



NOVEMBER 2011



FLOMOTION FM1100C
Ultrasonic Open Channel Flowmeter
USER'S MANUAL

NOVEMBER 2011



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Chapter 1. Introduction

About the FLOMOTION FM1100C

The FLOMOTION FM1100C Series operates on the principle of timing the echo received from a measured pulse of sound transmitted in air and utilizes “state of the art” echo extraction technology.

Easy calibration and maintenance free performance mean that you can install the FM1100C Series rapidly and with confidence.

The FM1100C Series can show level, space, distance, on the display. The switched outputs can be programmed to give an ‘ON’ and ‘OFF’ point for external control. There is a 4-20 mA output that can be connected to a remote chart recorder or PLC, to monitor level, space or distance, dependant on the measurement mode selected, and provides a ‘fault condition’ alarm of either 3.8mA or 21mA.

The FM1100C Series has an IP67 lid covering an integral LCD display and 5 buttons used for programming purposes, together with 4 LED’s which provide status information whilst in RUN and PROGRAM Mode.



Product Specification

Physical

Dimensions

Overall: 4.61 D x 8.22 in. H (117 D x 208.8 H mm)

Transducer: 2.2 D x 4.72 in H (56 D x 120 H mm)

Mounting: 2" NPT

Weight

Nominal: 3.3 lb (1.5 kg)

Case material/description

Polypropylene

Environmental

IP Rating (electronics housing)

Nema 6 (IP67)

Max. & Min. temperature (electronics)

-4°F to 185°F (-20°C to +85°C)

Pressure

up to 29 psi (2 Bar)

Performance

Accuracy

0.20% of the measured range or .39in (10mm) whichever is greater

Resolution

0.03% of full scale or 1mm (whichever is greater)

Max. Range

Liquids 19.6 ft (6m) or 32.8 ft (10m)

Beam Angle

8° at -3dB

Damping Rate

Adjustable from 0.1m/min to 10m/min

Temperature Compensation

Fully compensated via integral temperature sensor over entire operational span

Outputs

Analogue output

4-20mA into max 750 Ω (user adjustable) Fault condition Alarm
3.8mA or 21mA user selectable.

Display

5 Digit LCD Display

Programming

On-board programming

via 5 tactile push button keys

Supply

Power supply

DC 20 - 30V

Current Consumption

Less than 0.021A

Certificate

CE approval

EMC approval to BS EN 61326-1:2006 (Class A),.

Chapter 2. Installation

The **FLOMOTION FM1100C** is composed of one controller unit and one sensor

Power Supply Requirements

The FM1100C operates from a DC supply of 20–30V and will typically draw less than 0.08A.

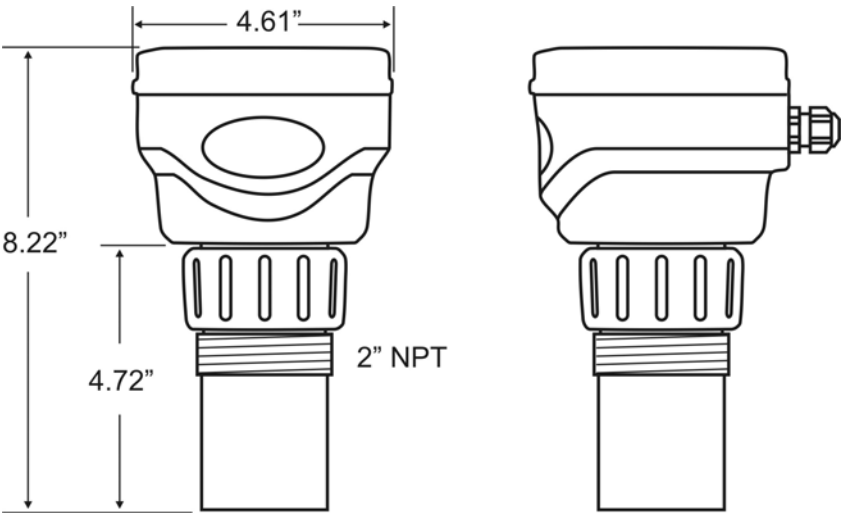
All electronic products are susceptible to electrostatic shock, so follow proper grounding procedures during installation.

The compact one-piece construction of the FM1100C can be mounted easily using the integral nose thread (2"NPT).

When choosing a location to mount the FM1100C, bear in mind the following:

- For easy access to the LCD display and programming buttons mount it where it is easily accessible.
- The ultrasonic signal path should be free of falling material and obstructions such as pipes, beams etc.
- The FM1100C should be mounted at least 1.15ft (30cm) above the maximum level of the material and be perpendicular to the surface.
- The mounting surface should be vibration-free.
- The ambient temperature is between -4° to 185°F (-20° to 85°C)
- There should be no high voltage cables or electrical inverters close by.
- Do not use any metal substances when installing (Please use the PVC nut & flange supplied as option)

Dimensions

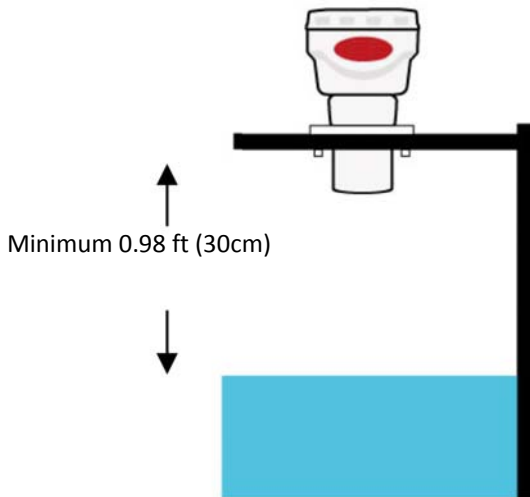


Outdoor and Open Vessel Installation

The FM1100C can be simply mounted on a bracket, suitable for the application and secured using the thread located at the top of the transducer (2" NPT).

Care should be taken to ensure that the FM1100C is not installed in direct sunlight, in order to avoid errors in the measurement of ambient temperature.

Attention should also be taken, when mounting the unit, to ensure that strong windy conditions are avoided, wherever possible, to prevent abnormal operation.



Closed Vessel Installation

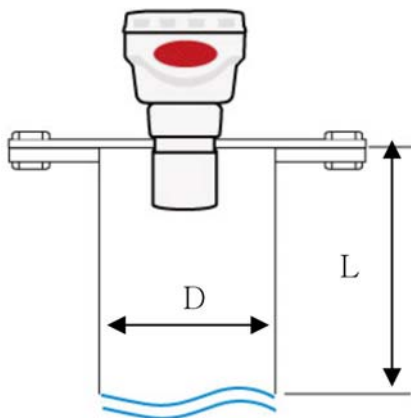
The FM1100C can be simply screwed into a flange and secured using the thread located at the top of the transducer (2"NPT).

Where possible use a flange made of a synthetic material such as PVC, to avoid vibration.

Place a rubber gasket between the flange of the FM1100C and the connection to the vessel to avoid vibration.

Stand Pipe Installations

When mounting the FM1100C to a standpipe care should be taken to ensure that the standpipe is of sufficient space with reference to its length, see the table below for details:



D	Length
3.15 in. (80mm)	9.22 in. (234mm)
3.94 in. (100mm)	11.42 in. (290mm)
5.91 in. (150mm)	16.93 in. (430mm)
7.87 in. (200mm)	22.44 in. (570mm)

When using a standpipe, fixed to the top of a vessel, ensure that the open end of the standpipe is clear of any obstructions such as weld seams, gaskets etc. in order to avoid unwanted signal returns.

If using standpipes, which extend into the vessel, beyond the blanking distance, but not as far as the empty level, then the open end of the standpipe should be cut to an angle of 45°.



The maximum level (100% of Span) is inside the Blanking Distance



Pipe should be free of obstructions such as weld seams



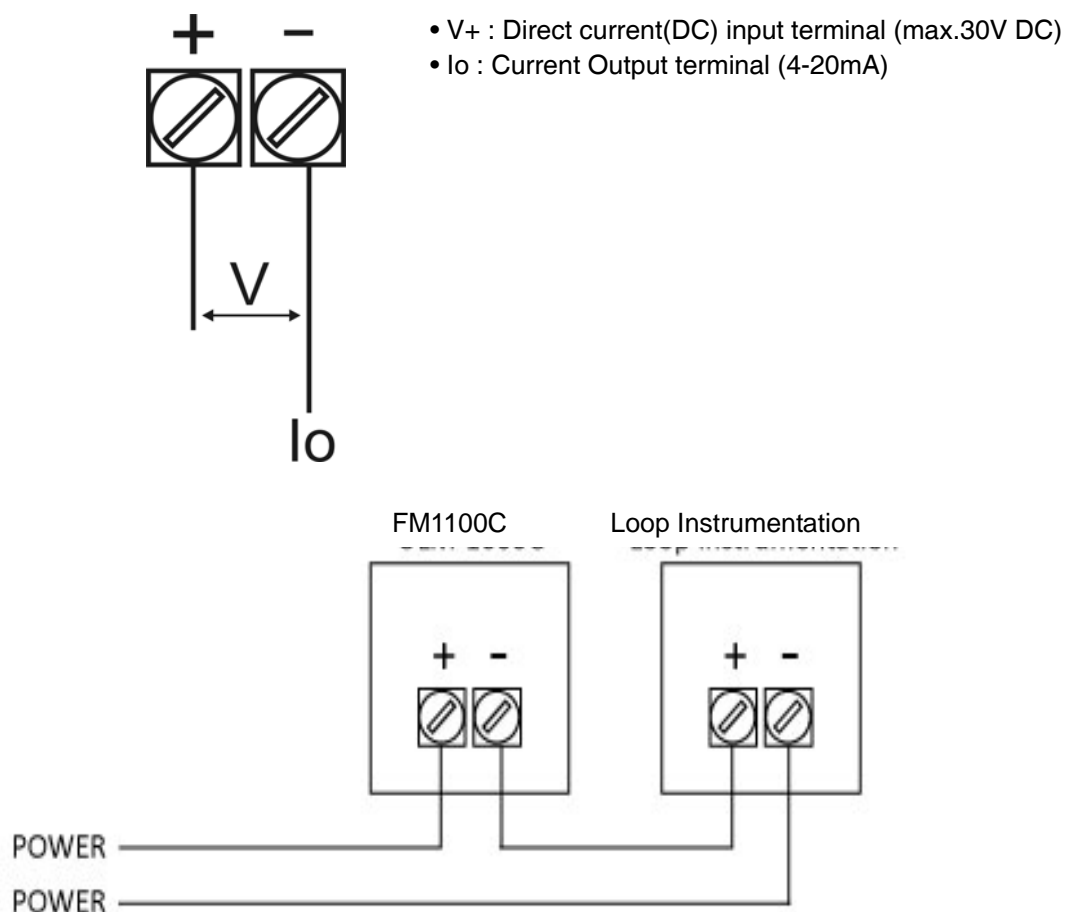
Incorrect Standpipe size

Cable Entry

Even though the FM1100C has a high NEMA rating, it can't be protect against moisture which comes in continuously for a long time. The FM1100C Series has a single PG13.5 cable entry, fitted with a suitable seal, to ensure moisture protection is maintained. After connecting the cable, route the cable down from the controller.

Terminal Connection Details

The FM1100C Series terminal connections are detailed below. Wiring details are also given on the terminals under the access cover.



Important Information

If the equipment is installed or used in a manner not specified in this manual, then the protection provided by the equipment may be impaired.

Preparation for Operation

Before switching on, check the following:

- The FM1100C is mounted correctly.
- The power supply is correctly installed.

Maintenance

There are no user-serviceable parts inside FM1100C, if you experience any problems with the unit, then please contact your local distributor for advice.

To clean the equipment, wipe with a damp cloth. Do not use any solvents on the enclosure.

Chapter 3. How To Use FM1100C Series

Display

While in the Run Mode, the 3-digit LCD display will show the current level reading in centimeters, it will also display a flashing “0” when a fault condition (Loss Of Echo) is detected. When in the Program Mode the display is used to read information on the Menu Options and the values entered.

There are two operating modes for your FM1100C, **Run Mode** and **Program Mode**.



Measuring Mode

This mode is used once the FM1100C has been set up in program mode. It is also the default mode that the unit reverts to when it resumes operation after a power failure.

When the FM1100C is switched on for the first time, it will display, in centimeters, the distance from the transducer face to the target.

After programming is complete, any switched outputs that are set will operate when the level reaches the relevant setpoints. While in Run Mode the Detect and Distance LED's provide information on the status of the signal.

Program Mode



This mode is used to set up the FM1100C or change information already set, this is achieved by using the 5 pushbuttons located either side of the display.

Entering a value for each of the menu options that are relevant to your application provides all the programming information.

The menu number is displayed with alphabet "P". Up and Down Key makes move to another menu.

How to use the buttons

To access the Program Mode simply press the "Mode" button. Confirmation that you have entered the Program Mode will be given by the Detect and Mode (Level, Distance or Space) LED's being extinguished, and the Software Version will also appear in the display. Each subsequent press of the Mode button will advance you through the options, 01 to 05. To access other group options, you have to press the Mode and Up/Down buttons.

- Access the Program Mode:



- Move to other group option:



- Move inside of each group option:



- Change option value:



- Return to Measuring Mode:



- Return to Program Mode:



Examples

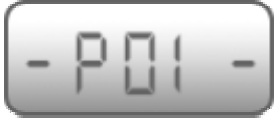
[Example] Changing the bottom distance value from 10 meters to 9 meters,



Press "MENU" button for 1 second in measuring mode.



2. Software version displays for 2 second.



3. After showing the S/W version, the menu number displays.



4. Use "UP" and "DOWN" button go to P04.



5. Press "menu" button, the first digit flickers. With "UP" and "DOWN" button, the number is changed.



6. After first digit setting, press "MENU" button to move the second digit.



7. After all setting, press "RUN" to save the value. it returns to measuring mode.



8. If press "ESC" button instead of "RUN" button, it returns to the menu which you selected right before. The setting value isn't saved.

LED Functions

There are 4 LED's, located above the display their functions are as follows:

LED	Condition	Function
Detect & Level	Flashing together	Indicates Normal Operation Mode selected = Level
Detect & Distance	Flashing together	Indicates Normal Operation Mode selected = Distance
Detect & Space	Flashing together	Indicates Normal Operation Mode selected = Space
Detect	Flashing alone	Indicates that FM1100C is detecting an echo but checking if the value is correct.
None	All Of Display indicates flashing "E*"	Indicates that FM1100C has gone into Fail condition. E0 means there is no reflected echo received. E1 means transducer and electronic part is disconnected

What to Do First

When you first power the FM1100C on, it will be reading the distance from the face of the transducer to the surface in meters or feet, as shown on the display.



TIP

In some applications it is simplest to empty the vessel, take a reading from the FM1100C for distance and then setup the empty level to this figure.

Once you are satisfied with the installation, and the FM1100C is reading what you would expect in terms of distance from the face of the transducer to the material level, then you can set up the options as detailed in Chapter 4 Program.

Chapter 4. Program

This chapter describes all of the menu options in the FM1100C, in numerical order. Press the menu button to change a menu option. Select from menu 1 to menu 18 by moving up or down with the arrow keys. The grey marked cell below is the factory set value.

Application Menu

[P01] Operating Mode

This option sets the mode of operation when in measuring mode, and can be set to one of the following:

Option	Description
1 = Level	Display shows how full the vessel is with respect to the Empty (0 % of Span)
2 = Distance	Display shows the distance from the transducer face to the surface.
3 = Space	Display shows how an empty vessel is with respect to Full (100 % of Span) i.e. how much space is available in the vessel.

[P02] Measuring Unit

This option is to choose the measuring unit between meter and feet.

Option	Description
1	Meter
2	FT

[P03] Display

This option sets the display unit of LCD display among 1. inch (cm), 2. mA, or 3. %

Option	Description
1	Distance by selected measuring unit
2	mA (Current value)
3	% (Percentage)

[P04] Empty Level

This option is to set the maximum distance from the face of the transducer to the bottom distance, in inches (cm). The tank has to be empty. User can set factory set value with up and down keys.

[P05] Blanking Distance

This option is the distance from the face of the transducer that is not capable of being measured, and is pre-set to 12 inches (30cm). It should not be set to less than this figure, but can be increased if required.

Current Output Menu

[P06] 4 mA Setpoint

The range of current is from 4mA to 20mA. This option sets the distance (or level or space, depending on the selected Operating Mode (Option 01) at which the 4mA output will occur. By default 4mA will represent Empty (0% of Span)

[P07] 20 mA Setpoint

The range of current is from 4mA to 20mA. This option sets the distance (or level or space), depending on the selected Operating Mode (Option 01) at which the 20mA output will occur. By default 20mA will represent Full (100% of Span). If you set the lowest point as 20mA, 4mA should be set for highest point.

Important Information

The Span is the maximum working distance from Empty (0%) to Full (100%), and is automatically calculated as Empty Level (Option 04) minus Blanking Distance (Option 05). Except for when Operating Mode (Option 01) = Distance in this case the Span is the same as the Empty Level (Option 04)

[P08] mA Fail-safe Value

If the FM1100C Series fails to receive a valid echo return from the target, then the mA output can be used to indicate a fault condition (Loss of Echo). This option determines the mA output value which will indicate such a condition.

Option	Description
1 = 3.8mA	Fault condition (LOE) indicated by 3.8mA
2 = Hold	The previous measured value outputs
3 = 22mA	Fault condition (LOE) indicated by 22mA

[P09] mA Fail-safe Time

In the event of a fail-safe condition occurring (LOE - Loss of Echo) the fail safe timer determines the time before the mA output indicates a fault condition (LOE). If a fault condition is present for the duration of the fail-safe time, it regards it as an error. The time range is between 20 and 900 seconds. The pre-set is 300 seconds.

Compensation Menu

[P10] Damping Rate

The measured value is not displayed in real time. The value is generated by averaging over a certain time period. This can be more effective for accurate value. But when the level is changing dramatically, it can cause some inaccuracy. For more accurate level, choose the suitable damping rate in accordance with the velocity of level. The pre-set is "1."

Option		Description
0.01	0.01m/min	Responds to changes to a max. 0.01m/min (Slow)
Step: 0.01		Minimum: 0.01 - Maximum: 100.0
100.0	100m/min	Responds to changes to a max. 100m/min (Fast)

[P11] Detection Threshold Voltage

This option determines detectable size of the return echo. This is useful when the first return echo is needed in a condition where small objects create various kinds of return echoes. In that case set the value higher, so the signal is stronger than the noise, but less likely to detect small echoes. The 8 is equal to 0.8V. The pre-set is "3."

No.	3	4	5	6	7	8	9	10	11	12	13	14	15
Voltage	□Low High□												

[P12] Output Power

This option is used to set the power output from the transducer to suit varying applications. By reducing the power emitted the beam angle will be effectively reduced and can be applied as detailed below:

Option	Description
1 = Low Power	For use on short range applications
2 = Normal Power	For use in normal conditions
3 = High Power	For use in outdoor applications, long range measurement
4 = Maximum Power	For use in difficult applications where conditions are dusty, steamy or turbulent.

[P13] Sound Velocity

This option allows for the velocity of sound to be changed according to the atmosphere the transducer is operating in. By default the velocity is set for sound traveling in air at a temperature of 32°F (0°C).

The table below gives details of the velocity of sound in various gaseous atmospheres. In all cases the velocity indicated is that in a 100% gaseous atmosphere at 32°F (0°C). In atmospheres less than 100% it may be necessary to check the level indicated at near empty and near full and compare with the actual level, several times, then adjust the Sound Velocity accordingly to obtain an accurately displayed reading.

Gas	Sound Velocity
Chlorine	206 m/sec
Carbon Dioxide.	259 m/sec
Argon	308 m/sec
Oxygen	316 m/sec
Air	331.5 m/sec
Ammonia	415 m/sec
Methane	430 m/sec
Helium	435 m/sec
Neon	965 m/sec

[P14] Vapor Temperature Compensation

The sound velocity in air increases or decreases at a uniform rate of 60cm/°C, however in atmospheres other than air it will change at a different rate.

This option allows the rate of change in cm/°C to be set according to the present atmosphere and temperature. The level indicated, should be compared with the actual level, several times, then Vapor Temperature Compensation adjusted accordingly, to obtain an accurately displayed reading. The pre-set is 60cm/°C.

[P15] Detection Algorithm

This option determines the detection algorithm. The returned signal can be strong or weak according to field conditions. This option chooses what signal is effective.

Option	Description
1	Automatic
2	Effective only for the First signal

[P16] Detection Target

The signals reflectance is subject to change by the measuring target.

Option	Description
1	Liquid
2	Bubble Liquid
3	Solid
4	Powder

Outputs Simulation Menu

When the FM1100C is operated with other instruments in a current loop, this menu can be used to simulate the output current from the FM1100C for testing purposes.

[P17] Simulation

Enter the range desired. FM1100C sends out the output current for the range. For example, if you put 7 meters (0.700), the output current is sent out in response to 7 meters. If the range value is over than the lowest level or highest level, the error signal is sent out.

Password Menu

[P18] Password

This option prevents malicious and unskilled user from changing option values. Once this option is set, the password is required whenever entering into program mode. **The initial password is "0"**



1. If the password is not "0", the "pass" shows on the display.
2. After 1 second, it moves to setting mode automatically. The first digit flickers. Use "UP" and "DOWN" button to set the password. Use "MENU" button to move the digit position.
3. After setting password, press "RUN" button, the password is saved and return to the program mode.
4. When the password is incorrect, the error message shows on the display. After 1 second it returns to setting password mode.

**** When you forget the password, please ask the manufacturer.**

Chapter 5. Troubleshooting

This section describes some problem symptoms, with suggestions as to what to do.

Symptom	Cause	What to Do
The level changes heavily periodically	Motor or mixer is installed.	1. Set the velocity lower than current setting value. OR 2. The level should be moved to another position where it is not affected by the machinery.
The level changes irregularly	Barrier within the ultrasonic range.	1. Set the velocity lower than current setting value. OR 2. Set the Detection Threshold Voltage lower than current voltage. OR 3. Check the sensor bottom surface to see if there is any foreign debris.
The level shows only within blanking distance	Error caused by the protrusions in the nozzle of the reservoir.	1. Check the nozzle inside surface. OR 2. Check the nozzle diameter which is recommended in the manual. OR 3. Increase the blanking distance not over the highest level point.
The level is incorrect in the sealed space.	The pressure is increased by gas generation.	1. Set the sound velocity according to the medium. OR 2. Install ventilation.

Menu Option Record Sheet

FM1100C Series Application Menu

Menu List		Values Note					
Menu No.	Description	Factory Set	1	2	3	4	5
P01	Operating Mode	1 = Level					
P02	System Unit	1 = cm					
P03	Display	1 = cm(inch)					
P04	Empty Level	Empty Dist.					
P05	Blanking Distance	30cm					

Current Output Menu

P06	4mA Setpoint	0					
P07	20mA Setpoint	600 / 1000					
P08	mA Fail Safe Value	3 = 22mA					
P09	Fail Safe Time	300 sec					

Compensation Menu

P10	Damping Rate	1m/min					
P11	DetectionThreshold Temperature	7 = 0.7V					
P12	Output Power	2					
P13	Sound Velocity	332					
P14	Vapor Temp. Comp.	60					
P15	Detection Algorithm	1					
P16	Detection Target	1					

Outputs Simulation Menu

P17	Outputs Simulation	-					
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Password Menu

P18	Password	0					
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