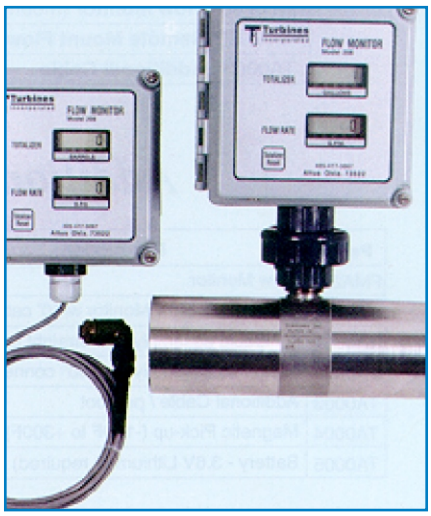
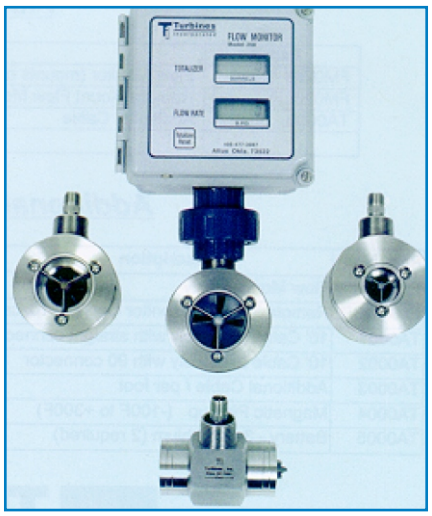
Turbines, Incorporated

TECHNICAL DOCUMENTS FOR
TURBINE FLOW MONITOR EQUIPMENT

TECHNICAL DOCUMENT LAST REVISION SEPTEMBER, 1998 | Turbinesdoc.FM0208-00

Calibration Information and Technical Summary for the





FM0208

FLOW MONITOR

The FM 0208 Flow Monitor, Its Role and Function in Turbine Flow Metering.

Turbines Incorporated is an original equipment manufacturer specializing in the design, marketing, sales, manufacturing and service of a broad line of turbine flow meters and associated flow monitors and accessories, all of which are specially created to provide the user with a complete turbine flow measurement system which includes the turbine itself, and in most cases, an electronic means of converting the pulse signals generated by the turbine meter into usable scalar read-out corresponding to the actual flow rate occurring through the mechanism of the turbine meter.

Although the standard turbines made available by Turbines incorporated can function using a variety of alternate flow monitors provided and produced by other sources, the ***FM0208*** is a proven device offering superior performance covering a wide range of application conditions, all the while offering economies of acquisition cost.

The accuracy of flow measurement using the turbine flow meter is dependent on several elements, the accuracy and quality of each therefore determining the ultimate accuracy and quality of the flow measurement.

Element 1:
The turbine meter must be of high quality with proper and precise machining of the internal mechanism. The turbine fan which is suspended within the turbine meter is so designed as to rotate at a unique number of revolutions per minute depending upon the velocity of the line flowing flowing through the meter. The revolution of the turbine fan, in turn, generates a magnetic (or sonic, depending upon the pickup method of the particular turbine) pulse which is imparted to the pick-up sensor on the top of the meter. A properly designed manufactured turbine flow meter will generate the same pulse for the same rate of flow. In order to verify the relationship of a particular meter with a particular flow rate/range, the turbine meter is laboratory calibrated to establish the specific K factor of meter, which is unique to that particular meter.

Element 2:
The turbine meter signal must be delivered to an appropriate flow monitor which can translate the signal input into flow indication.

In this manual, the proper calibration of the Turbines Incorporated **FM0208** is described in detail. By properly calibrating the flow monitor, the full performance potential of the turbine flow metering system will be realized. Should you have questions or require assistance with this product or procedure, please contact us at 1-800-809-1387.

FM 0208 Flow Monitor Calibration

The following four step process will complete the calibration procedure, and example follows.

Step1:
First determine the required unit of measure for your particular installation (i. e. gallons, barrels, etc.)
Step2:
Next, set switch SW 3 to reflect the model meter and the unit of measure which you have determined *(See tables 3 and 4.)*
Step3:
Calculate the scale factor, then set the 17 binary scalar switches as required *(refer to Table Number 2 and figure Number 1.)*
Step4:
Adjust resistor P1 to set the flow rate *(refer to figure 1.)*

Table No.- 1: Unit Multipliers vs Flow Units.

Flow Units	Unit Multiplier
Barrels, Oil	42
U. S. Gallons	1
Imperial Gallons	1.20095
Cubic Feet	7.48052
Cubic Meters	264.17
Liters	0.26417

Remember:

The K-Factor is provided with each and every Turbines Incorporated flow meter and represents Pulses per Gallon. Thus if you need monitor read-out in, barrels, multiply the K-Factor x 42 (from table number -1.)

The Scale Factor is the K-Factor times the Unit Multiplier.

There are 17 dip switches(series SW-1 and SW-2) that collectively relate to 17 different binary numbers*(see Figure 1.) After you have determined the scale factor for your application, subtract the binary number immediately smaller than your scale factor, and close the applicable dip switch. This process is then repeated until the remainder is zero(0.)*

EXAMPLE: In this instance, calibrate the Fm0208 flow monitor attached to a Tm0100 turbine meter to provide read-out in barrels per day assuming a turbine K-Factor of 867.5

Step 1:
From Table number 3, locate the TM 0100 turbine meter in the non-metric listing, selecting the unit of measure(barrels per day.) As the table shows, we will close dip switches number 2 and 3 on SW-3.

EXAMPLE: continued...

Step 2:
We are calibrating the monitor to read in barrels per day, therefore take the turbine K-Factor and multiply times 42, from Table Number-1 *(42 x 867.5 = 36435.)* Therefore 36435 pulses (scale factor) equals 1 barrel.

Step 3:
Subtract the binary number immediately smaller than the scale factor (see below.)

Iteration #1:	Iteration #4:	Iteration #7:
36435 -32768 3667	595 -512 83	3 -2 1
Close SW-2-6	*Close SW-1-10*	*Close SW-1-2*
Iteration #2:	**Iteration #5:**	**Iteration #8:**
3667 -2048 1619	83 -64 19	1 -1 0
Close SW-2-2	*Close SW-1-7*	*Close SW-1-1*
Iteration #3:	**Iteration #6:**	
1619 -1024 595	19 -16 3	
Close SW-2-1	*Close SW-1-5*	

Table Number: 2 Binary Number-Switch Number Chart

	BINARY NUMBER	SWITCH POSITION
SWITCH - 2	65536	7
	32768	6
	16384	5
	8192	4
	4096	3
	2048	2
	1024	1
SWITCH - 1	512	10
	256	9
	128	8
	64	7
	32	6
	16	5
	8	4
	4	3
	2	2
	1	1

The dip switches listed within this example should all be set in the closed position, as indicated. The remainder of the switches in the group listed in *Table number: 2* should remain open.

You must always finish with a remainder of zero(0) at the end of the iterations, otherwise the calibration has been done incorrectly.

Step 4:
Final adjustment of the flow rate is accomplished by rotating the potentiometer screw just below SW-3 (This control designated as P1, is used to adjust the flow rate.) Clockwise rotation increases the indication, and counter-clockwise decreases the indication. To determine the proper setting, precisely time the flow indication for a period of one minute. ***Example:*** if you find 1 barrel of flow occurs within the one minute timed span, then 1(totalizer reading) x 60(minutes per hour) x 24(hours per day) = 1440(barrels per day.) ***Adjust the indicated flow rate to 1440 Barrels per Day by using the potentiometer screw P1.***

All of the foregoing is completely done at the factory, if you have purchased the turbine and flow monitor as a package. The only reason(s) to perform this calibration is if replacement of existing turbine internals is required or if the flow monitor is installed on a non-Turbines Incorporated turbine flow meter.

Should you require any help, please call 1-800-809-1387 for immediate expert assistance.

Table Number: 3 - *Non- metric PCB Switch Settings*

FLOW METER		GALLONS PER MINUTE					BARRELS PER HOUR					BARRELS PER DAY				
Turbines Flow Meter Model Number	Nominal Range GPM (gallons per minute)	Indicated Display GPM (gallons per minute)	SW-3 Position ● Closed position	1	2	3	4	Indicated Display BPH (barrels per hour)	SW-3 Position ● Closed position	1	2	3	4	Indicated Display BPD (barrels per day)	SW-3 Position ● Closed position	1	2	3	4
TM 0038	0.3 - 3.0	0.30 - 3.00			●			0.40 - 4.00			●			10.0 - 100.0				●	
TM 0050	0.75 - 7.5	0.75 - 7.50			●			1.00 - 10.00			●			25.0 - 250.0				●	
TM 0075	2.0 - 15.0	2.00 - 15.00			●	●		2.85 - 21.42		●				68 - 514			●		
TM 0078	3.0 - 30.0	3.00 - 30.00		●				4.28 - 42.85		●				102 - 1028				●	
TM 0100	5.0 - 50.0	5.0 - 50.0			●			7.0 - 70.0				●		170 - 1700			●	●	
TM 0150	15.0 - 180.0	15.0 - 180.0			●	●		21.0 - 250.0			●	●		51 - 600 x 10			●		
TM 0200L	15.0 - 180.0	15.0 - 180.0			●	●		21.0 - 250.0			●	●		51 - 600 x 10			●		
TM 0200	40.0 - 400.0	40 - 400				●		54 - 540			●	●		130 - 1300 x 10		●		●	
TM 0300	60.0 - 600.0	60 - 600				●		88 - 880				●		210 - 2100 x 10		●	●		
TM 0400	100.0 - 1200.0	100 - 1200		●				142 - 1708		●				34 - 410 x 100			●		
TM 0600	200.0 - 2500.0	20 - 250 x 10				●		28 - 357 x 10				●		68 - 860 x 100		●			
TM 0800	350.0 - 3500.0	35 - 350 x 10		●				50 - 500 x 10		●				12 - 120 x 1000			●		
TM 1000	500.0 - 5000.0	50 - 500 x 10		●				71 - 714 x 10		●	●	●		17 - 272 x 1000				●	

Table Number: 4 - Metric PCB Switch Settings

FLOW METER		CUBIC METERS PER DAY						LITERS PER MINUTE					
Turbines Flow Meter Model Number	Nominal Range GPM (gallons per minute)	Indicated Display CMPD (cubic meters per day)	SW-3 Position (● Closed position) 1	2	3	4		Indicated Display LPM (liters per minute)	SW-3 Position (● Closed position) 1	2	3	4	
TM 0038	0.3 - 3.0	1.60 - 16.00			●			1.13 - 11.35			●		
TM 0050	0.75 - 7.5	4.0 - 40.0	●					2.83 - 28.38			●		
TM 0075	2.0 - 15.0	10.9 - 81.7			●			7.6 - 56.7		●			
TM 0078	3.0 - 30.0	16.0 - 160.0	●					11.3 - 113.5			●		
TM 0100	5.0 - 50.0	27 - 270		●				18.9 - 189.2		●	●		
TM 0150	15.0 - 180.0	80 - 1000			●			56 - 681		●			
TM 0200L	15.0 - 180.0	80 - 1000			●			56 - 681		●			
TM 0200	40.0 - 400.0	21 - 210 x 10		●				151 - 1514	●		●		
TM 0300	60.0 - 600.0	33 - 330 x 10		●				227 - 2271	●	●			
TM 0400	100.0 - 1200.0	54 - 650 x 10			●			38 - 454		●			
TM 0600	200.0 - 2500.0	10 - 140 x 100		●				76 - 946 x 10	●				
TM 0800	350.0 - 3500.0	19 - 190 x 100			●			13 - 132 x 100	●				
TM 1000	500.0 - 5000.0	27 - 272 x 100	●					19 - 189 x 100			●		

Figure Number: 1

Circuit Board