

Analog Input and Output Options for Syringe Pumps

Installation and Operation Instructions

Overview

Teledyne Isco offers several options for external analog control and for output signals to monitor flow rate and pressure:

Analog Feature	Voltage: 0-10V	Current: 4-20mA
Input	Standard feature, Internal circuit board	Optional, External converter box
Output	Optional, Internal circuit board	Optional, Internal circuit board

A single controller provides interfacing for up to three pumps. Voltage and current inputs control functions of run/stop, flow setpoint, and pressure setpoint. Voltage and current outputs transmit data for flow rate, pressure, and volume remaining in the cylinder.

Analog Input

Up to three pumps can be controlled externally for either constant flow or constant pressure. The analog voltage input is a built-in standard feature, and accepts a signal of up to 10 volts.

Voltage Input Wiring Connections

For analog control of a pump, connect the analog ground wire to the GND terminal under ANALOG INPUT on the ACCESSORIES terminal block on the rear panel of the controller (Figure 1). Connect the input wire to terminal 1. To control a second and third pump, connect input wires to terminals 2 and 3, respectively.

A multi-pump system running in continuous flow mode only requires connection to terminal 1.

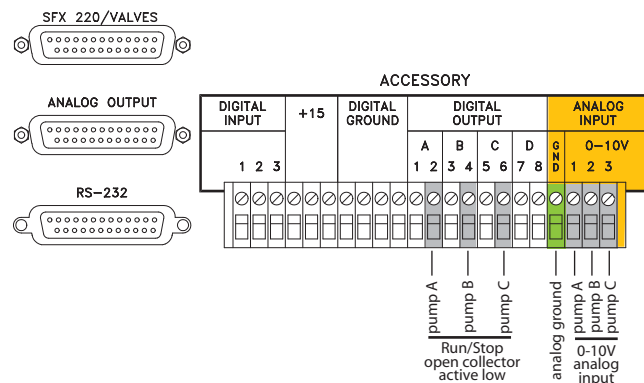


Figure 1: Analog voltage input/output terminals

0 Volts = Stop

V_{max} = Max flow in constant flow mode; max pressure in constant pressure mode

4-20mA Input Wiring Connections

Up to three pumps can be controlled externally for either constant flow or constant pressure. For the 4-20mA converter box, connect the signal source to the 25-pin D connector on the side of the box.

Table 1 describes the function of each terminal on the block, and also the converter box wiring (Figure 2, next page). Table 2 describes the pin functions for the 25-pin D input connector on the converter box.

The 4-20mA input option requires an external converter box connected to the rear panel of the controller. The box has two external cables, labeled Cable A for control of pump A and Cable B for control of pump B. The output for the converter box is limited to a maximum signal of 8 volts.

Table 1: Controller Terminal Connections for 4-20mA Input

Terminal Name	Function	4-20mA Wiring
Digital Input 1	Run/Stop, Pump A	Cable A: White
Digital Input 2	Run/Stop, Pump B	Cable B: Green
Digital Input 3	Direction, Pump A	Cable A: Green
+15 Volt	15VDC to converter box	Cable A: Red
Digital Ground	15V Rtn	Cable A: Black
Digital Ground	Run/Stop Rtn, Pump A	Cable A: Blue
Digital Ground	Direction Rtn, Pump A	Cable A: Yellow
Digital Ground	Run/Stop Rtn, Pump B	Cable B: Yellow
Digital Output A2	Run/Stop Status, Pump A	Cable A: Orange
Digital Output B4	Run/Stop Status, Pump B	Cable B: Brown
Analog Ground	Flow/Pressure Rtn, Pump A	Cable A: Gray
Analog Ground	Flow/Pressure Rtn, Pump B	Cable B: Blue
Analog Input 1	Flow/Pressure Ctrl, Pump A	Cable A: Purple
Analog Input 2	Flow/Pressure Ctrl, Pump B	Cable B: White

4 mA = Stop

20 mA = Max flow in constant flow mode; max pressure in constant pressure mode

Note

When using the 4-20 mA converter box, if a third pump is added, another cable will be installed and labeled Cable C.

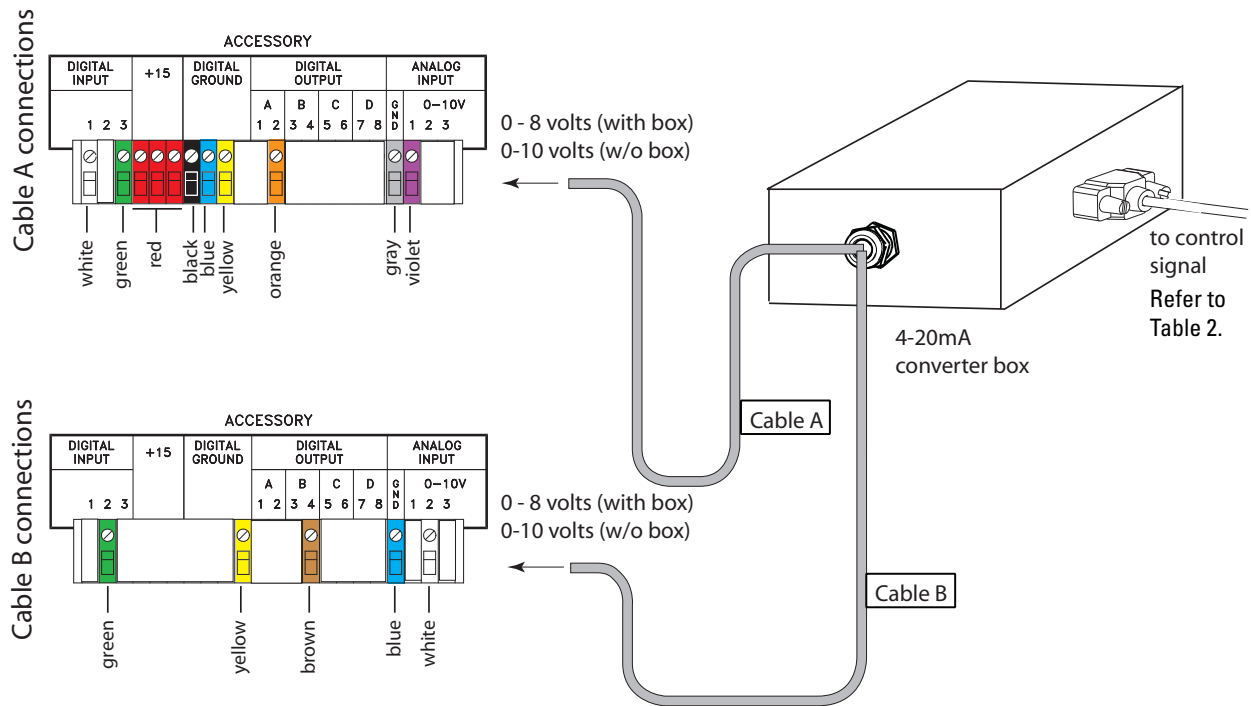


Figure 2: Analog control wiring connections

Table 2: 4-20mA Input Pin Functions for Operator Interface

Pin	Functions	Value	Pin	Functions	Value
1	Chassis		14	Flow Pump A Rtn	
2	Flow In, Pump A	4mA = 0 ml/min 20mA = max flow, depending on pump	15	Flow In, Pump B	4mA = 0 ml/min 20mA = max flow, depending on pump
3	Rtn Flow, Pump B		16	Flow In, Pump C	4mA = 0 ml/min 20mA = max flow, depending on pump
4	Rtn Flow, Pump C		17	R/S status, Pump C	Contact Closure
5	R/S status, Pump C	Common	18	R/S status, Pump B	Contact Closure
6	R/S status, Pump B	Common	19	R/S status, Pump A	Contact Closure
7	R/S status, Pump A	Contact Closure	20	Direction, Pump C	Logic High = Up Logic Low = Down
8	Run/Stop, Pump C	Logic High = On Logic Low = Off	21	Direction Rtn, Pump C	
9	Run/Stop Rtn, Pump C		22	Direction, Pump B	Logic High = Up Logic Low = Down
10	Run/Stop, Pump B	Logic High = On Logic Low = Off	23	Direction Rtn, Pump B	
11	Run/Stop Rtn, Pump B		24	Direction, Pump A	Logic High = Up Logic Low = Down
12	Run/Stop, Pump A	Logic High = On Logic Low = Off	25	Run/Stop Rtn, Pump A	
13	Direction Rtn, Pump A				

NOTE: Pump C references are not enabled at this time. Only Pump A and Pump B connections will be used. When Pump C is enabled, another cable from the interface box will be installed and labeled Cable C. Also note that the Direction control for Pump A (pins 24 & 13) will provide direction control for both pump A and B in dual pump mode.

Preparation

Before programming the controller to accept the analog signal, you must know the value of the maximum flow rate (constant flow) or the maximum pressure (constant pressure).

Note

The high and low limits you enter cannot exceed the pump specifications:
 4-20mA maximum input = 8V;
 Normal input = 10V.

To determine the analog voltage range, use the formula explained below:

$$FS \times \left(\frac{V}{U}\right) = V_{max}$$

where:

FS = Maximum flow rate or Maximum pressure (Full Scale): This is the same value entered when setting LIMITS, as described in Section 3 of your user manual, for MAX PRESS or MAX FLOW.

- V = Volts per unit of flow or pressure
- U = Incremental unit of flow or pressure
- V_{max} = Maximum input voltage

Calculation Examples

Flow Rate – If MAX FLOW is set at 25 ml/min in the LIMITS menu and the desired scale factor is 5.0 volts per 20 ml/min, do the following to determine the analog voltage range:

$$25 \times \left(\frac{5}{20}\right) = 6.25$$

In this example, the analog voltage range would be 0.0–6.25 volts.

Pressure – If MAX PRESS is set at 510.2 ATM in the LIMITS menu and the desired scale factor is 2.0 volts per 100 ATM, do the following to determine the analog voltage range:

$$510.2 \times \left(\frac{2}{100}\right) = 10.204$$

In this example, the analog voltage range would be 0.0–10.204 volts.

Setting Up External Control

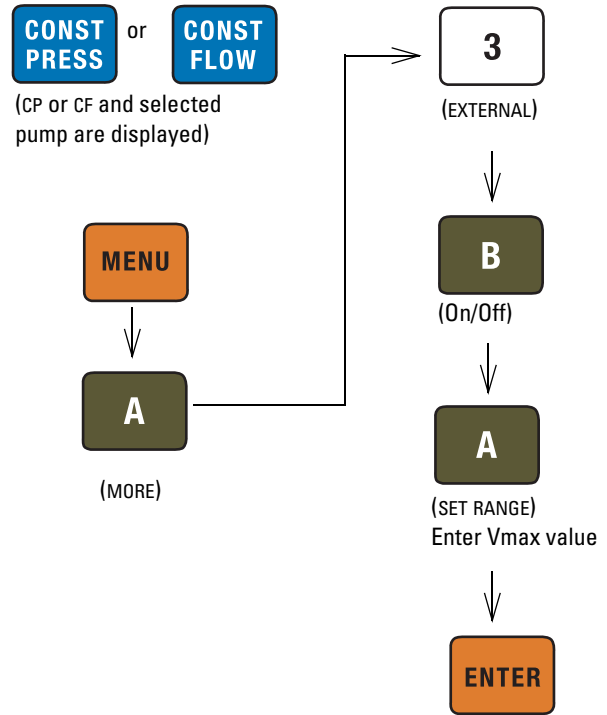


Figure 3: Button sequence for external control setup

Analog Outputs

Analog outputs are optional and installed inside the controller for monitoring flow rate (up to 3 pumps), and volume (up to 2 pumps).

Voltage Analog Output

Output voltage for pressure is located on the back panel of the pump module via standard banana jacks.

The output connection is the female 25-pin Sub-D connector located on the rear panel of the controller, under ANALOG OUTPUT.

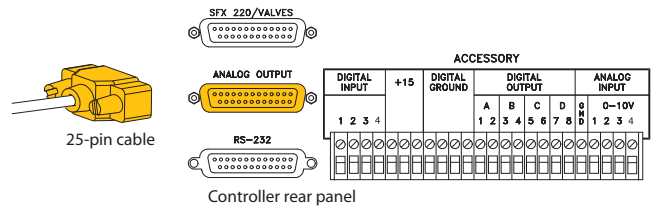


Figure 4: Analog voltage output connection, rear panel

Voltage analog outputs are pre-installed at the factory. This option has a total of four outputs for monitoring flow rate with selectable ranges from 0 to 5V, -5 to +5V, and 0 to 10V. The default range at installation is 0 to 10V. To adjust the range, remove the top cover of

the controller, (Figure 5), and move the jumper for each output to a new range (Figure 6). Each output can be set to a different range.

The top of the selected range is the same maximum value entered for MAX FLOW when setting LIMITS, as described in Section 3 of your user manual. For example: if the output range is 5V and the preferred output scale is 1 volt per 10 ml/min, MAX FLOW is set at 50 ml/min. MAX FLOW cannot exceed the pump specification.

A controller running one to two pumps can also output cylinder volume on the remaining outputs. The volume output range is not adjustable. Full scale is equal to one pump stroke.

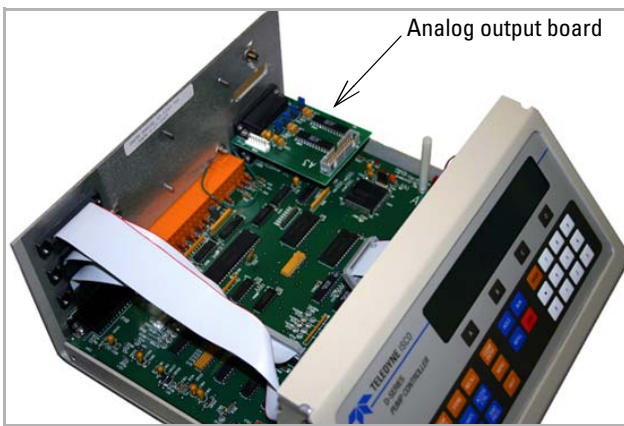


Figure 5: Accessing the analog output board (Voltage output board shown)

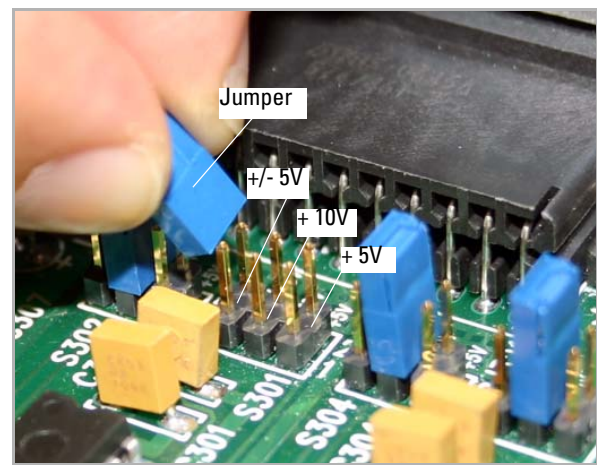
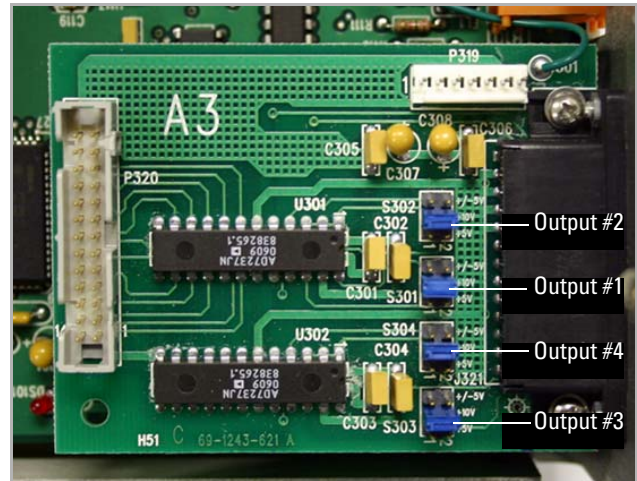


Figure 6: Adjusting the voltage output ranges

Table 3: Voltage Output Signal/Sub-D Pins

Pin #	Description	One/Two Pump Function	Three Pump Function
1	Chassis (earth)	—	—
2	Analog common	—	—
3	Analog common	—	—
4	Analog common	—	—
5	Analog common	—	—
14	Output #1	Flow Rate A	Flow Rate A
15	Output #2	Flow Rate B	Flow Rate B
16	Output #3	Volume A	Flow Rate C
17	Output #4	Volume B	Volume B

4-20mA Analog Output

The 4-20mA analog output board is pre-installed at the factory, but can also be purchased in an upgrade kit. The board initially contains three output cards, for flow rate, pressure, and volume for Pump A. Additional cards can be purchased to output data for one or two more pumps.

Table 4: Analog Output Signal/Sub-D Pins for 4-20mA

Channel	Data Type/Pump	Pin
1	Pump A Flow Rate	1
1	Pump A Flow Rate (Signal Return)	14
2	Pump A Pressure	2
2	Pump A Pressure (Signal Return)	15
3	Pump A Volume Remaining	3
3	Pump A Volume Remaining (Signal Return)	16
4	Pump B Flow Rate	4
4	Pump B Flow Rate (Signal Return)	17
5	Pump B Pressure	5
5	Pump B Pressure (Signal Return)	18
6	Pump B Volume Remaining	6
6	Pump B Volume Remaining (Signal Return)	19
7	Pump C Flow Rate	7
7	Pump C Flow Rate (Signal Return)	20
8	Pump C Pressure	8
8	Pump C Pressure (Signal Return)	21
9	Pump C Volume Remaining	9
9	Pump C Volume Remaining (Signal Return)	22

Part Numbers for Analog Options

Part numbers are listed in the table below. Contact Teledyne Isco for additional details and ordering information.

Table 5: Part Listing of Analog Options

Description	Part Number
4-20mA analog input converter box (external)	68-1247-119
Pump controller w/ analog voltage outputs	68-1240-046
Analog voltage output conversion package (internal)	68-1247-070
4-20mA analog output for one pump (3 outputs)	68-1247-120
Additional output cards	68-1247-121

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