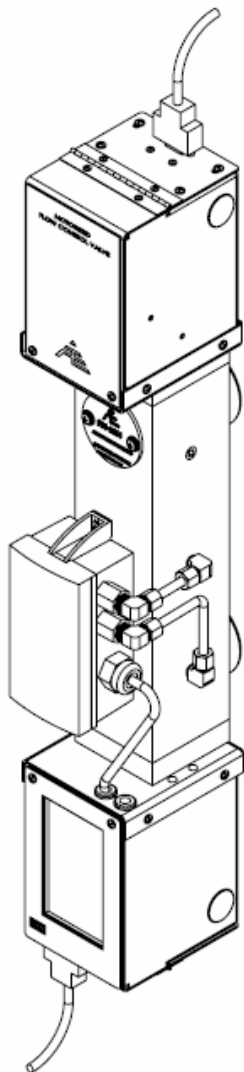




UPC-MARATHON

FURNACEMETER-TOUCH™

Installation and Operation Manual



CONNECT WITH US



**MASTERING
STRENGTH.
WORLDWIDE.**



MANUAL#: 419

Revision	Date	Technician	Revision Description
006	09/15/2017	S. Pfeiffle	Updated mechanical installation instructions
005	01/04/2017	J. Cruz	Added master terminal and gas type tables
004	05/31/2016	M. Lamster	Updated for new features & minor formatting
003	01/22/2016	M. Lamster	Updated Modbus register list
002	10/15/2015	T. Weitenbeck	Updates to AI Setup and minor formatting
001	09/25/2015	M. Lamster	Manual approved for release

THIS MANUAL IS SUPPLIED ELECTRONICALLY.

COPYRIGHT^(C)

No part of this publication may be reproduced, transmitted, transcribed, stored in a retrieval system, or translated into any language or computer language, in any form or by any means, electronic, mechanical, magnetic, optical, chemical, manual, or otherwise, without prior written permission of United Process Controls Inc. (UPC-Marathon).

The information contained in this document is STRICTLY CONFIDENTIAL and PROPRIETARY to UPC-Marathon, and shall not be: i) reproduced or disclosed in part or in whole, ii) used for any design or manufacturing of heat treating and/or control equipment, or any other purpose except for that which it is supplied under the terms of the Contract, unless the express written authorization is obtained from UPC-Marathon.

Drawings and photographs included in the documentation are the property of UPC-Marathon, and it is strictly forbidden to reproduce them, transmit them to a third party, or use them for manufacturing and/or design of equipment. Sub-licensing of any technical information contained in this Documentation is strictly forbidden under the terms of the Contract.

UPC-Marathon reserves the right to modify this document without prior notice.

TECHNICAL ASSISTANCE

For all questions or concerns regarding the operation of the **FurnaceMeter-Touch™**, please consult the last page of this manual for contact information.



Table of Contents

1	EXPRESS WARRANTY ON UPC-MARATHON EQUIPMENT	4
2	DESCRIPTION	6
3	SPECIFICATIONS	6
4	MECHANICAL COMPONENT OVERVIEW.....	8
5	MECHANICAL INSTALLATION	8
6	ELECTRICAL INSTALLATION.....	10
7	USER INTERFACE OPERATION.....	12
7.1	Home Screen Overview	12
8	SYSTEM OPERATION	13
8.1	Flow Control Modes	13
8.2	LOCKING THE HOME SCREEN	13
8.3	Flow Setpoint Setup	14
8.4	Flow Calibration Curve Input	15
8.5	Thermocouple Input Calibration	15
8.6	In-Field Screen Calibration	16
8.7	Valve Speed Adjustment	17
8.8	Extended Drive Time Setup	18
8.9	Communications Setup	18
8.10	FlowMeter Setup	19
8.11	Temperature.....	29
8.12	System Setup.....	31
9	MAINTENANCE	31
9.1	General Preventative Maintenance	31
9.2	Calibration Certification	31
9.3	Calibration Certification Procedure.....	32
10	MODBUS REGISTER LIST	32
10.1	Commonly Used Modbus Registers:	32
11	FURNACEMETER-TOUCH™ TROUBLESHOOTING	33
11.1	ISSUE: Meter is Displaying Flow when Gas is Shut Off	33
11.2	Issue: Valve is not Driving	33
11.3	Issue: Meter is not Controlling to Setpoint.....	34
11.4	Issue: Meter Cannot Achieve Full Flow Scale	34
11.5	Issue: Loss of Communications.....	34
12	FURNACEMETER-TOUCH™ SPARE PARTS LIST	35
13	CUSTOMER SUPPORT	36



1 EXPRESS WARRANTY ON UPC-MARATHON EQUIPMENT

United Process Controls Inc. (hereinafter referred to UPC-Marathon) warrants products for a period of one (1) year from the date of shipment from UPC-Marathon to the original purchaser to be free from defects in material and workmanship under normal recommended use, service, inspection, and maintenance. Normal recommended use, service, inspection, and maintenance, mean:

1. Not to be used in excess of nor below the rated capacity, pressure, and temperature ranges specified in the applicable quotation, purchase order, acknowledgment, marketing literature, nameplate, specification sheet, or the Installation, Operation, Inspection, and Maintenance Manual (THE MANUAL); and
2. Using only clean gases free of solids and other contaminants not considered constituents of the gas; and
3. Installation, operation, inspection, and maintenance in compliance with THE MANUAL; and
4. The UPC-Marathon products being used only in:
 - a. Ambient environments lower than 132 °Fahrenheit (54 °Celsius) unless specifically designed and so labeled by UPC-Marathon for higher temperatures; and
 - b. Non-corrosive environments; and
 - c. Completely protected from moisture, rain, snow, or other outside environments; and
 - d. Not to be used below 32 °Fahrenheit (0 °Celsius) unless precautions are taken for low temperature conditions as shown in THE MANUAL.
5. Being used only for applications permitted by THE MANUAL or other UPC-Marathon literature or special applications approved in a separate written authorization by UPC-Marathon.

WARRANTY EXCEPTIONS

This Warranty does not apply to damage caused by any or all of the following circumstances or conditions:

1. Freight damage;
2. Parts, accessories, materials, or components not obtained from nor approved in writing by UPC-Marathon;
3. Any consequential or incidental damages including but not limited to loss of use, loss of profits, loss of sales, increased costs, arising from the use of any product system or other goods or services manufactured, sold, or provided by UPC-Marathon;
4. Misapplication, misuse, and failure to follow THE MANUAL or other literature, instructions, or bulletins (including drawings) published or distributed prior to THE MANUAL.



The exclusive remedy under this Warranty or any other express warranty is the repair or replacement without charge for labor and materials of any UPC-Marathon parts found upon examination by UPC-Marathon to have been defective. Since certain UPC-Marathon equipment is heavy, bulky and not deliverable by U.S. mail or other parcel service, UPC-Marathon equipment may be returned only upon written consent of UPC-Marathon and then only to the location designated by UPC-Marathon. Generally, such consent will be given only upon the condition that the customer assume and prepay all carrier charges and responsibility for damage in transit.

Purchasers of UPC-Marathon products, equipment, goods, or services waive subrogation on all items covered under their own or any other insurance.

DISCLAIMER

THIS WARRANTY IS EXCLUSIVE. UPC-MARATHON EXPRESSLY DISCLAIMS ANY AND ALL OTHER WARRANTIES WHETHER EXPRESSED OR IMPLIED INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE OR ANY PURPOSE.

No person, including dealer, seller, or other representative of UPC-Marathon is authorized to make, on behalf of UPC-Marathon, any representations beyond those contained in UPC-Marathon literature and documents or to assume for UPC-Marathon any obligations or duties not contained in this Warranty and Warranty Policy.

UPC-Marathon reserves the right to make design and other changes, modifications or improvements to products, services, literature, or systems, without any obligation, to furnish or install same on any previously sold or delivered products or systems.

LIMITATION OF LIABILITY

It is expressly agreed that the liability of UPC-Marathon is limited and UPC-Marathon does not function as an insurer. The purchaser and/or user agree that UPC-Marathon is not liable for loss, harm, or damage due directly or indirectly to any occurrence or consequences there from. If UPC-Marathon should be found liable to anyone on any theory (except any express warranty where the remedy is set forth in Section 2 of this Warranty and Warranty Policy) for loss harm or damage, the liability of UPC-Marathon shall be limited to the lesser of the actual loss, harm or damage or the purchase price of the involved UPC-Marathon equipment or service when sold (or when service performed) by UPC-Marathon to customer. This liability is exclusive and regardless of cause or origin resulting directly or indirectly to any person or property from:

1. The performance or nonperformance of any obligations set forth in this Warranty and Warranty Policy;
2. Any agreement including specifications between UPC-Marathon and the customer;
3. Negligence, active, passive or otherwise of UPC-Marathon or any of agents or employees;



4. Breach of any judicially imposed warranty or covenant of workmanship, durability or performance; and
5. Misrepresentation (under the Restatement, common law or otherwise) and/or strict liability involvement;
6. Liability for fraud-in-the-inducement.

WARRANTY FIELD SERVICE

If Warranty Field Service is rendered at the request of the purchaser or user and the difficulty is found not to be with UPC-Marathon's product, the purchaser shall pay the time and expense (at the prevailing rate at the time of the service) of UPC-Marathon's field representative(s). Charges for service, labor, and other expenses that have been incurred by the purchaser, customer, or agent without written approval of UPC-Marathon will not be accepted. The OEM or other reseller is responsible for transmitting installation and operating instructions, THE MANUAL or other service literature supplied by UPC-Marathon with the equipment.

2 DESCRIPTION

The FurnaceMeter-Touch™, which utilizes differential pressure measurement across a fixed orifice, is a precision flow measurement and control instrument designed specifically to meet the rugged requirements of industrial flow measurement for heat treating furnace applications. The differential pressure produced is referenced to a NIST traceable flow measurement transfer standard. The resulting data is programmed into the FurnaceMeter-Touch™ control board and is provided in this manual as the "Calibration Curve". The calibration of the FurnaceMeter-Touch™ can be certified in-situ by measuring the actual differential pressure and comparing this value with the attached calibration curve.

The FurnaceMeter-Touch™ is coupled with a motorized needle and orifice control valve. The valve can be operated in either manual or automatic control modes. In automatic control mode the flow control board will compare the actual flow rate with the desired flow rate set point and, if necessary, drive the valve in the appropriate direction and speed to correct for differences. The FurnaceMeter-Touch™ can receive the desired flow rate setpoint either manually through the touchscreen user interface, remotely with a 4-20mA set point signal, or through communications.

3 SPECIFICATIONS

Power Required	24 VDC @ 400 mA
Flow Rate Capacity	See Calibration Report
Accuracy	4%
Repeatability	2%
Turndown Capability	6:1
Medium Temperature Limits	-10°F to 180°F



Ambient Temperature Limits.....	-10°F to 180°F
Flow Output Signal (Linear).....	4-20 mA
Max. Output Signal Load	500Ω Max.
Input Control Signal (Linear).....	4-20 mA, 0-1V, 0-2.5V, 1-5V
Response Time	1-10 seconds
Communications.....	RS-485, Modbus TCP (Selectable)
Communication Protocol.....	MODBUS RTU, MODBUS TCP/IP
Pressure Drop @ 100% Capacity.....	5"wcg (Standard Model)
(See Calibration Record for specific pressure drop)	1 psig (High Pressure Model)
Flow Meter Inlet Pressure Limits	5 psig max (Standard Model), 250 psig max (High Pressure Model)
Flow Meter Differential Pressure Limits	1 psig max (Standard Model), 10 psig max (High Pressure Model)



4 MECHANICAL COMPONENT OVERVIEW

The FurnaceMeter-Touch™ can be configured with manual or electronic valve options. Replacement spare parts assemblies are available for the valve enclosure, electronic sensor, and FurnaceMeter-Touch™ Display Assembly.

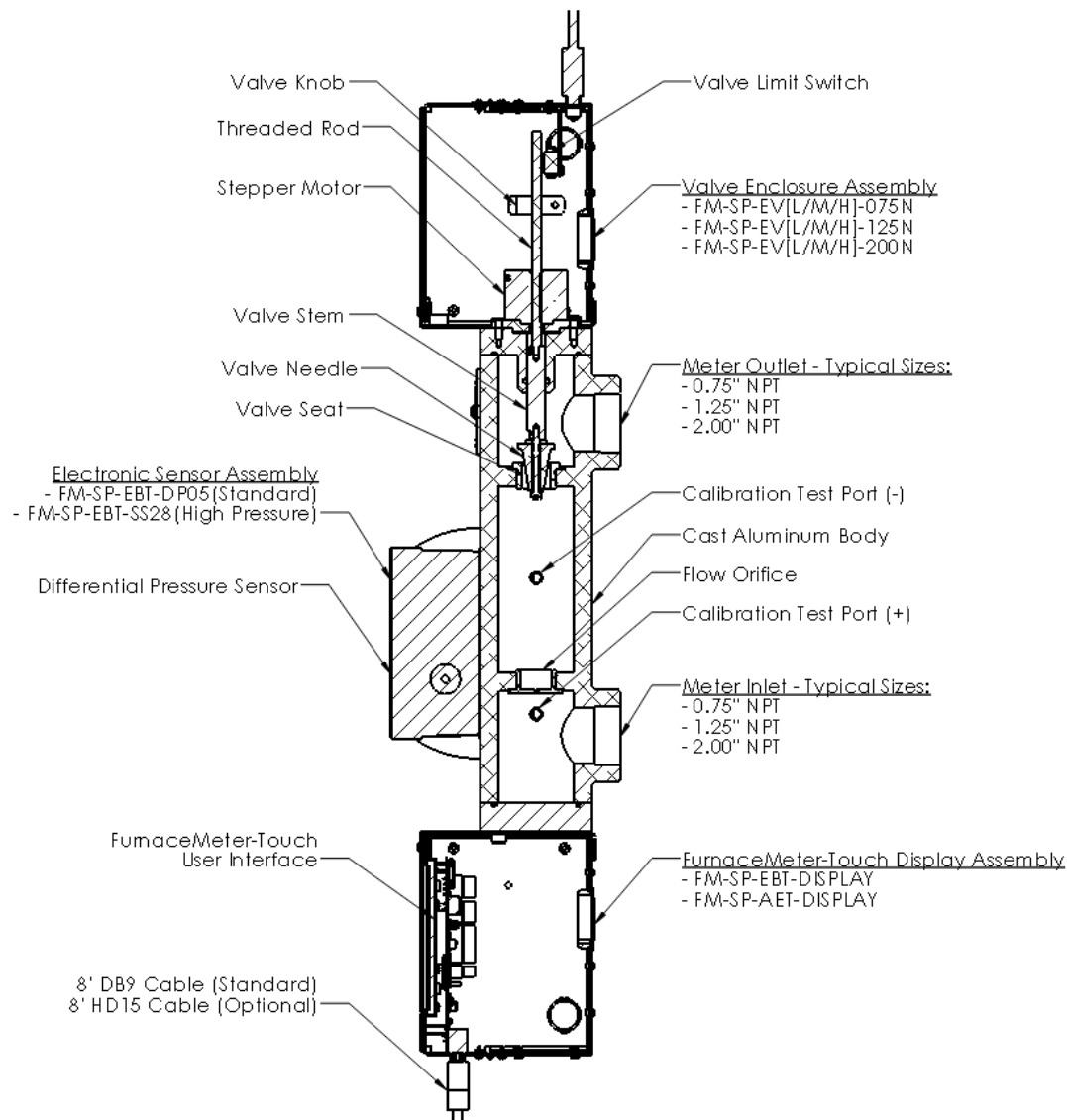


Figure 1 – FurnaceMeter-Touch™ Component Callout

5 MECHANICAL INSTALLATION

The FurnaceMeter-Touch™ is shipped as a complete unit and ready to be mounted and plumbed per the local codes for the gas or liquid to be measured. It is recommended that the following items be considered to ensure proper mechanical operation.



- Inspect the instrument for any obvious damaged or missing components.
- Secure the meter to a solid surface using the provided mounting holes.
- Attach pipe fittings to the inlet and outlet of the FurnaceMeter-Touch™ as identified in Figure 2 below. It is acceptable to utilize bushings or reducers at the FurnaceMeter-Touch™ ports to accommodate the desired pipe size. However, undersized piping may limit the maximum flow rate capability. Consult pipe sizing charts or contact UPC-Marathon to ensure that the desired flow rates will not be compromised.
- Ensure that the inlet pressure is within the limits of the installed FurnaceMeter-Touch™. Please see the calibration record that corresponds with your FurnaceMeter™ serial number for the calibrated inlet pressure. Note that pressure deviations from that of the calibrated specification will introduce an offset into the flow reading.
- It is recommended that manual isolation valves be installed prior to the FurnaceMeter-Touch™ to ensure positive flow rate shut off. The integrated valve provided with the FurnaceMeter-Touch™ is designed for precision control and will not guarantee positive shutoff.

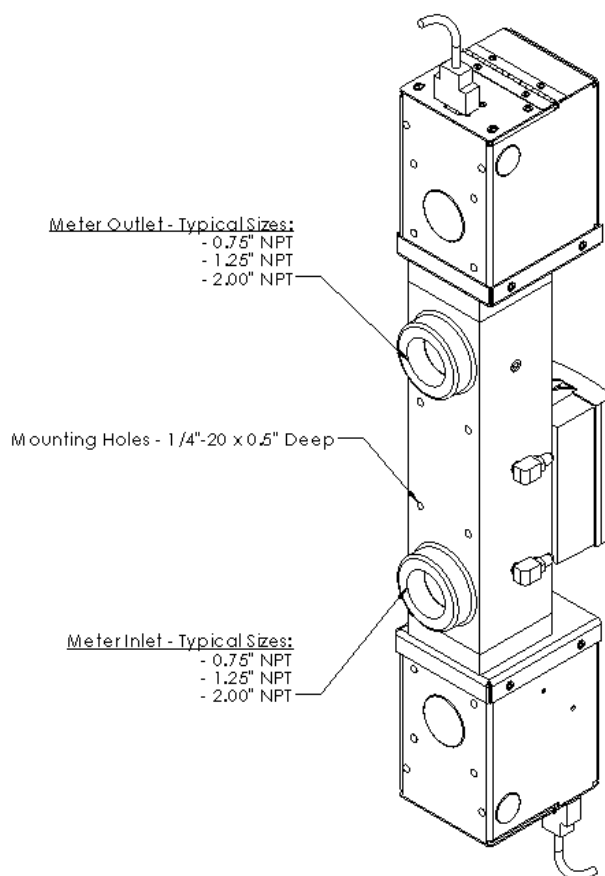


Figure 2 - FurnaceMeter-Touch™ Installation Callout



6 ELECTRICAL INSTALLATION

The electrical connections are typically made to the FurnaceMeter-Touch™ using either the DB9 (Standard, Table 2) or HD15 (Optional, Table 1) connector provided on the bottom of the display assembly enclosure. However, certain components such as Thermocouples, Pressure Sensors, and additional Digital & Analog I/O need to be wired to terminals located on the back of the PCB. The connections are shown in Figure 4.

Table 1 - FurnaceMeter-Touch™ HD15 Connector Pinout (Optional)

D-8618 FEMALE HD15 CABLE, 8'L			
PIN #	WIRE COLOR	DESCRIPTION	TERMINAL #
1	BLACK	POWER SUPPLY (+24VDC)	2
2	WHITE	GROUND SUPPLY	1
3	RED	AI#2 - FLOW SETPOINT +	6
4	LT. GREEN	AI#2 - FLOW SETPOINT -	5
5	ORANGE	AO#1 - FLOW RETRANS +	24
6	LT. BLUE	AO#1 - FLOW RETRANS -	27
7	WHITE/BLACK	AO#2 - PROCESS CONTROL +	25
8	RED/BLACK	AO#2 - PROCESS CONTROL -	27
9	LT. GRN/BLK	DI#1 - CONTROL DISABLE	19
10	ORNG/BLK	DI#2 - AUTO ONLY	18
11	LT. BLU/BLK	DO#1 - PCB FAULT ALARM	28
12	BLACK/WHITE	DO#2 - FLOW ALARM ON	29
13	RED/WHITE	DO#3 - MANUAL MODE ON	30
14	LT. GRN/WHT	+ RS485	35
15	LT. BLU/WHT	- RS485	36

Table 2 - FurnaceMeter-Touch™ DB9 Connector Pinout (Standard)

H-1115 FEMALE DB9 CABLE, 8'L			
PIN #	WIRE COLOR	DESCRIPTION	TERMINAL #
1	RED	POWER SUPPLY (+24VDC)	2
2	BLACK	GROUND SUPPLY	1
3	GREEN	AO#1 - FLOW RETRANS +	24
4	WHITE	AO#1 - FLOW RETRANS -	27
5	ORANGE	AI#2 - FLOW SETPOINT +	6
6	BLUE	AI#2 - FLOW SETPOINT -	5
7	BROWN	+ RS485	35
8	YELLOW	- RS485	36
9	PURPLE	DO#1 - PCB OK	28

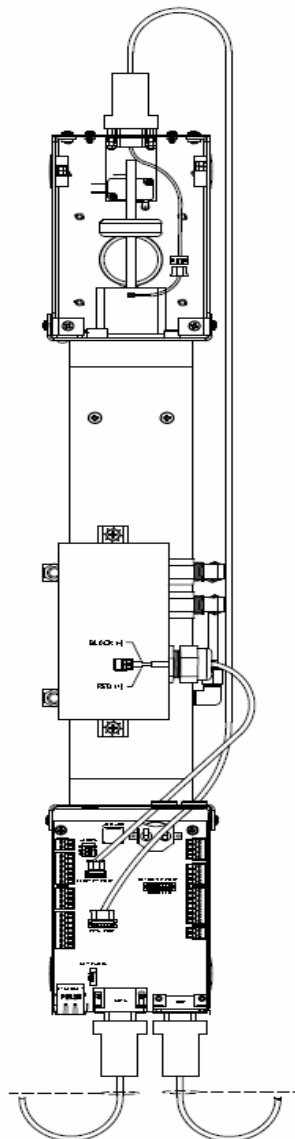


Figure 3 - FurnaceMeter – Touch™ Electrical Connections



*Communication is MODBUS over TCP/IP (Ethernet) or RTU (RS485). TCP/IP communications are available through the Ethernet port located at the bottom of the display enclosure.

FURNACEMETER-TOUCH™ PCB LAYOUT:

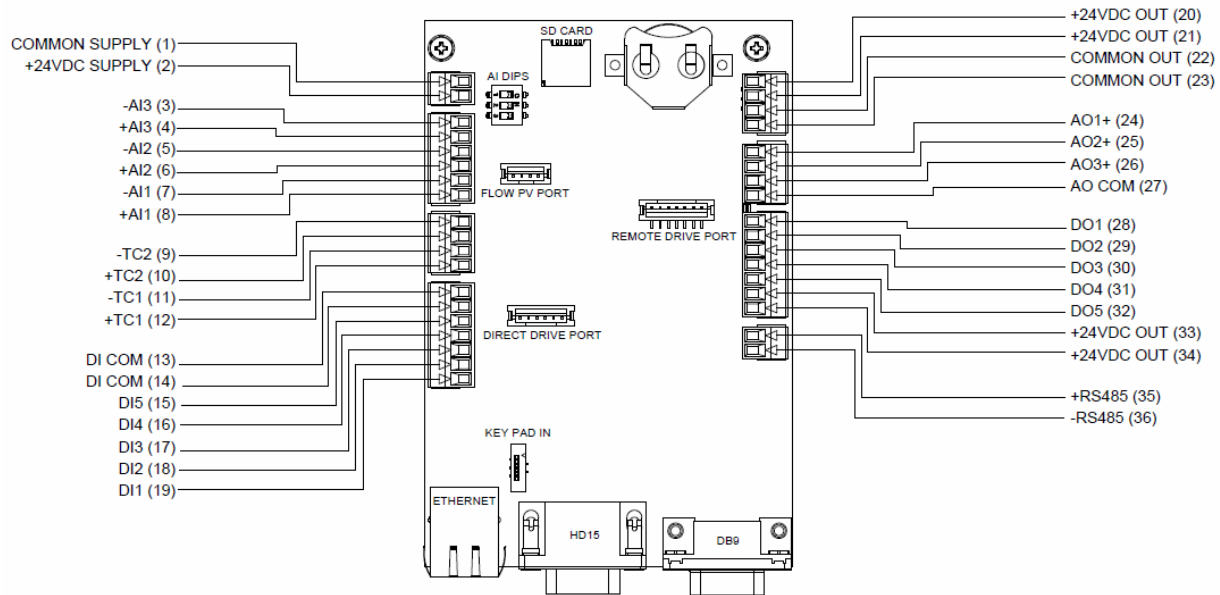


Figure 4 - FurnaceMeter-Touch™ PCB Layout

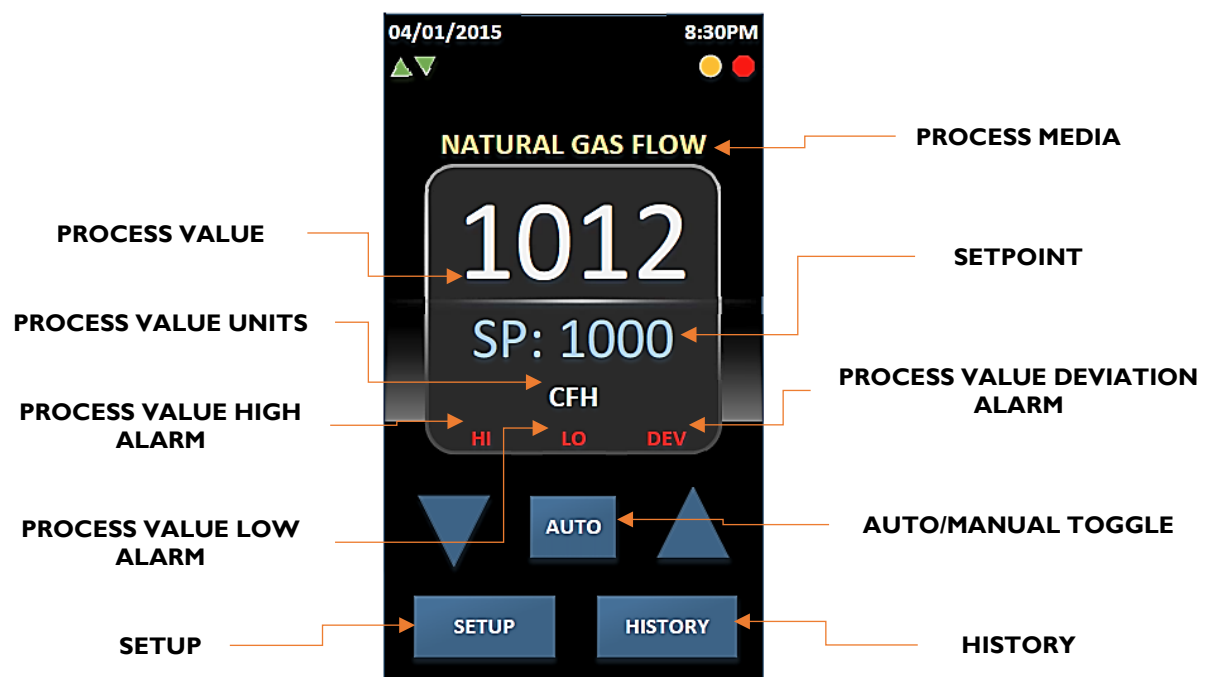
FURNACEMETER-TOUCH™ TERMINAL LIST:

DETAILED DESCRIPTION OF I/O'S					
Terminal #	Name	Description	Terminal #	Name	Description
1	COMMON SUPPLY	USE IF NOT USING DB9 OR HD15	20	+24VDC OUT	
2	+24VDC SUPPLY	USE IF NOT USING DB9 OR HD15	21	+24VDC OUT	
3	-AI3		22	COMMON OUT	
4	+AI3	FLOW PRESSURE SIGNAL (4-20mA)	23	COMMON OUT	
5	-AI2		24	AO1+	FLOW RETRANS SIGNAL (4-20mA)
6	+AI2	FLOW SETPOINT SIGNAL (4-20mA)	25	AO2+	PROCESS CONTROL SIGNAL (4-20mA)
7	-AI1		26	AO3+	VALVE SPEED SIGNAL (4-20mA)
8	+AI1	FLOW SENSOR SIGNAL (4-20mA)	27	AO COM	COMMON FOR AO1 - AO3
9	-TC2	NOT USED	28	DO1	ALARM#1 STATUS (PCB STATUS OK)
10	+TC2	NOT USED	29	DO2	ALARM#2 STATUS (FLOW ALARM)
11	-TC1		30	DO3	ALARM#3 STATUS (MANUAL MODE ALARM)
12	+TC1	FLOW TEMPERATURE SIGNAL	31	DO4	VALVE MOTOR DRIVE/STOP
13	DI COM	COMMON FOR DI1 - DI5	32	DO5	VALVE MOTOR DIRECTION
14	DI COM	COMMON FOR DI1 - DI5	33	+24VDC OUT	
15	DI5	SCALE TOGGLE	34	+24VDC OUT	
16	DI4	LOW LIMIT	35	+RS485	
17	DI3	HIGH LIMIT	36	-RS485	
18	DI2	AUTO/MAN REMOTE SIGNAL			
19	DI1	ENABLE CONTROL TOGGLE			

7 USER INTERFACE OPERATION

7.1 Home Screen Overview

The FurnaceMeter-Touch™ conveniently brings the most important flow information directly to the main screen. From here the user has the ability to change control modes, input a local setpoint, and access important setup parameters for the program. Understanding the indications and information displayed on the main screen critical to ensure proper functionality of the FurnaceMeter-Touch™. Figure 5 displays the main screen layout, refer to the list below for detailed information.



Home Screen Items:

- Gas Type:
 - o Display of the gas type being controlled by the meter.
- Flow PV:
 - o Real-time display of the amount of flow through the meter.
- Flow SP:
 - o Current flow setpoint of the meter (either local or remote).
 - o When controlling with a local setpoint, and the screen lockout disabled, this value can be changed by tapping on the value and entering in the desired setpoint using the on-screen keypad.
- Flow Units:
 - o Display of the Engineering Units being used to measure flow.
- High Flow Alarm:
 - o Indication that the amount of flow through the meter is greater than the “High Flow Alarm Setpoint.” This will only display when the alarm is ACTIVE.



- Low Flow Alarm:
 - o Indication that the amount of flow through the meter is less than the “Low Flow Alarm Setpoint.” This will only display when the alarm is ACTIVE.
- Flow Deviation Alarm:
 - o Indication that the difference between Flow SP and Flow PV is greater than the “Flow Deviation Alarm Setpoint.” This will only display when the alarm is ACTIVE.
- Auto/Man Toggle:
 - o Button that will allow the user to switch between Automatic and Manual Control Modes.
 - o When Digital Input #2 (See DI Setup Page) is ON, the Auto/Man toggle will display “LOCK.”
- Setup:
 - o Button that will take the user to the Program Setup menu.

8 SYSTEM OPERATION

8.1 Flow Control Modes

The FurnaceMeter-Touch™ is capable of controlling flow in either an Automatic or Manual control mode. These modes can be toggled in a number of different ways through the touch screen interface or even with a remote signal. Located on the main flow control screen, the “AUTO/MAN” button can be pressed to toggle between each mode. During a power failure the valve will store the last control mode and return to this state when the power returns. Flow alarms and totalizing features continue to operate in either control mode.

Automatic Mode	“AUTO” Button Displayed
Manual Mode	“MAN” Button Displayed

- **Manual Control Mode:**

When the unit is in manual control mode, the motorized valve will only drive when the “Up” or “Down” buttons are pressed. The “Up” button will drive the valve open and the “Down” button will close the valve. If no button is pressed, then the valve will remain in the current position. Manual mode should be used when flow control solenoids are used to provide “on/off” flow rate control. The mode can also be used to test the meter calibration and valve operation. In this mode, the “Up”/“Down” arrows will display allowing the user to drive the valve.
- **Automatic Control Mode:**

When the unit is in automatic control mode, the motorized valve will continue to drive until the actual flow rate equals the flow rate setpoint. The flow rate setpoint value is displayed on the main flow control screen next to “SP”. If the actual flow is less than the flow rate setpoint then the motor will drive the valve open and if the actual flow is greater than the flow rate setpoint then the motor will drive the valve closed.

8.2 LOCKING THE HOME SCREEN



The FurnaceMeter-Touch™ Home Screen can be locked out to limit operator access to control parameters that are available on the main screen.

- **Home Screen Lock Procedure**

- Navigate to the “Control Setup” menu. From the Home Screen: “Setup” → “FurnaceMeter Setup” → “Control Setup.”
- From the Control Setup menu, tap “Home Screen Lock” and change the toggle from “False” to “True”
 - Value [0] = False
 - Value [1] = True

8.3 Flow Setpoint Setup

The FurnaceMeter-Touch™ controls flow by constantly checking the “deviation” between the Flow Process Value (PV) and the Flow Setpoint (SP). This Flow SP can be set in two different ways, either remotely via an incoming analog signal or locally by simply entering a value from the display.

- **Using a Remote Setpoint (Analog Input #2):**

In order to send a Flow SP via a remote analog signal the control board must first be configured to accept and look for this incoming signal.

- Navigate to the “Control Setup” menu. From the Home Screen: “Setup” → “FlowMeter Setup” → “Control Setup.”
- In the “Control Setup” menu ensure that the “Setpoint Type” is set to “Remote.” To change the type, tap “Setpoint Type” and enter in the corresponding value using the on-screen keypad.
 - Value [0] = “Local”
 - Value [1] = “Remote”
- Once the board is set to receive this signal navigate to the “Analog Input #2 Setup” menu. From the Home Screen: “Setup” → “Analog Inputs” → “AI#2 Setup”
- In the AI Setup menu tap the “Curve” button located in the bottom right corner.
- The “AI#2 Calcurve” is where the scaling from Signal to Value is setup. Using the first 2 calibration points, enter the Min/Max Signal Values into the left column and the Min/Max Setpoint Values into the right column. (See “Analog Inputs” under “System Operation” for an example.)

- **Using an RS485 or Local Setpoint:**

In order to enter a Flow SP directly through the display, either manually or via RS485 communications, the control board must first be configured to accept and look for this local entry. After the setup process, simply tap the Flow SP value on the Home Screen and enter in the new value using the on-screen keypad. Note, when using a local setpoint, the user can change this value from the “Control Setup” screen as well as from the Home Screen.

- Navigate to the “Control Setup” menu. From the Home Screen: “Setup” → “FlowMeter Setup” → “Control Setup.”



- In the “Control Setup” menu ensure that the “Setpoint Type” is set to “Local.” To change this value, tap “Setpoint Type” and enter in the corresponding value using the on-screen keypad.
 - Value [0] = “Local”
 - Value [1] = “Remote”

8.4 Flow Calibration Curve Input

The FurnaceMeter-Touch™ displays flow by relating the mA reading from a differential pressure sensor to a flow value across a 10-point calibration curve. This calibration curve is accessible through the Analog Input #1 Setup menu.

- Entering the Calibration Curve:

- Navigate the Analog Input #1 Setup menu. From the Home Screen: “Setup” → “Analog Inputs” → “AI#1 Setup”
- In the AI setup menu tap the “Curve” button located in the bottom right corner.
- Using the FurnaceMeter’s Calibration Record, enter the mA Signal Values into the left column, and enter the Flow Values into the right column. Figure 6 shows an example calibration curve.

Note:

If display decimals is greater than zero, Calcurve Setup will show decimals as whole numbers. For example, 10.1 would show as 101.

Analog Input Calcurve Setup		
Cal Point	Signal	Value
Cal #1	4.0000	0
Cal #2	4.1500	13
Cal #3	4.5000	19
Cal #4	5.0000	26
Cal #5	6.0000	37
Cal #6	7.0000	49
Cal #7	9.0000	64
Cal #8	11.000	73
Cal #9	15.000	88
Cal #10	19.500	102

Figure 5 - Example 10 Point Flow Calcurve

8.5 Thermocouple Input Calibration

The FurnaceMeter-Touch™ has two Thermocouple Inputs available for real-time temperature correction in the flow measurement and for process temperature tracking. In order to take advantage of these features it is necessary to properly calibrate the TC Inputs to ensure that an accurate temperature reading is being displayed.

- Thermocouple Input Setup:



- Navigate to the TC Input Setup Screen. From the Home Screen: “Setup” → “Temperature” → “TC#1 Setup.”
- Select the TC Type to be used on this input by tapping “TC Type” and entering in the corresponding values.
 - Value [0] = Type B
 - Value [1] = Type E
 - Value [2] = Type J
 - Value [3] = Type K (Default)
 - Value [4] = Type N
 - Value [5] = Type R
 - Value [6] = Type S
 - Value [7] = Type T
- Select the temperature units that are to be used.
 - Value [0] = Fahrenheit (°F)
 - Value [1] = Celsius (°C) (Default)
- Wire a calibrated temperature sourcing device to the TC Input and determine a temperature range that is applicable for the application.
- Begin by sourcing the minimum value of the temperature range to the input and entering this value into “CAL Source Low.” At the same time, make note of the value that is displayed at the bottom of the setup menu next to “Temperature,” (this is the temperature value that the control board is seeing) and enter this into “CAL Display Low.”
- Next source the maximum value of the temperature range to the input and enter this value into “CAL Source High.” Again, make note of the value that is displayed next to “Temperature” and enter this into “CAL Display High.”
- Once this is done, the control board will calculate an “Offset” value and the calibration is complete.

Note:

Each TC Input is intended for a specific application. TC Input #1 is used for real-time temperature correction in the flow measurement and TC Input #2 is used for some Process Temperature that the user would like to record on the control board.

8.6 In-Field Screen Calibration

A major innovation in the FurnaceMeter-Touch™ is it's resistive touch screen display that puts all of the necessary control parameters of the FurnaceMeter at the operators fingertips. If it is noticed that the finger tap registering is offset, a screen calibration can be initiated through the user interface.

- Screen Calibration:

- Navigate to the “System Setup” menu. From the Home Screen: “Setup” → “System Setup.”
- Under the System Setup menu, select “Touchscreen Cal.” This will initiate the calibration procedure by displaying a bullseye in the middle of the screen.
- Press and hold the bullseye, preferably with a stylus until the target moves to its next location.



- Repeat this process until the board resets with the new calibration values.

8.7 Valve Speed Adjustment

The FurnaceMeter-Touch™ controls flow by checking the deviation between the Flow Setpoint (SP) and the Flow Process Value (PV), then applies this error to calculate an output percentage. This output percentage is then scaled to a usable engineering value to control a linear actuator motor. It is important for any operator to understand how to adjust both the PID Output Percentage and the actual motor speed to achieve proper flow control. These parameters are set from the factory to correctly control flow, however, it may be necessary to adjust these values at some point in the future should the process conditions change. Below are a few common scenarios where adjusting the valve control may be necessary.

- **Adjusting Valve Parameters:**

If it is noticed that the meter is having trouble controlling to a setpoint it may be necessary to consider the following procedure as the valve may either be reacting too quickly or too slowly.

- Navigate to the PWM Setup menu. From the Home Screen: “Setup” → “Analog Outputs” → “PWM Setup”
- In the PWM Setup menu, adjust the “Signal Span” or Speed value up or down in a manner that seems appropriate. It is recommended to start in increments of about 5 and adjust accordingly.
 - After the initial adjustment check to see if the control has improved. If it has, exit the setup menu. If not, continue to adjust the speed in the direction that will compensate for the control.

- **Overshoot when Driving to Setpoint:**

If it is noticed that the flow of the meter is overshooting when driving to a setpoint this is a good indication that the valve speed is set too high and the control loop cannot keep up with the valve. This can be easily corrected by following the above procedure and lowering the valve speed.

- **Slow to Reach to Setpoint:**

If it is noticed that the flow of the meter is taking a while to reach setpoint, this is a good indication that the valve speed is set too low. This can easily be corrected by following the above procedure and increasing the valve speed.

Note:

Indications of a Slow Valve (Controlling Setpoint):

- As valve drives open/closed (note direction status indicators on the Home Screen) the Flow PV does not increase/decrease.

Indications of a Fast Valve (Controlling Setpoint):

- When the valve drives open/closed (note direction status indicators on the Home Screen) the Flow PV increases/decreases by a large amount and the valve is constantly opening/closing to compensate for these large instantaneous changes.

In rare cases it may be necessary to adjust the PGain value in the PID Setup menu. (See PID Setup for details) The adjustment to the PGain can be used to implicitly make the valve drive



“faster” as it directly influences the output percentage, however, adjusting the PGain in the field is typically not required outside of retrofit applications

8.8 Extended Drive Time Setup

In the event that the flow setpoint and process value reach zero, the control board is designed to continue to drive the control valve closed at a fixed speed for a given amount of time in order to ensure proper seating of the needle against the valve seat. In order for the extended drive sequence to activate the user must define a drive time, hysteresis, and valve speed by navigating to “Setup” → “FlowMeter Setup” → “Control Setup.”

- Ext Drive Time:
 - Amount of time that the valve will continue to drive for after the flow PV and SP have reached zero. When set to a non-zero value the below parameters will display in the menu.
- Ext Drive Hysteresis:
 - Value of flow that the meter must see in order to allow the extended drive sequence to activate.
- Ext Drive PID Perc:
 - Drive speed value (0-100%) of the valve when the extended drive feature is active.

8.9 Communications Setup

The FurnaceMeter-Touch™ is capable of communicating via Modbus across two different protocols, RS485 and TCP/IP. Depending on which protocol is desired, the control board will need to be setup to look for one or the other. The FurnaceMeter-Touch™ Modbus register list is provided at the end of the manual.

- **RS485 Communications:**
 - Navigate to the Communications menu. From the Home Screen: “Setup” → “Communications.” In the setup menu, ensure that the “Type” is set to “RTU.” To change this, tap “Type” and enter the corresponding value using the on-screen keypad.
 - Value [0] = RTU (Default)
 - Value [1] = TCP
 - Set the “Device ID” to a desired value (Default = 1). Note that if multiple devices will be connected on the same network the “Device ID” will need to be unique for each device.
 - “RS485 Baud” can be set to three different values but must be consistent between the main device and the control board. Ex. Main PLC Baud = 19200, FM Control Board = 19200. To change this setting tap “RS485 Baud” and enter the corresponding value using the on-screen keypad.
 - Value [0] = 9600 Baud
 - Value [1] = 19200 Baud (Default)



- Value [2] = 115200 Baud
 - "RS485 Parity" can also be set to three different values, but again this must be consistent between the main device and the control board. Ex. Main PLC Parity = EVEN, FM Control Board = EVEN. To change this setting tap "RS485 Parity" and enter the corresponding value using the on-screen keypad.
 - Value [0] = NONE
 - Value [1] = ODD
 - Value [2] = EVEN (Default)
 - Finally, once all settings are correct tap "Save/Apply Settings." This will save the settings and reset the board. Once the reset is complete, the new communications settings will be applied.
- **TCP/IP Communications:**
 - Navigate to the Communications menu. From the Home Screen: "Setup" → "Communications." In the setup menu, ensure that the "Type" is set to "TCP." To change this, tap "Type" and enter the corresponding value using the on-screen keypad.
 - Value [0] = RTU (Default)
 - Value [1] = TCP
 - Set the "IP Address" to a desired value (Default = 192.168.0.100). Note that if multiple devices will be connected on the same network the "IP Address" will need to be unique for each control board. However, the IP Address must be set up such that the first three "octets" of the Address are the same between the main device and the control board. Ex. Main PLC IP = 192.168.0.110, FM Control Board IP = 192.168.0.100.
 - "Subnet" can be set to the desired value (Default = 255.255.255.0), but must be consistent between the main device and the control board.
 - "Gateway" can be set to the desired value (Default = 192.168.0.1), but again this must be consistent between the main device and the control network.
 - Once all settings are correct tap "Save/Apply Settings." This will save the settings and reset the board. Once the reset is complete, the new communications settings will be applied.

8.10 FlowMeter Setup

DISPLAY SETUP

Navigating to "Setup" → "FlowMeter Setup" → "Display Setup", will allow the user change important parameters with regards to how the measured flow is displayed on the main screen.

- Meter Scale:
 - This value is equal to the full flow scale of the meter and prevents a setpoint (remote or local) that is greater than the meter scale from being entered. **Note:** If display decimals is greater than zero, meter scale will show decimals as whole numbers. For example, 50.0 will show as 500.
- Display Decimals:



- This value determines the amount of decimals, to the left of the final digit, to display on all flow values. Ex: Decimal Value of 0 → flow value of 100, decimal value of 1 → flow value of 10.0.
- Gas Type:
 - Values entered into this category have corresponding gas types associated with them. This is set by the factory and should not be adjusted.

Gas Type Values			
0	Endothermic	10	Propane
1	Natural Gas	11	Propylene
2	Air	12	Argon
3	Nitrogen	13	Steam
4	Hydrogen	14	Iso. Alcohol
5	Ammonia	15	Butane
6	Methanol	16	Carbon Dioxide
7	D.A.	17	Carbon Monoxide
8	Exothermic	18	Methane
9	Water		

- Flow2 Multiplier:
 - This value is used as a constant multiplier in the case where the same meter is being used to measure two different gasses.
- Flow Unit:
 - Values entered into this category have corresponding flow units associated with them. This is set by the factory and should not be adjusted.

CONTROL SETUP

Navigating to “Setup” → “FlowMeter Setup” → “Control Setup”, will allow the user change important parameters with regards to flow control.

- Control Enable:
 - This True [1] / False [0] toggle will turn on or off the flow control logic in the program.
- Control Mode:
 - This Auto [1] / Manual [0] toggle will switch the control from Auto to Manual or vice-versa. Note: This is the same operation as changing the control mode from the Home Screen.
- Setpoint Type:
 - This Remote [1] / Local [0] toggle will switch how the setpoint is brought to the meter. If using an external analog signal to send setpoints, “Remote” must be selected.
- Local Setpoint:
 - Value that will be used to control flow when the “Setpoint Type” is set to “Local.” The same operation can be done from the Home Screen.
- Deadband:
 - This value is used to prevent the valve from driving when the difference between Flow PV and Flow SP is less than or equal to the Deadband. Typically set to 1% of full scale. **Note:** If display decimals is greater than zero, deadband will show decimals as whole numbers. For example, 0.5 will show as 5.
- Home Screen Lock:



- This True [1] / False [0] toggle will lock or unlock the control parameters that are available on the Home Screen (Local Setpoint & Auto/Man Toggle)
- Invert Control:
 - This True [1] / False [0] toggle will enable or disable the invert control logic on the board. When enabled the valve will drive open when the PV is greater than the SP and closed when the PV is less than the SP.
- Ext Drive Time:
 - This value sets the amount of time the valve will continue to drive for in the event that the PV and SP reach zero. Note that setting this parameter to a non-zero value will display the parameters listed below.
- Ext Drive Hysteresis:
 - This value sets the PV threshold that the meter must see before allowing the extended drive sequence to activate.
- Ext Drive PID Perc:
 - This value sets the drive speed (0-100%) of the valve when the extended drive sequence is active.

PRESSURE SETUP

Navigating to “Setup” → “FlowMeter Setup” → “Pressure Setup”, will allow the user change important parameters with regards to real-time pressure correction. Note that pressure correction is done using **absolute pressures** through the following equation. Users should be familiar with how the STD Pressure in their location could impact the Pressure Factor calculation, as the STD Pressure will change with varying elevations. Be sure to maintain a consistent unit system across Pressure Value, STD Pressure, and CAL Pressure when using real-time pressure correction. It is highly recommended that the user consults the factory prior to implementing pressure correction. Failure to do so can result in incorrect flow readings and a potentially dangerous situation.

$$\text{Pressure Factor} = \sqrt{\frac{\text{Pressure Value} + \text{STD Pressure}}{\text{CAL Pressure} + \text{STD Pressure}}}$$

- Pressure Enable:
 - This True [1] / False [0] toggle will turn on or off the pressure correction logic in the program.
- CAL Pressure:
 - This value is the Inlet Pressure, in Engineering Units, that the meter had been calibrated at.
Note: The pressure units used MUST be consistent between the CAL and STD Pressure values.
- STD Pressure:
 - This value is the Standard Atmospheric Pressure, in Engineering Units, for the meter’s **CURRENT** location. This value may have to be adjusted in the field to accommodate for atmospheric pressure changes due to elevation.
Note: The pressure units used MUST be consistent between the CAL and STD Pressure values.
- Pressure Value:



- The value of pressure measure at the inlet of the meter.
- Offset Factor:
 - Calculated value that is applied to the Flow Value to correct for pressure.

ALARM SETUP

Navigating to “Setup” → “Alarm Setup,” will allow the user to change important parameters with regards to the flow alarm setpoints. Note that the flow alarm setpoints are measured in the Engineering units displayed on the front of the meter. Indication of which flow alarms are active can be found on the Home Screen, located under the flow scale/units (See Figure 1). In addition, the LED’s on the keypad will indicate the current alarming state of the meter, (Blue = No Alarms Active / Red = Alarm Active). All flow alarms are tied to Digital Output#2 on the board. This output can be wired back to an external controller for feedback on the alarm status of the meter.

- High Flow SP:
 - Flow value at which the “ALM Delay” will begin to elapse due to the Flow PV breaching this point. Once time has elapsed the “HIGH” indicator will display on the Home Screen in red text and the LED’s on the Keypad will turn from Blue to Red.
- Low Flow SP:
 - Flow value at which the “ALM Delay” will begin to elapse due to Flow PV dropping below this point. Once time has elapsed the “LOW” indicator will display on the Home Screen in red text and the LED’s on the Keypad will turn from Blue to Red
- Deviation SP:
 - Value at which the “ALM Delay” will begin to elapse due to the difference between Flow PV and Flow SP breaching this point. Once time has elapsed the “DEV” indicator will display on the Home Screen in red text and the LED’s on the Keypad will turn from Blue to Red
- ALM Delay (sec):
 - Time delay, in seconds, before the High Flow, Low Flow, or Deviation Alarm(s) activate.

TEMPERATURE SETUP

Navigating to “Setup” → “FlowMeter Setup” → “Temperature Setup”, will allow the user change important parameters with regards to real-time temperature correction. Note that temperature correction is done using **absolute temperatures** through the following equation. Be sure to maintain a consistent unit system across Inlet Temperature, STD Temperature, and CAL Temperature. See below for English and Metric (SI) terms. It is highly recommended that the user consult the factory prior to implementing temperature correction. Failure to do so can result in incorrect flow readings and a potentially dangerous situation.

$$\text{Temperature Factor} = \sqrt{\frac{\text{STD Temperature} + \text{CAL Temperature}}{\text{CAL Temperature} + \text{Inlet Temperature}}}$$

$$\text{Metric STD Temp (Kelvin)} = 273$$

$$\text{English STD Temp (Rankine)} = 460$$

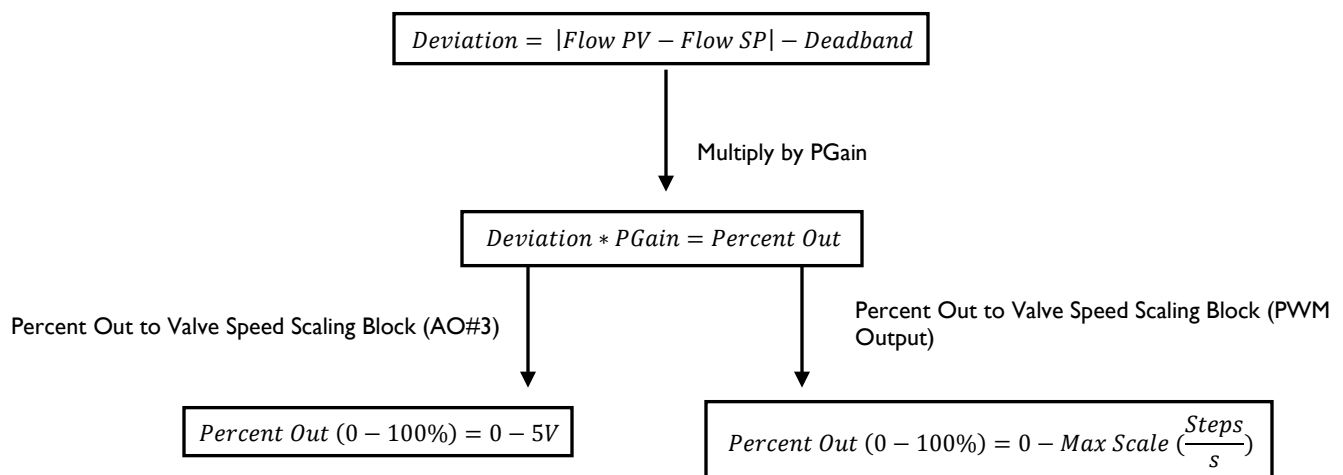
- Temperature Enable:



- This True [1] / False [0] toggle will turn on or off the temperature correction logic in the program.
- Note: Do not enable temperature correction unless an appropriate temperature sensing device is connected to the TC Inputs.
- CAL Temperature:
 - This value is the Inlet Temperature, in Engineering Units, that the meter had been calibrated at in units of Celsius or Fahrenheit.
 - Note: The temperature units used MUST be consistent between the CAL and STD Temperature values.
- STD Temperature:
 - This value is the Standard Absolute Temperature, in Engineering Units, for the meter's current location. See above for both English and Metric STD Temperature Values
 - Note: The pressure units used MUST be consistent between the CAL and STD Temperature values.
- Inlet Temperature:
 - The value of temperature measured at the inlet of the meter.
- Offset Factor:
 - Calculated value that is applied to the Flow Value to correct for temperature.

PID SETUP

Navigating to “Setup” → “FlowMeter Setup” → “PID Setup”, will allow the user change important parameters with regards to the flow control valve speed characteristics. The maximum speed of the valve and at what point the valve drives at this maximum speed are crucial to not only properly control a setpoint, but also being able to reach a given setpoint in a reasonable amount of time. Through the PID settings, the user can adjust how a deviation in Flow PV and Flow SP impact the valve drive speed. See diagram below. Note that the final scaling of the PID Output Percent to an Analog Signal is covered in more detail in “**System Operation – Analog Outputs.**”



- PGain:



- Floating 32-bit value that is applied to the “*Deviation*” in a multiplication operation. This value is set from the factory during the Calibration/QC process and should only be adjusted by qualified personnel.
- IGain:
 - Floating 32-bit value that is applied to the “*Deviation*” in a multiplication operation. This value is defaulted to 0 from the factory and should not be adjusted under any circumstances, unless advised by UPC-Marathon.
- DGain:
 - Floating 32-bit value that is applied to the “*Deviation*” in a multiplication operation. This value is defaulted to 0 from the factory and should not be adjusted under any circumstances, unless advised by UPC-Marathon.
- Percent Out:
 - Percentage value (-100 – +100%) of the PID output as outlined in the above diagram.

TOTALIZER SETUP

Navigating to “Setup” → “FlowMeter Setup” → “Totalizer Setup” will allow the user to view the totalized volume of gas that has passed through the meter and reset the totalizer function.

ANALOG INPUTS

Navigating to “Setup” → “Analog Inputs,” will allow the user to change important parameters with regards to the scaling and type of Analog Input Signal coming into the board. Note that the FurnaceMeter-Touch™ can accept both Current (mA) and Voltage (mV) inputs. It is required that the DIP switch be toggled for the corresponding input if Voltage is desired as the default input configuration is for Current (DIP is in the ON Position). It is recommended that the negative side of all Current (mA) signals coming into the board from an external controller be jumped to –VDC.

- AI#1 Signal (Flow Sensor):
 - Analog Input #1 Signal in Engineering Units (mA, mV, V).
- AI#2 Signal (Remote Setpoint):
 - Analog Input #2 Signal in Engineering Units (mA, mV, V).
- AI#3 Signal (Pressure Sensor Signal):
 - Analog Input #3 Signal in Engineering Units (mA, mV, V).

Analog Input Setup:

From the Analog Input Setup menus, the user can adjust the signal type and input scaling from ADC Count to Analog Signal, along with imputing a direct offset to the signal range to account for drift over time. The same parameters listed below exist for Analog Inputs 1, 2, & 3.

AI Setup

- Signal Type:
 - Input signal type selection. Tapping on the “Signal Type” will bring up a keypad that allows the user to change the type of signal that will be seen on that particular Analog Input.
 - Value [0] (Default) = Current Input (4-20mA) (Units: mA)
 - Value [1] = Voltage Input (0-1V) (Units: mV)



- Value [2] = Voltage Input (0-2.5V) (Units: mV)
- Value [3] = Voltage Input (0-5V) (Units: mV)
- Note: Failure to configure the Input DIP switch will cause an incorrect input signal reading.
- Unit:
 - Displays the units in which the input signal is being measured.
- Signal Zero:
 - The minimum signal value that will be used to scale from ADC to Analog Signal. Typically, equal to minimum value of the input signal scale. Ex: 4-20mA Signal, Signal Zero = 4mA.
- Signal Span:
 - The maximum signal value that will be used to scale from ADC to Analog Signal. Typically, equal to maximum value of the input signal scale. Ex: 4-20mA Signal, Signal Span = 20mA.
- Count Zero:
 - The minimum ADC Count value when the “Signal Zero” value is sourced to the Analog Input. This value is used to calibrate the Analog Input by means of a calibrated signal sourcing device.
- Count Span:
 - The maximum ADC Count value when the “Signal Span” value is sourced to the Analog Input. This value is used to calibrate the Analog Input by means of a calibrated signal sourcing device.
- Offset Zero:
 - Editable value that allows the user account for signal “drift” over time at the zero end of the signal scale. Ex: 4mA read on the sourcing device, 4.01mA read on the FurnaceMeter-Touch™ display, enter an Offset Zero = -0.01mA. This value has a diminishing effect on the Span end of the scale. Entering in an Offset Zero of -0.01mA will not bring the Span down to 19.99mA.
- Offset Span:
 - Editable value that allows the user account for signal “drift” over time at the span end of the signal scale. Ex: 20mA read on the sourcing device, 20.01mA read on the FurnaceMeter-Touch™ display, enter an Offset Span = -0.01mA. This value has a diminishing effect on the Zero end of the scale. Entering in an Offset Zero of -0.01mA will not bring the Zero down to 3.99mA.
- ADC Count:
 - Actual ADC Count seen by the microprocessor. This value is converted to the Analog Signal value.
- Signal:
 - Signal value in Engineering Units that had been converted from the ADC Count.

Analog Input Calcurve Setup:

Each Analog Input is scaled from the input signal to a usable value in Engineering Units via a calibration curve. In order to access this curve tap the “CURVE” button located in the bottom right corner of the Analog Input Setup Screen. This will bring up a 10-point calibration curve as shown in Figure 7:



Analog Input Calcurve Setup		
Cal Point	Signal	Value
Cal #1	4.000	0
Cal #2	4.150	13
Cal #3	4.500	19
Cal #4	5.000	26
Cal #5	6.000	37
Cal #6	7.000	49
Cal #7	9.000	64
Cal #8	11.000	73
Cal #9	15.000	88
Cal #10	19.500	102

Figure 6 - Example 10 Point Flow Calcurve

It is important to note that 10 points are not necessary for all Analog Input scaling. In the case where a 2-point, linear scaling operation is sufficient, the following “curve” can be used where Cal#1 is the Min Signal/Value and Cal#2 is the Max Signal/Value.

Analog Input Calcurve Setup		
Cal Point	Signal	Value
Cal #1	4.000	0
Cal #2	20.000	100
Cal #3	0	0
Cal #4	0	0
Cal #5	0	0
Cal #6	0	0
Cal #7	0	0
Cal #8	0	0
Cal #9	0	0
Cal #10	0	0

Figure 7 - Example 2 Point Remote SP Calcurve

Note:

All signals in the calibration curve setup are displayed in mA (milli-amp) for Current, and mV (milli-volt) for voltage. This means that a 4mA signal will display as 4.000 and that a 5V signal will display as 5000. This is important to keep in mind when entering in calibration points, as failing to do so will result in incorrect scaling.

ANALOG OUTPUTS

Navigating to “Setup” → “Analog Outputs,” will allow the user to change important parameters with regards to the scaling of Analog Signals being retransmitted by the board. Note that each



Analog Output has a specific signal type and is not capable of being configured for a different signal.

- AO#1 Signal – Flow Retransmission (4-20mA)
 - o Analog Output #1 Signal in mA
- AO#2 Signal – Process Signal (4-20mA)
 - o Analog Output #2 Signal in mA
- AO#3 Signal – Valve Speed (0-5V)*
 - o Analog Output #3 Signal in mV
- PWM Output – Valve Speed**
 - o Valve speed signal output in Steps/s.

Analog Output Setup:

From the Analog Output Setup menu the user can adjust the value to signal scaling for that specific output. Analog Outputs 1-3 have the same setup parameters associate with them.

AO Setup:

- Signal Type:
 - o Output signal type selection. This is not adjustable, see AO descriptions above for signal type and units used on specific outputs.
- Unit:
 - o Displays the units in which the output signal is being displayed.
- Value Zero:
 - o The minimum value that will be used to scale from the Process Value to an Analog Signal. Typically, equal to minimum value of the Process Value scale that is to be retransmitted as a signal. Ex: 0-100 CFH flow, Value Zero = 0.\
- Value Span:
 - o The maximum value that will be used to scale from Process Value to Analog Signal. Typically, equal to maximum value of the Process Value scale that is to be retransmitted as a signal. Ex: 0-100 CFH flow, Value Span = 100.
- Signal Zero:
 - o The minimum Signal Value when the Process Value is equal to zero. Ex. 0-100 CFH flow scaled to 4-20mA signal, Signal Zero = 4mA
- Signal Span:
 - o The maximum Signal Value when the Process Value is equal to full scale. Ex. 0-100 CFH flow scaled to 4-20mA signal, Signal Span = 20mA.
- Value:
 - o Actual Process Value, in Engineering Units, that is being scaled to the output signal.
- Signal:
 - o Signal Value, in Engineering Units, which had been converted from the Process Value.

PWM Setup:

From the PWM Setup menu, the user can adjust the speed scaling of the valve motor when using the on-board motor driver system.



- Signal Type:
 - Output signal type selection. This is not adjustable, see AO descriptions above for signal type and units used on all outputs.
- Unit:
 - Displays the units in which the output signal is being measured.
- Value Zero:
 - The minimum value that will be used to scale from Process Value to Analog Signal. Typically, equal to minimum value of the Process Value scale that is to be retransmitted as a signal. For use with PWM Valve Setup, the Process Value is the PID Output percentage, on a range from 0-100% output.
- Value Span:
 - The maximum value that will be used to scale from Process Value to Analog Signal. Typically, equal to maximum value of the Process Value scale that is to be retransmitted as a signal. For use with PWM Valve Setup, the Process Value is the PID Output percentage, on a range from 0-100% output.
- Signal Zero:
 - The minimum Signal Value when the Process Value is equal to zero. For use with PWM Valve setup, the output signal range is from 0 – Max Scale (steps/s).
- Signal Span:
 - The maximum Signal Value when the Process Value is equal to full scale. For use with PWM Valve Setup, the output signal range is from 0 – Max Scale (steps/s).
- Value:
 - Actual value of the PID Output in percent.
- Signal:
 - Signal value in steps/s that has been converted from PID Output percentage.

Note:

*AO#3 Signal is only used when the meter is utilizing a remotely mounted driver board to control motor speed and behavior.

**PWM Output is used when the meter is utilizing the on-board motor driver system to control motor speed and behavior.

Both outputs (AO#3 & PWM) will always be active on the board regardless of which configuration the meter is setup with. It is important to know how to identify the differences between the configurations and how to properly setup their control.

COMMUNICATIONS

Navigating to “Setup” → “Communications,” will allow the user to change important parameters with regards to the communications methods available on the control board, and to choose which type of communication is to be used. Note that the communications parameters require a “Save/Reset” after they are changed in order for the changes to take effect. In order to this, tap the “SAVE/APPLY SETTINGS” button located at the bottom of the menu AFTER the settings have been changed. Once this is done the board will reset with the new communications settings applied.

- Device ID (RS485 Only):



- ID number for the current device when using RS485 communications. When multiple devices are communicating on the same network, using RS485, this value will have to be unique for each device.
 - Default Value [1]
- RS485 Baud (RS485 Only):
 - Baud rate for RS485 communications.
 - Value [0] = 9600 Baud
 - Value [1] = 19200 Baud (Default)
 - Value [2] = 115200 Baud
- RS485 Parity (RS485 Only):
 - Parity setting for RS485 communications.
 - Value [0] = None
 - Value [1] = Odd
 - Value [3] = Even (Default)
- IP Address (TCP/IP Only):
 - IP Address for the current device when using TCP/IP communications. When multiple devices are communicating on the same network, using TCP/IP, this value will have to be unique for each device.
 - Default IP Address [192.168.0.100]
- Subnet (TCP/IP Only):
 - Subnet Mask for TCP/IP communications.
 - Default Subnet [255.255.255.0]
- Gateway (TCP/IP Only):
 - IP Address of network Gateway.
 - Default Gateway [192.168.0.1]
- Type:
 - Communications type toggle.
 - Value [0] = RTU (Default)
 - Value [1] = TCP

Note:

Hitting the “DEFAULT” button located at the bottom right corner of the menu will set all communications settings back to their default values. See descriptions above for default values.

8.11 Temperature

Navigating to “Setup” → “Temperature,” will allow the user to change important parameters with regards to the thermocouple inputs available on the control board. Note that when a thermocouple is not found on an input that the temperature will display high scale temperature.

- TC#1 Temperature – Inlet Temperature
 - Thermocouple Input #1 Temperature in °C/°F
- TC#2 Temperature – Process Temperature
 - Thermocouple Input #2 Temperature in °C/°F

TC Input Setup:



From the Thermocouple Input Setup menu the user can calibrate the TC Input, change the Temperature Alarm settings associated with that input, and change the unit of measurement and the TC Type.

TC Setup:

- TC Type:
 - Thermocouple type that is being used on this input.
 - Value [0] = Type B
 - Value [1] = Type E
 - Value [2] = Type J
 - Value [3] = Type K (Default)
 - Value [4] = Type N
 - Value [5] = Type R
 - Value [6] = Type S
 - Value [7] = Type T
- Unit:
 - Temperature measurement unit that is being used.
 - Value [0] = Fahrenheit (°F)
 - Value [1] = Celsius (°C) (Default)
- Low Alarm SP:
 - The temperature value that will be used to determine whether or not to activate a Low Temperature Alarm. Ex. Low Alarm SP = 200, Process Temperature = 150 → Alarm Active.
- High Alarm SP:
 - The temperature value that will be used to determine whether or not to activate a High Temperature Alarm. Ex. High Alarm SP = 2000, Process Temperature = 2100 → Alarm Active.
- CAL Source Low:
 - Input parameter used to calibrate the TC input for a given temperature range. When sourcing the range minimum temperature to the input, using a calibrated device, this value is equal to the temperature being sourced by the device.
- CAL Display Low:
 - Input parameter used to calibrate the TC input for a given temperature range. When sourcing the range minimum temperature to the input, using a calibrated device, this value is equal to the temperature being displayed by the control board.
- CAL Source High:
 - Input parameter used to calibrate the TC input for a given temperature range. When sourcing the range maximum temperature to the input, using a calibrated device, this value is equal to the temperature being sourced by the device.
- CAL Display High:
 - Input parameter used to calibrate the TC input for a given temperature range. When sourcing the range maximum temperature to the input, using a calibrated device, this value is equal to the temperature being displayed by the control board.



- Offset:
 - o Value of the calibration offset after entering the above values.
- Temperature:
 - o Value of the temperature, in Engineering Units, being read by the TC Input.

8.12 System Setup

Navigating to “Setup” → “System Setup,” will allow the user to view the current software and hardware versions of the control board and initiate a screen calibration if necessary.

9 MAINTENANCE

9.1 General Preventative Maintenance

The FurnaceMeter is designed to be a generally maintenance free instrument. To ensure many years of reliable performance it is recommended that precautions be taken to keep the inside of the valve control assembly and pressure transducer enclosures clean and free from carbon or water contamination. Annually, it is recommended that the valve stem be rubbed clean with a cloth and lightly coated with a silicone o-ring lubricant to prevent the seal from drying out.

9.2 Calibration Certification

The FurnaceMeter is supplied with calibration test ports for added quality control. These ports provide a location to test the actual differential pressure across the integrated flow orifice. This differential pressure can be measured with a portable calibrated instrument and checked against the original calibration certificate attached to this manual to confirm the long-term accuracy of the FurnaceMeter differential pressure transducer.

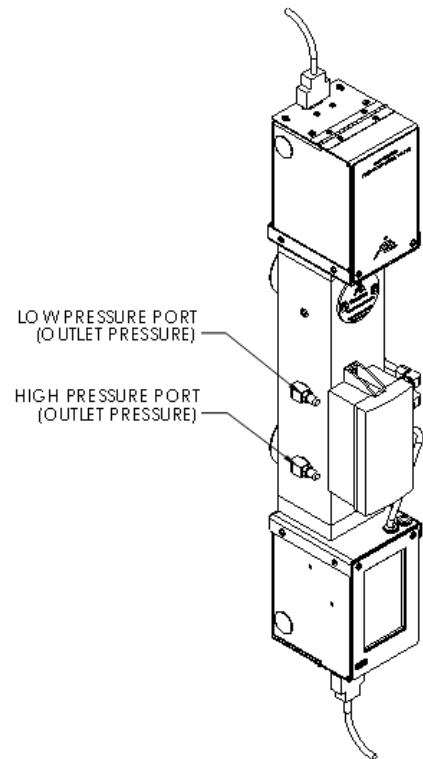


To perform a calibration certification requires the following items:

- Calibrated Handheld Manometer (Minimum: 28"wcg)
- Small Standard Screwdriver (to open and close the test ports)
- Original Calibration Certificate (for the Serial # of the meter to be tested)

9.3 Calibration Certification Procedure

1. Open the High and Low Pressure Ports by inserting a small standard screw driver into the port and turning small valve counterclockwise 1 time. *Note: There is a very small flow limiting orifice integrated into the port valve to ensure only a small amount of gas will escape during testing.*
2. Connect a calibrated differential pressure manometer to the test ports. Verify that the "high" and "low" ports of the test instrument are attached to the correct ports on the FurnaceMeter as shown.
3. Set the actual flow to a value on the original calibration certificate.
4. Take a reading of the actual differential pressure at this flow rate and verify this value against the original differential pressure on the calibration certificate.
(Rule of Thumb: 0.5"wc deviation = 5% flow error)
5. If actual differential pressure is outside acceptable limits, then the zero/span potentiometers within the differential pressure transducer can be accessed by opening the transducer cover. *Note: Only small adjustments should ever be necessary to bring the transducer back into calibration. If large adjustments or deviations are found, please contact the support staff at UPC-Marathon directly.*



10 MODBUS REGISTER LIST

10.1 Commonly Used Modbus Registers:

Modbus registers in the FurnaceMeter-Touch™ internal circuit board (flowboard) can be accessed in order to monitor and modify parameters from a remote location. Below is a table describing commonly used Modbus registers and their addresses:

Modbus Register	Description
5007	Flow Sensor mA Input Value*
5008	Flow Sensor mA Input Zero Value



Modbus Register	Description
5009	Flow Sensor mA Input Span Value
5023	Flow Setpoint mA Input Zero Value
5024	Flow Setpoint mA Input Span Value
5047	Flow Restrains Zero Value (Flow Units)
5048	Flow Restrains Span Value (Flow Units)
5118	Actual Flow Value (Float32)*
5136	Low Flow Alarm Setpoint
5137	High Flow Alarm Setpoint
5149	Flow Setpoint (Local)
5297	Flow Meter Full Scale Value
5155	Auto[1]/Man[0] Control Toggle
5161	Valve Control Deadband
5163	Display Decimals Value
5166	Control Gain Value (Float32)

Table 1 - Commonly Used Modbus Registers

*Registers are read only.

11 FURNACEMETER-TOUCH™ TROUBLESHOOTING

It is recommended to contact UPC-Marathon Support staff before making parameter changes to the FurnaceMeter-Touch™.

11.1 ISSUE: Meter is Displaying Flow when Gas is Shut Off

RESOLUTION:

- Ensure that there is a positive gas shutoff before the FurnaceMeter-Touch™
- The Differential Pressure Transducer will require a re-zero procedure.
- If the value is between 4.00mA and 4.15mA, navigate to the AI#1 Setup Screen and verify the mA reading from the Transducer.
- In the setup screen, enter in a value for the “Offset Zero” that will bring the signal to 3.95mA.
 - o Ex: 4.10mA displayed on screen, “Offset Zero” = -0.15mA

11.2 Issue: Valve is not Driving

RESOLUTION:

- Verify that the DB9 Cable, which runs from the display enclosure to the top of the valve enclosure is plugged in.
- Ensure that the control board is in AUTO Mode.



- Verify that the valve direction indicators are displaying on the Home Screen.

11.3 Issue: Meter is not Controlling to Setpoint

RESOLUTION:

- Verify that the control board is configured to look at either a local or remote setpoint depending on the application.
- If using a remote setpoint, verify the incoming signal at the control board is consistent with what is being displayed in the AI#2 setup screen.
 - o If not, adjust the “Signal Zero” or “Signal Span” to bring the input back within range.
- Verify the valve speed is setup correctly.
 - o If the flow through the meter is slow to respond to changes in the setpoint, increase the valve speed “Signal Value” in the PWM Setup menu.
 - o If the meter response is too fast when a setpoint is changed (flow values constantly overshooting setpoint), decrease the valve speed “Signal Value” in the PWM Setup menu.
- Verify that the inlet pressure of the meter is correct.

11.4 Issue: Meter Cannot Achieve Full Flow Scale

RESOLUTION:

- Verify that the inlet pressure of the meter is correct.
- Verify that the Valve Knob is not hitting the limit switch.
 - o If the limit switch is triggered and the meter is not at full scale, loosen the hex bolt in the valve knob and allow the meter to drive to full scale. Once at setpoint, re-position the valve knob against the limit switch and tighten it down.

11.5 Issue: Loss of Communications

-

RESOLUTION:

- Ensure that the board is configured properly for the desired communications protocol.
 - o TCP/IP Communications:
 - Check to make sure the Ethernet cable is securely connected at the bottom of the control board.
 - Verify IP Address is consistent between the control board and the master device.
 - o RTU Communications:
 - Ensure that the polarity of the RS485 wiring is correct.



12 FURNACEMETER-TOUCH™ SPARE PARTS LIST

FurnaceMeter-Touch™ Spare Parts	
Description:	Part Number:
Flow Sensor Assembly	
Electronic Flow Sensor (5" Pressure Drop) [Standard]	FM-SP-EB-DP05
Electronic Flow Sensor for Corrosive Gas (28" Pressure Drop)	FM-SP-EB-SS28
Electronic Flow Sensor for Corrosive and High Pressure Gases (28" Pressure Drop)	FM-SP-EB-SS28HP
Electronic Flow Sensor for Liquids (28" Pressure Drop)	FM-SP-LB-SS28HP
Manual Valve Assembly	
General FurnaceMeter™ Spare Manual Valve Assembly (Serial number must be specified when ordering)	FM-SP-MV
FurnaceMeter™ (1/8NPT) Spare Manual Valve Assembly for MicroFlow and Liquids	FM-SP-MVM-013
FurnaceMeter™ (3/4NPT) Spare Manual Valve Assembly with High Flow Needle	FM-SP-MVH-075
FurnaceMeter™ (3/4NPT) Spare Manual Valve Assembly with Medium Flow Needle	FM-SP-MVM-075
FurnaceMeter™ (3/4NPT) Spare Manual Valve Assembly with Low Flow Needle	FM-SP-MVL-075
FurnaceMeter™ (1-1/4NPT) Spare Manual Valve Assembly with High Flow Needle	FM-SP-MVH-125
FurnaceMeter™ (1-1/4NPT) Spare Manual Valve Assembly with Medium Flow Needle	FM-SP-MVM-125
FurnaceMeter™ (1-1/4NPT) Spare Manual Valve Assembly with Low Flow Needle	FM-SP-MVL-125
FurnaceMeter™ (2NPT) Spare Manual Valve Assembly with High Flow Needle	FM-SP-MVH-200
FurnaceMeter™ (2NPT) Spare Manual Valve Assembly with Medium Flow Needle	FM-SP-MVM-200
FurnaceMeter™ (2NPT) Spare Manual Valve Assembly with Low Flow Needle	FM-SP-MVL-200
Electronic Valve Assembly	
General FurnaceMeter-Touch™ Spare Electronic Valve Assembly (Serial number must be specified when ordering)	FM-SP-EVT
FurnaceMeter-Touch™ (1/8NPT) Spare Electronic Valve Assembly for MicroFlow and Liquids	FM-SP-EVMT-013
FurnaceMeter-Touch™ (3/4NPT) Spare Electronic Valve Assembly with High Flow Needle	FM-SP-EVHT-075
FurnaceMeter-Touch™ (3/4NPT) Spare Electronic Valve Assembly with Medium Flow Needle	FM-SP-EVMT-075
FurnaceMeter-Touch™ (3/4NPT) Spare Electronic Valve Assembly with Low Flow Needle	FM-SP-EVLT-075
FurnaceMeter-Touch™ (1-1/4NPT) Spare Electronic Valve Assembly with High Flow Needle	FM-SP-EVHT-125
FurnaceMeter-Touch™ (1-1/4NPT) Spare Electronic Valve Assembly with Medium Flow Needle	FM-SP-EVMT-125
FurnaceMeter-Touch™ (1-1/4NPT) Spare Electronic Valve Assembly with Low Flow Needle	FM-SP-EVLT-125
FurnaceMeter-Touch™ (2NPT) Spare Electronic Valve Assembly with High Flow Needle	FM-SP-EVHT-200
FurnaceMeter-Touch™ (2NPT) Spare Electronic Valve Assembly with Medium Flow Needle	FM-SP-EVMT-200
FurnaceMeter-Touch™ (2NPT) Spare Electronic Valve Assembly with Low Flow Needle	FM-SP-EVLT-200
Flow Display Assembly	
FurnaceMeter-Touch™ Electronic Flow Display	FM-SP-EBT-DISP
FurnaceMeter-Touch™ Electronic Flow Display for AE Meter Style (Display on top of Meter)	FM-SP-AET-DISP
Analog Flow Display with Mechanical Gauge (5" Pressure Drop) [Standard]	FM-SP-G05-DISP
Analog Flow Display Mechanical Gauge with Flow Switch (5" Pressure Drop)	FM-SP-G05S-DISP
Analog Flow Display Mechanical Gauge for Corrosive and High Pressure Gas (20" Pressure Drop)	FM-SP-GM20-DISP

Table 2 - FurnaceMeter-Touch™ Spare Parts List



13 CUSTOMER SUPPORT

Americas	Asia	Europe
<u>support.na@upc-marathon.com</u>	<u>service@mmichina.cn</u>	<u>support.eu@upc-marathon.com</u>
USA: +1 414 462 8200	Shanghai: +86 21 3463 0376	France: +33 3 81 48 37 37
Canada: +1 514 335-7191	Beijing: +86 10 8217 6427	Germany: +49 7161 94888-0
		Poland: +48 32 296 66 00

Reach us at www.upc-marathon.com

UPC-Marathon brings together leading brands to the heat-treating industry including Atmosphere Engineering, Furnace Control, Marathon Monitors and Process-Electronic, and Waukee Engineering. We provide prime control solutions through our worldwide sales and services network with easy-to-access local support.

