**Crompton INSTRUMENTS**

# 264 SERIES
### of
## 101 Segment Bargraphs
## with Digital Display

**Smart Tricolor or mono-color digital bargraph with a Universal Header Selectable Input, an optional isolated analog output and up to four fully programmable set points, for monitoring, measurement, and control applications.**

CE

## General Features

- A Tricolor or mono color (red or green), 101 segment high brightness bargraph. Optional vertical or horizontal format.
- Red 4-digit LED display with range between –1999 to 9999 (12000 counts). Optional green digital display.
- Front panel LED annunciators provide indication of set-point status.
- Two 10 Amp Form C, and two 5 Amp Form A relays available.
- Auto-sensing AC/DC power supply. For voltages between **85-264 V AC / 110-370 V DC (Z)** or 18-48 / 18-72 V AC / DC (Y).
- Optional isolated 16 bit analog output. User or factory scalable to 4 to 20 mA, 0 to 20 mA or 0 to 10 V across any desired digital span from ± one count to the full scale range of – 1999 to 9999 (12000 counts).
- Optional NEMA-4 front cover.
- Automatic averaging (16 sample moving average with eight count replacement window to speed up display response).
- 24 V DC excitation is available to power external 4/20 mA transmitters.
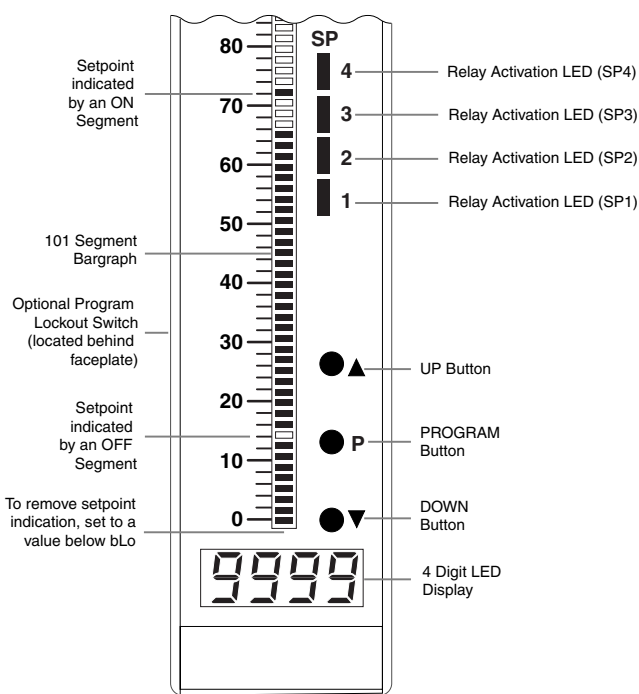
## Software Features

- The bargraph can display, full scale, any desired portion of the digital reading.
- Bargraph center zero function.
- Four programmable set-points.
- Setpoint 1 has delay-on-make and delay-on-break plus a special "pump on pump off" mode that cre-

ates a Hysteresis Band between SP1 and SP2.
- Relay activation can be selected to occur above (hi) or below (Lo) each set-point.
- Digital display blanking.
- Decimal point setting.
- Four-level brightness control of the bargraph and digital display.

## Specifications

| | |
|---|---|
| **Input Specs**: | Depends on range and function selected |
| **A/D Converter**: | 14 bit single slope |
| **Accuracy**: | ±(0.05% of reading + 2 counts) |
| **Temp. Coeff.**: | 100 ppm/°C (Typical) |
| **Warm up time**: | 2 minutes |
| **Conversion Rate**: | 10 conversions per second (Typical) |
| **Digital Display**: | **4 digit 0.31" LED red (std)**, green (optn) Range –1999 to 9999 counts. |
| **Bargraph Display**: | **101 segment 4" red vertical (std)**, green or tricolor (optn), horizontal (optn) |
| **Polarity**: | Assumed positive. Displays – negative |
| **Decimal Selection**: | Front panel button selectable, X•X•X•X• |
| **Positive Overrange**: | Bargraph and top segments of digital display flash. |
| **Negative Overrange**: | First segment of bargraph and bottom segments of digital display flash. |
| **Relay Output**: | Two 5 Amp Form A relays and Two 10 Amp Form C relays. |
| **Analog Output**: | Isolated 16 bit user scalable mA or V |
| 1: (volts out) | 0-10 V DC @ 500 Ω or higher resistance |
| 2: (mA out) | 4-20 mA @ 0 to 500Ω max loop resistance |
| **Power Supply**: | AC/DC Auto sensing wide range supply |
| Y | 18-48 VAC / 18-72 VDC @ 2.5W max 4.2W |
| **Z (std)** | **85-265 VAC / 95-370 VDC @ 2.5W max 4.2W** |
| **Operating Temp.**: | 0 to 60°C |
| **Storage Temp**: | –20°C to 70°C |
| **Relative Humidity**: | 95% (non condensing) |
| **Case Dimensions**: | 3/32 DIN (Bezel 36Wx144Hmm) Depth behind bezel 135 mm (5.32") Plus 16 mm (0.63") for connectors |
| **Weight**: | 9.5 oz., 12 oz when packed |

## Ordering Code

| RELAYS | POWER SUPPLY | UNIVERSAL PROCESS INPUT | DISPLAY | COLOR | ANALOG OUTPUT |
|---|---|---|---|---|---|
| **DTV: No Relays** | **A: 85 ~ 264V AC** | **: Custom Input | **VS: Vertical** | **RD: Red Bargraph** | _: Custom Output |
| DTT: Two 10A Form C Relays | **110 ~ 370V DC** | 1: 0 ~ 1mA | HS: Horizontal | GN: Green Bargraph | _: 0 ~ 10V |
| DTF: Two 10A Form C Relays and Two 5A Form A Relays | B: 19 ~ 36V AC/DC | **2: 4 ~ 20mA** | | YL: Yellow Bargraph | **_: 4 ~ 20mA** |
| | | 3: 0 ~ 1V | | : Tricolor Bargraph | _: 0 ~ 20mA |
| | | 4: 1 ~ 5V | | | |
| | | 5: 0 ~ 5V | | | |

**80** SP
**4** — Relay Activation LED (SP4)
**70** **3** — Relay Activation LED (SP3)
**60** **2** — Relay Activation LED (SP2)
**1** — Relay Activation LED (SP1)
**50**
**40**
**30** ●▲ — UP Button
**20**
**10** ●P — PROGRAM Button
**0** ●▼ — DOWN Button
*9999* — 4 Digit LED Display

Setpoint indicated by an ON Segment

101 Segment Bargraph

Optional Program Lockout Switch (located behind faceplate)

Setpoint indicated by an OFF Segment

To remove setpoint indication, set to a value below bLo

# Front Panel Buttons

## Program Button

The P button is used to move from one program step to the next.

When pressed at the same time as the ▲ button, it initiates the **calibration mode**. When pressed at the same time as the ▼ button, it initiates the **setpoint setting mode**.

## Up Button

When in the operational display, pressing the ▲ button allows you to view the setting of **setpoint 1**.

When setting a displayed parameter during programming, the ▲ button is used to increase the value of the displayed parameter.

## Down Button

When in the operational display, pressing the ▼ button allows you to view the setting of **setpoint 2**.

When setting a displayed parameter during programming, the ▼ button is used to decrease the value of the displayed parameter.

# Front Panel LED Display

## Relay Activation

The Relay Activation LEDs indicate the alarm status. They are labeled from bottom to top: SP1, SP2, SP3, SP4.

## Digital LED Displays

The digital LED displays are used to display the meter input signal readings. They also display the programming settings during programming.

## Setpoint Indication

The position of setpoints on the bargraph display are indicated by an ON or OFF segment depending on whether the bargraph display is below or above the setpoint.

To explain software programming procedures, logic diagrams are used to visually assist in following the programming steps. The following symbols are used throughout the logic diagrams to represent the buttons and indicators on the meter:
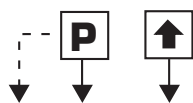
**8.8.8.8.** This symbol represents the OPERATIONAL DISPLAY.

**P** This is the PROGRAM button.

**▲** This is the UP button.

**▼** This is the DOWN button.

**P  ▲** When a button is shown, press and release it to go onto the next step in the direction indicated by the arrow. When an alternative dotted line is shown, this indicates that an alternative logic branch will be followed when a particular option is present.

**P ▲** When two buttons are shown side by side and enclosed by a dotted line, they must be pressed at the same time then released to go onto the next programming step.

**XXXX** If an X appears through a digit, it means that any number displayed in that digit is not relevant to the function being explained.

**0** ▲▼ When the ▲ and ▼ buttons are shown together, the display value can be increased by pressing and releasing the ▲ button or decreased by pressing and releasing the ▼ button.
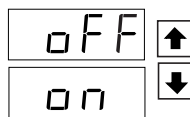
**oFF / on** ▲▼ When the ▲ and ▼ buttons are shown with two displays, either display can be selected by pressing and releasing the ▲ or ▼ buttons.
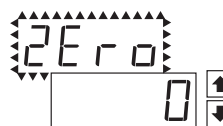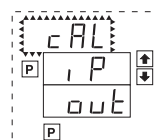
**ZEro / 0** ▲▼ When two displays are shown together with bursts, this indicates that the display is toggling (flashing) between the name of the function and the value.

**[Span]**
**[10000]** Text or numbers shown between square brackets in a procedure indicate the programming code name of the function or the value displayed on the meter display.
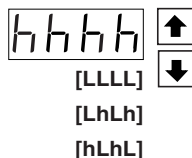
**hhhh** ▲▼
**[LLLL]**
**[LhLh]**
**[hLhL]** When there are more than two display selections they are shown in brackets below the first display and are also selectable by pressing and releasing the ▲ or ▼ buttons.

**cAL / iP / out** P ▲▼ A dotted line enclosing an entire logic diagram indicates that programming branch will appear only when a particular option is present.

# Software Logic Tree

These are intelligent meters with a hierarchical software structure designed for easy programming and operation, as shown below in the software logic tree.

## Software Version is Displayed on Power-up

When power is applied, all segments of the bargraph and digital display light up for 3 seconds. The version number of the installed software is then displayed for 2 seconds, after which, the operational display indicates the input signal.

**Operational Display**

`8.8.8.8.`

**MAIN MENU**

**Sub-menu MODE**

`c AL`
Calibration Mode
`oFF`
`on`

**SETPOINT VIEW ONLY MODE**

**SETPOINT VIEW ONLY MODE**

Set points cannot be changed in the SETPOINT VIEW ONLY MODE.

**Example**

`SP1`
`200`

`SP2`
`1000`

**SETPOINT SETTING AND RELAY CONFIGURATION MODE**
**See Page 8**

**Tricolor Bargraph**
The tri-color bargraph is designed like a traffic light, to display either red, orange or green, but only one color at a time. The color to be displayed is selected in two ways.

The first step is to select the color to be displayed when the bar is "below" whichever set point is set to the lowest position.

The second step is to select the color to be displayed when the bar is above each specific setpoint, regardless of the order or position to which the set points are set.

However, if two or more setpoints with differently specified colors are positioned at the same set point value, the color specified for the set point with the highest identifying number will be displayed. When setpoints are set to the same value, the SP4 color overrides the SP3 color, the SP3 color overrides the SP2 color, and the SP2 color overrides the SP1 color.

Set Setpoint 1 (SP1)
`SP1`
`0`

Delay-on-Make (doM)
0 to 9999 seconds
`doM`
`0`

**NOTE**: [dom] [dob] Functions are only available for SP1.

Delay-on-Break (dob)
0 to 9999 seconds
`dob`
`0`

**Hysteresis [hYSt]**
When hYSt is selected ON, and SP2 is set at a value higher than SP1, the SP1 relay will operate in a special "pump on pump off" Hysteresis mode. SP2 acts as the upper limit and SP1 acts as the lower limit of the Hysteresis Band.
**For filling applications**, rLYS should be set to LhLh. SP1 will then activate for inputs less than the SP1 setpoint, and remain ON until the SP2 setpoint is reached.
**For emptying applications**, rLYS should be set to hhhh. SP1 will then activate for inputs greater than the SP2 setpoint, and remain ON until the SP1 setpoint is reached.

`hYSt`
`on`
`oFF`

**BARGRAPH COLOR PROGRAMMING MODE**
**See Page 9**

**NOTE**: Will only appear if a tricolor display is installed

Goes directly to Zero setting if Analog Output is not installed

**TWO POINT DIGITAL CALIBRATION MODE**
**See Page 4**

This branch will only appear if the analog output option is installed

Calibration Input
Calibration Output
`c AL`
`iP`
`out`

**TWO POINT ANALOG OUTPUT RANGE SETTING AND CALIBRATION**
**See Page 7**

Select the desired reading for the applied Lo input signal
`ZEro`
`0`

Select the desired reading for the applied hi input signal
`SPAn`
`1000`

Err. Indicates unsuccessfull calibration
`Err`

Any new settings are canceled and previous settings are retained

Calibrate Analog Output Lo
`4.00`
`cLo`
`XXXX`

Calibrate Analog Output Hi
`20.00`
`chi`
`XXXX`

Setpoint 2 (SP2)
`SP2`
`0`

Setpoint 3 (SP3)
`SP3`
`0`

Setpoint 4 (SP4)
`SP4`
`0`

**Relays Activation [rLYS]**
**(H) High** the relay energizes when the setpoint is exceeded
**(L) Low** the relay energizes below the setpoint.
`rLYS`
`LLLL`
[LhLh]
[hhhL]
[hhhh]

**Setpoints Indication**
is from left to right SP1, SP2, SP3, SP4

`coL`
`grn`
[orAn]
[rEd]

`cSP1`
`grn`
[orAn]
[rEd]

`cSP2`
`grn`
[orAn]
[rEd]

`cSP3`
`grn`
[orAn]
[rEd]

`cSP4`
`grn`
[orAn]
[rEd]

**DIGITAL SPAN SELECTION FOR BARGRAPH DISPLAY**
**See Page 5**

This branch will only appear if the analog output option is installed

**DIGITAL SPAN SELECTION FOR ANALOG RANGE OUTPUT**
**See Page 6**

Bargraph Display Scale hi Range Setting (bhi)
`bhi`
`1000`

Bargraph Display Scale Lo Range Setting (bLo)
`bLo`
`0`

Select the Digital Reading at which the Analog Output Hi (chi) will occur
`Anhi`
`1000`

Select the Digital Reading at which the Analog Output Lo (cLo) will occur
`AnLo`
`0`

**DECIMAL POINT AND BRIGHTNESS SELECTION**
**See Page 5**

**BARGRAPH CENTER POINT DISPLAY MODE SELECTION**
**See Page 6**

Set the Decimal Point (dp)
`.dP`
[X·XXX]
[XX·XX]
[XXX·X]
[XXXX·]
[XXXX]

Bargraph Center Point Display Selection (cto)
`cto`
`oFF`
`on`

Display Brightness (br)
1 Dimmest
2 Dim
3 Bright
4 Brightest
`br`
`4`

**DIGITAL DISPLAY ON/OFF**
**See Page 6**

Digital Display ON/OFF Selection (diSP)
`diSP`
`on`
`oFF`

## 15 Second Program Timeout

Except for ZERO and SPAN settings in the Two Point Digital Calibration Mode and the Analog Output Range Setting and Calibration Mode (cLo and chi), the meter has a 15 second program timeout. If no buttons are pressed for 15 seconds in any of the other programming sequences, the meter will exit the programming mode and return to the operational display. Any program changes that were made prior to pressing the **P** button in the preceding step will not be saved.

# Two Point Digital Calibration Mode

This mode enables the meter to be calibrated by applying a zero or low input signal, entering the desired reading for that signal, then applying a high input signal, and then entering the desired reading for that signal. The meter then automatically calculates and programs in the requisite scale factor, within the following parameters.

1. Positive and negative signals may be applied, but the difference between the low and the high signal inputs must be at least 1000 counts or Err will be indicated.

2. Positive and Negative values for the desired reading can be entered, but the scale factor created can not exceed the Digital Display Span capability of the meter which is 12,000 counts between –1999 to 9999.

3. The internal Signal Span is limited to 3 V DC between – 1 V DC to + 2 V DC. Any outputs from an Input Signal Conditioning module that exceed these limits will cause the meter to indicate overrange regardless of the Digital Display Span scaled.

**Note**: Many input signal conditioners have provisions for analog calibration and scaling. If the meter is digitally set to read zero with a zero input (shorted input), and to read 1000 with a 1.000 V input, any pre-calibrated analog signal conditioner, with an output that does not exceed – 1 V to + 2 V, will read correctly without any further calibration when it is inserted in the meter.

**STEP A    Enter the Calibration Mode**
1) Press the [P] and [▲] buttons at the same time. Display toggles between [CAL] and [oFF].
2) Press the [▲] or [▼] button. Display changes from [oFF] to [on].
3) Press the [P] button. Display toggles between [CAL] and [out].

**Note:** If at this point, the display skips directly to STEP C and toggles between [SPAn] and the previous [SPan] setting, the software is detecting that the optional analog output hardware is NOT installed.

**STEP B    Select Two Point Digital Calibration of Input Signal**
1) Press the [▲] or [▼] button to select CAL [iP] for input signal calibration.
2) Press the [P] button. Display toggles between [ZEro] and the previous zero setting.

**STEP C    Set the Meter's Low Input Signal Reading on the Digital Display**
1) Apply a zero or low signal to the meter. (Positive or negative values are allowed).
2) Using the [▲] and [▼] buttons, adjust the meter display to the desired reading for the applied low input signal.
3) Press the [P] button. Display toggles between [SPAn] and the previous span setting.

**STEP D    Set the Meter's High Input Signal Reading on the Digital Display**
1) Apply a high input signal to the meter.
2) Using the [▲] and [▼] buttons, adjust the digital display to the desired reading for the applied high input signal.
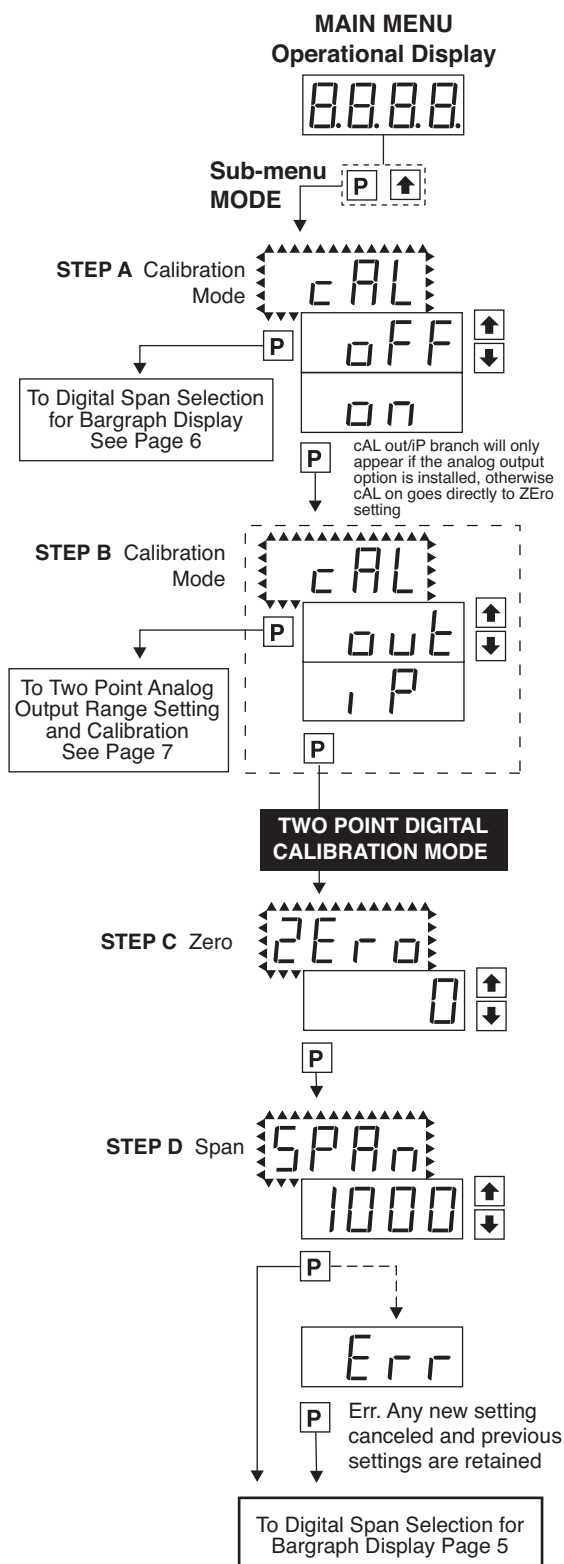3) Press the [P] button.

**The Digital Calibration Procedure is now complete**.
If the digital calibration was successfully completed, the menu branches to the Digital Span Selection for Bargraph Display (see page 5), and the display flashes [bhi] and the previous setting.

**ERROR    Indicates Unsuccessful Calibration**
If the calibration was unsuccessful, the display indicates [Err], the new calibration settings just entered will not take effect and the previously stored setting will remain. The three most likely causes of an error during calibration are:

1.    The full scale and zero signals were too similar. The full scale signal must be at least 1000 counts greater than the zero or low input signal (positive and negative values are allowed).
2.    The scaling requirement exceeded the digital display span capability of the meter (12,000 counts between –1999 to 9999).
3.    No input signal present, or incorrect input signal connections.

**MAIN MENU**
**Operational Display**

Sub-menu [P] [▲]
MODE

STEP A  Calibration Mode
cAL
oFF
on

To Digital Span Selection for Bargraph Display See Page 6

cAL out/iP branch will only appear if the analog output option is installed, otherwise cAL on goes directly to ZEro setting

STEP B  Calibration Mode
cAL
out
iP

To Two Point Analog Output Range Setting and Calibration See Page 7

**TWO POINT DIGITAL CALIBRATION MODE**

STEP C  Zero
ZEro
0

STEP D  Span
SPAn
1000

Err

Err. Any new setting canceled and previous settings are retained

To Digital Span Selection for Bargraph Display Page 5

## Digital Span Selection For Bargraph Display

The bargraph can be set to display full scale (0-101 bars) any portion of the digital reading from a minimum of 100 counts to a maximum of 12,000 counts. This provides higher resolution bargraph indication for those applications where the normal operating input signal range is less than the desired full scale display range of the digital display.

*For Example:*

*If the full scale range of the meter has been set from -1999 to 9999 (0-12,000 counts), but the normal operating range of the input signal is between 4000 & 6000. The bargraph high parameter [bhi] can be set to 6000 and the bargraph low parameter [bLo] can be set to 4000.*

*This means that although the meter could digitally display a signal from -1999 to 9999 (0-12,000 counts), the bargraph display only begins to function at a reading of 4000, and reaches full scale indication at a reading of 6000. Although the digital display will continue reading up to 9999 before indicating overrange, the bargraph display will indicate its overrange by flashing for readings above 6000.*

**Example of Setting the Digital Span of the Bargraph Display to be Different than the Digital Display Range**
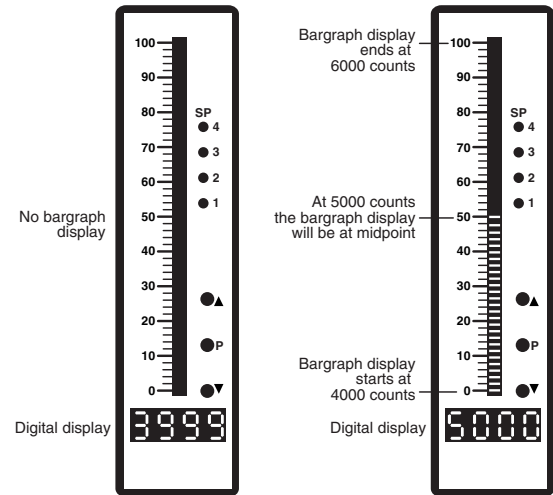
Bargraph does not light up for Input Signals up to 3999 counts

Bargraph lights up for Input Signals above 4000 counts

**STEP A** **Enter the Calibration Sub Menu Mode**
1) Press the [P] and [↑] buttons at the same time. Display toggles between [CAL] and [oFF].
2) Press the [P] button. Display toggles between [bhi] and the previous setting.

**STEP B** **Set the Digital Span of the Bargraph Display (See example above)**
1) Using the [↑] and [↓] buttons, adjust the display to the desired high parameter reading, e.g. 6000 counts.
2) Press the [P] button. Display toggles between [bLo] and the previous setting.
3) Using the [↑] and [↓] buttons, adjust the display to the desired low parameter reading, e.g. 4000 counts.
4) Press the [P] button. Display changes from [4000] to [dP].
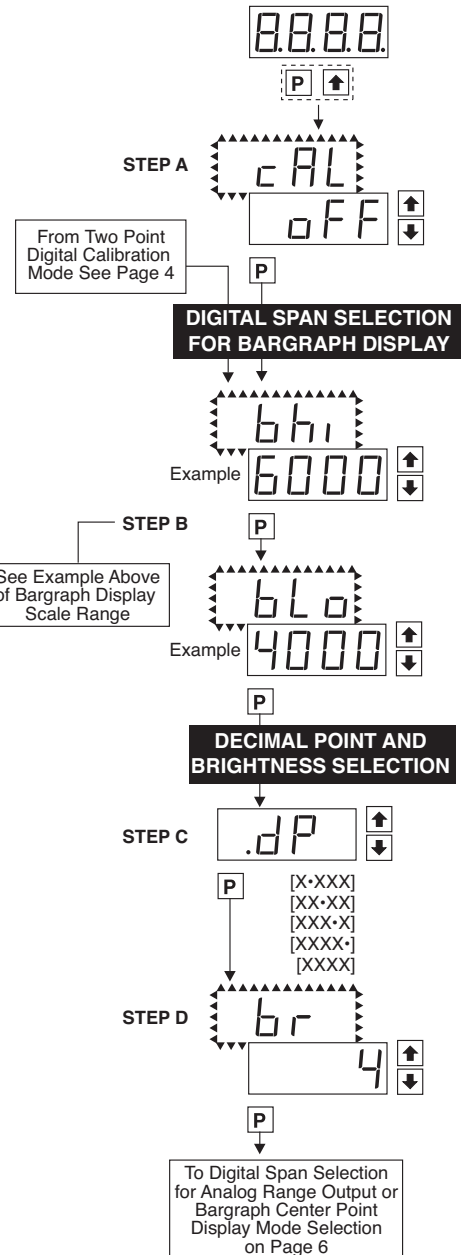
## Decimal Point and Brightness Selection

**STEP C** **Set the Decimal Point**
1) Using the [↑] and [↓] buttons, adjust the display to the desired decimal point setting.
2) Press the [P] button. Display toggles between [br] and the previous brightness setting.

**STEP D** **Set the Bargraph and Digital Display Brightness**
1) Using the [↑] and [↓] buttons, adjust the display to the desired brightness setting (4 is the brightest setting).
2) Press the [P] button. Display toggles between [Anhi] and the previous [Anhi] setting.

**Note:** If at this point, the display skips directly to STEP G and toggles between [Cto] and [oFF], the software is detecting that the optional analog output hardware is NOT installed.

From Two Point Digital Calibration Mode See Page 4

**DIGITAL SPAN SELECTION FOR BARGRAPH DISPLAY**

Example  bhi 6000

See Example Above of Bargraph Display Scale Range

Example  bLo 4000

**DECIMAL POINT AND BRIGHTNESS SELECTION**

STEP C  .dP

[X•XXX]
[XX•XX]
[XXX•X]
[XXXX•]
[XXXX]

STEP D  br 4

To Digital Span Selection for Analog Range Output or Bargraph Center Point Display Mode Selection on Page 6

## Digital Span Selection for Analog Range Output

**STEP E  Selecting the [Anhi] Digital Value for Analog High Output**

1) Using the ⬆ and ⬇ buttons, adjust the display to the desired digital value at which the [chi] Calibrated Analog High output will occur.  For digital readings outside the digital span selected, the analog output will linearly rise above the value set for chi, up to the maximum analog output capability.  However, the analog output will not go lower than the calibrated value set for cLo (see below).

2) Press the P button. Display toggles between [AnLo] and previous [AnLo] setting.

**STEP F  Selecting the [AnLo] Digital Value for Analog Low Output**

1) Using the ⬆ and ⬇ buttons, adjust the display to the desired digital value at which the [cLo] Calibrated Analog Low output will occur.  For Digital readings outside the Digital Span selected, the analog output will not go lower than the calibrated value set for cLo.

2) Press the P button. The display toggles between [cto] and [oFF].

**Note:** Any two digital span points from –1999 to 9999 can be selected. The digital values for [Anhi] analog high and [AnLo] analog low can be reversed to provide a 20 to 4mA output. The digital span selected can be as small as two counts, when using the analog output to function as a Control or Alarm Driver.  Small digital spans will cause the high resolution 16 bit D to A to increment digitally in stair case steps.

See Two Point Analog Output Range Setting and Calibration at the top of the next page.
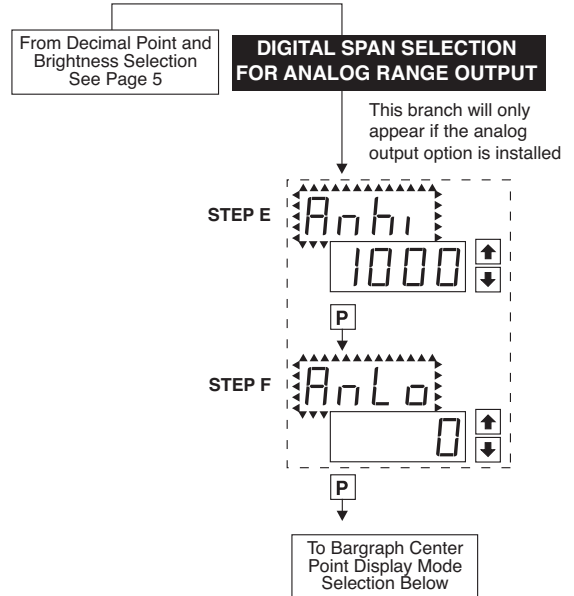
## Bargraph Center Point Display Mode Selection

### Example of Using the Center Point Bargraph Display Mode with a Unipolar Input

If the meter's full scale range is set to 5000 counts, the midpoint would be 2500 counts. If a signal of 2500 counts is applied only one segment at the 2500 count mark will light up. If a signal of 4000 counts is applied the segments between the center segment (2500 counts) and the 4000 count mark light up.

If a signal of 1000 counts is applied, the segments between the center segment (2500 counts) and the 1000 count mark will light up.
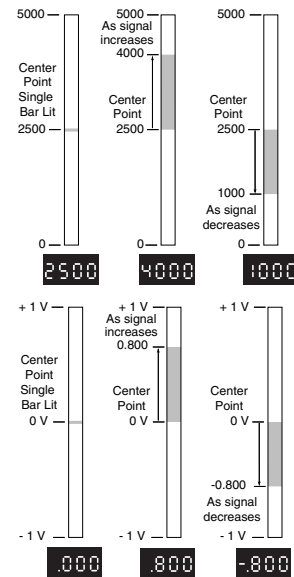
### Example of Using the Center Point Bargraph Display Mode with Bipolar Signal Inputs

The meter may also be calibrated to display symmetrical bipolar signals such as ± 1 V or ± 10 V. When the center point display mode is selected, it will then function as a center zero meter.  When positive signals are applied, the bar will go up from the center point, and when negative signals are applied, the bar will go down from the center point.
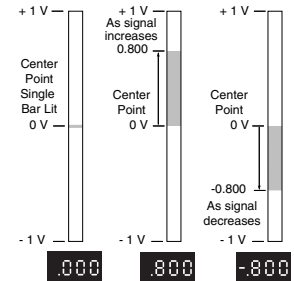
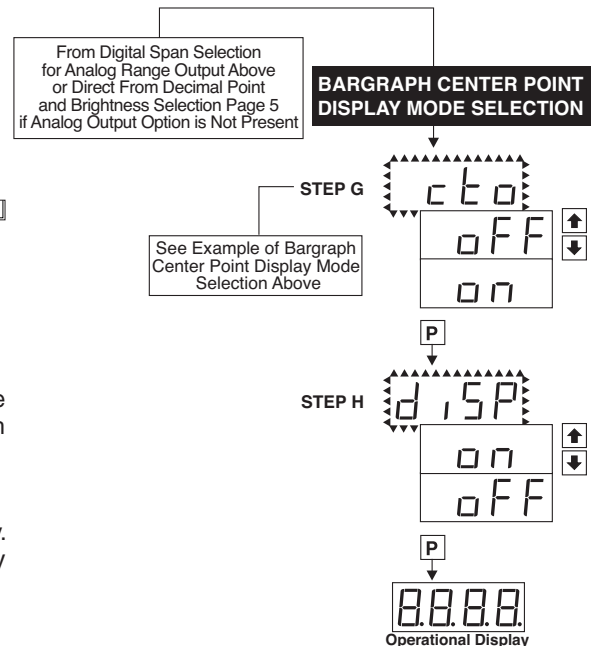**STEP G  Bargraph Center Point Mode Selection (See example above)**

1) To select bargraph center point mode, press the ⬆ or ⬇ button. Display changes from [oFF] to [on].

2) Press the P button. Display toggles between [diSP] and [on] or [oFF].

**STEP H  Digital Display ON/OFF Selection**

1) To set the display to [oFF], press the ⬆ or ⬇ button. Display toggles between [diSP] and [oFF].

2) Press the P button. The display exits the calibration mode and returns to the operational display. Only the bargraph display is on and the digital display is off.

If the digital display is selected to be off, pressing any button to make programming changes or to view setpoints activates the digital display. When the procedure is complete, the digital display will then automatically switch off.

**The Display/Bargraph settings are now complete.**

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From Decimal Point and Brightness Selection See Page 5

**DIGITAL SPAN SELECTION FOR ANALOG RANGE OUTPUT**

This branch will only appear if the analog output option is installed

STEP E  Anhi  1000

P

STEP F  AnLo  0

P

To Bargraph Center Point Display Mode Selection Below

5000 — Center Point Single Bar Lit 2500 — 0

5000 — As signal increases 4000 — Center Point 2500 — 0

5000 — Center Point 2500 — 1000 As signal decreases 0

2500   4000   1000

+ 1 V — Center Point Single Bar Lit 0 V — - 1 V

+ 1 V — As signal increases 0.800 — Center Point 0 V — - 1 V

+ 1 V — Center Point 0 V — -0.800 As signal decreases - 1 V

.000   .800   -.800

From Digital Span Selection for Analog Range Output Above or Direct From Decimal Point and Brightness Selection Page 5 if Analog Output Option is Not Present

**BARGRAPH CENTER POINT DISPLAY MODE SELECTION**

STEP G  cto  oFF  on

See Example of Bargraph Center Point Display Mode Selection Above

P

STEP H  diSP  on  oFF

P

8.8.8.8.
**Operational Display**

## Two Point Analog Output Range Setting and Calibration

Determine if the Analog Output Selection Header is in the 4 to 20mA (0-20mA) position or the 0 to 10VDC position. If necessary, the module may have to be removed and the header position changed (see Component Layout below).

**Note**: Always disconnect power from the meter before removing the analog output module to adjust the mA or Volts output selection header and reinstalling it. When power is reconnected, the meter's software will automatically detect the presence or absence of the analog output module.

**STEP A    Enter the Calibration Mode**
    1)  Press the [P] and [▲] buttons at the same time. Display toggles between [cAL] and [oFF].
    2)  Press the [▲] or [▼] button. Display changes from [oFF] to [on].
    3)  Press the [P] button. Display toggles between [cAL] and [out] input calibration.

**Note**: If at this point the display skips directly to toggle between Zero and the previous Zero setting, the software is detecting that the optional analog output hardware is NOT installed.

**STEP B    Enter the Two Point Analog [ouT] Output Range Setting and Calibration Mode**
    1)  Press the [P] button. Display toggles between [cLo] and an internal scale factor.

**STEP E    Set or Calibrate [cLo] the Low Analog Value of the Analog Output Range**
    1)  Connect a multimeter to analog output pins 4 and 5 (see Rear Panel Pinouts on page 10). Using the [▲] and [▼] buttons, adjust the analog output to the desired low value as measured on the multimeter. cLo may be adjusted to any value from –0.3 mA to 18 mA (mA output selected) or from –0.6 V to 8 V (volt output selected). However, the output of cLo must always be less than the value selected for chi. If a reversed analog output is desired, the values selected to establish the Digital Span can be reversed (see top of page 6). For digital readings outside the Digital Span selected, the analog output will not go any lower than the calibrated value set for cLo. However, the analog output will linearly rise above the value set for chi, up to the the maximum analog output capability (see chi below).
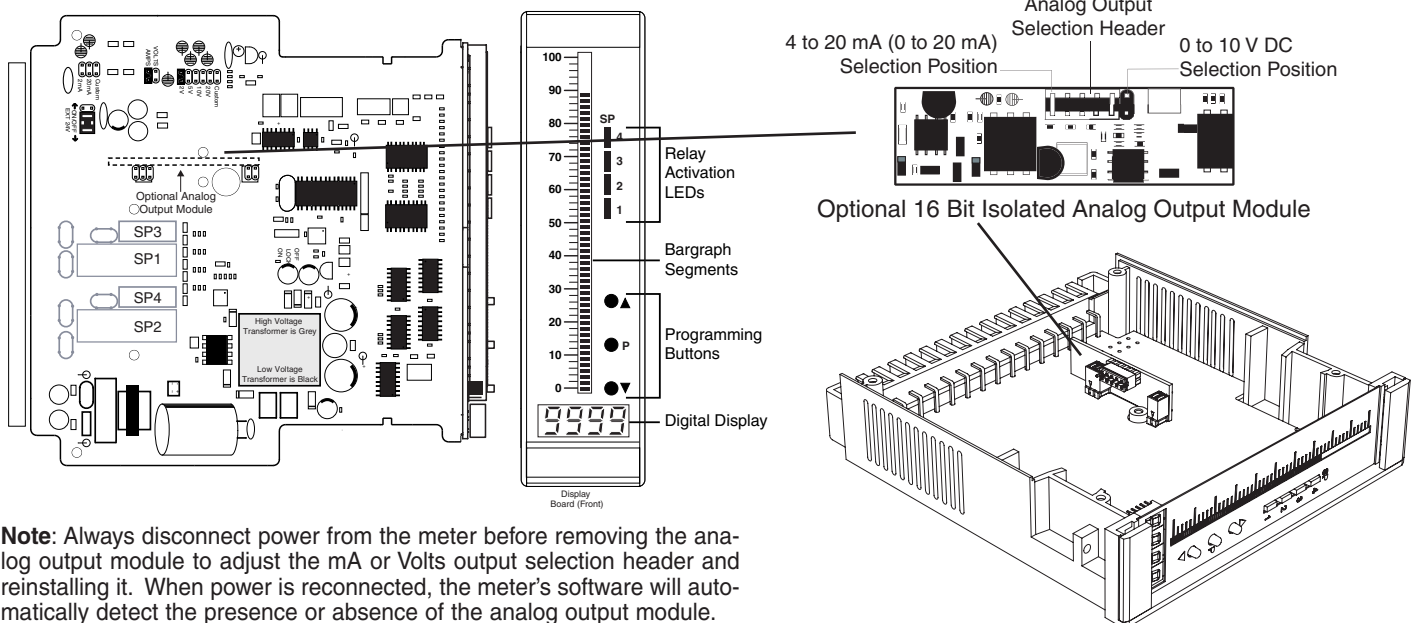    2)  Press the [P] button. Display toggles between [chi] and an internal scale factor.

**STEP F    Set or Calibrate [chi] the High Analog Value of the Analog Output Range**
    1)  Using the [▲] and [▼] buttons, adjust the analog output to the desired high value as measured on the multimeter display. chi may be adjusted to any value from 18 mA to 24 mA (mA output) or from 8 V to 10.3 V (volt output). However, the value must be higher than the value selected for cLo. For digital readings outside the Digital Span selected, the analog output will linearly rise above the value set for chi, up to the maximum analog output capability.
    2)  Press the [P] button. The meter exits the calibration mode and returns to the operational display.

**Note:** The analog output range established by the values selected for cLo and chi will occur, automatically scaled, between the two digital values selected for AnHi and AnLo. However, the analog output can linearly rise above the chi value set for digital readings outside the digital span selected. See Digital Span Selection on page 6.

Operational Display

Sub-menu MODE

STEP A  Calibration Mode

cAL
oFF
on

To Digital Span Selection for Bargraph Display See Page 5

Will only appear if the analog output option is installed

STEP B  Calibration Mode

cAL
iP
out

To Two Point Digital Calibration Mode See Page 4

**TWO POINT ANALOG OUTPUT RANGE SETTING AND CALIBRATION**

STEP E Calibrate Analog Output Lo

cLo
XXXX

STEP F Calibrate Analog Output Hi

chi
XXXX

Operational Display

4.00

20.00

---

## Component Layout

100
90
80  SP
4
70  3
60  2
50  1
40
30
20
10
0

Relay Activation LEDs

Bargraph Segments

Programming Buttons

Digital Display

Optional Analog Output Module

SP3
SP1
SP4
SP2

High Voltage Transformer is Grey

Low Voltage Transformer is Black

Display Board (Front)

4 to 20 mA (0 to 20 mA) Selection Position

Analog Output Selection Header

0 to 10 V DC Selection Position

Optional 16 Bit Isolated Analog Output Module

**Note**: Always disconnect power from the meter before removing the analog output module to adjust the mA or Volts output selection header and reinstalling it. When power is reconnected, the meter's software will automatically detect the presence or absence of the analog output module.

## Setpoint Setting and Relay Configuration Mode

The following programming steps are required to enter the setpoint values and configure the relay functions in a meter with four relays using four setpoints. Generally if less than four relays are installed, the setpoints without relays are operational in software for tri-color control or display only purposes. To remove unwanted setpoint indications, set them to 9999 or -1999 depending on the relay activation mode selected.

**STEP A    Enter the Setpoint Mode**
  1) Press the [P] and [↓] buttons at the same time. Display toggles between [SP1] and the previous SP1 setting.

**STEP B    Set Setpoint 1 (SP1)**
  1) Using the [↑] and [↓] buttons, adjust the display to the desired SP1 value.
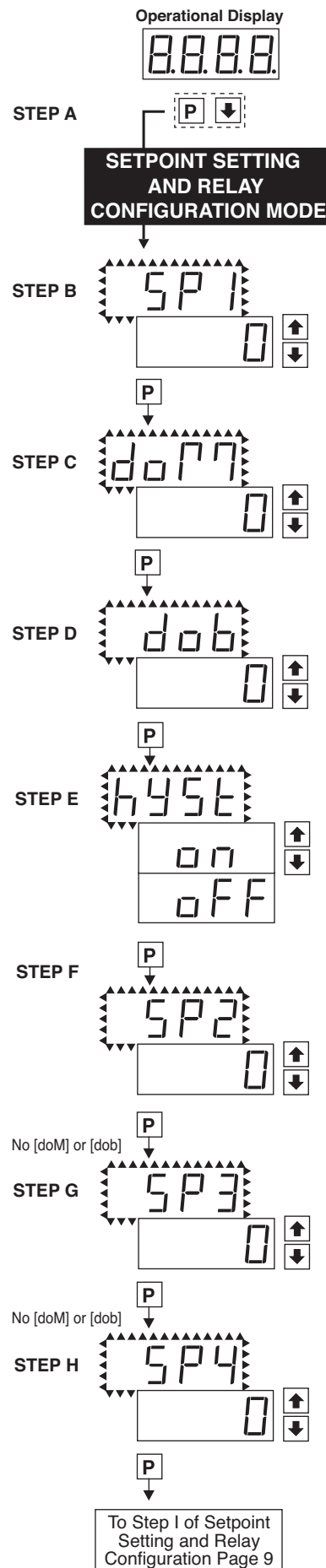  2) Press the [P] button. Display toggles between [doM] and the previous [doM] setting.

**STEP C    Set the SP1 Delay-on-Make (doM) Delay Time Setting**
  1) Using the [↑] and [↓] buttons, adjust the display to the desired [doM] value (0 to 9999 seconds). The reading must continuously remain in an alarm condition until this delay time has elapsed before the relay will make contact (energize).
  2) Press the [P] button. Display toggles between [dob] and the previous [dob] setting.

**STEP D    Set the SP1 Delay-on-Break (dob) Delay Time Setting**
  1) Using the [↑] and [↓] buttons, adjust the display to the desired [dob] value (0 to 9999 seconds). The reading must continuously remain in a non-alarm condition until this delay time has elapsed before the relay will break contact (de-energize).
  2) Press the [P] button. Display toggles between [hYSt] and the previous [hYSt] setting.

**STEP E    Select the Hysteresis (hYSt)**
  1) Using the [↑] and [↓] buttons, select the Hysteresis to be ON or OFF.
  2) Press the [P] button. Display toggles between [SP2] and the previous SP2 setting.

**Note:** When hYSt is selected ON, and SP2 is set at a value higher than SP1, the SP1 relay will operate in a special "pump on pump off" Hysteresis mode. SP2 acts as the upper limit and SP1 acts as the lower limit of the Hysteresis Band on the SP1 relay.

**For filling applications:**

rLYS should be set to LhLh (see step I). The SP1 relay and SP1 LED Annunciator will then activate for inputs less than the SP1 setpoint, and remain ON until the SP2 setpoint is reached.

**For emptying applications:**

rLYS should be set to hhhh (see step I). The SP1 relay and SP1 LED Annunciator will then activate for inputs greater than the SP2 setpoint, and remain ON until the SP1 setpoint is reached.

**STEP F    Set Setpoint 2 (SP2)**
  1) Using the [↑] and [↓] buttons, adjust the display to the desired SP2 value.
  2) Press the [P] button. Display toggles between [doM] and the previous [doM] setting.

**STEP G    Set Setpoint 3 (SP3)** (No [doM] or [dob])
  1) Using the [↑] and [↓] buttons, adjust the display to the desired SP3 value.
  2) Press the [P] button. Display toggles between [SP4] and the previous SP4 setting.

**STEP H    Set Setpoint 4 (SP4)** (No [doM] or [dob])
  1) Using the [↑] and [↓] buttons, adjust the display to the desired SP4 value.
  2) Press the [P] button. Display toggles between [rLYS] and the previous relay setting.

**Please Continue On Next Page.**

**Operational Display**

STEP A

**SETPOINT SETTING AND RELAY CONFIGURATION MODE**

STEP B  5P1  0

STEP C  doM  0

STEP D  dob  0

STEP E  hYSt  on  oFF

STEP F  5P2  0

No [doM] or [dob]

STEP G  5P3  0

No [doM] or [dob]

STEP H  5P4  0

**STEP I    Set Relay Activation mode [rLYS]**

(H) High the relay energizes when the setpoint is exceeded. (L) Low the relay energizes below the setpoint. The setpoint is indicated from left to right SP1, SP2, SP3, SP4.

1) Using the ⬆ and ⬇ buttons, adjust the reading on the display to the desired relay settings: [LLLL], [LhLh], [LLhh], [hhhh].
2) Press the P button.

If a mono-color red or green display is installed then the Setpoint Relay Programming Mode is now complete and the meter returns to the operational display.

If a tricolor bargraph display is installed then the Bargraph Color Programming Mode will be entered and display toggles between [CoL] and the previous setting. Color selection menu will be displayed.

## Bargraph Color Programming Mode

For safety, the tri-color bargraph is designed like a traffic light, to display either red, orange or green, but only one color at a time. The color to be displayed is selected in two ways.

**First** (Step J) is to select the color to be displayed, when the bar is "below*", whichever set point is set to the lowest position.

**Second** (Steps K, L, M, and N) is to select the color to be displayed when the bar is above each specific set point, regardless of the order or position to which the set points are set.

However, if two or more setpoints with differently specified colors are positioned at the same set point value, the color specified for the set point with the highest Identifying number will be displayed. When set points are set to the same value, the SP4 color overrides the SP3 color, the SP3 color overrides the SP2 color, and the SP2 color overrides the SP1 color.

**STEP J    Select Bargraph Color when the bar is BELOW* the Setpoint that is set to the lowest position**

1) Using the ⬆ and ⬇ buttons, select the desired bargraph color [grn], [oran] or [red]
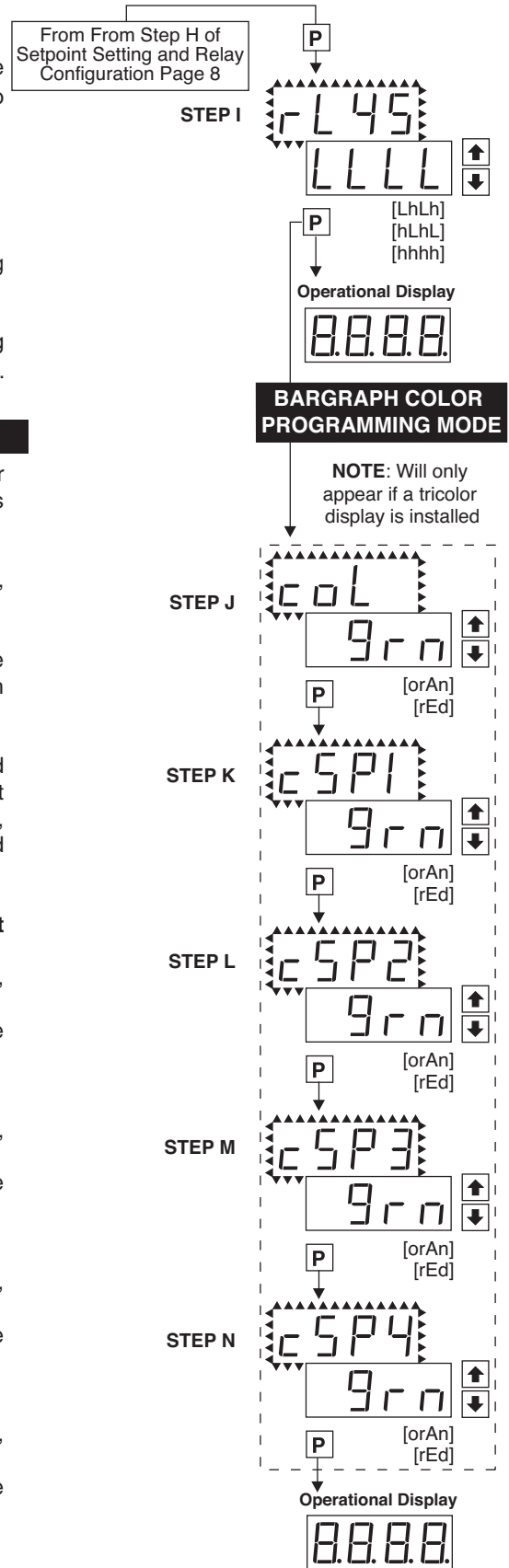2) Press the P button. Display toggles between [CSP1] and the previous color setting.

**STEP K    Select Bargraph Color when the bar is ABOVE* SP1 Setpoint**

1) Using the ⬆ and ⬇ buttons, select the desired bar graph color [grn], [oran] or [red]
2) Press the P button. Display toggles between [CSP2] and the previous color setting.

**STEP L    Select Bargraph Color when the bar is ABOVE* SP2 Setpoint**

1) Using the ⬆ and ⬇ buttons, select the desired bargraph color [grn], [oran] or [red]
2) Press the P button. Display toggles between [CSP3] and the previous color setting.

**STEP M    Select Bargraph Color when the bar is ABOVE* SP3 Setpoint**

1) Using the ⬆ and ⬇ buttons, select the desired bargraph color [grn], [oran] or [red]
2) Press the P button. Display toggles between [CSP4] and the previous color setting.

**STEP N    Select Bargraph Color when the bar is ABOVE* SP4 Setpoint**

1) Using the ⬆ and ⬇ buttons, select the desired bargraph color [grn], [oran] or [red]
2) Press the P button. The meter exits the setpoint mode and returns to the operational display.

**The Bargraph Color programming mode is now complete.**

From From Step H of Setpoint Setting and Relay Configuration Page 8

STEP I

rL45
LLLL    [LhLh] [hLhL] [hhhh]

Operational Display
8.8.8.8.

**BARGRAPH COLOR PROGRAMMING MODE**

**NOTE**: Will only appear if a tricolor display is installed

STEP J    CoL  grn    [orAn] [rEd]

STEP K    CSP1  grn    [orAn] [rEd]

STEP L    CSP2  grn    [orAn] [rEd]

STEP M    CSP3  grn    [orAn] [rEd]

STEP N    CSP4  grn    [orAn] [rEd]

Operational Display
8.8.8.8.

***Note:** For horizontal display formats BELOW* should be read as, "to the left" and ABOVE* should be read as, "to the right".*
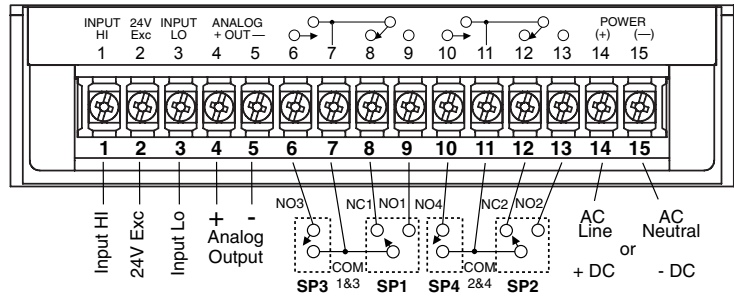
## Functional Diagram
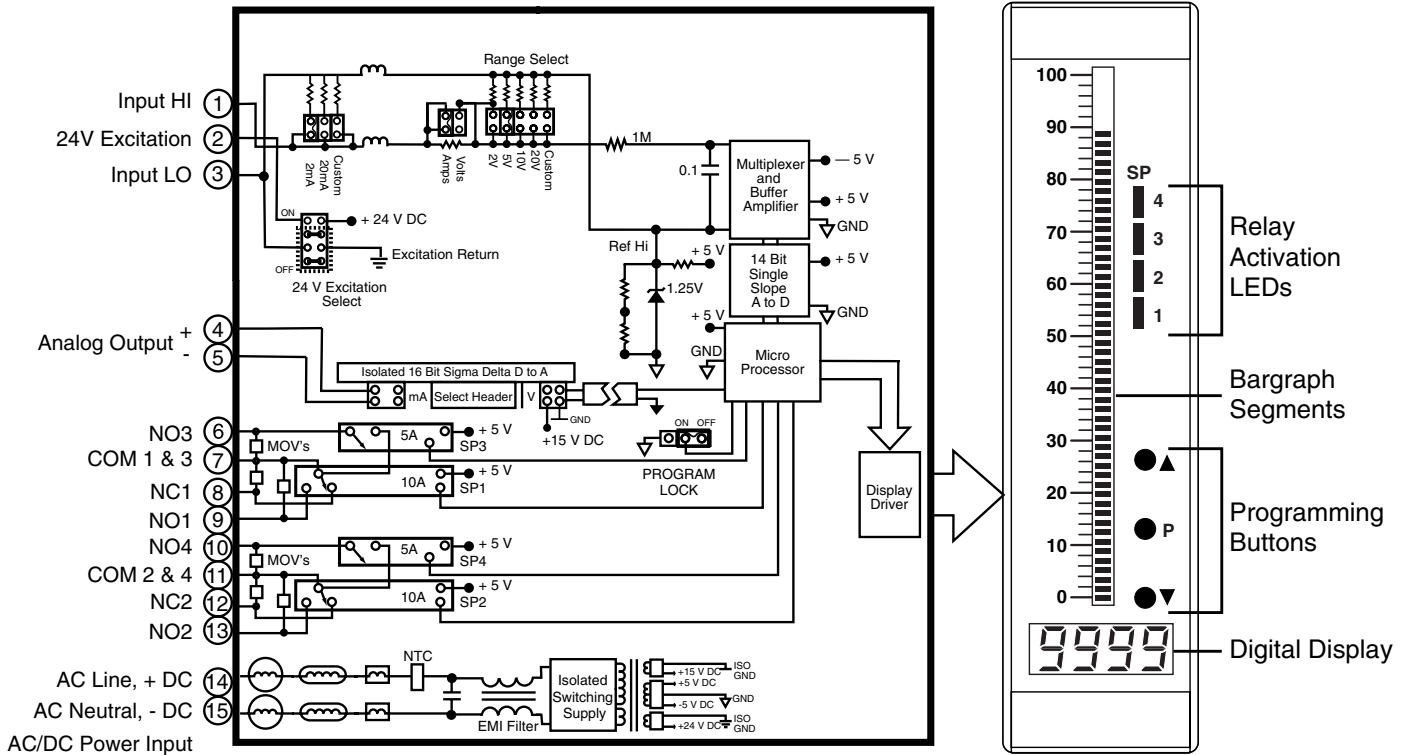


## Connector Pinouts

### Rear Panel Pinout Diagram

This meter uses screw terminals for all input and output connections.



⚠️ **WARNING:** AC and DC input signals and power supply voltages can be hazardous. Do Not connect live wires to screw terminals, and do not insert, remove or handle screw terminals with live wires connected.

## Pin Descriptions

### Input Signal – Pins 1 to 3

**Pin 1**     Input HI
**Pin 2**     24V EXC
**Pin 3**     Input Lo

### Analog Output – Pins 4 to 5

**Pin 4**     Analog Output +
**Pin 5**     Analog Output –

### *Pins 6 to 13 – Relay Output Pins*

**Pin 6**     **SP3 NO.** Normally Open 5 Amp Form A.
**Pin 7**     **SP1/3 COM.** Common for SP1 and SP3.
**Pin 8**     **SP1 NC.** Normally Closed 10 Amp Form C.
**Pin 9**     **SP1 NO.** Normally Open 10 Amp Form C.
**Pin 10**    **SP4 NO.** Normally Open 5 Amp Form A.
**Pin 11**    **SP2/4 COM.** Common for SP2 and SP4.
**Pin 12**    **SP2 NC.** Normally Closed 10 Amp Form C.
**Pin 13**    **SP2 NO.** Normally Open 10 Amp Form C.

### *Pins 14 to 15 – AC/DC Power Input*

**Pin 14**    AC line or +DC. Power input. The standard power is 85 to 265VAC or 95 to 370VDC. Optional power supply of 18 to 48VAC or 18 to 72VDC power is also available.

**Pin 15**    AC neutral or -DC. Power input. The standard power is 85 to 265VAC or 95 to 370VDC. Optional power supply of 18 to 48VAC or 18 to 72VDC power is also available.

*SINGLE CHANNEL 4 to 20 mA DC:*   Example shown is with the Isolated Analog Output Option.

with **External 24V DC Excitation.**
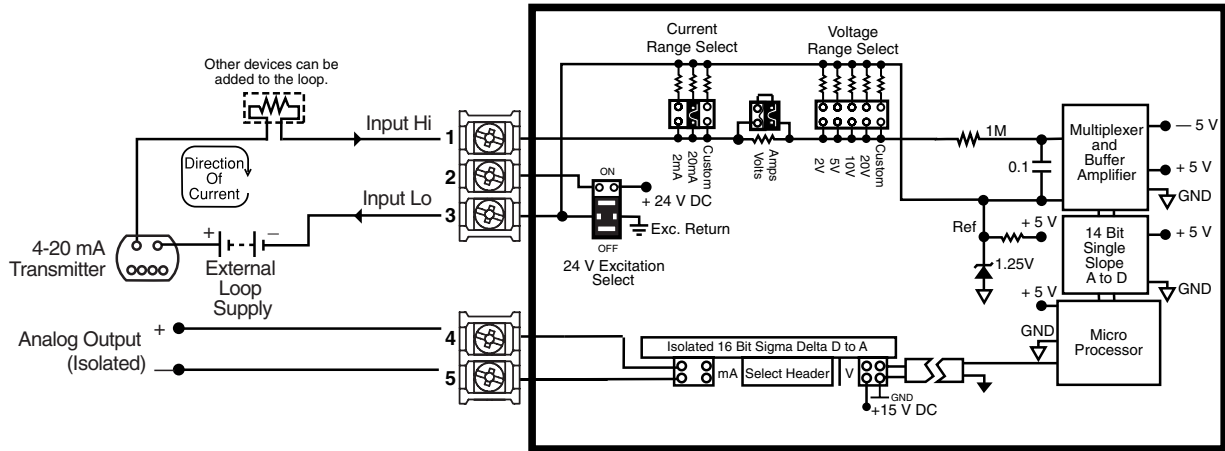


*SINGLE CHANNEL 4 to 20 mA DC:*   Example shown is with the Isolated Analog Output Option.

with **24V Excitation provided by the Bargraph**
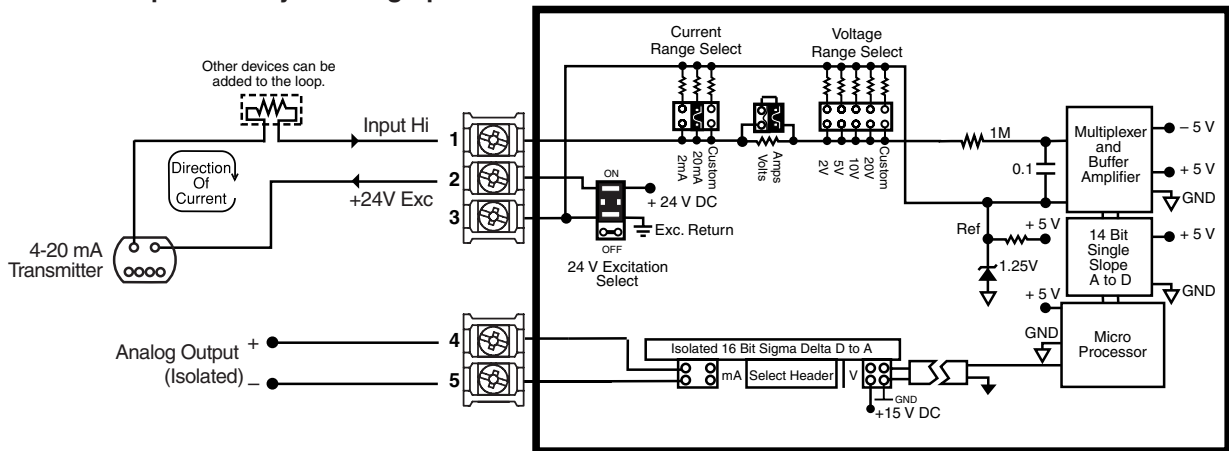


*SINGLE CHANNEL DC Volts:*   Select appropriate range of 2V, 5V, 10V or 20V. (Custom ranges also available).

Example shown is for 10V DC with Isolated Analog Output option.
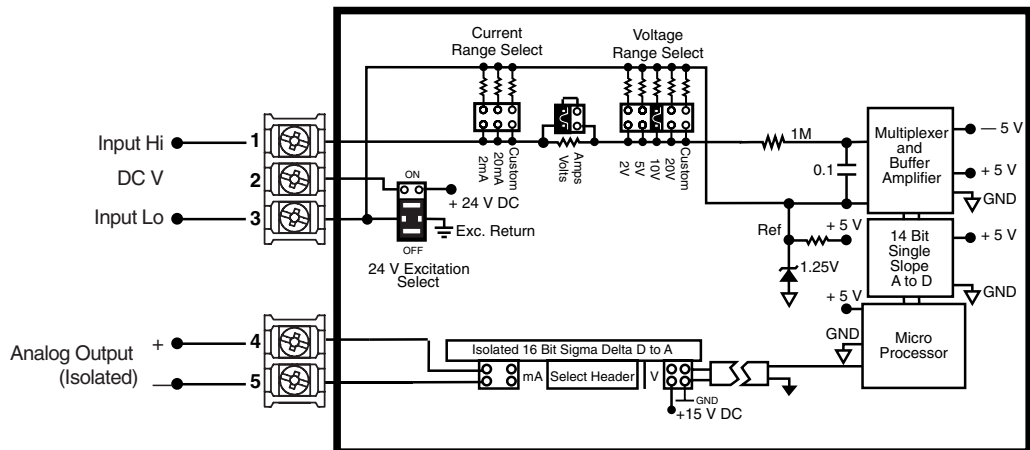
**STEP A    Prepare the Panel**

1) Cut a hole in the panel to suit the panel cutout. See Case Dimensions for panel cutout sizes.

**STEP B    Fit the Meter**

1) Turn both mounting screws counterclockwise to allow for the thickness of the panel.

2) Make sure that both lugs on the mounting screws are flush with the edge of the bargraph case.

3) Push the bargraph into the panel cutout from the front of the panel.
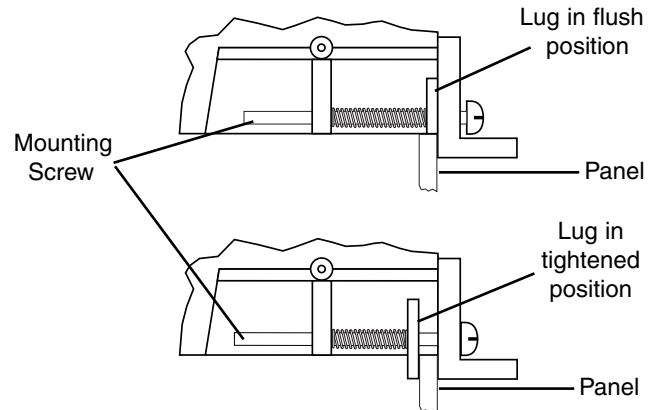
4) Push and turn the mounting screws in a clockwise direction until they are tight.

**STEP C    Connect the Cables**

1) Connect all input cables to the connector pins (see Connector Pinouts for details).

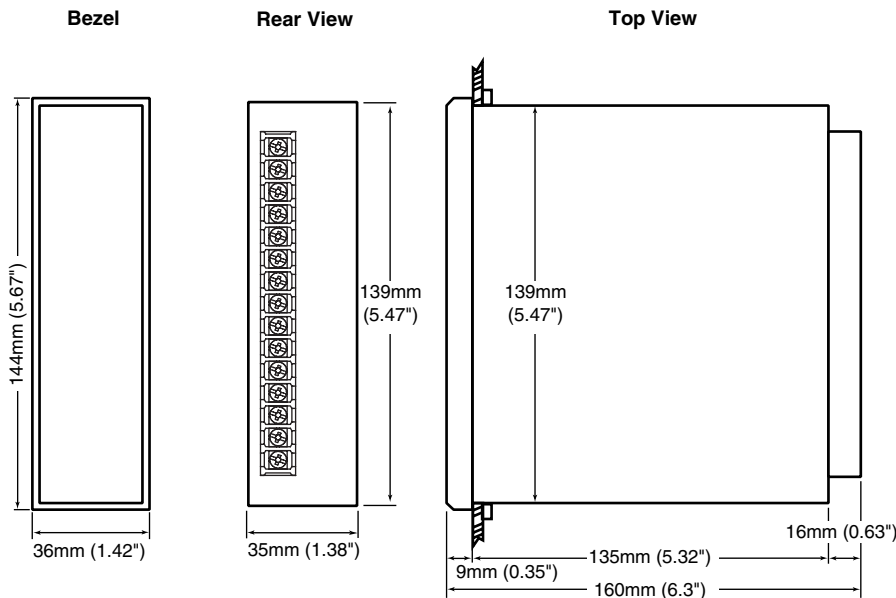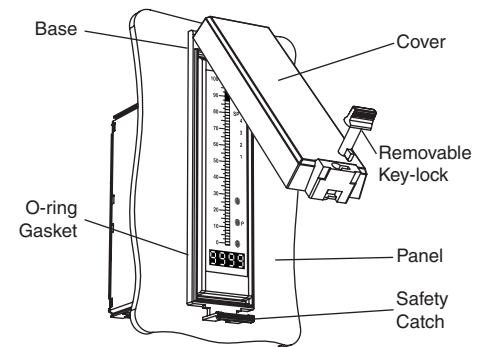2) Connect the power cables to the connector pins (see Connector Pinouts for details).

## WARNING

**AC and DC power supply voltages are hazardous. Make sure the power supply is isolated before connecting to the bargraph.**

Lug in flush position

Mounting Screw

Panel

Lug in tightened position

Panel

## Case Dimensions

**Bezel**

**Rear View**

**Top View**

**NEMA-4X Lens Cover**

144mm (5.67")

36mm (1.42")

139mm (5.47")

35mm (1.38")

139mm (5.47")

16mm (0.63")

9mm (0.35")

135mm (5.32")

160mm (6.3")

Base

Cover

O-ring Gasket

Removable Key-lock

Panel

Safety Catch

**Part #: OP-N4/144T36**

This cover is designed to be dust and water proof to NEMA-4 standards. The lens cover consists of a base and cover with a cam hinge and key-lock locking device.
An O-ring, or Neoprene gasket forms a seal between the base and the panel. The cam hinge holds the cover from closing when opened until pushed closed. A safety catch keeps the cover closed even when the key is removed and the key hole can be used to attach a safety seal clip, preventing unauthorized opening.