

# Operating Instructions

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## *Diaphragm Manometer*

- *50 milli Torr to 1000 Torr*
- *.05 millibar to 1300 millibar*

## *Digital Pressure Indicators*

## *Dual Set Point Controllers*

## *Slave Indicator / Controllers*

*With Stainless Steel and Silicon Transducers*



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Part No.: V795054  
Price: \$10.00  
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# INTRODUCTION

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These manometers are compact vacuum measurement and control instruments that are unaffected by gas composition. The diaphragm is 316L stainless steel and can measure liquid or gas under vacuum. Response time is less than 1 second for full scale and instruments are available with a variety of flanges including VCR and CF, NPT, or NW styles.

All models of the Diaphragm Manometer provide simultaneous linear outputs of 0 - 10 VDC and 4 - 20 mA. To improve the resolution of your PLC or data system the 4 - 20 mA signal can be changed in the field to have spans of either 0 to 1, 0 to 5, 0 to 10, 0 to 50, or 0 to 1000 Torr. 4 mA is always "zero" pressure but by moving a pin jumper on the circuit board 20 mA can be 1, 5, 10, 50 or 1000 Torr.

The Dual Set Point Controller option provides set point values adjusted from the front panel and displayed on the meter. Push to set switches simplify display of the set point vacuum.

Because it is often helpful to display the vacuum reading in more than one place, or to have the diaphragm sensor at a distance from the control room or operator's console, we offer slave displays. These displays do not have a diaphragm sensor but are accessories to the manometers and can be used with the transmitter, indicator, or controller models. The slave is built in a standard 1/4 DIN enclosure for panel mounting and is connected to the manometers with up to 500 ft. (150 m) of 4 conductor cable. The slave is powered with 115/230V, 50/60 Hz and provides 24 VDC to power the manometer. The 4-20 mA signal from the manometer is displayed on the slave in Torr or mbar.

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## Indicators

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The indicator instruments are rugged, digital gauges. They are small compact instruments that power the transducer and condition the output signal. Life expectancy for the transducer is excellent.

Your instrument is ready to operate as received. All that is needed to place the indicator in operation is installation of the transducer and instrument, connection of the transducer cable, and plugging the line cord into an AC power outlet.

The instrument is powered from a 115 VAC or 230 VAC line as specified when ordering. Power consumption is about 1 Watt. Either 50 or 60 Hz power may be used.

A 10 foot long transducer cable is attached and extensions up to 500 feet (if using #18 wire) may be added without affecting calibration.

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## Dual Set Point Controller

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In addition to acting as a digital indicator, the Dual Set Point Controller instrument operates two control relays. Set point pressures are set from the front panel and displayed on the meter. Push-to-set switches simplify display of the set points. Relays have 3 amp contacts, form C, and are terminated in screw terminal connectors on the rear. The mating half of the relay connector is provided.

The instrument is powered from a 115 VAC or 230 VAC line as specified when ordering. Power consumption is about 2 Watts. Either 50 or 60 Hz power may be used.

A 10 foot long gauge tube cable is attached and extensions up to 500 feet (if using # 18 wire) may be added without affecting calibration.

Installation of the controller is identical to the Digital Indicator except for wiring the relay connectors for the control action. This is described in the section, Relay Output Connector Wiring.

# INSTALLATION

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## Unpacking Instructions

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The instruments and gauge tubes are carefully packaged to protect them during shipment. Use reasonable care when removing them from the shipping box.

Inspect the instruments and gauge tubes carefully when you receive them. Should either the instruments or the gauge tubes show any signs of damage, file a claim with the carrier immediately. Do not destroy the shipping container. It will be required by the carrier as evidence to support claims. Call the factory immediately for instructions on return and repair of the instruments.

Please fill out and return the Warranty Registration card so that we can register your instrument in our warranty records.

# SPECIFICATIONS

## Diaphragm Manometer

**Standard Range:** 0.05 to 1000 Torr; Optional: 0.05 to 1300 mbar

### Readings from 50 milliTorr to 30.0 Torr

Resolution:  $\pm 10$  millitorr

Sensitivity: 10 milliTorr

Accuracy:  $\pm 50$  millitorr

Hysteresis: Less Than 10 milliTorr

### Readings from 30.0 Torr to 1,000 Torr

Resolution:  $\pm 0.1$  Torr

Sensitivity: 0.1 Torr

Accuracy:  $\pm 1$  Torr

Hysteresis: Less Than 0.1 Torr

**Display:** 4 digit green LED; characters 0.56 in. (15 mm) high.

**Calibration:** Any gas, liquid or vacuum compatible with sensor materials.

**Response Time:** For increase in pressure, less than 1 second.  
For decrease in pressure below 100 mTorr, less than 10 seconds.

**Analog Outputs:** 2 simultaneous linear signals.

- 1.) 0 to 10 volt DC: Linear, for 0 to 1000 Torr (1mv=100 mTorr)
- 2.) 4-20 mA: 4mA is always high vacuum ("zero" pressure). But 20 mA can be jumper selected by the user to be 1,5,10,50, or 1000 Torr. Shipped with jumper in 1000 Torr position unless otherwise requested.

**Optional Set Points:** SPDT (Form C) max current: 250 mA.  
Maximum power 350mw, maximum voltage: 250 V AC/DC.

**Set Point Range:** Full range of instrument. 50 mT to 1,000 Torr.

**Materials:** Diaphragm is 316L Stainless Steel. Other parts in contact with the process are 300 series stainless.

**Power:** Any voltage from +15 to +35 VDC unreg.; less than 250 mA

**Wattage:** Less than 1 Watt for indicator; 2 Watts with set points.

**Connector:** 15 pin DB15.

**Temperature Effects:** When changes occur in ambient temperature between 0 °C and 50 °C, reading will change no more than  $\pm 0.02\%$  per °C.

**Bakeout Temperature:** Instrument can be baked to 100 °C (212 °F) in air or vacuum.

**Maximum Pressure:** Pressure in excess of 1,000 Torr (5 psig) may damage the diaphragm.

**Weight:** Net: 0.75 lbs. (0.34 kg); Ship: 1.5 lbs. (0.68 kg)

# SPECIFICATIONS

## Slave Indicator/Controller

**Pressure Range:** 0 to 1000 PSIA

**Linearity:**  $\pm 1/2\%$  Full Scale

**Sensitivity:**  $\pm 0.1\%$  Full Scale Torr

**Response Time:** Less than 1 second for response to a step change.

**Calibration:** Any gas, liquid or vacuum compatible with sensor materials.

**Set Point Range:** Full scale, equal to full scale range of instrument.

**Set Point Repeatability:**  $\pm 2$  digits

**Analog Output:** 0 to 10.00 volts into 2000 ohm load or higher, 2 pin connector included. 4 - 20 mA optional.

**Transducers:** 1/4 inch NPT male thread standard  
1/8 inch NPT male pipe on stainless steel  
transducers

**Power Consumption:** Approximately 1 Watt for indicator, less than 2 Watts for controller.

**Relays (Controller Only):** Separate relays are provided for high and low set points. Each relay is SPDT with contacts rated 3 Amp @ 115 VAC; non-inductive. 3 pin screw terminal connectors are located on rear of instruments.

**Line Power:** 115 VAC, 50/60 Hz; 230 VAC optional at no additional cost.

**Line Regulation:**  $\pm 20\%$  change in line voltage produces less than 1% change in reading.

# OPERATING INSTRUCTIONS

## Readings On The Display

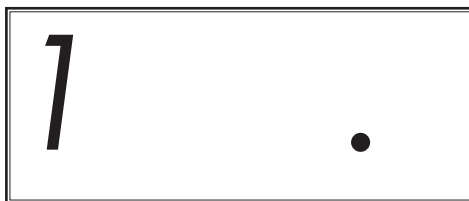
When the power is applied and the gauge tube connection is made, your instrument is in operation. After a short time period for stabilization, the Digital Display will show a reading of vacuum pressure.

At atmospheric pressure, and at any pressures above the designed range of the instruments, the display will show a "1" with the other digits blanked out.

When the pressure drops to be within the designed pressure range of the instrument the display will function normally.



Normal Display



Typical display when pressure is outside the range of the instrument

## Setting the Control Points

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To set the control points, press in either the Low or High “Push to Display” push-button on the front panel. This will display that set point on the digital meter. Adjust the multi-turn pot that corresponds to that set point until the desired pressure for the control action is read on the meter. The set point adjustment pots are located on the front panel on either side of the LED’s. release the “Push to Display” push-button and the instrument will again read pressure.

If the meter saturates and reads 1 xxx with the rightmost digits (xxx) blanked out, the control pressure is still correctly displayed when either of the push-buttons are depressed.

The LED’s show control action in the following manner:

Relay energized: LED - ON. Relay de-energized: LED - OFF

Relays are de-energized when pressure is above the set point (on atmospheric side of set point)

Atmospheric pressure = de-energized = loss of power

“NORMAL” = de-energized relay

No Power = in a no power state, relays are de-energized

## Relay Output Connector Wiring

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Recessed screwdriver adjustment potentiometers are standard, but front panel knobs can be provided instead when the optional 1/4 DIN case is used. Front panel knobs are not available on the standard enclosure style.

Contact rating:

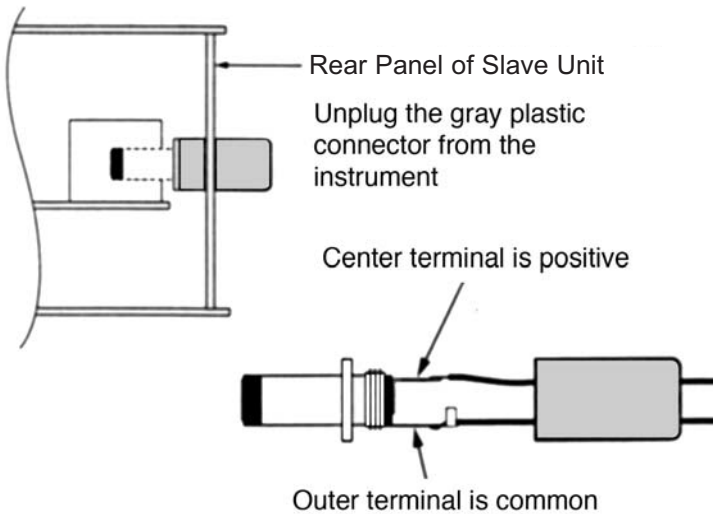
3 amps, 120 VAC, resistive

1.5 amp, 230 VAC resistive

1.5 amp, 28 VDC, inductive

Gently pull the connectors and they will detach from their sockets for wiring. Plug back in when connections are made. The “Low” set point relay is on the right side when looking at the instrument from the rear.

## Analog Output Signal



Gauges are shipped with a removable connector for analog output plugged into the rear panel of the instrument. Follow the steps below to wire the connector for output to remote recorders, dataloggers, etc.

1. Unplug the gray connector from the rear panel.
2. Unscrew the gray plastic connector cover.
3. Feed your analog output wires through this cover.
4. Solder the positive wire to the center terminal.
5. Solder the common or negative wire to the outer terminal.
6. Reinstall the connector cover and plug into the gauge.

## Optional 4-20 mA & 0-5 or 0-10 VDC Output

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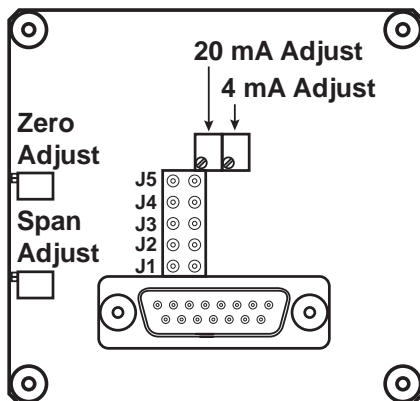
Gauges provided with an optional output are built in 1/4 DIN size cabinets which mount in 92 mm square panel cutouts.

On the rear panel of the instrument you will find a section identified as “analog output” which includes the zero and span adjustment potentiometers and a male connector similar to the standard output connector for the 4-20 mA, 0-5 or 0-10 VDC outputs.

Unplug this connector and unscrew the gray plastic shroud. Feed a shielded wire through this shroud and solder the shield to the outside lug and the center conductor to the inner lug. The shield is the circuit common or zero and the center conductor is 10 volts at 1000 Torr or mBar. The output is floating. The resistance in the mA output loop can be up to 1000 ohms. The 10 VDC output should have loads of 2000 ohms or higher.

Before being shipped from the factory the 4 mA is scaled to the low end of the instrument range (or zero pressure) and the 20 mA is adjusted to coincide with the full scale instrument reading of 1000 Torr / mbar. Rear panel zero and span adjustments are provided for fine tuning of pressure ranges in the field.

The standard analog output voltage signal described on the previous page continues to function even when these optional outputs are provided.



The 4-20 mA output signal can be adjusted to provide 5 different ranges; 0 to 1 Torr, 5 Torr, 10 Torr, 50 Torr or 1000 Torr. When shipped from the factory 20 mA equals 1000 Torr but to change ranges just remove the cover and position the jumpers to give the output you prefer. Note that 4 mA is always zero and the 0 to 10 volt output is always 1000 Torr.

	<b>1 Torr</b>	<b>5 Torr</b>	<b>10 Torr</b>	<b>50 Torr</b>	<b>1000 Torr</b>
20 mA	<b>1 Torr</b>	<b>5 Torr</b>	<b>10 Torr</b>	<b>50 Torr</b>	<b>1000 Torr</b>
19 mA	.937	4.68	9.37	46.87	937
18 mA	.874	4.36	8.75	43.75	874
17 mA	.812	4.05	8.12	40.62	812
16 mA	.749	3.74	7.50	37.50	749
15 mA	.687	3.43	6.87	34.37	687
14 mA	.625	3.11	6.25	31.25	625
13 mA	.562	2.80	5.62	28.12	562
12 mA	.500	2.50	5.00	25.00	500
11 mA	.437	2.18	4.37	21.87	437
10 mA	.375	1.87	3.75	18.75	375
9 mA	.312	1.56	3.12	15.62	312
8 mA	.250	1.25	2.50	12.50	250
7 mA	.187	.937	1.87	9.37	187
6 mA	.126	.625	1.25	6.25	125
5 mA	.062	.312	.625	3.125	62.5
4 mA	0	0	0	0	0

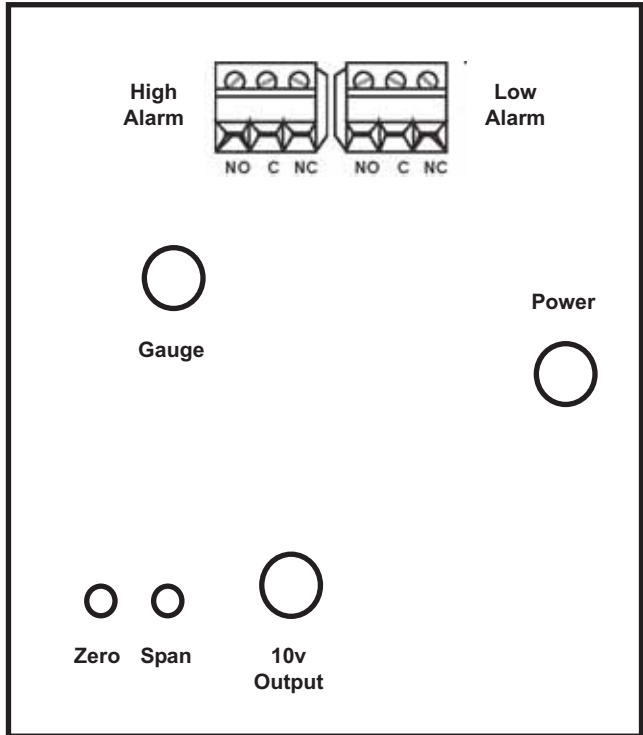
# Calibration

There are only 2 calibration adjustments that are normally necessary to re-standardize the slave instrument.

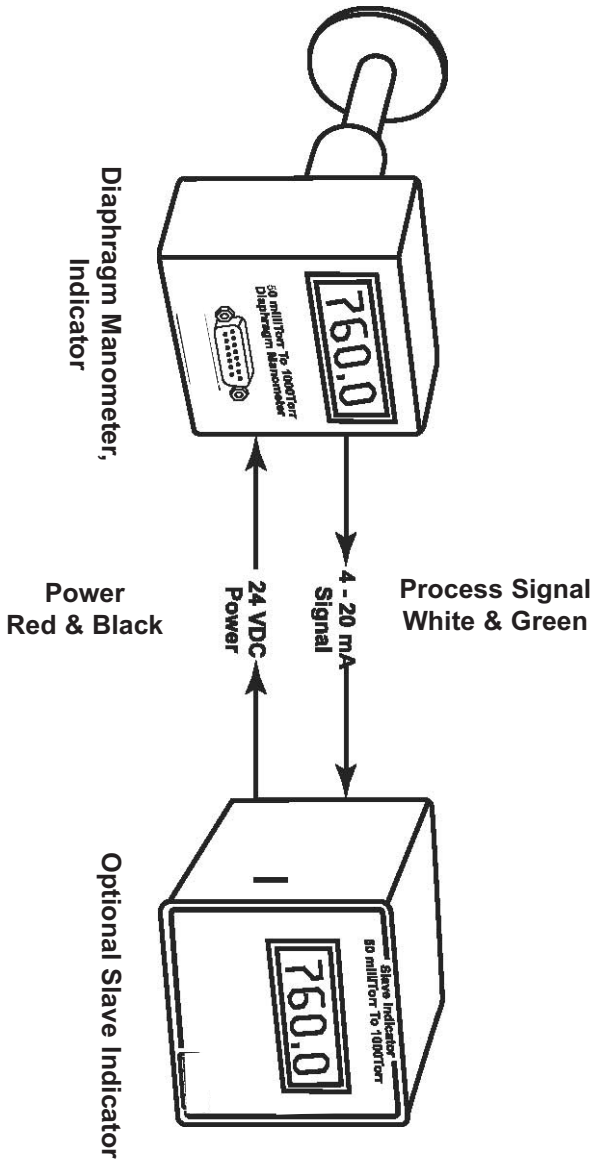
One is a “zero” adjustment for hard vacuum and the second is a span adjustment to set up scale tracking at some known pressure.

The adjustment pots are located on the rear of both the indicator and controller instruments. The pots are clearly marked.

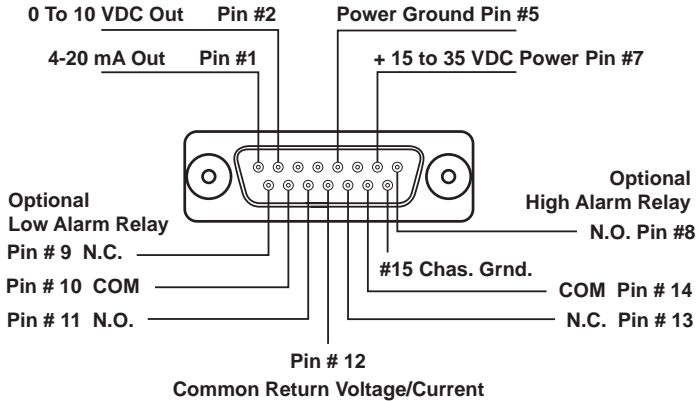
Plug in the power cord of the instrument and “warm up” the instrument for at least 30 minutes.



# Manometer Indicator & Slave Display Signal Block Diagram



## DB-15 Pin Wiring Diagram



### Wiring for DB-15 Connector on Transmitter, Indicator and Controller

#### PIN NUMBER

- 1 YELLOW
- 2 WHITE
- 5 BLACK
- 7 RED
- 12 GREEN

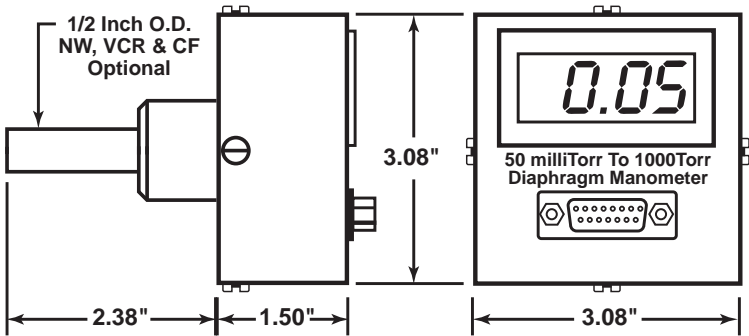
#### NOTE:

**GREEN AND BLACK WIRES  
ARE INTERNALLY  
CONNECTED AS COMMON  
SIGNAL AND POWER  
GROUND**

# DIMENSION DRAWINGS

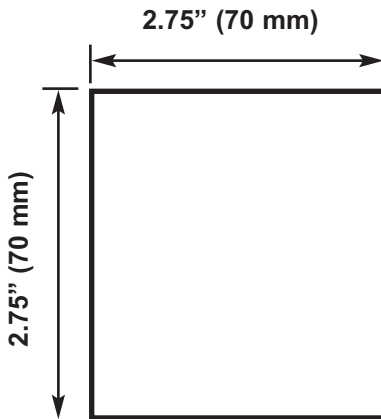
## Diaphragm Manometer

Transmitter, Indicator & Controller Models



## Panel Cut-Out Dimensions

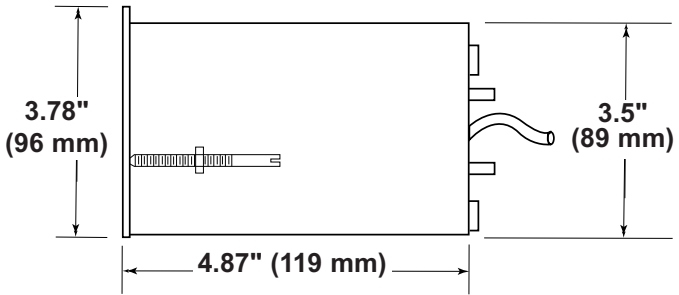
for Indicator, Controller Slave Models




92 mm square cut-out is standard 1.4 DIN. The DIN bezel adapter may also be used for appearance.

## 1/4 DIN Enclosure

The 1/4 DIN enclosure is rectangular and fits the standard 92 mm X 92 mm panel cutout. Panel mounting jackscrews are included with 1/4 DIN enclosure.



# Vacuum Dehydration Chart

Boiling Point of Water		Inches Hg Vacuum* (Gauge)	MICRONS (milliTorr) (Absolute)	Torr & mm Hg (Absolute)	mbar (Absolute)	Pascal (Absolute)	PSIA (Absolute)
212 °F	100 °C	0	760,000.	760.	1013	101,357	14.70
200 °F	93.3 °C	6.50	600,000.	600.	800.	80,032	11.50
		15.00	400,000.	400.	533	53,349	7.50
125 °F	51.7 °C	26.00	100,000.	100.	133.3	13,336	2.00
100 °F	37.8 °C	28.00	50,000.	50.	67	6,666	.97
72 °F	22.2 °C	29.00	20,000.	20.	27	2,666	.39
52 °F	11.1 °C	29.46	10,000.	10.	13.3	1,333	
34 °F	1.1 °C	29.69	5,000.	5.	6.6	666.6	
		29.74	1,000.	1.	1.33	133.3	.02
		29.93	1.	.001	.0013	.1333	.0005

\*Because "Inches Hg" is a "Gauge" measurement which uses atmospheric pressure as its reference, the readings at "hard vacuum" change with the local barometric pressure

# WARRANTY

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The manufacturer warrants all instruments for a period of one year against defects of material and workmanship subject to the terms and conditions set forth below:

1. The warranty is in effect at date of shipment from the manufacturer to the original purchaser.
2. This warranty covers both parts and labor and includes both display unit and sensors, but does not apply to instruments subjected to abuse or misuse or sensor damage caused by exposure to liquids or pressure in excess of 30 PSIG (3 atmospheres).
3. Claims against this warranty for replacement parts and/or service shall be limited to defects in materials and workmanship. Malfunctions attributable to neglect, abuse, or repair and operational procedures not specifically recommended by the manufacturer are not warranted.
4. Service repairs and/or piece part replacement shall be warranted for a period of ninety (90) days commencing on date of return shipment or until expiration of the remaining term of original instrument warranty, whichever is later.
5. The manufacturer shall not be liable for consequential damages nor for labor, loss or expenses directly or indirectly arising from use of their products or equipment.
6. This warranty does not apply to shipping damage. Claims for damage incurred while products are in transit rest with the purchaser. Said claims are to be levied against the carrier.
7. Amendments, assumed corollaries or statements contrary to the terms of this warranty shall not be binding upon the manufacturer unless stated in writing and approved by an officer of the manufacturer.
8. THE MANUFACTURER MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED, AND MAKES NO WARRANTY OF MERCHANTABILITY OR OF FITNESS FOR ANY PARTICULAR PURPOSE.
9. Warranty service is F.O.B. point of manufacture. All transportation charges to and from the manufacturer's plant shall be the responsibility of the purchaser.

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