

SG1 Pressure Controller



Operations Manual

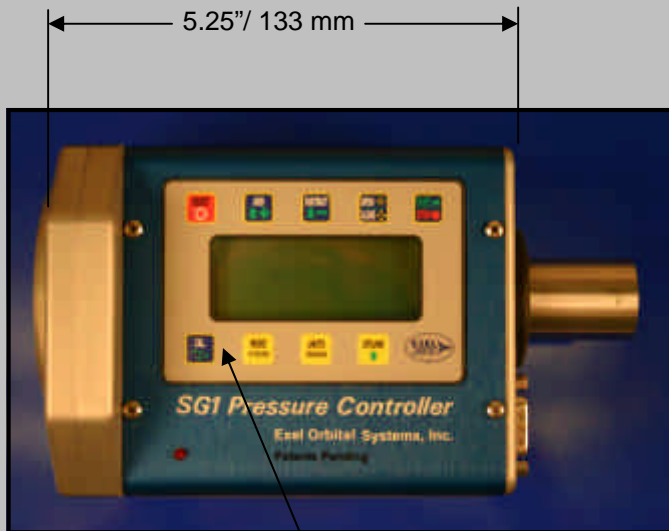
Internal automatic pressure control for orbital tube welding.



By EXEL Orbital Products

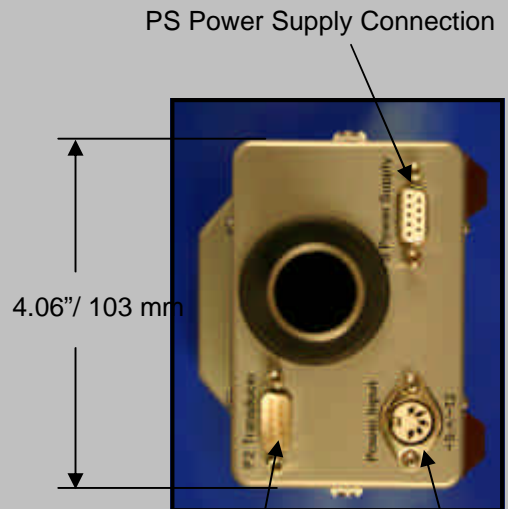
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SG1 Overview and Dimensions



Top View

Membrane Panel and Display Screen



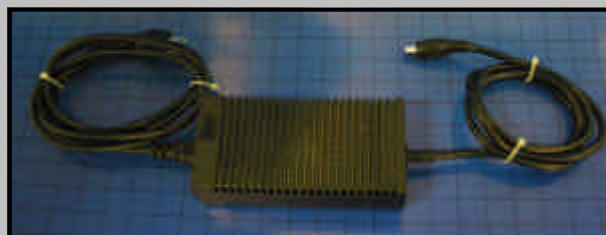
Back View

P2 Transducer Connection

Power Connection
+5, +/- 12 Volt



Side View



Power Cord with Switching Power Supply
Utilizes 100 to 240 volts with 60 to 60 Hz



P2 Transducer Assembly

How It Works

The SG1 Pressure Controller is a very low pressure closed loop digital controller designed to maintain a low internal pressure on tubes or components being welded. Pressure is controlled dynamically by adjusting the orifice size of an iris valve (shown below) while monitoring the pressure produced by the restriction the orifice creates, given a certain pressure of purge gas.



Iris Valve

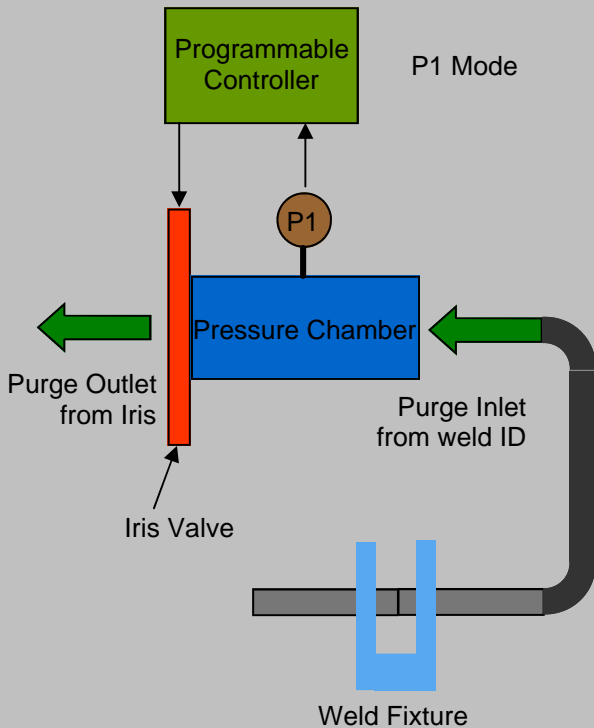


Diagram of Pressure Control in P1 Mode

Above is a diagram of the basic components of the pressure controller. A desired internal weld pressure is set on the Programmable Controller and the purge gas being exhausted from the weld ID is connected to the Pressure Chamber of the pressure controller. In

order to produce the programmed pressure (monitored by the P1 pressure transducer) the Iris Valve is closed to create an orifice that provides a flow restriction. The controller adjusts for any increase or decrease in pressure during the weld of flow variations which may result from a change of supply pressure or joint variation

Often it is necessary to know what the pressure is at the actual weld site and since there can be a substantial pressure loss if the distance from the weld site to the pressure controller is great it is necessary to calibrate the pressure of P1 against the pressure at the weld with a P2 transducer. By monitoring the P2 pressure at the weld site prior to welding and knowing P1 the pressure loss of the particular distance from the weld to the controller can be calculated. Once this loss is known the appropriate P1 pressure can be controlled to meet the desired pressure at the weld site. After calibration and before welding P2 is removed.

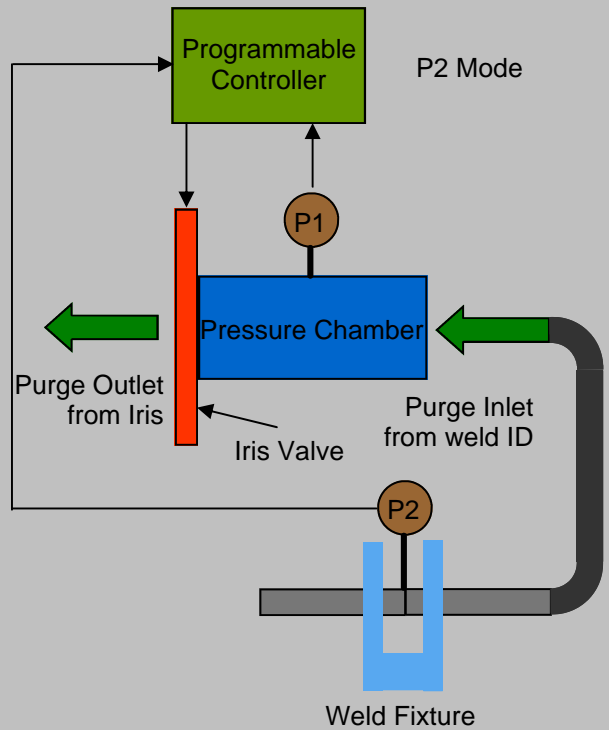


Diagram of Pressure Control in P2 Mode

Start-Up

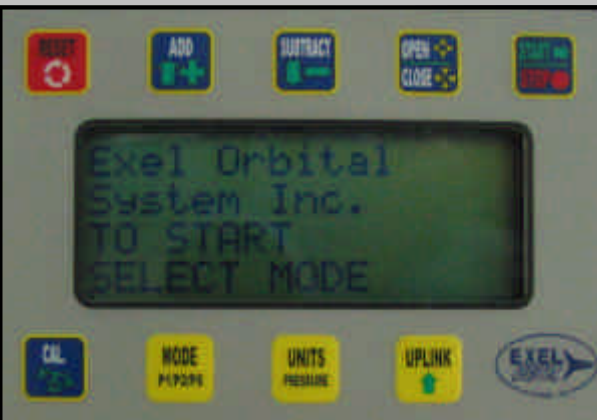


Turn on the power by plugging the power cord with switching power supply into a 100 to 240 volt, 50 to 60 Hz power outlet and the other end of the supply into the pressure controller, as shown above.



When powered the pressure controller will make an audible beep and will cycle the iris valve open. The display screen will display the message shown above, prompting the operator to select a Mode of Operation.

Control Panel



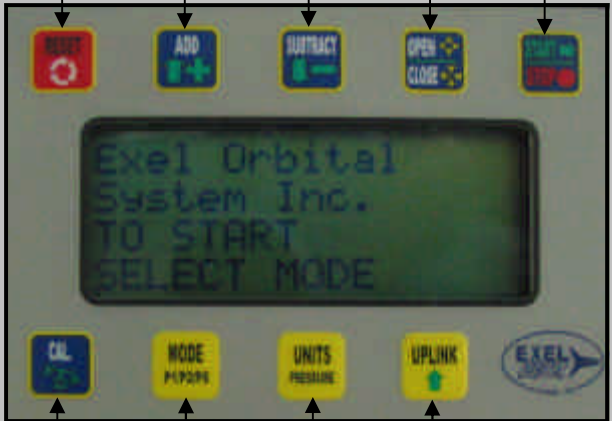
RESET reinitializes the system and returns the iris valve to its open position and sets the unit to atmospheric conditions.

ADD increases or scrolls the value displayed on the screen.

SUBTRACT decreases or scrolls the value displayed on the screen.

OPEN/ CLOSE cycles the iris to the open or closed position.

START/ STOP Begins or ends a cycle. Also used for Standby Mode.



UPLINK allows communication to EXEL's EPS-2000 Power Supply

UNITS selects the unit of measure for pressure

MODE selects the operating mode P1, P2 or PS

CAL or Calibrate is used to compare the P1 pressure to P2.

Modes of Operation

There are three modes of operation for the pressure controller they are:

1. P1 (Single pressure transducer operation)
2. P2 (two pressure transducer operation)
3. PS (Welding power supply control of pressure controller)
4. Standard Pressure Table

2. mm H₂O (millimeters of water)
3. ATM (atmospheres)
4. in Hg (inches of Mercury)
5. mm Hg (mm of Mercury)
6. cm H₂O (centimeters of water)
7. Kpa (Kilopascals)

Operation in P1 Mode



Select the P1 Mode by pushing the **MODE** button until the screen above can be seen. The message on the screen states that this mode uses only one transducer. This transducer is internal to the pressure controller. In this mode no calibration is required for operation. By pushing the **START/ STOP** button, P1 Mode will proceed.



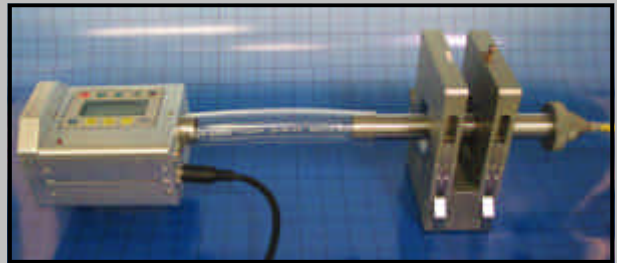
The Next screen that appears allows setting of the desired pressure. By pushing the **ADD** or **SUBTRACT** button the displayed pressure will either increase or decrease. The default unit of measure for pressure is H₂O however, several other options are available by depressing the **UNITS** button. The following units of measure may be selected:

1. in H₂O (inches of water)



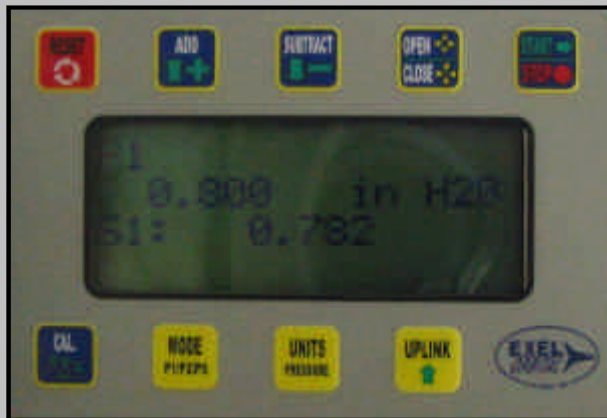
In this example a 1.00" diameter tube will be welded so .800 in H₂O is selected.

NOTE: For more information on pressure and flow selections refer to Mode 4 of operation or refer to Semi Standard F78-0304 on page ____



Before turning on the purge the weld to be made must be set-up. Above is a typical setup using the RTU-016-FMJ Fixture to weld a 1.00" diameter tube. To the right of the weld is the purge inlet, in this case pure Argon and to the left is the SG1 Pressure Controller. In P1 Mode the tubing used to connect the pressure controller to the welded component should be as short as possible and at least of the same diameter as the components being welded on order to minimize pressure drop.

Operation in P1 Mode Continued



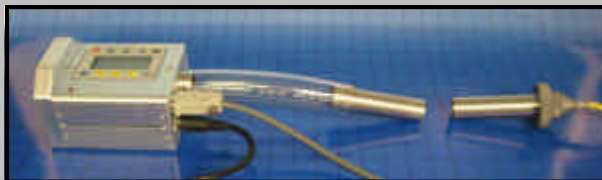
When the **START** button is depressed the pressure controller begins closing the iris valve and monitoring the internal pressure until the desired pressure is obtained. The view above shows the programmed pressure of 0.800 in H₂O and an actual internal pressure of 0.782. This actual pressure will vary slightly based on flow turbulence and is the same as the slight bounce experienced when a Magnehelic is used.

The programmed pressure can usually be achieved in about 10 to 15 seconds depending the flow and desired pressure. As soon as the pressure is obtained the weld can be made. During the welding process the pressure controller continues to maintain the programmed pressure compensating for sudden pressure loss during arc start and increase after the weld seam has been sealed.

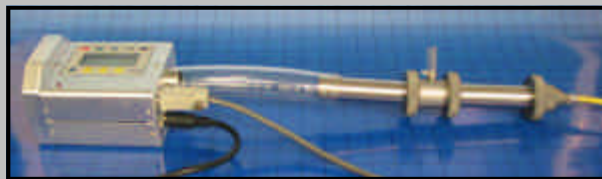
Operation in P2 Mode



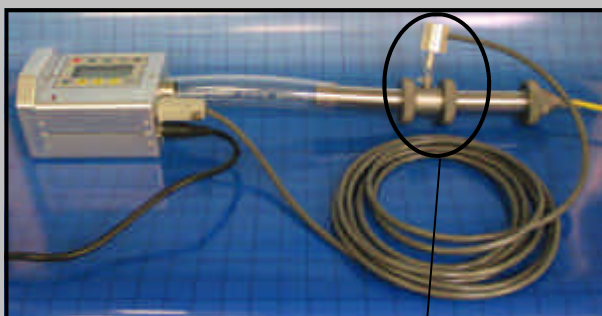
The P2 Mode requires that the P2 transducer be attached so that the pressure drop from the weld site to the pressure controller can be calibrated. If the P2 Transducer is added after the pressure controller has been turned on the reset button must be pressed to reinitialize and recognize the transducer.



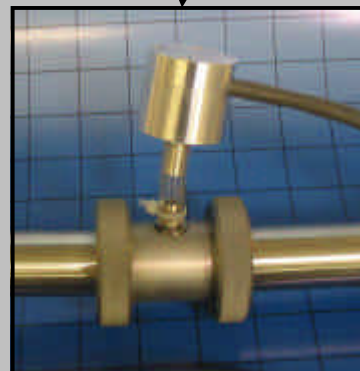
Before fixturing the weld joint as in the P1 Mode the pressure at the weld joint must be calibrated.



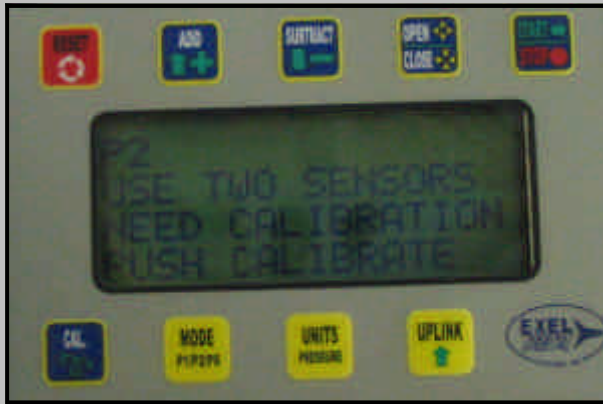
A union type fitting with a 1/4 tube leg must be used to connect the two components to be welded and allow the P2 Transducer to be attached.



Attach the P2 Transducer to the Union. This attachment can be made with compression fittings with polymer ferrules or with poly tube.



Operation in P2 Mode Continued



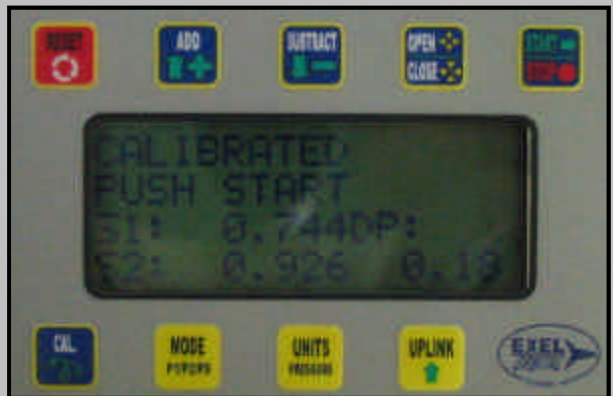
Using the mode button select the P2 Mode. A message is displayed noting that two transducers are needed the first is built into the controller and the second is the P2 transducer. Calibration is also required to measure the pressure drop between the weld site and the controller.



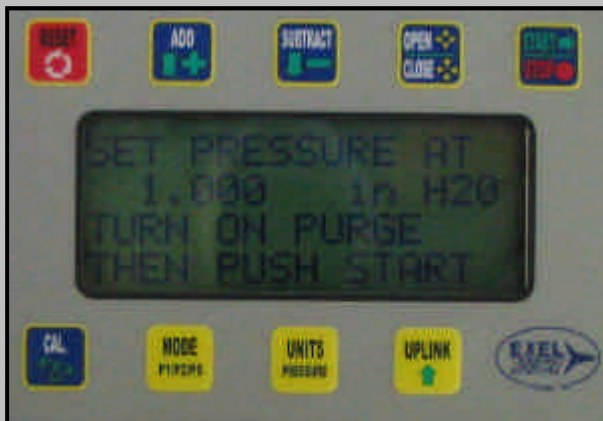
Adjust the pressure to the desired level, in this case 0.800 in H_2O . Turn on the purge supply then push **START**.



By pushing the **CAL** (Calibrate Button) the instruction "PLACE SENSOR 2 AT WELD JOINT THEN PUSH START" is displayed. This has been done by placing the P2 Transducer on the union at the weld joint.



The controller will close the iris valve until the pressure at the weld site (P2) is the desired 0.800 in H_2O , in this case S1 is 0.744 in H_2O . Also display in the screen is the pressure at the controller, in the case S2 is 0.926 in H_2O . Also displayed is the pressure drop from the weld site to the controller in this case DP or delta pressure is 0.18 in H_2O .

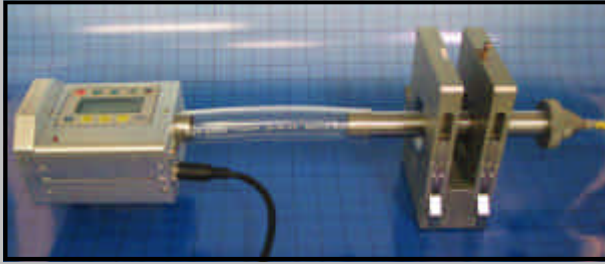


As in P1 Mode the default pressure is set to 1.00 in H_2O

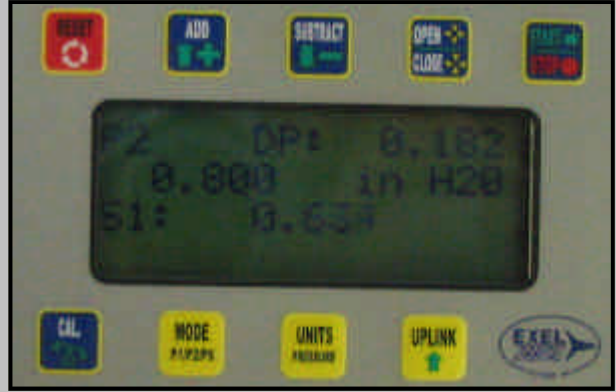


After calibration is complete and the **START** button is pushed the above message is displayed. Remove the P2 Sensor and union and fixture the weld joint.

Operation in P2 Mode Continued



Now that the controller is calibrated the weld can be made.

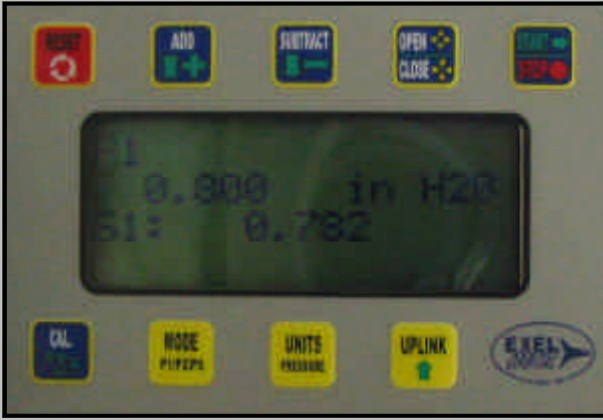


By pushing START the controller will begin closing the iris to reach the desired pressure located in the controller, which is 0.800 in H₂O - 0.182 in H₂O or 0.618 in H₂O. The tolerance or flow turbulence may give a slightly different reading, in this case 0.634 in H₂O.

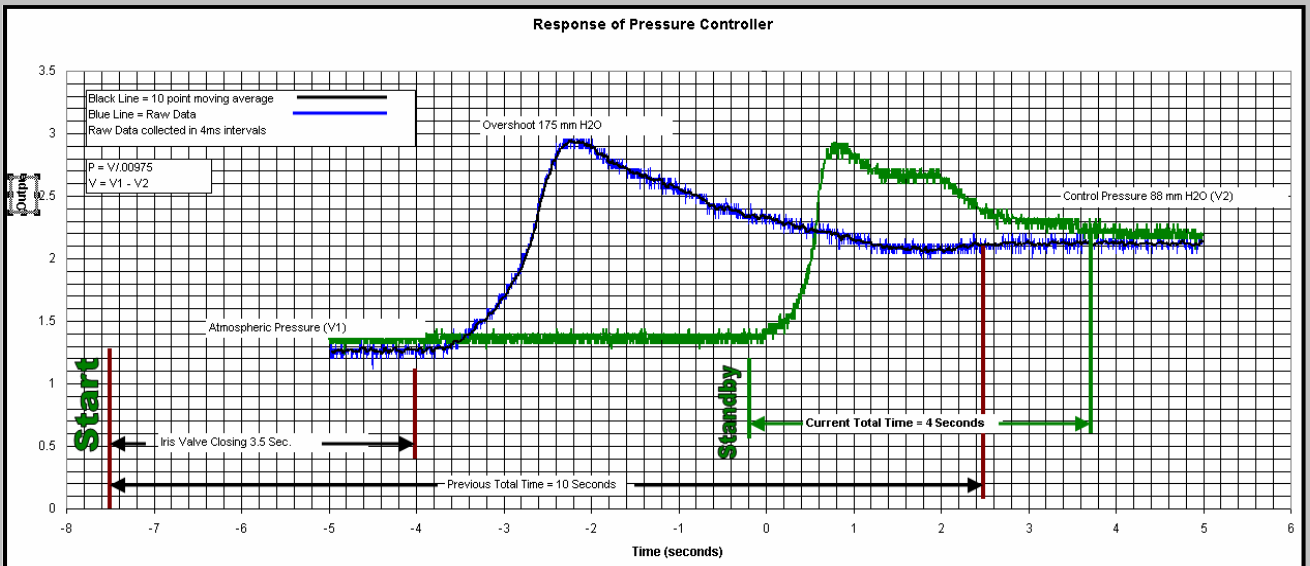
Tube Size	Wall Thickness	Minimum ID Purge Rate	ID Purge Pressure	Restrictor Size
1/4 in. 6 mm	0.035 in. 1 mm	10 scfh 3.5 l/m	2.9 to 3.4 in H ₂ O 75 to 86 mm H ₂ O	1/8 in. 3.2 mm
3/8 in. 10 mm	0.035 in. 1 mm	10 scfh 3.5 l/m	1.5 to 2.5 in H ₂ O 38 to 64 mm H ₂ O	1/8 in. 3.2 mm
1/2 in. 12 mm	0.049 in. 1.2 mm	15 scfh 7 l/m	1.0 to 1.5 in H ₂ O 25 to 38 mm H ₂ O	1/4 in. 6 mm
3/4 in. 20 mm	0.065 in. 1.5 mm	20 scfh 10 l/m	0.5 to 1.1 in H ₂ O 13 to 28 mm H ₂ O	1/4 in. 6 mm
1 in. 25 mm	0.065 in. 1.5 mm	40 scfh 20 l/m	0.5 to 1.0 in H ₂ O 13 to 25 mm H ₂ O	1/4 in. 6 mm
1 1/2 in. 38 mm	0.065 in. 1.5 mm	80 scfh 40 l/m	0.5 to 0.7 in H ₂ O 13 to 18 mm H ₂ O	1/4 in. 6 mm
2 in. 50 mm	0.065 in. 1.5 mm	150 scfh 70 l/m	0.4 to 0.7 in H ₂ O 13 to 18 mm H ₂ O	3/8 in. 10 mm
3 in. 75 mm	0.065 in. 1.5 mm	320 scfh 150 l/m	0.2 to 0.5 in H ₂ O 5 to 13 mm H ₂ O	1/2 in. 12 mm
4 in. 100 mm	0.083 in. 2 mm	600 scfh 275 l/m	0.2 to 0.4 in H ₂ O 5 to 13 mm H ₂ O	3/4 in. 20 mm
6 in. 150 mm	0.083 in. 2 mm	1000 scfh 475 l/m	0.2 to 0.4 in H ₂ O 5 to 13 mm H ₂ O	3/4 in. 20 mm

The table to the left is programmed into the SG1 Pressure Controller in Mode 4 and can be scrolled through using the **ADD** and **SUBTRACT** keys. These pressures and flows are recommended in order to give color free welding in the ID of the tube. Since this is a Semi Standard other flows and pressures may be used for other applications and this table is intended as a starting point.

Standby Mode

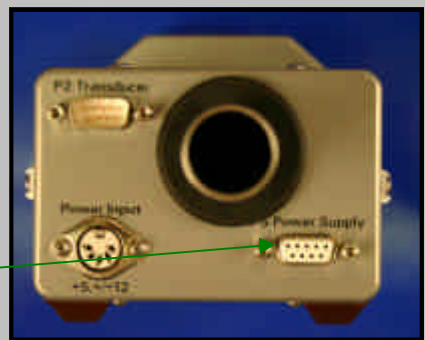


In order to reduce the amount of time for the SG1 Pressure Controller to achieve the programmed pressure between welds, the Standby Mode is used. After pushing the Start/Stop button for the first time the pressure controller requires about 10 seconds to acquire the set pressure. After the first weld is complete, pushing Start/Stop will cause the pressure controller to enter the Standby Mode where the iris valve is opened until the internal pressure reading is '0' this means the iris opens only slightly. When ready to make the next weld simply push Start/Stop again and the iris valve quickly closes until the proper pressure is reached. Because the valve is already partly closed as much as 6 seconds is saved, making the total response time as little as 4 seconds. See graph below.

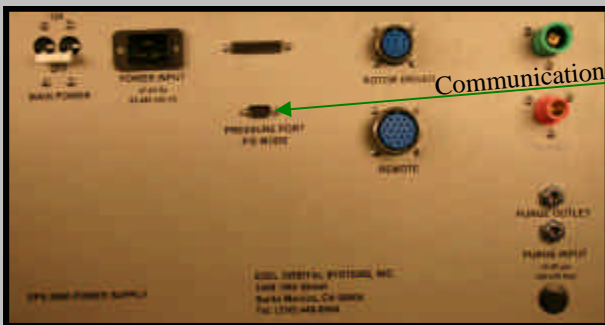


Integration with the EPS-2000 Power Supply

By using the cable provided with the SG1 Pressure Controller it is possible to integrate the pressure controller with the EPS-2000 Power Supply. By doing this it will not be necessary to push the Start/Stop button on the pressure controller between each weld. The EPS-200 Power Supply automatically sends the Start/Stop command before and after each weld.



SG1 Pressure Controller



EPS-2000 Power Supply

Fault Modes



If at any time during operation a pressure loss beyond the pressure controllers control limit is reached the controller will produce the error message below, the red warning light will flash and there will be an audible warning beep.



Maintenance of the Iris

Occasionally it is necessary to apply a light grease to the iris to insure proper operation and tight sealing. Apply a light grease to the face of the leaves of the iris for proper lubrication. Should the controller be unable to control at low pressures and flows it may be necessary to apply this lubricate.

