Parts

INSTRUCTIONS-PARTS LIST 309105

Rev. A

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

INSTRUCTIONS

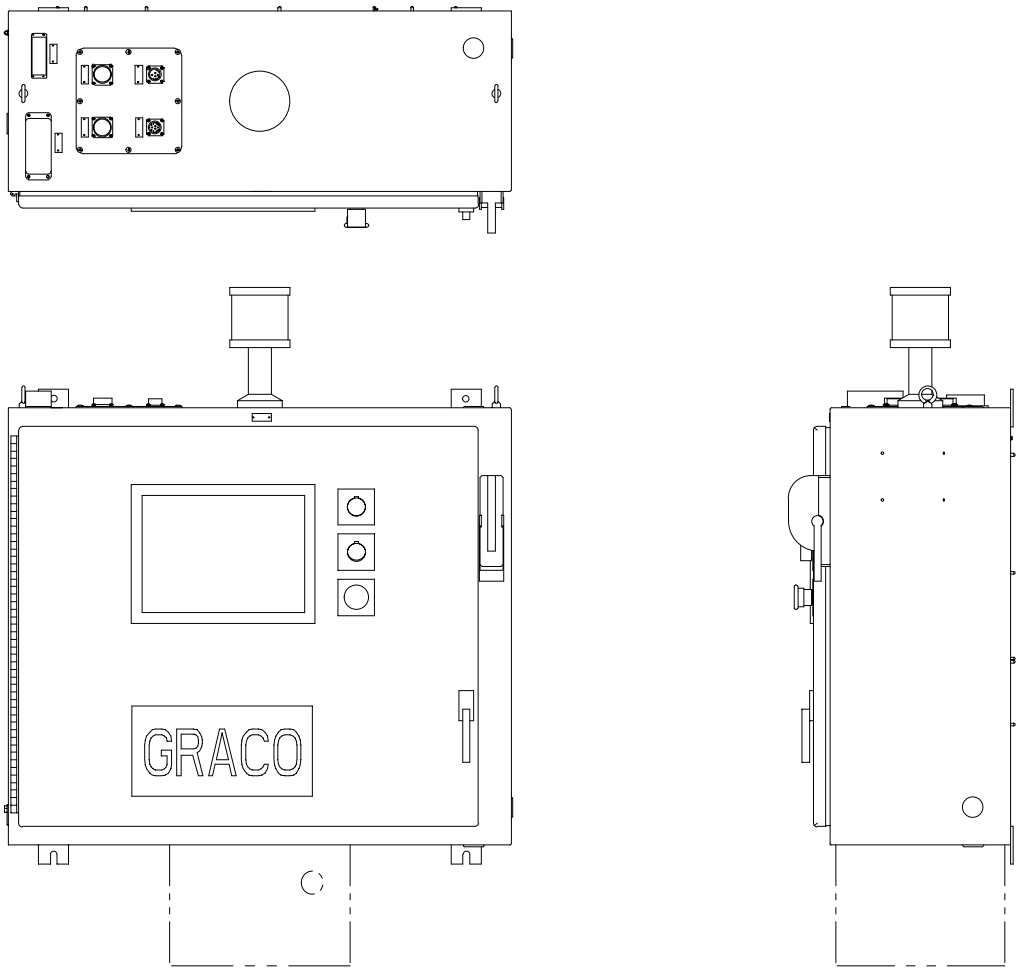
GRACO

First choice when quality counts.™

PrecisionSwirl™ for SD (Liquid Applied Sound Deadener)

Refer to page 2 for List of Models.

Refer to page 3 for Table of Contents.



TI0474B

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

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

List of Models

The table below provides the list the models that are covered in this manual.

Part Number	Robot I/O	Transformer
243242	24 Vdc	None
243943	120 Vac	None
243944	24 Vdc	3 kva
243946	120 Vac	3 kva

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.

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Table of Contents

Warnings

Warning Symbol

⚠ WARNING

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

Caution Symbol

⚠ CAUTION

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

⚠ WARNING

INJECTION HAZARD

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

- Fluid injected into the skin might look like just a cut, but it is a serious injury. **Get immediate medical attention.**
- Do not point the dispensing device at anyone or at any part of the body.
- Do not put hand or fingers over the front of the dispensing device.
- Do not stop or deflect fluid leaks with your hand, body, glove, or rag.
- Follow the **Pressure Relief Procedure** on page 37 whenever you are instructed to: relieve pressure; stop dispensing; clean, check, or service the equipment; or install or clean a spray tip or nozzle.
- Tighten all the fluid connections before operating the equipment.
- Check the hoses, tubes, and couplings daily. Replace worn, damaged, or loose parts immediately. Permanently coupled hoses cannot be repaired; replace the entire hose.
- Always wear eye protection and protective clothing when installing, operating, or servicing this dispensing equipment.

TOXIC FLUID HAZARD

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

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

⚠ WARNING

INSTRUCTIONS

EQUIPMENT MISUSE HAZARD

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

- This equipment is for professional use only.
- Read all instruction manuals, warnings, tags, and labels before operating the equipment.
- Use the equipment only for its intended purpose. If you are uncertain about usage, call the distributor closest to you. See the **Graco Phone Number** on page 102 for information.
- Only use the PrecisionSwirl regulator with the PrecisionSwirl Control Assembly.
- Only use a dispensing device appropriate for the fluid and application method, and capable of operating at the highest possible fluid supply pressure the module may experience.
- Do not alter or modify this equipment. Use only genuine Graco parts and accessories.
- Check the equipment daily. Repair or replace worn or damaged parts immediately.
- Do not exceed the maximum working pressure of the lowest rated system component. The maximum working pressure of the fluid regulator is shown on the device. **Other components may have lower working pressure ratings.**
- Route hoses away from traffic areas, sharp edges, moving parts, and hot surfaces. Do not expose Graco hoses to temperatures above 180°F (82°C) or below –40°F (–40°C).
- Do not use the hoses to pull the equipment.
- Use only fluids that are compatible with the equipment wetted parts. See the **Technical Data** sections of all the equipment manuals. Read the fluid manufacturer's warnings.
- Comply with all applicable local, state and national fire, electrical and other safety regulations.
- Do not attempt to modify the programming of the module. Any modification of the programming could result in serious injury or damage to the module.

⚠ WARNING

FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

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

- Ground the equipment and the object being sprayed. The fluid plate is grounded through proper connection of the two electrical cables. See **Grounding the Control Assembly** on page 17.
- If there is any static sparking or you feel an electric shock while using the equipment, **stop dispensing immediately**. Do not use the equipment until you have identified and corrected the problem.
- Make sure all electrical work is performed by a qualified electrician only.
- Have any checks, installation, or service to electrical equipment performed by a qualified electrician only.
- Make sure all electrical equipment is installed and operated in compliance with applicable codes.
- Do not install the PrecisionSwirl for SD module in a hazardous area, as defined in Article 500 of the National Electrical Code (USA).
- Make sure power is disconnected when servicing and repairing equipment.
- Keep the dispensing area free of debris, including solvent, rags, and gasoline.
- Before operating the equipment, extinguish all open flames or pilot lights in the dispense area.
- Do not smoke in the dispensing area.
- Keep liquids away from the electrical components
- Turn off power to the PrecisionSwirl for SD module before disconnecting **any** cables connected to the control assembly or fluid metering assembly.
- Disconnect electrical power at the main switch before servicing the equipment.

Notes

Overview

What This Manual Includes

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

Instruction Manual Conventions

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

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.

TouchScreen Conventions

The TouchScreen program is simple and intuitive. The operator navigates through the setup screens to enter data and set the parameters necessary to control the PrecisionSwirl for SD equipment either manually or via robotic interface.

Use your index finger to move the TouchScreen cursor to any location on the screen. The cursor appears in the form of an arrow (⇨).

Use the data screen to enter the operator's password. Use the popup keypad to enter numerical data relevant to operating the PrecisionSwirl for SD equipment.

In most cases, the TouchScreen entries are intuitive, especially if you are familiar with this type of software program. In other situations, instructions and screen-captures are provided to describe the entries, selections, and options that are available to you. See Graco Manual 310559 for more detail on TouchScreen operation.

Figure 1 shows the TouchScreen function keys.

Abbreviations and Acronyms

Abb.:	Stands For:
com	common
FM	flow meter
gnd	ground
msec	milliseconds
OP	operations cable
psi	pounds per square inch
PVC	Poly Vinyl Chloride
PWM	pulse width modulation
SPC	Statistical Process Control
V	volts
Vac	volts ac
Vdc	volts dc

PrecisionSwirl for SD Definitions

Control Assembly	The control assembly contains the electronics used to control the regulators, valves, and swirl orbiters.
Precision-Swirl for SD Module	The control assembly, fluid metering assemblies, flow meter (optional), and all cables and sensors used to measure and control the performance of the system. See Fig. 2.
Controller	An external electronic (robotic) system having some control interaction via electronic signals with the PrecisionSwirl for SD module.
Touch Screen	TouchScreen is used to set up, display, operate and monitor the PrecisionSwirl for SD module.
Fluid Metering Assembly	The fluid metering assembly contains the fluid regulators and other components that control and monitor fluid dispensing. See Fig 3.

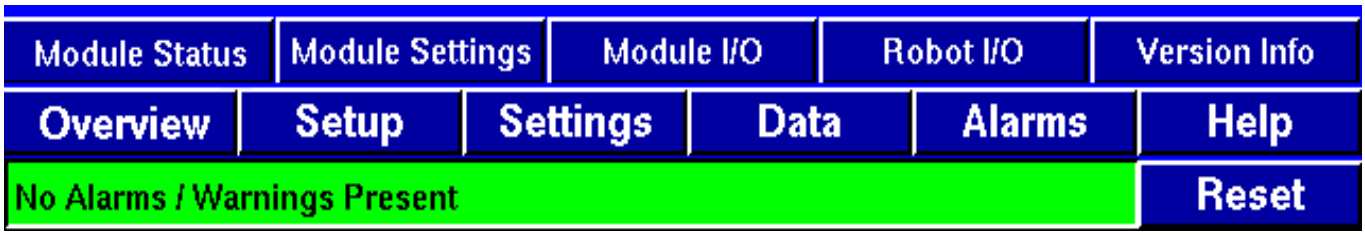


Fig. 1

Overview

PrecisionSwirl for SD Module Description

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

The PrecisionSwirl for SD module (Fig. 2) consists of:

- PrecisionSwirl for SD control assembly (1)
- TouchScreen (2)
- fluid metering assembly (3)
- cables (4)
- swirl applicators (5)
- fluid dispense valve (6)

PrecisionSwirl for SD options include:

- transformer kits for different supply voltages
- 3.5” floppy disk drive or ethernet connection for data transfer
- flow meter (PN 244343) for flow control and volume reporting

PrecisionSwirl for SD Control Assembly

The PrecisionSwirl for SD control assembly includes the enclosure containing controlling and sensing electronics for the TouchScreen that is used by the operator to easily monitor, configure, and test the module.

The PrecisionSwirl for SD control assembly (1) houses a microprocessor-based controller, that gives electronic commands to the PrecisionSwirl for SD regulators and collects Statistical Process Control (SPC) information about your application.

You program the PrecisionSwirl for SD module using the control assembly’s TouchScreen (2). Additional buttons on the control assembly start and stop the PrecisionSwirl for SD module.

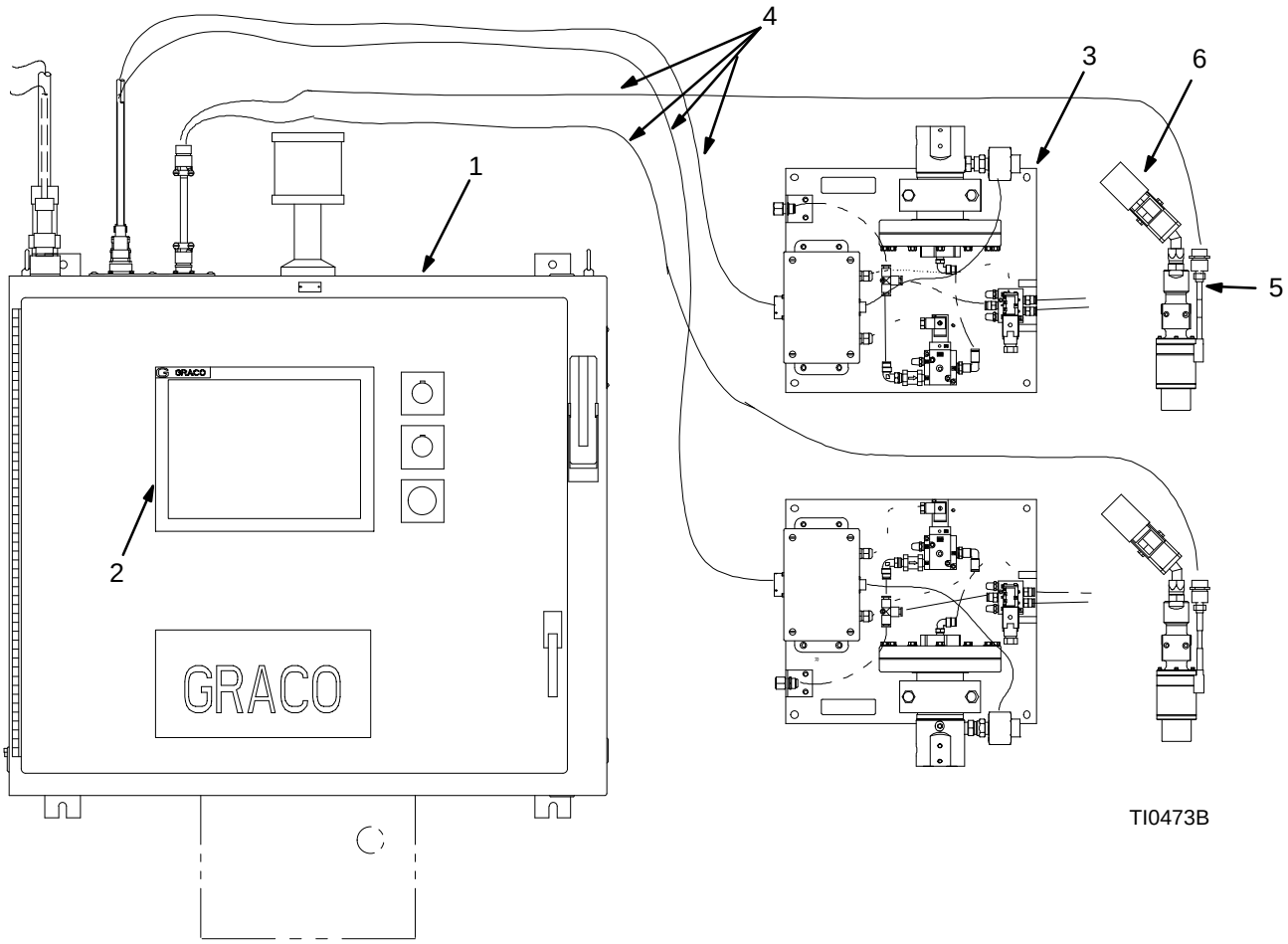


Fig. 2

Overview

Fluid Metering Assembly

The fluid metering assembly (Fig. 3) can be attached to a robotic arm, or mounted on a pedestal. Main components of the fluid metering assembly are:

- PrecisionSwirl regulator (1)
- solenoid air valve that controls a dispense device (2)
- voltage to pressure (v/p) controller for adjusting the air pressure to the regulator (3)

The PrecisionSwirl Regulator

The PrecisionSwirl regulator is the core of the PrecisionSwirl for SD module. The PrecisionSwirl 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.

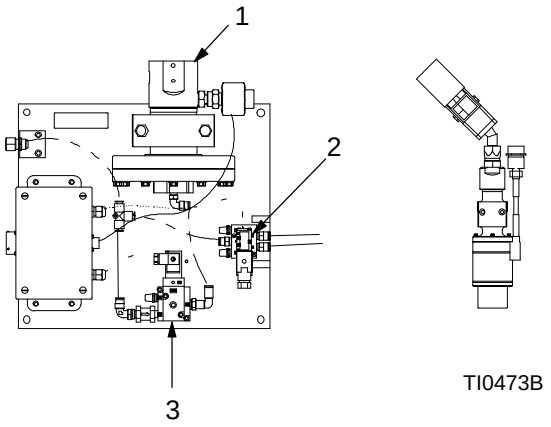


Fig. 3

PrecisionSwirl for SD Module Capabilities

The PrecisionSwirl for SD module combines continuous pressure control with the ability to change bead profiles almost instantaneously. When used with the optional flow meter (PN 244343), the PrecisionSwirl for SD module automatically adjusts for fluctuations in the operating environment, such as material viscosity, temperature, and robot speed, while maintaining the desired dispense rate.

The PrecisionSwirl metering valve is electrically controlled by the PrecisionSwirl for SD module, and consistent material flow is assured by a closed-loop pressure control design. The module responds to robot-supplied signals to provide an accurate and consistent output flow based on a comparison of actual to desired flow rates.

Typical Fluid Applications

- PVC Sealer
- Plastisols
- Sound deadening materials
- Body panel reinforcement

Overview

PrecisionSwirl for SD Features

- **Sophisticated Electrical Design:** Provides extremely fast and accurate response times.
- **Simple User Interface:** TouchScreen provides easy, menu-driven control to the operator.
- **Designed for Robotic Applications:** Microprocessor-based control electronics quickly and easily communicate faults, warnings, status, and operating data to external robotic systems via digital interfaces.
- **User Obtainable SPC Data:** The PrecisionSwirl for SD module supplies SPC data to the operator via the TouchScreen. A 3.5” floppy disk drive (PN 241236) or an ethernet kit (PN 241798) are available as options to enable transfer of these files to other PCs.
- **Cartridge Ball and Seat:** The easily replaceable cartridge ball and seat allow filled and abrasive materials to be dispensed.

PrecisionSwirl for SD Options

- **flow meter (PN 244343):** provides Real Time Volume Compensation for:
  - continuous volume compensation (not on the total batch job).
  - Ability to handle changes to body style and batch size quickly.
  - Ability to handle shear-thinning materials.
  - Ability to deliver steady flow rate during viscosity changes.
- **Dispensing Accessories:** A variety of hoses, cables, dispense devices, manifolds, and other components are available to meet the requirements of customer applications and material types.

Overview

Fig. 4 shows the components in a typical PrecisionSwirl for SD installation.

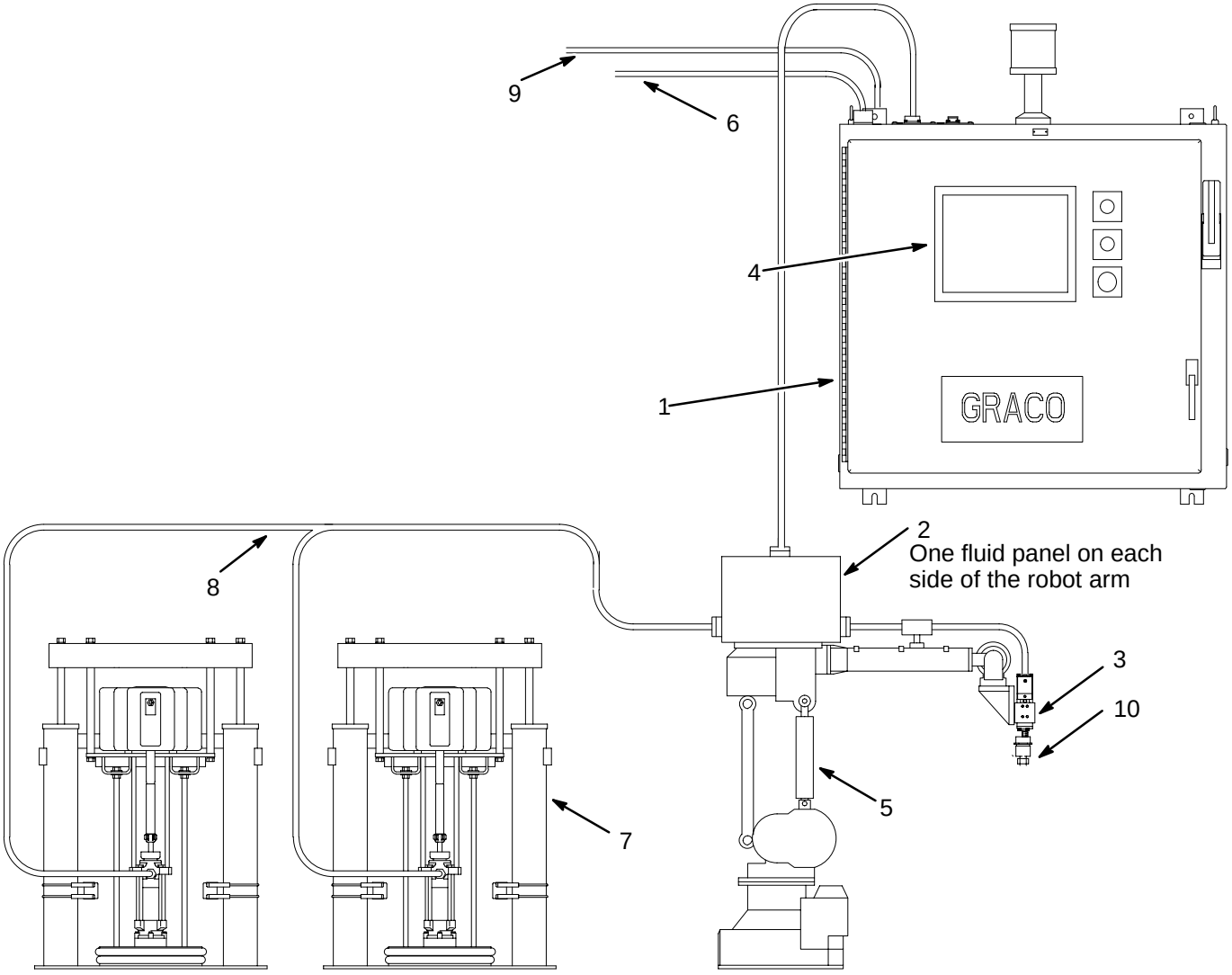


Fig. 4

No.	Description
1	Control Assembly (see Fig. 9 on page 21 for details)
2	Fluid Metering Assembly (see Fig. 8 on page 20 for details)
3	Dispense Gun
4	TouchScreen (see 310559 for details)
5	Sealer Robot
6	Robot Digital Interface Cable (RDR)
7	Fluid Supply System
8	Fluid Supply Header
9	Robot Analog Cable (RAR)
10	Swirl orbiter
—	Filter Module (not shown)

Installation

Default Password

Some software settings are password protected. The default password, which can be changed by the operator, is 555.

Installation Procedures

Three separate procedures must be performed to install and configure the PrecisionSwirl for SD module for operation.

The procedures are:

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

Fig. 5 shows the major steps for each procedure.

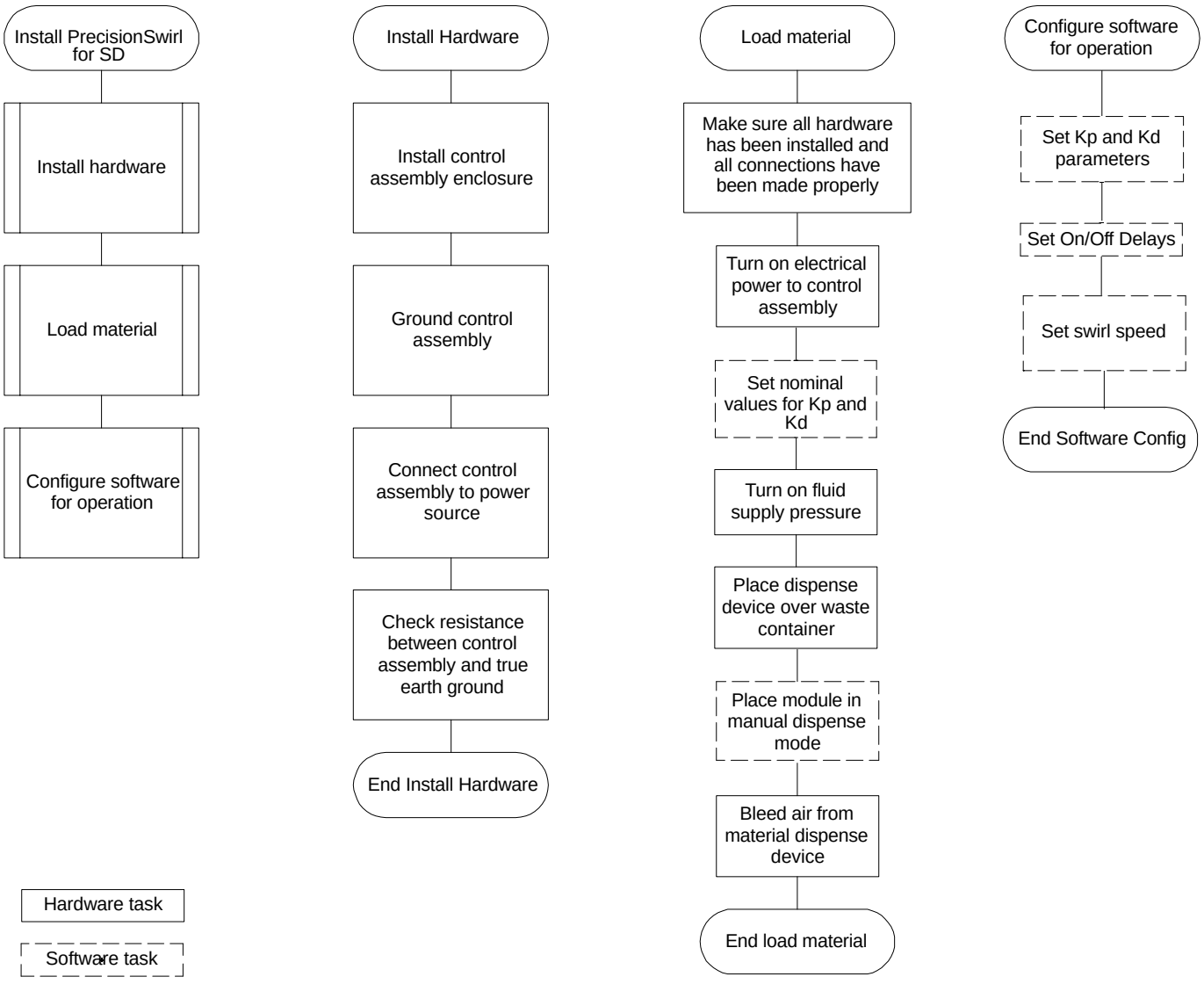


Fig. 5

Control Assembly Hardware Installation

To install the control assembly hardware:

- Install the PrecisionSwirl for SD control assembly
- Ground the system
- Connect the PrecisionSwirl for SD control assembly to a power source
- Check resistance between the control assembly and a true earth ground
- Connect fluid lines and cables

Installing the Control Assembly Enclosure

⚠ WARNING

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

Preparing to Install the Enclosure

Before installing the control assembly enclosure:

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

⚠ WARNING

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

Control Assembly Hardware Installation

Installing the Enclosure

1. Select a location for the PrecisionSwirl for SD control assembly enclosure that allows adequate space for installation, service, and use of the equipment.
   - Mount the control assembly so that the disconnect handle is readily accessible and located 24” to 67” (.6 to 1.7 m) above the floor.
   - Make sure all fluid lines, cables, and hoses easily reach the components they will be connected to.
   - Make sure there is sufficient clearance around the assembly enclosure for running fluid lines and cables to other components.
   - Make sure there is safe and easy access to an appropriate electrical power source. The National Electrical Code requires 3 feet (91.4 cm) of open space in front of the assembly enclosure.
   - Make sure the control assembly is installed between 1 foot (30.5 cm) and 4 feet (121.9 cm) off the floor to provide easy access for operating panel controls and for servicing the inside of the enclosure.
2. Locate and secure the PrecisionSwirl for SD control assembly enclosure with four 3/8” bolts through the .44” (11 mm) diameter holes in the mounting flanges. See the mounting hole spacing in Fig. 6.

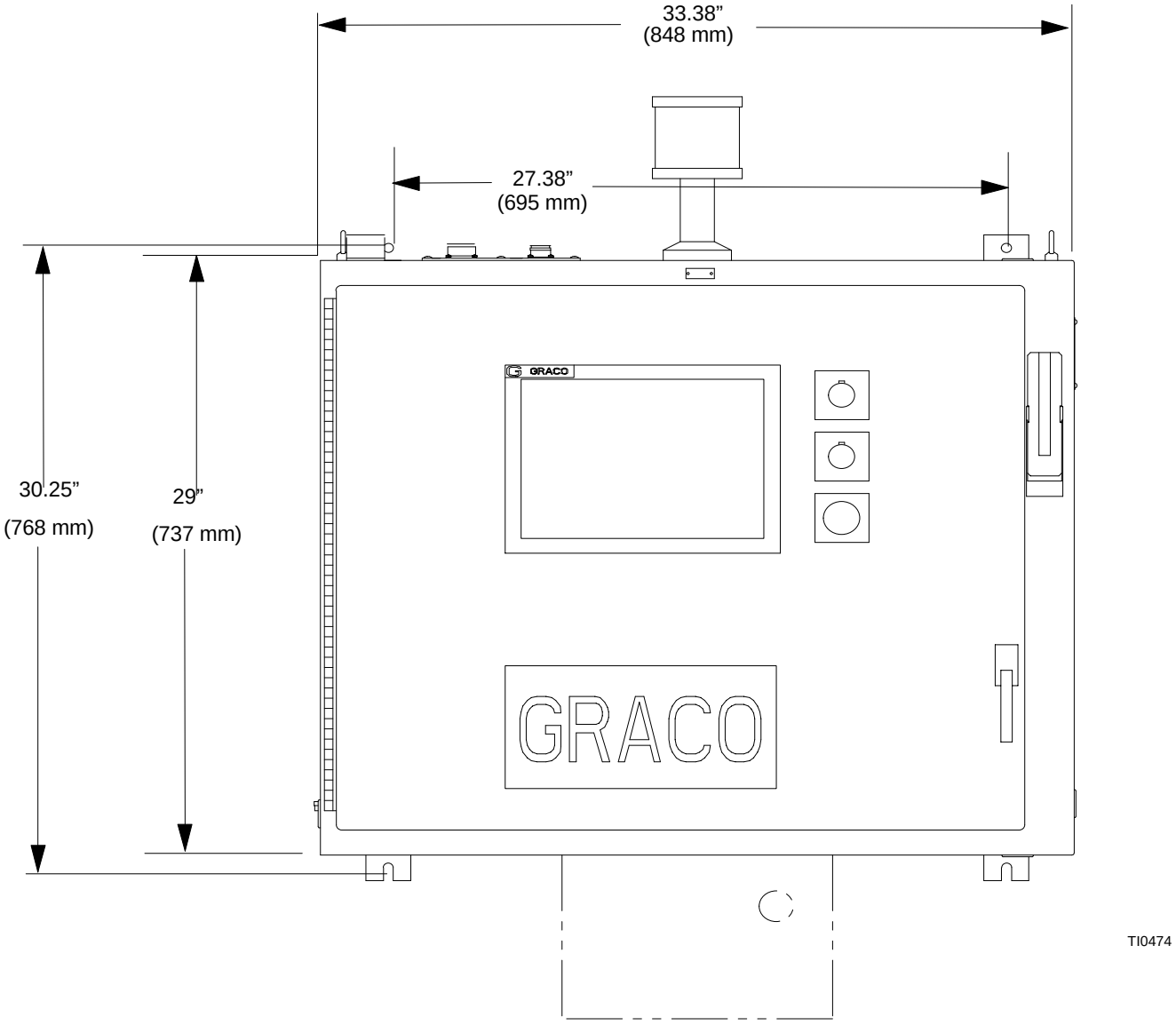


Fig. 6

Control Assembly Hardware Installation

Grounding the Control Assembly

⚠ WARNING

FIRE, EXPLOSION, AND ELECTRIC SHOCK HAZARD

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

- The PrecisionSwirl for SD control assembly must be electrically connected to a true earth ground; the ground in the electrical system may not be sufficient.
- All wires used for grounding must be 12 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.
- Also read and follow the warnings on pages 5 through 7.

⚠ CAUTION

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

Connect a ground wire from the ground point in the PrecisionSwirl for SD control assembly enclosure (shown in Fig. 7) to a true earth ground. The PrecisionSwirl for SD metering valve is grounded to the control assembly using cables provided with the metering valve.

A 10 AWG, 25 foot long ground wire with clamp, part no. 222011, is supplied.

⚠ CAUTION

To avoid damage to equipment, ensure that the robot and PrecisionSwirl for SD equipment are grounded to the same point.

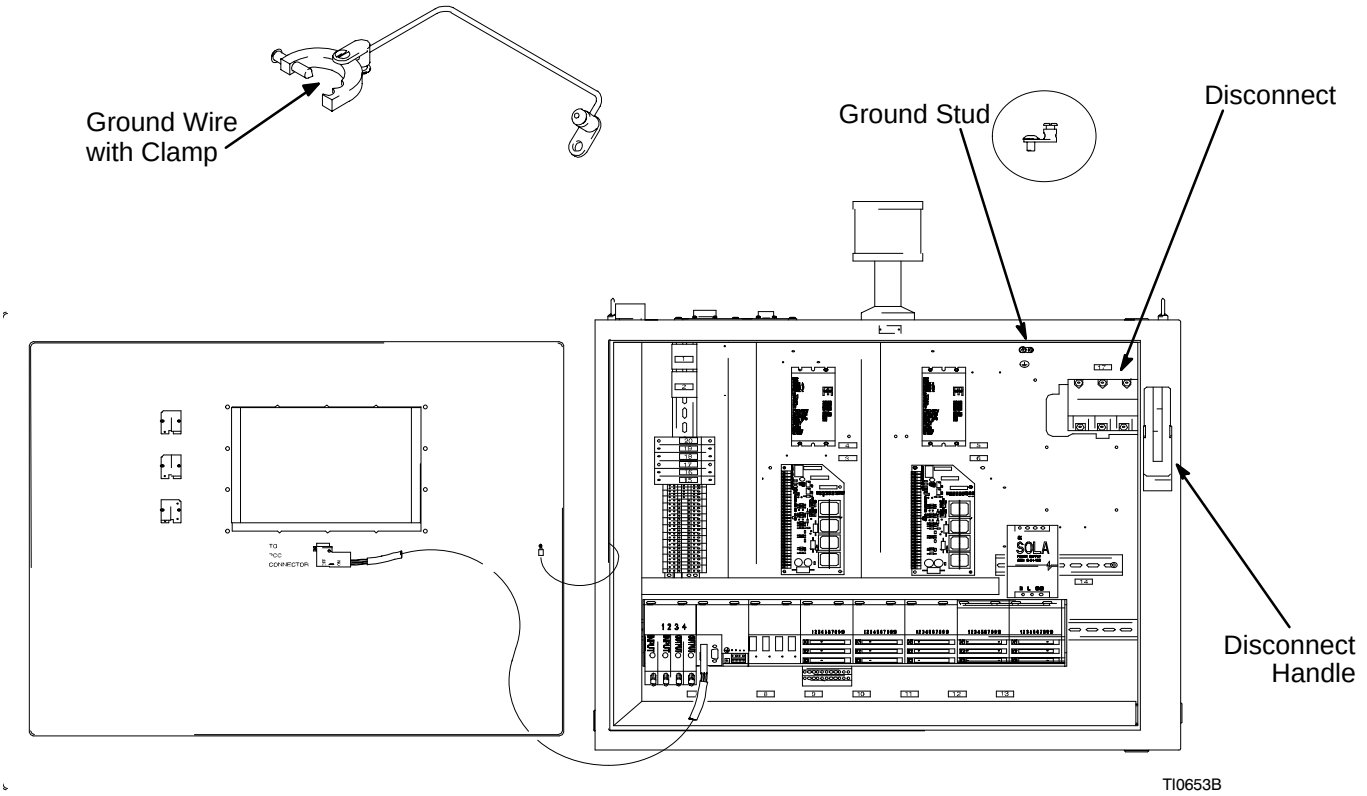


Fig. 7

Control Assembly Hardware Installation

Verifying Ground Continuity

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

Connect PrecisionSwirl for SD Control Assembly to Power Source

You must connect the PrecisionSwirl for SD control assembly to a power source.

⚠ WARNING

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

⚠ CAUTION

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

Have a qualified electrician connect the PrecisionSwirl for SD control assembly to a grounded electrical source that has the required service ratings:

PrecisionFlo Control Assembly	Power Requirements		
Vac:	90 – 120	200 – 240*	400 – 480*
Phase:	1	1	1
Hz:	50/60	50/60	50/60
Full Load Amps.	4	2	1

* When ordered with transformer ONLY (models 243944 and 243946. The transformer can be wired for 200 to 240 Vac or 400 to 480 Vac. It is shipped wired for 400 to 480 Vac, see the diagram on the transformer to wire for 200 to 240 Vac.

To connect the control assembly to the electrical 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.

2. Using 12 AWG wire, connect electrical power to the disconnect inside the control assembly enclosure (See Fig. 7.)

3. Use NEMA 4 cord grip to seal the area where wires enter the enclosure.

Checking Resistance Between the Control Assembly and the True Earth Ground

⚠ WARNING

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

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

Control Assembly Hardware Installation

Connecting Fluid Lines and Cables

Follow these steps to assemble the PrecisionSwirl for SD module and incorporate it into a complete fluid dispensing system. See Figs. 8 and 9 for details.

1. Make sure you have installed the fluid metering assemblies on the robot, or in another appropriate place.

2. Connect a fluid line between the PrecisionSwirl for SD regulator outlets (8 and the dispense devices (9).

3. Install a fluid filter.

4. Connect fluid lines to the regulator's fluid inlets (10).

5. If the optional flow meter (PN 244343) is used, connect the fluid supply line to the meter and connect the flow meter cable to the control assembly.

6. Connect the two electrical cables from the PrecisionSwirl for SD metering assemblies (11) to the mating connectors on the PrecisionSwirl for SD control assembly (4, 6).

⚠ CAUTION

Route all fluid lines and cables carefully. Avoid pinching and premature wear due to excessive flexing or rubbing.

7. Connect cables from the swirl orbiters (12) to the appropriate connectors on the PrecisionSwirl for SD control assembly (5, 7).

8. Connect digital and analog interface cables (4, 5) from the robot controller to the PrecisionSwirl for SD control assembly.

9. Connect an air supply line (not shown) to the 3/8" NPT inlet port on the module air supply inlet (13). Connect 1/4" air lines (14) from the device solenoid valves (15) to the dispense devices (9).

Control Assembly Hardware Installation

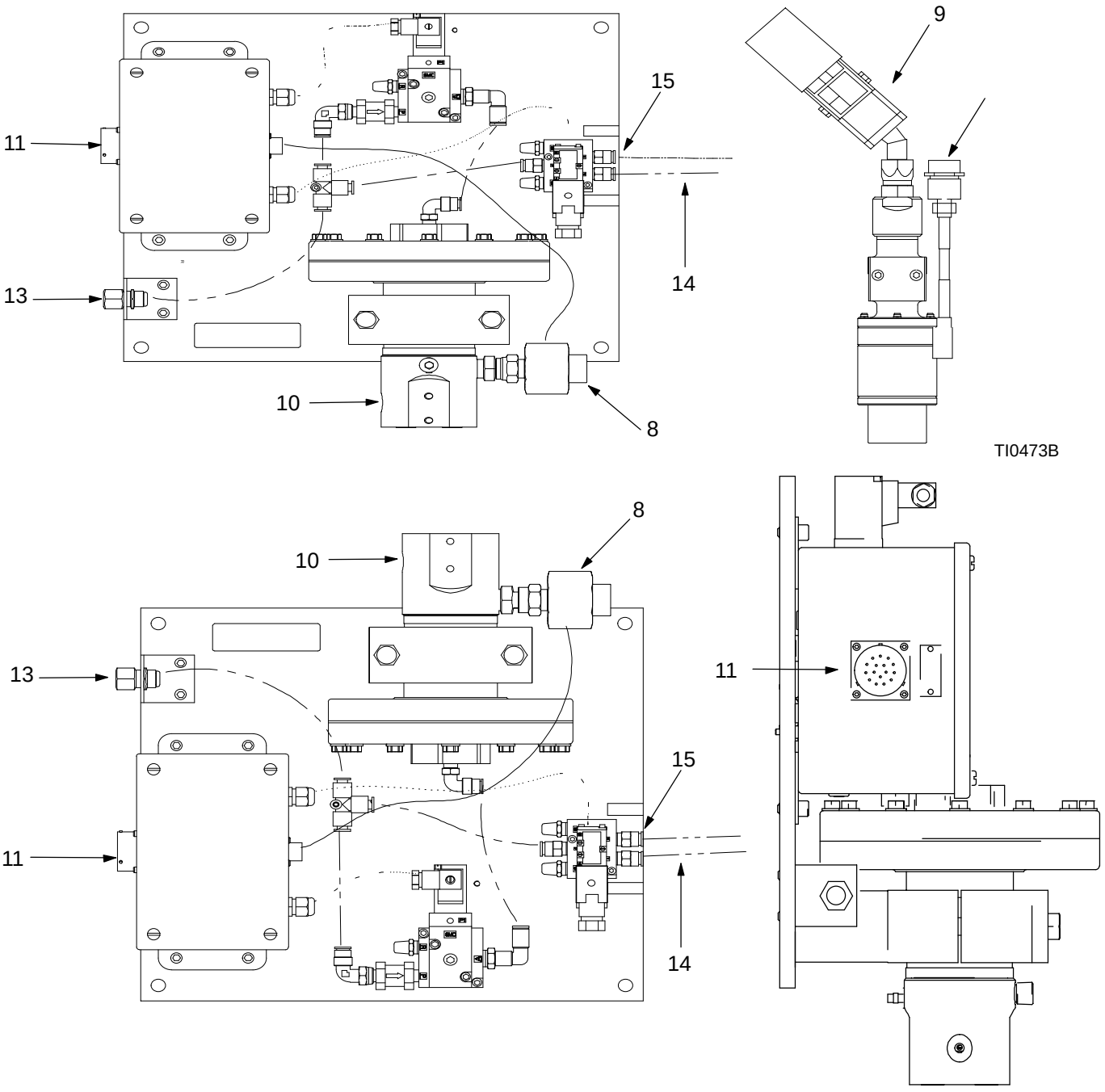


Fig. 8

Ref No.	Description	Ref No.	Description
8	Regulator outlet	12	Swirl cable connection
9	Dispense valve	13	Air supply connection
10	Regulator inlet	14	1/4” air lines
11	Operations cable connection	15	Solenoid valve

Control Assembly Hardware Installation

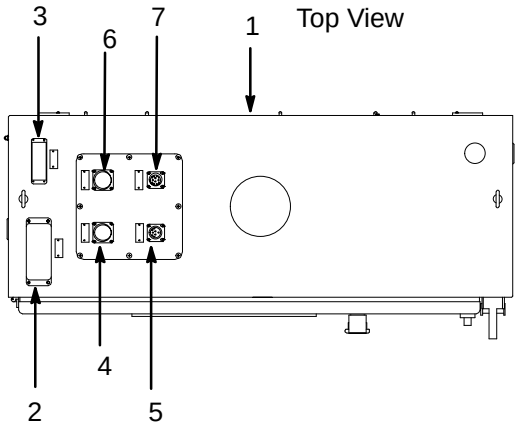


Fig. 9

Ref No.	Description
1	Control Assembly
2	External Interface Cable (Robot Digital)
3	External Interface Cable (Robot Analog)
4	Operations Cable Connector (Left)
5	Swirl Cable Connector (Left)
6	Operations Cable Connector (Right)
7	Swirl Cable Connector (Right)

Material Loading

The PrecisionSwirl for SD module 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 PrecisionSwirl for SD module software. Before you can configure the software for your application, you must load material into the supply system. Fig. 10 shows the major steps to follow to load material.

NOTE: Some of the software settings are password protected. For more information, refer to the **Default Password** section on page 14.

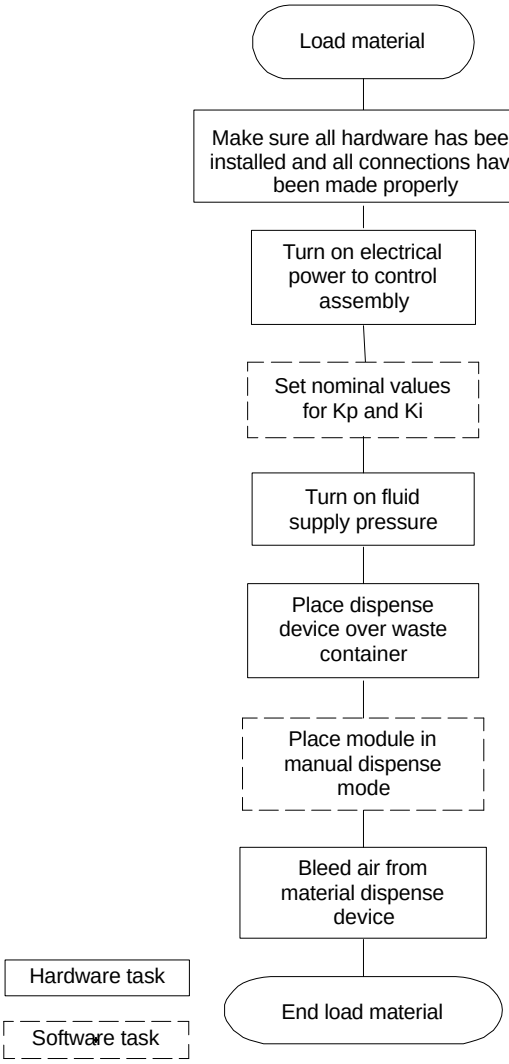


Fig. 10

Material Loading Procedure

⚠ WARNING

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

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

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

NOTE: Read this procedure before powering up the module.

1. Make sure you have installed and made all the proper connections to and from the PrecisionSwirl for SD control assembly enclosure.
2. Turn ON electrical power to the control assembly.
3. Set nominal values for Kp and Ki. You need to adjust Kp and Ki so the system can begin dispensing material. For more information, see page 23.
4. Turn on fluid supply pressure to the module.
5. Place the dispense device over a waste container.
6. Use TouchScreen to place the module in MANUAL mode. For more information about manual mode, see page 25.
7. Manually dispense fluid until clean, air-free fluid flows from the dispense device.
8. To configure the software, go to the **Configuration** section on page 26.

Entering Nominal Values for Kp and Ki

The values you enter for Kp and Ki depend on the viscosity of the material and type of application in which you are using the PrecisionSwirl for SD module. Use Table 1 as a guide for nominal Kp and Ki settings.

⚠ CAUTION

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

For more information about adjusting Kp and and Ki, see pages 27 – 29.

Table 1 — Nominal Settings* for Start-Up Calibration

Kp	Ki
8	2

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

On the TouchScreen, perform the following steps:

1. Touch **Setup**. Then touch **PrecisionFlo Plus**. The keypad pops up.
2. Enter your super user password and touch **Accept**.
3. Touch **Dispense Parameters**. The PrecisionSwirl for SD protected setup screen appears.
4. Enter the nominal value for Kp as follows:
   a. Touch the **Pressure Loop Kp** data cell. The numeric keypad pops up.
   b. Touch **Clear** to delete the current value.
   c. Enter the value for Kp and touch **Accept**.
5. Enter a nominal value for Ki as follows:
   a. Touch the **Pressure Loop Ki** data cell. The numeric keypad pops up.
   b. Touch **Clear** to delete current value.
   c. Enter the new value for Ki and touch **Accept**.
6. Touch **Back** twice and touch **Overview** to return to the Overview screen.

Material Loading

Setting Pressure Parameters

The pressure limit values are used to set the normal operating range of the regulator outlet pressure. If the regulator outlet pressure deviates from the set range, a Pressure High or Pressure Low fault will be generated

To set pressure parameters:

1. On the TouchScreen, perform the following steps:
    a. Touch **Setup**.
    b. Then touch **PrecisionSwirl for SD** . The keypad pops up.
    c. Enter your user password and touch **Accept**.
    d. Touch **Pressure Parameters**.
    e. Touch the **Outlet Pressure Low Limit** data cell. The numeric keypad pops up. Enter the value and touch **Accept**.
    f. Touch the **Outlet Pressure High Limit** data cell. The numeric keypad pops up. Enter the desired value and touch **Accept**.

To set PSI per volt parameters:

NOTE: For more information on the PSI/volt setting, see **Using Pressure Mode** on page 30.

2. On the TouchScreen, perform the following steps:
    a. Touch the **Pressure Mode PSI/V L** data cell. The numeric keypad pops up. Enter the value and touch **Accept**.
    b. Touch the **Pressure Mode PSI/V R** data cell. The numeric keypad pops up. Enter the value and touch **Accept**.
    c. Touch **Back** twice and touch **Overview** to return to the Overview screen.

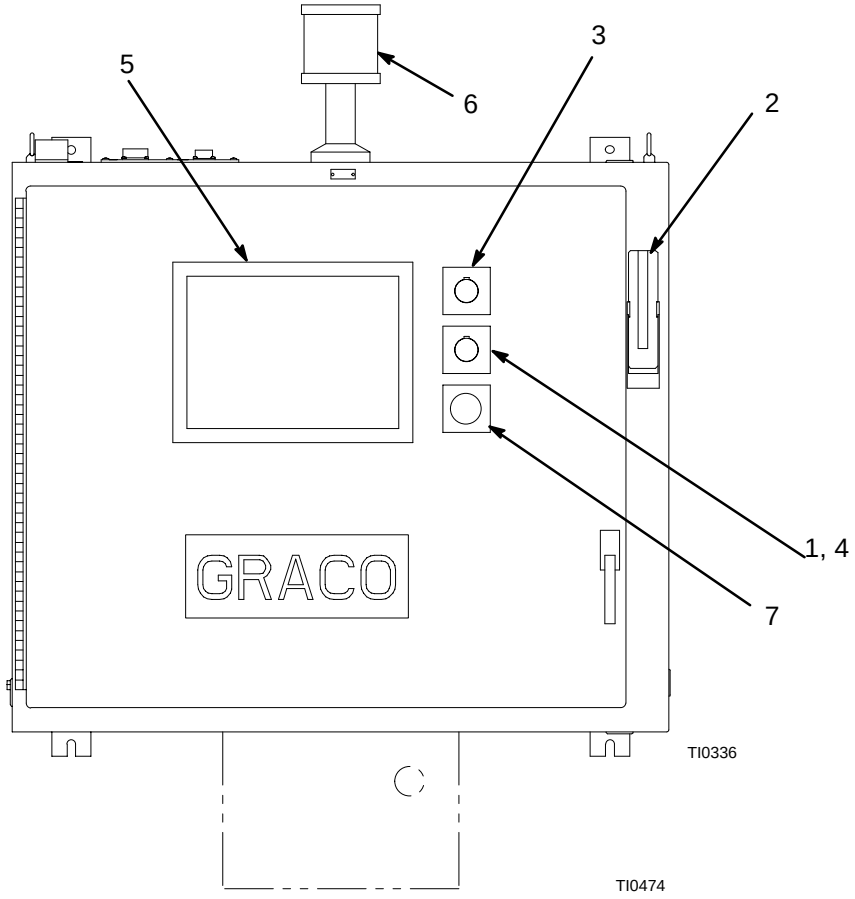


Fig. 11

Material Loading

Dispensing in Manual Mode

Using TouchScreen, perform the following steps:

NOTE: Make sure the CONTROL ON indicator, (4) in Fig. 17, is lit. If it is not, press the MASTER START button (1) to turn on power to the PrecisionSwirl for SD metering valve drive circuitry.

1. On the TouchScreen, perform the following steps:
   a. Touch the **Settings** control button.
   b. The keypad comes up. Enter your user password and touch **Accept**.
2. Read the data cell for **Dispense Mode**. If Automatic is displayed, touch the button to toggle to Manual mode.
3. Before dispensing in Manual mode, set Purge Gun Flow Rate value.
   a. Touch **Setup** to return to the Setup screen.
   b. Touch **PrecisionFlo Plus**. The keypad pops up.
   c. Enter your user password and touch **Accept**.
   d. Touch **Volume Parameters**.
   e. Touch the **Purge Gun Flow Rate** data cell. The numeric keypad pops up.
   f. Touch **Clear** to delete the existing value, then enter the new value and touch **Accept**.

NOTE: The Purge Gun Flow Rate scale of 0 to 100% is equivalent to 0 to 10 volts. For example, 50% equals 5 volts. The Purge Gun Flow Rate, in conjunction with the PSI/Volt settings establish the system target pressures.

4. Touch the **Back** button twice to return to the Setup screen. Touch the **Settings** control button.
5. The keypad comes up. Enter your user password and touch **Accept**.

⚠ WARNING

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

⚠ WARNING

PRESSURIZED FLUID HAZARD
To reduce the risk of serious bodily injury, such as fluid injection or splashing fluid in the eyes or on the skin, ALWAYS wear eye protection and protective clothing when installing, operating, or servicing this dispensing system.

⚠ WARNING

MOVING PARTS HAZARD
Moving equipment parts can cause personal injury, including severing of hands or fingers. Make sure all personnel are clear of moving parts before operating the equipment.

6. To start dispensing from Left Gun, touch and hold **Dispense Gun L** button. Dispensing continues as long as you continue to touch **Dispense Gun L**.
7. To stop dispensing, release the **Dispense Gun L** button.

   Repeat, using the **Dispense Gun R** button to dispense from the right gun.
8. Touch **Dispense Mode** to toggle to Automatic dispense mode.
9. Touch the **Overview** control button to return to the Overview screen.

Configuration

After you have loaded material into the dispensing system, configure the software for PrecisionSwirl for SD module operation. Figure 12 shows the major steps to follow to configure the PrecisionSwirl for SD software.

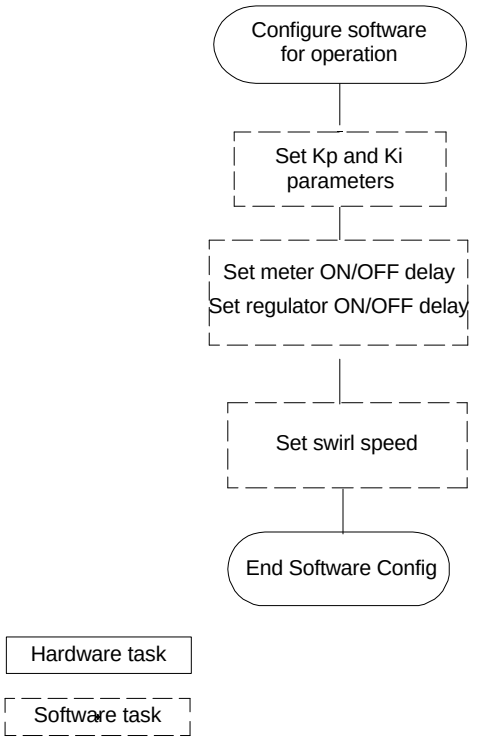


Fig. 12

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

- Kp and Ki parameters
- On and Off delays
- Set swirl speed

1. Set on and off delays for the dispense device and the fluid regulators. See page 33.

2. If the optional flow meter (PN 244343) is used, configure the system for flow control. See page 30 for more information.

3. Set the desired swirl speed. (See the PrecisioSwirl™ Module manual (PN 310554) for complete instructions on setting swirl speed.)

You may be entering Kp and Ki values more than once while you are starting up the PrecisionSwirl for SD module. After you have successfully loaded material into the dispense system you may change Kp and Ki values to ensure PrecisionSwirl for SD module accuracy and repeatability.

Adjusting Kp and Ki to Ensure Accuracy and Repeatability of Regulator Operation

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

- **Kp**, the proportional term, dictates how close the pressure control loop will get to the set point.
- **Ki**, the integral term, drives the regulators to eliminate any steady state pressure error.

For example, if the module receives a command to output a pressure of 1000 psi, higher values of Kp will result in output pressures closer to 1000 psi. High values of Ki will quickly eliminate any pressure errors. If either Kp or Ki is set too high, the module will become unstable and oscillate, which will show up as a ripple or wave pattern in the material bead.

Preparing to Adjust Kp and Ki

Fig. 13 shows the major steps to follow to adjust Kp and Ki values.

Make sure that material has been loaded into the dispense system.

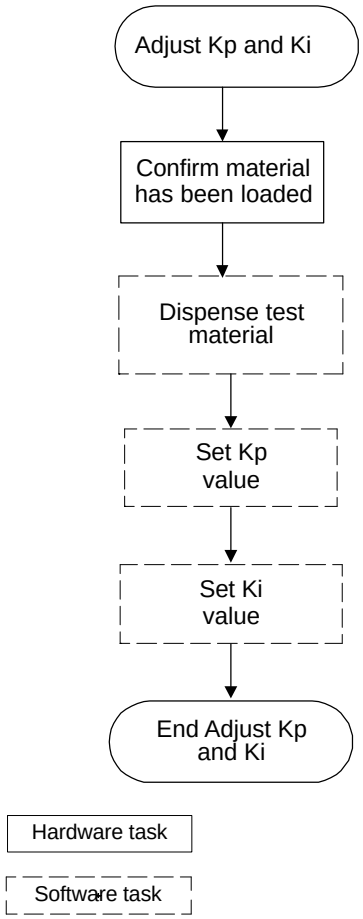


Fig. 13

Configuration

Setting Up to Dispense Test Material

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

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

2. Change the Kp and Ki values on the TouchScreen. See the procedure to **Adjust Kp and Ki Values**. Use Kp – 6 and Ki – 0 as a starting point.

3. Prepare to dispense the material in pressure mode, as follows:
   a. Using TouchScreen, touch the **Setup** control button.

   b. Touch the **PrecisionFlo Plus** button.

   c. The keypad comes up. Enter your user password and touch **Accept**.

   d. Touvh the **Tune Fluid Module** button.

   e. Read the data cell for **Dispense Mode**. If Auto is displayed, touch the button to toggle to Manual mode.

   f. Read the data cell for **Control Mode**. If Flow is displayed, touch the button to toggle to Pressure mode.

   g. Determine the new operating pressure:

Typical Application	psi/volt
Sound deadener	100
Hemflange structural adhesive	200

   h. Key in the new operating pressure per volt by touching the **Adjust Fluid Module** button, then touching **Done**.

   i. Activate the pressure traces by touching the **Expected Pressure L**, **Measured Pressure L**, **Expected Pressure R**, **Measured Pressure R**, and the **Start/Stop** buttons.

Adjust Kp and Ki Values

See Fig. 14 for additional information.

Set Kp

1. Prepare to dispense material into a waste container

2. Dispense material bu pressing the **Dispense Guns L&R** button. Monitor the pressure traces.

3. If the pressure is stable and does not oscillate rapidly above and below the target, increase Kp by 2.

4. Repeat steps 2 and 3 until oscillation occurs. Subtract 2 from the last Kp entered.

Set Ki

See Fig. 14 for more information.

1. Ki is set after Kp has been adjusted

2. Increase Ki by 2 and dispense material. Repeatedly increase Ki and retest until a slow oscillation appears which indicates unstable performance.

3. Decrease Ki to the last stable setting.

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

Adjust Kp and Ki Values

Set Kp and Ki

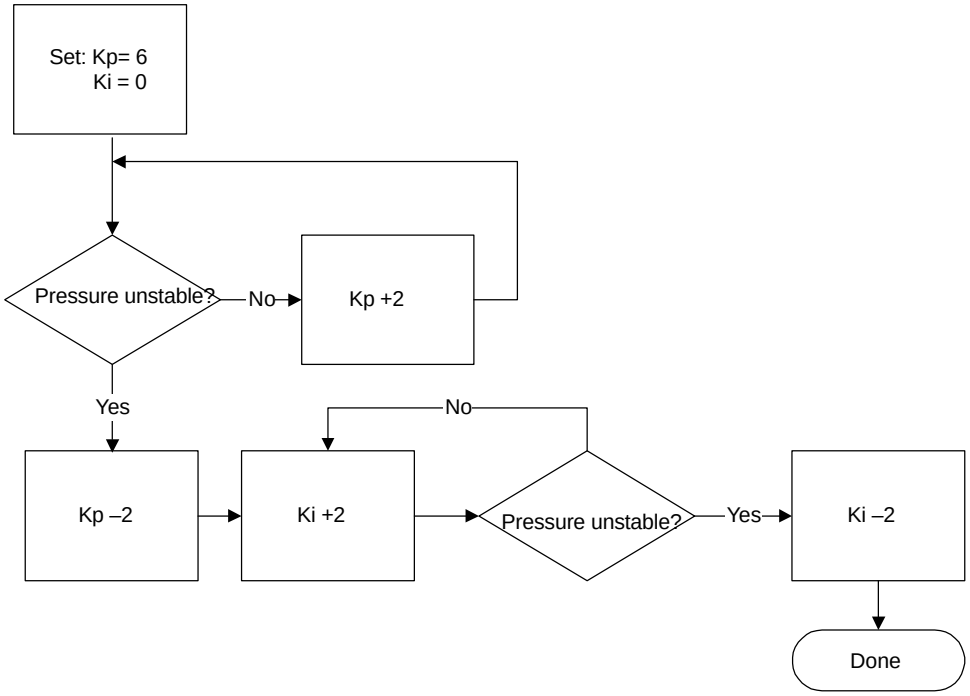


Fig. 14

Setting Swirl Speed

See manual 310554, PrecisionSwirl™ Module, for more detail regarding the swirl applicator.

1. Navigate to Settings screen.
2. Set Swirl mode to **Auto**. The swirl auto value will scale the robot analog swirl command to modify the swirl speed command.
3. Both swirl controls are given the same analog swirl speed command. For fine adjustment of the individual swirl controls, adjust R19 on the swirl control boards.

Configuration

Setting the Flow Meter K-Factor

The optional flow meter (PN 244343) sends an electrical pulse to indicate the passage of a specific amount of material. The K-factor represents the volume of material required to generate one pulse. You will enter that number during this procedure. The optional flow meter has a k-factor of 2000 pulses per liter.

On the TouchScreen, perform the following steps:

1. Touch the **Setup** control button. Then touch **Precision Flo Plus**. The keypad pops up.
2. Enter your super user password and touch **Accept**.
3. Touch **Dispense Parameters**. To access the PrecisionSwirl for SD Protected Setup screen.
4. Touch K-factor data cell. Then enter the 4-digit K-factor value (the number of flow meter pulses per liter of material).
5. Touch **Accept**.
6. Touch **Back** twice and touch **Overview** to return to the Overview screen.

Setting Module Operation Mode

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

- selecting the operating mode
  - Pressure mode (standard)
  - Flow mode (available only with optional flow meter)
- determining the pressure required to achieve the desired flow rate.

Pressure mode is the standard operating mode for the PrecisionSwirl for SD module. Flow mode is available only with the optional flow meter (PN 244343). After you determine the mode and enter the appropriate flow information, the PrecisionSwirl for SD module is ready for operation.

To access the Flow Rate Calibration screen:

1. Touch the **Setup** control button. Then touch **Precision Flo Plus**. The keypad pops up.
2. Enter your user password and touch **Accept**.
3. Touch the **Flow Rate Calibration** button.

Using Pressure Mode

In pressure mode, enter the outlet pressure high limit, outlet pressure low limit, and the setting for psi/volt values. See the procedure for **Setting Pressure Parameters** on page 24.

The PrecisionSwirl for SD module uses the psi/volt settings to calculate the target outlet pressure in pressure mode.

- For example: If 200 psi/volt is entered: 1 volt from the robot input equals 200 psi, 2 volts from the robot input equals 400 psi. (Each volt increments the psi value by a factor of 200.) 10 volts equal 2,000 psi.
- To operate in pressure mode, reference step 3, “Calibrate the material flow in pressure mode” on page 28.

Using Flow Mode

In flow mode, you enter the maximum flow rate required by the application. Fig. 15 shows the voltage to flow rate ratio. The PrecisionSwirl for SD module:

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

For example: When you enter the maximum flow rate, the PrecisionSwirl for SD module analyzes fluid characteristics, which are affected by factors such as viscosity and ambient temperature, then determines the pressure required to obtain the desired flow rate and adjusts the pressure/flow relationship accordingly. Fig. 15 shows the analog voltage to flow rate ratio.

Flow mode: Analog voltage to flow rate ratio

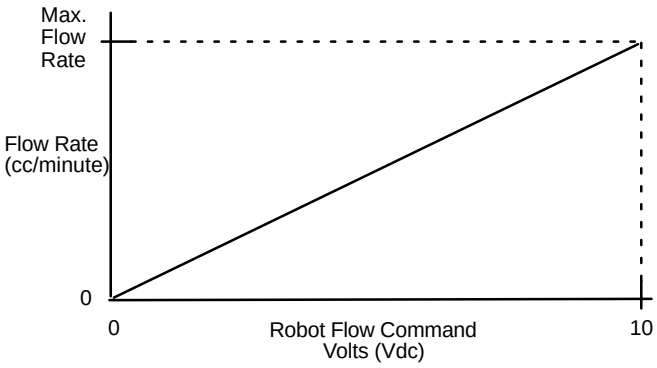


Fig. 15

Configuration

Setting the Flow Rate Control

1. Determine the desired flow rate per applicator
2. Determine the robot command for the desired flow rate.
3. Calculate the maximum (10 V robot command) flow rate per applicator.
   (Desired Flow Rate x 10) ÷ Robot Command = Maximum Flow Rate).

On the TouchScreen, perform the following steps:

1. Touch the **Setup** control button. Then touch **Precision Flo Plus**. The keypad pops up.
2. Enter your super user password and touch **Accept**.
3. Touch **Flow Rate Calibration** to access the flow calibration screen.
   a. Enter the calculated maximum flow rate.
   b. Touch **Calibrate Gun**
      No fluid is dispensed, the maximum flow rate entered is copied to the target maximum flow rate and the flow gain is set to 100%.
4. Touch **Dispense Parameters** The PrecisionSwirl for SD protected setup screen appears.
   a. If known, set the pressure loop Kp and Ki, otherwise, see pages 27 – 29 for information on adjusting Kp and Ki.
   b. Enter the flow meter k-factor (2000 pulses/liter with the optional flow meter (PN 244343) set to 2 pulses per cc)
   c. Set the Flow Average variable to 32 flow meter pulses. At 2000 cc/min, this gives two 1% flow gain adjustments per second, at 4000 cc/min four 1% adjustments per second. Enter a larger flow average number to lower the flow gain update frequency, a smaller number to increase the frequency.
5. Touch **Tune Fluid Module** to access the tune fluid module screen.
   a. Set Dispense Mode to **Manual** and Control Mode to **Pressure**.
   b. Touch **Adjust Fluid Module** to set:
      - the Purge Gun Flowrate to match the expected robot command (i.e., 80% for 8 Vdc)
      - the starting PSI/V L
      - the starting PSI/V R
   c. Touch **Done**.
   d. Touch **Measured Flow Rate**, **Measured Press L**, or **Expected Press L** to activate these three traces.
   e. Touch **Start/Stop Display** to start the trend screen display.
   f. Dispense material by touching **Dispense Gun L** and wait for the flow rate to stabilize.
   g. If the flow rate is too high, decrease the PSI/V L value.
   h. If the flow rate is too low, increase the PSI/V L value
   i. Repeat steps f through h until desired left gun flow rate is achieved.
   j. Touch **Measured Press L**, or **Expected Press L** to deactivate them.
   k. Touch **Measured Press R**, or **Expected Press R** to activate these traces.
   l. Dispense material by touching **Dispense Gun R** and wait for the flow rate to stabilize.
   m. If the flow rate is too high, decrease the PSI/V R value.
   n. If the flow rate is too low, increase the PSI/V R value
   o. Repeat steps l through n until desired right gun flow rate is achieved.
   p. Dispense material by touching the Dispense Guns L&R button. The flow rate should be about twice the individual gun flow rate. If the flow rate is much lower than desired, there may not be enough supply pressure to the system.
   q. Change the Control Mode to **Flow** , then activate the **Expected Flow Rate** trace and deactivate the **Measured Press R** and **Expected Press R** traces.
   r. Dispense material from left, right, or both guns by touching the appropriate **Dispense Gun** button.
   s. Verify that the Actual Flow Rate (red trace) is equal to the Expected Flow Rate (green trace).
   t. Change the Dispense Mode to **Auto**.

6. Return to the Overview screen and monitor the calculated volume for each style as material is dispensed.

   a. Enter the desired tolerances on the **Setup →PrecisionFlo Plus→Volume Parameters** screen. The volume tolerances should be set high enough to avoid nuisance volume faults and low enough to detect plugged guns.

   b. Flow gain can also be monitored on the Overview screen.

7. Monitor the dispensing pressure.

   a. Enter the volumes and desired tolerances on the **Setup →PrecisionFlo Plus→Pressure Parameters** screen. The pressure tolerances should be set high enough to avoid nuisance faults and low enough to detect plugged guns.

Configuration

Setting PrecisionSwirl for SD On and Off Delays

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

At the end of a cycle, the dispense valve can shut off before the pressure has dissipated or, the regulator can shut off before the valve has closed, causing the trapped pressure to drop too low. The ideal condition for the system is for the trapped pressure at the end of a dispense to be equal to the desired starting pressure of the next dispense. To achieve this optimal condition and eliminate shut off problems, you can change the delay time associated with opening or closing of the metering valve and/or the opening or closing of the dispense device (Table 2).

Table 2 — Delay On/Off 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. 16 and Table 3 show delay ON and OFF timing.

Fig. 16

Table 3 — 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 set 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 lower values will lower the trapped pressure.

To determine which delays to set and what values the delays should have, follow the test procedure on page 34.

Delay Timer Test Procedure

Use the **Tune Fluid Module** trend scree to determine ON and OFF delays:

1. Place the dispense device in a purge position over a waste container.
2. Set the analog Flow Command voltage from the robot to 5 Vdc, or select digital robot I/O and set the default (low speed) value to 50%.
3. Start the oscilloscope and dispense for 3 seconds.
4. Review the waveform on the trend screen, examining the end of the waveform:

If the:	Do This:
psi spikes high, or if excessive psi is trapped at the end of the cycle	Increase the GUN OFF delay in 10 msec intervals until the problem is eliminated.
pressure decreases greatly or to below desired trapped pressure value	Decrease GUN OFF or increase REGULATOR ON delay

5. Review the waveform on the trend screen, examining the start of the waveform. There should be no pressure overshoot visible in the pressure sensor output when the GUN ON signal rises.

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

Modifying PrecisionSwirl for SD ON and OFF Delays

On the TouchScreen, perform the following steps:

1. Touch **Setup**. Then touch **PrecisionFlo**. The keypad pops up.
2. Enter your super user password and touch **Accept**.
3. Touch **Gun Parameters** to access the PrecisionSwirl for SD Protected Setup screen.
4. Modify Gun On Delay setting as follows:
   a. Touch the Gun On Delay data cell. The keypad pops up.
   b. Enter the new value and touch **Accept**.
5. Repeat steps 4. a and 4. b to modify Gun OFF Delay setting. The procedure is the same for Regulator ON and Regulator OFF delay settings.
6. Touch **Overview** to return to the Overview screen.

Controlling Flow Compensation

When the control mode is set to Flow, the PrecisionSwirl for SD module measures the flow rate of material being dispensed and adjusts the actual material pressure to maintain the required flow rate. See **Volume Compensation** on page 59 for additional information regarding the flow counter.

Set the control mode as described in the following chart.

Control Mode	When to use it
Flow	Use Flow Mode when a constant bead size is required.
Pressure	Use Pressure Mode when a constant pressure is required for a spray application.

On the TouchScreen perform the following steps:

1. Touch the **Settings** control button. The PrecisionSwirl for SD Status screen appears.
2. Locate **Control Mode** button.
3. Toggle between modes by touching the Control Mode button.
4. Touch **Back** to return to the Overview screen.

Fine Tuning

The procedures in this section are for fine tuning the PrecisionSwirl for SD system when there are minor or temporary changes to the application requirements.

Setting Scale Analog In

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

To change the dispense rate, you must first determine the percentage by which to increase or decrease the material amount. Only values between 50% and 150% will be accepted. Larger changes must be made in the robot controller or the PrecisionSwirl for SD system must be recalibrated at a different flow rate.

On the TouchScreen perform the following steps:

1. Touch the **Settings** control button. The PrecisionSwirl for SD Status screen appears.
2. Locate the **Global Flow Rate** data cell. Using the arrows, adjust the global flow rate as follows:
   - Touch the up arrow as needed to increase the global flow rate a maximum 150%.
   - Touch the down arrow as needed to decrease the global flow rate a minimum 50%.
   - View the percent of adjustment in the data cell that is displayed adjacent to the arrows.

NOTE: The above steps are effective in automatic dispense mode only for both the flow and pressure.

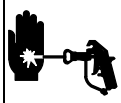
3. Touch **Back** to return to the **Overview** screen.

Operation

Pressure Relief Procedure

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

⚠ WARNING



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

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

1. Ensure dispence mode is set to Manual.
2. Shut off the fluid supply to the regulators.
3. Place a waste container beneath the fluid drain valve, which is located at the filter. Place a waste container beneath the dispense device.
4. Slowly open the drain valve, located at the filter, to relieve fluid pressure.
5. Leave the drain valve open until you are ready to pressurize the system again.
6. Shut off power and air to the fluid supply system.
7. Touch and hold the **Dispense Gun L** button to acutate the reglator and dispensing device. Continue to hold the button until fluid stops flowing.
8. Repeat step 7 using the **Dispense Gun R** button and then the **Dispense Guns L & R** button.

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

Operation

Using the PrecisionSwirl for SD Control Assembly Indicators

Use the tables below and Fig. 17 to read the indicators on the PrecisionSwirl for SD control assembly.

PrecisionSwirl for SD Buttons/Switches

Ref	Button/Switch	What it Does
1	Master Start Button	• Turns on power to PrecisionFlo's metering valve drive after power is applied to the module. • Engages the Plate Control Relay (PCR) and signals the external controller that the power has been applied to the module. • Lights Control On light (4).
2	Main Electrical Power (Disconnect) Switch	• Turns on power to system. • Lights Power On light (3).
7	Sealer Stop Button	• Disengages the Plate Control Relay (PCR). • Signals the external controller that a SEALER STOP condition is in effect. • Shuts down PrecisionSwirl for SD Assembly. • Turns off Control On light. • De-energizes the pneumatic drive for the PrecisionSwirl for SD regulators. • Disables all air solenoids

PrecisionSwirl for SD Indicators

Ref	Indicator	Indicator Light is	Meaning
3	Power On/ Ground Connected Light	On	Power is on to the PrecisionSwirl for SD assembly.
		Off	Power is off.
4	Control On Light	On	PCR is engaged and the PrecisionSwirl for SD Control Assembly is ready for operation.
		Off	PrecisionSwirl for SD control assembly is not ready for operation.
5	TouchScreen 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.
6	Main Fault Light	Off	Light is off when control assembly does not have a fault condition.
		On	Light turns on when an alarm condition is present.
		Flashing	Light flashes when a warning condition is present.

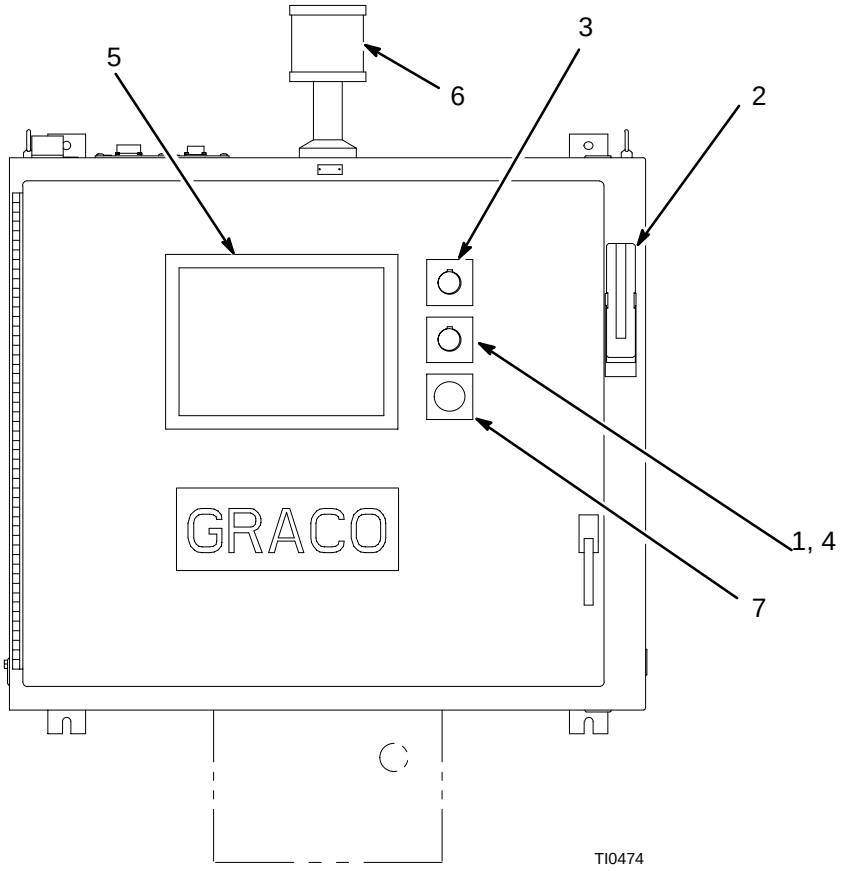


Fig. 17

Starting the Module

To start the module, you (Fig. 17):

1. Carefully inspect the entire system for signs of leakage or wear. Replace or repair any worn or leaking components before applying power.
2. Turn on air and electrical power to the system.
3. Turn on the main electrical disconnect (2) to supply power to the PrecisionSwirl for SD module.
4. The TouchScreen becomes active, showing first a diagnostic message and then the Overview screen.
5. Turn on material pump.
6. Press the MASTER START button (1) for 2 seconds to turn on power to the PrecisionSwirl for SD metering valve drive circuitry. This lights the CONTROL ON indicator (4).
7. If this is the first time the module has been started, or if you want to configure the software, go to **Configuration** on page 26.

Restarting the Module

If the module is on, but the CONTROL ON indicator (4) on the control assembly is not lit:

1. Press the MASTER START, button (1) on the control assembly.

Operation

Setting Operation Modes

The PrecisionSwirl for SD module has two operating states:

- Automatic dispense mode — enables the PrecisionSwirl for SD module to begin dispensing material when it receives a command from the robot.
- Manual dispense mode — enables the PrecisionSwirl for SD module to begin dispensing when you touch the **Dispense Gun L**, **Dispense Gun R**, or **Dispense Guns L & R** button on the TouchScreen display. Dispensing continues for as long as the key is pressed.

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

Using Automatic Dispense Mode

Entering Automatic Dispense Mode

Follow this procedure to put the PrecisionSwirl for SD module into Automatic dispense mode:

⚠ WARNING

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

1. Make sure the CONTROL ON indicator (4) in Fig. 17 is lit. If it is not, push the MASTER START button (1) to turn on power to the PrecisionSwirl for SD metering valve drive circuitry.
2. On the TouchScreen:
   a. Touch the **Overview** button.
   b. Touch the **Settings** control button. The PrecisionSwirl for SD Status screen appears.
   c. Locate **Dispense Mode** data cell.
3. Verify that **Auto** is displayed on the dispense mode indicator. If Manual is displayed, touch the indicator to change the display to Auto.
4. Touch the **Dispense Mode** button to toggle between Flow Mode and Pressure Mode.
5. Toggle between digital and analog **Robot Modes**:
   - If the robot command signal is analog, touch **Robot Mode** to display **Analog**.
   - If the robot interfacing with PrecisionSwirl for SD does not have an analog output, touch **Robot Mode** to display **Digital**.
6. Touch **Back** to return to the Overview screen.

NOTE: The PrecisionSwirl for SD module is enabled when it receives a DISPENSE command from the robot. When enabled, the module starts to dispense material at the requested flow rate.

7. Leave the TouchScreen settings in this state during normal operation.

Monitoring Dispense Statistics

While you are in Automatic dispense mode, you can view characteristics of the current dispense session. You see the data cells with statistics about your selection.

PrecisionFlo Plus Module	Indicator Data
Outlet Pressure	psi or bar
Style	user-entered style name
Desired flow rate	cc/min
Actual flow rate	cc/min

Operation

Using Manual Dispense Mode

1. Make sure the CONTROL ON indicator (4) in Fig. 17 is lit. If it is not, push the MASTER START button (1) to turn on power to the PrecisionSwirl for SD metering valve drive circuitry.

1. On the TouchScreen:

   a. Touch the **Overview** button.

   b. Touch the **Settings** control button. The PrecisionSwirl for SD Status screen appears.

   c. Read the data cell for **Dispense Mode**. If the Auto mode is displayed, touch the data cell to display the Manual mode.

⚠ WARNING

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

⚠ WARNING

PRESSURIZED FLUID HAZARD
To reduce the risk of serious bodily injury, such as fluid injection or splashing fluid in the eyes or on the skin, ALWAYS wear eye protection and protective clothing when installing, operating, or servicing this dispensing system.

⚠ WARNING

MOVING PARTS HAZARD
Moving equipment parts can cause personal injury, including severing of hands or fingers. Make sure all personnel are clear of moving parts before operating the equipment.

1. To start dispensing from the left gun, touch and hold **Dispense Gun L** button. Dispensing continues for as long as you touch the button.

2. To stop dispensing, release **Dispense Gun L** button.

3. Repeat steps 1 and 2 using the **Dispense Gun R** button to dispense from the right gun.

4. Repeat steps 1 and 2 using the **Dispense Guns L & R** button to dispense both guns simultaneously.

5. Touch **`Overview`** to return to the Overview screen.

Operation

Shutting Down the PrecisionSwirl for SD Module

1. Shut OFF the material supply to the module.

1. Follow the **Pressure Relief Procedure** on page 37.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** (page 37).

1. Turn OFF the PrecisionSwirl for SD module's compressed air supply.

1. Press the SEALER STOP (7) button. See Fig. 18.

1. Turn OFF the main electrical disconnect (2).

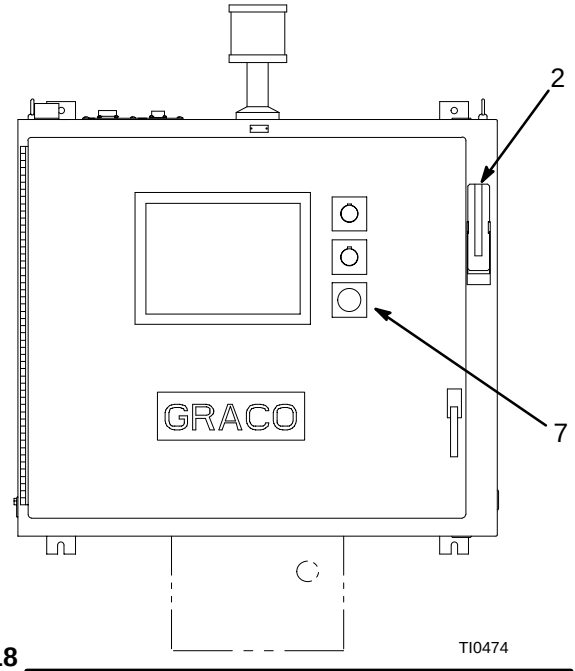


Fig. 18

Maintenance

Maintaining the PrecisionSwirl for SD Module

See Fig. 19 shows the basic components of a typical system equipped with a PrecisionSwirl for SD module.

Perform the **Pressure Relief Procedure** on page 37 before any service action that does not require the module to operate.

⚠ WARNING

To reduce the risk of serious injury whenever you are instructed to relieve pressure, always follow the **Pressure Relief Procedure** (page 37).

For Service and Maintenance Information on:	**See:**
PrecisionSwirl for SD Metering Valve.	Manual # 308601
other components	component documentation supplied with the component
PrecisionSwirl™ Module	Manual # 310554
Fluid Regulator	

No. Description

1 Control Assembly (see Fig. 9 on page 21 for details
2 Fluid Metering Assembly (see Fig. 8 on page 20 for details
3 Dispense Gun
4 TouchScreen (see 310559 for details)
5 Sealer Robot
6 Robot Interface Cable
7 Fluid Supply System
8 Fluid Supply Header
9 Robot Analog Cable
10 Swirl Orbiter
— Filter Module (not shown)

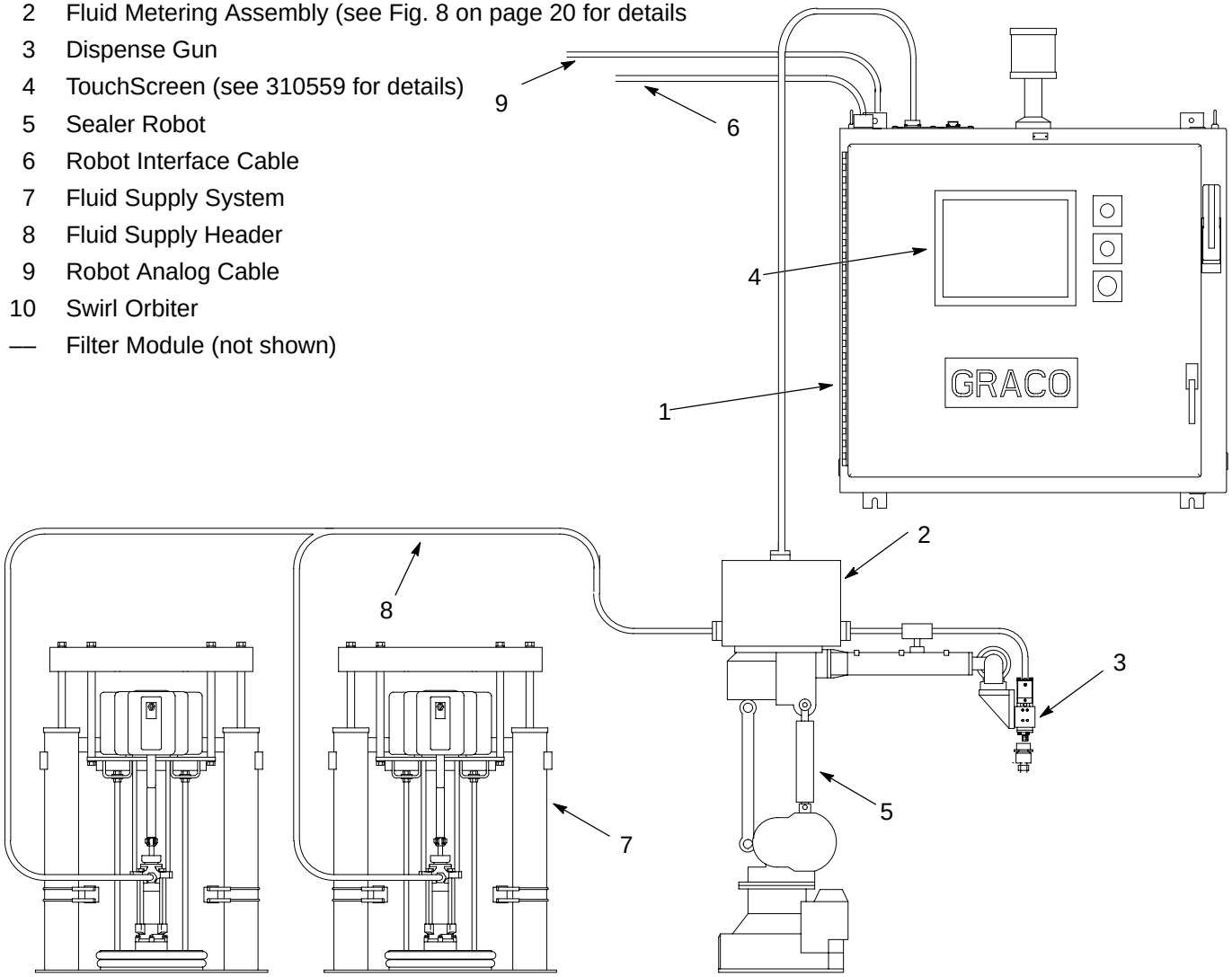


Fig. 19

PrecisionSwirl for SD Module I/O Schematic

Figure 20 shows the internal and external signals used by the PrecisionSwirl for SD module. Inputs to the control are digital signals from external sources, such as a robotic system, or from components of the system.

Outputs from the control are digital signals either sent to an external robotic system or used to control the system components.

Analog inputs from pressure sensors and the external robotic system go to the Programmable Computer Controller (PCC). Analog outputs are used to control the swirl speed and the regulator pressures.

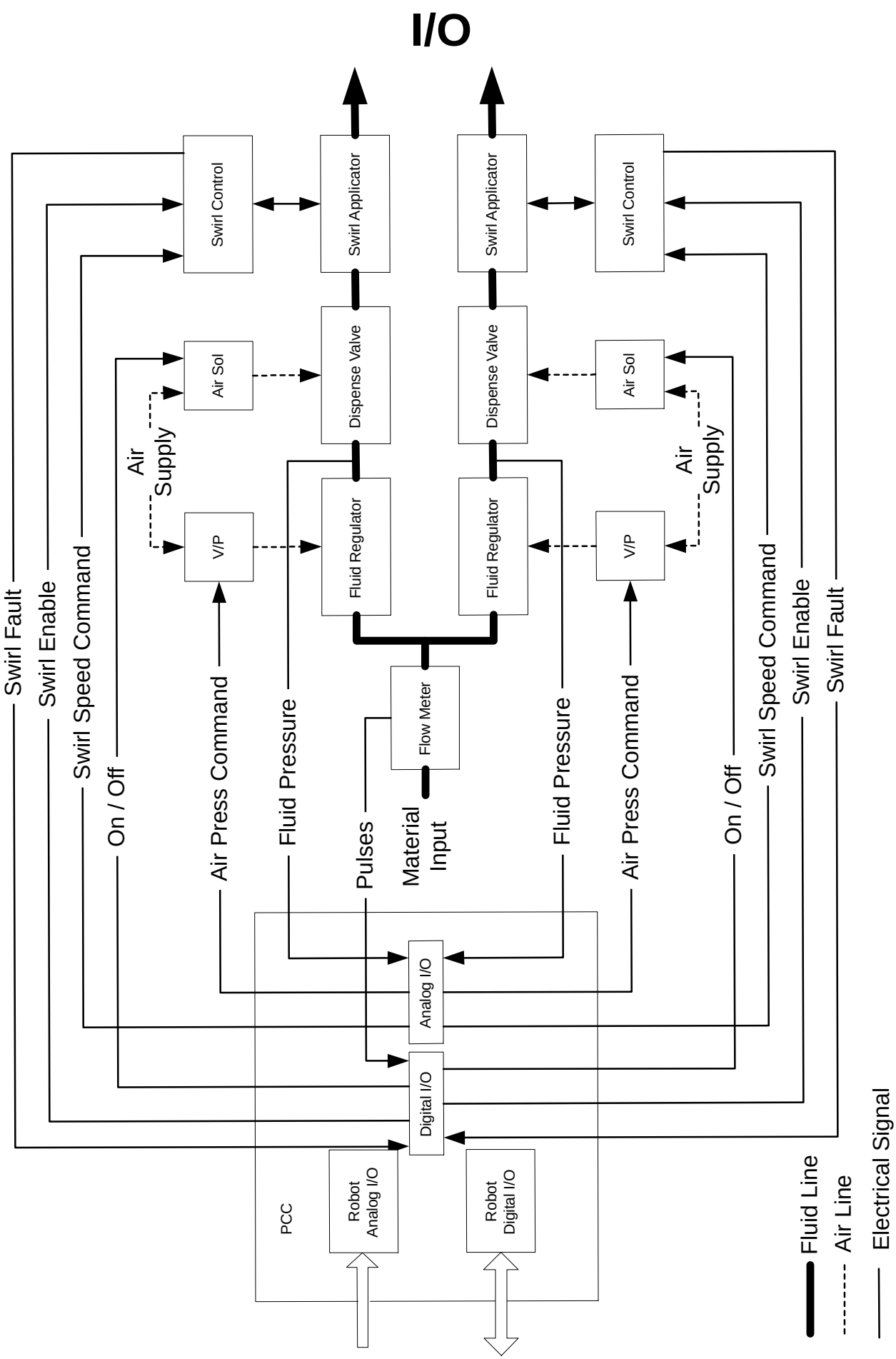
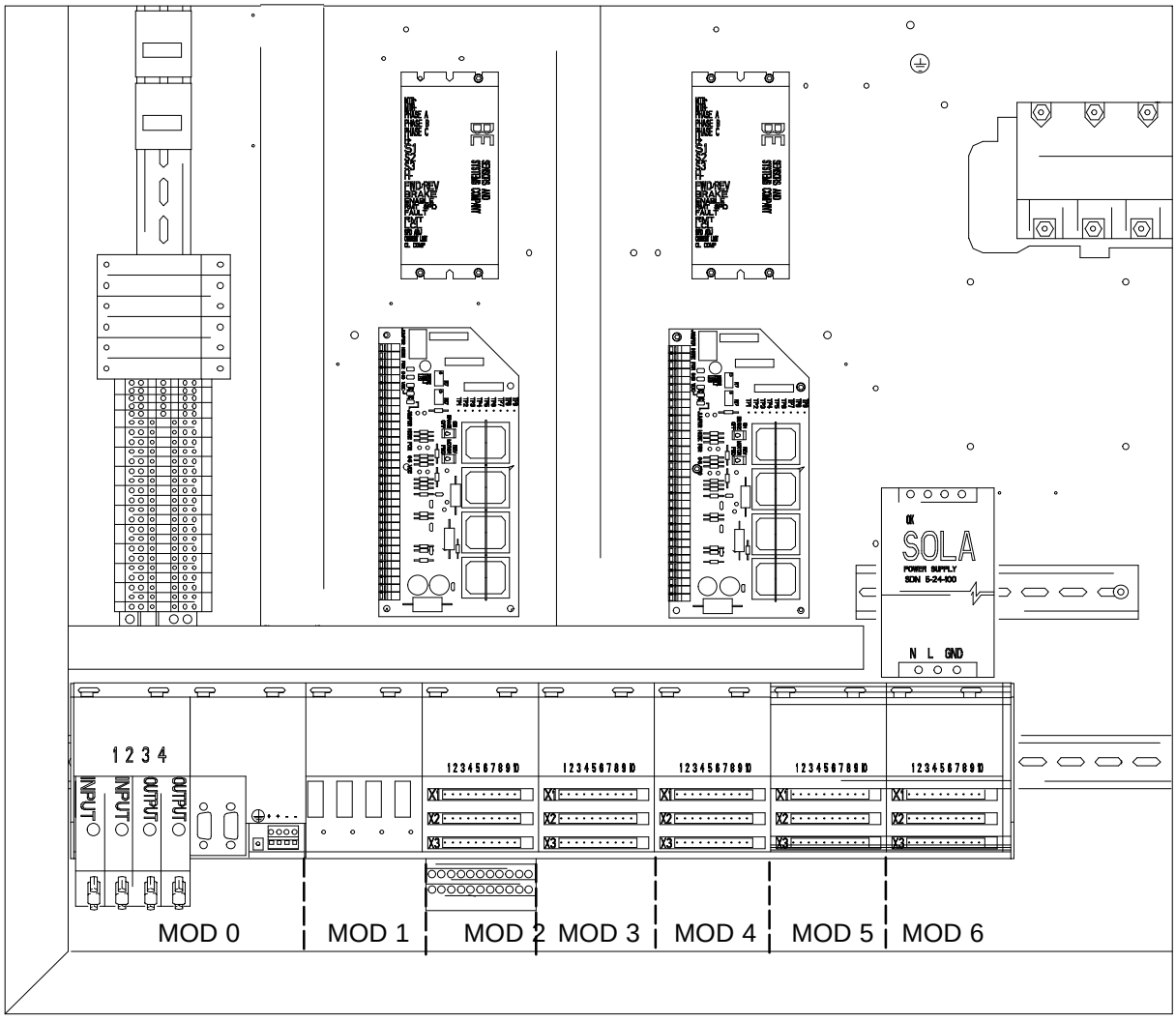

I/O
Swirl Control
Swirl Applicator
Swirl Applicator
Swirl Control
Air Sol
Dispense Valve
Dispense Valve
Air Sol
Air Supply
V/P
Fluid Regulator
Fluid Regulator
V/P
Air Supply
Swirl Fault
Swirl Enable
Swirl Speed Command
On / Off
Air Press Command
Fluid Pressure
Pulses
Flow Meter
Material Input
Fluid Pressure
Air Press Command
On / Off
Swirl Speed Command
Swirl Enable
Swirl Fault
Analog I/O
Digital I/O
PCC
Robot Analog I/O
Robot Digital I/O
Fluid Line
Air Line
Electrical Signal

Fig. 20

I/O Module Description

See Fig. 21 for module positions in the rack. Table 4 provides detailed information on the use and output states of the modules in the PrecisionSwirl for SD I/O rack.



TI0652B

Fig. 21

I/O

Table 4 — I/O Module Description

Description	I/O Type	Module Number	Slot Number	Channel Number	Other
Flow Meter	Digital Input	0	1	A	
Robot Pressure/Flow Command	Analog Input	0	2	1	
Robot Swirl Speed Command	Analog Input	0	2	2	
Pressure Sensor Left	Analog Input	0	2	3	
Pressure Sensor Right	Analog Input	0	2	4	
V/P Command Left	Analog Output	0	3	1	
V/P Command Right	Analog Output	0	3	2	
Swirl Speed Command	Analog Output	0	4	1	
Remote Start	Digital Input	2	X1	1	
Control On	Digital Input	2	X1	2	
Robot Stop Signal	Digital Input	2	X1	3	
Temperature Fault	Digital Input	2	X1	4	
Swirl Fault Left	Digital Input	2	X1	6	
Swirl Fault Right	Digital Input	2	X1	7	
PCR On	Digital Output	2	X2	1	
Open Gun 1 (L)	Digital Output	2	X2	2	
Open Gun 2 (R)	Digital Output	2	X2	3	
Swirl Enable 1 (L)	Digital Output	2	X2	5	
Main Fault Light	Digital Output	2	X2	6	
Swirl Enable 2 (R)	Digital Output	2	X2	7	
Dispenser Ready	Digital Output	3	X1	1	
Volume On Data	Digital Output	3	X1	2	
Fault On Data	Digital Output	3	X1	3	
Auto Mode	Digital Output	3	X1	4	
Cycle Complete/In Cycle	Digital Output	3	X1	6	
Data 1	Digital Output	3	X1	7	
Data 2	Digital Output	3	X1	8	
Data 4	Digital Output	4	X1	1	
Data 8	Digital Output	4	X1	2	
Data 16	Digital Output	4	X1	3	
Data 32	Digital Output	4	X1	4	
Data 64	Digital Output	4	X1	5	
Data 128	Digital Output	4	X1	6	
Data 256	Digital Output	4	X1	7	
Data 512	Digital Output	4	X1	8	
Dispense Gun 1 (L)	Digital Input	5	X1	1	
Dispense Gun 2 (R)	Digital Input	5	X1	2	
Request Volume	Digital Input	5	X1	3	
Fault Reset	Digital Input	5	X1	4	
Initiate Style	Digital Input	5	X1	5	

Note: Modules 3 through 6 are for Robot I/O.

Table 5– I/O Module Description *(continued)*

Description	I/O Type	Module Number	Slot Number	Channel Number
Job Complete/Measure Volume	Digital Input	5	X1	6
Swirl 1 (L)	Digital Input	5	X1	7
Swirl 2 (R)	Digital Input	5	X1	8
Style 1	Digital Input	6	X1	1
Style 2	Digital Input	6	X1	2
Style 4	Digital Input	6	X1	3
Style 8	Digital Input	6	X1	4
Style 16	Digital Input	6	X1	5
Low Speed	Digital Input	6	X1	6
Med Speed	Digital Input	6	X1	7
High Speed	Digital Input	6	X1	8

Theory of Operation

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, in their energized or active state.

Digital Inputs

Dispense Gun 1 (Left)

This is the Left Gun Dispense Signal. The PrecisionSwirl for SD unit will attempt to dispense at either the commanded flow rate or commanded pressure while this signal is SET, dependent on mode.

Dispense Gun 2 (Right)

This signal is used either independently or in conjunction with **Dispense Gun 1.** For purposes of Dispense Cycle timing, operating both or either are considered a single dispense signal.

Fault Reset

This signal is used to clear a fault using the robot I/O

Style Bits 1, 2, 4, 8, 12

These inputs are read at the start of a job to determine the selected style.

Initiate Style

This input can be used to start a new dispense job.

Low, Medium, High Speed

These are the digital robot flow commands.

Job Complete/Measure Volume

This input can be used to signal a job end.

Swirl 1 (Left)

This is the input signal to enable the left swirl orbiter.

Swirl 2 (Right)

This is the input signal to enable the right swirl orbiter.

Digital Outputs

Dispenser Ready

This signal will be SET under the following conditions:

1. the system is in automatic mode, and
2. the system does not have an active ALARM (Warnings have no effect).

Fault on Data

This bit is RESET under the following conditions:

1. The system is in Automatic mode
2. No Faults (alarms or warnings) are active

Auto Mode

This signal indicates if the PrecisionSwirl for SD system is in Auto mode.

Depressurized

Not used.

Cycle Complete/In Cycle

The **Cycle Complete** signal is RESET at the initiation of a dispense cycle. The signal is not SET again until the dispense cycle is complete. The dispense cycle is complete when the **Dispense Done Delay Timer** has timed out or the **Job Complete** signal has been received from the robot. This signal can be configured as **In Cycle** in the PrecisionSwirl for SD General Setup screen. Signal states SET and RESET will be reversed in the **In Cycle** configuration.

Data Bits 1, 2, 4, 8, 16, 32, 64, 218, 256, and 512

These bits should be read as a binary number. Data bits represent binary bits 0-9 respectively. All bits remain RESET until a fault occurs (value represents the fault code).

Theory of Operation

Analog Signals

Robot Analog

The robot analog signal input represent a flow or pressure request. 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 active.

Swirl Analog

This analog signal is used by the swirl controls when the Swirl Mode is set to Automatic. 0-10V represents a 0 to 100% Swirl Speed command.

Interlocks

Temperature Fault

This interlock should be wired to a set of normally open “Dry Contacts” in the temperature controller. The contacts should be SET when the temperature control system is operational and at temperature. If this signal is not used, it must be jumpered.

NOTE: This signal is always a 24 Vdc signal and should be wired as shown on the schematic on page 86.

Remote Stop

This signal needs to be set by a robot controller for the PrecisionSwirl for SD to function This signal not set is the same as pressing the Stop button on the front of the controller. If this signal is not used it must be jumpered as shown in the schematic on page 86.

Theory of Operation

Dispense Modes:

Manual Mode

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

Automatic Mode

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

When a fault is detected, the PrecisionSwirl for SD module sets the FAULT ON DATA signal HIGH, and may set the DISPENSER READY signal LOW. Fault detection can also occur during manual dispensing. (See **Fault Handling** on page 55.)

During dispensing, the PrecisionSwirl for SD module 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:

Pressure

The robot I/O or Manual dispense command and the psi/volt setting are used to set a pressure target. The regulators adjust to maintain this pressure.

Flow

The robot I/O or Manual dispense command and the psi/volt setting are used to set a flow rate target. The regulators adjust pressure to maintain this flow rate.

Robot I/O Modes:

Analog

0-10 Vdc signal from the robot is used to determine the pressure or flow command. A 10 volt command in Flow Control Mode will establish a flow rate command equal to the value entered during the flow calibration procedure.

Digital

Three digital I/O signals (High, Medium, Low speed) are used to set three discrete commands. 0 to 100% is equivalent to 0 to 10 volt analog command. If no digital I/O signal is given, the system defaults to the Low speed value.

Swirl Modes:

Automatic

- Analog input is used to set swirl speed
- Robot I/O for activating swirl orbiter
- Robot Analog Swirl signal scaled by “Swirl Auto” setting. A swirl auto value of 50% would give a 5 V command to the swirl controller with a 10 V robot analog swirl signal

Manual

- Manual setting of swirl speed by the “Swirl Manual” variable on the settings screen. 0 to 100% sets 0 to 100% of swirl speed
- Swirl enable from robot I/O or PrecisionSwirl for SD Manual dispense
- PrecisionSwirl for SD manual dispense will activate swirl enable.

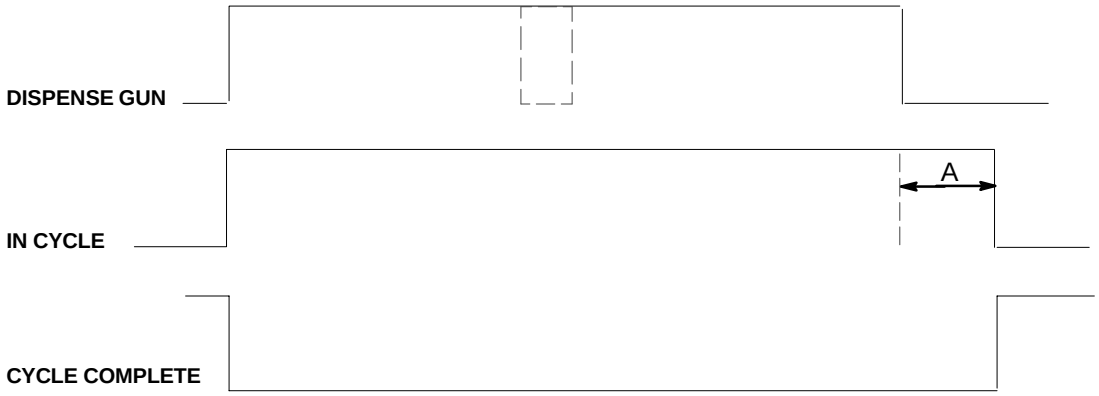
The PCR must be set (green light on) to enable the swirl controller

The swirl fault is selectable as an Alarm or a Warning.

A swirl fault is generated if a swirl enable command is given to a swirl controller and the swirl orbiter does not come up to speed.

Typical Dispense Cycle

Using Timer for Job End

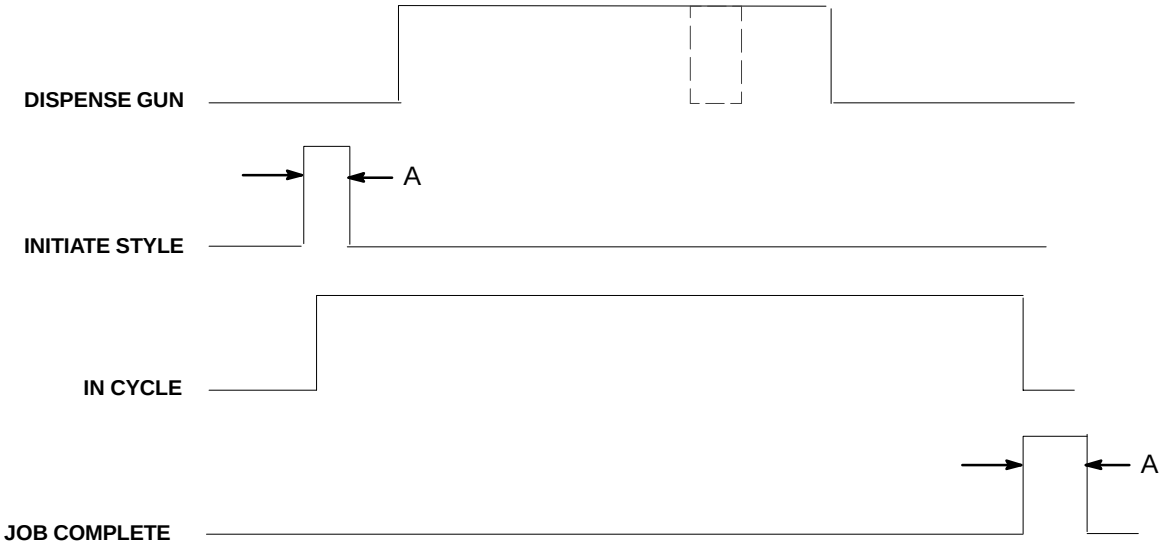


A = Dispense Done delay time, default is 5 seconds

Fig. 22

1. The job begins with a **Dispense Gun** signal or **Initiate Style** signal from the robot. The style bits from the robot are read at the beginning of the job.
2. The PrecisionSwirl for SD robot output (module 3, channel 6) can be selected as **In Cycle** or **Cycle Complete** from the Setup → Display Options screen. Job End mode (Timer or Robot I/O) is also set on this screen.

Using Robot I/O for Job End



A = Minimum pulse width is 150 milliseconds

Fig. 23

1. The job ends when the Job Complete input is pulsed HIGH by the robot.
2. This is the recommended method to end a job, as an unexpected production stoppage in the middle of the dispense will not give a false Job End signal.

Theory of Operation

Typical Job Cycle

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

   Style bit data must be valid a minimum of 15 msec before DISPENSE or INITIATE STYLE is raised, and must remain valid for a minimum of 130 msec afterward (Fig. 24).
5. PrecisionSwirl for SD module waits for DISPENSE signal from the robotic system to start dispensing.
6. Robotic system controller requests material to be dispensed by setting the DISPENSE signal HIGH.
7. PrecisionSwirl for SD module activates the closer solenoid, retracting the closer pneumatic cylinder.
8. Dispense gun opens after the GUN ON DELAY, immediately if the delay is set to zero.
9. PrecisionSwirl for SD module checks if a REGULATION ON DELAY has been set by the user.

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

   If the delay has not been set, the PrecisionSwirl for SD module immediately begins metering material to the gun.
10. PrecisionSwirl for SD module regulates output based on the PRESSURE COMMAND input signal from the robot.
11. PrecisionSwirl for SD module continuously monitors fluid pressures, and makes adjustments for changes in operating conditions.
12. PrecisionSwirl for SD module monitors operating parameters to detect and report any faults that may occur. (see Fault Handling on page 55.)
13. Robot sets the DISPENSE line LOW, indicating that no material is required during this portion of the program. (Robot can cycle the DISPENSE signal HIGH and LOW throughout a cycle if required. Volume measurement will still occur.)
14. The regulator closes after the REGULATOR OFF DELAY expires.
15. The PrecisionSwirl for SD module checks if a GUN OFF DELAY has been set by the user.

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

    If the delay has not been set, the PrecisionSwirl for SD module immediately closes the dispense gun solenoid, which closes the gun.
16. PrecisionSwirl for SD module deactivates closer, which closes the needle 2 seconds after the gun solenoid is deactivated.
17. PrecisionSwirl for SD module ends the job when the DISPENSE DONE DELAY timer expires or the JOB COMPLETE robot I/O signal is received.
18. PrecisionSwirl for SD module updates the Status screen and the Data table.
19. PrecisionSwirl for SD module waits to be polled for volume dispensed. (See Volume Reporting on page 56.)

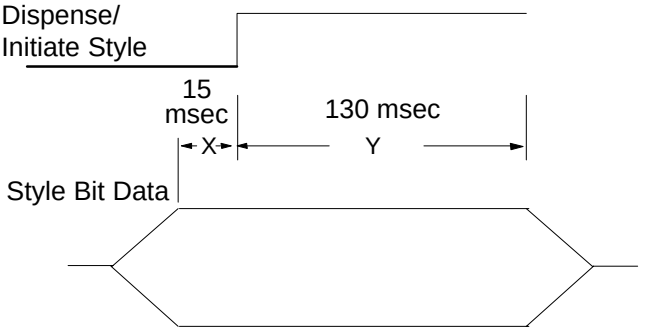


Fig. 24

Fault Handling

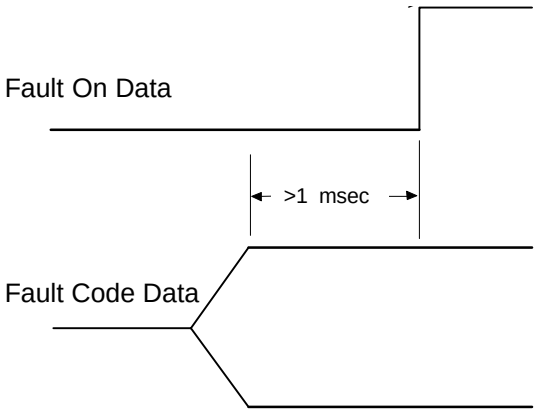


Fig. 25

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 robotic 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 PrecisionSwirl for SD module DISPENSER READY signal to go LOW or,
- **Warnings**, which keep the PrecisionSwirl for SD module DISPENSER READY signal HIGH.

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

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

The values of the fault bits are:

Data	Fault Bit Value
1	1
2	2
4	4
8	8
16	16
32	32
64	64
128	128
256	256
512	512

For example, if Data 1 and Data 16 are HIGH, the fault code value is equal to 1 + 16, or 17, and an OUTLET PRESSURE LOW fault is generated.

Refer to the **Troubleshooting and Fault Recovery** section page 60 for fault code causes, descriptions, and solutions for the various faults.

Typical Fault Handling Procedure

1. A problem occurs in the PrecisionSwirl for SD module.

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

3. If the fault is an alarm:

   a. The PrecisionSwirl for SD module sets the DISPENSER READY signal LOW.

   b. Then the PrecisionSwirl for SD module places the fault code on the data bus and sets the FAULT ON DATA signal HIGH.

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

NOTE: A fault condition causing an alarm must be corrected, and the PrecisionSwirl for SD module must be placed back in an operating mode using TouchScreen or FAULT RESET before dispensing can resume.

   If the fault is a Warning, normal operation continues to the end of the cycle. A Warning should be cleared using the TouchScreen or FAULT RESET.

4. On completion of the cycle, if volume information is requested, the PrecisionSwirl for SD module uses the data bus to transfer the volume data. (See Figure 26, Volume Reporting on page 56.) During volume transfer, the FAULT ON DATA signal is LOW.

5. When the cycle is completed and any volume information has been transferred, the PrecisionSwirl for SD module places the any fault code on the data bus and FAULT ON DATA goes HIGH.

Volume Reporting

The volume dispensed during the last job is available on the data bus at the end of a cycle. This information is reported in 10-bit binary code that reports the volume dispensed in the previous cycle in cubic centimeters (Fig. 26).

To determine the amount of material dispensed, convert the 10 bits from binary to decimal. The limit for one dispense job is 1023 cubic centimeters.

The last volume dispensed is overwritten when a new dispense job is started by the robot.

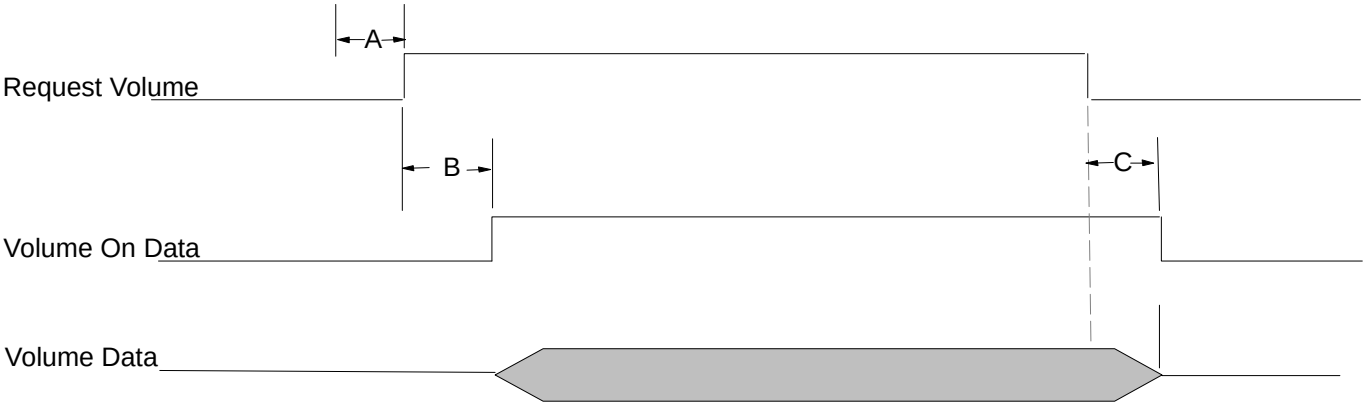


Fig. 26

Table 5 — Volume Data Timing Limits

		Minimum Time (msec)	Maximum Time (msec)
A	VOLUME REQUEST rises	–	–
B	VOLUME REQUEST rises to Volume On Data rises	0	100
C	VOLUME REQUEST drops to VOLUME On Data drops	0	100

1. Robotic controller sets DISPENSE to LOW and DISPENSE DONE DELAY expires or a JOB COMPLETE signal from the robot ends a dispense job.
2. The PrecisionSwirl for SD module stops measuring volume dispensed. An entry is made to the data log which records the volume dispensed.
3. Robot controller sets the VOLUME REQUEST signal HIGH.
4. PrecisionSwirl for SD module places the 10 bits of volume information on the data bus.
5. PrecisionSwirl for SD module sets the VOLUME ON DATA signal HIGH.
6. Robotic controller reads the data.
7. Robotic controller sets the VOLUME REQUEST signal LOW to indicate volume data has been read.
8. PrecisionSwirl for SD module sets the VOLUME ON DATA signal to LOW.
9. After volume is reported, if a fault was detected during the cycle, the PrecisionSwirl for SD module places the fault code on the data bus. (See Fault Handling on page 55.)
10. When the robot sets the DISPENSE line high to begin the next cycle, the PrecisionSwirl for SD module discards previously stored volume data.

Theory of Operation

Flow Meter Verification

The calibration factor is the number of flow meter pulses per liter, as determined by a measurement with oil. The factory setting for the optional flow meter (PN 244343) is 2000 pulses per liter.

Most sealant and adhesive materials are compressible and, since the flow meter of the PrecisionSwirl for SD fluid metering assembly is measuring the material under high pressure, the actual volume of material dispensed may vary slightly from the measured volume due to this compressibility.

To adjust the flow meter k factor to reflect the uncompressed volume dispensed more accurately, perform the following steps:

1. Obtain a beaker, 500 cc or larger, and measure the mass of the empty beaker.
2. Manually dispense material into the beaker.
3. Record both the volume displayed on the Overview screen and the flow meter k factor from the Setup→Dispense Parameters screen.
4. Measure the mass of the full beaker and subtract the mass of the empty beaker to determine the fluid mass.
5. Calculate the actual volume dispensed:

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

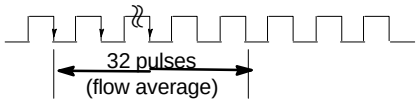
6. Calculate the new flow meter k factor:

$$\text{k factor (new)} = \frac{\text{displayed volume (cc)} \times \text{k factor (old)}}{\text{measured volume (cc)}}$$

7. Enter new k factor.
8. Go to step 1 and verify the calculated k factor.

Flow Rate Calculation

The user enters the flow meter k factor (default is 2000 pulses per liter) and then enters the flow average value (default is 32).



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

Example: Flow rate = 4000 cc/min
k factor = 2000 pulses/liter = 2 pulses/cc
This gives a pulse rate of 133.3 pulses/second or 7.5 milliseconds/pulse. A new flow rate is measured approximately every 240 milliseconds.

If the time measured with the same parameters (2000 pulses/liter, 32 pulses flow average) is 250 milliseconds, the flow rate calculation would be 3,840 cc/minute.

Theory of Operation

Flow Calibration

In order to control the flow rate of a material, the user must enter the pressure required at the regulator outlet to achieve a desired flow rate (Fig. 27).

The manual calibration procedure provides the pressure required to obtain the maximum desired flow rate (10 Vdc flow command.)

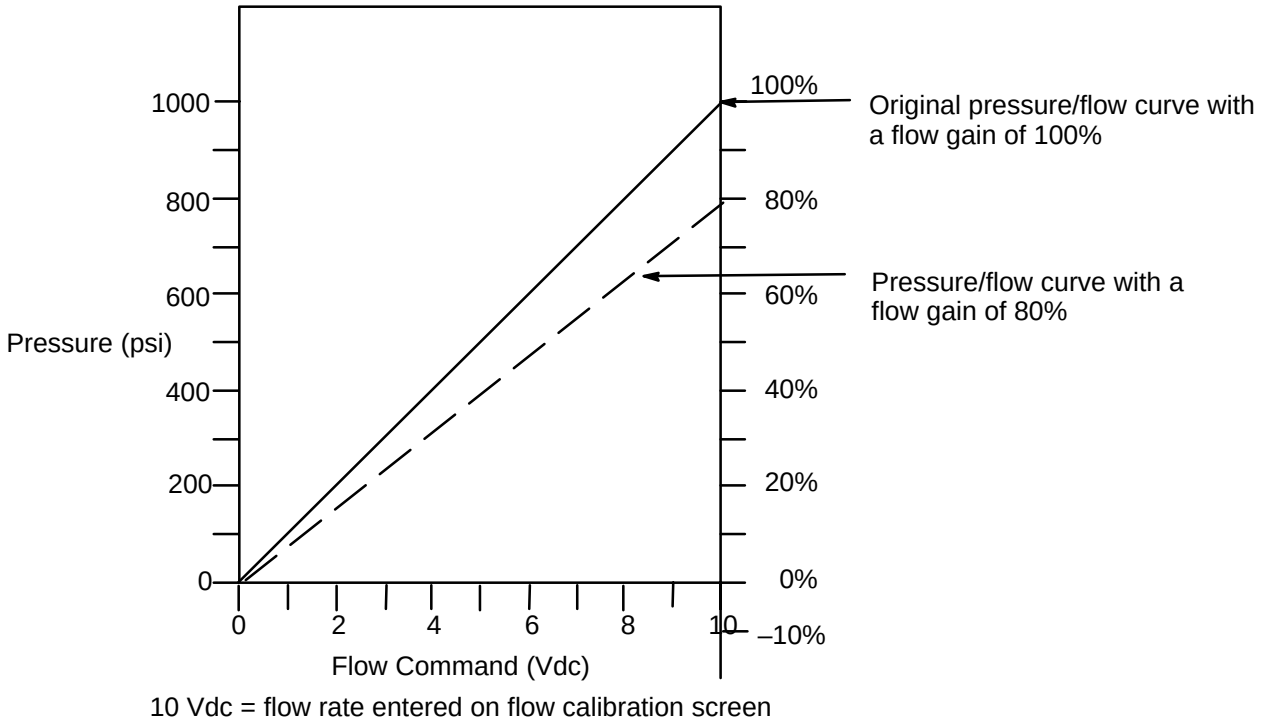


Fig. 27

Volume Compensation

Volume compensation is used when the PrecisionSwirl for SD system is operated in flow control mode. The system measures the actual flow rate and adjusts the pressure/flow relationship (as determined during flow

The initial flow gain is set to 100% (see Flow Calibration on page 58).

Each time a new flow rate measurement has been completed, the actual flow rate is compared to the requested flow rate. The flow gain value is increased if the flow rate is lower than the desired or decreased if the flow rate is higher than desired

Endpoint Adjustment	
Flow rate < desired flow rate	Increase flow gain
Flow rate ≥ desired flow rate	Decrease flow gain

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

The maximum adjustment range of the flow gain is 50% to 400% of the original value from calibration. If the 50% or 400% limits are reached, a flow compensation near-limit fault is generated.

Troubleshooting and Fault Recovery

Table 6 describes the valid fault codes used by the PrecisionSwirl for SD module, possible causes, and solutions. See **Theory of Operation** – **Fault Handling** on page 55 for detailed information on how fault codes are communicated.

The PrecisionSwirl for SD module displays warnings on the TouchScreen and alarms via the control assembly's fault light.

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

Restarting the Module After a Fault

If a fault has occurred, you must clear the fault before restarting the PrecisionSwirl for SD module.

1. Touch **Reset** on the TouchScreen to clear the fault, or use remote Fault Reset.

Table 6 — Fault Code Table

Fault Code	Fault Name	Fault Description	Causes	Solutions
The following fault is *always* an Alarm				
4	Dispenser Stop	There is no electrical power to the PCR or servo drive.	Control assembly not activated at start up	Press MASTER START
			SEALER STOP push button pressed	
			CONTROL ON light not lit, control assembly is off	Apply power to PrecisionSwirl for SD module, then press MASTER START
			Remote stop signal not connected in robot controller	Connect signal in robot controller or jumper signal as shown on page
The following faults are *always* Warnings				
102	Flow compensation near limit	The flow compensation value is reaching the 50% or 400% limit.	Major viscosity change of fluid	Recalibrate system
103	Manual mode	System is set to manual mode	Dispense mode is set to manual	Change dispense mode to Automatic
104	Battery low	The controller battery is Low	Battery has exceeded its useful life	Change battery

Troubleshooting and Fault Recovery

Table 6 — Fault Code Table

Fault Code	Fault Name	Fault Description	Causes	Solutions
Remaining faults are selectable by the user as Alarms or Warnings (Setup → Alarms/Warnings screen)				
17	Low Outlet Pressure	Output pressure of the PrecisionSwirl for SD metering valve is below the limit set for operation.	Incorrect limit set	Verify limit is set correctly
			No or insufficient material flow	Increase material flow rate
			Needle is stuck closed	Dislodge and inspect needle
			No air pressure	Verify air on
			Failed transducer	Verify transducer operation, replace if failed
20	High Outlet Pressure	Output pressure to the PrecisionSwirl for SD regulator is above the upper limit set for operation.	Incorrect limit set	Verify limit is set correctly
			Dispense hose/device plugged	Clean/replace hose/device
			Failed transducer	Check transducer, replace if failed
22	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 PrecisionSwirl for SD metering valve inlet. Error is outside flow compensation window	Increase flow rate to PrecisionSwirl for SD regulator inlet
			Material viscosity is outside flow compensation window	Verify material characteristics, recalibrate if necessary
			PrecisionSwirl for SD regulator is not regulating	Check PrecisionSwirl for SD regulator, repair if necessary
23	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
			PrecisionSwirl for SD regulator is not regulating	Check PrecisionSwirl for SD regulator, repair if necessary.
24	Temperature Conditioner Fault	The temperature conditioning fault signal (input module 6) is 0 volts. This warning tells the PrecisionSwirl for SD that the temperature conditioning unit is not operating properly.	Conditioning system is turned off	Turn conditioning system on.
			Over/under temperature fault	Inspect temperature conditioning system.
			No temperature conditioning unit and signal not jumpered to +24 volts	See schematic on page 86.
26	Swirl Fault	Optional swirl orbitor did not reach speed when swirl is enabled	Swirl failure	Inspect swirl system. See PrecisionSwirl Module manual 310554.
101	No Flow	No material was dispensed when a dispense gun signal was activated	No material supply	Replace drum or turn on pumps
			Tip plugged	Clean/relpace tip
			No air pressure to solenoid valves	Turn on air to solenoid valves
110	Process Volume	The requested volume differs from the entered process target by more than the entered tolerance.	Entered process target incorrect	Entered correct process target.
			Entered tolerance incorrect	Enter correct tolerance.
			Requested volume incorrect	Check robot program.
			Robot analog problem	Verify robot analog correct

Service

Servicing the Control Assembly

This manual provides removal and replacement procedures for the following list of control assembly (Fig.28). Some of the components are shown in Fig.29. (CE model 241395 is included, but not shown.)

- Relay (page 63)
- TouchScreen Service Options (page 64)
- I/O and Digital Modules (page 66)

NOTE: refer to the **Parts** information on page 69 while servicing the control assembly.

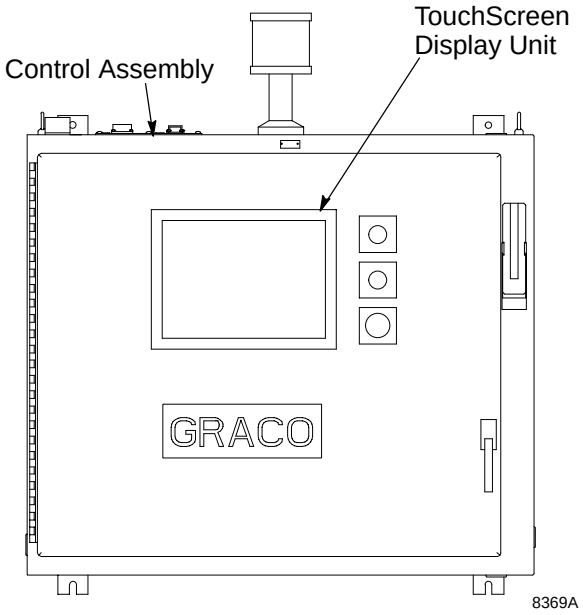


Fig. 28

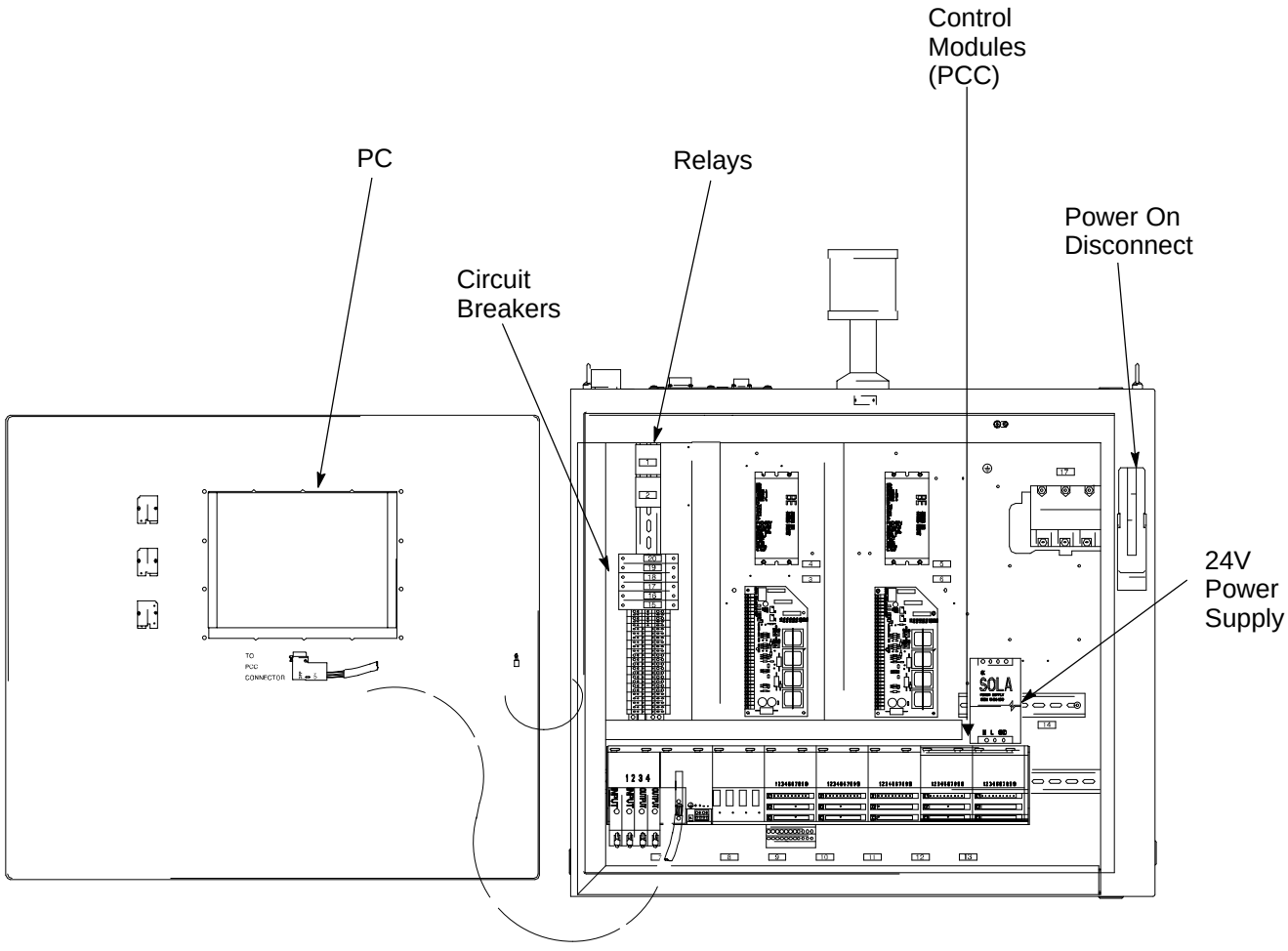


Fig. 29

Service

Relay Removal

Remove the relay as follows:

⚠ WARNING

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

1. At the control assembly, switch the POWER ON disconnect (rotary switch on CE model 241395) to the OFF position.
2. Open the hinged door of the control assembly as follows:
   a. Using a screwdriver, turn the slotted screw on the door handle clockwise 1/4 turn to unlock the door. (For the CE model 241395, turn both door latches counterclockwise 1/4 turn using the key supplied.)
   b. Turn the handle clockwise 45 degrees (excludes CE model 241395) and pull the door open.
3. Remove lead wires from the relay terminals. Note the wire numbers to facilitate reassembly after the relay is replaced.
4. Lift the retaining clip slightly to dislodge the relay (25) from the DIN rail. See Fig. 30.

Relay Replacement

Replace the relay as follows:

1. Reinstall the relay (25) on the DIN rail.
2. Reconnect the lead wires to the relay. Reference the wiring schematics on page 81 and ensure that the connections are correct.
3. Close and latch the hinged door on the control assembly.
4. Switch the POWER ON disconnect (rotary switch on CE model 241395)to the ON position, applying power to the control assembly.
5. Verify that the replaced component operates correctly.
6. Return the control assembly to normal operating condition.

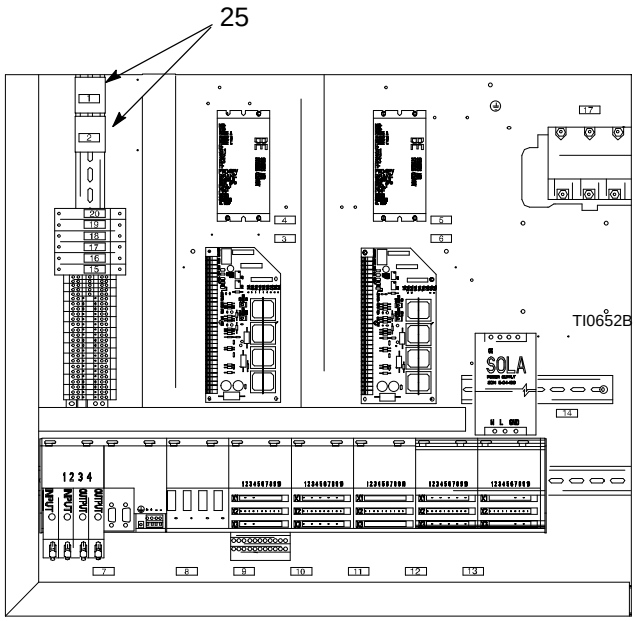


Fig. 30

Service

TouchScreen Service Options

The TouchScreen display unit is comprised of:

- TouchScreen display hardware
- TouchScreen proprietary software

When the TouchScreen display unit requires service, it is the purchaser's responsibility to take the required steps to have the unit repaired. The purchaser must select one of three options to have the unit serviced, replaced, or exchanged.

Service options include:

- removing and replacing the TouchScreen display unit. When service is required, follow the removal and replacement procedures described in this manual.
- having the unit serviced by an authorized Graco technician. When service is required, contact your Graco distributor, who will contact the certified Graco technician for an on-site service call. (The TouchScreen proprietary software is accessible to authorized Graco technicians only.)
- exchanging the defective TouchScreen display unit for a new unit. When service is required, follow the exchanging TouchScreen procedure described in this manual.

TouchScreen Display Unit Removal

Remove the TouchScreen display unit as follows:

⚠ WARNING

ELECTROCUTION HAZARD
Installing and servicing this equipment requires access to parts which could cause an electric shock or other serious injury. Only a qualified electrician should access the control assembly.

1. At the control assembly, switch the POWER ON disconnect (rotary switch on the CE model 241395) to the OFF position.

2. Open the hinged door of the control assembly as follows:

   a. Using a screwdriver, turn the slotted screw on the door handle clockwise 1/4 turn to unlock the door. (For the CE model 241395, turn both door latches counterclockwise 1/4 turn using the key supplied.)

   b. Turn the handle clockwise 45 degrees (excludes CE model 241395) and pull the door open.

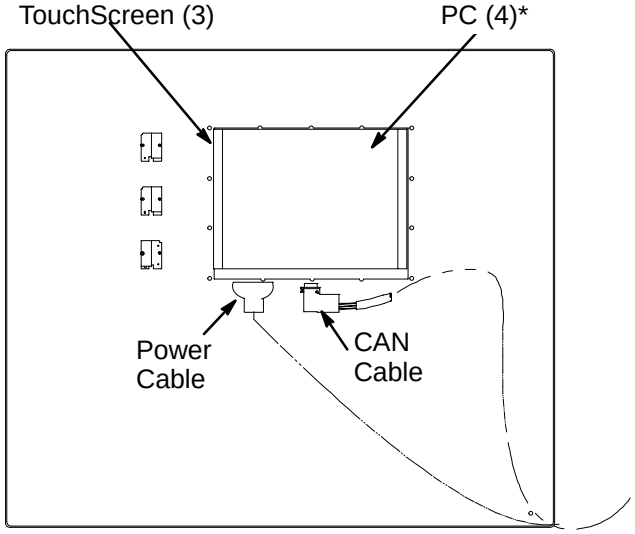
3. Disconnect the power cable and the CAN cable from the TouchScreen display unit. See Fig. 31.

4. At the rear of the hinged door, remove 14 hex nuts that fasten the TouchScreen display unit to the hinged door.

⚠ WARNING

EQUIPMENT MISUSE HAZARD
The TouchScreen display unit weighs approximately 14 lb. (6.3 kg)**.** Exercise care when mounting and handling the TouchScreen display unit to prevent personal injury or equipment damage.

5. At the front of the hinged door, remove the TouchScreen display unit. Exercise care when removing the unit.



***** A new PC (4) requires software (5) & (6), or the hard drive from the original PC must be reused.

Fig. 31

Service

TouchScreen Display Unit Replacement

Replace the TouchScreen display unit as follows:

1. Reverse the removal procedures in steps 3, 4, and 5 in the previous section to mount the TouchScreen display unit on the hinged door of the control assembly.
2. Close and latch the hinged door on the control assembly.
3. Switch the POWER ON disconnect to the ON position, applying power to the control assembly.
4. Verify that the replaced component operates correctly.
5. Return the control assembly to normal operating condition.

TouchScreen Display Unit Exchange

The TouchScreen display unit can be serviced by an authorized Graco distributor *after* completing a Return Goods Authorization (RGA) form. The purchaser must package and ship the unit to the Graco distributor. When packing the TouchScreen display unit, perform the following steps:

1. Place the TouchScreen display unit in a suitable box for shipment. Fill the box with packing material to minimize the possibility of damage.
2. Seal the box tightly to protect its contents and prevent shipping damage.
3. Insure your shipment for the proper replacement value of its contents.
4. Ship the TouchScreen display unit **freight prepaid** to the authorized Graco distributor for service.

Service

I/O and Controller Module Removal

This section describes how to remove all the modules from the control assembly.

NOTE: The I/O and controller modules are arranged on the module rack in an ordered sequence. When you have located the faulty module and removed it from the rack, omit the remaining steps in the removal procedure. Then perform the replacement procedure to ensure that you reinstall the modules back in the original position.

Removing Power from Control Assembly

⚠ WARNING

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

1. At the control assembly, switch the POWER ON disconnect (rotary switch on CE model 241395) to the OFF position.

2. Open the hinged door of the control assembly as follows:

   a. Using a screwdriver, turn the slotted screw on the door handle clockwise 1/4 turn to unlock the door. (For the CE model 241395, turn both door latches counterclockwise 1/4 turn using the key supplied.)

   b. Turn the handle clockwise 45 degrees (excludes CE model 241395) and pull the door open.

Removing Screw-In I/O Modules

To remove screw-in module from the module slot, perform the following procedure:

1. Loosen retaining screw enough to detach module from module slot. See Fig. 21.

2. Remove two screws and cover from module to access the wire terminals.

3. Disconnect wires from terminals. If necessary, label the wires to facilitate reassembly after the module is replaced.

4. Perform either step 4. a or step 4. b, to determine next step.

   a. If you have removed the faulty module, proceed to “Replacing Screw-In I/O Modules” procedure on page 67.

   b. If you have not yet removed the faulty module, continue with the following procedure.

Removing I/O and Control Modules

To remove I/O and controller modules from the module rack, perform the following procedure:

1. Remove two retaining screws and end plate from right end of module rack (see figures 32 and 33)

2. Remove terminal blocks from I/O modules 0 through 6 (as required) by depressing the ejection levers with a screwdriver. See Fig. 20 and Fig. 33 for module identification and location. Note which terminal block connects to which terminal row for the module(s) being removed.

3. Loosen or remove module-mounting screws as required. (See Fig. 20.) Be careful not to allow screws to fall inside module.

4. Carefully slide each module to the right (starting with module 6) to separate them. Grasp top of module and lift to remove module from rack. (See Fig. 20.)

NOTE: Remove connectors from module 0 and the ground lug on the rack, before removing this module.

Service

I/O and Controller Module Replacement

This section describes how to replace the modules on the control assembly.

Replacing I/O and Controller Modules

To replace I/O and controller modules on the module rack, perform the following procedure:

1. Position module just above the two slotted tracks on the rack and drop the module into the slots.

2. Slide the module to the left end of the rack or against the adjacent module. See Fig. 20 and Fig.33 for module identification and location. Be sure connectors between modules are properly mated for good connection.

3. Push module tight against adjacent module and secure with two module mounting screws (see Fig. 20).

4. Replace terminal blocks on I/O module. Push in place to secure block. Be sure terminal blocks are connected to the correct terminal rows on the module.

5. Repeat steps above for each module being replaced.

6. Replace end plate and two retaining screws on right end of module rack (see Fig. 20).

NOTE: Replace connectors from module 0 and the ground lug on the rack if it was removed (see Fig. 20).

Replacing Screw-In I/O Modules

To replace a screw-in I/O module in a module slot, perform the following procedure:

1. Remove the two screws and the cover from the replacement module.

NOTE: When modules for slots 3 or 4 (of module 2) are being replaced, be sure the two switches in each screw-in module are set to the “U” position.

2. Reconnect wires to the terminals on module. Reference the PrecisionSwirl for SD Control Assembly Diagrams on pages 83 and 84 for correct wiring

3. Replace cover and screws on replacement module.

4. Insert module into the proper module slot and secure in place with the retaining screw. See Fig. 20 and Fig. 33 for module identification and location.

5. Repeat procedure for each module being replaced.

Restoring Power to the Control Assembly

1. Switch the POWER ON disconnect (rotary switch on CE model 241395) to the ON position.

2. Close and latch the hinged door on the control assembly.

3. Apply power to the control assembly and verify normal PresciionFlo Plus module operation.

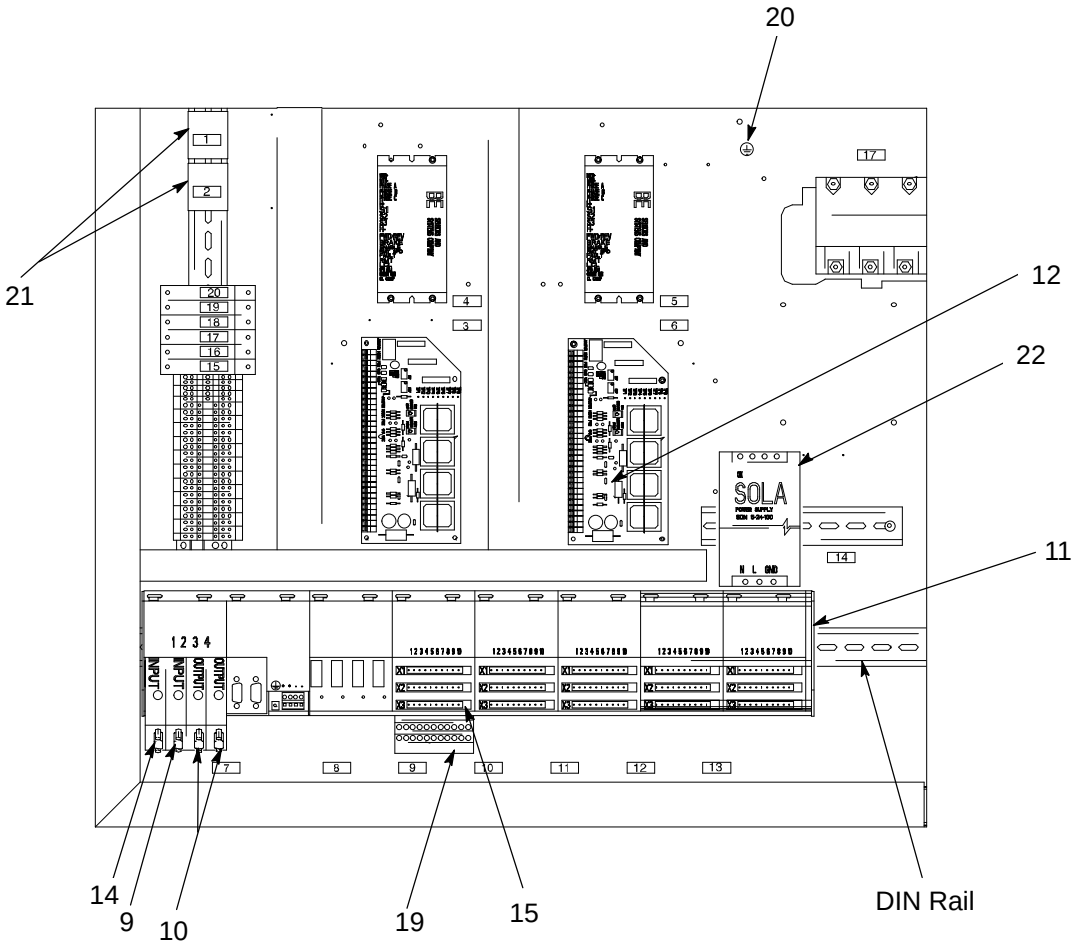


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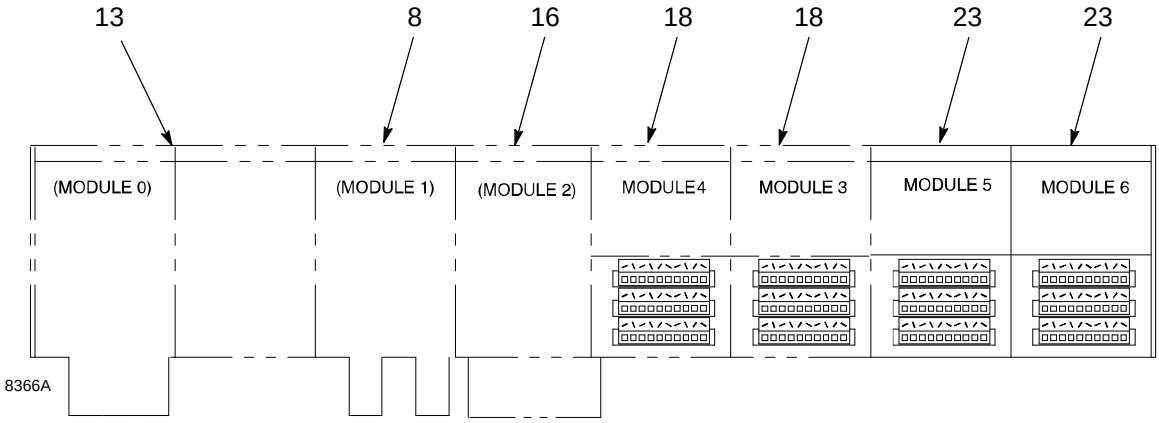
Fig. 32



ASSEMBLED VIEW

Fig. 33

Parts

PrecisionSwirl for SD Module

Ref No.	Part No.	Description
(1)1	617472	Label, Danger, Electric Shock
2	222011	Clamp, grounding
3	C69125	PC Touchscreen
(3)4	244106	Kit, Repair, Touchscreen
5	C69139	Software, PC, Operating System
6	196298	Software, PC, Application
7	196296	Software, PCC
8	C69100	Module, Analog Interface (AF101)
9	C69101	Module, Input, Analog (AI354)
10	C69118	Module, Output Analog (AO352)
11	C69114	Baseplate, Mounting (7BP708)
12	194898	Control, Swirl
(4)13	C69136	Module, CPU (CP474)
14	C69106	Module, Input, Digital (DI135)
15	C69112	Terminal Block, 10 Pin
16	C69107	Module, I/O, Digital (DM435)
17	617791	Amplifier, Swirl Motor
18	C69116	Module, Output, Digital (DO720)
19	C69115	Terminal Block, 22 Pin, (TB722)
(1)20	186620	Label, Symbol, Ground
21	115940	Relay
(2)22	196975	Power Supply, 24 Vdc, 125W
23	115583	Module, Input, Digital, 24Vdc (DI435)
	C69117	Module, Input, DIgital, 120 Vac (DI645)
	243482	Valve, Dispense
	918556	Operations cable, 60 ft (18.3 m)
	C59799	Robot digital cable, 40 ft (12.2 m) connector 1 end
	C59800	Robot analog cable, 40 ft (12.2 m) connector 1 end
	617870	PrecisionSwirl for SD cable, 55 ft (16.8 m)

(1) Replacement Danger and Warning labels are available at no cost
(2) Recommended spares
(3) A new PC (4) requires software (5) and (6) unless the hard drive from the original PC can be reused
(4) A new CPU (13) requires software (7)

Accessories

Part No.	Description
241798	Ethernet kit – Includes connection hardware and software license right
244343	Flow meter kit
196881	Japanese language kit
241236	Disk drive kit – includes 3.5” floppy drive and 5 foot (1.5 m) cable
233125	PrecisionSwirl for SD extension cable, 6 ft (1.8 m)
233124	PrecisionSwirl for SD extension cable, 9 ft (2.7 m)
233123	PrecisionSwirl for SD extension cable, 15 ft (4.6 m)

Control Assembly Operator Interface

PrecisionSwirl for SD Control Assembly

The control assembly has the following controls and indicators. For more information, see schematic on page 82.

Control / Indicator Name	Device ID	Control / Indicator Description
Display Power	DSP212	The TouchScreen display is ON when electric power is applied to the display. If the display is unlit, have a qualified electrician check the power wiring to the display.
	CB408	This 2 Amp circuit breaker controls power to the TouchScreen display.
Power on / Ground Connected	LT305	White light is ON when both electric power and a proper ground are connected to the PrecisionSwirl for SD control assembly.
Start	LT320	Green light is ON when the Plate Control Relay (PCR) is engaged.
Main Fault	LT335	Red light is ON when the control assembly has a fault condition.
Sealer Stop	PB325	Push this button to disengage the PCR and signal the external controller that a Sealer Stop to Robot condition is in effect. The PCR will remain disengaged until the START button is pressed.
Master Start	PB320	Push this button (green) to restart the PrecisionSwirl for SD module after power is applied to the module or the SEALER STOP button has been pressed. This energizes the PCR and signals the PrecisionSwirl for SD processor that the module has power applied.

Component Notes

The PrecisionSwirl for SD module schematics contain the following key components:

Device	Device ID	Description
120 Vac	CB405	This 6A Amp circuit breaker controls power supplied to the PrecisionSwirl for SD module. See schematic on page 81.
	CB408	This 2 Amp circuit breaker controls power supplied to the TouchScreen display. See schematic on page 81.
Pressure Sensor	None	The pressure sensor transmits a 1-5 Vdc analog signal proportional to system pressure.
Flow Meter (optional)	None	The optional flow meter (PN 244343) provides a pulse input to determine the actual volume dispensed. This feedback is necessary to perform flow calibration, Statistical Process Control (SPC) calculations, and Volume Compensation.
24 Vdc	PWR413	Power supply that provides 24 Vdc power for internal circuitry.
	CB4173	2A circuit breaker for internal circuitry.
	CB4171	2A circuit breaker for left swirl control.
	CB4172	2A circuit breaker for right swirl control.
Robot Interface Relay (RIR)	RIR905	Provides dry contact isolation for Remote Start and Remote Stop signals.
Plate Control Relay	PCR956	This is the master control relay for the PrecisionSwirl for SD internal power circuitry.

Control Interface Signals

The PrecisionSwirl for SD module is designed to be controlled by a robotic workcell or line control computer. This section describes the interface between the line or cell control system and the PrecisionSwirl for SD module, and provides cable/pin level information for the connections.

Digital Input

Signals sent from an external controller to the PrecisionSwirl for SD module.

Mod 2, Inputs 1–8 (See schematic on page 87.)

Signal Name	Connector / Pin	Signal Description
Remote Start	WIRE 9111 X1–P3 CH 1	A momentary signal that energizes the Plate Control Relay (PCR). This signal must be held active for 1 second and is always 24 Vdc.
Control On	WIRE 9171 X1–P4 CH 2	An input to the PCC indicating that the PCR is energized.
Robot Stop Signal	WIRE 9191 X1–P5 CH 3	A momentary signal that de-energizes the PCR. The RIR must be energized for the PCR to latch.
Temperature Fault	WIRE 9211 X1–P6 CH 4	A temperature conditioning system can raise this signal to indicate an over- or under-temperature condition to the PrecisionSwirl for SD module. The activation of this signal causes the PrecisionSwirl for SD module to transmit a fault code to the external controller.
Spare	X1–P7 CH 5	This pin is unused.
Swirl Fault	X1–P8 CH 6	Swirl fault 1 (Left). The fault signal from the swirl control is connected here.
Spare	X1–P9 CH 7	Swirl fault 2 (Right).
Spare	X1–P10 CH 8	This pin is unused.
Sealer Stop to Robot	WIRE 9342 PCR956	A dry contact that connects to the robot E-Stop circuit. This contact is closed whenever the PCR is energized.

Control Interface Signals

Digital Output

Signals sent to an external controller from the PrecisionSwirl for SD module.

Mod 2, Outputs 1–8 (See schematic on page 87.)

Signal Name	Connector / Pin	Signal Description
Open Gun 1	WIRE 4332 X5–P4	This signal is raised by the PrecisionSwirl for SD module to actuate the solenoid valve that opens Gun 1 (Left) to start dispensing. The PrecisionSwirl for SD module turns this signal ON in response to a manual or external dispense request. This signal is turned OFF to shut off Gun 1.
Open Gun 2	WIRE 4332 X5–P5	This signal is raised by the PrecisionSwirl for SD module to actuate the solenoid valve that opens Gun 2 (Right) to start dispensing. The PrecisionSwirl for SD module turns this signal ON in response to a manual or external dispense request. This signal is turned OFF to shut off Gun 2.
Spare	WIRE 4332 X5–P6	This terminal is unused
Swirl Enable 1 (Left)	WIRE 4332 X5–P7	This signal energizes a relay on the left swirl control board to initiate swirl rotation.
Main Fault Light	WIRE 4332 X5–P8	This signal is turned ON by the PrecisionSwirl for SD module when a fault condition occurs. This puts the module in a Sealer Stop to Robot condition, due to an internal failure. The signal is normally OFF when no fault condition exists.
Swirl Enable 2 (Right)	WIRE 4332 X5–P9	This signal energizes a relay on the right swirl control board to initiate swirl rotation.
Spare	WIRE 4332 X5–P10	This terminal is unused.

Control Interface Signals

Robot Interface Output

Signals sent to an external controller from the PrecisionSwirl for SD module.

Mod 3, Outputs 1–8 (See schematic on page 86.)

Signal Name	Connector / Pin	Signal Description
L1 (120Vac / 24Vdc) From Robot	WIRE 10041 X2–P1	Robot interface power.
L2 (120Vac / 0Vdc) From Robot	WIRE 10081 X3–P1	Robot power neutral.
Dispenser Ready	WIRE 10121 X1–P3 CH 1	This output signal is HIGH when the dispenser is ready to dispense. This signal is LOW when there is an alarm.
Volume On Data	WIRE 10141 X1–P4 CH 2	This output signal is HIGH when data bits are set to pass the volume for the last job.
Fault On Data	WIRE 10161 X1–P5 CH 3	This output signal is HIGH when the dispenser is faulted and the data bits are set for the fault code. The fault can be an alarm or a warning.
Auto Mode	WIRE 10181 X1–P6 CH 4	This output signal is HIGH when the PrecisionSwirl for SD module is in automatic mode.
Spare	WIRE 10201 X1–P7 CH 5	This terminal is not used.
Cycle Complete/In Cycle	WIRE 10221 X1–P8 CH 6	This output signal is HIGH when the dispense cycle is complete. This signal must remain HIGH for 50 msec.
Data 1	WIRE 10241 X1–P9 CH 7	These signals are used to pass volume and fault information to the robot.
Data 2	WIRE 10261 X1–P10 CH 8	

Control Interface Signals

Robot Interface Output

Signals sent to an external controller from the PrecisionSwirl for SD module.

Mod 4, Outputs 1–8 (See schematic on page 87.)

Signal Name	Connector / Pin	Signal Description
Data 4	WIRE 10631 X1–P3 CH 1	These signals are used to pass volume and fault information to the robot.
Data 8	WIRE 10651 X1–P4 CH 2	
Data 16	WIRE 10671 X1–P5 CH 3	
Data 32	WIRE 10691 X1–P6 CH 4	
Data 64	WIRE 10711 X1–P7 CH 5	
Data 128	WIRE 110731 X1–P8 CH 6	
Data 256	WIRE 10751 X1–P9 CH 7	
Data 512	WIRE 10771 X1–P10 CH 8	

Control Interface Signals

Robot Interface Input

Signals sent from an external controller to the PrecisionSwirl for SD module.

Mod 5, Inputs 1–8 (See schematic on page 88.)

Signal Name	Connector / Pin	Signal Description
Dispense Gun 1 (Left)	WIRE 11121 X1–P3 CH 1	This signal turns on Dispense Gun 1. When the input signal is applied, Dispense Gun 1 opens.
Dispense Gun 2 (Right)	WIRE 11141 X1–P4 CH 2	This signal turns on Dispense Gun 2. When the input signal is applied, Dispense Gun 2 opens.
Request Volume	WIRE 11161 X1–P5 CH 3	This signal request the volume data to be moved to the data bits. This signal must remain HIGH for 50 msec.
Fault Reset	WIRE 11181 X1–P6 CH 4	This signal is used to clear faults from the robot I/O. This signal must remain high for 50 msec.
Initiate Style	WIRE 11201 X1–P7 CH 5	This input signal takes information on the style bits and uses the number for the next job. This signal must remain HIGH for 50 msec.
Job Complete/ Measure Volume	WIRE 11221 X1–P8 CH 6	This signal can be used to inform the controller when a job is complete.
Swirl 1 (Left)	WIRE 11241 X1–P9 CH 7	This signal is used to activate the left swirl applicator.
Swirl 2 (Right)	WIRE 11261 X1–P10 CH 8	This signal is used to activate the right swirl applicator.

Control Interface Signals

Robot Interface Input

Signals sent from an external controller to the PrecisionSwirl for SD module.

Mod 6, Inputs 1–8 (See schematic on page 88.)

Signal Name	Connector / Pin	Signal Description
Style 1	WIRE 11621 X1–P3 CH 1	This signal indicates that a value of one should be added to the style.
Style 2	WIRE 11641 X1–P4 CH 2	This signal indicates that a value of two should be added to the style.
Style 4	WIRE 11661 X1–P5 CH 3	This signal indicates that a value of four should be added to the style.
Style 8	WIRE 11681 X1–P6 CH 4	This signal indicates that a value of eight should be added to the style.
Style 16	WIRE 11701 X1–P7 CH 5	This signal indicates that a value of 16 should be added to the style.
Low Speed	WIRE 11721 X1–P8 CH 6	This signal alerts the PrecisionSwirl for SD module to use a percentage of its full speed for the Robot Speed Signal instead of the analog signal. The percent is passed from the HMI. Low speed is the signal to use when more than one of the digital speeds are active. The default value is 25 percent of the maximum.
Med Speed	WIRE 11741 X1–P9 CH 7	This signal alerts the PrecisionSwirl for SD module to use a percentage of its full speed for the Robot Speed Signal instead of the analog signal. The percent is passed from the HMI. Medium speed is the signal to use when both High and Medium are active.
High Speed	WIRE 11761 X1–P10 CH 8	This signal alerts the PrecisionSwirl for SD module to use a percentage of its full speed for the Robot Speed Signal instead of the analog signal. The percent is passed from the HMI.
+24 Vdc to Robot	WIRE 4571 RDR–D5	None.
Remote Stop From Robot	WIRE 9051 RDR–D6	When LOW, this input signal stops the controller. This signal must be maintained HIGH (+24 Vdc) for the dispenser to operate.
Remote Start From Robot	WIRE 9111 RDR–D7	When HIGH, this input signal starts the dispenser. This signal must be maintained HIGH for the dispenser to operate.
Sealer Stop To Robot	WIRE 9341 RDR–D8	Used with D9 to pass the PCR state to the robot.
Sealer Start To Robot	WIRE 9342 RDR–D9	Used with D8 to pass the PCR state to the robot.
Spare	RDR–D10	Spare

Module Internal Interface Signals

Flow Meter Input

Mod 0, Slot 1

Channel 1: Digital flow meter pulse input for the optional flow meter (PN244343).

Analog Input

Signals tom the PrecisionSwirl for SD controller.

Mod 0, Slot 2 (See schematic on page 84.)

Signal Name	Channel	Signal Description
Robot flow command	CH 1 +	0-10 Vdc robot pressure/flow command for 0 to 100% pressure or flow output
Robot command common	CH 1 –	
Robot swirl speed	CH 2 +	0-10 Vdc robot swirl command for 0-100% swirl speed (0 to 24,000 rpm)
Robot swirls speed com-mon	CH 2 –	
Pressure sensor input, left	CH 3 + CH 3 –	A 1-5 Vdc signal from the pressure sensor at the outlet of the left regulator (0–3500 psi)
Pressure sensor input, right	CH 4 + CH 4 –	A 1-5 Vdc signal from the pressure sensor at the outlet of the right regulator (0–3500 psi)

Module Internal Interface Signals

Analog Output

Signals sent from the PrecisionSwirl for SD controller to the PrecisionSwirl system.

Mod 0, Slot 3 (See schematic on page 86.)

Signal Name	Channel	Signal Description
Volt/pressure command, left	CH 1 + CH 1 –	A 1-5 Vdc command to the volt/pressure converter on the left fluid plate
Volt/pressure command, right	CH 2 + CH 2 –	A 1-5 Vdc command to the volt/pressure converter on the right fluid plate

Mod 0, Slot 4 (See schematic on page 86.)

Signal Name	Channel	Signal Description
Swirl analog command	CH 1 + CH 1 –	0-10 Vdc signal sent to the swirl controllers that represents the desired swirl speed
Spare	CH 2 + CH 2 –	No connection

Robot Interface Plate Connections

The following tables summarized the analog and digital interface signal connections on the Robot Interface Plate. For descriptions of the signals, refer to pages 71 through 78. Refer to page 101 for schematic.

Digital Power Signals

Module	Connector	Receptacle	Signal Name
3, 4, 5, 6	X2-P1, P2	RDR-A1*	L1 (120Vac hot/24Vdc) from robot
3, 4, 5, 6	X3-P1, P2	RDR-A2	L2 (120Vac neutral/0Vdc) from robot

* RDR denotes Robot Digital Receptacle.

Digital Outputs to Robot

Module	Connector	Receptacle	Signal Name
3	X1-P3/CH 1	RDR-A3	Dispenser Ready
	X1-P4/CH 2	RDR-A4	Volume On Data
	X1-P5/CH 3	RDR-A5	Fault On Data
	X1-P6/CH 4	RDR-A6	Auto Mode
	X1-P7/CH 5	RDR-A7	Spare
	X1-P8/CH 6	RDR-A8	Cycle Complete/In Cycle
4	X1-P9/CH 7	RDR-A9	Data 1
	X1-P10/CH 8	RDR-A10	Data 2
	X1-P3/CH 1	RDR-B1	Data 4
	X1-P4/CH 2	RDR-B2	Data 8
	X1-P5/CH 3	RDR-B3	Data 16
	X1-P6/CH 4	RDR-B4	Data 32
	X1-P7/CH 5	RDR-B5	Data 64
	X1-P8/CH 6	RDR-B6	Data 128
	X1-P9/CH 7	RDR-B7	Data 256
	X1-P10/CH 8	RDR-B8	Data 512

Digital Inputs from Robot

Module	Connector	Receptacle	Signal Name
5	X1-P3/CH 1	RDR-B9	Dispense Gun 1 (left)
	X1-P4/CH 2	RDR-B10	Dispense Gun 2 (right)
	X1-P5/CH 3	RDR-C1	Request Volume
	X1-P6/CH 4	RDR-C2	Fault Reset
	X1-P7/CH 5	RDR-C3	Initiate Style
	X1-P8/CH 6	RDR-C4	Job complete/ measure volume
	X1-P9/CH 7	RDR-C5	Swirl 1 (left)
	X1-P10/CH 8	RDR-C6	Swirl 2 (right)
6	X1-P3/CH 1	RDR-C7	Style 1
	X1-P4/CH 2	RDR-C8	Style 2
	X1-P5/CH 3	RDR-C9	Style 4
	X1-P6/CH 4	RDR-C10	Style 8
	X1-P7/CH 5	RDR-D1	Style 16
	X1-P8/CH 6	RDR-D2	Low Speed
	X1-P9/CH 7	RDR-D3	Medium Speed
	X1-P10/CH 8	RDR-D4	High Speed
	RIR-1	RDR-D5	+24 Vdc to Robot
	RIR-2	RDR-D6	Remote Stop from Robot
	RIR-3	RDR-D7	Remote Start from Robot
	RIR-4	RDR-D8	Sealer Stop to Robot
	RIR-5	RDR-D9	Sealer Start to Robot
	–	RDR-D10	Spare

Robot Interface Plate Connections

Analog Inputs from Robot

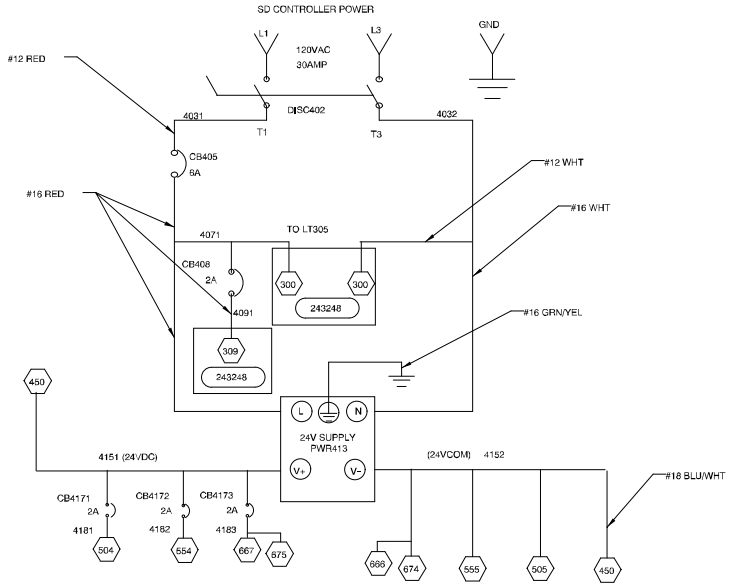
RAR* Contacts		Description
1	CH 1+	robot flow command, 0–10 Vdc
2	CH 1–	
3	CH 2+	no connection
4	CH 2–	
5	CH 3+	robot swirl speed command 0–10 Vdc
6	CH 3–	

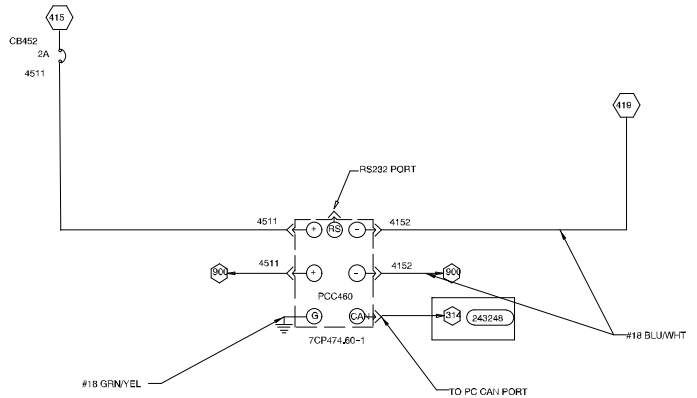
* RAR denotes Robot Analog Receptacle.

Analog Outputs to Robot

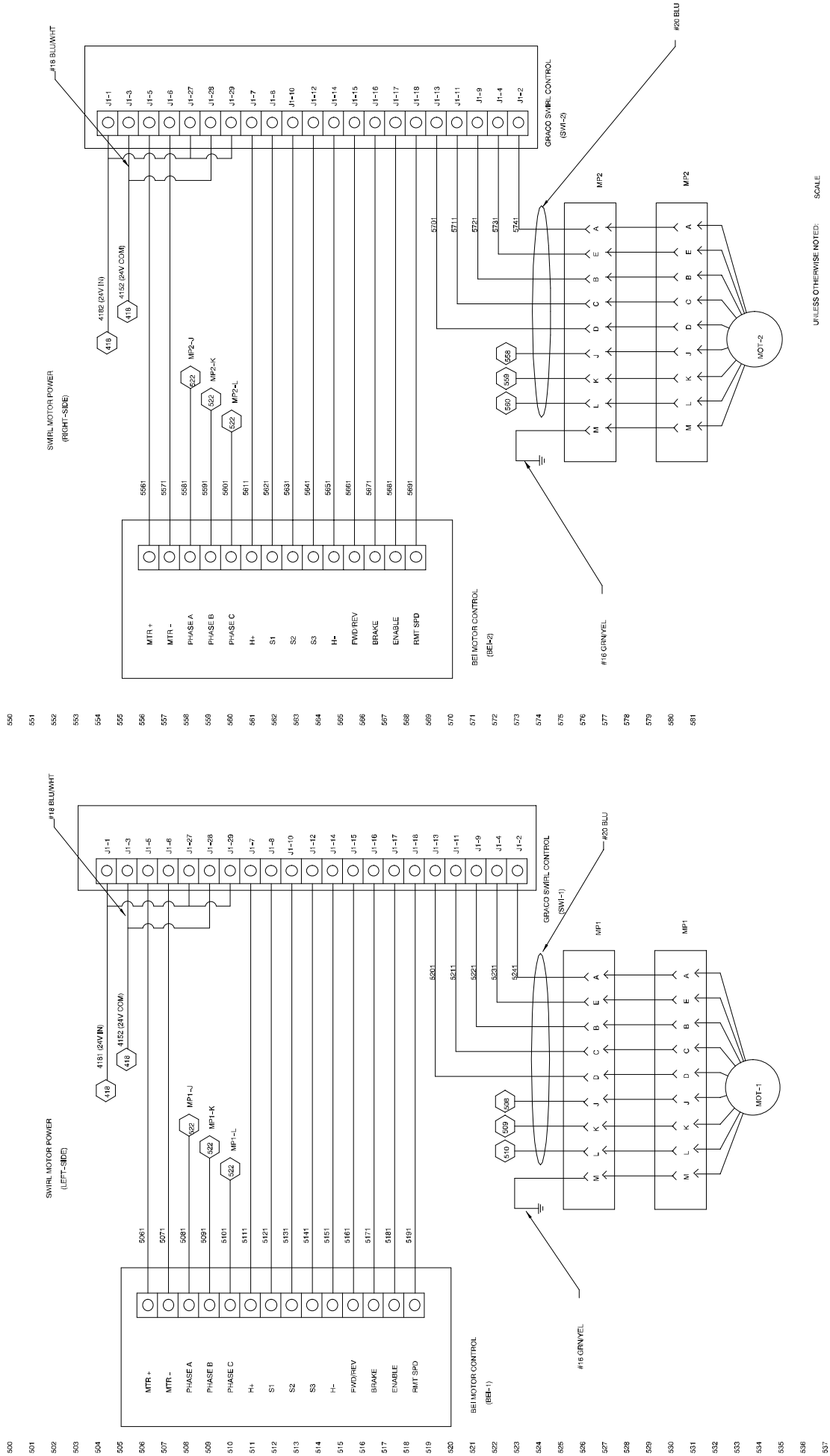
RAR Contacts		Description
7	CH 1 +	no connection
8	CH 1 –	
9	CH 2 +	no connection
10	CH 2 –	

Power 120 Vac 30 Amp Application Subplate Lines 400 – 488





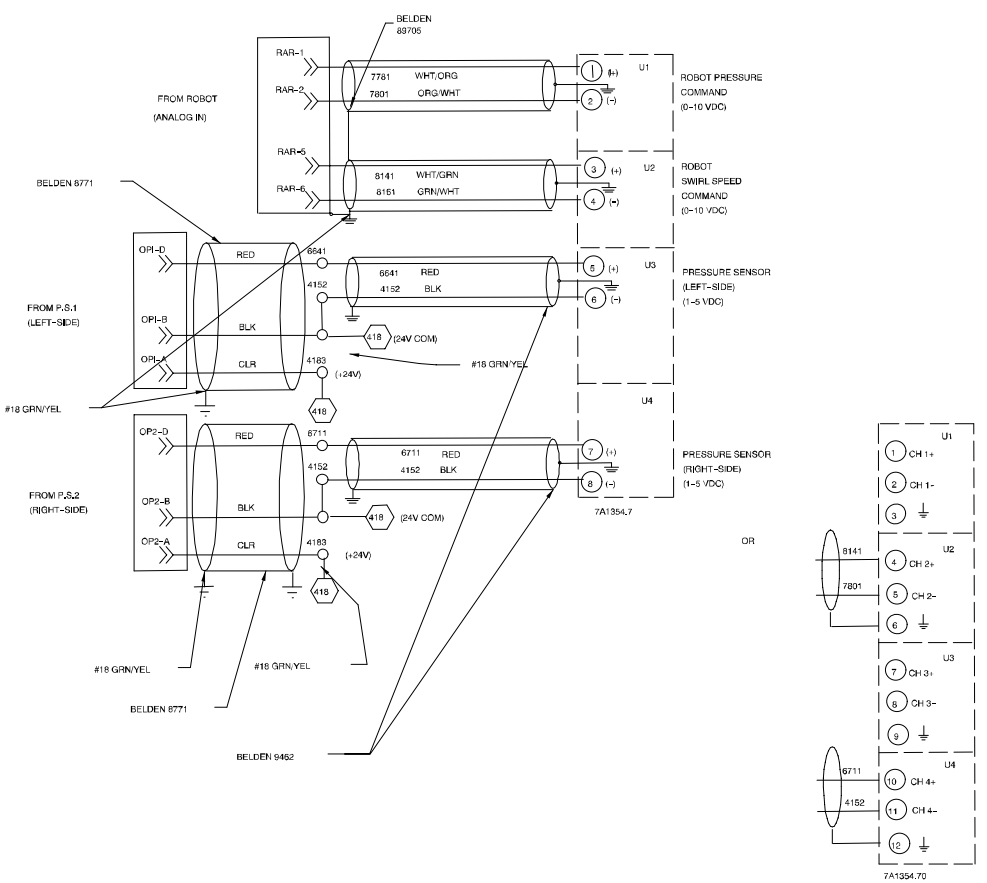
TI0632B


#18 BLU/WHT
J1-1
J1-3
J1-5
J1-6
J1-27
J1-28
J1-29
J1-7
J1-8
J1-10
J1-12
J1-14
J1-15
J1-16
J1-17
J1-18
J1-13
J1-11
J1-9
J1-4
J1-2
SWRL MOTOR POWER
(LEFT-SIDE)
4181 (24V IN)
4152 (24V COM)
418
MP1-J
MP1-K
MP1-L
522
5061
5071
5081
5091
5101
5111
5121
5131
5141
5151
5161
5171
5181
5191
MTR+
MTR-
PHASE A
PHASE B
PHASE C
H+
S1
S2
S3
H-
FWD/REV
BRAKE
ENABLE
RMT SPD
BEI MOTOR CONTROL
(BEI-1)
#16 GRN/YEL
GRACO SWRL CONTROL
(SWI-1)
#20 BLU
5201
5211
5221
5231
5241
MP1
M
L
K
J
D
C
B
E
A
510
509
508
MOT-1
#18 BLU/WHT
SWRL MOTOR POWER
(RIGHT-SIDE)
4182 (24V IN)
4152 (24V COM)
418
MP2-J
MP2-K
MP2-L
522
5561
5571
5581
5591
5601
5611
5621
5631
5641
5651
5661
5671
5681
5691
MTR+
MTR-
PHASE A
PHASE B
PHASE C
H+
S1
S2
S3
H-
FWD/REV
BRAKE
ENABLE
RMT SPD
BEI MOTOR CONTROL
(BEI-2)
#16 GRN/YEL
GRACO SWRL CONTROL
(SWI-2)
#20 BLU
5701
5711
5721
5731
5741
MP2
560
559
558
MOT-2
UNLESS OTHERWISE NOTED:
SCALE

Controls, Electrical, Analog Inputs Lines 600 – 682

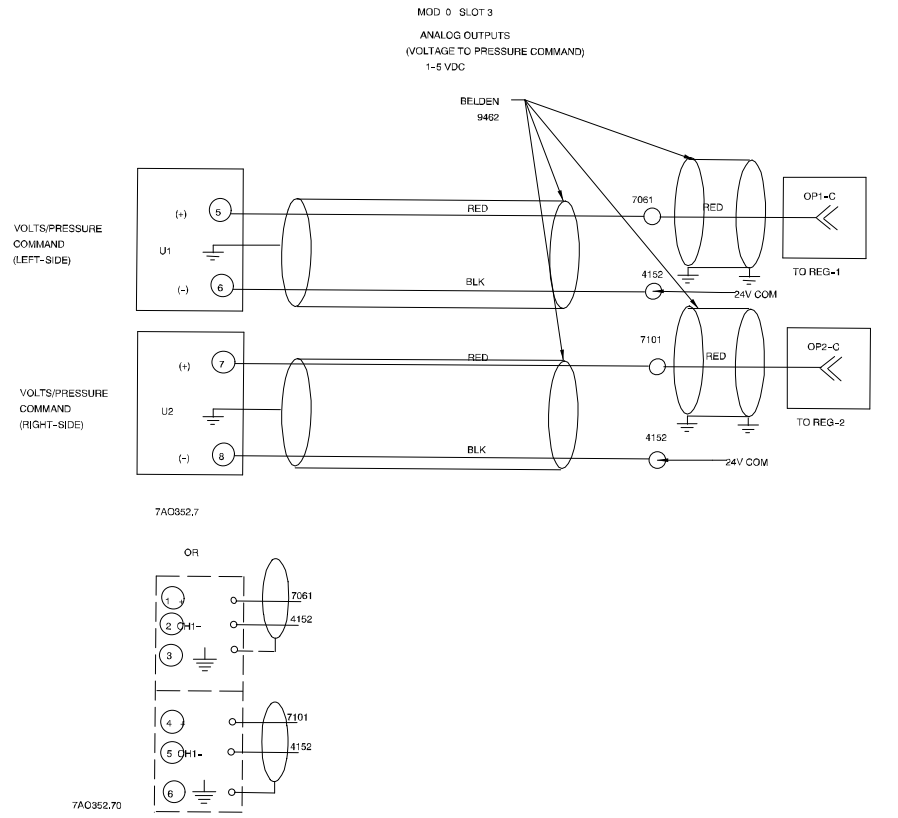
MOD 0 SLOT 1

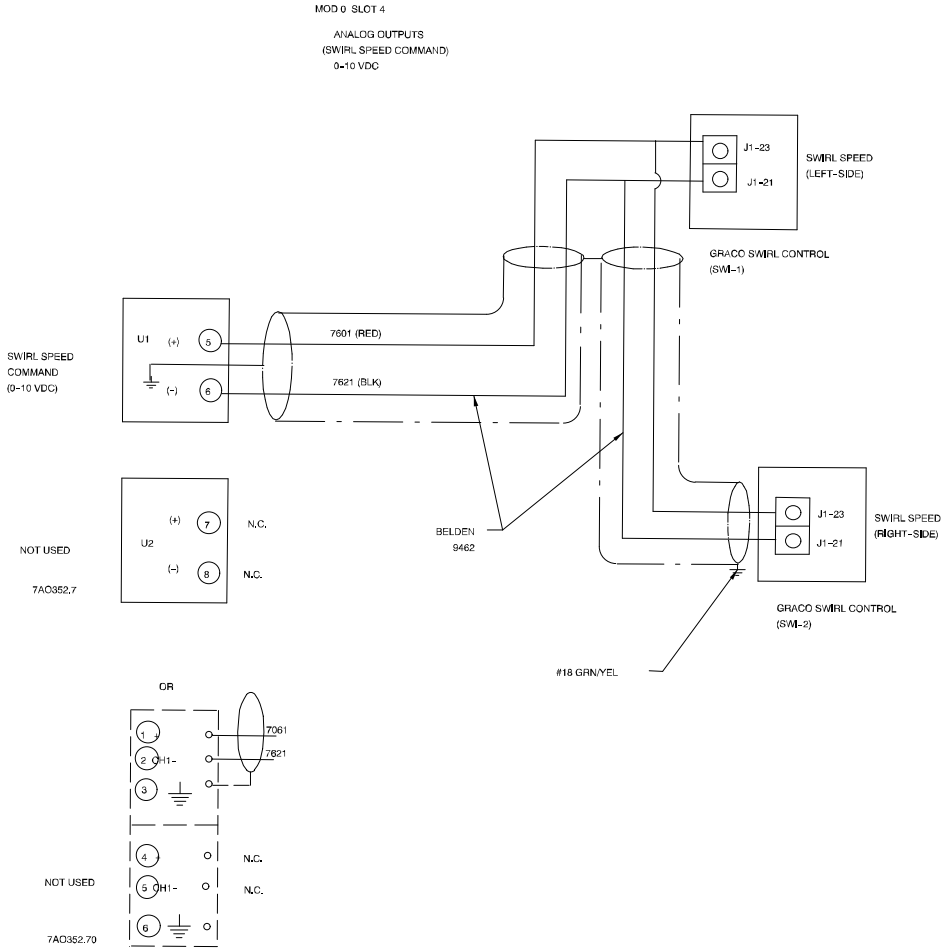
MOD 0 SLOT 2



TI0634B

Controls, Electrical, Digital Inputs and Outputs Lines 700 – 781





Controls, Electrical, Analog Inputs and Outputs Lines 800 – 882

820
821
822
823
824
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858

MOD 1 SLOT 1

SPARE SLOT

860
861
862
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864
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866
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873
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875
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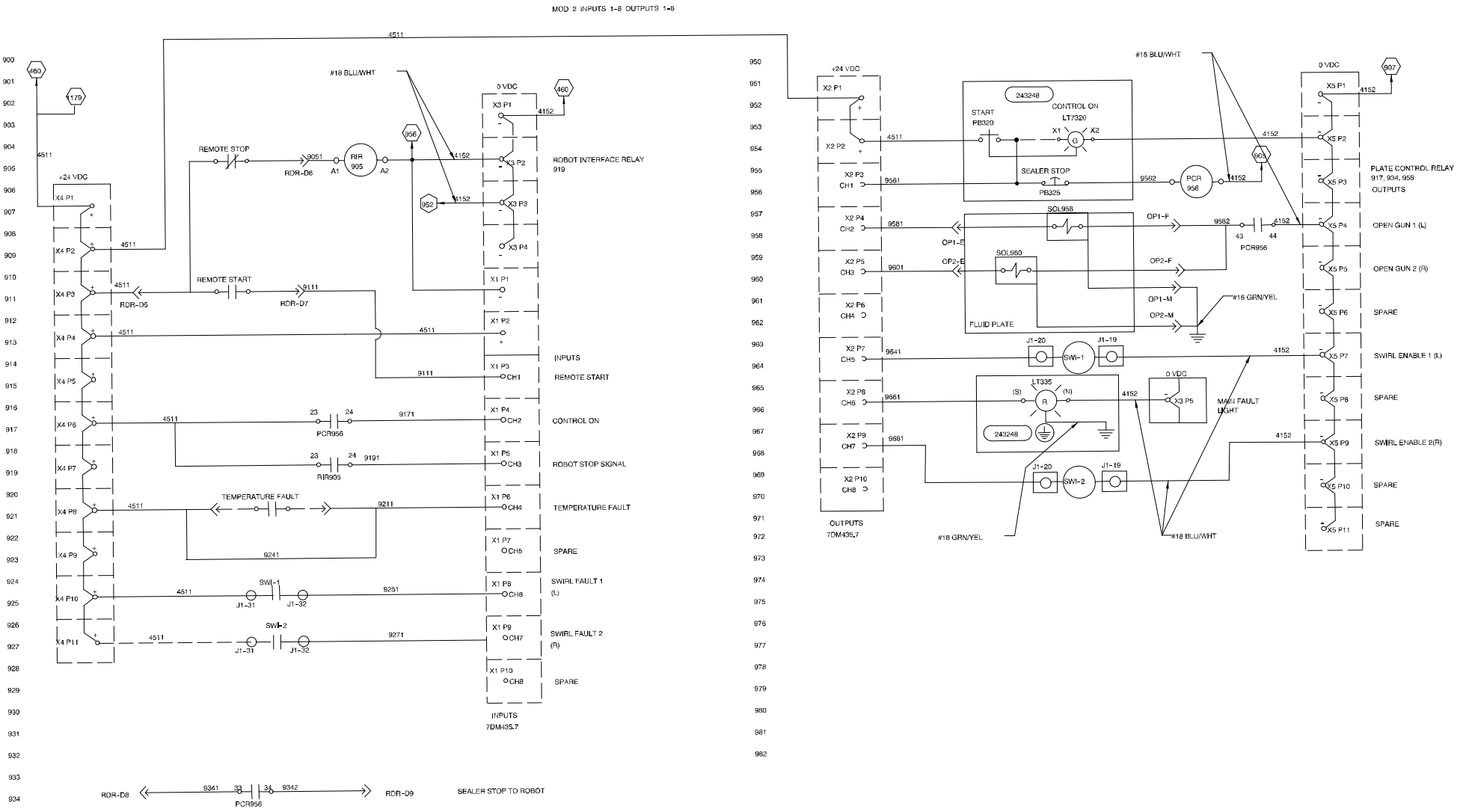
890
891
892

MOD 1 SLOT 2-4

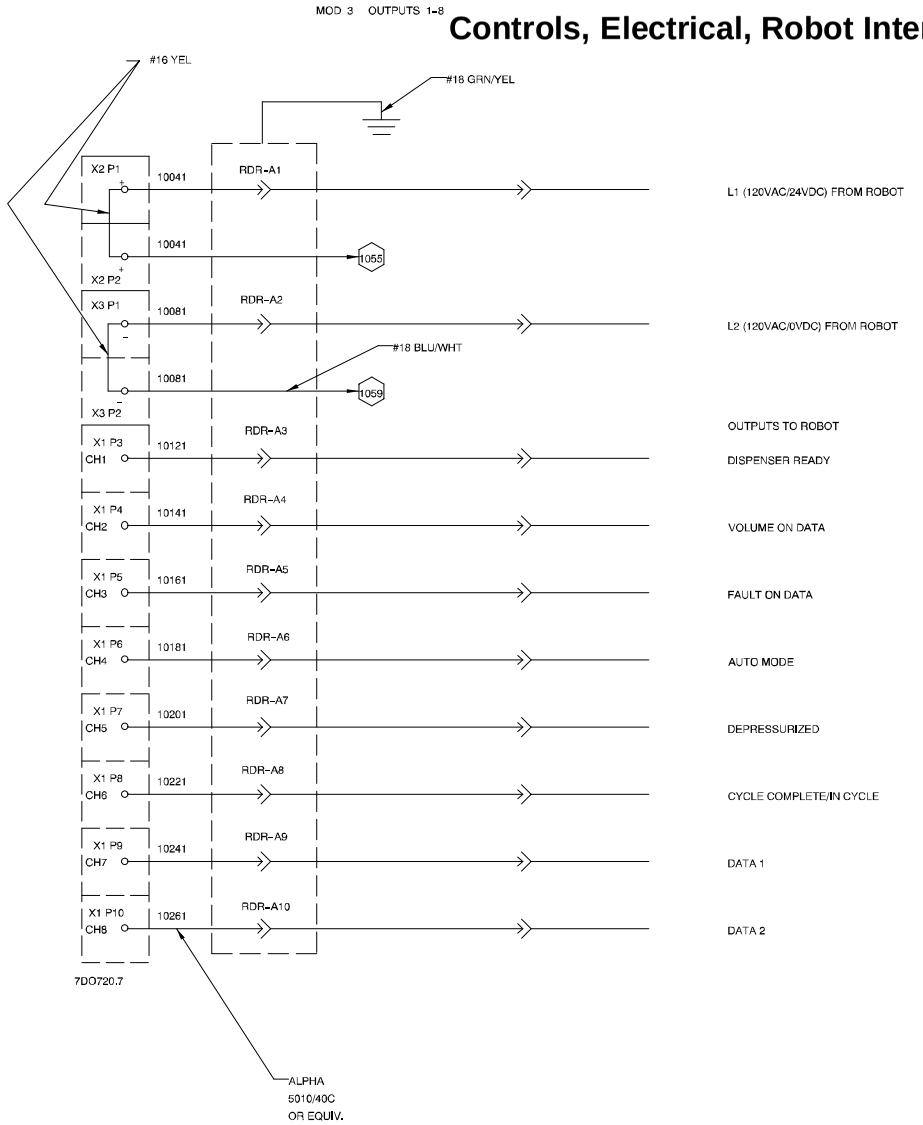
SPARE SLOT

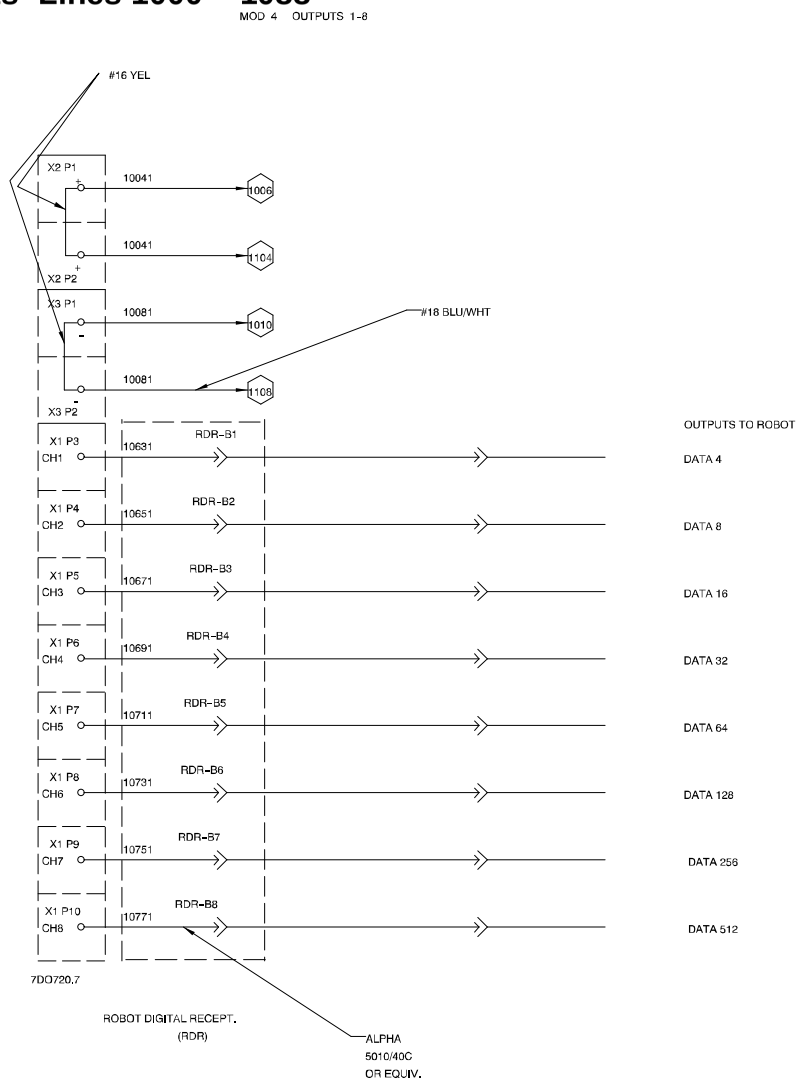
TI0636B

Controls, Electrical, Digital Inputs and Outputs Lines 900 – 982

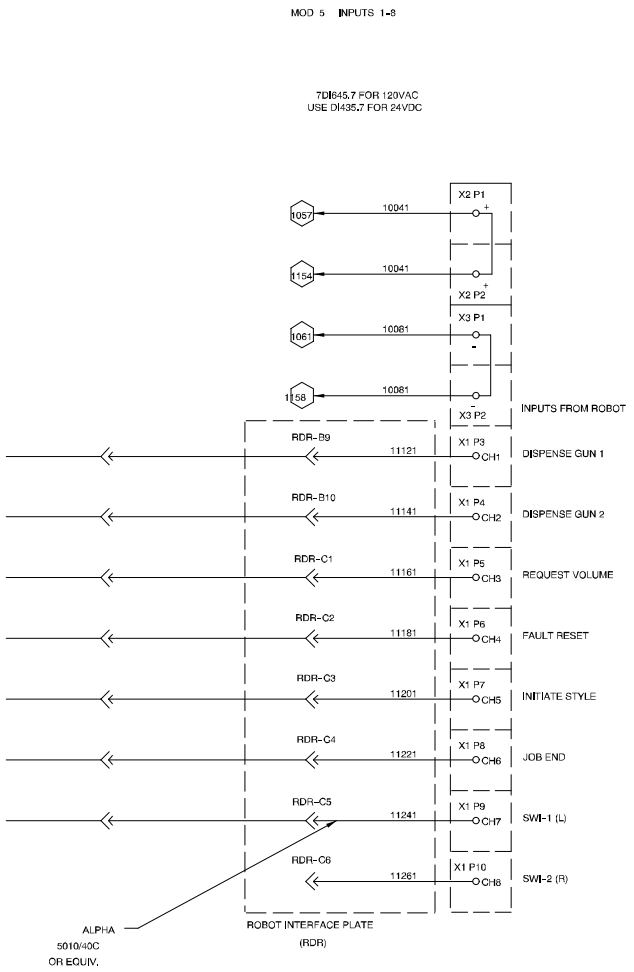


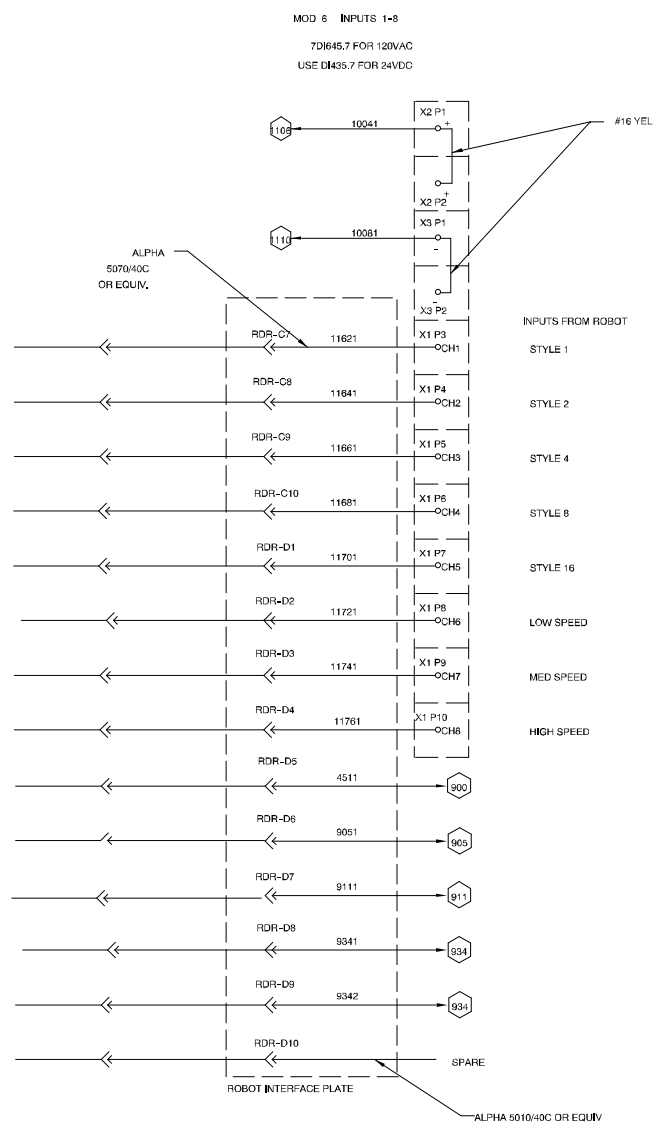
Controls, Electrical, Robot Interface Outputs Lines 1000 – 1088





Controls, Electrical, Robot Interface Inputs Lines 1100 – 1188





TI0639B

Technical Data

Unit	Description	Specification
Control Assembly	Input power	120 Vac, 1 phase, 50/60 Hz, 4 Amps 240 Vac, 1 phase, 2 Amps 480 Vac, 1 Amp
	Circuit breaker rating	30 Amps
	Dimensions	Height: 29 in. (737 mm) Width: 33.38 in. (848 mm) Depth: 12 in. (304.8 mm)
	Footprint	Length: 5 ft (1.53 m) Width: 5 ft (1.53 m) including space to open control assembly for servicing.
	Analog control signal from robot	0 to 10 Vdc
	Weight	150 lbs. (68 kg)* estimate
	Material viscosity range	10,000 to 1,000,000 cps**
	Fluid inlet pressure range	200-3500 psi (35-240 bar, 3.5-24.0 MPa)
	Fluid flow rate range	0 to 3000 cc per min.**
	Fluid inlet port	3/8 NPT(f)
	Fluid outlet port	3/8 NPT(f)
	Wetted components	Stainless steel (304, 303) hard chrome over 17-4 pH SST, polyurethane, Buna-N, tungsten carbide
	Max. fluid operating temperature	176°F (80°C)
	Ambient air temperature range	40°-120°F (5°-50°C)
	Response time: close to fully open	100 milliseconds
	Accuracy: repeatability to set point	+/– 5%
	Air pressure requirements	60-120 psi (4-8.3 bar, 0.4-0.83 MPa)
	Air inlet port	1/4 NPT(f)
	Meter package dimensions	15 in. W x 15 in. L x 8 in. H* (33cm W x 48cm L x 23 cm H)
	Meter package weight	55 lbs. (25 kg)* (Includes: regulator, v/p valve, junction box, gun solenoid, baseplate and mounting hardware.)

*Dimensions and weight are without mounting hardware, cables, hoses, etc.

**Flow rate is dependent upon material viscosity, tip size and supply pressure.

Related Publications

Product	Form#
Regulator	308647
Dispense Valve	310540
Swirl	310554
TouchScreen Operator’s Guide	310559

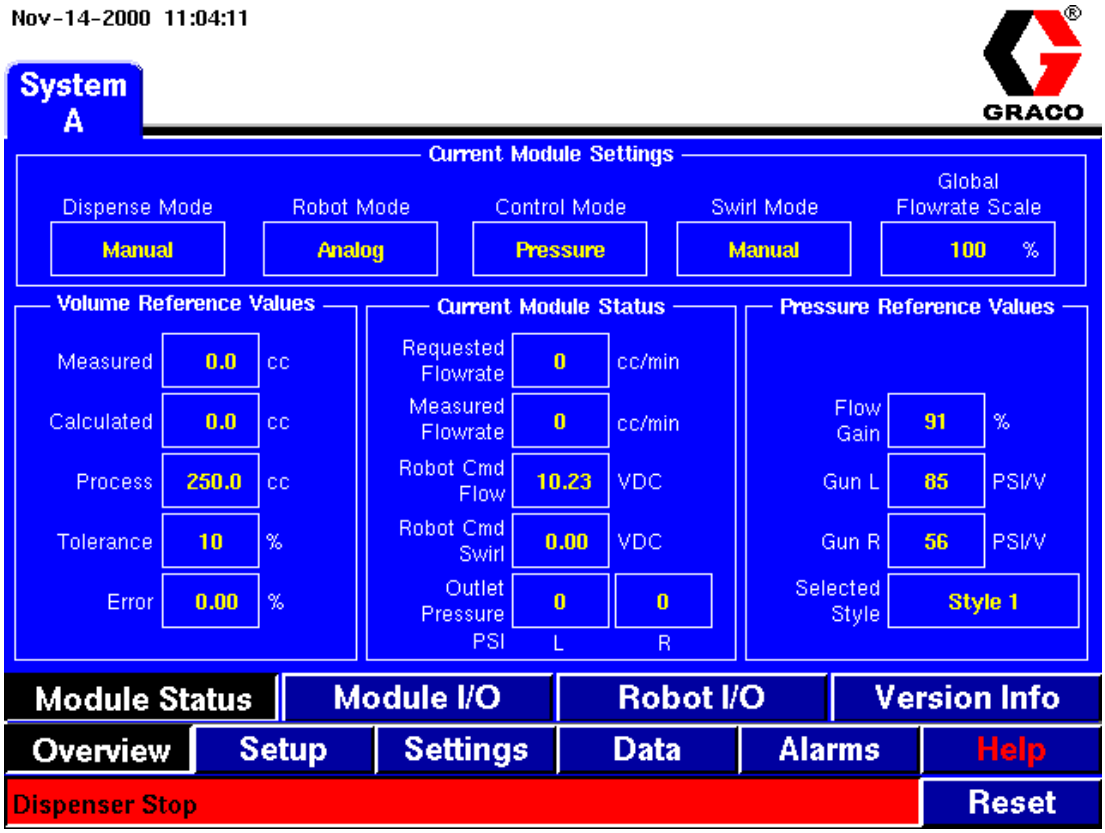
Appendix A
TouchScreen Software

NOTE: Detailed information on TouchScreen operation is provided in Graco Manual 310559, TouchScreen Operator's Guide. This appendix explains the minor differences between the SD software and the standard TouchScreen software. The screens that are unique to the SD software are also included here.

Summary:

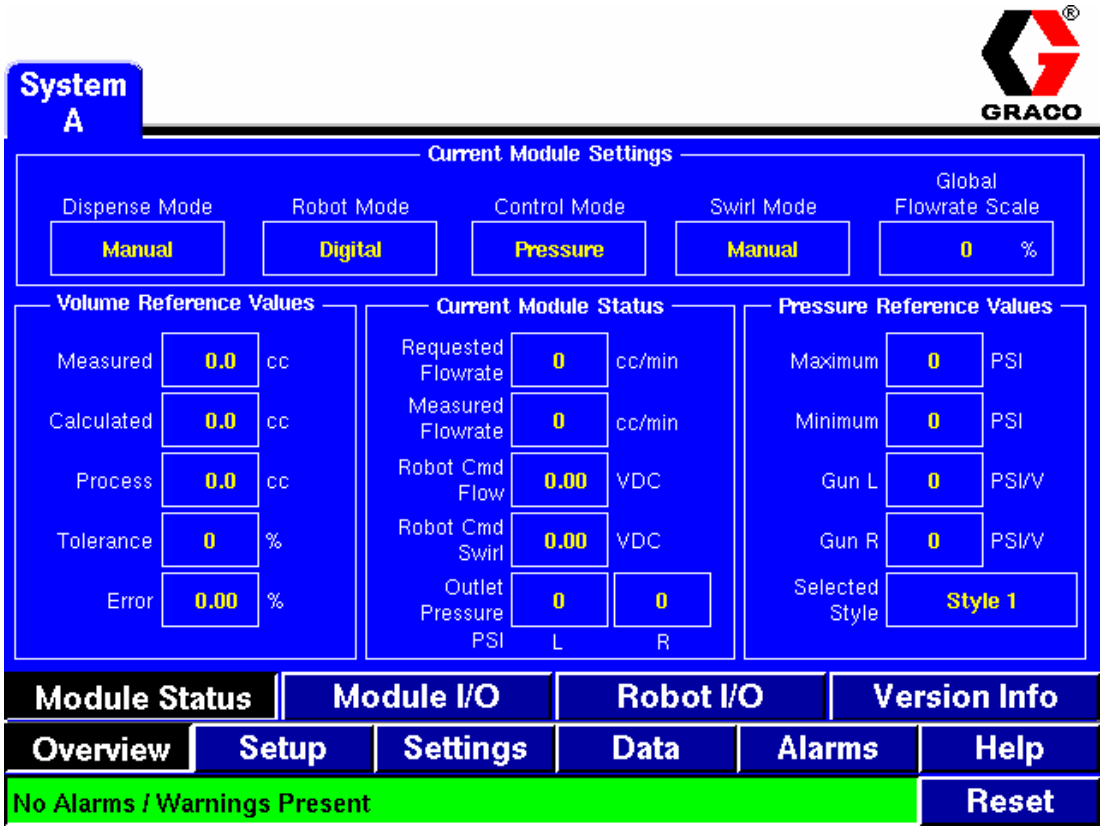
The standard TouchScreen software is configurable for one- or two-gun applications. The SD version looks very similar to the standard software but is different in that it always has two guns which are labeled Gun L and Gun R (for Left and Right) rather than Gun 1 and Gun 2. The two software applications are otherwise nearly identical.

As shown on the following screens, the system tab at the top of the screen is still labeled the default "System A", but SD is not configurable for multiple system operation like the standard is. That is, there will never be a System B, C, or D available.

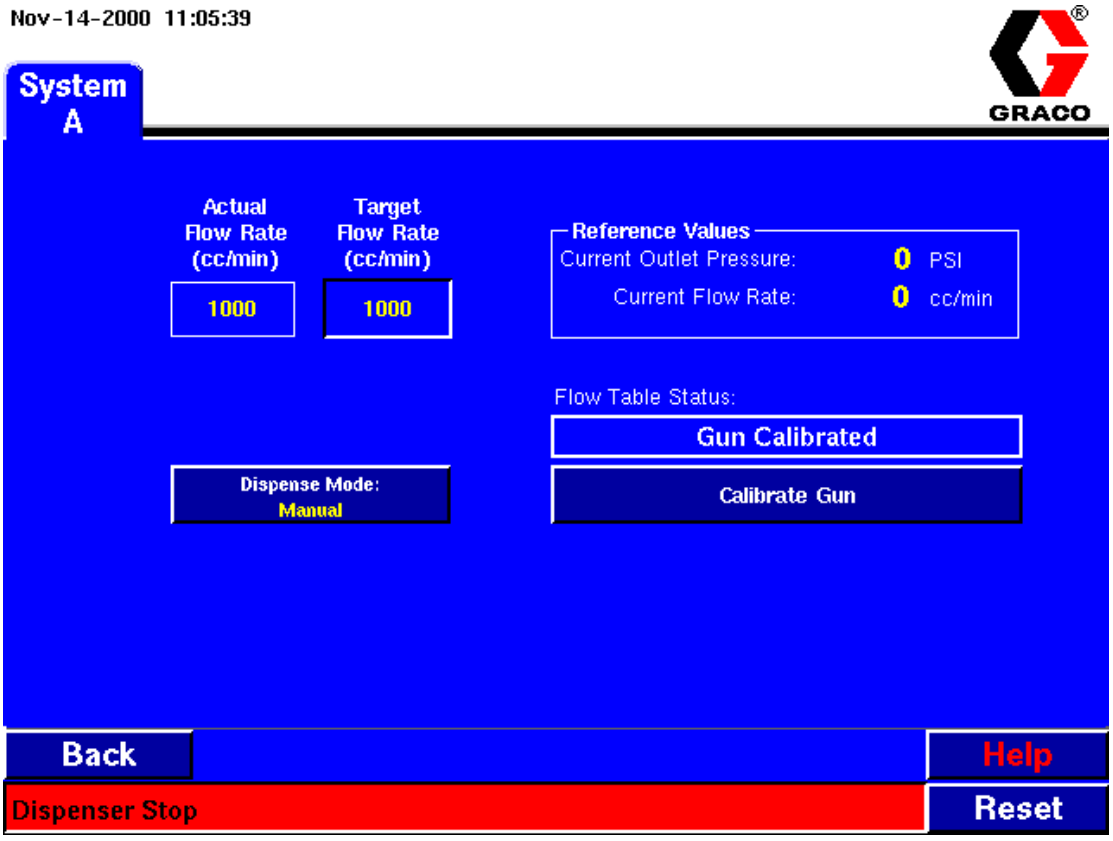


PrecisionSwirl for SD Overview Screen

Appendix A
TouchScreen Software

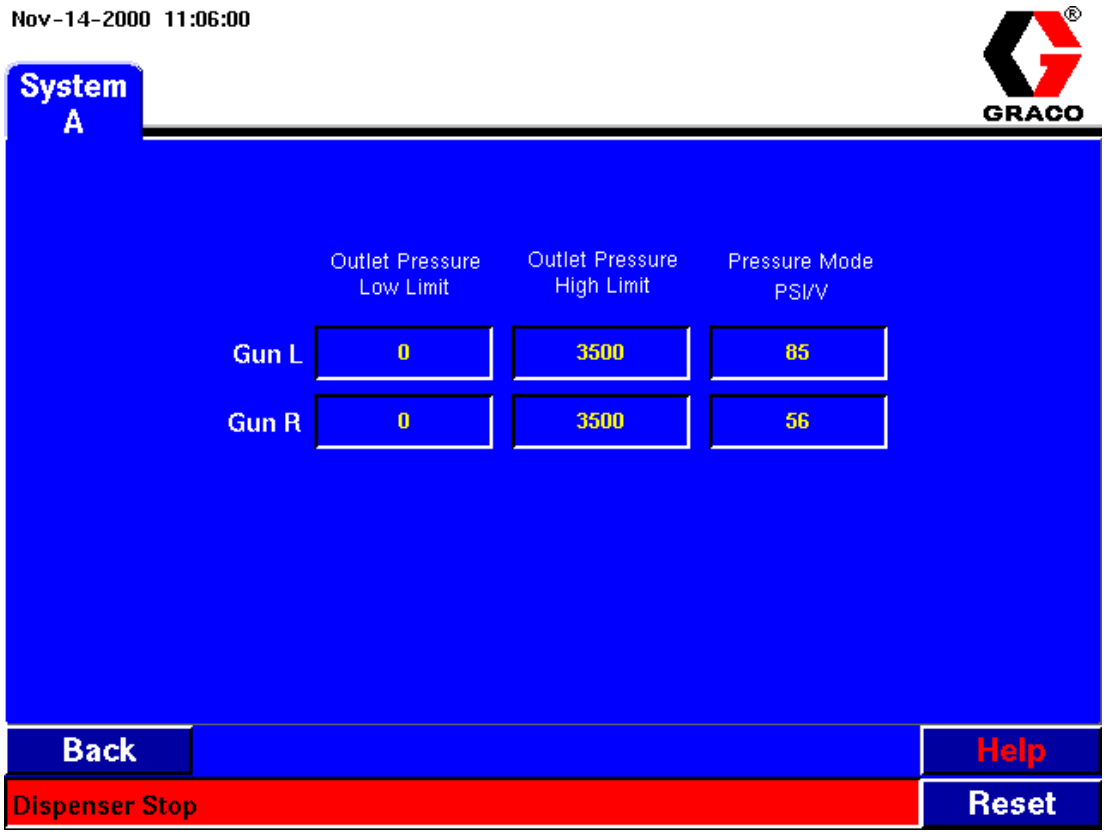


PrecisionSwirl for SD “No Module Settings” Screen

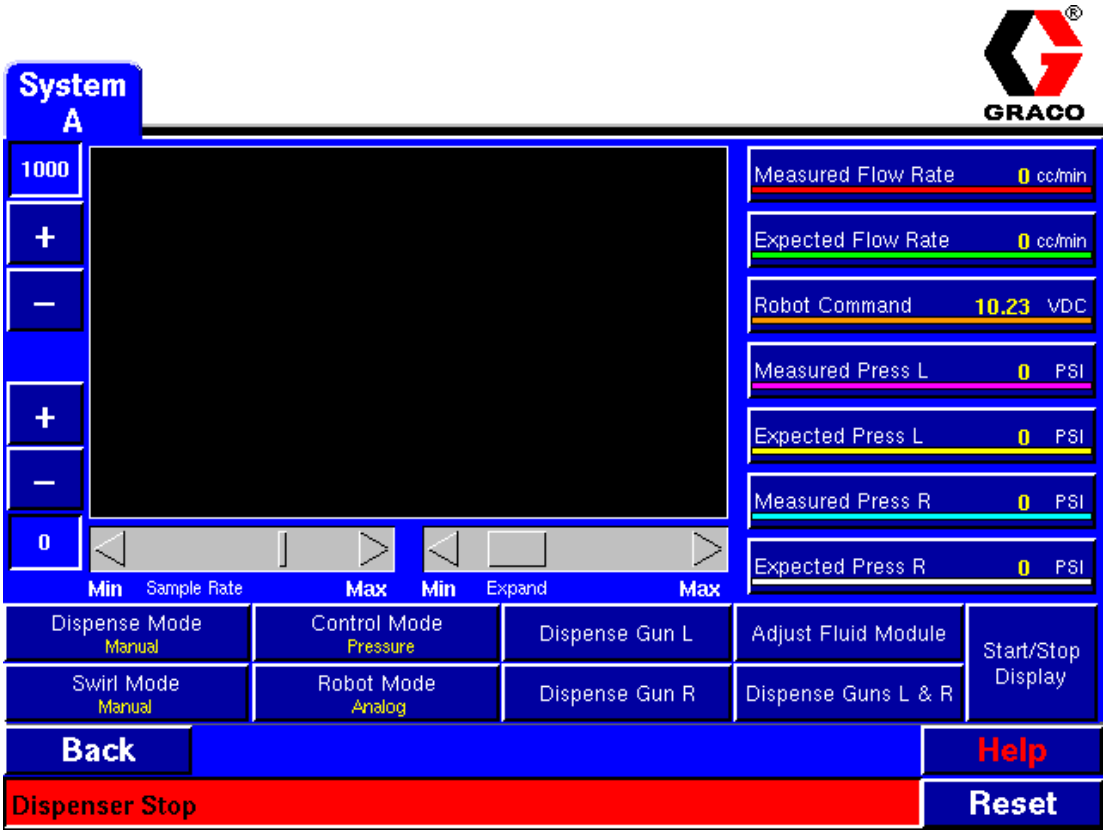


PrecisionSwirl for SD Calibration Screen

Appendix A
TouchScreen Software



PrecisionSwirl for SD Pressure Parameters Screen



PrecisionSwirl for SD Tune Screen

Notes

Appendix B
Installing Graco Accessory Kit 241798

Summary:

The PrecisionSwirl for SD is capable of communicating over an Ethernet network using 50 ohm RG58 coaxial cable, also called 10Base2 or thinnet. As shipped from the factory, the physical connection is not accessible outside of the control panel. The purpose of this accessory kit is to provide that connection by installing a patch cable from the internal connection to a bulkhead connector on the side of the enclosure. With this installed, the network cabling can be wired directly to this external connection.

Accessory Contents:

This accessory kit consists of a 36” length of RG58 coaxial cable with male BNC connectors on each end and a jack–jack BNC bulkhead connector (Amphenol part number 31–220G–RFX).

Typical Network Overview:

In an Ethernet network that uses 10Base2 media, the network configuration needs to be a trunkline/dropline configuration. At each connection are a T connector and, optionally, a short dropline cable; the node can also be connected directly to the bottom of the T.

NOTE: A 50–ohm termination resistor is required on each end of the trunkline.

Installation:

The bulkhead connector requires a 0.510 inch (13 mm) hole to be drilled in the enclosure wall. Recommended hole locations include the lower left side wall (the hinge side) or the left, bottom side of the enclosure. The cable included in the kit is long enough to reach the top of the enclosure, but the top is not recommended due to the risk of metallic shavings falling into electronic components mounted on the cabinet’s subpanel.

Insert the gasketed bulkhead connector in the hole and screw on the retaining nut over the washer. Tighten the nut to make a snug fit.

Inside the enclosure, connect one end of the supplied cable to the female BNC connector on the bottom of the door–mounted PC. The other end of the cable connects to the bulkhead connector. Fasten the cable with tie wraps (or equivalent) to the existing wire bundle leading to the PC.

Notes

Appendix C
Changing Control Assembly Wiring for 220-240 Vac Operation

Attention: The PrecisionSwirl for SD control assembly is pre-wired for 440-480, Vac single-phase operation with (4 amp) fuses installed. The appropriate fuses, wiring hardware, and label are provided to change the control assembly wiring for 220-240 Vac single-phase operation.

This appendix describes how to reconfigure the Precision-Flo Plus control assembly for 220-240 Vac, single-phase operation.

The following procedure requires:
- Reconfiguring transformer connections
- Replacing the input voltage label.

⚠ WARNING

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

⚠ WARNING

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

⚠ CAUTION

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

Reconfiguring Transformer Connections

1. Be sure no power is connected to the PrecisionSwirl for SD control assembly.

2. Locate the jumper wire connected to the transformer primary **H2** and **H3** terminals.

3. Move the jumper end from the **H2** terminal and secure it to the **H1** terminal, in addition to the other wire end that is already connected to the **H1** terminal.

4. Install a second jumper wire between transformer terminals **H2** and **H4**. Be sure to secure the other wire end that is already connected to the **H4** terminal.

5. Be sure the transformer primary is wired as illustrated in the following diagram:

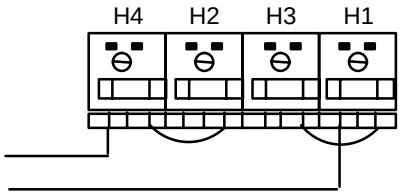


Fig. 34

Replacing the Input Voltage Label

1. Replace the 480 Volt label, located on the panel inside the control assembly, with a 240 Volt label.

2. Return to the Installing Control Assembly Hardware section of this manual (beginning on page 15) for additional installation instructions.

Notes

Appendix D

Installing Graco Accessory Kit 244343

Optional Flow Meter for PrecisionSwirl for SD

Initial Setup

1. Unpack flow meter and ensure all components are in the package.
2. Examine the components for shipping damage.
3. Become familiar with the navigation keys on the display (instructions are found in the next two pages)
4. When password is prompted, enter 63

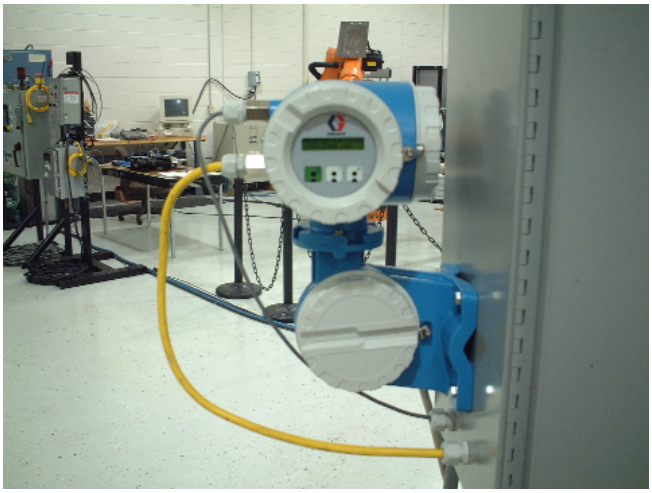
Setup

The following steps must be performed to set up the flowmeter. Detailed instructions are found later in this appendix.

1. Navigate to PULS/FREQ. OUTPUT. Set the following: (remember, password is 63)
   a. ASSIGN OUTPUT: Volume
   b. OPERATION MODE: Pulse
   c. PULSE VALUE: 0.5 CM3/P
   d. PULSE WIDTH: 0.05S
   e. OUTPUT SIGNAL: Active/Positive
   f. FAILSAFE MODE: Fall Back Value
   g. BALANCE: Off
   h. SIMULATION FREQ: Off
   i. NOMINAL FREQ: 0
2. Return to the main screen by pushing E for 3 seconds

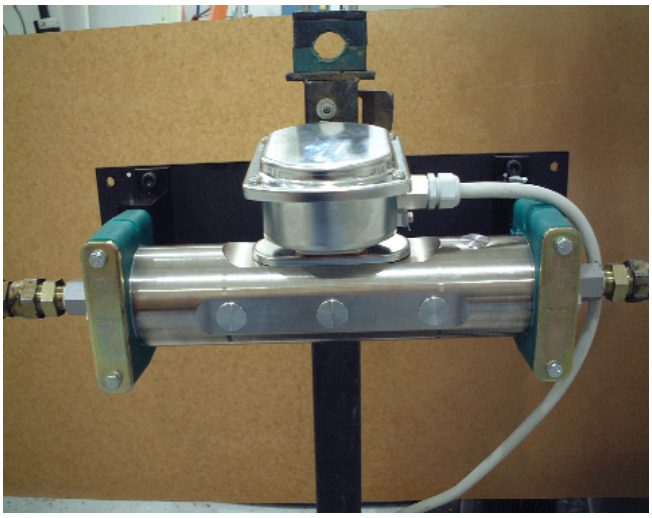
Mount the display

1. Lay out a (4) bolt hole pattern 100mm x 100mm on the control cabinet. Refer to the *E&H promass 63 manual, page 116 for more information.*
2. Drill (4) 8.6 mm holes and mount the display. Install the Flowmeter



Install the Flow Meter

1. Install the flow meter in the process line, near the dispense point. Refer to the *E&H promass 63 manual, pages 11–16 for more information.*
2. See photo for installation
3. Wire the signal, power, and control cables as shown on page .



Appendix D

Commission the Meter

Calibration

Calibration should be performed at least once when the system is being commissioned.

1. Adjust the dispense system so that the static pressure of the supply hose (not the display pressure on PrecisionFlo) is 1,500±500psi
2. Make sure the applicator is closed and there are no leaks
3. Navigate the flowmeter menu to SYSTEM PARAMETER
4. Choose ZEROPOINT ADJUST
5. Choose START (remember, password is 63)
6. Go back to main screen by pushing E for 3 seconds

To make ensure calibration was done correctly, dispense material into a cup and compare the actual measured volume to the displayed volume.

Flow Rate Control Setup

Determine the following:

1. Desired flow rate per applicator
   [example = 2000 cc/min]
2. The robot command for the desired flow rate
   [example = 8V Analog]

Calculate the maximum (10 V robot command) flow rate per applicator:
*(Desired Flow Rate * 10)/Robot Command = Maximum Flow Rate*
[example = 2500 cc/min]

Appendix D

Enter the required parameters:

1. Enter SETUP → PRECISION FLO PLUS → (super user password) to navigate to the setup screen
2. On the FLOW RATE CALIBRATION screen:
   a. Enter the calculated maximum flow rate [example = 2500]
   b. Press the CALIBRATE GUN button (no fluid is dispensed, the entered maximum flow rate is copied to the target maximum flow rate and the flow gain is set to 100%)
3. In the DISPENSE PARAMETERS screen:
   a. If known, set the pressure loop Kp and Ki [example Kp = 8, Ki = 6]
   b. Enter the flowmeter k–factor (2000 pulses/liter with the E&H meter set to 2 pulses per cc)
   c. Set the Flow Average variable to 32 flowmeter pulses [At 2000 cc/min, this gives two 1% flow gain adjustments per second, at 4000 cc/min four 1% adjustments per second]. Enter a larger number to lower the flow gain update frequency, a smaller number to increase the frequency.
4. In the TUNE FLUID MODULE screen:
   a. Set the Dispense Mode to Manual, the Control Mode to Pressure
   b. Touch the ADJUST FLUID MODULE button, set:
      (1). The Purge Gun Flowrate to match the expected robot command [80% for 8 Vdc]
      (2). The starting PSI/V L [example = 50 PSI/V]
      (3). The starting PSI/V R [example = 50 PSI/V]
   c. Touch DONE
   d. Activate the Measured Flow Rate, Measured Press L, and Expected Press L traces; press Start/Stop Display
   e. Dispense material by pressing Dispense Gun L and wait for the flow rate to stabilize
   f. If the flow rate is too high, decrease the PSI/V L value, if the flow rate is too low increase the PSI/V L value [example = flow rate should be 2000 cc/min].
   g. Repeat steps d and e until the flow rate is equal to the desired flow rate
   h. Deactivate the Measured Press L and Expected Press L traces, activate the Measured Press R and Expected Press R traces.
   i. Dispense material by pressing Dispense Gun R and wait for the flow rate to stabilize
   j. If the flow rate is too high decrease the PSI/V R value, if the flow rate is too low increase the PSI/V R value [example = flow rate should be 2000 cc/min].
   k. Repeat steps h and i until the flow rate is equal to the desired flow rate
   l. Dispense material by pressing the Dispense Guns L&R button, the flow rate should be about twice the individual gun flow rate [example = 4000 cc/min]
   m. Change the Control Mode to Flow, activate the Expected Flow Rate trace
   n. Dispense material from L, R, or both guns by pressing the appropriate Dispense Gun button. Verify the Actual Flow Rate (red trace) is equal to the Expected Flow Rate (green trace)
   o. Change the Dispense Mode to Auto
5. Return to the Overview screen, monitor the calculated volume per each style. Enter the volumes and desired tolerances in the SETUP → PRECISION FLO PLUS → VOLUME PARAMETERS screen. The volume tolerances should be set high enough to avoid nuisance volume faults and low enough to detect plugged guns. The flow gain can also be monitored on the Overview screen.
6. Monitor the dispensing pressure on the left and right guns, set the pressure high limit for each gun in the SETUP → PRECISION FLO PLUS → PRESSURE PARAMETERS screen. The pressure limits should be set high enough to avoid nuisance faults and low enough to detect plugged guns.

Graco Standard Warranty

Graco warrants all equipment referenced in this document which is manufactured by Graco and bearing its name to be free from defects in material and workmanship on the date of sale by an authorized Graco distributor to the original purchaser for use. With the exception of any special, extended, or limited warranty published by Graco, Graco will, for a period of twelve months from the date of sale, repair or replace any part of the equipment determined by Graco to be defective. This warranty applies only when the equipment is installed, operated and maintained in accordance with Graco's written recommendations.

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Sales Offices Worldwide

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

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