PCB PIEZOTRONICS
AN AMPHENOL COMPANY

Model 8159-0045B

Load cell panel meter

Installation and Operating Manual

**For assistance with the operation of this product,
contact the PCB Piezotronics, Inc.**

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MANUAL NUMBER: 23865
MANUAL REVISION: K
ECO. NO. 54396 11/22/23

1.0 DESCRIPTION

The Series 8159 is a microprocessor-based digital indicator capable of interfacing directly to low level strain gage transducers. An internal, high gain, fully differential amplifier and a 4-½ digit analog-to-digital converter combine to accurately digitize the input signal. A 5V @ 60mA or 10V @ 120mA, short circuit protected, transducer excitation supply is also provided. A +/- 10VDC analog output signal, with a 1kHz bandwidth, comes standard with the instrument. A 4-20 mA analog output signal is also standard with the instrument. A front panel RCAL switch provides a convenient calibration feature. TARE and CALIBRATION are easily performed via front panel pushbuttons.

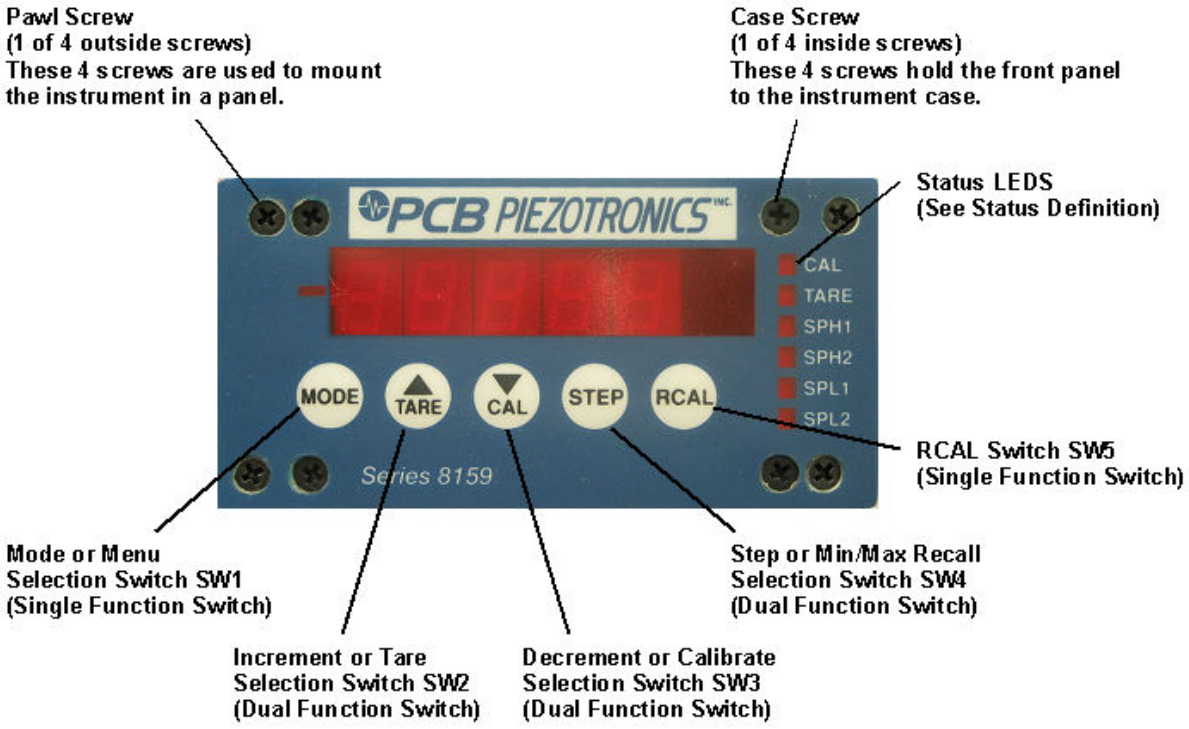


Figure 1 - Series 8159 Front Panel View

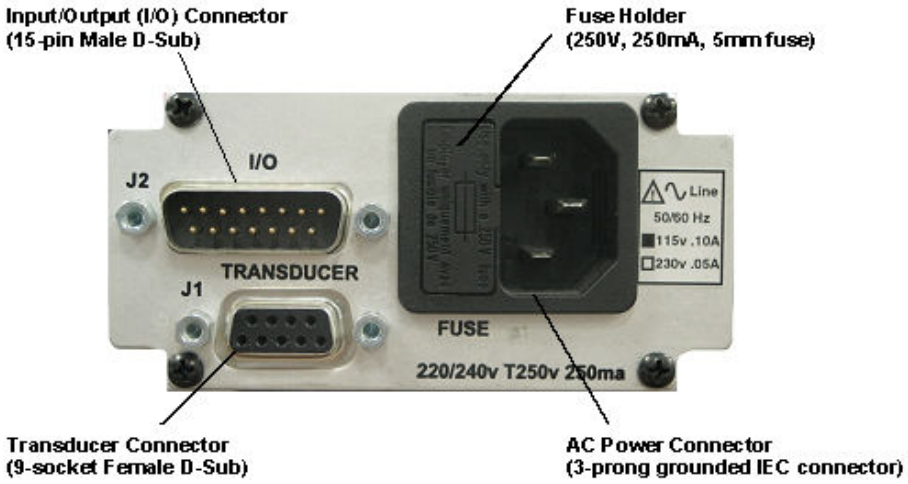


Figure 2 - Series 8159 Rear Panel View

2.0 INSTALLATION

The Series 8159 enclosure is designated for panel mounting in a 1/8 DIN cutout. The cutout dimensions are shown below.

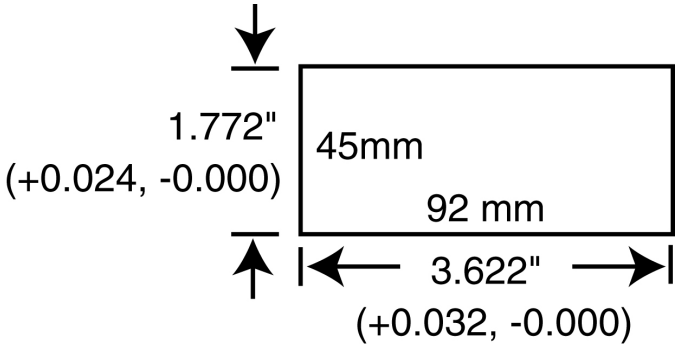


Figure 3 - Panel Mounting Cutout Dimensions

To panel mount the 8159, perform the following steps:

1. Rotate the four pawl screws (outside screws in each corner) several turns counter-clockwise to retract the pawls. Make sure the pawls retract enough to clear the back of the mounting panel. The pawls may be retracted to accommodate panel thickness up to 0.25 inches (6.35mm).

2. Insert the instrument into the panel cutout.

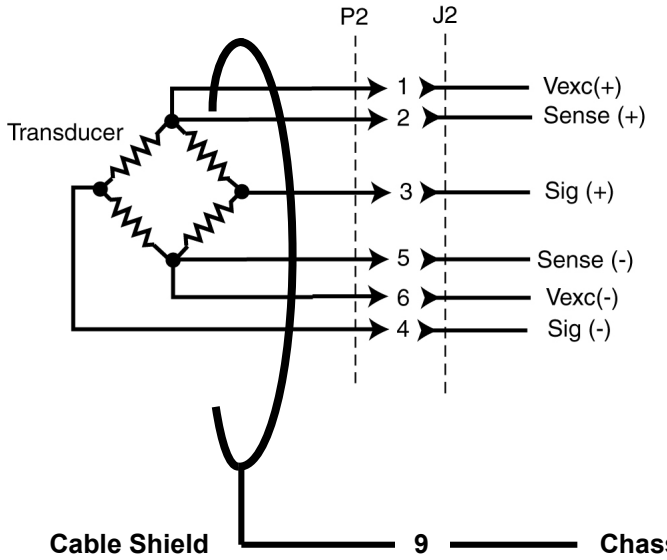
3. Position the pawls so that their elongated dimension overlaps the panel cutout, then tighten the screws. Do not over-tighten.

4. Installation complete.

3.0 WIRING

Reference Figures 4 and 5 for TRANSDUCER and INPUT/OUTPUT (I/O) wiring information. Power is applied with a 3-prong AC power cord. The instrument is protected by a 250V, 250mA fast acting 5mm fuse. The fuse holder is an integral part of the input power connector. A spare fuse is provided in the fuse holder. Internal solder jumpers are provided to allow 115VAC or 230VAC operation (Reference Figure 8).

⚠ **Warning:** Remove AC power to the 8159 meter before changing the fuse.



CE **The cable shield must connect directly to an RFI/EMI rated connector hood instead of pin 9. The shield must make a 360 degree bond to the connector hood at the cable entry.**

Figure 4 - Transducer Wiring

It is recommended that the sense leads be used with cable lengths longer than 20 feet. The excitation voltage is then sensed and regulated at the transducer for optimum shunt calibration. Consult factory for cable lengths over 100 feet.

⚠ **Warning:** Remove AC power to the 8159 meter before removing any enclosure panels or making any internal adjustments or changes.

To enable or disable the sense lead setting, perform the following:

1. Open the back panel of the meter case by removing the four (4) screws located in the corners of the panel face.
2. Expose the connector circuit board located on the back of the back panel.

NOTE: For newer units, the boards use R2 and R3 instead of JP2 and JP3.

3. Remove the solder jumpers from JP2 and JP3 to ENABLE sense lead setting.
4. Solder the JP2 and JP3 jumpers to DISABLE the sense lead setting.
5. Close the back panel of the meter case by fastening the panel face at each corner with the four (4) screws.

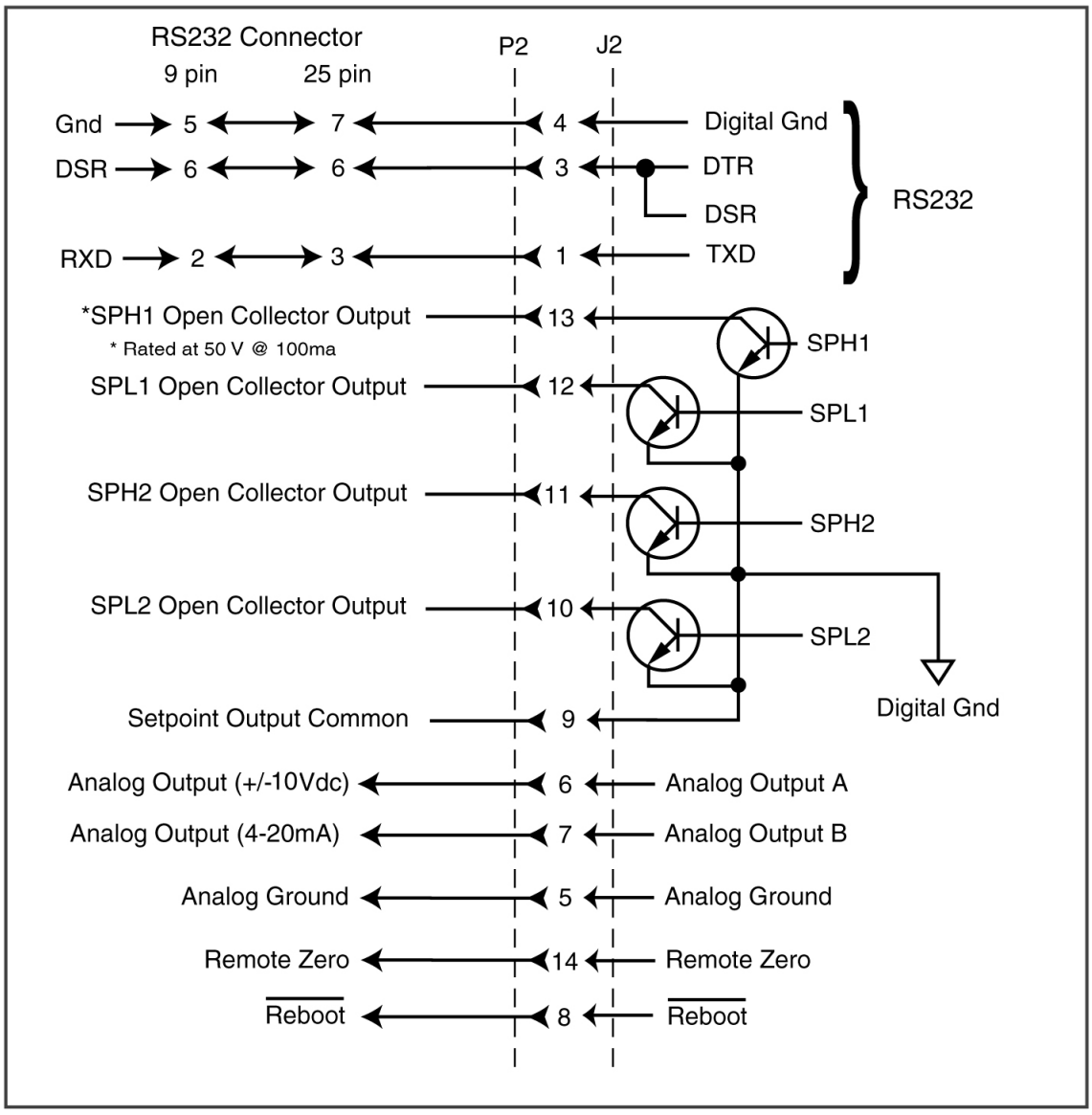


Figure 5 - Input/Output (I/O) Wiring

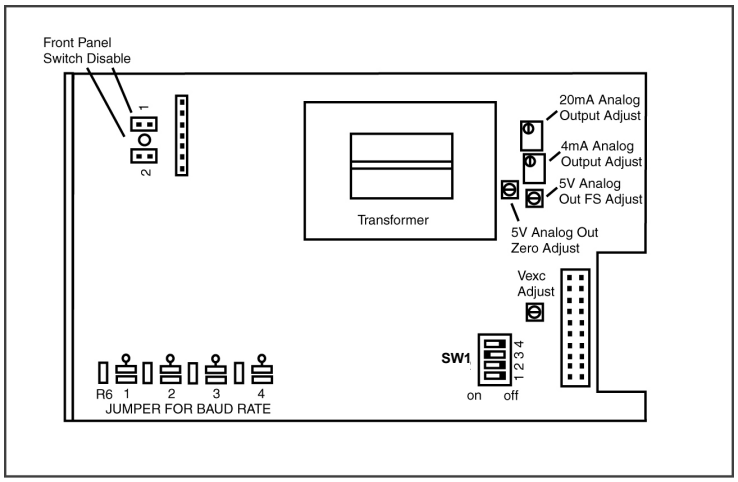


Figure 6 - Location of Jumpers and Potentiometers (Top View)

⚠ **Warning:** Remove AC power to the 8159 Meter before removing any enclosure panels or making any internal adjustments or changes.

	Switch 1	Switch 2	Switch 3	Switch 4	Switch 5
Bridge Excitation					
5.0 V_{EXC}	ON				
10.0 V_{EXC}	OFF				
Full-Scale Input					
1.5 mV/V		ON	ON	OFF	
2.5 mV/V		OFF	ON	OFF	
3.5 mV/V		ON	OFF	OFF	
4.5 mV/V		OFF	OFF	OFF	

Figure 7 - SW1 Switch Settings

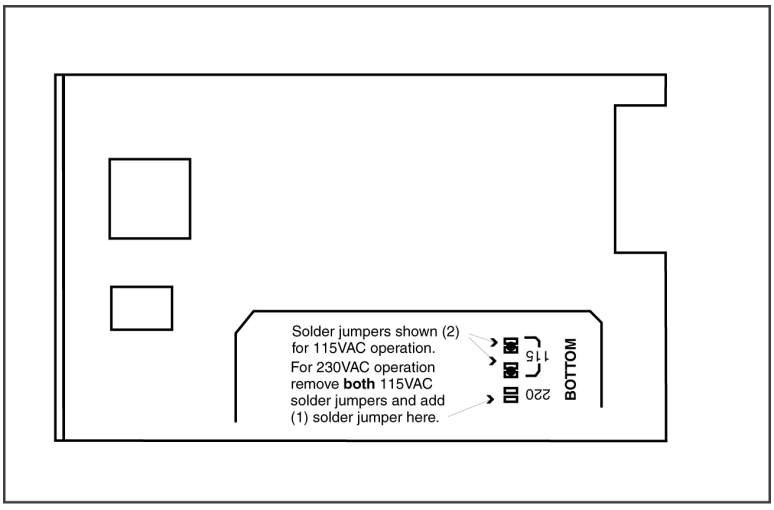


Figure 8 - Location of Jumper (Bottom View)

Warning: Remove AC power to the 8159 meter before removing any enclosure panels or making any internal adjustments or changes.

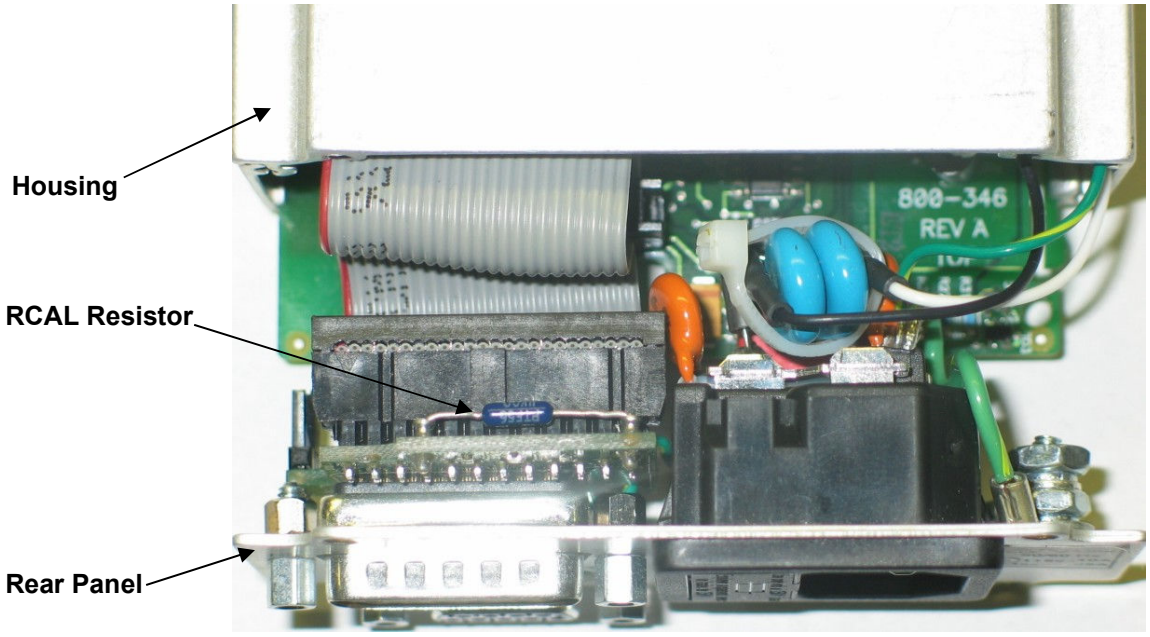


Figure 9 - Location of RCAL Resistor (Top View)

Warning: Remove AC power to the 8159 meter before removing any enclosure panels or making any internal adjustments or changes.

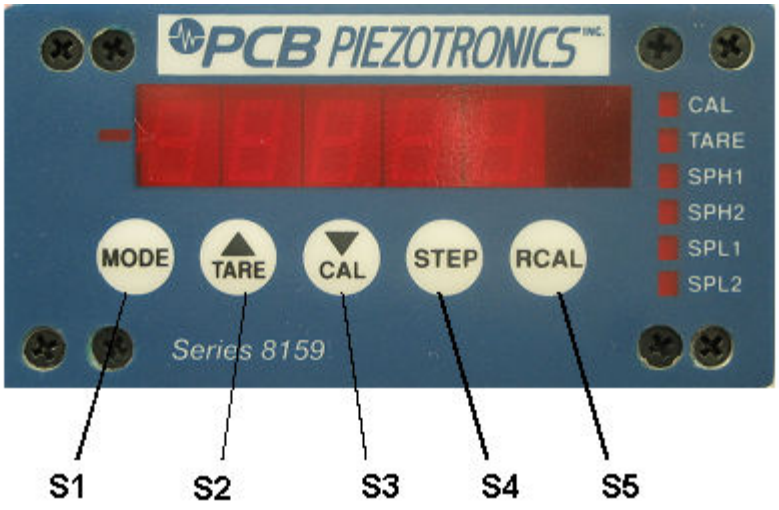


Figure 10 - Front Panel Switches

4.0 SWITCH DEFINITIONS

Mode Selection Switch (S1)

S1 is used to cycle through the various set points, Hysteresis, and calibration values and decimal point locations. The sequence is as follows. The designators, in parenthesis, identify text that will be displayed, momentarily, followed by the value.

Set Point High 1 (SPH1)
Set Point Low 1 (SPL1)
Set Point High 2 (SPH2)
Set Point Low 2 (SPL2)
Hysteresis High (HH)
Hysteresis Low (HL)
Auto Cal (CAL)
Decimal Point (dP)
Exit

While in the Mode Selection sequence, the indicator is no longer monitoring the input signal. To exit, depress S1, once, after the Decimal Point selection is completed.

Increment Switch (S2)

This switch serves two functions, depending on the present status of S1. If the instrument is in the Mode Selection sequence, this switch increments the flashing digit.

If the instrument is in its normal operating mode, S2 becomes the TARE switch. If the TARE LED, located on the front panel, is not illuminated, depressing S2 once will automatically zero the readout and illuminate the TARE LED. Depressing S2 again will UNTARE the readout and extinguish the TARE LED. TARING is accomplished by storing the reading prior to TARING and subtracting this value from all subsequent readings. It does not alter the calibration of the instrument. A remote tare function is available. See Section 6.0.

Decrement Switch (S3)
This switch serves two functions, depending on the present status of S1. If the instrument is in the Mode Selection sequence, this switch will decrement the flashing digit.

If the instrument is in its operating mode, S3 becomes an AUTO CAL switch.

CAUTION: *Depressing this switch will cause the instrument to recalibrate its full-scale reading. Be sure to read the CALIBRATION INSTRUCTIONS before using this switch.*

Step Switch (S4)
This switch also serves two functions, depending on the present status of S1. If the instrument is in the Mode Selection sequence, this switch allows the user to cycle through the digits. Used in conjunction with S2 and S3, it allows rapid updating of the Set Point, Hysteresis and Cal values.

RCAL Switch (S5)
This switch activates a reed relay that places a precision calibration resistor across Sig(-) and Vexc(-) for a positive RCAL reading, or across Sig(+) and Vexc(-) for a negative RCAL reading.

The calibration resistor is pre-installed at the factory when the conditioner is purchased with a sensor as part of a system. The resistor is mounted on terminals located inside the back panel of the conditioner. Removing the back panel can access it. See Figure 9.

Front Panel Switch Disable Jumper (Reference Figure 6)
This jumper, when removed, disables S1, S2, S3 and S4.

5.0 FUNCTION DEFINITIONS

Set Point High 1 (SPH1)
SPH1 is the present value being constantly compared with the displayed reading. If the magnitude and sign of the reading exceeds the present SPH1 value, the SPH1 relay will activate (relay option assembly required) and the front panel LED (H1) will illuminate. If the displayed reading equals the SPH1 value, nothing will happen. If SPH1 is exceeded, the readout must then drop below SPH1 less the Hysteresis High (HH) value before the relay deactivates and the H1 LED turns off.

Set Point Low 1 (SPL1)
SPL1 is another preset value being constantly compared with the displayed reading. If the magnitude and sign of the displayed reading is less than the SPL1 present value, the SPL1 relay will activate (relay option assembly required) and the front panel LED (L1) will illuminate. If the displayed reading equals the SPL1 value, nothing will happen. If the displayed reading drops below SPL1, it must then exceed SPL1 plus the Hysteresis Low (HL) value before the relay deactivates and the L1 LED turns off.

Set Point High 2 (SPH2)
SPH2 is independent and functions identically to SPH1. SPH2 has its own relay contact outputs and front panel LED (H2).

Set Point Low 2 (SPL2)
SPL2 is independent and functions identically to SPL1. SPL2 has its own relay contact outputs and front panel LED (L2).

Hysteresis High (HH)
HH is the hysteresis value for SPH1 and SPH2. The hysteresis value determines the number of counts the displayed reading must fall below SPH1 and SPH2 values before deactivating their respective relays and LEDs. The maximum value of hysteresis is 99 counts while the minimum is 00 counts.

Hysteresis Low (HL)
HL is the hysteresis value for SPL1 and SPL2. The hysteresis value determines the number of counts the displayed reading must exceed SPL1 and SPL2 values before deactivating their respective relays and LEDs. The maximum value of hysteresis is 99 counts while the minimum is 00 counts.

Auto Cal (CAL)
This input allows the user to calibrate the full-scale readout to any desired engineering points. The CAL number is entered in the same way as the Set Point and Hysteresis values. This input must be entered prior to performing the calibration. The CAL number may be any number from 1 to 99,999. Zero is an invalid CAL number. For best stability and performance. Keep the maximum CAL number below 19,999 counts.

Decimal Point (dP)
dP allows selection of decimal point locations for display. The locations selectable are X.XXXX, XX.XXX, XXX.XX, XXXX.X, XXXXX.

Min./Max. Recall (HI/LO)
The HI and LO values are the maximum and minimum values, respectively, of the displayed readings. Sign and magnitude are constantly compared with the displayed readings at the instrument update rate. The maximum value is initialized to –99,999 and the minimum value to 99,999.

6.0 OPERATING INSTRUCTIONS

TURN-ON INSTRUCTIONS
Reference Figures 4 and 5 for proper input and output signal wiring.

1. Apply power to the instrument.

2. Verify the instrument readout blanks momentarily, then displays the value of the input signal.

3. Allow 30-minute warm-up with transducer connected.

PROGRAM INSTRUCTIONS

Four front panel switches (S1, S2, S3, S4) allow the user to program Set Point, Hysteresis, Calibration Number (CAL) and Decimal Points and monitor minimum, maximum or real time values.

1. Depress MODE (S1) switch once. The text SPH1 followed by the current value of Set Point High 1 (SPH1) will be displayed. The system will idle in this condition until S2, S3, or S4 is depressed. If S2 or S3 is depressed, the most significant digit will be incremented or decremented, respectively. Incrementing the most significant digit will display numbers from –9 to 9.

   Depressing S4 will cause selection of the next least significant digit position for updating. The digit being updated will be flashing. Using S2, S3, and S4, set Set Point High 1 to the desired value.

2. Depress MODE (S1) switch once. The text SPL1 followed by the current value of Set Point Low 1 will be displayed. Repeat Step 1 to set Set Point Low 1 to the desired value.

3. Depress MODE (S1) switch once. The text SPH2 followed by the current value of Set Point High 2 will be displayed. Repeat Step 1 to set Set Point High 2 to the desired value.

4. Depress MODE (S1) switch once. The text SPL2 followed by the current value of Set Point Low 2 will be displayed. Repeat Step 1 to set Set Point Low 2 to the desired value.

5. Depress MODE (S1) switch once. The text HH followed by the current value of Hysteresis High will be displayed. Repeat Step 1 to set Hysteresis High to the desired value. The maximum value for HH is 99 counts.

6. Depress MODE (S1) switch once. The text HL followed by the current value of Hysteresis Low will be displayed. Repeat Step 1 to set Hysteresis Low to the desired value. The maximum value for HL is 99 counts.

7. Depress MODE (S1) switch once. The text CAL followed by the current CAL number will be displayed. Repeat Step 1 to set the CAL number. The maximum CAL number is 99,999.

8. Depress MODE (S1) switch once. The text dP followed by the current decimal position will be shown flashing. Increment (S2) or decrement (S3) the decimal point to the desired location.

9. Depress MODE (S1) switch once. The instrument will exit the Mode Selection Sequence and enter the normal operating mode (i.e. monitoring the input signal).

This is the end of the PROGRAM INSTRUCTIONS.

REMOTE TARE (ZERO)
Remote zero will tare out any residual value, such as that caused by fixturing a load cell into a test stand. It is activated by momentarily connecting pin 14 to pin 5 on the 15-pin I/O connector J8.

REMOTE REBOOT
This feature is used to clear the high or low set points if required. It is activated by momentarily connecting pin 8 to pin 5 on the 15-pin I/O connector J2.

7.0 CALIBRATION INSTRUCTIONS

The Series 8159 can be calibrated using (2) different methods. The first method uses actual or simulated ZERO and FULL SCALE (FS) inputs. Actual inputs may come from a strain gage transducer loaded with calibrated weights. Simulated inputs may come from a strain gage bridge simulator. The second method utilizes an RCAL resistor to simulate a load on a strain gage bridge. The RCAL resistor is activated when the RCAL (S5) switch is depressed. Reference Figure 10 for location of S5.

ACTUAL LOAD OR BRIDGE SIMULATED METHOD

1. Connect the strain gage transducer to the instrument using Figure 4 as a reference. Do not apply any load to the transducer.

2. Apply power to the instrument.

   NOTE: If the instrument was previously calibrated and no new calibration is required, do not proceed any further. All previous calibration information is stored in non-volatile EEPROM and is ready for use when power to the instrument is reapplied.

3. Calculate the CAL NUMBER by verifying the load that will be used to calibrate the full scale of the Series 8159.

   Example: If a 500-pound load is used to calibrate full scale and the desired readout is 500.0, the CAL NUMBER will be 5000. The decimal point can be selected later. If the desired readout is 500 then the CAL NUMBER will be 500.

4. Program in the CAL NUMBER. Reference PROGRAM INSTRUCTIONS, Step 7. If the CAL NUMBER was previously programmed, skip this step.

5. The TARE and CAL LED's on the front panel should be illuminated.

6. Depress the INCREMENT (S2) switch and hold until the TARE LED extinguishes. The instrument should now display the UNTARED reading.

7. Depress the DECREMENT (S3) switch and hold until the CAL LED extinguishes. The instrument should now display the UNCALIBRATED reading.

8. With no load on the transducer, verify the instrument reading is low.

9. Depress the INCREMENT (S2) switch and hold until the TARE LED illuminates. The readout should be ZERO +/- 1 digit.

10. Apply the FULL SCALE load to the transducer. If a strain gage simulator is used, set it to the desired mV/V setting. The instrument should display a value greater than 01000. For optimum performance the readout should be closer to 19000. Ignore decimal point.

11. Depress the DECREMENT (S3) switch and hold until the CAL LED illuminates. The readout should display the CAL NUMBER +/- 1 digit.

The CALIBRATION sequence is now complete.

NOTE: Calibration information (tare and slope values) is maintained in non- volatile memory and is updated every time CALIBRATION Steps 9 and 11 are performed. TARING the display does not change the scale factor (slope value) calculated when Step 11 is completed.

RCAL (SIMULATED) LOAD METHOD

1. Connect the strain gage transducer to the instrument using Figure 4 as a reference. Do not apply any load to the transducer.

2. An RCAL resistor is provided and installed on the rear panel printed circuit board.

3. Apply power to the instrument.

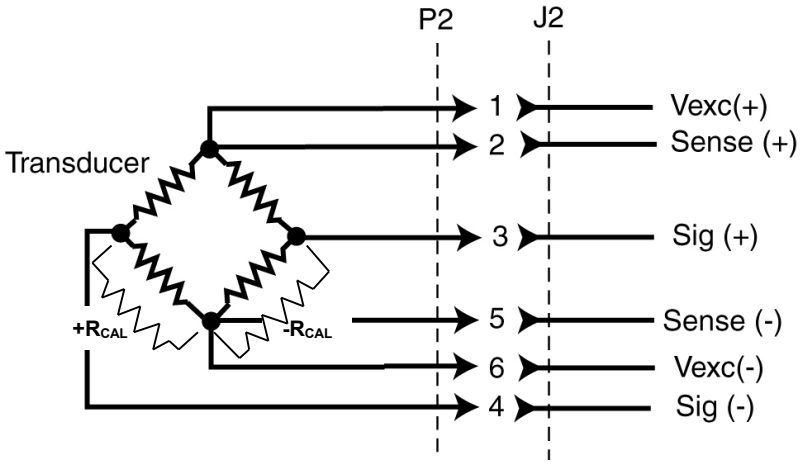


Figure 11 - Transducer Connections

NOTE: If the instrument was previously calibrated and no new calibration is required, do not proceed any further. All previous calibration information is stored in non-volatile EEPROM and is ready for use when power to the instrument is reapplied.

4. Set the CAL NUMBER to the full-scale value provided with the RCAL resistor. This is the shunt calibration valve indicated on the sensor's calibration certificate.

   Example: If the RCAL resistor supplied with the instrument creates an output equivalent to 80% of a full-scale 500-pound load, set the CAL NUMBER to 400.00, 0400.0 or 00400.

   See Section 6.0, Program Instructions, for details on how to set this value.

5. The TARE and CAL LED's on the front panel should be illuminated.

6. Depress the INCREMENT (S2) switch and hold until the TARE LED extinguishes. The instrument should now display the UNTARED reading.

7. Depress the DECREMENT (S3) switch and hold until the CAL LED extinguishes. The instrument should now display the UNCALIBRATED reading.

8. With no load on the transducer, verify the readout is approximately zero.

9. Depress the INCREMENT (S2) switch and hold until the TARE LED illuminates. The readout should be ZERO +/- 1 digit.

10. Depress and hold the RCAL switch. The display should read a value greater than 01000. For optimum performance the readout should be closer to 19000. Ignore decimal point. If system calibration was done by PCB, this displayed valve will be equal to the shunt calibration valve shown on the system calibration certificate.

11. While holding down the RCAL switch, depress the DECREMENT (S3) switch and hold until the CAL LED illuminates. The readout should display the CAL NUMBER +/- 1 digit.

The RCAL CALIBRATION sequence is now complete.

NOTE: Calibration information (tare and slope values) is maintained in non-volatile memory and is updated every time CALIBRATION Steps 9 and 10 are performed. TARING the display does not change the scale factor (slope value) calculated when Step 10 is completed.

8.0 OPTIONS

RS232 SERIAL COMMUNICATION OUTPUT

The RS232 transmission is of the displayed reading and is transmitted once every display update, if the DSR line is TRUE (HIGH). The data format is described below.

1. No parity bit
2. 1 stop bit
3. 8 data bits

The data transmission sequence is described below.

1. Sign: plus or minus (1st word)
2. Magnitude: most significant digit (MSD) first (2nd thru 6th word)
3. Decimal point: exponent (7th word)
4. End of Line (EOL): Control Z (8th word)

Note: Data are transmitted in ASCII characters. The decimal position is transmitted as a power of 10 exponent in ASCII.

The decimal point as a power of 10 exponent is:

x.xxxx	4	(ASCII)
xx.xxx	3	(ASCII)
xxx.xx	2	(ASCII)
xxxx.x	1	(ASCII)
xxxxx	0	(ASCII)

The baud rate is set by solder jumpers (Reference Figure 6 for location). The following baud rate with their corresponding solder jumpers are shown below.

Solder Jumper 1 2 3 4	Baud Rate	
0 1 1 1	600	
1 0 0 0	1200	
1 0 1 0	2400	
1 1 0 0	4800	
1 1 0 1	7200	
1 1 1 0	9600	(default)
1 1 1 1	19200	

"0" = solder jumper ON
"1" = solder jumper removed

SERIES 8159 PROGRAM MENU DIAGRAM

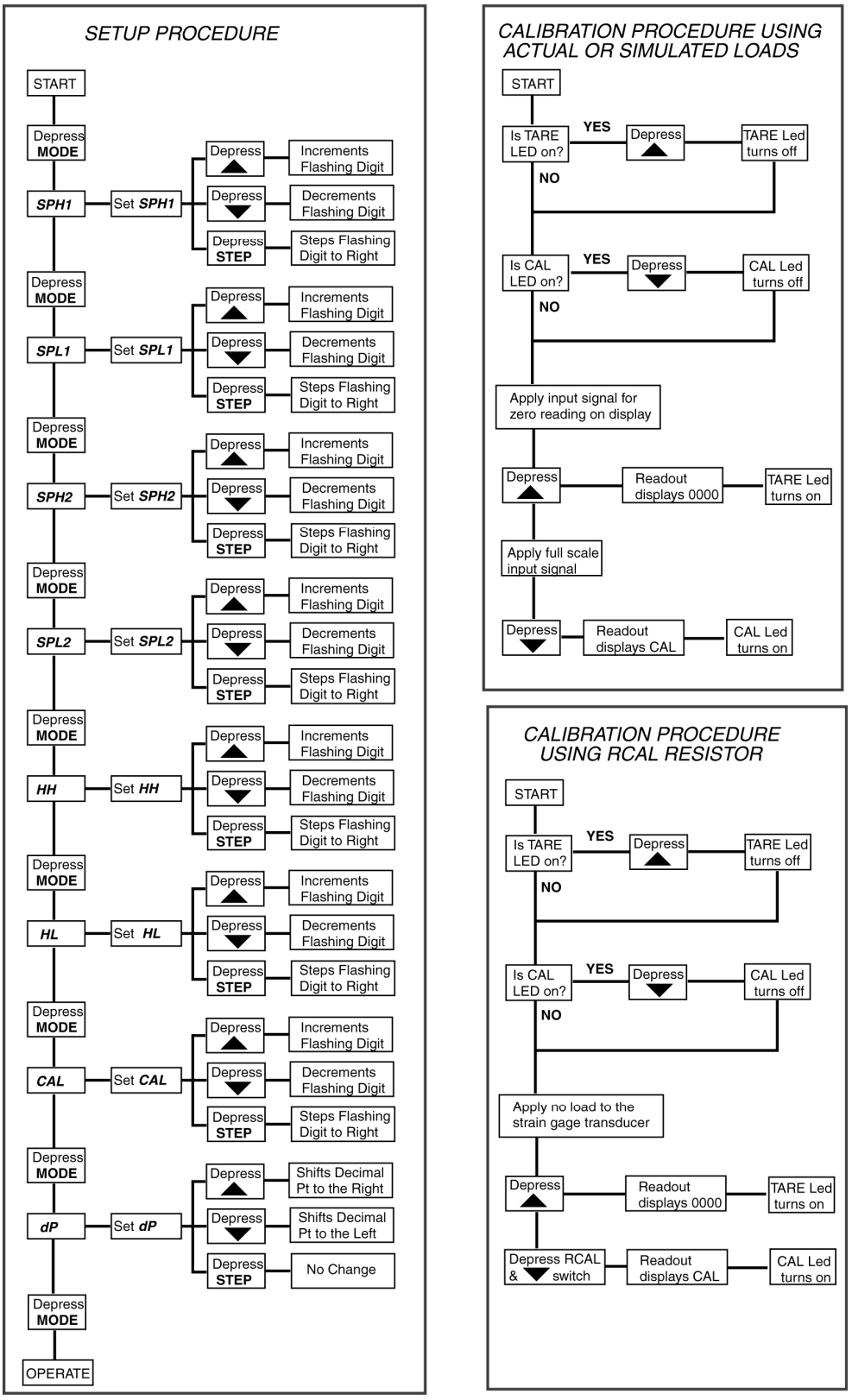


Figure 12

Model Number **8159-0045B**	**1 CHANNEL STRAIN GAGE SENSOR SIGNAL CONDITIONER**	Revision: NR ECN #: 8159-0045B

Performance	**ENGLISH**	**SI**	
Linearity	± 0.015 % FS	± 0.015 % FS	
Environmental			
Temperature Range	+14 to +122 °F	-10 to +50 °C	
Temperature Stability	± 0.56 µV/°F	± 1 µV/°C	
Maximum Humidity	90 %	90 %	[5]
Electrical			
Excitation Voltage(± 0.5 %)	10 VDC	10 VDC	[1]
Full Scale Input	4.5 mV/V	4.5 mV/V	[2]
Output Voltage(Analog Signal)	± 10 VDC	± 10 VDC	
Output Current(Analog Signal)	4 to 20 mA	4 to 20 mA	
Output Bandwidth	0 to 1000 Hz	0 to 1000 Hz	[3]
Digital Resolution	1 part in 19,999	1 part in 19,999	
Common Mode Rejection	>120 @50-60 Hz	>120 @50-60 Hz	
Display Type	0.4in. (10.2mm) LED	0.4in. (10.2mm) LED	
Display Range	± 99,999 (5 digits)	± 99,999 (5 digits)	
Decimal Point	Adjustable via front panel	Adjustable via front panel	
Set Points, Open Collector	2 High and 2 Low	2 High and 2 Low	
Shunt Calibration Resistor	Accessible through rear panel	Accessible through rear panel	
Power Required	115/50 to 60 VAC/Hz	115/50 to 60 VAC/Hz	[4]
Input	Fully Differential (bi-polar)	Fully Differential (bi-polar)	
Physical			
Electrical Connector(Sensor)	9-Pin Female D-sub	9-Pin Female D-sub	
Electrical Connector(input/output)	15-Pin Male D-sub	15-Pin Male D-sub	
Electrical Connector(AC Power Input)	IEC 320	IEC 320	
Size (Height x Width x Diameter)	1.89 in x 3.78 in x 5.88 in	48 mm x 96 mm x 149 mm	[6]
Weight	1.3 lb	0.59 kg	

CE[7]

All specifications are at room temperature unless otherwise specified.
In the interest of constant product improvement, we reserve the right to change specifications without notice.
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OPTIONAL VERSIONS

Optional versions have identical specifications and accessories as listed for the standard model except where noted below. More than one option may be used.

F - 230 VAC operation

NOTES:

[1]Default Value: Internally selectable between 5 VDC and 10 VDC @120 mA max with remote sense short circuit current limiting.
[2]Default Value: Internally selectable between 1.5 mV/V, 2.5 mV/V, and 3.5 mV/V.
[3]Upper frequency limited by single pole, low-pass filter.
[4]Unit set to 230 VAC when ordered as "F8159-0012A", internally selectable
[5]At +104 °F (+40 °C)
[6]1/8 DIN size.
[7]See PCB Declaration of Conformance PS113 for details.

SUPPLIED ACCESSORIES:

Model 017 AC Line Cord

Entered: AP	Engineer: PE	Sales: RM	Approved: JM	Spec Number:
Date: 1/12/2015	Date: 1/12/2015	Date: 1/12/2015	Date: 1/12/2015	**60548**

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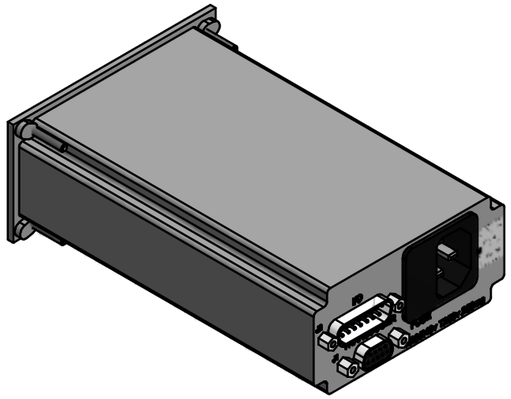
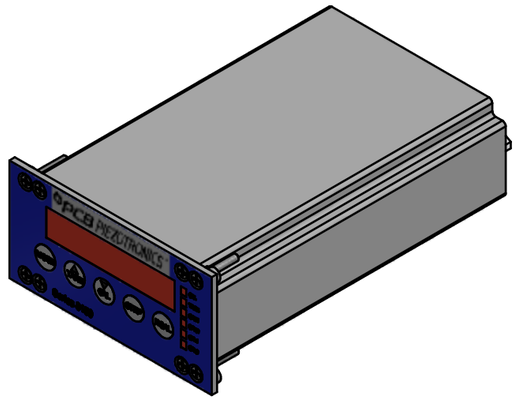
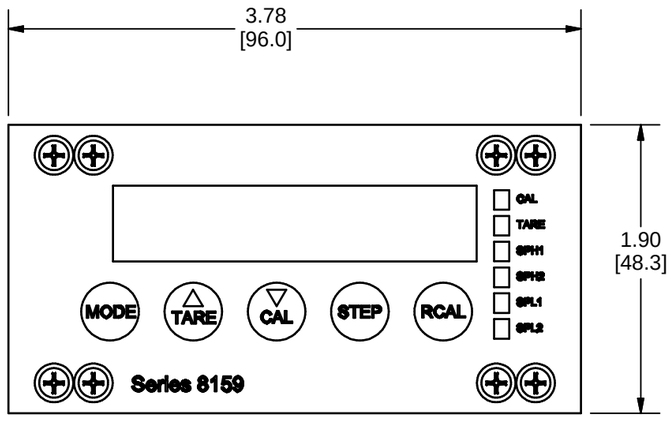
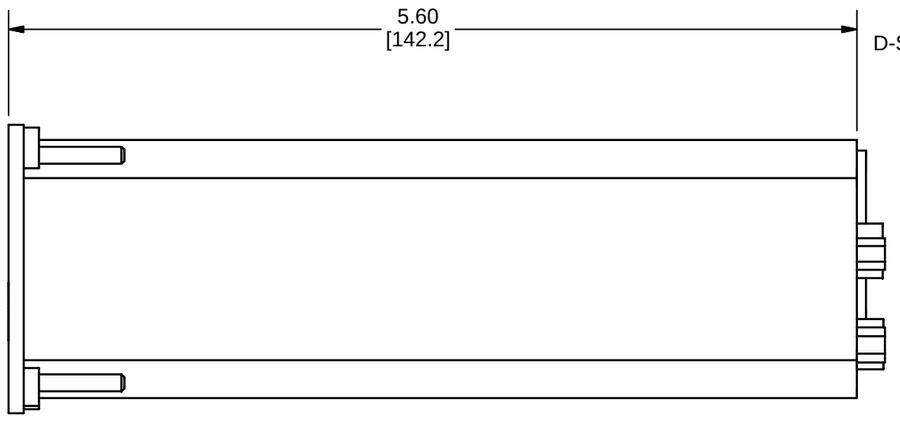
27735

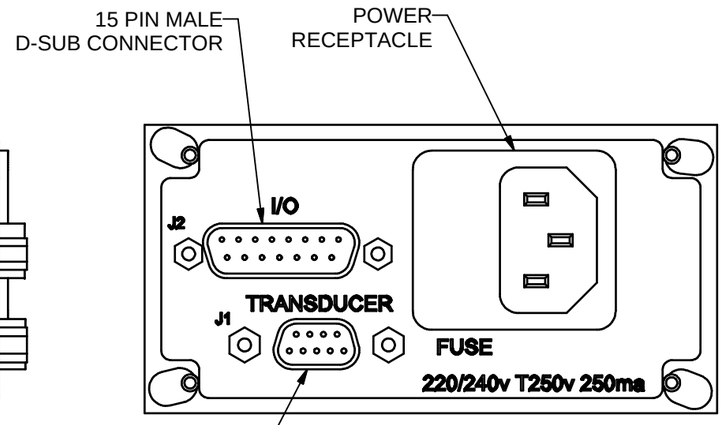
REVISIONS		
REV	DESCRIPTION	ECO
A	WAS +/-5VDC, UPDATED TO L&T - 05.14.13, PTE	41416











15 PIN D-SUB CONNECTOR PIN OUT	
PIN	CONNECTION
1	RXD
2	N/C
3	DSR
4	GROUND
5	ANALOG GROUND
6	ANALOG OUTPUT (+/- 10Vdc)
7	ANALOG OUTPUT (4-20 m A)
8	REBOOT
9	SETPOINT OUTPUT COMMON
10	SPL2 OPEN COLLECTOR OUTPUT
11	SPH2 OPEN COLLECTOR OUTPUT
12	SPL1 OPEN COLLECTOR OUTPUT
13	SPH1 OPEN COLLECTOR OUTPUT
14	REMOTE ZERO
15	N/C

9 PIN D-SUB PIN OUT	
PIN	CONNECTION
1	VEXC (+)
2	SENSE (+)
3	SIG (+)
4	SIG (-)
5	SENSE (-)
6	VEXC (-)
7	N/C
8	N/C
9	GROUND

UNLESS OTHERWISE SPECIFIED TOLERANCES ARE:	
DIMENSIONS IN INCHES	DIMENSIONS IN MILLIMETERS [IN BRACKETS]
DECIMALS XX ±.01 XXX ±.005	DECIMALS X ±0.3 XX ±0.13
ANGLES ± .5 DEGREES	ANGLES ± .5 DEGREES
FILLETS AND RADII .015 MAX	FILLETS AND RADII 0.38 MAX

DRAWN		CHECKED		ENGINEER	
JRM	09.17.04	DM	09.20.04	DMB	09.20.06

TITLE

OUTLINE DRAWING
MODEL 8159A
SIGNAL CONDITIONER

PCB LOAD & TORQUE
A PCB GROUP COMPANY
24350 Indoplex Circle, Farmington Hills,MI 48335
(716) 684-0001 E-MAIL: ltinfo@pcbloadtorque.com

DWG. NO. 27735

SCALE: FULL | SHEET 1 OF 1