A Model 2400 Explosion-Proof M/P Converters

Model 2400

24XC/24XS (shown)

The 24XC and 24XS M/P Converters are motor driven pneumatic regulators with motor assemblies enclosed in a NEMA 4X Explosion-Proof enclosure.

AC Control Unit (24XC)
The AC Control unit for the 24XC unit is a continuous operation motor available in 115vAC. A feedback potentiometer option is available for these units.

DC Pulse Input Unit (24XS)
The DC pulse input assembly for the 24 XS unit is a Clock Generator/Translator board available for the 12vDC or 24vDC pulse input. This allows the use of an external Controller with a 12vDC or 24vDC output.

DC Analog Input Unit (24XS)
The DC analog input assembly is an Amplifier (Proportional Control) and Translator board which allows operation with a 4-20mA or 1-5vDC analog input. Minimum-maximum limit switches are standard on this unit. Reverse action and split ranging on the analog unit can be achieved in the field.

TTL Input (+5vD) (24XS)
The TTL input unit is equipped with a Translator board only. The user is required to supply the digital input pulses.

The control assembly for the 24XS unit is a stepper motor with an integral Translator board which converts 12vDC or 24vDC digital input pulses supplied by the customer into control logic to drive the stepper motor.

Environmental

AC Control Unit
- Continuous Operation . . . . . -40°F to +100°F (-40°F to +90°C)
- Intermittent Operation . . . . . -40°F to +150°F (-40°F to +65.5°C)

DC Pulse/DC Analog Input Unit
- Operating Temp. Range . . . . . 0° to +125°F (-17.8°F to +51.6°C)
- Low Temp. Option . . . . . -40°F to +200°F (-40°F to +93.2°C)

Electrical

AC Control Unit
- Motor Voltage 115vAC, 60Hz
- Power Consumption (watts)
  - Model 10 Regulator . . . . . .5 (Max.)
  - Model 16 Regulator . . . . . .3 (Max.)
  - Model 80 Regulator . . . . . .3 (Max.)
  - Model 81 Regulator . . . . . .3 (Max.)

Stepper Motor
- Input to Translator Board . . . . . .12-24vDc @ 800 Ma

Inputs

Translator
All inputs except enable

Input Signal Voltage (High)	.2-5v
Input Signal Voltage (Low)	.0-0.8v Max.
Input Signal Current (High)	.0
Input Signal Current (Low)	.0.9mA (sink)
Enable Input Voltage (Low)	.0v-1.5v
Enable Input Voltage (High)	.2v-5v
Clock Time Duration	.0.5 us Min.
Clock Setup	.1.0 us Min.
Clock Freq. Range	.800Hz Max.

** Clock frequency between 80 and 200 Hz may cause noise; however, operation of the unit will not be adversely affected.*

DC Pulse Input

Input to Clock Generator/Translator Board	.12-15vDC or 23-26vDC @ 800 mA
Signal Current (sink)	.10mA @ 24v
Power Consumption (watts)	.21 (max.) for 12-24vDC

DC Analog Input

Input to Amplifier (Proportional Control)/Translator	.4-20mA 1-5vDC
Power Supply	.12-24vDC

Hazardous Locations
FM (Factory Mutual) Approval:
Class I, Division I, Groups B, C and D; dust ignition proof for Class II, Division I, Groups E, F, and G; indoor and outdoor (NEMA Type 4X)

Performance

Standard Unit- Regulator Characteristics

Regulator	Pressure Ranges (psig)	NPT	Flow SCFM*	Flow m³/HR	Flow SCFM**	Flow m³/HR
10E	0-30	1/4"	40	68	5.5	9.4
16 [1]	Vacuum to 10	1/4"	2.5	4.3		
80E	All Ranges	1/8"	14	23.8	2.5	4.3
81E	All Ranges	1/4"	50	85	5.5	9.4

** 100 psig, [7.0 BAR], (700 kPa) pressure 20 psig, [1.5 BAR], (150 kPa) setpoint*
***Downstream Pressure 5 psig, [.35 BAR], (35 kPa) above setpoint*
[1] At 29" Hg vacuum

Materials of Construction
Model 2400 - Steel, Brass, Aluminum, Nylon
NOTE: *For Materials of Construction of individual regulators, please see appropriate specification sheet.*

Model 2400 Explosion-Proof M/P Converters

A
Model 2400

Full Range Adjusting Time (seconds)
DC Pulse/DC Analog Input Unit 12vDC Supply

Estimated Full Range Adjusting Time (seconds) 12VDC Supply

				Mode of Operation			
				Full Step		Half Step	
				Full Range Adj. Times (seconds)		Full Range Adj. Times (seconds)	
Reg. Model	Pressure Ranges psig	[BAR]	(kPa)	Min.	Max.	Min.	Max.
10E	.5-30	0.03-2.0	3-200	25	25	26	48
	6-30	0.4-2.0	40-200	20	20	21	38
	3-27	0.2-1.8	20-180	17	20	19	38
	3-15	0.2-1.0	20-100	6	10	8	21
	3-9	0.2-0.6	20-60	3	6	4	11
	9-15	0.6-1.0	60-100	3	5	4	11
16	vac-10	vac-0.7	vac-70	not capable of performing in this range		26	43
80E	.5-20	0.03-1.5	3-150	10	14	11	28
	1-60	0.1-4.0	10-400	10	14	11	28
	2-100	0.15-7.0	15-700	13	13	8	17
81E	0-2	0-0.15	0-15	6	14	12	28
	0-5	0-0.35	0-35	8	21	16	41
	.5-20	0.03-1.5	3-150	10	14	11	28
	1-60	0.1-4.0	10-400	10	14	11	28
	2-100	0.15-7.0	15-700	13	13	8	17

DC Pulse/DC Analog Input Unit 24vDC Supply

Estimated Full Range Adjusting Time (seconds) 12VDC Supply

				Mode of Operation			
				Full Step		Half Step	
				Full Range Adj. Times (seconds)		Full Range Adj. Times (seconds)	
Model	Pressure Ranges psig	[BAR]	(kPa)	Min.	Max.	Min.	Max.
10E	.5-30	0.03-2.0	3-200	13	25	18	48
	6-30	0.4-2.0	40-200	11	20	15	38
	3-27	0.2-1.8	20-180	10	20	14	38
	3-15	0.2-1.0	20-100	4	10	8	21
	3-9	0.2-0.6	20-60	2	6	4	11
	9-15	0.6-1.0	60-100	2	5	4	11
16	vac-10	vac-0.7	vac-70	13	22	16	43
80E	.5-20	0.03-1.5	3-150	6	14	12	28
	1-60	0.1-4.0	10-400	7	14	11	28
	2-100	0.15-7.0	15-700	4	13	8	17
81E	0-2	0-0.15	0-15	6	14	12	28
	0-5	0-0.35	0-35	8	21	16	41
	.5-20	0.03-1.5	3-150	6	14	12	28
	1-60	0.1-4.0	10-400	7	14	11	28
	2-100	0.15-7.0	15-700	4	13	8	17

Full Range Adjusting Time (seconds)
AC Control Unit

Reg. Model	Pressure Range psig, [BAR], (kPa)							Motor RPM
	2,[.15],(15)	5,[.35],(35)	Vac 10,[.7],(70)	20,[1.5],(150)	30,[2.0],(200)	60,[4.0],(400)	100,[7.0],(700)	
10E					270 135 90 68			2 4 6 8
16			210 105 70 52					2 4 6 8
80E				132 66 44		132 66 44	141 71 47	2 4 6
81E	141 71 47 35	180 90 60 45		129 65 43 32		129 65 43 N/A	135 68 45 N/A	2 4 6 8

Full Range Adjusting Time for TTL Unit

NOTE: Required PPS for a specific FR Adj. Time can be calculated as follows:

$$PPS = \frac{\text{FR Adj. Time @ 500 PPS x 500}}{\text{Required Fr Adj. Time}}$$

For 110.8 Second Time Requirement

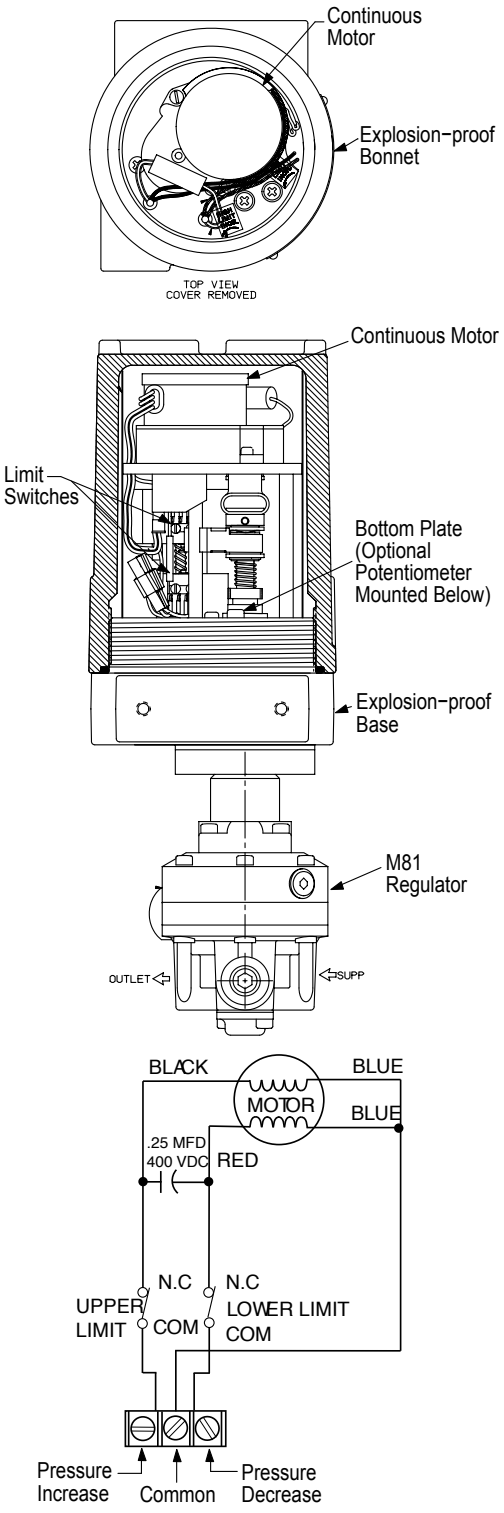
$$PPS = \frac{13.3 \times 500}{110.8} = 60.01 \text{ PPS}$$

Model 2400 Explosion-Proof M/P Converters

A

Model 2400

AC Control (XC)



Explosion-Proof AC Control Unit (XC)

The Model 2400 M/P Converter is isolated from an explosive environment by enclosing it in an explosion-proof housing. The Continuous Motor configuration includes limit switches.

The Continuous Motor is mounted on the top plate of the motor assembly. Wiring to the unit is made to a terminal block through a 1/2-14 NPT conduit fitting in the base of the housing.

The units as configured at the factory are wired so that connections to the motor are wired to the Normally Closed terminals of the limit switches. Customer connections are made to the Normally Open terminals of the the limit switches.

An optional potentiometer can be provided so that a feedback voltage proportional to the range screw travel is available to the customer. The potentiometer is accessed through the conduit fitting in the base of the housing.

Motor reversal is achieved by applying voltage between the common terminal of the block and the alternate motor winding.

Explosion-Proof Stepper Motor (CC)

The Model 2400 M/P Converter equipped with a stepper motor is a digital pulse controlled pneumatic regulator. Principle components include a 200 step/revolution stepper motor, a gear train connecting the motor and range screw, a translator circuit board and a pressure regulator. Switches used in the unit are Home Reference switches.

Electronic circuits in an integral translator convert the digital pulse input signals into control logic that operates a 200 step per revolution stepper motor. The stepper motor in turn controls the output of a pressure regulator by driving its range screw through a 4.5:1 reduction gear. The translator consists of a control logic section and a power output section.

NOTE:
The user's computer must supply the digital input pulse in accord with the specifications for stepper motor operation on page 47.

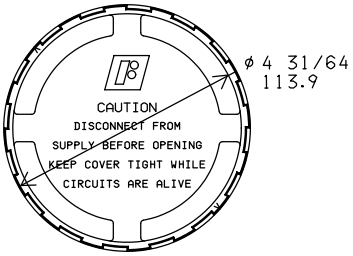
The Control/Logic section contains the logic sequence that determines the proper switching of the stepper motor windings to accomplish rotation. This section accepts the input signal that controls the direction of the motor and the type of switching sequence which is transmitted to the motor windings. This sections also contains a pulse width modulated chopper circuit that controls the current in the motor windings.

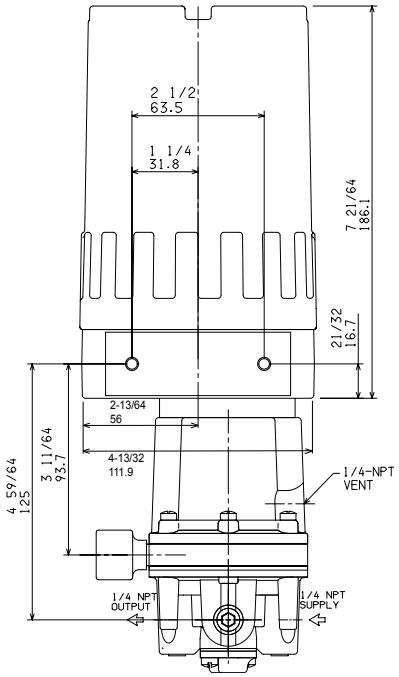
All inputs have pull up resistors to place them in a HIGH logic state. As a result all inputs can be changed by switch closures. This simplifies manual control circuits and as a result the controlling device does not have to supply input current to the translator inputs.

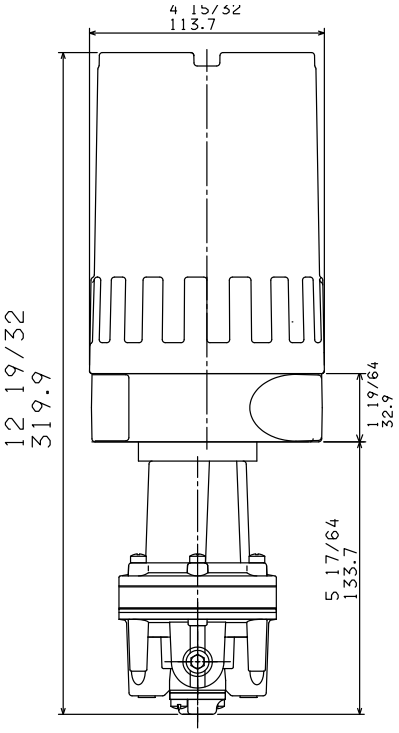
Model 2400 Explosion-Proof M/P Converters

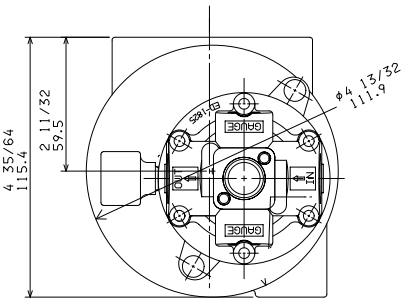
A

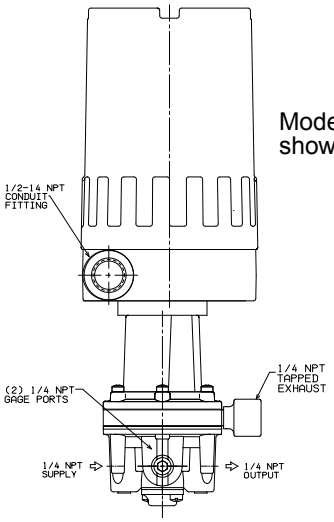
Model 2400











Model 10E shown

A Model 2400 Explosion-Proof M/P Converters

Clock Generator Limit Switch Connection

Model 2400

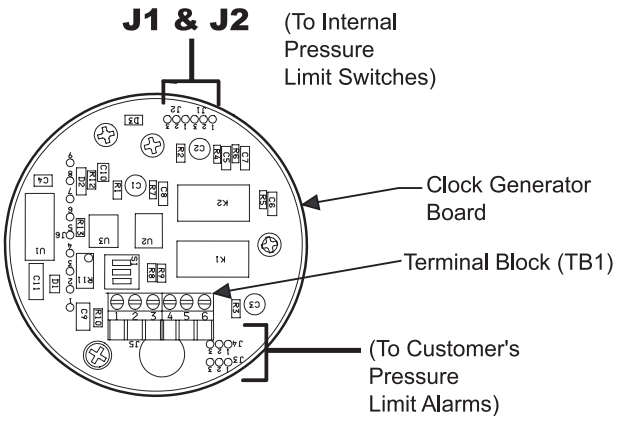
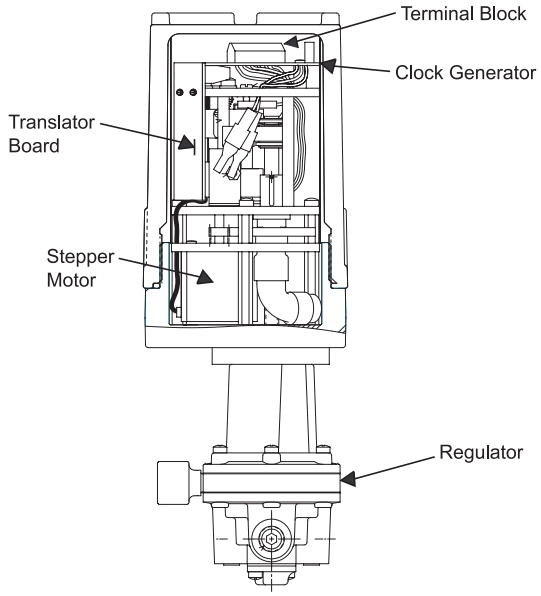


Table 1. Clock Generator PC Board Wiring Connections

From Connector	Color	Function	To Closure
J1-1	Green	Internal High Pressure Limit Switch	Normally Open
-2	White/Green		Normally Closed
-3	Black		Common
J2-1	Red	Internal Low Pressure Limit Switch	Normally Open
-2	White/Red		Normally Closed
-3	White/Black		Common
J3-1	Gray	Customer's High Pressure Limit Alarm	Common
-2	White/Yellow		Normally Closed
-3	Yellow		Normally Open
J4-1	Brown	Customer's Low Pressure Limit Alarm	Common
-2	White/Orange		Normally Closed
-3	Orange		Normally Open



Explosion-Proof DC Pulse Input (XS)

The Model 2400 M/P Converter is isolated from an explosive environment by enclosing in an explosion-proof housing. The Stepper Motor configuration is equipped with a clock generator positioned horizontally, which plugs into a vertically mounted translator board. The configuration includes limit switches.

The Stepper Motor is mounted on the bottom of the motor assembly in the base of the explosion-proof housing. Wiring to the unit is made to a terminal board through a 1/2" - 14 NPT conduit fitting in the base of the housing.

The unit includes two single pole, double throw, double break limit switches.

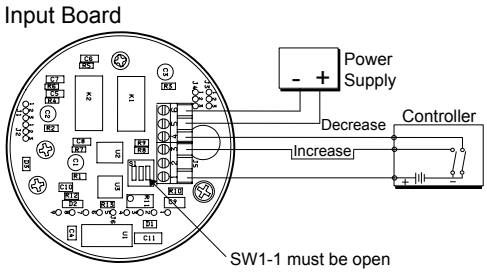
Switches on the clock generator board allow selection of:

a) Internally or Externally powered controls loops.
b) Half-step or Full step mode.
c) High-Speed or Low-Speed operation.

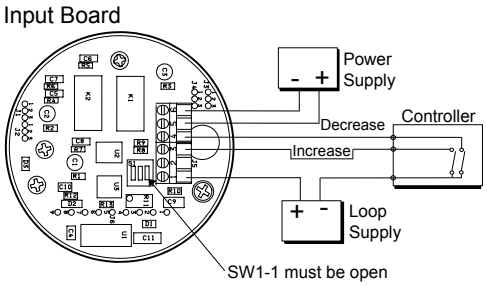
Model 2400 Explosion-Proof M/P Converters

A
Model 2400

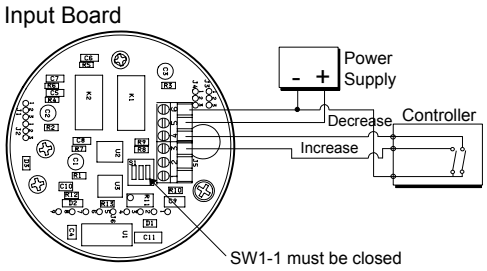
Pulse Input



Controller (Pulse Input) using the isolated loop supply.

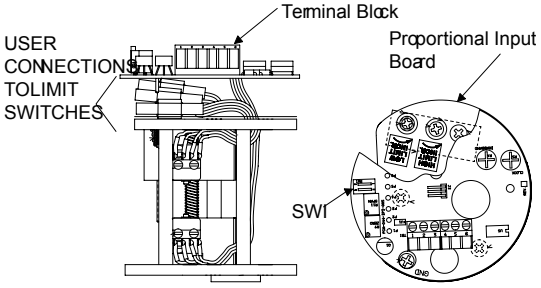


Controller (Pulse Input) using the dual isolated loop supply.



Controller (Pulse Input) using the non-isolated loop supply.

Analog Input



External Control Connections - Explosion-Proof (XS) Unit

The Explosion-Proof stepper motor unit is equipped with a Clock Generator and a Translator. Connections from an external Controller are made to the terminal clock on the Input Board as shown.

a) Controller with Isolated Loop Supply

FROM	TO
External Controller	Input Board
+DC	TB-1 Term 1
Switch Closure	TB-1 Term 3 (Increase)
Switch Closure	TB-1 Term 4 (Decrease)

b) Controller with Dual Isolated Loop Supply

FROM	TO
External Controller	Clock Generator DC Supply
Switch Closure	TB-1 Term 3
	TB-1 Term 4
	TB-1 Term 1

c) Controller using supply which powers Model 2400 as Control Loop Supply

FROM	TO
External Controller	DC Supply Clock Generator
Switch Comm	
Switch Closure	TB-1 Term 3
Switch Closure	TB-1 Term 4

Explosion-Proof DC Analog Input (XS)

The Model 2400 M/P Converter is isolated from an explosive environment by enclosing it in an explosion-proof housing. The stepper motor configuration for this option is equipped with a Proportional Board mounted horizontally on the top of the Motor Assembly.

The output of the 4-20 mA Proportional Board is wired to a vertically mounted translator board. The configuration includes limit switches.

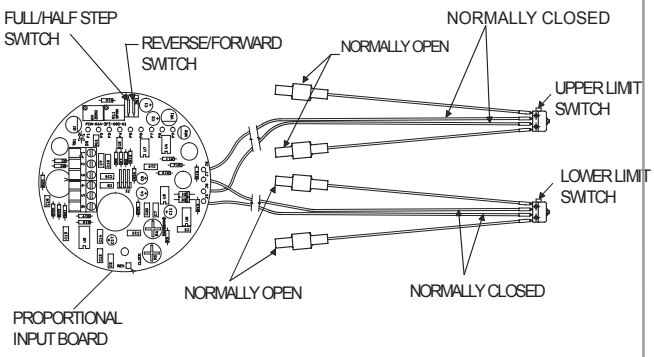
The stepper motor is mounted on the bottom of the motor assembly in the base of the explosion-proof housing. Wiring to the unit is made to a terminal block through a 1/2-14 NPT conduit fitting in the base of the housing.

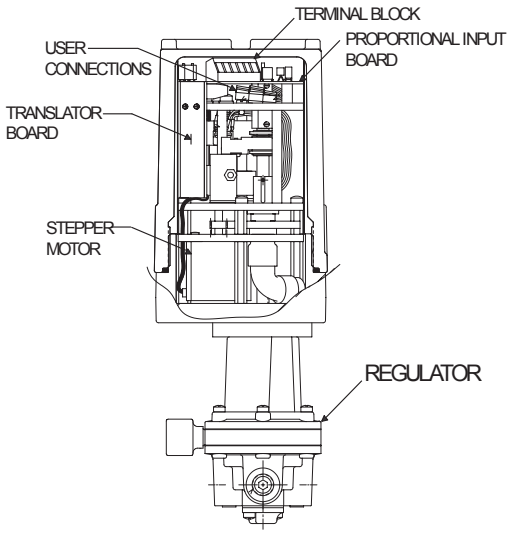
There is one switch (SW-1) located on the 4-20 mA board. SW-1 is made up of two switches (S1 and S2). S1 selects forward or reverse operation; S2 full or half step operation.

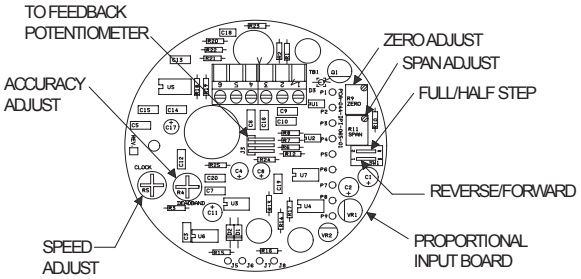
A Model 2400 Explosion-Proof M/P Converters

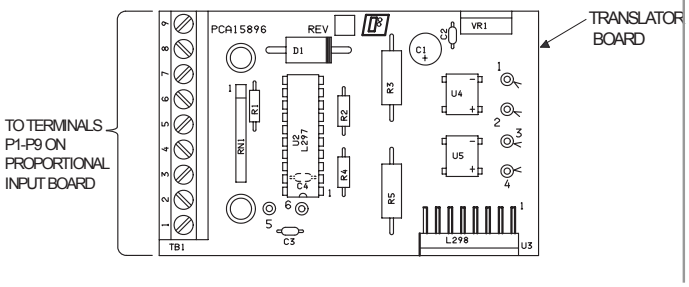
DC Analog Control

Model 2400









External Control Connections - Explosion-Proof (XS) Unit

Analog Input
4-20 mA, 1-5vDC Input

Connections are made to Terminal Board TB-1 as follows:

Terminal	Input Connection
1	4-20 mA signal current from Controller (+)
2	4-20 mA or 1-5vDC return (-)
3	1-5vDC signal voltage from Controller (+)
4	24vDC Power (+)
5	Common

The unit includes two single pole, double throw, double break limit switches. The Normally Closed terminals are used in the internal control circuit.

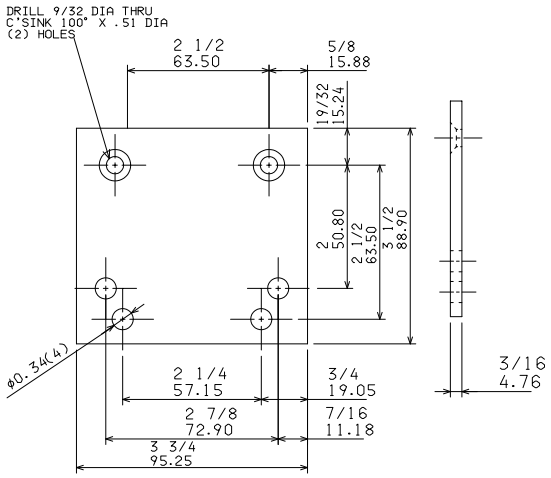
Normally Open terminals of the limit switches have connections available for customer use.

Switches on the Proportional Control Board allow selection of :

a) Reverse or Forward Operation.
b) Half-step or Full-step Mode.

Model 2400 M/P Converters

A



Mounting Plate: 18188-1 part of **18187-1** (Optional)
Mtg. Kit includes 2 screws, 1-1/2" and 2" pipe clamps

Model 2400 Explosion-Proof Kit & Accessories

Mounting Plate 18188-1
Part of 18187-1 (sold separately)

Catalog Information

Catalog Number **24XF** [ ] [ ] [ ] [ ] [ ] **0** [ ] **Model 2400**

Control Unit Type

DC Pulse/DC Analog	S
Continuous AC	C

Regulator Model

Model 10E	10
Model 16	16
Model 80E	80
Model 81E	81
Model 10E BSPT	10U
Model 16 BSPT	16U
Model 80E BSPT	80U
Model 81E BSPT	81U

Voltage

115 VAC 60 Hz	1
115 VAC 60 Hz with 1K Potentiometer	10
DC TTL Input with 12-24 VDC Translator Board	5
DC Pulse Input with 24 VDC Clock Generator Control	7
DC Pulse Input with 12 VDC Clock Generator Control	8
DC Analog Input with 12-24 VDC Supply	9

Pressure Range

	psig	[BAR]	(kPa)	
Model 10E	0.5-30	[0.03-2.0]	(3-200)	4
	0.5-20 [1]	[0.03-1.5]	(3-150)	3
Model 16	vac-10	[vac-0.7]	(vac-70)	8
Model 80E	0.5-20	[0.03-1.5]	(3-150)	3
	1-60	[0.07-4.0]	(7-400)	5
	2-100	[0.15-7.0]	(15-700)	6
Model 81E	0-2	[0-0.15]	(0-15)	1
	0.5-20	[0.03-1.5]	(3-150)	3
	1-60	[0.07-4.0]	(7-400)	5
	2-100	[0.15-7.0]	(15-700)	6
	0-5	[0-0.35]	(0-35)	7

Motor Speed

DC Motor Only	00
2 rpm	02
4 rpm	04
6 rpm	06
8 rpm	08

Enclosure

FM Explosion-Proof	2
FM Explosion-Proof with expanded temperature operation (XS Only).	3

[1] *Available on 24XFC Only.*