

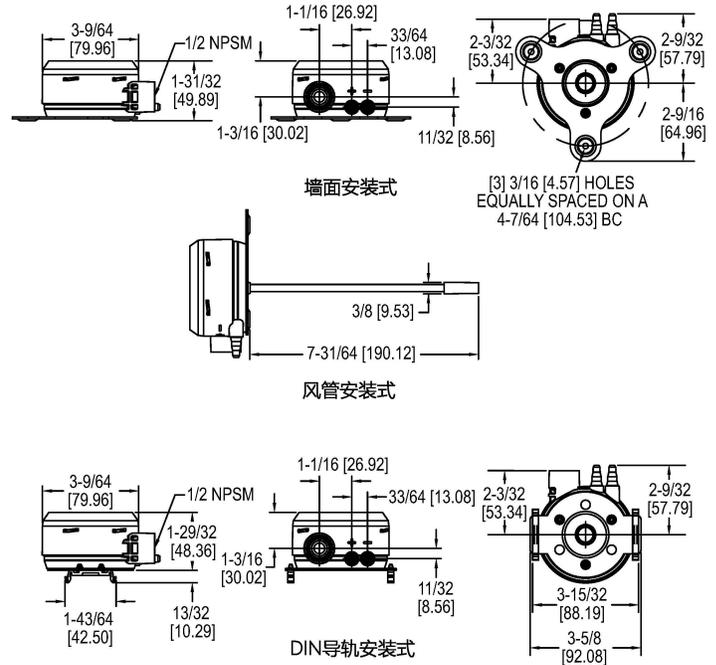


# MSX 系列 Magnesense® 差压变送器

## 技术指标 - 安装和操作说明

文件号: P-MSX-AC

如英文版与中文版有任何歧异, 概以英文版为准  
In case of any inconsistency between English and Chinese version, the English version shall prevail.  
® Translated and edited by William J. He



MSX系列Magnesense®差压变送器传承了MS2系列Magnesense®II差压变送器的稳定性和多功能的特点, 应用于楼宇自动化控制系统。它简化了订购流程, 可由工厂按客户需求配置, 节约产品安装设置时间。压力单位可选Pa, 毫米水柱或英寸水柱, 每个型号都有32个量程可选用, 均可配置成单向或正负组合量程。MSX系列差压变送器可线性输出差压信号, 或开方后线性输出风速风量信号。它能同时输出电压和电流信号, 便于维护和检修。

### 安装

#### 表面安装:

将变送器安装在垂直表面上。虽然传感器的测量不受安装方向的影响, 但建议在安装时将接口朝下, 以防止水份进入压力连接端口或电缆接口。使用 # 8x1/2" 盘头钣金螺钉将安装法兰片固定于安装平面。不要过度拧紧。

#### 风管安装 (必须选择通用安装型):

变送器在安装时, 要尽量远离风机口, 角落, 加热和冷却盘管, 以及其它可能会影响压力测量的设施。

1. 安装变送器前, 请先在风管上钻一个直径为0.562" (12.70毫米) 的孔。
2. 将风管探头从变送器背面拧入, 配置成风管安装式变送器。然后将变送器探头插入风管。
3. 直接用安装法兰片的螺钉孔比照, 在风管上标记安装螺钉孔的位置, 然后钻孔。
4. 用 # 8x1/2" 盘头钣金螺钉将安装法兰片固定在风管上, 请勿过度拧紧螺丝。
5. 将随附的堵头盖罩紧外部正压端口。

通用安装型也可以配置为标准的墙装式变送器。在这种情况下, 请勿使用风管探头。用随附的堵头堵上变送器背面的接口。

### 技术指标

<b>介质:</b> 空气和不可燃的兼容气体。	<b>回路电阻:</b> 电流输出: 0-1250Ω(最大);
<b>材质:</b> 请咨询工厂。	<b>电压输出:</b> 最小负载1kΩ。
<b>精度:</b> 满量程的±1%FSO。	<b>电流消耗:</b> 最大21mA。
<b>稳定性:</b> 每年±1%FSO。	<b>电气连接:</b> 可移除的欧式端子排。
<b>温度范围:</b> -4 - 158°F (-20 - 70°C)。	<b>进线方式:</b> 1/2"NPS螺纹。
<b>压力限制:</b> 量程0和1: 最大操作压力为3.6psi, 爆裂压力为6psi; 量程2和3: 最大工作压力为6psi, 爆裂压力为6psi。	<b>显示 (可选):</b> 4位LCD显示屏。
<b>电源要求:</b> 10-36VDC(2线), 17-36VDC或隔离的21.6-33VAC(3线)。	<b>过程连接:</b> 1/8", 3/16", 1/4", 5mm和6mm内径软管。
<b>输出信号:</b> 4-20mA (2线); 0-10V或0-5V (3线)。	<b>外壳防护等级:</b> NEMA 4X (IP66), 阻烟等级UL 2043, 阻燃等级UL94 V-0。
<b>响应时间:</b> 瞬时(默认)或3秒(可选)。	<b>安装方向:</b> 任意。
<b>零点和量程调整:</b> 数字按钮。	<b>重量:</b> 8.0盎司 (230克)。
	<b>机构认证:</b> CE。

### 选项

量程	英寸水柱	Pa (低)	Pa (高)	毫米水柱
量程 0	0.1	25	60	2.5
	0.15	30	75	5
	0.25	40	100	10
	0.5*	50	125*	12*
量程 1	0.1	25	100	2.5
	0.25	40	150	5
	0.5	50	160	10
	1*	60	250*	25*
量程 2	1	250	600	25
	2	300	750	50
	3	400	1000	100
	5*	500	1250*	125*
量程 3	10	1000	3000	250
	15	1500	4000	350
	25	2000	5000	500
	28*	2500	7000*	700*

\*是指每个量程代码下的正满量程输出值。

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## 电气连接

MSX变送器采用2线制4-20mA电流输出或3线制0-5V/0-10V电压输出。并且能够同时输出电流和电压信号。电源和信号连接采用可插拔的欧式四芯接线端子排。

### 注意

如果配备了LCD液晶显示屏，必须在接线前取下液晶显示屏。将LCD直接从产品上拔下即可。接线完成后，重新插入LCD。

## 2线制4-20mA电流输出

### 警告

注意：请勿超出额定电压值，由此造成的损坏不在保修范围内。同时输出电流和电压信号的功能不适用于交流供电。

如图1所示，通过端子排上的VDC和COM端子与变送器进行连接。端子排是可插拔的，每个端子在电路板上都有标印注明。由VDC和COM标明正负极，见图1。

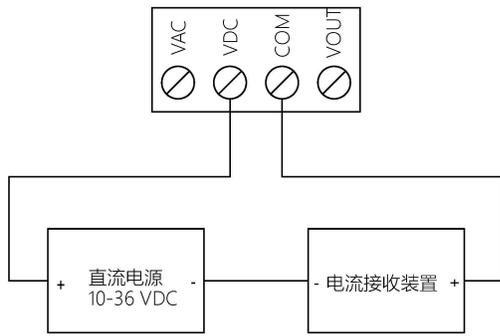


图 1

信号接收装置的最大负载电阻（ $R_L$ ）的计算公式如下， $V_{ps}$ 为供电电压：

$$R_L = \frac{V_{ps} - 10.0}{20 \text{ mA DC}}$$

控制回路中，建议采用2芯屏蔽电缆线，屏蔽层在电源端接地。

信号接收装置在环路中可以根据现场需要连接到环路的负极侧或正极侧。如果变送器或信号接收装置的正负极意外颠倒，则环路将无法正常工作，但不会损坏变送器。

变送器和信号接收装置之间的连线最大长度和导线粗细以及和信号接收装置的阻抗有关。对于超过300米的安装距离，请尽量选择电阻较低的信号接收装置，以使导线的粗细和安装成本尽可能降低。对于不超过30米的安装，可使用小至22ga的连接导线。

## 3线制0-10V/0-5V电压输出

### 警告

注意：请勿超出额定电压值，由此造成的损坏不在保修范围内。

端子排是可插拔的，每个端子在电路板上都有标印注明。正极由VOUT标示。交流或直流供电采用不同的端子连接供电。如果变送器正负极被意外接反了，则将无法正常工作，但不会损坏变送器。

通过端子的接线来选择使用直流或交流供电。

直流接线请参见图2。

交流接线请参见图3。

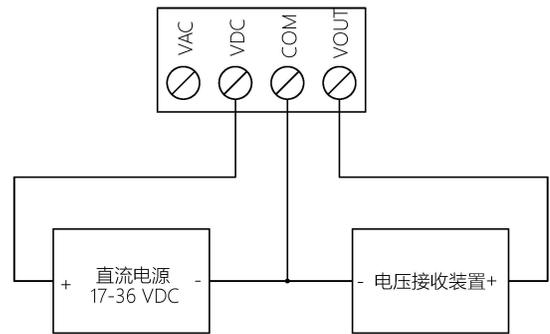


图 2: 直流接线图

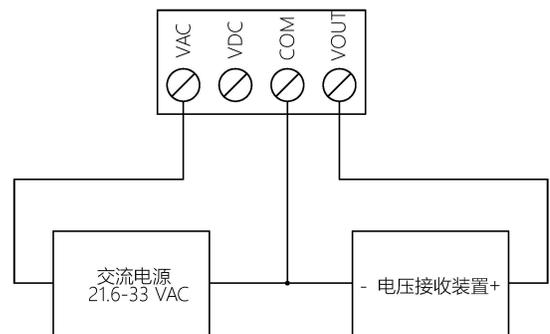


图 3: 交流接线图

信号接收装置的最小负载为1KΩ。连接导线的电阻应该比信号接收装置负载阻抗低。例如电压不变，在10mA电流时，导线电阻引起的电压损失确实会使得信号接收装置接收的电压值产生误差。对于精度为1%的仪表，导线的电阻应小于信号接收装置负载电阻值的0.1%。这样才能使得电流引起的误差保持在0.1%以下。

根据拨码开关的设置，VOUT和COM端子上的输出信号将为0-5V或0-10V。**更多信息，请参见拨码开关设置说明。**

## 同时输出电流和电压

### CAUTION

注意：请勿超出额定电压值，由此造成的损坏不在保修范围内。同时输出电流和电压信号的功能不适用于交流供电。

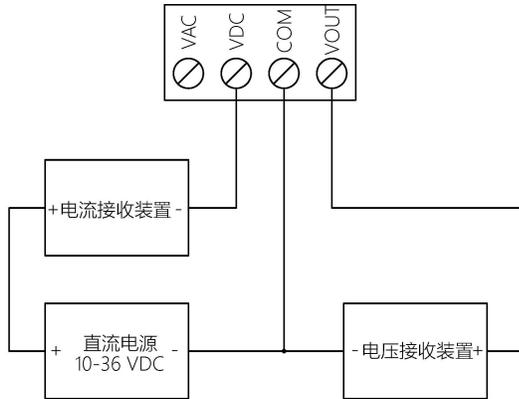


图 4: 电流和电压信号同时输出接线

端子排是可插拔的，每个端子在电路板上都有标印注明。正极由VOUT指示。如果需要同时输出电流和电压信号，必须采用直流电源。电压输出和电源必须各自用单独导线连接，然后在端子2处合并，否则可能会出现其它错误。

对于电流输出，最大允许环路电阻（导线电阻+信号接收装置电阻）和电源电压有关。在供电环路中，不得将变送器的电压降低到17V以下。可以使用以下公式计算最大环路电阻：

$$R_{MAX} = \frac{(V_{PS} - 17.0)}{20 \text{ mA DC}}$$

该公式使用17.0代替了先前在图1的公式中看到的10.0。在电流电压信号同时输出的线路中，最小供电电压需要更高。

控制回路中，建议采用4芯屏蔽电缆线接线。屏蔽层在电源端接地。如果变送器或信号接收装置的正负极意外颠倒，本机将无法正常工作，但不会损坏变送器。

对于电压输出，信号接收装置的最小负载为1KΩ。连接导线的电阻应该比信号接收装置负载阻抗低。如果电压不变，在10mA电流时，导线电阻引起的电压损失确实会使信号接收装置接收的电压值产生误差。对于精度为1%的仪表，导线的电阻应小于信号接收装置负载电阻值的0.1%。这样才能使得电流引起的误差保持在0.1%以下。

根据拨码开关的设置，VOUT和COM上的输出将为0-5V或0-10V。更多信息，请参见拨码开关设置说明。

## 电源供电

参见下面的表格

电流输出	
供电电压	10-36 VDC
回路电阻	0-1250 Ω

电压输出	
供电电压	17-36 VDC
	21.6 - 33 VAC (隔离)
最小负载电阻	1000 Ω

## 拨码开关设置

拨码开关设置直接标记在电路板上，如图5所示。拨码开关是根据订单型号配置进行出厂设置的。也可以使用小螺丝刀或笔来拨动改变开关的位置。

### 注意

图5是量程为5英寸水柱的电路板，其它量程的电路板和下图相似，但有所不同。

### 警告

在指定的供电电压范围内，没有能造成危险的电压。但是，尽量在改变拨动开关的时候关闭控制系统，以防止控制系统的不稳定。

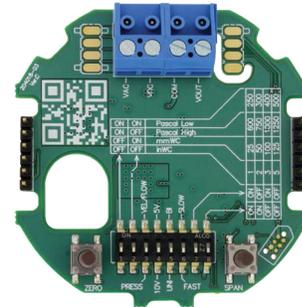


图 5: 量程为5英寸水柱的电路板

## 拨码开关的设置顺序

拨码开关编号1 - 8是从左到右

## 拨码开关1和2 - 选择测量单位

拨码开关1和2的组合来选择测量单位

在拨码开关3为OFF (朝下) 时为差压测量模式		
拨码开关 1	拨码开关 2	测量单位
ON	ON	Pa (低量程)
ON	OFF	Pa (高量程)
OFF	ON	毫米水柱
OFF	OFF	英寸水柱

在拨码开关3为ON (朝上) 时为风速/风量测量模式		
拨码开关 1	拨码开关 2	测量单位
ON	ON	m <sup>3</sup> /hr (风量)
ON	OFF	m/s (风速)
OFF	ON	CFM (风量)
OFF	OFF	FPM (风速)

### 拨码开关3-差压或风速/风量模式

拨码开关3在差压输出或风速/风量输出之间切换。

- 当开关处于OFF或向下位置时，处于差压模式。
- 当开关处于ON或向上位置时，处于风速/风量模式。

### 拨码开关4-电压输出信号值选择

电压输出可以是0-10V或0-5V，取决于拨码开关4的位置。

- 当开关处于OFF或向下位置时，输出将为0-10V。
- 当开关处于ON或向上位置时，输出将为0-5V。

### 拨码开关5-单向量程或正负组合量程输出

拨码开关5可以设置为单向或正负组合的差压量程。

- 当开关处于OFF或向下位置时，变送器将设置为单向从零开始(例如：0-5英寸水柱)。
- 当开关处于ON或向上位置时，变送器将被设置为双向正负组合量程，并且为所选最大量程的正负值(例如：±5英寸水柱)。

### 拨码开关6-响应时间选择

拨码开关6可以选择所需的响应时间。

- 当开关处于OFF或向下位置时，变送器的响应时间是即刻响应。
- 当开关处于ON或向上位置时，响应时间为3秒。

### 拨码开关7和8-最大量程范围选择(差压)

拨码开关7和8组合使用，以选择变送器的最大差压量程。根据下表列出的差压量程选择。如果用于测量风速和风量，则参见下一部分说明。

量程0的差压量程选择					
拨码开关 7	拨码开关 8	Pa (低)	Pa (高)	毫米水柱	英寸水柱
ON	ON	25	60	2.5	0.1
OFF	ON	30	75	5	0.15
ON	OFF	40	100	10	0.25
OFF	OFF	50	125	12	0.5

量程1的差压量程选择					
拨码开关 7	拨码开关 8	Pa (低)	Pa (高)	毫米水柱	英寸水柱
ON	ON	25	100	2.5	0.1
OFF	ON	40	150	5	0.25
ON	OFF	50	160	10	0.5
OFF	OFF	60	250	25	1

量程2的差压量程选择					
拨码开关 7	拨码开关 8	Pa (低)	Pa (高)	毫米水柱	英寸水柱
ON	ON	250	600	25	1
OFF	ON	300	750	50	2
ON	OFF	400	1000	100	3
OFF	OFF	500	1250	125	4

量程3的差压量程选择					
拨码开关 7	拨码开关 8	Pa (低)	Pa (高)	毫米水柱	英寸水柱
ON	ON	1000	3000	250	10
OFF	ON	1500	4000	350	15
ON	OFF	2000	5000	500	25
OFF	OFF	2500	7000	700	28

### 拨码开关7和8-最大量程范围选择(风速/风量)

拨码开关7和8组合使用，以选择变送器的最大风速/风量量程。使用以下表格选择风量或风速。

量程0的风速/风量量程选择					
拨码开关 7	拨码开关 8	m <sup>3</sup> /hr (风量)	m/s (风速)	CFM (风量)	FPM (风速)
ON	ON	1700	5	850	850
OFF	ON	2700	8	1250	1250
ON	OFF	3700	11	2000	2000
OFF	OFF	4800	14	2800	2800

量程1的风速/风量量程选择					
拨码开关 7	拨码开关 8	m <sup>3</sup> /hr (风量)	m/s (风速)	CFM (风量)	FPM (风速)
ON	ON	2500	7.5	1250	1250
OFF	ON	3300	10	2000	2000
ON	OFF	5200	15	2800	2800
OFF	OFF	6800	20	4000	4000

量程2的风速/风量量程选择					
拨码开关 7	拨码开关 8	m <sup>3</sup> /hr (风量)	m/s (风速)	CFM (风量)	FPM (风速)
ON	ON	6800	20	4000	4000
OFF	ON	8600	25	5600	5600
ON	OFF	11800	35	6900	6900
OFF	OFF	15200	45	8950	8950

量程3的风速/风量量程选择					
拨码开关 7	拨码开关 8	m <sup>3</sup> /hr (风量)	m/s (风速)	CFM (风量)	FPM (风速)
ON	ON	18000	55	9000	9000
OFF	ON	23000	70	12000	12000
ON	OFF	30000	90	15000	15000
OFF	OFF	36000	107	20000	20000

### 校准

在校准之前，必须先解锁变送器的安全密码保护功能，请参阅“菜单访问安全密码设置”说明。零点和量程按键在松开之后会延迟三秒才开始校准，这个延迟是保护由于应力变化可能产生的零点偏移。

### 零点校准

在两个压力端口无压的情况下，按下零点校准按钮3秒钟来进行零点校准。如带有LCD显示片，则会看到显示“ZERO”，完成后会自动返回到主菜单。

### 量程校准

**注意** 根据量程正值，加压于正端压力接口。

量程校准功能是经过调整使得施加的差压和最大设置量程一致，它将最大量程输出值和校准施加的差压值对应起来。建议先进行零点校准再进行量程校准。加压到最大设定量程值，然后按住量程校准键3秒钟，如果带LCD显示片，可以看到直到LCD显示“SPAN”，量程校准将会在量程按键松开三秒后开始校准量程。

## LCD显示片

LCD显示片还包括一个开窗的外盖，显示片直接插入电路板上的针脚。LCD倒转安装可以旋转180°显示，这样如果变送器接管接线朝上安装时，LCD也可正确读取。

如果带LCD显示片，当变送器处于错误状态时，会显示以下出错信息。

LCD显示出错信息	
出错代码	信息
OVER	高出3%过压，导致超出量程错误。
UNDR	低出1%欠压，导致低于量程错误
FAIL	按下量程校准按键时，加压值超出了允许设置的范围。
ER 1	加压超过传感器所能承受的范围。
ER 2	传感器正在传送信号，发现内部错误。
ER 3	传感器不能传送信号。
ER 4	存储的用户设置参数无效。
ER 5	存储的出厂设置参数无效。
ER 6	用户内存存储故障。
ER 7	出厂内存存储故障。

## 程序菜单

### 主菜单

在正常操作期间，显示片显示的是主菜单，并显示当前测得的差压值和工程单位。

### 菜单访问安全密码设置

默认情况下，不需要密码即可进入配置菜单。但是，如果需要限制对菜单的访问，请执行以下步骤。

- 1.在主菜单中，按住“ZERO”和“SPAN”按键，直到显示“PIN”。
- 2.按住“ZERO”和“SPAN”按键，直到显示当前的密码（默认为0000）。
- 3.使用“ZERO”按键增加所选数字（有黑色下箭头标出 ），或按“SPAN”按键选择右侧的下一个数字。
- 4.设置0001到9999之间的任何值都会要求输入密码。设置0000将禁用密码输入要求。
- 5.按住“SPAN”按钮，直到显示下一个菜单。完成密码设置。

## 保养/维修

安装MSX系列后，没有日常维护的需要。请勿现场维修MSX系列产品，如果需要维修，应退返工厂。请勿尝试现场维修，否则可能导致保修无效。



此符号表示废电子产品不应与生活垃圾一起处理。如需废弃，请交有处理能力的机构回收。请与地方政府或零售商联系以获取回收建议。

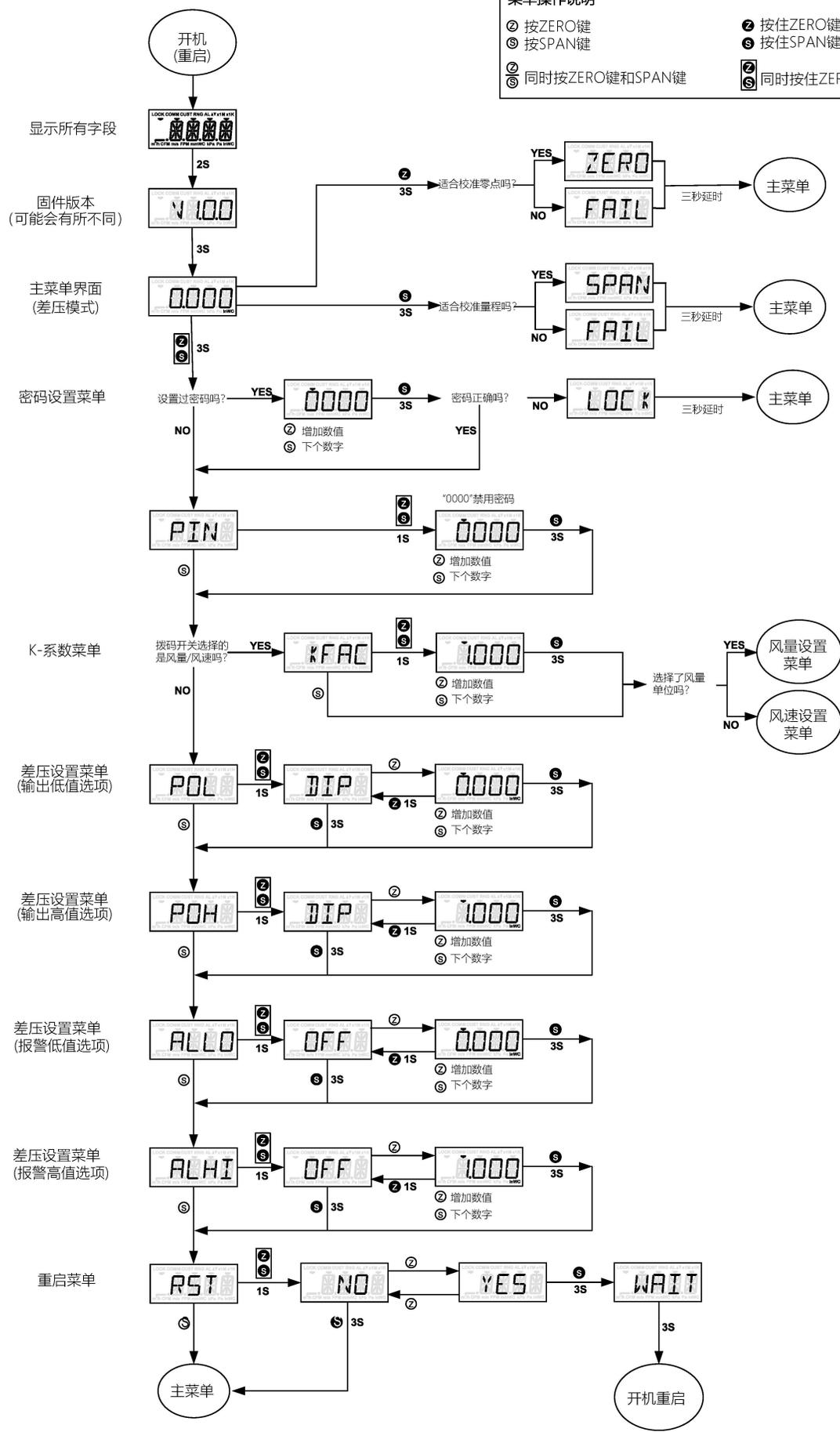
## 保修/退货

请参阅我们的产品目录中或网站中发布的“销售条款和条件”。在将产品退回维修之前，请联系客户服务中心索取退货授权号码（RMA）。并请附上关于产品问题的简短说明以及应用场合的说明。

MSX主菜单界面和差压设置流程图

**菜单操作说明**

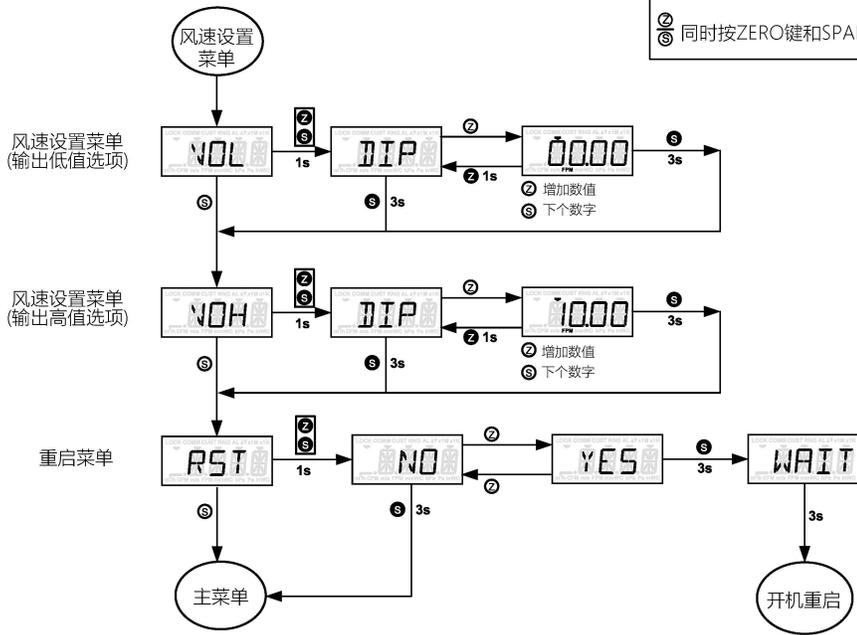
② 按ZERO键	② 按住ZERO键
③ 按SPAN键	③ 按住SPAN键
②③ 同时按ZERO键和SPAN键	②③ 同时按住ZERO键和SPAN键



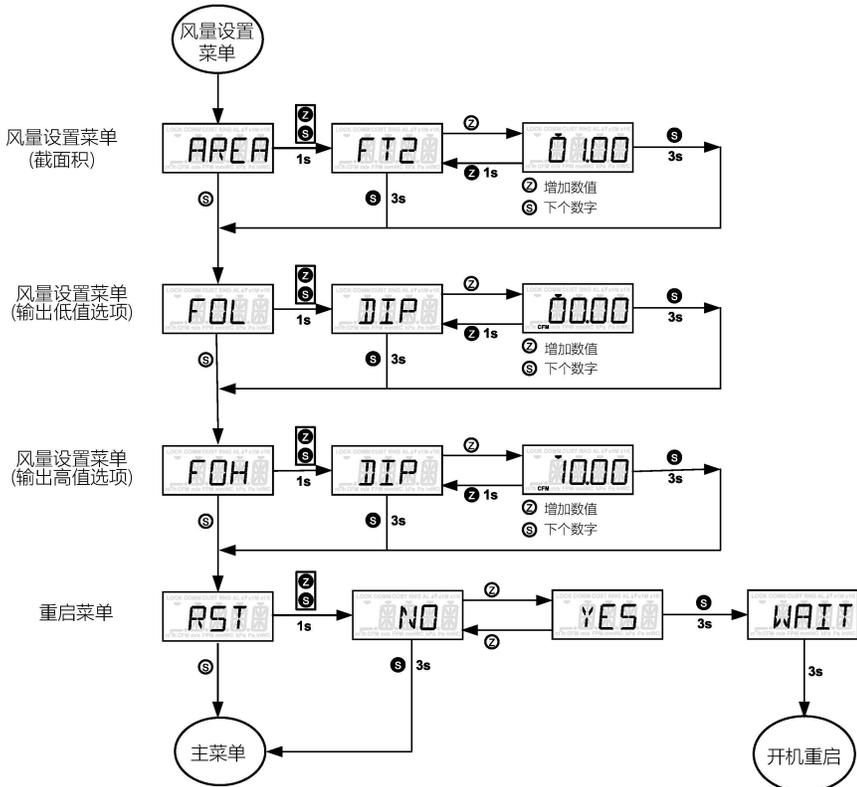
MSX风速设置流程图

**菜单操作说明**

⓪ 按ZERO键	⓪ 按住ZERO键
Ⓢ 按SPAN键	Ⓢ 按住SPAN键
⓪Ⓢ 同时按ZERO键和SPAN键	⓪Ⓢ 同时按住ZERO键和SPAN键



MSX风量设置流程图

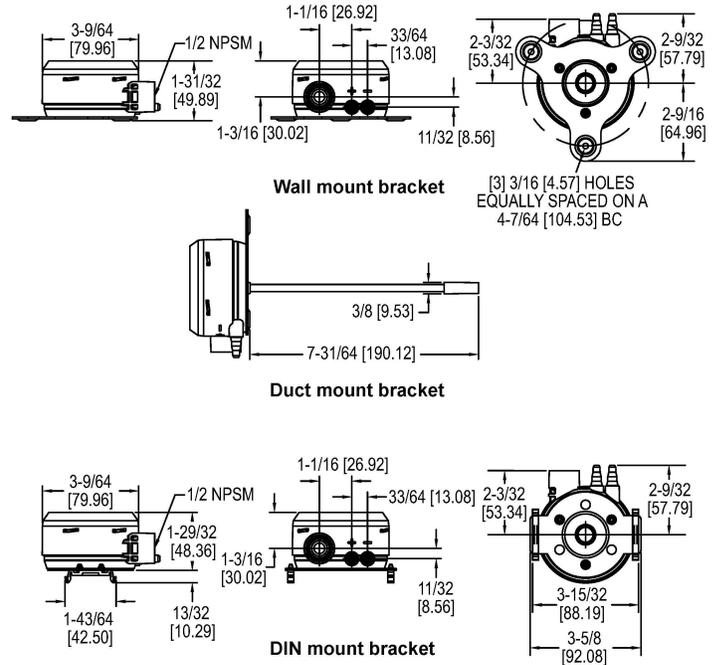






# Series MSX Magnesense® Differential Pressure Transmitter

## Specifications - Installation and Operating Instructions



The Series MSX Magnesense® Differential Pressure Transmitter combines the stability and versatility of the original Series MS2 Magnesense® II transmitter for use in building control applications. The MSX simplifies the ordering process to deliver the desired configuration, which reduces product setup time. Pressure ranges are available in Pa, mm w.c., and in w.c. All pressure ranges can be configured in unidirectional or bidirectional modes, providing a total of 32 ranges. The MSX transmitter can provide a linear pressure output or a linear velocity output with the square root extraction from the transmitter. Additional parameters have been included to expand the square root capability to calculate flow. Dual voltage and milliamp output signals can be used to provide both control and equipment output signal verification.

### INSTALLATION

#### Surface Mounting:

Mount the transmitter on a vertical surface. The pressure sensor measurement is unaffected by orientation, but it is recommended the unit be mounted with the connections facing down to prevent moisture from entering either the pressure ports or the electrical cable entry. Attach the mounting flange to a flat surface using #8 x 1/2" pan head sheet metal screws. Do not over tighten.

#### Duct Mounting (Universal model required):

Mount the transmitter away from fans, corners, heating and cooling coils and other equipment that will affect the measurement of the pressure.

- To mount the transmitter, drill a .562" (12.70 mm) diameter hole into the duct.
- Screw duct probe into back of housing. Insert transmitter probe into the duct.
- Mark location of mounting holes on duct using mounting flange as template. Drill holes.
- Attach mounting flange to duct with #8 x 1/2" pan head sheet metal screws. Do not over tighten screws.
- Place the included cap on the exterior positive pressure port.

The Universal model can also be used as a standard wall mount transmitter. In this mode, do not use the duct probe and plug the port on the backside of the transmitter with the included plug.

### SPECIFICATIONS

<b>Service:</b> Air and non-combustible, compatible gases. <b>Wetted Materials:</b> Consult factory. <b>Accuracy:</b> ±1% FSO. <b>Stability:</b> ±1% FSO/year. <b>Temperature Limits:</b> -4 to 158°F (-20 to 70°C). <b>Pressure Limits:</b> Ranges 0 and 1: 3.6 psi max operation, 6 psi burst; Ranges 2 and 3: 6 psi max operation, 6 psi burst. <b>Power Requirements:</b> 10-36 VDC (2-wire), 17-36 VDC or isolated 21.6-33 VAC (3-wire). <b>Output Signals:</b> 4-20 mA (2-wire); 0-10 V or 0-5 V selectable (3-wire). <b>Response Time:</b> Instantaneous (default) or 3 s (selectable). <b>Zero and Span Adjustments:</b> Digital push-button.	<b>Loop Resistance:</b> Current output: 0-1250 Ω max; Voltage output: min. load resistance 1 k Ω. <b>Current Consumption:</b> 21 mA max continuous. <b>Electrical Connections:</b> 4-wire removable European style terminal block for 16 to 26 AWG. <b>Electrical Entry:</b> 1/2" NPS thread. <b>Display (optional):</b> 4 digit LCD. <b>Process Connections:</b> 1/8", 3/16", 1/4", 5 mm, and 6 mm ID flexible tubing. <b>Enclosure Rating:</b> NEMA 4X (IP66); UL 2043 (Plenum); UL94 V-0. <b>Mounting Orientation:</b> Pressure sensor measurement unaffected by orientation. <b>Weight:</b> 8.0 oz (230 g). <b>Agency Approvals:</b> CE.
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### OPTIONS

Range	in w.c.	Pa low	Pa high	mm w.c.
Range 0	0.1	25	60	2.5
	0.15	30	75	5
	0.25	40	100	10
	0.5*	50	125*	12*
	Range 1	0.1	25	100
0.25		40	150	5
0.5		50	160	10
1*		60	250*	25*
Range 2		1	250	600
	2	300	750	50
	3	400	1000	100
	5*	500	1250*	125*
	Range 3	10	1000	3000
15		1500	4000	350
25		2000	5000	500
28*		2500	7000*	700*

\*Indicated values are the positive full scale output values per range.

## ELECTRICAL

The MSX transmitter utilizes a **2-wire 4-20 mA Current Output**, or a **3-wire 0-5 V / 0-10 V Voltage Output**. It is also capable of **Simultaneous Current and Voltage Output**. The power and signals interconnect via a removable European-style four conductor terminal block.

**NOTICE** If equipped, the LCD must be removed before wiring. Pull the LCD directly away from the product to remove. Reinstall the LCD after wiring is completed.

### 2-Wire 4-20 mA Current Output

**CAUTION** DO NOT EXCEED SPECIFIED SUPPLY VOLTAGE RATINGS. PERMANENT DAMAGE NOT COVERED BY WARRANTY WILL RESULT. SIMULTANEOUS OUTPUTS ARE NOT DESIGNED FOR AC VOLTAGE OPERATION.

The connections to the transmitter are made through terminals VDC and COM on the terminal block as shown in Figure 1. The terminal block is removable and each of the terminals are labeled next to the terminal block on the circuit board. Polarity is indicated by VDC and COM. See Figure 1.

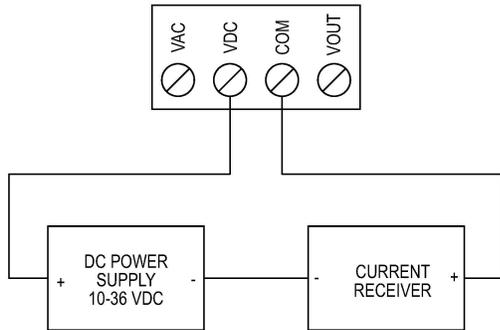


Figure 1

The maximum receiver load resistance ( $R_L$ ) for a given power supply voltage ( $V_{PS}$ ) is defined by the formula:

$$R_L = \frac{V_{PS} - 10.0}{20 \text{ mA DC}}$$

Shielded 2-wire cable is recommended for control loop wiring. Ground the shield at the power supply end only.

The receiver may be connected to 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.

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 lower 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, you can use a connecting lead wire as small as No. 22 ga.

### 3-Wire 0-10 V and 0-5 V Voltage Output

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

The terminal block is removable and each of the terminals are labeled next to the terminal block on the circuit board. Positive polarity is indicated by VOUT. AC/DC selection is made via the terminal block. If the polarity of the transmitter is inadvertently reversed, the unit will not function properly, but no damage will be done to the transmitter.

Selection of using a DC or AC power supply is made via the terminal block. See Figure 2 for DC Wiring. See Figure 3 for AC Wiring.

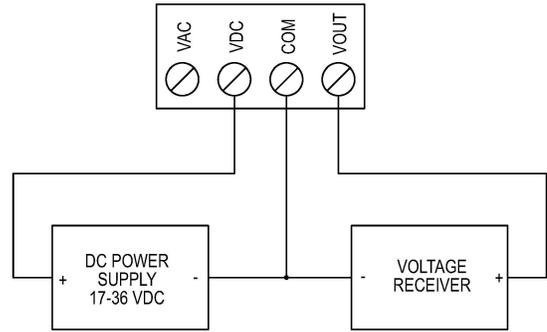


Figure 2: DC wiring

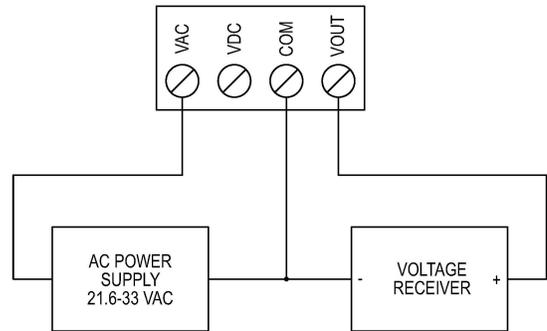


Figure 3: AC wiring

The minimum receiver load is 1 k $\Omega$ . The resistance due to the wire should be low compared to the receiver load resistance. While the voltage at the terminal block remains unchanged with a 10 mA current flow, resistive losses in the wiring do cause errors in the voltage delivered to the receiver. For a 1% accurate gage, the resistance of the wires should be less than 0.1% of the value of the receiver load resistance. This will keep the error caused by the current flow below 0.1%.

The output across VOUT and COM will be either 0-5 V, 0-10 V depending on the DIP switch setting. See **DIP Switch Settings Section** for more information.

## Simultaneous Current and Voltage Output

**CAUTION** DO NOT EXCEED SPECIFIED SUPPLY VOLTAGE RATINGS. PERMANENT DAMAGE NOT COVERED BY WARRANTY WILL RESULT. SIMULTANEOUS OUTPUTS ARE NOT DESIGNED FOR AC VOLTAGE OPERATION.

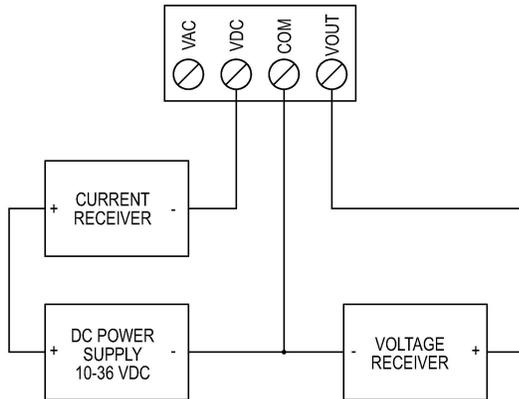


Figure 4: Simultaneous current and voltage output wiring

The terminal block is removable and each of the terminals is labeled underneath the terminal block on the circuit board. Positive polarity is indicated by VOUT. The VDC terminal and a DC power supply must be used for simultaneous current and voltage output. The voltage output and the power supply must have separate wire leads that are only joined at terminal 2 of the transmitter. Additional error may occur for the voltage output if a single wire is used or if the wires are joined at the power supply or receiver.

For the current output, the maximum allowable loop resistance (wiring + receiver resistance) is dependent on the power supply. The maximum loop voltage drop must not reduce the transmitter voltage below 17 V. The maximum loop resistance ( $R_{MAX}$ ) for a given power supply voltage ( $V_{PS}$ ) can be calculated using the following equation:

$$R_{MAX} = \frac{(V_{PS} - 17.0)}{20 \text{ mA DC}}$$

The equation uses 17.0 instead of 10.0 as seen in the equation earlier with Figure 1. This represents the minimum voltage supply which is higher on the simultaneous output configuration due to the requirements of the voltage outputs.

Shielded 4-wire cable is recommended for control loop wiring. Ground the shield at the power supply end only. Should the polarity of the transmitter or receiver be inadvertently reversed, the unit will not function properly, but no damage will be done to the transmitter.

For voltage outputs, the minimum receiver load is 1 k $\Omega$ . The resistance due to the wire should be low compared to the receiver load resistance. While the voltage at the terminal block remains unchanged with a 10 mA current flow, resistive losses in the wiring do cause errors in the voltage delivered to the receiver. For a 1% accurate gage, the resistance of the wires should be less than 0.1% of the value of the receiver load resistance. This will keep the error caused by the current flow below 0.1%.

The output across VOUT and COM will be either 0-5 V or 0-10 V depending on the DIP switch setting. See **DIP Switch Settings** Section for more information.

## Power Supply

Refer to the following tables for the required supply rating.

Current Output	
Supply Voltage	10-36 VDC
Loop Resistance	0-1250 $\Omega$

Voltage Output	
Supply Voltage	17-36 VDC
	21.6 to 33 VAC isolated
Minimum Output Load Resistance	1000 $\Omega$

## DIP SWITCH SETTINGS

DIP switch settings are marked directly on the PCBA as shown in Figure 5. Switches are factory-set, based on the order configuration. You can also use a small screwdriver or pen to change the position of the switches.

### NOTICE

Figure 5 is a depiction of a 5 in w.c. pressure board. Other pressure boards, while similar, will vary from the below.

### WARNING

There are no hazardous voltages if supplied power is within the specified range. However, it is a good idea to shut control systems down while changing DIP switches to prevent erratic control system behavior.

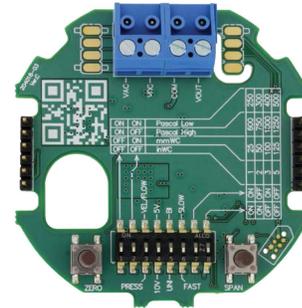


Figure 5: 5 in w.c. pressure board

## Key To DIP Switch Settings

Switches are numbered 1 to 8 beginning on the left.

### DIP Switches 1 and 2 - Unit of Measure Selection

DIP Switches 1 and 2 work as a pair to select the unit of measure.

PRESSURE UNIT SELECTION - DIP SWITCH 3 IS OFF (DOWN)		
DIP Switch 1	DIP Switch 2	Unit of Measure
ON	ON	Pa (low ranges)
ON	OFF	Pa (high ranges)
OFF	ON	mm w.c.
OFF	OFF	in w.c.

VELOCITY/FLOW UNIT SELECTION - DIP SWITCH 3 IS ON (UP)		
DIP Switch 1	DIP Switch 2	Unit of Measure
ON	ON	m <sup>3</sup> /hr (Flow)
ON	OFF	m/s (Velocity)
OFF	ON	CFM (Flow)
OFF	OFF	FPM (Velocity)

### DIP Switch 3 - Pressure vs Velocity/Flow Mode of Operation

DIP Switch 3 toggles between pressure output vs velocity or flow output.

- When the switch is in the OFF or down position, the device is in Pressure Mode.
- When the switch is in the ON or up position, the device is in Velocity/Flow Mode.

### DIP Switch 4 - Voltage Output Range

Voltage output range can be either 0-10 V or 0-5 V depending on the position of DIP Switch 4.

- When the switch is in the OFF or down position, the output will be 0-10 V.
- When the switch is in the ON or up position, the output will be 0-5 V.

### DIP Switch 5 - Unidirectional vs Bidirectional Output

DIP Switch 5 can be set to measure pressure in one direction (unidirectional) or in both directions (bidirectional).

- When the switch is in the OFF or down direction, the transmitter will be set for unidirectional and will be 0 based (i.e. 0 to 5 in w.c.).
- When the switch is in the ON or up position, the transmitter will be set for bidirectional and will be  $\pm$  the maximum of the selected range (i.e.  $\pm 5$  in w.c.).

### DIP Switch 6 - Response Time Selection

DIP Switch 6 toggles to select the desired response time.

- When the switch is in the OFF or down direction, the transmitter response time will be instantaneous.
- When the switch is in the ON or up direction, the response time will be 3 seconds.

### DIP Switches 7 and 8 - Maximum Range Selection (Pressure)

DIP switches 7 and 8 work as a pair to select the maximum range output of the transmitter. Use the tables below to navigate pressure range selection. Alternatively, if using the device for velocity and flow, proceed to the next section.

Range 0 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	Pa (set 1)	Pa (set 2)	mm w.c.	in w.c.
ON	ON	25	60	2.5	0.1
OFF	ON	30	75	5	0.15
ON	OFF	40	100	10	0.25
OFF	OFF	50	125	12	0.5

Range 1 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	Pa (set 1)	Pa (set 2)	mm w.c.	in w.c.
ON	ON	25	100	2.5	0.1
OFF	ON	40	150	5	0.25
ON	OFF	50	160	10	0.5
OFF	OFF	60	250	25	1

Range 2 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	Pa (set 1)	Pa (set 2)	mm w.c.	in w.c.
ON	ON	250	600	25	1
OFF	ON	300	750	50	2
ON	OFF	400	1000	100	3
OFF	OFF	500	1250	125	5

Range 3 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	Pa (set 1)	Pa (set 2)	mm w.c.	in w.c.
ON	ON	1000	3000	250	10
OFF	ON	1500	4000	350	15
ON	OFF	2000	5000	500	25
OFF	OFF	2500	7000	700	28

### DIP Switches 7 and 8 - Maximum Range Selection (Velocity/Flow)

DIP switches 7 and 8 work as a pair to select the maximum range output of the transmitter. Use the tables below to navigate velocity and flow range selection.

Range 0 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	m <sup>3</sup> /hr (Flow)	m/s (Velocity)	CFM (Flow)	FPM (Velocity)
ON	ON	1700	5	850	850
OFF	ON	2700	8	1250	1250
ON	OFF	3700	11	2000	2000
OFF	OFF	4800	14	2800	2800

Range 1 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	m <sup>3</sup> /hr (Flow)	m/s (Velocity)	CFM (Flow)	FPM (Velocity)
ON	ON	2500	7.5	1250	1250
OFF	ON	3300	10	2000	2000
ON	OFF	5200	15	2800	2800
OFF	OFF	6800	20	4000	4000

Range 2 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	m <sup>3</sup> /hr (Flow)	m/s (Velocity)	CFM (Flow)	FPM (Velocity)
ON	ON	6800	20	4000	4000
OFF	ON	8600	25	5600	5600
ON	OFF	11800	35	6900	6900
OFF	OFF	15200	45	8950	8950

Range 3 Pressure Range Selections					
DIP Switch 7	DIP Switch 8	m <sup>3</sup> /hr (Flow)	m/s (Velocity)	CFM (Flow)	FPM (Velocity)
ON	ON	18000	55	9000	9000
OFF	ON	23000	70	12000	12000
ON	OFF	30000	90	15000	15000
OFF	OFF	36000	107	20000	20000

### CALIBRATION

The transmitter security feature must be unlocked before calibration is accessible. See **Section Program Menu-Menu Access Security**. There is a 3 second delay from the time the zero or span calibration buttons are released until the time that the change in calibration takes place. This delay is used to prevent stress related offsets on the lower ranges.

#### Zero Calibration

The zero calibration can be set by applying zero pressure to both of the pressure ports and pressing the zero button for 3 seconds. If the LCD display is present, the display will read ZERO and then sequence back to the home display.

#### Span Calibration

##### NOTICE

For a positive span, apply pressure to the positive "+" port.

The span calibration function allows the pressure value to be adjusted so that the currently applied pressure is the maximum configured pressure. This will in turn set the maximum analog output at the set pressure. It is recommended that the ZERO function be applied before performing a span. Apply the maximum desired pressure to the device, press and hold span for 3 seconds. If the LCD display is present, SPAN is displayed. The span function will be processed 3 seconds after the span button is released.

## LCD DISPLAY

The LCD comes with a housing cover, which contains a window. The display plugs into the pins on top of the circuit board. The LCD is 180° rotatable so that it will read properly if the device must be mounted with the connections facing up.

The following error messages will appear if an LCD is present and the device is in an error state.

LCD Error Messages	
Error Code	Message
OVER	The applied pressure is 3% greater than the selected output high value causing an Over Range Error.
UNDR	The applied pressure is 1% less than the selected output low value causing an Under Range Error.
FAIL	When the span button is pressed, the pressure value is out of the range to allow a correct setting.
ER 1	The pressure applied to the sensor is beyond its ability to read.
ER 2	The pressure sensor is communicating but reporting an internal error.
ER 3	The pressure sensor is not communicating.
ER 4	The stored user settings are invalid.
ER 5	The stored factory settings are invalid.
ER 6	Non-volatile user memory has failed.
ER 7	Non-volatile factory memory has failed.

## PROGRAM MENU

### Home Menu

During normal operation, the display will be in the Home Menu and will display the current measured pressure and the engineering units.

### Menu Access Security

By default, a PIN code is not required to enter the configuration menus. However, if access to the menus needs to be restricted, follow the steps below.

1. While in the Home Menu, press and hold the Zero and Span buttons until "PIN" is displayed.
2. Press and hold the Zero and Span buttons until the current PIN setting is displayed (default is 0000).
3. Use the Zero button to increment the selected digit (denoted by the caron ◌̂) or press the Span button to select the next digit to the right.
4. Any value between 0001 and 9999 will result in the requirement to enter the PIN each time the menu is entered. The value 0000 will disable the PIN entry requirement.
5. Press and hold the Span button until the next menu is displayed. PIN security set up is now complete.

## MAINTENANCE/REPAIR

Upon final installation of the Series MSX, no routine maintenance is required. The Series MSX is not field serviceable and should be returned if repair is needed. Field repair should not be attempted and may void warranty.



This symbol indicates waste electrical products should not be disposed of with household waste. Please recycle where facilities exist. Check with your Local Authority or retailer for recycling advice.

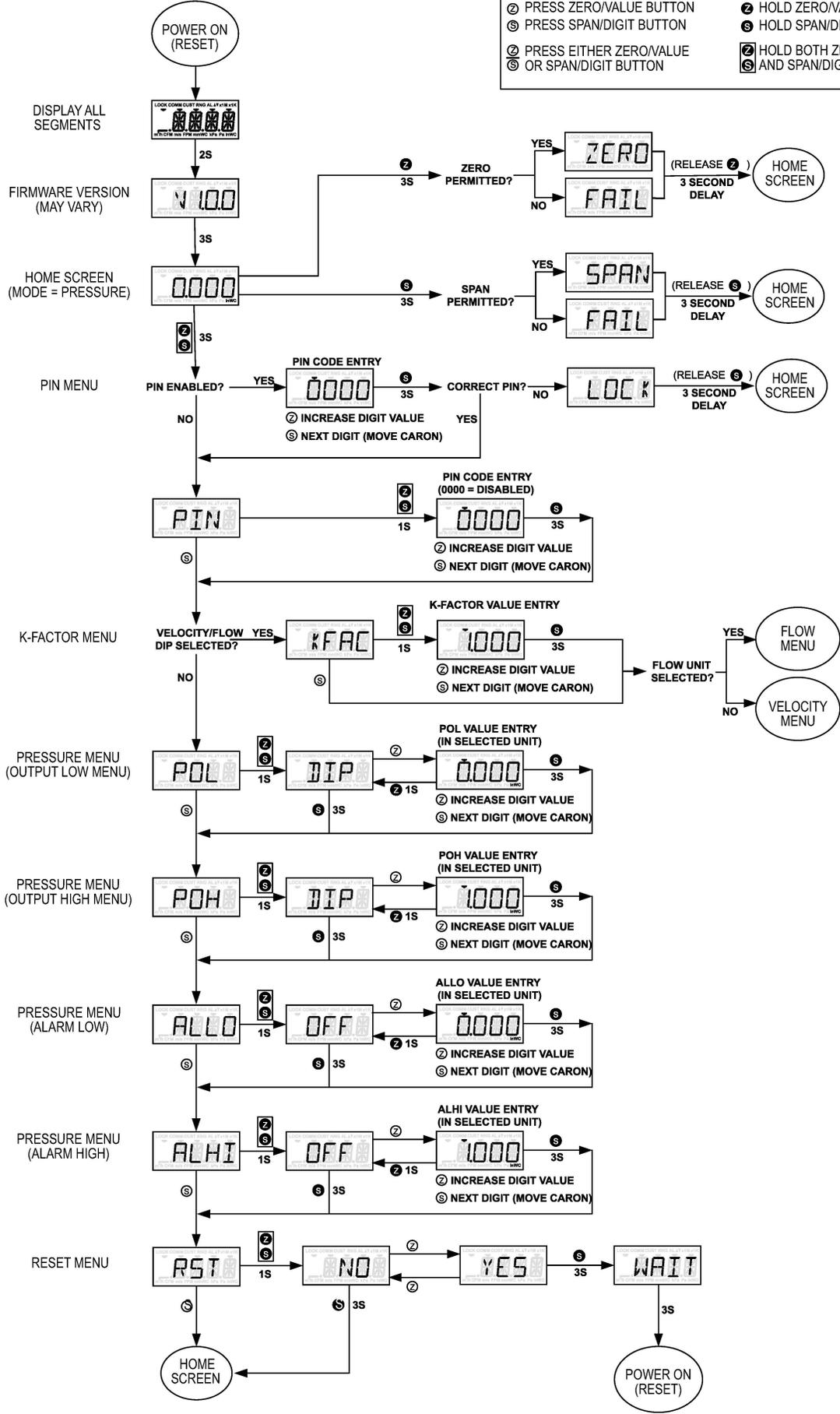
## WARRANTY/RETURN

Refer to "Terms and Conditions of Sale" in our catalog and on our website. Contact customer service to receive a Return Materials Authorization (RMA) number before shipping the product back for repair. Be sure to include a brief description of the problem plus any additional application notes.

**MSX MAIN UI AND PRESSURE FLOWCHART**

**MENU LEGEND**

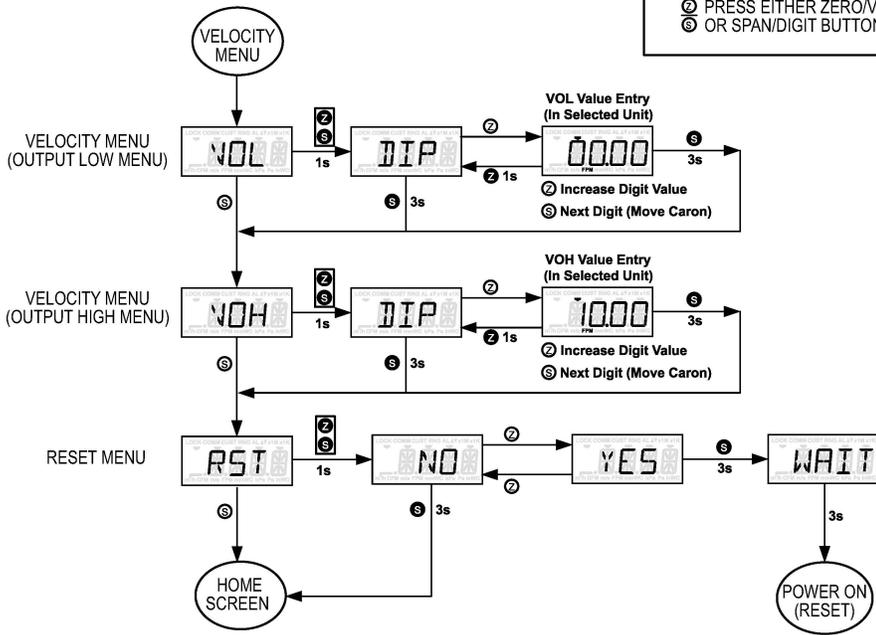
- ⓪ PRESS ZERO/VALUE BUTTON
- Ⓛ PRESS SPAN/DIGIT BUTTON
- Ⓜ PRESS EITHER ZERO/VALUE OR SPAN/DIGIT BUTTON
- Ⓝ HOLD ZERO/VALUE BUTTON
- Ⓞ HOLD SPAN/DIGIT BUTTON
- Ⓟ HOLD BOTH ZERO/VALUE AND SPAN/DIGIT BUTTON



**MSX VELOCITY SETTINGS FLOWCHART**

**MENU LEGEND**

- ⓪ PRESS ZERO/VALUE BUTTON      Ⓜ HOLD ZERO/VALUE BUTTON
- Ⓛ PRESS SPAN/DIGIT BUTTON      Ⓨ HOLD SPAN/DIGIT BUTTON
- Ⓛ OR SPAN/DIGIT BUTTON      ⓂⓎ HOLD BOTH ZERO/VALUE AND SPAN/DIGIT BUTTON



**MSX FLOW SETTINGS FLOWCHART**

