

Installation, Operation, and Maintenance Manual

MASS-tron II

**Microprocessor Based
Mass Flow "Smart" Transmitter**

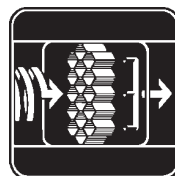
Version 5.3X

Installation, Operation & Maintenance

**Air Monitor Corporation provides complete
technical support between the hours of
7 a.m. and 5 p.m. PST, M-F**

**Contact our Service Department
Toll Free: 1-800-AIRFLOW**

or fax us at 1-707-526-2825



**AIR MONITOR
CORPORATION**

TABLE OF CONTENTS

INSTRUMENT WARRANTY i

SECTION 1 – GENERAL INFORMATION

1.1 DESCRIPTION 1
 1.2 THEORY OF OPERATION 1

SECTION 2 – PERFORMANCE SPECIFICATIONS

2.1 TRANSMITTER 2
 2.2 INDICATION 2
 2.3 INPUTS/OUTPUTS 2
 2.4 POWER 2

SECTION 3 – FEATURES

3.1 OPERATOR SETUP MENU 3
 3.2 AIR DENSITY CORRECTION 3
 3.3 TRANSMITTER HOLD 3
 3.4 AUTOMATIC ZEROING 3
 3.5 AUTO-purge MANAGEMENT (option) 3
 3.6 ALARM (option) 4
 3.7 SPECIAL FUNCTIONS (option) 4
 3.8 DATA DISPLAY 5
 3.9 K-FACTOR 5
 3.10 FLOW/DIFFERENTIAL PRESSURE CALCULATOR 5
 3.11 NETWORK 5
 3.12 MULTIPLE OPERATING POWER SELECTIONS 5
 3.13 ENCLOSURE 5

SECTION 4 – INSTALLATION

4.1 RECEIVING AND INSPECTION 6
 4.2 LOCATION 6
 4.3 MOUNTING 6
 4.4 PROCESS CONNECTIONS 7
 4.5 POWER/SIGNAL CONNECTIONS 8-10
 4.6 INPUT/OUTPUT SELECTION 11
 4.7 DISPLAY CONTRAST ADJUSTMENT 11

SECTION 5 – OPERATION

5.1 INTRODUCTION 12
 5.2 START-UP 12
 5.3 NORMAL OPERATION 13
 5.4 CONFIGURATION 14
 5.5 PUSHBUTTON DEFINITION 15
 5.6 CONFIGURATION PROGRAMMING 16-18
 5.7 OPERATOR PASSWORD SELECTION 19
 5.8 TRANSMITTER SCALING & CONFIGURATION 20-31

TABLE OF CONTENTS

SECTION 5 – OPERATION (con't)

5.9 LOW PASS FILTER SELECTION 32

5.10 AUTO-zero CONFIGURATION 33

5.11 AUTO-purge CONFIGURATION 34

5.12 AUTO-calibration CONFIGURATION 34

5.13 ALARM CONFIGURATION 35-36

5.14 CONTROLLER CONFIGURATION 36

5.15 SPECIAL FUNCTION CONFIGURATION 37-38

5.16 K-FACTOR CONFIGURATION 39-40

5.17 ENHANCED DISPLAY CONFIGURATION 41-45

5.18 ANALOG OUTPUT CONFIGURATION 46

5.19 TRANSMITTER SPAN SELECTION 47

5.20 TRANSMITTER INPUT CALIBRATION 47

5.21 TRANSMITTER OUTPUT CALIBRATION 48

5.22 POWER SUPPLY CALIBRATION 48

5.23 TRANSDUCER CHARACTERIZATION SELECTION 49

5.24 NETWORK CONFIGURATION 50

5.25 MENU INACTIVITY TIMEOUT SELECTION 51

SECTION 6 – CALIBRATION

6.1 REQUIRED EQUIPMENT 52

6.2 PREPARATION 52

6.3 TRANSMITTER INPUT CALIBRATION 53-58

6.4 TRANSMITTER OUTPUT CALIBRATION 59-60

SECTION 7 – MAINTENANCE 61

SECTION 8 – TROUBLESHOOTING 62-63

SECTION 9 – PARTS LIST 64-65

SECTION 10 – CUSTOMER SERVICE 66

APPENDIX A 67-70

- BACnet over RS485 – Signal Wire Connections and Network Configuration
- LonWorks – Signal Wire Connections and Network Configuration
- Modbus over TCP – Signal Wire Connections and Network Configuration

INSTRUMENT WARRANTY

Air Monitor Corporation (hereinafter referred to as "Seller") warrants that at the time of shipment, products sold pursuant to this contract will be free from defects in materials and workmanship, and will conform to the specifications furnished or approved in writing by Seller. No warranty is given that delivered products will conform to catalog sheets, data sheets, and the like, which are subject to change without notice.

product which has been repaired or altered by persons not expressly approved by Seller. Nor does Seller warrant equipment against normal deterioration due to environment; nor items such as lamps, glass, and similar items subject to wear or burnout through usage. Adjustments for items or equipment not manufactured by Seller shall be made to the extent of any warranty of the manufacturer or supplier thereof.

Seller will repair or replace, at its option, any products listed under this warranty which is returned freight prepaid to Seller within the earlier of three (3) years after start-up or thirty-nine (39) months after shipment that, upon test and examination, proves defective within the terms of this warranty. The warranty period for any item repaired or replaced shall be for the time remaining on the warranty period of the original components. Purchaser shall notify Seller in writing of such defect within sixty (60) days of discovery of the defect.

Seller shall not be liable for any special or consequential damages or for loss of damage, directly or indirectly arising from the use of the products. Seller's warranty shall be limited to replacement of defective equipment and shall not include field removal and installation expenses.

This warranty does not extend to any product sold by Seller which has been the subject of misuse, neglect, accident, damage or malfunction caused by interconnection with equipment manufactured by others, improper installation or storage, or used in violation of instructions furnished by Seller, nor does it extend to any

The warranty set forth above is in lieu of all other warranties either express or implied and constitutes the full extent of Air Monitor Corporation's liability to the customer, or any other party for breach of warranty.

THERE ARE NO EXPRESS WARRANTIES EXCEPT AS SET FORTH HEREIN AND THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY OF FITNESS FOR ANY PARTICULAR PURPOSE, WHICH ARE PARTICULARLY DISCLAIMED.

NOTICE OF PROPRIETARY RIGHTS

This document contains confidential technical data, including trade secrets and proprietary information which are the sole property of Air Monitor Corporation. The use of said data is solely limited to use as specified herein. Any other use is strictly prohibited without the prior written consent of Air Monitor Corporation.

1 – GENERAL INFORMATION

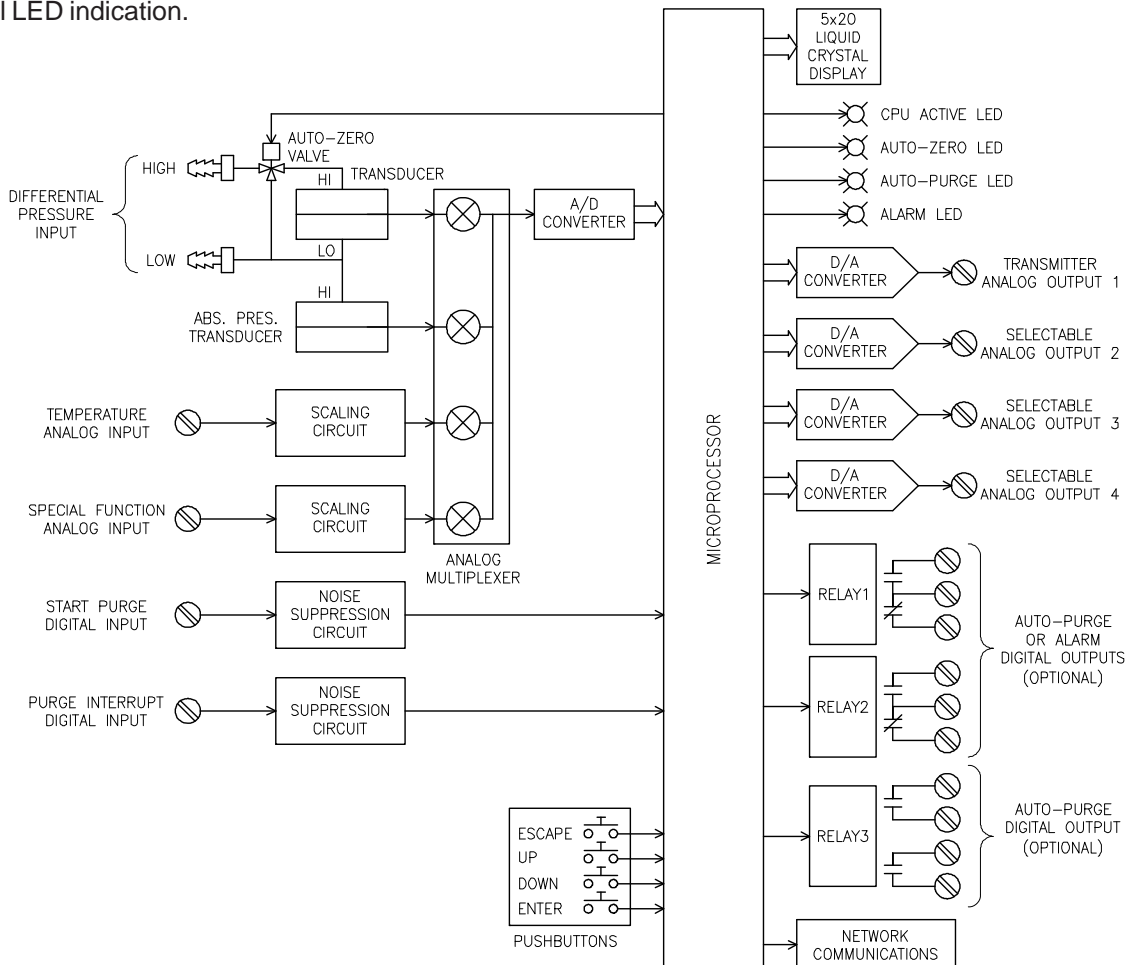
1.1 – DESCRIPTION

The MASS-tron II is an ultra-low differential pressure "smart" mass flow transmitter designed to convert the low magnitude pressure signals generated by airflow stations or probes, plus process temperature and static pressure inputs into multiple transmitter output signals (4-20mA, 0-5VDC or 0-10VDC) linear to mass flow, temperature, and/or pressure.

Each MASS-tron II is equipped with numerous standard features: A multi-line LCD used during configuration/calibration and for display of process; AUTO-zero for elimination of transmitter zero error; user selectable primary signal noise filter, input power isolation; capability of 10:1 flow or 100:1 pressure turndown; NEMA 1 enclosure; and a long list of construction options.

1.2 – THEORY OF OPERATION

High and low pressure signals generated by airflow stations or probes act upon opposite sides of a flexible diaphragm within the transducer. The differential between the two pressure signals displaces the diaphragm; the magnitude of the displacement being measured creates an electrical DC output from the transducer. Additional analog signals of process temperature (via external temperature input) and process static pressure (via internal absolute pressure transmitter) are made available. After being multiplexed and undergoing A/D conversion, the resulting digital signals representing process velocity pressure, temperature and static pressure can be manipulated within the microprocessor: square rooted; density compensated for air temperature and air pressure correction; scaled for units of measure and area for process outputs; filtered and scaled for local data display and utilized in performing a Special Function (see Section 3 – Features). The built-in microprocessor runs the program that provides the following basic functions: Timing, logic, mathematical operations, analog input signal multiplexing, analog input/output calibration, digital input (contact closure) detection, output relay operation, automatic zeroing valve operation, Operator Setup menu system, display (LCD) indication, and individual LED indication.



2 – PERFORMANCE SPECIFICATIONS

2.1 – TRANSMITTER

Ranges.	<u>Natural Full Span</u>	
	0 to 25.00 IN w.c.	0 to 0.50 IN w.c.
	0 to 10.00 IN w.c.	0 to 0.25 IN w.c.
	0 to 5.00 IN w.c.	0 to 0.10 IN w.c.
	0 to 2.00 IN w.c.	0 to 0.05 IN w.c.
	0 to 1.00 IN w.c.	

Span Rangeability. The calibrated span can be down ranged to 40% of the Natural Span.

Accuracy. ±0.1% of Natural Span, including non-linearity, hysteresis, and non-repeatability.

Stability. ±0.5% of Natural Span for six months.

Transducer Response Time. 0.5 second to reach 98% of a step change.

Temperature Effect. Zero. None; corrected by AUTO-zero. Span. 0.015% of Full Span/°F.

Mounting Position Effect. None; corrected by AUTO-zero.

Span and Zero Adjustment. Digital, via internally located push-buttons.

Automatic Zeroing.
Accuracy. Within 0.1% of calibrated span.
Frequency. Every 1 to 24 hours selectable on 1 hour intervals.

Low Pass Filtration. Response time to reach 98% of a step change is adjustable from 2.0 to 256.0 seconds.

Overpressure and Static Pressure Limit. 25 psig.

Temperature Limits. -20 to 180°F Storage.
+40 to 140°F Operating.

Humidity Limits. 0-95% RH, non-condensing.

2.2 – INDICATION

Displays. Graphical backlit LCD provides up to five lines of data display.

LED's indicate CPU Activated, AUTO-zero in Progress, AUTO-zero over-ranged, AUTO-purge in Progress, and Auxiliary Alarm "On" status.

2.3 – INPUTS/OUTPUTS

Analog Inputs. Dual inputs are field configurable via jumper for 0-5VDC, 0-10VDC, or 4-20mADC. One is reserved for temperature input; the other for use with optional Special Function.

Analog Outputs. Four standard outputs are individually configurable via jumper for 0-5VDC, 0-10VDC, or 4-20mADC.

Digital Inputs. Dry contacts for AUTO-purge external start and purge interrupt.

Digital Outputs. Dry contacts for optional Alarm or AUTO-purge activation/acknowledgment. Contacts are rated for:

- Maximum 3 amps @ 24 to 120VAC
- Maximum 3 amps @ 24VDC
- Maximum 0.5 amp @ 48VDC

Temperature Compensation Selection. Push-button selection of linearized or non-linear input. Choice of thermocouple or 100 ohm platinum RTD temperature sensor type.

Type E	-50 to 1750°F	-50 to 950°C
Type T	-50 to 750°F	-50 to 400°C
Type J	-50 to 2000°F	-50 to 1090°C
Type K	-50 to 2000°F	-50 to 1090°C
RTD	-50 to 1500°F	-50 to 815°C

Pressure Compensation. Absolute pressure (atmospheric or duct static), up to 60 IN Hg.

Network Communication. Optional ModBus TCP/IP over Ethernet, BACnet or LonWorks.

2.4 – POWER

Power Supply. Standard 24VAC or 24VDC. Optional 120VAC via external transformer.

Power Consumption.

	Standard		w/AUTO-purge	
	In Rush	Contin	In Rush	Contin
24VAC	14.4VA	14VA	85VA	73VA
24VDC	9.6W	9.0W	37W	37W
120VAC	19.2VA	18.67VA	106VA	92VA

Circuit Protection. Power input is isolated, fused, and reverse polarity protected.

3 – FEATURES

3.1 – OPERATOR SETUP MENU

The microprocessor program contains a Operator Setup menu system for setting user selectable parameters. Four pushbuttons, **ESC**, **UP**, **DN**, **ENT**, allow the user access to the menu for setting configuration modes and values. Refer to the Configuration Programming (Section 5.6) instructions for operation details. Also contained in the Operator Setup menu is all input and output calibration. The calibration method is completely digital and contains no analog potentiometer adjustments which are susceptible to drift. Non-volatile memory is used for storing all setup parameters and calibration values, and will remain unchanged after set, even when power to the unit is off.

3.2 – AIR DENSITY CORRECTION

The MASS-tron II transmitter is capable of performing both process temperature and process static pressure correction. Temperature input is an analog signal from a remote temperature device; non-linear temperature inputs can be linearized by the microprocessor. Process static pressure is measured by means of an internal absolute pressure transmitter connected to the transmitter static pressure signal input.

3.3 – TRANSMITTER HOLD

Certain operations performed by the microprocessor place the unit into a *Hold* mode. This occurs when the Operator Setup menu system is activated, when an AUTO-zero is performed, or when an AUTO-purge cycle is in progress. When in *Hold*, all *Normal* mode processing is halted and outputs are held at their last value prior to *Hold*. *Normal* operation is indicated by the "CPU Activated" LED flashing at a rate of four times per second. A *Hold* mode is indicated by the "CPU Activated" LED flashing at a rate of one flash per second.

3.4 – AUTOMATIC ZEROING

At periodic intervals the microprocessor will automatically execute an AUTO-zero cycle consisting of the following sequence: The transmitter output and display signals are put on *Hold*; a valve is activated which disconnects the process high pressure from the high port of the transducer and connects the process static pressure to both sides of the transducer, creating a true zero differential pressure; after a brief stabilization period, the transducer zero offset signal is measured and stored in memory; the valve is deactivated and after a brief period for process signal stabilization, the *Hold* is released and *Normal* process measurement resumes. During *Normal* operation, the zero offset value stored in memory is subtracted from subsequent transducer readings until the next AUTO-zero cycle occurs and repeats the process. AUTO-zero On/Off and Interval are available and configurable using the Operator Setup menu.

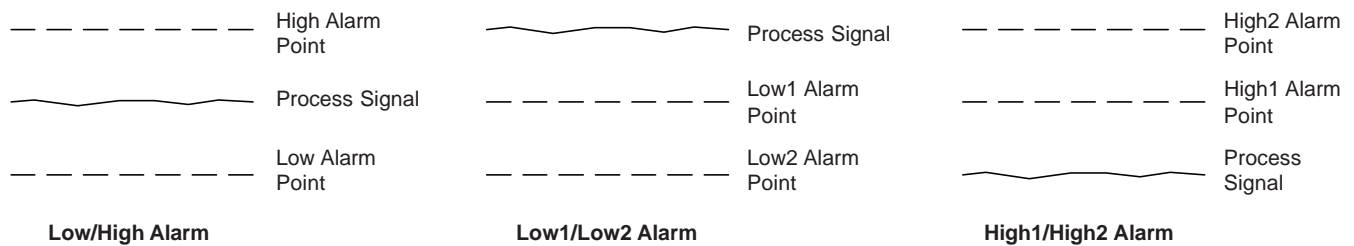
3.5 – AUTO-purge MANAGEMENT (option)

For "dirty process air" applications requiring the use of an Air Monitor AUTO-purge system, the MASS-tron II provides the capabilities of establishing purge frequency and duration, while also giving the user a choice of either internally timed cycle frequency or externally triggered purge initiation. During the purge cycle all transmitter outputs are maintained at their last value prior to the start of the purge cycle.

3.6 – ALARM (option)

The MASS-tron II Alarm Option provides the means for having the process signal compared to user selectable alarm points and automatically activates a Form C relay to generate dry contact alarm signal(s). Operator selectable alarm configurations of Low/High, Low1/Low2, and High1/High2 plus Alarms On/Off, Setpoints, Dead Bands, and Delays are configurable via the Operator Setup menu. Alarm Setpoints can be displayed on an Enhanced Display during *Normal* operating mode.

One choice among three alarm types are available to the user: Low/High; Low1/Low2; or High1/High2. An Alarm Delay is available, if implemented (any time setting greater than zero), any condition that would normally cause an alarm, triggers the delay timer first. If the alarm condition still exists after the delay times out, then the appropriate alarm relay(s) are activated. The "Auxiliary Alarm On" LED will light whenever any alarm relay is activated. Alarm On/Off, Type, Setpoints, Deadbands, and Delays are available and configurable using the Operator Setup menu. The Alarm Setpoints can be displayed during *Normal* operation.



3.7 – SPECIAL FUNCTIONS (option)

When used in conjunction with an external input (second transmitter) applied to the special function input terminals, the MASS-tron II can perform one of the Special Functions listed below. Within the Operator Setup menu, both the external input and the internal transmitter signals can be individually scaled to achieve a correct weighted basis. The resulting Special Function output is available as an analog output and/or for the display. When % Deviation is selected as Special Function Type, contact closure is available for alarm/notification. Special Function ON/OFF and Type are available and configurable using the Operator Setup menu.

%Deviation. | EXTERNAL – INTERNAL | / | EXTERNAL |. This function has Alarm Setpoint, Deadband, and Delay that are configurable via the Operator Setup menu. (If this function is selected, Alarm Option, Section 3.6, is not available.)

Summed Flow. INTERNAL + EXTERNAL

Averaged Flow. (EXTERNAL + INTERNAL) / 2

Delta Flow, Internal - External. INTERNAL – EXTERNAL

Delta Flow, External - Internal. EXTERNAL – INTERNAL

Low Select. Selecting the lesser of the INTERNAL and EXTERNAL signals.

High Select. Selecting the greater of the INTERNAL and EXTERNAL signals.

3.8 – DATA DISPLAY

The integral display is a graphical backlit LCD. It is capable of displaying the transmitter flow, process temperature and static pressure signals in Engineering units, plus other signals that become available when the Alarm and/or Special Function options described in Sections 3.6 and 3.7 are implemented. It can also display a user settable I.D. number using any combination of standard ASCII characters. It is also used by the User Setup menu for displaying the menu parameters and values. Configuring the enhanced display for *Normal* operation is done using the User Setup menu.

3.9 – K-FACTOR

The MASS-tron II is equipped with a K-factor feature which allows for the introduction of a bias and/or gain factor into the transmitter's flow calculations. The K-factor feature is intended to be used in two types of applications:

1. To adjust for flow measurement error as a result of highly distorted airflow induced by upstream or downstream flow disturbances.
2. To adjust the transmitter's output to bring it into close correlation with field measured flow data.

The K-Factor gain and bias values can be entered directly or the MASS-tron II can calculate these values based on measured and reference values from a 1 or 3 point airflow traverse.

3.10 – FLOW/DIFFERENTIAL PRESSURE CALCULATOR

The MASS-tron II is equipped with an integral calculator feature that allows the user to determine the maximum flow or differential pressure from the appropriate variables. This feature allows the user to determine input or output values at various points of the process or new values if the process parameters have changed. Also, the calculator can be used to implement a single-point density compensation for operating temperature and/or absolute pressure.

3.11 – NETWORK (option)

The MASS-tron II can be provided with optional ModBus TCP/IP over Ethernet, BACnet or LonWorks for serial data communication.

3.12 – MULTIPLE OPERATING POWER SELECTIONS

The MASS-tron II can be powered by 24VAC or 24VDC.

3.13 – ENCLOSURE

The MASS-tron II transmitter is furnished in a NEMA 1 aluminum enclosure with external, unitary plug in terminal strips for ease of installation and removal. An optional conduit connection box is available for applications requiring enclosed field wiring.

4 – INSTALLATION

4.1 – RECEIVING AND INSPECTION

- Carefully remove the MASS-tron II from the shipping container taking ESD (electrostatic discharge) precautions.
- Inspect unit for any damage. If damaged, contact freight company.
- Review the Factory Setup Information Sheet provided with the unit and verify the W.O. # and Serial # match those on the unit. Verify that the configuration recorded on the Factory Set-Up Information Sheet is correct for your application. If not, contact Air Monitor's Customer Service Department at 1-800-AIRFLOW for further guidance.

Note: The MASS-tron II has been configured and calibrated to customer specified parameters (see "Factory Set-Up Information Sheet" provided with the unit), and requires no additional calibration/verification prior to installation.

4.2 – LOCATION

- The MASS-tron II is housed in a NEMA 1 enclosure which provides some degree of protection which is sufficient for most clean indoor locations.
- Where additional protection is deemed necessary, the MASS-tron II should be mounted in an enclosure with adequate NEMA rating.
- The ambient temperature of the selected mounting location must be between 40° – 140°F. Consideration should be given to units installed in enclosures exposed to direct sunlight.
- The selected mounting location should be rigid and free of vibration.

4.3 – MOUNTING

Tools Required: Electric Drill; #25 (0.1495") or #26 (0.1470") Drill Bit; Screwdriver or Nutdriver; Four #8 - 32 Self-Tapping Machine Screws

- The MASS-tron II can be mounted in any position provided it is secured using all four mounting slots.
- Reasonable consideration should be given to clearances for pressure and electrical connections.
- Once a suitable location is found, mark the centers of the four mounting slots and drill four pilot holes. With the unit in position, install the four #8 - 32 screws.

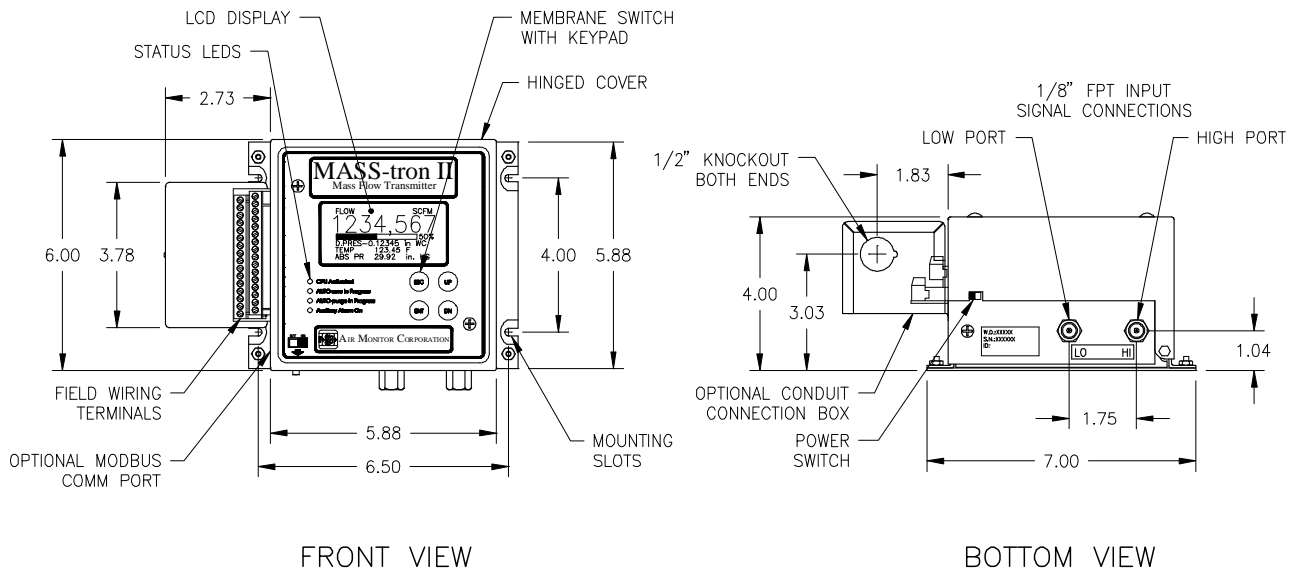


Figure 4.1

4.4 – PROCESS CONNECTIONS

The MASS-tron II comes standard with brass 1/8" FPT connections (or special fittings if ordered). To these connections the customer can install fittings required for the type of tube/pipe used to connect to process sensor (i.e. flow station, flow probe, static pressure sensors).

When connecting the MASS-tron II to an airflow measuring device, connections must be completed as follows:

- High Port on MASS-tron II connects to Total Pressure from airflow measuring device.
- Low Port on MASS-tron II connects to Static Pressure from airflow measuring devices.

CAUTION

- Selected fittings should be compatible with the brass 1/8" FPT bulkhead connection, and installed using an appropriate thread lubricant/sealant.
- When signal fittings are added or removed, use a 9/16 wrench to prevent the 1/8" FPT bulkhead fitting from turning.
- It is extremely important that no pressure be present in signal tubing at the time of installation, and the orientation of high and low pressure signal lines is maintained between the source and the MASS-tron II.

If process being measured contains humidity or moisture, it is recommended a drip leg with drain on each tube/pipe be installed to preclude the migration of water into the MASS-tron II. See Figure 4.2. for typical drip leg installation.

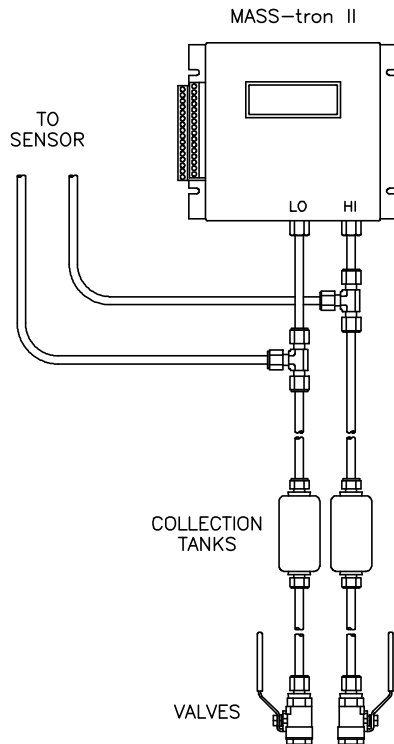


Figure 4.2

CAUTION

Migration of water into the MASS-tron II will void warranty.

4.5 – POWER/SIGNAL CONNECTIONS

All power and signal wiring is done at the terminal strip at the left side of the MASS-tron II. Figure 4.3 below represents the terminal strip and the connections for power input and the various inputs/outputs available (review Factory Set-Up Information Sheet provided separately for which inputs/outputs are included with your unit).

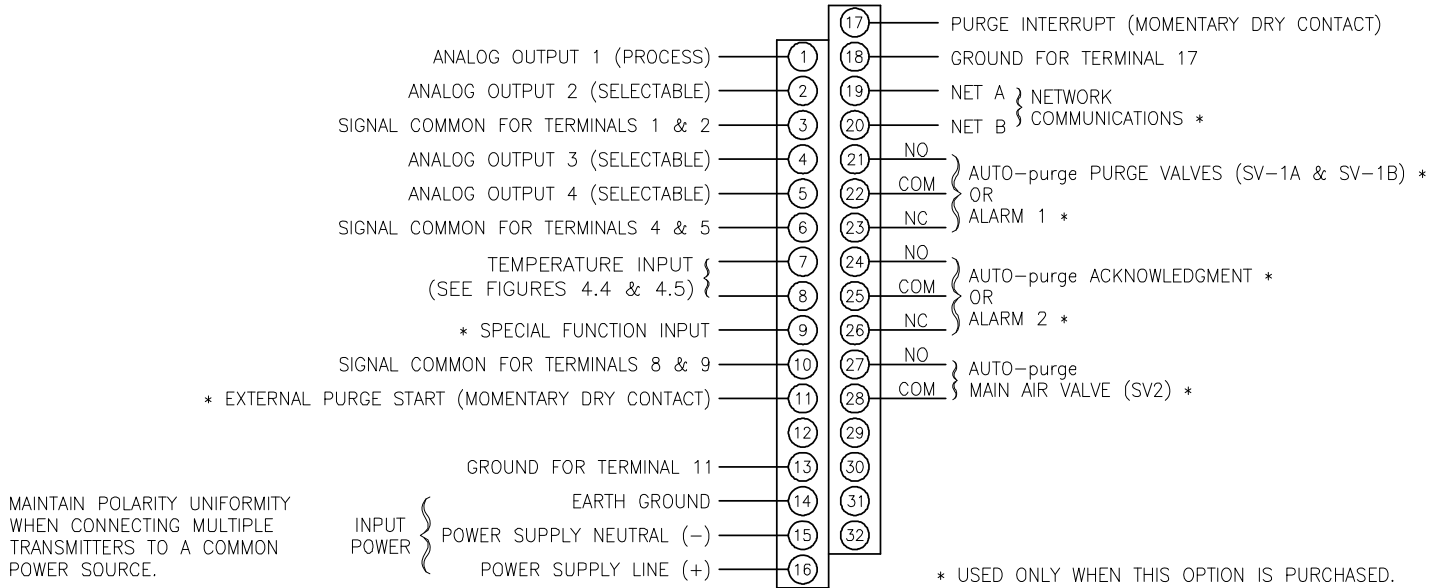


Figure 4.3

CAUTION

When connecting or disconnecting any wiring to the MASS-tron II, the unit's power switch (see Figure 4.1) must be in the OFF position.

WIRING.

It is recommended that any power wiring be 14 awg to 18 awg, and any signal wiring should be 14 awg to 22 awg. 14 awg is the maximum wire gauge that the terminal strip can accommodate.

No more than two wires should be connected to any one terminal. 18 awg is the maximum gauge wire that can be doubled up in one terminal.

To facilitate wiring and any future removal of the MASS-tron II, each terminal strip is removable from the unit. Remove terminal strip marked 1-16 first by pulling sideways, away from the unit. A flat blade screwdriver can also be used to gently pry strip free. Once the strip is removed, the second strip marked 17-32 can be similarly removed.

If the unit was furnished with optional conduit connection box, loosen screw, and remove cover to gain access to the terminal strip.

4.5 – POWER/SIGNAL CONNECTIONS (con't)

Analog Output 1 and 2 (Terminals 1, 2, and 3). These outputs are sourced (powered) by the MASS-tron II (refer to Section 4.6 for selection).

- 4-20mADC: Maximum load resistance is 750 ohms.
- 0-10VDC: Minimum load resistance is 5000 ohms.
- 0-5VDC: Minimum load resistance is 2500 ohms.

Review Factory Set-Up Information Sheet for your signal type.

Analog Output 3 and 4 (Terminals 4, 5, and 6). These outputs are sourced (powered) by the MASS-tron II (refer to Section 4.6 for selection).

- 4-20mADC: Maximum load resistance is 750 ohms.
- 0-10VDC: Minimum load resistance is 5000 ohms.
- 0-5VDC: Minimum load resistance is 2500 ohms.

Review Factory Set-Up Information Sheet for your signal type.

Network Communications (Terminals 18, 19, and 20).

	Terminal 18	Terminal 19	Terminal 20
BACnet	Network ground	Net A or Net+	Net B or Net-
LonWorks	Network ground	LonWorks A	LonWorks B
Modbus TCP/IP	Connection is made via Ethernet cable port (see Figure 4.1) below terminal strip		

Temperature Input (Terminals 7, 8, and 10). Follow the appropriate figure below for connecting a temperature input signal.

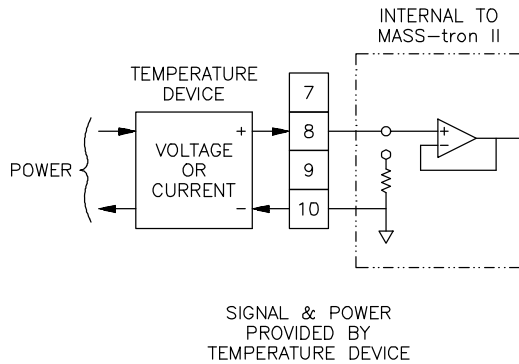


Figure 4.4

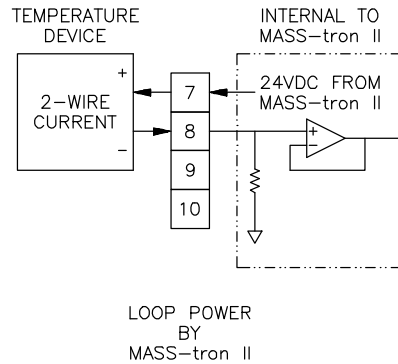


Figure 4.5

Special Function Input (Terminals 9 and 10). Input is required to be sourced (powered) from the customer. Input can be 4-20mA, 0-5V, or 0-10V (refer to Section 4.6 for selection).

External Purge Start (Terminals 11 and 13). Customer to provide momentary (0.5 to 10 second unpowered) dry contact to initiate purge cycle.

Purge Interrupt (Terminals 17 and 18). Customer to provide momentary (0.5 to 10 seconds unpowered) dry contact to interrupt a purge cycle in progress.

4.5 – POWER/SIGNAL CONNECTIONS (con't)

AUTO-purge Purge Valves (SV-1A & SV-1B) or Alarm 1 (Terminals 21, 22, and 23).

- For AUTO-purge Option. Customer to connect terminals 21 and 22 to AUTO-purge panel (terminal 23 not used). Contacts close upon AUTO-purge cycle initiation, remain closed through the programmed Purge Duration, and open at the start of the After Purge Duration (see Section 5.11).
- For Alarm Option. Customer to connect according to desired alarm logic. Figure 4.3 indicates de-energized (alarm off) state.

Note: Contacts can be dry (un-powered) or internally powered with 24V ac/dc through the selection of jumpers J19 & J20 (see Figure 4.6). Power (ac or dc) is the same provided at terminals 15 & 16.

- For Purge option, unit is supplied with contacts powered.
- For Alarm option, unit is supplied with contacts un-powered.

AUTO-purge Acknowledgment or Alarm 2 (Terminals 24, 25, and 26).

- For AUTO-purge Option. Acknowledgment contact for customer use. Contacts close upon AUTO-purge cycle initiation, remain closed through the entire purge cycle (see Section 5.11).
- For Alarm Option. Customer to connect according to desired alarm logic. Figure 4.3 indicates de-energized (alarm off) state.

Note: Contacts can be dry (un-powered) or internally powered with 24V ac/dc through the selection of jumpers J21 & J22 (see Figure 4.6). Power (ac or dc) is the same provided at terminals 15 & 16.

- For Purge option, unit is supplied with contacts un-powered.
- For Alarm option, unit is supplied with contacts un-powered.

AUTO-purge Main Air Valve (SV-2)(Terminals 27 and 28).

- For AUTO-purge Option. Customer to connect Terminals 27 & 28 to AUTO-purge Panel.

Note: Contacts can be dry (un-powered) or internally powered with 24V ac/dc through the selection of jumpers J23 & J24 (see Figure 4.6). Power (ac or dc) is the same provided at Terminals 15 & 16.

- For Purge option, unit is supplied with contacts powered.

Figure 4.6 depicts location of Jumpers J19 through J24, on the left side of the I/O board (CPU board will need to be removed to gain access).

Jumper should be positioned on the 2 pins that correspond to desired option:
 INT – Powered
 EXT – Un-powered

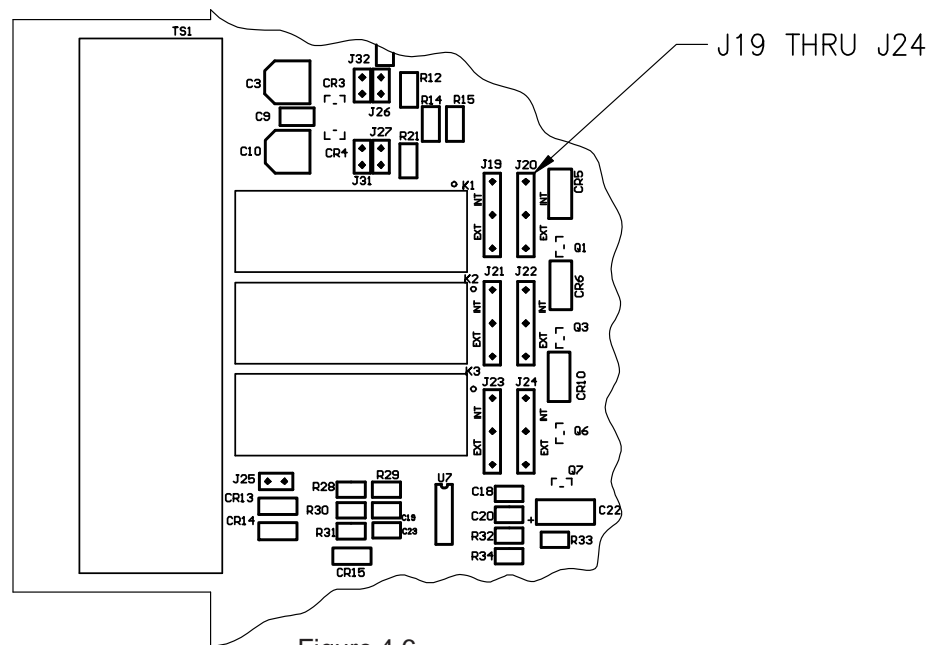


Figure 4.6

4.6 – INPUT/OUTPUT SELECTION

Selections of input and output signal types are made on the Jumper section of the I/O board, see Figure 5.1. Remove top cover to gain access to the Jumper board. Figure 4.7 depicts the Jumper board and the pins associated with specific input and output signal types.

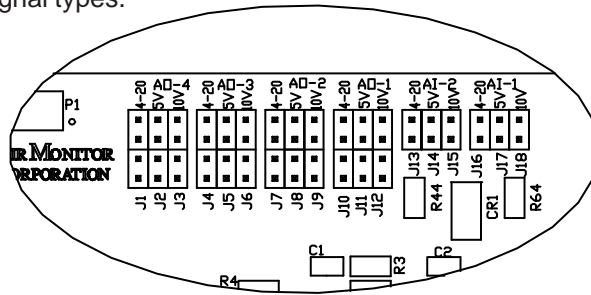


Figure 4.7

Table 4.1 lists the identifier for each row of pins to be jumpered for a specific input or output signal type.

	SIGNAL TYPE		
	4-20mADC	0 to 5 Volts	0 to 10 Volts
Analog Output (AO-1) (Transmitter)	J10	J11	J12
Analog Output (AO-2) (Transmitter)	J7	J8	J9
Analog Output (AO-3) (Optional)	J4	J5	J6
Analog Output (AO-4) (Optional)	J1	J2	J3
Analog Input (AI-1) (Not used)	J16	J17	J18
Analog Input (AI-2) (Special Function Input)	J13	J14	J15

Table 4.1

The necessary jumpers have been installed at the Factory for customer specified inputs and outputs (see Factory Set-Up Information Sheet). The availability of inputs and outputs depends on options purchased.

To change the signal type of an available input or output, remove all jumpers from the present signal type pins and install them on the desired signal type pins.

Inputs have a single jumper covering two pins, and outputs have two jumpers covering four pins.

4.7 – DISPLAY CONTRAST ADJUSTMENT

To compensate for different ambient lighting conditions and viewing angles, the MASS-tron II display's contrast can be adjusted for optimum visibility.

Contrast is adjusted using potentiometer R1 on CPU board (see Figure 5.1). To gain access to R1:

- Remove the two 10-32 screws on front cover and pull the cover straight and to the right.
- Turn R1 clockwise to increase contrast (darken characters relative to background) and counterclockwise to decrease contrast.

5 – OPERATION

5.1 – INTRODUCTION

The MASS-tron II has been configured and calibrated at the Factory to customer specified parameters which are recorded on the MASS-tron II Factory Set-Up Information Sheet, included with the unit. Review this information and verify that the MASS-tron II setup is correct for your applications. If any problems or discrepancies are detected, contact Air Monitor's Customer Service Department at 1-800-AIRFLOW prior to proceeding.

5.2 – START-UP

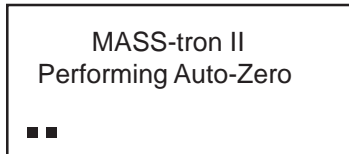
1. After Installation has been verified in accordance with Section 4, turn power switch located at the lower front side to the ON position (see Figure 4.1).

2. Display will briefly indicate:



with the ■ progressing from left to right.

Followed by:



with the ■ progressing from left to right.

for approximately 10 seconds, and then return to *Normal* display mode, and green LED indicating "CPU Activated" will flash rapidly (4 times per second). This is *Normal* operation mode and no further user interface is required. If, however, user would like to verify configuration or change user selectable parameters, continue to Section 5.4 entitled "CONFIGURATION".

5.3 – NORMAL OPERATION

Under *Normal* operation the MASS-tron II's display will continuously indicate current process variables or other selected parameters.

AUTO-zero

At periodical intervals* (see Factory Set-Up Information Sheet) the AUTO-zero cycle will be initiated. When this occurs, the display will be frozen and all outputs will remain constant. During this cycle the "AUTO-zero in Progress" LED will be lit.

This cycle will not occur if AUTO-zero has been turned OFF in configuration programming (see Section 5.10).

The AUTO-zero cycle can be manually activated by user (if ON in configuration programming) by simultaneously pressing **ESC** and **UP**, then scrolling until Perform Auto-Zero is displayed, then press **ENT**.

If "AUTO-zero In Progress" LED remains on continuously or flashes rapidly, refer to Section 8 - Troubleshooting for required action.

AUTO-purge

If the AUTO-purge option has been installed at the factory (see Factory Set-Up Information Sheet), it will activate at periodic intervals*. When activated, display will be frozen and all outputs will remain constant. During this cycle, the "AUTO-purge In Progress" LED will remain lit. Length of cycle depends on purge duration and after-purge duration (see Factory Set-Up Information Sheet).

This cycle will not occur if AUTO-purge has been turned OFF in configuration programming (see Section 5.11).

The AUTO-purge cycle can be manually activated by user (if ON in configuration programming) by simultaneously pressing **ESC** and **DN**, then scrolling until Perform Auto-Purge is displayed, then press **ENT**.

Alarms

Alarms are available with either the Alarm Option or % Deviation (Alarm 1 only) in the Special Function Option, but not both.

If either option has been installed at the factory (see Factory Set-Up Information Sheet) and process conditions exist to activate the alarm, the "Auxiliary Alarm On" LED will light and corresponding alarm relay will be energized (after set delay time).

*Note: The interval clock for AUTO-zero and AUTO-purge cycles is initiated when the MASS-tron II's power switch is turned on. The time intervals (preset in User Setup menu) will then start their timing sequence.

To reset the interval clock, turn power off for a minimum of 10 seconds, then turn power back on. Interval clock will then initiate at time zero.

Changing the interval selection in User Setup does not reset time clock.

5.4 – CONFIGURATION

The MASS-tron II's onboard microprocessor controls Configuration: Operating parameter selection; input/output activation and scaling, display scaling, and transducer calibration.

The customer can verify configuration and change certain parameters (within defined ranges) by entering the MASS-tron II's Configuration mode. This is accomplished using the four pushbuttons located on the MASS-tron II's top cover.

The type (i.e., 4-20mA, 0-5V, 0-10V) of available outputs can also be changed by jumper selections on I/O board (see Section 4.6).

To gain access to the jumpers, remove two 10-32 screws on front cover and pull the cover straight up and to the right.

CAUTION: With cover removed, ESD (electrostatic discharge) precautions should be observed at all times to protect sensitive components.

Refer to Figure 5.1 for location of pushbuttons: **UP, DN, ESC, ENT**, and Figure 5.2 for location of Jumper board.

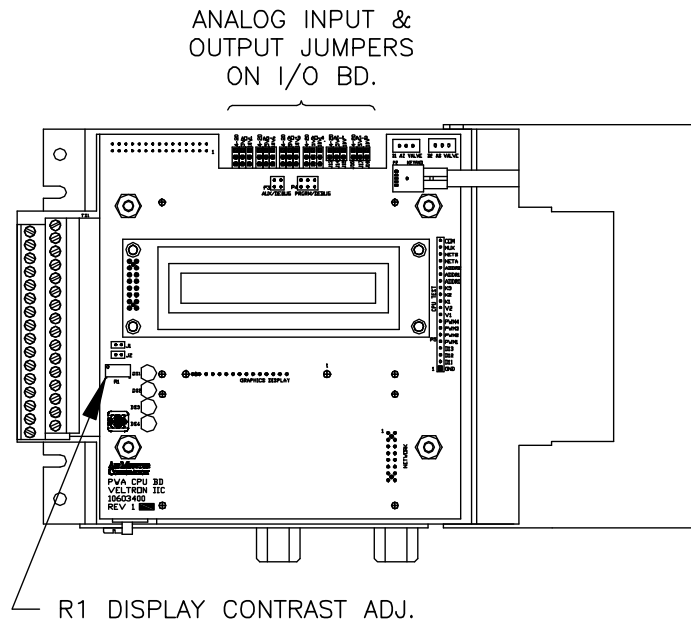


Figure 5.1

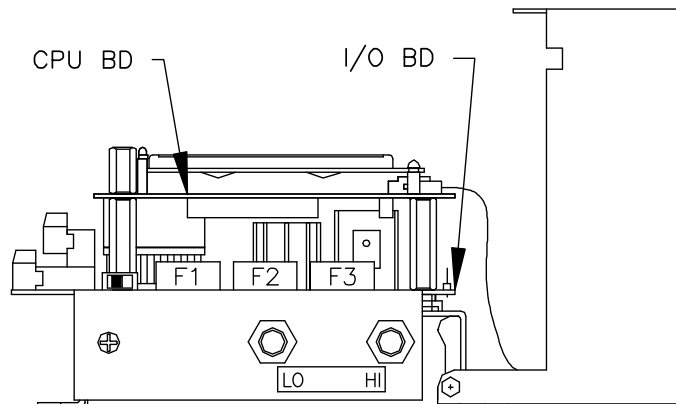


Figure 5.2

5.5 – PUSHBUTTON DEFINITION

In addition to Configuration programming, pushbuttons can be used for certain functions when in the *Normal* operation mode. The following list describes the pushbutton function when in the *Normal* operation mode and in the User Setup (programming).

When in Normal Operation Mode.

- ESC + ENT** Activates the Operator Setup menu.
- ESC + UP** Displays a list of Manual Actions available on the top line of the display. Use **UP** or **DN** to scroll through selections.

The following list describes all possible actions. Those available depend on installed options.

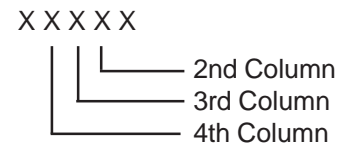
- Turn On AutoZero Vlv Output not held.
- Perform Auto-Zero Output held.
- Perform Auto-Purge Output held.
- UP + DN** Displays software Version, W.O. #, S/N, and ID.

When in Operator Setup.

- UP or DN** Use to scroll to the desired Main Menu item.
Use to scroll to the value or mode within a Parameter.
- ENT** Enters user into specific selection sub-menu from Main Menu Selection.
Displays current setting of selected Parameter.
Enters the selected value or mode into memory.
- ESC** Use to exit Main Menu selection to avoid scrolling to "Return to MAIN MENU".

The following pushbutton combinations can be used to more quickly set user selected values (i.e. display zero and span, K-factor, Scaling Values, etc.).

- UP* + ESC** Increase the second column digit.
- DN* + ESC** Decrease the second column digit.
- UP* + DN** Increase the third column digit.
- DN* + UP** Decrease the third column digit.
- UP* + ESC and DN** Increase the fourth column digit.
- DN* + ESC and UP** Decrease the fourth column digit.



*Must be pressed and held before other button(s) are pressed.

NOTE
Pushbuttons are momentary type and should be quickly pressed and released to initiate desired change, unless otherwise instructed to press and hold.

5.6 – CONFIGURATION PROGRAMMING

Note: User selectable parameters are limited to standard features and those available for options purchased and installed at the factory. The following will detail all user parameters, which may or may not be available on your unit.

With power ON and initialization complete (see Section 5.2), simultaneously press **ESC** and **ENT**, and display will indicate:

OPERATOR SETUP

Pressing **ENT** again will enter the user into the Main Menu of configuration programming. The display will indicate:

Operator Password
Selection

Refer to next page for Main Menu Selections.

5.6 – CONFIGURATION PROGRAMMING (con't)

By using **UP** and **DN**, the user can scroll through the following selections:

MAIN MENU SELECTION	DESCRIPTION
Operator Password Selection	Allows for the selection of a numeric password needed to gain further access to menu items. Also allows for the password to be bypassed.
Transmitter Scaling & Configuration	Allows for the configuration of process variable such as: Density Compensation Type, Square root, process type, process minimum/ maximum/units, duct area, percent lockdown, and Temperature & Pressure configuration. Also offers a Flow/ D.P. calculator that allows user to calculate maximum flow or differential pressure based on entered variables.
Low Pass Filter Selection	Selects amount of filtering applied to transducer output.
AUTO-zero Configuration	Turns AUTO-zero function ON or OFF, and selects interval.
AUTO-purge Configuration	Turns AUTO-purge function ON or OFF, and selects internal/external activation, interval, purge duration, after purge time.
AUTO-calibration	Not installed with MASS-tron II.
Alarm Configuration	Turns alarm function ON or OFF, select Alarm Type, High and Low Setpoints, Deadband selection, and Alarm Delay.
Controller Configuration	Not installed with MASS-tron II.
Special Function Configuration	Turns Special Function ON or OFF, select from the following special functions: % Deviation; Summed Flow; Averaged Flow; Delta: Internal-External; Delta: External-Internal; Low Select; High Select; and Setup parameters specific to Special Function selected.
K-Factor Configuration	Turns K-Factor ON or OFF, and allows for the calculation or selection of gain and bias values.
Display Configuration	Allows for the configuration of Display Parameter and Filter (if enhanced).
Analog Output Configuration	Allows for the selection of Analog Output 2, 3 and 4 parameters.
Transducer Span Selection	Allows for displaying the transducer's natural span and operating span.
Transmitter Input Calibration	Allows for the zeroing and spanning of transmitter analog Inputs.
Transmitter Output Calibration	Allows for the zeroing and spanning of transmitter analog Outputs.
Power Supply Calibration	Allows for adjustment of power supply voltage.
Transducer Characterization Selection	Allows transducer characterization data to be entered when transducer is replaced.
Network Configuration	Turns the Network ON or OFF, selection of input source.
Menu Inactivity Timeout Selection	Allows for the selection a time after which the unit returns to normal operation if no activity in the Operator Menu.
Exit Operator Setup	Returns display to <i>Normal</i> operation.

5.6 – CONFIGURATION PROGRAMMING (con't)

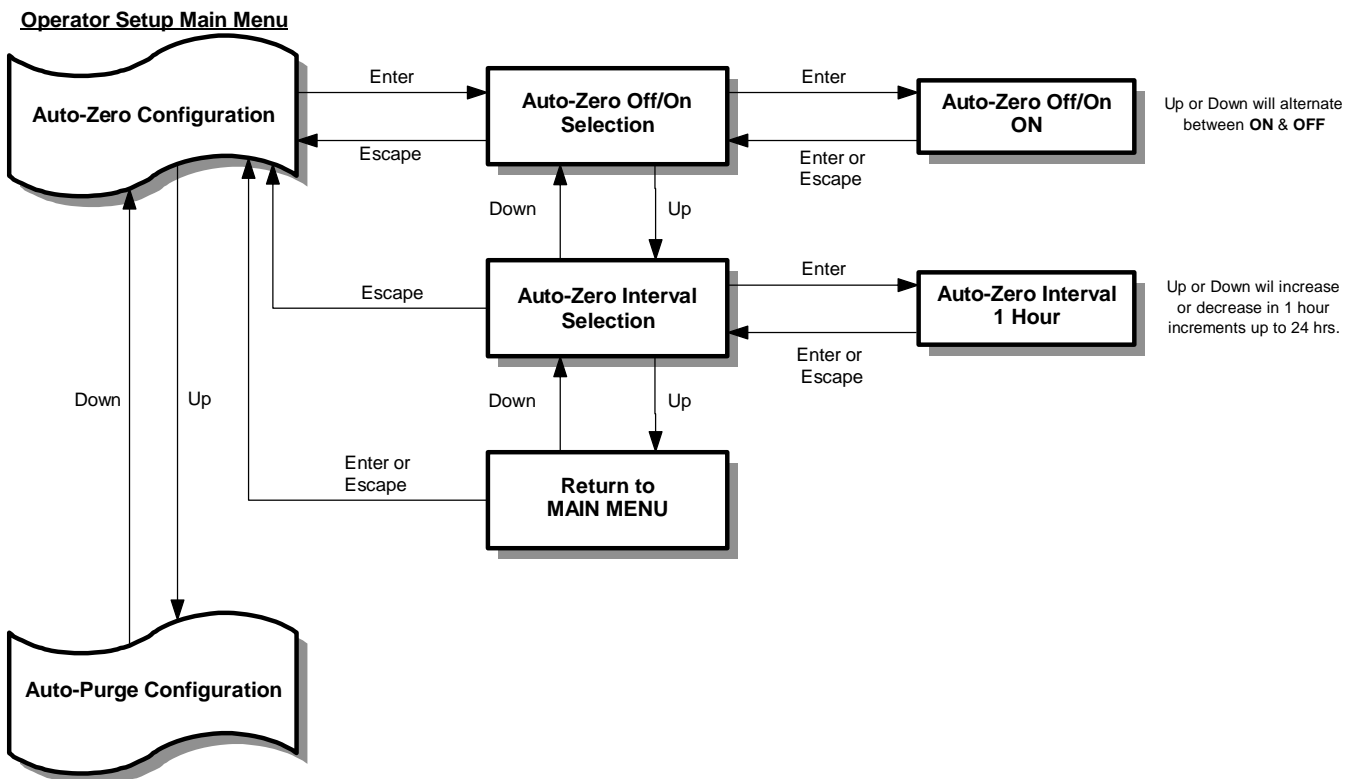
At any time while in the Main Menu, User can return to *Normal* operation mode by pressing **ESC** or scrolling to:



and pressing **ENT**.

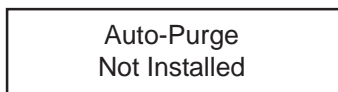
Once the desired Selection is displayed, its sub-menu can be entered by pressing **ENT**.

To better understand the process of Configuration Programming, arrows with pushbutton designations have been included on the following flow chart of AUTO-zero Configuration. This will aid in the navigation of the Configuration Programming Process.



This example of navigation is similar for all Main Menu selections.

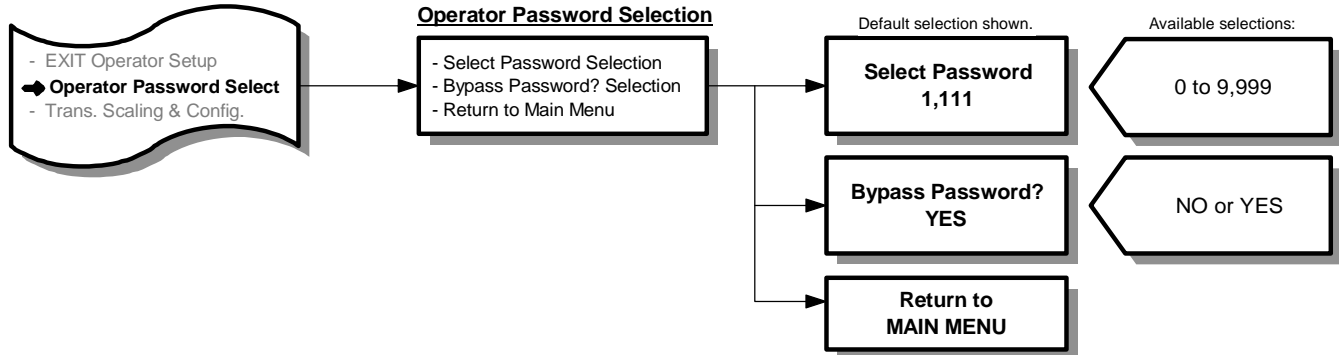
Note: All selections that are available for further configuration programming will have an "arrow" symbol displayed in the right side of the display field. Those that are not available for further configuration programming will not have the "arrow" symbol displayed and will display Not Installed beneath the selection description. Example:



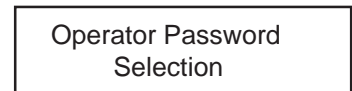
The remainder of this Section details steps to verify or change Configuration Programming of all Main Menu Selections.

5.7 – OPERATOR PASSWORD SELECTION

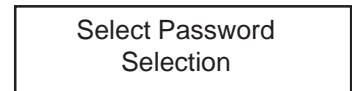
User can select numeric password or bypass password requirement. Note: Units are shipped from the Factory with the password set to 1,111 and bypassed..



1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** to enter Operator Password Selection menu. Display will indicate:



3. Press **ENT** and display will indicate current password (1,111).

4. Use **UP** or **DN** to change password. Once desired password is displayed, press **ENT**. New password will be stored in memory and display will return to Operator Password Selection menu as in Step 2.

Note: If user desired not to change the password and return to Operator Password Selection menu, press **ESC**. Unit will remain programmed as it was originally.

5. Use **UP** or **DN** to select remaining parameters to be changed.

6. Follow Step 4 to make any changes to parameters.

7. To return to Main Menu, select Return to MAIN MENU in Standard Display Configuration menu and press **ENT**.

5.8 – TRANSMITTER SCALING & CONFIGURATION

This Main Menu selection is where all application specific data is entered to configure the MASS-tron II for a unique application. Data is entered in sub-menu, Process Configuration, and as applicable, sub-menus, Temperature Configuration and Absolute Pressure Configuration. Typical data includes: Process Type, Process Minimum/Maximum, Density Compensation Type, Temperature Range, Absolute Pressure Range, Duct Area/Units, etc.

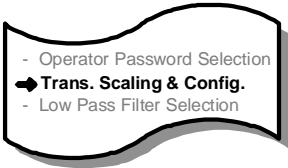
Note: Factory has entered data in this section based on customer supplied information. Data can be reviewed and verified by scrolling through the individual menu items or reviewing the Factory Set-Up Information sheet provided with the unit. Review this information **BEFORE** making any changes, as they can have a significant effect on the operation of the MASS-tron II.

Under a fourth sub-menu, Calculator for Max Diff. Pres. or Flow, user can calculate either maximum flow or maximum differential pressure (D.P.) when operating parameters have changed.

Each sub-menu will be addressed separately.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

Operator Setup Main Menu

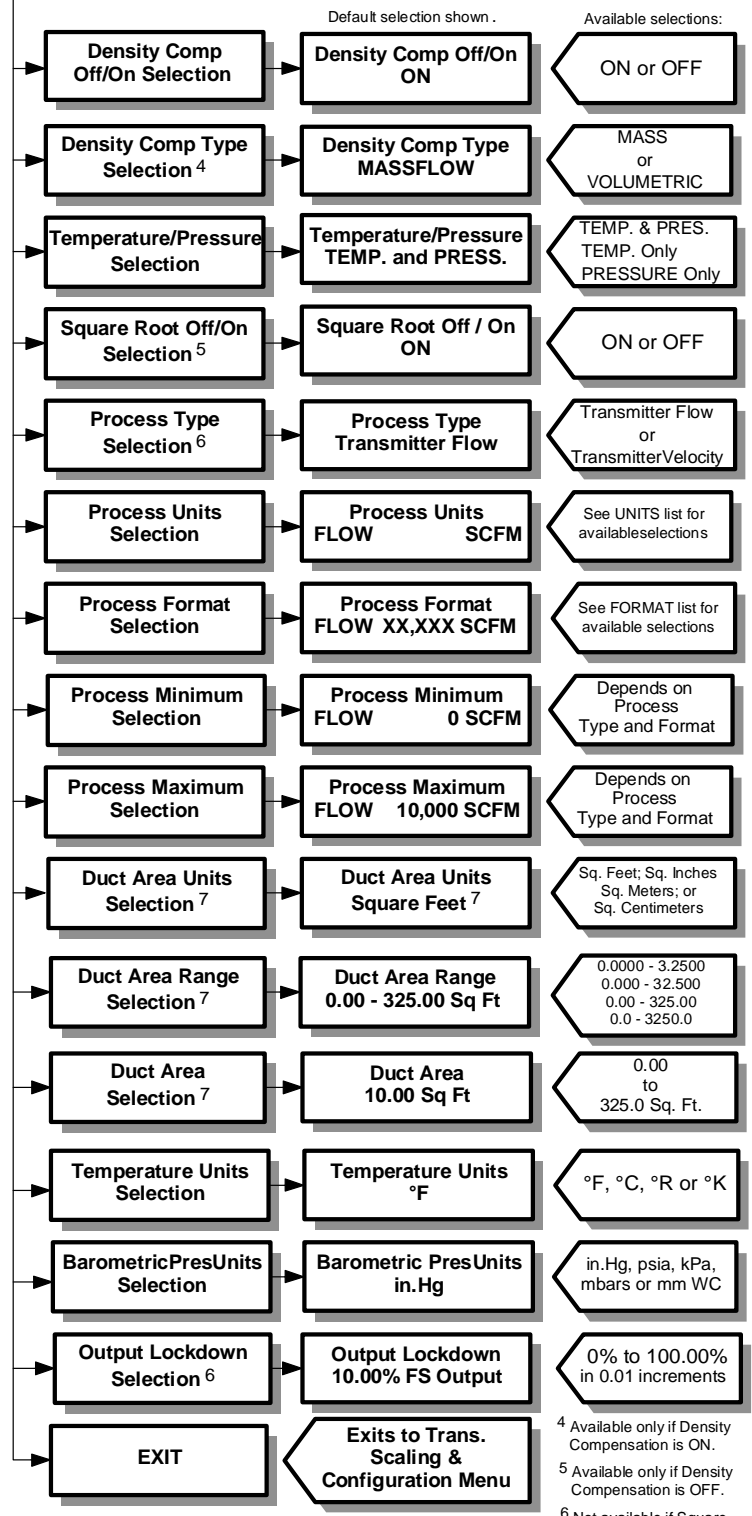


Trans. Scaling & Configuration

- Process Configuration
- Temperature Configuration ¹
- Absolute Pressure Configuration²
- Calc. for Max Diff Pres or Flow³
- Return to MAIN MENU

¹ Not available if PRESSURE Only is selected in Process Configuration.
² Not available only if TEMPERATURE Only is selected in Process Config.
³ Available only if Square Root is ON in Process Configuration.

Process Configuration



⁴ Available only if Density Compensation is ON.
⁵ Available only if Density Compensation is OFF.
⁶ Not available if Square Root is OFF. If Square Root is OFF, Process Type is Differential Pressure (D.P.).
⁷ Available only if Process Type is Transmitter Flow. Available units depends on Process Type selected.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

1. While in Main Menu, use **UP** or **DN** to scroll to:

Transmitter Scaling and Configuration
--

2. Press **ENT** to enter Transmitter Scaling & Configuration menu. Display will indicate:

Process Configuration

3. Press **ENT** to enter the Process Configuration sub-menu. Display will indicate:

Density Comp. Off/On Selection

4. Press **ENT** and display will indicate current setting of Density Compensation (OFF or ON).

5. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**, new setting will be stored in memory and display will return to Process Configuration sub-menu as in Step 3.

Note: If user desires not to change the setting and return to the Process Configuration sub-menu, press **ESC**. Unit will remain programmed as it was originally.

6. Use **UP** or **DN** to select remaining parameters to be changed within the Process Configuration sub-menu.

See the following Units Lists for the available Process Units selections for the appropriate Process Type.
See the following Format List for the available Process Format selections.

7. Follow Step 5 to make any changes to parameters.

8. To return to the Transmitter Scaling & Configuration menu, select EXIT in the Process Configuration sub-menu and press **ENT**.

Note: If Process Minimum is selected to be a value greater than zero (0), Transmitter Output 1 will not increase until the actual process exceeds this selected value. This is known as "Zero Suppression".

Zero Suppression (Process Minimum) can be set up to 60% of the Process Maximum selected.

Display of process is not affected by this selection, and will indicate the actual process value.

If Analog Output 2, 3 and/or 4 is selected to represent TRANSMITTER, it will act the same as Transmitter Output 1.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

UNITS LIST For Process Type – Flow

		UNIT OF MEASUREMENT	DISPLAY
NOTE 1		cubic feet per second	CFS
		cubic feet per minute	CFM
		cubic feet per hour	CFH
		liters per second	l/s
		liters per minute	l/m
		liters per hour	l/hr
		cubic meters per second	m3/s
		cubic meters per minute	m3/m
		cubic meters per hour	m3/hr
NOTES 1 & 2		Actual cubic feet per second	ACFS
		Actual cubic feet per minute	ACFM
		Actual cubic feet per hour	ACFH
		Actual liters per second	Al/s
		Actual liters per minute	Al/m
		Actual liters per hour	Al/hr
		Actual cubic meters per second	Am3/s
		Actual cubic meters per minute	Am3/m
NOTES 1 & 3		Actual cubic meters per hour	Am3/h
		Percent	%
		Standard cubic feet per second	SCFS
		Standard cubic feet per minute	SCFM
		Standard cubic feet per hour	SCFH
		Standard liters per second	Sl/s
		Standard liters per minute	Sl/m
		Standard liters per hour	Sl/hr
		Standard cubic meters per second	Sm3/s
		Standard cubic meters per minute	Sm3/m
		Standard cubic meters per hour	Sm3/h
		Normal liters per second	Nl/s
		Normal liters per minute	Nl/m
		Normal liters per hour	Nl/hr
		Normal cubic meters per second	Nm3/s
		Normal cubic meters per minute	Nm3/m
		Normal cubic meters per hour	Nm3/h
		pounds per second	lb/s
		pounds per minute	lb/m
		pounds per hour	lb/hr
		Tons per hour	T/hr
Tons per day	T/day		
grams per second	gm/s		
kilograms per second	kg/s		
kilograms per minute	kg/m		
kilograms per hour	kg/hr		

Notes:

1. All units listed are available if Density Compensation is OFF.
2. Only these units are available if Density Compensation is ON and Type is Volumetric.
3. Only these units are available if Density Compensation is ON and Type is Mass.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

UNITS LIST for Process Type – Velocity		
	UNIT OF MEASUREMENT	DISPLAY
NOTE 1	feet per second	FPS
	feet per minute	FPM
	feet per hour	FPH
	meters per second	m/s
	meters per minute	m/m
	meters per hour	m/hr
NOTES 1 & 2	Actual feet per second	AFPS
	Actual feet per minute	AFPM
	Actual feet per hour	AFPH
	Actual meters per second	Am/s
	Actual meters per minute	Am/m
	Actual meters per hour	Am/hr
	Percent	%
NOTES 1 & 3	Standard feet per second	SFPS
	Standard feet per minute	SFPM
	Standard feet per hour	SFPH
	Standard meters per second	Sm/s
	Standard meters per minute	Sm/m
	Standard meters per hour	Sm/hr
	Normal meters per second	Nm/s
	Normal meters per minute	Nm/m
	Normal meters per hour	Nm/hr
	Percent	%

Notes:

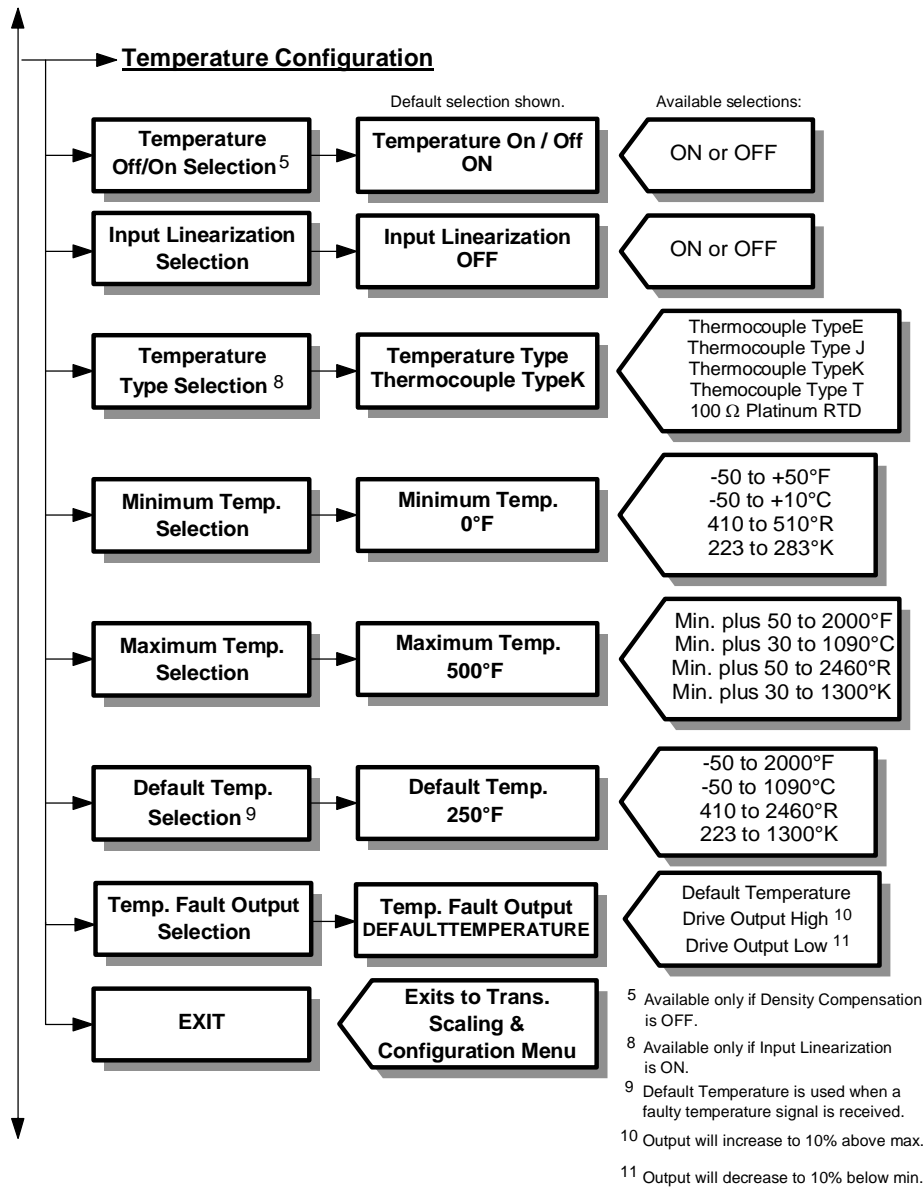
1. All units listed are available if Density Compensation is OFF.
2. Only these units are available if Density Compensation is ON and Type is Volumetric.
3. Only these units are available if Density Compensation is ON and Type is Mass.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

UNITS LIST for Process Type – Differential Pressure	
UNIT OF MEASUREMENT	DISPLAY
inches of water column	in.WC
inches of mercury	in.Hg
pounds per square inch, gauge	psig
Pascals	Pa
kilo Pascals	kPa
bars	bars
millibars	mbars
millimeter of water column	mm WC
millimeter of mercury	mm Hg
kilograms per square meter	kg/m ²
Percent	%

FORMAT LIST	
.0XXXXX	(–.025000 to .025000)
0.XXXXX	(–0.25000 to 0.25000)
X.XXXX	(–2.5000 to 2.5000)
XX.XXX	(–25.000 to 25.000)
XXX.XX	(–250.00 to 250.00)
X,XXX.X	(–2,500.0 to 2,500.0)
XX,XXX	(–25,000 to 25,000)
XXX,XX0	(–250,000 to 250,000)
XXXX,X00	(–2500,000 to 2500,000)
XXXX,000	(–9999,000 to 9999,000)

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)



9. While in Transmitter Scaling & Configuration menu, use **UP** or **DOWN** to scroll to:

Temperature Configuration

10. Press **ENT** to enter the Temperature Configuration sub-menu.

If Density Compensation is ON (see Process Configuration above), display will indicate:

Input Linearization Selection

If Density Compensation is OFF display will indicate:

Temperature Off/On Selection

11. Press **ENT** and display will indicate current selection of applicable menu from Step 10.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

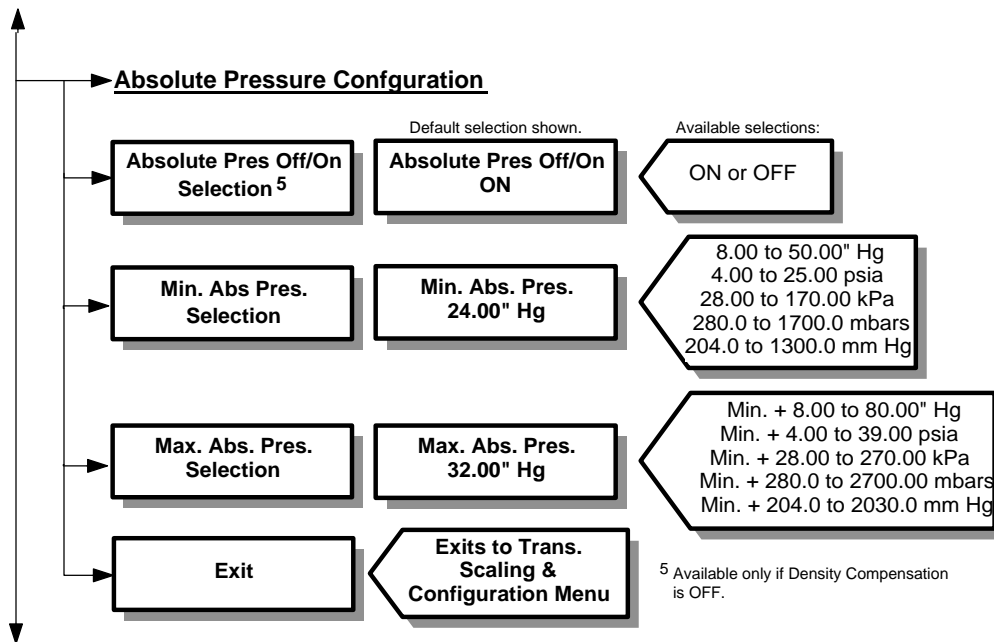
12. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**, new setting will be stored in memory and display will return to the Temperature Configuration sub-menu as in Step 10.

Note: If user desires not to change the setting and return to the Temperature Configuration sub-menu, press **ESC**. Unit will remain programmed as it was originally.

13. Use **UP** or **DN** to select remaining parameters to be changed within the Temperature Configuration sub-menu.

14. Follow Step 12 to make any changes to parameters.

15. To return to the Transmitter Scaling & Configuration menu, select EXIT in the Temperature Configuration sub-menu and press **ENT**.



16. While in Transmitter Scaling & Configuration menu, use **UP** or **DN** to scroll to:

Absolute Pressure Configuration

17. Press **ENT** to enter the Absolute Pressure Configuration sub-menu.

If Density Compensation is ON (see Process Configuration above), display will indicate:

Min Abs. Pressure Selection

If Density Compensation is OFF (see Process Configuration above), display will indicate:

Abs. Pressure Off/On Selection

18. Press **ENT** and display will indicate current selection of applicable menu from Step 17.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

19. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**, new setting will be stored in memory and display will return to the Absolute Pressure Configuration sub-menu as in Step 17.

Note: If user desires not to change the setting and return to the Absolute Pressure Configuration sub-menu, press **ESC**. Unit will remain programmed as it was originally.

20. Use **UP** or **DN** to select remaining parameters to be changed within the Absolute Pressure Configuration sub-menu.

21. Follow Step 19 to make any changes to parameters.

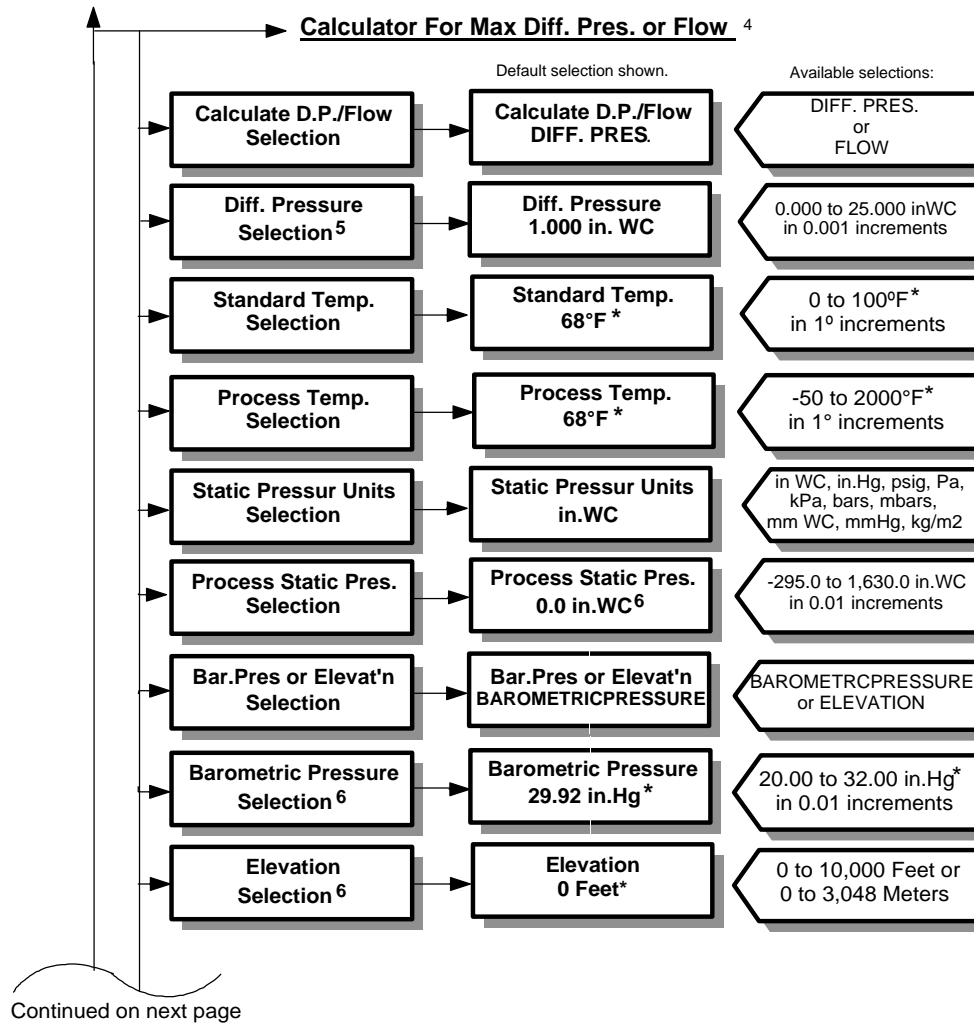
22. To return to the Transmitter Scaling & Configuration menu, select EXIT in the Absolute Pressure Configuration sub-menu and press **ENT**.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

User should not need to use the following Calculator unless:

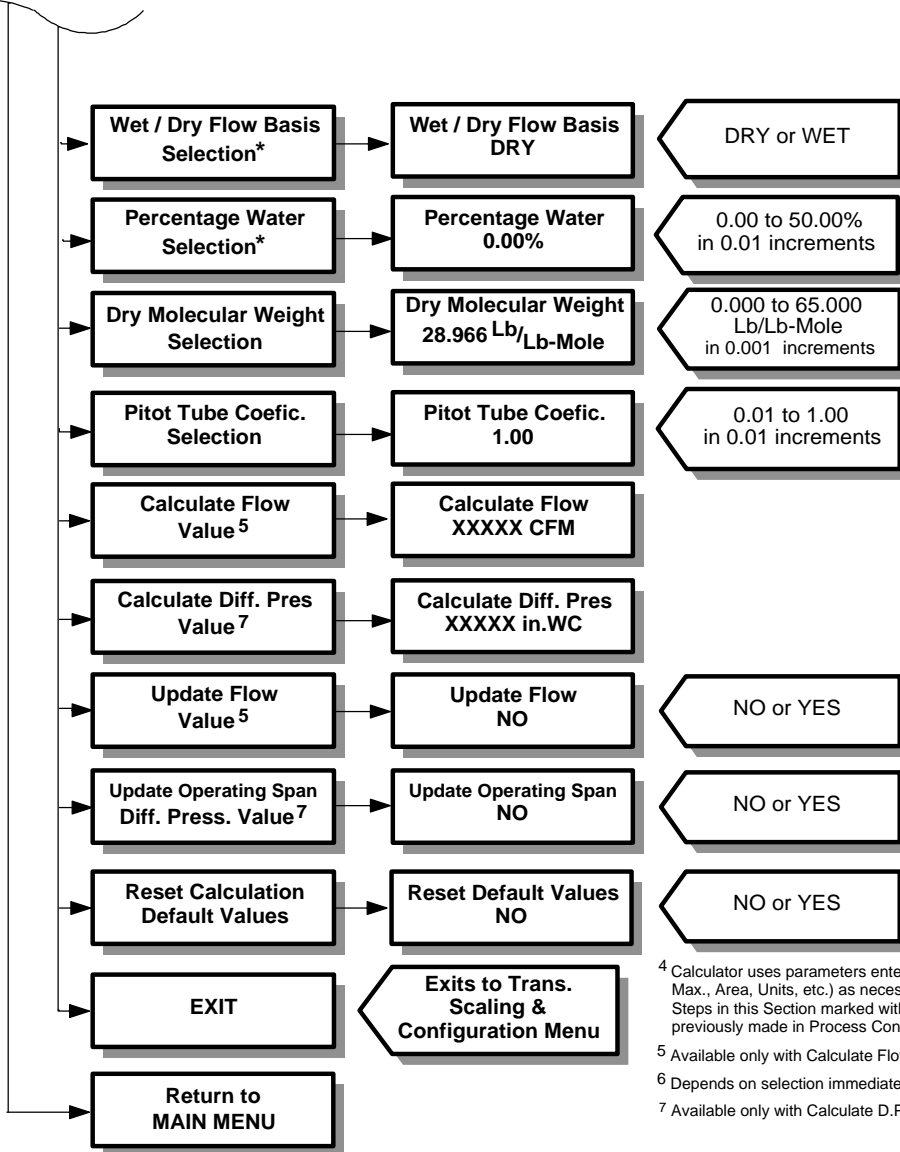
- a. Process parameters have changed and new Differential Pressure or Flow values are needed.
- b. Mid-point operating Differential Pressure or Flow values are wanted.
- c. It is desired to implement a single-point density compensation for process temperature and/or absolute pressure that is significantly different than standard conditions (68°F and 29.92" Hg).

Values entered in this section will have no effect on normal operation unless user enters YES in the Update Flow/ Operating Span Value menu item (see below).



5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

Continued from next page



⁴ Calculator uses parameters entered in Process Configuration (ie.Type, Max., Area, Units, etc.) as necessary to perform calculation. Steps in this Section marked with * indicate values or choices previously made in Process Configuration.

⁵ Available only with Calculate Flow.

⁶ Depends on selection immediately above.

⁷ Available only with Calculate D.P.

5.8 – TRANSMITTER SCALING & CONFIGURATION (con't)

As an example of how to utilize the calculator, the following shows how to change the Operating Span if the process temperature is 150°F.

23. While in Transmitter Scaling & Configuration menu, use **UP** or **DN** to scroll to:

Calculator for Max
Diff. Pres. or Flow

24. Press **ENT** to enter the Calculator for Max Diff. Pres. or Flow sub-menu.
Display will indicate:

Calculate D.P./Flow
Selection

25. Press **ENT** and display will indicate:

Calculate D.P./Flow
DIFF. PRES.

26. Press **ENT** and then **UP** twice and display will indicate:

Process Temperature
Selection

27. Press **ENT** and use **UP** button until temperature reads 150°F.

28. Press **ENT** and scroll to:

Calculate Diff. Pres
Value

29. Press **ENT** and a new value for Differential Pressure will be displayed.

30. Press **ENT** and then **UP** and display will read:

Update Operating Span
Diff. Pres. Value

31. Press **ENT**, scroll to YES and press **ENT**, display will return to that shown in Step 30, and new operating span will be stored in memory.

Note: If during this step, display indicated CAL. SPAN NOT UPDATED NAT. SPAN TOO LOW or HIGH, new span is less than 40% or greater than 100% of the natural span of the transducer installed. User should contact Factory for further assistance (see section 11.0).

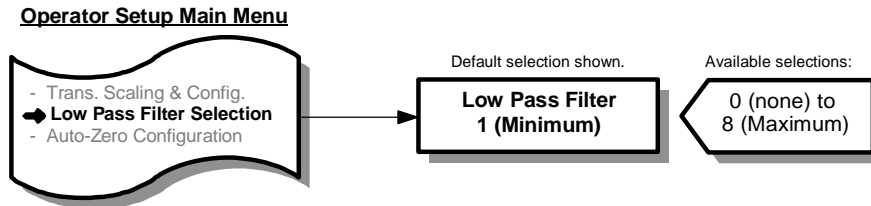
32. To return to the Transmitter Scaling & Configuration menu, select EXIT in the Calculator for Max Diff. Pres. or Flow sub-menu and press **ENT**.

33. To return to the Main Menu, select Return to MAIN MENU in the Transmitter Scaling & Configuration menu and press **ENT**.

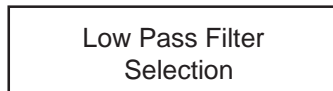
5.9 – LOW PASS FILTER SELECTION

User can select level of filtering applied to the transducer output*. Levels are 0 to 8, with 0 representing no filtering, 1 representing minimal filtering (0.5 sec time constant), and 8 representing maximum filtering (64 sec time constant).

*This filtering affects all subsequent outputs, displays, special function, alarms, etc., that utilize the transducer output.



1. While in Main Menu, use **UP** or **DN** to scroll to:



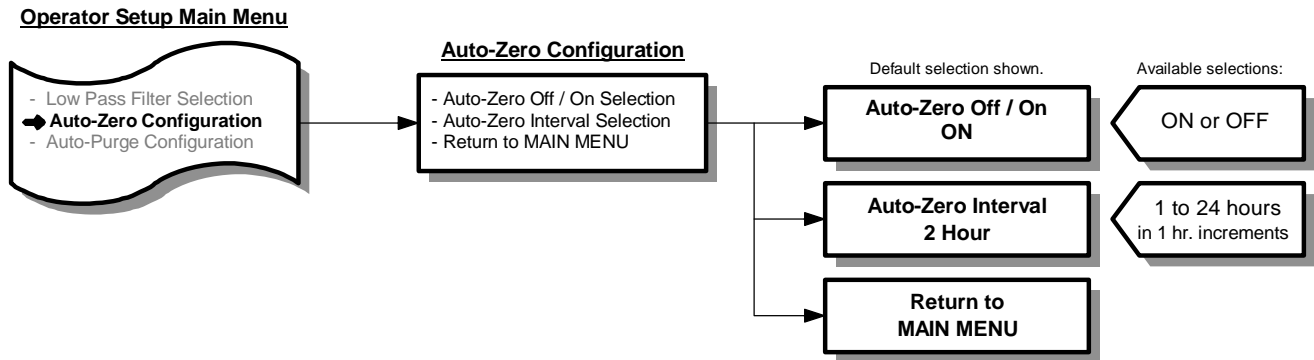
2. Press **ENT** and display indicates current setting of Low Pass Filter; 0 (none) to 8 (Maximum).

3. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT** and new setting will be stored in memory and display will return to Main Menu.

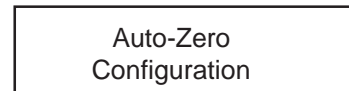
Note: If user desires not to change the setting and return to Main Menu, press **ESC**. Unit will remain programmed as it was originally.

5.10 – AUTO-zero CONFIGURATION

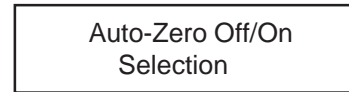
User can turn AUTO-zero function ON or OFF, and select activation interval.



1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** to enter AUTO-zero Configuration menu. Display will indicate:



3. Press **ENT** and display will indicate current setting of AUTO-zero (OFF or ON).

4. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT** and new setting will be stored in memory and display will return to AUTO-zero Configuration menu as in Step 2.

Note: If user desires not to change the setting and return to AUTO-zero Configuration menu, press **ESC**. Unit will remain programmed as it was originally.

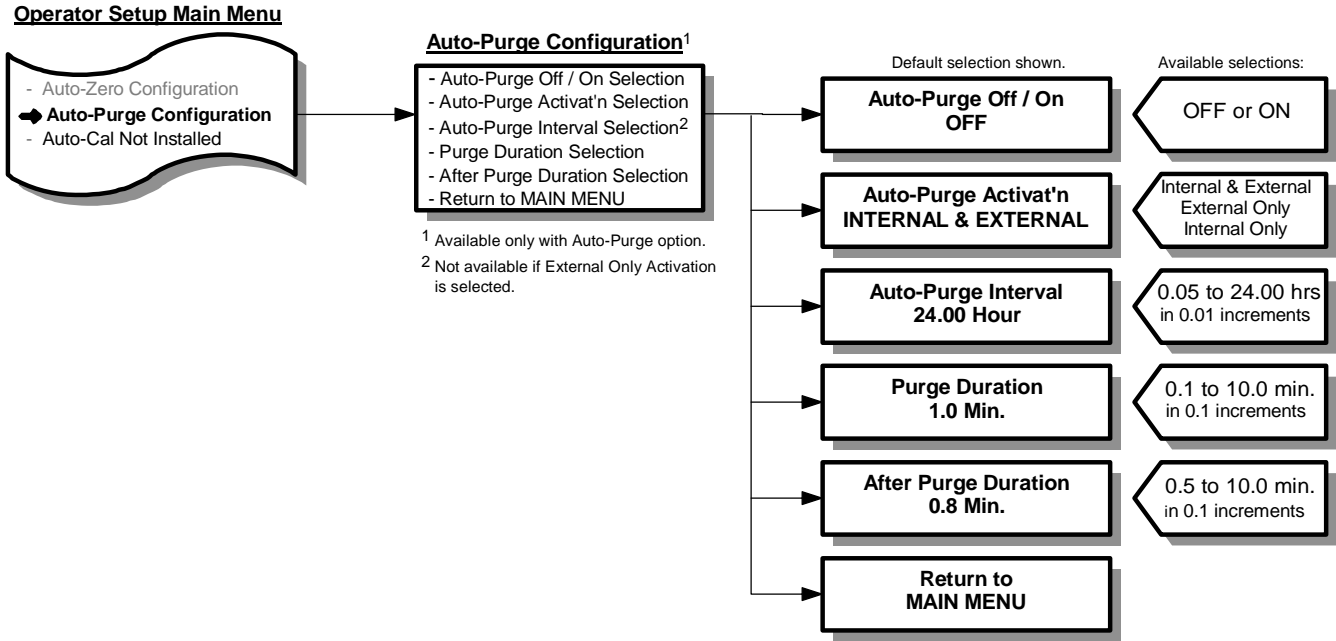
5. Use **UP** or **DN** to select remaining parameters to be changed.

6. Follow Step 4 to make any changes to parameters.

7. To return to Main Menu, select Return to MAIN MENU in AUTO-zero Configuration menu and press **ENT**.

5.11 – AUTO-purge CONFIGURATION

User can turn AUTO-purge function ON or OFF, select method of activation, activation interval, purge duration, and after purge duration.

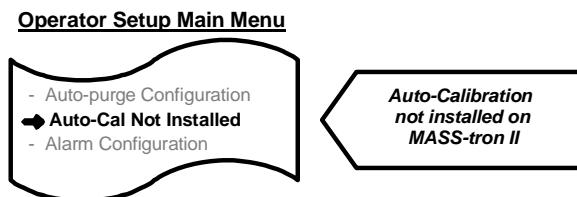


- While in Main Menu, use **UP** or **DN** to scroll to:

Auto-Purge Configuration
 - Press **ENT** to enter AUTO-purge Configuration menu. Display will indicate:

Auto-Purge Off/On Selection
 - Press **ENT** and display will indicate current setting of AUTO-purge (OFF or ON).
 - Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**. New setting will be stored in memory and display will return to AUTO-purge Configuration menu as in Step 2.
- Note: If user desires not to change the setting and return to AUTO-purge Configuration menu, press **ESC**. Unit will remain programmed as it was originally.
- Use **UP** or **DN** to select remaining parameters to be changed.
 - Follow Step 4 to make any changes to parameters.
 - To return to Main Menu, select Return to MAIN MENU in AUTO-purge Configuration menu and press **ENT**.

5.12 – AUTO-cal



5.13 – ALARM CONFIGURATION

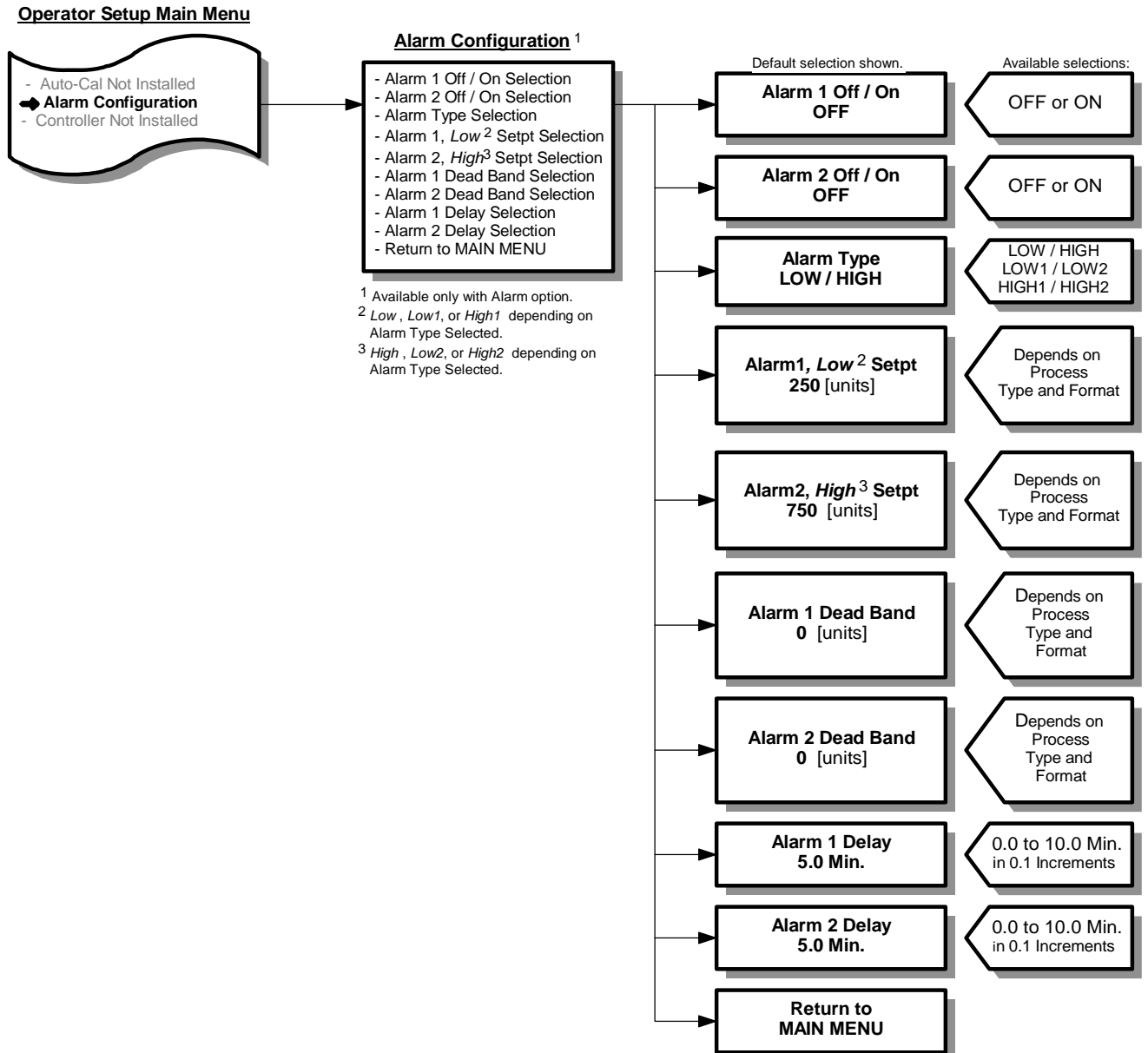
User can turn Alarm function ON or OFF, select type of alarm (See Section 3.6 – Features for description of the different Alarm types), and set the following values:

Low Setpoint (this is Low, Low1, or High1 depending on Alarm Type): Selected value of transmitter span, below (for Low and Low1) or above (for High 1) which an alarm condition will exist. Value is selected in same units as transmitter format.

High Setpoint (this is High, Low2, or High2, depending on Alarm Type): Selected value of transmitter span below (for Low2) or above (for High and High2) which an alarm condition will exist. Value is selected in same units as transmitter format.

Alarm Deadband: Value that transmitter signal has to reach above (for Low, Low1, or Low2) or below (for High, High1, or High2) before an activated alarm will reset. Value is selected in same units as transmitter span.

Alarm Delay: Time between an alarm condition existing and alarm activation. Adjustable between 0.0 and 10.0 minutes in 0.1 minute increments.

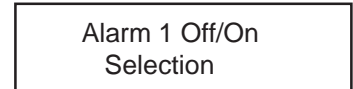


5.13 – ALARM CONFIGURATION (con't)

1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** to enter Alarm Configuration menu. Display will indicate:



3. Press **ENT** and display will indicate current setting of Alarm 1 (OFF or ON).

4. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**. New setting will be stored in memory and display will return to Alarm Configuration menu as in Step 2.

Note: If user desires not to change the setting and return to Alarm Configuration menu, press **ESC**. Unit will remain programmed as it was originally.

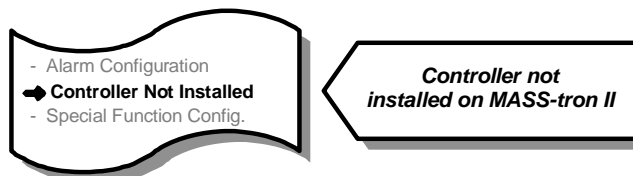
5. Use **UP** or **DN** to select remaining parameters to be changed.

6. Follow Step 4 to make any changes to parameters.

7. To return to Main Menu, select Return to MAIN MENU in Alarm Configuration menu and press **ENT**.

5.14 – CONTROLLER CONFIGURATION

Operator Setup Main Menu



5.15 – SPECIAL FUNCTION CONFIGURATION

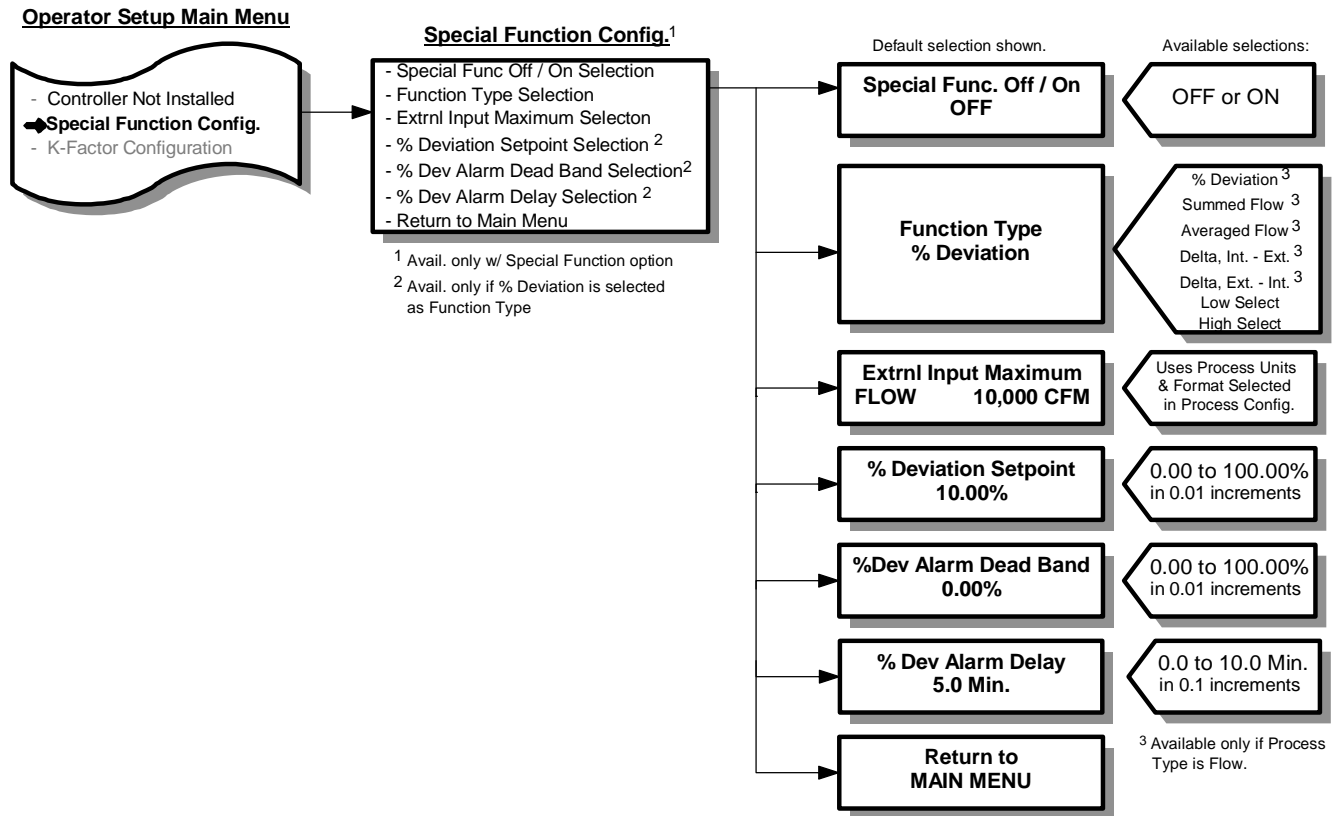
User can turn Special Function ON or OFF, select type of function (See Section 3.7 Features, for description of the different special functions), and set the following values:

External Input Maximum: This value represents the maximum value of the external input. This value is used if External Special Function Input is selected as a display parameter.

Percent Deviation Setpoint: (Note: Available only if Percent Deviation is selected as Function Type.) The percent difference between the transmitter signal and an external input that will cause an alarm condition when exceeded.

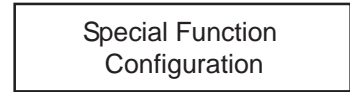
Alarm Deadband: (Note: Available only if Percent Deviation is selected as Function Type.) A percentage below the percent deviation setpoint which the deviation must reach to reset an activated alarm.

Alarm Delay: (Note: Available only if Percent Deviation is selected as Function Type.) Time between an alarm condition existing and alarm activation. Adjustable between 0.0 and 10.0 minutes in 0.1 minute increments.

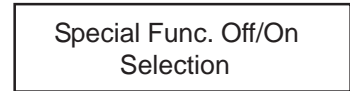


5.15 – SPECIAL FUNCTION SELECTION (con't)

1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** to enter Special Function Configuration menu. Display will indicate:



3. Press **ENT** and display will indicate current setting of Special Function (OFF or ON).
4. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**. New setting will be stored in memory and display will return to Special Function Configuration menu as in Step 2.

Note: If user desires not to change the setting and return to Special Function Configuration menu, press **ESC**. Unit will remain programmed as it was originally.

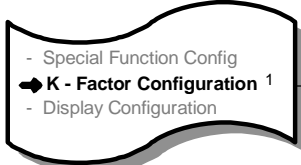
5. Use **UP** or **DN** to select remaining parameters to be changed.
6. Follow Step 4 to make any changes to parameters.
7. To return to Main Menu, select Return to MAIN MENU in Special Function Configuration menu and press **ENT**.

5.16 – K-FACTOR CONFIGURATION

Caution. In the majority of applications, the use of a K-Factor is neither required nor desirable. Before using the K-Factor feature, contact the Service Department (see Section 10) to review the application and obtain assistance in determining the K-Factor gain and bias values.

User can turn K-Factor function ON or OFF, select K-Factor Type, calculate K-Factor Gain and Bias (or Exponent) from measured data or select a K-Factor Gain and Bias (or Exponent) value. Note: If K-Factor is ON, Process displays will have an asterisk (*) after the description (i.e., FLOW*).

Operator Setup Main Menu



¹ Not available if Process Type is D.P. (see Transmitter Scaling & Config.)

K- Factor Configuration

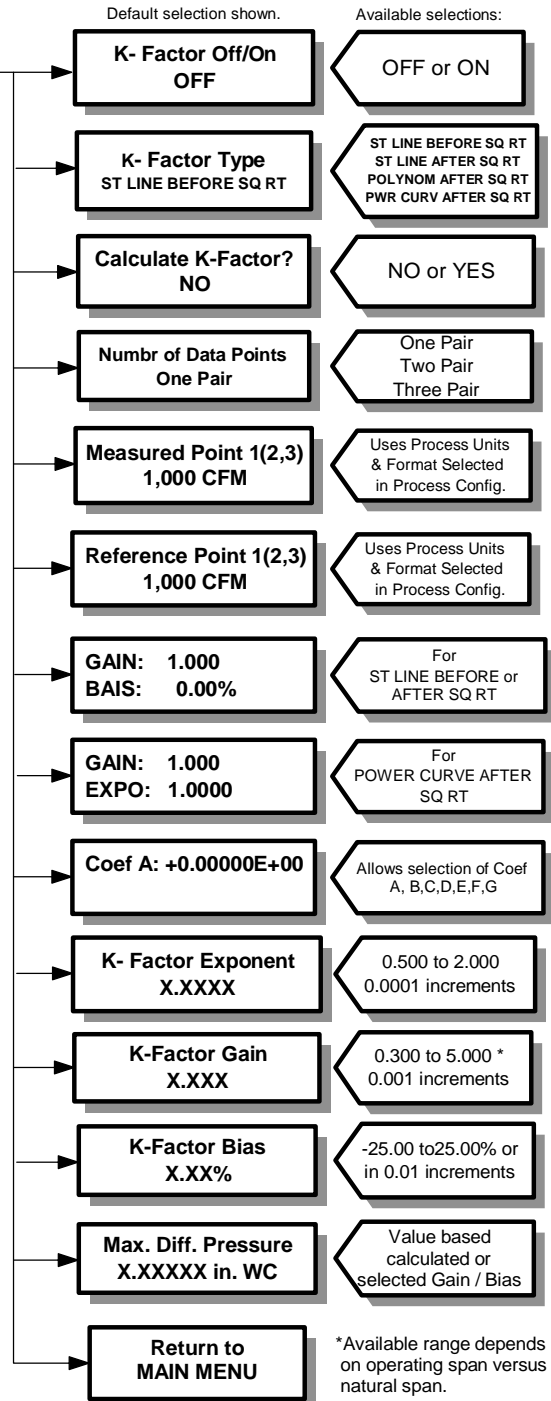
- K - Factor Off/On Selection
- K - Factor Type Selection
- Calculate K-Factor? Selection ²
- Numbr of Data Points Selection ³
- Measured Point 1 (2,3) Selection ³
- Reference Point 1 (2,3) Selection ³
- Perform Calculation ³
- Coefficient A (B,C,D,E,F,G) Selection ⁴
- K - Factor Exponent Selection ⁵
- K - Factor Gain Selection ⁵
- K - Factor Bias Selection ⁵
- Display Max D.P. ²
- Return to MAIN MENU

² Not available if K-Factor Type is Polynomial.

³ Available only if YES is selected in Calculate K-Factor? Measured refers to transmitter's indicated flow value. Reference refers to flow value obtained by traversing.

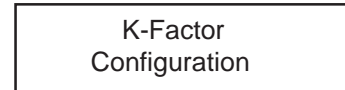
⁴ Available only if K-Factor Type is Polynomial.

⁵ Available only if NO is selected in Calculate K-Factor? and depends on Type of K-Factor.



5.16 – K-FACTOR CONFIGURATION (con't)

1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** to enter K-Factor Configuration menu. Display will indicate:



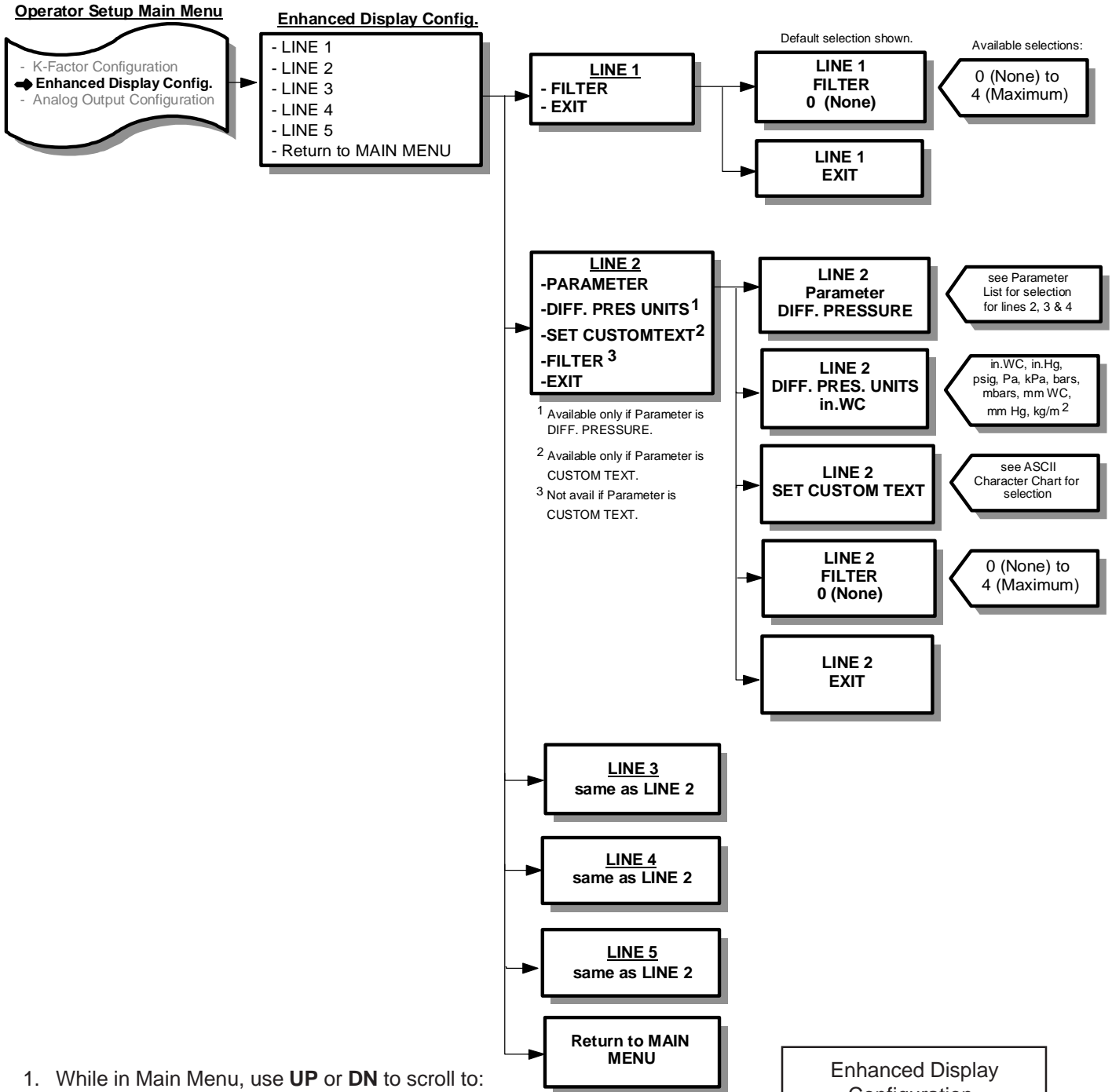
3. Press **ENT** and display will indicate current setting of K-Factor (OFF or ON).
4. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**. New setting will be stored in memory and display will return to K-Factor Configuration menu as in Step 2.

Note: If user desires not to change the setting and return to K-Factor Configuration menu, press **ESC**. Unit will remain programmed as it was originally.

5. Use **UP** or **DN** to select remaining parameters to be changed.
6. Follow Step 4 to make any changes to parameters.
7. To return to Main Menu, select Return to MAIN MENU in parameter menu and press **ENT**.

5.17 – ENHANCED DISPLAY CONFIGURATION

User can select display parameter, for lines 2, 3, 4, and 5. Also, each line can have a level of filtering, 0 through 4 (4 is maximum) selected by User.



1. While in Main Menu, use **UP** or **DN** to scroll to:

2. Press **ENT** to enter Enhanced Display Configuration menu. Display will indicate:

Enhanced Display Configuration

3. Press **ENT** to enter Setup menu. Display will indicate:

LINE 1

LINE 1 FILTER

5.17 – ENHANCED DISPLAY CONFIGURATION (con't)

- 4. Press **ENT**, and display will indicate current setting of the filter [0 (None), 1 (Minimum), 2, 3, or 4 (Maximum)].
- 5. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**. New setting will be stored in memory and display will return to Enhanced Display Configuration menu as in Step 3.

Note: If user desires not to change the setting and return to Enhanced Display Configuration menu, press **ESC**. Unit will remain programmed as it was originally.

6. Press **UP** and display will indicate:

LINE 1
EXIT

7. Press **ENT** then **UP** and display will indicate:

LINE 2

8. Press **ENT** and display will indicate:

LINE 2
PARAMETER

- 9. Press **ENT** and display will indicate current parameter selected to display on Line 2 (see Parameter List at the end of this section for available selections).

- 10. Use **UP** or **DN** to scroll to desired parameter. Press **ENT** and parameter will be stored in memory and display will indicate as in Step 8.

Note: If user desires not to change the setting and return to Setup menu, press **ESC**. Unit will remain programmed as it was originally.

- 11. If CUSTOM TEXT was selected and **ENT** pressed in Step 10, proceed to Step 20. For other parameters, continue with Step 12.

12. Press **UP** and display will indicate:

LINE 2
FILTER

Note: Filter selection will not be available if selected parameter is ALARM SETPOINT.

- 13. Press **ENT** and display will indicate current Filter setting selected for Line 2 [0 (None), 1 (Minimum), 2, 3, or 4 (Maximum)].

- 14. Use **UP** or **DN** to scroll to desired filter setting. Press **ENT** and filter setting will be stored in memory and display will indicate as in Step 12.

15. Press **UP** and display will indicate:

LINE 2
EXIT

16. Press **ENT** then **UP** and display will indicate:

LINE 3

5.17 – ENHANCED DISPLAY CONFIGURATION (con't)

17. Repeat Steps 8 through 16 for Line 3, 4, and 5. The only differences being the change of Line # in the display.

18. After Line 4 has been set, Step 16 will yield a display:

Return to
MAIN MENU

19. Press **ENT** to return to Main Menu.

20. If Custom Text was selected and **ENT** pressed in Step 10, (for any line 2, 3, 4), press **UP** and display will indicate:

LINE 2
SET CUSTOM TEXT

21. Press **ENT** , display will indicate:

LINE 2
SET CUSTOM TEXT

Cursor indicates position to be set.
There are 20 positions available to hold custom text.

22. Use **UP** or **DN** to scroll through available characters (see ASCII Chart at the end of this section for available characters).

23. When desired character is displayed, press **ENT**, character will be stored and cursor will advance one position to the right.

24. Repeat Steps 22 and 23 for all 20 positions. When position 20 is entered, user will be exited back to display as in Step 20.

25. Press **UP** and display will indicate:

LINE 2
EXIT

26. Press **ENT** then **UP** and display will indicate:

LINE 3

27. Repeat Steps 8 through 16 for Line 3, 4, and 5. The only differences being the change of Line # in the display.

Note: In "Set Custom Text" mode, the pushbuttons can be used in the following combinations to facilitate programming:

ESC + UP: Moves position cursor to the right, one position at a time.

ESC + DN: Moves position cursor to the left, one position at a time.

ESC + ENT: Exits "Set Custom Text". Does not enter any changes to the display since the last time **ENT** was pressed.

UP + DN: Jumps up five characters at a time, to the desired character.

DN + UP: Jumps down five characters at a time, to the desired character.

5.17 – ENHANCED DISPLAY CONFIGURATION (con't)

PARAMETER LIST for Lines 2, 3, 4, and 5	
PARAMETER	DISPLAY IN "NORMAL" MODE
NONE	
DIFF. PRESSURE *	D. PRESS
TRANSMITTER VELO •	VELO.
TEMPERATURE	TEMP.
ABSOLUTE PRESSURE	ABS PR
EXT. SPEC FUNC INPUT ⁿ	SF EXT
SPEC FUNCTION OUTPUT [†]	%DEV.
	SUM
	AVG.
	DELTA
	LO SEL
	HI SEL
ALARM LOW SETPOINT [‡]	LO SP
ALARM HIGH SETPOINT [‡]	HI SP
ALARM LOW1 SETPOINT [‡]	LO1 SP
ALARM LOW2 SETPOINT [‡]	LO2 SP
ALARM HIGH1 SETPOINT [‡]	HI1 SP
ALARM HIGH2 SETPOINT [‡]	HI2 SP
ALARM %DEV. SETPOINT ^{†n}	DEV SP
PERCENT OF PROCESS	(Display will indicate process type selected in Process Configuration.
Bar Graph of Process	XX%
CUSTOM TEXT	
<p>* Available only if Square Root Function is ON.</p> <p>• Available only if Transmitter Flow is selected as Process Type.</p> <p>‡ Available only if Alarm Function option has been installed, and Percent Deviation has not been selected as a Special Function.</p> <p>† Available only if Percent Deviation has been selected as a Special Function.</p> <p>ⁿ Available only if Special Function option has been installed.</p>	

} Depends on Special Function Selected

5.17 – ENHANCED DISPLAY CONFIGURATION (con't)

ASCII Character Chart										
!	*	3	<	E	N	W	`	i	r	{
"	+	4	=	F	O	X	a	j	s	|
#	'	5	>	G	P	Y	b	k	t	}
\$	-	6	?	H	Q	Z	c	l	u	↑
%	.	7	@	I	R	[	d	m	v	↓
&	/	8	A	J	S	¥	e	n	w	
'	0	9	B	K	T	]	f	o	x	
(	1	:	C	L	U	^	g	p	y	
)	2	;	D	M	V	-	h	q	z	

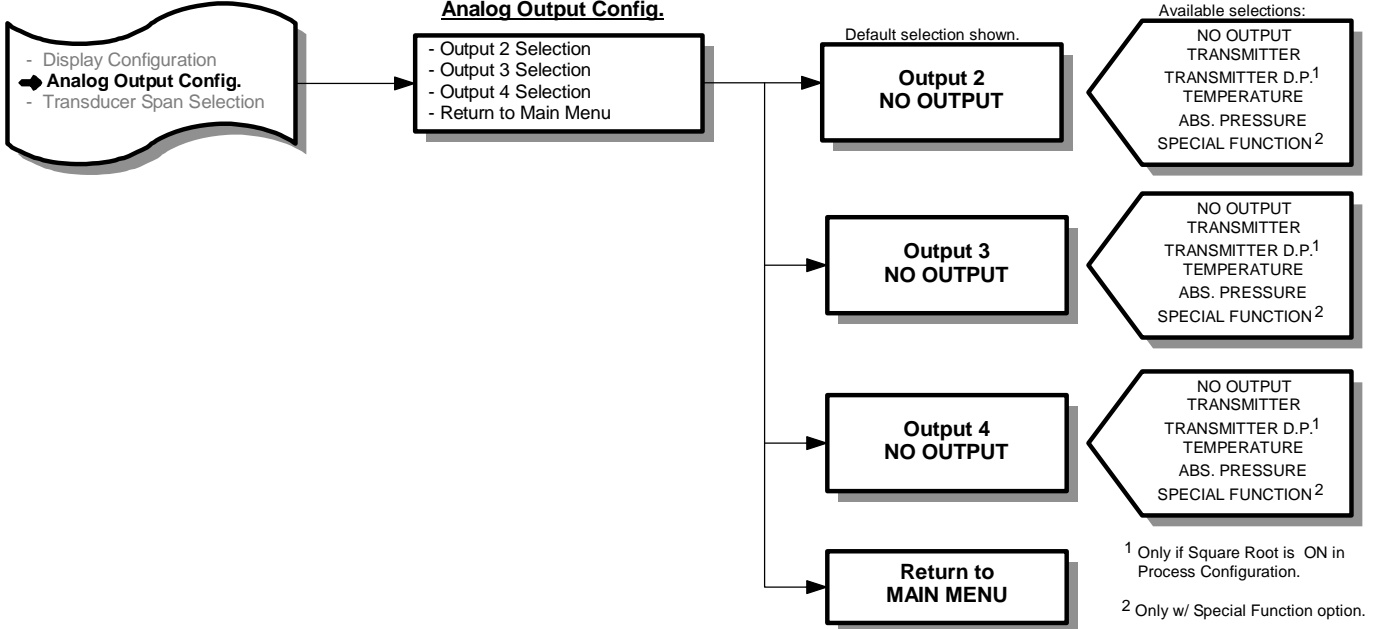
5.18 – ANALOG OUTPUT CONFIGURATION

User can select which process variables Output 2, 3, and 4 represent.

Process variables available for output are:

- Transmitter Differential Pressure. Output represents transducer's Natural span, **not** Operating span.
- Special Function (only available if Special Function option is installed)
- Transmitter Flow
- Temperature (only if temperature is a parameter used in Density Compensation)
- Absolute Pressure (only if Absolute Pressure is a parameter used in Density Compensation)

Operator Setup Main Menu



1. While in Main Menu, use **UP** or **DN** to scroll to:
- Analog Output Configuration
2. Press **ENT** to enter Analog Output Configuration menu. Display will indicate:
- Output 2 Selection
3. Press **ENT** and display will indicate current setting of Analog Output #2 (NO OUTPUT, TRANSMITTER, TRANSMITTER D.P., TEMPERATURE, ABS. PRESSURE, SPECIAL FUNCTION).
 4. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**. New setting will be stored in memory and display will return to Analog Output Configuration menu as in Step 2.

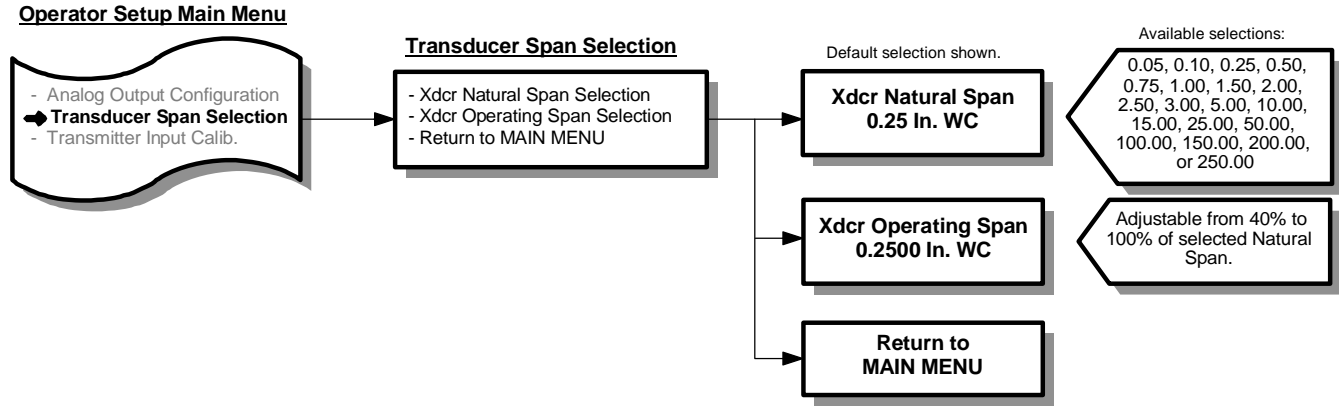
Note: If user desires not to change the setting and return to Analog Output Configuration menu, press **ESC**. Unit will remain programmed as it was originally.

5. Use **UP** or **DN** to select remaining parameters to be changed.
6. Follow Step 4 to make any changes to parameters.
7. To return to Main Menu, select Return to MAIN MENU in Analog Output Configuration menu and press **ENT**.

5.19 – TRANSDUCER SPAN SELECTION

Displays the transducer's natural span and operating span. The natural span represents the maximum process pressure that the transducer can accept. The displayed natural span is for user/technician reference only and should not be changed unless a new transducer of different natural span has been installed.

The operating span represents the calculated process pressure for a specific application, and can be adjusted 40% to 100% of the natural span.



1. While in Main Menu, use **UP** or **DN** to scroll to:

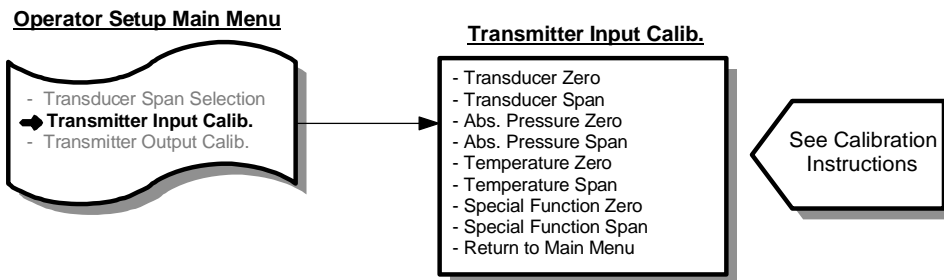
Set Transducer Natural Span
2. Press **ENT** and display indicates the natural span of the installed transducer (0.05, 0.10, 0.25, 0.50, 0.75, 1.00, 1.50, 2.00, 2.50, 3.00, 5.00, 10.00, 15.00, 25.00, 50.00, 100.00, 200.00 or 250.00 IN w.c.).
3. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT**. New setting will be stored in memory and display will return to Main Menu.

Caution: Only change setting if a transducer of different natural span has been installed.

Note: If user desires not to change the setting and return to Main Menu, press **ESC**. Unit will remain programmed as it was originally.

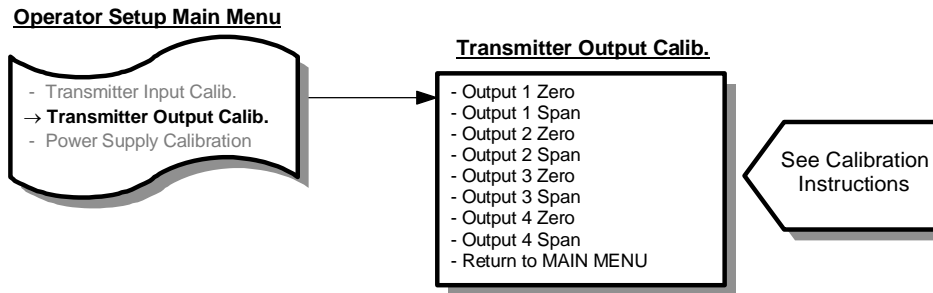
5.20 – TRANSMITTER INPUT CALIBRATION

See Section 6.3 – Calibration for details on Transmitter Input Calibration.



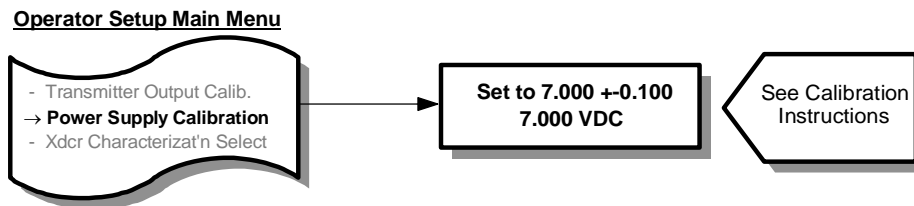
5.21 – TRANSMITTER OUTPUT CALIBRATION

See Section 6.4 – Calibration for details on Transmitter Output Calibration.

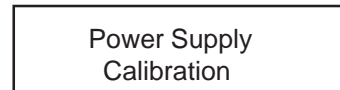


5.22 – POWER SUPPLY CALIBRATION

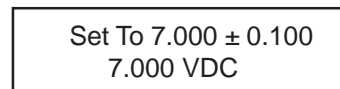
User can adjust power supply Voltage to an optimum value. The voltage has been adjusted at the Factory and should not require adjustment.



1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** and display will indicate current power supply voltage on line 2.



3. If supply voltage is less than 6.900V or greater than 7.100V, adjust R36 on I/O Board (see Figure 5.2) until acceptable voltage reading is displayed on line 2.

4. When done, press **ENT** to return to Main Menu.

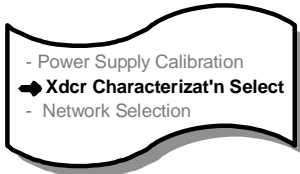
5.23 – TRANSDUCER CHARACTERIZATION SELECTION

Allows user to enter unique transducer characterization data when the transducer has been changed.

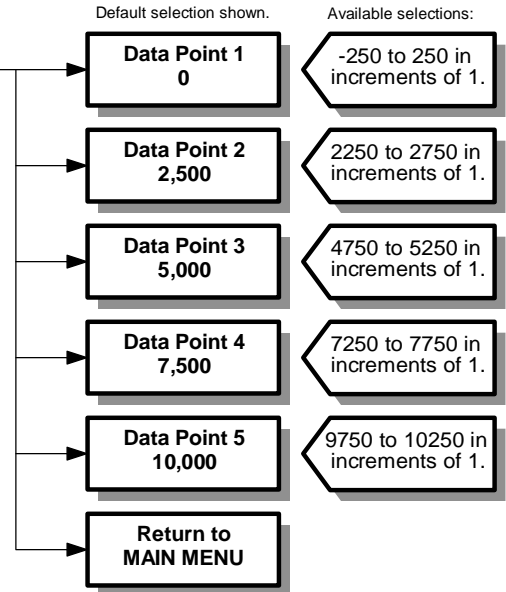
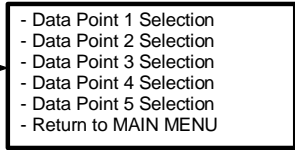
CAUTION:

- User should not make any changes to the data entered in the following menu items.
- This data has been entered by the Factory for the specific transducer installed in the unit.
- Only if the transducer is replaced by the user should new data be entered.
- This new data along with instructions will be provided with the new transducer from the Factory.

Operator Setup Main Menu

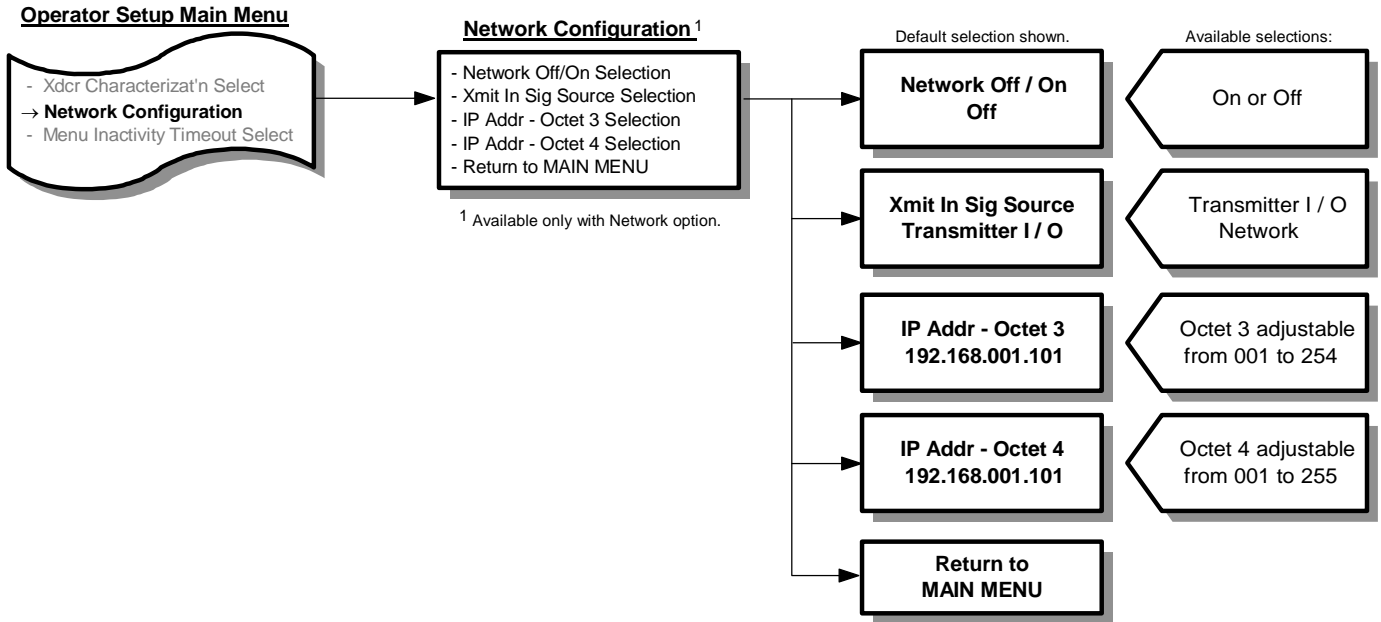


Xdcr Character. Selection

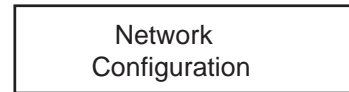


5.24 – NETWORK CONFIGURATION

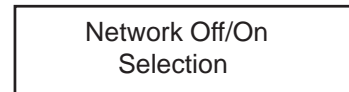
Operator can turn network communications ON or OFF, select source, and assign IP addresses.



1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** to enter Network Configuration menu. Display will indicate:



3. Press **ENT** and display will indicate current setting of Network (OFF or ON).

4. Use **UP** or **DN** to change setting. Once desired setting is displayed, press **ENT** and new setting will be stored in memory and display will return to Network Configuration menu as in Step 2.

Note: If user desires not to change the setting and return to Network Configuration menu, press **ESC**. Unit will remain programmed as it was originally.

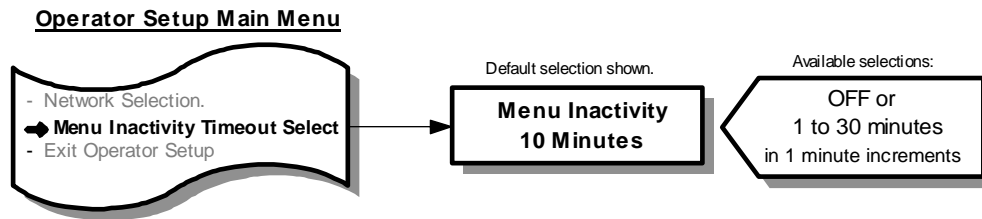
5. Use **UP** or **DN** to select remaining parameters to be changed.

6. Follow Step 4 to make any changes to parameters.

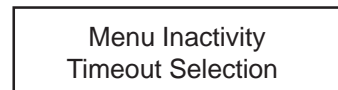
7. To return to Main Menu, select Return to MAIN MENU in Network Configuration menu and press **ENT**.

5.25 – MENU INACTIVITY TIMEOUT SELECTION

Allows user to select a time (minutes) after which the unit returns to Normal operation if no activity in the Operator Menu.



1. While in Main Menu, use **UP** or **DN** to scroll to:



2. Press **ENT** and display will indicate current timeout value (1 to 30 minutes or OFF).

3. Use **UP** or **DN** to change timeout value. Once desired value is displayed, press **ENT**. New setting will be stored in memory and display will return to Main Menu.

Note: If user desires not to change the setting and return to Main Menu, press **ESC**. Unit will remain programmed as it was originally.

6 – CALIBRATION

This section will detail steps necessary to calibrate the MASS-tron II. Calibration is accomplished using the four programming push buttons detailed in Section 5.

This section can be accomplished with MASS-tron II mounted in its operating location or at a test bench in a calibration lab.

If calibrated at a test bench, MASS-tron II should be positioned in the same attitude as in its operating location.

6.1 – REQUIRED EQUIPMENT

1. Digital Manometer capable of reading to the nearest 0.001" w.c.
2. Digital Multimeter.
3. Absolute Pressure gauge capable of reading 0 to 40" Hg.
4. Voltage/Current generator.
5. Source of clean, dry instrument air.
6. Adjustable low pressure regulator, such as AMC "Low Pressure Air Source" or equal.
7. Vacuum pump with regulator.
8. Temperature Simulator.
9. Pressure Regulator.

6.2 – PREPARATION

1. Turn MASS-tron II Power switch OFF (see Figure 4.1).
2. Remove Low and High pressure signal lines to the MASS-tron II.
3. Remove all signal wires connected to terminals 1 through 10 (see Figure 4.3).
4. Prepare test equipment as shown in Figure 6.1.
5. Turn Power switch ON.

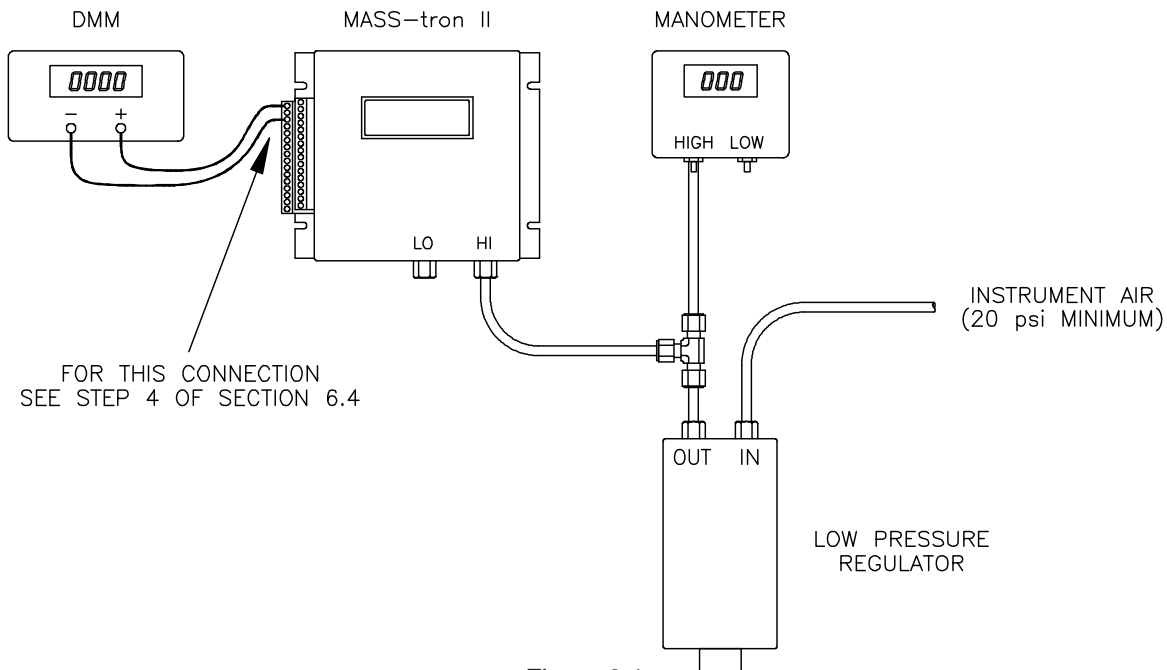


Figure 6.1

6.3 – TRANSMITTER INPUT CALIBRATION

6.3.1 Transducer Calibration

Minimum and maximum full scale differential pressure will be applied to the MASS-tron II, unit will be programmed to recognize these pressures as zero and span for transmitter input calibration.

1. While in Main Menu, scroll to:

Transmitter Input
Calibration

2. Press **ENT**, and display will indicate:

Transducer Zero
Calib: 0.00 in.WC

3. Press **ENT**, and display will indicate:

Transducer Zero
-- Push ENTER --

4. Press **ENT**, and display will indicate:

Transducer Zero
Settle Time:4 Sec

Display will count down to 0, after which it will indicate:

Input Zero Done
-- Push ESCAPE --

5. Press **ESC** and then **UP**, display will indicate:

Transducer Span
Calib: X.XX in.WC

6. Apply input pressure (as read on manometer) to the High port of the MASS-tron II. Adjust pressure to equal the transducer natural span value, which is indicated on the display.

7. Press **ENT**, and display will indicate:

Transducer Span
-- Push ENTER --

8. Press **ENT**, and display will indicate:

Transducer Span
Settle Time:4

Display will count down to 0, after which it will indicate:

Input Span Done
-- Push ESCAPE --

Note: If pressure input is less than 40% or greater than 110% of transducer's natural span value (see Factory Set-Up Information Sheet), display will indicate:

Bad Input Span
-- Push ESCAPE --

If this occurs, check input pressure (as read on manometer), and readjust as necessary. Press **ESC** and repeat Steps 6 through 8.

9. Press **ESC**.

10. Remove input pressure from High port on MASS-tron II.

6.3 – TRANSMITTER INPUT CALIBRATION (con't)

Note: The following Sections (6.3.2, 6.3.3, and 6.3.4) detail steps necessary to calibrate absolute pressure, temperature, and special function inputs. Follow those sections that are applicable to your unit (see Factory Set-Up Information Sheet).

6.3.2 Absolute Pressure Calibration. Follow these steps if Pressure was selected as a parameter in Section 5.8.

1. Prepare test equipment as shown in Figure 6.2. Have vacuum pump preset to approximately the required minimum pressure (see Factory Set-Up Information Sheet).

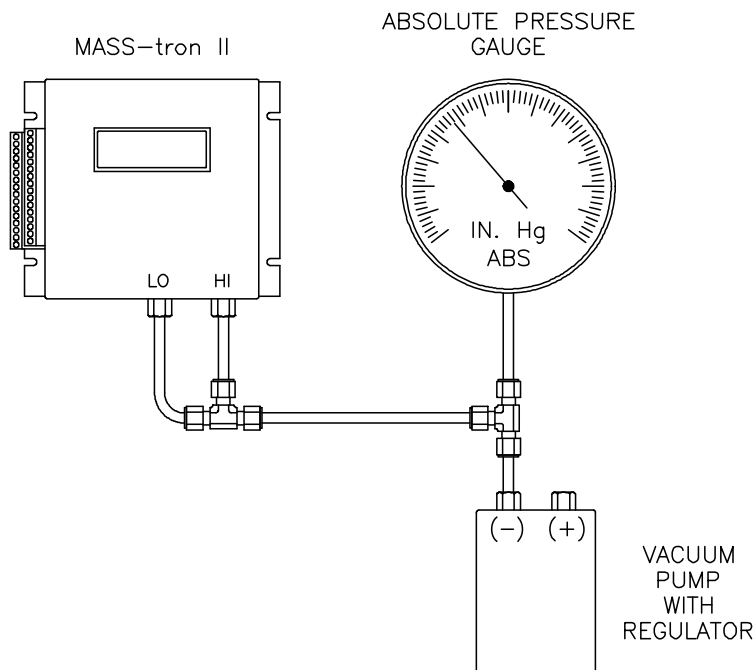


Figure 6.2

2. While in Transmitter Input Calib., scroll to:

Abs. Pressure Zero
Calib: 24.00 in.WC

3. Start vacuum pump and adjust (as read on gauge) to minimum absolute pressure value, which is indicated on the display.

4. Press **ENT**, and display will indicate:

Abs. Pressure Zero
-- Push ENTER --

5. Press **ENT**, and display will indicate:

Abs. Pressure Zero
Settle Time:4

Display will count down to 0, after which it will indicate:

Input Zero Done
-- Push ESCAPE --

6.3 – TRANSMITTER INPUT CALIBRATION (con't)

6.3.2 (con't)

Note: If zero input is less than 80% or greater than 120% of Absolute Pressure minimum input (see Factory Set-Up Information Sheet), display will indicate:

Bad Input Span
-- Push ESCAPE --

If this occurs, check input pressure (as read on gauge), and readjust as necessary. Press **ESC** and repeat Steps 4 through 5.

6. Press **ESC** and then **UP**, display will indicate:

Abs. Pressure Span
Calib: 36.00 in.Hg

7. Prepare test equipment as shown in Figure 6.3.

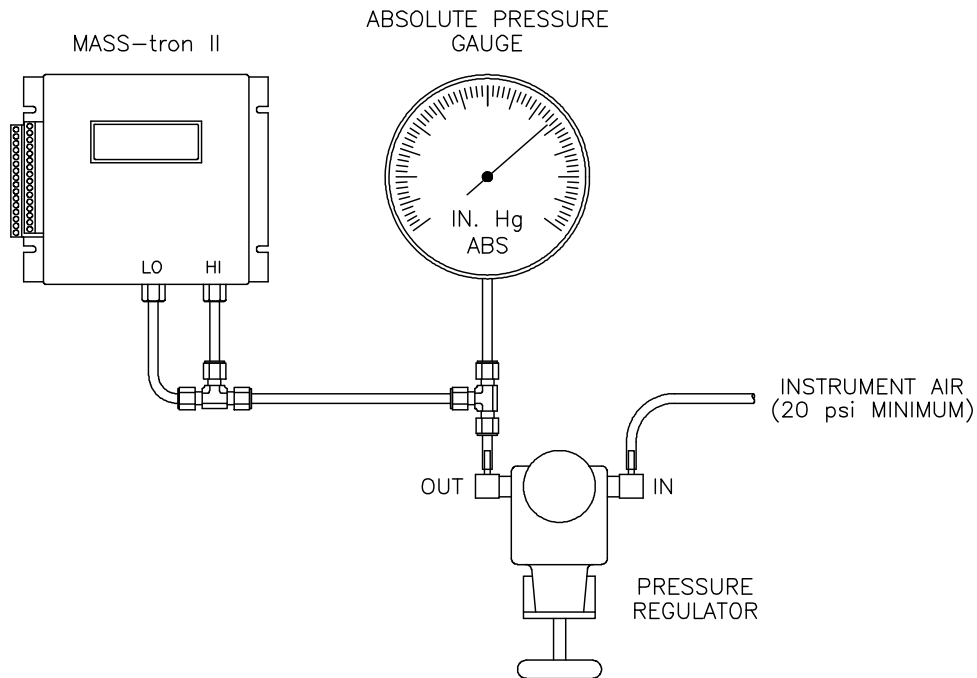


Figure 6.3

8. Adjust input pressure (as read on gauge) to the maximum absolute pressure value, which is indicated on the display.

9. Press **ENT** and display will indicate:

Abs. Pressure Span
-- Push ENTER --

10. Press **ENT**, and display will indicate:

Abs. Pressure Span
Settle Time:4

Display will count down to 0, after which it will indicate:

Input Span Done
-- Push ESCAPE --

6.3 – TRANSMITTER INPUT CALIBRATION (con't)

6.3.2 (con't)

Note: If span input is less than 80% or greater than 120% of Absolute Pressure maximum input (see Factory Set-Up Information Sheet), display will indicate:

Bad Input Span
-- Push ESCAPE --

If this occurs, check input pressure (as read on gauge), and readjust as necessary. Press **ESC** and repeat Steps 9 and 10.

11. Press **ESC**.

12. Remove test equipment.

6.3 – TRANSMITTER INPUT CALIBRATION (con't)

6.3.3 **Temperature Calibration.** Follow these steps if Temperature was selected as a parameter in Section 5.8.

1. While in Transmitter Input Calib, scroll to:

Temperature Zero
Calib: XXX°F

2. If temperature signal is provided by temperature device, connect a voltage/current generator across Terminals 8 and 10 (see Figure 4.4). If temperature signal is powered by MASS-tron II, connect a loop powered temperature simulator across Terminals 7 and 8 (see Figure 4.5).

3. Adjust temperature signal for minimum value of temperature input value which is indicated on the display.

4. Press **ENT**, and display will indicate:

Temperature Zero
-- Push ENTER --

5. Press **ENT**, and display will indicate:

Temperature Zero
Settle Time:4

Display will count down to 0, after which it will indicate:

Input Zero Done
-- Push ESCAPE --

6. Press **ESC** and then **UP**, display will indicate:

Temperature Span
Calib: XXX°F

7. Adjust temperature signal for maximum value of temperature input value which is indicated on the display.

8. Press **ENT**, and display will indicate:

Temperature Span
-- Push ENTER --

9. Press **ENT**, and display will indicate:

Temperature Span
Settle Time:4

Display will count down to 0, after which it will indicate:

Input Span Done
-- Push ESCAPE --

Note: If span input is less than 80% or greater than 120% of Temperature maximum input (see Factory Set-Up Information Sheet), display will indicate:

Bad Input Span
-- Push ESCAPE --

If this occurs, check input signal and readjust as necessary. Press **ESC** and repeat Steps 7 through 9.

10. Press **ESC**.

11. Remove test equipment.

6.3 – TRANSMITTER INPUT CALIBRATION (con't)

6.3.4 **Special Function Calibration.** Follow these steps if Special Function is utilized.

1. While in Transmitter Input Calib, scroll to:

Special Func. Zero
Calib: Aux.2 Minimum

2. Press **ENT**, and display will indicate:

Special Func. Zero
-- Push ENTER --

3. Connect a voltage/current generator adjusted for minimum value of Special Function input (see Factory Set-Up Information Sheet) across terminals 9 and 10 (see Figure 4.5).

4. Press **ENT**, and display will indicate:

Special Func. Zero
Settle Time:4

Display will count down to 0, after which it will indicate:

Input Zero Done
-- Push ESCAPE --

5. Press **ESC** and then **UP**, display will indicate:

Special Func. Span
Calib: Aux.2 Maximum

6. Press **ENT**, and display will indicate:

Special Func. Span
-- Push ENTER --

7. With voltage/current generator still connected as in Step 2, adjust to maximum value of Special Function input (see Factory Set-Up Information Sheet).

8. Press **ENT**, and display will indicate:

Special Func. Span
Settle Time:4

Display will count down to 0, after which it will indicate:

Input Span Done
-- Push ESCAPE --

Note: If span input is less than 80% or greater than 120% of Special Function's maximum input (see Factory Set-Up Information Sheet), display will indicate:

Bad Input Span
-- Push ESCAPE --

If this occurs, check input signal and readjust as necessary. Press **ESC** and repeat Steps 6 through 8.

9. Press **ESC** and then **UP**, display will indicate:

Return to
MAIN MENU

10. Press **ENT**, and display will be in Main Menu.

11. Remove test equipment.

6.4 – TRANSMITTER OUTPUT CALIBRATION

1. Scroll Main Menu to:

Transmitter Output
Calibration

2. Press **ENT**, and display will indicate:

Output 1 Zero

3. Press **ENT**, and display will indicate:

Output 1 Zero
Perform Calibration

4. Connect a DMM set for type and scale of Transmitter Output 1 (see Factory Set-Up Information Sheet) across terminals 1 and 3 on MASS-tron II (see Figure 4.3).

Note: If the output is 4-20mA, a load resistance should be in series with the DMM. This can be accomplished by connecting the actual process load or a resistor of similar value to the actual process load.

DMM should be reading minimum value; 0.00 ± 0.01 volts or 4.00 ± 0.01 mA.

5. If DMM is reading out of tolerance, use **UP** or **DN** to adjust MASS-tron II output for an acceptable DMM reading.

Depending on DMM's selected range, the **UP** or **DN** button may need to be pressed and held for a period of time before any change occurs in the DMM's display. To speed up changes in output, pushbutton combinations can be used. The following chart lists these combinations along with the associated change in output type.

PUSHBUTTON COMBINATION	4-20mA	OUTPUT TYPE 0-5VDC	0-10VDC
UP only	+0.001mA	+0.3mV	+0.6mV
DN only	-0.001mA	-0.3mV	-0.6mV
UP* + ESC	+0.01mA	+0.003V	+0.006V
DN* + ESC	-0.01mA	-0.003V	-0.006V
UP* + DN	+0.1mA	+0.03V	+0.06V
DN* + UP	-0.1mA	-0.03V	-0.06V
UP* + ESC* and DN	+1.0mA	+0.3V	+0.6V
DN* + ESC* and UP	-1.0mA	-0.3V	-0.6V

*Must be pressed and held before other button(s) are pressed.

6.4 – TRANSMITTER OUTPUT CALIBRATION (con't)

6. Once an acceptable zero reading is obtained, press **ENT** and then **UP** and display will indicate:

Output 1 Span

7. Press **ENT**, and display will indicate:

Transmitter Span
Perform Calibration

8. With DMM still connected as in Step 4, reading should be at maximum value; 10.00 ± 0.01 volts, 5.00 ± 0.01 volts, or 20.00 ± 0.01 mA.

9. If DMM is reading out of tolerance, use **UP** or **DN** to adjust MASS-tron II output for an acceptable DMM reading.

10. Once an acceptable span reading is obtained, press **ENT** and then **UP** and display will indicate.

Output 2 Zero

11. Repeat Steps 3 through 10 for other Outputs. For Temperature Output 2, connect DMM across terminals 2 and 3; for Absolute Pressure Output 3 across terminals 4 and 6, and for Analog Output 4 across terminals 5 and 6 (see Figure 4.5).

12. Press **UP** until display indicates:

Return to
MAIN MENU

13. Press **ENT** and scroll Main Menu to:

EXIT
Operator Setup

14. Press **ENT** and MASS-tron II will return to *Normal* mode of operation.

7 – MAINTENANCE

The MASS-tron II is a solid state device having few mechanical parts requiring special periodic maintenance. The following maintenance steps are not requirements, but guidelines for establishing a maintenance program for your specific installation.

Operating experience should be used to set frequency of specific types of maintenance.

7.1 – CLEANLINESS

- Periodically inspect MASS-tron II for build-up of dust and debris.
- Keep field wiring terminal strips clean to preclude shorting between terminals.
- Verify condensation (or other sources of liquids) are not present inside the MASS-tron II.

7.2 – MECHANICAL

- Verify pressure signal connections are secure.
- Inspect pressure signal lines for any cracks or leaks.
- Verify mounting hardware is secure.

7.3 – ELECTRICAL

- Periodically inspect all wiring to the MASS-tron II for good connections and absence of corrosion.

7.4 – CALIBRATION

- MASS-tron II should have calibration verified annually as a minimum.

8 – TROUBLESHOOTING

Personnel should be familiar with the operation of the MASS-tron II (see Section 5) before performing any troubleshooting.

Note: Prior to performing any troubleshooting, turn power switch OFF. After 10 seconds, turn power switch ON. If problem still exists, proceed with troubleshooting steps.

<i>Problem</i>	<i>Solution</i>
No Display and "CPU Activated" LED is not lit.	<ul style="list-style-type: none"> – Verify input 24V ac/dc power is connected to Terminals 15 and 16. – Verify power switch is in the ON position. – Check fuse F2 (see Section 9.0 for location). – Replace I/O Board.
No output or incorrect output (Transmitter Output 1) and display responding correctly with process change.	<ul style="list-style-type: none"> – Review Factory Set-Up Information Sheet for type of output. – Check terminal strip wiring for proper installation. – Verify jumpers are correct for desired type of output (see Section 4.6). – Check fuse F3 (see Section 9.0 for location). – Perform Transmitter Output Calibration (see Section 6.4). – Replace I/O Board.
No output or incorrect output (Transmitter Output 1) and display not responding or correctly with process change.	<ul style="list-style-type: none"> – Verify pressure signal lines are connected correctly. – Check for leaky or obstructed lines between MASS-tron II and process sensor. – Check for kinked internal signal pressure lines in transmitter base. – Replace Transducer. – Replace CPU Board.
No output or incorrect output. (Analog Output 2, 3 or 4).	<ul style="list-style-type: none"> – Verify correct output is selected (see Section 5.18). – Verify correct input is applied for process application or special function. – Verify jumpers are correct for desired type of output (see Section 4.6). – Check wiring for proper installation. – Verify menu configuration setup is correct for process application or special function. – Replace I/O Board.
Special Function not working.	<ul style="list-style-type: none"> – Verify that Special Function is ON and desired type is selected (see Section 5.15). – Verify special function parameters (depends on type selected) are configured properly (see Section 5.15). – Verify any required external input is connected properly (see Section 4.5). – Verify any required external input is calibrated properly (see Section 6.3). – Replace I/O Board.
AUTO-zero Function not working.	<ul style="list-style-type: none"> – Verify AUTO-zero is ON and interval is properly set (see Section 5.10). – Verify AUTO-zero valve switch S1 on CPU Board is in the NORMAL position (see Figure 5.1). – Replace I/O Board.
"AUTO-zero in Progress" LED is continuously lit.	<ul style="list-style-type: none"> – Zero value measured during AUTO-zero cycle is between 90 and 100% of span. Transmitter Input Calibration should be performed as soon as possible (see Section 6.3). – Replace Transducer Board.
"AUTO-zero in Progress" LED is flashing rapidly.	<ul style="list-style-type: none"> – Zero value measured during AUTO-zero cycle is greater than 100% of span. Transmitter Input Calibration should be performed immediately (see Section 6.3). – Replace Transducer Board.

If after following the Troubleshooting steps the MASS-tron II continues to operate improperly, contact the Service Department for further assistance (see Section 10).

8 – TROUBLESHOOTING (con't)

Personnel should be familiar with the operation of the MASS-tron II (see Section 5) before performing any troubleshooting.

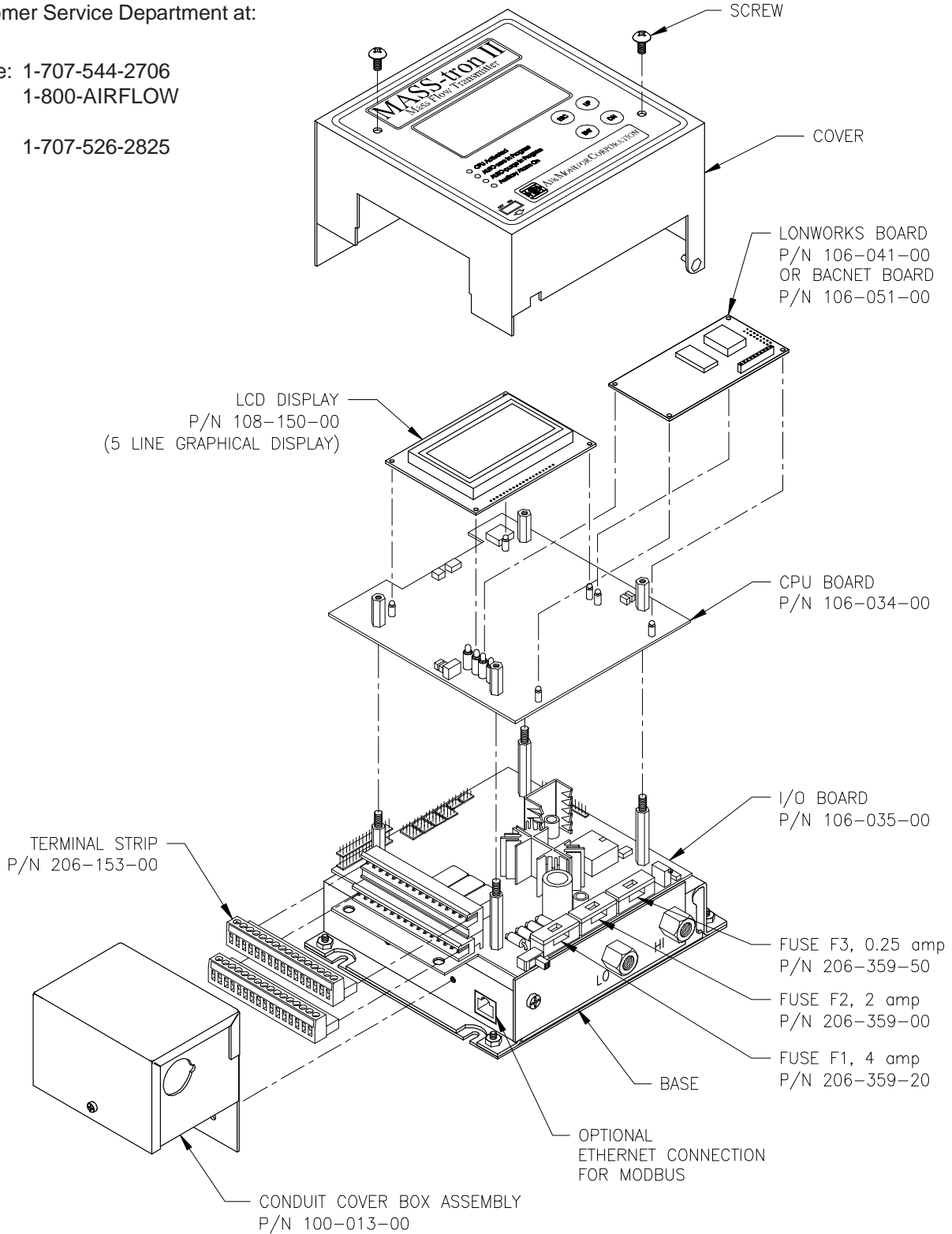
Problem	Solution
AUTO-purge Function is not working.	<ul style="list-style-type: none"> – Verify AUTO-purge is on, interval and activation are properly set (see Section 5.11). – Check for proper terminal strip wiring and connections (see Section 4.5).
AUTO-purge Function goes through cycle but purge panel does not initiate.	<ul style="list-style-type: none"> – Verify correct wiring to purge panel (see Section 4.5). – Check Fuse F2 (see Figure 5.2 for location).
Alarms not working.	<ul style="list-style-type: none"> – Verify that Alarm is ON and setpoints are set to correct value (see Section 5.13). – Check for proper terminal strip wiring and connections (see Section 4.5). – Replace I/O Board.
"CPU Activated" LED is not flashing	<ul style="list-style-type: none"> – Turn power switch OFF and back ON. – Replace CPU Board.
"CPU Activated" LED is flashing, display has characters but is not functioning.	<ul style="list-style-type: none"> – Replace CPU Board.
Temperature output is at minimum, and display (if used) says Bad Temp.	<ul style="list-style-type: none"> – Check Temperature input for open circuit between temperature device and MASS-tron II's terminal strip. – Verify temperature device is connected correctly (see Figure 4.4 or 4.5). – Verify jumpers are correct for desired type of input (see Section 4.6).
Absolute pressure calibration display indicates "Bad Input Zero" or "Bad Input Span".	<ul style="list-style-type: none"> – Verify pressure gauge is an <u>Absolute</u> Pressure Gauge. – Check for signal line leaks.
Temperature output and display (if used) have an error of $\geq 5\%$.	<ul style="list-style-type: none"> – Verify Temperature input signal from temperature device is correct. – Verify correct linearization has been selected (see Section 5.7).
"Unreliable" is displayed on Line 1 of the display.	<ul style="list-style-type: none"> – Process signal is outside of -10% to $+110\%$ of the calibrated process range. – Independently verify flow. If measured flow is higher than MASS-tron II's Process Maximum, contact Factory to discuss respanning.
"Unreliable" is displayed on Line selected to display Temperature.	<ul style="list-style-type: none"> – Temperature input signal is outside of -10% to $+110\%$ of calibrated Temperature Range.
"Unreliable" is displayed on Line selected to display Absolute Pressure.	<ul style="list-style-type: none"> – Absolute Pressure input signal is outside of -10% to $+110\%$ of calibrated Absolute Pressure Range.
Unable to access Operator Setup	<ul style="list-style-type: none"> – If the password has changed from the factory default of 1,111 and forgotten, Operator can access the Password Selection Menu by sequentially pressing UP, DN, UP, and ESC.
<p>If after following the Troubleshooting steps the MASS-tron II continues to operate improperly, contact the Service Department for further assistance (see Section 10).</p>	

9 – PARTS LIST

The following drawing with part numbers lists components of the MASS-tron II that are easily replaced by the user. When contacting the Customer Service Department about parts, please have the applicable Factory Set-Up Information sheet available for reference. To inquire about price and availability of a specific part number, please contact the Customer Service Department at:

Phone: 1-707-544-2706
1-800-AIRFLOW

Fax: 1-707-526-2825

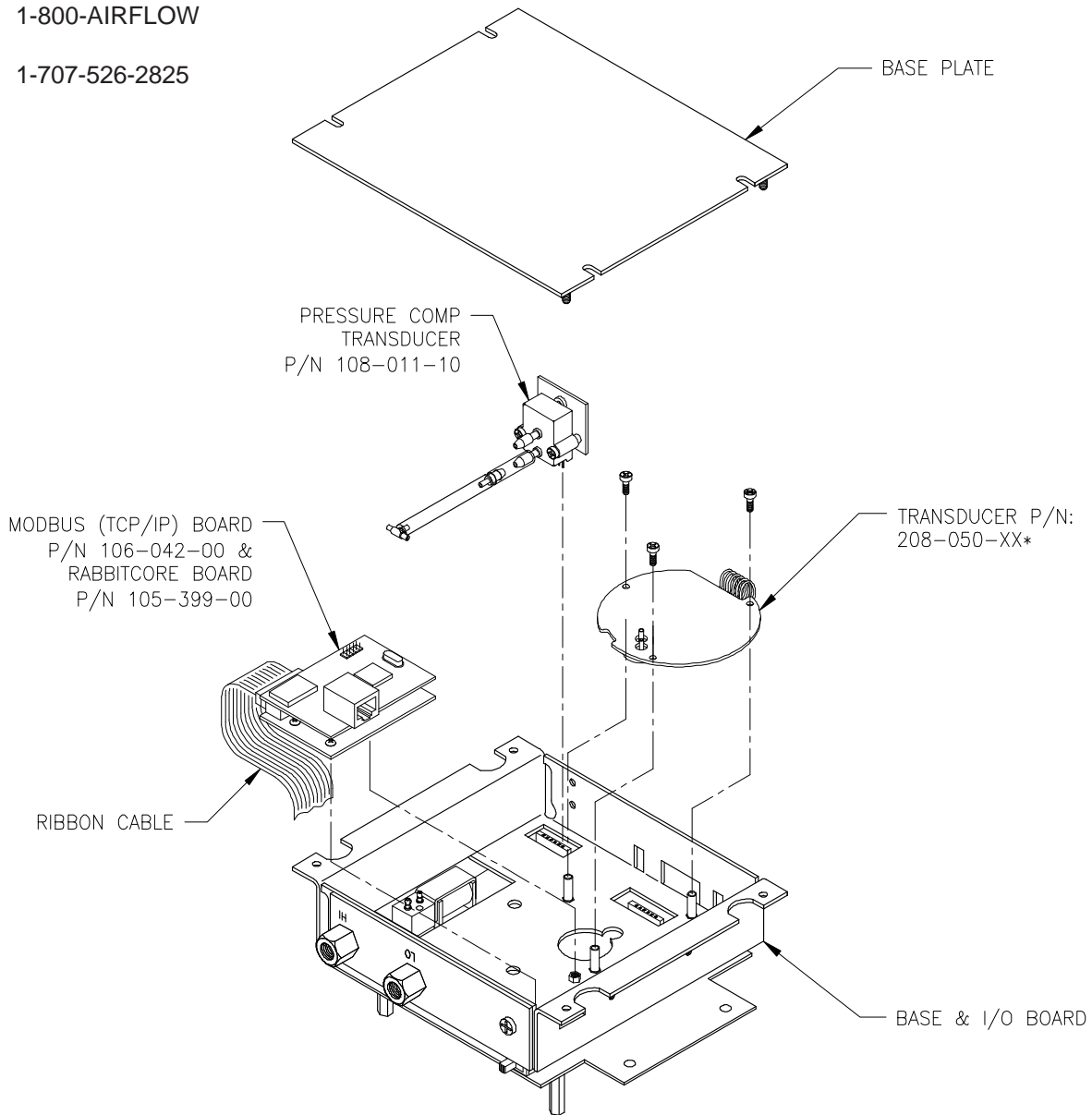


9 – PARTS LIST

The following drawing with part numbers lists components of the MASS-tron II that are easily replaced by the user. When contacting the Customer Service Department about parts, please have the applicable Factory Set-Up Information sheet available for reference. To inquire about price and availability of a specific part number, please contact the Customer Service Department at:

Phone: 1-707-544-2706
 1-800-AIRFLOW

Fax: 1-707-526-2825



* NOTE: REFER TO FACTORY SET-UP INFORMATION SHEET TO DETERMINE WHICH TRANSDUCER IS UTILIZED IN YOUR MASS-tron II.

10 – CUSTOMER SERVICE

10.1 – CUSTOMER SERVICE/TECHNICAL SUPPORT

Air Monitor Corporation provides in-house technical support for our products:

Monday through Friday
7 am to 5 pm (pst)
Phone: 707-544-2706 or 1-800-AIRFLOW
Fax: 707-526-2825

Additionally, on-site technical assistance is available. Before contacting the Customer Service Department, please ensure any applicable troubleshooting steps outlined in Section 8 have been performed.

10.2 – REPAIRS/RETURNS

If after contacting the Customer Service Department it is determined that equipment will require return to Air Monitor Corporation for further repair, a Return Authorization number will be issued by the Customer Service Department. A Confirmation of Return Authorization with shipping instructions will be sent via facsimile or e-mail.

Equipment to be returned to Air Monitor should be returned in its original shipping container if possible. If this is not possible, ensure equipment is packaged sufficiently to protect it during shipment.

CAUTION
All damage occurring during transit is the Customer's responsibility.

List the Return Authorization (R/A) number on the packing list and clearly mark this number on the outside of each shipping container.

Costs associated with return of equipment to Air Monitor are the customer's responsibility regardless whether the repair/return is under warranty.

10.3 – WARRANTY REPAIRS/RETURNS

Once the Customer Service Department determines that the equipment repair is under warranty, the item will be repaired and returned to the customer at no charge.

10.4 – NON-WARRANTY REPAIRS/RETURNS

Customer will be invoiced for all parts and labor required for the repair of equipment. Return shipping charges will also be added to invoice.

10.5 – FIELD SERVICE

Requests for field service should be made to the Customer Service Department, who will coordinate sending a technician to customer's site.

Phone: 707-544-2706 or 1-800-AIRFLOW
Fax: 707-526-2825

Upon completion of work, technician completes a Field Service Report and gives a copy to the customer. Field service is charged on a daily basis and all travel expenses are also added to customer's invoice.

APPENDIX A

BACnet over RS485 Signal Wire Connections and Network Configuration

The MASS-tron II Transmitter with BACnet option provides a differential bus transceiver designed to be compatible with the TIA/EIA-485-A specification and the BACnet MS/TP protocol. Receiver inputs incorporate an idle bus failsafe feature which eliminates the need for system network biasing. The RS485 presents a 1/4 unit load to the network which allows up to 128 MASS-tron II Transmitters to be present on the network. On board field selectable switches allow for selecting network end of line termination. Address selection and network baud rate are selected via the Network Configuration section in the Transmitter’s Operator Setup menu.

Connect the RS-485 wiring to the MASS-tron II terminals as follows:

Signal	Terminal
Network Ground	18
Net A or Net+	19
Net B or Net-	20

The MASS-tron II’s BACnet objects consist of the following types:

Device Type	Device Object	Default Units
Analog Input	Air Flow	CFM
Analog Input	Differential Pressure	In. WC

Set the S1 Termination switches on the BACnet module (see Section 9) as follows:

Termination Type	S1 Switch Position		
	1	2	3
No Termination	OFF	OFF	OFF
End of Line	ON	OFF	OFF
Fail-safe Bias	ON	ON	ON

Note that the Fail-safe Bias termination includes End of Line termination.

The MASS-tron II’s Network Configuration menu consists of the following items:

Network Configuration Item	Range	Default Value
Network Off/On	Off or On	On
BACnet InstanceID Selection	0 – 4,194,303	1
BACnet Address Selection	0 – 127	1
BACnet Max Masters Selection	1 – 127	127
BACnet Baud Rate Selection	9600, 19200, 38400, 76800	38400

APPENDIX A

LonWorks
Signal Wire Connections and Network Configuration

The MASS-tron II Transmitter with BACnet option provides a differential bus transceiver designed to be compatible with the TIA/EIA-485-A specification and the BACnet MS/TP protocol. Receiver inputs incorporate an idle bus failsafe feature which eliminates the need for system network biasing. The RS485 presents a 1/4 unit load to the network which allows up to 128 MASS-tron II Transmitters to be present on the network. On board field selectable switches allow for selecting network end of line termination. Address selection and network baud rate are selected via the Network Configuration section in the Transmitter’s Operator Setup menu.

Connect wiring to the Transmitter terminals as follows:

Signal	Terminal
Network Ground	18
Lon A	19
Lon B	20

The MASS-tron II provides two output variables:

SNVT	SNVT Index	Measurement	Units	Type Category	Type Size
SNVT_flow_f	53	Flow Volume	Liters/Sec	Floating Point	4 bytes
SNVT_temp_p	105	Temperature	°C x 100	Signed Long	2 bytes

APPENDIX A

Modbus over TCP **Signal Wire Connections and Network Configuration**

Modbus over TCP implementation includes the following data types:

Modbus Points and Addresses

Function	Function	Data Type	Register Address	Discrete Bit
Read Input Register	Primary Process	float	31001	
Read Input Register	Process Units	int	31003	
Read Input Register	Temperature	float	31004	
Read Input Register	Temperature Units	int	31006	
Read Input Register	Absolute Pressure	float	31007	
Read Input Register	Absolute Pressure Units	int	31009	
Read Input Register	Differential Pressure	float	31010	
Read Input Register	Differential Pressure Units	int	31012	
Read Input Register	Special Function Output	float	31013	
Read Input Register	Special Function Units	int	31015	
Read Discrete	AUTO-purge Acknowledge	int	11001	BIT0
Read Discrete	AUTO-cal Acknowledge	int	11001	BIT1
Read Discrete	AUTO-zero Acknowledge	int	11001	BIT2
Write Discrete*	Start/Stop Purge	int	11	X
Write Discrete*	Perform Calibration	int	12	X
Write Holding	Damper Position	Int	41001	

Table 1 – Modbus Register Definitions

***Note:**

- Writing the discrete register value of 11 will start a purge cycle.
- If the purge cycle is in progress, a write of the discrete register value of 11 will stop the purge cycle.
- A write of the discrete register value 12 will cause the transmitter to perform a zero calibration.

APPENDIX A

Modbus over TCP (con't)

Units are encoded as follows:

Transmitter Codes for Units of Measure

Process Type	Value	Units
Differential Pressure	0	in.WC
	1	in.Hg
	2	psig
	3	Pa
	4	kPa
	5	bars
	6	mbars
	7	mm WC
	8	mm Hg
	9	kg/m2
	10	%
Velocity	11	FPS
	12	FPM
	13	FPH
	14	m/s
	15	m/m
	16	m/hr
	17	AFPS
	18	AFPM
	19	AFPH
	20	Am/s
	21	Am/m
	22	Am/hr
	23	SFPS
	24	SFPM
	25	SFPH
	26	Sm/s
	27	Sm/m
	28	Sm/hr
	29	Nm/s
	30	Nm/m
31	Nm/hr	
	32	%
Flow	33	CFS
	34	CFM
	35	CFH
	36	l/s
	37	l/m
	38	l/hr
	39	m3/s
	40	m3/m
	41	m3/hr
	42	ACFS

Process Type	Value	Units
Flow (con't)	43	ACFM
	44	ACFH
	45	Al/s
	46	Al/m
	47	Al/hr
	48	Am3/s
	49	Am3/m
	50	Am3/h
	51	SCFS
	52	SCFM
	53	SCFH
	54	Sl/s
	55	Sl/m
	56	Sl/hr
	57	Sm3/s
	58	Sm3/m
	59	Sm3/h
	60	Nl/s
	61	Nl/m
	62	Nl/hr
	63	Nm3/s
	64	Nm3/m
	65	Nm3/h
	66	lb/s
	67	lb/m
	68	lb/hr
	69	T/hr
	70	T/day
	71	gm/s
	72	kg/s
	73	kg/m
	74	kg/hr
	75	%
Temperature	76	°F
	77	°C
	78	°R
	79	°K
Absolute Pressure	80	in.Hg
	*81	psia
	*82	kPa
	*83	mbars
	*84	mm Hg