Instructions

309738 rev.G

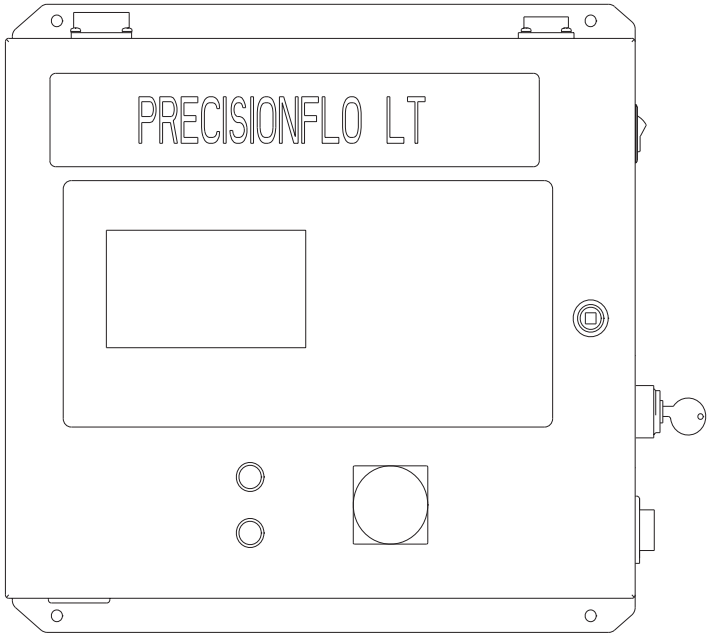
Important Safety Instructions
Read all warnings and instructions in this manual.
Save these instructions.

PrecisionFlo LT™ Standard, Series B

Electronically controlled fluid dispensing packages

- **Pneumatically operated fluid regulators**
- **EasyKey keypad interface**

See page 2 for a list of models and maximum working pressures.



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Graco Inc. P.O. Box 1441 Minneapolis, MN 55440-1441

List of Models

Control Modules

PrecisionFlo LT Control Module Number	Description	Power Supply Voltage	Power Requirement
234129, Series B	Standard PrecisionFlo LT Control Unit	93 - 264 VAC, 50-60 HZ	Full Load Amps - 1 Fused Amps - 2

Fluid Modules

Precision-Flo LT Fluid Module Number	Description	Maximum Fluid Inlet Pressure	Regulated Fluid Pressure	Maximum Inbound Air Pressure
234168	Ambient cartridge style regulator with no flow meter	6000 psi (41 MPa, 414 bar)	100 - 4500 psi (0.7-31 MPa, 7-310 bar)	100 psi (0.7 MPa, 7 bar)
234165	Ambient cartridge style regulator with a G3000 flow meter	4000 psi (28 MPa, 276 bar)	100 - 4000 psi (0.7-28 MPa, 7-276 bar)	100 psi (0.7 MPa, 7 bar)
234166	Ambient cartridge style regulator with a G3000HR flow meter	4000 psi (28 MPa, 276 bar)	100 - 4000 psi (0.7-28 MPa, 7-276 bar)	100 psi (0.7 MPa, 7 bar)
234167	Ambient cartridge style regulator with a Graco helical flow meter	6000 psi (41 MPa, 414 bar)	100 - 4500 psi (0.7-31 MPa, 7-310 bar)	100 psi (0.7 MPa, 7 bar)
234195	Ambient cartridge style regulator with a Graco high resolution helical flow meter	6000 psi (41 MPa, 414 bar)	100 - 4500 psi (0.7-31 MPa, 7-310 bar)	100 psi (0.7 MPa, 7 bar)
234170	Ambient mastic style regulator with no flow meter	5000 psi (34.4 MPa, 344 bar)	100 - 4500 psi (0.7-31 MPa, 7-310 bar)	100 psi (0.7 MPa, 7 bar)
234169	Ambient mastic style regulator with a Graco helical flow meter	5000 psi (34.4 MPa, 344 bar)	100 - 4500 psi (0.7-31 MPa, 7-310 bar)	100 psi (0.7 MPa, 7 bar)
234196	Ambient mastic style regulator with a Graco high resolution helical flow meter	5000 psi (34.4 MPa, 344 bar)	100 - 4500 psi (0.7-31 MPa, 7-310 bar)	100 psi (0.7 MPa, 7 bar)
234193	Heated mastic style regulator with no flow meter	5000 psi (34.4 MPa, 344 bar)	100 - 3500 psi (0.7-24.1 MPa, 7-241 bar)	65 psi (0.45 MPa, 4.5 bar)
234194	Heated mastic style regulator with a heated Graco helical flow meter	5000 psi (34.4 MPa, 344 bar)	100 - 3500 psi (0.7-24.1 MPa, 7-241 bar)	65 psi (0.45 MPa, 4.5 bar)

Standard Systems

PrecisionFlo LT System Number	Description	Configurator Code	Control Module	Fluid Module	Cables
234284	Advanced PFlo LT Control with Ambient Cartridge Regulator and Helical Gear Meter	PFlo LT-A-2-5-04-1	234190	234167	I/O-117752
234285	Advanced PFlo LT Control with a Heated Mastic Regulator and Heated Helical Flow Meter	PFlo LT-A-2-5-10-1	234190	234194	Automation-117774

Contents

Manual Conventions

Warning

WARNING


A warning alerts you to possible serious injury or death if you do not follow instructions.

Symbols, such as fire and explosion (shown), alert you to a specific hazard and direct you to read the indicated hazard warnings beginning on page 6.

Caution

CAUTION

A caution alerts you to possible equipment damage or destruction if you do not follow instructions.

Note

A note indicates additional helpful information.

WARNINGS

EQUIPMENT MISUSE HAZARD

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

- This equipment is for professional use only.
- Use the equipment only for its intended purpose. Call your Graco distributor for information.
- Read all instruction manuals, tags, and labels before operating equipment.
- Check equipment daily. Repair or replace worn or damaged parts immediately.
- Do not alter or modify this equipment. Use only Graco parts and accessories.
- **Do not exceed the maximum working pressure of the lowest rated system component.**
- Be sure that all spray/dispensing equipment and accessories are rated to withstand the maximum working pressure of the pump. Do not exceed the maximum working pressure of any component or accessory used in the system.
- Route hoses and cables away from traffic areas, sharp edges, moving parts, and hot surfaces.
- Do not exceed the maximum working temperature of the lowest rated system hose.
- Use fluids and solvents that are compatible with equipment wetted parts. See **Configuring Software** in all equipment manuals. Read fluid and solvent manufacturer's warnings.
- Always wear protective eyewear, gloves, clothing, and respirator as recommended by the fluid and solvent manufacturer.
- Comply with all applicable local, state, and national fire, electrical, and safety regulations.

⚠ 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 dispensed.
- Do not use this equipment with flammable liquids.
- Keep the dispense area free of debris, including solvent, rags, and gasoline.
- 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.
- Be 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.
- Be sure all electrical equipment is installed and operated in compliance with applicable codes.
- Be sure power is disconnected when servicing and repairing equipment.
- Before operating the equipment, extinguish all open flames or pilot lights in the dispense area.
- Do not smoke in the dispensing area.
- Keep liquids away from the electrical components.
- Disconnect electrical power at the main switch before servicing the equipment.

TOXIC FLUID OR FUMES HAZARD

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

- Provide fresh air ventilation to avoid the buildup of vapors from the fluid being dispensed.
- Know the specific hazards of the fluid you are using.
- Store hazardous fluid in an approved container. Dispose of hazardous fluid according to all local, state and national guidelines.
- Always wear protective eyewear, gloves, clothing and respirator as recommended by the fluid and solvent manufacturer.
- Avoid exposure to heated material fumes.

⚠ WARNING

SKIN INJECTION HAZARD

Spray from the gun, 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 surgical attention.**
- Do not stop or deflect fluid leaks with you hand, body, glove, or rag.
- Follow the **Pressure Relief Procedure** on page 30 and in your separate equipment manuals whenever you are instructed to: relieve pressure, stop dispensing, clean, check, or service the equipment; or install or clean a 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.
- Never wipe off build-up around the nozzle or inlet cap until pressure is fully relieved.

MOVING PARTS HAZARD

Moving parts can pinch fingers.

- Keep clear of any moving parts when starting or operating the equipment.

HEAVY EQUIPMENT

Use adequate personnel and support devices when mounting, moving, or handling the control unit to prevent equipment damage or personal injury.

HOT SURFACE AND FLUID HAZARD

Heated fluid can cause severe burns and can cause equipment surfaces to become very hot.

- Wear protective gloves and clothing when operating this equipment in a heated system.
- Do not touch the metal heat sink when the surface is hot.
- Allow the equipment to cool thoroughly before servicing.
- Some heated systems are designed to dispense Polyurethane (PUR) heated materials. PUR Systems are supplied with ventilation hoods, and require proper ventilation and specifically designed system components.

Model Identification

PrecisionFlo LT

Graco's PrecisionFlo LT is an electronically controlled fluid regulating package designed to meter and dispense adhesives and sealants. Your equipment was likely ordered as a configured package to fit your applicator.

Model Number Identification

On your control unit, there is an ID plate with a model number on it. Use the table on this page for explanations of each code letter and to define what equipment was ordered as part of the configured package from Graco.

Typical Model Number

LT-A -___ - ___ - ___ - ___

Code A B C D

Example: LT-A-1-2-04-5

Code A: Control Unit

Options 1-3

1. Standard
2. Advanced
3. Automation Integrated

Code C: Fluid Regulator

Options 01-10

01. Ambient Cartridge Regulator / No Flow Meter
02. Ambient Cartridge Regulator / G3000 Flow Meter
03. Ambient Cartridge Regulator / G3000 HR Flow Meter
04. Ambient Cartridge Regulator / Helical Flow Meter
05. Ambient Cartridge Regulator / HR Helical Flow Meter
06. Ambient Mastic Regulator / No Flow Meter
07. Ambient Mastic Regulator / Helical Flow Meter
08. Ambient Mastic Regulator / HR Helical Flow Meter
09. Heated Mastic Regulator / No Flow Meter
10. Heated Mastic Regulator / Helical Flow Meter

Code B: Operations Cable

Options 1-N

1. High Flex 25'
2. High Flex 60'
3. High Flex 125'
4. Standard Flex 25'
5. Standard Flex 60'
6. Standard Flex 125'
7. Low Flex 25'
8. Low Flex 60'
9. Low Flex 125'

N. None

Code D: Language

Options 1-8

1. English
2. French
3. German
4. Italian
5. Japanese
6. Korean
7. Portuguese
8. Spanish

Overview

What This Manual Includes

This manual provides detailed information about the PrecisionFlo LT control unit and operation of the PrecisionFlo LT system. Specific information on the fluid module for example is contained in other instruction forms supplied with each component as part of the PrecisionFlo LT system.

Instruction Manual Conventions

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

Unless otherwise specified, the step-by-step procedures in this manual must be performed in numerical order. Procedures that contain a list preceded by bullets can be performed in any order.

Abbreviations and Acronyms

Abbreviation:	Stands For:
COM	common
FM	flow meter
GND	ground
msec	milliseconds
OP	operations cable
psi	pounds per square inch
PVC	poly vinyl chloride
V	volts
VAC	volts AC
VDC	volts DC

PrecisionFlo LT Definitions

Component	Description
Control Unit	The PrecisionFlo LT control unit contains the electronics used to control the fluid module.
PrecisionFlo LT System	The control unit, fluid module, and all cables and sensors used to measure and control the fluid application.
Automation Controller	An external electronic (automation) system having some control interaction via electronic signals with the PrecisionFlo LT system.
EasyKey	EasyKey is the type of interface used to set up, display, operate and monitor the PrecisionFlo LT system.
Fluid Module	The fluid module includes components that control and monitor fluid dispensing, such as a flow meter and regulator.

PrecisionFlo LT Module Overview

The block diagram in FIG. 1 shows an example of the PrecisionFlo LT module, robot I/O signals, and wire numbers.

The fluid metering assembly contains the components that control and monitor fluid dispensing. It can be attached to an automation arm or mounted on a pedestal.

The control assembly sends continuous voltage signals to the PrecisionFlo LT fluid assembly regulator to control fluid pressure and the opening and closing of the dispense valve.

The control assembly receives input from the automation controller. The control assembly uses these inputs to determine the signals it should send to the fluid metering assembly.

The PrecisionFlo LT fluid regulator is electrically controlled by the PrecisionFlo LT module, and consistent material flow is assured by a closed-loop pressure or closed-loop flow control design. The module responds to automation-supplied signals to provide an accurate and consistent output flow based on a comparison of actual to desired flow rates. The pneumatic regulator uses air pressure to control fluid pressure and to provide fast response to electronic commands and ensure a precisely controlled, continuous flow of material.

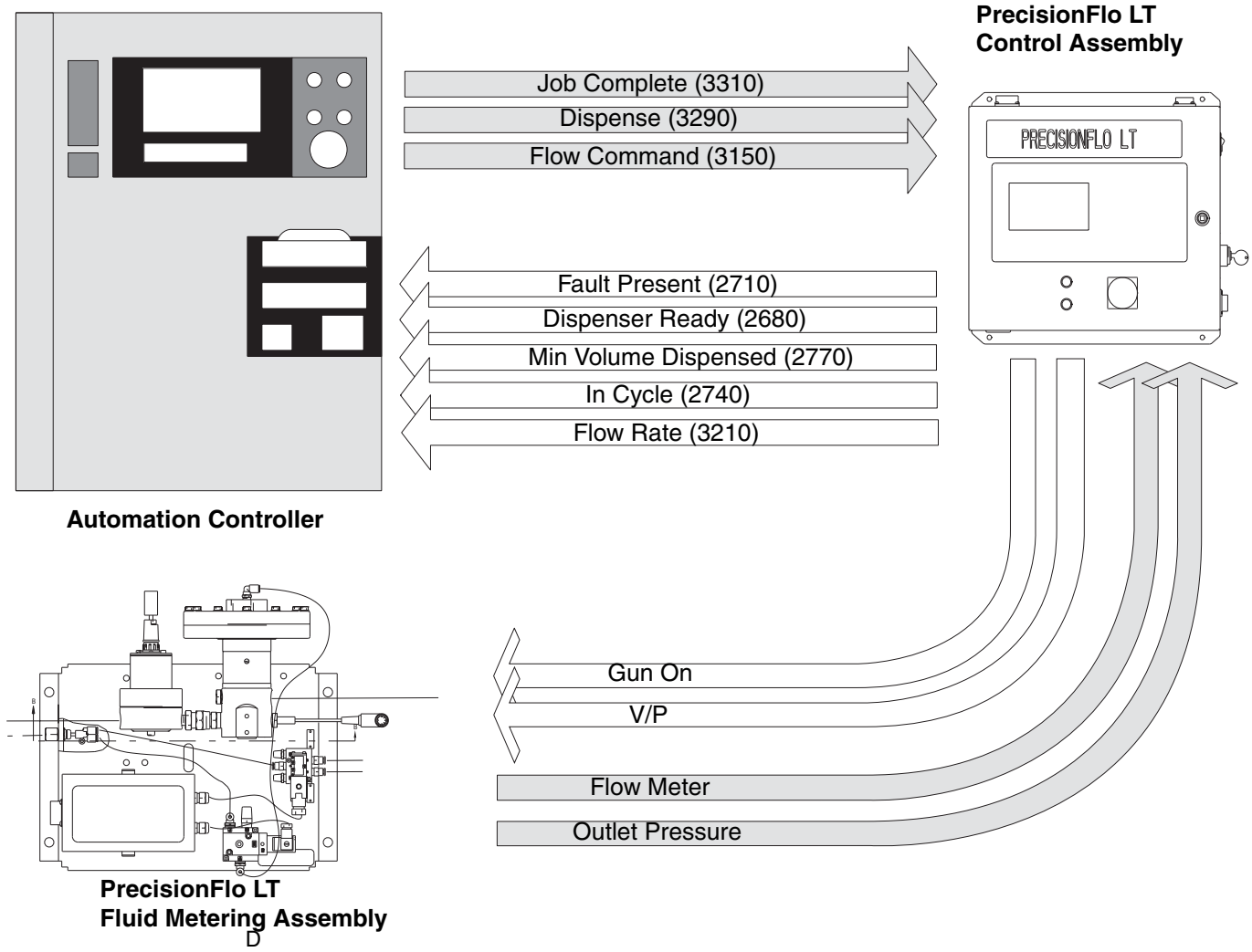
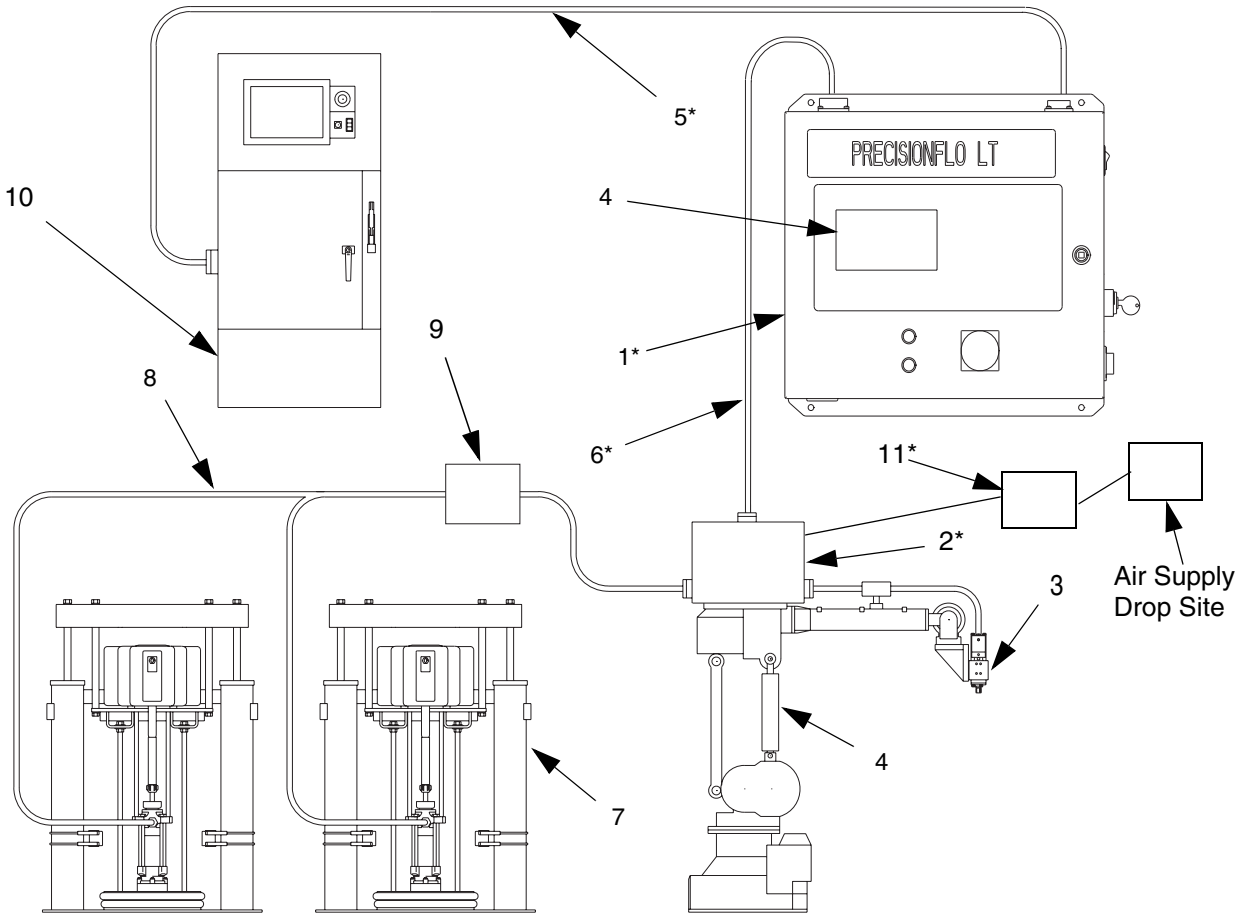


FIG. 1

Typical PrecisionFlo LT Configurations

Major components in a typical PrecisionFlo LT installation.



Note: For proper operation of filter assembly, filter orientation must be such that the bowls are orientated so the bowls are always perpendicular to the ground (i.e. do not attach to robotic arms, as the filters may not remain in the proper orientation.)

FIG. 2

No.	Description
1*	PFlo Control Assembly
2*	PFlo Fluid Metering Assembly
3	Applicator/Dispense Valve
4	User Interface
5*	PFlo LT Automation Control Cable Interface
6*	PFlo LT Operations (OP) Cable
7	Fluid Supply System
8	Fluid Supply Header
9	Filter Module
10	Automation Controller
11*	Filter Assembly

* included

Typical PrecisionFlo LT Configurations

Optional Temperature Conditioned System

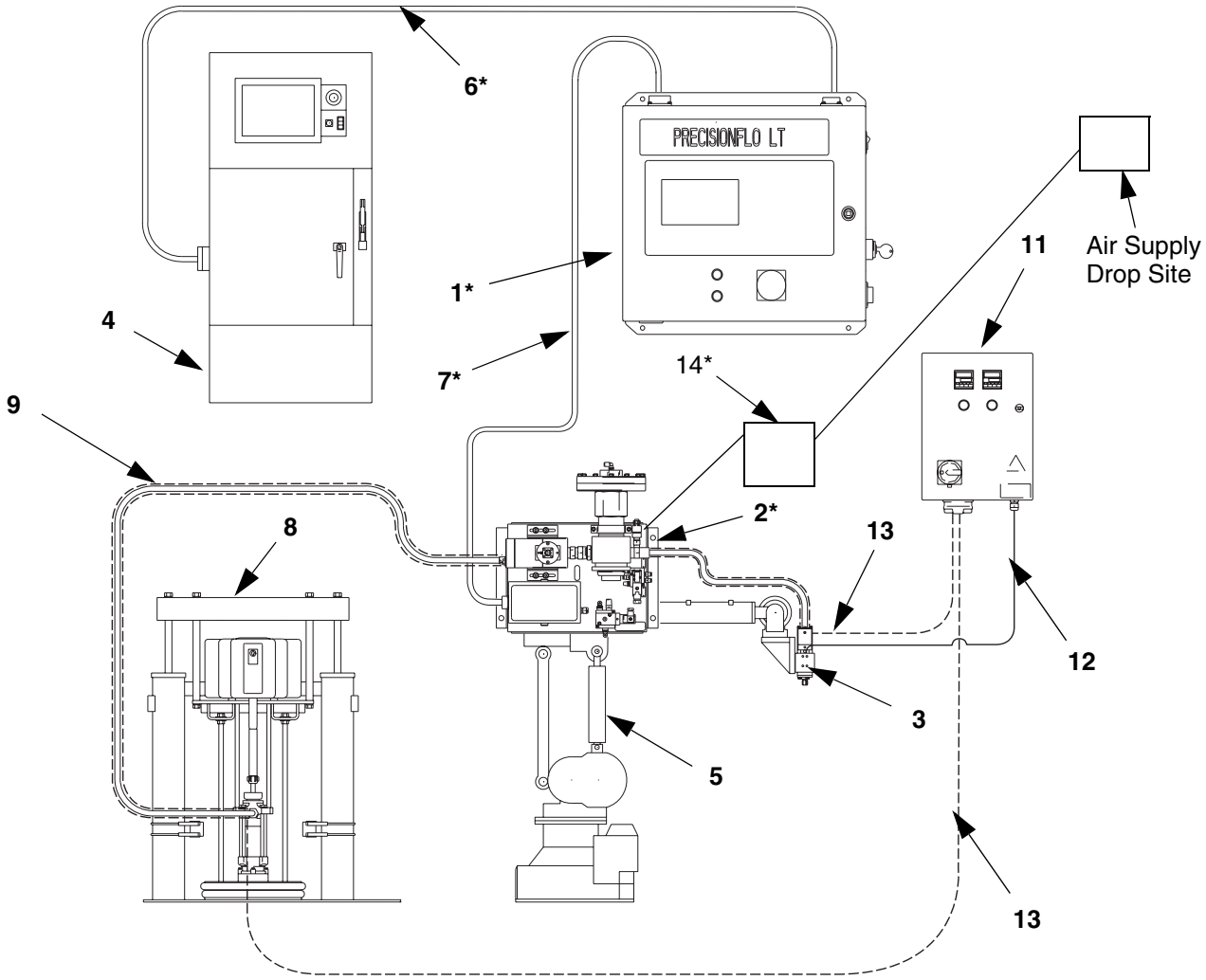


FIG. 3

No.	Description
1*	PFlo LT Control Assembly
2*	PFlo LT Fluid Metering Assembly
3	Water Conditioned Applicator / Dispense Valve
4	Automation Controller
5	Sealer Automation
6*	PFlo LT Automation Control Cable Interface
7*	PFlo LT Operations (OP) cable
8	Fluid Supply System
9	Water Jacketed Supply Hose
10	Water Jacketed Dispense Hose
11	Temperature Control Unit
12	RTD Cable
13	Water Hose
14*	Filter Assembly

* included

Typical PrecisionFlo LT Configurations

Major components in a typical heated PrecisionFlo LT installation.

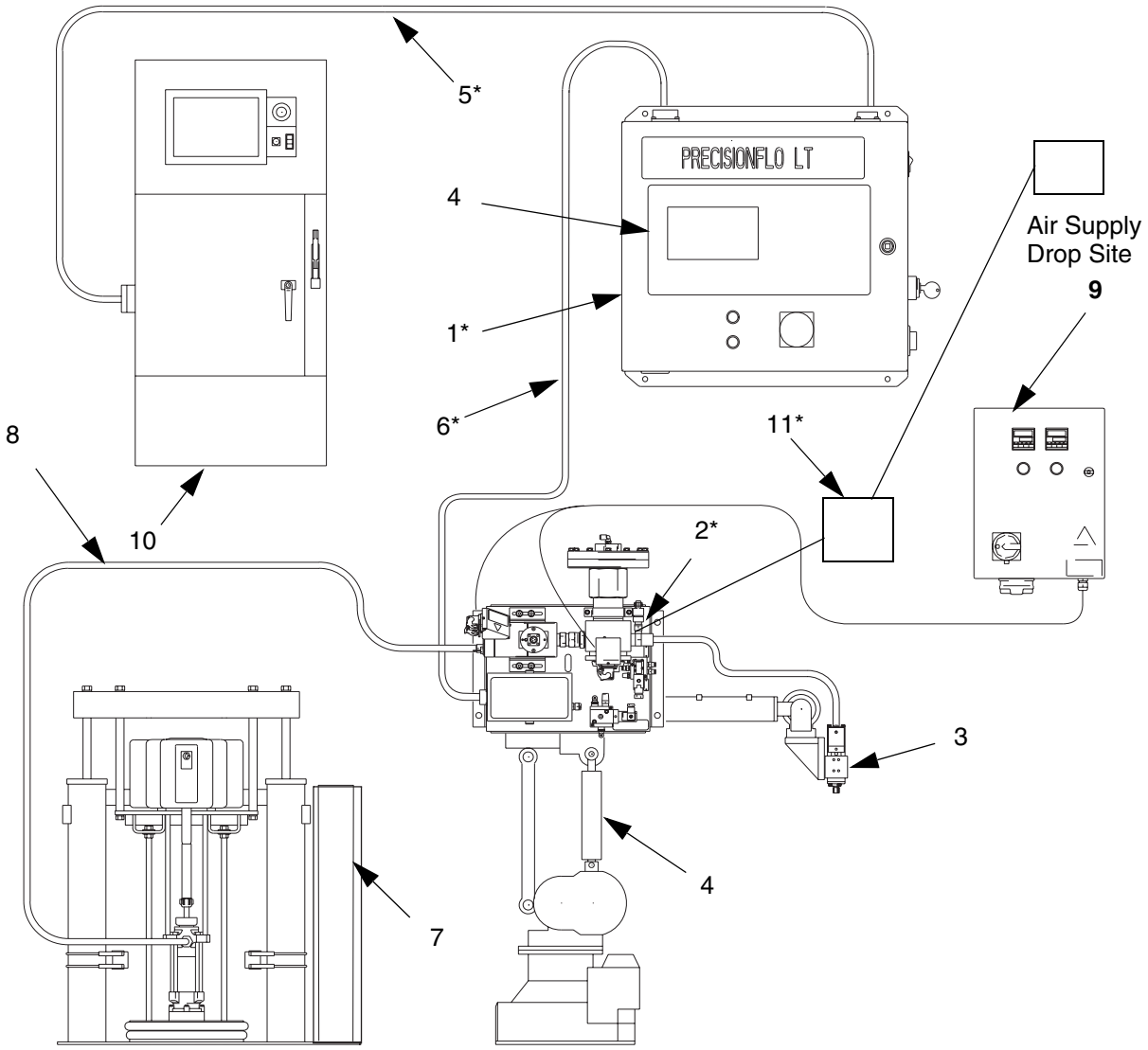


FIG. 4

No.	Description
1*	PFlo LT Control Assembly
2*	PFlo LT Fluid Metering Assembly
3	Applicator/Dispense Valve
4	Sealer automation
5*	PFlo LT Automation Control Cable Interface
6*	PFlo LT Operations (OP) Cable
7	Heated Fluid Supply System
8	Fluid Supply Hose
9	2 - Zone Accessory Heat Control
10	Automation Controller

* included

Fluid Metering Assembly Overview

Pneumatic Fluid Metering Assembly

The fluid metering assembly in FIG. 5 can be attached to an automation arm, or mounted on a pedestal. Main components of the fluid metering assembly are:

- PrecisionFlo LT pneumatic fluid regulator (A)
- Optional flow meter (B) to precisely measure the amount of fluid dispensed
- Solenoid air valve (C) that controls a dispense valve
- Voltage to pressure (V/P) controller (D) for adjusting the air pressure to the fluid regulator (A)

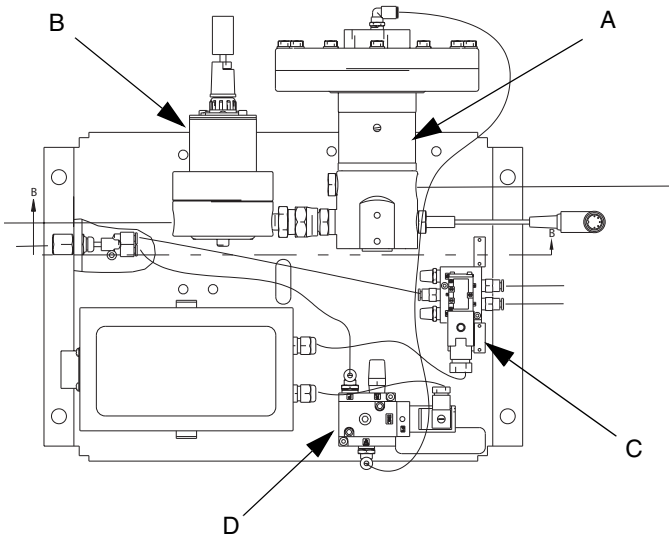


FIG. 5

PrecisionFlo LT Pneumatic Fluid Regulator

The PrecisionFlo LT pneumatic fluid regulator is a precision fluid pressure regulator that uses air pressure to control fluid pressure and to provide fast response to electronic commands and ensure a precisely controlled, continuous flow of material.

The PrecisionFlo LT module combines continuous pressure control with the ability to change bead profiles quickly. When used with one of the optional flow meters, the PrecisionFlo LT module automatically adjusts for fluctuations in the operating environment, such as material viscosity, temperature, tip wear, and automation speed, while maintaining the desired dispense rate. The module responds to automation-supplied signals to provide an accurate and consistent output flow based on a comparison of actual to desired flow rates.

Typical Fluid Applications

- PVC sealer
- Plastisols
- Sound deadening materials
- Body panel reinforcement
- Silicones
- Hot melt

Installation

Overview

The basic steps to install a Graco PrecisionFlo LT system are shown below. See the separate component manuals for detailed information.

Installation Steps

1. Mount LT control unit
2. Ground LT control unit
3. Mount fluid plate
4. Connect cables between the LT control unit and:
   a. Junction box of the fluid module (OP cable)
   b. Automation or cell controller (automation I/O cable)
5. Check ground continuity
6. Connect air and fluid lines
   a. Connect fluid lines between fluid module and applicator. Connect fluid supply line and air supply to module
   b. Plumb filter assembly near air drop site that will be used for fluid metering assembly
   c. Connect other fluid and air lines to additional system components as instructed in their manuals
7. Connect control unit to power source

A number of different types of applicators can be used with the system. Refer to the manual for your applicator.

Before Beginning Installation

- Have all system and component documentation available during installation.
- See component manuals for specific data on component requirements. Data presented here applies to the PrecisionFlo LT assemblies only.
- Electrical schematics are included in this manual. Refer to the schematics as required when connecting power and I/O signals.
- Be sure all accessories are adequately sized and pressure-rated to meet system requirements.
- Use the Graco PrecisionFlo LT control unit only with the PrecisionFlo LT fluid module.

Installing the Control Unit

Mounting the Control Unit

WARNING

Read Warnings, page 6.

- Select a location for the PrecisionFlo LT control unit that allows adequate space for installation, service, and use of the equipment. See FIG. 6.
- Mount the control unit so that the disconnect is readily accessible and located 54-67 in. (137-170 cm) above the floor.
- For best viewing, the control display should be 60-64 in. (152-163 cm) from the floor.
- Ensure all fluid lines, cables, and hoses easily reach the components to which they will be connected.
- Ensure there is sufficient clearance around the control unit to run cables to other components.
- Ensure there is safe and easy access to an appropriate electrical power source. The National Electric Code requires 3 ft. (0.91 m) of open space in front of the assembly enclosure.
- Ensure the mounting surface can support the weight of the control unit and the cables attached to it.

8. Secure the PrecisionFlo LT control unit with appropriate size bolts through the 0.31 in. (8 mm) diameter holes in the mounting tabs.

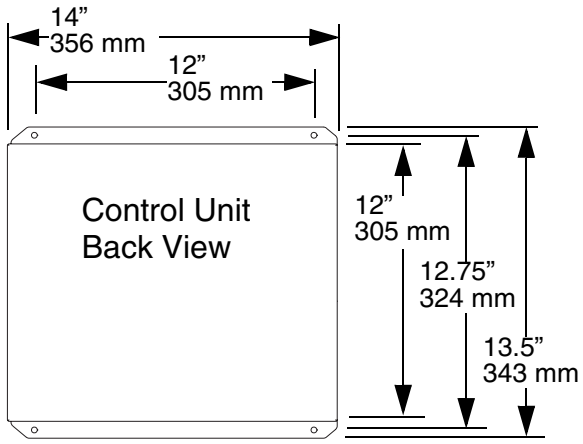


FIG. 6

Electrical Connections

Follow these precautions when grounding, connecting cables, connecting to a power source or making other electrical connections.

⚠ WARNING

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

- The PrecisionFlo LT control unit 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 18 AWG 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.

Read Warnings, page 6.

⚠ CAUTION

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

Grounding Control Unit

⚠ CAUTION

To avoid control voltage differences, ensure that the automation and PrecisionFlo LT equipment are grounded to the same point.

Connect a ground wire from the ground point in the PrecisionFlo LT control enclosure to a true earth ground. See FIG. 7. A 10 AWG, 25 ft. (7.6 m) long ground wire with clamp, Part No. 222011, is supplied.

The PrecisionFlo LT fluid module is grounded to the control unit, using cables provided with the module.

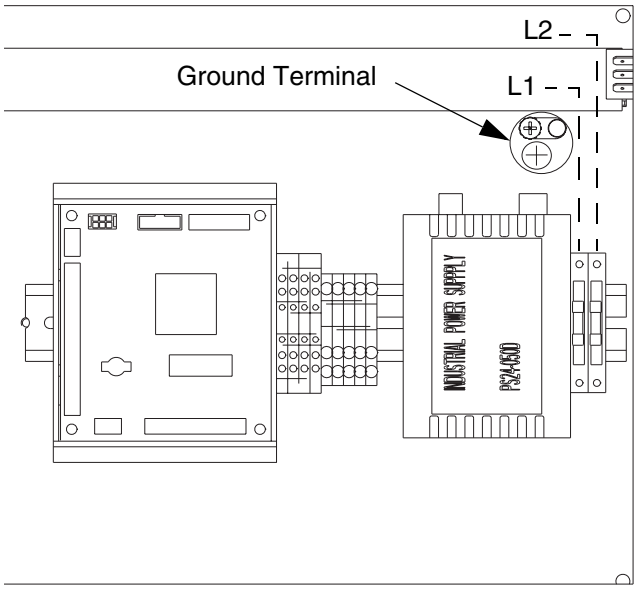


FIG. 7

Connecting to Power Source

WARNING

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.

Read Warnings, page 6.

Have a qualified electrician connect the PrecisionFlo LT control assembly to a grounded electrical source that has the required service ratings, as shown in the Power Requirement table.

To connect the control unit to the power source:

1. Remove a hole plug to use one of the pre-cut enclosure holes or, if necessary for your installation, create an opening in the control assembly enclosure. Protect interior components from metal chips when cutting or drilling.
2. Using the appropriate gauge wire, connect electrical power L1 and L2 to the top of the fuse terminal blocks, see FIG. 7, page 18.
3. Use NEMA 4 cord grip to seal the area where wires enter the enclosure.

Power Requirements:

VAC:	93 - 264
Phase:	1
Hz:	50/60
Full Load Amps.	1
Fused Amps	2

Installing Fluid Metering Assembly

To install the fluid metering assembly hardware:

- Install the PrecisionFlo LT fluid metering assembly.
- Connect the PrecisionFlo LT fluid metering assembly to the control assembly.
- Connect fluid lines and cables.

Installing the Fluid Metering Assembly

WARNING

Read Warnings, page 6.

Preparing to Install the Assembly

Before installing the fluid metering assembly:

- See component manuals for specific data on component requirements. Data presented here pertains to the PrecisionFlo LT fluid metering 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 LT fluid metering assembly with the PrecisionFlo LT control assembly.

Installing the Assembly

WARNING

Read Warnings, page 6.

1. Select a location for the PrecisionFlo LT fluid metering assembly. Keep the following in mind:

- Allow sufficient space for installing the equipment.
- Make sure all fluid lines, cables and hoses easily reach the components to which they will be connected.
- Make sure the fluid metering assembly allows the automation unit to move freely along all axis.
- Make sure the fluid metering assembly provides easy access for servicing its components.

2. Locate and secure the PrecisionFlo LT fluid metering assembly to the automation unit (or other mounting surface) with appropriate size bolts through the 0.42 in. (10.7 mm) diameter holes in the base plate. See the mounting dimensions in **Table 1 - Measurement, inches (mm)** and FIG. 8.

Table 1 - Measurement, inches (mm)

A	16.0 (407)
B	15.0 (381)
C	11.0 (280)
D	8.0 (204)

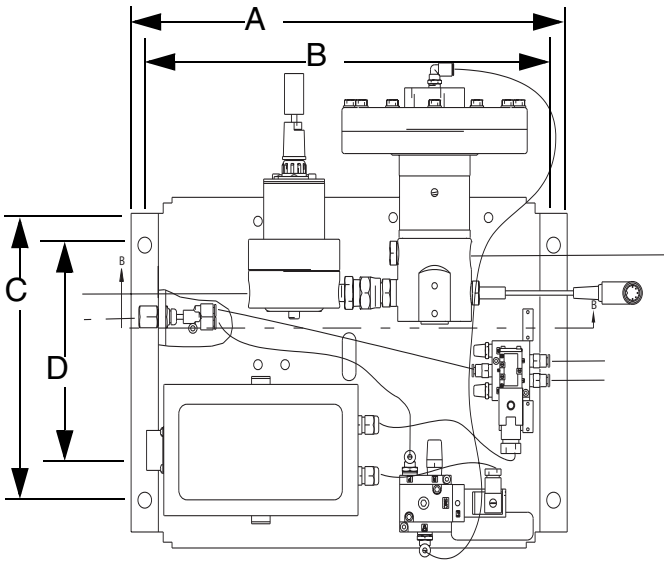


FIG. 8

Connecting Fluid and Air Lines

⚠ CAUTION

Route all fluid and air lines carefully. Avoid pinching and premature wear due to excessive flexing or rubbing. Hose life is directly related to how well they are supported.

Follow the instructions in your separate component manuals to connect air and fluid lines. General guide lines are provided below.

- The PrecisionFlo LT fluid module should be installed on the automation unit or in another appropriate place, as close as practical to the dispense valve.
- Connect a fluid line between the fluid module outlet and the dispense device. Smaller diameter and shorter fluid lines (hoses) will provide better fluid system response.
- Connect a fluid line to the flow meter fluid inlet or regulator inlet if your system does not have a flow meter.
- Air must be clean and dry, between 60-120 psi (0.41 MPa - 4.14 bar). Flush air line before plumbing in air filter assembly (234967). Plumb in air filter assembly near air drop site (upstream of fluid plate module). Adding an air regulator to this line will provide more consistent dispense valve response times.
- Connect an air supply line to the 1/4 npt inlet port on the fluid module(s) air supply inlet.
- Connect 5/32 in. or 4 mm OD air lines from the applicator's solenoid valve to the applicator. Plug any unused solenoid ports.

To maximize system performance keep the dispense hose length and ID as small as the application will allow.

Grounding the Metering Assembly

Grounding the Fluid Metering Assembly

⚠ WARNING

Read Warnings, page 6.

⚠ CAUTION

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

Ground the fluid metering assembly as instructed here and in the individual component manuals. Make sure the fluid metering assembly and its components are installed correctly to ensure proper grounding.

Air and Fluid Hoses

For static dissipation, use only electrically conductive hoses or ground the applicator / dispense valves.

Metering Module

The PrecisionFlo LT fluid metering assembly is grounded to the control assembly through proper connection of the electrical cable provided with the metering module.

Dispense Device

Follow the grounding instructions in the dispense device documentation.

Installing Cable Assemblies

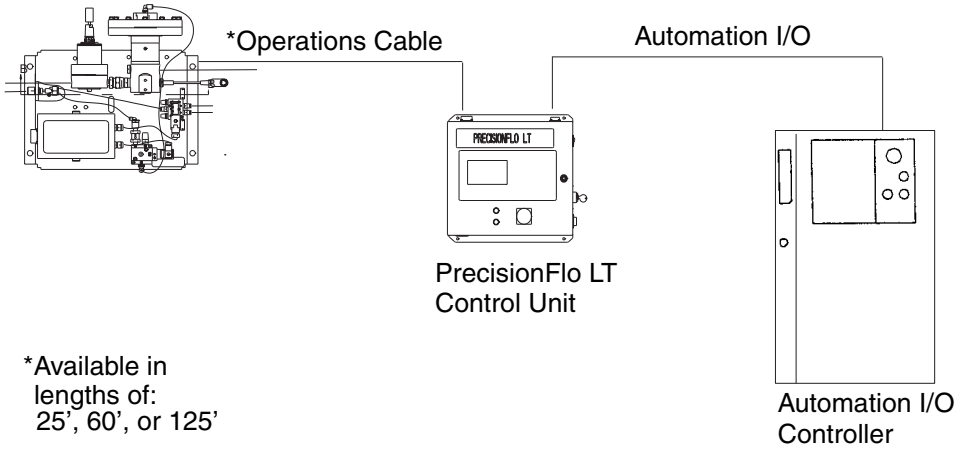


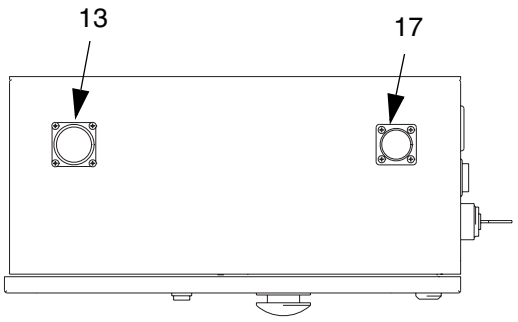
FIG. 9

Fluid Module Cables

Operations Cable (13) - This cable carries signals between the fluid module and the control unit. The applicator solenoid, V/P valve, pressure transducer and flow meter signals are carried through this cable.

Automation I/O Cable (17) - This cable carries signals between the automation controller and the PrecisionFlo LT control unit.

Maximum recommended length of both the operations and automation cable is 125 ft. (38.1 m).



Control Unit - Top View

FIG. 10

⚠ CAUTION
Always make connections to the control assembly with the power off.

Connecting the Operations Cable

Operation cables are offered in three lengths (25, 60, and 125 ft.) and three flexibilities (see page 6 for cable options.)

To connect the operation cable between the control unit and fluid module do the following:

1. Locate the receptacle on the top of the control unit. See Fig. 8.
2. Connect the operation cable to the control unit revceptable.
3. Locate the receptacle on the fluid module junction box.
4. Route the operation cable and conform to the following cable routing requirements:
   - Avoid small bend radii.
   - Avoid pinch points.
   - Avoid cable pulling or stretching.
   - Keep cables from rubbing against other components or machinery.
   - If a lot of robot wrist motion is required, leave sufficient cable length to allow for the motion, avoiding any cable droops that may interfere with the machinery or substrate.
   - Cable ties should only be used to loosely bundle hoses together. Do not tighten cable ties to the point where cable movement is restricted.
5. Connect the operation cable to the fluid module junction box.
6. Check the connections to ensure the cable is connected correctly.

Installing the Cable Assemblies

⚠ CAUTION

Always make connections to the control assembly with the power off.

Connecting the Automation Control Cable

The PrecisionFlo LT control assembly is provided with an 18-pin receptacle for the automation I/O cable.

Any wiring from an external source such as an automation controller, must follow the automation manufacturer's instructions and must comply with the appropriate codes and standards.

The automation cable has terminated individual leads. The installer will need to configure the proper connector for the automation/cell controller being used. Refer to **Appendix C Theory of Operation** on page 95 and **Appendix A PrecisionFlo LT User Interface** on page 84.

To connect the automaton control cable between the control assembly and the automation perform the following steps:

1. Locate the receptacle on the top of the control assembly. See FIG. 10.
2. Connect the cable assembly to the automation I/O receptacle in FIG. 10.
3. Connect the opposite end of the cable assembly to the applicable terminals or receptacle on the robot controller.

For information about specific control assembly circuitry and connections, read the chart on this page and see the Wiring Diagrams beginning on page 69 and FIG. 10.

4. Check the connections to ensure the cable is connected correctly.

Signal Wire No	Description
Digital Input	
Dispense Gun / 3290	This signal is used to control the opening of the dispense valve.
Job Complete / 3310	This signal can be used to signal the end of a job.
Digital Output	
Dispenser Ready / 2680	This signal indicates to the automation controller that the PrecisionFlo LT unit is ready to dispense.
Fault Present / 2710	This signal indicates to the automation control when a fault is present.
In Cycle / 2740	This signal indicates to the automation control that the PrecisionFlo LT unit is currently in a job cycle.
Minimum Volume Dispensed / 2770	This signal indicates when the minimum amount of material is dispensed.
PFlo LT E-Stop / 2170	This signal indicates to the automation control when the emergency stop is depressed on the PrecisionFlo LT unit.
Analog Input	
Analog Flow Command / 3150	This signal represents the flow or pressure requests from the automation control.
Analog Output	
Actual Flow Rate Signal 3210	Analog output signal of the current system flow rate.
24 VDC / 2120	24 VDC from the PrecisionFlo LT control box.
24 VDC Common / 2121	Digital reference point.
Analog Common / 3170	Analog reference point.
GND	Shield connection.

Checking Ground Continuity

WARNING

To reduce the risk of fire, explosion, or electric shock, the resistance between the supply unit components and true earth grounding must be less than 0.25 ohms.

Read Warnings, page 6.

Have a qualified electrician check the resistance between:

- true earth ground and the panel ground lug
- the application device and the automation unit
- the fluid module and the automation unit
- the regulator and the automation unit
- each supply system component and 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.

PrecisionFlo LT Module Operation

Reading PrecisionFLo LT Control / Indicators

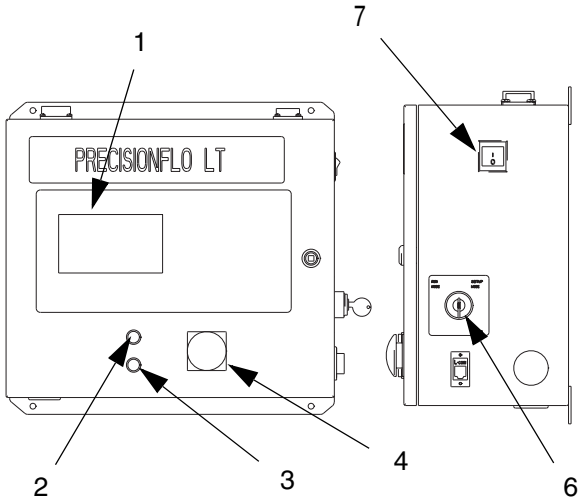


FIG. 11

Table 2 - PrecisionFlo Buttons/Switches

Ref	Button/Switch	What it Does
4	Sealer Stop Button	• Disables all air solenoids and V/P regulators. • Signals the external controller that a SEALER STOP condition is in effect.
6	Run/Setup Mode Key Switch	• Turn key switch counter-clockwise to set control unit to Run Mode. When the key is in Run Mode or removed, you can operate and monitor the system. • Turn key switch clockwise to set control unit to Setup Mode (for software configuration). The key cannot be removed while turned to Setup Mode.
7	Main Electrical Power (Disconnect) Switch	• Turns on power to system. • Lights Condition Light(s).

Table 3 - PrecisionFlo LT Indicators

Ref	Indicator	Indicator light	Meaning
1	User Display	On	Display is on when power is applied to the control assembly.
		Off	Display is off when power is removed from the control assembly or the screen saver is active. Press any key to activate the screen.

Table 4 - PrecisionFlo Indicator Lights

Dispenser Ready Light (Ref 2) Status	Fault Present Light (Ref 3) Status	
Off	Off	No System Power or the system is in manual mode with no fault present.
On	Off	System is in auto mode with no fault present.
On	On	System is in auto mode with a minor fault present.
Off	On	System is in auto or manual mode with a major fault present or the system is in manual mode with a minor fault present.

PrecisionFlo LT User Interface

The EasyKey User Interface is available with the PrecisionFlo LT control unit.

For screen-captures of the screens and your selection options, see page 84 for the EasyKey interface.

EasyKey User Interface Overview

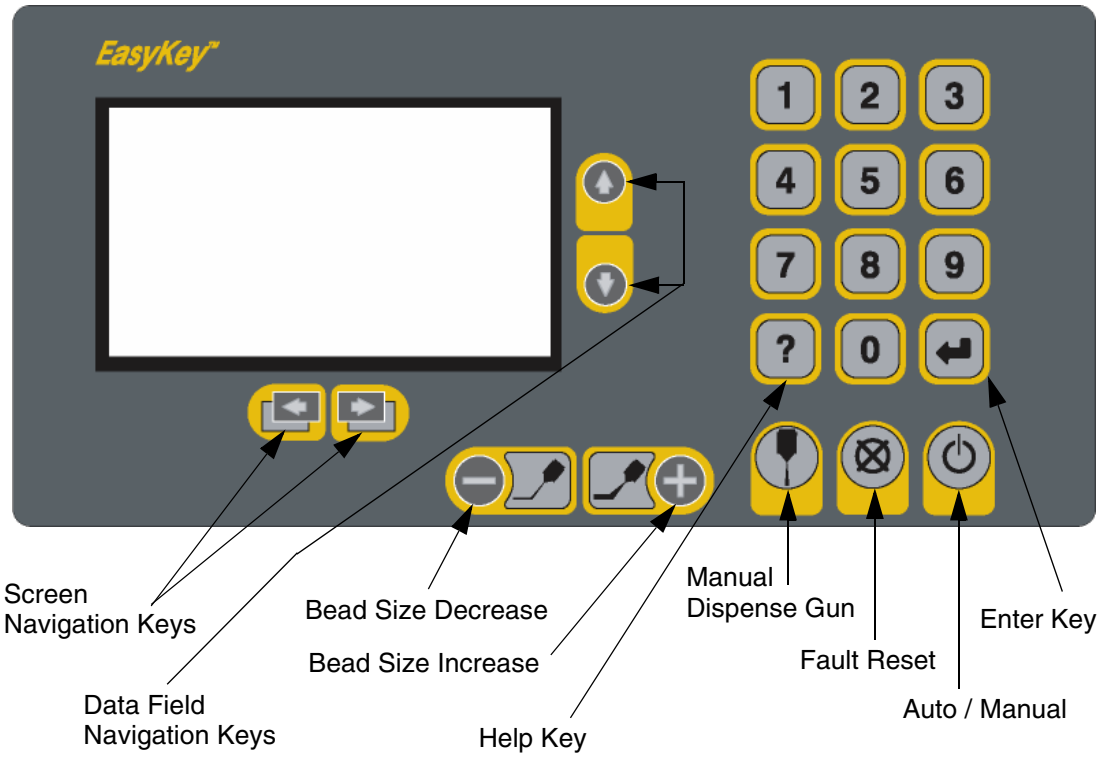


FIG. 12

Key Groups

There are three groups of keys on the PrecisionFlo LT user interface.

- **Action Keys –** perform an action when they are pressed. Manual Dispense Gun, Fault Reset, Bead Size Increase, Bead Size Decrease, Help, and Auto/ Manual. See Action Keys at right.
- **Numeric Entry Keys –** are used to enter variable data into the controller.
- **Navigation Keys –** are used to navigate between and within the different user screens.

Action Keys

- **Manual Dispense Gun –** is used for functions related to the regulator and dispense gun, including manual dispense, and calibration.
- **Bead Size –** is used to increase or decrease the bead size during unit operation. This feature is enabled / disabled in the setup screens.
- **Help Key –** is used to display the help screen.
- **Fault Reset –** is used to reset a fault generated on the control once the fault has been corrected.
- **Auto / Manual –** is used to change the mode of operation between Automatic and Manual.

Operation Modes

The PrecisionFlo LT system has two operating modes:

- **Automatic dispense mode –** enables the PrecisionFlo LT module to begin dispensing when it receives a command from the automation unit.
- **Manual dispense mode –** enables the Precision Flo LT module to begin dispensing when you press Manual Dispense Gun on the EasyKey interface. Dispensing continues for as long as the Manual Dispense Gun button is pressed. Manual mode is also used for system tuning or calibration.

To select the Operation Mode and to operate in manual dispense mode, see the following specific instructions.

Refer to **Appendix C**, **Theory of Operation**, page 95 for more information on Operation Modes.

Refer to **Keypad Overview** on page 27 for key locations.

Setting Operation Mode

On the keypad, perform the following steps:

1. The dispense mode is indicated on the run screen, either Auto or Manual.
2. To change the mode, press the Auto/Manual key.

Manually Dispensing Fluid

On the keypad, perform the following steps:

1. Place the system in manual dispense mode. Refer to **Setting Operation Mode**, above.
2. Press the Manual Dispense Gun key  .
   a. Press the key and verify that the dispense device opens.
   b. Continue to press the key as long as needed to load material or dispense.

Control Modes

The PrecisionFlo LT module has four fluid dispensing control modes:

- **Bead Control –** the control unit measures the flow rate of material being dispensed. The regulator outlet pressure is varied to control the fluid flow rate to the requested value. Use Bead Control Mode when a consistent bead size is required.
- **Volume Monitor –** regulator outlet pressure is controlled to the requested value. Use Volume Monitor Mode when a constant pressure is required for a spray application.
- **Batch Dispense –** regulator outlet pressure is controlled to the requested value. Dispense valve is closed when target volume is reached or the automation provides a signal.
- **Pressure Control –** regulator outlet pressure is controlled to the requested value. Use pressure control mode if the system does not include a flow meter.

Refer to **Appendix C**, **Theory of Operation**, page 95 for more information on Control Modes.

Setting the Control Mode

1. Place the system in setup mode (key switch clockwise).
2. The control mode is indicated on the dispense screen.
3. To change the mode, press the down arrow key  until the cursor is over the mode cell.
4. Press Enter and use the up and down arrow keys,  or  to change values.
5. Press Enter.

Automation Modes

The PrecisionFlo LT system has two automation command modes:

- **Fixed mode –** enables the PrecisionFlo LT system to dispense at preset rate in the control unit.
- **Analog mode –** enables the PrecisionFlo LT system to dispense at a rate proportional to a 0-10 VDC analog input signal from the automation unit.

Refer to **Appendix C**, **Theory of Operation**, page 95 for more information on Automation Command Modes.

Setting Automation Mode

On the keypad, perform the following steps:

1. With the system in setup mode (key switch clock wise), press the right arrow key  until the OTHER screen appears. The command mode is indicated on this screen, either Fixed or Analog.
2. To change the mode, press the down arrow key  until the cursor is over the desired mode cell.
3. Press Enter and use the up and down arrow keys,  or  to change values.
4. Press Enter.

Operation

Pressure Relief Procedure

WARNING

Read Warnings, page 6.

This procedure describes how to relieve pressure for the PrecisionFlo LT system.

1. Shut off the fluid supply to the fluid module.
2. Place a waste container beneath the fluid drain valve, which is located at the filter. Place a waste container beneath the dispense device.
3. Slowly open the drain valve, located at each filter, to relieve fluid pressure. Close valve when pressure gauge reads zero.
4. In manual dispense mode, touch and hold the Manual Dispense Gun key  , which will open the regulator and the dispensing device, until the fluid stops flowing from them.
5. If the dispense device cannot be actuated from the control unit, refer to FIG. 13 and perform the following steps to open the dispense device and relieve fluid pressure:
   a. Manually actuate the plunger on the solenoid, that opens the dispense device, to relieve fluid pressure. Refer to FIG. 13.
   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.
6. Shut off power and air to the fluid supply systems.

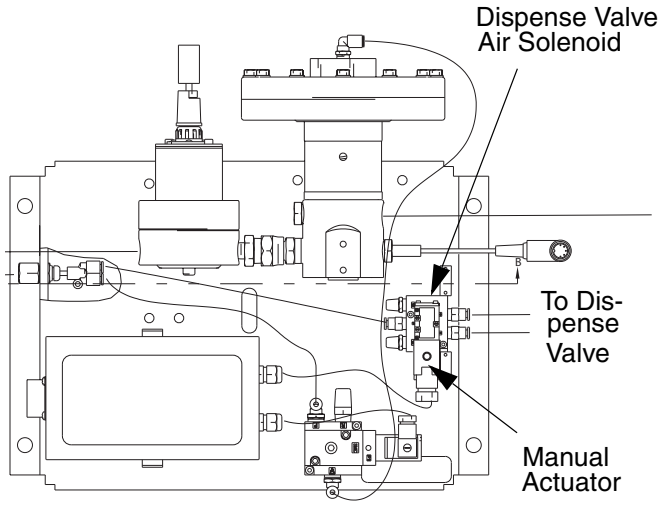


FIG. 13

If you have followed the steps above and still suspect that a valve, hose, or dispense nozzle is clogged or pressure has not been fully relieved, very slowly remove the dispense tip, clean the orifice, and continue relieving pressure.

If this does not remove the obstruction, very slowly loosen the hose end coupling and relieve pressure gradually, then loosen the coupling completely. Clear the valves or hose. Do not pressurize the system until the blockage is cleared.

Safety Reminder

Follow the precautions below and the warnings that begin on page 6.

WARNING

Read Warnings, page 6.

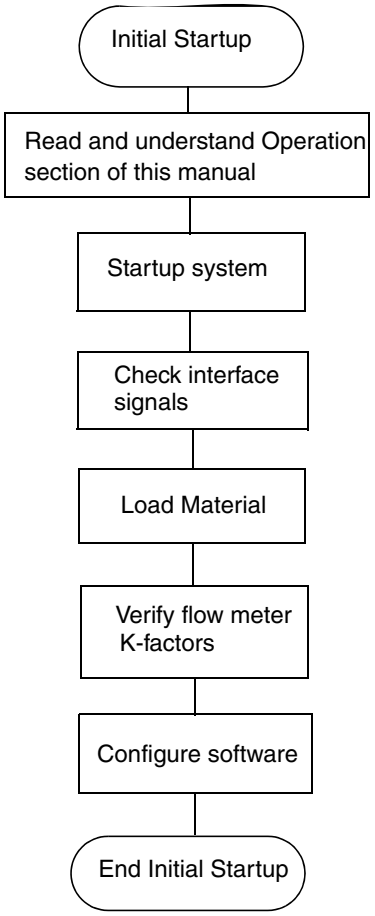


FIG. 14

Starting the System

Initial Startup

1. Make sure you have installed and made all the proper connections to and from the PrecisionFlo LT control assembly enclosure. Make sure fittings are tight.

2. Read and understand the Operation and Software Configuration sections of this manual.

3. Continue startup with step 2 in Standard Startup.

Be sure to set the max outlet pressure range switch in the fluid module junction box to the appropriate value. See page 72. The pressure range (5 VDC sensor pressure) must match the junction box setting. See page 92.

See **Table 2 - PrecisionFlo Buttons/Switches** and **PrecisionFlo LT User Interface**, page 32 for information on the PrecisionFlo LT control unit buttons, switches, and indicator lights.

1. Carefully inspect the entire system for signs of leakage or wear. Replace or repair any worn or leaking components before operating the system.

2. Press the E-stop button (4). See FIG. 15.

3. Turn on air and electrical power to the system.

4. Turn on the main electrical disconnect (7) to supply power to the PrecisionFlo LT module.

   The user interface becomes active, showing first a diagnostic message and then the first screen. The dispenser ready (2) and / or the fault present indicator light (3) turns on.

5. **Check Interface Signals:** If this is a new installation, power each of the system inputs and verify that the input is being received.

6. Turn on material supply system.

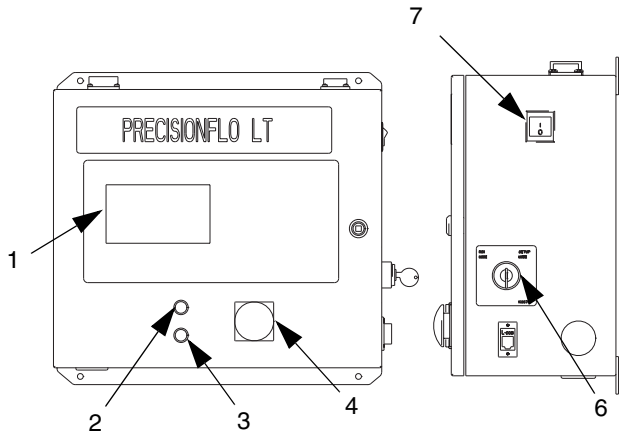


FIG. 15

Loading Material

Before you can configure the software, you must load material into the supply system.

1. If this is a new installation, follow the **Initial Start up** procedure. Otherwise, follow the **Standard Startup** procedure. See page 31.
2. Turn on fluid supply pressure to the fluid module.
3. Place the dispense device(s) over a waste container.
4. Set the control unit to Manual mode. See **Operation Modes**, below.
5. Select a control mode other than bead control. Dispensing in bead control mode is not possible until a flow calibration has been performed. See **Control Modes** on page 28.
6. Disengage the E-stop button (4). See FIG. 15.
7. Press and hold the Manual Dispense Gun key  . Manually dispense fluid until clean, air-free fluid flows from the Dispense Gun.

Configuring Software

After you have loaded material into the dispensing system, configure the PrecisionFlo LT software. FIG. 16 shows the major configuration steps.

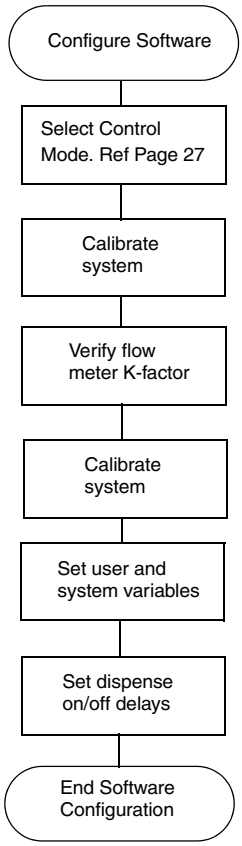


FIG. 16

The PrecisionFlo LT system compensates for temperature, flow, or pressure fluctuations. However, if you change hardware on the dispensing system or change the type of material being dispensed, you must reconfigure the PrecisionFlo LT software.

To configure the PrecisionFlo LT software, perform the following procedure. When you have completed this procedure, the module is ready for operation.

1. Select the desired control mode. See page 28.
2. Calibrate the system. See page 34.
3. Verify the flow meter K-Factor. See page 34.
4. Verify other controller preset values. See page 37 for more information.
5. The **PrecisionFlo LT User Interface** section on page 27 gives detailed operating instructions for the display keypad and each screen.

For more information regarding applications that run continuously see **Appendix C**, **Theory of Operation**, page 95.

Setting Flow Meter K-Factors

The accuracy of the PrecisionFlo LT volume reporting depends on precise adjustment of the K-factor(s). The control unit uses the K-factor(s) to calculate the volume dispensed. If the set value is not correct, the system still delivers accurate and repeatable flow rates; however, the reported value may not be correct. See page 36 for additional K-factor information.

Table 4 - Flow Meter K-Factors

Part No.	Description	K-Factor
239716	G3000 Gear Meters	8400
244292	G3000 HR Gear Meter	16400
246190	Helical Gear Meter	3500
246652	High Resolution Helical Gear Meter	7000
246340	Heated Helical Gear Meter	3500

Set Flow Meter K-Factor

On the keypad, perform the following steps:

1. With the system in setup mode, press the screen navigation key  until the OTHER screen appears.
2. Press the down data field navigation key until the flow meter K factor value is highlighted.
3. Key in the K-factor value and press Enter. See **Table 4 - Flow Meter K-Factors** for values.

System Calibration

Pressure Calibration

The PrecisionFlo LT system uses variables (Kp and Ki) in the software calculations to accurately and precisely control the fluid pressure and flow rate. The control unit calculates Kp and Ki automatically during pressure calibration. These values are different with every material.

The system must be loaded with material before calibrating pressure. The nozzle or tip should be installed on the dispense device.

Before Calibrating

1. Verify that the system is in setup mode and manual dispense mode.
2. Verify that dispense device is placed over a material waste container.
3. Verify that the fluid module air supply is on.
4. Verify that the control mode is set to the desired value.

Calibrate

On the keypad, perform the following steps:

1. Press the right screen navigation key  until the **Calibrate** screen appears.
2. Enter the desired 100% command Flow/Pressure.
3. Press the Manual Dispense Gun key  . The system will dispense material for 15-30 seconds and gather the required information.

Manually Adjusting Kp and Ki

If automatic pressure calibration does not result in proper system pressure control, you can change the Kp and Ki values manually:

- If the regulator outlet pressure does not closely follow the desired pressure increase Kp with the Ki value set to zero. Continue to increase the Kp value by 10% increments until the proper pressure control is achieved.
- Decrease Kp if the regulator outlet pressure oscillates rapidly above and below the commanded pressure. Continue to decrease the Kp value by 10% increments until the outlet pressure is stable.
- Set Ki volume to 2 and continue to increase the Ki value by 2 until the system oscillates.
- Decrease Ki until oscillation stops.

Flow Rate Calibration

The system only calibrates flow rate if you are operating in Bead Control Mode. Flow rate calibration takes place immediately after the pressure calibration in bead control mode.

How Flow Rate Calibration Works

Each application may have different flow rate requirements. Flow rate calibration verifies the maximum flow rate of the system and determines the regulator outlet pressure required to achieve the required flow rate.

At the start of the flow rate calibration procedure, you need to enter the maximum flow rate required by the application. When you actuate the dispensing device during calibration, the control unit:

1. Measures the maximum system flow rate. If the maximum system flow rate is less than the required maximum flow rate a fault is generated.
2. Determines the outlet pressure required to obtain the flow rate value you entered.
3. Calculates a linear ratio of the automation analog input voltage to the desired flow rate. Refer to FIG. 17.

Flow mode: Analog voltage to flow rate ratio

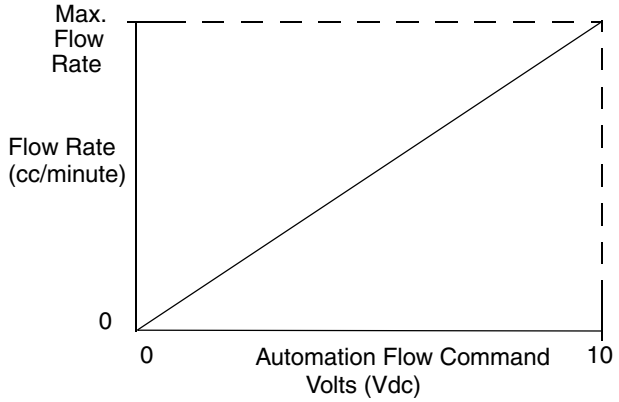


FIG. 17

Flow Rate Guide

Use the values in **Table 5 - Maximum Flow Rate Values (cc/min)** as a guide to determine the maximum flow rate to enter during flow rate calibration.

Table 5 - Maximum Flow Rate Values (cc/min)

Round Equivalent Bead Diameter (mm)					
Max. Automation Speed (mm/sec)	**2**	**3**	**5**	**7**	**9**
50	10	21	59	115	191
100	19	42	118	231	382
200	38	85	236	462	763
300	57	127	353	693	1145
400	75	170	471	924	1527
500	94	212	589	1155	1909
600	113	254	707	1385	2290
700	132	297	825	1616	2672
800	151	340	943	1847	3054
900	170	382	160	2078	3435
1000	189	424	1178	2309	3817

Setting Inlet Pressure

The inlet pressure reading should be in the range of 300 psi (2.1 MPa, 21 bar) to 500 psi (3.4 MPa, 34 bar) above the outlet pressure reading under your highest flow condition.

Excessive inlet pressure will cause accelerated wear on the regulating valve and the pump feed system.

Feed System Pressure Drop

During material flow, the regulator inlet pressure decreases. The amount the pressure decreases is the amount of pressure lost between the feed pump and the regulator inlet. With high viscosity fluids, long line lengths, or small diameter line sizes this pressure decrease can be thousands of psi (hundreds of bar). This means that the static pump pressure is set much higher than the regulator needs at its inlet. To prevent excessive control regulator wear or surging, a mastic fluid pressure regulator is recommended on the feed line close to the control regulator. The mastic regulator will suppress the static feed pressure at the control regulator inlet.

Verifying Flow Meter Calibration

Most sealant and adhesive materials are compressible. Since the flow meter is measuring the material under high pressure, the actual volume of material dispensed may vary slightly from the measured volume, due to this compressibility. If the K-factor is not correct, the displayed volume will not be accurate.

Follow this procedure to calibrate the flow meter during initial setup and on a routine basis to check for flow meter wear.

Method 1. Using a gram scale

1. Obtain a beaker, 500 cc or larger, and measure the mass of the empty beaker.
2. Manually dispense material into the beaker. Hold the beaker so that the stream of material is submerged in the captured material. This is to minimize air entrapment in the container.
3. Record the volume dispensed on the Run screen and the flow meter K-factor from the Setup Other screen.
4. Calculate the actual volume dispensed:

$$\frac{\text{fluid mass (g)}}{\text{density (g/cc)}} = \text{measure volume (cc)}$$

5. Calculate the new flow meter K-factor:

$$\text{K-Factor (new)} = \frac{\text{displayed volume (cc) x K-Factor (old)}}{\text{measured volume (cc)}}$$

6. Enter new K-factor.
7. Repeat the procedure to verify the new K-factor.

Method 2. Without using a gram scale, visual measurement

1. Obtain a beaker, 500 cc or larger with measurement increments.
2. Manually dispense material into the beaker. Hold the beaker so that the stream of material is submerged in the captured material. This is to minimize air entrapment in the container.
3. Record the volume dispensed on the Run screen and the flow meter K-factor from the Setup screen.
4. Settle the material into the beaker and view the actual volume dispensed.
5. Calculate the new flow meter K-factor:

$$\text{K-Factor (new)} = \frac{\text{displayed volume (cc) x K-Factor (old)}}{\text{dispensed volume (cc)}}$$

6. Enter new K-factor.
7. Repeat the procedure to verify the new K-factor.

Other Software Settings

There are various software settings that are preset at the factory, based on the system configuration that was ordered. A quick check of these variables is recommended. See **Table 5 - PrecisionFlo LT User Variables and Presets** and **Table 6 - PrecisionFlo LT System Variables**.

The **PrecisionFlo LT User Interface** screens are listed in **Appendix B** beginning on page 84 to guide you through the process.

Setting User Variables

The following variables and presets should be verified prior to calibration and path programming and/or operation in automatic mode. All of the screens as well as additional screen information can be viewed in **Appendix B**, **PrecisionFlo LT User Interface**, starting on page 84.

There are additional variables that should be set after the path programming is completed, they include; High/Low pressure settings and Style (volume) information.

Table 5 - PrecisionFlo LT User Variables and Presets

Values in italics are factory defaults.

Screen	Variable / Preset	Values	Comments
Dispense	Control Mode	*Bead Control*, Volume Monitor, Batch Dispense, or pressure control	Only bead control mode controls flow.
Other	Command Mode	*Analog* or Fixed	
	Job End Mode	Timer or *Digital* I/O	
	Language	Many	Set the desired language.
	Pressure Units	*psi* or bar	Set the desired pressure units.
	Manual Gun Flow Rate	0 - 100%, *50%*	Flow rate or pressure setting for Manual Dispense.
	Job End Delay	0 - 999 sec, *4 sec*	Delay time after dispensing for job complete if Job End Mode is set to Timer.
	Year, Month, Day, Hour, Minute		Set the Time and Date.
	Default / Fixed Command	0-100%, *50%*	Set value for fixed command mode. If the command signal falls below 1 VDC in analog mode, this value will be used as the command.

Other System Variables

After the calibration and automation path programming is complete and the desired bead profiles have been achieved, verify that the following variables are set.

Table 6 - PrecisionFlo LT System Variables

Screen	Variable / Preset	Values	Comments
Dispense	Volume	0 - 9999 cc, *25 cc*	Set the volume set point for each of the styles being used.
	Tolerance	0 - 99.9%, *10%*	Set the volume tolerance for each of the styles being used.
Other	Set the User configurable faults to Alarms or Warnings. More information on the faults can be found in **Appendix B**, **PrecisionFlo LT User Interface**.		
	An Alarm will cause the fault present signal to activate and the dispenser ready signal to drop out. This is something considered by the user to be a major fault, one which should cause the system to stop dispensing.		
	A Warning will cause the fault present signal to activate and the dispense ready signal to stay on. This is something considered by the user to be a minor fault, one which will warn the user but will continue dispensing even if the bead profile is degraded.		

On/Off Delays

The PrecisionFlo LT regulator can physically respond faster than the dispense device and its solenoid. As a result, the regulator can supply material to the dispense device before the device has time to open. Supplying material to a closed device can create trapped-pressure.

At the end of a cycle, the dispense device can shut off before the pressure has dissipated. This can cause a dispense of an excess of material at the beginning of the next cycle.

To eliminate these two problems, you can change the delay time associated with the opening of the regulator/dispense and/or the closing of the dispense device, see **Table 7 - On/Off Delay Variables**.

In general, your outlet pressure on the screen during “no flow” should be slightly below the outlet pressure during dispense. If your dispense hose to the gun is creating too much pressure drop during flow, you may want the no flow reading to be lower. High trapped pressures shorten the dispense device life.

Table 7 - On/Off Delay Variables

Variable:	Sets the Amount of Time:
Gun ON	Sets time from Dispense Gun High to Gun Open command
Regulator ON	Sets time from Dispense Gun High to Regulator ON
Gun OFF	Sets time from Dispense Gun Low to Gun Close command
Regulator OFF	Sets time from Dispense Gun Low to Regulator OFF

FIG. 18 and **Table 8 - Delay On/Off Timing** show delay ON and OFF timing.

FIG. 18

Table 8 - Delay On/Off Timing

A	Regulator ON delay	The user sets the regulator ON delay timing.
B	Gun ON delay	Usually set to zero. Can be used to change the starting point of a bead.
C	Gun OFF Delay	Usually set to zero. Higher values will lower the trapped pressure.
D	Regulator OFF delay	The user sets the regulator OFF delay timing. Zero or small values will lower the trapped pressure.
E	Gun Open Reaction Time	Time delay for gun to physically open. Delay varies based on pneumatic hose length and valve air volume.
F	Gun Close Reaction Time	Time delay for gun to physically close. Delay varies based on pneumatic hose length and valve air volume.

Regulator Pre-Charge

Another method which can be used to increase the dispense hose pressure while the dispense valve is closed is to use a regulator pre-charge. Setting this value to a range of 1.00 to 5.00 VDC causes the V/P to apply 0 to 100 psi (.60 MPa, 68 bar) air pressure to the fluid regulator. Typical values entered would be about 1.2 VDC.

Shutting Down the System

1. Shut off the material supply to the fluid module.
2. Follow the **Pressure Relief Procedure** on page 30.

WARNING

Read Warnings, page 6.

3. Turn off the PrecisionFlo LT system's compressed air supply.
4. Press the sealer stop button (7). See FIG. 19.
5. Turn off the main electrical disconnect (2).

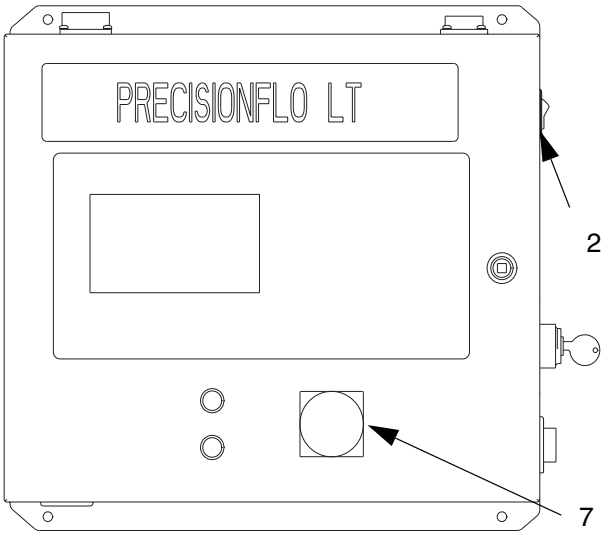


FIG. 19

Communicating with PrecisionFlo LT

Communication with the PrecisionFlo LT is carried out through the Graco Shell program (included). This is a text based menu program that you can use to perform the following tasks:

- Upgrade software
- Display software versions
- Download job and alarm logs
- Backup and restore setup parameters
- Restore the factory defaults

You can access the Graco Shell program via the programming port on the side of the control box. Plug one end of the programming cable into the RJ12 (phone jack style) on the control box and the other end of the cable into the serial (COM port) of a computer.

 For more information on the use of Ethernet and Ethernet Kit 118329 see **Appendix D**, **Ethernet Kit 118329**, page 106.

The laptop computer used to interface to the Graco Shell must be running some type of terminal emulation software. Some examples are Hyper Terminal or Tera Term. Graco recommends using Tera Term which can be downloaded from **http://hp.vector.co.jp/authors/VA002416/teraterm.html**. The following communications parameters must be used (these are the default parameters in Tera Term).

Setting	Value
Port	COM 1 or COM 2
Baud Rate	57600
Data	8 Bit
Parity	None
Stop	1 bit
Flow Control	None

Once the programming cable is connected and the communications software is running, the user can activate the Graco Shell by pressing the Enter key on the keyboard. The main menu will be displayed.

The main menu will look as follows:

```
****Welcome to the Graco Control Application Menu****
Build date: Mar 05 2003 14:23:23
a. Software Update and Version Information
b. Data Transfer
c. Restore settings to factory defaults
Enter Selection [a-c]:
```

Upgrading Control Board Software

To upgrade the controller software, you must first obtain the latest version of **Ltcontrol.rec**. Contact your Graco distributor for details.

Select option “a”. Make sure the key switch is turned to Setup mode. The following text will be displayed.

```
Are you sure?  Enter yes to continue:
```

Type “yes”. The following text will be shown.

```
****Welcome to the Graco Control Boot Software.****
Version: 1.01.001 Built: Mar 10 2003 14:39:33.
Warning: you are about to erase your applica-
tion software.
Type ‘yes’ to continue upgrading software
(reboot to cancel).
```

Type “yes”. The following text will be shown.

```
Sector 1 erased.
Sector 2 erased.
Sector 3 erased.

Hyperterminal: Go to (Menu Transfer XXX Send
Text File) and select *.rec file.
Tera Term: Go to (File XXX Send File) and
select *.rec file.
```

Select Send File from the File menu in Tera Term. Then select the **Ltcontrol.rec** from the selection box window (you will need to browse to the appropriate directory).

The file will begin to download to the controller, which will take approximately one to two minutes. When the download is complete, a new menu will appear on the screen. The software upgrade is now complete. Cycling power to the controller is recommended after a software upgrade.

Upgrading Display Board Software

To upgrade the display software, you must first obtain the latest version of **Ltdisplay.rec**. Contact your Graco distributor for details.

To upgrade the Display Software the jumpers between terminals 2540 and 2541and terminals 2550 and 2551 should be moved to connect terminals 2541 and 3720 and terminals 2551 and 3740.

Once the programming cable is connected and the communications software is running, the user can activate the Graco Shell by pressing the Enter key on the keyboard. The main menu will be displayed.

```
****Welcome to the Graco EasyKey Display****
Build date: Mar 10 2003 14:23:23.
a. Install Display Application Software
b. Display Software Versions
Enter Selection (a-b)
```

Select option “a”. Make sure the key switch is turned to Setup mode. The following text will be displayed.

```
Are you sure?  Enter yes to continue:
```

Type “yes”. The following text will be shown.

```
****Welcome to the Graco Control Boot Soft-
ware.****
Version: 1.01.001 Built: Mar 10 2003 14:39:33.
Warning: you are about to erase your applica-
tion software.
Type ‘yes’ to continue upgrading software
(reboot to cancel).
```

Type “yes”. The following text will be shown.

```
Sector 1 erased.
Sector 2 erased.
Sector 3 erased.

Hyperterminal: Go to (Menu Transfer XXX Send
Text File) and select *.rec file.
Tera Term: Go to (File XXX Send File) and
select *.rec file.
```

Select Send File from the File menu in Tera Term. Then select the **Ltdisplay.rec** from the selection box window (you will need to browse to the appropriate directory).

The file will begin to download to the controller, which will take approximately one to two minutes. When the download is complete, a new menu will appear on the screen. The software upgrade is now complete. Cycling power to the controller is recommended after a software upgrade.

Displaying Versions

Select option “b”. Text similar to this will be shown.

```
Boot Code version: 1.01.001, checksum=52c2f6,
built:Mar 10 2003 14:47:49
Application: 1.01.001, checksum=cc5bd,
built:Mar 05 2003 14:47:49
```

Return to Main Menu

Select option “h”. The main menu will be shown.

```
Welcome to the Graco Control Application Menu
Build date: Jul 06 2001 15:45:38 (debug build)
a. Software Update and Version Information
b. Data Transfer
c. Restore settings to factory defaults
Enter Selection [a-c]:
```

Restoring Defaults

Select option “c” and the following message will appear.

```
Are you sure?  Enter yes to continue:
```

Type “yes”.

When the operation is complete, the main menu will

Maintenance

The following is a list of recommended maintenance procedures and frequencies to operate your equipment safely. The maintenance is divided between mechanical and electrical tasks. Maintenance must be performed by trained personnel per this schedule to assure safety and reliability of the equipment.

Mechanical

Operator	Maintenance Person

Task	Daily	Weekly	Monthly	3-6 months or 125,000 cycles	6-12 months or 250,000 cycles	18-24 months or 500,000 cycles	36-48 months or 1,000,000 cycles
Inspect system for leaks	✓						
Depressurize fluid, after operation	✓						
Remove heat from system, after operation	✓						
Inspect filter (234967) bowls and drain		✓					
Check hoses for wear		✓					
Check/tighten fluid connections		✓					
Check/tighten air connections		✓					
Lubricate dispense valves*			✓				
Rebuild regulator*				✓			
Rebuild dispense valve*				✓			
Replace air filter (234967) assembly						✓	
Replace Solenoid							✓
Replace V/P valve							✓
* Check component manual for more detailed maintenance information.							

Electrical

Task	Daily	Weekly	Monthly	6 months	12 months
Calibrate flow meter**			✓		
Check cables for wear		✓			
Verify cable connections		✓			
Verify resistance of electric heaters*					✓
Verify operation of “System Stop” button		✓			

** Weekly calibration is recommended for applications using abrasive materials.

* Check Component Manual for more detailed maintenance information.

Troubleshooting

WARNING

Read Warnings, page 6.

Troubleshooting for individual regulators and flow meters is discussed in their separate manuals. These manuals are called out in the parts lists later in this manual. Also refer to the section on Troubleshooting and Fault Recovery for detailed information on how fault codes are communicated.

Check all possible solutions in the chart below before you disassemble the regulator.

Fluid Modules

Problem	Cause(s)	Possible Solution(s)
No outlet pressure	Air pressure low	Verify air pressure is above 60 psi (0.4 MPa, 4 bar)
	No “Gun On” signal from automation unit	Check input from automation unit
	No output signal from system I/O board	Check signal from system I/O board, verify that a signal is being sent (1-5 VDC)
	No air signal to air diaphragm	Check for loose/disconnected/worn operations cable; tighten/replace as required
		Check for loose/disconnected DIN connector to V/P valve; tighten
	False signal being sent to control	Check outlet pressure sensor out put; verify that it corresponds to zero pressure; replace sensor and/or amplifier
High outlet pressure	Needle/seat is worn	Rebuild regulator; replace needle/seat
Air leaks from fluid module	Loose air connections	Check air connections; tighten if necessary
	Worn gaskets	Check/replace gaskets on V/P and solenoid valve
Fluid module heater does not heat	Temperature controller turned off	Verify Zone is properly adjusted.
	Loose electrical connections	Verify connection between inlet hose and fluid module connector
		Verify connections between inlet hose and main enclosure
	Blown fuse	Check/verify fuse in heater control box
	Broken heater element	Check/verify heater resistance
	Broken sensor	Check/verify sensor resistance

Flow Meter

Problem	Cause(s)	Possible Solution(s)
No flow measurement	Flow meter pick-up sensor loose	Tighten flow meter pick-up sensor
	Flow too low	Verify flow rate is above minimum for the flow meter selected
	Loose wiring	Verify wiring connections from flow meter to junction box
	Damaged flow meter pick-up sensor	Replace pick-up sensor
False measurement	Flow meter not calibrated	Calibrate flow meter
	Flow meter cable shield wire not connected	Verify shielding to ground
	System not grounded properly	Verify system ground
	Noisy power source	Verify clean power supply power to main enclosure
Flow reported is not correct or inconsistent	Flow meter not calibrated	Calibrate flow meter
	Flow meter is worn	Replace flow meter

Regulator

Problem	Cause(s)	Possible Solution(s)
No pressure regulation	Damaged diaphragm	Replace diaphragm
	Leaking or dirty seat	Replace cartridge, or clean seat
No fluid flow	Damaged valve actuator	Replace valve actuator
Pressure creeps above setting	Metal chip or contamination between ball and seat	Replace cartridge, or clean seat area
	Damaged diaphragm	Replace diaphragm
	Damaged o-ring or improper seal	Replace the o-ring under the seat
	Damaged or clogged air regulator or line (air-operated regulator only)	Clear obstruction in line. Service regulator if necessary
	Leaking or dirty seat	Replace cartridge, or clean seat
	Large change in inlet pressure	Stabilize regulator inlet pressure
Pressure drops below setting	Empty/clogged supply line	Fill/flush supply line
	Damaged or clogged air regulator or line (air-operated regulator only)	Clear obstruction in line. Service regulator if necessary
	Using valve beyond its rated flow capacity	Install valve for each spray gun or dispensing valve
	Large change in inlet pressure	Stabilize regulator inlet pressure
Fluid leaks from spring housing	Loose fluid housing	Tighten the four cap screws
	Damaged diaphragm	Replace diaphragm
Chatter	Excessive pressure differential be tween pump and gun	Reduce pump pressure to not more than 2000 psi (14 MPa, 138 bar) greater than required gun pressure.
	Excessive flow rate	Reduce fluid flow through regulator. Connect only one spray gun or dispensing valve to each fluid regulator

Dispense Valves

Problem	Cause(s)	Possible Solution(s)
Valve not opening	Air not getting to open port	Verify air pressure solenoid
	No “Gun On” signal from automation unit	Check input from automation unit
	No output from system I/O board	Check output from system I/O board; verify that it is on
Valve not shutting off	Air not getting to close port (except AutoPlus valve)	Verify air pressure to solenoid
		Verify solenoid operation
		Verify air line routing and connections
	“Gun On” signal from automation unit is on	Check input from automation unit
		Check output from system I/O board; verify that it is on
Sluggish open/close	Air pressure low	Verify air pressure is above 60 psi (0.4 MPa, 4 bar)
	Needle/seat worn	Rebuild valve; replace needle/seat
	Pressurized material past the valve shut-off is escaping	Reduce running pressure
		Reduce nozzle length
		Increase nozzle orifice size
Material leaks from back of valve	Shaft seal is worn	Rebuild valve; replace seals
Air leaks from dispense valve	Loose air connections	Check air connections; tighten if necessary
	Worn piston o-ring	Rebuild valve; replace piston o-ring
Dispense valve does not heat	Temperature controller turned off	Verify zone #4 is on through the user interface
	Loose electrical connections	Verify connection between outlet hose and valve connector
		Verify connection between outlet hose and main enclosure through extension cord
	Blown fuse	Check/verify fuse in Electric Heat box
	Broken heat cartridge	Check/verify heater resistance
	Broken sensor	Check/verify sensor resistance

Electrical Component Paths

Use the following table to troubleshoot wiring to the automation:

Component	Description	Cable / Pin	Enclosure Wire	Board / Connector	Wire Color
Dispense Gun	+24 VDC Input	1	3290	J8-4	WHT
Job Complete	+24 VDC Input	2	3310	J8-5	BLU
24 VDC From IFC	+24 VDC Input	5	2120	+24 VDC	RED
24 VDC Common	COM	6	2121	Common	BLK
Analog Flow Command	0-10 VDC Input	7	3150	J7-3	GRN/BLK
Analog Common	COM	8	3170	J7-4	GRN
Actual FLow Rate Signal	0-5 VDC Output	9	3210	J7-6	ORN/BLK
Dispenser Ready	+24 VDC Output	10	2680	J5-5, Green Light	BLU/BLK
Fault Present	+24 VDC Output	11	2710	J5-7, Red Light	BLK/WHT
In Cycle	+24 VDC Output	12	2740	J5-9	RED/WHT
Minimum Volume Dispensed	+24 VDC Output	13	2770	J5-11	GRN/WHT
24 VDC Thru E-Stop	+24 VDC Output	14	2170	E-Stop Switch	ORN
GND	Shield GND	15	Shield	Chassis GND	N/A

KEY

Component – External component wired into module's junction box.

Description – Type of signal.

Component ID – Where it originates from on the component.

J-Box Wire – Wire number or terminal location in the module's junction box.

Cable/Pin – Pin number on the operations cable. The operations cable connects the module's junction box to the main electrical enclosure.

Enclosure Wire – The wire number inside of the main electrical enclosure.

Board/Connector – Where the wire terminates inside of the main electrical enclosure.

Troubleshooting and Fault Recovery

The following table describes the valid fault codes used by the PrecisionFlo LT module, possible causes, and solutions. PrecisionFlo LT module displays warnings and alarms on the user interface and alarms via the control unit fault light.

- Alarms set the dispenser ready signal LOW.
- Warnings **do not** set the dispenser ready signal LOW.

Resetting Control Unit After a Fault

If a fault has occurred, you should clear (reset) the fault before restarting the PrecisionFlo LT control unit. Press the fault reset key  to clear the fault, or press the ? key for additional information.

Table 9 – Fault Priority Table

Fault Priority	Fault Name	Fault Description	Causes	Solutions
The following faults are *always* Alarms				
2	Dispenser Stop	There is no electrical power	E-Stop has been pressed	Turn E-Stop switch to release
			Green and/or red light not lit, control assembly is off	Apply power to PrecisionFlo LT module
5	Closed Gun Flow	System reading flow meter pulses from Flow Meter with Gun closed. These meter pulses correspond to a flow rate that is greater than 1000 cc/min	Dispense hose leak	Check hose; replace if needed
			Flow meter providing false pulses	Replace flow meter sensor or calibrate meter (corilis)
			Dispense valve not operating properly	Repair dispense valve
			Flow meter providing false pulses	Replace flow meter sensor
The following faults are *always* Warnings				
1	Communication Error	Communication has been lost between the control board nd the display board	The display board and the control board are no longer communicating	Repair any loose or disconnected wires in the connectors between the two circuit boards
				Replace one or both of the circuit boards if their “heartbeat” LEDs are no longer blinking
				Replace the wiring harness between the two circuit boards
3	Power Up	Control box power up		
4	Calibration Error	System was not able to complete a flow calibration	Flow setpoint higher than the flow rate the system can deliver	Lower calibration flow setpoint
				Increase dispense valve tip size or dispense hose diameter
				Increase supply pressure
			Regulator worn or not operating properly	Repair regulator
			A dispense command in flow mode was received without a valid flow calibration being performed	Perform a flow calibration

Table 9 - Fault Priority Table *(continued)*

Fault Priority	Fault Name	Fault Description	Causes	Solutions
The following faults are *always* Warnings (con't)				
6	Volume Comp Limit	Peak value of flow compensation for regulator has reached the 25% or 400% limit	Fluid supply too low to achieve desired flow rate	Increase fluid supply pressure or check for clogged filter
			Regulator is not able to close completely	Repair regulator
			Major change to fluid or fluid system downstream of the regulator	Check fluid viscosity Check hoses and tips for problems Perform a new calibration if necessary
			Operating below the minimum regulator operating pressure	Increase fluid pressure above regulator minimum
7	Low Analog	Analog command dropped below 1 VDC while dispensing	Bad or loose I/O cable connection	Check cable and connection
			Entered command mode incorrectly	Enter correct command mode
			Automation program error	Verify correct automation program or set the default flow rate to 3500 or disable this fault
15	Default Kp/Ki	Default Values for Kp & Ki have been loaded	The autotune portion of the calibration has failed to find new Kp and Ki values. Default values for these parameters are being used.	Decrease the volume of the dispense hose (length and / or diameter)
				Choose a smaller tip size for the dispense valve
				Increase the fluid supply pressure
				Manually adjust Kp and Ki (see page 34)
16	Setup Values Changed	Setup change notification	When the Key Switch was turned from Setup to Run mode, the control detected a change from previous setup data value(s)	No action necessary if changes were desired
Remaining faults are selectable by the user as Alarms or Warnings (Setup → Alarms/Warnings screen)				
8	High Outlet Pressure	Output pressure to the PrecisionFlo LT regulator is above the upper limit set for operation. If this fault occurred while doing a pressure calibration, pressure calibration could not determine optimum values and default values were used	Incorrect limit set	Verify limit is set correctly
			Dispense hose/device plugged	Clean/replace hose/device
			Failed transducer	CHeck transducer, replace if failed
			Regulator is not closing completely.	Repair regulator
			Incorrect pressure amplification switch setting	Verify switch is set correctly

Table 9 - Fault Priority Table *(continued)*

Fault Priority	Fault Name	Fault Description	Causes	Solutions
9	Low Outlet Pressure	Output pressure of the PrecisionFlo LT regulator is below the limit set for operation. If this fault occurred while doing a pressure calibration, system pressure was too low (<500 psi [3.4MPa, 34 bar] at the regulator outlet) to complete the calibration	Incorrect limit set	Verify limit is set correctly
			No or insufficient material flow	Increase material flow rate
			Dispense valve needle is stuck closed	Dislodge and inspect needle
			Dispense valve leaking	Repair dispense valve
			Regulator not operating properly	Repair regulator
			Pump wink passed through outlet	Recalibrate PrecisionFlo LT or increase pump pressure
			Failed transducer	Check transducer, replace if failed
			Incorrect pressure amplification switch setting	Verify switch is set correctly
10	High Volume	Material dispensed during the last dispense cycle was above the amount established by request and above the allowable (entered) tolerance	Material viscosity is outside flow compensation window	Verify material characteristics, recalibrate if necessary. Increase Bead scale
			PrecisionFlo LT regulator is not regulating properly	Check regulator, repair if necessary. Increase pressure to regulator above.
			Incorrect volume or tolerance when using Volume Monitor or Batch Dispense	Enter correct values or minimum operating pressure
11	Low Volume	Material dispensed during the last dispense cycle was below the amount established by request and below the allowable (entered) tolerance	Partially plugged tip or supply system. Error is outside flow compensation window	Clean tip and/or supply system.
			Insufficient flow to PrecisionFlo LT regulator inlet. Error is outside flow compensation window	Increase flow rate to PrecisionFlo LT regulator inlet
			Material viscosity is outside flow compensation window	Verify material characteristics, recalibrate if necessary
			Material viscosity increased	Increase bead scale
			PrecisionFlo LT regulator is not regulating properly	Enter correct values or set the tolerance to 0% to disable this fault
12	Low Flow Rate	Measured flow rate less than desired flow rate minus tolerance	Fluid supply too low to achieve desired flow rate	Increase fluid supply pressure or check for clogged filter
			Tip plugged	Clean/replace tip
			No air pressure to solenoid valves	Turn on air to solenoid valves
			No flow meter signal	Check cable and sensor
			No material supply	Replace drum or turn on pumps
			Incorrect flow tolerance or flow fault time	Enter correct tolerance or flow fault time

Fault Priority	Fault Name	Fault Description	Causes	
13	High Flow Rate	Measured Flow rate more than desired flow rate plus tolerance	Operating below the minimum regulator operating pressure	Increase fluid pressure above regulator minimum
			Regulator worn or not operating properly	Repair regulator
			Flow meter providing false pulses	Replace flow meter sensor
			Incorrect flow fault tolerance or flow fault time	Enter correct tolerance or flow fault time
14	Computed Target	The requested volume differs from the entered process target by more than the entered tolerance for style requested	Entered process target incorrectly	Enter correct process target
			Entered tolerance incorrectly	Enter correct tolerance
			Requested volume incorrect	Check automation program
			Automation problem	Verify automation is correct

Control Assembly Service

Servicing the Panel Assembly

This part of the manual provides information about the following panel assembly component:

- Main Control Board
- Software Upgrade
- Fuse
- Display Backlight

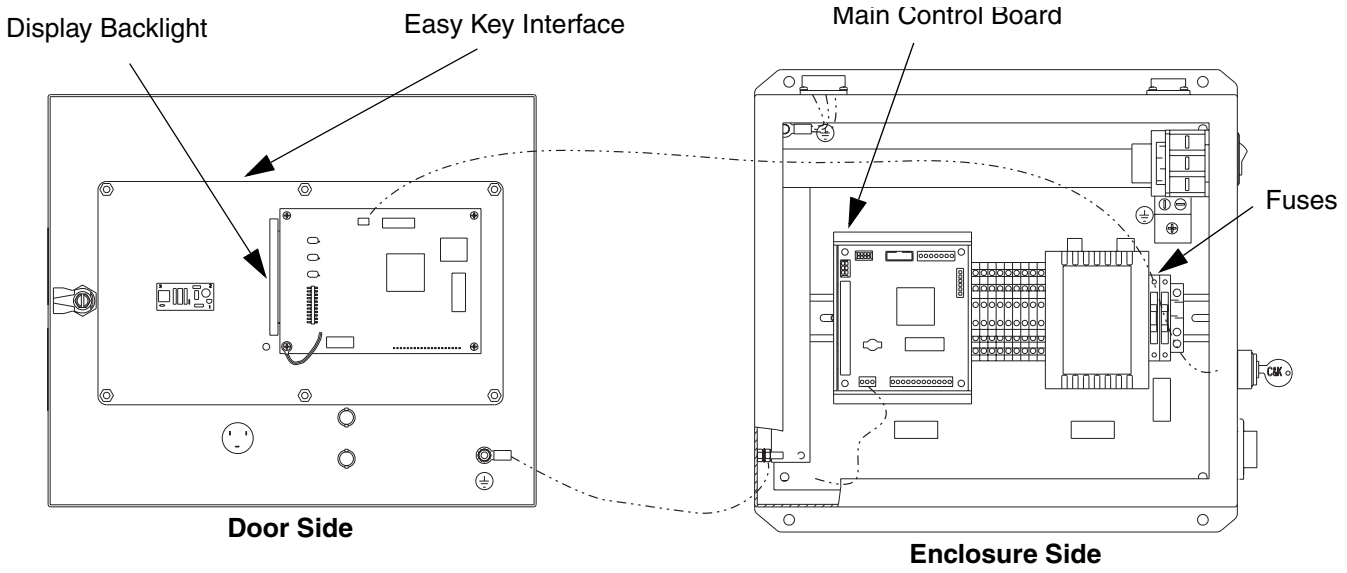


FIG. 20

Main Control Board Removal

Remove the control board as follows:

WARNING

Read Warnings, page 6.

1. Shut off system power at the main circuit breaker.
2. At the control assembly, move the MAIN power switch to the OFF position.
3. Open the hinged cover of the control assembly.
4. Unplug the connectors from the control board.
5. Pry the plastic cups off the board with a screwdriver to release the board from the din rail.

Control Board Replacement

Replace the control board as follows:

1. Snap the main control board onto the din rail.
2. Plug the connectors into the control board.
3. Close and lock the hinged cover on the control assembly.
4. Apply system power at the main circuit breaker.
5. Move the MAIN power switch to the ON position, applying power to the control assembly.
6. Verify that the control board operates correctly.
7. Restore the system parameters to return the control assembly to normal operating condition.

Software Upgrade

There are two ways to upgrade the software in the PrecisionFlo LT system.

- Use the Graco Shell Serial menu System (see **Communicating with PrecisionFlo LT**, page 40).
- Replace the flash memory in the two circuit boards.

The software upgrade kit (253614 Standard) can also be used to upgrade software. This kit contains flash memory chips for the display board (see FIG. 21) and control board (see FIG. 22). The kit also includes a chip pulling tool.

To replace a flash memory chip on either the display board or the control board, perform the following steps.

1. Attach the grounding strap included with the kit to your wrist and ground appropriately.
2. Turn off the power to the LT system.
3. Press the two feet of the chip extraction tool into the open holes in the corners of the flash chip socket on the circuit board. See **Display Board** FIG. 21 or **Control Board** FIG. 22.
4. Position the chip extraction tool so that the feet of the tool are underneath the flash chip. Squeeze the tool to grip the chip.
5. Continue squeezing the tool while pulling the chip out of the socket.
6. Orient the new flash chip such that the beveled corner on the chip aligns with the beveled corner of the socket.
7. Press the new chip into the open socket. Make sure that the pins are not bent or touching.
8. Repeat this procedure for both circuit boards.
9. Turn the power on the LT back on.

Display Board

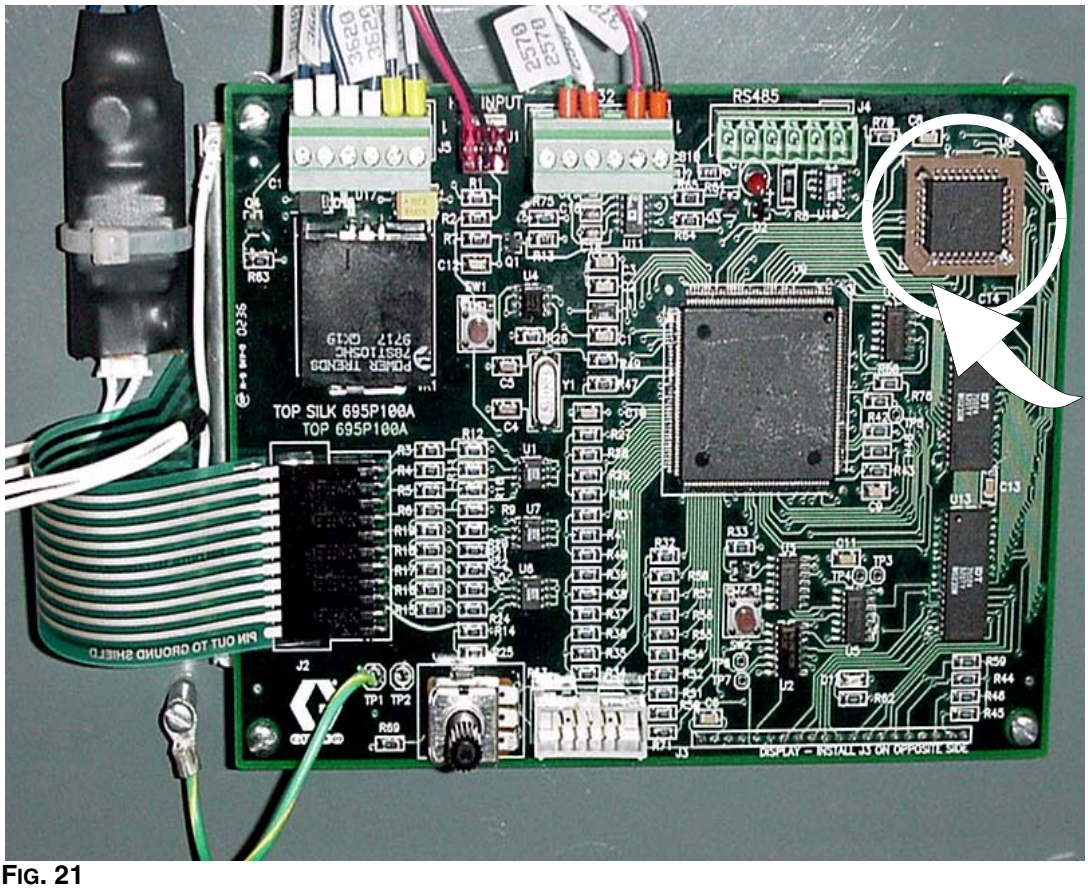


FIG. 21

Control Board

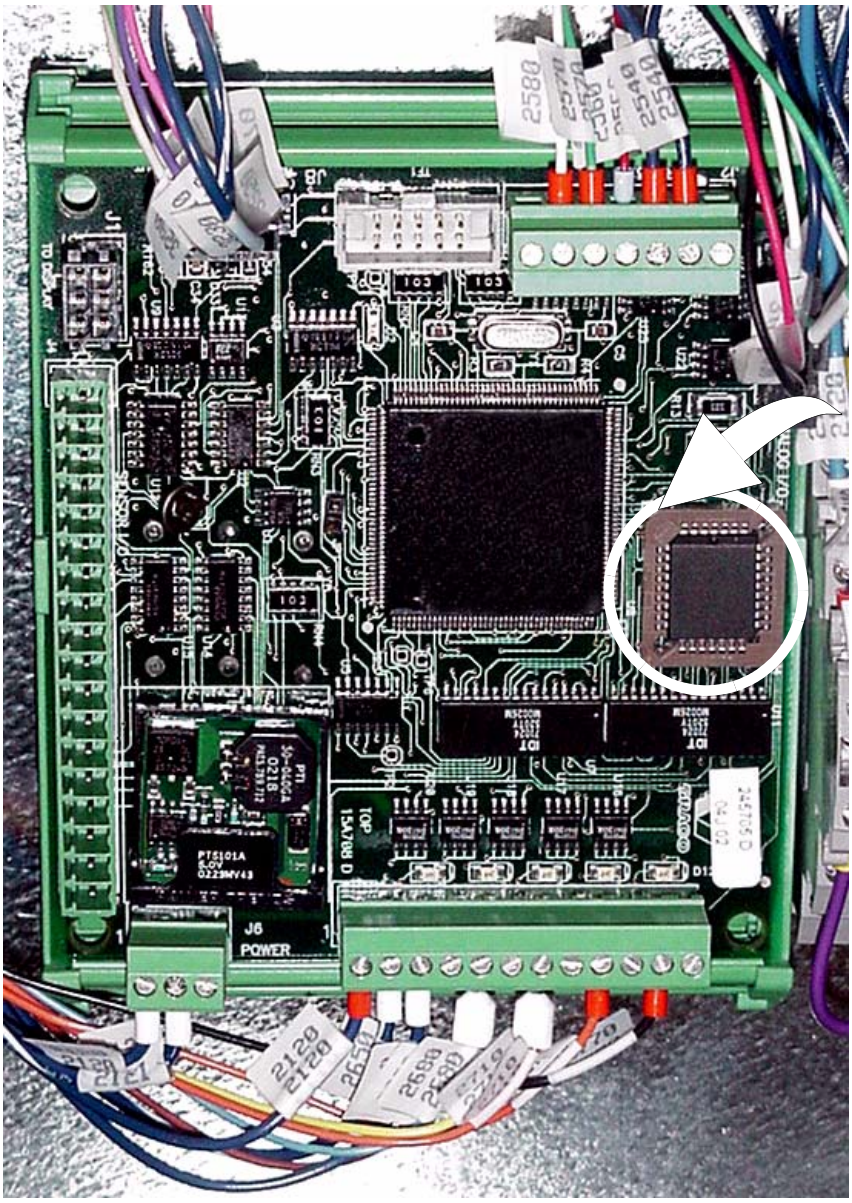


FIG. 22

Panel Assembly Service

Fuse Removal

Remove the fuse as follows:

WARNING

Read Warnings, page 6.

1. Shut off system power at the main circuit breaker.
2. At the control assembly, move the MAIN power switch to the off position.
3. Unlock and open the hinged cover of the control assembly.
4. Lift to unlock the top of the fuse holder, which is hinged at the bottom, from its clamp.
5. Open the fuse holder fully. Locate the failed fuse inside.
6. Carefully remove the fuse from the fuse holder.

Fuse Replacement

Replace the fuse as follows:

Check the new fuse to ensure that it matches the amp rating of the failed fuse.

1. Press both ends of the new fuse evenly into place in the fuse holder.
2. Close and lock the fuse holder into place.
3. Close and lock the hinged cover on the control assembly.
4. Apply system power at the main circuit breaker.
5. Move the MAIN power switch to the ON position applying power to the control assembly.
6. Verify that the fuse operates correctly.
7. Return the control assembly to the normal operating condition.

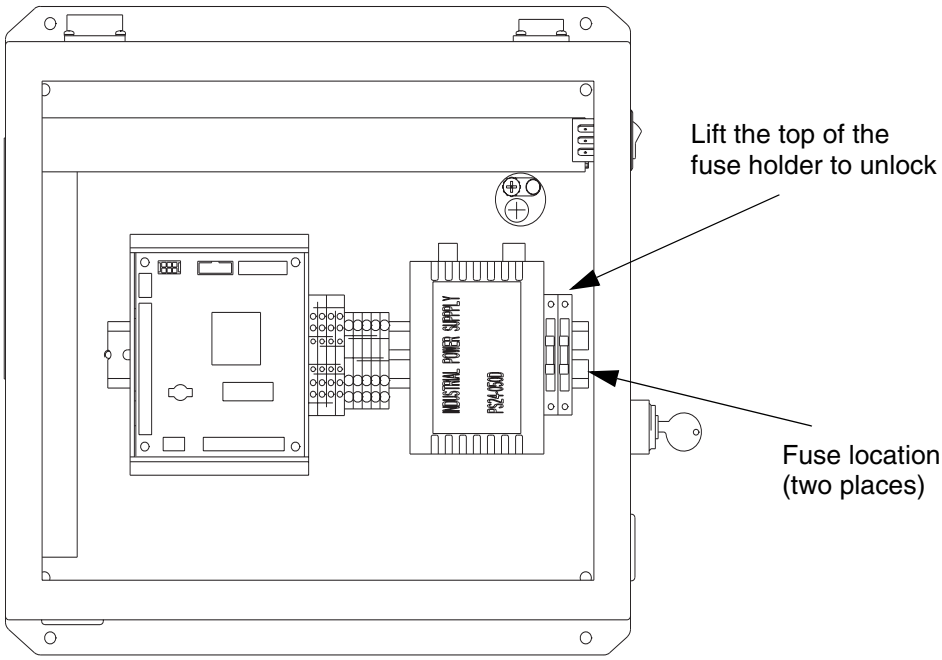


FIG. 23

Replacing the Backlighting

WARNING

A qualified electrician must complete all grounding and wiring connections.

Read Warnings, page 6.

A Backlighting Replacement Kit is available. Order part no. 118337.

Before replacing the backlighting, check the inverter (9) for proper voltage by unplugging the backlighting connector (1), turning on the PFlo LT and carefully measuring the AC voltage across the two pins of the inverter. Voltage should read approximately 700 VAC. If not replace the inverter.

1. Shut off system power at the main circuit breaker.
2. At the control assembly, move the main power switch to the off position.
3. Unlock and open the hinged cover of the control assembly.
4. Unplug the ribbon cable from the board (4) by sliding it out of the connector. Note the position of the cable in the connector. The arrow indicates pin #1, reconnect later with pin #1 engaged.
5. Unplug the remaining connectors on the board and note their location. Unplug the connector (1) coming from the backlighting bulb.
6. Remove the four screws from the board.
7. Disconnect the ground wire.
8. Remove the two small screws holding the backlighting (3) to the display (2), and slide the backlighting out the side of the display.
9. Install the parts in reverse order of disassembly
10. Return the control assembly to normal operating conditions.

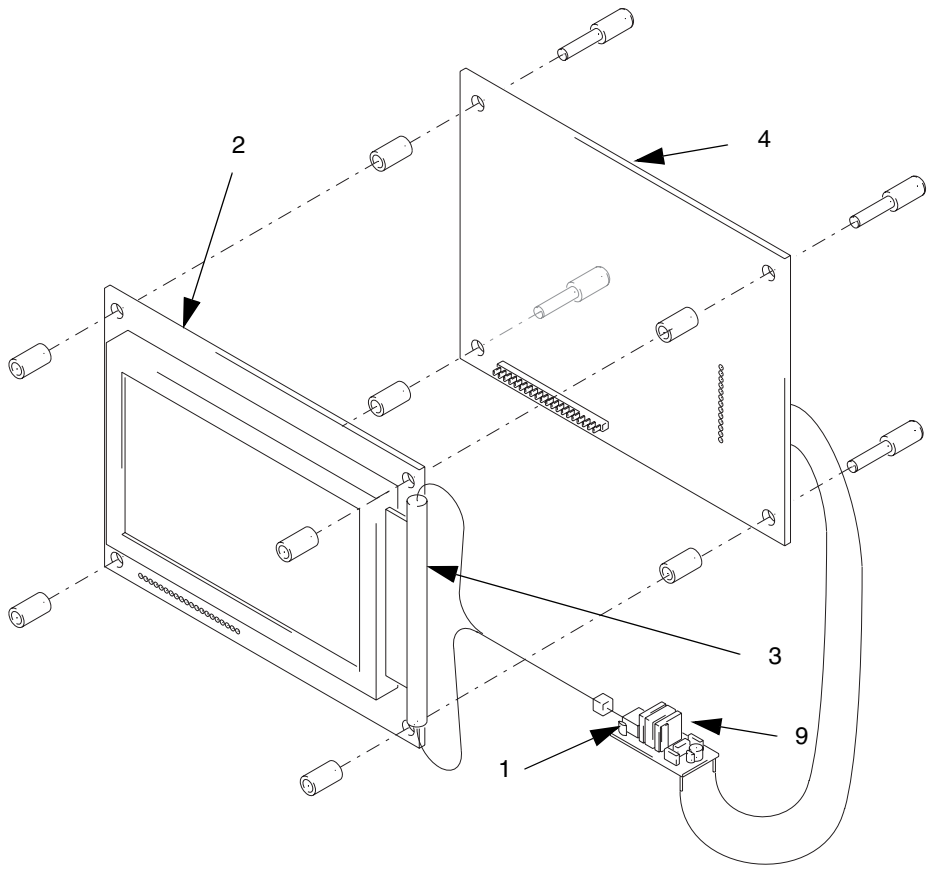


FIG. 24

Fluid Module Service

This section describes how to remove and replace these components on the fluid metering assembly:

- flow meter (20) (FIG. 25)
- regulator (14) (FIG. 25)

The numbers in parentheses in the text refer to reference numbers in the parts drawings and parts lists.

Prepare the System for Service

Relieve the system pressure. Follow procedure on page 30.

WARNING

Read Warnings, page 6.

Servicing the Flow Meter

For complete flow meter service instructions refer to the maintenance and service sections of the following manuals: 308778 for all G3000 meters, and 309834 for all Graco Helical flow meters.

Remove the Flow Meter from the Mounting Plate

1. Prepare the system for service as instructed above.
2. Disconnect the flow meter cable (J) from the flow meter sensor. See FIG. 25.
3. Disconnect the material hose.
4. Disconnect the swivel fitting (18) from the regulator.
5. Loosen the four screws (12), and remove the bracket (22) and flow meter.
6. The flow meter (20) weighs approximately 15 lbs. (6.75 kg). Carefully lift it off the mounting plate (10).

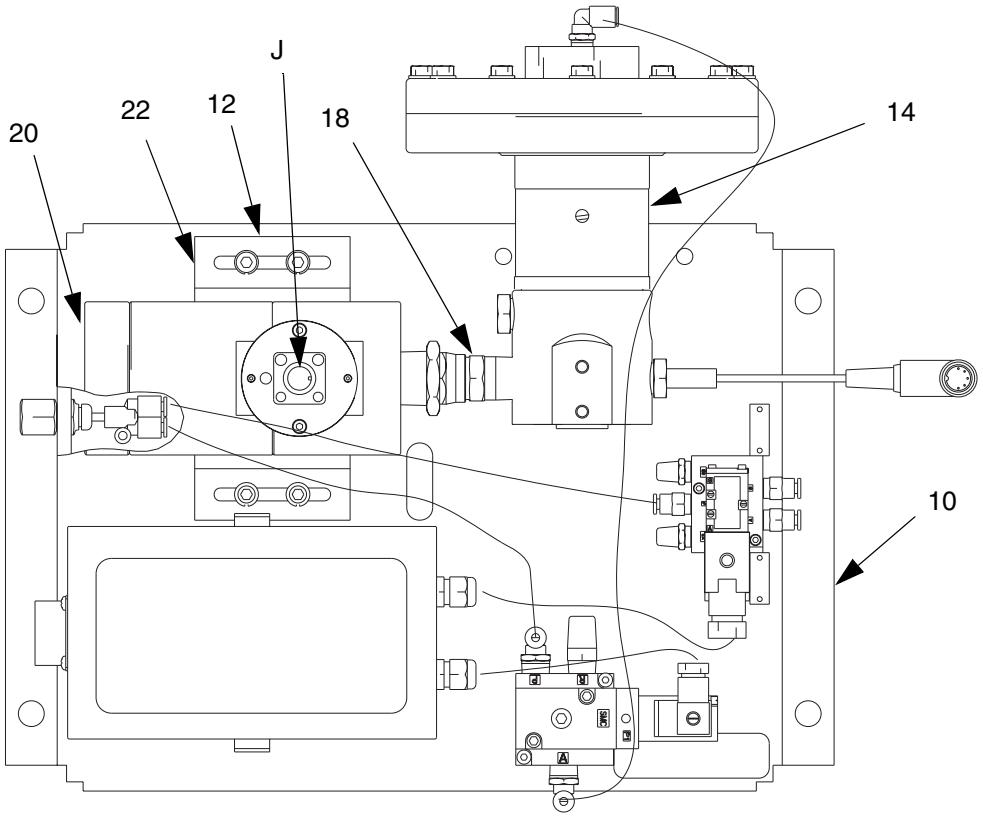


FIG. 25

Install the Flow Meter on the Mounting Plate

1. Rest the flow meter and bracket (20) on the fluid plate while threading the swivel fitting (18) onto the regulator material inlet. See FIG. 25.
2. Tighten the swivel fitting (18) to the regulator material inlet.
3. Tighten the four screws (12) to hold the bracket and flow meter in place.
4. Check that the flow meter (20) and regulator (14) are still aligned.
5. Connect the material hose.
6. Connect the flow meter cable (J).

Servicing the Fluid Regulator

For complete cartridge fluid regulator service refer to instruction manual 308647. For Mastic Fluid Regulators refer to instruction manual 307517.

Replacing the Cartridge

See FIG. 26 and perform the following steps.

⚠ CAUTION

Handle the hard carbide parts ball, valve actuator, and valve seat, carefully to avoid damaging them.

1. Relieve the pressure.

⚠ WARNING

Read Warnings, page 6.

2. Remove the cartridge assembly by loosening the valve housing (5) with a 6 mm hex wrench and pulling the cartridge assembly out of the base housing (4).

The retaining nut (3) often loosens when removing the cartridge assembly from the base housing. Be sure to re-torque as described in step 4.

3. Inspect and clean the internal walls of the base housing (4).

Be careful to not scrape or gouge the internal walls of the base housing. They are a sealing surface.

4. Re-torque the retaining nut (3) to 140 to 160 in-lb (16 to 18 N•m).

You must re-torque the retaining nut **before** you install it in the base housing in step 5.

5. Install the new cartridge assembly in the base housing (4), and torque the valve housing (5) to 30 to 35 ft-lb (41 to 48 N•m).

The valve seat is double sided and may be reversed for extended life. The o-ring and ball must be replaced. See instruction manual 308647.

Service Kits for Regulator 244734

For the Fluid Diaphragm Repair Kit, order Part No. 238747.

For the Cartridge Repair Kit, order Part No. 238748.

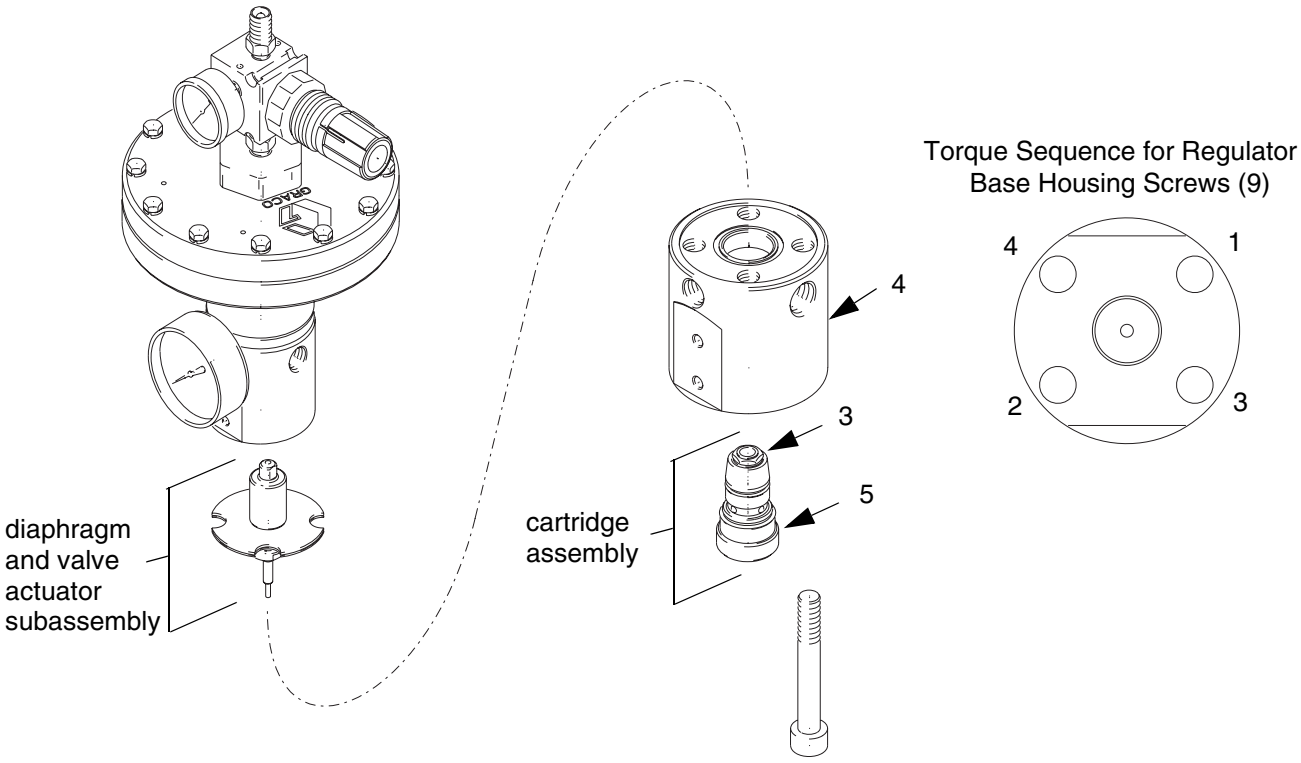

diaphragm
and valve
actuator
subassembly
cartridge
assembly
4
3
5
Torque Sequence for Regulator
Base Housing Screws (9)
4
1
2
3

FIG. 26

Frequently Asked Questions

Q: What is the difference between running in Volume Monitor versus Bead Control?

A: In *Volume Monitor* the control will maintain a specific pressure at the fluid regulator outlet. If the viscosity of the fluid changes or the nozzle becomes restricted, that pressure will result in a different flow rate. If you have a flow meter installed it can still monitor the job volume for faults. Volume monitor is sometimes desirable for spray applications to maintain a specific spray pattern.

In *Bead Control* the fluid regulator is still reacting to the fluid pressure for quick adjustment, but the control also monitors the flow meter. If the flow rate does not agree with the flow command, the pressure target is adjusted. This method gives you the quick response of a pressure transducer, while maintaining the rate accuracy of a flow meter.

Q: How do I adjust the flow rate up or down without changing my automation commands?

A: There is an adjustment called *Bead Scale* which appears on the EasyKey Run screen or on the Dispense Setup Screen. This can be set from 50-150% of command flow. To change the Bead Scale turn the key switch to the right to enter Setup mode. The Setup mode screen allows you to change the Bead Scale percentage. To change to the new setting press the Enter key on the EasyKey interface. The new value will be stored when you turn the key switch back to Run mode. In Run mode the Bead Scale can be changed using the bead adjust keys.

Q: Why do I get a warning for “Volume Compensation Limit”?

A: Something has changed since you calibrated the regulator. The control has changed the regulator pressure set point too far away from the calibration point. This happens in Bead Control when the control is monitoring the flow meter and trying to maintain the proper flow rate. The cause is some factor that has changed the pressure, downstream of the regulator, at the desired flow rate. This might be a plugged nozzle or a fluid viscosity change. The viscosity difference could be caused by a change in temperature or a new batch of material. If the pressure needs to increase to maintain the desired flow rate, but the fluid regulator is already fully open, the volume compensation continues to increase the desired pressure target until the limit is reached. The fluid feed pressure at the regulator inlet needs to be increased. If the fluid and equipment are all right you need to recalibrate to your flow target.

Q: How is a fluid control regulator calibration performed?

A: There are three steps: (1) determine system maximums (2) pressure calibration (3) flow calibration. These steps are performed sequentially during the calibration process. If you are not using a flow meter and will run in pressure control mode, only the pressure calibration and system maximums will be performed. To calibrate pressure and flow, see page 104.

Q: How do I know if the fluid control regulator calibration was successful?

A: On the EasyKey display, calibration was successful if the calibrate setup screen indicates “Calibration Valid”.

Q: Why will my fluid control regulator not calibrate in the calibration screen?

A: You may not have enough fluid pressure downstream of the regulator. Raising the downstream pressure becomes more important if the pressure is below 500 psi (3.5 MPa, 34.5 bar). Try a smaller nozzle on the dispense valve.

Q: Why is my calibration failing after only a few seconds?

A: You may not have been able to reach the maximum flow rate or maximum pressure you entered. To reach a higher flow rate or pressure, you can increase the feed pressure or increase the dispense valve nozzle size.

Q: Why will my dispense valve not operate?

A: The valve will not dispense in Bead Control Mode until a valid calibration has been performed. Try switching to volume monitor or pressure control mode or calibrate again.

Q: Does Volume Monitor Mode use a flow meter?

A: Running in Volume Monitor Mode requires a flow meter to monitor the job volume limits or job log volumes. If you do not have a flow meter set the system to the pressure control mode.

Q: How do I know my flow and volume measurements are accurate?

A: Calibrate the flow meter as instructed on page 104. This is strongly recommended as many sealants are compressible, and the flow meter measures the fluid while it is under pressure. Calibrating the meter makes it accurate for your fluid at ambient pressure. Periodic calibration is also important to monitor your meter for wear.

Q: I have flow, but how do I know if my fluid regulator is working?

A: If a fluid regulator fails it can no longer hold back fluid pressure. If the outlet pressure climbs up to equalize with the inlet pressure when you stop dispensing, the regulator has lost the ability to shutoff or fully regulate flow. If you have pressure limits set you will get a *High Outlet Pressure* alarm. If you have job volume limits set you will get a *High Volume On Last Job alarm*.

Q: Is there a way to put the fluid plate control regulator in a bypass mode to still operate the dispense valve when I have a problem?

A: With the air operated regulators you can move the air tube that feeds the V/P valve directly to the fluid regulator air inlet. Turn off the air supply before moving tubes.

Q: How do I download job logs or alarm logs from the PrecisionFlo LT control?

A: There is an external phone-style connection on the right side of the control enclosure. You need a PC or laptop computer with terminal emulation software and part number 233657 accessory cable kit. See **Communicating with PrecisionFlo LT**, page 40.

Q: Will I lose any of my Setup parameters or logged information if power is lost?

A: No. All setup parameters, job logs, and alarm logs are saved to flash memory and do not need any power. This is non-volatile memory similar to the cards used with digital cameras. There also is no battery to replace. The setup parameters are stored to flash memory when the key switch is moved from the setup to the run position.

Q: Can I cause an error or system problem while looking at screens when production is running?

A: If the key switch is turned counter clockwise or removed, which means the system is in Run mode, you can view the run screen but you cannot change any parameters except Bead Scale when enabled. You can still select Manual or Automatic mode on the user interface which would stop the automation initiated dispensing.

Q: Can I change my Setup values while the machine is running?

A: Yes. If you turn the key switch to Setup mode, you have complete control of the system. Changes to control modes, pressure values, time delays, alarms, etc. become effective when you press Enter and the changes are saved to memory when the key switch is turned back to Run mode.

Q: How can I get out of Setup without saving the changes I have entered?

A: You can turn the power off before turning the key switch back to Run mode. When you turn the power back on, the changes will not be there.

Q: How do I set my pressures?

A: *First, set the dispense pressure.* A dispense valve hose and nozzle should be used, which will maintain at least 500 psi (3.5 MPa, 34.5 bar) back pressure at the fluid control regulator outlet at your lowest flow rate setting.

Second, set the feed pressure. Once you are running, back down the feed pressure to a point where the regulator inlet pressure stays at least 500 psi (3.5 MPa, 34.5 bar) greater than the regulator outlet pressure, when dispensing at your maximum flow rate. If you will have multiple valves open at the same time, being fed by the same feed pump, do this check with all of those valves open. Excessive feed pressure will cause excessive wear.

Fault Reporting

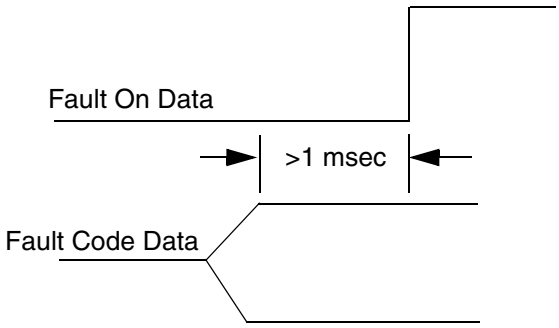


FIG. 27

Fault code data is valid for a minimum of 1 msec before FAULT ON DATA goes HIGH. Fault code data remains valid, and the FAULT ON DATA remains HIGH, until a FAULT RESET is received from the automation controller, or the fault is cleared using the display.

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

- **Alarms**, which cause the PrecisionFlo LT DISPENSER READY signal to go LOW or,
- **Warnings**, which keep the PrecisionFlo LT DISPENSER READY signal HIGH.

Both volume and fault data are available on the I/O interface. Volume and fault data share I/O points, Data 1 - Data 32768. If the VOLUME ON DATA output is on, the outputs contain volume data. If the FAULT ON DATA output is on, the outputs contain fault data.

The automation unit can read a fault code any time during the cycle, If several faults are present at the same time, the highest priority fault code is sent to the data bus. At the end of the dispense cycle the data bus is used for volume reporting, If requested by the automation controller. Once volume reporting has been competed, the fault code is placed back on the data bus.

Each fault is recorded on the user interface. The fault data is also available on the I/O interface until the fault is cleared.

Refer to the Troubleshooting and Fault Recover section for fault code causes, descriptions, and solutions for the various faults.

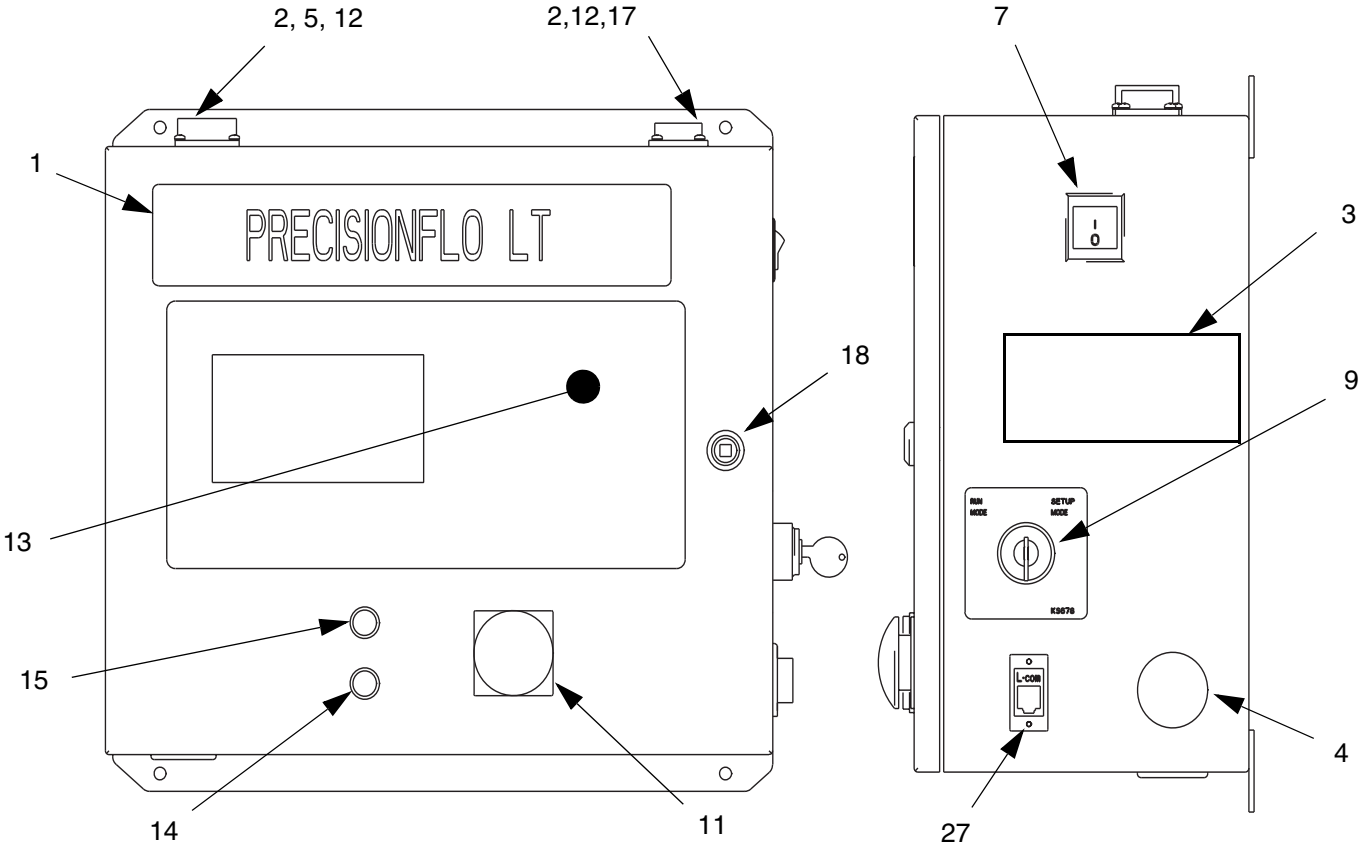
Control Assembly Parts

Part No. 234129, Series B, PrecisionFlo LT Standard Control Assembly

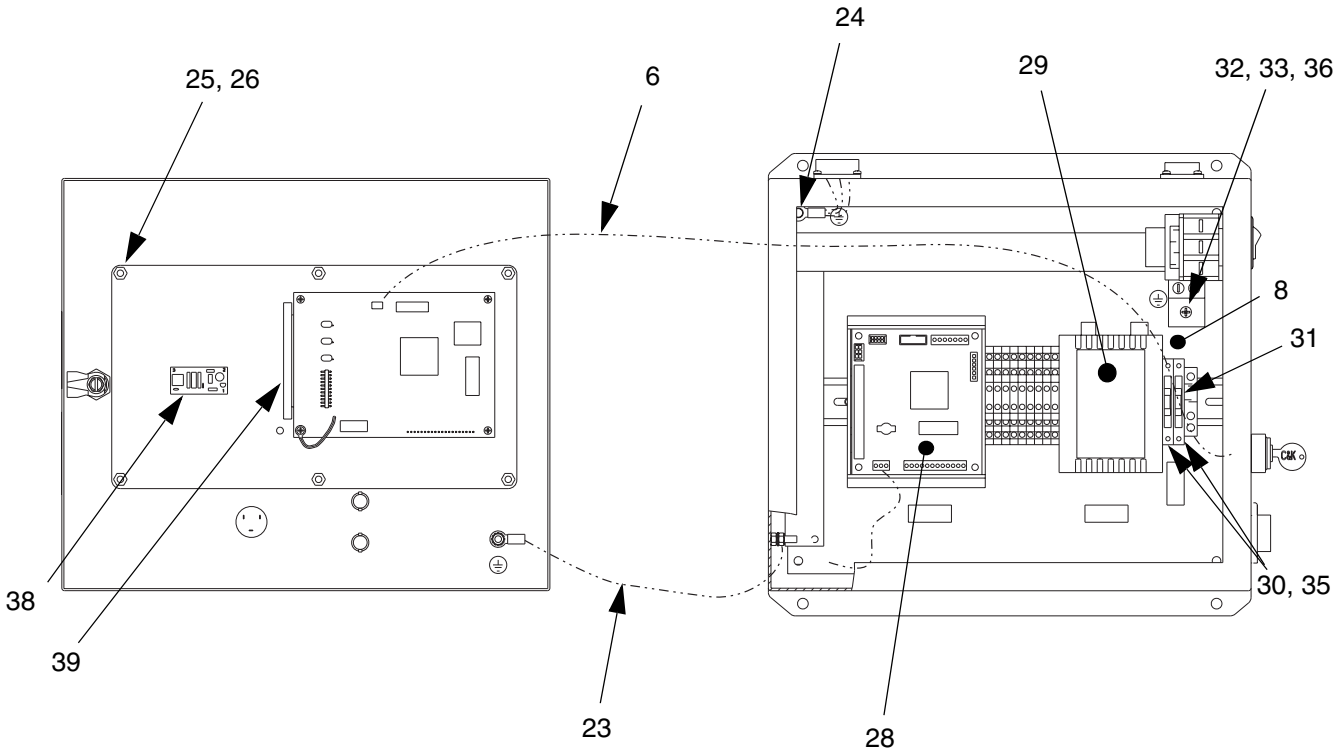
Ref No	Part No	Description	Qty.
1		ENCLOSURE	1
2	112546	SCREW, machine	8
3◆	118334	LABEL, warning	1
4		PLUG, conduit	2
5		CONNECTOR	1
6		HARNESS, key switch wire	1
7		SWITCH, power rotary	1
8		PANEL, control assembly	1
9	116653	SWITCH, key	1
10		LABEL, identification switch	1
11	117689	SWITCH, emergency stop	1
12	C19208	WASHER, lock	8
13	117788	KIT, accessory	1
14	117762	LAMP, led red snap in	1
15	117763	LAMP, led green snap in	1
16		LABEL, identification control box	1
17		CONNECTOR	1
18		LATCH, quarter turn	1
20†	223547	WIRE, assy 25 ft.	1
21		NUT, hex	4
22		WASHER, lock	2
23		WIRE, grounding	1
24		TERMINAL	1
25		WASHER, lock	6
26		NUT, hex	6
27		CONNECTOR, RJ12	1
28	253620	BOARD, control circuit	1
29	117782	POWER supply	1
30	115216	FUSE, 1 amp	2
31		BLOCK, clamp end	1
32		WASHER, lock	1
33		TERMINAL, ground	1
34		TERMINAL, block	4
35		FUSE, holder	2
36		SCREW, machine	1
37		TERMINAL, block	5
38	117790	POWER, supply 5V inverter	1
39	118337	DISPLAY, backlight	1

† These parts are not shown on the parts drawing.

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

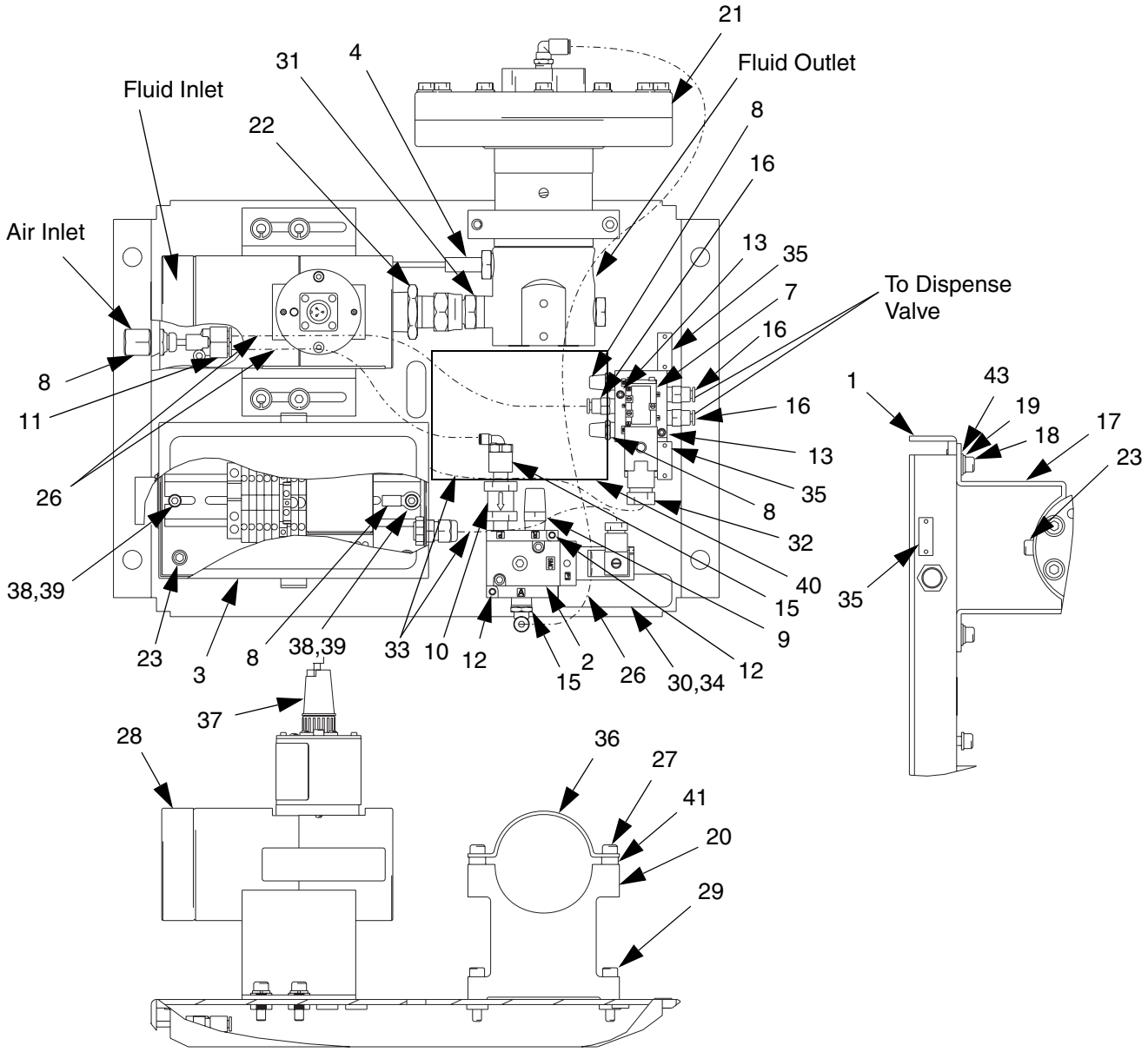


Control Assembly Parts (continued)



Fluid Module Parts

For additional parts see page 66.



Ref No	Part No	Description	Qty.
1		PLATE, blank fluid	1
2	195942	REGULATOR, I/P	1
6	198179	FITTING, bulkhead	1
7	551348	VALVE, sol 4-W	1
8	C06061	MUFFLER, sinter	2
9		MUFFLER, sinter	1
10	234967	FILTER, inline (not shown)	1
11	198175	FITTING, push	1
12	111119	SCREW, valve	4
13	117820	SCREW, cap skt	2
15	198178	FITTING, elbow	2
16	198177	FITTING, push	3
20	198269	BRACKET, flowmeter	1
23	107530	SCREW, cap skt	4

Ref No	Part No	Description	Qty.
24		SEALANT, anaero	1
25		SEALANT, pipe s	1
26	054753	TUBE, nylon rd	2.3
29	110580	SCREW, cap sock	2
30		BLANK, label	1
32	196108	PLUG, assy 100V	1
33	198683	WIRE, 3 cond 2	2
34		ARTWORK, identification	1
35		LABEL, rectangular	3
36	198268	BRACKET, flowmeter	1
38	107100	SCREW, cap skt	2
39	112906	WASHER, lock sp	2
42	804500	LABEL, warning	1
43	112512	FERRULE, wire o	8

Fluid Module Parts (continued)

Code C	Option-01	Model No 234168	1
3		Junction box	1
4	198082	Transducer, pressure	1
21	244734	Regulator, assembly	1
27		Screw, cap, skt	2
40	C34045	Spacer	

Code C	Option-02	Model No 234165	
3		Junction box	1
4	198082	Transducer, pressure	1
17	198327	Bracket, flowmeter	1
18	110501	Screw, cap, skt	4
21	244734	Regulator, assembly	1
22	162449	Fitting, nipple	1
27		Screw, cap, skt	2
28	239716	Meter, gear, G3000	1
31	156684	Union, adapter	1
37	198578	Harness, cable	1
40	C34045	Spacer	2

Code C	Option-03	Model No 234166	
3		Junction box	1
4	198082	Transducer, pre	1
17	198327	Bracket, flowmeter	1
18	110501	Screw, cap, skt	4
21	244734	Regulator, assembly	1
22	162449	Fitting, nipple	1
27		Screw, cap, skt	2
28	244292	Meter, gear, G3000 HR	1
31	156684	Union, adapter	1
37	198578	Harness, cable	1
40	C34045	Spacer	2

Code C	Option-04	Model No 234167	
3		Junction box	1
4	198082	Transducer, pressure	1
17		Bracket, flowmeter	1
19	115226	Washer, lock sp	6
21	244734	Regulator, assembly	1
22	C20461	Fitting, nipple	1
27		Screw, cap, skt	6
28	246190	Meter, helical gear	1
31	156684	Union, adapter	1
37	198578	Harness, cable	1
40	C34045	Spacer	2
44	C19197	Washer, plain	4

Code C	Option-05	Model No 234195	
3		Junction box	1
4	198082	Transducer, pressure	1
17		Bracket, flowmeter	1
19	115226	Washer, lock sp	6
21	244734	Regulator, assembly	1
22	C20461	Fitting, nipple	1
27		Screw, cap, skt	6
28	246652	Meter, helical gear, HR	1
31	156684	Union, adapter	1
37	198578	Harness, cable	1
40	C34045	Spacer	2
44	C19197	Washer, plain	4

Code C	Option - 06	Model No 234170	
3		Junction Box	1
4	198082	Transducer, Pressure	1
21	246642	Regulator, mastic	1
27		Screw, cap skt	2

Code C	Option-07	Model No 234169	
3		Junction box	1
4	198082	Transducer, pressure	1
17		Bracket, flowmeter	1
19	115226	Washer, lock, sp	6
21	246642	Regulator, mastic	1
22	C20487	Fitting, nipple	1
27		Screw, cap, skt	6
28	246190	Meter, helical gear	1
31	157785	Union, swivel	1
37	198578	Harness, cable	1
44	C19197	Washer, plain	4

Code C	Option-08	Model No 234196	
3		Junction box	1
4	198082	Transducer, pressure	1
17		Bracket, flow meter	1
19	115226	Washer, lock	6
21	246642	Regulator, mastic	1
22	C20487	Fitting, nipple	1
27		Screw, cap, skt	6
28	246652	Meter, helical gear, HR	1
31	157785	Union, swivel	1
37	198578	Harness, cable	4
44	C19197	Washer, plain	4

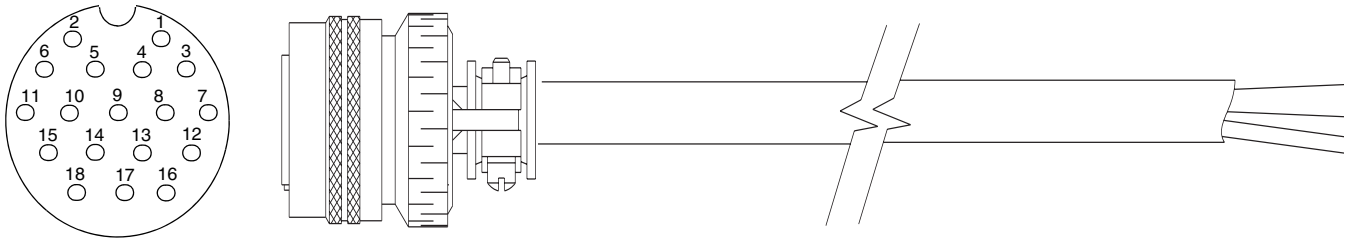
Code C	Option-09	Model No 234193	
3		Junction box	1
4	234191	Cable, pressure	1
5	117764	Sensor, pressure	1
21	246643	Regulator, mastic	1
27		Screw, cap, skt	2
41	118331	Label, warning	1
45	624545	Fitting, tee 3/4 x 1/4	1

Code C	Option-10	Model No 234194	
3		Junction, box	1
4	234191	Cable, pressure	1
5	117764	Sensor, pressure	1
17		Bracket, flowmeter	1
19	115226	Washer, lock, sp	6
21	246643	Regulator, mastic	1
22	175013	Nipple, pipe	1
27		Screw, cap, skt	6
28	246340	Meter, helical gear, HTD	1
31	157785	Union, swivel	1
37	198578	Harness, cable	1
41	118331	Label, warning	1
44	C19197	Washer, plain	4
45	624545	Fitting, tee, 3/4 x 1/4	1

Accessory Parts

Automation Interface Cable Assembly

The cable length of automation interface cable assembly 117774 is 40 ft (12.2 m). This figure shows the cable and identifies the cable interface signals.

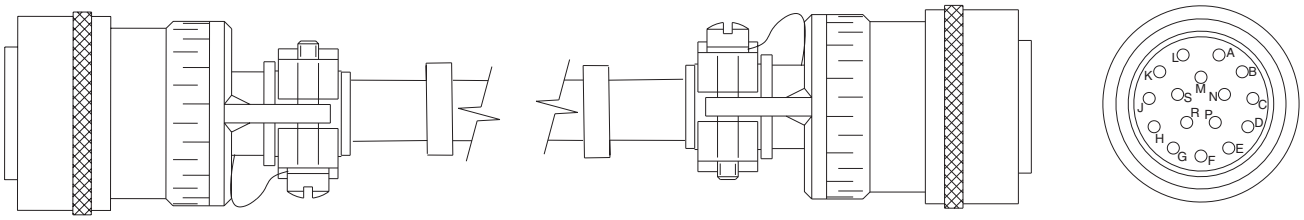


Pin #	Wire #	Color	Description
1	3290	Blk	Dispense Gun
2	3310	Red	Job Complete
3	3350	Wht	Style Bit 1
4	3370	Grn	Style Bit 2
5	2120	Orn	24 VDC from IFC
6	2121	Blu	24 VDC common
7	3150	Brn	Analog flow command
8	3170	Yel	Analog common
9	3210	Vlt	Actual Flow rate signal
10	2680	Gry	Dispenser ready
11	2710	Pnk	Fault present
12	2740	Tan	In cycle
13	2770	Red / Grn	Minimum volume dispensed
14	2170	Red / Orn	24 VDC thru E-stop
15			Ground
16	3390	Red / Blk	Style Bit 3
17	3410	Wht / Blk	Style Bit 4
18	Spare	Wht / Red	N/C
N/A	Spare	Wht / Grn	N/C
N/A	Spare	Wht / Yel	N/C
N/A	Spare	Wht / Blu	N/C

Operations Cable Assembly

The operations cable is offered in these lengths (25 ft, 60 ft, and 125 ft.) and three different flexibilities. See page 9 for cable options.

A		1		A	24 VDC thru E-stop
B		2		B	24 VDC common
C		3		C	Gun solenoid
D		4		D	Ground
E		5		E	V/P +
F		6		F	V/P -
G		-		G	
H		-		H	
J		7		J	Pressure Sensor +
K		8		K	Pressure sensor -
L		-		L	
M		-		M	
N		9		N	Flow meter signal
P		10		P	Flow meter common
R		11		R	
S		12		S	



Electrical Schematics

PrecisionFlo LT Control Box

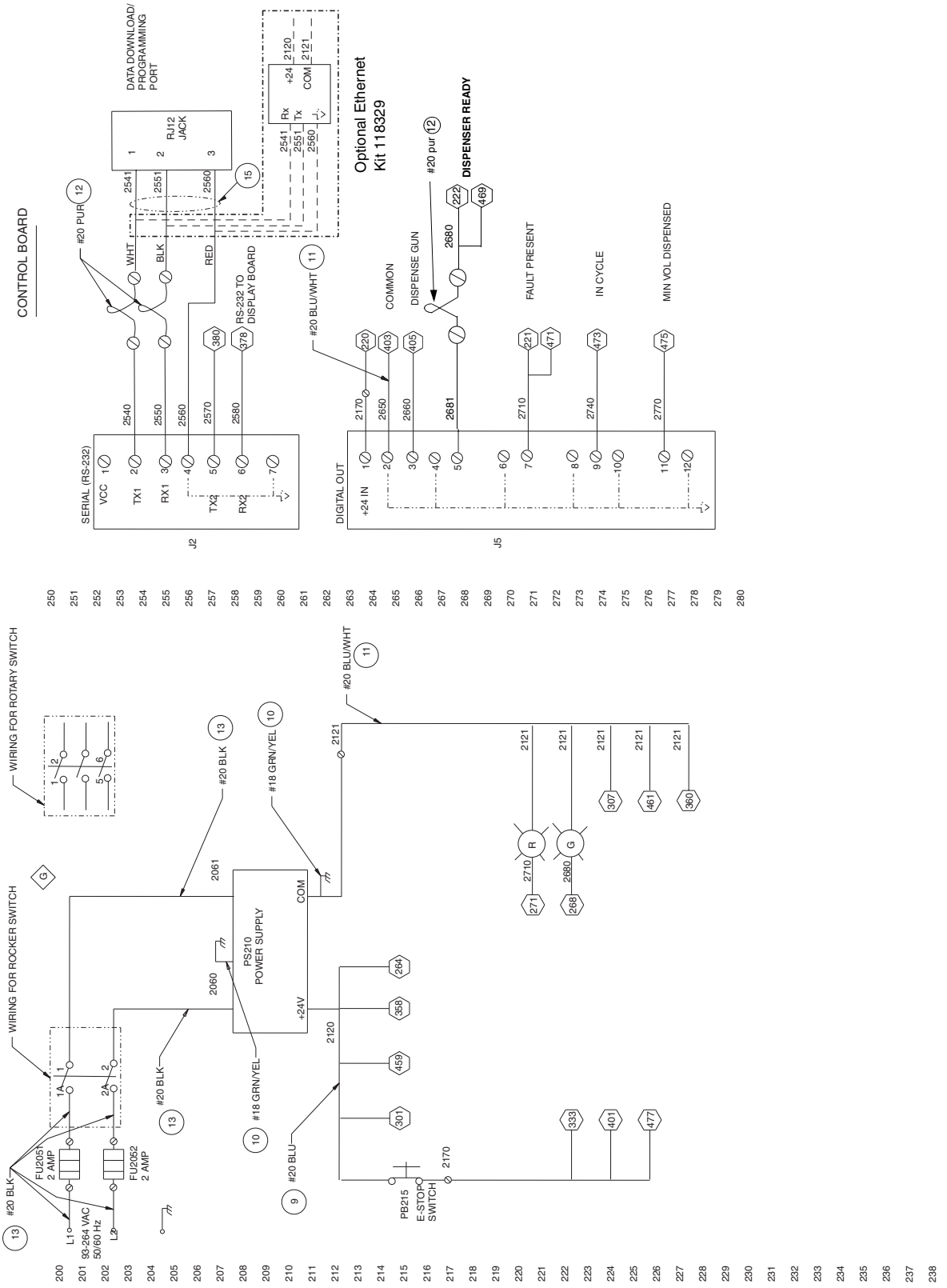


FIG. 28

PrecisionFlo LT Control Box

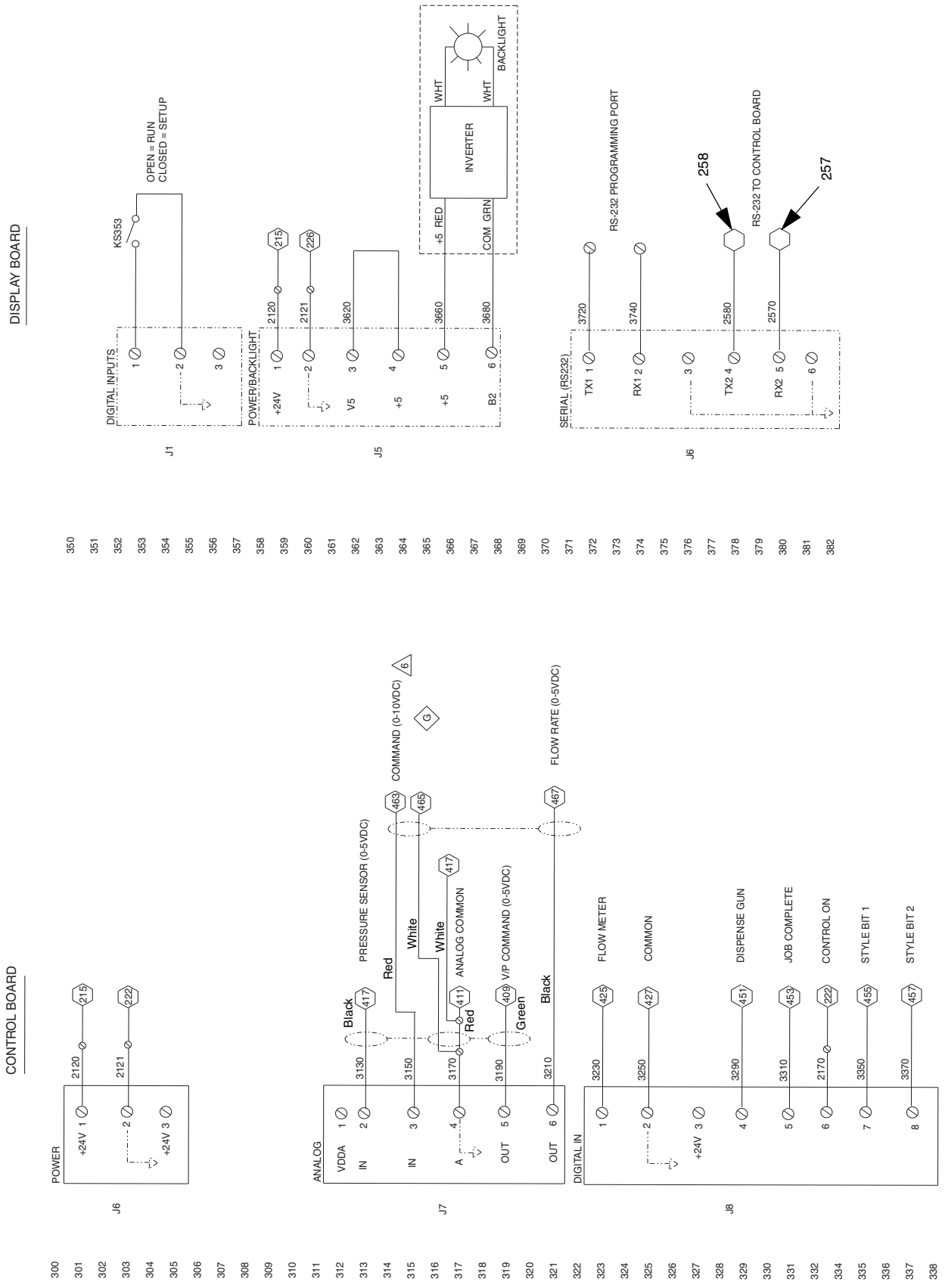


FIG. 29

PrecisionFlo LT Control Box

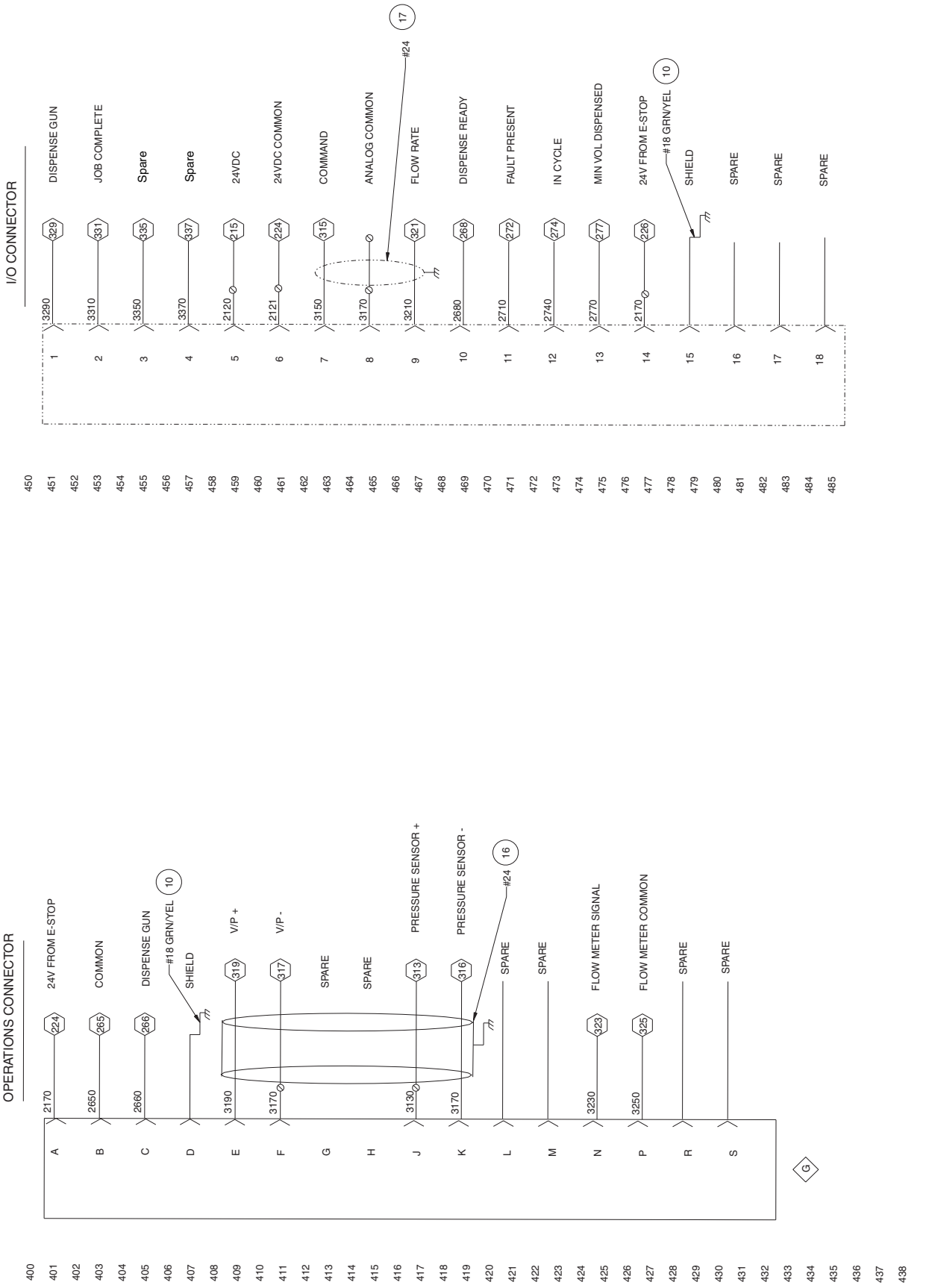


FIG. 30

Fluid Module Junction Box

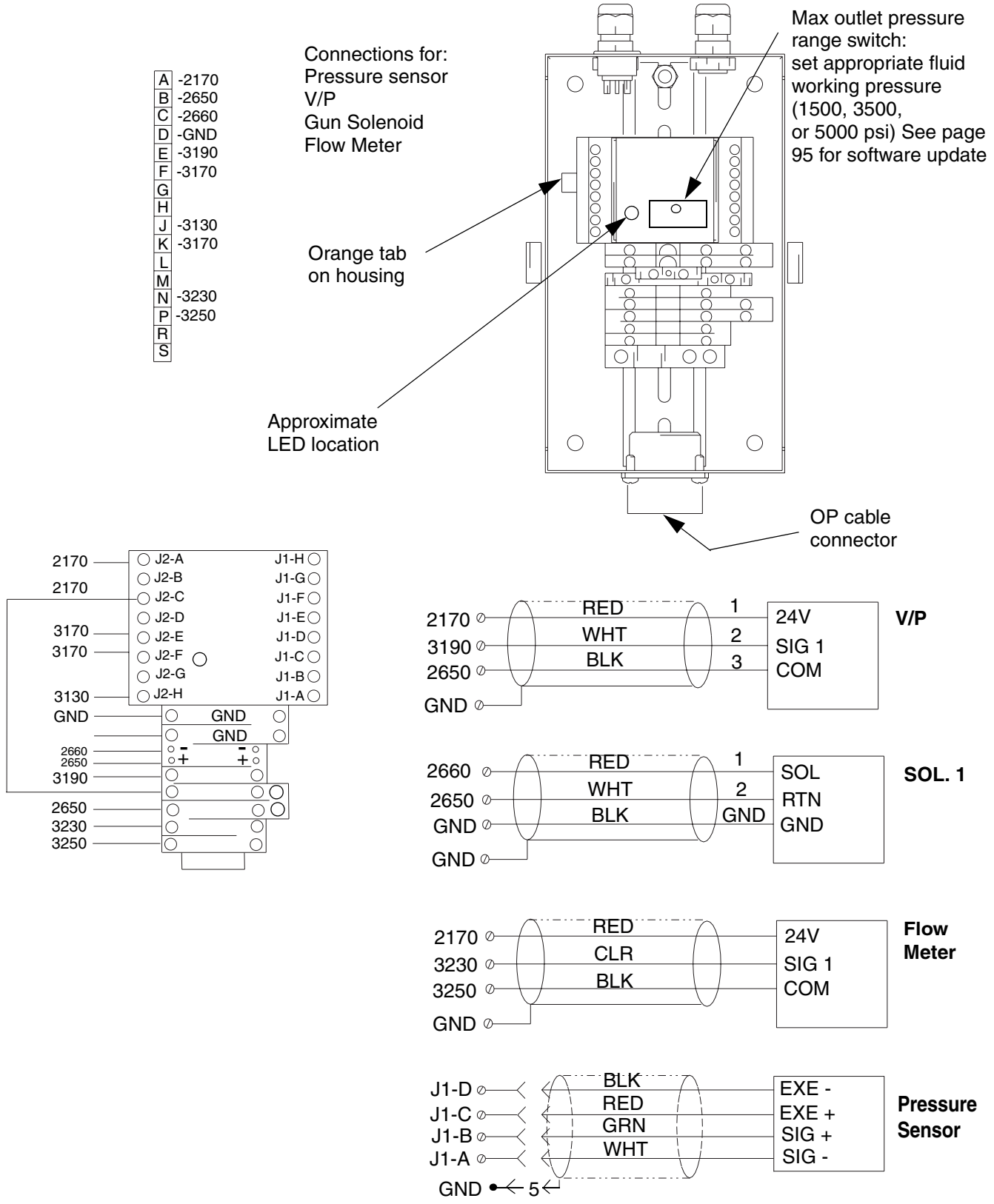


FIG. 31

Technical Data

*Minimum Flow Rates	38 cc/minute with G3000HR meter 75 cc/minute with G3000 meter 50 cc/minute with High Resolution Helical flow meter 100 cc/minute with Helical flow meter (ambient/heated)
*Maximum Flow Rates	1900 cc/minute with G3000HR meter 3800 cc/minute with G3000 meter 3750 cc/minute with High Resolution Helical flow meter 7500 cc/minute with Helical flow meter (ambient/heated)
Maximum Fluid Working Pressure	See **List of Models** on page 2
Minimum Fluid Working Pressure	At Regulator Outlet ..... 500 psi (3.5 MPa, 34.5 bar)
Minimum Back Pressure	Between Regulator Outlet and Dispense Nozzle ..... 500 psi (3.5 MPa, 34.5 bar)
Air Supply Pressure Range	60-120 psi (.4 - .8 MPa, 4.1- 8.3 bar) - 10 Micron filtration recommended
Fluid Filtration Required	30 mesh (500 micron) minimum
*Viscosity Range of Fluids	50 to 50000 cps with G3000 meter 10000 to 1000000 cps with Helical meter
*Minimum Dispensed Shot Size	3 cc with G3000HR meter 6 cc with G3000 meter 4 cc with High Resolution Helical meter 7 cc with Helical meter
V/P Output	1 to 5 VDC provide 0 to 100 psi (.68 MPa, 6.8 bar)
Wetted Parts	Meters and Fluid Panels ..... 303, 304, 321, 17- 4 stainless steel; tungsten carbide, PTFE, steel, Fluoroelastomer
Power Requirements	Full Load Amps - 1, Fused Amps - 2
Power Supply Voltage Range	120 VAC nominal ..... 93 - 264 VAC, 50-60 Hz., single phase
Operating Temperature Range	Controller ..... 40° - 122° F (4° - 50° C) Fluid Panel ..... see regulator rate technical data, page 74.
Operating Humidity Range	0 - 90% non-condensing

*Flow rates and viscosities are general estimates. Flow rates drop as viscosity increases. Fluids are expected to shear under pressure. New applications or fluids should always be tested to determine proper line sizes and equipment selections.

See your Graco Authorized distributor for other capabilities.

Regulator Plates

Mounting dimensions and parts breakdowns for the Air-Operated Regulator Fluid Plates are in the installation section of this manual.

	Cartridge Regulator	**Mastic Regulator**
Regulator Manual	308647	307517
Weight - No Flow Meter	25.5 lbs (11.6 kg)	33 lbs (15 kg)
Weight - W/G3000	30 lbs (13.6 kg)	N/A
Weight - Helical	40 lbs (18 kg)	48 lbs (22 kg)
Fluid Port Inlet	G3000 1/4” NPT (f) Helical 3/4” NPT(f)	3/4” npt(f)
Fluid Port Outlet	1/2” npt(f)	3/4” npt(f)
Maximum Inlet Pressure	See **List of Models** on page 2	5000 psi (34 MPa, 340 bar)
Maximum Working Pressure*	4500 psi (31 MPa, 310 bar)	Ambient 4500 psi (31 MPa, 310 bar) Heated 3500 psi (24 MPa, 241 bar)
Air Supply	1/4” npt(f)	1/4” npt(f)
Maximum Air Pressure	100 psi (0.7 MPa, 7.0 bar)	100 psi (0.7 MPa, 7.0 bar)
Minimum Air Pressure	60 psi (0.4 MPa, 4.1 bar)	60 psi (0.4 MPa, 4.1 bar)
Range Operating Temperature	Ambient 40° - 120°F (4° - 50°C))	Heated 40° - 400°F (4° - 204°C) Ambient 40° - 120°F (4° - 60°C)
Minimum Flow Rate - G3000	50 cc/min	N/A
Minimum Flow Rate - Helical	100 cc/min	100 cc/min

*Maximum system pressure depends on dispense valve.

Air outlets, open and close to dispense valve	5/32” or 4 mm tube fittings
Electric Power Requirements	24 VDC, from PrecisionFlo LT control
Height	8” (203 mm) (varies with model)
Fluid Specifications	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.
Ambient Air Temperature Range	40° to 120° (5° to 50° C)
Noise Data Continuous operator (full current)	70 dBA
Dispensing device exhaust (with muffler, peak-hold)	84 dBA

Kits and Accessories

PrecisionFlo LT Recommended Spare Parts

Part Number	Description
234282	Advanced control manual set in binder
244283	Standard control manual set in binder
117782	Power Supply
246496	Board, Circuit Assy, HI-Temp Press Sensor
246517	Board, Circuit Assy, Ambient Press Sensor
115216	Fuse, 2 Amp
117764	Sensor, Pressure, Assembly, High Temp.
246786	Sensor, High Temp., Helical
198082	Sensor, Pressure, Ambient
118342	Kit, Accessory, Communications Cable
195942	V/P
234967	Filter

Control Parts and Accessories

253620	PFlo LT Control Board Assy
117788	Kit, Accessory, Interface & Board, Std
117790	Power Supply, 5V Inverter
117818	Key, Panel Access
116728	Key, Set-Up
118329	Ethernet Kit
118337	Kit, Backlight Repair
117762	LED, Red
117763	LED, Green
117689	E-Stop
116320	Power Switch Rocker
116653	Rotary Disconnect
253614	Chip Set, CNTRL & Display Std

Fluid Plates

234168	Fluid plate, Ambient Cartridge Regulator with no flow meter
234165	Fluid plate, Ambient Cartridge Regulator with G3000 flow meter
234166	Fluid plate, Ambient Cartridge Regulator with a G3000HR flow meter
234167	Fluid Plate, Ambient Cartridge with helical flow meter
234195	Fluid plate, Ambient Cartridge Regulator with high resolution helical flow meter
234170	Fluid plate, Ambient Mastic Regulator with no flow meter
234169	Fluid plate, Ambient Mastic Regulator with helical flow meter
234196	Fluid plate, Ambient Mastic Regulator with high resolution helical flow meter
234193	Fluid plate, Heated Mastic Regulator with no flow meter
234194	Fluid plate, Heated Mastic Regulator with helical flow meter

Fluid Plate Parts and Accessories

246687	Mastic regulator, 3/4” air operated (no transducer ports)
246642	Mastic regulator, 3/4” air operated, with transducer ports for ambient fluid plates
246643	Mastic regulator, 3/4” air operated, for heated fluid plates
246688	Mastic regulator, 3/4” air operated for heated applications (no transducer ports)
244734	Cartridge regulator with transducer ports for fluid plates
238748	Repair kit, cartridge regulator
238747	Fluid diaphragm repair kit, cartridge regulator
233131	Fluid section repair kit, mastic fluid regulator
246190	Flow meter, ambient helical, w/sensor
234134	Flow meter, ambient helical, w/o sensor
246652	Flow meter, high resolution helical, w/sensor
246650	Flow meter, high resolution helical, w/o sensor
246340	Flow meter, heated helical, w/sensor
246191	Flow meter, heated helical, w/o sensor
246786	Sensor, HG6000 (all models)
239716	Flow meter assembly, G3000 spur gear, meter and sensor
239719	Flow meter, G3000 spur gear, does not include sensor
244292	Flow meter assembly, G3000 HR spur gear, meter and sensor
244291	Flow meter, G3000HR spur gear, does not include sensor
239717	Sensor, flow meter, G3000 & G3000HR
198082	Pressure sensor, outlet for ambient regulators
117764	Pressure sensor, outlet for heated regulators
198579	Kit, cable, for adding SRZ40 meter
198578	Kit, cable, for adding G3000 meter
244343	Mass flow meter kit, non-intrusive
246596	Kit, Helical gear set repair (standard and heated)
246949	Kit, Helical gear set repair (high resolution)

Cables

118342	Cable kit, PrecisionFlo LT to personal computer
117774	Cable, automation analog, 40 ft. (12.9 m)
198731	Cable, High Flex Operation, 20 ft. (6.11 m)
198296	Cable, High Flex Operation, 60 ft. (18.29 m)
198732	Cable, High Flex Operation, 125 ft. (38.1 m)
117751	Cable, Standard Flex Operation 20 ft. (6.11 m)
117752	Cable, Standard Flex Operation 60 ft. (18.29 m)
117753	Cable, Standard Flex Operation 125 ft. (38.1 m)
117747	Cable, Low Flex Operation, 20 ft. (6.11 m)
117748	Cable, Low Flex Operation, 60 ft. (18.29 m)
117749	Cable, Low Flex Operation, 125 ft. (38.1 m)
234191	Cable, Heated Pressure Sensor

Filters and Accessories

C59725	Dual filter bank with gauges, ball and drain valves, 30 mesh element, 5000 psi, (345 bar, 34.5 MPa) 1-1/4” NPT Inlet 1” NPT Outlet
C59547	Single filter kit, gauges, ball and drain valves, 30 mesh element, 5000 psi, (345 bar, 34.5 MPa) 1” NPT
C58997	Fluid filter, polyethylene support, 30 mesh element, 5000 psi (345 bar, 34.5 MPa) 1” NPT
515222	Fluid filter, polyethylene support, no element from above kits
157630	Spring, filter
521477	Fluid shutoff valve, 1” NPT(F), 5000 psi (345 bar, 34.5 MPa) CS, Fluoroelastomer
210657	Ball valve, high pressure, 1/2” NPT(M), 5000 psi, (345 bar, 34.5 MPa) CS, Fluoroelastomer
210658	Ball valve, high pressure, 3/8” NPT(M), 5000 psi, (345 bar, 34.5 MPa) CS, Fluoroelastomer
210659	Ball valve, high pressure, 3/8” x 1/4” NPT(M), 5000 psi, (345 bar, 34.5 MPa) CS, Fluoroelastomer

Applicators and Repair Kits

918533	Dispense Valve, Extrusion, Ambient, Ball Seat
918535	Dispense Valve, Extrusion, Ambient, Snuff Back
918537	Dispense Valve, High Viscosity
918539	Dispense Valve, Extrusion, High Flow, High Viscosity
918623	Compact Dispense Valve, Extrusion
918625	Compact Dispense Valve, Spray
233670	AutoPlus SAE valve
244930	Manifold, Fluid Inlet, AutoPlus SAE valve
243482	1K Ultra-Lite valve 45° outlet for orbiter
244535	EnDure Valve replacement, no manifold
244910	EnDure Valve with ambient or temperature conditioning manifold
244961	EnDure Valve with 120 volt electric heat (200°F) (93.3°C)
244962	EnDure Valve with 230 volt electric heat (200°F) (93.3°C)
239807	Needle assembly, AutoPlus SAE valve
233671	Seat, AutoPlus SAE valve
189970	Gasket, AutoPlus SAE valve, seat
192443	Gasket, AutoPlus SAE valve, inlet
114134	Gasket, AutoPlus SAE valve, inlet air
570267	Fluid Section Seal kit, 1K Ultra-Lite valve
570268	Rebuild kit, 1K Ultra-Lite valve
15E012	Standard seal kit, EnDure valve
15E011	High temperature seal kit, EnDure valve
104661	Quick exhaust valve, 1/8” NPT(F)
244021	Cable kit, 8 pin connector and 10 ft. cable for 240 VAC valves

PrecisionSwirl

234029	PrecisionSwirl Module, Narrow Pattern
241658	PrecisionSwirl Module, Wide Pattern
243402	Swirl orbiter, narrow pattern
243403	Swirl orbiter, wide pattern
243437	Tube/bearing repair kit, narrow pattern

918620	Tube/bearing repair kit, wide pattern
617870	Cable, PrecisionSwirl, 55’
617829	Cable, PrecisionSwirl, automation, 40’
233125	Extension cable, 6’
233124	Extension cable 9’
233123	Extension cable 15’
241479	Motor kit
196008	Bellows (12-pack)
241569	Bearing Repair Tool Kit

Tips, Nozzles and Adapters

918610	Swirl dispense tip 0.012”, (0.31 mm) carbide
918601	Swirl dispense tip 0.015”, (0.38 mm) carbide
918602	Swirl dispense tip 0.017”, (0.43 mm) carbide
918603	Swirl dispense tip 0.019”, (0.48 mm) carbide
918604	Swirl dispense tip 0.021”, (0.53 mm) carbide
918605	Swirl dispense tip 0.023”, (0.58 mm) carbide
918606	Swirl dispense tip 0.025”, (0.64 mm) carbide
918607	Swirl dispense tip 0.027”, (0.69 mm) carbide
918608	Swirl dispense tip 0.031”, (0.79 mm) carbide
918611	Swirl dispense tip 0.035”, (0.90 mm) carbide
918612	Swirl dispense tip 0.039”, (0.99 mm) carbide
918613	Swirl dispense tip 0.043”, (1.09 mm) carbide
918614	Swirl dispense tip 0.047”, (1.19 mm) carbide
241813	Swirl dispense tip 0.051”, (1.30 mm) carbide
241814	Swirl dispense tip 0.055”, (1.40 mm) carbide
241816	Swirl dispense tip 0.070”, (1.78 mm) carbide
198316	Nozzle nut, 1/8” NPT for AutoPlus SAE valve, extruding applications
198391	Tip nut, AutoPlus SAE valve, fan or stream
617585	Nozzle nut for streaming tips, EnDure valve
197504	Straight 3/4-16 JIC outlet for swirl, EnDure valve
197842	Nozzle, 45° nose piece, orbiter to EnDure valve
198323	Adapter, 45° orbiter to EnDure
198324	Fitting, 45° orbiter to EnDure
607665	Dispense nozzle, steel, 1/8” NPT(M), 0.125”, (3.18 mm), 2’ (0.6 m) long
161505	Dispense nozzle, steel, 1/8” NPT(M), 0.094”, (2.39 mm), 2’ (0.6 m) long
164799	Dispense nozzle, steel, 1/8” NPT(M), 0.055”, (1.4 mm), 2’ (0.6 m) long
C17009	Dispense nozzle, steel, 1/8” NPT(M), 0.125”, (3.18 mm), 1.22’ (0.36 m) long
C01025	Dispense nozzle, steel, 1/8” NPT(M), 0.9” x 0.37 (22.86 mm x 9.40 mm) ribbon hardened tip, 2.43” (61.72 mm) long
182XXX	Airless 182xxx fan tips for AutoPlus SAE valve, ref. 308813 manual
270025	Streaming tip, 0.025 (0.64 mm) orifice
270027	Streaming tip, 0.027 (0.69 mm) orifice
270029	Streaming tip, 0.029 (0.74 mm) orifice

270035	Streaming tip, 0.035 (0.89 mm) orifice
270037	Streaming tip, 0.037 (0.94 mm) orifice
270039	Streaming tip, 0.039 (0.99 mm) orifice
270041	Streaming tip, 0.041 (1.04 mm) orifice
270043	Streaming tip, 0.043 (1.09 mm) orifice
270059	Streaming tip, 0.059 (1.50 mm) orifice
C08224	Shower tip, 6 orifices, 0.021” (0.53 mm) orifice size

Hoses

116760	Dispense, 0.50” (1.27 mm) ID x 6’, (1.83 m), Neoprene core, 4000 psi, (276 bar, 27.6 MPa) high flex, abrasion resistant for automation units
116762	Dispense, 0.62” (1.57 mm) ID x 6’, (1.83 m), Neoprene core, 3625, (250 bar, 25.0 MPa) high flex, abrasion resistant for automation units
116761	Dispense 0.50” (1.27 mm) ID x 10’, (3.05 m), Neoprene core, 4000 psi, (276 bar, 27.6 MPa) high flex, abrasion resistant for automation units
116763	Dispense, 0.62” (1.57 mm) ID x 10’, (3.05 m) Neoprene core, 3625 psi, 250 bar, 25.0 MPa) high flex, abrasion resistant for automation units
C12383	Feed, 1.0” (25.4 mm) ID x 10’, (3.05 mm), Neoprene core 5000 psi (345 bar, 34.5 MPa)
C12218	Feed, 1.0” (25.4 mm) ID x 20’, (3.03 m), Neoprene core, 5000 psi (345 bar, 34.5 MPa)
116749	Co-axial feed, 1.0” (25.4 mm) ID x 10’ (3.05 mm), synthetic rubber, 5000 psi (345 bar 24.5 MPa)
116748	Co-axial feed, 1.0” (25.4 mm) ID x 20’ (3.03 m), synthetic rubber, 5000 psi (345 bar 24.5 MPa)
115875	Dispense, 240 volt electric heat, 0.5” (1.27 mm) x 6’, (1.83 m) PTFE core
115903	Dispense, 240 volt electric heat, 0.62” (15.75 mm) x 6’, (1.83 m) PTFE core
115876	Dispense, 240 volt electric heat, 0.5” (1.27 mm) x 10’, (3.05 m) PTFE core
115880	Dispense, 240 volt electric heat, 0.62” (15.75 mm) x 10’, (3.05 m) PTFE core
115885	Feed, 240 volt electric heat, 0.87” (22.10 mm) x 10’, (3.05 m) PTFE core
115887	Feed, 240 volt electric heat, 0.87” (22.10 mm) x 20’, (6.1 m) PTFE core
116770	Jacket, 6’ (1.83 m) dispense hose, temperature conditioning
116769	Jacket, 10’ (3.05 m) dispense hose, temperature conditioning
C50239	Hose swivel, 1/2” NPT(F), 5000 psi (345 bar, 34.5 MPa)
512028	PTFE hose, SS braid, 0.187 (4.75 mm) ID, 10’ (3.05 m) long, 3000 psi (207 bar, 20.7 MPa)
685612	PTFE hose, SS braid, 0.22 (5.59 mm) ID, 6’ (1.83 m) long, 4000 psi (276 bar, 27.6 MPa)
205099	PTFE hose, SS braid, 0.25 (6.35 mm) ID, 2.5’ (0.76 m) long, 3000 psi (207 bar, 20.7 MPa)
205058	PTFE hose, SS braid, 0.25 (6.35 m) ID, 6’ (1.83 m) long, 3000 psi (207 bar, 20.7 MPa)
205349	PTFE hose, SS braid, 0.25 (6.35 m) ID, 15’ (4.57 m) long, 3000 psi (207 bar, 20.7 MPa)
204938	PTFE hose, SS braid, 0.25 (6.35 mm) ID, 25’ (7.62 m) long, 3000 psi (207 bar, 20.7 MPa)
206024	PTFE hose, SS braid, 0.25 (6.35 mm) ID, 50’ (15.35 m) long, 3000 psi (207 bar, 20.7 MPa)
235905	PTFE hose, SS braid, 0.308 (7.82 mm) ID, 2.5’ (0.76 m) long, 4000 psi (276 bar, 27.6 MPa)
685602	PTFE hose, SS braid, 0.308 (7.82 mm) ID, 15’ (4.57 m) long, 4000 psi (276 bar, 27.6 MPa)
685603	PTFE hose, SS braid, 0.308 (7.82 mm) ID, 25’ (7.62 m) long, 4000 psi (276 bar, 27.6 MPa)
511381	PTFE hose, SS braid, 0.401 (10.19 mm) ID, 10’ (3.05 m) long, 4000 psi (276 bar, 27.6 MPa)
685605	PTFE hose, SS braid, 0.617 (15.67 mm) ID, 6’ (1.85 m) long, 4000 psi (276 bar, 27.6 MPa)
685606	PTFE hose, SS braid, 0.617 (15.67 mm) ID, 10’ (3.05 mm) long, 4000 psi (276 bar, 27.6 MPa)
685607	PTFE hose, SS braid, 0.617 (15.67 mm) ID, 15’ (4.57 m) long, 4000 psi (276 bar, 27.6 MPa)

686608	PTFE hose, SS braid, 0.617 (15.67 mm) ID, 25’ (7.62 m) long, 4000 psi (276 bar, 27.6 MPa)
C12288	PTFE hose, SS braid, 0.51 (12.95 mm) ID, 10’ (3.05 m) long, 1500 psi (103 bar, 10.3 MPa)
514428	PTFE hose, SS braid, 0.25 (6.35 m) ID, 10’ (3.05 mm) long, 3000 psi (207 bar, 20.7 MPa)
511385	PTFE feed 3/4”, (19.05 mm) 10’ (3.05 m) long, SS braid, PTFE feed, 4000 psi (276 bar, 27.6 MPa)
511387	PTFE feed 3/4”, (19.05 mm) 25’ (7.62 m) long, SS braid, PTFE feed, 4000 psi (276 bar, 27.6 MPa)
511390	PTFE feed 1”, (25.4 mm) 10’ (3.05 m) long, SS braid, PTFE feed, 4000 psi (276 bar, 27.6 MPa)
109161	Hose Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/8” (9.52 mm) ID, 2’ (0.61 m) long
109162	Hose Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/8” (9.52 mm) ID, 4’ (1.22 m) long
109163	Hose Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/8” (9.52 mm) ID, 6’ (1.83 m) long
215441	Hose Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/8” (9.52 mm) ID, 10’ (3.05 m) long
215443	Hose Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 1/2” (12.7 mm) ID, 25’ (7.62 m) long
215444	Hose Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 1/2” (12.7 mm) ID, 50’ (15.24 m) long
215445	Hose Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 1/2” (12.7 mm) ID, 5’ (1.52 m) long
215241	Hose Neoprene core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 6’ (1.83 m) long
215238	Hose Neoprene core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 10’ (3.05 m) long
215239	Hose Neoprene core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 15’ (4.57 m) long
215240	Hose Neoprene core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 25’ (7.62 m) long
626721	Dried hose, Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 1/2” (12.7 mm) ID, 10’ (3.05 m) long, dried, capped with desiccant
626722	Dried hose, Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 1/2” (12.7 mm) ID, 25’ (7.62 mm) long, dried, capped with desiccant
626720	Dried hose, Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 1/2” (12.7 mm) ID, 5’ (1.52 m) long, dried, capped with desiccant
626723	Dried hose, Neoprene core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 6’ (1.83 m) long, dried, capped with desiccant
626724	Dried hose, Neoprene core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 10’ (12.7 m) long, dried, capped with desiccant
626725	Dried hose, Neoprene core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 15’ (4.57 m) long, dried, capped with desiccant
626726	Dried hose, Buna-N core and cover, 5000 psi, (345 bar, 34.5 MPa) 3/4” (19.05 mm) ID, 25’ (7.62 m) long, dried, capped with desiccant

Temperature Conditioning and Electric Heat

198457	RTD Sensor, 100 ohm, 3 pin picofast connector
198458	Sensor cable, 6 ft., (1.83 m) 198457 sensor to temperature conditioning unit
116824	Heat zone controller module, temperature conditioning (spare parts)
116503	Heat zone controller module, electric heat (spare parts)
116201	Control relay 12v coil, electric heat box (spare parts)
116204	Zone relay, qty. 4, electric heat box (spare parts)

Appendix A

Using the PrecisionFlo LT I/O

The PrecisionFlo LT uses several I/O signals to communicate with plant automation controllers. There are four digital inputs, four digital outputs, one analog input, and one analog output. All of these signals are routed to the I/O connector on the top of the controller.

Other pins on the I/O connector include 24 VDC power, 24 VDC common, analog common, and a signal which is 24 VDC power only when the controller E-Stop switch is not latched in. None of the signals are isolated; all are referenced to the ground plane of the control board. The following paragraphs describe typical connection methods for the automation controller signals.

Digital Inputs

The two digital inputs are Dispense Gun and Job Complete. These inputs require a 24 VDC current sourcing output from the automation controller. See FIG. 32.

If the automation controller uses relay contacts to activate I/O signals, the 24 VDC available at the PrecisionFlo LT I/O connector (pin 5) should be used to drive the inputs. If the automation controller uses high-side switching of 24 VDC, the automation outputs can be directly connected to the inputs as long as the 24 VDC common (pin 6) of the PrecisionFlo LT is able to be connected to the automation controller common. If the automation controller outputs are low-side switching (open collector) or a voltage other than 24 VDC, relays must be used as shown in FIG. 32.

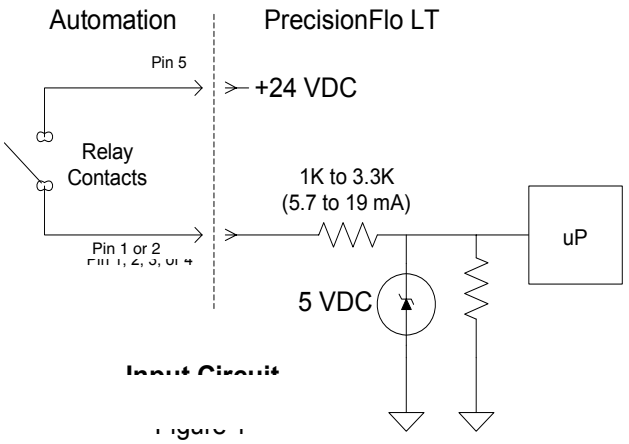


FIG. 32

Digital Outputs

The four digital outputs are Dispenser Ready, Fault Present, In Cycle, and Minimum Volume Dispensed. These outputs perform high-side switching of 24 VDC and require a 24 VDC current sinking input at the automation controller. See FIG. 33. If the automation controller uses 24 VDC relay coils to receive I/O signals, the signals should be connected as shown in FIG. 33.

If the automation controller uses optocouplers to receive digital I/O signals, the inputs must be designed for 24 VDC and the optocoupler emitter cathode must be connected to the PrecisionFlo LT 24 VDC common (pin 6). See FIG. 34.

If the automation controller inputs are current sourcing or use a voltage other than 24 VDC, relays with 24 VDC coils must be used as shown in FIG. 33.

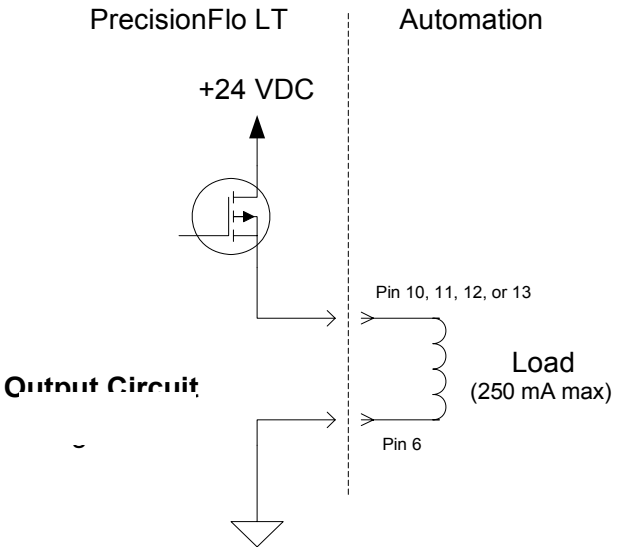


FIG. 33

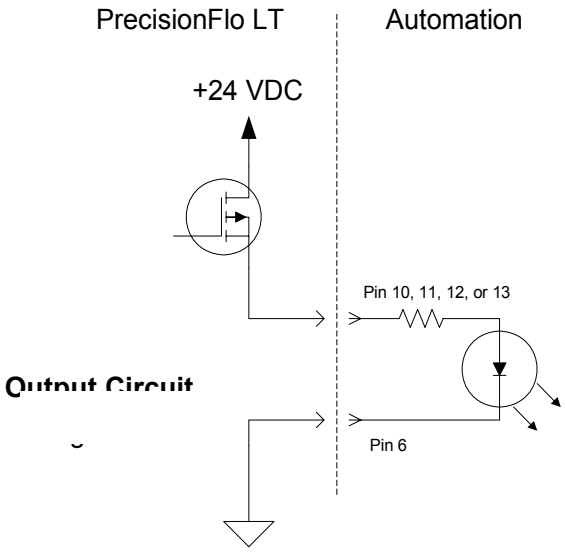
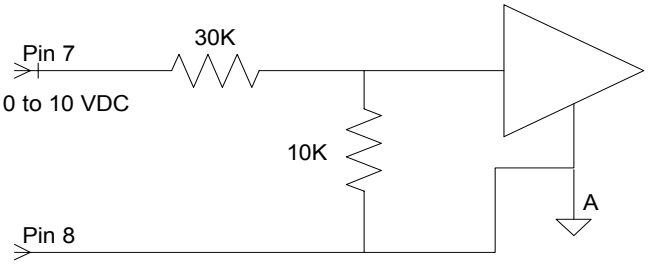


FIG. 34

Analog Inputs

The PrecisionFlo LT receives a flow rate or pressure analog command from the automation. The 0 to 10 VDC analog input is referenced to analog common on the control board. See FIG. 35. The reference for the automation controller analog output must be connected to the PrecisionFlo LT analog reference (pin 8) for this signal to function properly. If this reference connection is not possible an analog isolator must be used.

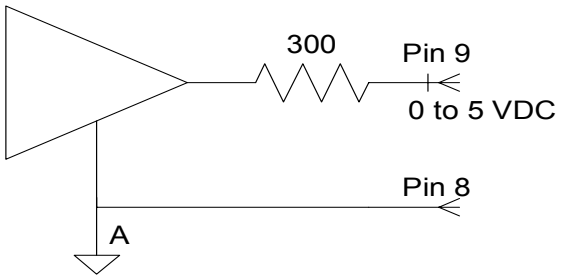


Analog Input

FIG. 35

Analog Outputs

The PrecisionFlo LT provides a flow rate (tach) signal for use in the automation. The 0 to 5 VDC analog output is referenced to analog common on the control board. See FIG. 36. The reference for the automation controller analog output must be connected to the PrecisionFlo LT analog reference (pin 8) for this signal to function properly. If this reference connection is not possible an analog isolator must be used.



Analog Output

FIG. 36

24 VDC From E-Stop

The PrecisionFlo LT provides a signal that can be used by the automation controller to monitor the emergency stop switch position of the PrecisionFlo LT controller. See FIG. 37.

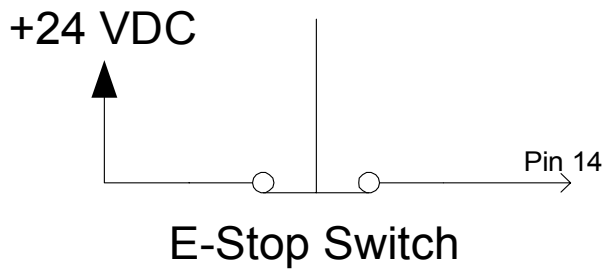


FIG. 37

Relays

If the use of relays is required to condition the digital I/O signals, these are some examples of part numbers that could be used.

For 24 VDC Coils:

- Relay: IDEC Part # RH1B-UDC24V
- Socket (DIN Rail): IDEC Part # SH1B-05
- Spring: IDEC Part # SY2S-02F1

For 120 VAC Coils:

- Relay: IDEC Part # RH1B-UAC120V
- Socket (DIN Rail): IDEC Part # SH1B-05
- Spring: IDEC Part # SY2S-02F1

Appendix B

PrecisionFlo LT User Interface

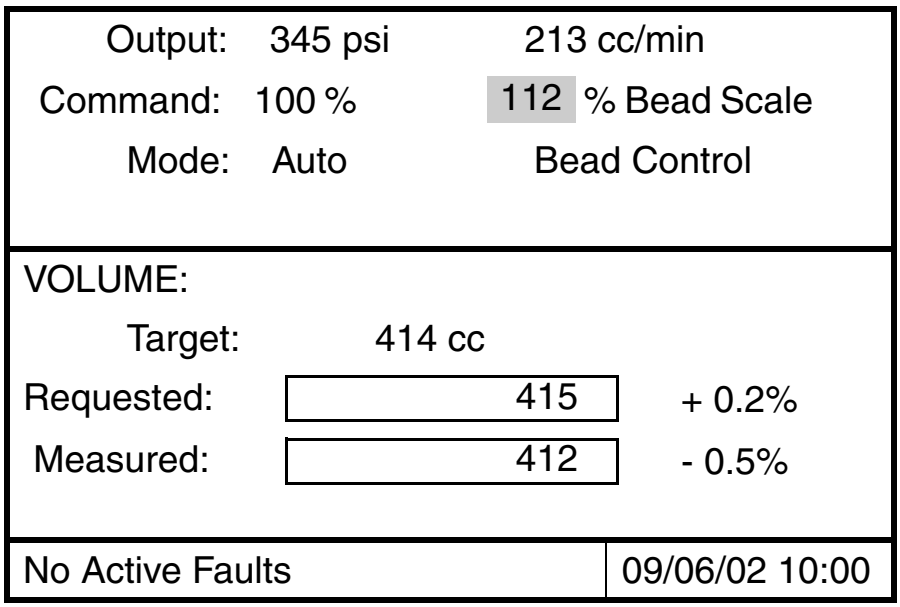
Screen Overview - Run Screen (Bead Control Mode)

The purpose of this screen is to display the required run parameters.

Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
Pressure	0-9999	N/A
Pressure Units	psi or bar	psi
Actual Flow Rate	0-9999 cc/min	N/A
Command	0-100 %	N/A
Bead Scale note 1	50-150%	100 %
Dispense Mode	Auto or Manual	N/A
Control Mode	Bead Control, Volume Monitor, Batch Dispense, or Pressure Control	Bead Control
Style (not shown in low end)	1 to 4	1
Target Volume note 2	0 to 9,999.9 cc	25.0 cc
Requested Volume	0 to 9,999,999.9 cc	N/A
Actual Volume	0 to 9,999,999.9 cc	N/A
Volume Error note 3	-100.0 to 999.9 %	N/A
Active Fault	Numerous text strings	N/A

Notes:

1. Reverse image indicates Run Mode Bead scale is enabled in the setup → other screen.
2. Target Volume should change based on style.
3. Error values reflect the last completed job's data.



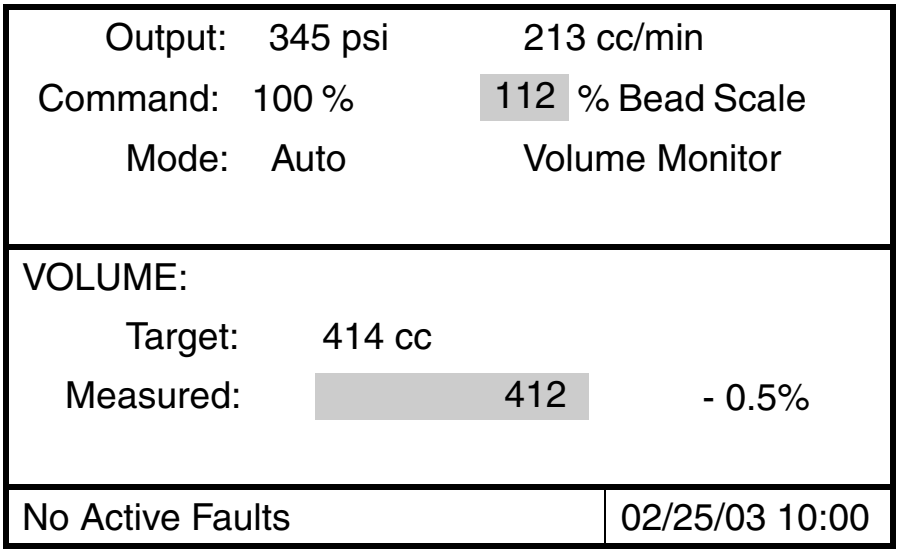
Run Screen (Volume Control Mode)

The purpose of this screen is to display the required run parameters.

Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
Pressure	0-9999	N/A
Pressure Units	psi or bar	psi
Actual Flow Rate	0-9999 cc/min	N/A
Command	0-100 %	N/A
Bead Scale note 1	50-150%	100 %
Dispense Mode	Auto or Manual	N/A
Control Mode	Bead Control, Volume Monitor, Batch Dispense, or Pressure Control	Bead Control
Style	1 to 4	1
Target Volume note 2	0 to 9999.9 cc	25.0 cc
Actual Volume	0 to 9,999,999.9 cc	N/A
Volume Error note 3	-100.0 to 999.9 %	N/A
Active Fault	Numerous text strings	N/A

Notes:

1. Reverse image indicates Run Mode Bead Scale is enabled in the setup → other screen.
2. Target Volume should change based on style.
3. Error Values reflect the completed last job's data.



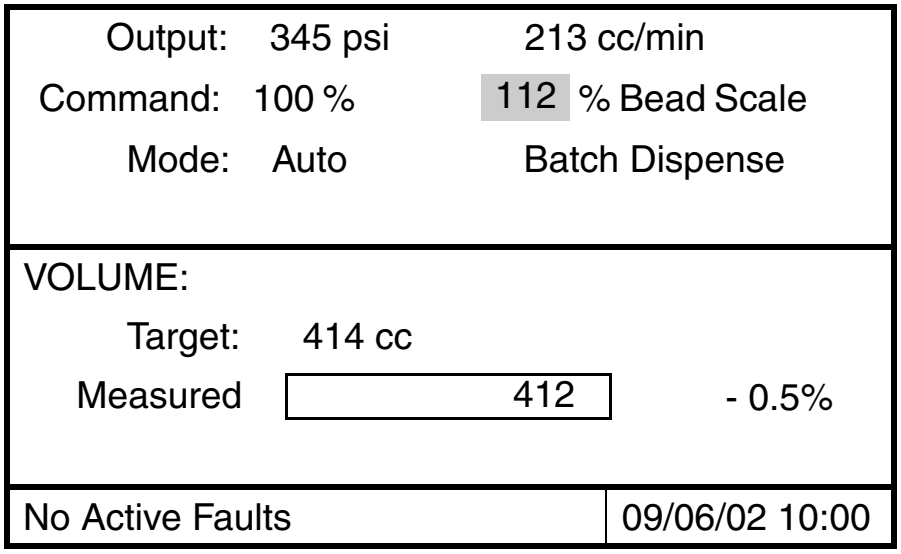
Run Screen (Batch Dispense Mode)

The purpose of this screen is to display the required run parameters.

Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
Pressure	0-9999	N/A
Pressure Units	psi or bar	psi
Actual Flow Rate	0-9999 cc/min	N/A
Command	0-100 %	N/A
Bead Scale note 1	50-150%	100 %
Dispense Mode	Auto or Manual	N/A
Control Mode	Bead Control, Volume Monitor, Batch Dispense, or Pressure Control	Bead Control
Style	1 to 4	1
Target Volume note 2	0 to 9999.9 cc	25.0 cc
Actual Volume	0 to 9,999,999.9 cc	N/A
Volume Error note 3	-100.0 to 999.9 %	N/A
Active Fault	Numerous text strings	N/A

Notes:

1. Reverse image indicates Run Mode Bead scale is enabled in the setup → other screen.
2. Target volume should change based on style.
3. Error values reflect the last completed job's data.



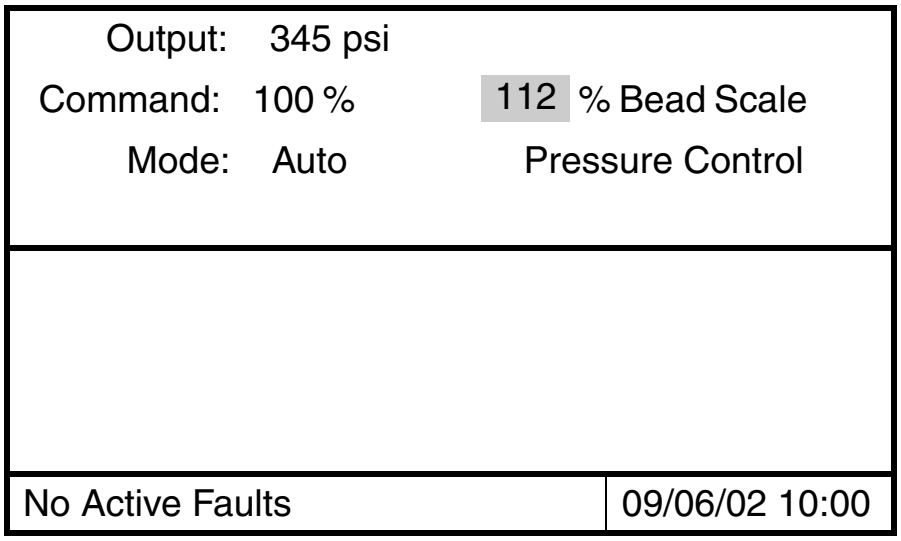
Run Screen (Pressure Control Mode)

The purpose of this screen is to display the required run parameters.

Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
Pressure	0-9999	N/A
Pressure Units	psi or bar	psi
Command	0-100 %	N/A
Bead Scale note 1	50-150%	100 %
Dispense Mode	Auto or Manual	N/A
Control Mode	Bead Control, Volume Monitor, Batch Dispense, or Pressure Control	Bead Control
Style	1 to 4	1
Active Fault	Numerous text strings	N/A

Notes:

1. Reverse image indicates Run Mode Bead scale is enabled in the setup → other screen.

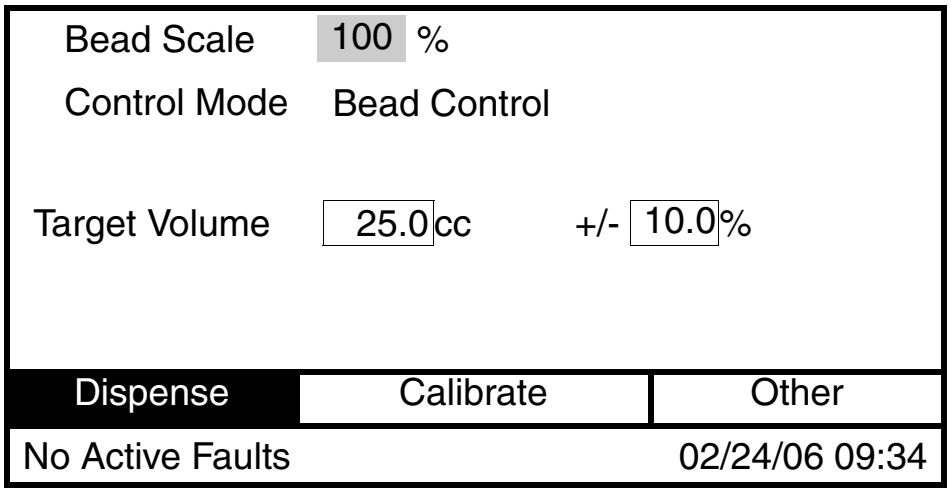


Setup Screen 1 Dispense Screen

The purpose of this screen is to display the required run parameters.

Notes:

1. Reverse image to indicate an input cell only if Run Mode Bead Adjust is enabled.

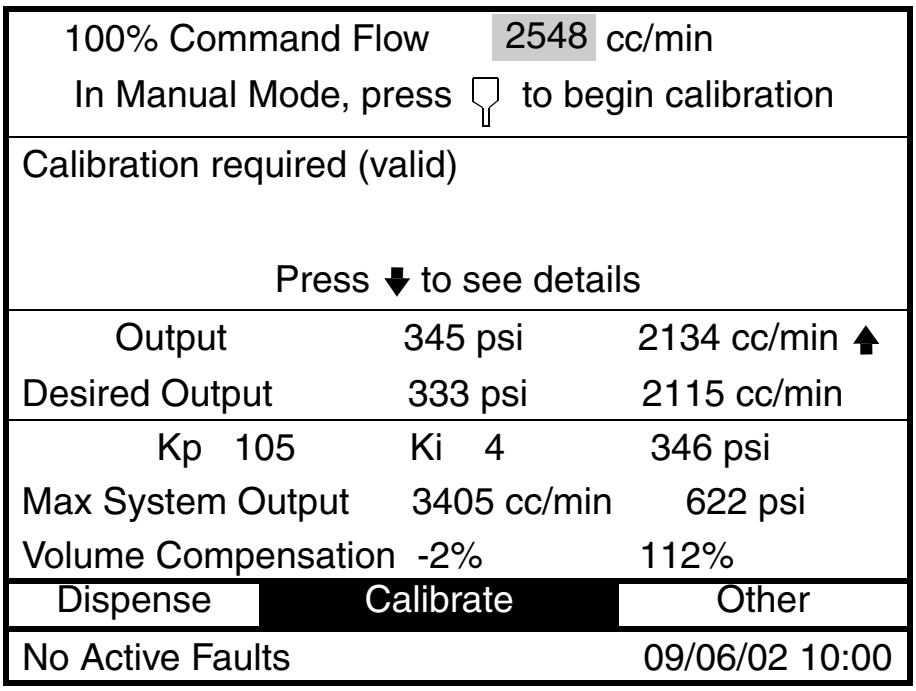


Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
Bead Scale	50-150%	100 %
Control Mode	Bead Control, Volume Monitor, Batch Dispense, or Pressure Control	Bead Control
Target Volume	0 to 9999.9	N/A
Volume Tolerance 1 to 4	0 to 99.9%	10.0%
Active Fault	Numerous text strings	N/A

Notes:

Bead Scale cannot be changed with the membrane buttons in Setup mode, only with the number keys.

Setup Screen 2: Calibrate Screen (Bead Control Mode)

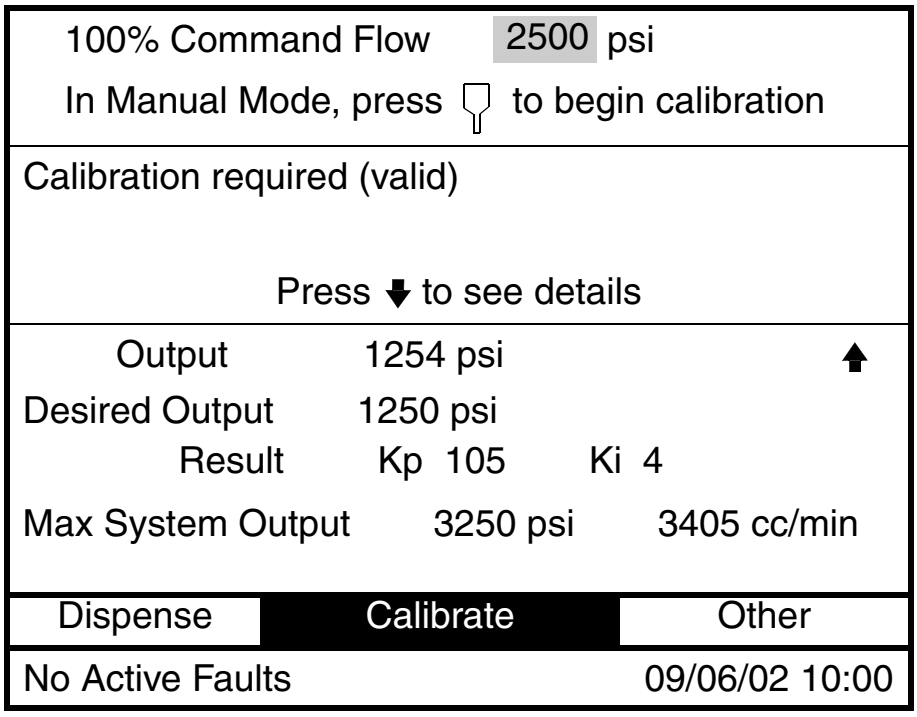


Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
100% commanded flow rate	50-150%	100 %
Pressure tuning status	In process, complete	N/A
Flow calibration status	In process, complete	N/A
Flow calibration result	Required, Valid	Required
Pressure	0-9999	N/A
Pressure units	psi or bar	psi
Actual flow rate	0-9999cc/min	N/A
Desired outlet pressure	0-9999	N/A
Desired flow rate	0-9999	N/A
Calculated optimal KP note 1	0 to 9999	100
Calculated optimal Ki note 1	0 to 9999	6
Pressure for 100% flow	0 to 9999	N/A
System maximum flow with completely open reg	0 to 9999	N/A
Compensation zero offset	-50 to 399%	0%
Compensation peak	25 to 400	100%
Active Fault	Numerous text strings	N/A

Notes:

The values for the pressure loop constants Kp and Ki can also be directly entered by the user in the OTHER setup screen.

Setup Screen 2: Calibrate Screen (Batch Dispense and Volume Monitor Modes)

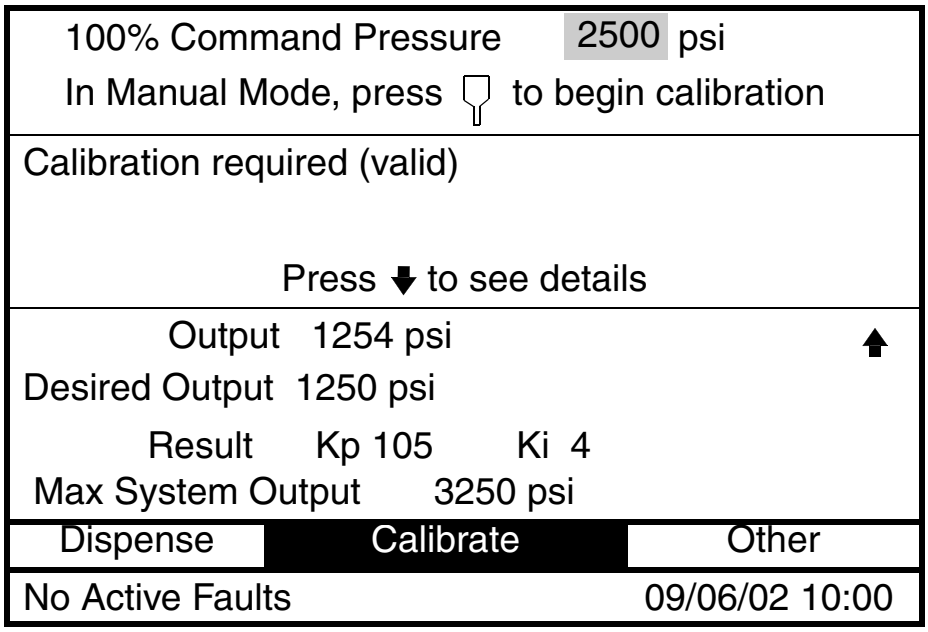


Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
100% commanded pressure	1 to 9999	1000
Calibration status	In process, complete	N/A
Pressure	0-9999	N/A
Pressure Units	psi or bar	psi
Desired Outlet Pressure	0 - 9999	N/A
Calculated optimal Kp note 1	0 to 9999	100
Calculated optimal Ki note 1	0 to 9999	6
System maximum pressure with completely open reg	0 to 9999	N/A
System maximum flow with completely open reg	0 to 9999	N/A
Active Fault	Numerous text strings	N/A

Notes:

1. The values for the pressure loop constants Kp and Ki can also be directly entered by the user in the OTHER setup screen.

Setup Screen 2: Calibrate Screen (Pressure Control Mode)



Description	Possible Values	Default Value
Hour	0-23	N/A
Minute	0-59	N/A
Day	1-31	N/A
Month	1-12	N/A
Year	2000-2099	N/A
Date Format	mm/dd/yy-dd/mm/yy	mm/dd/yy
100% commanded pressure	1 to 9999	1000
Calibration status	In process, complete	N/A
Pressure	0-9999	N/A
Pressure Units	psi or bar	psi
Desired Outlet Pressure	0 - 9999	N/A
Calculated optimal Kp [note 1]	0 to 9999	100
Calculated optimal Ki [note 1]	0 to 9999	6
System maximum pressure with completely open reg	0 to 9999	N/A
Active Fault	Numerous text strings	N/A

Notes:

1. The values for the pressure loop constants Kp and Ki can also be directly entered by the user in the OTHER setup screen.

Setup Screen 3: Other Screens

Language	English	⇧
Control Mode	Bead Control	
Command Mode	Analog	
Pressure Loop Kp	107	1
Pressure Loop Ki	9	
Job End Mode	Timer	
Job End Delay	4 seconds	⇩
Run Mode Bead Scale?	No	⇧
Regulator Pre-Charge	.00 VDC	
Gun On Delay	0 ms	
Gun Off Delay	0 ms	2
Reg On Delay	0 ms	
Reg. Off Delay	0	
Pulses per Flow Reading	6	⇩
Flow Comp Pivot	50 %	⇧
Flow Fault Time	2 seconds	
Screen Saver Timeout	0 minutes	
Pressure Units	psi	3
Flow Meter K Factor	3500 pulses/L	
Default/Fixed Command	50 %	
Manual Command	50 %	⇩
Zero Pressure Signal	1.00 VDC	⇧
5 VDC Pressure	3500 psi	
Minimum Pressure	0 psi	
Maximum Pressure	5000 psi	4
5 VDC Output Flow Rate	1000 cc/min	
		⇩
Date Format	mm/dd/yy	⇧
Year	2003	
Month	09	
Day	06	5
Hour	18	
Minute	00	
		⇩

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Low Volume	Alarm ⇩	⇧
High Volume	Warning ⇩	
Low Flow Rate	Alarm ⇩	
High Flow Rate	Alarm ⇩	6
Low Pressure	Warning ⇩	
High Pressure	Warning ⇩	
Computed Target	Warning ⇩	⇩

Description	Possible Values	Default Value
Language	English, Spanish, French, German, Italian, Portuguese, Japanese, or Korean	English
Date Format	dd/mm/yy or mm/dd/yy	mm/dd/yy
Year	00 to 99 (2000 to 2099)	N/A
Month	1 to 12	N/A
Day	1 to 31	N/A
Hour	0 to 23	N/A
Minute	0 to 59	N/A
Pressure Units	PSI or BAR	PSI
Command Mode	Fixed or Analog	Analog
Default Command note 1	0 to 100%	50%
Manual Command	0 to 100%	50%
Job End Mode	Timer or Digital I/O	Digital I/O
Job End Delay	1 to 99 seconds	4 sec
Flow Meter K-Factor	1 to 99,999 pulses/L	3500
Regulator Pre-Charge	0.00 to 5.00 VDC	0.00 VDC
Gun On Delay	0 to 999 msec	0 msec
Gun Off Delay	0 to 999 msec	0 msec
Reg On Delay	0 to 999 msec	0 msec
Reg Off Delay	0 to 999 msec	0 msec
Zero Pressure Sensor Signal	0.00 to 5.00 VDC	1.00 VDC
5 VDC Sensor Pressure	0 to 5000 PSI	3500 PSI
Minimum Outlet Pressure for Fault	0 to 5000 PSI	0 PSI
Maximum Outlet Pressure for Fault	0 to 5000 PSI	5000 PSI
Pressure Loop Kp note 2	0 to 9999	100
Pressure Loop Ki note 2	0 to 9999	6

Pulses per Flow Reading note 3	2 to 99 pulses	4 pulses
Flow Compensation Pivot Point note 4	0 to 100%	50%
Flow Fault Time	1 to 99 seconds	2 seconds
Enable Run Mode Bead Adjust?	Yes or No	No
Screen Saver Timeout	0 to 99 minutes note 5	0 minutes
5 VDC Output Flow Rate (scale analog “tach” out)	1 to 9999 cc/min	5000 cc/min
Low Volume Fault	Alarm or Warning	Alarm
High Volume Fault	Alarm or Warning	Warning
Low Flow Rate Fault	Alarm or Warning	Alarm
High Flow Rate Fault	Alarm or Warning	Warning
Low Pressure Fault	Alarm or Warning	Warning
High Pressure Fault	Alarm or Warning	Warning
Computed Target Fault	Alarm or Warning	Warning
Active Fault	Numerous text strings	N/A

Notes:

1. The default flow rate command would be used if there is no analog signal (fixed) or the analog signal is lost. Setting this value to zero disables the low analog fault.

2. The values for the pressure loop constant Kp and Ki are automatically calculated during the calibration process and can be manually changed here. See page 104.

3. The value for the number of pulses per flow reading is automatically calculated during the calibration process and can be manually changed here. See page 34.

4. The Flow Comp Pivot is the command level that determines whether the zero offset or peak is adjusted during volume compensation. See page 104.

5. This variable sets the number of minutes without button press activity before the screen backlight will turn off. This function increases the life of the backlight. Setting this value to zero disables the screen saver function, keeping the light on continuously.

Appendix C

Theory of Operation

Input and Output Signals

Terminology

For the purpose of this document a digital signal is said to be SET when voltage is present (or above the minimum threshold). A signal is said to be RESET when the signal voltage is not present (below minimum threshold). **Devices** are referred to as SET when they are in their energized or active state.

Digital Inputs

Dispense Gun - This is the Dispense Signal. The PrecisionFlo LT unit will attempt to dispense at either the commanded flowrate or commanded pressure while this signal is SET, dependent on mode.

Control On - This input is reset when the E-stop button is pressed.

Job Complete - This input can be used to signal a job end.

The dispenser ready signal is an important signal for the automation to monitor. When the dispenser ready output is not on, the LT may not be responding to requests form the automation. This could create the situation where the automation is running production, but the LT is not dispensing any material.

Gun Solenoid - This signal will be set to energize the gun solenoid at the beginning of a dispense cycle.

Minimum Volume Dispensed - This signal will be set when the minimum volume (target volume - tolerance) has been dispensed for the job.

Fault Present - This bit is RESET under the following conditions:

1. No Faults (alarms or warnings) are active.

In Cycle - In Cycle signal is set at the beginning of a dispense cycle. It is reset at the end of the dispense cycle. The dispense cycle can end in two ways, depending on how the Job End mode is set:

- If the Job End mode is set to automation I/O, dispense cycle ends when the job complete signal is received from the automation I/O.
- If the Job End mode is set to Timer, dispense cycle ends when the Job End delay timer expires.

Analog Input

Flow Command - The flow command signal input represents flow or pressure requests. The voltage must be between 0 and 10 volts DC. The 0-10 volt signal is interpreted as a relative 0-100% flow or pressure command signal. The system must be in Analog Mode for this input to be used.

Outlet Pressure- The outlet pressure input represents the fluid pressure at the regulator outlet. The default voltage ranges from 1 to 5 VDC for 0 to 3500 psi (23.8 MPa, 238 bar).

Analog Output

V/P Command - The V/P command output corresponds to an air pressure driving the regulator. The voltage ranges from 1 - 5 VDC to adjust flow and/or pressure in the fluid system.

Flow Rate - The flow rate output relates to the fluid flow through the meter. The voltage ranges from 0 - 5 VDC corresponding to a 0 - 5000 cc/min.

Operation Modes

Dispense Modes:

Manual Mode
When in Manual mode, the PrecisionFlo LT control reacts only to input from the user interface. The PrecisionFlo LT control ignores automation controller signals when in Manual mode.

Automatic Mode
When in Automatic mode, the PrecisionFlo LT control remains in a ready state, indicated by the DISPENSER READY signal, and reacts to inputs such as DISPENSE and VOLUME REQUEST signals from the automation unit.

When a fault is detected, the PrecisionFlo LT control sets the FAULT present signal HIGH, and may set the DISPENSER READY signal LOW. Fault detection can also occur during manual dispensing.

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

Control Modes:

Volume Monitor
The automation I/O or Manual dispense command and the 100% pressure setting are used to set a pressure target. The regulator adjusts to maintain this pressure. In automatic mode the controller compares the dispensed volume to the target volume and sets volume faults if needed.

Bead Control
The automation I/O command for manual dispense establishes a Flow Rate target. A pressure setpoint is determined from the calibration results and the volume compensation values. The regulator adjusts to maintain the pressure setpoint, volume compensation will adjust the pressure setpoint to achieve the desired flow rate.

Batch Dispense:
The automation I/O command and the 100% pressure settings are used to set the pressure target. The regulator adjusts to maintain this pressure. In automatic mode the dispense valve is closed when the target volume is reached, a job complete signal is received by the control, or the job timer expires.

Pressure Control
The automation I/O or manual dispense command and the 100% pressure setting are used to set a pressure target. The regulator adjusts to maintain this pressure.

Automation I/O Modes:

Analog
0-10 VDC signal from the automation unit is used to determine the pressure or flow command. A 10 volt command will establish a pressure or flow rate command equal to the 100% value entered during the calibration procedure. If an analog signal < 1vdc is given the pressure or flow command is determined by the value entered in the default/fixed command parameter.

Fixed
The default/fixed value entered in the setup is used to determine the pressure or flow command.

Jobs

The PrecisionFlo LT system operates using the concept of jobs. A job is a specified amount of material that is dispensed by the system. The amount of material specified for a job varies, depending on the application. In some applications, a job may be the amount of material dispensed on a part. Other applications may define a job to be the amount of material dispensed on a number of parts or dispensed over a period of time.

A job is initiated when the automation sends a “Dispense Gun” signal to the LT. Once the job is initiated, the LT will start tracking the amount of volume requested by the automation and the amount of material that is actually dispensed. These volumes will be tracked until the job is completed. At the end of the job, fault calculations are made and the volumes are stored to non-volatile memory on the LT system (Job Log).

The LT system watches two things to decide when a job is complete. Either the “Job Complete” signal is sent by the automation, or the job complete timer expires. The type of job end signal is configured in the “Other” screen to be of type “Timer” or “Digital I/O”. If the timer method is used, the timer begins counting every time the dispense gun is turned off. If the gun stays off for more than the preset timer value, then the job is considered complete.

Once the job is complete, the job information is stored to memory. The most recent jobs can then be viewed on the “Job” screen or by using the Graco Shell Menu System. The information stored with each job is as follows.

Measured Volume - The amount of material measured by the flow meter during a job.

Requested Volume - The amount of material that the automation tries to dispense during a job. This volume is calculated by measuring how long the dispense gun is on, taking in effect the command voltage from the automation over time.

Target Volume - The theoretical amount of material that a job should have. This value is usually calculated or found using trial and error when the application is first set up.

In Bead Mode, all of these volumes are monitored. The High Volume, Low Volume, and Computed Target faults are evaluated at the end of the job. The volume alarms compare the measured volume to the requested volume and the computed target alarm compares the requested volume to the target volume.

In Volume Monitor Mode and Batch Mode, the requested volume is not measured. In these two modes, the automation command voltage corresponds to a pressure instead of flow rate. For this reason the requested volume is not available (as well as the Computed Target fault). The high and low volume alarms compare the measured volume to the target volume for Volume Monitor and Batch modes.

In Pressure Mode, there are no flow meters available and the controls are all performed based on pressure. For this reason the LT does not monitor measured, requested, or target volume. The High Volume, Low Volume, and Computed Target faults are all inactive when using Pressure mode.

Typical Job Cycle

1. Automation system controller verifies that the DISPENSER READY signal is HIGH.
2. Automation system goes into cycle.
3. PrecisionFlo LT control waits for DISPENSE gun signal from the automation system to start dispensing.
4. Automation system controller requests material to be dispensed by setting the DISPENSE gun signal HIGH.

   In Batch Dispense Mode the dispense gun signal must remain valid for a minimum of 20 msec.
5. Dispense gun opens after the GUN ON DELAY, immediately if the delay is set to zero.
6. PrecisionFlo LT control checks if a REGULATOR ON DELAY has been set by the user.

   If the delay has been set, the PrecisionFlo LT control waits until the delay has expired, then begins regulating material to the gun.

   If the delay has not been set, the PrecisionFlo LT control immediately begins regulating material to the gun.
7. PrecisionFlo LT control regulates output based on the COMMAND input signal from the automation unit in analog mode or the set value in Default/Fixed mode.
8. PrecisionFlo LT control measures the volume dispensed continuously in all modes except pressure control.
9. PrecisionFlo LT control continuously monitors the outlet fluid pressure and the flow rate, as measured by the flow meter, and makes adjustments for changes in operating conditions.
10. PrecisionFlo LT control monitors operating parameters to detect and report any faults that may occur.
11. Automation unit sets the DISPENSE gun signal LOW, indicating that no material is required during this portion of the program. (automation unit can cycle the DISPENSE gun signal HIGH and LOW throughout a cycle if required. Volume measurement will still occur.)
12. The regulator closes after the REGULATOR OFF DELAY expires.
13. The PrecisionFlo LT control checks if a GUN OFF DELAY has been set by the user.

    If the delay has been set, the PrecisionFlo LT control 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 LT control immediately closes the dispense gun solenoid, which closes the gun.
14. PrecisionFlo LT control stops measuring volume after the DISPENSE DONE DELAY timer expires or the JOB COMPLETE automation I/O signal is received, depending on the job end mode selected. The job complete signal must remain valid for a minimum of 20 msec.
15. PrecisionFlo LT control updates the Status screen and the Data table.
16. The PrecisionFlo LT waits for the next cycle to begin.

Typical Dispense Cycle

The **In Cycle** signal is set at the beginning of a dispense cycle, which starts with a Dispense Gun signal from the automation unit.

Bead Control / Vol. Monitor / Pressure Control

Using I/O for Job End

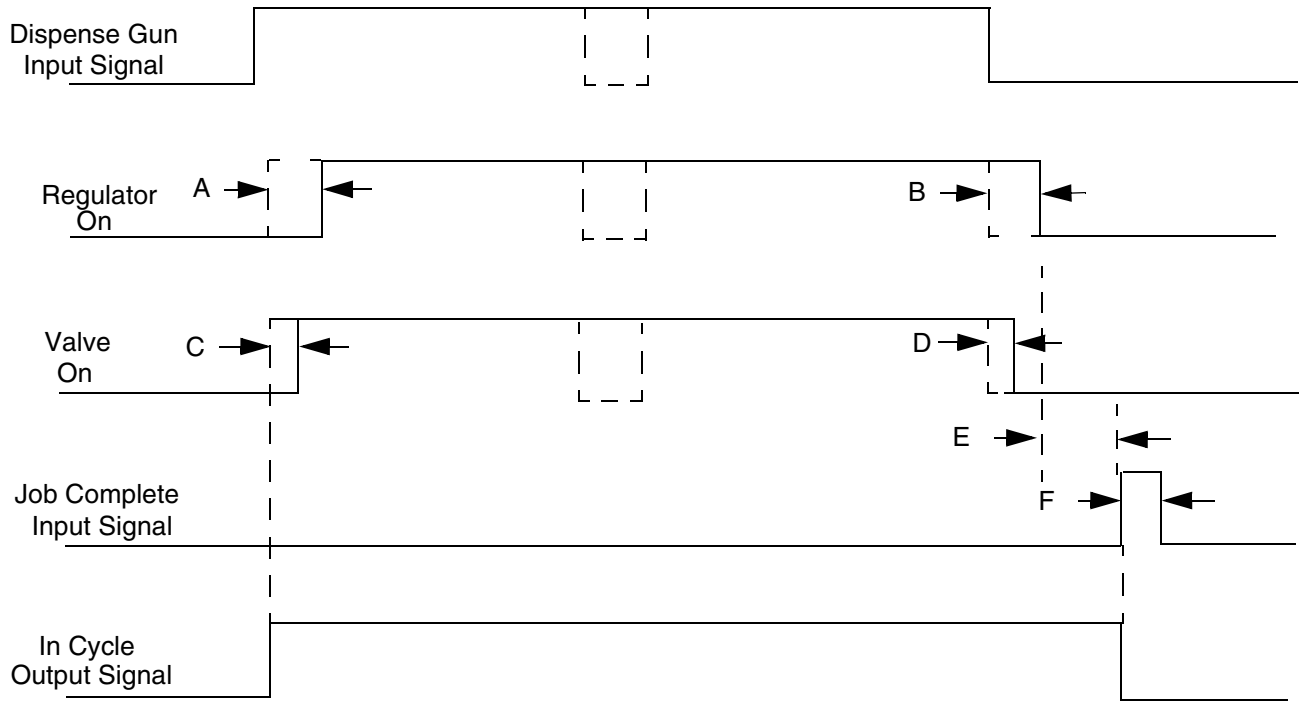


FIG. 38

A = Regulator On Delay

B = Regulator Off Delay

C = Gun On Delay

D = Gun Off Delay

E = Minimum delay between regulator / valve closing is 10 msec

F = The minimum pulse width for the Job Complete signal is 20 msec

Typical Bead Control / Vol. Monitor / Pressure Control

Using Timer for Job End

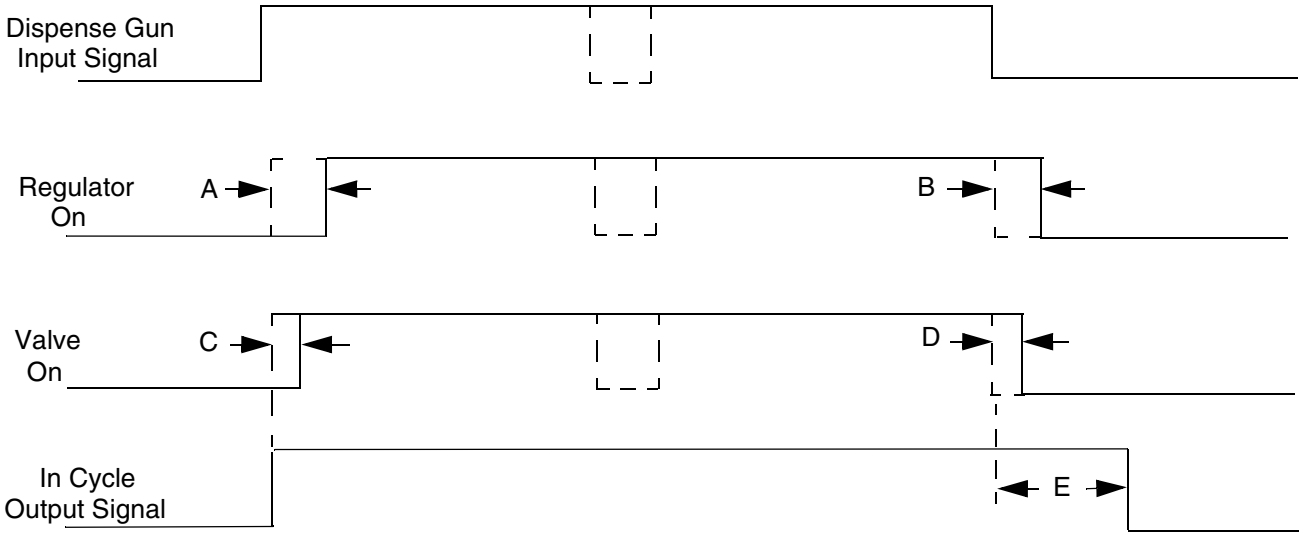


FIG. 39

A = Regulator On Delay

B = Regulator Off Delay

C = Gun On Delay

D = Gun Off Delay

E = Job end delay time, default value is 4 seconds

Typical Batch Dispense Cycle (I/O)

Using I/O for Job End

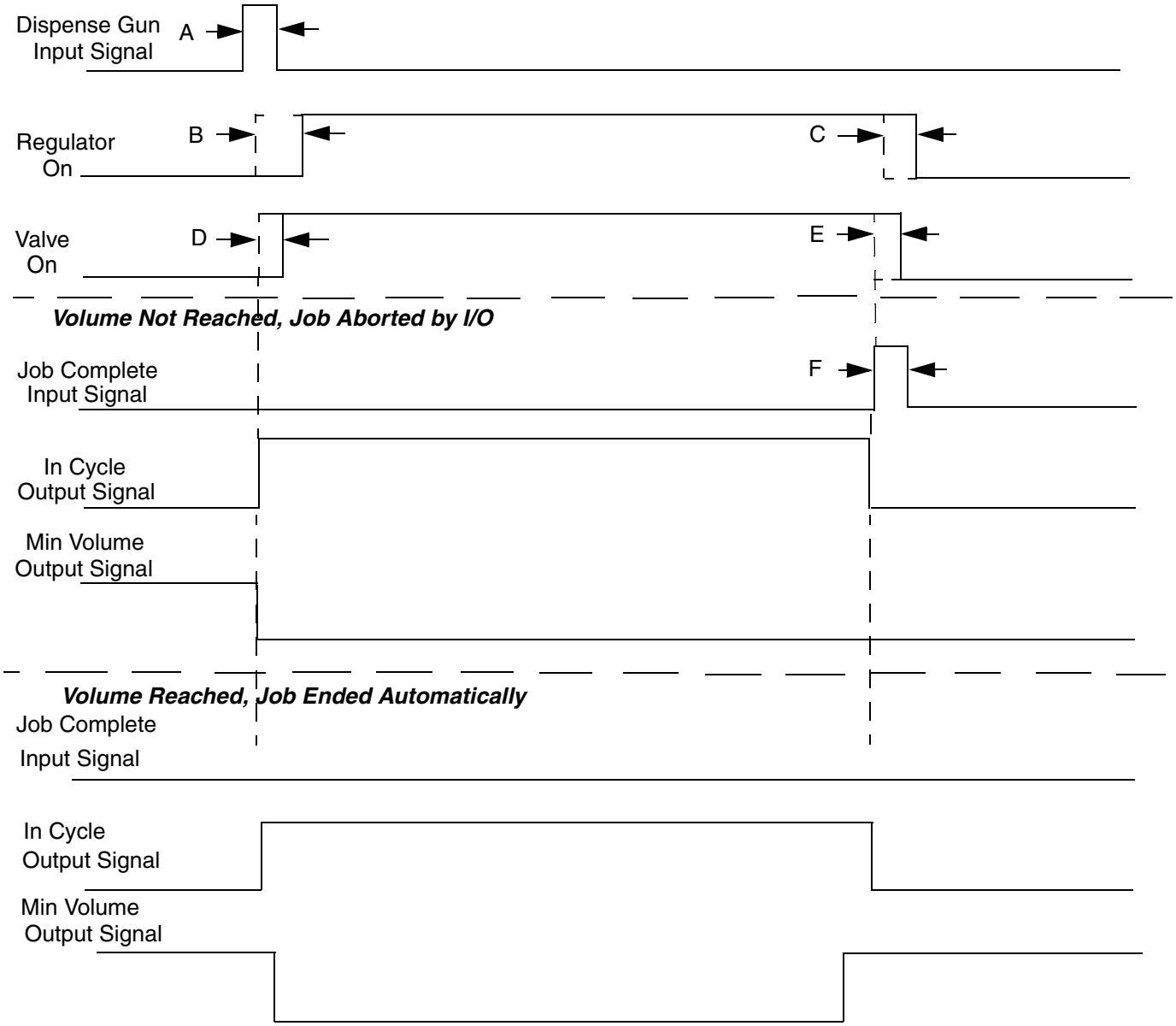


FIG. 40

A = The minimum pulse width for the Dispense Gun input signal is 20 msec.
B = Regulator On Delay
C = Regulator Off Delay
D = Gun On Delay
E = Gun Off Delay
F = The minimum pulse width for the Job Complete signal is 20 msec

Typical Batch Dispense Cycle (Timer)

Using Timer for Job End

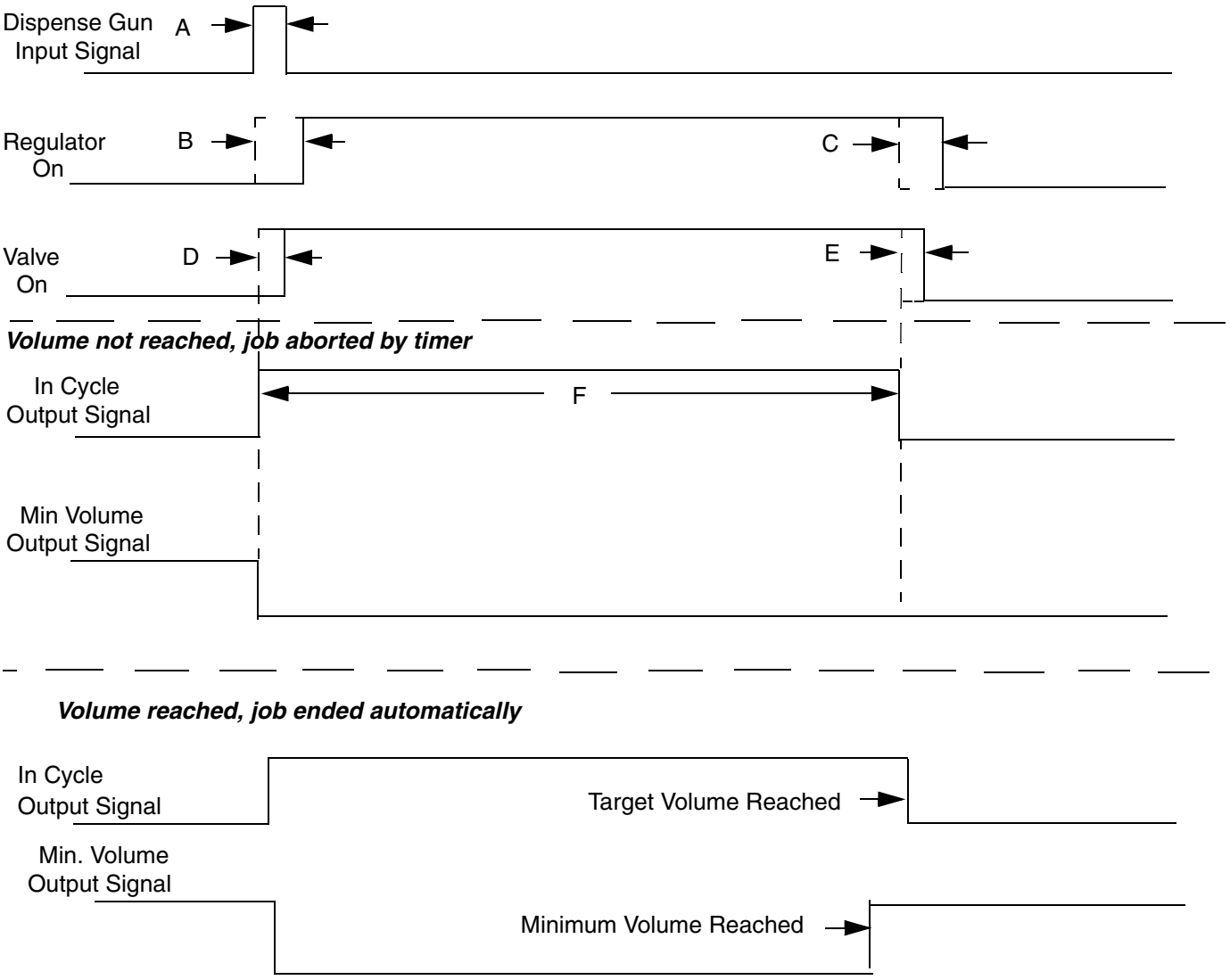


FIG. 41

(Minimum Volume = Target Volume - Volume Tolerance)
A = The minimum pulse width for the Dispense Gun input signal is 20 msec.
B = Regulator On Delay
C = Regulator Off Delay
D = Gun On Delay
E = Gun Off Delay
F = The Job End Delay time, default is 4 seconds.

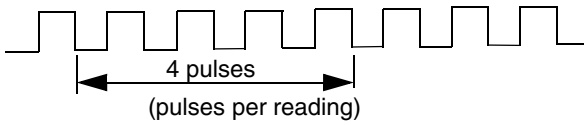
Continuously Running Applications

In some cases the target volume for a job is not known. An example of a case where the target volume is unknown is a continuously running system. This would be a system that does not run jobs, but runs continuously over a day or a shift. In this case, the flow rate becomes more important than the amount of volume dispensed in a job. The way to handle this situation is to set the target volume to a value of zero. This effectively disables the computed target fault. The controls will still maintain the desired flow rate and report faults corresponding to the tolerance set for the running style.

Another situation where it may be desirable to set the target volume to be zero is when there are too many styles for the LT to keep track of. For the standard configuration, the LT only maintains one style and for the advanced configuration there are four styles. If the target volume is set to zero, then the LT will be able to handle running jobs with varied volumes with out generating faults. The flow rate faults will still be active and the high and low volume faults will also still be active. The computed target faults will not be active and the job logs will always show a value of 0 in the Target Volume column.

Flow Rate Calculation

The pulses per flow reading value is calculated by the system based on the K-factor and the flow rate entered during flow calibration.



The time is measured for the number of flow meter pulses in the flow average variable to occur and the flow rate is calculated.

Example: pulses per reading = 4 pulses

Flow Rate = 400 cc/min

K-factor = 3500 pulses/liter = 3.5 pulses/cc

This gives a pulse rate of 23.3 pulses/second or 43 milli-seconds/pulse. A new flow rate is measured approximately every 171 milli-seconds.

If the time measured with the same parameters (3500 pulses/liter, 4 pulses flow average) is 180 milliseconds, the flow rate calculation would be 380 cc/minute.

Flow Calibration

In order to control the flow rate of a material, the system must determine the pressure required at the regulator outlet to achieve a desired flow rate (Fig. 20).The flow calibration procedure provides the pressure required to obtain the maximum desired flow rate (10 VDC flow command.)

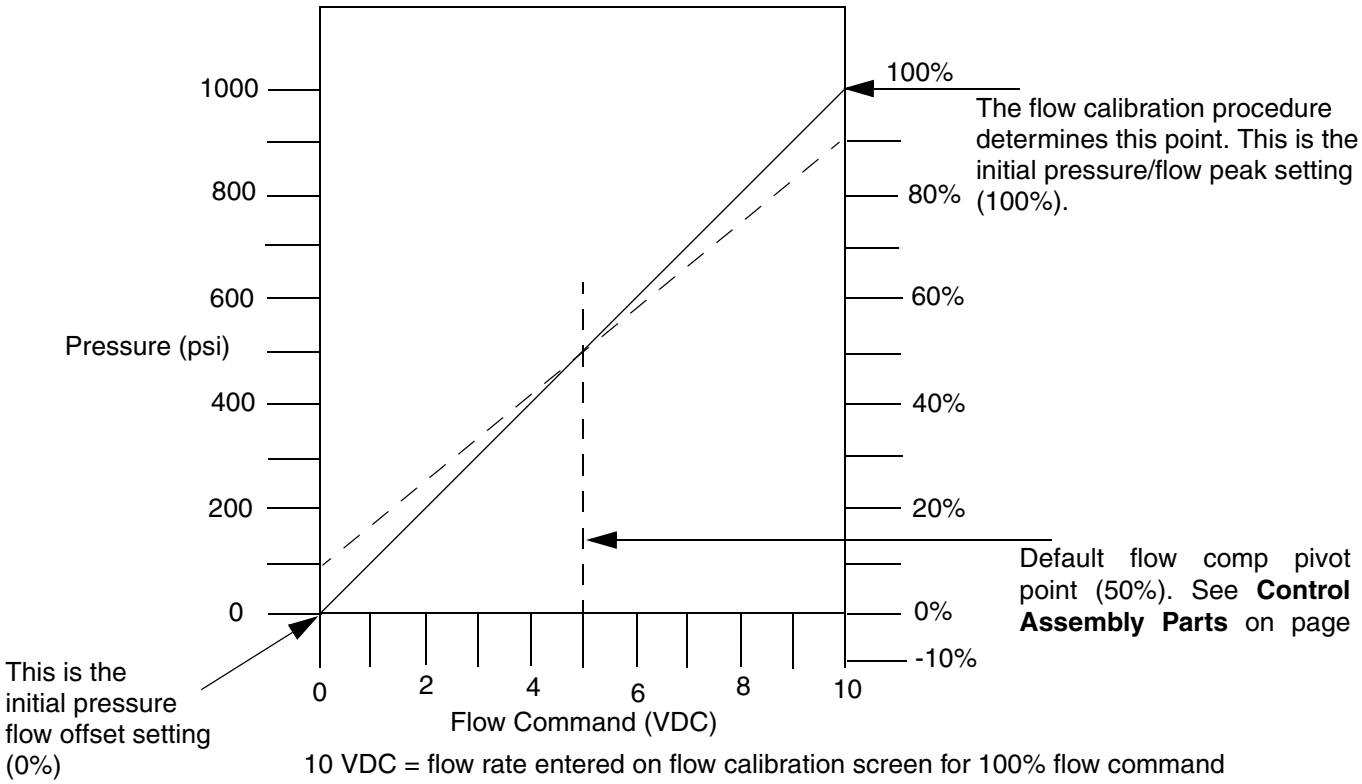


FIG. 42

Volume Compensation

Volume compensation is used when the PrecisionFlo LT system is operated in bead control mode. The system measures the actual flow rate and adjusts the pressure/flow relationship (as determined during flow calibration) to achieve the desired flow.

When flow calibration is completed, the resulting pressure value is divided by 100 to obtain a 1% value. The initial offset is set to 0%, the initial peak is set to 100% (see Flow Calibration on page 104).

Each time a new flow rate measurement has been completed, the actual flow rate is compared to the requested flow rate. The flow rate command from the automation unit (analog or fixed) is also compared to the flow rate defined by the flow comp pivot point value. The pivot point should be set to the average value of the minimum and maximum automation commands when using Analog for automation mode.

Endpoint Adjustment	Flow Command ≤ Flow comp Pivot Point	Flow Command > Flow comp Pivot Point
Flow rate < desired flow rate	Increase offset	Increase peak
Flow rate ≥ desired flow rate	Decrease offset	Decrease peak

The volume compensation routine moves the end points of a straight line which defines the pressure/flow relationship of the system.

The end point of the pressure/flow line (offset or peak) is moved the 1% value determined at the end of the flow calibration routine. The magnitude of the flow rate error does not affect the size of the adjustment.

The maximum adjustment range of the peak point is 25% to 400% of the original value from calibration. If the 25% or 400% limits are reached, a Volume Comp Limit fault is generated.

Appendix D

Ethernet Kit 118329

The Ethernet kit for PrecisionFlo LT provides for a way to communicate with the LT via an industrial or office network. This kit converts the serial (RS232) information provided in the Graco Shell menu system into Ethernet packets that can be accessed using TCP/IP networking. A DIN rail mounted module that has terminal screws for the RS232 wires as well as a RJ45 port for Ethernet performs the conversion.

The kit comes from the factory pre-wired with the wires needed to connect to the LT system. The five wires are labeled with wire numbers that indicate where they should be located inside of the LT control box. The wiring for the converter module is as follows.

Wire function	Wire Number
+24 V	2120
Common	2121
RS232 Transmit	2551
RS232 Receive	2541
RS232 Ground	2560

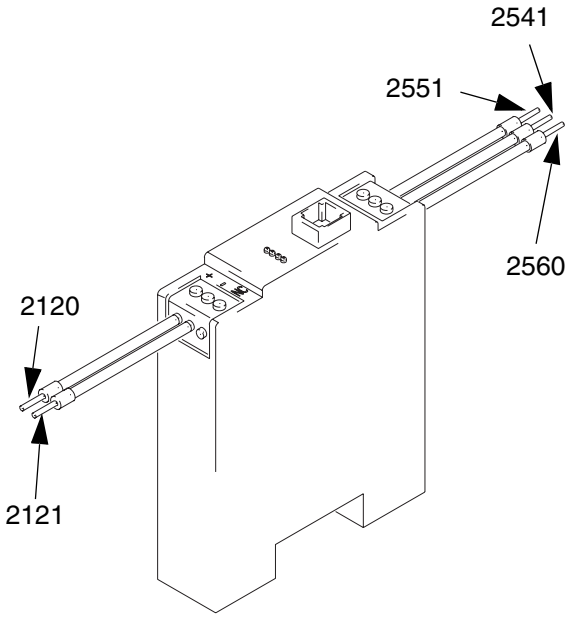


FIG. 43

The kit ships with a User's Guide that provides detailed instructions on how to configure the conversion module. The module can be configured using a graphical web based configuration connection or by using a serial connection to the module. In general, the default settings of the unit may be used with the following exceptions.

- The Baud Rate needs to be changed to 57600
- The "End Char" setting needs to be "0x0D"
- The dip switches on the outside the box should be set to "Terminal". This would be switch #4 on and all of the other switches are off.

Once the conversion module has been configured, the Graco Shell menu system (see page 40) for the LT can be accessed by any computer that exists on the same network as the LT. The LT will be uniquely identified by its IP Address. This IP address could be an internal IP address assigned by your IS department or it could be a public IP address that will make the system accessible on the Internet. The module can also be configured to obtain its IP address automatically from the network that it is attached to using DHCP. Due to the security implications and the complexity of setting up a new IP addresses, the IP address selection and configuration should be done with the help of an IS professional.

It is important to note that Xmodem and Ymodem do not work reliably through the Ethernet conversion module. These protocols are used when selecting the menu options that "Transfer" or "Restore" files to and from the LT. The alternative is to use the options that "Dump" the file to the screen. The data can then be copied to the clipboard.

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