STELLAR TECHNOLOGY INCORPORATED

TECHNICAL MANUAL

SERIES AP5201
In-Line DC Strain Gage Conditioner

ISO 9001:2000

237 Commerce Drive • Amherst, NY 14228 • USA
Tel: 716.250.1900 • ***Fax:*** 716.250.1909
Email: info@stellartech.com

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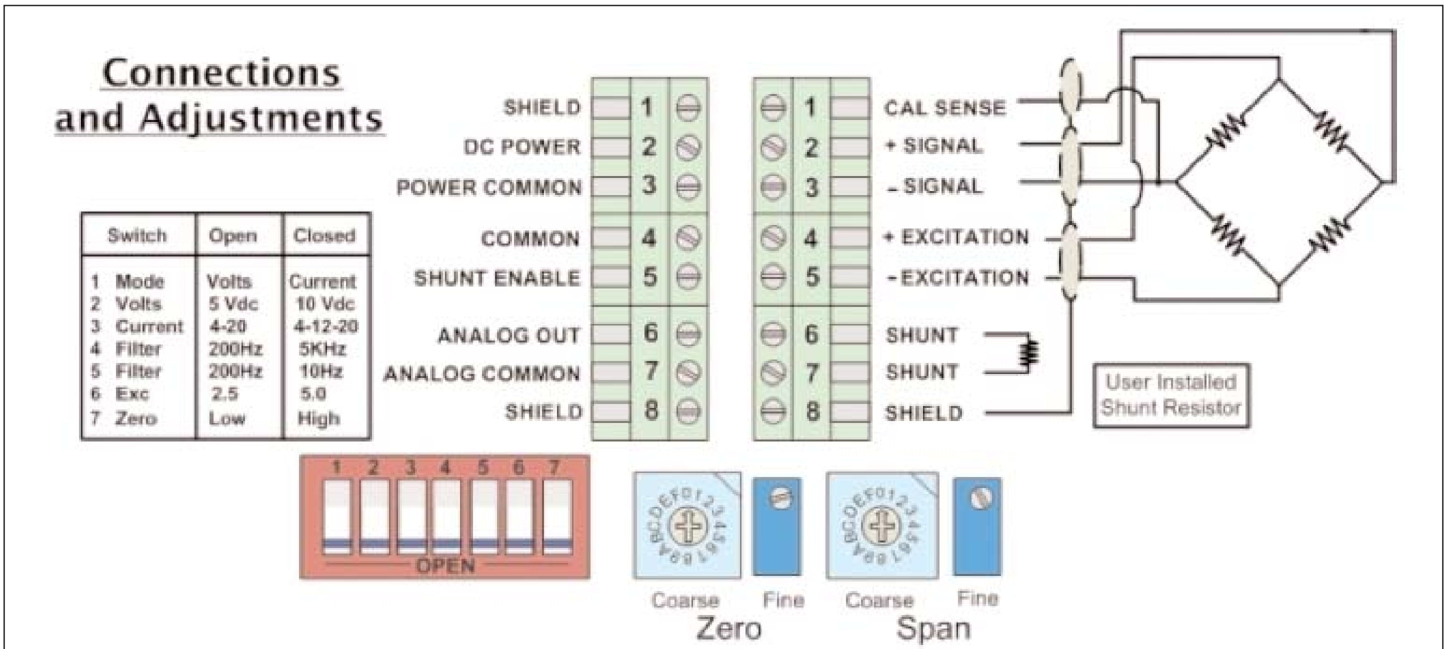
GENERAL DESCRIPTION AND SPECIFICATIONS

The Series AP5201 is a single-channel In-Line instrument which is easily configured, rugged, analog based signal conditioner made to operate with traditional Wheatstone mv/V stain gage bridge sensors used to measure force, pressure, torque and other DC strain gage related measurements. The Series AP5201 has an extremely wide DC power input range with user selectable gain, zero and analog output making it adaptable to any users sensor application that requires stable, repeatable and noise free analog signals for control or data acquisition.

The Series AP5201 is best calibrated by means of a “two-point (dead-weight)” or shunt-calibration technique, which is outlined in section three. The user supplied calibration resistor is installed as indicated below.



Access switch settings by removing the top cover of the case (4 phillips head screws) and position the switch settings per the application. Leave case open to access cable connections, calibration adjustments and shunt resistor (if required).

Top View of the Series AP5201 DC Strain Gage Module

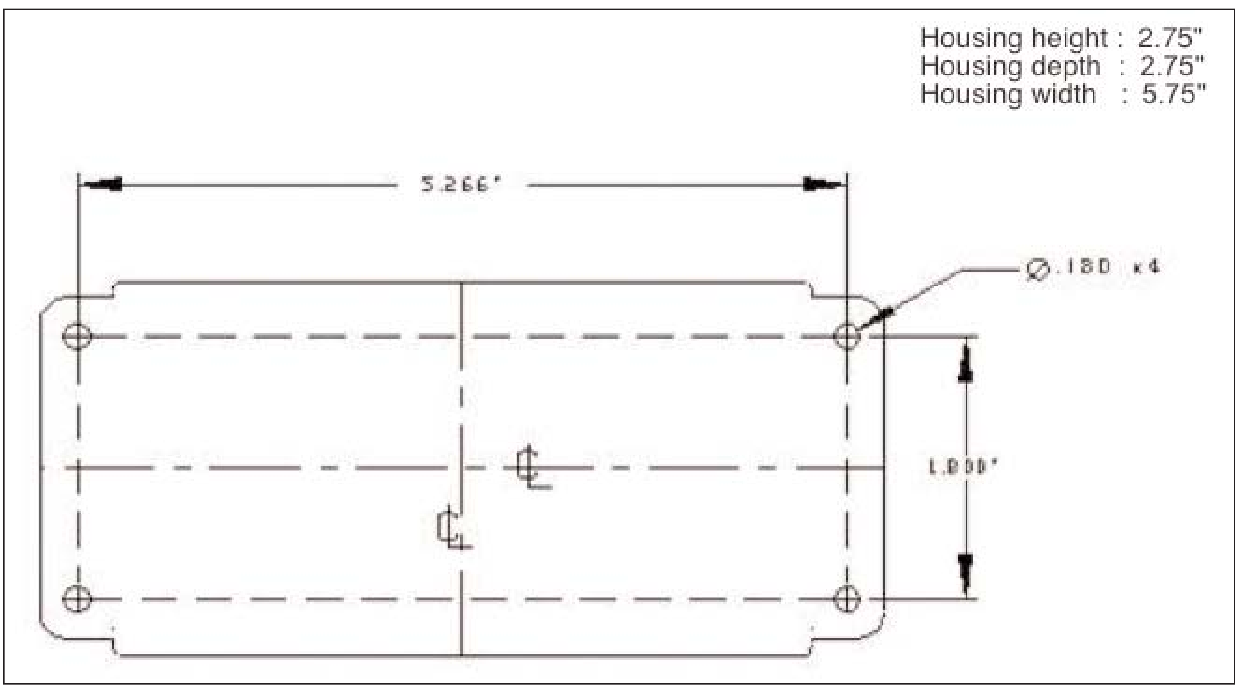
AP5201 SPECIFICATIONS

Measurement Range: Adjustable 0.5 mV/V to 10.0 mV/V; nominal full-scale
Transducer Types: Conventional 4-arm strain gage bridges, 120 to 10 k ohm
Excitation: 2.5 or 5.0, selectable - up to 70mA
Power Supply : 11 - 28 Vdc regulated; 100 mA max.
Analog Ouput : selectable ± 0 to 5, ± 0 to 10 Vdc, 4-12-20 or 4-20mA
(20% over-range, voltage only)
Operating Temperature : -10 to +70 Degrees C, 5 to 95% relative humidity, non-condensing

Amplifier
Common - Mode Range : ± 3 V operating; ± 30 V without instrument damage
Common - Mode Rejection Ratio : - 60 dB @ 1/2 excitation
Input Impedance : Differential and Common-Mode > 10,000 MΩ
Offset : user adjustable; vs. Temperature: ±30 ppm /°C; vs. Time: ±10 ppm/month
Gain Accuracy : Limited only by calibration accuracy
Gain Stability : vs. Temperature: ±30 ppm/°C; vs. Time: ±10 ppm/month

Filter: 3-pole modified Butterworth; 3 dB down at 10 Hz, 200 Hz or 5 kHz; selectable
Step-Response Settling Time (Full-Scale Output @ 10 Hz):
To 1% of final value: 0.120 sec; (0.060 sec @ 200 Hz) (0.002 sec @ 5 KHz)
To 0.1% of final value: 0.160 sec; (0.080 sec @ 200 Hz) (0.004 sec @ 5 KHz)
To 0.02% of final value: 0.250 sec; (0.012 sec @ 200 Hz) (0.008 sec @ 5 KHz)

Dimensions



TRANSDUCER CONNECTIONS

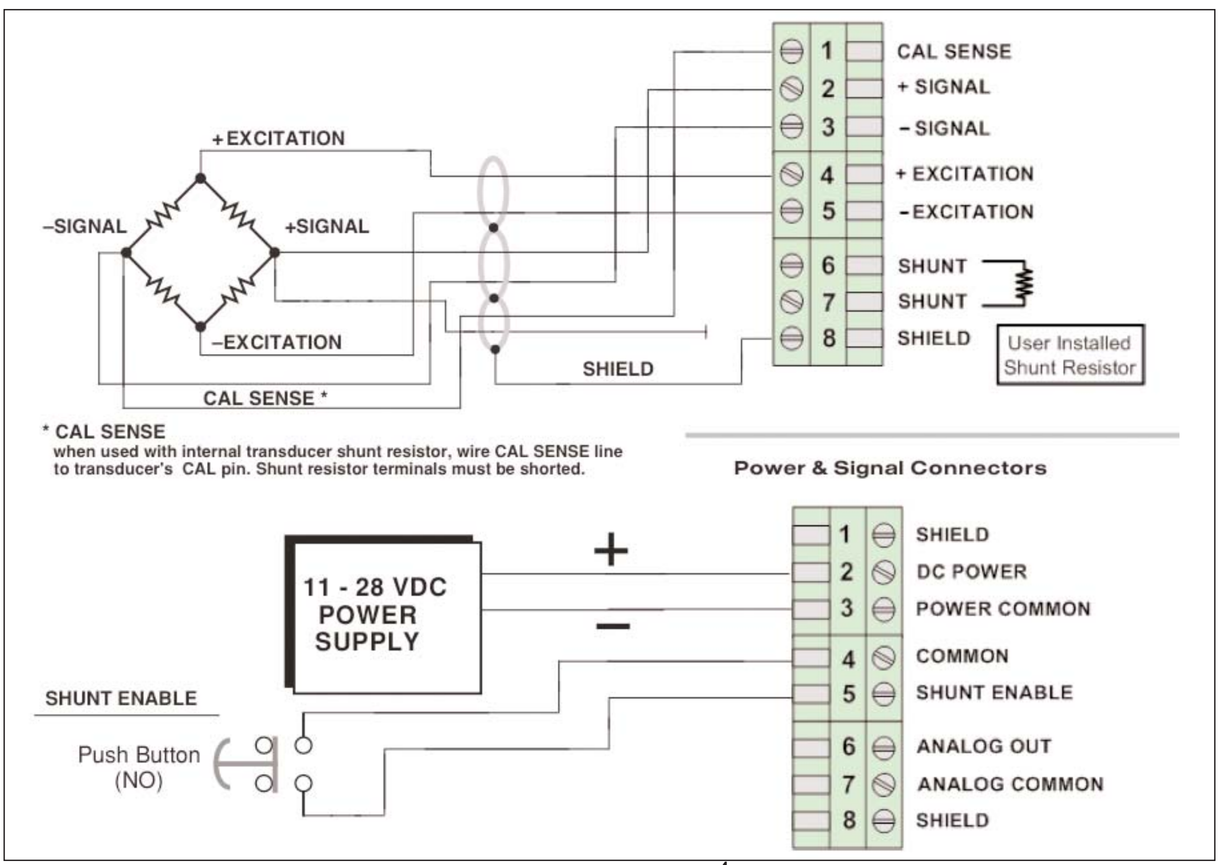
The Series AP5201 I/O CONNECTIONS are via non-removable screw terminals which will accept wire sizes from AWG 12 to 26.

NOTE: The recommended transducer cabling would be six wire, individually shielded, twisted pair - wired as indicated (Fig. 1) The AP5201 does not contain external sensing wires for the excitation lines. It is recommended that the AP5201 is mounted near the sensor to minimize errors due to cable length.

Table 2 Series AP5201 Pin Assignments

I/O Connector Screw Terminal	Terminal Label	Conditioner Line Function
1	SHIELD	EARTH SHIELD
2	DC POWER	11 - 28 Vdc INPUT POWER
3	POWER COMMON	POWER SUPPLY COMMON
4	SHUNT COMMON	SHUNT COMMON (FIG. 3)
5	SHUNT ENABLE	SHUNT SWITCH ENABLE
6	ANALOG OUT	+ SIGNAL OUTPUT
7	ANALOG COMMON	- SIGNAL OUTPUT
8	SHIELD	EARTH SHIELD
1	CAL SENSE	CALIBRATION SENSE LINE
2	+ SIGNAL	+ SIGNAL FROM SENSOR
3	- SIGNAL	- SIGNAL FROM SENSOR
4	+ EXCITATION	+ POWER TO SENSOR
5	- EXCITATION	- POWER TO SENSOR
6	SHUNT	SHUNT CALIBRATION RESISTOR
7	SHUNT	SHUNT CALIBRATION RESISTOR
8	SHIELD	SHIELD

Figure 1- Series AP5201 Transducer Cabling



CALIBRATION

Calibration of the AP5201 is accomplished by the conventional shunt technique, using an internally installed calibration resistor, or via the "dead-weight" method.

Calibration Resistor.
If a fixed resistor is shunted across one arm of a strain gage bridge, it produces an unbalance equivalent to that of a particular value of mechanical input. If this Equivalent Input value is accurately known, it can be used as a reference point for shunt calibration of the system. Upon completion of installation of the transducer and its associated cabling, the user can:

1. Perform an overall dead weight calibration using a precisely known value of mechanical input. The calibration can then be transferred to the installed calibration resistor for convenience in subsequent checking.

2. Replace the installed calibration resistor with one (or an equivalent resistance value) supplied by the transducer manufacturer to achieve a precisely known Equivalent Input allowing the instrument sensitivity to be adjusted correctly.

3. Determine the Equivalent Input value for the installed calibration resistor, knowing the transducer sensitivity, and adjust the instrument sensitivity accordingly.

   Note: A variety of DC Load Cells and Slip Ring Torque Transducers are supplied with the appropriate calibration resistor integral to the transducer. When this type of transducer is used it will be necessary to place a short across the Shunt terminals internal to the instrument. The transducer calibration resistor can be appropriately connected to the AP5201 calibration circuit via the transducer cabling. Refer to cabling diragam section of this manual in the area of CAL SENSE.

CALIBRATION (cont.)

This section contains the instructions for calibrating the AP5201. Included is a functional description of the instrument front-panel (see Figure 2). To perform calibration, proceed as follows with the sensor or calibration standard connected.

A. Turn power ON to the AP5201 DC Power input terminal (11 to 28 Vdc input) The front-panel indicator should light green to indicate the application of dc power. Allow 10 minutes of warmup for stabilization of transducer characteristics. Set the Coarse Zero and Span controls to the "0" position.

B. Set the Fine ZERO, Fine SPAN, and SYMMETRY controls fully counter-clockwise.

C. Position the front panel switches to the desired settings for the application. Refer to Fig. 2 for details. Connect readout device (i.e. voltmeter) to ANO & A Common.

D. With the transducer unloaded, adjust the Coarse Zero and the Fine Zero control until the desired analog output is achieved. If greater zero authority is desired, place the front panel Switch 7 - "Zero Adj" to the extended range. This will allow the user to obtain 100% zero offset control. The Normal postion of switch 7 allows for approx. 20% Zero authority.

E. Apply a known dead weight value which is greater than one half of full scale in the positive direction or activate the "SHUNT" terminal (shunt positive) by connecting "SHUNT" to "Comon" as described in Fig. 3. Adjust Coarse Span to obtain your nominal full scale analog output. Use Fine Span control to adjust the signal to the precise value required (i.e. 10.000 Vdc for full scale or a value that correspondes to the appropriate Shunt Calibration value). Unload the transducer and check "Zero" and adjust as necessary. Repeat Span load and verify values.

F. Repeat step (e) as needed to obtain analog output precision. Note that any Span (gain) will effect the Zero (balance) value.

Note: When completed, replace the plastic front cover to its original position and ensure connections and proper shielding to the module are correct.When appling the SHUNT resistor value for calibration, the sensor should be in an "unloaded" condition.

CALIBRATION (cont.)

If the transducer calibration is unknown, the following calculation is useful to calculate an Equivalent Input value for a 59k Ohm shunt resistor. This will approximate the value assuming that the mV/V sensititivity and bridge resistance of the sensor are known.

$$X = \frac{25000\,R_b}{K\,R_c}$$

where X = Equivalent Input, % of full scale

R_b = bridge resistance, ohms

K = transducer sensitivity, mV/V full scale

R_c = calibration resistance, ohms (59 k installed)

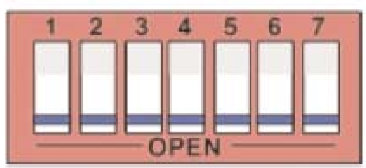
Sample Calculation: Assume that K = 3.000 mV/V for a 5000-pound loadcell (fullscale) with a bridge resistance of 350 ohms.

$$X = \frac{25000 \times 350}{59000 \times 3} = 49.4\%$$ of full scale = 2472 pounds

Figure 2 - Front Panel Settings and Indicators

Switch	Open	Closed
1 Mode	Volts	Current
2 Volts	5 Vdc	10 Vdc
3 Current	4-20	4-12-20
4 Filter	200Hz	5KHz
5 Filter	200Hz	10Hz
6 Exc	2.5	5.0
7 Zero	Low	High

Switch is in the "OPEN" position when the rocker is depressed down (inward) to the OPEN direction



Switch 1 - Mode - selects current (I) or voltage analog output
Switch 2 - Volts - selects +/- 5 or +/- 10 Vdc when mode is voltage
Switch 3 - Current - selects 4-12-20 or 4-20mA when mode is current
Switch 4 - Filter - selects 5 kHz or 200 Hz at 3 dB, for 200 Hz switch 5 must be set Open
Switch 5 - Filter - selects 10 Hz or 200 Hz at 3 dB, for 200 Hz switch 4 must be set Open
Switch 6 - Excitation - selects excitaton level, 2.5 or 5.0 Vdc - effects mv/V gain
Switch 7 - Zero Adj. - selects extended (100%) or normal (20%) zero authority

Coarse Zero - 16 position switch adjustment for stepped zero balance control
Fine Zero - 18 turn potentiometer for fine zero balance control

Coarse Span - 16 position switch adjustment for stepped gain control
Fine Span - 18 turn potentiometer for fine gain - span control

Power - indicates the power input votlage is ON

VERIFICATION OF NORMAL OPERATION

It is the purpose of this section to aid the user in determining, in the event of a malfunction to which the Series AP5201 is suspected of contributing, whether the instrument is functioning normally or whether it is the source of the observed trouble. In the event the unit requires repair, the user may also contact the factory Service Department or the local STI Representative for assistance. STI service information is located on the last page of this document.

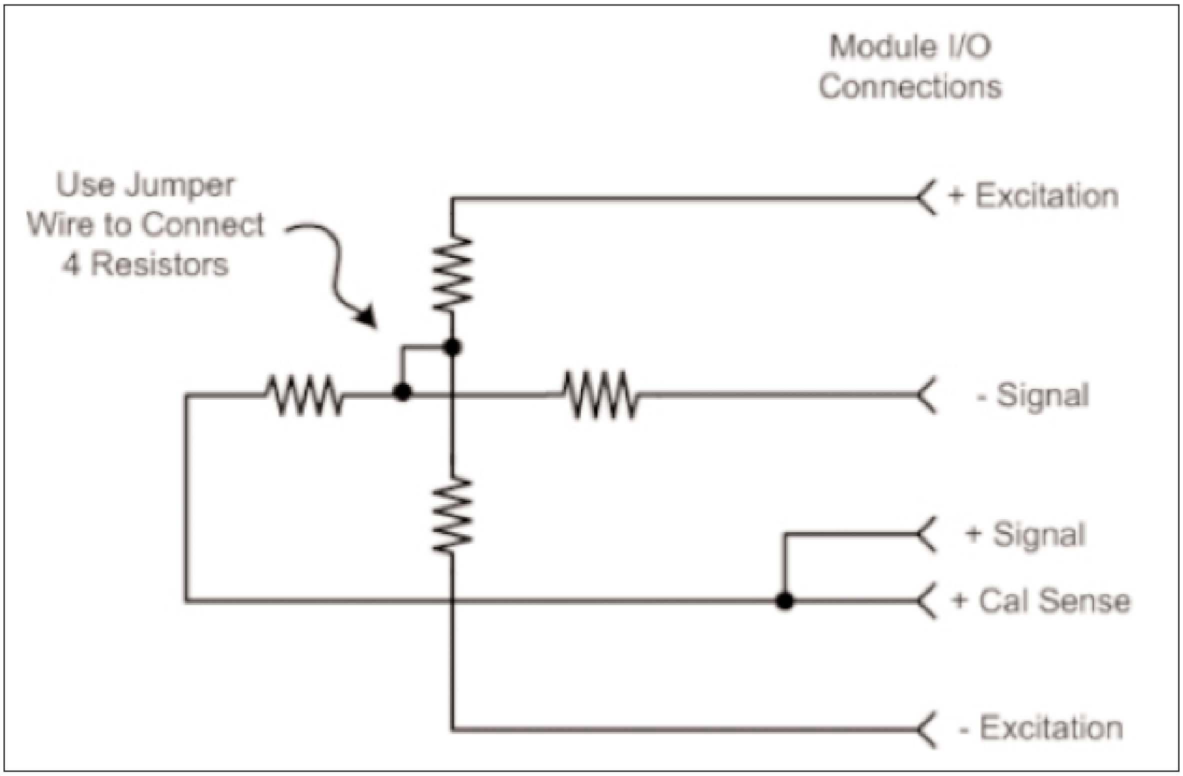
If the instrument is suspected of faulty operation, observe the following steps.

A. If the unit is totally inoperational (internal green power indicator does not light), check the primary power input terminals for proper connection. Input power can be from 11 to 28 Vdc and will draw less than 100ma. If properly connected, the internal Green LED will be illuminated. Before reapplying power, visually inspect the power supply and the input power connections for any discrepancy which could have caused the overload.

B. If the transducer has some preloading, the BALANCE controls may not allow successful zeroing of the instrument output. This condition can be remedied by connecting a resistor (50 k- 200 k range, metal-film type) from the +Signal terminal of the transducer to the + or –Excitation terminals. The Excitation terminal to which the connection is made is determined by the direction of the loading or off-zero reading.

C. The inability to balance correctly, where the instrument output reads totally off scale and the BALANCE controls have no authority, can very likely be the result of a damaged or defective transducer or cable. This possibility can be confirmed (or eliminated) by substituting a transducer and cable known to be in good condition or by simulating a balanced transducer, using either a commercially available transducer simulator or the simple star bridge arrangement shown in Figure 7. The star bridge simulates a conventional four-arm bridge in an exact condition of balance. To construct a star bridge, connect four 10% carbon resistors as shown in Figure 5. Use 180-ohm resistors to simulate a 350-ohm bridge and use 56-ohm resistors to simulate a 120-ohm bridge. Neither the resistor values nor temperature characteristics are critical since the balance condition of a star bridge is not determined by the resistance values. Solder two resistors together, then solder the remaining two resistors together. Next, connect the two junctions together using a separate wire as shown. There is a good reason for this method of construction, and it should be followed. Connect the substitute or simulated transducer to the instrument I/O connector using a short 4-wire cable configuration as shown in Figure 4. Attempt to balance the substitute simulated transducer. If conditions now appear to be normal, the transducer or cable is at fault. If the previous difficulties persist, the AP5201 may be faulty.

Figure 4 - Star Bridge



WARRANTY: Stellar Technology warrants that its product shall be free from defective workmanship and/or material for a twelve month period from the date of shipment, provided that Stellar Technology's obligation hereunder shall be limited to correcting any defective material FOB our factory. No allowance will be made for any expenses incurred for correcting any defective workmanship and/or material without written consent by Stellar Technology. This warranty is in lieu of all other warranties expressed or implied.