



# QUICK START GUIDE

## BFU-100-F

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**BELL**  
Flow Systems

## 1) POWERING UP

### 1. TURNING ON

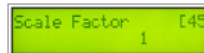
Ensure the flow meter is connected to a 15-24VDC or 85-260 VAC power supply. The meter will then go through a self-checking process and a screen similar to that pictured to the right will appear. If it does not, take a note of the error message and contact your supplier.



## 2) PROGRAMMING

### 1. ENTER TRANSDUCER SCALE FACTOR

1.1) Press keys 'M45' (press **ESC**, **4** and **5**) then **ENTER**.  
Key in the new scale factor of the transducer pair and press **ENTER**.  
Scale Factors: Standard M: 1.1 / Standard S: 1



### 2. ENTER PIPE INFORMATION

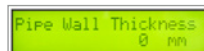
#### 2.1) Pipe Outer Diameter

Press keys 'M11' and then **ENTER**.  
The screen should be similar to the one pictured on the right.  
Now enter the pipe outer diameter and press **ENTER** to confirm.



#### 2.2) Wall-thickness

Press the **DOWN** key to scroll down to the next menu or press 'M12' then press **ENTER**, input the pipe wall-thickness value. Press **ENTER** to confirm.



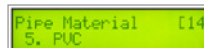
#### 2.3) Pipe Inner Diameter

Press **DOWN** to scroll down to M13 or press 'M13' **ENTER**.  
The correct ID value should be displayed on the screen.  
There is no need to change anything.



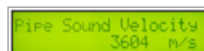
#### 2.4) Pipe Material

Press **DOWN** to scroll down to M14 or press 'M14' **ENTER** then navigate the menu using **DOWN** until you find the item that matches your pipe material, then press **ENTER**. Proceed to step 2.5 if your pipe material is not shown as an available option.



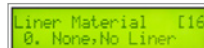
#### 2.5) Sound Speed in Pipe Wall

Press **DOWN** to scroll down to M15 or press 'M15' **ENTER**.  
If you found your pipe material on the list in the previous step the flow meter should already know the sound speed (you can skip this step).  
Otherwise press **ENTER** and enter the sound speed of your pipe material, press **ENTER** again to confirm (this information can be found in the user manual).



#### 2.6) Pipe Lining

If your pipe has a liner inside enter the lining information on menu windows M16, M17 and M18.



### 3. ENTER FLUID INFORMATION

#### 3.1) Fluid Type

Press **DOWN** to scroll down to M20 or press 'M20' **ENTER**, then navigate the menu using **DOWN** until you find the item that matches your fluid type then press **ENTER**.  
If you do not find a match (non-standard fluid) select "other".  
Press **ENTER** to confirm and follow the steps in 3.2.



#### 3.2) Sound Speed in Fluid

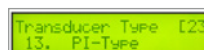
If you found your fluid type in the previous step, the flow meter already has the sound speed info therefore skip this step. Otherwise press **DOWN** to scroll down to M21 or press 'M21' **ENTER**. Key in the sound speed of your fluid and press **ENTER** to confirm (this information can be found in the user manual).



### 4. ENTER TRANSDUCER INFORMATION

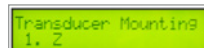
#### 4.1) Transducer Type

Press **DOWN** to scroll down to M23 or press 'M23' **ENTER**.  
Here you can select your chosen transducer type.  
We offer three varieties: *Standard-S* (for pipes 25-100mm), *Standard-M* (for pipes 50-700mm) and *Standard-L* (for pipes 300-6000mm).  
Please identify and then press **ENTER** to select.



#### 4.2) Transducer Mounting Method

Press **DOWN** to scroll down to M24 or press 'M24' **ENTER**.  
Then use the **DOWN** key to select your mounting method and press **ENTER**.  
(See section 5 opposite for mounting methods).



#### 4.3) Transducer Spacing

Press **DOWN** to scroll down to M25 or press 'M25' **ENTER**.  
The displayed value is the mounting spacing between the two transducers.  
Write down this number as you will need it later when installing the transducers.



### 3) SELECTING DISPLAY UNITS

#### Measurement Units:

To select a measurement unit for the BFU-100-F use the  $\nabla$  key to scroll down to M30 or press 'M30'. Here you will be presented with the options of English and Metric, navigate using the  $\nabla$  to chose your required unit of measurement and press  $\rightarrow$  to confirm. As standard the device is supplied with 'metric' as the unit of measurement.

#### Flow Rate Unit:

To choose a flow rate measurement unit use the  $\nabla$  key to scroll down to M31 or press 'M31'. Navigate using the  $\nabla$  key and press  $\rightarrow$  to select your flow rate unit.

#### Totaliser Units:

To select a totaliser measurement unit use the  $\nabla$  key to scroll down to M32 or press 'M32'. Navigate using the  $\nabla$  key until on the correct totaliser unit and press  $\rightarrow$  to select it.

#### Totaliser multiplying unit:

To select the required totaliser multiplying unit use the  $\nabla$  key to scroll down to M33 or press 'M33'. Navigate using the  $\nabla$  key until on the correct totaliser multiplying unit and press  $\rightarrow$  to select it.

\*Please note this change will also vary the flow meters pulse output value.

### 4) STORING INFORMATION

The BFU-100-F allows users to save site details and load previously saved site files.

#### Storing application information:

To store site information use the  $\nabla$  key to scroll down to M26 or press 'M26'. You will then be asked to enter a name for your application using the keypad. Ensure the name is correct then press  $\rightarrow$  to save the site information.

#### Loading Application information:

To load site information use the  $\nabla$  key to scroll down to M27 or press 'M27'. You will then need to select the correct site from the list using the  $\nabla$  key then press  $\rightarrow$  to load the application information.

### 5) INSTALLATION PREPARATION

#### Mounting Location:

When installing the ultrasonic transducers on to a pipe you should allow for a minimum of 10 diameters upstream of straight pipe and 5 diameters downstream of straight pipe to ensure accurate flow readings.

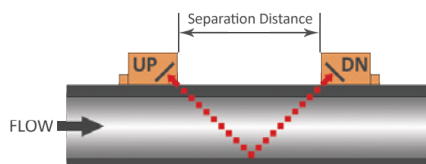
#### Preparing your Pipe:

The pipe on which you will be installing the sensors needs to be free from debris- this includes removing any paint or corrosion on the pipe surface.

#### Sensor Positioning:

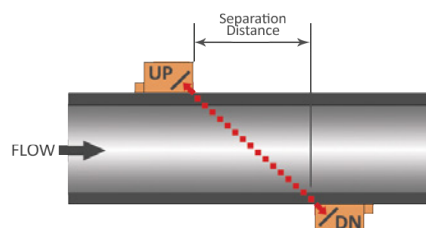
##### V-Method (standard spacing)

V-Method installation is the most widely used method for daily measurement with pipe inner diameters ranging from 1" to 12" (20mm to 300mm). It is also called reflective method.



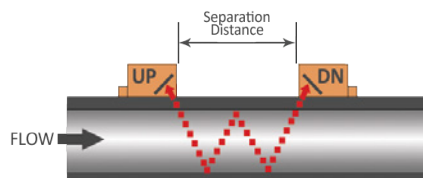
##### Z-Method

Z-Method is commonly used when the pipe diameter is between 4" to 20" (100mm to 500mm). This method is the most direct for signal transfer and can therefore provide better results than V-Method on many applications.



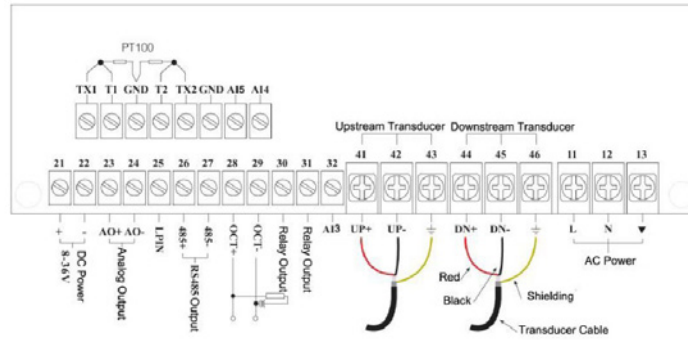
##### W-Method

W-Method is usually used on plastic pipes with a diameter from 1" and 4" (25mm to 100mm). This method can be effective on smaller pipes that have internal deposits.

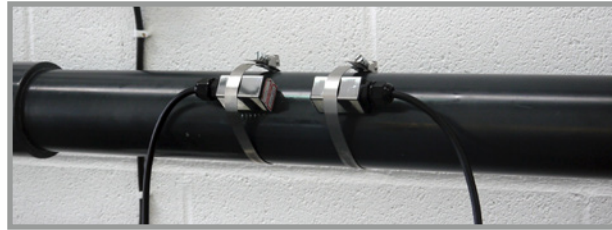
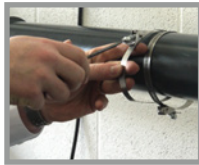


## 6) INSTALLATION OF TRANSDUCERS

### 1. WIRING DIAGRAM



### 2. INSTALLING STANDARD-S TRANSDUCER



- 2.1) Connect the transducer cables to the main unit (see wiring diagram above).
- 2.2) Move the transducer pair apart so that the mounting spacing between the two transducers is equal to the one shown in menu 'M25'.
- 2.3) Apply a single bead of couplant approximately 1/2" ( 12mm) thick on to the flat, translucent face of the transducers.
- 2.4) Place one transducer on the pipe and secure using a banding strap.
- 2.5) Mark the mounting position for the second transducer on the pipe and place it on this mark and secure it with a banding strap.

### 3. INSTALLING STANDARD-M TRANSDUCER



- 3.1) Connect the transducer cables to the main unit (see wiring diagram above).
- 3.2) Move the transducer pair apart so that the mounting spacing between the two transducers match the displayed value shown in menu M25.
- 3.3) Apply a single bead of couplant approximately 1/2" ( 12mm) thick on to the flat, translucent face of the transducers.
- 3.4) Place one transducer on the pipe and secure using a banding strap.
- 3.5) Mark the mounting position for the second transducer on the pipe and place it on this mark and secure it with a banding strap.

### 4. INSTALLING STANDARD-L TRANSDUCER

- 4.1) Mark the transducer installation location on the pipe surface according to the mounting spacing given in menu 'M25'. You may need to make a paper template to help you accurately locate the transducer position, especially if you plan to use Z-Method for the installation.
- 4.2) Connect the mounting fixture around the pipe. Leave the chain loose so you can slip the transducer underneath.
- 4.3) Apply a single bead of couplant approximately 1/2" ( 12mm) thick on to the flat, translucent face of the transducers.
- 4.4) Slip the transducer under the clamp fixture and tighten the screw. Do the same thing for the other transducer.
- 4.5) If the pipe material is metal you do not need the clamp fixtures as the transducers will automatically attach to the pipe by magnetic force.
- 4.6) Finally, connect the transducer cables to the main unit (see wiring diagram above).



## 7) INSTALLATION OF TEMPERATURE SENSORS

Each BFU-100-RF is supplied with a choice of either insertion or clamp on temperature sensors to provide temperature measurement. To install the sensors follow the steps below.

\*Please note- heating application T1 temperature sensor must be installed on the flow pipe and T2 sensor on the return.  
Chilled applications will require T1 to be installed on the return pipe and T2 on the flow pipe.

### 1. INSERTION SENSORS

- 1.1) Two 1/2" BSP threaded tapping points will be required on the pipe, one on the flow pipe and the other on the return line.
- 1.2) Install one of the thermowells into the flow pipe temperature tapping and another into return pipe temperature tapping.
- 1.3) Apply heat sink compound to temperature sensor tip to create an air tight seal.
- 1.4) Undo the screw on the thermowell, insert the temperature sensor into the pocket and re-tighten the screw to secure.
- 1.5) Run the temperature sensor cables to the BFU transmitter and connect the sensors as shown in the wiring diagram (see section 6).



### 2. BAND CLAMP ON SENSORS

- 2.1) Loosen the band clamp until the screw and the thread are apart.
- 2.2) Wrap the band clamp around the pipe and reinsert the thread into the screw and tighten, the band can be shortened if required. Ensure the sensor is positioned on the side of the pipe.
- 2.4) Apply heat sink compound to temperature sensor tip to create an air tight seal.
- 2.5) Run the temperature sensor cables to the BFU transmitter and connect as shown in the wiring diagram (see section 6).



## 8) PROGRAMMING FOR ENERGY MEASUREMENT

### 1. HEAT METER SETUP

#### 1.1) Enter Energy Unit

Press  $\nabla$  to scroll down to M84 or press 'M84'  $\square$ , navigate through the options until you find the required thermal energy measurement unit. Press  $\square$  to confirm your selection.

Energy Unit Select  
2. kWh

#### 1.2) Select Temperature Source

Press  $\nabla$  to scroll down to M85 or press 'M85'  $\square$ . Choose option "temperature from T1 / T2" and press  $\square$  to confirm.

Temperature Select  
0. From T1,T2

#### 1.3) Select Specific Heat Value

Press  $\nabla$  to scroll down to M86 or press 'M86'  $\square$ . Choose option "GB", press  $\square$  to confirm.

Specific Heat Select  
0. GB

#### 1.4) Energy Totaliser ON / OFF

Press  $\nabla$  to scroll down to M87 or press 'M87'  $\square$ . Choose option "ON", press  $\square$  to confirm.

Energy Totliser ON-OFF  
ON

#### 1.5) Energy Multiplier

Press  $\nabla$  to scroll down to M88 or press 'M88'  $\square$ . Choose the required energy multiplier, press  $\square$  to confirm.

Energy Multiplier [88  
4. x1 (E0)

#### 1.6) Temperature difference

Press  $\nabla$  to scroll down to M89 or press 'M89'  $\square$ . Here you can view the temperature difference between your temperature sensors. In correct operation a positive value should appear.

Temperature Diff. [89  
-0.0001 C

#### 1.7) Heat Meter location

Press the  $\nabla$  key to scroll down to the next menu. Select "Inlet" if your ultrasonic flow sensors are to be installed on the return pipe (cold) or "Outlet" if you are installing on the flow pipe (hot).

Heat Meter Is On [8.  
1. Inlet

### 2. CONFIGURING A OCT/PULSE ENERGY OUTPUT

2.1) Press  $\nabla$  to scroll down to M78 or press 'M78'  $\square$ . If looking to configure a pulse output for positive energy select "Energy POS Pulse".

OCT Pulse Width [54  
199.981 mS

\*Please Note- the output frequency will be dependent on the value set in the "Energy Multiplier" M88. As standard this is set to X1, thus the flow meter will provide a Pulse output per 1 unit of thermal unit. As an example: every 1 KW if your thermal unit is set to KW.

### 3. CONFIGURING A CURRENT LOOP OUTPUT

#### 3.1) Current Loop (CL) Mode

Press  $\nabla$  to scroll down to M55 or press 'M55'  $\square$ . Here you can select the required CL output for your flow meter. For energy we recommend "4-20mA vs. Energy", this will then provide a 4-20mA output proportional to instantaneous energy consumption.

CL Mode Select [55  
4. 20-4-20 mA

#### 3.2) Configuring the 4mA Output Value

Press  $\nabla$  to scroll down to M56 or press 'M56'  $\square$ . Here you can set your 4mA energy value. As standard we would recommend setting this value to "0".

CL 4mA Output Value  
0 m3/h

#### 3.3) Configuring the 20mA Output Value


Press  $\nabla$  to scroll down to M57 or press 'M57'  $\square$ . Here you can set your 20mA energy value, this value will need to be set to cover the maximum energy consumption expected from your application. In most cases we would advise allowing a percentage above this maximum consumption in case energy consumption exceeds those expected.

CL 20mA Output Value  
10000 m3/h



## 4. VIEWING ENERGY CONSUMPTION


### 4.1) Energy Consumption Display

Press  $\nabla$  to scroll down to M05 or press 'M05' .

Here you can view instantaneous energy consumption and totalised energy consumption.



### 4.2) Temperature reading Display



Press  $\nabla$  to scroll down to M06 or press 'M06' .

Here you can view instantaneous temperature values from T1 (flow) and T2 (return). Please note that if it is installed on a chilled water application the temperature must be reversed- T1 (return) and T2 (flow).



## 9) DIAGNOSTICS

### 1. SIGNAL STRENGTH / QUALITY

On the main unit press , (9) and (0) then  to load the 'Strength and Quality' window. There are three important numbers displayed on this window:

**UP / DN:** Signal Strength

**Q:** Signal Quality

For the most accurate readings their values should fall within these ranges:

**UP / DN:** 60 - 99

**Q:** 60 - 99



### 2. TRANSIT-TIME RATIO

On the main unit press , (9) and (1) then .

Here you will see a transit time ratio (**TOM/TOS**) value displayed. The value should fall within the range 97% - 103%.



If your values are not within these ideal ranges you will need to check the parameters you have entered. If you believe your entries are correct and the numbers are still not in range you may need to check your installation.

*Here are some tips:*

- Moving transducers closer to or away from each other will increase or decrease the transit-time ratio (**TOM/TOS**).
- Make sure the transducer mounting area on the pipe is coating-free and smooth.
- Do not use excessive couplant on either the transducer face or the pipe surface.
- The sound speed information in menu 'M92' might also be useful for debugging. The displayed value should be close to the one you have entered in programming 2) 3.2. If you have entered the fluid type in step 2) 3.1 instead and you do not know the fluid sound speed you can find this information in the appendix of the user manual.

If all the three of your parameters are within range your installation is complete and you are ready to see your measurement results on menu window 'M00'.

*\* Please note that the menu images shown are for illustration only.*

## 10) ERROR CODES

Error Codes can be found as an asterisk and single letter in the lower right corner on the menu windows of M00, M01, M02, M03 and M08.

CODE	MESSAGE	CAUSES	SOLUTIONS
*R	System Normal	No error	
*I	No Signal	(1) Unable to receive signals	(1) Adjust measuring location
		(2) Transducers installed incorrectly	(2) Clean and polish pipe surface
		(3) Loose contact or not enough couplant between transducer and pipe outer surface.	(3) Make sure there is enough couplant
		(4) Pipe liners are too thick or the deposition inside of the pipe is too thick.	(4) Check the transducer cables
		(5) Transducer cables are not properly connected	
*J	Hardware Error	Hardware problem	Contact the manufacturer
*H	PoorSig Detected	(1) Poor signal detected	(1) Adjust measuring location
		(2) Transducers installed incorrectly	(2) Clean and polish pipe surface
		(3) Too much fouling (corrosion, deposition, etc.)	(3) Make sure there is enough couplant
		(4) The pipe liner is too thick	(4) Check the transducer cables
		(5) Problem with transducer cables	
*Q	Frequ OutputOver	The actual frequency for the Frequency Output is out of the range specified by the user	Check the values entered in window M66, M67, M68 and M69 and use a larger value in M69
*F	System RAM Error	(1) Temporary problems with RAM, RTC	(1) Turn on the power again
	Date Time Error	(2) Permanent problems with hardware	(2) Contact the manufacturer
	CPU or IRQ Error		
	ROM Parity Error		
*1 *2 *3	Adjusting Gain	Instrument is in the progress of adjusting the gain for the signal and the number indicates the progressive steps	No need for action
*K	Empty Pipe	No liquid inside the pipe, incorrect setup in M29	Relocate the meter to where the pipe is full of liquid enter 0 in M29





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