ADEPT5 mk.2

DIGITAL PANEL METER OWNERS MANUAL

London Electronics Ltd.

ThorncoteRoad, Sandy, Beds SG19 1PU

Tel: 01767 626444 Website: www.london-electronics.com

1. ORDERING GUIDE

Configure a model number in this format: **L20201DCV1, CBL01**

L .....Digital panel meter with screw terminal connectors.

Display Color

1 .... DPM with green LED
2 ....DPM with red LED
3 .... Extended DPM, green LED
4 .... Extended DPM, red LED

Note: Extended versions add rate of change and linearization of non-linear inputs. Not available for thermocouple or RTD inputs.

Power

0 ....95-240Vac, 95-300 Vdc
1 ....10-48 Vdc, 10-34 Vac

Setpoint Output

0 .... None
1 ....Dual 8A contact relays
2 .... Dual solid state relays

Analog Output

0 .... None
1 .... 4-20 mA, 0-10 Vdc

Digital Interface

0 .... None
1 .... RS232
2 .... RS485
3 ....Parallel BCD
4 .... RS485-Modbus

Input Type

DC Volts

DCV1 ....200.00 mV
DCV2 ....2.0000 V
DCV3 ....20.000 V
DCV4 ....200.00 V
DCV5*............................600.0 V
DCV6 ....300.0 V

* Range not UL approved.

DC Amperes

DCA1 ....2.0000 mA
DCA2 ....20.000 mA
DCA3 .... 200.00 mA
DCA4 ....5.000 A

100 Ohm Platinum RTD's

P385C............... -202 to 850°C
P385F .... -331 to 1562°F
P392C............... -202 to 850°C
P392F .... -331 to 1562°F

Thermocouples

JC .... -210 to 760°C
JF .... -347 to 1400°F
KC .... -244 to 1372°C
KF.................. -408 to 2501°F
TC..................... -257 to 400°C
TF .... -430 to 752°F
EC.................. -240 to 1000°C
EF .... -400 to 1830°F
NC .... -245 to 1300°C
NF.................. -410 to 2370°F
SC..................... -46 to 1768°C
SF .... -51 to 3214°F
RC .... -45 to 1768°C
RF..................... -49 to 3213°F

Process Signals
(4-20 mA, 0-10V, etc.)

P...........4-20 mA = 0-100.00
P1................Custom Scaling

Specify min signal & reading, max signal & reading.

Strain Gauge, Potentiometer (4-wire ratio)

SG .... 0-200 mV = 0-100.00
SG1 .... Custom Scaling

Specify min signal & reading, max signal & reading. Full-scale ranges 200 mV to 20V.

RMS Volts

RMV1......................200.00 mV
RMV2....................... 2.0000 V
RMV3....................... 20.000 V
RMV4....................... 200.00 V
RMV5* .... 600.0 V
RMV6......................... 300.0 V

RMS Amperes

RMA1......................2.0000 mA
RMA2......................20.000 mA
RMA3......................200.00 mA
RMA4......................... 5.000 A

Load Cells (6-wire ratio)

WM1.........-99,999 to +99,999

Specify min input signal & displayed reading, and max input signal & displayed reading. Full-scale inputs 20 mV to 500 mV. 10 Vdc excitation.

Options

EB......... Extra bright red LED display.
BL .... Blank lens, no button pads.

Accessories

CBL01 .. RJ11-to-DB9 RS232 cable. Connects meter to PC com port.
CBL02 .. USB-to-DB9 adapter. For use with CBL01.

2. TABLE OF CONTENTS

3. PRODUCT INTRODUCTION

These UL-certified digital panel meters are versatile, cost effective solutions to a wide variety of monitoring and control applications. Depending on the choice of signal conditioner, they are easily set up for an accurate display of temperature, pressure, flow, weight, voltage or current, all in appropriate engineering units and with zero and span adjustment when needed. Setup can be via front panel pushbuttons or RS232/RS485. Selective security lockout of the front panel keys protects against accidental changes to meter setup.

High read rates up to 60 per second (50 for 50 Hz operation) are made possible by Concurrent Slope Conversion (Pat 5,262,780), which integrates the signal over an AC power line cycle for maximum noise rejection. High read rates provide accurate peak and valley capture, and quick response for control applications. An adaptive digital filter supplies a time constant for the encountered signal noise level, yet responds rapidly to changes that exceed a selected threshold. Self-calibration occurs automatically after every 17th reading.

The standard power supply is a high-efficiency switching unit that operates from AC or DC, and allows the meters to be powered from worldwide AC without changes. A low-voltage supply is optional for power from 10-48V batteries or 10-34 Vac. Both supplies provide an isolated 5, 10 or 24Vdc transducer excitation output .

The meter case conforms to the 1/8 DIN size standard. It is made of high impact, 94V-0 UL-rated plastic and is watertight to NEMA-4 (IP65) when panel mounted. Mounting is from the front of the panel and requires less than 110 mm behind the panel. Power and signal wiring is via removable plugs conforming to UL61010C safety standards. All output options are isolated from meter and power ground to 250 Vac.

Extended meter versions can linearize nonlinear inputs. Up to 240 data points may be linearized by a computer program that stores setup parameters in nonvolatile memory. Extended meters can also display rate of change. For example, they can display flow based on changing tank level.

Alarm or setpoint control is made possible by two optional Form C mechanical relays (8A at 250 Vac) or two Form A solid state relays. The setpoints may be latching or non-latching, and may be configured to be energized above or below the setpoint or in a fail-safe mode. The relays can operate from the filtered signal to reduce relay chatter or from the unfiltered signal for fastest response. Snubber circuits and a programmable relay switching time delay extend relay contact life.

An isolated analog output of 4-20 mA or 0-10V is available with an optional analog output board. The output is linearized to the display, and can operate from the filtered or unfiltered signal input. It can be scaled via front panel pushbuttons or RS232/RS485.

Communications options available with Series 2 include RS232 or RS485 I/O, and parallel BCD output. Serial communications can utilize a custom ASCII protocol or Modbus protocol compliant with the Modbus Over Serial Line Specification V1.0 (2002) for 2-wire, half-duplex connection. This includes RTU or ASCII modes, up to 247 digital addresses, and up to 32 devices per RS485 line without a repeater.

Computer-aided meter programming using special Setup Software is available for use with the RS232 and RS485 serial interfaces.

4. RECEIVING & UPACKING

Your meter was carefully tested and inspected prior to shipment. Should the meter be damaged in shipment, notify the freight carrier immediately. In the event the meter is not configured as ordered or the unit is inoperable, return it to the place of purchase for repair or replacement. Please include a detailed description of the problem.

5. SAFETY CONSIDERATIONS

Warning: Use of this equipment in a manner other than specified may impair the protection of the device and subject the user to a hazard. Visually inspect the unit for signs of damage. If the unit is damaged, do not attempt to operate.

Caution:

- This unit must be powered with AC (mains) from 95-240 Vac ±10% (90-300 Vdc) with the high voltage power supply option, or 10-34 Vac ±10% (10-48 Vdc) with the low voltage power supply option. Verify that the proper power option is installed for the power to be used. This meter has no AC (mains) switch. It will be in operation as soon as power is connected.
- The 95-240 Vac (95-300 Vdc) mains connector (P1 Pins 1-3) is colored Green to differentiate it from other input and output connectors. The 10-34 Vac (10-48 Vdc) mains connector is colored Black.
- Do not make signal wiring changes or connections when power is applied to the instrument. Make signal connections before power is applied. If reconnection is required, disconnect the AC (mains) power before such wiring is attempted.
- To prevent electrical or fire hazard, do not expose the instrument to excessive moisture.
- Do not operate the instrument in the presence of flammable gases or fumes; such an environment constitutes a definite safety hazard. This meter is designed to be mounted in a metal panel.
- Verify the panel cutout dimensions, and mount according to instructions.

Symbols used

Caution (refer to accompanying documents)

Caution, risk of electric shock.

Equipment protected throughout by double insulation or reinforced insulation.

Earth (ground) terminal.

Both direct and alternating current.

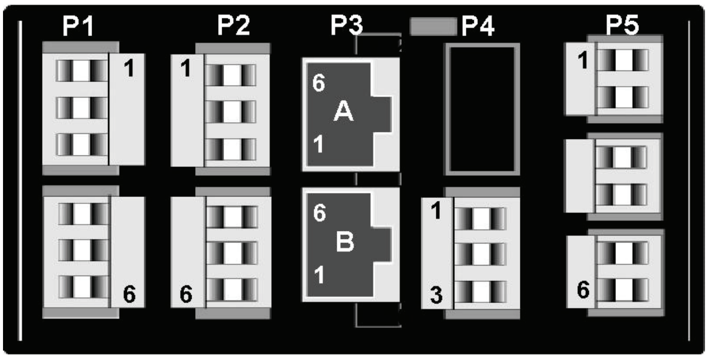
Operating environment:

The meter is Class II (double insulated) equipment designed for use in Pollution degree 2.

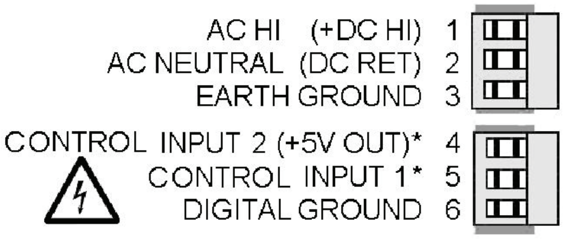
6. CONNECTOR WIRING INFORMATION

CONNECTORS

Connectors for signal and power are U/L rated screw-clamp terminal blocks that plug into mating jacks on the printed circuit board. Communication connectors are a single RJ11 plug for RS232, dual RJ11 plugs for RS485, dual RJ45 plugs for RS485 Modbus, and a 30-pin, mass termination connector for parallel BCD.

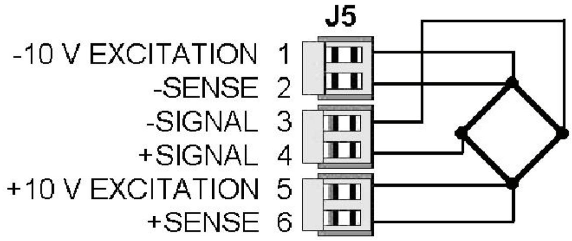


P1 - POWER AND DIGITAL CONTROLS



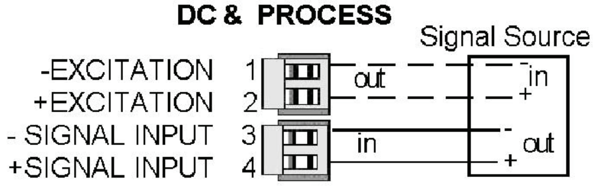
Caution: Hazardous voltages may be present on pins 4, 5 & 6.
Note: Control inputs 1 & 2 are menu selectable.

LOAD CELL METER

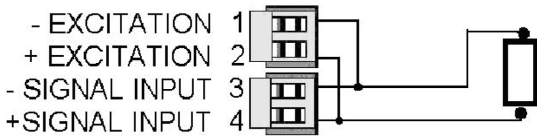


P5 - SIGNAL INPUT

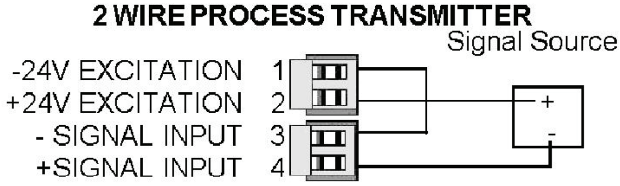
DC & PROCESS



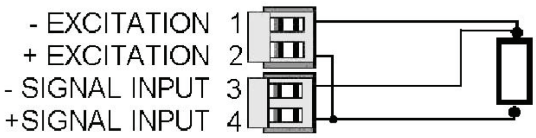
RTD (2-WIRE)



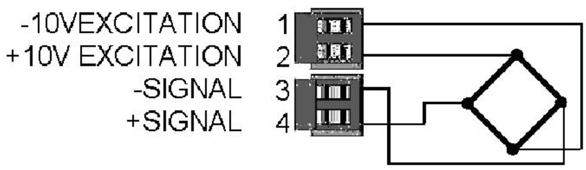
2 WIRE PROCESS TRANSMITTER



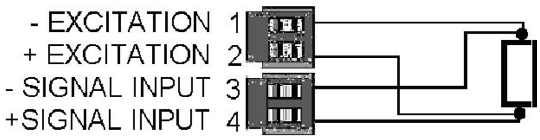
RTD (3-WIRE)



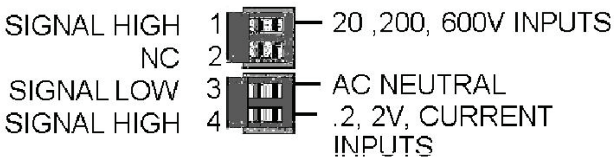
STRAIN GAUGE



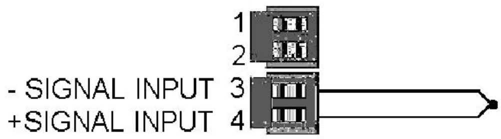
RTD (4-WIRE)



AC (TRUE RMS)



THERMOCOUPLE



P2 - DUAL SETPOINT CONTROLLER

RELAY OUTPUTS (Rev J and earlier)

ALARM 1 - N/O CONTACT	1
ALARM 1 - N/C CONTACT	2
ALARM 1 - COMMON	3
ALARM 2 - N/O CONTACT	4
ALARM 2 - N/C CONTACT	5
ALARM 2 - COMMON	6

RELAY OUTPUTS (Rev K and later)

ALARM 1 - N/O CONTACT	1
ALARM 1 - COMMON	2
ALARM 1 - N/C CONTACT	3
ALARM 2 - N/O CONTACT	4
ALARM 2 - COMMON	5
ALARM 2 - N/C CONTACT	6

SOLID STATE RELAY OUTPUTS (Rev J and earlier)

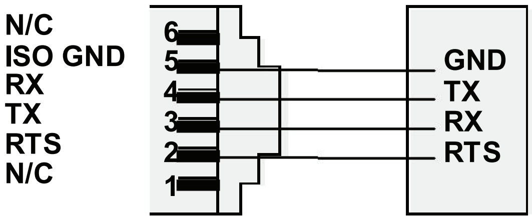
ALARM 1	1	+DC (AC)
ALARM 1	2	+DC (AC)
ALARM 1	3	-DC (NC)
ALARM 2	4	+DC (AC)
ALARM 2	5	+DC (AC)
ALARM 2	6	-DC (NC)

SOLID STATE RELAY OUTPUTS (Rev K and later)

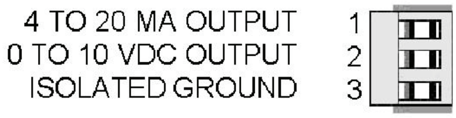
ALARM 1	1	DC OR AC
ALARM 1	2	NOT USED
ALARM 1	3	DC OR AC
ALARM 2	4	DC OR AC
ALARM 2	5	NOT USED
ALARM 2	6	DC OR AC

P3 - SERIAL COMMUNICATIONS

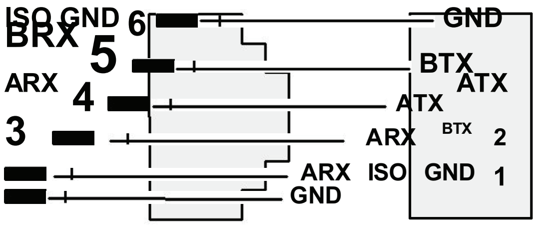
RS232 INTERFACE **Computer**



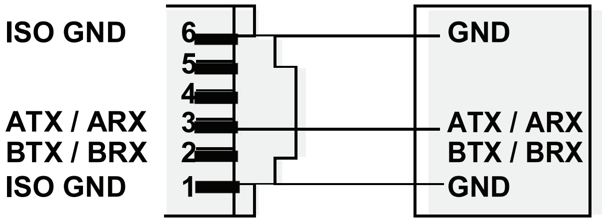
P4 - ANALOG OUTPUT



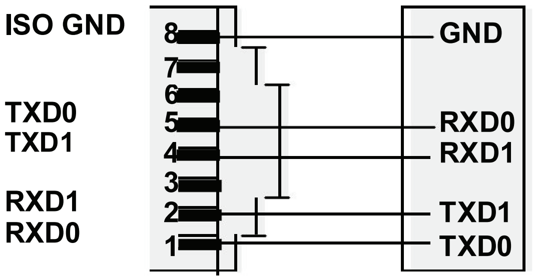
RS485 INTERFACE - FULL DUPLEX



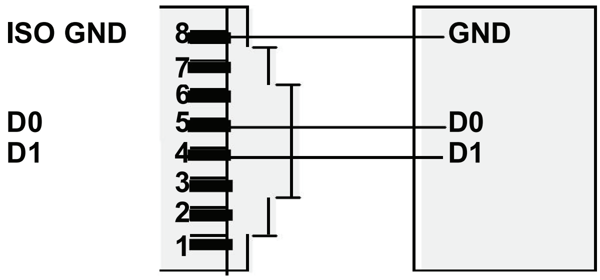
RS485 INTERFACE - HALF DUPLEX



RS485-MODBUS - FULL DUPLEX



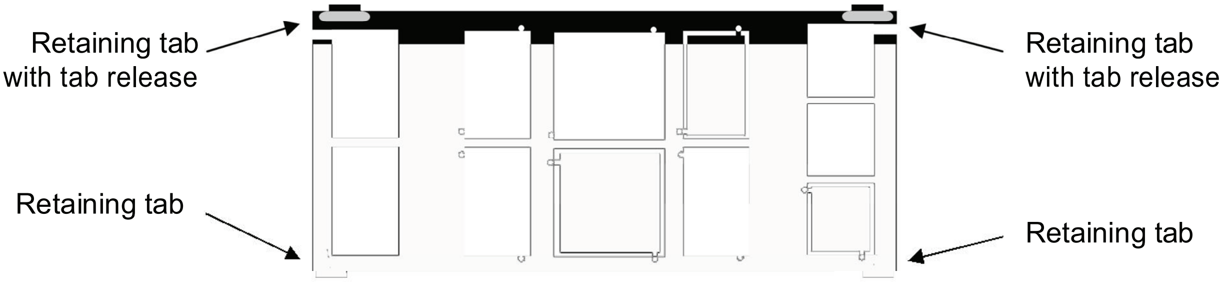
RS485-MODBUS - HALF DUPLEX



7. MECHANICAL ASSEMBLY

REMOVING THE REAR PANEL

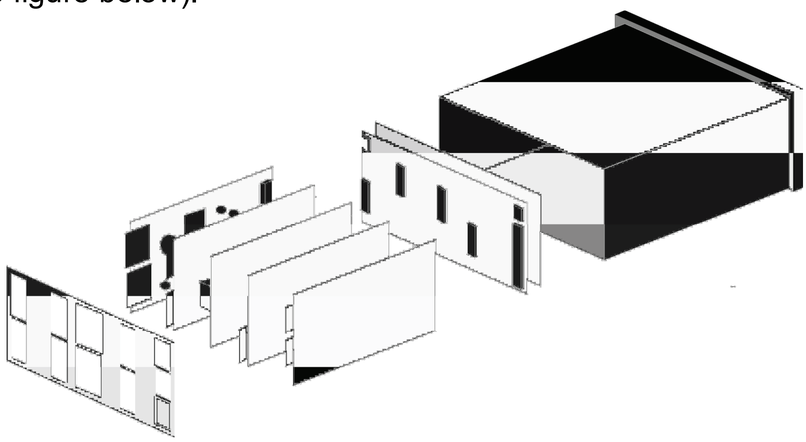
First remove any connectors. Use one hand to press in the two sides of the rear of the case, and the other hand to press down the two protruding tab releases at the top of the rear panel (see figure below). This will unhook the rear panel from the case.



Rear Panel

REMOVING THE ELECTRONICS

With the rear panel removed, grasp the power supply board to the left and signal conditioner board to the right, and carefully slide the electronic assembly out through the rear of the case. (see figure below).



INSTALLING NEW 0PTION BOARDS

Options boards plug into the main board at the front of the meter. These are plug-and-play and may installed in the field. They will be recognized by the software, which will provide access to the menu items associated with that board. If necessary, remove rear panel knockouts for new boards. Boards plug into connectors as follows:

Option Board	Main Board Plug	Rear Panel Jack
Power supply	P11	J1
Relay board	P12	J2
Serial interface board	P13	J3
Analog output board	P14	J4
Signal conditioner board	P15	J5

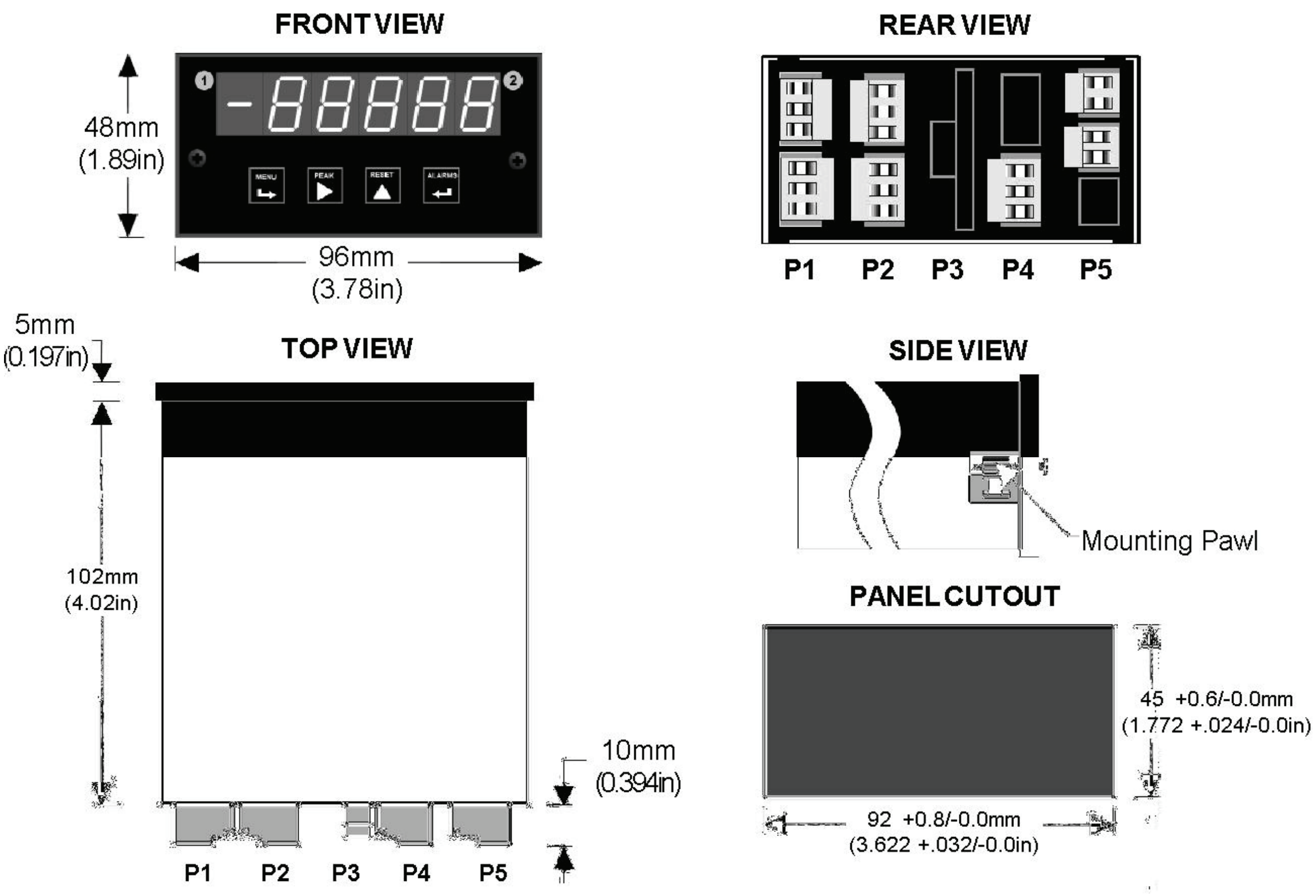
Note: Corresponding main board and option board connectors have the same number of electrical lines. When an option board is correctly installed, the top and bottom edges of the main board and option board are aligned.

REASSEMBLING YOUR METER

Slide the electronics assembly into the case until the display board is seated flush against the front overlay. Insert the bottom tabs of the rear panel into the case, then carefully align the board connectors with the openings in the rear panel. If necessary, remove any rear panel knockouts for new option boards that may have been installed. Ensure that all option boards are properly aligned with the molded board retaining pins on the inside of the rear panel. Once the rear panel is in place, reinstall the input/output screw clamp terminal plugs.

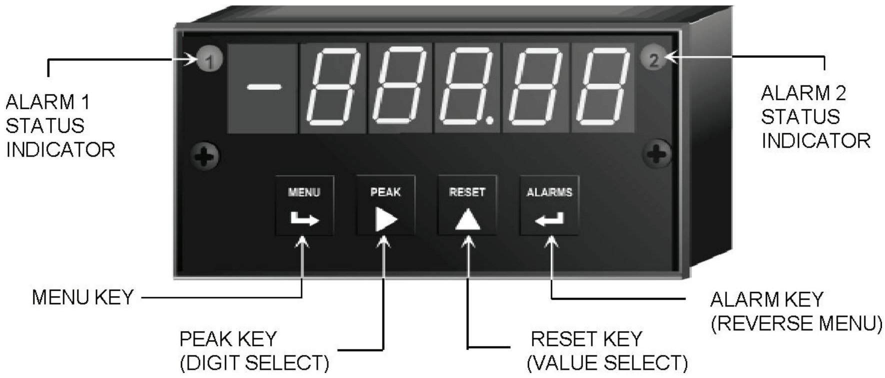
PANEL MOUNTING

Ensure that the panel mounted gasket is in place against the back of the bezel. Turn the two mounting screws counterclockwise until the space between the mounting pawl and the rear of the gasket is greater than the panel thickness. Insert the meter in the panel cutout. Turn the mounting screws clockwise until the meter is securely mounted in the panel. Do not overtighten.



Dimensioned case drawings

8. FRONT PANEL SETUP KEYS



Meter Front Panel

There are four front panel keys, which change function for the **Run Mode** and **Menu Mode**, effectively becoming eight keys. The keys are labeled with alphanumeric captions (MENU, PEAK, RESET, ALARMS) for the Run Mode and with symbols (right arrow, right triangle, up triangle, left arrow) for the Menu Mode.

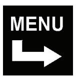
FRONT PANEL LOCKOUT

The Menu Mode will not work with most meters as received from the factory, since all menu items have been disabled in software and a lockout jumper is in place. That jumper needs to be removed for the Menu Mode to work, and menu items under *Loc 1*, *Loc 2* and *Loc 3* then need to be set to "0" via the front panel for these menu items to be unlocked See Section 9. The paragraphs below assume that all menu items have been unlocked.

MENU MODE KEY ACTION

In the Menu Mode, pressing a key momentarily advances to the next menu item. Holding down a key automatically advances through multiple menu items for fast menu navigation.

KEYS IN RUN MODE



MENU Key. Pressing *MENU* from the Run Mode enters the Menu Mode. Pressing *MENU* repeatedly will step the meter through the various menu items (if these have not been locked out) and then back to the Run Mode.

PEAK Key. Pressing *PEAK* normally causes the peak value of the input signal to be displayed. The peak display then blinks to differentiate it from the normal present value display. Pressing *PEAK* again will return the display to the present value. The *PEAK* key can also be programmed to display Valley, to display alternating Peak or Valley, or to Tare the reading to zero. When Peak or Valley is selected, periodic horizontals bars at the top of the display indicate Peak, and periodic horizontals bars at the bottom indicate Valley.

RESET Key. Pressing *RESET* with *PEAK* resets peak and valley values. Pressing *RESET* with *ALARMS* resets latched alarms. Pressing *RESET* with *MENU* performs a meter reset (same as power on). Meter reset can also be applied via a rear panel connect or a serial ASCII command.

ALARMS Key. Pressing *ALARMS* once displays the setpoint for Alarm 1. Pressing it again displays the setpoint for Alarm 2. Pressing it again returns to the present value.

KEYS IN MENU MODE

Right Arrow Key (MENU). Pressing ➡ steps the meter through all menu items that have been enabled and then back to the Run Mode. With the DC signal conditioner board and no option boards, available menu items are InPut, SEtuP, ConFG, FiLtr, dEc.Pt, SCALE, OFFst, Loc 1, Loc 2, Loc 3. If a change has been made to a menu item, that change is saved to non-volatile memory when the ➡ key is pressed next, and StoreE is displayed briefly.

Right Triangle Key (Digit Select).

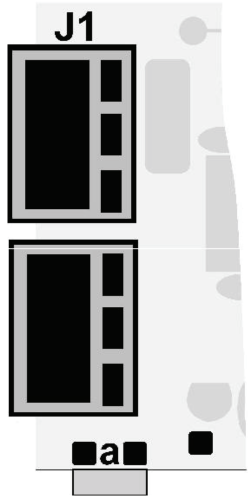
- Pressing ▶ from the *InPut* menu brings up all meter functions available with the meter's signal conditioner. For the DC signal conditioner, these are dC U, dC A and rAtio.
- Pressing ▶ from the *SEtuP*, *ConfFG*, *FiLtr*, *SCALE, OFFSt*, *Loc 1*, *Loc 2* or *Loc 3* menus items sequentially selects digit positions 1 - 5, as indicated by a flashing digit: 00000, 00000, 00000, 00000, 00000.
- Pressing ▶ from the *dEC.Pt* menu item sequentially selects decimal point positions, which will flash: d.dddd dd.ddd dd.dd d ddd.d d ddd. .d ddd

Up Triangle Key (Value Select). Pressing ▲ for a flashing item (digit position or decimal point position) will increment that item. Pressing *MENU* will save any changes.

Left Arrow Key (Reverse Menu). Pressing ⬅ has the same effect as the *MENU* key, except that menu items are brought up in reverse order.

9. ENABLING & LOCKING OUT MENU ITEMS

For security reasons and ease of meter operation, any and all menu items may be disabled or "locked out" so that they are no longer directly accessible from the front panel. Each function to be <u>disabled</u> is set to "1" in menu items *Loc 1*, *Loc 2* or *Loc 3*, and each function to be <u>enabled</u> is set to "0." The top menu items *Loc 1*, *Loc 2* and *Loc 3* can in turn be locked out by installing an internal hardware jumper. With the jumper <u>installed</u>, the operator only has access only to enabled menu items. With the jumper <u>removed</u>, the operator also has access to menu items *Loc 1*, *Loc 2* and *Loc 3.*



SETTING HARDWARE LOCKOUT JUMPER

To access the lockout jumper, remove the rear panel per Section 9 and locate jumper "**a**" in the lower portion of the power supply board next to the input connectors (see figure at right).

SETTING SOFTWARE LOCKOUTS

When setting up the meter, it may be necessary to enable specific menu items by setting the corresponding lockout digit to 0. Be sure to reset the lockout digit to "1" if you do not want the menu item to be changed by an operator.

Loc 1 **Loc 2** **Loc 3**

Press the *MENU* key until *Loc 1, Loc 2* or *Loc 3* is displayed, as desired. **Note:** the hardware lockout jumper must be removed (see above).

11111

Press ▶ to display the lockout status, consisting of 1's and 0's. The left digit will flash. Press ▶ again to step to the next digit, which will flash.

00000
12345

Press ▲ to set the flashing digit to "0" to enable the menu item or to "1" to disable. Press *MENU* to enter. See the table to the right for list of menu items that can be enabled or disabled.

Enabled or Disabled Menu Items

Loc 1

1 - Input type selection.
2 - Meter setup, configuration & decimal pt.
4 - Filter selection.
5 - Scale or Lo, Hi input.
6 - Offset or Lo, Hi reading

Loc 2

2 - Alarm setup.
3 - Alarm setpoint value programming.
4 - Analog output scaling.
5 - Serial interface setup.

Loc 3

2 - View peak value
3 - View alarm setpoints
4 - Reset (peak & latched alarms)
5 - Reset (meter reset)

10. READING COORDINATES OF 2 POINTS SCALING METHOD

When the *reading coordinates of 2 points** scaling method has been selected under SEtuP, the four menu items below will appear ahead of all other menu items when the *MENU* or ⮕ key is first pressed from the run mode.

This scaling method applies a straight line fit between two points, which are determined from actual transducer signals and the desired corresponding meter readings. A low signal, such as the output of a pressure transducer at zero pressure, and high signal, such as the output of the same transducer at a known high pressure, are applied to the meter. The desired corresponding low and high readings are then entered from the front panel. The meter then applies straight line fit between the high and low calibration points. This scaling method has the advantage of calibrating the transducer and meter as a system. The actual voltage or current at either point does not need to be known. This method is ideal for process and load cell meters, which require zero and span adjustment. It is also available for DC or AC meters. It is not available with thermocouple or RTD meters.

The programming example below is for a process meter used with a 4-20 mA pressure transducer for 0 to 100 psi. Decimal points are set separately using the *dEC.Pt* menu.

MENU ⮕ ***Press Menu Select Key***	PEAK ▶ ***Press Digit Select Key***	RESET ▲ ***Press Value Select Key***
Lo In Apply low signal input (e.g., transducer output for 0 psi).	40.21 Press ▶| to display reading at low signal input (e.g., 4.021 mA).	40.21 Press ▲| to store low reading.
Hi In Apply high signal input (e.g., transducer output for known 100.00 psi source).	200.94 Press ▶| to display reading at high signal input (e.g., 20.094 mA).	200.94 Press ▲| to store high reading.
Lo rd Mode to enter desired low reading (e.g., 0.00).	000.00 000.00 000.00 000.00 000.00 Select digit to flash.	0.00 Select 9 thru for flashing first digit, 0 thru 9 for other flashing digits.
Hi rd Mode to enter desired high reading (e.g., 100.00).	000.00 000.00 000.00 000.00 000.00 Select digit to flash.	100.00 Select 9 thru for flashing first digit, 0 thru 9 for other flashing digits.

11. DC VOLTS, AMPS, PROCESS, STRAIN

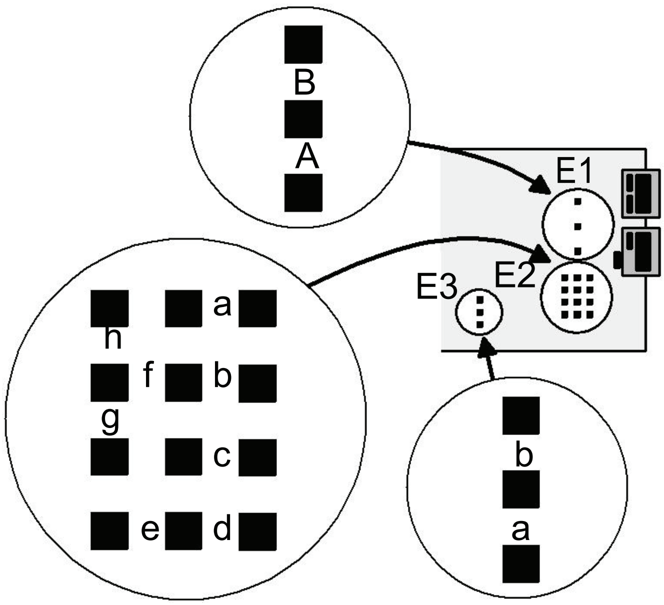
The DC Volts, Amps, Process and Strain meters utilize the DC signal conditioner board, which needs to be configured via jumpers for the desired voltage or current range. All signal ranges are factory calibrated with calibration factors stored in EEPROM. The meter software recognizes the board and will bring up the appropriate menu items for it; however, it does not recognize the jumper settings. Please see further manual sections for setup of the following: relay output (15), analog output (16), communication I/O (17), parallel BCD output (18), and transducer excitation output (19).

Voltage Ranges

FS Input	E1	E2	E3
±200.00 mV	A	f	b
±2.0000 V	A	f	a
±20.000 V	B	h	b
±200.00 V	B	h	a
±300V (UL)	B	g	a
±600V (not UL)	B	g	a

Current Ranges

FS Input	E1	E2	E3
±2.0000 mA	A	e, g	b
±20.000 mA	A	d, g	b
±200.00 mA	A	c, g	b
±5.000 A	A	a, b, g	b



1. Use 5 mm (0.2") jumpers for locations designated by a capital letter.
2. Use 2.5 mm (0.1") jumpers for locations designated by a lower case letter.
3. Store spare jumpers on an unused jumper post not associated a capital letter.

SCALE & OFFSET SETUP

For DC voltmeters & ammeters, a scale factor of 1 and an offset of 0 are used for direct readings in (milli)volts or (milli)amperes. Decimal point selection does not affect the displayed digits. For example, 0-20V or 0-20 mA signals can both be displayed as 0-20000. A full scale of 20000 may be displayed as 20.000 mA or 20000 µA. Use with a current shunt will require a scale factor to be set. For example, for a 500-100 (500A, 100 mV) shunt, divide 5000 (the desired full scale display with 0.1A resolution) by 10000 (displayed value with 100 mV when the scale factor is 1.0) for a scale factor of 0.5.

For process & strain meters, scaling is normally set up from the front panel using the ▶| and ▲| keys, but can also be set up via RS232/485 using special PC-compatible setup software (available at no charge). The meter allows three scaling methods to be selected: 1) S*cale and offset**, 2) *Coordinates of 2 points**, and 3) *Reading coordinates of 2 points**. Only menu items applicable to the selected method will be presented. Please see the Glossary for an explanation of items marked by an *.

KEYSTROKES FOR SETUP

If the *MENU* key does not work, see Section 9 “Enabling & Locking Out Menu Items.”

MENU ***Press Menu Select Key***	PEAK ***Press Digit Select Key***	RESET ***Press Value Select Key***
InPut Selection of signal input type & range	**dC U** DC Volts	**0.2U 2.0U 20.0U 200.0U 6 0.0U** 0.2, 2, 20, 200, 660V FS
	dC A DC Amps	**2.0a 20.0a 200.0a 5.0a** 0.2, 20, 200 mA, 5A FS.
	rAtio Strain gauge & ratio	**0.2U 2.0U 20.0U** 0.2, 2, 20V FS.
SEtuP Meter Setup	**00_00** Display selection with scale factor of 1.	**0** 4-1/2 digits (±20,000) **1** Remote display* (±99,999) **2** 4-1/2 digits, counts by 10 (±20,000) **3** 3-1/2 digits (±2,000)
	00_00 Power line frequency	**0** Noise minimized for 60 Hz **1** Noise minimized for 50 Hz
	00_00 Scaling method	**0** Scale and offset method* **1** Coordinates of 2 points method* **2** Reading coordinates of 2 points method*
	00_00 Operation of control inputs 1 & 2: **True** = logic 1 (0V or tied to digital ground) **False** = 0 (5V or open)	1= Reset*, 2 = Meter Hold* 1= Function Reset*, 2 = Peak*or Valley* 1= Hold*, 2 = Peak or Valley Display 1= Hold*, 2 = Tare* 1= Peak or Valley Display, 2 = Tare* 1= Tare*, 2 = Reset* 1= 1, 2 = 1, decimal point = XXXXX 1= 0, 2 = 1, decimal point = XXXX.X 1= 1, 2 = 0, decimal point = XXX.XX 1= 0, 2 = 0, decimal point = XX.XXX 1= 1, 2 = 1, decimal point = XXXX.X 1= 0, 2 = 1, decimal point = XXX.XX 1= 1, 2 = 0, decimal point = XX.XXX A = 0, 2 = 0, decimal point = X.XXX.X 1= Function Reset*, 2 = Display Blank* 1= Hold*, 2 = Display Blank **A** 1 = Peak or Valley, 2 = Display Blank* **B** 1 = Tare*, 2 = Display Blank* **C** 1 = Valley Display, 2 = Peak Display **D** 1 = Tare*, 2 = Reset Tare to Zero Both inputs 1 and 2 set to 1 for selections **2**, **4**, **A**, **C** = Function Reset* Both inputs 1 and 2 set to 1 for selections **0**, **1**, **3**, **5**, **8**, **9**, **B**, **D** = Meter Reset*

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
ConFG Meter Configuration	**000 _0** Operation as a rate of change meter*. *Extended meter* only.*	**0** Not rate of change **1** Rate x 0.1 **2** Rate x 1 **3** Rate x 10 **4** Rate x 100 **5** Rate x 1000 **6** Rate x 10000
	_0_ _0 Operation of front panel *PEAK* button and rear connector for Peak or Valley Display	**0** Peak Display*. Also selects "Peak" in "Peak or Valley" at connector above. **1** Valley Display*. Also selects "Valley" in "Peak or Valley" at connector above. **2** Peak* (1st push), Valley* (2nd push) **3** Front panel Tare*
	000_ 0 Auto-tare	**0** Meter comes up in normal run mode. **1** Meter comes up in auto-tare* mode
	000 _0 Nonlinear input scaling *Extended meter* only.*	**0** Linear input **1** Custom curve linearization
FiLtr Filtering	**00000** Alarm filtering	**0** Unfiltered output **1** Filtered output
	00000 Peak & Valley filtering	**0** Unfiltered Peak* & Valley* **1** Filtered Peak* & Valley*
	00000 Display filtering	**0** Display batch average every 16 readings **1** Display filtered signal
	00000 Adaptive filter threshold	**0** Low adaptive filter threshold level **1** High adaptive filter threshold level
	00000 Input signal filtering. *Can be applied to display, setpoint, analog output, data output.*	**0** Autofilter* **1** Batch average, 16 readings **2** Moving average*, 0.08 sec. **3** Moving average*, 0.15 sec. **4** Moving average*, 0.3 sec. **5** Moving average*, 0.6 sec. **6** Moving average*, 1.2 sec. **7** Moving average*, 2.4 sec. **8** Moving average*, 4.8 sec. **9** Moving average*, 9.6 sec. **A** Unfiltered
dEc.Pt Dec. point selection	**d.dddd** Decimal point flashes.	**d.dddd** **dd.ddd** **ddd.dd** **dddd.d** **ddddd.** **.ddddd** Press ▲ to shift the decimal point.

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
Scaling method "Scale and Offset" if selected under SEtuP		
SCALE Scale factor*	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Select decimal point location when decimal point is flashing.
OFFst Offset value*	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point location is selected by dEC.Pt.
Scaling method "Coordinates of 2 points" if selected under SEtuP		
Lo In Low signal input.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by input range chosen.
Lo rd Desired reading at Lo In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Hi In High signal input.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by input range chosen.
Hi rd Desired reading at Hi In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Scaling method "Reading coordinates of 2 points" if selected under SEtuP		
Lo In Low signal input.	0.021 Apply a low reference signal to the meter.	0.021 Press ▲ to store the low signal input in the meter.
Hi In High signal input.	20.094 Apply a high reference signal to the meter.	0.021 Press ▲ to store the high signal input in the meter.
Lo rd Desired reading at Lo In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	0.0000 Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Hi rd Desired reading at Hi In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	6.7500 Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.

Option board dependent menu items
ALSEt **dEU1H** **dEU2H** **dEU1b** **dEU2b** Menu items related to **alarm setup** These will only appear if a relay board is detected. If so, please see Section15.
AnSEt **An Lo** **An Hi** Menu items related to **analog output setup**. These will only appear if an analog output board is detected. If so, see Section 16.
SEr 1 **SEr 2** **SEr 3** **SEr 4** Menu items related to **serial communications**. These will only appear if an RS232 or RS485 I/O board is detected. If so, see Section 17.
Menu lockout items
Loc 1 **Loc 2** **Loc 3** Menu items used to enable or lock out (hide) other menu items. **Loc** menu items may in turn be locked out by a hardware jumper. Please see Section 9.

* *See Glossary for explanation of item.*

** *Scaling method 2, "Reading Coordinates of 2 Points Scaling Method," will appear before all other Menu items, including* **InPut**. *Decimal point is set by* **dEC.Pt**.

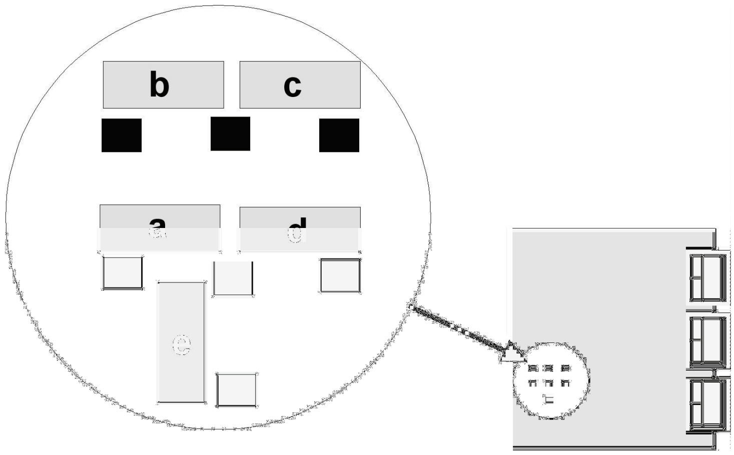
12. LOAD CELL & MICROVOLT INPUTS

The Load Cell and Microvolt meters utilize the load cell signal conditioner board, which offers sensitivity to ±20 mV full scale and 4 or 6-wire load cell connection. This board needs to be configured via jumpers for the desired voltage range. All signal ranges are factory calibrated with calibration factors stored in EEPROM. The meter software recognizes the board and will bring up the appropriate menu items for it; however, it does not recognize the jumper settings. Please see further manual sections for setup of the following features: relay output (15), analog output (16), communication I/O (17), parallel BCD output (18), and transducer excitation output (19).

RANGE SELECTION VIA JUMPERS

Ranges & Display with Scale Factor = 1

Input	Jumpers	Full scale display
±20 mV	e	±20000
±50 mV	a	±50000
±100 mV	b	±10000
±250 mV	c	±25000
±500 mV	d	±50000



Notes **1.** See Section 19 to select 10V excitation.
2. Jumpers are 2.5 mm (0.1 in).

SCALE & OFFSET SETUP

For DC microvolt meters, a scale factor of 1 and an offset of 0 are used for direct readings in microvolts or millivolts. Decimal point selection does not affect the displayed digits. For example, 20 mV can be displayed as 20.000 mV or 20000 µV. The decimal point is set separately.

For load cell applications, scaling is normally set up from the front panel using the ▶ and ▲ keys, but can also be set up via RS232/485 using special PC-compatible setup software (available at no charge). The meter allows three scaling methods to be selected: 1). *Manual scale and offset**, 2) *Coordinates of 2 points**, and 3) *Reading coordinates of 2 points**. Please see the Glossary for an explanation of each method. Please see the Glossary for an explanation of each method marked by an *.

KEYSTROKES FOR SETUP

If the *MENU* ➥ key does not work, see Section 9 “Enabling & Locking Out Menu Items.”

MENU ➥ ***Press Menu Select Key***	PEAK ▶ ***Press Digit Select Key***	RESET ▲ ***Press Value Select Key***
InPut Selection of signal input type & range	**Strn** Strain or ratiometric	**20.0** **50.0** **100.0** **250.0** **500.** 20, 50, 100, 250, 500 mV FS voltage
	dC U DC millivolts	**20.0** **50.0** **100.0** **250.0** **500.** 20, 50, 100, 250, 500 mV FS voltage
SEtuP Meter Setup	**0**0_00 Display type	**0** 4-1/2 digit meter, counts by 1 **1** 5-digit remote display* (±99,999) **2** 4-1/2 digit meter, counts by 10 **3** 3-1/2 digit meter
	0**0**_00 Power line frequency	**0** Noise minimized for 60 Hz **1** Noise minimized for 50 Hz
	00_**0**0 Scaling method	**0** Scale and offset method* **1** Coordinates of 2 points method* **2** Reading coordinates of 2 points method*
	00_0**0** Operation of control inputs 1 & 2: True = logic 1 (0V or tied to digital ground) False = 0 (5V or open)	[illegible] 1= Reset*, 2 = Meter Hold* [illegible] 1= Function Reset*, 2 = Peak*or Valley* [illegible] 1= Hold*, 2 = Peak or Valley Display [illegible] 1= Hold*, 2 = Tare* [illegible] 1= Peak or Valley Display, 2 = Tare* [illegible] 1= Tare*, 2 = Reset* [illegible] 1= 1, 2 = 1, decimal point = XXXXX 1= 0, 2 = 1, decimal point = XXXX.X 1= 1, 2 = 0, decimal point = XXX.XX 1= 0, 2 = 0, decimal point = XX.XXX [illegible] 1= 1, 2 = 1, decimal point = XXXX.X 1= 0, 2 = 1, decimal point = XXX.XX 1= 1, 2 = 0, decimal point = XX.XXX 1= 0, 2 = 0, decimal point = X.XXX.X [illegible] 1= Function Reset*, 2 = Display Blank* [illegible] 1= Hold*, 2 = Display Blank **A** 1 = Peak or Valley, 2 = Display Blank* **B** 1 = Tare*, 2 = Display Blank* **C** 1 = Valley Display, 2 = Peak Display **D** 1 = Tare*, 2 = Reset Tare to Zero -- Both inputs 1 and 2 set to 1 for selections **2**, **4**, **A**, **C** = Function Reset* Both inputs 1 and 2 set to 1 for selections **0**, **1**, **3**, **5**, **8**, **9**, **B**, **D** = Meter Reset*

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
ConFG Meter Configuration	000_0 Operation as a rate of change meter*. *Extended meter* only.*	0 Not rate of change 1 Rate x 0.1 2 Rate x 1 3 Rate x 10 4 Rate x 100 5 Rate x 1000 6 Rate x 10000
	000_0 Operation of front panel *PEAK* button and rear connector for Peak or Valley Display	0 Peak Display*. Also selects "Peak" in "Peak or Valley" at connector above. 1 Valley Display*. Also selects "Valley" in "Peak or Valley" at connector above. 2 Peak* (1st push), Valley* (2nd push) 3 Front panel Tare*
	000_0 Auto-tare	0 Meter comes up in normal run mode. 1 Meter comes up in auto-tare* mode
	000_0 Nonlinear input scaling Extended meter* only.	0 Linear input 1 Custom curve linearization
FiLtr Filtering	00000 Alarm filtering	0 Unfiltered output 1 Filtered output
	00000 Peak & Valley filtering	0 Unfiltered Peak* & Valley* 1 Filtered Peak* & Valley*
	00000 Display filtering	0 Display batch average every 16 readings 1 Display filtered signal
	00000 Adaptive filter threshold	0 Low adaptive filter threshold level 1 High adaptive filter threshold level
	00000 Input signal filtering. *Can be applied to display, setpoint, analog output, data output.*	0 Autofilter* 1 Batch average, 16 readings 2 Moving average*, 0.08 sec. 3 Moving average*, 0.15 sec. 4 Moving average*, 0.3 sec. 5 Moving average*, 0.6 sec. 6 Moving average*, 1.2 sec. 7 Moving average*, 2.4 sec. 8 Moving average*, 4.8 sec. 9 Moving average*, 9.6 sec. A Unfiltered
dEc.Pt Dec. point selection	d.dddd Decimal point flashes.	d.dddd dd.ddd ddd.dd dddd.d ddddd. .ddddd

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
Scaling method "Scale and Offset" if selected under SEtuP		
SCALE Scale factor*	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Select decimal point location when decimal point is flashing.
OFFst *Offset value**	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point location is selected by dEC.Pt.
Scaling method "Coordinates of 2 points" if selected under SEtuP		
Lo In Low signal input.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by input range chosen.
Lo rd Desired reading at Lo In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Hi In High signal input.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by input range chosen.
Hi rd Desired reading at Hi In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Scaling method "Reading coordinates of 2 points" if selected under SEtuP		
Lo In Low signal input.	0.021 Apply a low reference signal to the meter.	0.021 Press ▲ to store the low signal input in the meter.
Hi In High signal input.	20.094 Apply a high reference signal to the meter.	0.021 Press ▲ to store the high signal input in the meter.
Lo rd Desired reading at Lo In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	0.0000 Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Hi rd Desired reading at Hi In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	6.7500 Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.

Option board dependent menu items
ALSEt **dEU1H** **dEU2H** **dEU1b** **dEU2b** Menu items related to **alarm setup** These iwill only appear if a relay board is detected. If so, please see Section15.
AnSEt **An Lo** **An Hi** Menu items related to **analog output setup**. These will only appear if an analog output board is detected. If so, see Section 16.
SEr 1 **SEr 2** **SEr 3** **SEr 4** Menu items related to **serial communications**. These will only appear if an RS232 or RS485 I/O board is detected. If so, see Section 17.
Menu lockout items
Loc 1 **Loc 2** **Loc 3** Menu items used to enable or lock out (hide) other menu items. **Loc** menu items may in turn be locked out by a hardware jumper. Please see Section 9.

** See Glossary for explanation of item.*

13. AC RMS VOLTS & AMPS

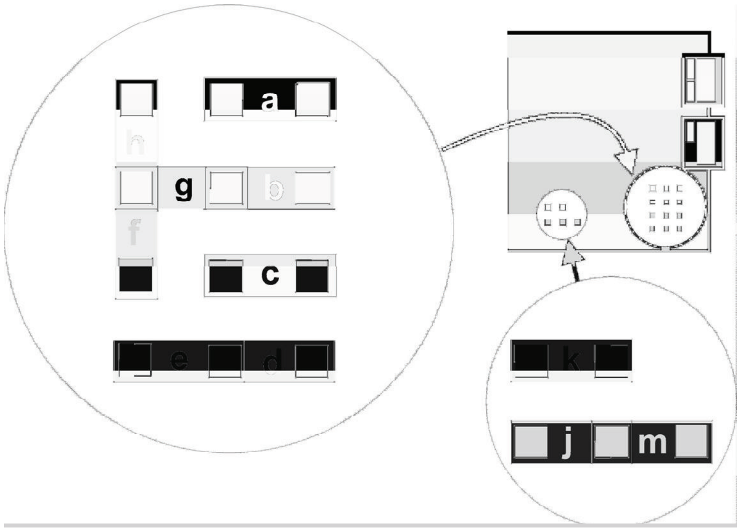
The AC RMS Voltmeters and Ammeters utilize an AC signal conditioner board with precision circuitry to compute the root-mean-square of complex waveforms from 10 Hz to 10 kHz. Spikes up to 2.4 times the maximum of each range are accurately measured. The input is AC coupled to read only the AC component, such as ripple on a power supply. The board needs to be configured via jumpers for the desired voltage or current range. All signal ranges are factory calibrated with calibration factors stored in EEPROM. The meter software recognizes the board and will bring up the appropriate menu items for it; however, it does not recognize the jumper settings which set the ranges. These need to be entered manually. Please see further manual sections for setup of the following features: relay output (15), analog output (16), communication I/O (17), parallel BCD output (18), and transducer excitation output (19).

Voltage Ranges

Full Scale Input	Counts	Jumpers
200 mV	20000	g, k
2V	20000	g, j
20V	20000	h, k
200V	20000	h, j
300V (UL)	3000	f, j
600V (not UL)	6000	f, j

Current Ranges

Full Scale Input	Counts	Jumpers
2 mA	20000	e, f, k
20 mA	20000	d, f, k
200 mA	20000	c, f, k
5A	5000	a, b, f, m



RANGE SELECTION VIA JUMPERS

1. Use 2.5 mm (0.1") jumpers.

2. Store spare jumpers on unused jumper post.

METER SCALING

Refer to the above tables for the full scale counts (or displayed digits) produced by the available full scale input ranges with a scale factor of 1 and an offset of 0. The decimal point can be set for direct readout in (milli)volts or (milli)amperes. Decimal point selection does not affect the counts. For example, a 20V input may be displayed as 20.000V or 20000 mV.

The 5A range, designed for use with a 5A current transformer (CT), is scaled to produce 5000 counts with a scale factor of 1 and an offset of 0. Use with a specific CT will require the scale factor to be set. For example, for an 800A input, 5A output CT, set a scale factor of 1.6. This is the desired 8000 count display at 5A divided by the default 5000 count display at 5A. Then set the decimal point to display to 800.0 at 5A.

All scaling methods applicable to DC, process, strain and load cell meters are available with AC RMS meters. Readings below 10 counts are displayed as 0.

KEYSTROKES FOR SETUP

If the *MENU* ➡ key does not work, see Section 9 "Enabling & Locking Out Menu Items."

MENU ↳ ***Press Menu Select Key***	PEAK ▶ ***Press Digit Select Key***	RESET ▲ ***Press Value Select Key***
InPut Selection of signal input type & range	**AC U** Strain or ratiometric	**0.2U** **2.0U** **20.0U** **200.0U** **660.0U** 0.2, 2, 20, 200, 660V FS
	AC A DC millivolts	**2.0a** **20.0a** **200.0a** **5.0a** 0.2, 20, 200 mA, 5A FS.
SEtuP Meter Setup	**00_00** Display selection with scale factor of 1	**0** 4-1/2 digits (±20,000) **1** Remote display* (±99,999) **2** 4-1/2 digits, counts by 10 (±20,000) **3** 3-1/2 digits (±2,000)
	00_00 Power line frequency	**0** Noise minimized for 60 Hz **1** Noise minimized for 50 Hz
	00_00 Scaling method	**0** Scale and offset method* **1** Coordinates of 2 points method* **2** Reading coordinates of 2 points method*
	00_00 Operation of control inputs 1 & 2. **True** = logic 1 (0V or tied to digital ground) **False** = 0 (5V or open)	**0** 1 = Reset*, 2 = Meter Hold* **1** 1 = Function Reset*, 2 = Peak*or Valley* **2** 1 = Hold*, 2 = Peak or Valley Display **3** 1 = Hold*, 2 = Tare* **4** 1 = Peak or Valley Display, 2 = Tare* **5** 1 = Tare*, 2 = Reset* **6** 1 = 1, 2 = 1, decimal point = XXXXX 1= 0, 2 = 1, decimal point = XXXX.X 1= 1, 2 = 0, decimal point = XXX.XX 1= 0, 2 = 0, decimal point = XX.XXX **7** 1 = 1, 2 = 1, decimal point = XXXX.X 1= 0, 2 = 1, decimal point = XXX.XX 1= 1, 2 = 0, decimal point = XX.XXX 1= 0, 2 = 0, decimal point = X.XXX.X **8** 1 = Function Reset*, 2 = Display Blank* **9** 1 = Hold*, 2 = Display Blank **A** 1 = Peak or Valley, 2 = Display Blank* **B** 1 = Tare*, 2 = Display Blank* **C** 1 = Valley Display, 2 = Peak Display **D** 1 = Tare*, 2 = Reset Tare to Zero -- Both inputs 1 and 2 set to 1 for selections **2**, **4**, **A**, **C** = Function Reset* Both inputs 1 and 2 set to 1 for selections **0**, **1**, **3**, **5**, **8**, **9**, **B**, **D** = Meter Reset*

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
ConFG Meter Configuration	**000_0** Operation as a *rate of change meter**. *Extended meter* only.*	0 Not rate of change 1 Rate x 0.1 2 Rate x 1 3 Rate x 10 4 Rate x 100 5 Rate x 1000 6 Rate x 10000
	00_ _0 Operation of front panel *PEAK* button and rear connector for Peak or Valley Display	0 Peak Display*. Also selects "Peak" in "Peak or Valley" at connector above. 1 Valley Display*. Also selects "Valley" in "Peak or Valley" at connector above. 2 Peak* (1st push), Valley* (2nd push) 3 Front panel Tare*
	000_ _0 Auto-tare	0 Meter comes up in normal run mode. 1 Meter comes up in auto-tare* mode
	000_ 0 Nonlinear input scaling Extended meter* only.	0 Linear input 1 Custom curve linearization
FiLtr Filtering	**00000** Alarm filtering	0 Unfiltered output 1 Filtered output
	00000 Peak & Valley filtering	0 Unfiltered Peak* & Valley* 1 Filtered Peak* & Valley*
	00000 Display filtering	0 Display batch average every readings 1 Display filtered signal
	00000 Adaptive filter threshold	0 Low adaptive filter threshold level 1 High adaptive filter threshold level
	00000 Input signal filtering. *Can be applied to display, setpoint, analog output, data output.*	0 Autofilter* 1 Batch average, 16 readings 2 Moving average*, 0.08 sec. 3 Moving average*, 0.15 sec. 4 Moving average*, 0.3 sec. 5 Moving average*, 0.6 sec. 6 Moving average*, 1.2 sec. 7 Moving average*, 2.4 sec. 8 Moving average*, 4.8 sec. 9 Moving average*, 9.6 sec. A Unfiltered
dEc.Pt Dec. point selection	**d.dddd** Decimal point flashes.	d.dddd dd.ddd ddd.dd dddd.d ddddd. .ddddd

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
Scaling method “Scale and Offset” if selected under SEtuP		
SCALE Scale factor*	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Select decimal point location when decimal point is flashing.
OFFst *Offset value**	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point location is selected by dEC.Pt.
Scaling method “Coordinates of 2 points” if selected under SEtuP		
Lo In Low signal input.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by input range chosen.
Lo rd Desired reading at Lo In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Hi In High signal input.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by input range chosen.
Hi rd Desired reading at Hi In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Scaling method “Reading coordinates of 2 points” if selected under SEtuP		
Lo In Low signal input.	0.021 Apply a low reference signal to the meter.	0.021 Press ▲ to store the low signal input in the meter.
Hi In High signal input.	20.094 Apply a high reference signal to the meter.	0.021 Press ▲ to store the high signal input in the meter.
Lo rd Desired reading at Lo In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	0.0000 Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.
Hi rd Desired reading at Hi In.	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	6.7500 Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point is set by dEC.Pt.

Option board dependent menu items
ALSEt **dEU1H** **dEU2H** **dEU1b** **dEU2b** Menu items related to **alarm setup** These iwill only appear if a relay board is detected. If so, please see Section15.
AnSEt **An Lo** **An Hi** Menu items related to **analog output setup**. These will only appear if an analog output board is detected. If so, see Section 16.
SEr 1 **SEr 2** **SEr 3** **SEr 4** Menu items related to **serial communications**. These will only appear if an RS232 or RS485 I/O board is detected. If so, see Section 17.
Menu lockout items
Loc 1 **Loc 2** **Loc 3** Menu items used to enable or lock out (hide) other menu items. **Loc** menu items may in turn be locked out by a hardware jumper. Please see Section 9.

* *See Glossary for explanation of item.*

** *Scaling method 2, "Reading Coordinates of 2 Points Scaling Method," will appear before all other Menu items, including* **InPut***. Decimal point is set by* **dEC.Pt**.

14. TEMPERATURE: THERMOCOUPLE & RTD

Thermocouple and RTD meters utilize the temperature signal conditioner board, which can be configured via jumpers for 7 thermocouple types (J, K, T, E, N, S, R) and 2 Pt 100 RTD types (DIN with temperature coefficient of 0.00385 ohms/ohm/°C or ANSI with temperature coefficient of 0.003925 ohms/ohm/°C). All signal ranges are factory calibrated. The meter software recognizes the board and will bring up the appropriate menu items for it; however, it does not recognize the jumper settings. Display in °C or °F and resolution of 1°, 0.1° or 0.01° are user programmable. High resolution should only be used for relative readings, not absolute readings. Although available, 0.01° resolution is not recommended for thermocouples.

The addition of a relay output board turns the meter from a temperature indicator into a temperature controller. Please see further manual sections for setup of the following features: relay output (Section 15), analog output (16), communication I/O (17), parallel BCD output (18), and transducer excitation output (19).

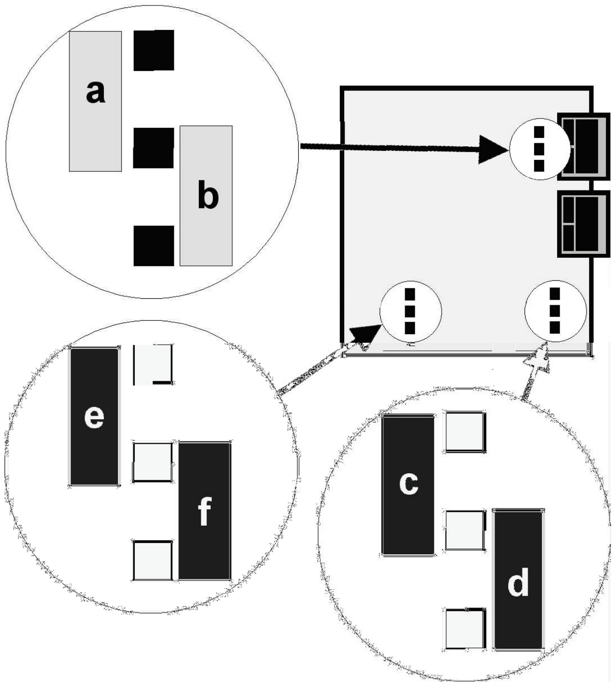
SIGNAL CONDITIONER BOARD SETUP VIA JUMPERS

Thermocouples

Type	Jumpers
J, K, E, N T, R, S	e f
Open Indication	Jumpers
Upscale Downscale	c d

Pt 100 RTD connection

Connection	Jumpers
2- or 4-wire 3-wire	b, e a, e



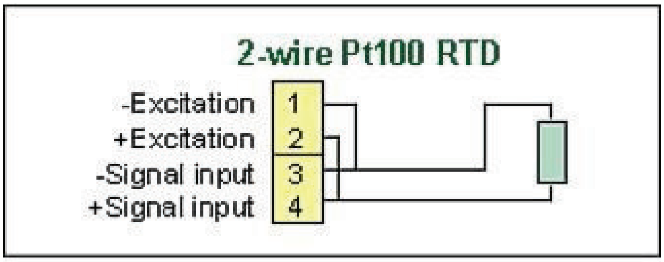
1. Use 2.5 mm (0.1") jumpers.
2. Store spare jumpers on an unused jumper post.

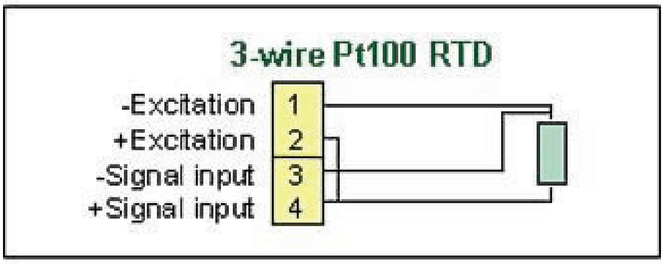
SCALE & OFFSET SETUP

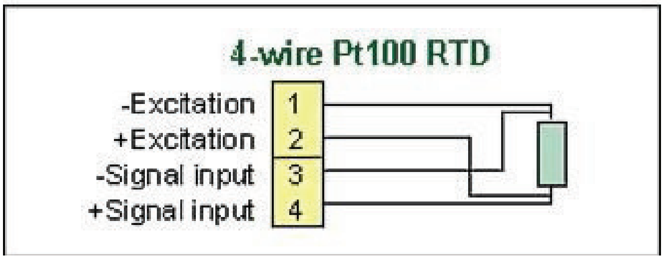
Scale is available for RTDs (but not thermocouples) and is normally set to 1.0000. Scale can be used as an adjustment when actual resistance is other than 100 ohms, as stated on the RTD calibration sheet. To calculate scale, divide 100 by the stated resistance at 0°C. For example, for a 99.04 ohm RTD, scale should be set to 100 / 99.04 = 1.0097.

Offset is available for thermocouples and RTDs, and is normally set to 0000.0. If °C is selected, entering an offset of 0273.2 will change the display to Kelvin. If °F is selected, entering 0459.7 will change the display to Rankine.

RTD CONNECTION







With the appropriate a, b, e jumper positions, the RTD meter allows 2, 3 or 4-wire RTD hookup to the J5 connector, as illustrated. The meter applies an excitation current of 0.2 mA, which it monitors to make ratiometric corrections for excitation supply variations.

In 2-wire hookup, the meter senses the voltage drop across the 100 ohm RTD and both lead wires. The effect of the lead wires can be measured and subtracted by shorting out the RTD during meter setup. The short should be as close as possible to the RTD. Ambient temperature changes will still cause some error in the readings -- the higher the lead resistance, the greater the error.

2-wire lead resistance compensation

Under the **Short** menu selection, the two RTD leads are shorted out, the ▶| key is pushed, a value proportional to lead resistance is displayed, and that value is automatically stored in the meter. After this step, DIN or ANSI and °F or °C need to be selected.

In 3-wire hookup, the meter automatically compensates for lead resistance by measuring the voltage drop in one current carrying lead and assuming that the other current carrying lead is the same.

In 4-wire hookup, no compensation for lead resistance is necessary. The step of shorting out the RTD during meter setup is not necessary with either 3 or 4-wire hookup.

KEYSTROKES FOR SETUP

If the *MENU* ⮑ key does not work, see Section 9 "Enabling & Locking Out Menu Items."

MENU ⮑ ***Press Menu Select Key***	PEAK ▶ ***Press Digit Select Key***	RESET ▲ ***Press Value Select Key***
InPut Selection of signal input type & range	**tC** Thermocouple	**J °F** **J °C** Type J, °F or °C **K °F** **K °C** Type K, °F or °C **n °F** **n °C** Type N, °F or °C **E °F** **E °C** Type E, °F or °C **t °F** **t °C** Type T, °F or °C **S °F** **S °C** Type S, °F or °C **r °F** **r °C** Type R, °F or °C
	rtd Pt 100 ohm RTD	**4d °F** **4d °C** 4-wire DIN , °F or °C **4A °F** **4A °C** 4-wire ANSI, °F or °C **3d °F** **3d °C** 3-wire DIN, °F or °C **3A °F** **3A °C** 3-wire ANSI, °F or °C **2d °F** **2d °C** 2-wire DIN, °F or °C **2A °F** **2A °C** 2-wire ANSI, °F or °C **Short** 2-wire lead resistance compensation. After selecting *Short*, press ⮑ to reset the meter, short the two leads adjacent to the RTD, and press ▶ to automatically store a value proportional to lead resistance. After that, go back to select **2d °F** .. **2d °C** .. **2A °F** or .. **2A °C**
SEtuP Meter Setup	**00_00** Display selection with scale factor of 1.	**0** 0.1 degree resolution **1** Remote display* (±99,999) **2** 0.01 degree resolution **3** 1 degree resolution
	00_00 Power line frequency	**0** Noise minimized for 60 Hz **1** Noise minimized for 50 Hz
	00_00 Scaling method	**0** Scale and offset method* for RTDs, offset only for thermocouples
	00_00 Operation of control inputs 1 & 2: True = logic 1 (0V or tied to digital ground) False = 0 (5V or open)	**0** 1 = Reset*, 2 = Meter Hold* **1** 1 = Function Reset*, 2 = Peak*or Valley* **2** 1 = Hold*, 2 = Peak or Valley Display **3** 1 = Hold*, 2 = Tare* **4** 1 = Peak or Valley Display, 2 = Tare* **5** 1 = Tare*, 2 = Reset*

MENU **_Press Menu Select Key_**	PEAK **_Press Digit Select Key_**	RESET **_Press Value Select Key_**
SEtuP Meter Setup (continued)	**00_00** Operation of control inputs 1 & 2: (continued)	**6** 1 = 1, 2 = 1, decimal point = XXXXX 1 = 0, 2 = 1, decimal point = XXXX.X 1 = 1, 2 = 0, decimal point = XXX.XX 1 = 0, 2 = 0, decimal point = XX.XXX **7** 1 = 1, 2 = 1, decimal point = XXXX.X 1 = 0, 2 = 1, decimal point = XXX.XX 1 = 1, 2 = 0, decimal point = XX.XXX 1 = 0, 2 = 0, decimal point = X.XXX.X **8** 1 = Function Reset*, 2 = Display Blank* **9** 1 = Hold*, 2 = Display Blank **A** 1 = Peak or Valley, 2 = Display Blank* **B** 1 = Tare*, 2 = Display Blank* **C** 1 = Valley Display, 2 = Peak Display **D** 1 = Tare*, 2 = Reset Tare to Zero -- Both inputs 1 and 2 set to 1 for selections **2**, **4**, **A**, **C** = Function Reset* Both inputs 1 and 2 set to 1 for selections **0**, **1**, **3**, **5**, **8**, **9**, **B**, **D** = Meter Reset*
ConFG Meter Configuration	**000_0** Operation as a rate of change meter*. *Extended meter* only.*	**0** Not rate of change **1** Rate x 0.1 **2** Rate x 1 **3** Rate x 10 **4** Rate x 100 **5** Rate x 1000 **6** Rate x 10000
	00_ _0 Operation of front panel *PEAK* button and rear connector for Peak or Valley Display	**0** Peak Display*. Also selects “Peak” in “Peak or Valley” at connector above. **1** Valley Display*. Also selects “Valley” in “Peak or Valley” at connector above. **2** Peak* (1st push), Valley* (2nd push) **3** Front panel Tare*
FiLtr Filtering	**00000** Alarm filtering	**0** Unfiltered output **1** Filtered output
	00000 Peak & Valley filtering	**0** Unfiltered Peak* & Valley* **1** Filtered Peak* & Valley*
	00000 Display filtering	**0** Display batch average every 16 readings **1** Display filtered signal
	00000 Adaptive filter threshold	**0** Low adaptive filter threshold level **1** High adaptive filter threshold level

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
FiLtr Filtering (continued)	00000 Input signal filtering. *Can be applied to display, setpoint, analog output, data output.*	0 Autofilter* 1 Batch average, 16 readings 2 Moving average*, 0.08 sec. 3 Moving average*, 0.15 sec. 4 Moving average*, 0.3 sec. 5 Moving average*, 0.6 sec. 6 Moving average*, 1.2 sec. 7 Moving average*, 2.4 sec. 8 Moving average*, 4.8 sec. 9 Moving average*, 9.6 sec. A Unfiltered
dEc.Pt Dec. point selection	d.dddd Decimal point flashes.	d.dddd dd.ddd ddd.dd dddd.d ddddd. .ddddd
SCALE Scale factor*	0.0000 0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select 9 thru [illegible] for flashing first digit, [illegible] thru [illegible] for other flashing digits. Select decimal point location when decimal point is flashing.
OFFst Offset value*	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select 9 thru [illegible] for flashing first digit, [illegible] thru [illegible] for other flashing digits. Use offset for display in Rankine or Kelvin. Decimal point location is selected by **dEC.Pt**.

Option board dependent menu items

ALSEt dEU1H dEU2H dEU1b dEU2b
Menu items related to **alarm setup** These will only appear if a relay board is detected. If so, please see Section15.

AnSEt An Lo An Hi
Menu items related to **analog output setup**. These will only appear if an analog output board is detected. If so, see Section 16.

SEr 1 SEr 2 SEr 3 SEr 4
Menu items related to **serial communications**. These will only appear if an RS232 or RS485 I/O board is detected. If so, see Section 17.

Menu lockout items

Loc 1 Loc 2 Loc 3
Menu items used to enable or lock out (hide) other menu items. **Loc** menu items may in turn be locked out by a hardware jumper. Please see Section 9.

** See Glossary for explanation of item.*

15. DUAL RELAY OUTPUT OPTION

An optional dual contact relay board or dual solid state relay board may be may be installed in the meter main board at plug position P12, adjacent to the power supply board. Once installed, the relay board is recognized by the software, which will bring up the appropriate menu items. These menu items will not be brought up if a relay board is not installed. Both relay boards offer a choice of operating modes: latched* or non-latched*, hysteresis band*, deviation band*, actuation based on the filtered or unfiltered signal, and selectable number of readings in alarm zone to cause an alarm. Please see the Glossary at the end of this manual for an explanation of terms marked by an *.

KEYSTROKES FOR VIEWING & CHANGING SETPOINTS

It is not necessary to enter the setup menu to view or change setpoints. This allows the meter to continue conversions and provide outputs when setpoints are displayed. After pressing ⮠ (Alarms), you have 30 seconds to enter a change, or the meter reverts to normal display.

ALARMS ⮠ ***Press Alarms Key***	PEAK ▶ ***Press Digit Select Key***	RESET ▲ ***Press Value Select Key***
300.24 Press ⮠ (Alarms) to display Alarm 1 setpoint.	200.00 Current setpoint 1 value blinks, and Alarm 1 LED indicator lights. Press ▶ to select a digit, which will blink.	295.00 To change setpoint 1 value, press ▲ to change selected blinking digits.
395.00 Press ⮠ (Alarms) to display Alarm 2 setpoint.	395.00 Current setpoint 2 value blinks, and Alarm 2 LED indicator lights. Press ▶ to select a digit, which will blink.	305.00 To change setpoint 2 value, press ▲ to change selected blinking digits.
300.24 Press ⮠ (Alarms) again. The meter will reset and display the current reading.		

KEYSTROKES FOR SETUP

If the *MENU* ⮡ key does not work, see Section 9 "Enabling & Locking Out Menu Items."

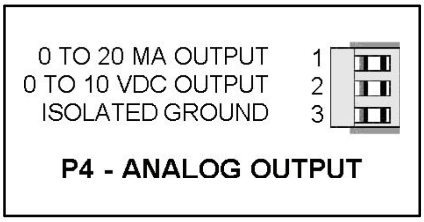
MENU ⮡ ***Press Menu Select Key***	PEAK ▶ ***Press Digit Select Key***	RESET ▲ ***Press Value Select Key***	
ALSEt Alarm Setup. Press ⮡ until *ALSEt* is displayed (with relay board).	00000 Relay state when alarm is active.	0 Relay 1 on 1 Relay 1 off 2 Relay 1 on 3 Relay 1 off	Relay 2 on Relay 2 on Relay 2 off Relay 2 off
	00000 Alarm latching* or non-latching* (auto reset).	0 Alarm 1 auto reset 1 Alarm 1 latching 2 Alarm 1 auto reset 3 Alarm 1 latching	Alarm 2 auto reset Alarm 2 auto reset Alarm 2 latching Alarm 2 latching

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key	
ALSEt Alarm Setup. (continued)	**00000** Alarm operates at and above setpoint (active high) or at and below setpoint (active low).	**0** AL1 active high **1** AL1 active low **2** AL1 disabled **3** AL1 active high **4** AL1 active low **5** AL1 disabled **6** AL1 active high **7** AL1 active low **8** AL1 disabled	AL2 active high AL2 active high AL2 active high AL2 active low AL2 active low AL2 active low AL2 disabled AL2 disabled AL2 disabled
	00000 Hysteresis mode* or band deviation mode*	**0** AL1 band deviation **1** AL1 hysteresis **2** AL1 band deviation **3** AL1 hysteresis **4** No deviation or hysteresis in menu.	AL2 band deviation AL2 band deviation AL2 hysteresis AL2 hysteresis
	00000 Number of readings in alarm zone to cause an alarm.	**0** After 1 reading **1** After 2 readings **2** After 4 readings **3** After 8 readings **4** After 16 readings **5** After 32 readings **6** After 64 readings **7** After 128 readings	
dEU1H Alarm 1 hysteresis*	**0.0000** **0.0000** **0.0000** **0.0000** **0.0000** Select digit to flash.	Select **-9** thru **9** for flashing first digit, **0** thru **9** for other flashing digits. Alarms will operate above and below the setpoint by the value entered (half of hysteresis band).	
DEU2H Alarm 2 hysteresis*	**0.0000** **0.0000** **0.0000** **0.0000** **0.0000** Select digit to flash.	Select **-9** thru **9** for flashing first digit, **0** thru **9** for other flashing digits. Alarms will operate above and below the setpoint by the value entered (half of hysteresis band).	
DEU1b Alarm 1 deviation*	**0.0000** **0.0000** **0.0000** **0.0000** **0.0000** Select digit to flash.	Select **-9** thru **9** for flashing first digit, **0** thru **9** for other flashing digits. Alarms will operate above and below the setpoint by the value entered (half of deviation band).	
DEU2b Alarm 2 deviation*	**0.0000** **0.0000** **0.0000** **0.0000** **0.0000** Select digit to flash.	Select **-9** thru **9** for flashing first digit, **0** thru **9** for other flashing digits. Alarms will operate above and below the setpoint by the value entered (half of deviation band).	

** See Glossary for explanation of item.*

16. ANALOG OUTPUT OPTION

An optional analog board may be may be connected to the meter main board at plug position P14, adjacent to the signal conditioner board. Once installed, the analog output board is recognized by the meter, which will bring up the appropriate menu items. These items will not be brought up if an analog output board is not installed.



Both current (0-20 mA or 4-20 mA) and voltage (0-10 Vdc) analog outputs are selectable at connector P4. One of three analog output spans (0-20 mA, 4-20 mA or 0-10 Vdc) may be selected in software for scaling. The low analog output (0 mA, 4 mA or 0V) may be set to correspond to any low displayed reading **An Lo**. The corresponding high analog output (20 mA or 10V) may be set to correspond to any high displayed reading **An Hi**. The meter will then apply a straight line fit between these two end points, thereby providing an analog output scaled to the displayed reading for the selected span.

Although both current and voltage outputs are available at connector P4, only one is calibrated to specifications. If the calibrated output is 0-10V, the non-calibrated output is 0-20 mA. If the calibrated output is 0-20 mA, the non-calibrated output is 0-10V. Both of these non-calibrated outputs are accurate to 1% typical, 2% max. If the calibrated output is 4-20 mA, the non-calibrated output is 2.5-10V.

KEYSTROKES FOR SETUP

If the *MENU* key does not work, see Section 9 "Enabling & Locking Out Menu Items."

MENU ***Press Menu Select Key***	PEAK ***Press Digit Select Key***	RESET ***Press Value Select Key***
AnSEt Analog Output Setup. Press until *AnSEt* is displayed (requires analog output board).	00 Selection of calibrated output.	0 0-20 mA current output 1 0-10V voltage output 2 4-20 mA current output
	00 Analog output filtering.	0 Analog output unfiltered 1 Analog output filtered
An Lo Low displayed value for 0 mA, 4 mA or 0V output	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point location is fixed by **dEC.Pt** selection.
An Hi High displayed value for 20 mA or 10V output	0.0000 0.0000 0.0000 0.0000 0.0000 Select digit to flash.	Select -9 thru 9 for flashing first digit, 0 thru 9 for other flashing digits. Decimal point location is fixed by **dEC.Pt** selection.

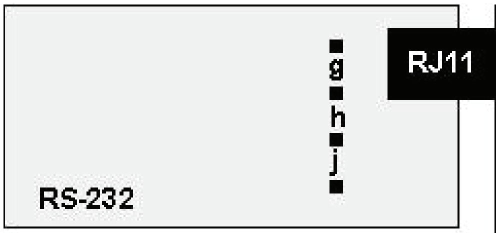
17. SERIAL COMMUNICATION OPTIONS

An optional serial communications board (RS232, RS485 or RS485-Modbus) may be connected to the meter main board at plug position P13 (middle position). Once installed, this board is recognized by the meter, which will bring up the appropriate serial communication menu items. These items will not be brought up if a communication board is not installed.

The RS485 and RS485-Modbus boards are electrically equivalent, but have a slightly different physical layout. The RS485 version uses two RJ11 connectors, while the RS485-Modbus version uses two RJ45 connectors for compliance with the Modbus standard. Both boards feature dual connectors, which are wired in parallel to allow daisy chaining of addressable meters with no need for a communications hub. All three boards are compatible with the same serial three communication protocols, which are selectable under meter setup: Custom ASCII*, Modbus* RTU, and Modbus* ASCII. Digital addressing of multiple meters on the same serial communication line requires RS485 or RS485-Modbus boards.

BOARD SETUP VIA JUMPERS

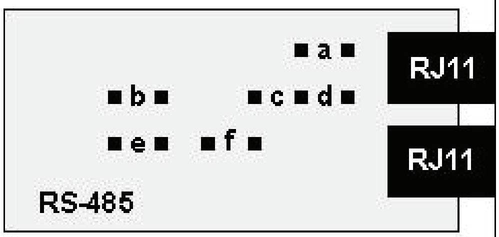
RS232 Board

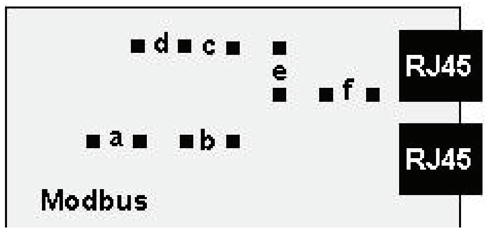


- **g** - Normal operation.
- **h** - Slave display operation to RS232 output of another meter.
- **J** - Pull-up resistor on RTS line.

Note: The board is shipped standard with jumpers **g** and **j** installed.

RS485 and RS485-Modbus Boards





Full Duplex Operation

- **b & e** - These bias jumpers should be installed on 1 (and only 1) meter.
- **a & d** - installed on last meter in line with long cable runs.

Half Duplex Operation

- **b & e** - bias jumpers installed on 1 board.
- **c & f** - installed for half duplex operation.
- **a** - installed on last meter in line with long cable runs.

Note: The boards are shipped standard with no jumpers installed.

KEYSTROKES FOR SETUP

If the *MENU* ⮩ key does not work, see Section 9 “Enabling & Locking Out Menu Items.”

MENU ⮩ ***Press Menu Select Key***	PEAK ▶ ***Press Digit Select Key***	RESET ▲ ***Press Value Select Key***
SEr 1 Fixed Parameters: No parity 8 data bits 1 stop bit	000 Output filtering	0 Send unfiltered signal 1 Send filtered signal
	000 Baud rate	0 300 baud 1 600 baud 2 1200 baud 3 2400 baud 4 4800 baud 5 9600 baud 6 19200 baud
	000 Output update rate	60 Hz / 50 Hz 0 Line frequency / Line frequency 1 0.28 sec / 0.34 sec 2 0.57 sec / 0.68 sec 3 1.1 sec / 1.4 sec 4 2.3 sec / 2.7 sec 5 4.5 sec / 5.4 sec 6 9.1 sec / 10.9 sec 7 18.1 sec / 21.8 sec 8 36.6 sec / 43.5 sec 9 72.5 sec / 97 sec
SEr 2 Serial Setup 2	0000 Line feed	0 No line feed after carriage return 1 Line feed after carriage return
	0000 Alarm data with readings	0 No alarm data 1 Alarm data with reading
	0000 Control of data output	0 Continuous data output 1 Data output on ASCII command only
	0000 Meter address with Custom ASCII protocol*	Select 0 thru F for addresses 1 thru 15. Select 0. thru F. (with decimal point) for addresses 16 thru 31.
SEr 3 Serial Setup 3	00000 Half or full duplex	0 Full duplex 1 Half duplex
	00000 Special start & stop char.	0 Standard continuous mode 1 Special start & stop characters
	00000 RTS mode	0 Normal RTS 1 Single transmission
	00000 Termination characters	0 Only at end of all items 1 At end of each item

MENU Press Menu Select Key	PEAK Press Digit Select Key	RESET Press Value Select Key
SEr 3 Serial Setup 3 (continued)	00000 Data sent in continuous mode	0 Reading 1 Peak 2 Valley 3 Reading + peak 4 Reading + valley 5 Reading + peak + valley
SEr 4 Serial Setup 4	_000 Modbus* ASCII gap timeout	0 1 sec 1 3 sec 2 5 sec 3 10 sec
	_000 Serial protocol	0 Custom ASCII* 1 Modbus* RTU 2 Modbus* ASCII
	_000 Parity	0 None 1 Odd 2 Even
Addr Modbus Address	_000 _000 _000 Select digit to flash.	_158 Select 0 through 9 for flashing digit. Address range is 1 to 247.

** See Glossary for explanation of item.*

18. PARALLEL BCD OUTPUT OPTION

An optional parallel BCD output board may be connected to the meter main board at plug position P13 (middle position). Once installed, the board is recognized by the meter, which will bring up the appropriate menu items. The BCD board provides isolated, buffered, stored, 3-state parallel outputs that are jumper selectable for either 0-5V logic (LSTTL, CMOS compatible) or 0-15V dc. BCD outputs are positive true. Polarity bit is positive true for +sign.

Logic Level	Jumper
0 to 5 Vdc	b
0 to 15 Vdc	a

BCD OUTPUT

Signal	Pin	Pin	Signal
1	1	2	2
4	3	4	8
10	5	6	20
40	7	8	80
100	9	10	200
400	11	12	800
1K	13	14	2K
4K	15	16	8K
10K	17	18	20K
40K	19	20	80K
100K	21	22	200K
400K	23	24	800K
+ POL	25	26	$\overline{\text{DATA READY}}$
$\overline{\text{BCD HOLD}}$	27	28	BCD ENABLE
ISOLATED GND	29	30	ISO 5 / 15VDC

BCD CONTROL SIGNALS

Enable Logic **0** - All outputs go to high impedance state.
Logic **1** - BCD information is available at outputs.

/ BCD Hold Logic **0** - BCD from last update prior to BCD Hold going low is stored.
Logic **1** - BCD information is updated at selected rate.

/ Data Ready Logic **0** - BCD outputs are valid. Logic **1** - BCD outputs are not valid.

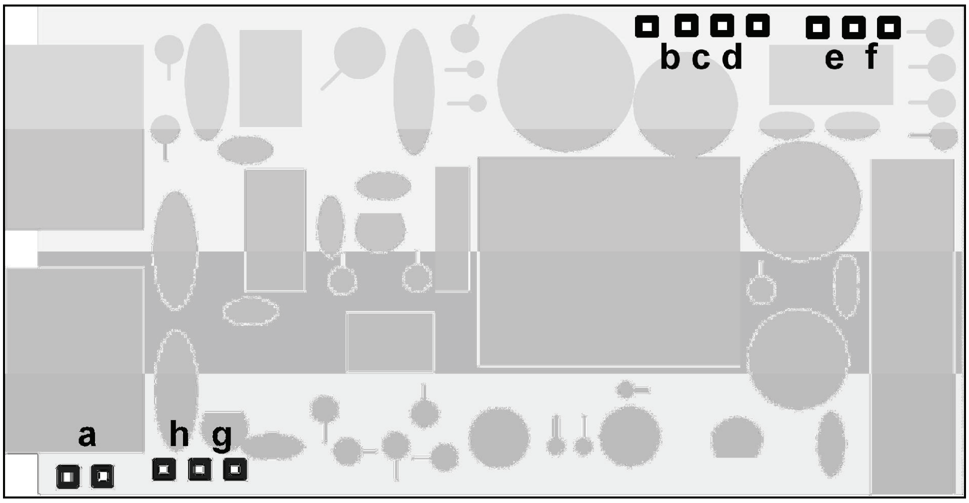
KEYSTROKES FOR SETUP

If the *MENU* key does not work, see Section 9 “Enabling & Locking Out Menu Items.”

MENU ***Press Menu Select Key***	PEAK ***Press Digit Select Key***	RESET ***Press Value Select Key***
SEr 1 Press until *SEr 1* is displayed.	**_0_0** Output filtering	0 Send unfiltered signal 1 Send filtered signal
	_0_0 Output update rate	60 Hz / 50 Hz 0 Line frequency 1 0.28 sec / 0.34 sec 2 0.57 sec / 0.68 sec 3 1.1 sec / 1.4 sec 4 2.3 sec / 2.7 sec 5 4.5 sec / 5.4 sec 6 9.1 sec / 10.9 sec 7 18.1 sec / 21.8 sec 8 36.6 sec / 43.5 sec 9 72.5 sec / 97 sec

19. EXCITATION OUTPUTS & POWER SUPPLY

Three isolated transducer excitation output levels are available from the power supply board. These are selectable via jumpers b, c, d, e, f in the upper right of the board, as illustrated. In addition, the board provides three jumper positions for special features. The same jumper locations apply to the universal power supply (95-240 Vac ±10% and 95-300 Vdc ±10%) and to the low voltage power supply (10-34 Vac & 10-48 Vdc).



Excitation output	Jumper locations	
5 Vdc ±5%, 100 mA max	**b, d, e**	b d e
10 Vdc ±5%, 120 mA max	**b, d, f**	b d f
24 Vdc ±5%, 50 mA max	**c**	c

SELECTION OF OTHER JUMPERS

Jumper a - Front panel menu lockout, locked when installed. See Section 9)
Jumper g - Provides +5V power output at P1-4 when installed.
Jumper h - Connects "Control Input 2" to P1-4 when installed.

20. INSTRUMENT SETUP VIA PC

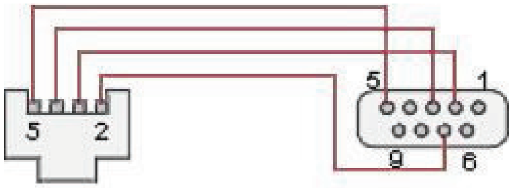
Instrument Setup software is a PC program which is much easier to learn than front panel programming. It is of benefit whether or not the meter is connected to a PC. With the meter connected to a PC, it allows uploading, editing and downloading of setup data, execution of commands under computer control, listing, plotting and graphing of data, and computer prompted calibration. With the meter unconnected to a PC, it provides quick selection of jumper locations and a printable display of menu selections for front panel setup.

SOFTWARE INSTALLATION

Download *IS2*.exe* onto your PC from the web or the distribution CD. Double-click on the downloaded file to unzip it into a special directory, such as *c:\temp*. Within that directory, double-click on *setup.exe*, which will install the software on your PC.

PREREQUISITES FOR CONNECTED USE

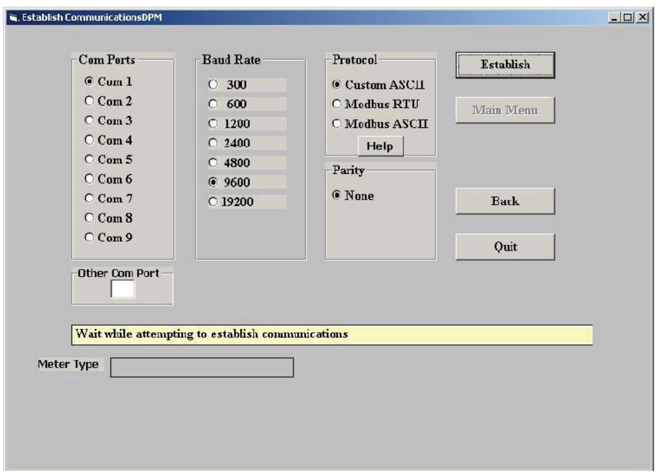
1) PC with available RS232 com port.
2) Meter to be set up.
3) RS232 board in the meter. This board can be used for meter setup, then be removed.
4) RJ11-to-DB9 RS232 cable to connect the meter and PC (see Section 1, Ordering Guide).
5) *Instrument Setup* software.

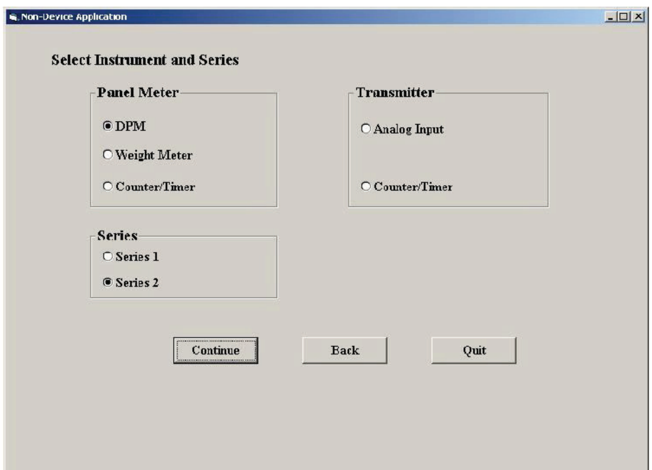


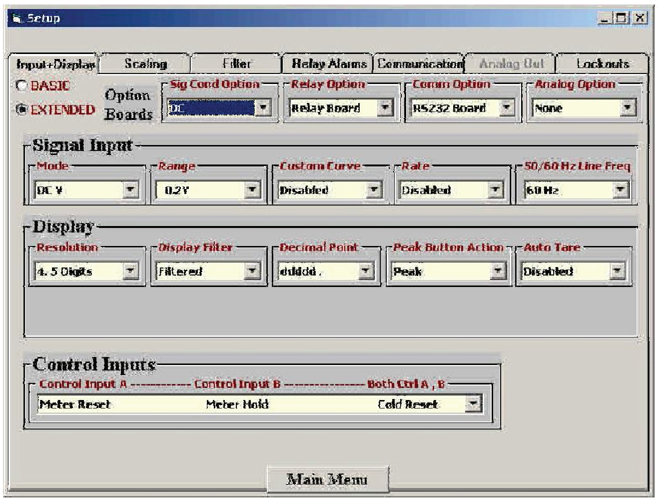
RJ11-to-DB9 RS-232 cable

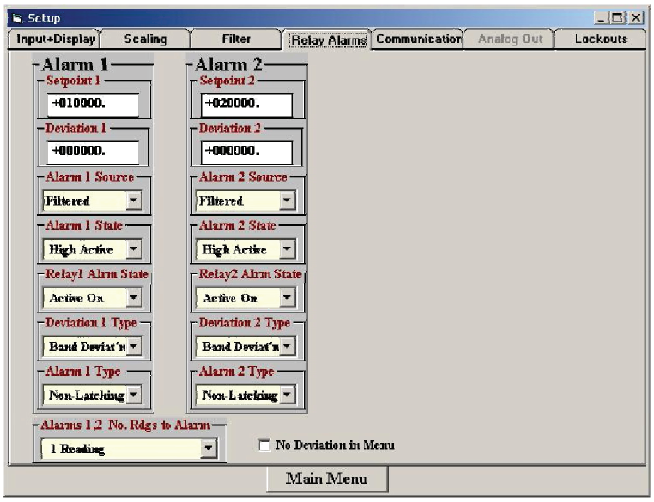
ESTABLISHING COMMUNICATIONS

Connect the meter and PC. Apply power to the meter. Be sure that the meter is in Run Mode, not Setup Mode. To start the software from Windows, click on *Start* => *Programs* => *IS2* => *IS2*. Click on *RS232* => *Establish*. The program will temporarily set the selected Com port to the required baud rate, parity, data bits and stop bit. Once communications have been established, click on *Main Menu*. The software will sense the type of meter and installed boards, but it cannot sense jumpers positions nor set jumpers for you. If the computer is not connected to a meter, select *DPM* and *Series 2*.









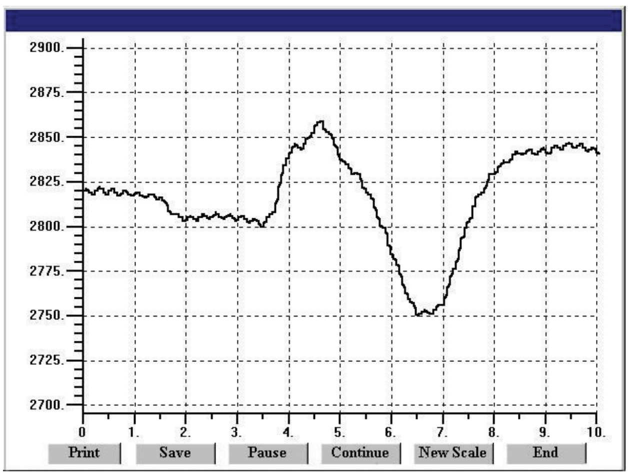
SETUP OF CONNECTED METER

A setup file can be retrieved from the meter (*DPM => Get Setup*), be edited (*View => Setup*), be saved to disk (*File => Save Setup*), be retrieved from disk (*File => Open Setup*), and be downloaded into one or multiple meters (*DPM => Put Setup*). Downloading of setup files from a PC can be a major time saving when multiple meters have to be set up in the same way.

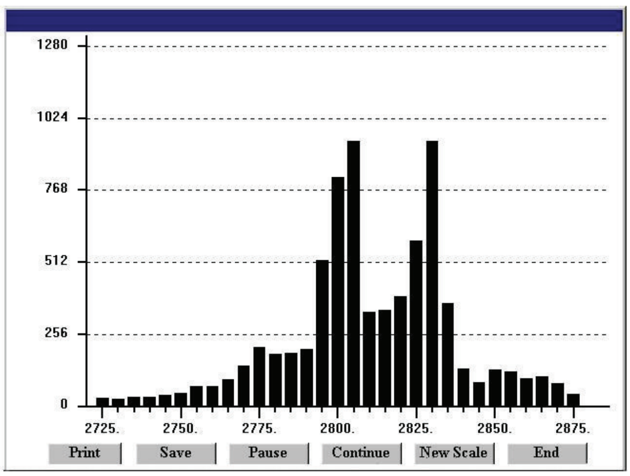
You will find that *Instrument Setup software* is very user friendly, with separate tab-selectable windows for *Input+Display*, *Scaling*, *Filter*, *Relay Alarms*, *Communications*, *Analog Out*, and *Lockouts*. If the required hardware, such as the analog output board, is not sensed, the corresponding tab will be grayed out.

ADDITIONAL FEATURES

- **The Commands pull-down menu** allows you to execute certain meter functions by using your computer mouse. You can reset individual meter functions, display current or peak readings, and enter numbers to be displayed remotely by the DPM. The first position of a transmitted number must be a blank, + sign or - sign. Five digits and a decimal point must be transmitted. Leading 0's serve as blanks. The *Commands* pull-down menu will be grayed out unless a *Get Setup* has been executed.

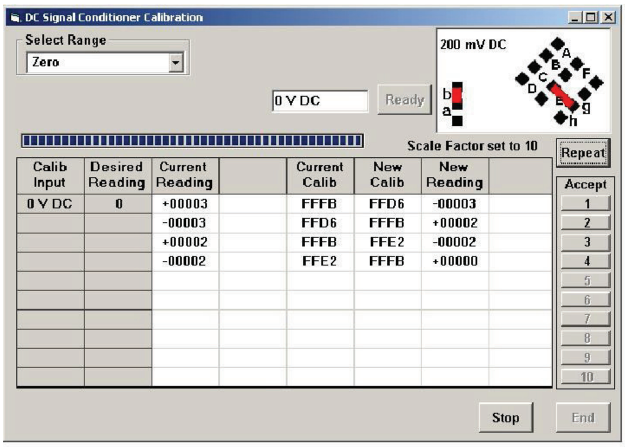


Plot



Graph

- **The Readings pull-down menu** provides three formats to display DPM data on the PC monitor. Use the *Pause* and *Continue* buttons to control the timing of data collection, then press **Print** for a hardcopy using your PC printer.
  - **List** presents the latest readings in a 20-row by 10-column table. Press *Pause* at any time to freeze the display. Press *Print* for a hardcopy. *List* can capture peak readings.
  - **Plot** generates a plot of readings vs. time in seconds. It effectively turns the DPM-PC combination into a printing digital oscilloscope.
  - **Graph** generates a histogram, where the horizontal axis is the reading and the vertical axis is the number of occurrences of readings. The display continually resizes itself as the number of readings increases.



- **The Jumpers pull-down menu** provides jumper positions for the various meter boards, duplicating information in this manual.
- **The Calibration pull-down menu** allows easy calibration of voltage and current ranges for the DC, load cell, and AC RMS signal conditioner boards. The PC first recognizes the type of board, then prompts you to apply specific jumpers and calibration signals. Press *Ready* to take a reading. Press *Repeat* to take more readings. When you have decided on which reading to accept, press on the number *1* through *10* of that reading. Additional calibration software is available online.

METER SETUP WITH AN UNCONNECTED PC

Instrument Setup software is also of benefit when the PC is not connected to a meter. Upon launching the software, click on *None* for *Communications*, then on *DPM* and *Series 2*. Click on *File => Default Setup* to retrieve a default setup file from disk, or on *File => Open Setup* to retrieve a previously saved setup file from disk.

MENU KEY	S	1	2	3	4	5
InPut			d	C		V
SEtuP		0	0	0	0	0
ConFiG		0	0	0	0	0
FiLtEr		0	0	1	1	6
DecPt		d	d	d.	d	d
SCALE		0	0	0	1	0
OFFSt		0	0	0.	0	0
SEr 1				0	5	0
SEr 2			0	0	1	1
Loc 1		0	0	0	0	0
Loc 2			0	0	1	0
Loc 3			0	0	0	0

To enter new setup information, click on *View => Setup*, then make your screen selections as if you were connected to a meter. Tabs will be grayed out if you have not selected the required hardware under the *Input+Display* tab. When done, press on *Main Menu*, then on *View => Menu*. The selections made under *Setup* will now be shown in the form of the required front panel programming sequence, where each row corresponds to a menu item selected by the ➥ key, and the seven data columns correspond to values entered via the ▶| and ▲| keys.

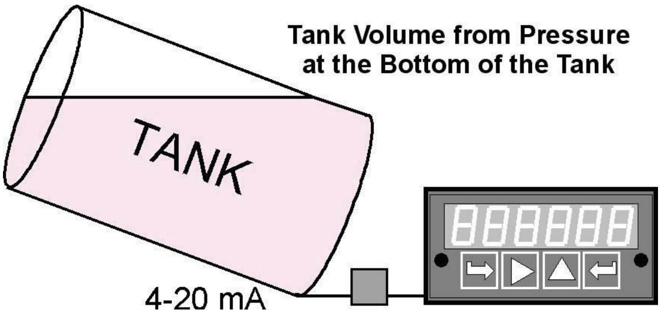
Click on any step in the sequence to bring up a detailed help window.

Click on *Print* for a hardcopy, which you can then use as an instruction sheet to program your meter via its front panel.

Click on *Main Menu => File => Save Setup As* to save your setup to disk and have an electronic record.

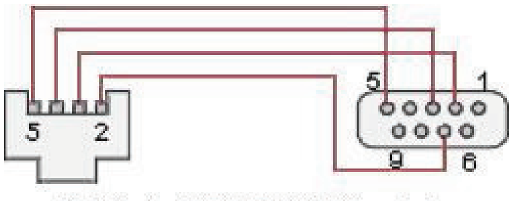
21. CUSTOM CURVE LINEARIZATION

Curve.exe is a DOS-based, executable PC program used to set up an Extended meter* so that the readings have a user-defined, non-linear relationship with the input signal. The calculated linearizing parameters are downloaded into non-volatile memory of the meter. For example, it allows a meter to correct for transducer nonlinearity or to display volume of an irregularly shaped tank based on liquid level. The curve-fitting algorithm uses quadratic segments of varying length and curvature, and provides diagnostics to estimate curve fitting errors. The program is self-prompting, avoiding the need for a detailed printed manual. This manual section is only intended as an introduction and get-started guide.



PREREQUISITES

1) PC-compatible computer with an available Com 1 or Com 2 RS232 port.
2) Extended meter*.
3) An RS232 board in the meter. This board can be used for meter setup only, then be removed.
4) An RJ11-to-DB9 RS232 cable to connect the meter and PC (see Section 1, Ordering Guide).
5) *Curve.exe* software (downloadable from the web at no charge).



RJ11-to-DB9 RS-232 cable

GETTING STARTED

Download *curve.exe* into the same directory that will contain your data files, such as *c:\curves*. Set the meter baud rate to 9600. To do so, press the ➡ key to get to **SEr 1**, then set the entry to **__050**. Set the meter address to 1. To do so, press the ➡ key to get to **SEr 2**, then set the entry to **_0011**. To execute the program from Windows, simply double-click on *curve.exe*, which is an executable file. Follow the steps on computer screens, which will prompt you and provide extensive information. Pressing **R** (Enter) returns to the main menu.

You will be given the choice to enter your data in one of four modes:

1) **Text file entry mode,** with an X value in one column and a Y value in another. There can be additional columns, which are ignored. The file must have a DOS name of up to 8 characters and the extension .RAW. There can be from 5 to 180 rows. X is the input value and should be in the unit of measure for which the meter was set up, such as mV, V, mA or A. Y is the desired corresponding reading and can range from -99999 to 99999 with any decimal point.
2) **2-coordinate keyboard entry mode,** where an actual X input signal is applied, and the desired Y reading is entered from the keyboard.
3) **2-coordinate file entry mode,** where an actual X input signal is applied, and the desired Y reading is provided from a file.

4) **Equation entry mode,** where the coefficients of a polynomial Y = K1X^P1 + K2X^P2 + K3*X^P3 + … are entered. Up to 20 terms are allowed. An offset can be built into X.

You will be asked if your DPM has a revision of DPM4L or later. You will normally select **2** (yes), since revision DPM4L started to ship in August 2000.

You will be asked to supply the following:

LOW X-COORDINATE VALUE >
LOW INPUT MEASUREMENT VALUE >
HIGH X-COORDINATE VALUE >
HIGH INPUT MEASUREMENT VALUE >

This informs the computer of your signal conditioner jumper settings. Enter 0 and 0 for the two LOW values. For HIGH X, enter your signal conditioner jumper range in the same units of measure that you will be using in your *.RAW data input file. Enter **20** for 20 mV or 20V. Enter **200** for 200 mV or 200V. Enter **5** for 5A AC or DC. For HIGH INPUT MEASUREMENT VALUE, enter **20000**, except for 5A DC, where you should enter **5000**.

Position of the decimal point from 6=X.XXXXX, 5= XX.XXX, 4=XXX.XXX, 3=XXXX.XX, 2=XXXXX.X, 1=XXXXXX (for DPMs, the leading X is a blank). Specify the same position that you specified in the **dEc.Pt** decimal point menu selection.

Follow the steps on the screens to finish generating the custom curve. When prompted to download the file to the meter, select **Y**. When prompted to set the meter to custom curve mode, also select **Y**.

KEYPAD CONTROL

You can take a meter in and out of custom curve linearization using the meter keypad. From the Menu mode, press the → key to get to **nFG** hen set the fifth digit to either **0** (normal linear operation) or to **1** (custom curve operation). This fifth digit will only be displayed with an Extended meter*.

FILES USED OR CREATED BY CURVE.EXE

1) ***.RAW** is the raw input file generated by all four data entry methods.
2) ***.DVD** adds three columns from which the smoothness of the input data and obvious input errors can be judged. The more data points and the smoother the data, the better the curve fit.
3) ***.NUM** lists Y readings prior to custom curve linearization and addition of the decimal point.
4) ***.CCF** is an internal file used by the software.
5) ***.SIM** lists simulated linearized meter readings and calculated corresponding errors.
6) ***.PRM** contains the final hex data that is downloaded into the meter.

22. METER CALIBRATION

All analog input and analog output ranges of the meter have been digitally calibrated at the factory prior to shipment using calibration equipment certified to NIST standards. Calibration constants are stored digitally in non-volatile memory in EEPROM on the signal conditioner board and analog output board. As a result, these boards may be mixed and interchanged without requiring meter recalibration. Digital calibration eliminates much of circuitry that would be associated with analog calibration, providing superior long term accuracy and stability.

If recalibration is required, the meter may be returned to the factory or to any authorized distributor. Easy calibration of DC, AC and load cell signal conditioner ranges is possible using the Instrument Setup software, as described in Section 20. To allow computer aided calibration, an RS232 or RS485 interface card must be installed in the meter. This card may be installed temporarily and be removed following calibration. Step-by-step instructions and advanced calibration software are available from the factory.

23. SPECIFICATIONS

BASIC METER

Display

Type.................................... 5 LED, 7-segment, 14.2mm (.56") high digits & 3 LED indicators
Color .... Red or green
Range .... -99999 to +99999 and -99990 to +99990

A to D Conversion

Technique (Pat.5,262,780) ....Concurrent Slope™
Read Rate ....60/s for 60 Hz NMR, 50/s for 50 Hz NMR
Output Update Rate.. 56/s at 60 Hz, 47/s at 50 Hz
Display Update Rate... 3.5/s at 60 Hz, 3/s at 50 Hz

Noise Rejection

CMV from DC to 60 Hz .... Withstand 250Vac
Dielectric strength .... 3.5 kV ac for 5 sec, 2.3 kV ac for 1 min
CMR from DC to 60 Hz .... 130 dB
NMR at 50/60 Hz .... 90 dB with minimum digital filtering

Control Inputs (CMOS/TTL levels, logic 1 = tied to digital ground, logic 0 = open)

/ Hold input .... Logic 1 holds display and outputs
/ Peak input..Logic 1 displays peak value
/ Tare input .... Logic 1 offsets input value to zero
/ Reset input .... Logic 1 resets all meter functions
/ Function Reset input.. Logic 1 resets peak values and alarms
/ Decimal Point input..................... Overrides internal DP selections and controls DP position

ACCURACY

DC Volts

Voltage Range	Resolution	Input Ohms	Error at 25°C
200.00 mV 2.0000 V 20.000 V 200.00 V 300.0 V	10 µV 100 µV 1 mV 10 mV 100 mV	1 GO 1 GO 1 MO 1 MO 1 MO	0.01% of FS ±2 Cts

DC Amps

Current Range	Resolution	Input Ohms	Error at 25°C
2.0000 mA 20.000 mA 200.00 mA 5.000 A	0.1 µA 1 µA 10 µA 1 mA	100 O 10 O 1 O 0.01 O	0.01% of FS ±2 Cts

Ratio

Current Range	Resolution	Input Ohms	Error at 25°C
200.00 mV 2.0000 V 20.000 V	10 µV 100 µV 1 mV	1 GO 1 GO 1 MO	0.01% of FS ±2 Cts

True RMS Volts (1% to 100% of Full Scale)

Voltage Range	Resolution	Input Ohms	Error at 25°C
200.00 mV 2.0000 V 20.000 V 200.00 V 250.0 V	10 µV 100 µV 1 mV 10 mV 100 mV	22 MO 22 MO 1 MO 1 MO 1 MO	0.15% of FS, 10 Hz to 10 kHz

True RMS Amps (1% to 100% of Full Scale)

Current Range	Resolution	Input Ohms	Error at 25°C
2.0000 mA 20.000 mA 200.00 mA 5.000 A	0.1 µA 1 µA 10 µA 0.25 mA	100 O 10 O 1 O 0.01 O	0.15% of FS, 10 Hz to 10 kHz

RTD (0.01°, 0.1°, 1° resolution)

Pt 100 Type	Range	Error at 25°C
DIN .00385	-202 to 850°C -331 to 1562°F	.01% FS ±0.03°C .01% FS ±0.05°F
ANSI .003925	-202 to 631°C -331 to 1168°F	.01% FS ±0.04°C .01% FS ±0.07°F

Thermocouple (0.1°, 1° resolution)

TC Type	Range	Error at 25°C
J	-210 to 760°C -347to 1400°F	.01% FS ±0.09°C .01% FS ±0.16°F
K	-244 to 1372°C -408to 2501°F	.01% FS ±0.10°C .01% FS ±0.17°F
T	0 to 400°C -257 to 0°C 32 to 752°F -430 to 32°F	.01% FS ±0.03°C .01% FS ±0.20°C .01% FS ±0.05°F .01% FS ±0.36°F
E	-240 to 1000°C -400 to 1830°F	.01% FS ±0.18°C .01% FS ±0.32°F
N	-245 to 1300°C -410 to 2370°F	.01% FS ±0.10°C .01% FS ±0.17°F
S	-46 to +68°C -51 to +213°F	.01% FS ±0.12°C .01% FS ±0.22°F
R	-45 to 1768°C -49 to 3214°F	.01% FS ±0.17°C .01% FS ±0.31°F

Load Cell Input

Input Range	Reso-lution	Output Zero Range	Output Span Range	Error at 25°C
20.000 mV 50.000 mV 100.00 mV 250.00 mV 500.00 mV	1 µV 2.5 µV 5 µV 12.5 µV 25 µV	-99999 to 99999	0 to ±99,999	0.01% of FS ±1 Ct

Span Tempco .... 0.003% of reading/°C
0.0015% of reading/°C for load cell meter Zero Tempco
....0.2 μV/°C
Reference Junction Accuracy .... 1°C, 10°C to 40°C

POWER REQUIREMENTS

Input Voltage rating (standard) .... 95-240V ac ±10% or 90-300V dc ±10%
Input Voltage rating (low voltage option)...10-34V ac or 10-48V dc
Power Line Frequency..DC and 47-63 Hz
Power Consumption, Max.. 5 Watts

EXCITATION OUTPUTS

Voltage & Current Levels (jumper selectable) .... 5V dc ±5%, 100 mA max
10V dc ±5%, 120 mA max
24V dc ± 5%, 40 mA max
Excitation Output Ripple .... 100 mVp max
Isolation from power and outputs.. 250 Vac
Insulation dielectric strength to power and outputs ..... 3.5 kV ac for 5 sec, 2.3 kV ac for 1 min
Isolation to signal common .... 50V dc

DUAL RELAY OPTION

Power to Relay Option... Powered by meter
Setpoint Setup ....Via front panel pushbuttons or RS232/485
Update Rate .... 56/s at 60 Hz, 47/s at 50 Hz
Response to input signal (min) .... Display update rate
Input Signal (selectable) .... Filtered or unfiltered input signal
Actuation Modes (selectable) ...... Above or below setpoint, latching or non-latching, disabled Output Time Delay (selectable) ....1 to 128 readings Front Panel Enable / Lockout Modes (selectable) .... 1) Display and change setpoints 2) Display but do not change setpoints 3) Neither display nor change setpoints

Alarm Status Indication..2 red LED lamps
Status Indication Setup (selectable) .... Lit when output is ON or OFF, or disabled

Contact Relay Output:
AC Rating .... 8A @ 240V ac
DC Rating .... 8A @ 24V dc
Isolation rating between signal common and contacts.. 250V ac
Insulation dielectric strength between signal common and contacts.......................................
.... 3.5 kV ac for 5 sec, 2.3 kV ac for 1 min

Solid State Relay Output:
AC Rating ....120 mA @ 125V ac, 24 ohms series resistance
DC Rating ....240 mA @ 150V dc, 6 ohms series resistance
Isolation rating between signal common and contacts.. 250V ac
Insulation dielectric strength between signal common and contacts.......................................
.... 3.5 kV ac for 5 sec, 2.3 kV ac for 1 min

ANALOG OUTPUT OPTION

Power to Analog Output Option .... Powered by meter
Output Levels (voltage & current available simultaneously) ...0-20 mA or 4-20 mA and 0-10V
Voltage Compliance, 0-20 mA Output .... 12V (0-600 Ohm load)
Current Compliance, 0-10V Output.. 2 mA (5 kOhm or higher load)
Accuracy... Meter input accuracy ±0.1% of full scale analog output
Response Time.. Display update rate
Scaling of Reading for Zero Output .... -99,999 to +99,999
Scaling of Reading for Full Scale Output .... -99,999 to +99,999
Isolation rating between signal common and analog output .... 250V ac
Insulation dielectric strength between signal common and analog output ....
.... 3.5 kV ac for 5 sec, 2.3 kV ac for 1 min

SERIAL INTERFACE OPTION (RS232, RS485, RS485-Modbus boards)

Power to Interface Option .... Powered by meter
RS485 Wiring ....Half or full duplex
Baud Rates..300, 600, 1200, 2400, 4800, 9600, 19200
Serial Protocols.......................... Custom ASCII*, Modbus* RTU, Modbus* ASCII (selectable)
Signal Levels ....Meet RS232 and RS485 standards
Connectors .... Single RJ11 (RS232), two RJ11 (RS485), two RJ45 (RS485-Modbus)
Isolation rating between signal common and serial I/O... 250V ac
Insulation dielectric strength between signal common and serial I/O......................................
.... 3.5 kV ac for 5 sec, 2.3 kV ac for 1 min

PARALLEL BCD OUTPUT OPTION

Power to BCD Output Option... Powered by meter
Type.. 3-state, stored, parallel
Signal Levels ....LSTTL, CMOS compatible
Controls .... BCD Enable, Hold, Data Ready
Isolation rating between signal common and BCD output .... 250V ac
Insulation dielectric strength between signal common and BCD output ....
.... 3.5 kV ac for 5 sec, 2.3 kV ac for 1 min

ENVIRONMENTAL

Operating Temperature .... 0°C to 55°C
Storage Temperature... -40°C to 85°C
Relative Humidity..95% from 0°C to 40°C, non-condensing
Case .... NEMA-4X from front when panel mounted
Shock..10 G at 1 kHz, applied in X, Y, Z axes
Vibration .... 15 Hz to 150 Hz, 1 mm to 2 mm amplitude, 20 G max.

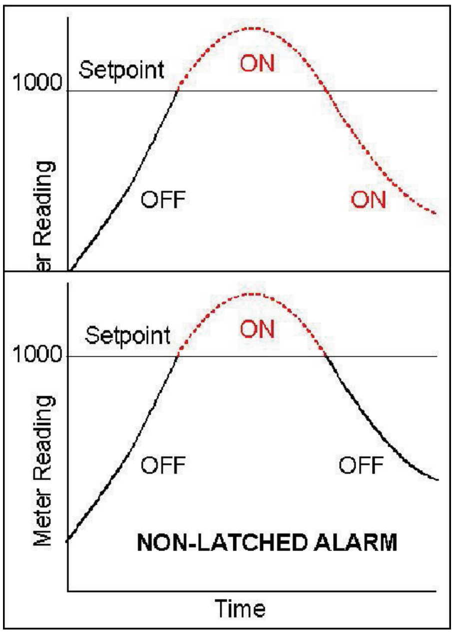
24. GLOSSARY OF TERMS

Adaptive Filter Threshold

A threshold which causes an adaptive moving average filter to be reset to the latest reading when the accumulated difference between individual readings and the filtered reading exceeds that threshold. Adaptive moving average filtering allows a meter to respond rapidly to actual changes in signal while filtering out normal noise. The accumulated difference is also reset to zero when the latest reading has a different polarity than the filtered reading. A low adaptive filter threshold is normally selected. A high filter threshold should be selected if the signal has large transients.

Alarm, Latched

An alarm which stays actuated until reset. Latched alarms can shut down machinery or a process when an operating limit has been exceeded, or maintain an alarm condition until acknowledged by an operator.



Alarm, Non-latched

An alarm which changes state automatically when the reading rises above a specified limit and changes back automatically when the reading falls below a limit.

Autofilter A selectable digital filter mode which automatically selects an appropriate moving average filter time constant from 0.08 sec to 9.6 sec for the encountered noise condition.

Auto-tare A selectable meter operating mode, where the first reading following power-on or meter reset is used to zero the display. Further readings are then relative to this new zero.

Batch Average Filter

A digital filter mode which averages 16 readings and then displays the average. Readings are taken at 60/sec with 60 Hz power and 50/sec with 50 Hz power.

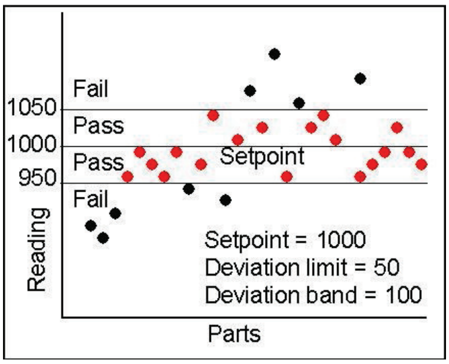
Counts The reading displayed on the panel meter ignoring the decimal point.

Custom ASCII Protocol

A simplified, short protocol for use with these panel meters. It allows 31 digital addresses. Not an industry-standard protocol, like the more complex *Modbus protocol*, which is also offered with the meters.

Deviation Band

A band in counts which controls relay action symmetrically around a *setpoint*. The relay actuates when the reading falls within the deviation band, and de-actuates when the reading falls outside. A limit (e.g., 50 counts) is set up around both sides of the setpoint to create a deviation band (e.g., 100 counts).



Setting up a passband around a setpoint is often used for component testing. Deviation limits are programmed by entering menu item *dEU1b* for Alarm 1 and *dEU2b* for Alarm 2. The deviation band will be equal to two limits.

Display Blank A rear panel input which blanks the display when the input is tied to logic ground by a switch or 0V is applied (logic level true). The meter display will light when the input is open or is held at +5V (logic level false).

Extended Meter
A digital panel meter with an enhanced microcomputer that provides added capabilities, specifically linearization of nonlinear inputs and display of rate of change from successive readings.

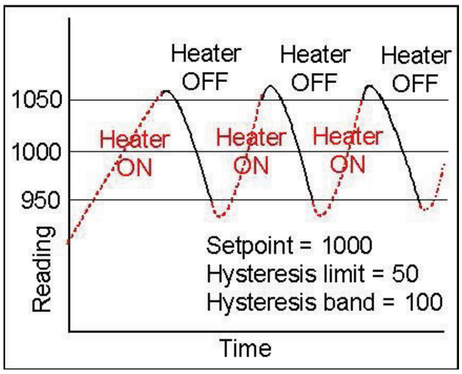
Full Scale The maximum input signal range for which the meter has been configured. For example, the most sensitive full scale for the load cell meter is ±20 mV (signal range from -20 mV to +20 mV).

Function Reset
A rear panel control input which resets Peak, Valley and any latched alarms when the input is tied to logic ground by a switch or 0V is applied (logic level true). To reset the value again, the input must be open or 5V applied (logic level false) and then set low.

Ground Loop A closed conductive path in external ground wiring that allows stray currents to flow in ground wiring, creating ground noise. The meters in this manual minimize ground loop problems by mutually isolating the grounds associated with meter power, signal input, and all output and communication options.

Jumper A push-on component which provides a short between two adjacent posts on a circuit board. Jumpers are used to configure signal conditioner boards for specific signal types and full scale ranges, and to configure power supply and communications boards for various modes of operation. Unused jumpers are stored by pushing one side over an unused post.

Hysteresis Band
A band which controls relay action symmetrically around a setpoint. The relay closes (or opens) when the reading goes above the setpoint plus one hysteresis limit, and opens (or closes) when the reading falls below the setpoint less one hysteresis limit. A narrow hysteresis band is often used to minimize relay chatter around a setpoint due to electrical noise or signal feedback caused by load switching. A wide hysteresis band can be used for control applications, such as turning on a fill pump when the tank level has reached a lower limit and shutting off the pump



when the tank level has reached an upper limit. The hysteresis band will be equal to two hysteresis limits.

Menu Mode The meter programming mode used for input and range selection, meter setup, and meter configuration. Entered into from the Run mode by pressing the *MENU* key. The Menu mode can be locked out completely by a jumper.

Meter Hold A rear panel input which freezes the meter display and all meter outputs while that input is tied to logic ground by a switch or is held at 0V (logic level true). The meter will resume operation when the input is allowed to float or is held at +5V (logic level false).

Modbus An industry-standard serial communications protocol which allows devices by different manufacturers to be digitally addressed by a PC on the same communication line, with up to 247 digital addresses. More complex than the *Custom ASCII* protocol, which is also supported by these meters.

Moving Average Filter

A digital filter mode which displays a weighting moving average of readings. Readings are taken at 60/sec with 60 Hz power and 50/sec with 50 Hz power. Display update rates remain 3.5/sec with 60 Hz power and 3.0/sec with 50 Hz power. There are eight moving average modes:

Old average x 1/2 + new reading x 1/2 (equivalent to 0.08 sec RC time constant).
Old average x 3/4 + new reading x 1/4 (equivalent to 0.15 sec RC time constant).
Old average x 7/8 + new reading x 1/8 (equivalent to 0.3 sec RC time constant).
Old average x 15/16 + new reading x 1/16 (equivalent to 0.6 sec RC time constant).
Old average x 31/32 + new reading x 1/32 (equivalent to 1.2 sec RC time constant).
Old average x 63/64 + new reading x 1/64 (equivalent to 2.4 sec RC time constant).
Old avg. x 127/128 + new reading x 1/128 (equivalent to 4.8 sec RC time constant).
Old avg. x 255/256 + new reading x 1/256 (equivalent to 9.6 sec RC time constant).

Offset A constant adder used for the displayed reading. This is the term b in the straight line formula $y = mx + b$, where y is the displayed reading in counts, m is the scale factor, x is the measured reading in counts, and b is the offset. For direct readout in (milli)volts or (milli)amps, *offset* is 0.

Peak Display The maximum (or most positive) reading since that maximum was last reset. Reset can be via the meter front panel, an external input, or a software command. The displayed value can reflect the filtered or unfiltered readings.

Process Signal

A signal whose display requires setup of *scale* and *offset* settings for display in engineering units. A classical process signal is 4-20 mA, where the 4 mA and 20 mA end points can each correspond to a desired meter reading.

Rate of Change Meter

A configuration mode of the *Extended meter* which allows the display of rate based on successive readings. The conversion to engineering units is achieved with the combination of a multiplier from 0.1 to 10,000 and a scale factor.

Reading The value displayed by the meter. "Taking a reading" is the action of the meter to make an analog-to-digital conversion. Readings are taken at 60/sec with 60 Hz power or 50/sec with 50 Hz power, and are displayed with an update rate of 3.5/sec with 60 Hz power or 3.0/sec with 50 Hz power.

Remote Display
A display mode which allows the meter to serve as a remote display to another meter when connected to it by a 4-wire phone cord. Also allows the meter to transmit raw measurement data to a computer and then display processed data from the computer. A serial communications option board is required in the meter. If such a board is not installed or no serial data is received, the meter displays *rESEt*.

Reset There are three types of Reset:

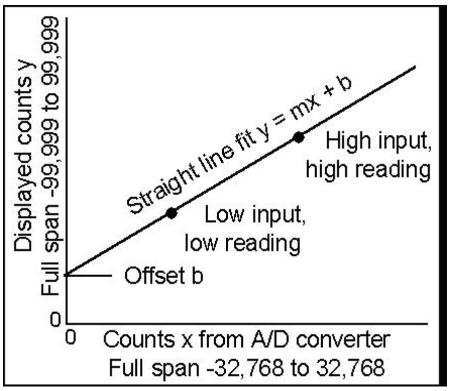
- Peak and Valley Reset. Achieved by simultaneously pressing the *RESET* and *PEAK* keys.
- Latched Alarm Reset. Achieved by simultaneously pressing the *RESET* and *ALARMS* keys.
- Meter Reset. Causes the meter to reinitialize and take a tare reading when set up for *auto-tare*. Achieved powering up the meter, by pressing the *RESET* and *MENU* keys simultaneously, stepping through all top-level menu choices, grounding a rear panel connector, or supplying an ASCII command. *rESEt* is displayed briefly.

RS485 Half Duplex
Serial communications implemented with two wires, allowing data transmission in both directions, but not simultaneously.

RS485 Full Duplex
Serial communications implemented with four wires, allowing data transmission in two directions simultaneously.

Run Mode The normal operating mode of the meter, where readings are taken, as opposed to the *menu mode*.

Scale A constant multiplier used to go from A/D converter counts to displayed counts. This is the slope term *m* in the straight line formula $y = mx + b$, where *y* is the displayed reading in counts, *m* is the scale factor, *x* is the measured reading in counts, and *b* is the offset. For direct readout in (milli)volts or (milli)amps, scale is 1.



Scaling The process of setting *scale* and *offset* so that the meter reads properly in engineering units (such as psi).

Scaling, Coordinates of 2 Points Method
A scaling method where four numbers are entered manually: low input, desired reading at low input; high input, and desired reading at high input. The meter

then applies a straight line fit. The decimal point is set by the separate *dEC.Pt* menu item.

Scaling, Scale and Offset Mmethod

A scaling method where *scale* and *offset* are entered manually.

Scaling, Reading Coordinates of 2 Points Method

A scaling method, where the low and high input values are determined from actual signals. A known low signal is first applied to the meter, such as the output of a pressure transducer at zero pressure. That signal is captured as the low input value, and the desired low reading is entered. A known high signal is then applied, such the output of a transducer for a know weight or pressure. That signal is captured as the high input value, and the desired high reading is entered. The meter then applies straight line fit. This scaling method has the advantage of calibrating the transducer and meter as a system. The actual voltage or current at either point does not need to be known. The decimal point is set by the separate *dEC.Pt* menu item.

Setpoint A value compared to the reading to determine the state of a relay. Term often used interchangeably with "alarm setpoint." The relay action can by *latching* or *non-latching*, utilize a *hysteresis band*, or utilize a *deviation band*. Hysteresis bands and deviation bands are specified by two symmetrical limits around the *setpoint*.

Span The number of *counts* corresponding to a given signal range.

Tare A rear panel input which causes the display to be set to zero when the input is momentarily tied to logic ground by a switch or is held at 0V (logic level true). When the input is allowed to float or is held at +5V (logic level false), the meter displays readings relative to this new zero. A common application is in weighing, where an external Tare button is pressed to read the weight of an empty scale (tare), and tare is then automatically subtracted as a constant from gross weight for display of net weight. Tare can also be used for other applications where a reading relative to starting point is desired.

Valley Display

The minimum (or most negative) reading since that minimum was last reset. Reset can be via the meter front panel, an external input, or a software command. The displayed value can reflect the filtered or unfiltered readings.

Zero When used with process meters, *zero* is an adjustment so that a given low transducer output reads zero on the meter. *Zero* is adjusted by programming *offset*.

25. WARRANTY

London Electronics Ltd. warrants its products against defects in materials or workmanship for a period of one year from the date of purchase.

In the event of a defect during the warranty period, the unit should be returned, freight prepaid (and all duties and taxes) by the Buyer, to the authorized London distributor where the unit was purchased. The distributor, at its option, will repair or replace the defective unit. The unit will be returned to the buyer with freight charges prepaid by the distributor.

LIMITATION OF WARRANTY

The foregoing warranty shall not apply to defects resulting from:

1. Improper or inadequate maintenance by Buyer.
2. Unauthorized modification or misuse.
3. Operation outside the environmental specifications of the product.
4. Mishandling or abuse.

The warranty set forth above is exclusive and no other warranty, whether written or oral, is expressed or implied. London specifically disclaims the implied warranties of merchantability and fitness for a particular purpose.

EXCLUSIVE REMEDIES

The remedies provided herein are Buyer's sole and exclusive remedies. In no event shall London be liable for direct, indirect, incidental or consequential damages (including loss of profits) whether based on contract, tort, or any other legal theory.