# INSTRUCTIONS FOR THE 16L  SERIES MICROPROCESSOR  BASED TEMPERATURE / PROCESS LIMIT CONTROL
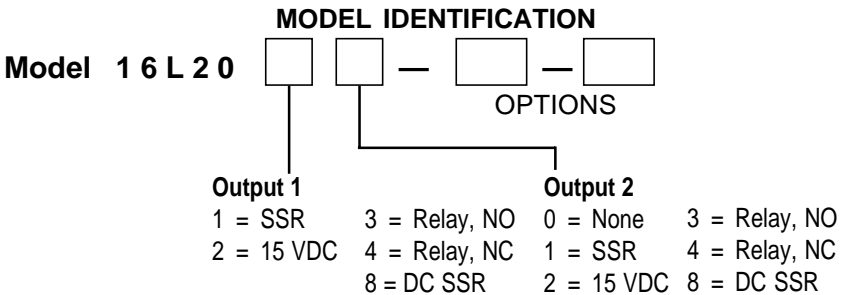


$C \in$  FM

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Dwyer Instruments, Incorporated

December, 1998                                           949-1270

# CONTENTS

## MODEL IDENTIFICATION

**Model 1 6 L 2 0** [ ] [ ] — [ ] — [ ]

OPTIONS

**Output 1**
1 = SSR    3 = Relay, NO
2 = 15 VDC   4 = Relay, NC
              8 = DC SSR

**Output 2**
0 = None    3 = Relay, NO
1 = SSR     4 = Relay, NC
2 = 15 VDC   8 = DC SSR

**Options:**

934    Analog Retransmission of Process Variable, 4 to 20 mAdc.
936    Analog Retransmission of Process Variable, 0 to 10 Vdc.
948    4-Stage Set Point.
992    RS-485 Serial Communications.
993    RS-232 Serial Communications.
9502 12 - 24 Vdc/Vac 50-400Hz power supply (control operates on low
        voltage equipment).
Note:    Only Option 9502 may be combined with another option.

# GETTING STARTED

1.  Install the control as described on page 4.

2.  Wire your control following the instructions on page 5. If you are using a two-wire transmitter as an input, see the drawing and instructions on page 6. Option wiring instructions are on Page 7. Option descriptions and specific instructions start on page 16.

3.  Most controls do not need many (if any) program changes to work on your process. For best results when programming changes are necessary, make all the necessary changes in the Secure Menu (page 26) before making changes to the Secondary Menu (page 19). If error messages occur, check the Diagnostic Error Messages on page 35 for help.

Take the example of a Model 16L2010 that comes from the factory programmed for type J thermocouples. Suppose for this example you wish to change the input to type K and limit the set point range between 0° and 1000° C.

First, enter the Secure menu as instructed on page 5. Press the INDEX key until the display shows **Inp** and press the DOWN ARROW until the display shows **CA**. Don't forget to press the ENTER key to retain your setting.

Next, press the INDEX key to display **Unit**. Press the DOWN ARROW until the display shows **C**. Press ENTER.

Next, press the INDEX key until **SPL** is displayed (pass the **dPt** and **InPt** selections). Press the UP ARROW until the display shows **0**. Press ENTER.

Finally, press INDEX key to display **SPH**. Press the DOWN ARROW until the display shows **1000**. Press ENTER.

The necessary program changes are now complete. After 30 seconds the display will switch back to the temperature reading. If you want to return faster, press the UP ARROW and ENTER keys (at the same time) and then press the DOWN ARROW and INDEX keys ( again at the same time). This will 'back out' of the menu and immediately display the temperature reading.

# INSTALLATION

Mount the instrument in a location that will not be subject to excessive temperature, shock, or vibration. All models are designed for mounting in an enclosed panel.

Select the position desired for the instrument on the panel. If more than one instrument is required, maintain the minimum of spacing requirements as shown on the drawing below. Closer spacing will structurally weaken the panel, and invalidate the IP66, UL type 4 rating of the panel.

Prepare the panel by cutting and deburring the required opening.
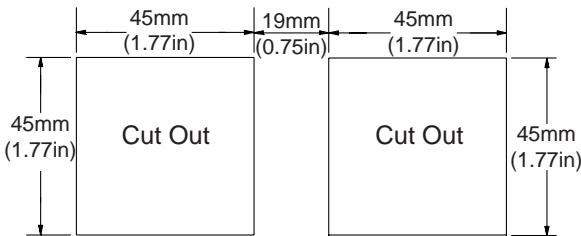


All Tolerances are -0.00 +0.60mm (-0.000 +0.020)

From the front of the panel, slide the housing through the cut out. The housing gasket should be against the housing flange before installing.

From the rear of the panel slide the mounting collar over the housing. Hold the housing with one hand and using the other hand, push the collar evenly against the panel until the spring loops are slightly compressed. The ratchets will hold the mounting collar and housing in place.
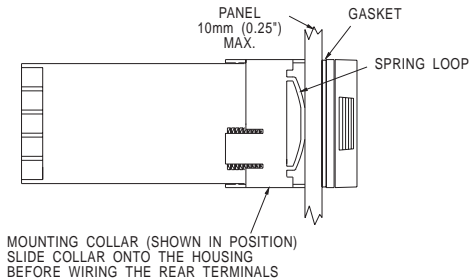


**CAUTION: It is not necessary to remove the instrument chassis from the housing for installation. If the instrument chassis is removed from the housing, you must follow industry standard practice for control and protection against Electro-Static Discharge (ESD). Failure to exercise good ESD practices may cause damage to the instrument.**

# WIRING

Do not run thermocouple or other class 2 wiring in the same conduit as power leads. Use only the type of thermocouple or RTD probe for which the control has been programmed. Maintain separation between wiring of sensor, auxiliary in or out, and other wiring. See the "Secure Menu" for input selection.

For thermocouple input always use extension leads of the same type designated for your thermocouple.

For supply connections use No. 16 AWG or larger wires rated for at least 75°C. Use copper conductors only. All line voltage output circuits must have a common disconnect and be connected to the same pole of the disconnect.

Input wiring for thermocouple, current, and RTD; limit reset function; and output wiring for 15 VDC is rated CLASS 2.

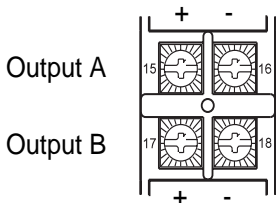Control wiring is as shown.
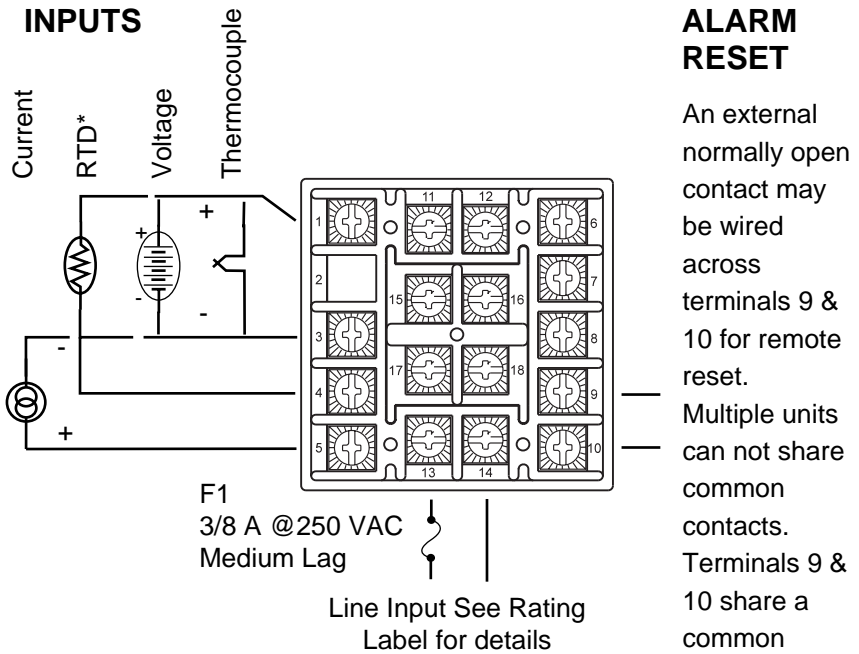


**INPUTS**

**ALARM RESET**

An external normally open contact may be wired across terminals 9 & 10 for remote reset. Multiple units can not share common contacts. Terminals 9 & 10 share a common ground with the input.

F1
3/8 A @ 250 VAC
Medium Lag

Line Input See Rating Label for details

\* For 2-wire RTD use terminals 1 & 3, and place a jumper wire between terminals 3 & 4.

## OUTPUTS

Output A

Output B

+ -

15 16

17 18

+ -

For relay, NO (Order Code 3) or SSR (Order Code 1) outputs, 15 & 16 and 17 & 18 are Normally Open.

For relay, NC (Order Code 4) outputs, 15 & 16 and 17 & 18 are Normally Closed.

For Pulsed DC (Order Code 2) and DC SSR (Order Code 8) outputs, 15 & 17 are positive and 16 & 18 are negative.

## Wiring for 4 to 20mA Transmitter inputs

Wire power and outputs as shown above. Two-wire transmitters wire as shown below.

For three or four wire transmitters follow the wiring instructions provided with your transmitter.

**CAUTION: DO NOT WIRE THE 24 VOLT POWER SUPPLY ACROSS THE INPUT OF THE CONTROL. DAMAGE TO THE CONTROL INPUT CIRCUITRY WILL RESULT.**

Power Supply
15 to 28 VDC

Transmitter
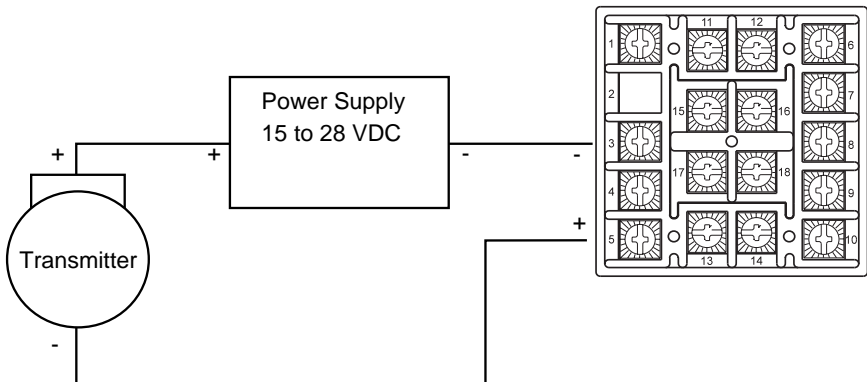
## Wiring for Optional Inputs and Outputs

Wire power and outputs as shown on page 5 and 6. Wiring for options is shown opposite. All wiring shown below is Class 2. Shielded twisted pair is required for Option 992.

CAUTION: DO NOT RUN SIGNAL WIRING IN THE SAME CONDUIT OR CHASE AS THE POWER WIRING. ERRATIC OPERATION OR DAMAGE TO THE CONTROL CIRCUITRY WILL RESULT.

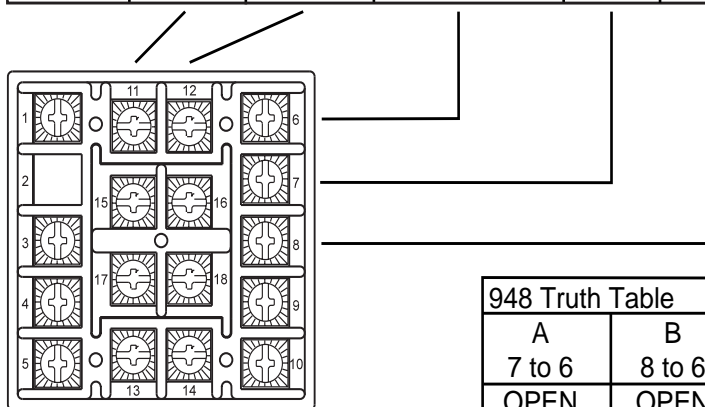SWITCH CONTACTS FOR OPTION 948 MUST BE ISOLATED AND CAN NOT SHARE WIRING WITH OTHER CONTROLS.

| OPTION | 11 | 12 | 6 | 7 | 8 |
|---|---|---|---|---|---|
| 934, 936 | + | - | na | na | na |
| 948 | na | na | Signal Ground | A | B |
| 992 | B | A | na | na | na |
| 993 | Data In | Data Out | Signal Ground | na | na |

| 948 Truth Table | | |
|---|---|---|
| A | B | |
| 7 to 6 | 8 to 6 | SP |
| OPEN | OPEN | 1SP1 |
| CLOSED | OPEN | 2SP1 |
| OPEN | CLOSED | 3SP1 |
| CLOSED | CLOSED | 4SP1 |

RS-232 DB-25 WIRING
(VIEWED FROM WIRE SIDE)

DATA IN          11
DATA OUT       12
DATA GROUND  6

1 2 3 4 5 6 7 8 9 10 11 12 13
14 15 16 17 18 19 20 21 22 23 24 25
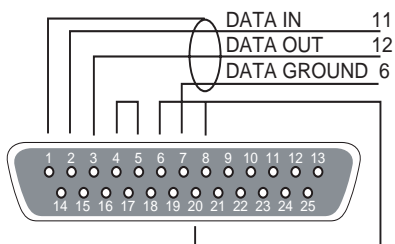
| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | SHIELD | 6 | DSR |
| 2 | TRANSMIT | 7 | GROUND |
| 3 | RECEIVE | 8 | DCD |
| 4 | RTS | 20 | DTR |
| 5 | CTS | | |

RS-232 DB-9 WIRING
(VIEWED FROM WIRE SIDE)

DATA OUT       12
DATA IN          11
DATA GROUND  6

1 2 3 4 5
6 7 8 9
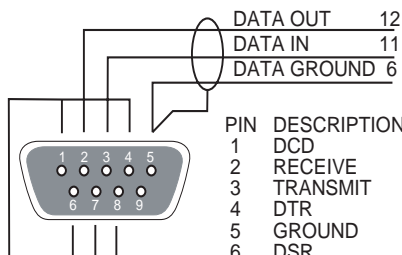
| PIN | DESCRIPTION |
|---|---|
| 1 | DCD |
| 2 | RECEIVE |
| 3 | TRANSMIT |
| 4 | DTR |
| 5 | GROUND |
| 6 | DSR |
| 7 | RTS |
| 8 | CTS |

# FRONT PANEL KEY FUNCTIONS



Remote Indicator

Limit 1 Lamp

Limit 2 Lamp

Process Display

Set Point Display

Limit Reset Key*

°F Indicator

°C Indicator
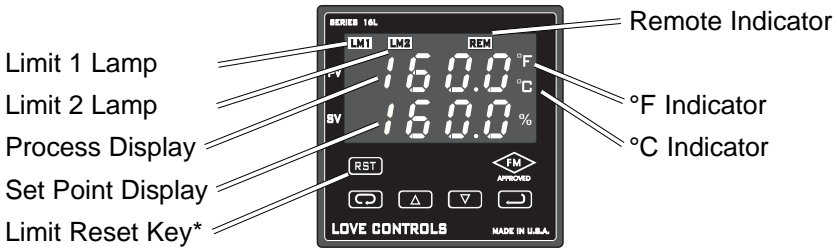
\* Limit Reset key flashes when limit condition is present.

Keys are illuminated when pressed.  Key functions are as follows:

**INDEX:**   Pressing the INDEX key advances the display to the next menu item. May also be used in conjunction with other keys as noted below.

**UP ARROW:**   Increments a value, changes a menu item, or selects the item to ON.   The maximum value obtainable is 9999 regardless of decimal point placement.

**DOWN ARROW:**   Decrements a value, changes a menu item, or selects the item to OFF.  The minimum value obtainable is -1999 regardless of decimal point placement.

**ENTER:**   Pressing ENTER stores the value or the item changed. If not pressed, the previously stored value or item will be retained.  The display will flash once when ENTER is pressed.

**LIMIT RESET:**  This key resets the limit when the limit condition has been removed.  Press and hold for three seconds to activate.

**UP ARROW & ENTER:**   Pressing these keys simultaneously brings up the **secondary menu** starting at the **SP1d** menu item. Pressing these keys for 5 seconds will bring up the **secure menu.**

**INDEX & DOWN ARROW:**   Pressing these keys simultaneously will allow backing up one menu item, or if at the first menu item they will cause the display to return to the **primary menu.**

**INDEX & ENTER**:   Pressing these keys simultaneously and holding them for 5 seconds allows recovery from the various error messages.   The following menu items will be reset:

**S1iH:** Set Point 1 limit inhibit     **S2iH:** Set Point 2 limit inhibit

**OPEn InP:** Input error message     **CHEC CAL:** Check calibration error

**Correct the problems associated with the above conditions <u>before</u> using these reset keys.** More than one error could be present. Caution is advised since several items are reset at one time.

While in the **Primary or Secondary Menu,** if no key is pressed for a period of 30 seconds, the display will return to the HOME position displaying the temperature value. While in the **Secure Menu,** if no key is pressed for a period of 60 seconds, the display will return to the HOME position displaying the temperature value.  Outputs are disabled (turned off) when the **Secure Menu** is active.

**NOTE:**   To move to the **Primary Menu** quickly from any other menu, press the **UP ARROW** & **ENTER** keys followed by pressing the **INDEX** & **DOWN ARROW** keys.

### SECURITY LEVEL SELECTION

Four levels of security are provided. The display shows the current security level. To change security levels change the password value using the **UP & DOWN ARROW** keys and pressing the **ENTER** key.  Refer to the password table (following) for the correct value to enter for the security level desired. The **SECr** menu item security level may be viewed or changed at any time regardless of the present security level.

To set the access level to, for example, **2**, at the **SECr** menu item press the **UP ARROW** key until the upper display show the password, **1101**.  Press the **ENTER** key.  The display will blink, and return with the level value, **2**, in the upper display.

The password values shown in the table cannot be altered, so retain a copy of these pages for future reference. This is the only reference made to password values in this instruction book.

**PASSWORD  TABLE**

| Security Level Menu | Status | Displayed Value When Viewed | Password Value To Enter |
|---|---|---|---|
| Primary Secondary Secure | Locked Locked Locked | 1 | 1110 |
| Primary Secondary Secure | Unlocked Locked Locked | 2 | 1101 |
| Primary Secondary Secure | Unlocked Unlocked Locked | 3 | 1011 |
| Primary Secondary Secure | Unlocked Unlocked Unlocked | 4 | 111 |

## NOTATION CONVENTIONS FOR THE MENUS

Because of the number of features available in this control, information is included that may not apply to your specific control.  All usable features are included in this book, but may not be used in your process.  To increase clarity the following conventions are used:

1.   Certain features, Menu Items, and functions shown in this book may or may not appear on your control, depending on other Menu Item selections. At various places in the Menus there are notes identifying Menu Items that "control" or "direct" other menu items.  If you are looking for a particular menu item and can't find it, check the menu item that is its "control" for proper setting.

2.   The "#" symbol is used in two ways.  It is used inside a group of characters to indicate which set point function (SP1 or SP2) is being affected.  It is also used before a group of characters of a menu item to indicate that there may be more than one selection or value for that menu item.

3.   *Features that apply only to Options will be printed in Italics.*

## THE HOME DISPLAY

The home display is the normal display while the control is operating. The HOME display may be programmed to operate in one of three different ways. This is controlled by the **diSP** menu item in the Secure Menu.

If **diSP** is set for **Pro**, the HOME display will show only the Process Variable (the temperature, pressure, flow, RH, etc., that is being measured) on the top display with the bottom display blank. If **diSP** is set for **SPt**, the home display will show only the Set Variable (Set Point 1) on the top display with the bottom display blank. If **diSP** is set for **both**, the HOME display will indicate the Process Variable on the top display and the Set Variable on the bottom.

If no errors or functions are active, the HOME display as programmed will be shown.

## OPERATION AND PROGRAMMING OF OPTIONS

### Option 934, 936, Isolated Analog Retransmission.

The analog retransmission option allows the Process Variable or the Set Variable to be sent as an analog signal to an external device. The signal may be either 0 to 10 VDC (Option 936) or 0 (or 4) to 20 mADC (Option 934). The output may be changed in the field from one to the other by the toggle switch located on the top printed circuit board.

Wire the output as shown on page 7.

To set up the analog retransmission, first determine the scale range that the analog signal will represent. The maximum scale is 9999°F, 5530°C, or 9999 counts. In the Secondary Menu set **POL** for the scale value that will be represented by the low end of the analog signal (0 Volts or 0 mA). Set **POH** for the scale value that will be represented by the high end of the analog signal (10 Volts or 20 mA).

If you require a suppressed scale or output, you may use the following equations to determine the proper settings for **POL** and **POH**.

**K** = (Highest desired scale reading - Lowest desired scale reading) / (Maximum desired analog signal - Minimum desired analog signal).
**POH** = ((Maximum possible analog output - Maximum desired analog signal) * K) + Highest desired analog reading.

*POL = Lowest desired scale reading - ((Minimum desired analog output) * K).*

Next select whether you want the retransmission signal to follow the Process Variable or the Set Variable. Usually the Process Variable is sent to recorders or other data acquisition devices. Usually the Set Variable is sent to other controls to be used as an analog remote set point. If you want the analog retransmission signal to follow the PV, in the Secondary Menu set **POSr** to **InP**. If you want the analog retransmission signal to follow the SV, set **POSr** to **SPt**.

Operation is automatic. There are no further programming steps required.

**Option 948, 4-Stage Set Point.**

The 4-stage set point option allows four different values to be used for **SP1**. The control will switch to a given stage when an external contact or contacts are made or opened across the appropriate terminals at the rear of the control (when **SPSA**, Set Point Switch Action, is set for remote, **rE**), or when the stage is selected from the Secondary Menu, **SP** (when **SPSA** is set for **Int**). When the state of a contact changes (or the stage number is changed in the Secondary Menu), the values in use are stored and the previously stored values for the new stage are used.

Wire the input as shown on page 7.

Usually the control is configured for external switching of the stages. In this case, the operation is usually automatic, selected by the external switches driven by the machine logic. If it is necessary to program the stages in advance, you may select the stage to modify with the **SP** menu item. When **SP** is changed while the **SPSA** is set for **rE**, the selected stage is displayed for modification, but only used when the appropriate contact is made.

**Option 992, 993, Serial Communication.**

The serial communications options allow the control to be written to and read from a remote computer or other similar digital device. Communication is allowed either through a RS-485 (Option 992) port, or a RS-232 (Option 993) port.

Wire the communication lines as shown on Page 7. Wiring for the RS-485 is run from control to control in a daisy chain fashion with a termination resistor (120 ohms) across the transmit and receive terminals of the last control in the chain.

Select the control address and communication baud rate with the **Addr** and **bAUd** menu items in the Secure Menu. THE BAUD RATE AND ADDRESS MENU ITEMS WILL TAKE EFFECT ON THE NEXT POWER UP OF THE CONTROL. BE SURE TO POWER CYCLE THE CONTROL BEFORE USING THE NEW BAUD RATE AND ADDRESS.

In operation, you have the option of preventing a write command from the host computer. To prevent the host from writing to the control change the **LOrE** menu item in the Secondary Menu to **LOC**. To allow the host to write commands to the control set **LOrE** to **rE**. (The host does have the ability to change the **LOrE** state, but it is not automatic.)
If your system depends on constant reading or writing to and from the host, you may wish to set the No Activity Timer (**nAt**) to monitor the addressing of the control. When the **LOrE** is set to **rE** and the **nAt** is set to any value other than Off, the control will expect to be addressed on a regular basis. If the control is not addressed in the time set by the value of **nAt**, then the control will display the error message **CHEC LOrE**. To clear the message set **LOrE** to **LOC**.

# MENU SELECTIONS

## PRIMARY MENU
Press **INDEX** to advance to the next menu item.  Press **UP ARROW** or **DOWN ARROW** to change the value in the display.  Press **ENTER** to retain the value.

***#SP1*** *(Option 948, 4-Stage Set Point) or*
**SP1**     Set Point 1 Adjust, Limit Point 1.

**SP2**     Set Point 2 Adjust (if equipped), Limit Point 2.

## SECONDARY MENU
Hold **UP ARROW** & **ENTER.**  Press **INDEX** to advance to the next menu item.  Press **UP ARROW** or **DOWN ARROW** to change the value in the display.    Press **ENTER** to retain the value.
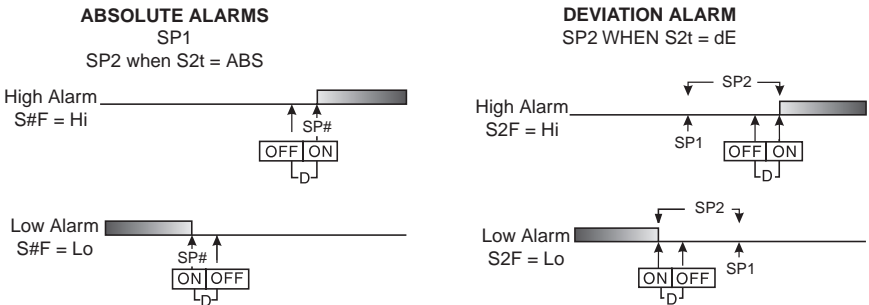
**SP1d**    Set Point On-Off Differential (hysteresis).  Select **1** to **9999** (when **S1F**=**Lo**) or **-1** to **-9999** (when **S1F**=**Hi**).  Set the value for the amount of difference between the turn on point (Set Point 1) and the turn off point.  See the following chart.



**The following menu items apply only if your control is equipped with a second set point (last digit of model number is not zero).  If your control does not have a second set point, jump to the "SP" menu item below.**

**SP2d**    Set Point On-Off Differential (hysteresis).  Select **1** to **9999** (when **S2F**=**Lo**) or **-1** to **-9999** (when **S2F**=**Hi**).  Set the value for the amount of difference between the turn on point (Set Point 2) and the turn off point.  See chart above.

**SP**      *(Option 948, 4-Stage Set Point) Active Set Point Stage. Select* **1SP1**, **2SP1**, **3SP1**, **4SP1**. *(See Page 17 for more detail.)*

        **1SP1**    *Set Menu Items to display Stage 1 for view and change access. If* **SPSA** *is set for* **Int**, **1SP1** *is made active.*

        **2SP1**    *Set Menu Items to display Stage 2 for view and change access. If* **SPSA** *is set for Int,* **2SP1** *is made active.*

        **3SP1**    *Set Menu Items to display Stage 3 for view and change access. If* **SPSA** *is set for Int,* **3SP1** *is made active.*

        **4SP1**    *Set Menu Items to display Stage 4 for view and change access. If* **SPSA** *is set for* **Int**, **4SP1** *is made active.*

**#SP1**    *(Option 948, 4-Stage Set Point) Adjust Control Point 1 for Stage selected above.*

**PEA**    The Peak feature stores the highest input the control has measured since the last reset or Power On. At Power On PEA is reset to the present input. To manually reset the value **PEA** must be in the lower display. Press the **ENTER** key to reset. **PEA** will be reset and display the present input value.

**UAL**    The Valley feature stores the lowest input the Instrument has measured since the last reset or Power On. At Power On **UAL** is reset to the present input. To manually reset the value **UAL** must be in the lower display. Press the **ENTER** key. **UAL** will be reset and display the present input value.

**InPC**    Input Correction: Select **±500** °F, °C, or counts. This feature allows the input value to be changed to agree with an external reference or to compensate for sensor error. **Note:** InPC is reset to zero when the input type is changed, or when decimal position is changed.

**FiLt**    Digital Filter: Select **OFF**, **1** to **99**. In some cases the time constant of the sensor, or noise could cause the display to jump enough to be unreadable. A setting of 2 is usually sufficient to provide enough filtering for most cases, (2 represents approximately a 1 second time constant). When the 0.1 degree resolution is selected this should be increased to 4. If this value is set too high, controllability will suffer.

**POL**    *(Option 934, 936, Analog Retransmission Output) Process Output Low: Select -450°F, -260°C, or -1999 counts to any value less than* **POH**.

**POH** (Option 934, 936, Analog Retransmission Output) Process Output High: Select from any value greater than **POL** to +9999°F, +5530°C, or 9999 counts.

**LOrE** (Option 992, 993, Serial Communications) Local / Remote Status: Select **LOC** or **rE**.

    **LOC** The host computer is advised not to send remote commands. Any write commands sent to the controls will be rejected.

    **rE** The host computer is allowed to send write commands. If the control is not addressed within the time set in the **nAt** (No Activity Timer, see Secure Menu) the **CHEC LorE** error message will be displayed.

**Addr** (Option 992, Serial Communications) Control Address: Set from 1 to 3FF. This number (hexadecimal, base 16) must match the address number used by the host computer. Viewed only in this menu. To change this parameter, see **Addr** in the Secure Menu.

**SECURE MENU**

Hold **UP ARROW** & **ENTER** for 5 Seconds.  Press **INDEX** to advance to the next menu item. Press **UP ARROW** or **DOWN ARROW** to change the value in the display.    Press **ENTER** to retain the value.

**OUTPUTS ARE DISABLED (TURNED OFF) WHILE CONTROL IS IN SECURE MENU.**

**SECr**    Security Code: See the Security Level Selection and the Password Table in this manual, in order to enter the correct password.

**InP**    Input Type: Select one of the following.  Refer to the Input wiring section for the proper wiring.

| | | |
|---|---|---|
| **J-IC** | Type "J" Thermocouple |
| **CA** | Type "K" Thermocouple |
| **E-** | Type "E" Thermocouple |
| **t-** | Type "T" Thermocouple |
| **L-** | Type "L" Thermocouple |
| **n-** | Type "N" Thermocouple |
| **r-13** | Type "R" Thermocouple |
| **S-10** | Type "S" Thermocouple |
| **b-** | Type "B" Thermocouple |
| **C-** | Type "C" Thermocouple |
| **P392** | 100 ohm Platinum (NIST 0.00392 $\Omega/\Omega/°C$) |
| **n120** | 120 ohm Nickel |
| **P385** | 100 ohm Platinum (DIN 0.00385 $\Omega/\Omega/°C$) |
| **1P38** | 1000 ohm Platinum (DIN 0.00385 $\Omega/\Omega/°C$) |
| **Curr** | DC Current Input 0.0 to 20.0 or 4.0 to 20.0 mA. |
| **UoLt** | DC Voltage Input 0.0 to 10.0 or 2.0 to 10.0 volts. |
| **diFF** | DC Voltage Input -10 to +10 mV. |
| **- - - -** | Reserved |

**OSUP**    Zero Suppression: Select **On** or **OFF**. Only with Current and Voltage input types.

> **OFF**    The input range will start at 0 (zero) Input.
> **On**    The input range will start at 4.00 mA or 2.00 V.

**Unit**    **F**, **C** or **None**.

> **F**        °F descriptor is On and temperature inputs will be displayed in actual degrees Fahrenheit.
> **C**        °C descriptor is On and temperature inputs will be displayed in actual degrees Celsius.
> **nonE**    °F and °C descriptors will be Off. This is only available with Current and Voltage Inputs.

**dPt**    Decimal Point Positioning: Select **0**, **0.0**, **0.00**, **0.000, or .0000**. On temperature type inputs this will only effect the Process Value, SP1, SP2, and InPC. For Current and Voltage Inputs all Menu Items related to the Input will be affected.

        **0**    No decimal Point is selected. This is available for all Input Types.

        **0.0**    One decimal place is available for Type J, K, E, T, L, RTD's, Current and Voltage Inputs.

        **0.00**    Two decimal places is only available for Current and Voltage Inputs.

        **0.000**    Three decimal places is only available for Current and Voltage inputs.

        **.0000**    Four decimal places is only available for Current and Voltage inputs.

**diSP**    Home Display:  Select **Pro**, **SPt**, or **both**.

        **Pro**    The upper display of the HOME display shows the current Process Variable.   The lower display is blank.

        **SPt**    The upper display of the HOME display shows the current Set Variable.  The lower display is blank.

        **both**    The upper display of the HOME display shows the current Process Variable.  The lower display shows the current Set Variable.

**InPt**    Input Fault Timer: Select **OFF, 0.1** to **540.0** minutes. Whenever an Input is out of range (UFL or OFL displayed), shorted, or open the timer will start. When the time has elapsed, the controller outputs will be forced into their de-energized states. If OFF is selected, the Input Fault Timer will not be recognized (time = infinite).

**SEnC**    Sensor Rate of Change: Select **OFF, 1** to **4000** °F, °C, or counts per 1 second period. This value is usually set to be slightly greater than the fastest process response expected during a 1 second period, but measured for at least 2 seconds. If the process is faster than this setting, the SEnC bAd error message will appear. The outputs will then be turned off. This function can be used to detect a runaway condition, or speed up detection of an open thermocouple. Use the INDEX & ENTER keys to reset.

**SCAL**    Scale Low: Select **100** to **9999** counts below **SCAH.** The total span between **SCAL** and **SCAH** must be within 11998 counts. Maximum setting range is -1999 to +9999 counts. For Current and Voltage inputs, this will set the low range end. Viewable only for Thermocouple and RTD ranges.

**SCAH**     Scale High: Select **100** to **9999** counts above **SCAL**. The total span between **SCAL** and **SCAH** must be within 11998 counts. Maximum setting range is -1999 to +9999 counts. For Current and Voltage inputs, this will set the high range end. Viewable only for Thermocouple and RTD ranges.

**SPL**      Set Point Low: Select from the lowest input range value to **SPH** value. This will set the minimum SP1 or SP2 value that can be entered. The value for SP1 or SP2 will not stop moving when this value is reached.

**SPH**      Set Point High: Select from the highest input range value to **SPL** value. This will set the maximum SP1 or SP2 value that can be entered. The value for SP1 or SP2 will not stop moving when this value is reached.

**SP1O**     Set Point 1 Output Select: Select **A** or **A-b**.
- **A**        Set Point 1 is routed through Output A, Set Point 2 (if equipped) is routed through Output B.
- **A-b**      Set Point 1 is routed through both Output A and Output B. Set Point 2 menu items are suppressed. This allows for both NO and NC (Order Code types 3 and 4) outputs to be driven at the same time.

**S1F**      **Set Point 1 Function:  Select Hi or Lo.**
- Hi         Output is energized above set point.
- Lo         Output is energized below set point.

**S1rE**     Set Point 1 Reset.  Select **OnOF** or **Hold**.
- **OnOF**     Control will automatically reset when process passes back through **SP1d**.
- **HoLd**     Manual Reset. Reset (acknowledge) by pressing the **LIMIT RESET** key for 3 seconds.

**S1Pi**     Set Point 1 Power Interrupt.  Select **On** or **OFF**.
- **On**       Alarm Power Interrupt is **On**.  Control will automatically reset on power-up if no alarm condition exists.
- **OFF**      Alarm Power Interrupt is **OFF**.  Control will power-up in alarm condition regardless of condition of process.

**S1iH**     Set Point 1 Inhibit: Select **On** or **OFF**.
- **On**       Alarm Inhibit is **On**. Alarm action is suspended until the process value first enters a non-alarm condition.
- **OFF**      Alarm Inhibit is **OFF**.

**S1St**    Set Point 1 State: Select **Eng** or **dEng**.

        **Eng**      Output Energized. The output device (per Order Code) will be energized at set point. (Normally Open contacts will close, Normally Closed contacts will open.)

        **dEng**    Output De-energized. The output device (per Order Code) will be de-energized at set point. (Normally Open contacts will open, Normally Closed contacts will close.)

**S1LP**    Set Point Lamp: Select **O on** or **OoFF.**

        **O on**     Lamp ON when Output is ON (energized).

        **OoFF**    Lamp OFF when Output is ON (energized).

**If your instrument is not equipped with Set Point 2, then proceed to the option section (next page). If the instrument has no Set Point 2 and no options, then the menu ends.**

**S2t**      Set Point 2 type: Select **Abs** or **dE**.

        **AbS**     Absolute **SP2**. **SP2** is independent of **SP1**, and may be set anywhere between the limits of **SPL** and **SPH**.

        **dE**      Deviation **SP2**. **SP2** is set as a deviation from **SP1**, and allows **SP2** to retain its relationship with **SP1** when **SP1** is changed (tracking **SP2**).

**S2F**     **Set Point 2 Function:  Select Hi of Lo.**

        Hi       Output is energized above set point.

        Lo       Output is energized below set point.

**S2rE**    Set Point 2 Reset.  Select **OnOF** or **Hold**.

        **OnOF**    Control will automatically reset when process passes back through **SP2d**.

        **HoLd**    Manual Reset. Reset (acknowledge) by pressing the **LIMIT RESET** key for 3 seconds.

**S2Pi**    Set Point 2 Power Interrupt.  Select **On** or **OFF**.

        **On**      Alarm Power Interrupt is **On**. Control will automatically reset on power-up if no alarm condition exists.

        **OFF**    Alarm Power Interrupt is **OFF**. Control will power-up in alarm condition regardless of condition of process.

**S2iH**    Set Point 2 Inhibit: Select **On** or **OFF**.

        **On**      Alarm Inhibit is **On**. Alarm action is suspended until the process value first enters a non-alarm condition.

        **OFF**    Alarm Inhibit is **OFF**.

**S2St**    Set Point 2 State: Select **Eng** or **dEng**.
- **Eng**    Output Energized. The output device (per Order Code) will be energized at set point. (Normally Open contacts will close, Normally Closed contacts will open.)
- **dEng**    Output De-energized. The output device (per Order Code) will be de-energized at set point. (Normally Open contacts will open, Normally Closed contacts will close.)

**S2LP**    Set Point 2 Lamp: Select **O on** or **OoFF.**
- **O on**    Lamp ON when Output is ON (energized).
- **OoFF**    Lamp OFF when Output is ON (energized).

***SPSA***    *(Option 948, 4-Stage Set Point) Switch Action: Select rE or Int.*
- **rE**    Set Point Stage selected by external contact closures.
- **Int**    Set Point Stage selected by internal menu selection. See **SP** menu item in Secondary Menu.

***Addr***    *(Option 992, 993, Serial Communications) Control Address: Set from **1** to **3FF**. This number (hexadecimal, base 16) must match the address number used by the host computer.*

***bAUd***    *(Option 992, 993, Serial Communications) Communication Baud Rate: Select **300**, **1200**, **2400**, **4800**, **9600**, or **192**00. This number must match the baud rate used by the host computer.*

***nAt***    *(Option 992, 993, Serial Communications) No Activity Timer: Set from **OFF** or **1** to **99** minutes.*
- ***1 - 99***    *Maximum time between host computer accesses. If timer counts to 0, CHEC/LorE will be displayed.*
- ***OFF***    *No Activity Timer function is disabled.*

# DIAGNOSTIC ERROR MESSAGES

| DISPLAY | MEANING | SP OUTPUTS | ACTION REQUIRED |
|---|---|---|---|
| **No display lighted** | Display is blank. Instrument is not getting power, or the supply voltage is too low. | Set point outputs inactive Alarm inactive | Check that the power supply is on, or that the external fuses are good. |
| **FAIL tESt** | Fail test appears upon power up if the internal diagnostics detect a failure. This message may occur during operation if a failure is detected. Displays flash. | Set point outputs inactive Alarm inactive | The display alternate between FAIL tESt and one of the following messages: **FACt dFLt**: Memory may be corrupted. Press the **ENTER** key and the **DOWN ARROW** key to start the factory default procedure. Recheck controller programming. **rEt FACt**: Unrecoverable error, return to factory for service. |
| **CHEC SP1, CHEC SP2** | This message will appear upon power up if SP1, SP2, or #SP1 is set outside of the **SPL** or **SPH** values. | Set point outputs inactive Alarm active | Correct the **SP1, etc.** or adjust the **SPL** or **SPH** values by programming new values. |
| **CHEC SPL** or **CHEC SPH** | This message appears at power up if **SPL** or **SPH** values are programmed outside the input range ends. | Set point outputs inactive Alarm inactive | Correct the **SPL** or **SPH** values by programming new values. |
| **CHEC LorE** | This message appears if the Serial Communications has timed out. | Set point outputs active Alarm inactive | Restore the communications line and switch the LorE to LOC. |
| **ArEA (Alternates with PV)** | This message appears when the ambient temperature of the control approaches unacceptable ambients. | Set point outputs active Alarms active | Correct the ambient temperature conditions. Ventilate the area of the cabinet or check for clogged filters. If RJC broken, return to factory for service. |
| **ArEA** | This message appears if the ambiient temperature of the control is out of range or RJC sensor is broken. | Set point outputs active Alarms active | Correct the ambient temperature conditions. Ventilate the area of the cabinet or check for clogged filters. If RJC broken, return to factory for service. |

# DIAGNOSTIC ERROR MESSAGES

| DISPLAY | MEANING | SP OUTPUTS | ACTION REQUIRED |
|---|---|---|---|
| **UFL** or **OFL** | Underflow or Overflow: Process value has exceeded input range ends. | Set point outputs active Alarm active | Input signals may normally go above or below range ends. If not, check input and correct. |
| **bAd InP** **OPEn InP** | **UFL** or **OFL** will sequence to display one of these messages if the **InPt** is set for a time value.<br><br>For RTD inputs RTD is open or shorted.<br><br>For THERMOCOUPLE inputs thermocouple is open. | Set point outputs inactive Alarm active | To reset use the **INDEX** & **ENTER** keys. When **InPt** (input fault timer) has been set for a time, the outputs will be turned off after the set time. Setting the time to OFF causes the outputs to remain active, however **UFL** or **OFL** will still be displayed.<br>Correct or replace sensor. To reset use the **INDEX** & **ENTER** keys. |
| **SEnC bAd** | Sensor Rate of Change exceeded the programmed limits set for SEnC. | Set point outputs inactive. Alarm Active | Check for the cause of the error. The value setting may be too slow for the process, or the sensor is intermittent. Correct the problem and press INDEX and ENTER to reset. |
| **CHEC CAL** | Check calibration appears as an alternating message if the instrument calibration nears tolerance edges. | Set point outputs active Alarm active | Remove the instrument for service and / or recalibration. To reset use the **INDEX** & **ENTER** keys. |
| | Check calibration appears as a flashing message if the instrument calibration exceeds specification. | Set point outputs inactive Alarm active | Remove the instrument for service and / or recalibration. To reset use the **INDEX** & **ENTER** keys. |

# SPECIFICATIONS

**Selectable Inputs:** Thermocouple, RTD, DC Voltage, or DC Current selectable.

**Input Impedance:**

Thermocouple = 3 megohms minimum.     RTD current = 200 µA.

Current = 10 ohms.                  Voltage = 5000 ohms.

**Sensor Break Protection:** De-energizes output(s) to protect system after customer set time.  (See **InPt** in Secondary Menu.)

**Set Point Range:** Selectable (See Range Chart Page 26).

**Display:** Two 4 digit, 7 segment 0.3" high LEDs.

**Output Action:** Fully programmable to allow output(s) to energize or de-energize above or below set point(s).

**On - Off Differential:** Adjustable 1° F, 1° C, or 1 count to full scale in 1° F, 1° C, or 1 count steps.

**Accuracy:** ±0.25% of span, ±1 least significant digit.

**Resolution:** 1 degree or 0.1 degree, selectable.

**Line Voltage Stability:** ±0.05% over the supply voltage range.

**Temperature Stability:** 4µV/°C (2.3 µV/°F) typical, 8 µV/°C (4.5 µV°F) maximum (100 ppm / °C typical, 200 ppm / °C maximum).

**Common Mode Rejection:** 140 db minimum at 60 Hz.

**Normal Mode Rejection:** 65 db typical, 60 db at 60 Hz.

**Isolation:**

**Relay and SSR outputs:**  1500 Vac to all other inputs and outputs.

**SP1 and SP2 Switched Voltage outputs:**  500 Vac to all other inputs and outputs, but not isolated from each other.

**Process Output (934, 936):**  500 VAC to all other inputs and outputs.

**Supply Voltage:** 100 to 240 Vac, nominal., +10 -15%, 50 to 400 Hz. single phase; 132 to 240 Vdc, nominal., +10 -20%.

**Supply Voltage (Option 9502):**   12 to 24 Vdc, Vac 40-400 Hz, ±20%.

**Power Consumption:** 5VA maximum.

**Operating Temperature:** -10 to +55 °C (+14 to 131 °F).

**Storage Temperature:** -40 to +80 °C (-40 to 176 °F).

**Humidity Conditions:** 0 to 90% up to 40 °C non-condensing 10 to 50% at 55 °C non-condensing.

**Memory Backup:** Nonvolatile memory. No batteries required.

**Output Ratings:**
> **AC SSR:** 2.0 A @ 240 Vac at 25 °C (77°F). Derates to 1.0 A @ 55° C (130°F).
> **DC SSR:** 1.75 A @ 32 Vdc maximum.
> **Relay:** SPST, 3 A @ 240 Vac resistive; 1.5A @240 Vac inductive; Pilot duty rating 240 VA, 2 A @ 120 Vac or 1 A 240 Vac.
> **Switched Voltage (isolated):** 15 Vdc @ 20 mA.

**Panel Cutout:** 45 mm x 45 mm (1.775" x 1.775").
**Depth Behind Mounting Surface:** 121.6 mm (4.79"), maximum.
**Weight:** 220 g (8 oz).
**Agency Approvals:** FM, CE.
**Front Panel Rating:** IP66, (NEMA4X).

# Input Ranges (Field Selectable)
## Thermocouple Types

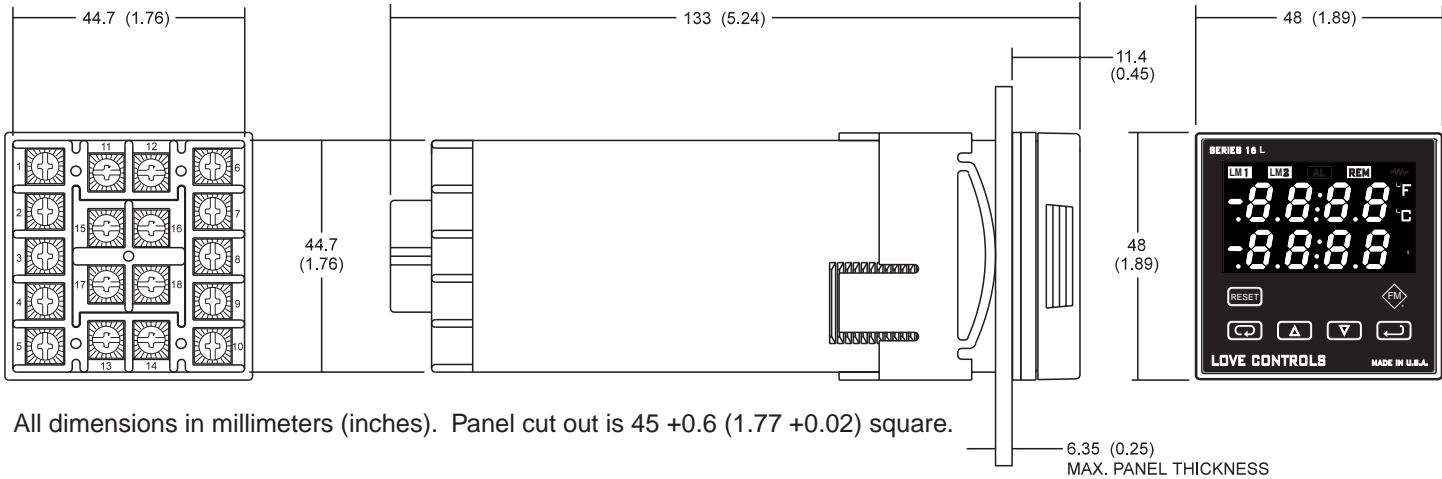| Input Type | Type J or L* | Type K* | Type T* | Type E* |
|---|---|---|---|---|
| Range 1°F 1°C | -100 to +1600 -73 to +871 | -200 to +2500 -129 to +1371 | -350 to +750 -212 to +398 | -100 to +1800 -73 to +982 |
| Input Type | Type R | Type S | Type B | Type C |
| Range 1°F 1°C | 0 to 3200 -17 to +1760 | 0 to 3200 -17 to +1760 | +75 to 3308 +24 to 1820 | 0 to 4208 -17 to 2320 |
| Input Type | Type N* | * These Input Types can be set for 0.1° display. If temperature goes above 999.9° or less than -199.9° the display will return to whole degree resolution. | | |
| Range 1°F 1°C | -100 to +2372 -73 to +1300 | | | |

## RTD Types

| Input Type | 100 Ohm Platinum 0.00385 DIN Curve* | 100 Ohm Platinum 0.00392 Nist Curve* | 120 Ohm Nickel 0.00628 US Ind. Curve* | 1000 Ohm Platinum 0.00385 Nist Curve* |
|---|---|---|---|---|
| Range 1°F 1°C | -328 to +1607 -200 to +875 | -328 to +1607 -200 to +875 | -112 to +608 -80 to +320 | -328 to +1607 -200 to +875 |

## Process Input Types

The 0 to 20 mAdc, 4 to 20 mAdc, 0 to 10 Vdc, 2 to 10 Vdc, and -10 to +10 mVdc inputs are fully scalable from a minimum of 100 counts span placed anywhere within the within the range of -1999 to +9999. Decimal point position is adjustable from the zero place (9999), tenths (999.9), hundredths (99.99), thousandths (9.999), or ten thousandths (.9999).

# DIMENSIONS

44.7 (1.76)

133 (5.24)

11.4 (0.45)

48 (1.89)

44.7 (1.76)

48 (1.89)

SERIES 16 L

LM 1  LM 2  AL  REM  °F  °C

RESET  FM

LOVE CONTROLS  MADE IN U.S.A.

All dimensions in millimeters (inches).  Panel cut out is 45 +0.6 (1.77 +0.02) square.

6.35 (0.25)
MAX. PANEL THICKNESS

## MOD·TRONIC

www.mod-tronic.com | sales@mod-tronic.com | 1-800-794-5883