4200 Series Electronic Position Transmitters

The 4200 Series electronic position transmitters combine Fisher's field-proven electronic and mechanical expertise in a versatile, accurate instrument that senses the position of a device, and sends a standard (4 to 20 milliampere) output signal to an indicating device. The instrument is available as a transmitter with integral high and low electronic travel limit alarms, as a transmitter only, or with electronic travel limit alarms only.

The instrument can sense the position of rotary or sliding stem valves, vents, dampers or other devices. When the instrument is mounted, a potentiometer shaft is mechanically connected to the device to sense mechanical motion. For a standard instrument, a single potentiometer is provided for position input, or an optional dual element potentiometer is available to allow independent electrical operation of the transmitter and alarm circuits.

The instrument has standard, or long stroke (see figure 5), capabilities for sliding stem actuator applications. For long stroke applications, a multiturn potentiometer attached to a cable/pulley assembly is used to sense linear motion of the actuator stem or other devices. The instrument with standard capabilities can also be used on quarter-turn actuators.

For instruments equipped with electronic travel limit alarms, individual electronic high and low alarm circuits drive separate high and low alarm SPDT relays. The user adjusts the trip point and deadband of the high and low alarms to the desired travel limits. When the sense potentiometer voltage is higher than the high trip point, the electronic high alarm circuit de-energizes the high alarm relay. When the sense potentiometer voltage is lower than the low trip point, the low alarm circuit de-energizes the low alarm relay. The low trip point may be offset from the high trip point by as little as 5% of the remaining span. In the event of a power loss to the alarm circuits, both alarms are tripped (both relays are de-energized). This indicates a

(Continued page 3)

Figure 1. *4200 Series Transmitter*

Figure 2. *4200 Series Transmitter on a Control Valve*

Specifications

Available Configurations

See table 1

Input Signal[1] Source

■ Standard single potentiometer, or optional ■ dual potentiometer is the source for the transmitter and travel limit alarm circuit inputs. Refer to table 2 for zero and span limits.

Transmitter Output Signal[1]

Range[1]: 4 to 20 milliampere dc transmitter output
Load Impedance[1]: See figure 3
Output Current Limit: 30 mAdc maximum

Travel Limit Alarms

Number of Possible Alarms: Two or none. Each SPDT relay indicates limit and fault conditions as follows:

Operating Condition	Relay Coil State	NC Contact State	NO Contact State
Travel within limits	energized	open	closed
Travel beyond limits	de-energized	closed	open
Power loss	de-energized	closed	open

NC—Normally closed. Contacts are closed when relay is de-energized
NO—Normally open. Contacts are open when relay is de-energized.

Power Supply Requirements

See table 3

Recommended Power Supply

+24 volts dc nominal

Reference Accuracy

±1% of output span. Includes combined effects of hysteresis, linearity, and deadband
Repeatability[1]: ±0.25% of span

Operating Influences[1]

Ambient Temperature[1]: For a 100°F (56°C) change in normal operating conditions, maximum zero shift is ±0.5%, and the maximum span shift is ±0.75% of span
Power Supply: Output signal changes less than ±0.1% when operating terminal voltage varies between 11 and 30 volts dc
Electromagnetic Interference (EMI)[1]: When tested per SAMA Standard PMC 33.1-1978, change is less than ±0.5% of span in an electromagnetic field classified as 3-abc with a field strength of 30 V/m [this is approximately equivalent to a 5 watt, 20 to 1000 megahertz radio transmitter operating 19 inches (483 mm) from the instrument]. The instrument is tested with the caps on. Type 4211 and 4221 comply with European EMC directive.

Travel Limit Alarm Relays

Type: Two single-pole, double-throw relays
Contacts: 1 Form C, silver-nickel alloy with gold overlay
Service Rating: The relay rating is 5 amperes at either 30 volts dc or 120 volts ac (resistive load).
Life Expectancy: 100,000 operations at rated load, or 50,000 operations at a typical in-rush current of 10 amperes with a 120 volt ac lamp or motor load

Operating Conditions[1]

Condition	Normal and Operative Limits	Transportation and Storage Limits	Normal Reference
Ambient Temperature	–50 to 160°F (–46 to 70°C)	–60 to 180°F (–50 to 80°C)	77°F (25°C)
Ambient Relative Humidity	10 to 95%	10 to 95%	40%

Construction Materials

Transmitter Housing and Covers: Aluminum Alloy
O-Rings: Nitrile
Mounting Hardware: Steel
Pipe Plug: Nickel coated steel
Cable: Nylon-coated stainless steel (long stroke only)
Pulley: Delrin plastic (long stroke only)

Mounting

The instrument can mount on the actuator of sliding stem or rotary valves (refer to figure 5), or it can be used for other applications

Electrical Classification

Refer to the hazardous area classification bulletins for specific approvals

Housing Classification

Refer to the hazardous area classification bulletins

Approximate Weight

Transmitter Without Mounting Bracket: 4 pounds (1.8 kg)

Options

Long Stroke Applications: ■ Small, or ■ large pulley

1. These terms are defined in ISA Standard S51.1-1979.

Table 1. *Available Configurations*

TYPE NUMBER	TRANSMITTER	TRAVEL LIMIT ALARMS	TRAVEL		DUAL POTENTIOMETER
			Standard Stroke Up to 4-1/8 Inches(1) (Up to 105 mm)	Long Stroke Up to 24 Inches(1) (Up to 610 mm)	
4210	X	X	X	– – –	– – –
4211	X	– – –	X	– – –	– – –
4212	– – –	X	X	– – –	– – –
4215	X	X	X	– – –	X
4220	X	X	– – –	X	– – –
4221	X	– – –	– – –	X	– – –
4222	– – –	X	– – –	X	– – –

1. See table 2 for zero and span limits.

Table 2. *Zero and Span Limits(2)*

TYPE NUMBER	DEGREES OF POTENTIOMETER ROTATION			LINKAGE CONNECTION(1)	INCHES			mm		
	Zero Position	Span			Zero Position	Span		Zero Position	Span	
		Min.	Max.			Min.	Max.		Min.	Max.
4210 4211 4212 4215	0 to 90	15	90	1	0 to 2	1/3	2	0 to 51	8	51
				2	0 to 4-1/8	2/3	4-1/8	0 to 105	17	105
4220 4221 4222	0 to 884	150	884	Small Pulley	0 to 12	4-1/8	12	0 to 305	105	305
				Large Pulley	0 to 24	12	24	0 to 610	305	610

1. Refer to figure 5 for location of connections and pulleys.
2. Zero position is the range of values over which the transmitter zero can be adjusted. Span is the range of shaft rotation or stem travel the transmitter span can be adjusted. For example, a zero position of 45 degrees and a span of 15 degrees means the transmitter output is 4 mAdc after 45 degrees of shaft rotation. The output then increases from 4 mAdc to 20mAdc as the shaft rotates from 45 to 60 degrees.

system failure because the actuator cannot be physically at both travel limits simultaneously. The relay contacts are isolated from the transmitter and alarm circuits.

To reduce field wiring requirements from 4 to 3 wires, the transmitter and alarm circuits share the positive supply wire. A separate return wire is required to isolate relay coil currents from the 4 to 20 mA transmitter signal.

Features

- **High Accuracy**—A precision film-element potentiometer in the standard unit and a precision multiturn-wirewound potentiometer in the long-stroke unit provide exceptional linearity by matching the span of the sense element to the application.

- **Application Versatility**—This instrument may be used with sliding-stem or rotary valves as well as with other mechanical devices such as furnace dampers or louvers.

- **Electronic Travel Limit Alarms**—To eliminate the need for externally mounted mechanical limit switches, instruments with travel limit alarms incorporate comparator circuits that monitor the sense potentiometer voltage output.

- **Adjustable Deadband**—Electronic travel limit alarms have an adjustable deadband up to 10 percent of the maximum span.

- **Compact Design**—The instrument, even with travel limit alarms, uses little space when mounted, allowing room for additional devices.

- **Durable Construction**—A rugged housing and a corrosion-resistant coating on the printed wiring board help protect the instrument from harsh environments.

- **Simple Circuitry**—A simple hybrid electronic design combines the best qualities of discrete components and integrated circuits for improved reliability and performance.

- **Easy Maintenance**—The simple design of the transmitter and alarms allows easy maintenance. The high reliability of the instrument requires minimum spare parts inventory.

- **Moisture Resistant**—The field wiring compartment is isolated from the electronic compartment. This protects the electronic circuits from any moisture brought into the housing via the field wiring ports.

(Features Continued page 4)

Table 3. *Power Supply Requirements and Wiring Connections*

	Transmitter Terminal Voltage (Vdc)		Current Required (mA)	Field Wiring Connections		
	Min	Max		Supply Wire(1)	Signal Wire(2)	Relay Return Wire(3)
Transmitter Only	11	30	20 max.	X	X	– – –
Transmitter with Travel Limit Alarms	20	30	80 max.	X	X	X
Travel Limit Alarms without Transmitter	20	30	50 max.	X	– – –	X

X indicates this connection required.
1. Supply wire provides power supply positive connection for electronic circuits and relay coils (in instruments with travel limit alarms).
2. Signal wire provides connection for device receiving 4 to 20 mA transmitter signal.
3. Relay return wire provides separate return wire for relay coil currents.

Features (Continued)

- **Field Reversible Action**—The output is easily reversed in the field simply by switching two potentiometer leads on the printed wiring board.

- **Electromagnetic Interference (EMI) Filters**—Filters between the electronic compartment and the field wiring compartment of the housing help provide protection against electromagnetic interference.

Applications

Standard Position Transmitter

Sliding-Stem Valve—In typical valve applications, the transmitter is mounted on the actuator as shown in figure 1. Two linkage configurations sense up to 2 inches (51 mm) or up to 4-1/8 inches (105 mm) of stem travel. The linkages incorporate mechanical gearing to linearize the transformation from linear motion to rotational. To reduce the possibility of physical damage if the linkage should slip, the potentiometer has no physical stops. Zero and span can be adjusted as follows:

- *Zero*—Between 0 and 2 inches (51 mm) of travel, or between 0 and 4-1/8 inches (105 mm) of travel.

- *Span*—Between 1/3 inch (9 mm) minimum span and 2 inches (51 mm) maximum span, or between 2/3 inch (17 mm) minimum span and 4-1/8 inches (105 mm) maximum span.

Rotary-Shaft Valve—In typical valve applications, the transmitter is mounted on the actuator as shown in figure 2. A coupling connects the hub of the actuator to the potentiometer shaft. To reduce the possibility of physical damage if the coupling should slip, the potentiometer has no physical stops. Zero and span can be adjusted as follows:

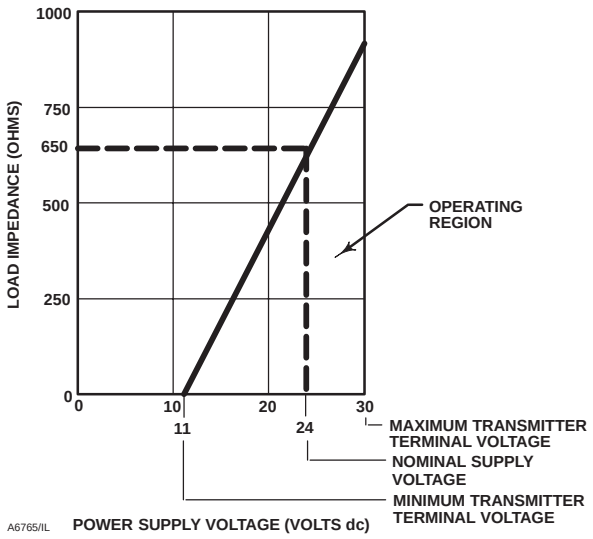

Figure 3. *Transmitter Load Limitations*

- *Zero*—Between 0 and 90 degrees of shaft rotation.

- *Span*—Between 15 and 90 degrees of shaft rotation.

Other Devices—The transmitter is mounted such that the potentiometer shaft or linkage aligns with the motion of the device. The motion of the device should not exceed the zero and span input signal limits in degrees of rotation.

Long-Stroke Position Transmitter

Long-Stroke Sliding-Stem Valve—The transmitter is mounted on the actuator as shown in figure 5. The cable/pulley assembly can sense from a 4-1/8 inch (105 mm) minimum to a 24-inch (610 mm) maximum stem travel. The sensing element is a multiturn potentiometer with physical stops. Two pulley sizes are used for long stroke applications.

- *Zero*—Between 0 and 12 inches (305 mm) for the small pulley. Between 0 and 24 inches (610 mm) for the large pulley.

- *Span*—Between 4-1/8 inches (105 mm) minimum and 12 inches (305 mm) maximum for the small pulley. Between 12 inches (305 mm) minimum and 24 inches (610 mm) maximum for the large pulley.

Other Devices—The transmitter is mounted such that the cable/pulley assembly aligns with the motion of the device to allow straight retraction of the cable to the pulley. The motion of the device should not exceed the zero and span limits in inches (mm).

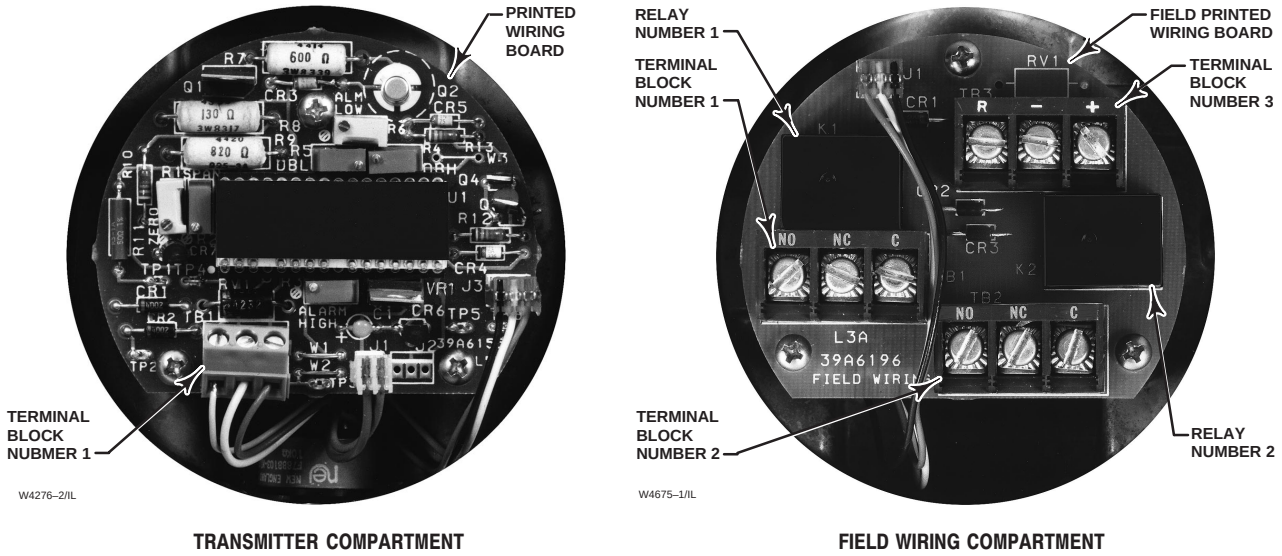

Figure 4. *Type 4210 Transmitter Details*

Installation

Field wiring is inserted into one of the ports and connected to the terminal blocks mounted on the printed wiring board in the field wiring compartment. The instrument with transmitter circuits and travel limit alarms, and the instrument with alarms only (no transmitter circuits), use terminal blocks numbered 1, 2, and 3 (see figure 4) on the printed wiring board. These terminal blocks are accessible when the field wiring compartment cover is removed. The instrument with transmitter circuits only (no alarms) uses a barrier strip mounted in the field wiring compartment without the printed wiring board. Dimensions of the transmitter housing are shown in figure 5.

Ordering Information

When ordering, specify:

1. Transmitter type number.

2. Actuator type, size, and length of stroke. (Note: For 490 Series actuators, specify yoke boss and cylinder size.)

3. Valve body design.

4. Other applications(1).

1. Contact your Fisher Controls sales office or sales representative for assistance in determining the type and style of linkage and mounting hardware required for the application.

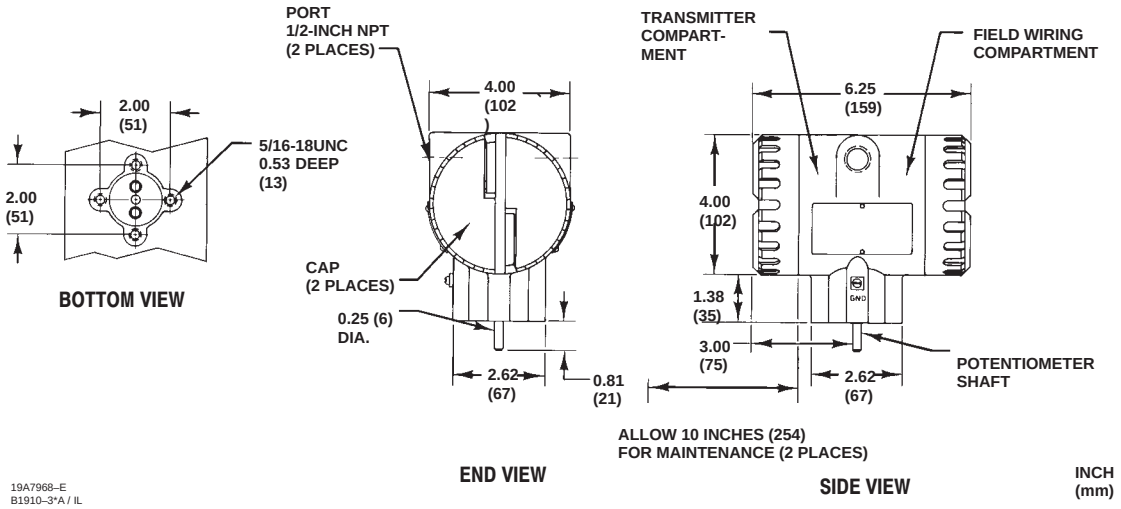

Figure 5. *Dimensions*

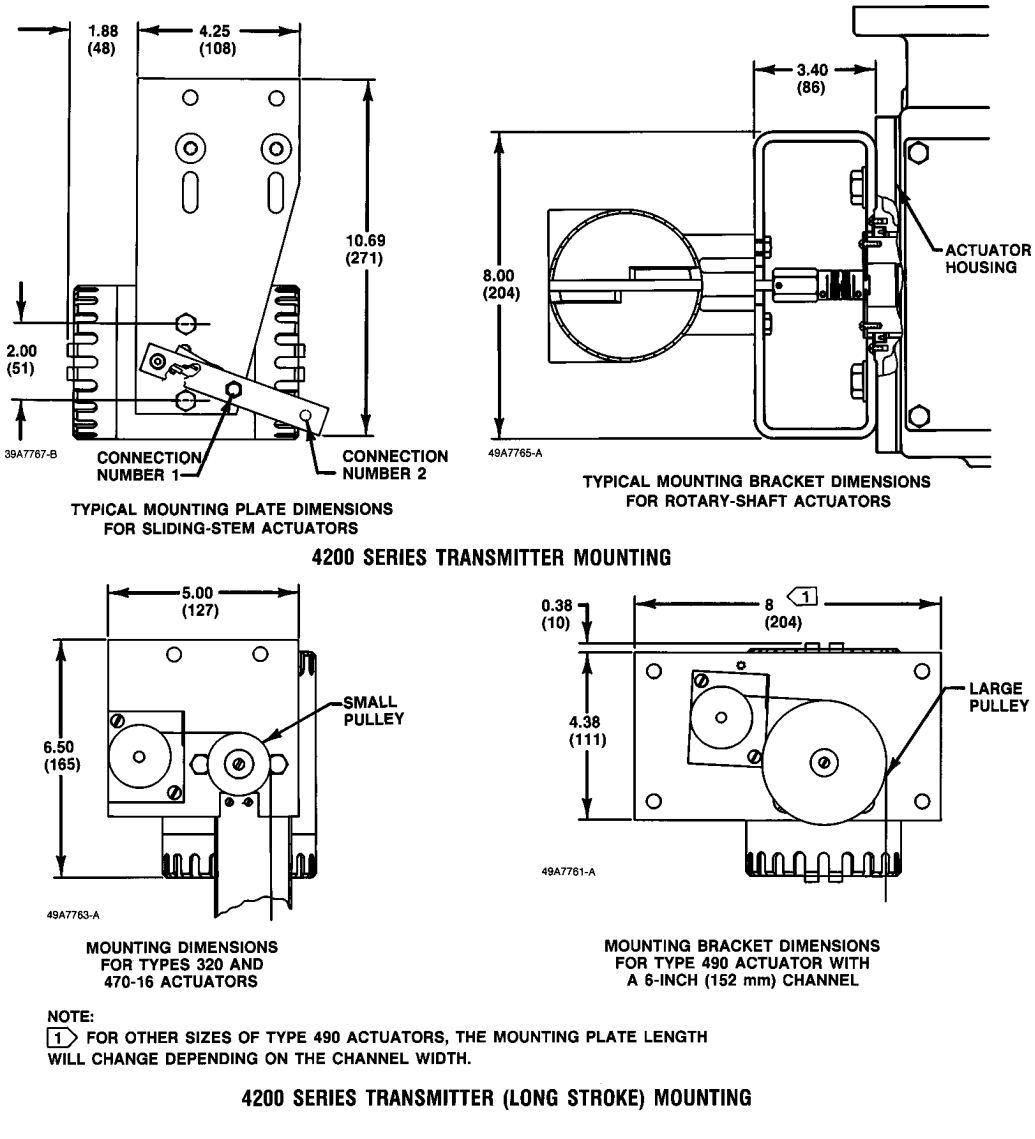

Figure 5. *Dimensions (Continued)*

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