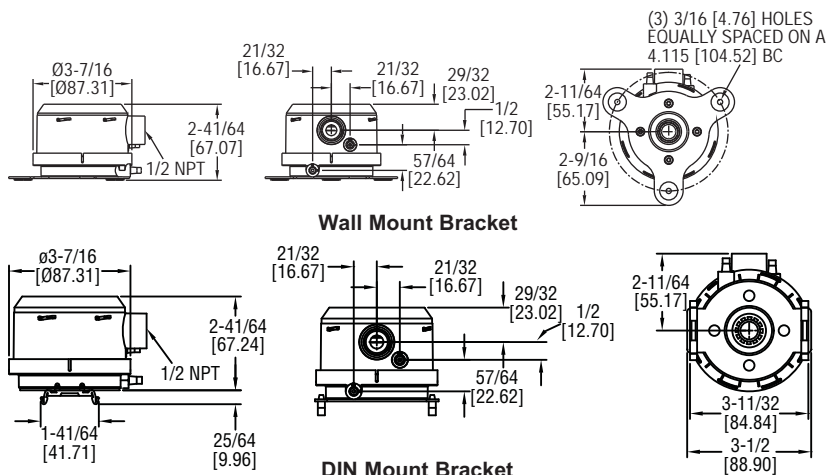




# Series MS Magnesense® Differential Pressure Transmitter

## Specifications - Installation and Operating Instructions



The Series MS Magnesense® Differential Pressure Transmitter is an extremely versatile transmitter for monitoring pressure and air velocity. This compact package is loaded with features such as: field selectable English or metric ranges, field upgradeable LCD display and the ability to select a square root output for use with pitot tubes and other similar flow sensors. Also, a single digital push button simultaneously calibrates both zero and span reducing installation and setup time. These features along with exceptional long term performance enables the Magnesense® to be the solution for a myriad of pressure and air flow applications.

### INSTALLATION

#### Mounting:

The transmitter should be mounted on a vertical surface with the connections directed down to prevent moisture from entering either the pressure ports or the electrical cable entry.

Mount the transmitter using #8 x 1/2" pan head sheet metal screws in the mounting flanges. Do not over tighten.

#### Electrical Connection:

##### 2-Wire Operation:

**CAUTION** DO NOT EXCEED SPECIFIED SUPPLY VOLTAGE RATINGS. PERMANENT DAMAGE NOT COVERED BY WARRANTY WILL RESULT. 2-WIRE UNITS ARE NOT DESIGNED FOR AC VOLTAGE OPERATION.

### SPECIFICATIONS

**Service:** Air and non-combustible, compatible gases.

**Wetted Materials:** Consult factory.

**Accuracy:** ±1% @ standard conditions.

**Stability:** ±1% F.S./ year.

**Temperature Limits:** 0 to 150°F (-18 to 66°C).

#### Pressure Limits:

1 psi (6.89 kPa) maximum, operation;

10 psi (68.9 kPa), burst.

#### Power Requirements:

2-wire, 10 to 35 VDC;

3-wire, 17 to 36 VDC or isolated 21.6 to 33 VAC.

#### Output Signals:

2-wire, 4 to 20 mA;

3-wire, 0 to 10 V or 0 to 5 V.

**Response Time:** 300 msec.

**Pressure Calibration:** One digital push button set both zero & span simultaneously.

#### Loop Resistance:

Current output: 0 to 1250 ohm max.;

Voltage output: min. load resistance 1 k ohmΩ.

**Current Consumption:** 40 mA max.

**Display (optional):** 4 digit LCD.

#### Electrical Connections:

4 to 20 mA units: 2-wire: European style terminal block for 16 to 26 AWG;

0 to 10 V units: 3-wire: European style terminal block 16 to 22 AWG.

**Electrical Entry:** 1/2" NPS thread.

Accessory: A-151 cable gland for 5 to 10 mm diameter cable.

**Process Connections:** 3/16" (5 mm) ID tubing. Maximum OD 9 mm.

**Enclosure Rating:** NEMA 4X (IP65).

**Mounting Orientation:** Insensitive to mounting orientation.

**Weight:** 8.0 oz (230 g).

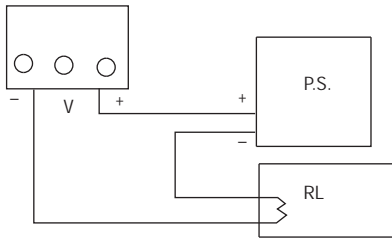
**Agency Approval:** CE.

The following standards were used for CE approval:

- CENELEC EN 61000-4-2: 2001
- CENELEC EN 61000-4-3: 2002
- CENELEC EN 61000-4-4: 1995
- CENELEC EN 61000-4-5: 2001
- CENELEC EN 61000-4-6: 2003
- CENELEC EN 61000-4-8: 2001
- CENELEC EN 55011: 2003
- CENELEC EN 61326: 2002
- 89/336/EED EMC Directive

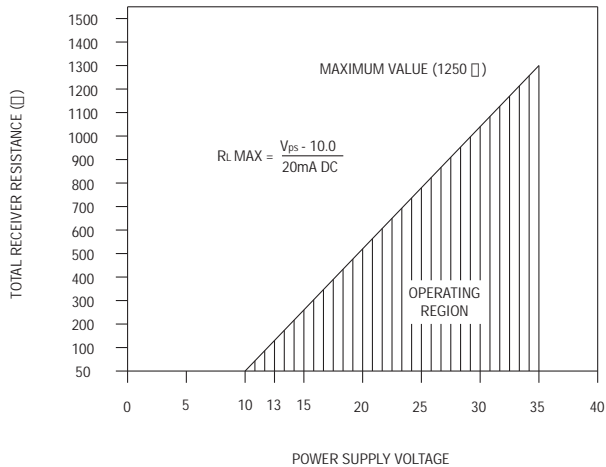
**Electrical Connection:**  
**2-Wire Operation, continued:**

The connections to the transmitter are made through a two circuit European style terminal block CONN6 located at the bottom of the main PCB board. Polarity is indicated by + and - signs on the PCB board. Do not connect to the (V) terminal.



**Figure 1**

An external power supply delivering 10 to 35 VDC with a minimum current capability of 40 milliamps must be used to power the control loop in which the Magnesense® transmitter is connected. Refer to Fig. 1 for connection of the power supply, transmitter and receiver. The range of appropriate receiver load resistances (RL) for the power supply voltage available is given by the formula and graph in Fig. 2. Shielded two wire cable is recommended for control loop wiring and the negative side of the loop may be grounded if desired. Note also that the receiver may be connected in either the negative or positive side of the loop, whichever is most convenient. Should polarity of the transmitter or receiver be inadvertently reversed, the loop will not function properly but no damage will be done to the transmitter.



**Figure 2**

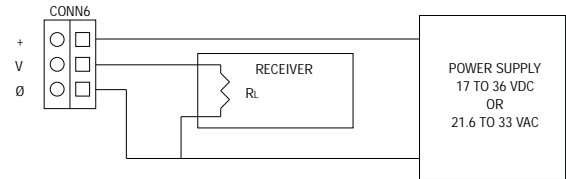
The maximum length of connecting wire between the transmitter and the receiver is a function of wire size and receiver resistance. That portion of the total current loop resistance represented by the resistance of the connecting wires themselves should not exceed 10% of the receiver resistance. For extremely long runs (over 1,000 feet), it is desirable to select receivers with higher resistances in order to keep the size and cost of the connecting leads as low as possible. In installations where the connecting run is no more than 100 feet, connecting lead wire as small as No. 22 Ga. can be used.

**3-Wire Operation:**

**CAUTION** DO NOT EXCEED SPECIFIED SUPPLY VOLTAGE RATINGS. PERMANENT DAMAGE NOT COVERED BY WARRANTY WILL RESULT.

The connections to the transmitter are made through a three circuit European style terminal block. Connect the power and signal leads to the corresponding terminals as shown in Fig. 3. When using a DC supply, the positive of the supply should be connected to (+) and the negative connected to (-). Connecting the leads in reverse will not damage the device but it will not operate. The DC supply should be capable of providing 20 mA or more of current per Magnesense® transmitter.

When using an isolated AC supply, either leads of the supply may be connected to (-) and (+). The input diode of the device half wave rectifies and filters the applied AC voltage. A small DC current of less than 20 mA is thus drawn through the transformer. The transformer used for the AC supply must be capable of handling this small DC current. Use a UL 1584 Class 2 rated transformer rated between 24 V and 30 VAC, 40 VA or larger, 50/60 Hz. UL 1584 Class 2 rated transformers are limited to 30 VAC maximum under any conditions at nominal line. The AC input voltage to the device is thus limited to a minimum of 21.6 at low line (24 V-10%) and 33 V at high line (30 V+10%).



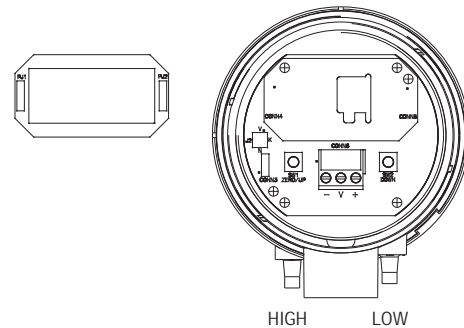
**Figure 3**

The output of (V) is 0 to 5 VDC or 10 VDC depending on model. As much as 10 mA may be drawn from (V) without affecting accuracy. This limits the minimum load RL connected to Vo to 1 KΩ or higher. Remember to keep the wiring resistance between the output and the receiver RL low compared to value of RL. While the voltage at the terminals remains unchanged with a 10 mA current flow, resistive losses in the wiring do cause errors in the voltage delivered to RL. For a 1% accurate gauge, a good rule of thumb would be to keep the resist 0.1% of the value of RL. This will keep the error caused by current flow below 0.1%.

To minimize noise in the signal use shielded cable. The common line may also be grounded.

**Pressure Connections**

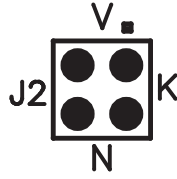
Two integral tubing connectors are provided. They are designed to fit 3/16" (5 mm) ID tubing. Connect the high pressure to the High side as shown in Fig. 4. Be sure the pressure ratings of the tubing exceed that of the operating ranges.



**Figure 4**

**Select Operation Mode:**

The operating modes and ranges are controlled by a shorting jumper on jumper block J2. This jumper block is shown in Fig. 5.



**Figure 5: Mode Programming Jumpers**

Jumper block J2 primary function is to control the operating mode. There are two operating modes, Normal and Velocity. The Normal operating mode provides for zero pressure to correspond to 0 V or 4 mA output. This mode is selected by placing the supplied shorting jumper for J2 on the pins next to the letter "N". The jumper for J2 is factory installed to the Normal mode. If no jumper is installed on J2, the device defaults to the "N" selection.

The Velocity mode provides the ability for the unit in conjunction with a pitot tube or similar flow sensor with known K factor to give a direct output in air velocity. This mode is selected by placing the supplied shorting jumper for J2 on the pins next to the letter "V". If the optional display is present, this mode prompts the display to read in air velocity. The current or voltage output is modified such that full scale output is  $4004 \cdot K \cdot \sqrt{\Delta P}$  feet per minute or its metric equivalent in meters per second depending upon which units are selected. The factory programming for the K factor is 1.00 but may be adjusted (see Adjust K Factor). The velocity displayed for the various models can be found in Table 1a, 1b, and 1c.

Standard Velocity Displayed		
Model	English	Metric
MS-X3X	K* 12.66 x 1000 fpm	K* 57.7 m/s
MS-X4X	K* 15.51 x 1000 fpm	K* 70.7 m/s
MX-X5X	K* 20.02 x 1000 fpm	K* 91.2 m/s

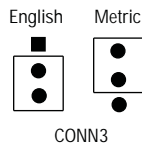
**Table 1a**

**SETUP**

**Set Measurement Units:**

Standard Magnesense® transmitters can be easily set to operate in either English or metric units.

The programming jumper is CONN3. A representation of this jumper is shown in Fig. 6. English units are selected by placing the provided shorting jumper on the lower two pins of the block. Metric units are selected by placing the provided shorting jumper on the upper two pins of the block. If no jumper is present English units are selected by default.



**Figure 6a: Measurement Units Programming Jumper**

In addition to the obvious change in the scale of the LCD display, the full scale range and corresponding analog outputs are also affected by the measurement units selection. The analog output goes to full scale output (5 volts, 10 volts or 20 mA depending on model) of the selected range and units. See Table 2.

**FULL SCALE ANALOG OUTPUT**

Model	English	Metric
MS-X31	10 in w.c.	2 kPa
MS-X41	15 in w.c.	3 kPa
MX-X51	25 in w.c.	5 kPa

**Table 2**

**Install Optional Display:**

The A-435 LCD conversion kit allows any non display model to have the LCD added at a later time. The kit contains an LCD display and replacement cover with LCD window. The optional display may be set to read pressure either in Inches Water Column or Kilopascal. The optional display can be also set to display air velocity in X1000 feet per minute or meters per second when used with a pitot tube or similar flow sensor with a known K factor.

The optional display for the Magnesense® is mounted on the main board by connectors CONN4 and CONN5. The display is properly mounted when CONN4 and CONN5 on the display are connected to the corresponding CONN4 and CONN5 on the main board. See Fig. 4. Installing the display upside down causes no harm the display or the main board. The display just simply reads upside down.

**Label (Included with display):**

The optional LCD display does not contain engineering unit indication. So that the display may be appropriately marked, four adhesive labels have been provided with the units. The unit labels are INWC, kPa, X1000 fpm, and M/S. Attach the appropriate provided units label above the display window on the cover of the device to indicate to which units the display has been set.

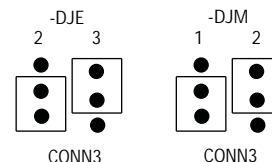
**Adjust K Factor:**

If the optional display is present, the K factor used in velocity measurements may be adjusted. This is done by activating the K factor adjustment function of the unit. To activate the K factor adjustment function, take the shorting jumper from programming block J2 and place it on the upper two terminals next to the letter "K". See Fig. 5. The display will now show the programmed pitot tube K factor. The K factor can be adjusted up and down by using the up and down buttons as up and down buttons. Once the desired K factor has been set, replace the shorting jumper on J2 to its velocity position ("V"). The shorting jumper must not be left in the "K" position for proper operation of the unit. The factory setting for the K factor is 1.0 and it is adjustable from 0.1 to 4.0.

**One button pressure calibration** – Leaving the hose barbs vented, press and hold the "Zero/Up" switch for about 4 to 5 seconds. The zero point should now be set and if the display is present, the display will read zero. Span is also simultaneously adjusted at the time the zero is set. No further calibration is required. It does not matter if in metric or English unit made when performing this "one button" calibration of both zero & span.

**DJE/DJM MODELS**

Magnesense® transmitters having the -DJE or -DJM option are configurable to show velocity in two different formats. CONN3 selects the number of decimal places displayed in velocity mode as shown in Figure 6b.



**Figure 6b: Velocity Decimal Place Jumper**

## **MAINTENANCE**

Annual recalibration is suggested. No lubrication or other periodic servicing is required. Keep exterior and cover clean. Occasionally disconnect pressure lines to vent both sides of gauge to atmosphere and re-zero. Do not use solvent to clean transmitter. Use only plastic compatible cleaners or water.

The Series MS is not field serviceable and should be returned if repair is needed (field repair should not be attempted and may void warranty). Be sure to include a brief description of the problem plus any relevant application notes. Contact customer service to receive a return goods authorization number before shipping.