
***DIN* SERIES**

OWNERS MANUAL

EN35V

EN35P

EN35E

EN45V

EN45P

MANUAL NO. 500-197



**ELECTRO-
NUMERICS, INC.**

SECTION 1

DPM MODELS:

EN35V

EN35P

EN35E

See page 12 for models EN45V and EN45P.

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DESCRIPTION

The EN35 series meters are economical 3 1/2 digit, LED Digital Panel Meters designed to be used in many applications. These units are enclosed in a 96mm x 48mm (1/8 DIN) sized panel mount case and may be either ac or dc powered.

EN35V, dc Voltage and dc Current Meter.

Model EN35V will accept voltage inputs in four user programmable ranges from 200mV to 200 Vdc. These ranges are selectable from inside the meter by moving the positions of a shorting bar located on a pin forest. Wide range scaling is standard, allowing the user to set the full scale input to any displayed value between 20 and 1,999 counts.

The meter's input circuitry is normally configured as differential, however it may be changed to single ended by adding one jumper at the rear connector. With the addition of shunt resistors, this unit will measure dc current in several ranges.

EN35P, dc Process Meter.

Model EN35P may be configured to accept either a dc voltage or dc current loop by moving the position of shorting bars located on a pin forest. The input signal range for the voltage loop model is 0 to 10 Vdc, for example 0/5V, 1/5V, 0/10V or 1/10V. The current loop version input range is 0 to 20mAdc, for example 0/20mA, or 4/20mA.

This model features wide range scaling similar to model EN35V. A zero offset range of +/-1,000 counts is provided to compensate for, or create large zero offsets. The input configuration is single ended. Standard features include Screw Terminal connection, jumper selectable Polarity, Digit Control and Decimal Points.

EN35E, dc Process Meter with dc Excitation Voltage Output.

Model EN35E is identical to model EN35P with the addition of an adjustable dc Excitation Voltage power supply built in. This excitation voltage may be adjusted between 5 and 24Vdc from inside the meter. This voltage may be used to power transducers or as an auxillary voltage supply.

SPECIFICATIONS

SIGNAL INPUT

Voltage Ranges (EN35V)

Range	+/-199.9mV	+/-1.999V	+/-19.99V	+/-199.9V
Resolution	100uV	1mV	10mV	100mV
Max. input	130Vp	130Vp	250Vp	250Vp
Input impedance	50kohm	50kohm	50kohm	50kohm
Bias current	1pA	1pA	1pA	1pA

Voltage Ranges (EN35P and EN35E)

Range	0/5Vdc	0/10Vdc	1/5Vdc	1/10Vdc
Max. input	250V	250V	250V	250V
Input resistance	1 Mohm	1 Mohm	1 Mohm	1 Mohm
Bias current	5pA	5pA	5pA	5pA

Current loop Ranges (EN35P and EN35E)

Range	0/20mA	4/20mA
Max. Current	55mA	55mA
Input resistance	3ohm	13ohm
Bias current	50pA	50pA
Burden voltage	200mV	200mV

	EN35V	EN35P and EN35E
3 WIRE RATIO REFERENCE		
Analog input range	+/-200mV to +/-200V	N/A
External ref. input	+0.05 to +0.2V	N/A
Load on ref. standard	2 kohm	N/A
Load on ref. (ER option)	100 Mohm	N/A
Accuracy	99.9%	N/A
INPUT CONFIGURATION		
Configuration	Differential, bipolar	Single ended, bipolar
Zero	Automatic	Adjustable
Zero offset control	+/-100 cnts. (ZO option)	+/- 1,000 counts
Span adjustment	+/-20 to 1,999 counts	+/-20 to 1,999 counts
NOISE REJECTION		
NMR	56dB, 50/60Hz	56dB, 50/60Hz
CMR, ac gnd to sig gnd	120dB,dc to 60Hz	120dB, dc to 60Hz
CMR, sig high to sig gnd	80dB, dc to 60Hz	80dB, dc to 60Hz
CMV, ac gnd to sig gnd	1,500Vp per HV test	1,500Vp per HV test
CMV, sig low to sig gnd	+/- 1Vp	N/A
ACCURACY AT 25 °C		
Max. error	+/-0.05% rdg./+/-1 cnt.	+/-0.05% rdg. +/-1 cnt.
Span tempco	+/-0.01% rdg./°C	+/-0.03% rdg./°C
Zero tempco	Automatic Zero	+/-0.01% offset/°C
Step response	500ms	500ms
Warmup to rated acc.	2 min.	2 min.
ANALOG TO DIGITAL CONVERSION		
Technique	Dual slope, avg. value	Dual slope, avg. value
Polarity	Automatic, (-) sign only	Auto./select, (-) or none
Integration time	333ms	333ms
Read rate	3 rdg's./second	3 rdg's/second
DISPLAY		
Type	7 seg., red/org. LED	7 seg., red/org. LED
Height	0.56" (14.2mm)	0.56" (14.2mm)
Symbols	-1.8.8.8	-1.8.8.8
Decimal points	3 position programmable internally or at connector J1.	3 position programmable by jumper on display brd.
Overrange indication	3 right hand digits blank	3 right hand digits blank.
Least significant digit	Hardwired 1,999	Controllable ON/OFF. Displays: 1,999 or 199
DIGITAL SIGNALS AND CONTROLS		
Hold input	TTL or 5V CMOS compat. (Digital gnd. to HOLD)	TTL or 5V CMOS compat. (Digital gnd to HOLD)
EXCITATION SUPPLY (EN35E ONLY)		
Adjustable range	N/A	5 to 24Vdc
Excitation current	N/A	50mA @ 5Vdc, 30mA @ 24Vdc
Line regulation	N/A	0.02% maximum for 15% change in linevoltage.

	EN35V	EN35P and EN35E
Load regulation	N/A	0.2% no load to full load at low line.
Ripple voltage (50/60 Hz.)	N/A	0.01% maximum
POWER		
ac voltage	115/230Vac +15, -10%	115/230Vac +15, -10%
Operation frequency	47 to 400Hz.	47 to 400Hz.
dc voltage	9 to 32Vdc, isolated to 300Vp.	9 to 32Vdc, isolated to 300Vp.
Power consumption	2.5 Watts (nominal)	2.5 Watts (nominal)
Output voltages	+5 and -5Vdc, 10mA max.	+5 and -5Vdc, 10mA max.
ENVIRONMENTAL		
Operating temperature	-10 to +60 °C	-10 to +60 °C
Storage temperature	-40 to +85 °C	-40 to +85 °C
Relative humidity	95% at +40 °C (non-condensing)	95% at +40 °C (non-condensing)
MECHANICAL		
Dimensions	1/8 DIN case	1/8 DIN case
Weight	12 oz. (340 g)	12 oz. (340 g)
Case material	94 V-0 UL rated polycarb.	94 V-0 UL rated polycarb.
Window material	Red acrylic, silkscreened	Red acrylic, silkscreened
Connectors:		
Power and signal	J1 std., T1 (optional screw terminals)	T1 (Screw terminals)
J1 connector	Dual 18 pin edge card	Dual 18 pin edge card

EN35V I/O CONNECTIONS

See page 25 for connector orientation on case.

ac HIGH	A	1	
	B	2	ac LOW or dc PWR(+)
ac GND or dc PWR RET	C	3	
	D	4	
	E	5	
	F	6	DIGITAL GND
\overline{DP} (199.9)	H	7	\overline{DP} (199.9)
\overline{DP} (19.99)	J	8	\overline{DP} (19.99)
\overline{DP} (1.999)	K	9	\overline{DP} (1.999)
	L	10	
(+) 5Vdc OUTPUT	M	11	(+) 5Vdc OUTPUT
(-) 5Vdc OUTPUT	N	12	
(+) REFERENCE	P	13	
HOLD	R	14	\overline{HOLD}
ANALOG GND	S	15	
ANALOG GND	T	16	SIGNAL LOW (-)
	U	17	SIGNAL HIGH (+)
SIGNAL HIGH (+)	V	18	ANALOG OUTPUT

NOTE: For single ended operation connect J1-16 to J1-T

EN35P and EN35E I/O CONNECTIONS

See page 25 for connector orientation on case

		J1			
		A	1		
		B	2		
		C	3		
		D	4		
		E	5		
		F	6	DIGITAL GND	
	\overline{DP} (199.9)	H	7	\overline{DP} (199.9)	
	\overline{DP} (19.99)	J	8	\overline{DP} (19.99)	
	\overline{DP} (1.999)	K	9	\overline{DP} (1.999)	
		L	10		
	(+) 5Vdc OUTPUT	M	11	(+) 5Vdc OUTPUT	
	(-) 5Vdc OUTPUT	N	12	(-) EXCITATION OUTPUT "E"	
		P	13	(+) EXCITATION OUTPUT "E"	
	\overline{HOLD}	R	14	\overline{HOLD}	
	ANALOG GND	S	15		
	ANALOG GND	T	16		
		U	17		
		V	18	ANALOG OUTPUT	

SIX TERMINAL BARRIER STRIP CONNECTIONS

Optional on EN35V, standard on EN35P and EN35E. See page 25 for orientation.

ac POWERED VERSIONS

T1	
1	ac HIGH
2	ac LOW
3	ac GND
4	ANALOG GND
5	SIGNAL LOW (-)
6	SIGNAL HIGH (+)

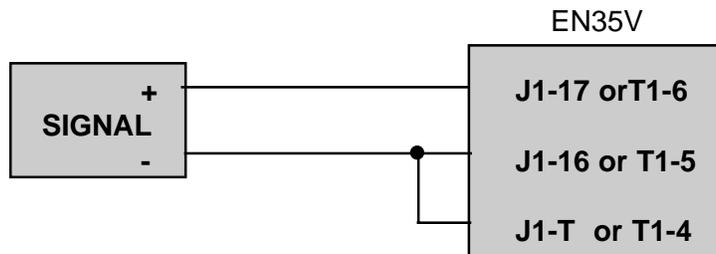
dc POWERED VERSIONS

T1	
1	N/C
2	dc PWR(+)
3	dc PWR RET.
4	ANALOG GND
5	SIGNAL LOW (-)
6	SIGNAL HIGH (+)

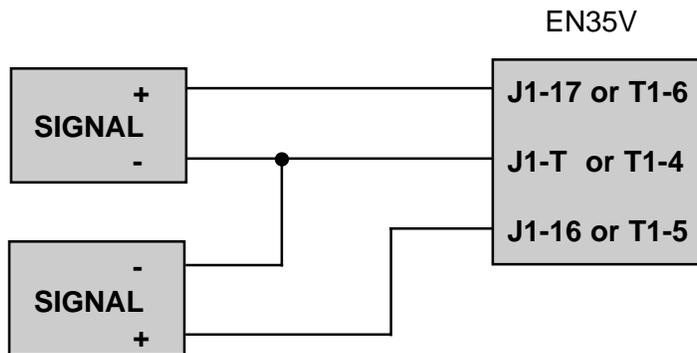
NOTE: For single ended operation connect T1-4 to T1-5.

EN35V INPUT CONFIGURATIONS

SINGLE ENDED INPUT CONNECTIONS



DIFFERENTIAL INPUT CONNECTIONS



CALIBRATION

GENERAL

EQUIPMENT REQUIRED

Precision dc voltage source.

Precision dc constant current source.

WINDOW REMOVAL

To remove the lens so that the calibration controls may be accessed, insert a small screwdriver between the bottom center of the lens and the case. Gently pry down on the screwdriver until the lens is bowed outward enough to make it pop out of the retaining slots in the case.

Installation is done in the reverse manner using your fingers to bow the lens outward for insertion into the lens retaining slots.

CASE REMOVAL

- 1] Remove the two screws located at the rear of the case which hold the plastic latches to the case.
- 2] Remove the two latches by pulling them off of their studs.
- 3] Remove the two metal slide clamps holding the case halves together by sliding them toward the rear of the case.
- 4] Remove the top half of the case to expose the meter components.
- 5] Lift out the window from the lower half of the case.

Assembly is done in the reverse order. On models EN35P and EN35E and optionally on model EN35V (T1 option), take care that the two screw terminal blocks are in place in their case grooves when mating the top and bottom case halves.

EN35V SELECTION OF RANGE AND CALIBRATION

Model EN35V allows the user to internally select one of four dc voltage ranges, (200mV, 2V, 20V, or 200V) and adjust the display to read between 20 and 1,999. An optional single current range may also be added to indicate dc currents between 19.99uA to 199.9mA. Adjustment is accomplished by selection of a range jumper located on a pin forest inside the meter and setting the coarse and fine span controls. It is necessary to disassemble the meter case to access the range pin forest and coarse span control. To adjust the fine span or optional zero offset controls, it is only necessary to remove the window.

SELECTING DIFFERENT RANGES

In order to access the jumpers for selecting different full scale ranges the case must be disassembled.

- 1] Disassemble the case.
- 2] Locate the pin forest labeled P1 on the main board (see Page 11). Along this pin forest are three positions marked A2 through A4. There may or may not be a shorting bar in one of these locations depending on the configured range. Listed below are the full scale ranges and the shorting bar position which control them.

dc VOLTAGE RANGES

RANGE	LOCATION
0.2V & all current ranges	None
2V	A2
20V	A3
200V	A4

- 3] To activate any of these ranges, place a shorting bar at the A() location indicated. For model EN35V, with optional dc current measurement, the 200mV range must always be selected.

dc CURRENT RANGES

RANGE	R33 Value
19.99uA	10 kohm 1%
199.9uA	1 kohm 1%
1.999mA	100 ohms 1%
19.99mA	10 ohms 1%
199.9mA	1 ohm 1%

- 4] Connect the precision voltage (or current) source to the signal input terminals.
- 5] Connect the ac or optional dc power to the power input terminals.
- 6] Apply 0 volts (or current) to the meter and verify that the display is reading 000. If the zero offset, (ZO) option is installed, adjust the zero offset control (R4) for a reading of 000.
- 7] Apply full scale voltage (or current) being sure that it is within the range selected in step 2 above.
- 8] Adjust the fine span control (R1), and if necessary, the coarse span control (R32) for the desired full scale reading. To access the coarse control, it is necessary to remove the meter from the case. Locate the single turn control marked R32. Adjust R32 as near to the desired scaling as possible. Adjust the fine span control (R1) to the exact reading.
- 9] Recheck the calibration at zero, (step 5), and full scale, (steps 6 and 7), adjusting the zero offset control, if installed, and fine span control if required.

EN35P and EN35E SELECTION OF RANGE AND CALIBRATION

Models EN35P and EN35E may be configured as a current or voltage loop receiver simply by changing pin forest jumper locations on the main PC board.

Broad range scaling is provided allowing the display to be adjusted for readings between 20 and 1,999. It is necessary to disassemble the meter to access the coarse span control. The zero offset and fine span controls may be accessed by removing the window.

EN35P and EN35E (Voltage Input)

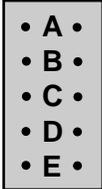
- 1] Remove the meter from the case.
- 2] On pin forest P1, remove any jumper at locations A1 or 6 (see page 11).
- 3] Connect the precision voltage source to the signal input terminals.
- 4] Connect ac or optional dc power to the power input terminals.
- 5] Apply 0 volts to the meter and adjust the zero offset control (R4) for a reading of 000.
- 6] Calculate the difference between the full scale voltage and the zero offset voltage, if any, (IE. $1V = 000$, $5V = \text{full scale}$, $5V - 1V = \mathbf{4V}$).
- 7] Apply this voltage difference. Adjust the fine span control (R1), and if necessary, the coarse span control (R32) for the desired full scale reading. To access the coarse control, it is necessary to remove the meter from the case. Locate the single turn control marked R32. Adjust R32 as near to the desired scaling as possible. Adjust the fine span control (R1) to the exact reading.
- 8] Apply the zero offset voltage, if any, and adjust the zero offset control (R4) for a reading of 000.
- 9] To check the calibration, apply full scale voltage and the zero offset voltage. The meter should read the desired full scale and 000. Adjust the zero offset and fine span controls slightly if necessary.

EN35P and EN35E (Current Input)

- 1] Remove the meter from the case.
- 2] On pin forest P1, install a jumper at locations A1 and 6.
- 3] Connect the precision current source to the signal input terminals.
- 4] Connect ac or optional dc power to the power input terminals.
- 5] Apply 0 mA to the meter and adjust the zero offset control (R4) for a reading of 000.
- 6] Calculate the difference between the full scale current and the zero offset current, if any, (IE. $4mA = 000$, $20mA = \text{full scale}$, $20mA - 4mA = \mathbf{16mA}$).
- 7] Apply this difference current. Adjust the fine span control (R1), and if necessary, the coarse span control (R32) for the desired full scale reading. To access the coarse control, it is necessary to remove the meter from the case. Locate the single turn control marked R32. Adjust R32 as near to the desired scaling as possible. Adjust the fine span control (R1) to the exact reading.
- 8] Apply the zero offset current, if any, and adjust the zero offset control (R4) for a reading of 000.
- 9] To check the calibration, apply full scale current and the zero offset current. The meter should read the desired full scale and 000. Adjust the zero offset and fine span controls slightly if necessary.

EN35P and EN35E DISPLAY CONTROLS

The decimal point, least significant digit and polarity sign are programmable at the display board pin forest labeled W1. The following table illustrates the control locations.

PIN FOREST (W1)	W1	FUNCTION (with jumper installed)
	A	LSD control (1,999)
	B	Decimal 1XX.X
	C	Decimal 1X.XX
	D	Decimal 1.XXX
	E	Polarity (Negative only)

HOLD COMMAND

All EN35 models may be put into the hold mode, (display retains last reading), by connecting J1-14 or J1-R to J1-6.

EN35V RATIOMETRIC OPERATION

By connecting an external reference source between J1-P(+) and J1-T or J1-S(-), and moving the soldered-in jumper on pin forest P1 position 4 to position 12, the meter will read the ratio between the input signal and the reference voltage. The approximate formula for the displayed reading is shown below. The required reference voltage will vary slightly for each different voltage range selected.

$$\text{Display} = (\text{Voltage input} / \text{Reference input}) \times 1000$$

EN35E EXCITATION SUPPLY

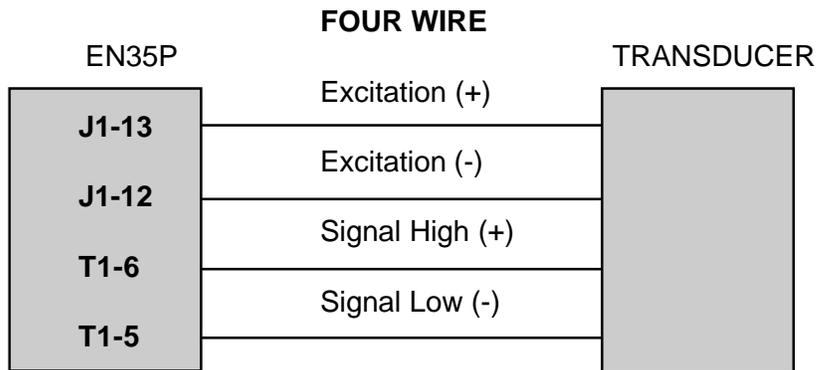
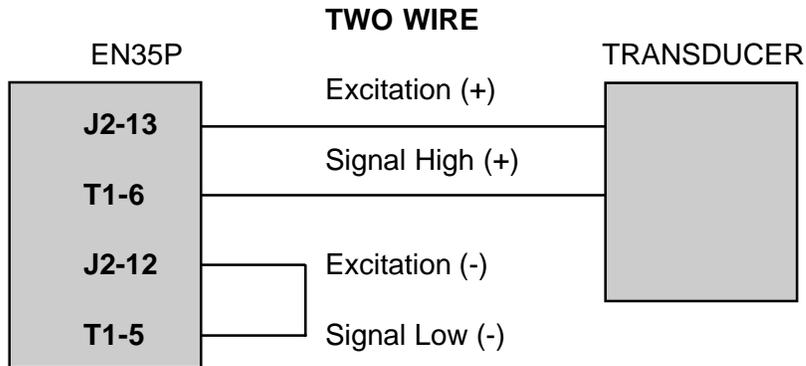
Model EN35E is identical to model EN35P except that it also has an adjustable dc power supply to provide power to an external transducer. This feature provides an output voltage range between 5 and 24Vdc at load currents from 50 to 30mA respectively.

EXCITATION VOLTAGE CALIBRATION PROCEDURE

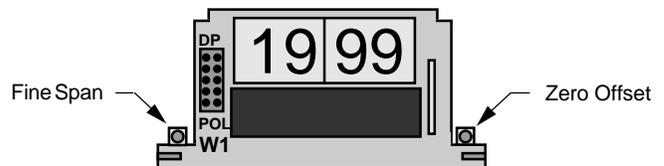
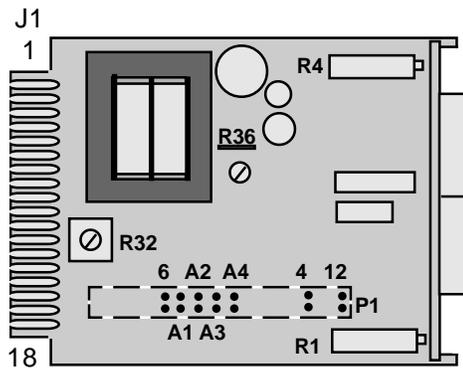
To calibrate the supply, it is necessary to disassemble the meter case. See the section under CALIBRATION, CASE REMOVAL.

- 1] Connect a DVM, set to a 30Vdc range or greater, between J1-12(-) and J1-13(+).
- 2] Connect ac or the optional dc power to the power terminals.
- 3] Locate the control labeled R36 on the main board (see Page 11).
- 4] While observing the DVM reading, adjust control R36 for the required excitation voltage.

EN35P and EN35E INPUT CONFIGURATIONS



CALIBRATION POINTS



JUMPER and POT LOCATIONS

6	Current (EN35P/E)
A1	Current (EN35P/E)
A4	200V Range (EN35V)
A3	20V Range (EN35V)
A2	2V Range (EN35V)
(none)	200mV Range (EN35V)
R4	Zero Offset & ZO Opt.
R1	Fine Span
R32	Coarse Span
R36	Excitation Adjust
4	Ratio jumper (installed)
12	Ratiometric Input

W1 (Display Control)

LSD (ON)	●●
DP 1XX.X	●●
DP 1X.XX	●●
DP 1.XXX	●●
POLARITY (-)	●●

Note: W1 header is not installed on model EN35V. Solder-in jumpers may be added in the positions shown to actuate decimals. Polarity(-) and LSD (on) are installed at the factory.

SECTION 2

**DPM MODELS:
EN45V
EN45P**

See page 1 for models EN35V, EN35P and EN35E.

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DESCRIPTION

The EN45 series meters are economical 4 1/2 digit, LED Digital Panel Meters designed to be used in many applications. These units are enclosed in a 96mm x 48mm (1/8 DIN) sized panel mount case and may be either ac or dc powered.

EN45V, dc Voltage Meter

Model EN45V will accept voltage inputs in three user programmable ranges from 2V to 200Vdc. These ranges are selectable from inside the meter by moving the positions of a shorting bar located on a pin forest. Wide range scaling is standard, allowing the user to set the full scale reading to any displayed value between 400 and 19,999 counts.

The meter's input circuitry is normally configured as differential, however it may be changed to single ended by adding one jumper at the rear connector.

EN45P, dc Process Meter.

Model EN45P may be configured to accept either a dc voltage or dc current loop by moving the position of shorting bars located on a pin forest. The input signal range for the voltage loop model is 0 to 10 Vdc, for example 0/5V, 1/5V, 0/10V or 1/10V. The current loop version input range is 0 to 20mAdc, for example 0/20mA, or 4/20mA.

This model features wide range scaling similar to model EN45V. A zero offset range of +/-10,000 counts is provided to compensate for, or create large zero offsets. The input configuration is single ended. Standard features include Screw Terminal connection, jumper selectable Polarity, Digit Control and Decimal Points.

SPECIFICATIONS

SIGNAL INPUT

Voltage Ranges (EN45V)

Range	+/-1.9999V	+/-19.999V	+/-199.99V
Resolution	100uV	1mV	10mV
Max. input	130Vp	250Vp	250Vp
Input impedance	250kohm	1Mohm	1Mohm
Bias current	1pA	1pA	1pA

Voltage Ranges (EN45P)

Range	0/5Vdc	0/10Vdc	1/5Vdc 1/10Vdc
Max. input	250Vp	250Vp	250Vp 250Vp
Input resistance	1Mohm	1Mohm	1Mohm 1Mohm
Bias current	5pA	5pA	5pA 5pA

Current loop Ranges (EN45P)

Range	0/20mA	4/20mA
Max. Current	55mA	55mA
Input resistance	12.4ohm	12.4ohm
Bias current	50pA	50pA
Burden voltage	200mV	200mV

EN45V

EN45P

INPUT CONFIGURATION

Configuration	Differential, bipolar	Single ended, bipolar
Zero	Automatic	+/-10,000 counts adjustable
Zero offset control	+/- 100 cnts.(ZO option)	+/- 10,000 counts
Span adjustment	+/-400 to 19,999 counts	+/-400 to 19,999 counts

NOISE REJECTION

NMR	56dB, 50/60Hz	70dB, 50/60Hz
CMR, ac gnd to sig gnd	120dB,dc to 60Hz	120dB, dc to 60Hz
CMR, sig to sig gnd	86dB, dc to 60Hz	N/A
CMV, ac gnd to sig gnd	1500Vp per HV test	1500Vp per HV test
CMV, sig low to sig gnd	+/- 1Vp	N/A

ACCURACY AT 25 °C

Max. error	+/-0.01% rdg.+/-1 cnt.	+/-0.01% span +/-2 cnt.
Span tempco	+/-0.01% rdg./°C	+/-0.01% span/°C
Zero tempco	Automatic	+/-0.05 counts/°C
Step response	1sec.	1sec.
Warmup to rated acc.	2 min.	2 min.

ANALOG TO DIGITAL CONVERSION

Technique	Dual slope, avg. value	Dual slope, avg. value
Polarity	Automatic, (-) sign only	Auto./select, (-) or none
Integration speed	400ms	400ms
Read rate	2.5 rdg's./second	2.5 rdg's/second

3 WIRE RATIO REFERENCE

Analog input range	+/-2V, 20V, 200V	N/A
External ref. input	+0.5 to +2.0V	N/A
Load on ref. standard	10kohm	N/A
Load on ref. (ER option)	100Mohm	N/A
Accuracy	99.98%	N/A

DISPLAY

Type	7 seg., red/org. LED	7 seg., red/org. LED
Height	0.56" (14.2mm)	0.56" (14.2mm)
Symbols	-1.8.8.8.8	-1.8.8.8.8
Decimal points	4 position programmable internally.	4 position programmable by jumper on display board.
Overrange indication	4 right hand digits flash	4 right hand digits flash
Least significant digit	Hardwired 19,999	Controllable ON/OFF on display board. Displays: 19,999 or 1,999

DIGITAL SIGNALS AND CONTROLS

Hold input	TTL or 5V CMOS compatible	TTL or 5V CMOS compatible
Blanking input	TTL or 5V CMOS compatible	TTL or 5V CMOS compatible
BCD output (Multiplexed)	TTL compatible	TTL compatible

EN45V

EN45P

POWER

ac voltage	115/230Vac +15,-10%	115/230Vac +15,-10%
Operating frequency	47 to 400Hz.	47 to 400Hz.
dc voltage (optional)	9 to 32Vdc, isolated to 300Vp.	9 to 32Vdc, isolated to 300Vp.
Power consumption	4.5 Watts (nominal)	4.5 Watts (nominal)
Output voltages	+5 and -5Vdc, 10mA max.	+5 and -5Vdc, 10mA max.

ENVIRONMENTAL

Operating temperature	-10 to +60 °C	-10 to +60 °C
Storage temperature	-40 to +85 °C	-40 to +85 °C
Relative humidity	95% at +40 °C (non-condensing)	95% at +40 °C (non-condensing)

MECHANICAL

Dimensions	1/8 DIN case	1/8 DIN case
Weight	12 oz. (340 g)	12 oz. (340 g)
Case material	94 V-0 UL rated polycarb.	94 V-0 UL rated polycarb.
Window material	Red acrylic, silkscreened	Red acrylic, silkscreened
Connectors:		
Power and signal	J1 std., T1 (optional screw terminals)	T1 screw terminals
J1 connector	Dual 18 pin edge card	Dual 18 pin edge card

EN45V I/O CONNECTIONS

See page 25 for connector orientation on case.

J1

ac HIGH	A	1	
	B	2	ac LOW or dc PWR(+)
ac GND or dc PWR RE-	C	3	
TURN	D	4	
	E	5	
DIGIT SELECT (D1, LSD)	F	6	BCD 1
DIGIT SELECT (D2)	H	7	BCK 2
DIGIT SELECT (D3)	J	8	BCD 4
DIGIT SELECT (D4)	K	9	BCD 8
DIGIT SELECT (D5, MSD)	L	10	OVERRANGE
STROBE	M	11	(-) 5Vdc OUTPUT
POLARITY	N	12	(+) 5Vdc OUTPUT
DATA READY	P	13	
	R	14	
DIGITAL GROUND	S	15	HOLD
ANALOG GROUND	T	16	SIGNAL LOW (-)
DISPLAY BLANKING	U	17	SIGNAL HIGH (+)
100kHz OSCILLATOR	V	18	

NOTE: For single ended operation, connect J1-16 to J1-T.

EN45P I/O CONNECTIONS

See page 25 for connector orientation on case.

		J1			
		A	1		
		B	2		
		C	3		
		D	4		
		E	5		
	DIGIT SELECT (D1, LSD)	F	6	BCD 1	
	DIGIT SELECT (D2)	H	7	BCK 2	
	DIGIT SELECT (D3)	J	8	BCD 4	
	DIGIT SELECT (D4)	K	9	BCD 8	
	DIGIT SELECT (D5, MSD)	L	10	OVERRANGE	
	STROBE	M	11	(-) 5Vdc OUTPUT	
	POLARITY	N	12	(+) 5Vdc OUTPUT	
	DATA READY	P	13		
	(-) EXCITATION OUTPUT (E opt.)	R	14	(+)EXCITATION OUTPUT	
	DIGITAL GROUND	S	15	(E opt.)	
	ANALOG GROUND	T	16	HOLD	
	DISPLAY BLANKING	U	17		
	100kHz OSCILLATOR	V	18		

SIX TERMINAL BARRIER STRIP CONNECTIONS

Optional on EN45V, standard on EN45P.

ac POWERED MODELS

T1	
1	ac HIGH
2	ac LOW
3	ac GND
4	ANALOG GND
5	SIGNAL LOW (-)
6	SIGNAL HIGH (+)

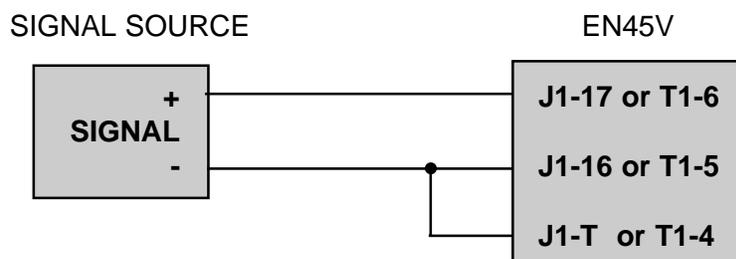
dc POWERED MODELS

T1	
1	N/C
2	dc PWR(+)
3	dc PWR RET.
4	ANALOG GND
5	SIGNAL LOW (-)
6	SIGNAL HIGH (+)

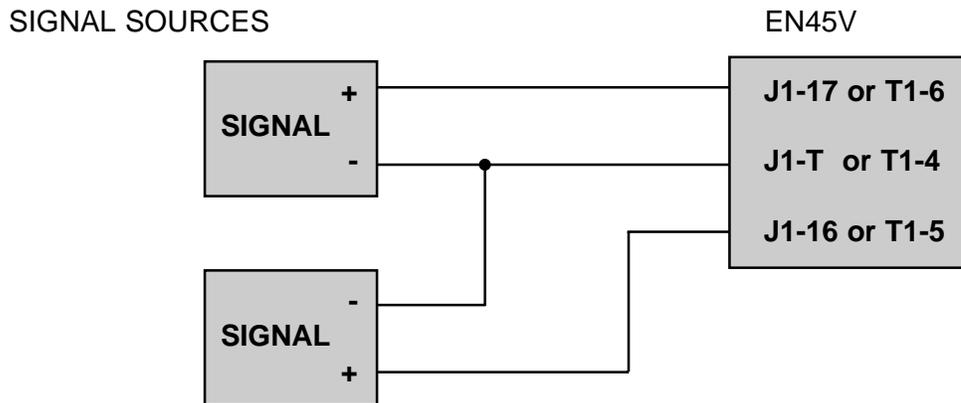
NOTE: For single ended operation, connect T1-4 to T1-5.

EN45V INPUT CONFIGURATIONS

SINGLE ENDED INPUT CONNECTIONS



DIFFERENTIAL INPUT CONNECTIONS



CALIBRATION

GENERAL

EQUIPMENT REQUIRED

Precision dc voltage source.
Precision dc constant current source.

WINDOW REMOVAL

To remove the lens insert a small screwdriver between the bottom center of the lens and the case. Gently pry down on the screwdriver until the lens is bowed outward enough to make it pop out of the retaining slots in the case.

Installation is done in the reverse manner using your fingers to bow the lens outward for insertion into the lens retaining slots.

CASE REMOVAL

- 1] Remove the two screws located at the rear of the case which hold the plastic latches to the case.
- 2] Remove the two latches by pulling them off of their studs.
- 3] Remove the two metal slide clamps holding the case halves together by sliding them toward the rear of the case.
- 4] Remove the top half of the case to expose the meter components.
- 5] Lift out the window from the lower half of the case.

Assembly is done in the reverse order. On model EN45P and optionally on model EN45V (T1 option), take care that the two power and signal input screw terminal blocks are in place in their case grooves when mating the top and bottom case halves.

EN45V SELECTION OF RANGE AND CALIBRATION

Model EN45V allows the user to internally select one of three dc voltage ranges, (2V, 20V, or 200V) and adjust the display to read between 400 and 19,999. Adjustment is accomplished by selection of a range jumper located on a pin forest inside the meter, and setting the coarse and fine span controls. It is necessary to disassemble the meter case to access the range pin forest. To adjust the span or optional zero offset controls, it is only necessary to remove the window.

SELECTING DIFFERENT RANGES

In order to access the jumpers for selecting different full scale ranges the case must be disassembled.

- 1] Disassemble the case.
- 2] Locate the pin forest on the main board (see Page 23).
- 3] Along this header are three pin forest positions marked W2, W3 and W4. There may or may not be a shorting bar in one of these locations depending on the configured range. Listed below are the full scale ranges and the shorting bar position which control them.

RANGE	LOCATION
2V	W2
20V	W4
200V	W3

- 4] To activate any of these ranges, place a shorting bar at the W() location indicated.

EN45V CALIBRATION

- 1] Connect the precision voltage source to the signal input terminals.
- 2] Connect the ac or optional dc power to the power input terminals.
- 3] Apply 0 volts to the meter and verify that the display is reading 0000. If the zero offset, (ZO option) is installed, adjust the zero offset control (R8) for a reading of 0000.
- 4] Apply full scale voltage being sure that it is within the range selected in step 2 above.
- 5] Adjust the fine span control (R1), and if necessary, the coarse span control (R2) for the desired full scale reading between 400 and 19,999 counts.
- 6] Recheck the calibration at zero, (step 5), and full scale, (steps 6 and 7), adjusting the zero offset control, if installed, and fine span control if required.

EN45P SELECTION OF RANGE AND CALIBRATION

Model EN45P may be configured to measure either dc voltage or current by moving two jumper positions on the pin forest located on the main board. Broad range scaling is provided allowing the display to be adjusted for readings between 400 and 19,999. The zero offset and span controls may be accessed by removing the window.

EN45P (VOLTAGE INPUT)

- 1] Remove the meter from the case.
- 2] Remove jumper W10 and W2 . There should be no other jumpers installed.
- 3] Connect the precision voltage source to the signal input terminals.
- 4] Connect ac or optional dc power to the power input terminals.

- 5) Apply 0 volts to the meter and adjust the coarse (R8) and fine (R7) zero offset controls for a reading of 0000.
- 6) Calculate the difference between the full scale voltage and the zero offset voltage, if any,. (IE. $1V = 0000$, $5V = \text{full scale}$, $5V - 1V = 4V$).
- 7) Apply this voltage difference and adjust the coarse (R2) and fine (R1) span controls to the desired full scale reading between 400 and 19,999 counts. Adjust the coarse span control to as close to the desired scaling as possible. Adjust the fine span control to the exact reading.
- 8) Apply the zero offset voltage, if any, and adjust the coarse and fine zero offset controls for a reading of 0000.
- 9) To check the calibration, apply full scale voltage and then the zero offset voltage. The meter should read the desired full scale and then 0000. Adjust the fine zero offset and span controls slightly if necessary.

EN45P (CURRENT INPUT)

- 1) Remove the meter from the case.
- 2) Install jumper W10 and W2. There should be no other jumpers installed.
- 3) Connect the precision current source to the signal input terminals.
- 4) Connect ac or optional dc power to the power input terminals.
- 5) Apply 0 mA to the meter and adjust the coarse (R8) and fine (R7) zero offset controls for a reading of 0000.
- 6) Calculate the difference between the full scale current and the zero offset current, if any, (IE. $4mA = 0000$, $20mA = \text{full scale}$, $20mA - 4mA = 16mA$).
- 7) Apply this current difference and adjust the coarse (R2) and fine (R1) span controls to the desired full scale reading between 400 and 19,999 counts. Adjust the coarse span control as near to the desired scaling as possible. Adjust the fine span control to the exact reading.
- 8) Apply the zero offset current, if any, and adjust the coarse and fine zero offset controls for a reading of 0000.
- 9) To check the calibration, apply full scale current and then the zero offset current. The meter should read the desired full scale and then 0000. Adjust the fine zero offset and span controls slightly if necessary.

HOLD COMMAND

All EN45 models may be put into the hold mode, (display retains last reading), by connecting J1-15 to J1- S.

EN45V RATIOMETRIC OPERATION

By connecting an external reference source between J1-13 (+) and J1-T (-), the meter will read the ratio between the input signal and the reference voltage. The approximate formula for the displayed reading is shown below. The required reference voltage will vary slightly for each different voltage range selected.

$$\text{Display} = (\text{Voltage input} / \text{Reference input}) \times 10,000$$

EN45P DISPLAY CONTROLS

The decimal point, least significant digit and polarity sign are programmable at the display board pin forest by removing the window. The following table illustrates the control locations.

PIN FOREST LOCATION	FUNCTION (with jumper installed)
A	Decimal 1XXX.X
B	Decimal 1XX.XX
C	Decimal 1X.XXX
D	Decimal 1.XXXX
F	Polarity (Negative only)
G	LSD control (19,999)

DISPLAY BOARD PIN FOREST



DISPLAY BLANKING

The display may be blanked, with the exception of the decimal point and polarity sign by connecting J1-U to J1-S.

MULTIPLEXED BCD OUTPUT SIGNALS

The displayed values are represented in multiplexed BCD format at the I/O connector J1. Besides the BCD data lines, there are several other signals which will aid in providing the correct reception of the data at a peripheral device, and in indicating data status. See the I/O diagram for the J1 pin numbers on pages 16 and 17.

The BCD data is presented on four lines, (1 2 4 8) along with 5 digit select lines, D1 through D5. D1 through D5 are sent sequentially with D5 transmitted first. D1 is the drive signal for the least significant digit. The BCD data changes, if necessary, between the time each of the digit drive signals are transmitted. A strobe pulse is sent at a time causing it to fall at the center of each digit drive signal. This strobe signal may be used to provide reliable data to any peripheral storage device.

By "ANDing" the strobe with the digit drive signal, a resulting pulse will be generated which falls precisely in the center of the valid data time for each digit. This pulse may be used to strobe the data for each digit into a storage device.

Each digit drive pulse goes positive for 200 clock periods, and are provided on a continuous basis unless an overrange condition occurs. They will then go to zero from the end of the strobe sequence until the beginning of the integrate sequence, when they repeat again. A clock period is approximately 8usec. The DATA READY signal will be at a low level during the time data is valid.

EN45P EXCITATION SUPPLY (Option E)

The optional excitation supply module is a separate PC board which is installed into connector CT1 on the main board. It provides an adjustable output voltage between 5 and 24Vdc at load currents from 50mA to 30mA respectively. To install this option, it is necessary to solder in several parts on the main PC board.

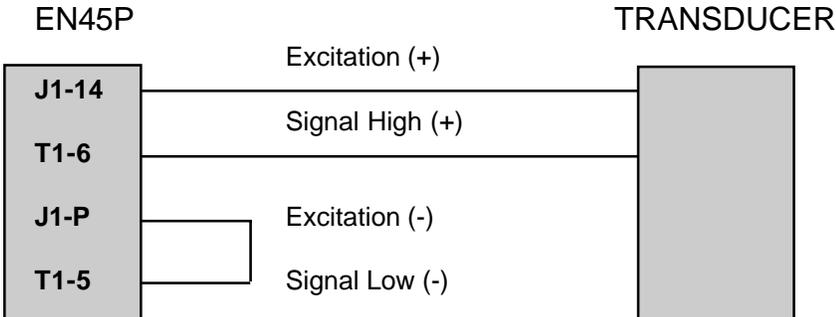
To calibrate the supply, it is necessary to remove the window from the meter case. See the section under CALIBRATION, WINDOW REMOVAL.

CALIBRATION PROCEDURE

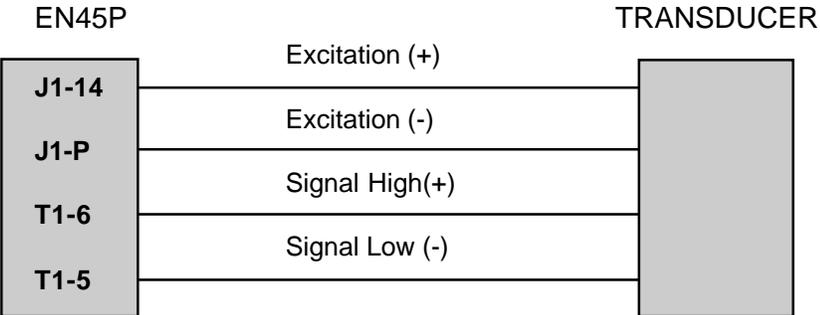
- 1] Connect a DVM, set to a 30Vdc range or greater, between J1-P (-) and J1-14 (+).
- 2] Connect ac or optional dc power to the power terminals.
- 3] The calibration control is labled R5 on the plug-in excitation module and is located to the left of the meter display (see Page 23).
- 4] While observing the DVM reading, adjust control R5 for the required excitation voltage.

EN45P INPUT CONFIGURATIONS

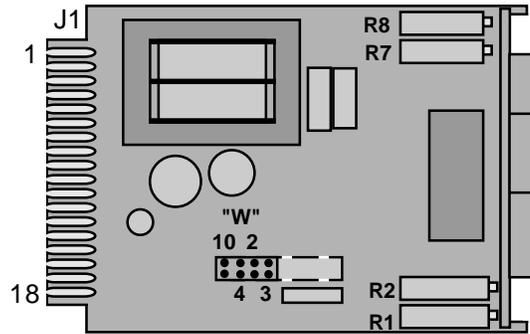
TWO WIRE



FOUR WIRE



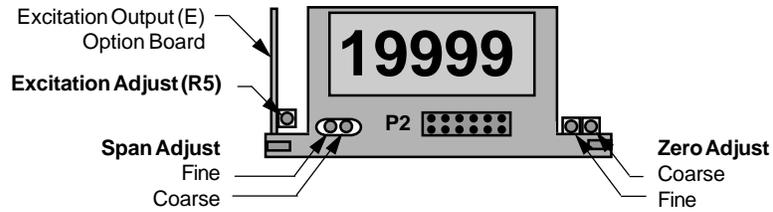
CALIBRATION POINTS



JUMPER AND POT LOCATIONS	
W3	200V Range (EN45V)
W4	20V Range (EN45V)
W2	2V Range (EN45V) & Current Loop Range (EN45P)
W10	Current Loop Range (EN45P)
R8	Coarse Zero & ZO opt. (EN45V)
R7	Fine Zero (EN45P)
R2	Coarse Span
R1	Fine Span

Notes:

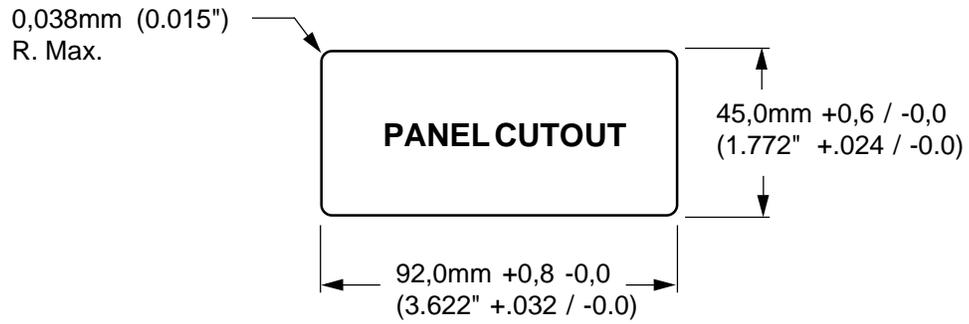
- 1) "W" header is for range selection on model EN45V. This header is also used to select Voltage Receiver or Current Receiver on model EN45P (W10 & W2).
- 2) R1 and R2 are installed on both models.
- 3) R7 and R8 are not installed on model EN45V unless the ZO option is installed. In this case, only R8 is installed.



P2 (Display Control)	
G	LSD (On)
A	DP 1XXX.X
B	DP 1XX.XX
C	DP 1X.XXX
D	DP 1.XXXX
F	POLARITY (-)

Note: P2 header is not installed on model EN45V. Solder-in jumpers may be added in the positions shown to activate decimals. Jumper G and F are installed at the factory.

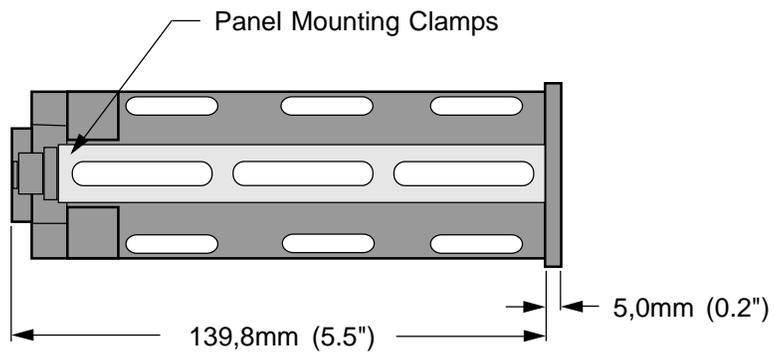
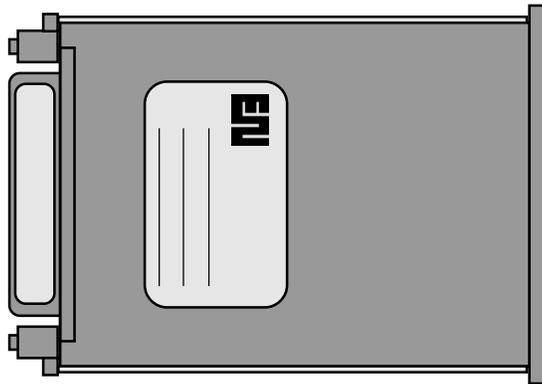
CASE DIMENSIONS

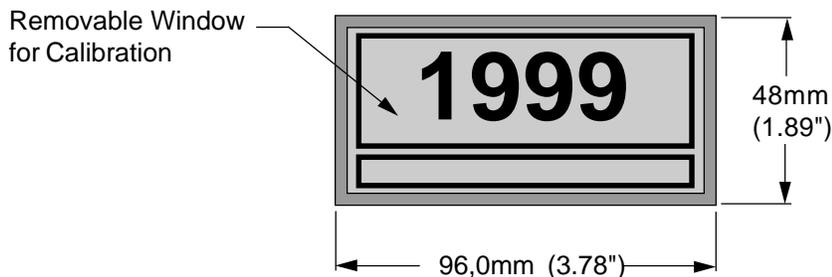
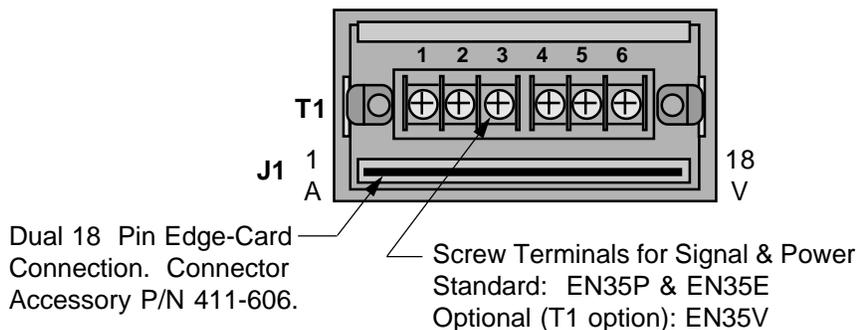


PANEL THICKNESS

Maximum: 6,4mm / 0.25"

Minimum: 0,8mm / 0.03"





WARRANTY

Electro-Numerics Inc., warrants these products to be free in defects in workmanship and materials for two years from the date of shipment to original customer. This warranty on workmanship and materials may be considered as unconditional provided that, in the opinion of Electro-Numerics, the equipment has not been mechanically, environmentally or electrically abused and has been installed, maintained and operated within the limits of rated or normal usage. Defective products must be sent, transportation charges prepaid with notice of defect, to our plant in Temecula CA. 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. All warranty freight charges are F.O.B. our plant, Temecula, CA. Electro-Numerics assumes no liability in connection with the sale of it's products beyond that stated above and is not responsible for any incidental or consequential loss or damage which might result from a failure of any Electro-Numerics' product.

SERVICE POLICY

Products being returned for service should be sent, freight prepaid, to Electro-Numerics, Inc., 42213 Sarah Way, Temecula, CA, U.S.A. to the attention of the Repair Department with a full description of the problem or reason for return. All items sent for service are subject to a minimum evaluation charge of \$65.00 in the event that the product is found to be out-of-warranty or, if under warranty, not in need of additional service. Out-of-warranty service and repair charges will be quoted on a case-by-case basis. All repair products will be shipped to you F.O.B. , Temecula, CA. Direct all warranty and out-of-warranty requests/inquiries to Electro-Numerics, Inc., Customer Service Repair Dept., telephone number (909) 699-2437, FAX (909) 695-7246.

DIN SERIES



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