

EN SERIES

NEMA CASED DIGITAL PANEL METERS



**ELECTRO-
NUMERICS, INC.**

1,999 COUNT DIGITAL PANEL METERS



Models EN35L, EN35LCD & EN35B

FEATURES

- 1,999 Counts Full Scale
- NEMA Case (1.682" x 3.924" Cutout)
- LSI State-of-the Art Circuitry
- Bipolar, Auto Polarity and Auto Zero
- Differential and Single-Ended Inputs
- Large Bright LED, LCD or PLASMA Digits
- 115/230Vac Powered
- Many Options
- Two Year Warranty

INTRODUCTION

The EN35 Series of 3 1/2 digit (1,999 Count) Digital Panel Meters combines high reliability and moderate cost with rugged construction and large bright digits to meet the most demanding applications. These meters are panel mountable and utilize state-of-the-art circuit design. All three of these models use the passive integration, dual slope analog to digital conversion technique. This technique provides excellent long term stability, accuracy, linearity, noise rejection and jitter-free performance.

Many standard features and a variety of options are offered to extend the applications of the basic dc voltage input meters. Standard features include **Bipolar, Differential and Single-Ended Signal Inputs; 200mV or 2Vdc full scale ranges; rugged glass-filled Cycolac (ABS) plastic case; single edge-card type electrical connection, 115Vac Power and a Two Year Warranty.** Optional features include 20V and 200V Ranges, Ratio Input, Zero Offsets, dc Current Input, Special Scaling, Dummy Zero (19,990 count), Read Rate, Tri-State BCD Outputs, Excitation Voltage Output, Analog Output and 230Vac Power.

SPECIFICATIONS

Full Scale Range	Resolution	Input Impedance	Maximum Overload
+/-199.9mVdc	100uV	1000Mohm	100V
+/-1.999Vdc	1mV	1000Mohm	100V
+/-19.99Vdc	10mV	1Mohm	250V
+/-199.9Vdc	100mV	1Mohm	250V

PERFORMANCE

Accuracy +/-0.05% Reading, +/-0.5 Digit
 Linearity +/-0.5 Digit Max.
 Indecision +/-0.2 Digit Max.

Temperature Coef.

Full Scale 0.005% Reading/°C Max.
 Zero 1uVolt/°C Max.
 Read Rate 3 Readings/sec.
 Common Mode Rejection 80dB @ 60Hz
 Normal Mode Rejection 40dB @ 60Hz
 Bias Current 1pA Max.
 Step Response 500ms

ANALOG INPUT

Bipolar Standard (1,999 to -1,999)
 Differential Standard
 Single-Ended Standard (requires jumper J2-10 to J2-N at the connector)

DIGITAL INPUTS

Hold: Logic "0" or digital ground holds the reading and optional BCD output. In "hold", a logic "1" pulse (>330msec.) will cause the display to update.
 Decimal: Selectable at J2 by logic "0" or connection to J2-N.
 Point: By DIP switch on model EN35LCD.

POWER AND ENVIRONMENTAL

Model	Voltage	Power
EN35L/B	115/230Vac, +/-15%	4.0W Typ
EN35LCD	115/230Vac, +/-15%	750mW Typ

Frequency Range (ac Power) 47 to 400Hz
 Power Line Isolation 1500V above ac power line
 Operating Temperature -10 to +60°C (EN35L/B)
 -10 to +50°C (EN35LCD)
 Storage Temperature -40 to +80°C (EN35L/B)
 -40 to +60°C (EN35LCD)
 Relative Humidity 0 to 90% (non-condensing)

DISPLAY

EN35L (LED) 0.56" Red-Orange, SevenSegment
 EN35LCD (LCD) 0.5" Black on silver background
 EN35B (PLASMA) 0.55" Orange, no gap segments
 Overrange Indication 3 Least Significant Digits blank

PHYSICAL CHARACTERISTICS

Termination Dual 15 pin edge-card type, 0.156" center spacing. 1/16" PC thickness.
 Weight 16oz.
 Case Glass filled Cycolac (ABS) KJB, fire retardant
 Window Acrylic filter matched to display color

OPTIONS

-02E Ratio
 -04N Narrow Zero Offset (+/-100 cnts)
 -04 Customer Specified Offset
 -06 dc Current Measurement
 -09 Dummy Zero (EN35L)
 -10 Read Rate (EN35L/B)
 -12 Tri-State BCD
 -EO Excitation Output
 -AO Analog Output
 -08 Special Scaling
Power Option:
 230Vac Power

ELECTRO-NUMERICS, INC.

Call 800-854-8530 or FAX (951) 695-7246 for Applications Assistance

19,999 COUNT DIGITAL PANEL METERS



Model EN45L

FEATURES

- 19,999 Counts Full Scale
- NEMA Case (1.682" x 3.924" Cutout)
- LSI State-of-the Art Circuitry
- Bipolar, Auto Polarity and Auto Zero
- Differential and Single-Ended Inputs
- Large Bright LED Digits
- 115/230Vac Powered
- Many Options
- Two Year Warranty

INTRODUCTION

The EN45 Series of 4 1/2 digit (19,999 Count) Digital Panel Meters combines high reliability and moderate cost with rugged construction and large bright digits to meet the most demanding applications. These meters are panel mountable and utilize state-of-the-art circuit design. These models use the passive integration, dual slope analog to digital conversion technique. This technique provides excellent long term stability, accuracy, linearity, noise rejection and jitter-free performance.

Many standard features and a variety of options are offered to extend the applications of the basic dc voltage input meters. Standard features include **Bipolar, Single-Ended Signal Inputs; 200mV & 2Vdc full scale ranges;** rugged glass-filled **Cycolac (ABS) plastic case;** single edge-card type electrical connection, **115Vac Power** and a **Two Year Warranty**. Optional features include 20V & 200V Ranges, Ratiometric Voltage Input, Differential Signal Input, Zero Offsets, BCD Digital Outputs, dc Current Measurement, Special Scaling, Dummy Zero (199,990 count) and 230Vac Power.

SPECIFICATIONS

Full Scale Range	Resolution	Input Impedance	Maximum Overload
+/-199.99mVdc	10uV	1000Mohm	100V
+/-1.9999Vdc	100uV	1000Mohm	100V
+/-19.999Vdc	1mV	1Mohm	250V
+/-199.99Vdc	10mV	1Mohm	250V

PERFORMANCE

Accuracy +/-0.01% Reading, +/-1 Digit
 Linearity +/-1 Digit Typ., +/-2 Digit Max..
 Indecision +/-0.5 Digit Typ.
 Temperature Coef.
 Full Scale 0.005% Full Scale/°C Max..
 Zero +/-0.02 Counts/°C Max..
 Read Rate 2.5 Readings/sec.
 Common Mode Rejection 80dB @ 50Hz
 Normal Mode Rejection 40dB @ 60Hz
 Common Mode Voltage (Full Scale) +/-2V
 Settling Time (To Rated Accuracy) <700msec
 Conversion Time 330msec

ANALOG INPUT

Bipolar Standard (19,999 to -19,999)
 Differential Optional (specify -03)
 Single-Ended Standard

DIGITAL INPUTS

Hold: Logic "0" or digital ground holds the reading and optional BCD output. With the meter in "hold", a logic "1" pulse (> 330msec.) will cause the display to update.

Decimal PT: Selectable at J2 by logic "0" or connection to J2-10 (Digital Ground).

POWER AND ENVIRONMENTAL

Power 115/230Vac, +/-15%, 4.0W Typ.
 Frequency Range (ac Power) 47 to 400Hz
 Power Line Isolation 1500V above ac power line
 Operating Temperature -10 to +60°C
 Storage Temperature -40 to +80°C
 Relative Humidity 0 to 90% (non-condensing)

DISPLAY

EN45L (LED) 0.56" Red-Orange, Seven Segment
 Overrange Indication 4 Least Significant Digits blink

PHYSICAL CHARACTERISTICS

Termination Dual 15 pin edge-card type, 0.156" center spacing. 1/16" PC thickness.
 Weight 16oz.
 Case Glass filled Cycolac (ABS), fire retardant (KJB)
 Window Acrylic filter matched to display color

OPTIONS

-02E Ratio
 -03 Differential Signal Input
 Narrow Zero Offset (+/-100 cnts)
 -04 Customer Specified Offset
 -05A TTL, BCD Digital Output
 -06 Current Measurement
 -08 Special Scaling-04N
 -09 Dummy Zero
Power Option:
 230Vac Power

PIN DESIGNATIONS

EN35 Series

J2

(Without SP Option Installed)

SIGNAL +, (20V, 200V & -08 OPT.)	A	1	RATIO
	B	2	SIGNAL +, (2V & 200mV)
AO + & BCD OVERRANGE	C	3	BCD PRINT (E.O.C.)
HOLD	D	4	BCD POLARITY
BCD 1	E	5	BCD 8
BCD 4	F	6	BCD 2
BCD 10	H	7	BCD 80
BCD 40	J	8	BCD 20
EO - & BCD 100	K	9	EO + & BCD 800
DP3 (1XX.X)	L	10	SIGNAL -
DP2 (1X.XX)	M	11	BCD 400
DIGITAL & AO GND	N	12	BCD 200
DP1 (1.XXX)	P	13	BCD TRI-STATE CONTROL
	R	14	BCD 1000
AC POWER LINE 2	S	15	AC POWER LINE 1

J1

(With 05 Option Installed Only)

BCD 4,000	A	1	BCD 8,000
BCD 2,000	B	2	BCD 1,000
BCD 800	C	3	BCD 400
BCD 100	D	4	BCD 200
BCD 40	E	5	BCD 80
BCD 10	F	6	BCD 20
	H	7	DIGITAL GROUND
	J	8	
	K	9	
BCD 2	L	10	BCD 10
BCD 8	M	11	BCD 4
POLARITY	N	12	OVERRANGE
BCD 10,000	P	13	PRINT
	R	14	
	S	15	

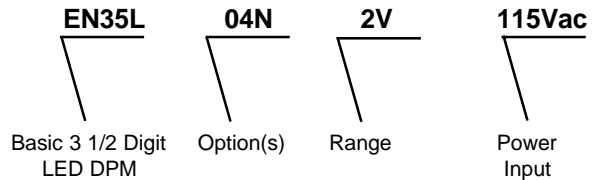
EN45 Series

J2

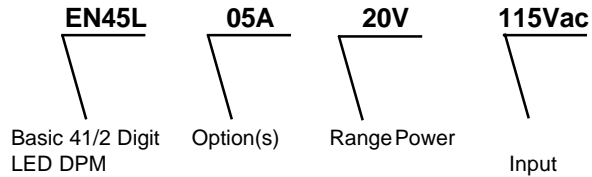
SIGNAL INPUT -	A	1	DP3 (1XX.XX)
	B	2	BUSY (E.O.C)
DP4 (1XXX.X)	C	3	OVERRANGE
DIGITAL GROUND	D	4	
SIGNAL INPUT + (EN45L)	E	5	SIGNAL INPUT +
ANALOG COMMON	F	6	
RATIO +	H	7	SIGNAL INPUT - (EN45L)
DISPLAY BLANK	J	8	
HOLD	K	9	
DP2 (1X.XXX)	L	10	DIGITAL GROUND (EN45L)
DP1 (1.XXXX)	M	11	
RATIO + (EN45L)	N	12	
DP1 (1.XXXX, EN45L)	P	13	
	R	14	
AC POWER LINE 2	S	15	AC POWER LINE 1

ORDERING INFORMATION

EN35 Series



EN45 Series



INSTALLATION & OPERATION

MOUNTING

Two standard mounting methods are available; through the panel or behind the panel. To mount the meter through the panel, a panel cutout of 3.924" X 1.682" +/- .010" is required. To mount the meter, remove the snap-in bezel; rotate the latch screws several turns counter-clockwise to retract the latches; insert the meter into the panel; tighten the latch screws and replace the bezel.

To mount the meter behind the panel, utilize the mounting brackets provided in kit HW06.

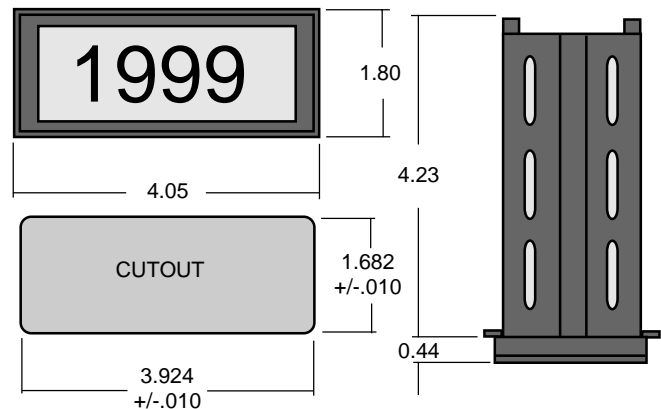
WIRING

EN Series DPMs require an edge-card connector at J2. An additional connector is required if the SP (Setpoint) option or the 05A (BCD) options are specified. Part No. 411-806 provides solder-tail connection while Part No. 600-220 provides screw terminal connection.

OPERATION

Upon application of ac or dc power and with a signal input equal to or less than full scale, the meter will begin operation.

MOUNTING DIMENSIONS



EN SERIES OPTIONS

- 02E RATIO

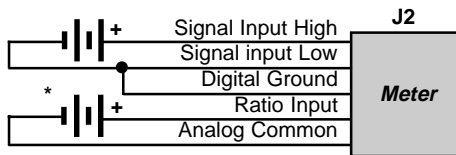
When ratiometric signal input is specified, the meter is connected as shown in FIGURE 1. Ratio input may be used when it is desired to have the meter display readings as a function of both signal input and a reference voltage. The digital display will indicate according to the formula:

$$\text{Display Reading} = \frac{\text{Signal Input Voltage}}{\text{* Ratio Input Voltage}} \times A$$

A = 1,000 for 3 1/2 digit meters, 10,000 for 4 1/2 digit meters.

FULL SCALE RANGE	RATIO INPUT RANGE (after adjustment)
0 to 2V 0 to 20V	0.7Vdc to 1.1Vdc 7 Vdc to 11Vdc

FIGURE 1



* The ratio (reference) voltage must be adjusted by the customer, typically a maximum of +/- 100mV

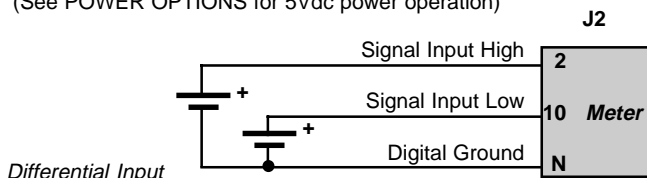
- 03 DIFFERENTIAL

(EN45 Series Only)

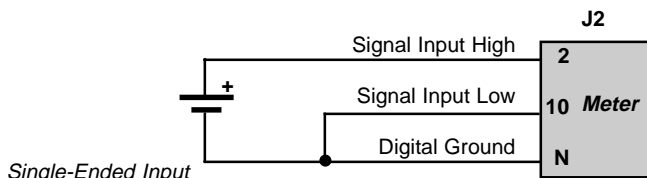
EN35 Series meters are differential and single-ended signal input standard. To operate these meters in a single-ended mode, it is necessary to externally jumper Signal Input (-) to Digital Ground. The EN45 Series meters are single-ended signal input standard. If differential signal input is required, the option - 03 must be specified.

FIGURE 2 (EN35 Series)

(See POWER OPTIONS for 5Vdc power operation)

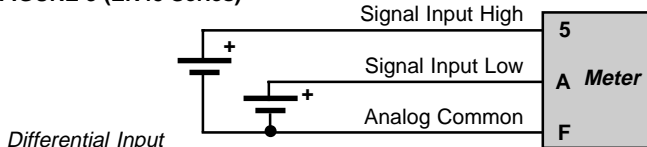


Differential Input

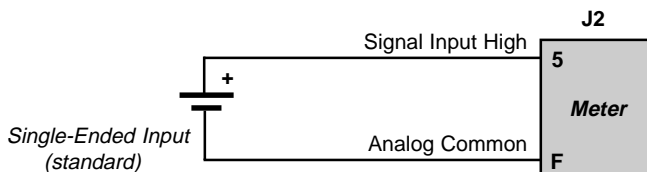


Single-Ended Input

FIGURE 3 (EN45 Series)



Differential Input



Single-Ended Input (standard)

ZERO OFFSET- 04 (SPECIAL), - 04N (NARROW)

EN Series meters are auto-zero standard. No zero offset or zero adjustment is normally possible. When the -04 or -04N options are specified, the zero may be offset in either the positive or negative directions as follows:

Option	Offset
- 04N	+/- 100 counts (customer adjustable)
- 04	* Offset +/- 100 counts (customer adjustable)

* When the -04 option is ordered, the desired offset must be specified i.e. 1V = 000, 1.5V = 500 etc.

The offset is normally a voltage offset; however, if the -06 (current measurement) option is also specified, the -04 or -04N option becomes a current offset.

The offset control (zero adjust pot) "O" is located on the right side of the display board by removing the window (see FIGURES 8 & 9).

With either of these offset options installed, the meter is single ended only.

- 05A PARALLEL BCD OUTPUT

(EN45 Series Only)

Option -05A provides parallel, latched, positive true BCD at connector J1. This data may be used to drive a remote display or printer with a maximum of 2 TTL loads per data line.

Print, Overrange and Polarity are provided as follows:

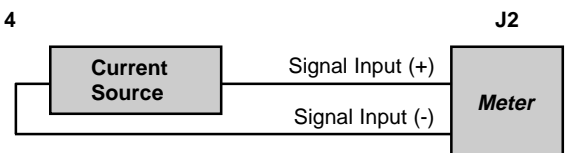
Print	Logic "0" represents valid data
Overrange	Logic "1" represents overrange
Polarity	Logic "1" represents positive

-06 CURRENT MEASUREMENT

When the -06 option is specified, an internal shunt resistor is added to a standard 200mV voltage input meter.

Full Scale Range EN35	Full Scale Range EN45	Resolution		Impedance (ohms)
		EN35	EN45	
19.99uA	19.999uA	10nA	1nA	10,000
199.9uA	199.99uA	100nA	10nA	1,000
1.999mA	1.9999mA	1uA	100nA	100
19.99mA	19.999mA	10uA	1uA	10
199.9mA	199.99mA	100uA	10uA	1

FIGURE 4



Single Ended Signal Input

- 08 SPECIAL SCALING

Special Scaling allows the displayed reading to represent voltage or current inputs other than standard. Engineering units may be displayed such as gallons per minute, PSI, temperature etc. Special Scaling is accomplished by internal component changes. When ordering, indicate the input voltage or current and the desired reading in counts full scale.

Example: EN35L -08 (5V = 1500) 115Vac

- 09 DUMMY ZERO (EN35L and EN45L Only)

With the addition of this option, a dummy (fixed) zero digit is added to the right side of the standard 3 1/2 or 4 1/2 digit display. This gives the meter an effective "count by 10" capability.

Model	With -09	Without -09
EN35L:	19990	1999
EN45L:	199990	19999

Decimal Points are activated from the rear connector (J2) except as follows:

EN45L-09 DP5 (1XXXX.0) is activated by connecting solder tab DP5 located by removing the window, upper right hand corner. DP3 (1XX.X0) is activated by connecting J2-L to J2-N (digital ground) and by removing R102. DP4 (1XXX.0) is activated by connecting J2-L to J2-N (digital ground) and removing R101. One of these resistors must be removed or both DP3 and DP4 will be activated at the same time. These resistors are located by removing the window. They are identified on the display board in the lower center.

- 10 READ RATE (EN35L, EN35B Only)

The Read Rate or the number of times per second the meter samples the measured data can be internally changed at the factory. A slower or faster read-rate can be useful depending on the rate-of-change of the data being measured. A fast read-rate may be required when the data is changing rapidly and a fluctuation may be missed. A slow read-rate can be used to average small fluctuations in the data. When the read-rate is changed, the conversion speed or transfer of data from analog to digital is also changed proportionally. The - 10 option allows selection of read-rates between 4 and 12 readings per second. The read rate must be specified at time of ordering.

Example: EN35B - 10 (8 Rdg / Sec), 115Vac

- 12 TRI-STATE BCD OUTPUT (EN35 Series Only)

Option -12 provides parallel, latched, positive true BCD available at connector J2. This BCD may be used to drive a remote display, printer or provide data to microprocessors or computers. The BCD has latched output and is presented in positive true, parallel format having a drive capability of 1 TTL load per data line. Print, Overrange and Polarity are provided as follows:

Print:	Logic "0" represents valid data
Overrange:	Logic "1" represents overrange
Polarity:	Logic "1" represents positive

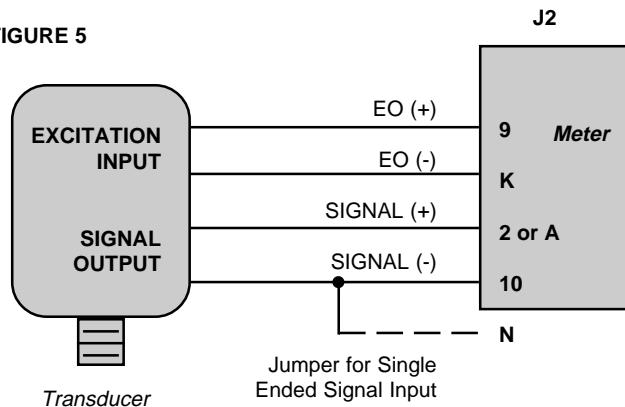
All outputs may be placed in a high impedance mode by the application of a logic "1" to Tri-State Control J2-13. This feature allows bussing several meters together and then selecting one meter at a time to be read.

- EO EXCITATION OUTPUT (EN35L, EN35LCD, With ac Power Only)

This Option adds an adjustable dc power supply to the meter. This voltage output may be used to excite transducers or be used as an auxiliary power source. This option utilizes a separate transformer winding to provide isolation and is pinned out to connector J2. This voltage output is adjustable by a pot located behind the window and positioned to the right of the display (see FIGURE 8).

Specifications: Output Voltage Range: 1.3 to 24Vdc
Output Current: 30mA Maximum
Pin Connections: J2 -9 (+)
J2 -K (-)

FIGURE 5



- AO ANALOG OUTPUT (EN35 Series)

This option provides an Analog Output voltage proportional to the signal input. This output may be used to drive a recorder or remote analog meter. Zero and span controls are accessible by removing the window (see FIGURE 8).

Specifications:
Output Voltage: 1mV / count displayed i.e. with 1800 counts on the display, the AO will be 1.8Vdc.
Accuracy: +/- 1mV
Settability: +/- 1mV
Temperature Coef: Full Scale: +/- 0.05mV / °C
Zero: +/- 0.02mV / °C

POWER OPTION

230Vac Power (All Models)

230Vac +/-15%, 47 to 400Hz, 4.0 Watt typical. Selection of either 115 or 230Vac is factory set by selection of jumpers.

OPTION COMPATIBILITY CHART

The following chart shows those options which normally may be combined. If your application requires a combination that is shown as non-compatible, contact the factory.

	02	03	04	05A	06	08	09	10	12	SP	AO	EO	230Vac
02	X												
03		X											
04, 04N			X										
05A				X									
06					X								
08						X							
09							X						
10								X					
12									X				
SP										X			
AO											X		
EO												X	
230Vac													X

X Indicates that the options are compatible.

WARRANTY (2 YEARS)

Electro-Numerics Incorporated warrants these products to be free of defects in material and workmanship for two years from date of shipment to original customer. This warranty on materials and workmanship may be considered as unconditional provided that, in the opinion of Electro-Numerics, the equipment has not been mechanically, environmentally or electrically abused.

This warranty is limited, at the option of Electro-Numerics, to repair, replacement, or an appropriate credit adjustment not to exceed the original equipment sales price.

Electro-Numerics assumes no liability in connection with the sales of its products beyond that stated above.

ELECTRO-NUMERICS, INC. PRODUCTS

The Electro-Numerics family of **Digital Panel Meters** and **Large Digit Displays** are high quality, accurate, solid-state instruments designed for years of trouble free operation. Over 30 years of digital instrumentation experience has resulted in a series of displays recognized in the field as reliable, well designed instruments. From our compact sized DPM's with 0.6" LED, LCD or PLASMA digits to our Large Digit Displays with 1", 2 1/4" & 4" LED or 4", 6" & 9" tall electromagnetic digits, we cover most applications in process measurement and display.

FIGURE 8

Pot locations for Span and options AO, EO, 04 & 04N on **EN35 Series**. Shown with window/bezel removed.

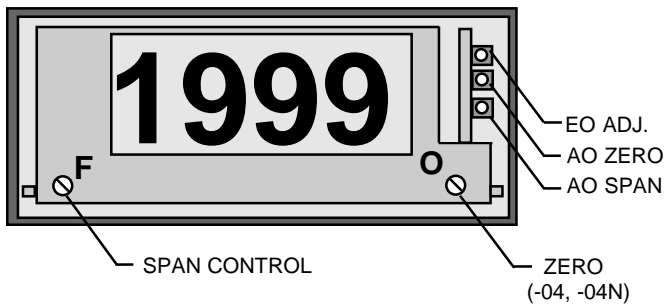
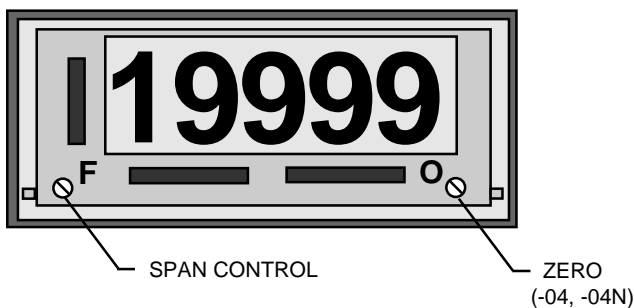


FIGURE 9

Pot locations for Span and options 04 and 04N on **EN45 Series**. Shown with window/bezel removed.

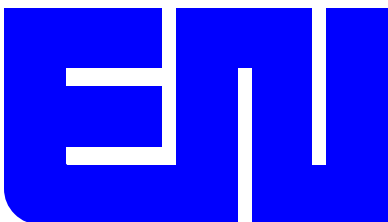


ELECTRO-NUMERICS

DIGITAL PANEL METERS

THE BEST

**QUALITY
PERFORMANCE
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