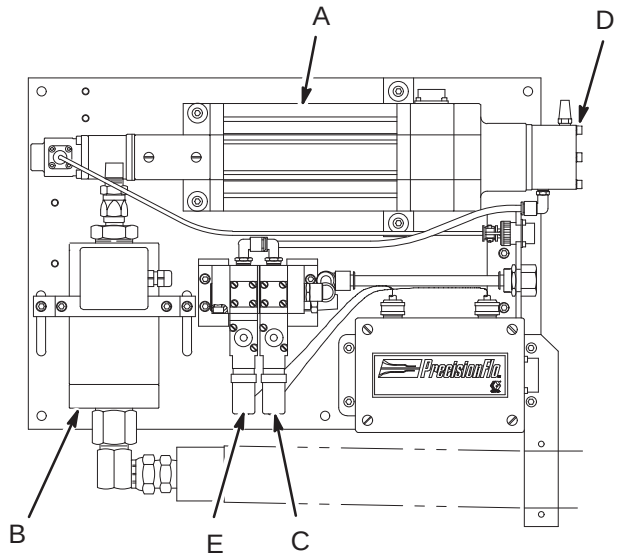


Fig. 2 8781A

The PrecisionFlo Metering Valve

The PrecisionFlo metering valve (A) is the core of the PrecisionFlo module. The PrecisionFlo metering valve is a precision fluid pressure regulator that uses a linear servo motor to achieve fast response to electronic commands while providing a precisely controlled, continuous flow of material.

PrecisionFlo Module Capabilities

The PrecisionFlo module combines continuous pressure control with the ability to change bead profiles almost instantaneously. The PrecisionFlo module automatically adjusts for fluctuations in the operating environment, such as sealant viscosity, temperature, and robot speed, while maintaining the desired dispense rate.

The PrecisionFlo metering valve is electrically controlled by the PrecisionFlo module, and consistent material flow is assured by a closed-loop pressure control design. The module responds to robot-supplied signals to provide an accurate and consistent output flow based on a comparison of actual with desired flow rates. Fluid temperature conditioning is also available as an option.

Typical Fluid Applications

- PVC Sealer
- Plastisols
- Low Viscosity Mastics
- Adhesives
- Silicone Materials

PrecisionFlo Features

- **Sophisticated Electrical Design:** Provides extremely fast and accurate response times.
- **Simple User Interface:** A control pendant provides easy, menu-driven control to the operator.
- **Designed for Robotic Applications:** Microprocessor-based control electronics communicate faults, warnings, status, and operating data quickly and easily to external robotic systems via digital interfaces.
- **Module Monitors Motor Temperatures:** The PrecisionFlo module monitors metering valve motor temperature for enhanced diagnostics and motor protection.
- **User Obtainable SPC Data:** The PrecisionFlo module supplies SPC data to the operator via the control pendant, or to an external system on command.
- **Carbide Needle and Seat:** Filled and abrasive materials can be dispensed.
- **Solenoid Closer:** Provides positive closing of the dispense valve.
- **Real Time Volume Compensation provides:**
  - ±10% continuous volume compensation (not on the total batch job).
  - Capability to handle body style and batch size changes quickly.
  - Ability to handle shear-thinning materials.
  - Ability to deliver steady flow rate during viscosity changes.

PrecisionFlo Module Overview

PrecisionFlo Options

- **Flow Monitor:** Allows precise control of material volumes and accumulation of accurate SPC data.
- **Material Conditioning:** Allows precise regulation of material temperature.
- **Dispensing Accessories:** A variety of hoses, cables, dispense devices, manifolds, and other components are available to meet the requirements of customer applications and material types.
- **Inlet and Dispense Device Pressure Sensors:** Monitor inlet and device pressures. Report inlet and device faults.

Instruction Manual Conventions

Reference numbers (10) and letters (A) in parentheses in this manual's text refer to the numbers and letters in the illustrations.

Lines that appear like the one below tell you to go from the HOME menu to the SETUP menu to the Outlet Pressure Limit screen.

HOME ⇨ SETUP ⇨ Outlet Pressure Limit

Specific keys on the control pendant look like this:

[ENTER] [BACK] [HOME]

Screens into which you enter data look like this:

```
--MODIFY PD/VOL COMP--
Kp xxxx Kd xxxx
Vol Comp= xxx  xx cts
Press F1 To Toggle
```

Abb.:	Stands For:
msec	milliseconds
SPC	Statistical Process Control
PVC	Poly Vinyl Chloride
psi	pounds per square inch
gnd	ground
com	common
V	volts
Vac	volts ac
Vdc	volts dc

PrecisionFlo Definitions

Control Assembly	The pendant (2) and the enclosure (1) containing the electronics used to control the metering valve. See Fig. 3.

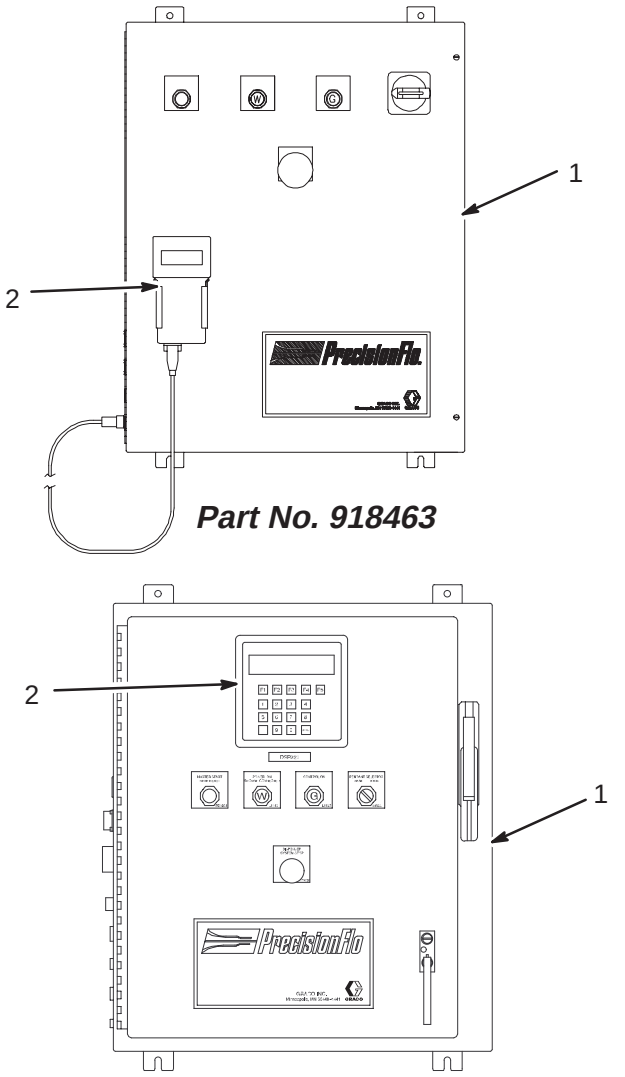


Fig. 3

PrecisionFlo Module	The control assembly, metering valve, flow meter, and all cables and sensors used to measure and control the performance of the metering valve. See Fig. 1.
Controller	An external electronic (robotic) system having some control interaction via electronic signals with the PrecisionFlo module.
Pendant	The data entry and display pendant (2) that is wired to the enclosure. The pendant contains the control electronics, by which the operator monitors and operates the PrecisionFlo module.
Fluid Metering Assembly	The fluid metering assembly contains the fluid metering valve and other components that control and monitor fluid dispensing. See Fig 29.

PrecisionFlo Module Overview

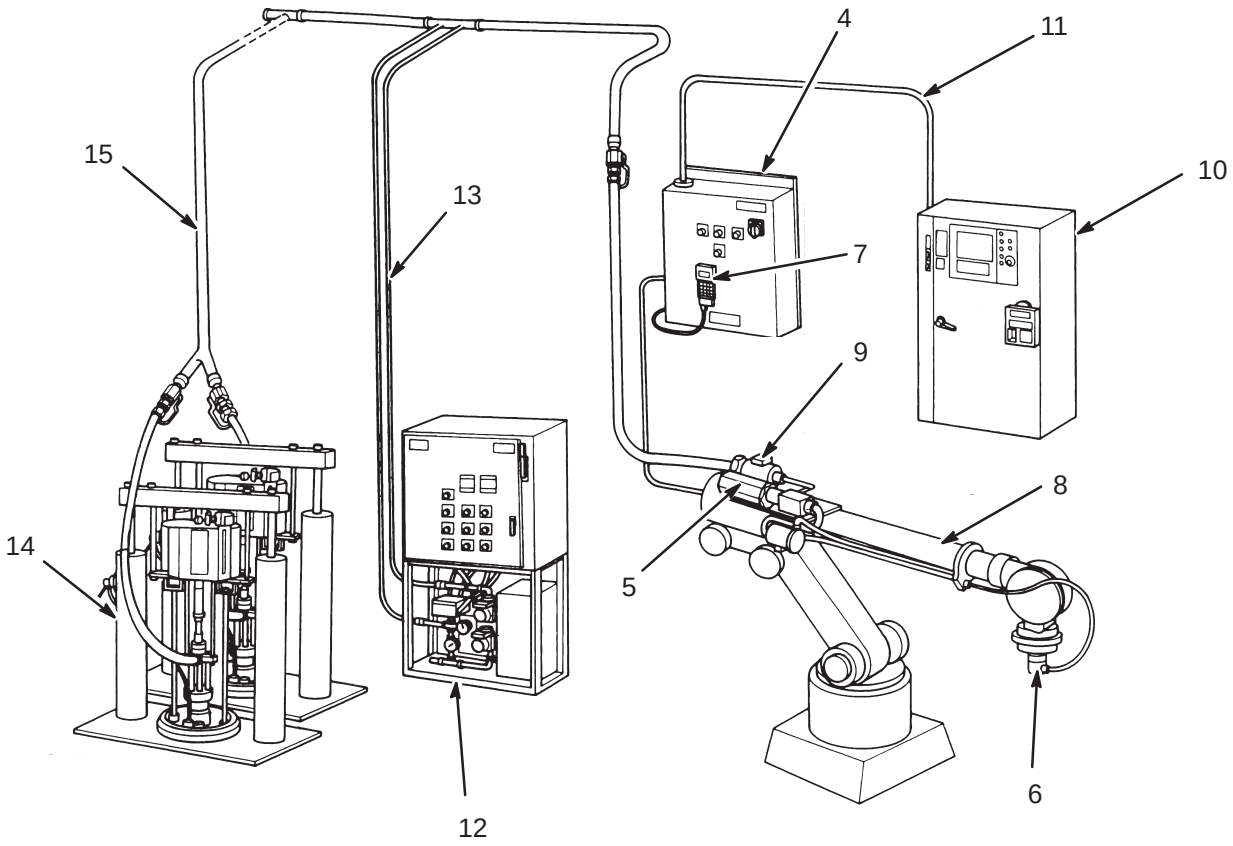


Fig. 4

The following list describes the numbered components in the typical installation drawing.

No.	Description
4	Control Assembly
5	Metering Valve
6	Dispense Gun
7	Control Pendant
8	Sealer Robot
9	Flow Meter
10	Robot Controller
11	Robot Interface Cable
12	Temperature Conditioning System
13	Temperature Conditioning Hoses
14	Fluid Supply System
15	Fluid Supply Header
	Filter Module (not shown)

Installation

There are 3 separate procedures to perform when you install the PrecisionFlo and configure it so the PrecisionFlo module is ready for operation.

Some of the software settings are password protected. To obtain the password, contact your Graco service representative.

Fig. 5 shows the tasks that make up each procedure.

The procedures are:

- installing PrecisionFlo control assembly hardware
- loading material into the material delivery system
- configuring the software for operation

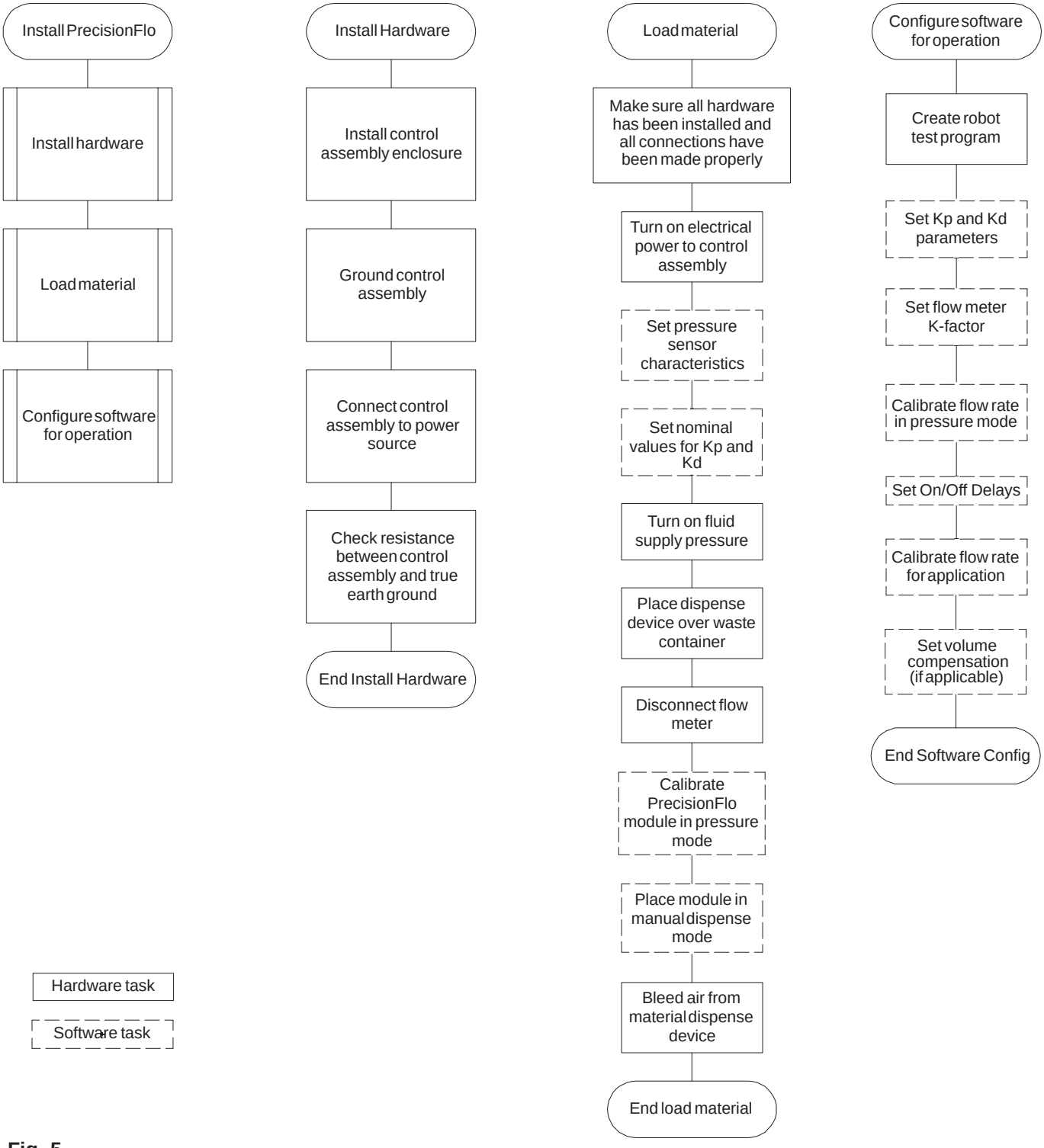


Fig. 5

Installing Control Assembly Hardware

To install the control assembly hardware, you:

- install the PrecisionFlo control assembly
- ground the system
- connect the PrecisionFlo control assembly to a power source
- check resistance between the control assembly and a true earth ground
- connect fluid lines, air lines, and cables
- calibrate the PrecisionFlo system
- initially load material

Installing the Control Assembly Enclosure

⚠ WARNING

ELECTROCUTION HAZARD
Installing and servicing this equipment requires access to parts which could cause an electric shock or other serious injury. Have only qualified electricians access the control assembly enclosure.

Preparing to Install the Enclosure

Before installing the control assembly enclosure:

- See component manuals for specific data on component requirements. Data presented here pertains to the PrecisionFlo control assembly only.
- Have all system and subassembly documentation available during installation.
- Be sure all accessories are adequately sized and pressure-rated to meet the system's requirements.
- Use only the Graco PrecisionFlo control assembly with the PrecisionFlo metering valve.

⚠ WARNING

EQUIPMENT MISUSE HAZARD
The PrecisionFlo control assembly weighs approximately 50 kg (110 lbs), and should never be moved or lifted by one person. Use adequate personnel and support devices when mounting, moving or handling the control assembly to prevent equipment damage or personal injury.

Installing the Enclosure

1. Select a location for the PrecisionFlo control assembly enclosure. Keep the following in mind:

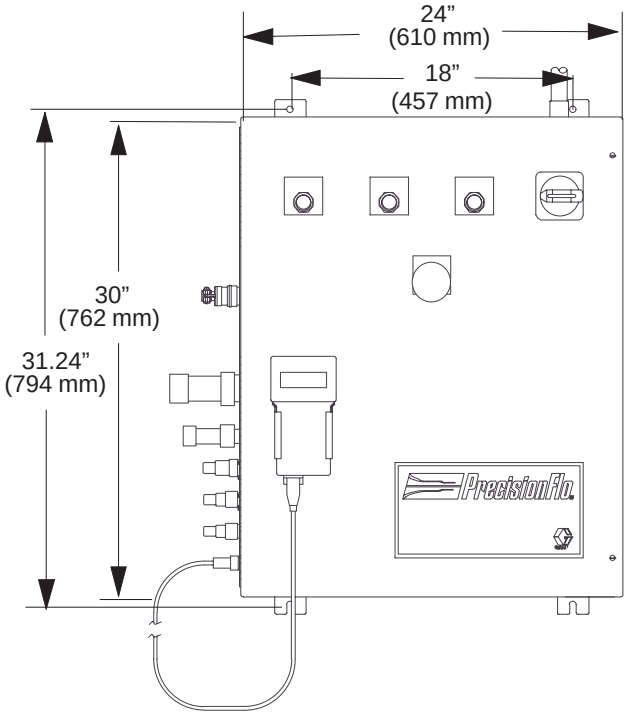
   Allow sufficient space for installing and using the equipment:

   - Make sure all fluid lines, cables and hoses easily reach the components they will be connected to.
   - Make sure there is sufficient clearance around the assembly enclosure for running fluid lines and cables to other components in the cell.
   - For 918463, make sure the hand-held pendant reaches to a distance that provides easy access for working with the robot and/or dispense device.
   - Make sure there is easy and safe access to an appropriate electrical power source. The National Electrical Code requires 3 feet (91.4 cm) of open space in front of the assembly enclosure.
   - Make sure the control assembly is installed between 1 foot (30.5 cm) and 4 feet (121.9 cm) off the floor to provide easy access for operating panel controls and also for servicing the inside of the enclosure.

2. Locate and secure the PrecisionFlo control assembly enclosure with four 3/8¨ bolts through the .44" diameter holes in the mounting flanges.

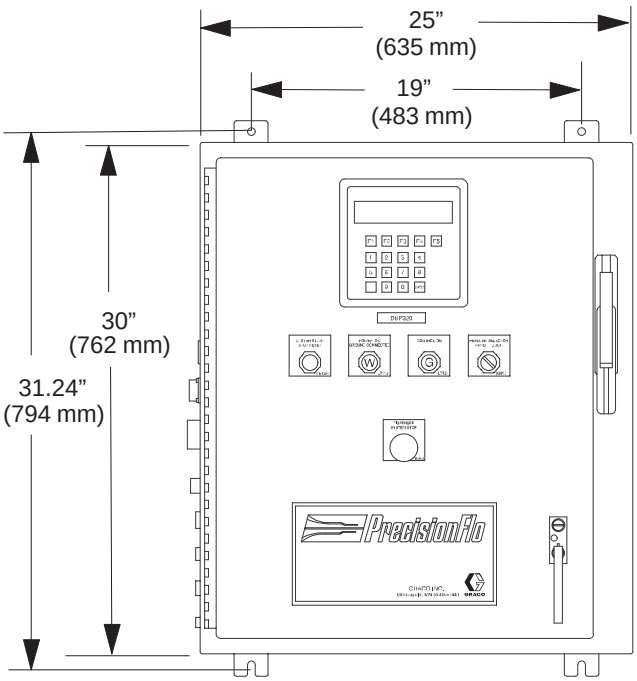
   - For 918463, see the mounting hole spacing shown in Fig. 6.
   - For 918644, see the mounting hole spacing shown in Fig. 7.

Installing Control Assembly Hardware



Part No. 918463

Fig. 6



8646A

Part No. 918644

Fig. 7

Installing Control Assembly Hardware

Grounding Control Assembly 918463

⚠ WARNING

FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

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

- The PrecisionFlo control assembly must be electrically connected to a true earth ground; the ground in the electrical system may not be sufficient.
- All wires used for grounding must be 8 AWG (8.36 mm^2) minimum.
- A qualified electrician must complete all grounding and wiring connections.
- Refer to your local code for the requirements for a “true earth ground” in your area.
- Also read and follow the warnings on pages 3 through 5.

⚠ CAUTION

If power and grounding connections are not done properly, the equipment will be damaged and the warranty will be voided.

Connect a ground wire from the ground point in the PrecisionFlo control assembly enclosure (shown in Figs. 8 and 9) to a true earth ground. The PrecisionFlo metering valve is grounded to the control assembly using cables provided with the metering valve.

An 8 AWG, 25 foot long ground wire with clamp, part no. 222011, is available from Graco.

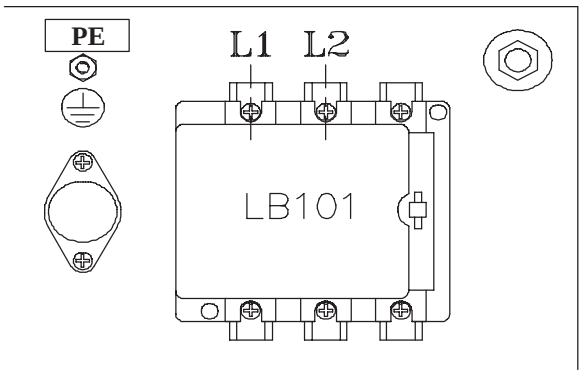


Fig. 8

⚠ CAUTION

To help avoid damage to equipment, make sure that the robot and PrecisionFlo equipment are grounded to the same point.

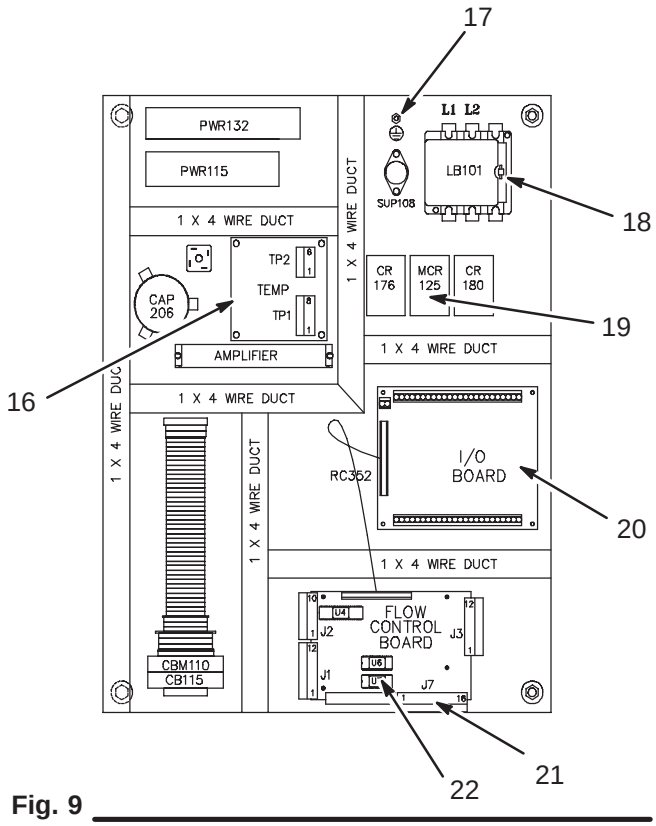


Fig. 9

Ref. No.	Description
16	Current / Temperature Board
17	Grounding Stud
18	Main Electrical Switch
19	Master Control Relay
20	I/O Board1
—	Service Control Board Assy
21	. Flow Control Board
22	. Programmed EPROM Set

See Fig. 35 and Fig. 36 for **Parts** information.

Installing Control Assembly Hardware

Grounding Control Assembly 918644

⚠ WARNING

FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

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

- The PrecisionFlo control assembly must be electrically connected to a true earth ground; the ground in the electrical system may not be sufficient.
- All wires used for grounding must be 8 AWG (8.36 mm^2) minimum.
- A qualified electrician must complete all grounding and wiring connections.
- Refer to your local code for the requirements for a “true earth ground” in your area.
- Also read and follow the warnings on pages 3 through 5.

⚠ CAUTION

If power and grounding connections are not done properly, the equipment will be damaged and the warranty will be voided.

Connect a ground wire from the ground point in the PrecisionFlo control assembly enclosure (shown in Fig. 10) to a true earth ground. The PrecisionFlo metering valve is grounded to the control assembly using cables provided with the metering valve.

An 8 AWG, 25 foot long ground wire with clamp, part no. 222011, is available from Graco.

⚠ CAUTION

To help avoid damage to equipment, make sure that the robot and PrecisionFlo equipment are grounded to the same point.

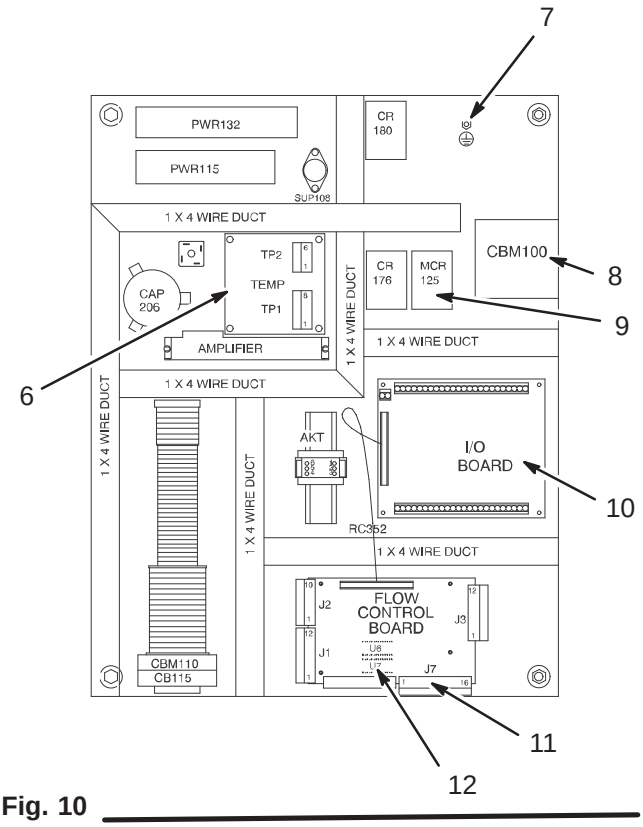


Fig. 10

Ref. No.	Description
6	Current / Temperature Board
7	Grounding Stud
8	Main Electrical Switch
9	Master Control Relay
10	I/O Board1
—	Service Control Board Assy
11	. Flow Control Board
12	. Programmed EPROM Set

See Fig. 35 and Fig. 36 for **Parts** information.

Installing Control Assembly Hardware

Verifying Ground Continuity

Verify ground continuity between:
- true earth ground and the panel ground lug
- the application device and the robot
- the metering valve and the robot

Connect PrecisionFlo Control Assembly to Power Source

You must connect the PrecisionFlo control assembly to a power source.

⚠ WARNING

ELECTRIC SHOCK HAZARD
Do not connect the PrecisionFlo control assembly to a power source unless you are a trained electrician. Failure to follow standard procedures or to observe the necessary precautions could result in serious bodily injury or equipment damage.

⚠ CAUTION

If power and grounding connections are not done properly, the equipment will be damaged and the warranty will be voided.

NOTE: Have a qualified electrician connect the PrecisionFlo control assembly to a grounded electrical source that has the required service ratings.

Power Requirements for Control Assembly 918463

PrecisionFlo:	918463	with optional 617474	with optional 617497
Vac:	120	220	100
Hz:	60	50	50
Phase:	1	1	1
Full Load Amps:	13	8	16
Circuit Breaker	20	10	20

Power Requirements for Control Assembly 918644

918644	VAC:	Hz:	Phase:	Full Load Amps
	120	60	1	13.3

To connect the control assembly to the electrical source:

1. Create an opening in the enclosure.
2. For 918463 or 918644, connect electrical power to L1 (hot) and L2 (neutral) at main switch inside the control assembly enclosure. (See Fig. 8).
3. Use NEMA 4 cord grip to seal the area where wires enter the enclosure.

Checking Resistance Between the Control Assembly and the True Earth Ground

⚠ WARNING

FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD
To reduce the risk of fire, explosion, or electric shock, the resistance between the supply unit components and true earth ground must be less than 0.25 ohms.

Have a qualified electrician check the resistance between each supply system component and the true earth ground. The resistance must be less than 0.25 ohms. If the resistance is greater than 0.25 ohms, a different ground site may be required. Do not operate the system until the problem is corrected.

Installing Control Assembly Hardware

Connecting Fluid Lines, Air Lines, and Cables

Follow these steps to assemble the PrecisionFlo module and incorporate it into a complete fluid dispensing system. See Figs. 11 and 12 for details.

NOTE: Except for connecting the hand-held control pendant cable to the control assembly, the fluid line, air line, and cable connections are the same for Models 918463 and 918644.

1. Make sure you have installed the fluid metering assembly (2) on the robot, or in another appropriate place.

2. Connect a fluid line to the 3/8” NPT (f) fluid outlet port located between the PrecisionFlo metering valve outlet (not shown) and the dispense device (not shown). Refer to the metering valve and device instruction manuals for detailed information.

3. Connect the fluid line to the 3/4” NPSM (f) fluid supply inlet port on the flow meter (3).

4. Install a fluid filter.

5. Connect the following cables from the PrecisionFlo metering valve (2) to the mating receptacles on the control assembly (1).

   a. Operations cable to the OP receptacle (6). Then, connect the operations cable to the PrecisionFlo junction box connector (4).

   b. Robot I/O cable to the I/O receptacle (7).

   c. Robot analog cable to the RAR receptacle (8).

   d. Motor cable to the MP receptacle (9).

   e. Pressure sensor cable to the MS receptacle (10).

   f. Flow meter cable to the FM receptacle (11).

   g. Control pendant cable, if applicable, to the TP receptacle (12).

6. Connect an air supply line to the 3/8” NPT inlet port on the module air supply inlet.

7. Connect 1/4” air lines (not shown) from the device solenoid valve (5) to the dispense device.

8. If the shaping air option is included in the module, connect the shaping air line from the servo pressure regulator to the dispense device.

Installing Control Assembly Hardware

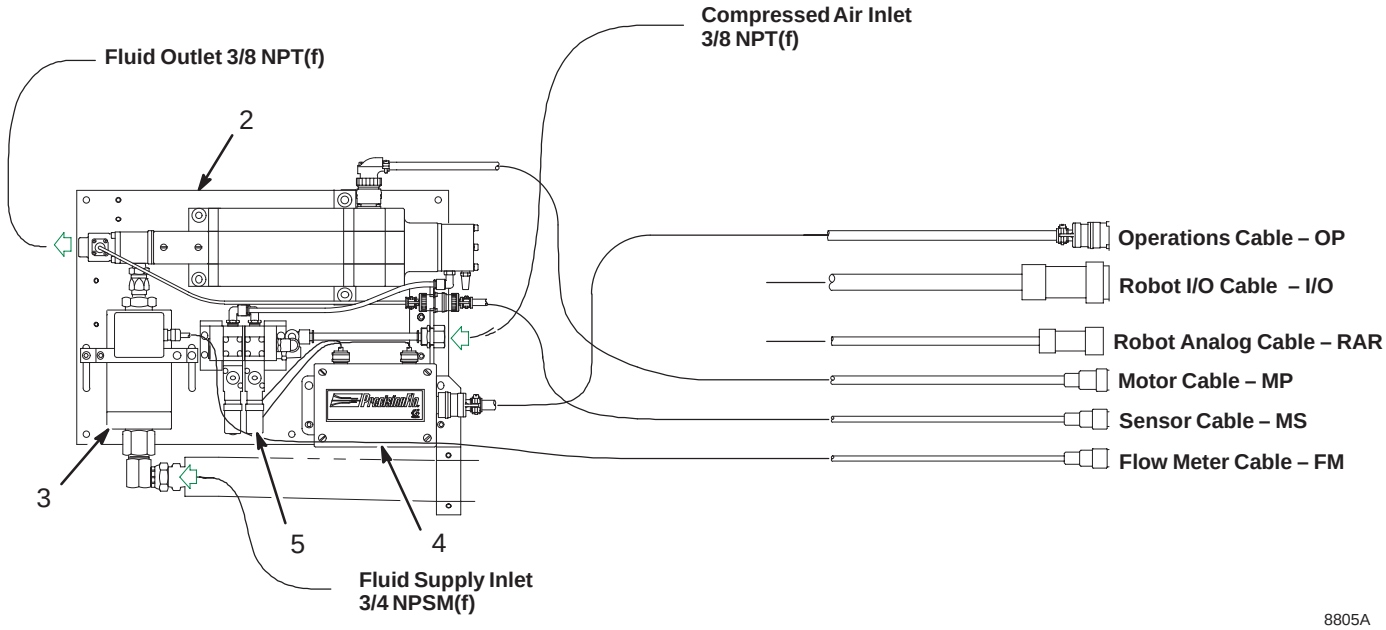


Fig. 11

Ref No.	Description
1	PrecisionFlo Control Assembly See Figs. 41 and 42 for **Parts** information.
2	PrecisionFlo Metering Valve See 308601 for parts.
3	Flow Meter
4	PrecisionFlo Junction Box Connector
5	Device Solenoid Valve

Ref No.	Cable Receptacle	Label
6	Operations Cable	OP
7	Robot I/O Cable	I/O
8	Robot Analog Cable	RAR
9	Motor Power Cable	MP
10	Pressure Sensor Cable	MS
11	Flow Meter Cable	FM
12	Pendant Cable (for hand-held pendant)	TP

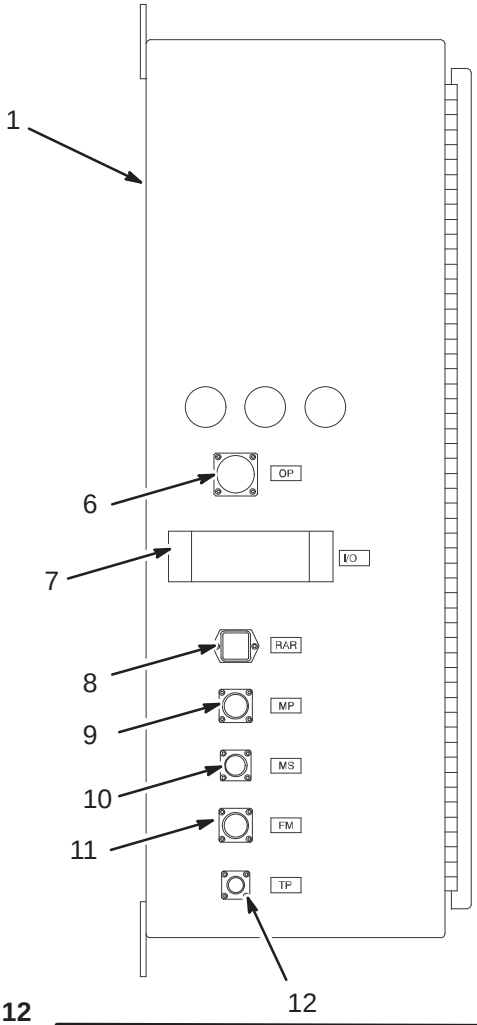


Fig. 12

Loading Material into PrecisionFlo Module

The PrecisionFlo module compensates for temperature, flow, or pressure fluctuations, but if you change hardware on the dispensing system or change types of material, reconfigure the PrecisionFlo module's software. Before you can configure the software for your application, you must load material into the supply system.

NOTE: Some of the software settings are password protected. To obtain the password, contact your Graco service representative.

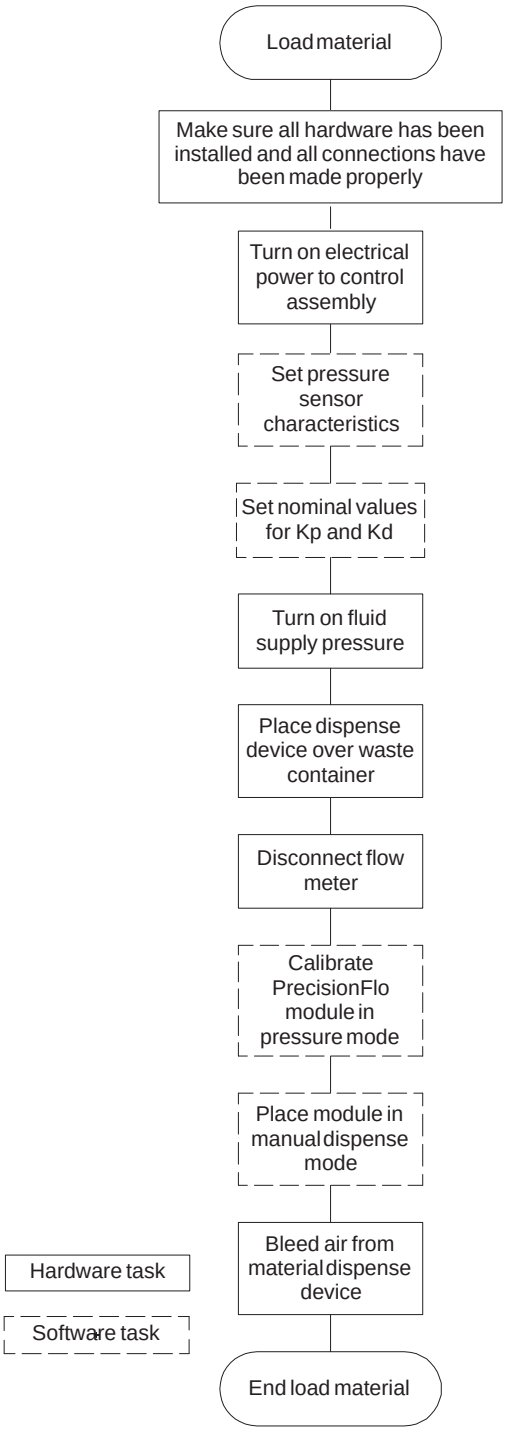


Fig. 13

Material Loading Procedure

⚠ WARNING

COMPONENT RUPTURE HAZARD

Never exceed the maximum air or fluid working pressure rating of the lowest rated component in the system. Overpressurization can cause component rupture and serious bodily injury.

To help reduce the risk of injury or equipment damage, do not pressurize the system until you have verified the system is ready and it is safe to do so.

To reduce risk of injury or damage to equipment, make sure all material hose connections are secure.

NOTE: Read this procedure before powering up the module.

1. Make sure you have installed and made all the proper connections to and from the PrecisionFlo control assembly enclosure.
2. Turn ON electrical power to the control assembly.
3. Set pressure sensor characteristics:
   h. Set scale factor for pressure sensors (page 19).
   i. Set sensor pressure limits using the procedures beginning on page 20.
4. Set nominal values for Kp and Kd. You need to adjust Kp and Kd so the system can begin dispensing material. For more information, see page 21.
5. Turn on fluid supply pressure to the module.
6. Place the dispense device over a waste container.
7. Disconnect the flow meter from the control assembly.
8. Calibrate the PrecisionFlo module in pressure mode at 1500 psi so you can dispense fluid in step 9. See page 21 for more information.
9. Use the pendant to place the module in MANUAL mode and set it for 80% of full output. For more information about manual mode, see page 22.
10. Manually dispense fluid until clean, air-free fluid flows from the dispense device.
11. To configure the software, go to the **Configuring the PrecisionFlo Module** section on page 23.

Loading Material into PrecisionFlo Module

Configuring Pressure Sensors

This section describes how to set maximum and minimum limits for these pressure sensors:

- material outlet
- material inlet (if used)
- material-applicator tip (if used)

The material inlet and applicator tip sensors are optional. If you do not have them, you must still run the procedures for setting the limits, but you will set the limits to 0. See the procedures on page 20.

Before setting the sensor pressure limits, you must set the sensors' scale factor. Setting the scale factor lets the PrecisionFlo module correlate voltage signal with inlet or outlet pressures.

Only set the scale factor once and it applies to the material outlet, material inlet, and material-applicator tip sensors.

Setting the Scale Factor for Pressure Sensors

This procedure sets the operating ranges so that the maximum and minimum limits of the pressure sensors correspond to the maximum and minimum voltages produced by the sensors.

For example: If the sensor has a pressure range of 0 to 1500 psi, and an output range of 1 to 5 volts, the PrecisionFlo control assembly correlates a 1 volt signal with a pressure of 0 psi, and a 5 volt signal with a pressure of 1500 psi (Fig. 14).

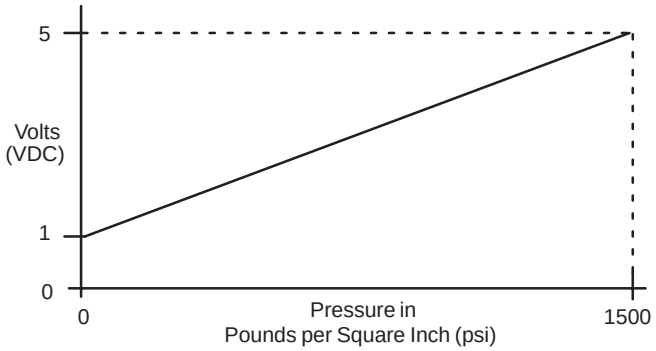


Fig. 14

Before you set the scale factor, determine which type of sensor you have and what settings you have to enter into the software.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Protected Setup

2. Key in the password, then press **[ENTER]**.

3. Then go to:

   PROTECTED SETUP ⇨ Scale Press. Sensor

4. You see:

```
--SCALE PRESS SENSOR--
Enter Max and Min
x.xxxVdc=xxxxpsi Max
x.xxxVdc=xxxxpsi Min
```

See Fig. 15 and Table 1 for sensor type and corresponding voltage and pressure settings.

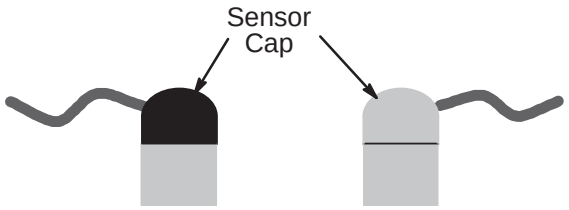


Fig. 15

Table 1 — Scale Pressure Sensor Settings

	Black Sensor Cap	Aluminum Sensor Cap
Max Vdc	5	5
Min Vdc	1	1
Max psi	1500	3500
Min psi	0	0

Continued on the next page.

Loading Material into PrecisionFlo Module

Setting the Scale Factor for Pressure Sensors ***(continued)***

5. Enter the information:

   a. Key in the 4-digit maximum Vdc, (the PrecisionFlo software automatically enters the decimal point) and press **[ENTER]**.

   b. Use the ↑ arrow to move to the maximum pressure field.

   c. Key in the maximum pressure, and press **[ENTER]**.

   d. Use the ↑ arrow to move to the minimum Vdc field.

   e. Key in the 4-digit minimum Vdc, (the PrecisionFlo software automatically enters the decimal point) and press **[ENTER]**.

   f. Use the ↑ arrow to move to the minimum pressure field.

   g. Key in the minimum pressure, and press **[ENTER]**.

6. Press either **[BACK]** to return to the PROTECTED SETUP menu or **[HOME]** to return to the HOME screen.

7. To set sensor pressure limits, go to the next procedure.

Setting Pressure Sensor Limits

Set pressure limits, according to material, hose lengths, and dispense device configurations used. The PrecisionFlo module uses the pressure limits to trigger corresponding low and high pressure warning faults (see page 48).

⚠ CAUTION

Do not set the pressure above maximum psi of your pressure sensor. Attempting to operate the PrecisionFlo module with a pressure above the maximum psi could result in damage to the equipment.

Setting the Outlet Pressure Limit

Enter 3500 for the high pressure limit and 0 for the low pressure limit.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Outlet Pressure Limit

2. Key in the High Pressure Limit, then press **[ENTER]**.

3. Move the cursor to the next line. Key in the Low Pressure Limit and press **[ENTER]**.

4. Press **[BACK]** to return to the SETUP screen.

Setting the Inlet Pressure Limit

If you have an inlet pressure sensor, you must first determine the maximum and minimum pressure limits. If you do not have an inlet pressure sensor, enter 0 for the high and low pressure limits.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Inlet Pressure Limit

2. Key in the High Pressure Limit, then press **[ENTER]**.

3. Move the cursor to the next line. Key in the Low Pressure Limit and press **[ENTER]**.

4. Press **[BACK]** to return to the SETUP screen.

Setting the Tip Pressure Limit

If you have a tip pressure sensor, you must first determine the maximum and minimum pressure limits. If you do not have a tip pressure sensor, enter 0 for the high and low pressure limits.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Tip Pressure Limit

2. Key in the High Pressure Limit, then press **[ENTER]**.

3. Move the cursor to the next line. Key in the Low Pressure Limit and press **[ENTER]**.

4. Press **[BACK]** to return to the SETUP screen.

Loading Material into PrecisionFlo Module

Entering Nominal Values for Kp and Kd

The values you enter for Kp and Kd depend on the viscosity of the material and type of application in which you are using the PrecisionFlo module. Use Table 2 as a guide for nominal Kp and Kd settings.

⚠ CAUTION

Kp and Kd are control loop parameters which, if changed incorrectly, could result in damage to the module. These parameters should be changed by qualified personnel only.

For more information about setting Kp and and Kd, see pages 24 – 33.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Protected Setup

2. Key in the password, then press **[ENTER]**.

3. Then go to:

   PROTECTED SETUP ⇨ Modify PD/Vol Comp

4. You see:

   ```
   --MODIFY PD/VOL COMP--
   Kp xxxx Kd xxxx
   Vol Comp= xxx  xx cts
   Press F1 To Toggle
   ```

Table 2 — Nominal Settings* for Start-Up Calibration

Viscosity Range (in cps)	Typical Application	Kp	Kd
40,000 – 80,000	Paint-shop sealer	600	5000
80,000 – 150,000	Hemflange structural adhesive	1000	4000
150,000 +	Body-shop sealer		

*Settings that are appropriate for your configuration may be different depending on the characteristics of your material and dispensing system.

5. Key in the Kp parameter, then press **[ENTER]**. Move the cursor to the Kd field. Key in Kd and press **[ENTER]**.

6. Press either **[BACK]** to return to the SETUP menu or **[HOME]** to return to the HOME screen.

Calibrating PrecisionFlo Module in Pressure Mode

For more information about flow calibration, or for instructions on how to calibrate a system with a connected flow meter, see pages 34 – 36.

To calibrate the material flow:

1. Make sure the CONTROL ON indicator is lit on the control assembly. If not, press MASTER START/ STOP RESET on the control assembly, (24) in Fig. 30.

2. Disconnect the flow meter from the control assembly.

3. On the control pendant:

   HOME ⇨ SETUP ⇨ FLOW CALIBRATION

   You see:

   ```
   --FLOW CALIBRATION--
   Enter Maximum Operating
   Flow Rate
   00cc/min
   ```

4. At the prompt, key in 0, then press **[ENTER].** You see:

   ```
   --WARNING!!!--
   Material Will Be
   Dispensed, Press
   F2 To Continue.
   ```

5. Place the dispensing device over a waste container, then press **[F2]**.

   You see:

   ```
   --FLOW CALIBRATION--
   Working, Please Wait
   Outlet=   00 psi
   ```

   When the PrecisionFlo module determines there is no flow meter connected, you see:

   ```
   --No Flowmeter!!!!--
   Max Outlet
   Operating Pressure=
         0000 psi
   ```

6. Key in 1500 for the material outlet, then press **[ENTER]**.

7. Press either **[BACK]** to return to the SETUP menu or **[HOME]** to return to the HOME screen.

Loading Material into PrecisionFlo Module

Dispensing in Manual Mode

For more information about manual dispense mode, see page 46.

1. On the control pendant:

   HOME ⇨ Manual

2. You see:

   ```
   --MANUAL DISPENSE--
   Desired Flow  = xx%
   Press F2 to Dispense
   ```

3. Key in 80 (the software automatically adds the percent), then press **[ENTER]**.

⚠ WARNING

The system is now ready to dispense. Make sure dispensing will not endanger people or equipment before proceeding.

4. Press **[F2]** on the pendant to begin dispensing.

   Dispensing continues as long as you continue to press **[F2]** and stops when you release the **[F2]** key.

5. Press **[HOME]** to exit Manual dispense mode and return to the HOME screen.

Configuring the PrecisionFlo Module

After you have loaded material into the dispensing system, configure the software for PrecisionFlo module operation. To configure the PrecisionFlo software, perform the following procedures.

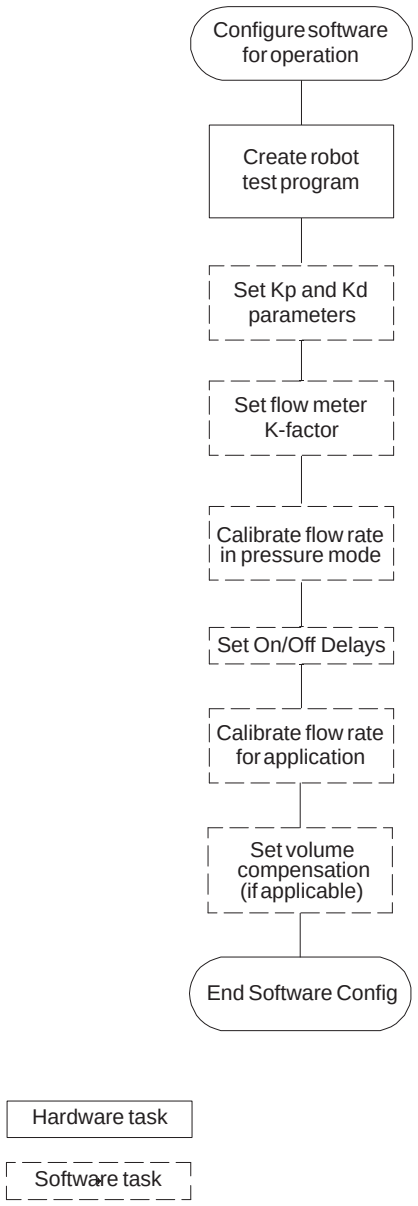


Fig. 16

NOTE: You have the option of using a dual channel storage oscilloscope to run tests for determining:

- Kp and Kd parameters
- On and Off delays

1. Create a robot test program to dispense material on a flat surface in a straight line for 36 inches. The robot must provide the PrecisionFlo module with:

Command Voltage	**Portion of Path**
4 volts	first 12 inches
8 volts	second 12 inches
4 volts	third 12 inches

2. Set the Kp and Kd parameters using the procedures beginning on page 24.

3. Calibrate the flow rate in pressure mode. See step 3 on page 25 for more information.

4. Set the flow meter's K-Factor. See page 34.

5. Set on and off delays for the dispense device and the metering valve regulator. See page 37.

6. Calibrate the flow rate for the application. See page 34 for more information.

The module is ready for operation.

Configuring the PrecisionFlo Module

You will be entering Kp and Kd values more than once while you are starting up the PrecisionFlo module. The first time you enter values is to simply load material into the dispense system. (See page 21 for more information). After you have successfully loaded material into the dispense system you will enter Kp and Kd values to ensure PrecisionFlo module accuracy and repeatability.

Adjusting Kp and Kd to Ensure Accuracy and Repeatability of Metering Valve Operation

The accuracy and repeatability of the PrecisonFlo module depend on precise adjustment of the operating parameters Kp and Kd. The module uses these parameters to control metering valve operation and must be adjusted to compensate for such module characteristics as hose lengths and diameters, dispense device tip sizes, supply pressures and flow rates, and material viscosity.

- **Kp**, the proportional term, dictates how close the pressure control loop will get to the set point.
- **Kd**, the derivative term, sets the amount of damping used to prevent oscillation and instability in module output.

For example, if the module receives a command to output a pressure of 1000 psi, higher values of Kp will result in output pressures closer to 1000 psi. Low values of Kd will “soften” or slow module responses to changes in the command input voltage, while higher values of Kd will “tighten” or speed up module responses. If either Kp or Kd is set too high, the module may become unstable and oscillate, which will show up as a ripple or wave pattern in the material bead.

Preparing to Adjust Kp and Kd

To adjust the Kp and Kd parameters, you need:

- robot program you created, see page 23
- dual channel storage oscilloscope (optional)

  If you do not have an oscilloscope, adjust Kp and Kd by dispensing material onto a surface.

Fig. 17 shows the major steps to follow to adjust Kp and Kd values.

Make sure that:

1. Material has been loaded into the dispense system.
2. You have disconnected the electrical cable to the flow meter, if the PrecisionFlo module is using a flow meter.

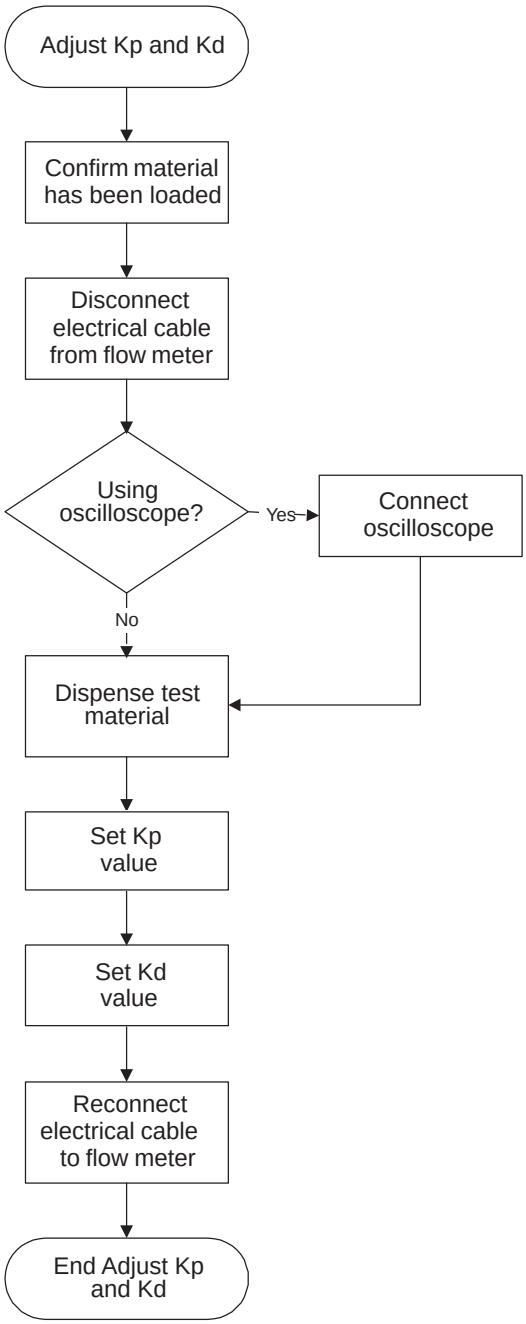


Fig. 17

Configuring the PrecisionFlo Module

Setting Up to Dispense Test Material

To set up for dispensing test material, perform the following tasks:

1. Supply material pressure to the PrecisionFlo module. Adequate pressure should be available to sustain the maximum flow rate plus 400 psi.

2. Change the Kp and Kd values on the control pendant. See the procedure for **Using the Control Pendant to Modify Kp and Kd** on page 33.

   Use the values described in Table 3 as starting points for entering values for both Kp and Kd. Note, however, that settings that are appropriate for your configuration may be different from those in the table, depending on the characteristics of your material and dispensing system.

Table 3 — Initial Settings for Fine Tuning Kp and Kd Values

Viscosity Range (in cps)	Typical Application	Kp	Kd
40,000 – 80,000	Paint-shop sealer	100	1000
80,000 – 150,000	Hemflange structural adhesive	700	3000
150,000 +	Body-shop sealer		

3. Calibrate the material flow in pressure mode.
   a. On the control pendant:

   HOME ⇨ SETUP ⇨ FLOW CALIBRATION

   You see:

   ```
   --FLOW CALIBRATION--
   Enter Maximum Operating
   Flow Rate
   00cc/min
   ```

   b. Make sure the flow meter has been disconnected.

   c. At the prompt, key in 0, then press **[ENTER].** You see:

   ```
   --WARNING!!!--
   Material Will Be
   Dispensed, Press
   F2 To Continue.
   ```

   d. Place the dispensing device over a waste container, then press **[F2]**.

   You see:

   ```
   --FLOW CALIBRATION--
   Working, Please Wait
   Outlet=   00 psi
   ```

   When the PrecisionFlo module determines there is no flow meter connected, you see:

   ```
   --No Flowmeter!!!!--
   Max Outlet
   Operating Pressure=
         1500 psi ◄──────── 23
   ```

   (23) is the maximum operating pressure entered the last time calibration was performed without the flow meter.

   e. Determine the new operating pressure:

Typical Application	psi
Paint-Shop sealer	1000
Hemflange structural adhesive	2000

   f. Key in the new operating pressure and press **[ENTER]**.

   For more information, see the **Setting Flow Calibration Procedure** on page 35.

4. If you are using an oscilloscope, go to the procedure for **Determining Kp and Kd Using an Oscilloscope** page . If you are not using an oscilloscope, go to the next procedure, **Determining Kp and Kd Visually**.

Configuring the PrecisionFlo Module

Evaluating Beads

In order to set Kp and Kd, dispense material and check it to see if the bead or outlet pressure is even and stable (Fig. 18). A properly adjusted bead has equal segments and a smooth appearance. An even bead may be stable (Fig. 18) or unstable (Fig. 20).

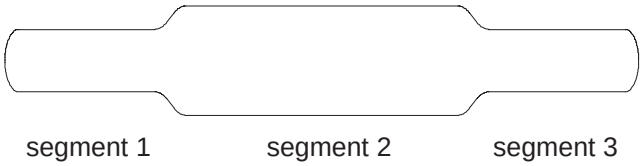


Fig. 18

Example Properly Adjusted Bead

Kp affects the evenness of the bead, Kd affects the stability of the bead. You must first adjust Kp and then adjust Kd. Fig. 19 shows uneven beads where Kp needs to be adjusted, Fig. 20 shows beads where Kp has been adjusted and now Kd needs to be adjusted.

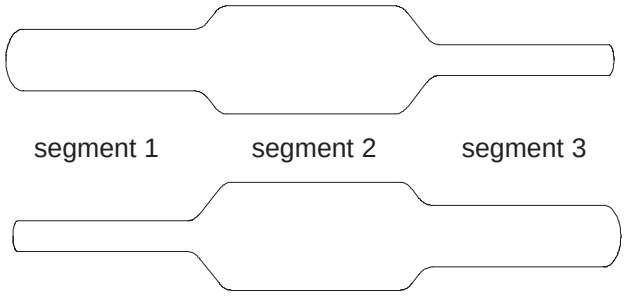


Fig. 19

Example Uneven Bead Patterns

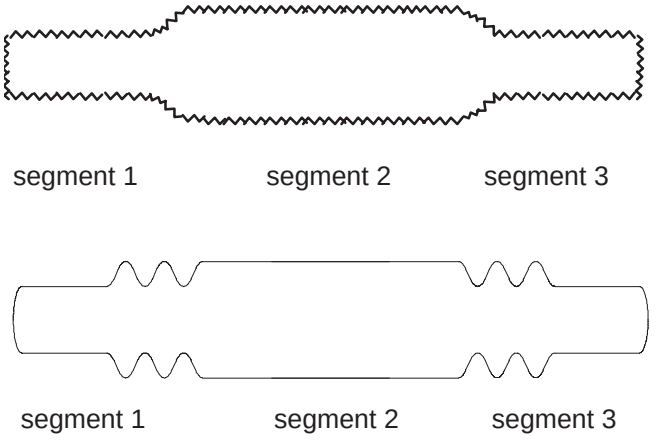


Fig. 20

Example Unstable Bead Patterns

NOTE: Some materials, such as compressible or shear-thinning materials, may achieve stable performance while bead widths in the first and third segments of the bead are unequal. If this occurs, Kp and Kd must be adjusted together.

Configuring the PrecisionFlo Module

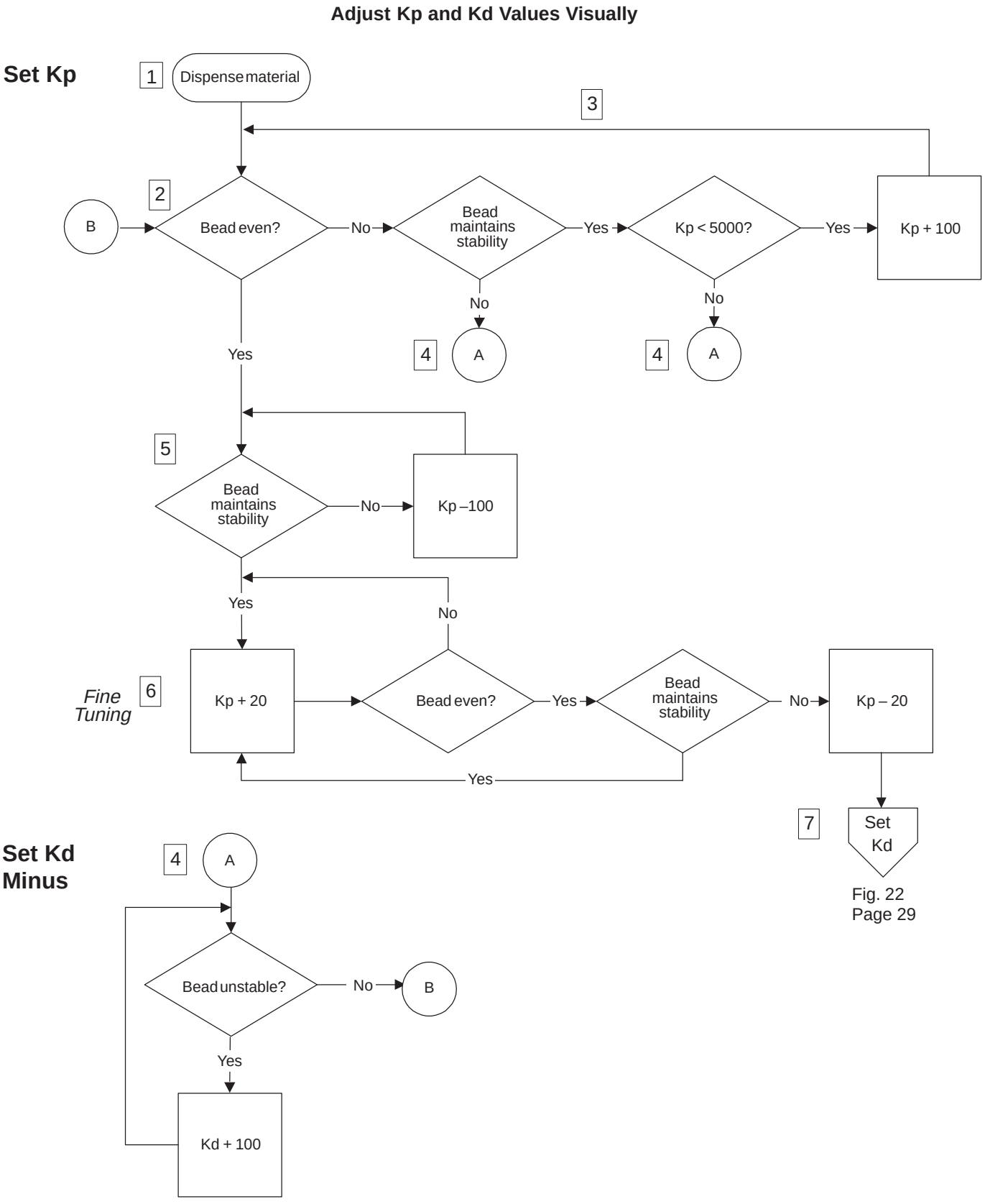


Fig. 22
Page 29

Fig. 21

Configuring the PrecisionFlo Module

Adjust Kp and Kd Values Visually

Refer to the chart in Fig. 21 on page 27 for more information. The 1 corresponds to the steps in this procedure.

Set Kp Visually

To adjust Kp:

1. Use the robot test program you created, from the description on page 23, to dispense material on a flat surface in a 36-inch long path.

2. Determine if the bead widths for the first and third segments of the path are the same. If the segments are the same size, the bead is even. If the segments are even, go to step 5.

3. If the1st and 3rd segments are not the same, as shown in Fig. 19, increase Kp by 100 and examine the bead again. Continue to increase Kp in increments of 100 until either the beadwidths become equal as in Fig. 18, or until you reach 5000 Kp.

   When the beadwidths become equal, go to step 5.

   If you reach 5000 Kp and the bead still is not even, go to step 4.

4. Add 100 to Kd and rerun the test. If this does not stabilize bead performance, repeatedly increase Kd by 100 and retest until stability is achieved. Then return to step 3.

5. If the bead maintains its stability (Fig. 18 or Fig. 20), go to step 6.

   If the bead does not maintain its stability, reduce Kp by 100. Continue reducing Kp by 100 until stability is maintained. Then go to step 6.

6. Fine tune Kp:
   a. Continue adding 20 to Kp until the beadwidths stay even, but the bead goes unstable.

   b. Subtract 20 from Kp. The bead should now be stable and even in width.

7. Go to the next section, Adjusting Kd.

Configuring the PrecisionFlo Module

Adjust Kp and Kd Values Visually (continued)

Set Kd

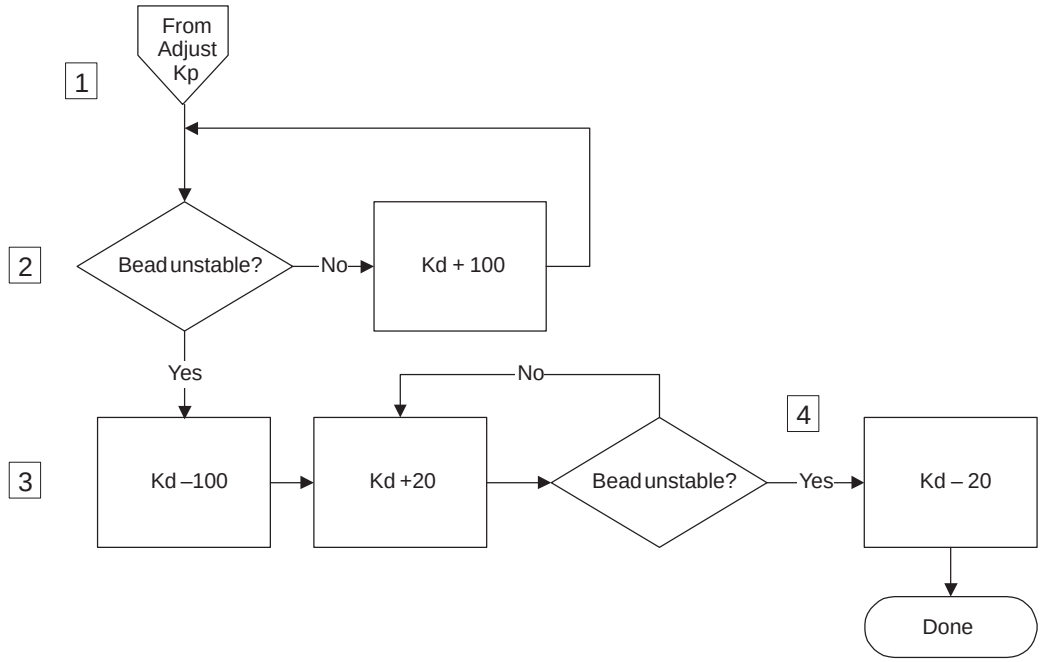


Fig. 22

Set Kd *(Visually)*

Refer to the chart in Fig. 22 for more information. The 1 corresponds to the steps in this procedure.

1. After you have adjusted Kp, examine the most recent test bead and see if it has any waves in it after a change in bead width.

2. If no waves exist, increase Kd by 100 and dispense another test bead. Repeatedly increase Kd and retest until a wave appears after a width change, to indicate unstable performance (Fig. 20).

3. Reduce Kd by 100 and resume adjusting upward by increments of 20 and retesting until the waviness or instability appears again.

4. Decrease Kd to the last previous setting.

5. Reconnect the electrical cable to the flow meter.

The adjustment procedure is complete and the module is set for optimum performance with the current material and module configuration.

Notes

Configuring the PrecisionFlo Module

Adjust Kp and Kd Values Using an Oscilloscope

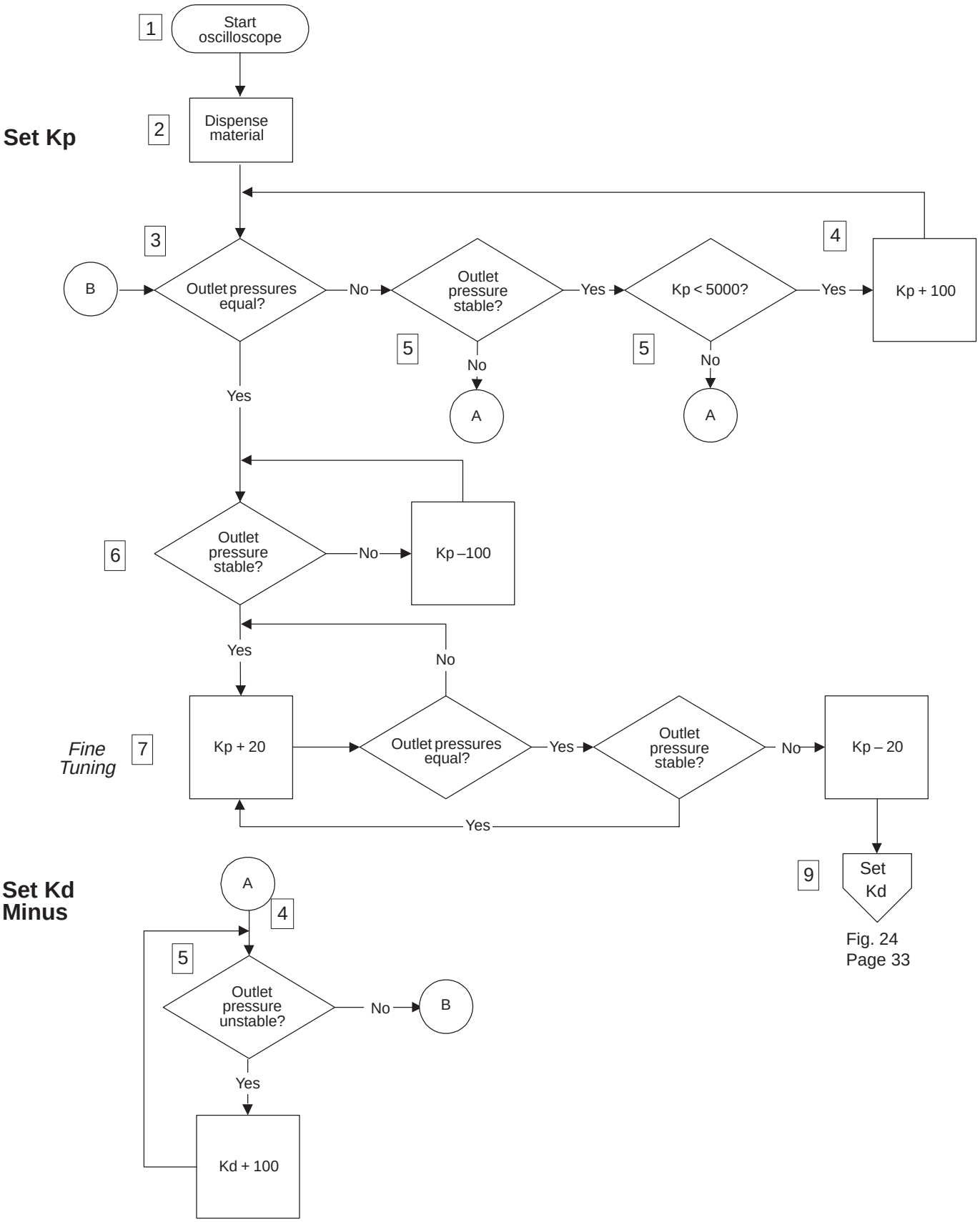


Fig. 24
Page 33

Fig. 23

Configuring the PrecisionFlo Module

Adjust Kp and Kd Values Using an Oscilloscope

Connecting The Oscilloscope

If you are using an oscilloscope, follow this procedure to connect it to the PrecisionFlo module:

1. Connect one input channel of the oscilloscope to the command signal jumper J7-pin 3 and the common for the input channel to jumper J7-pin 4.

2. Connect a second oscilloscope channel to the outlet pressure transducer signal jumper J7-pin 5, and the common to jumper J7-pin 6.

3. Set the oscilloscope to trigger on a rise in the outlet pressure transducer signal, and configure it to store an entire 36-inch dispense path.

Set Kp (*with an oscilloscope)*

To adjust Kp:

1. Start the oscilloscope.

2. Use the robot test program you created, from the description on page 23, to dispense material in a 36 inch long path.

3. Examine the oscilloscope trace and determine if the outlet pressures for the first and third segments of the path are the same. If the pressures are equal, the bead is even. If the pressures are equal, go to step 6.

4. If the1st and 3rd pressures are not the same, increase Kp by 100 and examine the pressures again. Continue to increase Kp in increments of 100 until either the pressures become equal, or you reach 5000 Kp.

   When the pressures become equal, go to step 6.

   If Kp reaches 5000 and the pressures are still not equal, go to step 5.

5. Add 100 to Kd and rerun the test. If this does not equalize the pressures, repeatedly increase Kd by 100 and retest until equality is achieved. Then return to step 4.

6. If the outlet pressure maintains its stability (Fig. 18 or Fig. 20), go to step 7.

   If the bead does not maintain its stability, reduce Kp by 100. Continue reducing Kp by 100 until stability is maintained. Then go to step 7.

7. Fine tune Kp by:
   a. Adding 20 to Kp until the pressures become equal.

   b. Then subtracting 20 from Kp until the pressures maintain equality and stability.

8. Fine tune Kp:
   a. Continue adding 20 to Kp until the outlet pressures become equal, but the bead goes unstable.

   b. Subtract 20 from Kp. The bead should now be stable and have even outlet pressure.

9. Go to the next section, Adjusting Kd *(with an Oscilloscope)*.

Adjust Kp and Kd Values Using an Oscilloscope (continued)

Set Kd

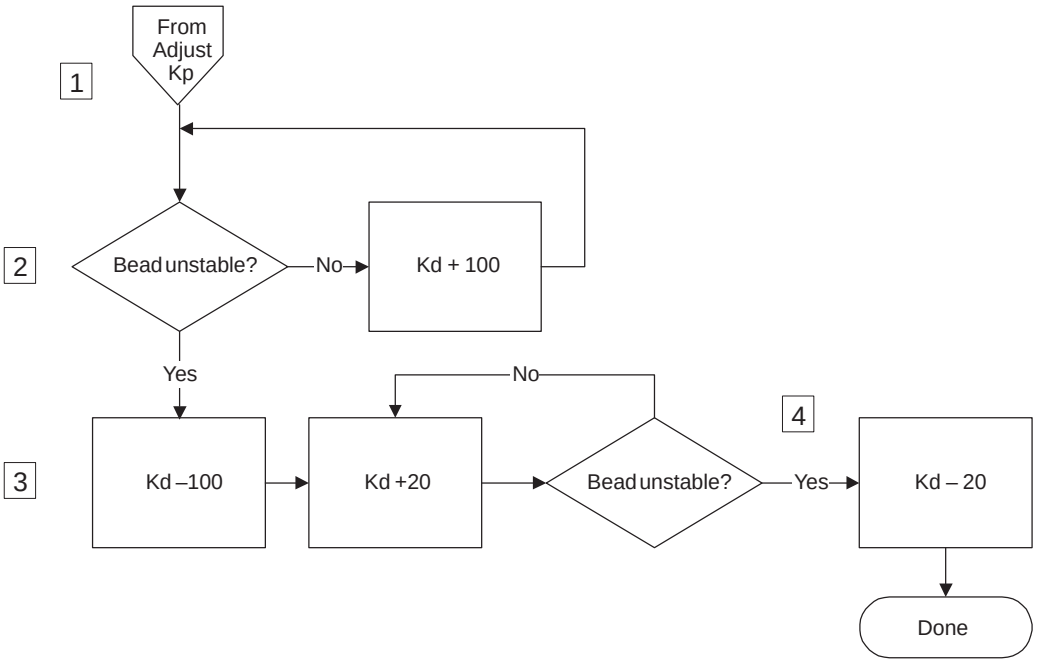


Fig. 24

Set Kd *(with an Oscilloscope)*

Refer to the chart in Fig. 24 for more information. The 1 corresponds to the steps in this procedure.

1. After you have adjusted Kp, examine the most recent test pattern and see if it has any waves in it after a change in bead width.
2. If no waves exist, increase Kd by 100 and dispense another test bead. Repeatedly increase Kd and retest until a wave appears, after a width change, to indicate unstable performance (Fig. 20).
3. Reduce Kd by 100 and resume adjusting upward by increments of 20 and retesting until the waviness or instability appears again.
4. Decrease Kd to the last previous setting.
5. Disconnect the oscilloscope.
6. Reconnect the electrical cable to the flow meter.

The adjustment procedure is complete and the module is set for optimum performance with the current material and module configuration.

Using the Control Pendant to Modify Kp and Kd Parameters

NOTE: Kp and Kd are control loop parameters which, if changed incorrectly, could result in damage to the module. These parameters should be changed by qualified personnel only.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Protected Setup

2. Key in the password, then press **[ENTER]**.
3. Then go to:

   PROTECTED SETUP ⇨ Modify PD/Vol Comp

4. You see:

```
--MODIFY PD/VOL COMP--
Kp xxxx Kd xxxx
Vol Comp= xxx  xx cts
Press F1 To Toggle
```

5. Key in the Kp parameter, press **[ENTER]**, then move the cursor to the Kd field. Key in Kd and press **[ENTER]**.
6. Press **[HOME]** to return to the HOME screen.

Configuring the PrecisionFlo Module

Setting the Flow-Meter K-Factor

If your PrecisionFlo unit has a flow meter, you need to set the K-factor.

The flow meter sends an electrical pulse to indicate the passage of a specific amount of material. The K-factor represents the volume of material required to cause one pulse. The manufacturer prints the K-factor on the flow meter's label. You will enter that number during this procedure.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Protected Setup

2. Key in the password, then press **[ENTER]**.

3. Then go to:

   PROTECTED SETUP ⇨ Flowmeter K-factor

4. You see:

   ```
   –FLOWMETER K-FACTOR–
   Enter Number Of
   cc/pulse
         .xxxx
   ```

5. Key in the 4-digit K-factor value (the number of cubic centimeters of material the flow meter passes for each pulse). The PrecisionFlo software automatically enters the decimal point. Then press **[ENTER]**.

6. Press **[HOME]** to return to the HOME screen.

7. Press either **[BACK]** to return to the PROTECTED SETUP menu or **[HOME]** to return to the HOME screen.

Calibrating Flow Rate and Setting Module Operation Mode

When you calibrate the flow rate you are performing 2 functions:

- selecting whether the PrecisionFlo module will be operating in pressure mode or flow mode
- calibrating flow rate

The PrecisionFlo module has two modes of operation, pressure mode and flow mode. You can only use flow mode if your PrecisionFlo configuration includes a flow meter. After you determine the mode and enter the appropriate flow information, the PrecisionFlo module automatically calibrates the flow rate.

Using Pressure Mode

In pressure mode, you enter the maximum outlet pressure and the PrecisionFlo module calculates a linear ratio of outlet pressure to the robot's analog input voltage.

For example: If you enter 1000 psi as your maximum outlet pressure, the PrecisionFlo module would relate an input voltage of 10 volts to 1000 psi and 0 volts to 0 psi. As shown in the graph below, every value between 0 and 1000 psi then has a linear relationship to the analog voltage.

Pressure mode: psi to analog voltage ratio

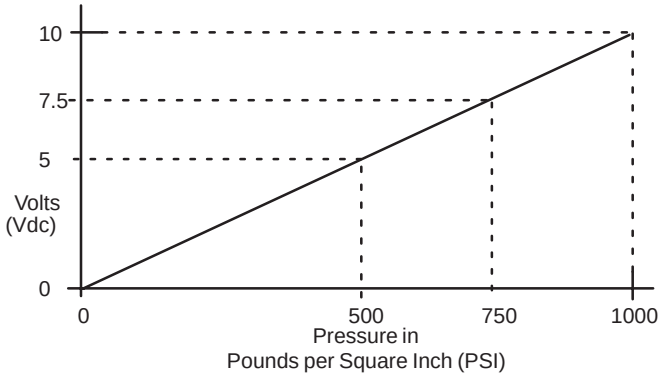


Fig. 25

Configuring the PrecisionFlo Module

Using Flow Mode

In flow mode, you enter the maximum flow rate required by the application. The PrecisionFlo module:

1. Determines current flow rate.
2. Calculates the outlet pressure required to obtain the desired flow rate.
3. Calculates a linear ratio of the robot's analog input voltage to the desired flow rate.
4. Adjusts outlet pressure to maintain the desired flow rate.

For example: When you enter the maximum flow rate, the PrecisionFlo module analyzes fluid characteristics, which are affected by factors such as viscosity and ambient temperature, then determines the pressure required to obtain the desired flow rate and adjusts the pressure/flow relationship accordingly.

Flow mode: Analog voltage to flow rate ratio

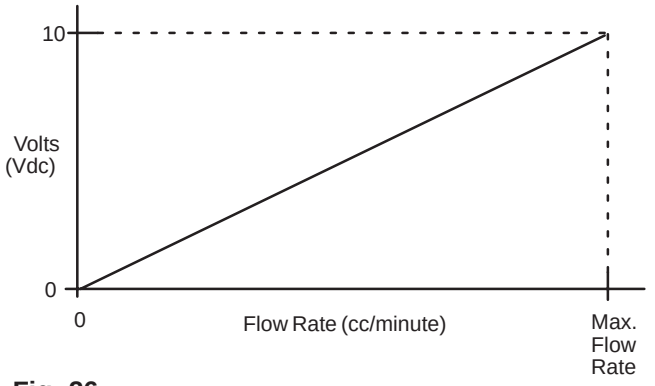


Fig. 26

To set flow calibration:

1. Determine whether the PrecisionFlo module will be using pressure mode or flow mode.
2. If your PrecisionFlo configuration includes a flow meter (A), determine the maximum flow rate required by the application.

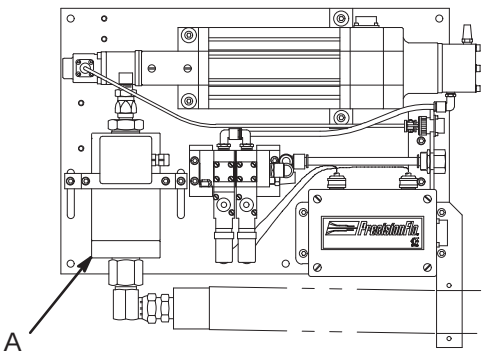


Fig. 27

3. If your PrecisionFlo configuration does not include a flow meter, determine the maximum outlet pressure for your application.

Setting Flow Calibration

⚠ WARNING

COMPONENT RUPTURE HAZARD
Never exceed the maximum air or fluid working pressure rating of the lowest rated component in the system. Overpressurization can cause component rupture and serious bodily injury.

There are 2 procedures for calibrating the flow. The procedure you use depends on whether or not your PrecisionFlo configuration has a flow meter connected to the PrecisionFlo control assembly.

Calibration for Systems that have a Flow Meter Connected to the Control Assembly

To calibrate the material flow:

1. Make sure the CONTROL ON indicator is lit on the control assembly. If not, press MASTER START/STOP RESET on the control assembly, (24) in Fig. 30.
2. On the control pendant:

   HOME ⇨ SETUP ⇨ FLOW CALIBRATION

   You see:

   ```
   --FLOW CALIBRATION--
   Enter Maximum Operating
   Flow Rate
   xxxcc/min
   ```

3. Place the dispensing device over a waste container.

NOTE: In the pressure mode, the volume component is automatically disconnected.

Continued on the next page.

Configuring the PrecisionFlo Module

Calibration for Systems that have a Flow Meter Connected to the Control Assembly *(continued)*

4. Key in the maximum operating flow rate, in cubic centimeters/minute, then press **[ENTER]**. You see:

```
--WARNING--
Material Will Be
Dispensed.  Press
F2 to Continue.
```

5. Press **[F2]** to start calibration. Wait while the module dispenses fluid to calibrate the system. This should take no more than 4 minutes. Calibration is complete when the flow rate reaches 0.

   If you wish to halt the calibration process, press **[BACK]**. This stops the system from dispensing and takes you back to the FLOW CALIBRATION screen.

6. Press either **[BACK]** to return to the SETUP menu or **[HOME]** to return to the HOME screen.

If you cannot obtain the desired flow rate, you see a warning.

If you see:	Adjust:
`--WARNING!--` `Unable to obtain requested flow rate!`	system components, such as inlet pressure, hose diameter, or amount of flow rate
`--WARNING!--` `Unable to regulate within tolerance`	Kp and Kd

1. Leave the FLOW CALIBRATION screen by pressing the **[BACK]** key.

2. Adjust either the system components or the software configuration settings.

3. Run the calibration procedure again.

Calibration for Systems with a Disconnected Flow Meter or Without a Flow Meter

To calibrate the material flow:

1. Make sure the CONTROL ON indicator is lit on the control assembly. If not, press MASTER START/ STOP RESET on the control assembly, (24) in Fig. 30.

2. On the control pendant:

   HOME ⇨ SETUP ⇨ FLOW CALIBRATION

   You see:

```
--FLOW CALIBRATION--
Enter Maximum Operating
Flow Rate
xxxcc/min
```

3. The flow meter should be disconnected, so at the prompt, key in 0, then press **[ENTER].** You see:

```
--WARNING!!!--
Material Will Be
Dispensed, Press
F2 To Continue.
```

4. Place the dispensing device over a waste container, then press **[F2]**.

   You see:

```
--FLOW CALIBRATION--
Working, Please Wait
Outlet=   00 psi
```

   When the PrecisionFlo module determines there is no flow meter connected, you see:

```
--No Flowmeter!!!!--
Max Outlet
Operating Pressure=
      1500 psi
```

NOTE: The displayed pressure is the maximum operating pressure entered the last time calibration was performed without the flow meter.

5. Key in the maximum working pressure for the material outlet, in psi, then press **[ENTER]**.

6. Press either **[BACK]** to return to the SETUP menu or **[HOME]** to return to the HOME screen.

Configuring the PrecisionFlo Module

Setting PrecisionFlo On and Off Delays

The PrecisionFlo metering valve can physically respond faster than the dispense device and dispense gun solenoid. As a result, the metering valve can supply material to the dispense device before the device has time to open. Supplying material to the closed device can create a trapped-pressure condition and cause an excess of material to be dispensed at the beginning of a cycle.

Similarly, at the end of a cycle, the PrecisionFlo metering valve can shut off before the dispense device closes, causing the bead of material to taper off at the end of a cycle.

To eliminate these problems, you can change the delay time associated with the opening or closing of the device and metering valve (Table 4).

Table 4 — Delay On/Off Variables

Variable:	Sets the Amount of Time:
Gun ON	the device delays opening after regulation begins
Regulation ON	regulation delays starting after the gun solenoid is activated
Gun OFF	the device delays closing after regulation ends
Regulation OFF	regulation delays stopping after the gun solenoid is activated

Fig. 28 and Table 5 show delay ON and OFF timing.

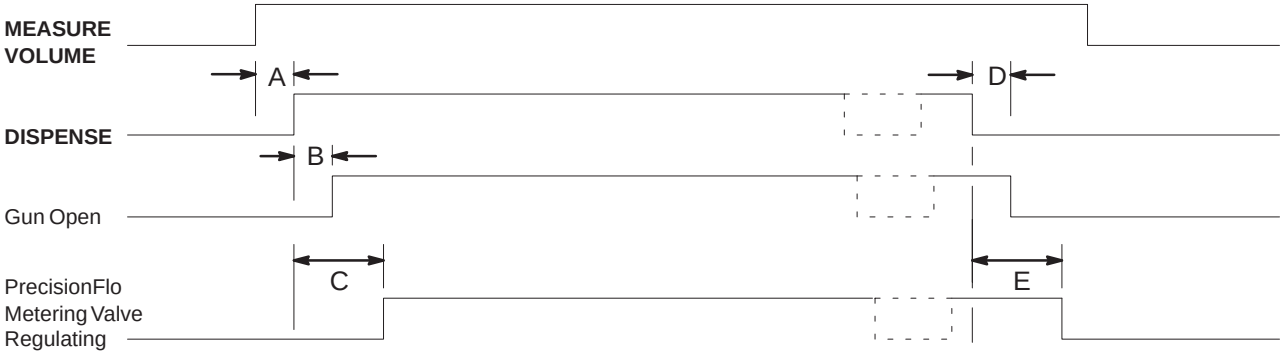


Fig. 28

Table 5 — Delay On/Off Timing

A	65 msec	Time between MEASURE VOLUME and DISPENSE
B	Gun ON delay	The user sets either the gun on delay or regulation on delay timing. The other delay is set to 0.
C	Regulation ON delay	
D	Gun OFF delay	The user sets either the gun off delay or regulation off delay timing. The other delay is set to 0.
E	Regulation OFF	

To determine which delays to set and what values the delays should have, follow one of the test procedures on page 38. If you are using an oscilloscope, follow **Test Procedure A**. Otherwise, follow **Test Procedure B** to set the PrecisionFlo On and Off delays.

Configuring the PrecisionFlo Module

Test Procedure A

To use an oscilloscope to determine ON and OFF delays:

1. Connect one input channel of an oscilloscope to the outlet pressure transducer at pins J7–6 and J7–5 on the flow control board.

2. Connect the second input channel of the oscilloscope to the GUN ON signal at pins GS–1 (or wire 1831) and GS–2 (or wire 1182).

3. Place the dispense device in a purge position over a waste container.

4. Set the analog Flow Command voltage from the robot to 5 Vdc.

5. Start the oscilloscope and dispense for 3 seconds.

6. Review the waveform on the oscilloscope, examining the end of the waveform:

If the:	Do This:
Pressure tapers off or stair steps during the fall of the Gun ON signal	Increase the REGULATION OFF delay in 10 msec intervals until the problem is eliminated.
psi spikes high, or if excessive psi is trapped at the end of the cycle	Increase the GUN OFF delay in 10 msec intervals until the problem is eliminated.

7. Review the waveform on the oscilloscope. There should be no pressure overshoot visible in the pressure sensor output when the GUN ON signal rises.

If the:	Do This:
Initial psi spikes then drops to regular psi	Increase the REGULATION ON delay in 10 msec intervals until the problem is eliminated.
Initial psi drops then builds to regular psi	Increase the GUN ON delay in 10 msec intervals until the problem is eliminated.

Test Procedure B

To determine ON and OFF delays:

1. Set the GUN ON and REGULATION ON delays to 0.

2. Set the GUN OFF delay to 0.

3. Place a bead on the substrate and examine the end of the bead.

If the:	Do This:
Bead tapers off at the end of the bead	Increase the REGULATION OFF delay in 10 msec intervals until the problem is eliminated.
Start of the next bead results in a wide bead	Increase the GUN OFF delay in 10 msec intervals until the problem is eliminated.

4. Place a bead on the substrate and examine the start of the bead.

If the:	Do This:
Beginning of the bead has an excess of material	Increase the REGULATION ON delay in 10 msec intervals until the problem is eliminated.
Beginning of the bead is small	Increase the GUN ON delay in 10 msec intervals until the problem is eliminated.

Configuring the PrecisionFlo Module

Modifying PrecisionFlo ON Delays

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Protected Setup

2. Key in the password, then press **[ENTER]**.

3. Then go to:

   PROTECTED SETUP ⇨ Set On Delay

4. You see:

   ```
   --SET ON DELAY--
   Gun = xxx msec
   Reg = xxx msec
   ```

5. Key in a value for either the gun or regulation ON delay, then press **[ENTER]**.

   You can enter a value for only one delay. The other delay is automatically set to 0.

6. Press either **[BACK]** to return to the PROTECTED SETUP menu or **[HOME]** to return to the HOME screen.

Modifying PrecisionFlo OFF Delays

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Protected Setup

2. Key in the password, then press **[ENTER]**.

3. Then go to:

   PROTECTED SETUP ⇨ Set Off Delay

4. You see:

   ```
   --SET OFF DELAY--
   Gun = xxx msec
   Reg = xxx msec
   ```

5. Key in a value for either the gun or regulation OFF delay, then press **[ENTER]**.

   You can enter a value for only one delay. The other delay is automatically set to 0.

6. Press either **[BACK]** to return to the PROTECTED SETUP menu or **[HOME]** to return to the HOME screen.

Configuring the PrecisionFlo Module

Controlling Volume Compensation

If the PrecisionFlo module is operating in flow mode, you should turn on volume compensation. When volume compensation is on, the PrecisionFlo module measures the volume of material dispensed and then adjusts the actual material flow rate to match the required flow rate.

For more information, see the Volume Compensation section in the theory of operation section (page 61).

Choice	When to use it
Off	If you are using pressure mode, or if your application does not require volume compensation.
Auto	If you are using flow mode.
Man	When volume compensation does not correct quickly enough. Reduce the number of flow meter pulses/updates to improve the volume compensation ratio. **⚠ CAUTION** To reduce risk of damage to the metering valve motor, do not set resolution so low that the metering valve continuously oscillates in an attempt to match the required flow rate. Refer to the Volume Compensation section in the theory of operation section (page 61) before using manual mode.

1. On the control pendant:
   HOME ⇨ SETUP ⇨ Protected Setup
2. Key in the password, then press **[ENTER]**.
3. Then go to:
   PROTECTED SETUP ⇨ Modify PD/VOL COMP
4. You see:

```
--MODIFY PD/VOL COMP--
Kp xxxx Kd xxxx
Vol Comp= xxx  xx cts
Press F1 To Toggle
```

5. Press **[F1]** to step the volume compensation between AUTO, MAN and OFF.
6. If you choose AUTO, you see:

```
--MODIFY PD/VOL COMP--
Kp xxxx Kd xxxx
Vol Comp= Auto  xx cts
Press F1 To Toggle
```

   The PrecisionFlo module automatically determines the number of counts. Now go to step 9.

7. If you choose OFF, you see:

```
--MODIFY PD/VOL COMP--
Kp xxxx Kd xxxx
Vol Comp= Off
Press F1 To Toggle
```

   The PrecisionFlo module turns off Volume Compensation. Now go to step 9.

8. If you choose MAN, you see :

```
--MODIFY PD/VOL COMP--
Kp xxxx Kd xxxx
Vol Comp= Man   xx cts
Press F1 To Toggle
```

   a. Press **[↓]** to move the to the Vol Comp line.

   b. Key in a number between 1 and 99, then press **[ENTER]**.

9. Press either **[BACK]** to return to the PROTECTED SETUP menu or **[HOME]** to return to the HOME screen.

Fine Tuning

The procedures in this section are for fine tuning the PrecisionFlo system when there are minor or temporary changes to the material characteristics.

Setting Scale Analog In

The Scale Analog In allows the operator to uniformly increase or decrease the dispense rate throughout the entire cycle without having to reprogram the robot.

To change the dispense rate, you must first determine the percentage by which to increase or decrease the material amount. The maximum adjustment permitted is ± 10% of the initial value. Only values between 90% and 110% will be accepted. Larger changes must be made in the robot controller.

1. On the control pendant:

   HOME ⇨ SETUP ⇨ Scale Analog In

2. You see:

   ```
   --SCALE ANALOG IN--
   Analog Input Scale
   Factor=xxx%
   Previous=xxx%
   ```

3. Key in a number from 90 through 110 percent, then press **[ENTER]**.

4. Press **[HOME]** to return to the HOME screen.

PrecisionFlo Module Operation

Pressure Relief Procedure

This procedure describes how to relieve pressure for the PrecisionFlo unit. Use this procedure whenever you shut off the dispenser/sprayer and before checking or adjusting any part of the system, to reduce the risk of serious injury.

⚠ WARNING

The PrecisionFlo module pressure must be manually relieved to prevent the module from starting or spraying accidentally. To reduce the risk of serious bodily injury, including fluid injection, splashing in the eyes or on the skin, or injury from moving parts, always follow the **Pressure Relief Procedure** whenever you:

- are instructed to relieve the pressure
- check or service any of the system equipment
- shut off the pump, or install or clean the spray tip.

1. Shut off the fluid supply to the Metering Valve.
2. Actuate the Metering Valve and the dispensing device until the fluid stops flowing from them.
3. Shut off power to the fluid supply system.
4. Place waste containers beneath the fluid drain valve and the dispense device.
5. Refer to Fig. 29. and perform the following steps to open the dispense device and relieve fluid pressure:

   a. Manually actuate the plunger on the solenoid (B), which opens the dispense device, to relieve fluid pressure.

   b. Continue actuating the plunger until all pressure is purged from the system between the needle and the dispense device before proceeding to the next step.

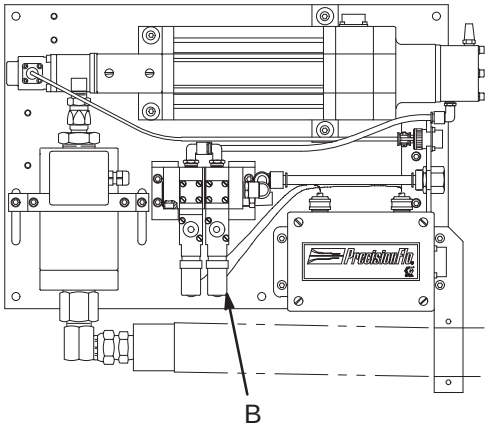


Fig. 29

6. Slowly open the drain valve to relieve fluid pressure.
7. Leave the drain valve open until you are ready to pressurize the system again.

If you suspect a valve, hose, or the dispenser nozzle has become completely clogged, or that pressure has not been fully relieved after following the steps above, VERY SLOWLY loosen the tip guard retaining nut or hose end coupling and relieve the pressure gradually, then loosen completely. Clear the tip, valve, or hose at this point. DO NOT attempt to pressurize the system until the blockage is cleared.

PrecisionFlo Module Operation

Starting the Module

To start the module, you (Fig. 30):

1. Carefully inspect the entire system for signs of leakage or wear. Replace or repair any worn or leaking components before applying power.
2. Turn on air and electrical power to the system.
3. Turn on the main electrical disconnect (27) to supply power to the PrecisionFlo module.
4. The control pendant becomes active, showing first a diagnostic message, that includes the software's version number, and then the Home menu.
5. Turn on material pump.
6. Push the MASTER START button (24) to turn on power to the PrecisionFlo metering valve drive circuitry. This lights the CONTROL ON indicator.
7. If this is the first time the module has been started, or you want to configure the software, go to **Configuring the PrecisionFlo Module** on page 23.

Restarting the Module

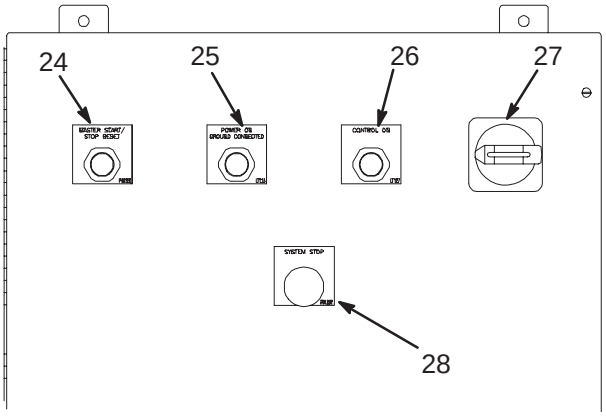
If the module is on, but the CONTROL ON indicator on the control assembly is not lit:

1. Check the control pendant to see if a fault has occurred. If a fault has occurred, you must clear the fault before restarting the PrecisionFlo module. Press **[F1]** to clear the fault.
2. Press MASTER START/STOP RESET, (24) in Fig. 30, on the control assembly.
3. Choose AUTOMATIC dispense mode from the HOME menu.

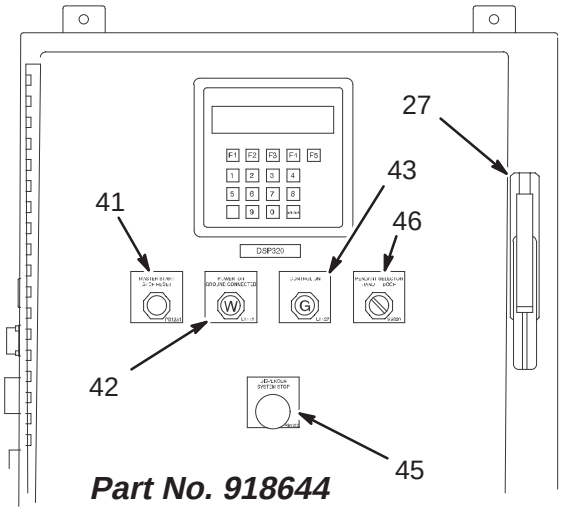
PrecisionFlo Module Operation

Reading the PrecisionFlo Control Panel Indicators

Use the tables below and Fig. 30 to read the indicators on the PrecisionFlo control panel.



Part No. 918463



Part No. 918644

Fig. 30

Ref	Button/Switch	What it Does
24	Master Start / Stop Reset Button	• Turns on power to PrecisionFlo's metering valve drive after power is applied to the module. • Restarts the PrecisionFlo module after the DISPENSER SYSTEM STOP button has been pressed. • Engages the Master Control Relay and signals the external controller that the power has been applied to the module. • Lights Control On light.
27	Main Electrical Power (Disconnect) Switch	• Turns on power to system. • Lights Power On/ Ground Connected light
28	Dispenser System Stop Button	• Disengages the Master Control Relay. • Signals the external controller that a DISPENSER SYSTEM STOP condition is in effect. • Shuts down PrecisionFlo Assembly. • Turns off Control On light. • De-energizes the drive for the PrecisionFlo metering valve.
46	Hand / Door Pendant Selector	• Selects the hand-held pendant or door pendant.

Ref	Indicator	Indicator Light is	Meaning
25	Power On/ Ground Connected Light	ON	Power is on and a proper ground is connected to the PrecisionFlo assembly.
		OFF	Power is off and/or ground is disconnected.
		DIMLY LIT	There may be a problem with the PrecisionFlo system power connections. Have the power wiring and connections checked by a qualified electrician before attempting to start the PrecisionFlo system.
26	Control On Light	ON	Master Control Relay (MCR) is engaged and the PrecisionFlo Control Assembly is ready for operation.
		OFF	PrecisionFlo Control Assembly is not ready for operation.

PrecisionFlo Module Operation

Setting Operation Mod

The PrecisionFlo module has 3 operating states:

- Automatic dispense mode — enables the PrecisionFlo module so that when it receives a command from the robot, PrecisionFlo can begin dispensing material.
- Manual dispense mode — enables the PrecisionFlo module to begin dispensing when you press a key on the command pendent. Dispensing continues for as long as the key is pressed.
- Idle — disables the PrecisionFlo module so that material cannot be dispensed.

The PrecisionFlo module is normally in an idle state unless you place it in either Automatic or Manual dispense mode. The only time the PrecisionFlo module can dispense material is when the pendant display indicates either one of these modes. When the pendant is returned to the HOME screen by pressing the **[HOME]** key, the PrecisionFlo module becomes idle and will not dispense material.

The following procedures configure the module for manual or automatic operation.

Using Automatic Dispense Mode

Entering Automatic Dispense Mode

Follow this procedure to put the PrecisionFlo module into Automatic dispense mode:

⚠ WARNING

You are about to place the system under robotic control. Make sure dispensing will not endanger people or equipment before proceeding.

1. Make sure the CONTROL ON indicator, (26) in Fig. 30, is lit. If it is not, push the MASTER START button (24) to turn on power to the PrecisionFlo metering valve drive circuitry.

2. On the control pendant:

   HOME ⇨ Automatic

3. You see:

   ```
   –AUTOMATIC DISPENSE–
   >Monitor Pressure
    Volume Dispensed
    Last Fault
   ```

   The PrecisionFlo module is now enabled. When it receives a DISPENSE ENABLE command from the robot, the PrecisionFlo module will begin dispensing material.

4. Leave the pendant in this state during normal operation.

Monitoring Dispense Statistics

While you are in Automatic dispense mode, you can view characteristics of the current dispense session.

1. Move the cursor to one of the menu choices and press **[ENTER]**.

   ```
   –AUTOMATIC DISPENSE–
   >Monitor Pressure
    Volume Dispensed
    Last Fault
   ```

2. You see the screen with statistics about your selection.

3. Press **[BACK]** to return to the AUTOMATIC DISPENSE menu.

Leaving Automatic Dispense Mode

To stop automatic dispensing, leave Automatic dispense mode, and idle the module:

1. Press the **[HOME]** key. You see:

   ```
   Caution! Leaving
   Auto Will Disable
   Dispense. Hit F2 To
   Cancel, F3 to Leave
   ```

2. Press **[F3]** to return to the HOME screen.

PrecisionFlo Module Operation

Using Manual Dispense Mode

1. Make sure the CONTROL ON indicator, (26) in Fig. 30, is lit. If it is not, push the MASTER START button (24) to turn on power to the PrecisionFlo metering valve drive circuitry.

2. On the control pendant:

   HOME ⇨ Manual

3. You see:

   ```
   --MANUAL DISPENSE--
   Desired Flow  = xx%
   Press F2 to Dispense
   ```

4. Key in a dispense rate percentage between 1 and 99, then press **[ENTER]**.

⚠ WARNING

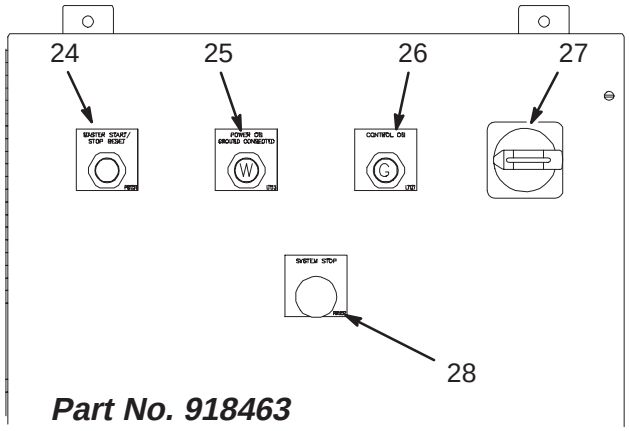
The system is now ready to dispense. Make sure dispensing will not endanger people or equipment before proceeding.

5. Press **[F2]** on the pendant to begin dispensing.

   Dispensing continues as long as you continue to press **[F2],** and stops when you release the **[F2]** key.

6. Press **[HOME]** to exit Manual dispense mode and return to the HOME screen.

Shutting Down the PrecisionFlo Module



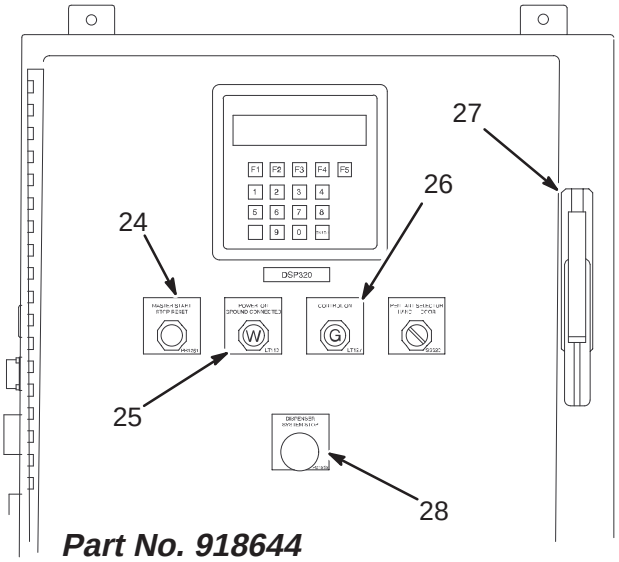


Fig. 31

1. Shut OFF the material supply to the module.

2. Follow the **Pressure Relief Procedure** on page 42.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** (page 42).

3. Turn OFF the PrecisionFlo module's compressed air supply.

4. Press the DISPENSER SYSTEM STOP (28) button.

5. Turn OFF the main electrical disconnect (27).

Maintenance

Maintaining the PrecisionFlo Module

See Fig. 4 on page 9 for a description of the basic components in a typical system equipped with a PrecisionFlo module.

Perform the **Pressure Relief Procedure** on page 42 before any service action that does not require the module to operate.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** (page 42).

For Service and Maintenance Information on:	See
PrecisionFlo circuit boards, program chips, and operator control pendant.	Appendix C
PrecisionFlo Metering Valve.	Form# 308601
other components	component documentation supplied with your module

Testing the Metering Valve's Motor

The motor test procedure is intended to verify motor operation and the integrity of cables and connections between the PrecisionFlo control assembly and the metering valve motor.

The motor is only energized for 5 seconds at a time, so position yourself where you can watch the needle and seat on the metering valve when performing this procedure.

⚠ CAUTION

This procedure should be conducted only by trained personnel, since incorrect use of this procedure can overheat and damage the motor.

1. Perform the Pressure Relief Procedure on page 42 to ensure the module is depressurized.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** (page 42).

2. Make sure that the panel is energized and that the CONTROL ON light is lit.
3. On the control pendant:

   HOME ⇨ SETUP ⇨ Protected Setup

4. Key in the password, then press **[ENTER]**.
5. Then go to:

   PROTECTED SETUP ⇨ Test Motor

6. You see:

```
-----Test Motor-----
Setpoint Moves Shaft
Current= xxx
```

7. Enter either a positive or negative percentage of full scale current. Use the ↑ or ↓ arrow keys to increment or decrement the value by 10%.

+ Percentage	– Percentage
opens needle	closes needle
pulls out of seat	pushes into seat

   After 5 seconds, you return to the PROTECTED SETUP screen.

8. To repeat the test, repeat steps 5 – 7.

Troubleshooting and Fault Recovery

The following table describes the valid fault codes used by the PrecisionFlo module, possible causes, and solutions. See **Theory of Operation** – **Fault Handling** on page 58 for detailed information on how fault codes are communicated.

The PrecisionFlo module displays warnings and alarms on the control pendent's screen.

- **Warnings do not stop the module from dispensing.**
- **Alarms stop the module from dispensing.**

Warnings are listed in Table 6, Alarms are listed in Table 7.

Restarting the Module After a Fault

If a fault has occurred, you must clear the fault before restarting the PrecisionFlo module.

1. Press **[F1]** on the control pendant to clear the fault.
2. Press MASTER START/STOP RESET, (24) in Fig. 30, on the control assembly. This turns on power to the PrecisionFlo metering valve drive circuitry and lights the CONTROL ON indicator.
3. Choose AUTOMATIC dispense mode from the HOME menu on the control pendant.

Warnings

Table 6 — Fault Code Table

Fault Code	Fault Name	Fault Description	Causes	Solutions
16	Inlet Pressure Low	Input pressure to the PrecisionFlo metering valve is below the lower limit set for operation.	Supply pumps empty	Check supply pumps
			Material supply shut off	Check pumps and valves
			Material supply not connected	Check supply connections
			Incorrect limit set	Check limit setting and correct if necessary.
			Failed transducer	Check transducer, replace if failed
17	Outlet Pressure Low	Output pressure of the PrecisionFlo metering valve is below the lower limit set for operation.	Incorrect limit set	Verify limit is set correctly
			No or insufficient material flow	Increase material flow rate
			Needle is stuck	Dislodge and inspect needle
			No power to motor	Apply power to motor
			Pump wink passed through outlet	Recalibrate PrecisionFlo module or increase pump pressure
			Failed transducer	Verify transducer operation, replace if failed
18	Tip Pressure Low	Pressure measured at the PrecisionFlo dispense tip is below the lower limit set for operation.	Incorrect limit set	Verify limit is set correctly
			Control On light not lit because control assembly is off	Apply power to assembly, then press MCR Start/Stop Reset Button.
			Broken hose between outlet and dispense device	Repair/replace hose
			Plugged hose between outlet and dispense device	Clear or replace plugged hose
			Failed transducer	Check transducer, replace if failed

Troubleshooting and Fault Recovery

Warnings *(continued)*

Table 6 — Fault Code Table

Fault Code	Fault Name	Fault Description	Causes	Solutions
19	Inlet Pressure High	Input pressure to PrecisionFlo metering valve is above the upper limit set for operation.	Incorrect limit set	Check limit setting and correct if necessary.
			Material supply pressure is too high	Decrease material supply pressure
			Failed transducer	Check transducer, replace if failed
20	Outlet Pressure High	Output pressure to the PrecisionFlo metering valve is above the upper limit set for operation.	Incorrect limit set	Verify limit is set correctly
			Dispense hose/device plugged	Clean/replace hose/device
			Failed transducer	Check transducer, replace if failed
21	Tip Pressure High	Pressure measured at the PrecisionFlo dispense tip is above the upper limit set for operation.	Incorrect limit set	Verify limit is set correctly
			Plugged tip	Clean or replace tip
			Damaged tip	Repair or replace tip
22	Dispense Volume Low	Material dispensed during the last dispense cycle was more than 10% lower than expected for that job.	Volume compensation is turned off	Turn on volume compensation
			Partially plugged tip or supply system. Error is outside volume compensation window	Clean tip and/or supply system
			Insufficient flow to PrecisionFlo metering valve inlet. Error is outside volume compensation window	Increase flow rate to PrecisionFlo metering valve inlet
			Material viscosity is outside volume compensation window	Verify material characteristics
			PrecisionFlo metering valve is not regulating	Check PrecisionFlo metering valve, repair if necessary
23	Dispense Volume High	Material dispensed during the last dispense cycle was more than 10% higher than expected for that job.	PrecisionFlo module volume compensation is turned off	Turn on volume compensation
			Material viscosity is outside volume compensation window	Verify material characteristics
			PrecisionFlo metering valve is not regulating	Check PrecisionFlo metering valve, repair if necessary. See Form# 308601 for more information.
24	Temperature Controller Fault	The temperature conditioning fault signal (input module 6) is 0 volts. This warning tells the PrecisionFlo that the temperature conditioning unit is not operating properly.	Conditioning system is turned off	Turn conditioning system on
			Over/under temperature fault	Inspect temperature conditioning system
			No temperature conditioning unit and signal not jumpered to +24 volts	Connect a wire between terminal 1561 and 1181 (temperature fault signal and +24 volts)

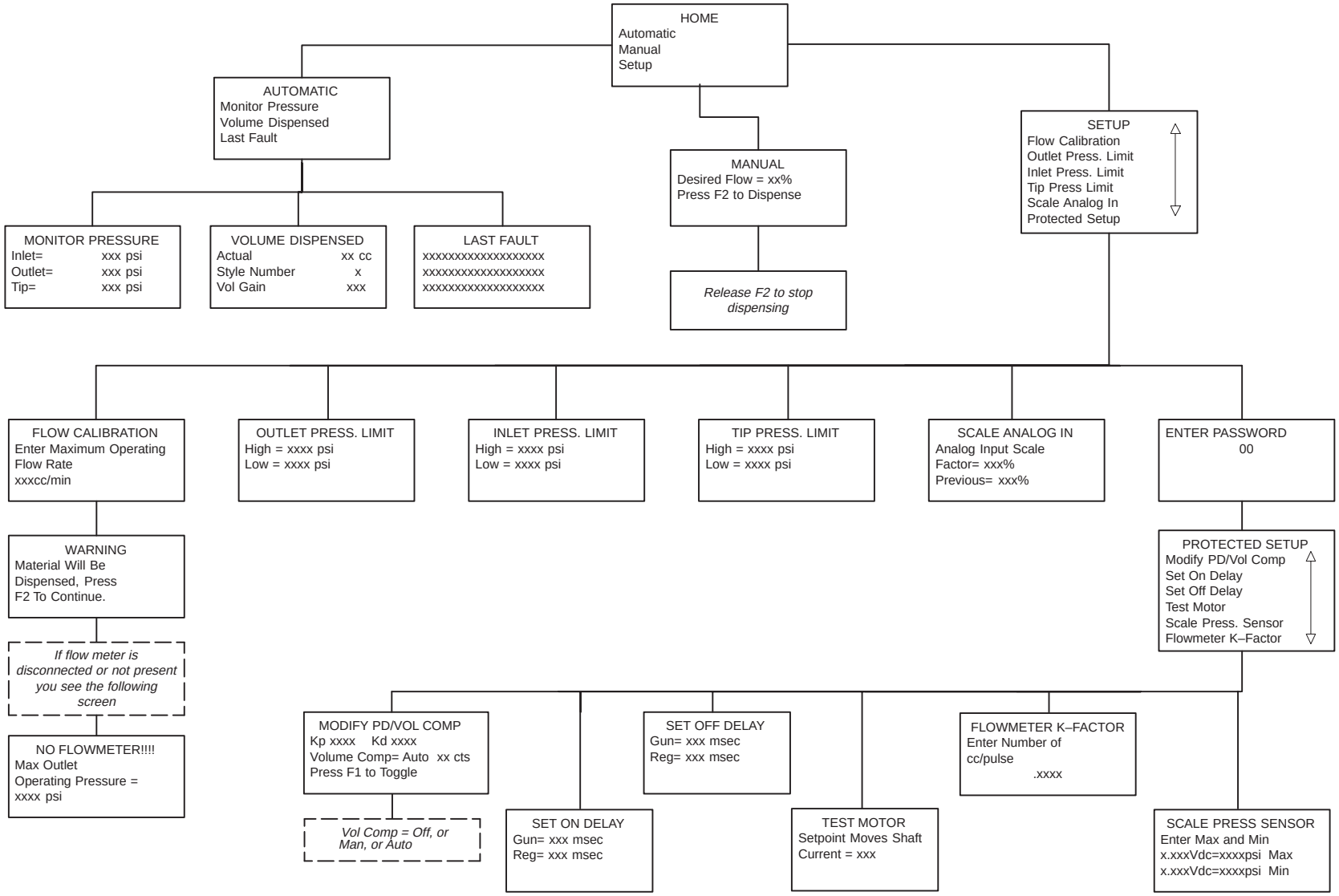
Troubleshooting and Fault Recovery

Alarms

Table 7 — Alarm Code Table

Alarm Code	Alarm Name	Alarm Description	Causes	Solutions
2	Servo Drive Fault	Servo circuit condition at servo drive's output, or hardware failure occurred on the drive.	Servo drive failure	Replace servo drive
			Motor short	Check that motor coil resistance is 10–13 Ohms.
			Surge current to motor.	Decrease input step rate change and/or limit maximum command signal.
4	Dispenser Stop	There is no electrical power to the MCR or servo drive.	Control assembly not activated at start up	Press MASTER START / STOP RESET
			Control assembly not reactivated after fault	
			SEALER STOP push button pressed	
			CONTROL ON light not lit, control assembly is off	Apply power to PrecisionFlo module, then press MASTER START / STOP RESET
5	Motor Over Temperature	PrecisionFlo metering valve linear motor temperature sensor has exceeded 85˚ C (185˚ F).	Servo drive short	Check for continuity between + and – outputs of servo drive
			Servo motor short	Insure that motor coil resistance is between 10 and 13 ohms
			Excessive current to motor over period of time	Monitor command signal outlet pressure to determine operating range
			Dirty motor heat sink	Clean motor surface
			Poor motor ventilation	Increase air flow around motor
			Failed transducer	Check transducer operation and grounding. Replace if required.

Menu Selection Map



PrecisionFlo Module I/O

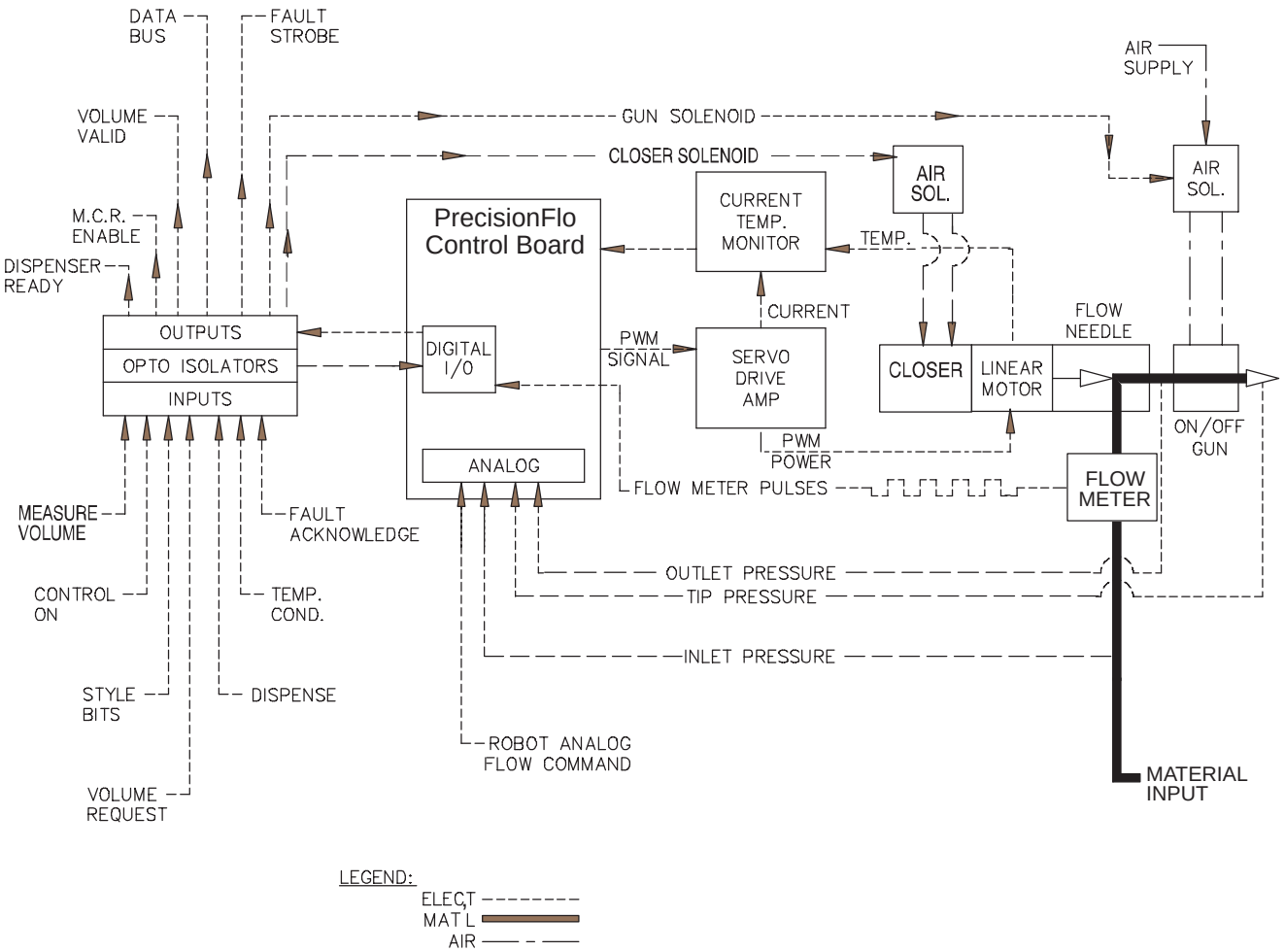


Fig. 32

PrecisionFlo Module I/O Schematic

Figure 32 shows the internal and external signals used by the PrecisionFlo module. Inputs to the opto-isolators are digital signals from external sources such as a robotic system or temperature conditioning system. Outputs from the opto-isolators are digital signals either sent to an external robotic system and used to control the solenoid air valve which opens and closes the dispense gun. Analog inputs from pressure sensors, the optional flow meter, and the external robotic system go to the PrecisionFlo control board. Other internal signals control the linear motor in the metering valve, or provide motor temperature and needle position information for the metering valve.

PrecisionFlo Module I/O

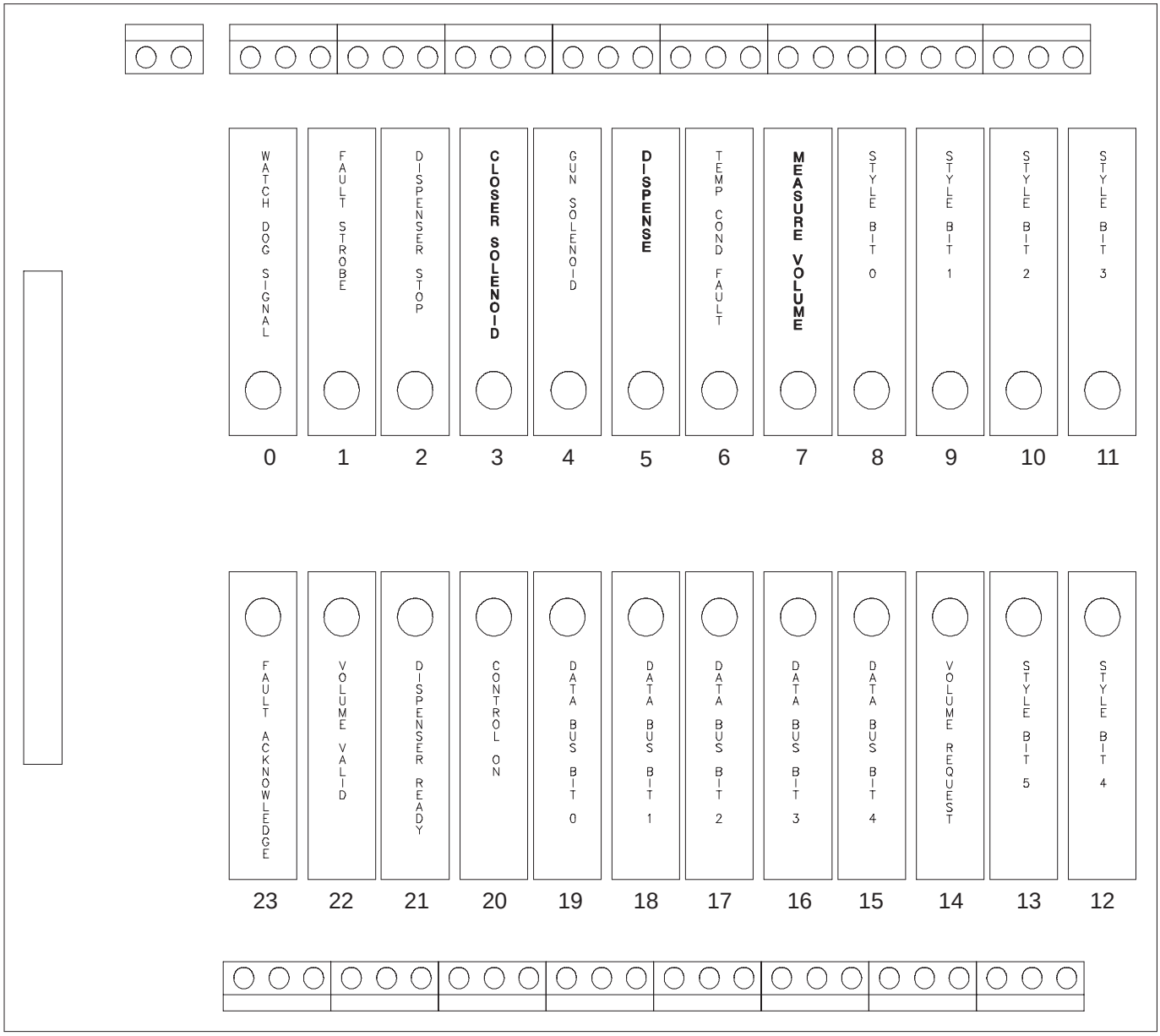


Fig. 33

I/O Rack Layout

Figure 33 shows the layout of input/output (I/O) modules in the PrecisionFlo control enclosure. Table 8 describes these I/O modules on page 54.

For wiring information, see the wiring diagram in your system documentation.

PrecisionFlo Module I/O

Table 8 — I/O Module Description

Module Number	Description	Input/Output	Active State	Normal (no fault) LED State
0	Watch Dog Signal	Output	Low	On
1	Fault Strobe	Output	High	Off
2	Dispenser Stop	Output	Low	On
3	Closer Solenoid	Output	High	*
4	Gun Solenoid	Output	High	*
5	Dispense	Input	High	*
6	Temperature Conditioning Fault	Input	Low	On
7	Measure Volume	Input	High	Off
8	Style Bit 0	Input	High	*
9	Style Bit 1	Input	High	*
10	Style Bit 2	Input	High	*
11	Style Bit 3	Input	High	*
12	Style Bit 4	Input	High	*
13	Style Bit 5	Input	High	*
14	Volume Request	Input	High	*
15	Data Bus Bit 4	Output	High	*
16	Data Bus Bit 3	Output	High	*
17	Data Bus Bit 2	Output	High	*
18	Data Bus Bit 1	Output	High	*
19	Data Bus Bit 0	Output	High	*
20	Control On	Input	High	On
21	Dispenser Ready	Output	High	On
22	Volume Valid	Output	High	*
23	Fault Acknowledge	Input	High	*

* can be either On or Off

I/O Module Description

Table 8 provides detailed information on the use and output states of the modules in the PrecisionFlo I/O rack. See Fig. 33 on page 53 for module positions in the rack.

Theory of Operation

Manual Mode

When in Manual mode, the PrecisionFlo module remains in a ready state, and reacts only to operator input to the control pendant. The PrecisionFlo module ignores robotic control signals when in Manual mode.

Automatic Mode

When in Automatic mode, the PrecisionFlo module remains in a ready state, indicated by the DISPENSER READY signal, and reacts to inputs such as MEASURE VOLUME, DISPENSE, and VOLUME REQUEST signals from the robot. The only independent action taken by the PrecisionFlo module in this state is taken in response to the detection of a fault.

When a fault is detected, the PrecisionFlo module sets the FAULT STROBE signal HIGH and disables dispensing by disengaging the Master Control Relay (MCR), which shuts off power to the PrecisionFlo metering valve and sets the DISPENSER READY signal LOW. Fault detection can also occur during dispensing. (See **Fault Handling** on page 58.)

During dispensing, the PrecisionFlo module performs a variety of functions in the background. These functions include fault monitoring, real time volume compensation, flow linearization, measuring volume (per job), and continuous calculations to maintain the pressure and optional flow control loops.

Typical Dispense Cycle

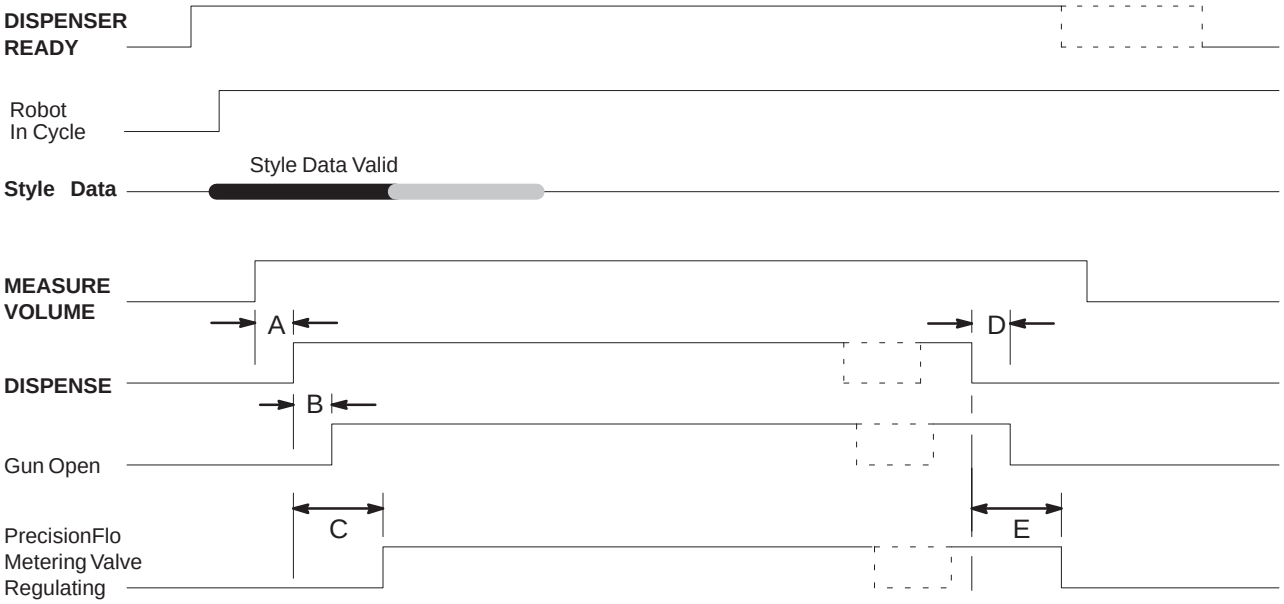


Table 9 — Dispensing Operation Timing

A	65 msec	Time between MEASURE VOLUME and DISPENSE
B	Gun on delay	The user sets either the gun on delay or regulation on delay timing. The other delay is set to 0.
C	Regulation on delay	
D	Gun off delay	The user sets either the gun off delay or regulation off delay timing. The other delay is set to 0.
E	Regulation off	

Fig. 34

1. Robotic system controller verifies that the DISPENSER READY signal is HIGH.
2. Robotic system goes into cycle.
3. Robotic system controller places the style information on the style data bus.
4. Robot sets the MEASURE VOLUME signal HIGH.
5. PrecisionFlo module reads the style bits from the data bus. (Style Bits 0–5*)*

   Style bit data must be valid a minimum of 1 msec before MEASURE VOLUME is raised, and must remain valid for a minimum of 130 msec afterward (Fig. 35).

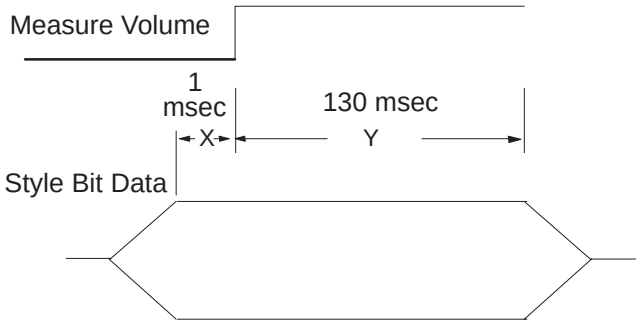


Fig. 35

6. PrecisionFlo module waits for DISPENSE signal from the robotic system to start dispensing.

Continued on the next page.

Theory of Operation

Typical Dispense Cycle *(continued)*

7. Robotic system controller requests material to be dispensed by setting the DISPENSE signal HIGH.

8. PrecisionFlo module activates the closer solenoid, retracting the closer pneumatic cylinder.

9. PrecisionFlo controller checks if a GUN ON DELAY has been set by the user.

   If the delay has been set, the PrecisionFlo module waits until the delay has expired, then activates the dispense gun solenoid, which opens the gun.

   If the delay has not been set, the PrecisionFlo module immediately activates the dispense gun solenoid, which opens the gun.

10. PrecisionFlo module checks if a REGULATION ON DELAY has been set by the user.

    If the delay has been set, the PrecisionFlo module waits until the delay has expired, then begins metering material to the gun.

    If the delay has not been set, the PrecisionFlo module immediately begins metering material to the gun.

11. PrecisionFlo module regulates output based on the analog FLOW COMMAND input signal from the robot.

12. PrecisionFlo module measures the volume dispensed while the MEASURE VOLUME line is high.

13. PrecisionFlo module continuously monitors fluid pressures, and the flow rate as measured by the flow meter, and makes adjustments for changes in operating conditions.

14. PrecisionFlo module monitors operating parameters to detect and report any faults that may occur. (see Fault Handling on page 58.)

15. Robot sets the DISPENSE line LOW, indicating that no material is required during this portion of the program. (Robot can cycle the DISPENSE signal HIGH and LOW throughout a cycle if required. Volume measurement will still occur.)

16. At the end of the cycle, PrecisionFlo module checks if a GUN OFF DELAY has been set by the user.

    If the delay has been set, the PrecisionFlo module waits until the delay has expired, then closes the dispense gun solenoid, which closes the gun.

    If the delay has not been set, the PrecisionFlo module immediately closes the dispense gun solenoid, which closes the gun.

17. PrecisionFlo module checks if a REGULATION OFF DELAY has been set by the user.

    If the delay has been set, the PrecisionFlo module waits until the delay has expired, then stops regulating material to the gun.

    If the delay has not been set, the PrecisionFlo module immediately stops regulating material to the gun.

18. PrecisionFlo module deactivates gun closer, which closes the needle, 1.9 seconds after the gun solenoid is deactivated.

19. At the end of the cycle, MEASURE VOLUME goes LOW.

20. PrecisionFlo module stops measuring volume.

21. PrecisionFlo module waits to be polled for volume dispensed or until MEASURE VOLUME is raised to start the next cycle. (See Volume Reporting on page 59.)

22. After volume is requested and reported, PrecisionFlo module places the last fault/warning code on the data bus.

23. If a fault occurred during the cycle, and the fault code was not acknowledged by the robotic controller, the robotic controller can read the fault code at the end of cycle. NOTE: volume data does not erase fault data. (See Figure 36, Fault Handling on page 58.)

Theory of Operation

Fault Handling

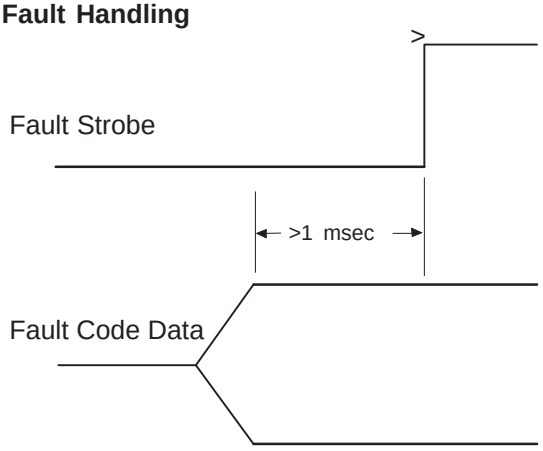


Fig. 36

Fault code data is valid for a minimum of 1 msec before FAULT STROBE goes HIGH. Fault code data remains valid, and the FAULT STROBE remains HIGH, until a FAULT ACKNOWLEDGE is received from the robotic controller, or the fault is cleared using the pendant.

Fault codes are reported using the FAULT STROBE signal and the data bus. Fault codes can be either:

- **alarms**, which cause the PrecisionFlo module to shut down
- **warnings**, which allow the PrecisionFlo module to keep operating

The robot can read a fault code immediately or at the end of the cycle. If an alarm occurs after a warning, the alarm will be displayed instead of the warning. At the end of the dispense cycle the data bus is used for volume reporting, if requested by the robotic controller. Once volume reporting has been completed, the last previous fault code is placed on the data bus.

Fault codes are reported to the robotic controller in conjunction with the FAULT STROBE signal. The fault code value is obtained by adding the values assigned to the fault code bits that are HIGH.

The values of the fault bits are:

Bit	Fault Bit Value
0	1
1	2
2	4
3	8
4	16

For example, if bits 2 and 3 are HIGH, the fault code value is equal to 4 + 8, or 12, and a Volume Fault is indicated.

Typical Fault Handling Procedure

1. A problem occurs in the PrecisionFlo module.

2. The PrecisionFlo module analyzes the problem indication and determines if the fault is an alarm or a warning.

3. If the fault is an alarm:

   a. The PrecisionFlo module disables the MCR, which sets the DISPENSER READY signal LOW and shuts down the module.

   b. Then the PrecisionFlo module places the fault code on the data bus and sets the FAULT STROBE signal HIGH.

   The robot can detect the fault strobe signal and read the fault data immediately or at the end of the cycle (see steps 4 and 5).

NOTE: A fault condition causing an alarm must be corrected, and the PrecisionFlo module must be placed back in an operating mode using the control pendant, before dispensing can resume.

   If the fault is a warning, normal operation continues to the end of the cycle.

4. On completion of the cycle, if volume information is requested, the PrecisionFlo module uses the data bus to transfer the volume data. (See Figure 37, Volume Reporting on page 59.)

5. Once the cycle is completed and any volume information has been transferred, the PrecisionFlo module places the last occurring warning code on the data bus. The robot has the option of reading the warning code or not, and can initiate another cycle.

Refer to the **Troubleshooting and Fault Recovery** section page 48 for fault code causes, descriptions, and solutions for the various faults.

Volume Reporting

The volume dispensed during the last job is available on the data bus at the end of a cycle. This information is reported in two groups of 5 bits which combine to form a 10-bit binary code that measures the volume dispensed in the previous cycle in cubic centimeters (Fig. 37).

To determine the amount of material dispensed, convert the 10 bits from binary to decimal. The accuracy depends on the accuracy of the flow meter.

The last volume dispensed is overwritten when the MEASURE VOLUME line is changed from LOW to HIGH by the robot.

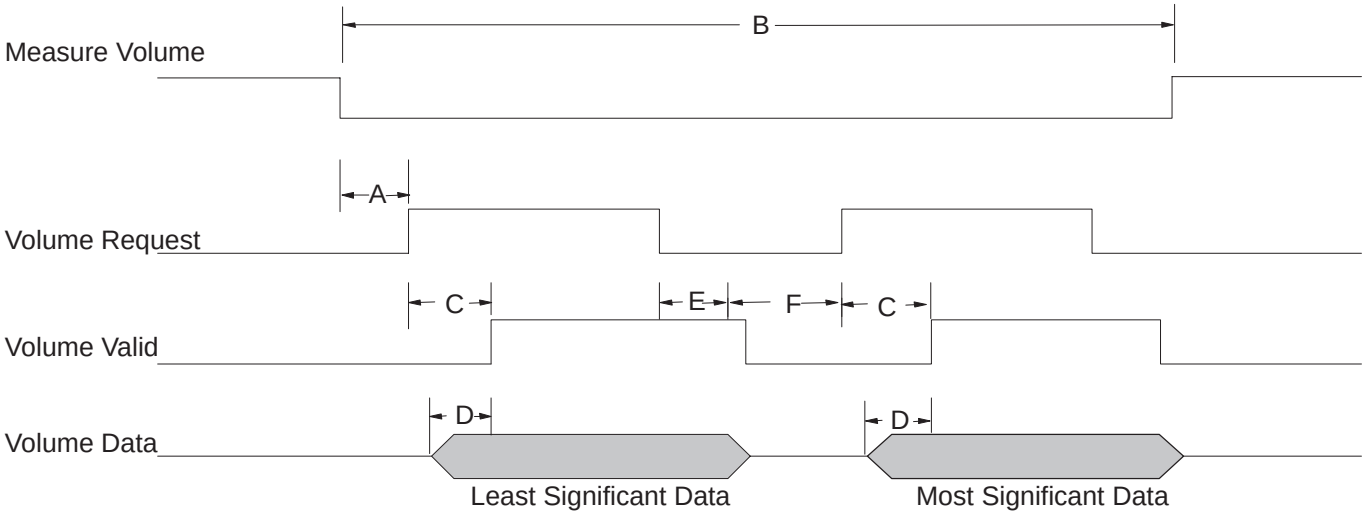


Fig. 37

Table 10 — Volume Data Timing Limits

		Minimum Time (msec)	Maximum Time (msec)
A	MEASURE VOLUME drops to VOLUME REQUEST rises	1	–
B	MEASURE VOLUME stays LOW	500	–
C	VOLUME REQUEST rises to Volume VALID rises	–	130
D	Data bus valid to Volume VALID rises	–1	1
E	VOLUME REQUEST drops to VOLUME VALID drops	–	130
F	VOLUME VALID drops to VOLUME REQUEST rises	0	–

Continued on the next page.

Volume Reporting *(continued)*

1. Robotic controller sets MEASURE VOLUME to LOW after the cycle is complete.
2. PrecisionFlo module stops measuring volume dispensed.
3. Robot controller sets the VOLUME REQUEST signal HIGH.
4. PrecisionFlo module places the first 5 bits (B0–B4) of volume information on the data bus.
5. PrecisionFlo module sets the VOLUME VALID signal HIGH.
6. Robotic controller reads the data.
7. Robotic controller sets the VOLUME REQUEST signal LOW.
8. PrecisionFlo module sets the VOLUME VALID signal LOW.
9. Robotic controller sets the VOLUME REQUEST signal HIGH.
10. PrecisionFlo module places the second 5 bits (B5–B9) on the data bus.
11. PrecisionFlo module sets the VOLUME VALID signal HIGH.
12. Robotic controller reads the data.
13. Robotic controller sets the VOLUME REQUEST signal LOW to indicate volume data has been read.
14. PrecisionFlo module sets the VOLUME VALID signal to LOW.
15. After volume is reported, if a fault was detected during the cycle, the PrecisionFlo module places the last fault code on the data bus. (See Fault Handling on page 58.)
16. When the robot sets the MEASURE VOLUME line high to begin the next cycle, the PrecisionFlo module discards previously stored volume data.

Theory of Operation

Volume Compensation

The PrecisionFlo module compensates for changes in material viscosity by:

1. Comparing actual flow rate with the flow rate commanded by the robot.
2. Increasing or decreasing material pressure until the required flow rate is achieved.

The PrecisionFlo module performs this comparison and correction after a fixed number of pulses from the flow meter (Fig. 38). Automatic mode automatically determines the interval, Manual mode permits the user to set the interval.

Choice:	Number of Flow Meter Pulses Determined By:	PrecisionFlo Module Automatically:
Auto	PrecisionFlo module	1. Calculates current flow rate. 2. Compares current flow rate to requested flow rate. 3. Compensates for changes in flow rate.
Manual	User	
Off	N/A	Turns off volume compensation

Volume Compensation Algorithm

The algorithm for controlling flow:

1. Find the pressure from commanded flow and flow calibration curve.
2. Multiply the pressure by the flow correction gain. Send the corrected pressure as a command to the metering valve.
3. If the flow meter has registered the correct number of pulses (i.e. the flow correction interval of volume has been dispensed):
   a. Calculate the actual flow from the number of pulses
   b. Compare the commanded flow to actual flow.

      If the actual flow is greater than the commanded flow, decrease the flow correction gain by 1%.

      If the actual flow is less than the commanded flow, increase the flow correction gain by 1%.

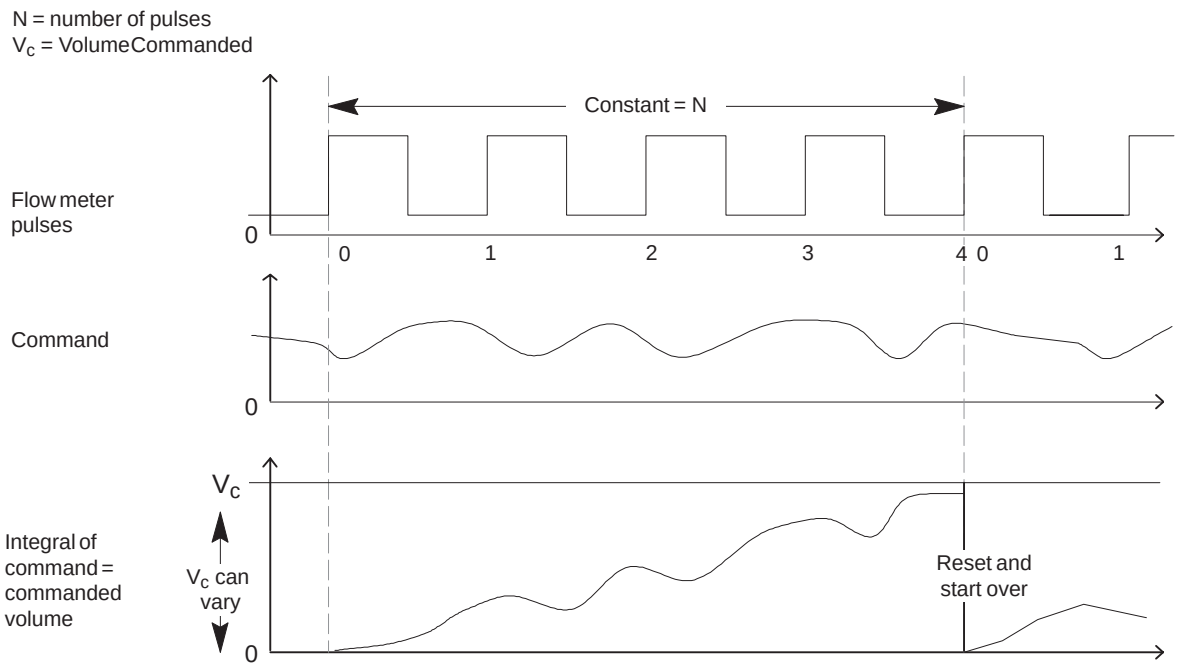


Fig. 38

Parts

Model 918463, PrecisionFlo Control Assembly

Ref No.	Part No.	Description	Qty.
10✓	617350	Pendant, PrecisionFlo	1
20	187764	Holster, pendant	1
30✓	617353	Cable, assy, pendant, 4.57 m (15 ft)	1
40	617508	Label, PrecisionFlo, 15.2 x 30.5 mm (6 x 12")	1
50▲	617472	Label, danger, electric shock	1
60✓	238093	Board assy., current/temp	1
70✓	918583	Board assy., service, control, PrecisionFlo Includes items 80 and 90	1
80	918494	. EPROM set, programmed	1
90	237955	. Board assy., flow control	1

▲ *Replacement Danger and Warning labels, tags and cards are available at no cost.*

✓ *Keep these spare parts on hand to reduce down time.*

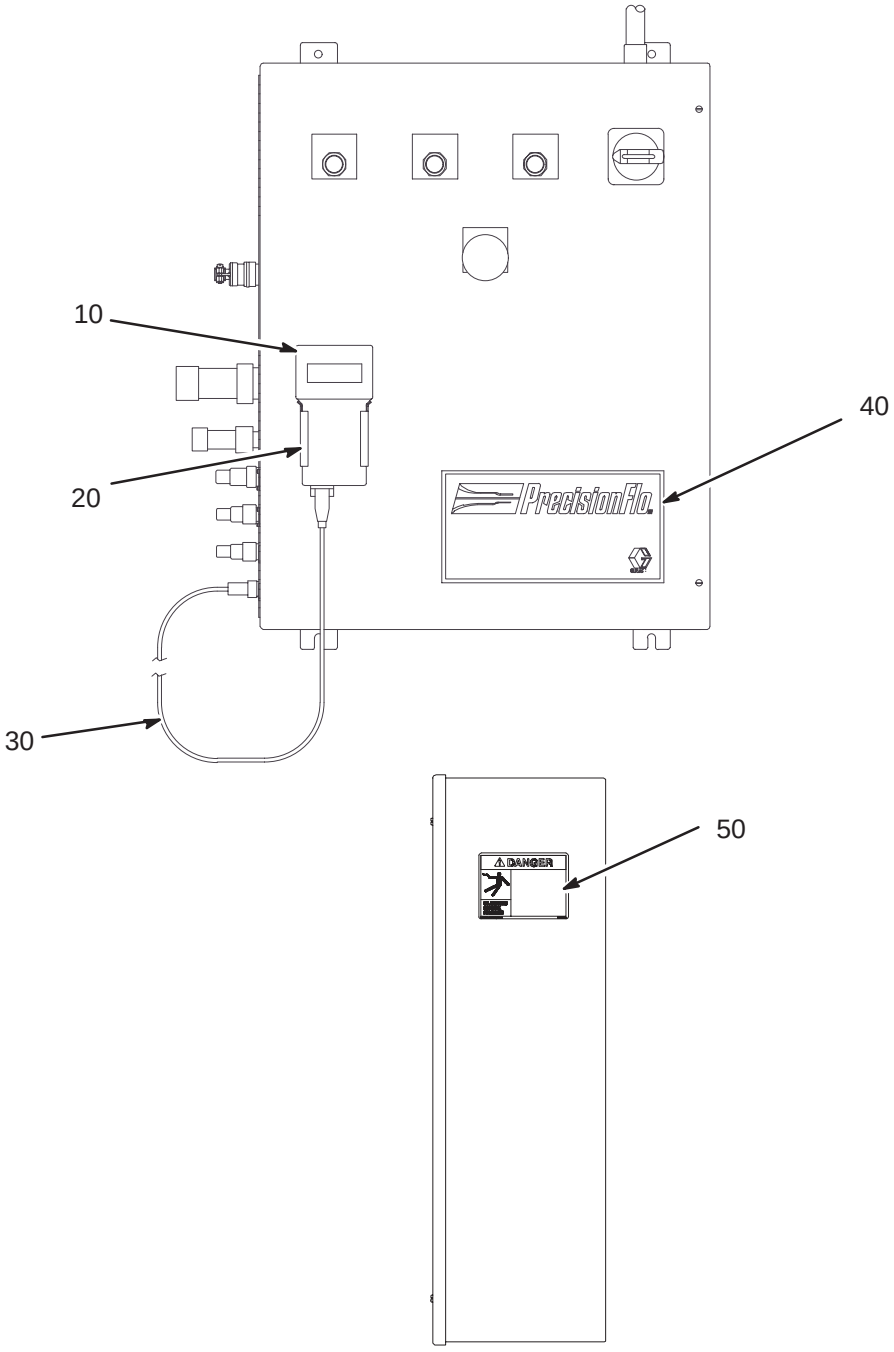


Fig. 39

Parts

Model 918463, PrecisionFlo Control Assembly (continued)

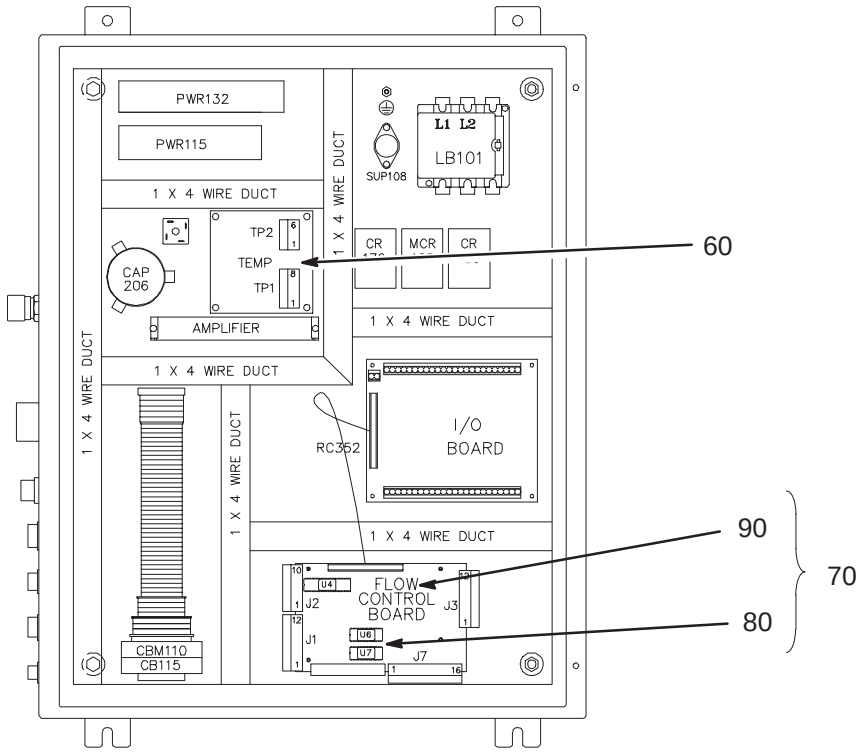


Fig. 40

Parts

Model 918644, PrecisionFlo Control Assembly

Ref No.	Part No.	Description	Qty.
1	114617	Pendant, door	1
2	617508	Label, PrecisionFlo, 15.2 x 30.5 mm (6 x 12”)	1
3✓	238093	Board assy., current/temp	1
4✓	918583	Board assy., service, control, PrecisionFlo Includes items 8 and 9	1
5	918494	. EPROM set, programmed	1
6	237955	. Board assy., flow control	1
7▲	617472	Label, danger, electric shock (not shown)	1

▲ *Replacement Danger and Warning labels, tags and cards are available at no cost.*

✓ *Hole cover (not shown) provided inside cabinet.*

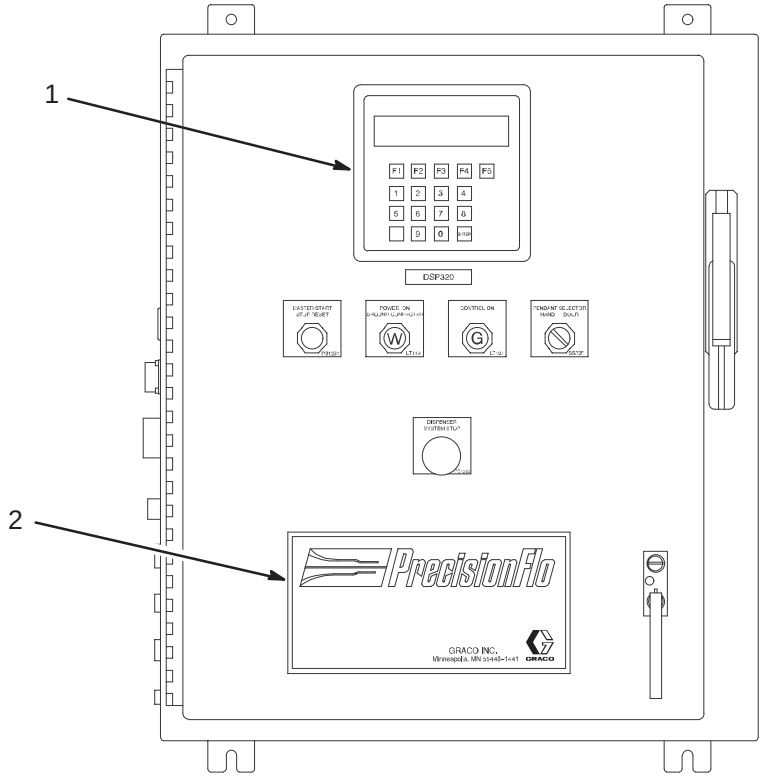


Fig. 41

Parts

Model 918644, PrecisionFlo Control Assembly (continued)

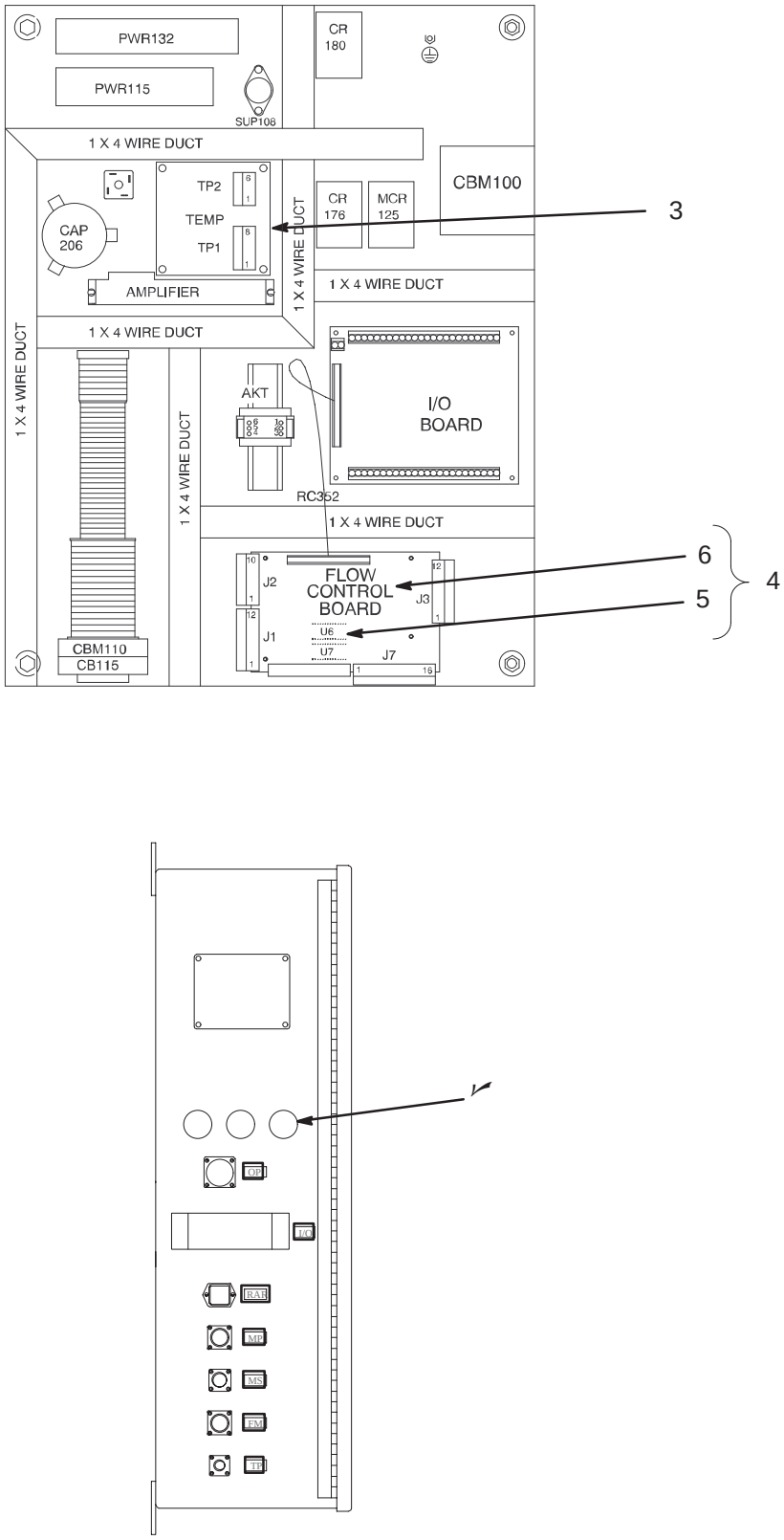


Fig. 42

PrecisionFlo Control Interface Signals

The PrecisionFlo module is designed to be controlled by a robotic workcell or line control computer. This section describes the interface between the line or cell control system and the PrecisionFlo module, and provides cable/pin level information for the connections. For information about the connector pin-outs, see page 71 .

Digital Input

Signals sent from an external controller to the PrecisionFlo module.

Signal Name	Connector / Pin	Signal Description
Dispense	I/O–D2	ON to dispense material in Automatic Mode. OFF to stop dispensing.
Measure Volume	I/O–A3	When this signal goes HIGH, style bits are read and the measured volume is reset. When the signal goes LOW, total volume for the cycle becomes available. (Refer to Fig. 34 on page 56.)
Style Bit 0 Style Bit 1 Style Bit 2 Style Bit 3 Style Bit 4 Style Bit 5	I/O–D3 I/O–D7 I/O–D13 I/O–D5 I/O–A1 I/O–D8	Make the appropriate style bits HIGH to indicate the style bit code for the current job before raising DISPENSE ENABLE. The style bits are used by the PrecisionFlo module for SPC data collection. No compensation is done based on this input. (Refer to figure 35, on page 56.)
Volume Request	I/O–A8	Make this signal HIGH, after DISPENSE ENABLE has been dropped, to request volume reporting on the current job. The PrecisionFlo module will provide the least significant 5 bits of volume data and raise VOLUME VALID. VOLUME REQUEST can then be lowered and raised again, at which time the PrecisionFlo module will provide the most significant 5 bits of volume data. (Refer to figure 37 on page 59.)
Fault Acknowledge	I/O–D1	Make this signal HIGH to acknowledge receipt of fault information by the external controller and clear the fault/warning buffer. This signal will not clear the fault/warning log displayed on the control pendant.

PrecisionFlo Control Interface Signals

Digital Output

Signals sent to an external controller from the PrecisionFlo module.

Signal Name	Connector / Pin	Signal Description
Fault Strobe	I/O–D16	Signal is HIGH when the PrecisionFlo module has detected a fault, and valid data representing the current fault condition is available to be read from the data bus. If the fault is an Alarm, the PrecisionFlo module will stop dispensing and will require the operator to clear the Alarm using the control pendant. If the fault is a Warning, dispensing will not be interrupted.
Dispenser Ready	I/O–D6	Signal is HIGH when no faults exist and the PrecisionFlo module is in AUTO mode and ready to dispense. This signal should be continuously monitored, and should be HIGH before a dispense cycle is initiated.
Data Bus 0 Data Bus 1 Data Bus 2 Data Bus 3 Data Bus 4	I/O–A2 I/O–D14 I/O–D9 I/O–D15 I/O–A5	These output bits are used to signal volume and fault data. (Refer to the timing diagrams and descriptions on pages 58 through 59.)
Volume Valid	I/O–D10	Signal is made HIGH to indicate that the data bus is presenting valid volume information. (Refer to figure 37 on page 59.)

Analog Input

Signals sent from an external controller to the PrecisionFlo module.

Signal Name	Connector / Pin	Signal Description
Flow Command	+ SIG = WIRE 2351 / RAR–1 – SIG = WIRE 2371 / RAR–2	Provide an analog voltage to signal the desired material flow rate. This signal can be scaled through the control pendant and can represent, dependent on the calibration mode, either outlet pressure or flow rate. During calibration, the PrecisionFlo module automatically assumes the signal represents a desired pressure if a flow meter is not present.

Module Internal Interface Signals

Digital Input

Signal Name	Connector / Pin	Signal Description
Temperature Fault	WIRE 1561	A temperature conditioning system can raise this signal to indicate an over- or under-temperature condition to the PrecisionFlo module. The activation of this signal will cause the PrecisionFlo module to place fault code 24 on the data bus for transmission to the external controller (unless volume data is currently being reported).
Control On	WIRE 1251	This signal is made high by the PrecisionFlo module Master Control Relay (MCR) to indicate that power is applied to the PrecisionFlo drive circuitry.
Flow Meter	+12 = FM –A COM = FM–B SIG = FM–C	Provide a pulse input to determine the actual volume dispensed. This feedback is necessary to perform flow calibration, SPC calculations, and Automatic Volume Compensation (AVC).

Digital Output

Signal Name	Connector / Pin	Signal Description
Gun On	SIG = OP–E COM = OP–B	This signal is raised by the PrecisionFlo module to actuate the solenoid valve that opens the dispense gun. The PrecisionFlo module turns this signal ON in response to a manual or external dispense request. This signal is turned OFF to shut off the dispense gun.
MCR Enable	WIRE 1801 CR180	This signal is turned ON by the PrecisionFlo module to disable the MCR in the event of a motor over-temperature fault. The disabled MCR removes power from the PrecisionFlo motor drive.
Watchdog	WIRE 1761 CR176	This signal is turned OFF by the PrecisionFlo module processor to put the module in a Dispenser System Stop condition. This occurs when the processor halts due to an internal failure. The signal is normally ON.
Closer	SIG = OP–E COM = OP–B	This signal is turned on by the PrecisionFlo to release the positive needle closing mechanism after the PrecisionFlo has stopped regulating and before the closing force current is removed from the motor.

Module Internal Interface Signals

Analog Input

Signal Name	Connector / Pin	Signal Description
PrecisionFlo Outlet Pressure	SIG = MS–C COM = MS–B	Provides an input from the pressure transducer at the PrecisionFlo metering valve outlet to the PrecisionFlo control assembly. This signal is necessary for the module to control outlet pressure, and allows the operator to monitor fluid pressure from the control pendant.
PrecisionFlo Inlet Pressure	SIG= OP–K COM = OP–L	(Optional) Provides an input from a pressure transducer at the inlet to the PrecisionFlo metering valve. This allows the PrecisionFlo module to monitor inlet pressure, and the user to view inlet pressure by using the control pendant to enter AUTOMATIC mode and display pressures.
Tip Pressure	—— ——	(Optional) Provides an input from a pressure transducer at the tip of the dispense gun. Tip pressure can be used to detect bead skips in extrusion applications. The operator can view tip pressure by using the control pendant to enter AUTOMATIC mode and display pressures.
Motor Temperature	SIG = MP–C COM = MP–D	Provides an input from a thermistor temperature sensor mounted on the metering valve motor. This input is used to detect excessive temperature rise in the motor. If an excessive temperature rise is detected, the PrecisionFlo module signals a fault, places fault code 5 on the data bus, and disengages the MCR to remove power from the PrecisionFlo drive circuitry.

Control Panel Operator Interface

PrecisionFlo Module Control Panel

The control panel has these indicators and switches:

Control / Indicator Name	Device ID	Control / Indicator Description
POWER ON / GROUND CONNECTED	LT113	Light is ON when both electric power and a proper ground are connected to the PrecisionFlo control assembly. If the main circuit breaker is ON and the light is either dimly lit or unlit, have a qualified electrician check the power wiring to the module.
CONTROL ON	LT127	Light is ON when the MASTER CONTROL RELAY (MCR) is engaged.
DISPENSER SYSTEM STOP	PB1252	Push this button to disengage the MCR and signal the external controller that an Dispenser System Stop condition is in effect. The MCR will remain disengaged until the MASTER START button is pressed.
MASTER START / STOP RESET	PB1251	Push this button to restart the PrecisionFlo module after power is applied to the module or the DISPENSER SYSTEM STOP button has been pressed. This engages the MCR and signal the PrecisionFlo processor that the module has power applied.

Connector Pin-outs

These pin-outs are for the connectors on the side of the PrecisionFlo Control Assembly cabinet. For descriptions of the signals, see the tables beginning on page 66.

Motor Power (MP)

Contacts	Connects to
A	+ motor
B	– motor
C	+ thermistor
D	– thermistor
E	motor gnd
F	shield

Robot Analog Receptacle (RAR)

Contacts	Connects to
1	+ command
2	– command
3	– air shaping
4	+ air shaping
5	+12 Vdc
6	12 Vdc common
7	no connection
8	shield

Flow Meter (FM)

Contacts	Connects to
A	+12 Vdc
B	dc common
C	flow meter signal
D	gnd
E	shield

Motor Sensor (MS)

Contacts	Connects to
A	+12 Vdc (200 ohms resistance)
B	dc common
C	outlet pressure sensor signal
D	inlet pressure sensor signal
E	shield

Pendant (TP)

Contacts	Connects to
A	in
B	out
C	5 Vdc common
D	+5 Vdc
E	shield

I/O

Con-tacts	Connects to	Con-tacts	Connects to
A1	style bit 4 (input)	D1	fault acknowledge (input)
A2	data bit 0 (output)	D2	dispense (input)
A3	measure volume (input)	D3	style bit 0 (input)
A4	24 Vdc common	D4	24 Vdc
A5	data bit 4 (output)	D5	style bit 3 (input)
A6	gnd	D6	dispenser ready (output)
A7	——	D7	style bit 1 (input)
A8	request volume (input)	D8	style bit 5 (input)
A9	——	D9	data bit 2 (output)
A10	——	D10	volume valid (output)
A11	——	D11	MCR enabled
A12	——	D12	——
A13	——	D13	style bit 2 (input)
A14	——	D14	data bit 1 (output)
A15	——	D15	data bit 3 (output)
A16	——	D16	fault strobe (output)

Connector Pin-outs

Operations (OP)

Contacts	Connects to
A	+ 24 V
B	24 V common
C	gun solenoid
D	–
E	closer solenoid
F	command + (servo pressure valve)
G	command – (servo pressure valve)
H	+12 V
J	12 V common
K	signal (auxiliary pressure transducer)
L	common (auxiliary pressure transducer)
M	ground
S	shield

Appendix A. Hand Pendant Operation

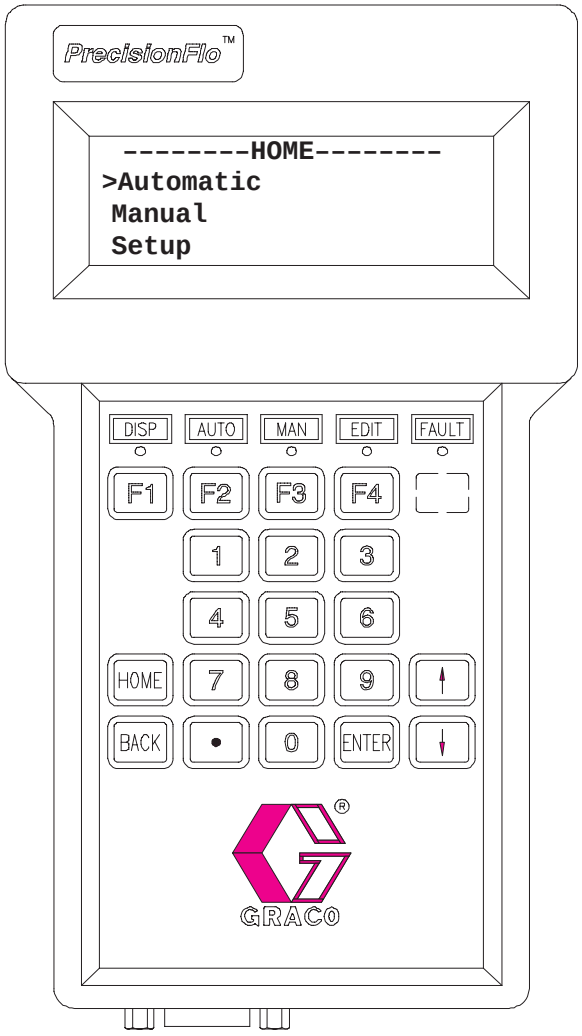
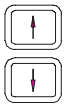


Fig. 43

Use the PrecisionFlo Control Pendant (Fig. 43) to communicate with the PrecisionFlo module.

For a complete map of the PrecisionFlo menu structure, see page 51.

To:	Do this:
Select from the menu	 1. Use the UP and DOWN arrow keys to move the cursor to your choice.  2. Press **[ENTER]**.
Signal that you have completed entering information into a field or screen	 Press the **[ENTER]** key.
Move to the next field or previous field	Use either the:  UP arrow key  DOWN arrow key
Return to the previous menu	 Press the **[BACK]** key.
Return directly to the HOME menu	 Press the **[HOME]** key.
Enter data in response to screen prompts	1. Key in numbers.  2. Press **[ENTER]**. PrecisionFlo accepts the data.
Resume operation after an alarm has been triggered	 Press the **[F1]** key.
Change language of display from HOME menu	 Press the **[.]** key until the display appears in the language you want (American English, French or German)

Appendix B. Configuring the Hand Pendant

You must set three parameters on the pendant: the display contrast, baud rate, and data format.

During the set-up procedure, the pendant automatically steps to the next parameter that needs to be configured. To select a setting for a parameter, use:

- **[F4]** (30) to step down through the selections
- [blank] (31) to step up through the selections
- **[F3]** (29) to save a selection

To configure the control assembly's pendant, follow the procedure below.

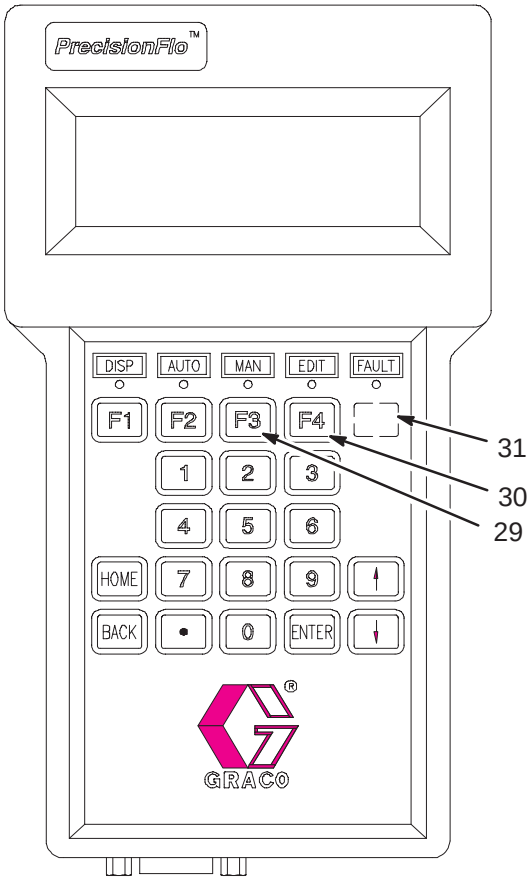


Fig. 44

1. Make sure the pendant and pendant cable are connected to the control assembly.
2. Remove power from the control assembly.
3. Hold in the **[ENTER]** key and turn on power to the Control Assy. The pendant displays the software version number.
4. Release the **[ENTER]** key and you see:

   `CONTRAST`
5. Adjust the display contrast.
   a. Step through the selections, until the display is at the desired contrast.
   b. Save your selection. The pendant displays:

      `BR:XXXX`
6. Adjust the baud rate.
   a. Step through the selections until the display shows

      `BR:9600`
   b. Save your selection. The pendant displays:

      `DF: XXX`
7. Set the data format.
   a. Step through the selections until the display shows:

      `DF: 8n1`
   b. Save your selection.
8. To complete the pendant set-up, press **[F3]** again.
9. If you need to change a setting, turn the control assembly's power off, then return to step 1.

Appendix C. Changing the Software Chips

This appendix describes servicing the following components in the PrecisionFlo control assembly box:

- Service Control Board Assembly
- Current/Temperature Board Assembly

⚠ WARNING

ELECTRIC SHOCK HAZARD
Installing and servicing this equipment requires access to parts which could cause an electric shock or other serious injury if the work is not performed properly.

- Do not service this equipment unless you are trained and qualified.
- The power to the PrecisionFlo Control must be off before you begin to change the software.

⚠ CAUTION

The service technician and the equipment must be grounded to avoid static electricity discharge, which can damage electronic components. It is recommended that the technician wear a static-strap.

NOTE: Have the system binder (a collection of manuals and diagrams in a three-ring binder, supplied by Graco) available to refer to.

Installing the New Software

To install the new software, do the following:

1. Turn off the power to the PrecisionFlo Control.
2. Locate the control board (32) in the control box assembly. See Fig. 45.

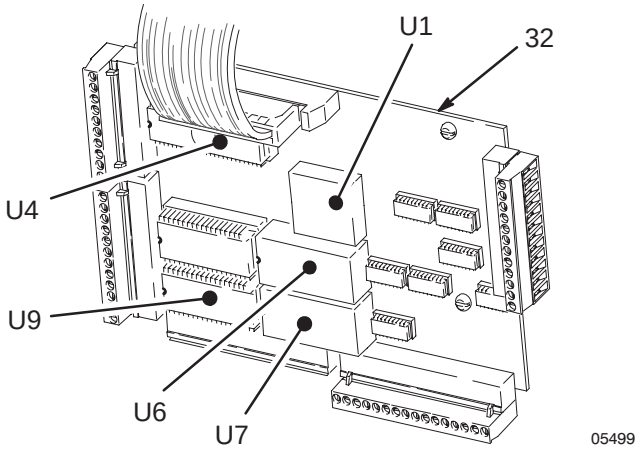


Fig. 45

3. Locate the software chips U6 and U7 on the control board (32). Note the direction of the chips.
4. Use an I.C. extraction tool (33) to remove the old software chips. Pull the chips directly up. See Fig. 46.

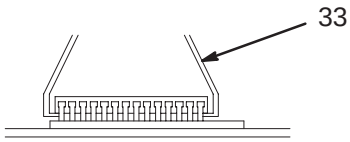


Fig. 46

To remove the software chips without an extraction tool, carefully pry the chips out evenly on both sides. See Fig. 47.

Fig. 47

5. Install the new software chips. Make sure chips U6 and U7 are placed in their proper locations. Verify the chips are facing the correct direction and all the pins are in the holes. See Fig. 48.

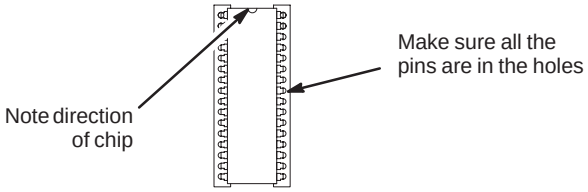


Fig. 48

6. Set the proper parameters in the setup program.

Service Control Board

Electrical Troubleshooting

Have the following items available before you begin troubleshooting.

- PrecisionFlo system binder (collection of manuals and diagrams in a three-ring binder, supplied by Graco)
- Voltmeter that is capable of reading values in ac and dc voltage.
- Small standard screwdriver

Appendix C. Changing the Software Chips

Control Component Identification

There are four major control components:

- Power Supply
- Service Control Board
- Current/Temperature Board
- Pendant

Before you troubleshoot the PrecisionFlo Control, it is important to understand what the control components are and what they do.

Power Supply – See the electrical diagram in the system binder

The power supply consists of several transformers that convert the 110 or 220 Vac power supplied to the system into four different dc voltages (+24,+5, +12, and –12). These dc voltages are required for the system to operate.

Service Control Board

The service control board does all of the math. It monitors the regulator pressure and sends signals to the motor control. It retains the set points in memory, and sounds an alarm if a problem occurs.

The service control board holds five major integrated circuit chips: two PrecisionFlo program chips (U6 and U7), one micro-control chip (U4), one static ram chip (U9), and a CPU chip (U1).

The service control board can only accept and send out signals that are no greater than +5 Vdc.

Current/Temperature Board

The current/temperature board provides voltage isolation and signal conditioning for the current and temperature signals that the PrecisionFlo motor sends to the control board.

Pendant

The pendant hooks directly to the PrecisionFlo computer and communicates with it through RS–232 communication.

The function of the pendant is similar to the function of a computer keyboard and monitor. The pendant allows the operator to see information about the PrecisionFlo operation and to make changes to the operation.

Checking for Control Panel DC Voltage Problems

⚠ WARNING

ELECTRIC SHOCK HAZARD
High voltage is present when performing the following voltage checks, which could cause an electric shock injury if the work is not performed properly. Do not service this equipment unless you are trained and qualified.

NOTE:

- If any of the voltages are not present while following steps 1 to 5 below, find the problem and fix it before continuing to troubleshoot.
- If the correct voltages are present and the software is installed correctly, replace the control board if the problem continues. The control board cannot be repaired, it must be replaced.

1. Verify that all dc common terminals are connected together.
2. Verify that the main power switch on the front of the PrecisionFlo enclosure is on. Check all of the dc voltages on the power supply outputs. There should be +5, +12, –12, and +24 Vdc. See your system binder for the wire numbers.
3. Verify that the correct dc voltages are going to the control board. There should be +5, +12, and –12 Vdc. See your system binder for the wire numbers.
4. Verify that the correct dc voltage is going to the current/temperature board. It should be +5 Vdc. See your system binder for the wire numbers.
5. Verify that the dc voltages are on all other dc terminals inside the control panel. See your system binder for the terminal numbers.

Appendix D. Door Pendant Operation

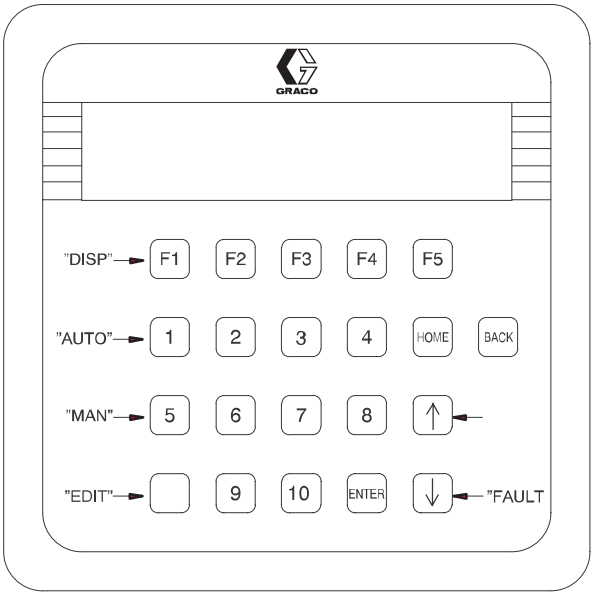
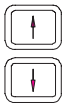


Fig. 49

Use the PrecisionFlo door pendant (Fig. 49) to communicate with the PrecisionFlo module.

For a complete map of the PrecisionFlo menu structure, see page 51.

To:	Do this:
Select from the menu	 1. Use the UP and DOWN arrow keys to move the cursor to your choice.  2. Press **[ENTER]**.
Signal that you have completed entering information into a field or screen	 Press the **[ENTER]** key.
Move to the next field or previous field	Use either the:  UP arrow key  DOWN arrow key
Return to the previous menu	 Press the **[BACK]** key.
Return directly to the HOME menu	 Press the **[HOME]** key.
Enter data in response to screen prompts	1. Key in numbers.  2. Press **[ENTER]**. PrecisionFlo accepts the data.
Resume operation after an alarm has been triggered	 Press the **[F1]** key.
Change language of display from HOME menu	 Press the **[.]** key until the display appears in the language you want (American English, French or German)

Appendix E. Configuring the Door Pendant

You must set three parameters on the pendant: the display contrast, baud rate, and data format.

During the set-up procedure, the pendant automatically steps to the next parameter that needs to be configured. To select a setting for a parameter, use:

- **[F3]** (3) to save a selection
- **[F4]** (4) to step down through the selections
- **[F5]**(5) to step up through the selections

To configure the control assembly's pendant, follow the procedure below.

1. Make sure the pendant and pendant cable are connected to the control assembly.
2. Remove power from the control assembly.
3. Hold in the **[ENTER]** key and turn on power to the Control Assy. The pendant displays the software version number.
4. Release the **[ENTER]** key and you see:

   `CONTRAST`

5. Adjust the display contrast.
   a. Step through the selections, until the display is at the desired contrast.
   b. Save your selection. The pendant displays:

      `BR:XXXX`

6. Adjust the baud rate.
   a. Step through the selections until the display shows

      `BR:9600`

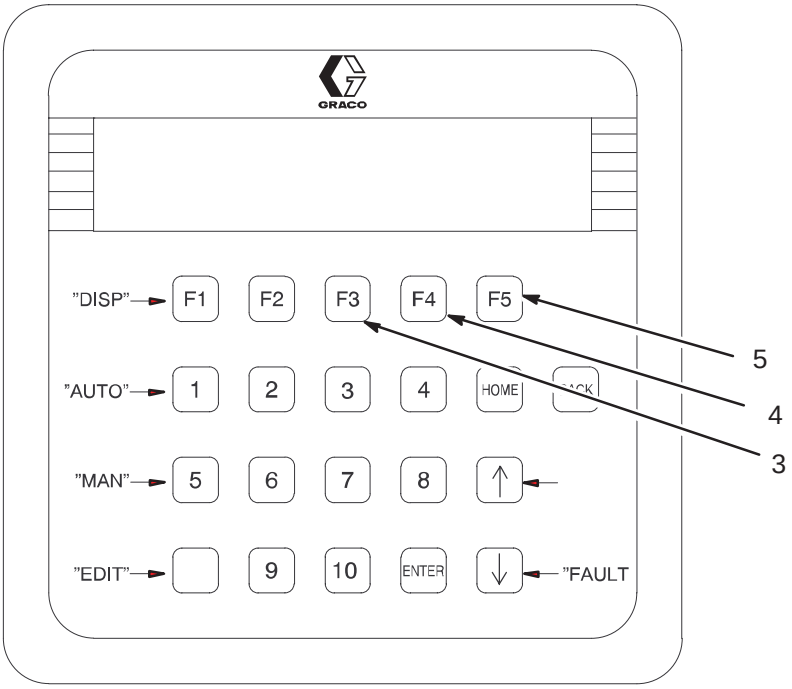
   b. Save your selection. The pendant displays:

      `DF: XXX`

7. Set the data format.
   a. Step through the selections until the display shows:

      `DF: 8n1`

   b. Save your selection.
8. To complete the pendant set-up, press **[F3]** again.
9. If you need to change a setting, turn the control assembly's power off, then return to step 1.



8652A

Fig. 50

Technical Data

Control Assemblies 918463 and 918644	Specifications
Weight	Approx. 110 lbs. (50.0 kg)
Dimensions	Control Assembly Enclosure, either: • For 918463: 30 inches (762 mm) high by 24 inches (610 mm) wide by 10 inches (254 mm) deep • For 918644: 30 inches (762 mm) high by 25 inches (635 mm) wide by 10 inches (254 mm) deep
Control Enclosure Footprint	5 feet (1.53 meters) by 5 feet (1.53 meters) including space to allow control enclosure to be opened for servicing.
Electrical Input Requirement	120 VAC ±10%, Single Phase, 60 Hz., 13.3 Ampere maximum current.
Circuit Breaker Rating	15 Amperes
Flow Command Input Signal Voltage	0–10 Volts D.C.*, minimum impedance 44 KΩ
Flow Meter Option Output Signal Voltage	12–30 Volts D.C.
Control Assembly Storage Temperature	–25° to +55° C (–13° F to + 131° F)

* 4–20 mA. current mode flow control is available as a factory configuration of the control board. Contact Graco Technical Assistance for information.

Related Publications

Product	Form#
PrecisionFlo Metering Valve	308601
PrecisionFlo Module	310540

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