USER'S GUIDE
Installation & Operation
Instructions

SAFSONIC DFM2
DOPPLER FLOW METER

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Introduction

The Safsonic DFM2 Flow Meter measures the velocity of liquids in pipelines using a totally non-intrusive principle.

The DFM2 utilises a high speed, 16-bit microprocessor unit with 32-Kbyte FLASH memory. The user-friendly flow meter comes with a range of features to ensure easy and reliable flow measurement. The flow signal from the flow sensor is continuously analysed and should the signal quality become unacceptable an error message is displayed.

Standard features include an isolated 4 – 20mA output signal, an isolated pulse output and a relay output.

It is designed for use with sewage, waste water, pulp stock, mining slurries, food products and other liquids which contain in excess of 0,01% **suspended solids or bubbles.** The particle size for successful operation must be greater than 100 microns.

Available configurations

The model DFM2-2 is supplied with an in-line signal transmitter. The 3 metre sensor cable is supplied connected to the in-line transmitter, and a 3 core screened cable is used to connect the in-line transmitter to the flow meter display. The 3 core cable can be up to 100m long.

Sensor mounting

Location

- Select a location for mounting the sensor at a point where the flow profile is fully developed. Generally the principle of 10 pipe diameters of straight pipe upstream, and 5 pipe diameters downstream will suffice, but should valves or bends exist upstream of the sensor, the amount of straight pipe immediately upstream will need to be increased.

- Ensure that the sensor is mounted as far as possible from potential noise sources, such as pumps, control valves etc. and mount the sensor at approximately 3/9 o'clock on the pipe (if horizontal) to avoid errors due to air pockets on top, or sediment at the bottom of the pipe.

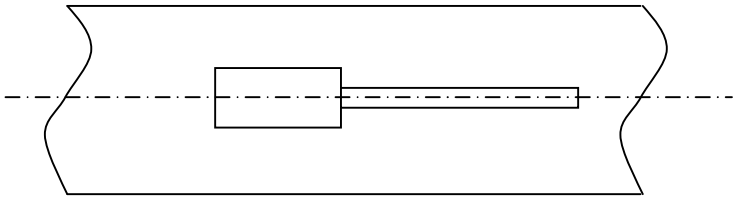
- Either vertical-up or horizontal pipe runs are acceptable for sensor mounting. Vertical down flow should be avoided.

Surface preparation

- Before attaching the transducer head to the pipe surface, an area slightly larger than the flat surface of the transducer must be cleaned to bare metal. (A small amount of pipe pitting, even with spots of paint or rust, will not cause problems).

Orientation

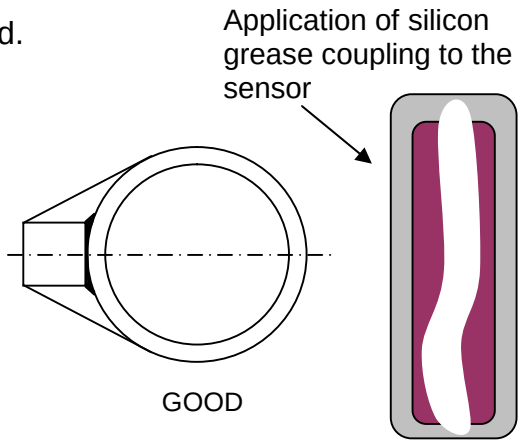
- The transducer must be mounted accurately, parallel to the pipe axis, for correct performance, and transducer to pipe contact should be along the centre line of the transducer head.



SIDE VIEW - 3 O'CLOCK POSITION ON PIPE IF HORIZONTAL

Ultrasonic Bonding

- **<u>The sensor must not have any air gap between it and the pipe.</u>** Bonding to the pipe is achieved with silicone coupling compound. Hold the sensor steady during tensioning of straps to limit sensor movement. Be sure to fill in any air gaps that may remain at the pipe transducer interface with additional compound.



GOOD

- A pipe clamp kit is included with the flow meter. It includes silicone coupling compound, a Neoprene rubber pad, and straps for pipe diameters up to 600mm. In applications with excessive vibration it is recommended that the Neoprene rubber pad is inserted between the pipe and the transducer. Coupling compound must be applied to both sides of the pad.

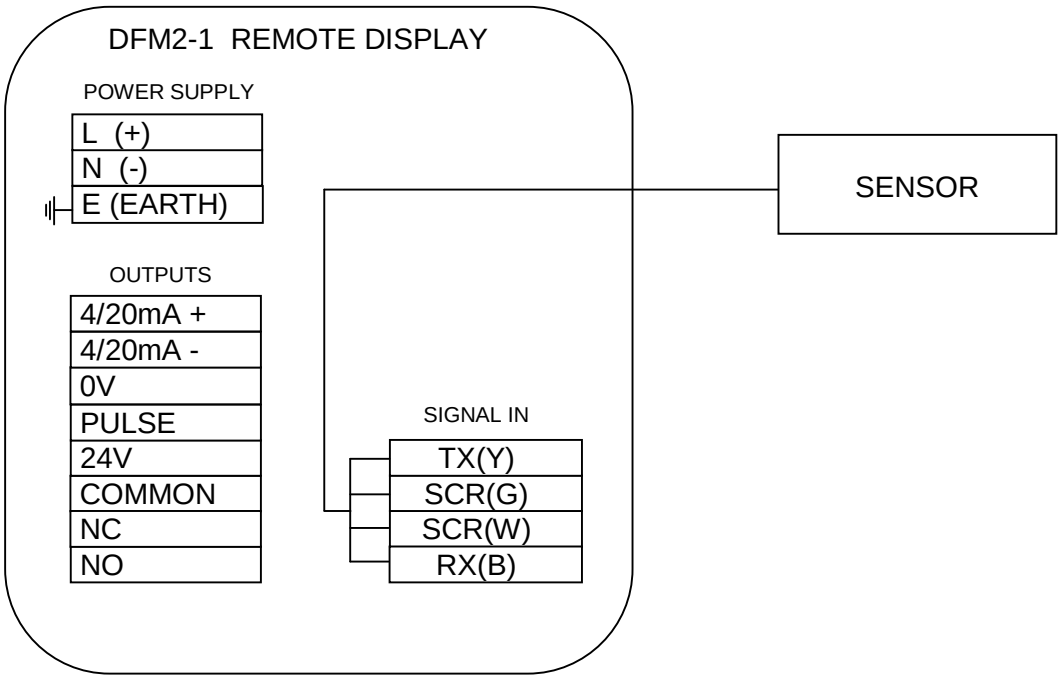
- Steel band strapping tools and steel strapping for installation of sensors provide excellent sensor strap tension, however care should be taken not to damage sensor with excessive force.

Wiring

DFM2-1
(Now discontinued see DFM2-2)

N.B.
Supply correct voltage to the Display
Earth the Display to ground for surge protection and signal noise screening

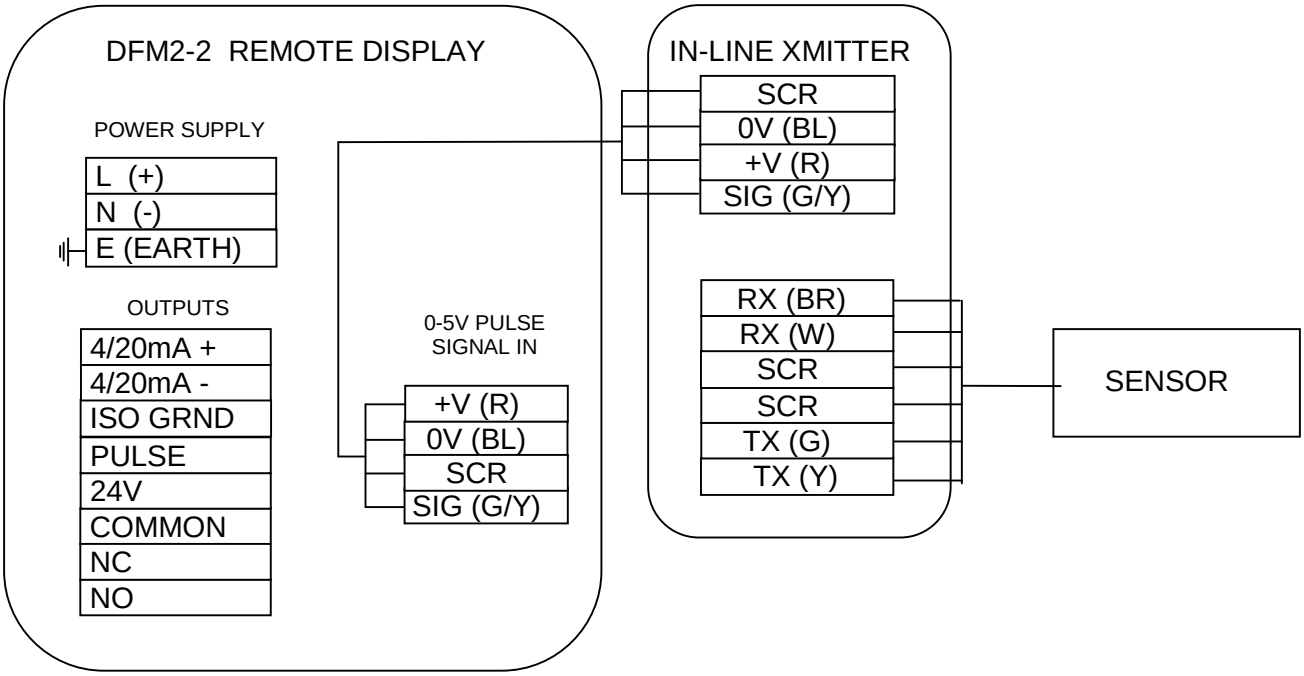
Model	Power Supply Voltage
DFM2-1-1	115 Vac ±10% 50/60Hz 6VA
DFM2-1-2	230 Vac ±10% 50/60Hz 6VA
DFM2-1-3	24Vdc ±10% 3.6W

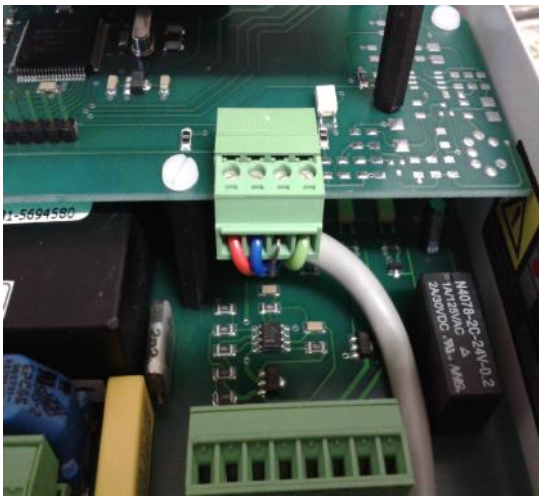


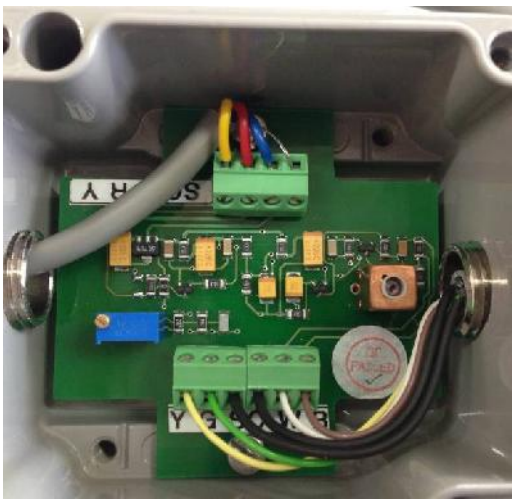
DFM2-2

N.B.
Supply correct voltage to the Display
Earth the Display to ground for surge protection and signal noise screening

Model	Power Supply Voltage
DFM2-2-1	115 Vac ±10% 50/60Hz 6VA
DFM2-2-2	230 Vac ±10% 50/60Hz 6VA
DFM2-2-3	24Vdc ±10% 3.6W

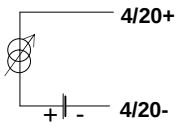
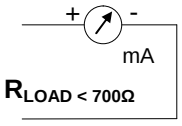
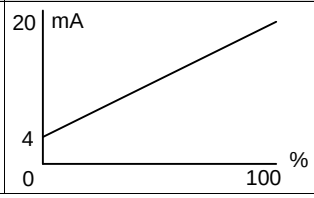




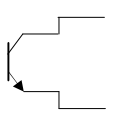
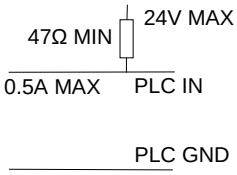
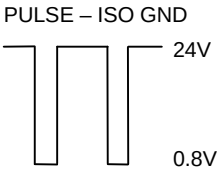
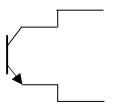
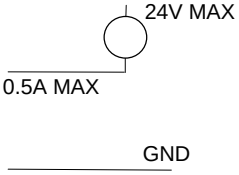
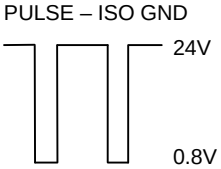
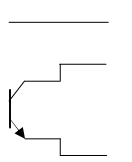
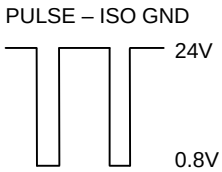
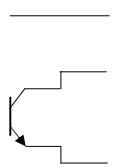
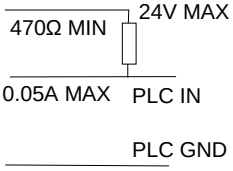
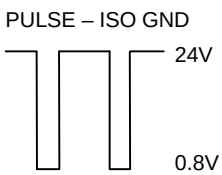


Output Functions

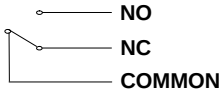
- The 4 – 20mA output signal is proportional to the flow rate. The full-scale value (i.e. 20mA) is the flow rate figure programmed into menu item M1_2.

OUTPUT	DFM2 TERMINALS	EXT. CIRCUIT	SIGNAL
Flow rate Current Loop (Active)			

- The totaliser pulse output signal is either a 24V pulse available between the '24V' terminal and the 'PULSE' terminal, or an open collector output between 'PULSE' terminal and the 'ISOGND' terminal. The width of the pulse is selectable in menu item M2_5, however if the pulse rate exceeds 1,33 pps, the pulse output will change to an output with equal mark-space ratio. M2_3 is used to reduce the pulse output frequency.

OUTPUT	DFM2 TERMINALS	EXT. CIRCUIT	SIGNAL
Totaliser pulse Binary Output (Open-Collector) External supply and pull up resistor			
Totaliser pulse Binary Output (Open-Collector) External supply and relay/counter			
Totaliser pulse Binary Output (Open-Collector) Internal supply and relay/counter			
Totaliser pulse Binary Output (Open-Collector) Internal supply and external pull up resistor			

- The function of the relay is selectable from menu M2_5
  1. relay off - the relay is disabled.
  2. tot output – the relay energises each time the totaliser counts the selected number of counts. The relay will not energise if the count rate is > 1.33Hz.
  3. flow alarm – the relay can be set to operate in a window between 'lo – alarm' and 'hi – alarm'. The flow rate settings for these alarms are programmed into menu item M1_3 and M1_4 respectively. This function can be used for pump protection.
  4. signal loss – the relay is set to energise if the doppler signal is lost.

OUTPUT	DFM2 TERMINALS	EXT. CIRCUIT	SIGNAL
Relay Output		 Relay Mechanical Totaliser Etc.	Relay NC/NO contacts <1A 125VAC <2A 30VDC

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Pump protection

For low flow or high flow pump protection it is necessary to power the DFM2-2 from the pump supply or auxiliary contact to allow the delay timer to reset (start to count) on pump start-up. The relay must be programmed for "flow alarm" in M2_5 relay-opts. The relay response is delayed in menu M2_6 relay-delay. When the flow rate moves below or above the trip points M1_3 "lo alarm" or M1_4 "hi alarm" the relay will energise after the delay time runs out. The relay will latch if programmed in M2_7 relay-latch as yes. The relay will energise and remain energised (latched) until main power is turned off.

FLOW RATE GUIDE

PIPE SIZE	PIPE SIZE	FLOWRATE @ 1m/s (3ft/s)				FLOWRATE @ 10m/s (30ft/s)			
(mm)	(INCH)	(l/s)	m3/hr	ft3/s	gal(US)/s	(l/s)	m3/hr	ft3/s	gal(US)/s
25	1	0.5	1.8	0.02	0.13	5	18	0.18	1.32
40	1.6	1.25	4.5	0.04	0.33	12.5	45	0.44	3.30
50	2	2	7.2	0.07	0.53	20	72	0.71	5.28
65	2.6	3.3	11.9	0.12	0.87	33	118.8	1.17	8.72
80	3.2	5	18.0	0.18	1.32	50	180	1.77	13.2
100	4	8	28.8	0.28	2.11	80	288	2.83	21.1
125	5	12	43.2	0.42	3.17	120	432	4.24	31.7
150	6	18	64.8	0.64	4.75	180	648	6.36	47.5
200	8	31	111.6	1.09	8.19	310	1116	10.95	81.9
250	10	49	176.4	1.73	12.9	490	1764	17.30	129.4
300	12	70	252.0	2.47	18.5	700	2520	24.72	184.9
350	14	96	345.6	3.39	25.4	960	3456	33.90	253.5
400	16	125	450.0	4.41	33.0	1250	4500	44.14	330.1
450	18	159	572.4	5.62	42.0	1590	5724	56.15	419.9
500	20	196	705.6	6.92	51.8	1960	7056	69.22	517.6
600	24	283	1018.8	9.99	74.7	2830	10188	99.94	747.4
700	28	385	1386.0	13.60	101.7	3850	13860	135.96	1016.8
750	30	442	1591.2	15.61	116.7	4420	15912	156.09	1167.3
800	32	500	1800.0	17.66	132.1	5000	18000	176.57	1320.5

Keypad System

The DFM2 has a 4-button programming system.

- The MENU button (M) is used to scroll through the menu structure.
- The SAVE button (S) is used to save entered changes to the flow meter programme, only when in the Save & Exit Menu.
- The ► and ▲ buttons are used to change numbers and scroll through options.

Menu System

The DFM2 menu system is easy to use and designed for programming simplicity.

With the DFM2 powered up the DFM2 will test the suitability of the flow signal. If the signal is suitable the flow total and flow rate are displayed, if not an error message is displayed.

00000000 lt **3.9768 l/s**

All set-up requirements are contained in the menus, and each item is stepped to by pressing the **M** button. **N.B.** The new data is only accepted if the 'save & exit' instruction is executed.

START PROGRAMMING - Press "MENU"

Main Menu

The Main Menu consists of **Password?, Change?, Units?, Menu-1**, **Menu-2**, (**Cal mode** hidden menu) and **Save & exit.**

Password? ********

Enter the required password. The flow meter is shipped with the password 1000. (Default password = 1942). The set-up can be viewed without the password, however, no changes can be saved at the Save & exit menu item and the error message "wrong password" is displayed.
Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed and **M** to continue

Change? **1000**

Providing the correct password was entered, a new password can now be entered. Enter the required password.

Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed
Press **M** to continue

Units?
Metric

Metric and US units of rate and total measurement are available.
Press ▲ until desired value is displayed and **M** to continue.

Menu-1
M-cont S-enter

Press **S** to enter or **M** to continue

Menu-2
M-cont S-enter

Press **S** to enter or **M** to continue

Cal mode
M-cont S-enter

Press **S** to enter or **M** to continue (Cal mode is a hidden menu)

Save & exit
M-cont S-yes

Press **S** to save and exit or **M** to continue

MENU-1 Flow Data

M1_1 rate units
l/s

Press ▲ repeatedly until desired units are displayed and **M** to continue

M1_2 max flow
100 l/s

Enter the maximum flow rate at which to output 20mA
Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed and **M** to continue

M1_3 lo_alarm
20 l/s

Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed and **M** to continue

M1_4 hi_alarm
100 l/s

Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed and **M** to continue

M1_5 total units
m^3

Select the unit you wish to totalise.
Press ▲ to select the option required and **M** to continue

M1_6 clr total?
save tot

Select to clear the existing flow total or to keep existing flow total
Press ▲ to select option required and **M** to continue

M1_7 damping
Minimum

Minimum, medium, maximum damping settings are available
Press ▲ to select the required value and **M** to continue

M1_8 cutoff
2%

1%, 2%, 3%, 5% & 10% of full scale (i.e. 10m/s) cutoff settings available
Select the level below which the DFM2 will output no flow
Press ▲ to select the required value and **M** to continue to **Main Menu**

Menu - 2 Setup Data

M2_1 pipe ID mm
108.2

Enter the I.D. of the pipe.
N.B. The actual pipe ID must be entered here, not a nominal figure e.g. a 150NB Schedule 10 pipe should be calculated as follows, PIPE OD – (2 x pipe wall thickness) i.e. 168.3 – (2 x 3.4) = 161.5mm and not 150mm (16% error).
Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed and **M** to continue

M2_2 sim % o/p
100.

The output current can be driven to any percentage of full scale by entering the desired value. This facility can be used for testing the mA loop. A continuous pulse out is also simulated at the open collector PULSE.
Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed and **M** to continue

M2_3 puls-factor
1.00 pulse/unit

0.01, 0.10 & 1.00 pulse/unit options are available where the units are those selected in **Menu 1_5.** Press ▲ to select and **M** to continue
N.B. The count rate of the totaliser is limited to 100 counts/second. Above this count rate an error message is displayed. Change the total unit of measure, e.g. l to m3.

M2_4 puls-width
20ms

The output pulse width can be varied.
Press ▲ repeatedly until the desired value is displayed and **M** to continue
N.B. the pulse output will change to a frequency with equal on-off period for a pulse rate >1.33Hz. The maximum frequency is 100Hz in line with the totaliser count rate see M2_3.

M2_5 relay-opts
relay off

The relay function is selectable.
1. relay off
2. tot output
3. flow alarm
4. signal loss

Press ▲ to select option required and **M** to continue.

M2_6 relay-delay
9.

The delay time can be varied from 0-99 seconds.
Press ▲ repeatedly until the desired value is displayed and **M** to continue

M2_7 relay-latch
no

The relay latch function is selectable.
Press ▲ to activate (yes) or de-activate (no) the relay latch function and **M** to continue

Cal Mode (hidden menu)

Cal mode is a hidden menu, for the setup of the current output and calibration (K factor) for the DFM2. To access this menu, press and hold **M** immediately after Menu 2 until cal_mode appears on screen.

Cal Mode
M-cont S-enter

Press **S** to enter.

M3_1 set 4 mA
750

Connect an accurate milliamp meter to the current output terminals
Select a value that drives the output to 4mA (approx. 750)
Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed
Press **M** to continue

M3_2 set 20 mA
3800

Connect an accurate milliamp meter to the current output terminals
Select a value that drives the output to 20mA (approx. 3800)
Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed
Press **M** to continue

M3_3 cal_factor
1.0603

Enter the calibration factor or K Value of the flow sensor
Press ► repeatedly until cursor is under digit to be edited
Press ▲ repeatedly until desired value is displayed

Press **M** to continue
Continue pressing **M** until the **Save & exit** menu, then press **S** to save the entered values.

NOTE:
Changes that are made to values in the menu system will only be saved when accessing the **Save & exit** menu and the **S** button is pressed.

Error/Warning Messages

ERROR MESSAGE	ERROR	POSSIBLE SOLUTION
• poor signal	• Poor signal • Flow rate less than minimum flow rate of 0.25m/s	• Inject air into line • Increase flow rate
• no signal	• No signal	• Establish flow • Inject air into line
• total error counts > 100/s	• Totaliser count-rate too high	• Select more suitable total units
• rate overflow	• Rate > 999 999	• Select more suitable rate units
• lo > hi alarm	• Alarm settings incorrect, changes will not be saved	• Re-enter alarm settings hi alarm > lo alarm

Trouble Shooting guide

PROBLEM	POSSIBLE SOLUTION
Meter reading **lower** than expected	
• Source particles velocity not indicative of average velocity	• Relocate sensor to a position where source particles are expected to be moving at the average velocity
• Incorrect mounting of flow sensor	• Remount sensor correctly
• Programming error	• Review all programmed entries
• Flow rate lower than expected	• Investigate possible causes and confirm flow rate independently
• Insufficient particle size or concentration	• Locate sensor at position where acceptable particle size or concentration is expected. • Inject air into the line
Meter reading when there is **no flow**	
• Local ultrasonic noise source	• Relocate sensor or remove noise source
• Local electric noise interference	• Check ground/earth of display and cable screens to ground
“Poor signal” displayed when flow exists	
• Insufficient particle size or concentration	• Locate sensor at position where acceptable particle size or concentration is expected. • Inject air into the line
• Sensor coupling to pipe poor	• Remount sensor to pipe correctly
Meter reading **higher** than expected	
• Programming error	• Review all programmed entries
• Flow rate higher than expected	• Investigate possible causes and confirm flow rate independently
• Particle velocity at sensor not indicative of average velocity	• Relocate sensor to a position where source particles are expected to be moving at the average velocity
• Incorrect mounting of flow sensor	• Remount sensor correctly
• Local electrical noise	• Relocate sensor
Meter reading **erratic**	
• Particle velocity at sensor not indicative of average velocity and erratic	• Relocate sensor to a position where the velocity profile is expected to be suitable

Questions and Answers

The pipe vibrates. Will it affect the flow meter?
Common vibration frequencies are far lower than the sonic frequencies used by the flow meter, and will not normally affect accuracy or performance.

Will pipe corrosion affect accuracy of the flow meter?
Yes. Rust, loose paint etc. must be removed from the outside of the pipe to provide a clean mounting area when installing a Doppler sensor. Severe corrosion/oxidation on the inside of the pipe may prevent the Doppler signal from penetrating into the flow. If the pipe cannot be cleaned, a spool piece should be installed for sensor mounting.

What effect do pipe liners have on the flow meter?
The air gap between loose insertion liners and the pipe wall prevent the Doppler signal from entering the flow. Better results can be expected with bonded liners such as rubber, epoxy or tar, however an on site test is recommended to determine if the application is suitable for a Doppler flow meter.

Why is Doppler only recommended for liquids containing suspended solids or gases?
The Doppler sensor transmits sound into the flow stream, which must be reflected back to the sensor to indicate flow velocity. Gas bubbles or suspended solids act as reflectors for the Doppler signal. As a guideline, Safsonic Doppler flow meters are recommended for liquids containing solids or bubbles with a minimum size of 100 microns and a minimum concentration of 100 ppm.

Can the sensor be submerged in water?
Yes, for short periods of time or by accident, but not for continuous operation. The sensor is constructed to withstand submersion without damage, but external liquid moving in contact with the sensor can be interpreted as flow and cause false readings.

Can I change the length of the sensor cable?
The DFM2-1 is supplied with a 3 meter sensor cable as standard but is now discontinued. The DFM2-2 comes standard with an in-line transmitter which allows for the change in cable length.

Does the direction of flow matter for Sensor mounting?
The Safsonic DFM Doppler flow meter will measure and totalise flow in either direction. A check valve should be used in applications where backflow may occur.

Warranty

Flowmetrix SA warrants to the purchaser that the equipment to be delivered hereunder will be free from defects in materials, workmanship and title and will be of the kind and quality designated in the proposal.

The foregoing warranty is exclusive and in lieu of all other warranties whether express or implied including any warranty of merchantability or of fitness for a particular purpose.

Warranties other than the above will only be effective if written and signed by an officer of Flowmetrix SA

If within 1 (one) year from the date of delivery, the equipment delivered hereunder does not meet the warranties specified above, Flowmetrix SA shall thereupon correct such defects, at its sole discretion, either by repairing or by replacing the instrument in its entirety.
The costs of returning the equipment to Flowmetrix SA and for the repaired or replaced item being returned to the purchaser shall be for the account of the purchaser.
The liability of Flowmetrix SA is conditioned upon the equipment covered hereunder being handled, installed, operated, maintained, stored or used, as the case may be, in strict accordance with the written instructions or technical direction supplied by Flowmetrix SA, and is further conditioned upon the purchasers prompt written notice (within 30 days) to Flowmetrix SA of such defects.
Flowmetrix SA makes no warranties which extend to the items covered hereby due to improper handling, installation, operation, maintenance, storage or use; abnormal or undisclosed environmental conditions; or operating or use in an otherwise improper manner.

The liability of Flowmetrix SA to the purchaser, except as to title, arising out of the supplying of the equipment or its use, under this warranty article, shall not, in any case, exceed the cost of correcting defects in the equipment as herein provided and upon the expiration of the warranty described herein, all such warranty liability shall terminate. The foregoing shall constitute sole warranty remedy of the purchaser and the sole warranty liability of Flowmetrix SA.

Goods Return Procedure

Damaged or defective equipment should be returned to the supplier prepaid. Do not return goods until written authorisation to do so has been obtained. Returned goods must have accompanying them a letter stating the following:

- Your company name and order number
- The contact person at your company
- Serial number and name of product
- Description of damage and cause if known
- Nature of any repair attempted by the user
- Type of repair, replacement or adjustment requested

Features & Specifications

Velocity Range	0.25 to 10m/s (0.82 to 30.5ft/s)
Liquids	Containing 0.01% solids >100micron
Pipes	25-3000mm (1”-120”) Most pipe materials
Accuracy	±2% of Rate for velocities >0.5m/s (1.6ft/s)
Repeatability	±2%
Indication	Rate and Total (password resettable) 2 - Line 16 Character backlit LCD
Units	Rate units: m/s, l/s, l/m, l/hr, m^3/s, m^3/m, m^3/hr, ft/s, ft^3/s, ft^3/m, ft^3/hr, USgps, USgpm, USgph, USmgd Total units: l, m^3, Ml, ft^3, 10^3ft^3, 10^6ft^3, USG, 10^3USG, 10^6USG
Power Supply	115/230Vac ±10%, 50/60Hz, (<6VA) 24VDC, ±10% (<4W)
Programming	4 Key external keypad
Isolated Outputs	Active 4-20mA (<700Ω load) 24VDC Auxiliary supply (<50mA) OCT Totaliser pulse (<24VDC <500mA, <100Hz) Relay Form C (1A 125VAC, 2A 30VDC) Flow Rate Alarm, Signal Loss, Totaliser RS485 Modbus RTU (Optional)
Response Time	3 Selectable levels of damping
Electronics enclosure	IP67 (NEMA 6) Polycarbonate Wall Mount 125 x 125 x 75mm HxWxD (5” x 5” x 3”)
Transducer	IP68 (NEMA 6P) Aluminium epoxy-faced 21 x 80 x 28mm HxWxD (0.8” x 3” x 1.1”)
Temperature limits	Sensor -20 to 90ºC (-4 to 194ºF) Electronics -10 to 50ºC (14 to 122ºF)
Inline transmitter enclosure	IP67 (NEMA 6) Aluminium Epoxy coated 75 x 80 x 57mm HxWxD (3” x 3.1” x 2.2”)
Cable length with inline transmitter	3m (9ft) Sensor to transmitter and ≤100m (300ft) from transmitter to DFM2 display
Shipping	36 x 20 x 13cm (15” x 10” x 5.2”), 2kg (5lbs)
Model No.	DFM2-2-1-x (115VAC 50/60Hz) DFM2-2-2-x (230VAC 50/60Hz) DFM2-2-3-x (24VDC)
Model Example	DFM2-2-1-30 115VAC 50/60Hz with 30m sensor cable
Standards	CE Certified
Calibration	Certificate with each flow meter

ASA steel pipe schedules

			ANSI B36.19								ANSI B36.10			
			Schedule											
	Outside diameter		5S		10S		40S/STD		80S/XS		STD		XS	
			Wall thickness and weight kg/mm											
DN	mm	NPS	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
8	10.3	1/8			1.24	0.28	1.73	0.37	2.41	0.48				
8	13.7	1/4			1.65	0.50	2.24	0.64	3.02	0.81				
10	17.2	3/8			1.65	0.64	2.31	0.86	3.20	1.12				
15	21.3	1/2	1.65	0.81	2.11	1.01	2.77	1.28	3.73	1.64				
20	26.7	3/4	1.65	1.03	2.11	1.3	2.87	1.71	3.91	2.23				
25	33.4	1	1.65	1.31	2.77	2.12	3.38	2.54	4.55	3.28				
32	42.2	1 1/4	1.65	1.67	2.77	2.73	3.56	3.44	4.85	4.53				
40	48.3	1 1/2	1.65	1.92	2.77	3.15	3.68	4.11	5.08	5.49				
50	60.3	2	1.65	2.42	2.77	3.99	3.91	5.51	5.54	7.59				
65	73.0	2 1/2	2.11	3.74	3.05	5.34	5.16	8.75	7.01	11.6				
80	88.9	3	2.11	4.58	3.05	6.55	5.49	11.5	7.62	15.5				
100	101.6	3 1/2	2.11	5.25	3.05	7.52	5.74	13.8	8.08	18.9				
100	114.3	4	2.11	5.92	3.05	8.49	6.02	16.3	8.56	22.6				
125	141.3	5	2.77	9.60	3.40	11.7	6.55	22.1	9.53	31.4				
150	168.3	6	2.77	11.5	3.40	14.0	7.11	28.7	10.97	43.2				
200	219.1	8	2.77	15.0	3.76	20.2	8.18	43.1	12.70	65.6				
250	273.0	10	3.4	22.9	4.19	28.2	9.27	61.1	12.70	82.7				
300	323.9	12	3.96	31.7	4.57	36.5	9.53	74.9	12.70	98.8				
350	355.6	14	3.96	34.8	4.78	41.9					9.53	82.5	12.70	109
400	406.4	16	4.19	42.1	4.78	48.0					9.53	94.6	12.70	125
450	457	18	4.19	47.4	4.78	54.1					9.53	107	12.70	141
500	508	20	4.78	60.2	5.54	69.6					9.53	119	12.70	157
	559	22	4.78	66.2	5.54	76.7					9.53	131	12.70	173
600	610	24	5.54	83.7	6.35	95.9					9.53	143	12.70	190
	660	26									9.53	155	12.70	206
700	711	28									9.53	167	12.70	222
	762	30	6.35	120	7.92	149					9.53	179	12.70	238
800	813	32									9.53	191	12.70	254
	864	34									9.53	204	12.70	270
900	914	36									9.53	216	12.70	286
	965	38									9.53	228	12.70	303
1000	1016	40									9.53	240	12.70	319
	1067	42									9.53	252	12.70	335
	1118	44									9.53	264	12.70	351
	1168	46									9.53	276	12.70	367
	1219	48									9.53	288	12.70	383
	1321	52									9.53	313	12.70	417
	1422	56									9.53	339	12.70	449
	1524	60									9.53	362	12.70	482
	1626	64									9.53	387	12.70	514

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			Schedule													
	Outside diameter		10		20		30		40		60		80		120	
			Wall thickness and weight kg/mm													
DN	mm	NPS	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m	mm	kg/m
8	10.3	1/8	1.24	0.28					1.73	0.37			2.41	0.48		
8	13.7	1/4	1.65	0.50					2.24	0.64			3.02	0.81		
10	17.2	3/8	1.65	0.64					2.31	0.86			3.20	1.12		
15	21.3	1/2	2.11	1.01					2.77	1.28			3.73	1.64		
20	26.7	3/4	2.11	1.30					2.87	1.71			3.91	2.23		
25	33.4	1	2.77	2.12					3.38	2.54			4.55	3.28		
32	42.2	1 1/4	2.77	2.73					3.56	3.44			4.85	4.53		
40	48.3	1 1/2	2.77	3.15					3.68	4.11			5.08	5.49		
50	60.3	2	2.77	3.99					3.91	5.51			5.54	7.59		
65	73.0	2 1/2	3.05	5.34					5.16	8.75			7.01	11.6		
80	88.9	3	3.05	6.55					5.49	11.5			7.62	15.5		
100	101.6	3 1/2	3.05	7.52					5.74	13.8			8.08	18.9		
100	114.3	4	3.05	8.49					6.02	16.3			8.56	22.6	11.13	28.7
125	141.3	5	3.40	11.7					6.55	22.1			9.53	31.4	12.70	40.8
150	168.3	6	3.40	14.0					7.11	28.7			10.97	43.2	14.27	55.0
200	219.1	8	3.76	20.2	6.35	33.8			8.18	43.1	10.31	53.8	12.70	65.6	18.26	91.7
250	273.0	10	4.19	28.2	6.35	42.3	7.8	51.7	9.27	61.1	12.70	82.7	15.09	97.3	21.44	135
300	323.9	12	4.57	36.5	6.35	50.4	8.38	66.1	10.31	80.9	14.27	110	17.48	134	25.40	190
350	355.6	14	6.35	55.5	7.92	68.9	9.53	82.5	11.13	95.9	15.09	128	19.05	160	27.79	228
400	406.4	16	6.35	63.5	7.92	78.9	9.53	94.6	12.7	125	16.66	162	21.44	206	30.96	291
450	457	18	6.35	71.6	7.92	88.9	11.13	124	14.27	158	19.05	209	23.83	258	34.93	369
500	508	20	6.35	79.7	9.53	119	12.70	157	15.09	186	20.62	251	26.19	316	38.10	448
	559	22	6.35	87.8	9.53	131	12.70	173			22.23	298	28.58	379	41.28	534
600	610	24	6.35	95.9	9.53	143	14.27	213	17.48	259	24.61	360	30.96	448	46.02	649
	660	26	7.92	129	12.70	206										
700	711	28	7.92	139	12.70	222	15.88	276								
	762	30	7.92	149	12.70	238	15.88	296								
800	813	32	7.92	159	12.70	254	15.88	317	17.48	348						
	864	34	7.92	170	12.70	270	15.88	337	17.48	370						
900	914	36	7.92	179	12.70	286	15.88	357	19.05	426						
	965	38	9.53	228	12.70	302	15.88	377								
1000	1016	40	9.53	240	12.70	319	15.88	397								
	1067	42	9.53	252	12.70	335	15.88	417								
	1118	44	9.53	264	12.70	351	15.88	438								
	1168	46	9.53	276	12.70	367	15.88	458								
	1219	48	9.53	288	12.70	383	15.88	478								
	1321	52	9.53	313	12.70	416	15.88	518								
	1422	56	9.53	337	12.70	448	15.88	558								
	1524	60	9.53	361	12.70	480	15.88	599								
	1626	64	9.53	385	12.70	512	15.88	639								

The table shows a part of the ANSI B36.10 standard;
some of these dimensions are outside AST's production programme.