FLOMOTION BE6300

Clamp-On Transit-Time Flow Meter

INSTRUCTION MANUAL

BE6300 Version 18

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I. Introduction

1. Preface

Welcome to BE6300 series ultrasonic flow meter. Please read this instruction manual thoroughly before installation and operation.

BE6300 ultrasonic flow meter is a time-difference type ultrasonic flow meter, whose transducers are mounted by being clamped to the external surface of a pipe. It measures clean, well-distributed flows of liquids in which the content of suspended particles is minimal.

The system is configured as below;

1. Sensor Set: A pair of ultrasonic transducers mounted on the external surface on a pipe.

2. Processor: The processor and the transducers are connected by two double shield high frequency cables. The processor can be monitored and controlled remotely through a PC connected via Internet. The following illustrates the configuration of the processor unit and the transducer sets;

BE6300 Processor   Transfer   Controller

"Up" Upstream Sensor   "Dn" Downstream Sensor

Flow Direction

Cables

Pipe
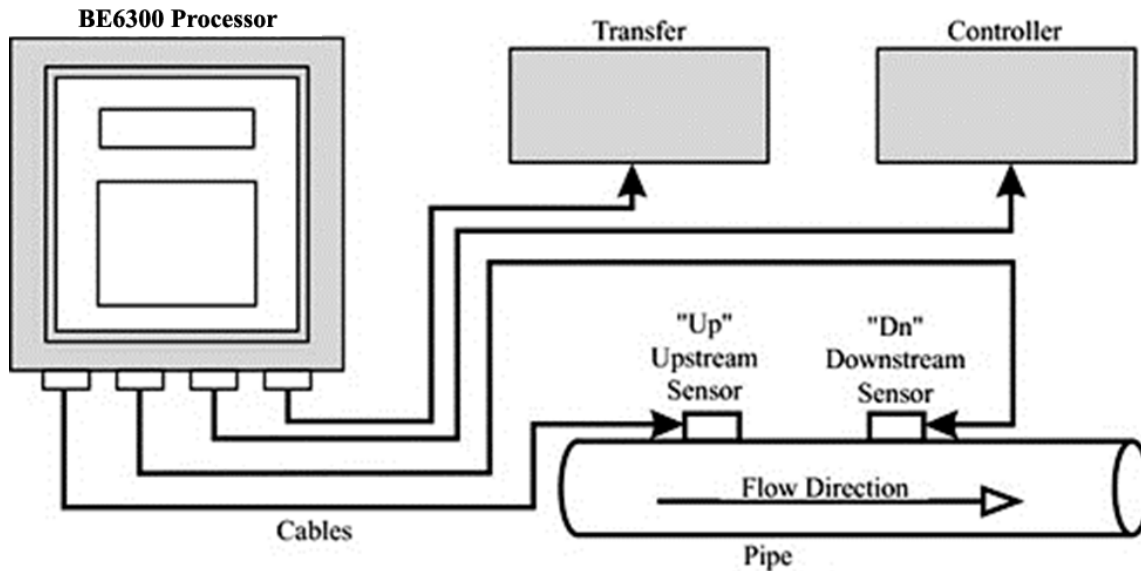
2. Characteristics

BE6300 ultrasonic flow meter is based on single-board technology featuring high accuracy, reliability and repeatability.

Additional advantages:

Transducers are not intrusive. Therefore there's no pressure drop. They are mounted on the outside wall of the pipe.

Advanced intelligent instrumentation, processing and printing (logging) according to user requirements. Almost all common flow units are used. It uses normal power, built-in battery or DC power, etc.

It uses the most advanced direct time measurement method with the resolution of 0.2 ns. Coupled with the advanced data processing functions, it provides high level of linearity.

Various output options available including analog current output, frequency output, relay output, etc.

3. Operation Principle

This time-of-travel (transit-time) meter has a pair of transducers mounted on each side of the pipe. The configuration is such that the sound waves traveling between the devices are at a 45-degree angle to the direction of liquid flow. The speed of the sound signal traveling between the transducers increases or decreases depending upon the direction of transmission and the velocity of the liquid being measured. A time-differential relationship proportional to the flow can be obtained by transmitting the signal alternately in both directions.
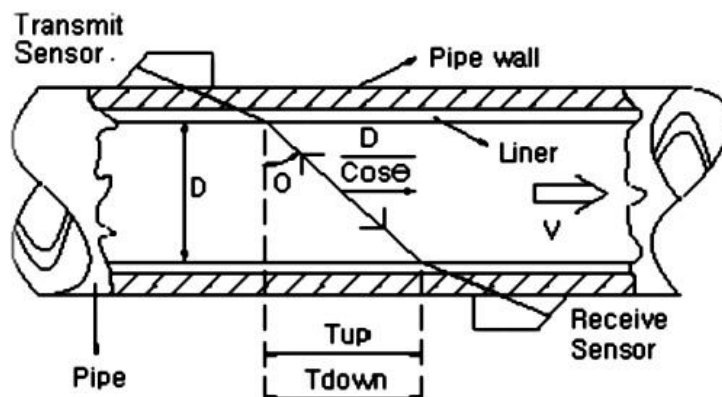
$$T_{UP} = \frac{M \times D / \cos\theta}{C_0 + V\sin\theta} \quad\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\quad (1)$$

$$T_{DOWN} = \frac{M \times D / \cos\theta}{C_0 - V\sin\theta} \quad\cdots\cdots\cdots\cdots\cdots\cdots\quad (2)$$

$$\Delta T = T_{DOWN} - T_{UP} \quad\cdots\cdots\cdots\cdots\cdots\cdots\cdots\quad (3)$$

As per equation (1) and (2) above, the velocity of flow is calculated as below;

$$V = \frac{M \times D}{\sin 2\theta} \times \frac{\Delta T}{T_{UP} \times T_{DOWN}} \quad\cdots\cdots\cdots\cdots\quad (4)$$

The ultrasonic transit-time method is suitable for measuring single-phase, pure liquids without entrained air bubbles. In industrial sites, the liquids may contain a certain level of impurities and flow conditions are often not very uniform, thereby negatively affecting the performance of the ultrasonic flow meters. But our BE6300 ultrasonic flow meter adopts the most advanced direct time measuring method that considers the influence of temperature and crude inside pipe situation in order to increase the accuracy and the reliability of the result. With the use of the zero setting function, the meter renders 0.5% accuracy.

4. Typical Applications

- Water supply, drainage, water purification facility
- Oil field and petrochemical plants
- Power plants(thermal and hydro power plants)
- Steel factory and mining industries
- Food and beverage plants
- Paper mills
- HVAC, Etc.

5. Packing List

Items included are as follows;

- 1 processor
- 1 set of transducers(2 each)
- 1 transducer mounting bands
- 1 couplant
- 1 instruction manual
- 1 USB 2G memory (optional)

6. Technical Specifications

CLASSIFICATION		PERFORMANCE/PARAMETER
Pipe	Materials	Steel, Stainless Steel, Cast Iron. Plastics, Concrete, etc.
	Inner Diameter	0.5 to 236 in. (15 ~ 6000mm)
	Straight Pipe Section Requirement	10D upstream, 5D downstream (required length may be longer depending on site conditions)
Fluid	Types	Clean, sonically conductive
	Turbidity	Smaller than 10,000ppm (mg/l) with a low level of air bubble content
	Temperature	-4° F to 140° F (-20° C to 60° C)
Flow Velocity		-53 to +53 ft/s (-16 to +16 m/s)
Transducer	Pipe Size Range	S: 0.5 to 4 in. (15 ~100mm)
		M: 2 to 40 in. (50 ~ 1000mm)
		L: 12 to 236 in. (300 ~ 6000mm)
	Mounting Method	'V' method: Suitable for pipe sizes 16 in. (400mm) or smaller
		'Z' method: Suitable for pipe size 10 in. (250mm) or larger
Cable Length		16 ft (5m) Std. (longer lengths available)
Flow Computer	Display	Alphanumeric
	Keyboard	4x4 keypad
	Mounting	Wall Mount or optional Panel Mount
	Output	4-20mA or 0-20mA analog output (max load 500 ohms), frequency output (12-9999Hz), relay, serial output
	Power	Wall Mount: 120VAC or 24VAC,50mADC
	Dimension	Wall Mount: 9.9 x 3.6 x 3.2 in. (251 x 92 x 80mm)
	Weight	7 lbs. (3kg) Wall Mount
Operating Condition	Temperature	Flow Computer: -4 to 158°F (-20 to 70°C) Transducers: -4 to 140°F (-20 to 60°C)
	Humidity	Flow Computer: 85% RH at 104°F (40°C) Transducers: 98% RH at 104°F(40°C) (water submersible up to 3 m)
Performance	Accuracy	±1.0% of reading above ±1 ft/s
	Repeatability	±0.2% at 1 to 53 ft/s (0.3 ~16m/s)
	Linearity	0.5%

BE6300 Version Updated to Version 18

Differences Listed:

| PREVIOUS VERSION 7	VERSION 18
Output : RS232 and 4-20mA	Output: RS 485 and 4-20mA
No SD card	Optional SD card for the data logger
Add temperature transmitter test heat	Add PT100 can test the heat
No MUDBUS or M-BUS protocol	with MODBUS, M-BUS protocol

7. Power Connection

The meter can use standard 120VAC or 24VDC power supply. By default, the meter is provided with the standard 120VAC power type. Therefore, should the user want 24VDC model, such should be indicated when ordering.

8. Cables

Cables should never be spliced or cut. This may cause damage to the unit and void the warranty.

9. Wire Connections
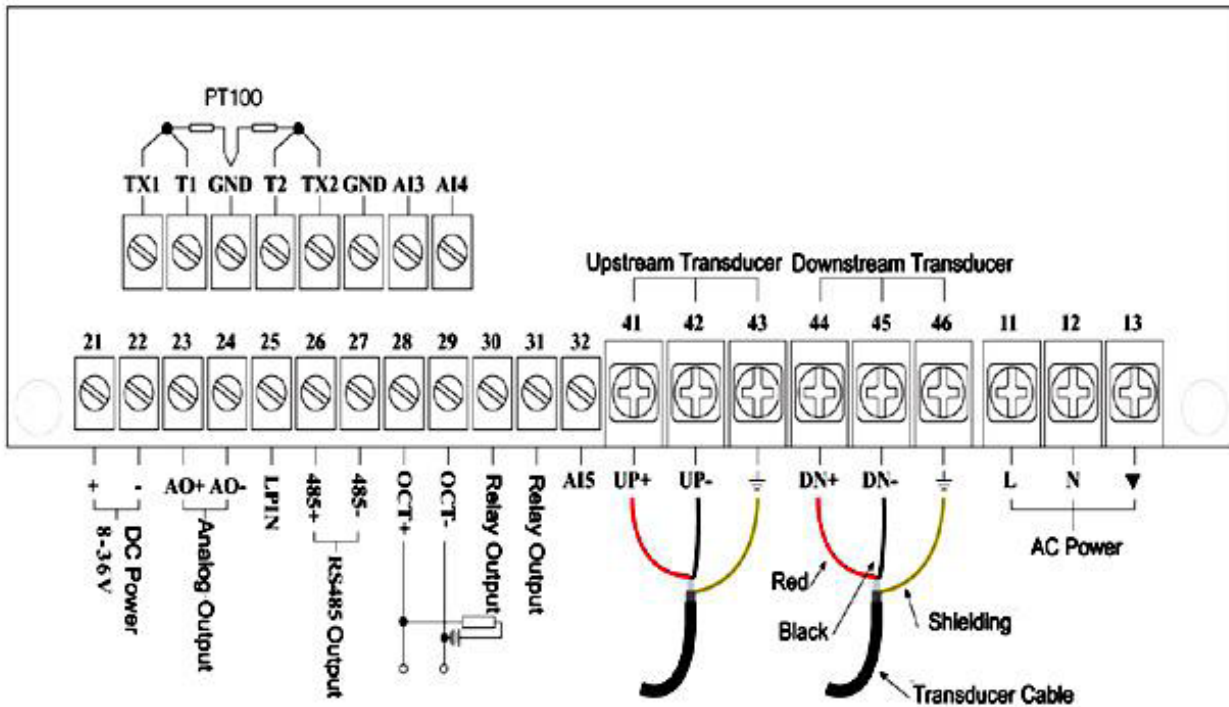
II. Installation and Operation

The clamp-on type ultrasonic flow meter allows for the simplest and the easiest installation of all types of flowmeters, though careful attention in selecting the measurement point, inputting pipe parameters, fixing the transducers onto pipe, etc. in order to ensure accurate and reliable measurement of flow is needed. In this chapter, you'll be introduced to how to select the measurement point, input parameters, select mounting method, etc.

1. Selecting the Measurement Point

Selecting the right measurement point is the most important factor for ensuring the accuracy and should be done according to the following steps;

· Make sure the pipe to be measured is full.
· Select a location where it allows for straight pipe run of 10D upstream and 5D downstream. In case there's a pump or a bending section in the upstream, increase the upstream run to 30D in order to allow the flow to fully develop into stable flow profile.
· Ensure the temperature at the measuring point is within the specified range.
· Avoid sections where the inner wall of the pipe is scaled or rusted that can negatively affect the performance of the meter.

2. Setting the Parameters

In order to get the correct transducer mounting distance (the distance between the front edges of both transducers) verify and set the following parameters;

1) Pipe outer diameter
2) Pipe inner diameter
3) Pipe material
4) Liner
5) Fluid type
6) Transducer type
7) Transducer mounting method type

When the above parameters are properly set, the correct transducer mounting distance is calculated and displayed in the M25 window. Then the machine searches for proper amplifier gain. After S1, S2, S3 and S4 steps, the machine enters into the normal operation state.

3. Rapid Setup Procedure

(1) Preprograming

Each BE6300 is preprogramed with the following values to help reduce setup time.

MENU	SELECTED VALUE
77 BEEPER SETUP	25. Disable Beeper
30 MEASURE UNITS IN	1. ENGLISH
31 FLOW RATE UNITS	US Gallon/min (g/m)
32 TOTALIZER UNITS	US Gallon
34 NET TOTALIZER	OFF
35 POS TOTALIZER	ON
36 NEG TOTALIZER	ON
40 DAMPENING	10 SEC
41 LOW CUTOFF VALUE	0.2 FT/S
57 CL 20MA OUTPUT VALUE	1000
60 TIME, DATE (int. time std.)	YY-MM-DD HH:MM:SS
23 TRANSDUCER TYPE	Based upon order S1, M1 or L1

(2) BE6300 Keypad & isplay
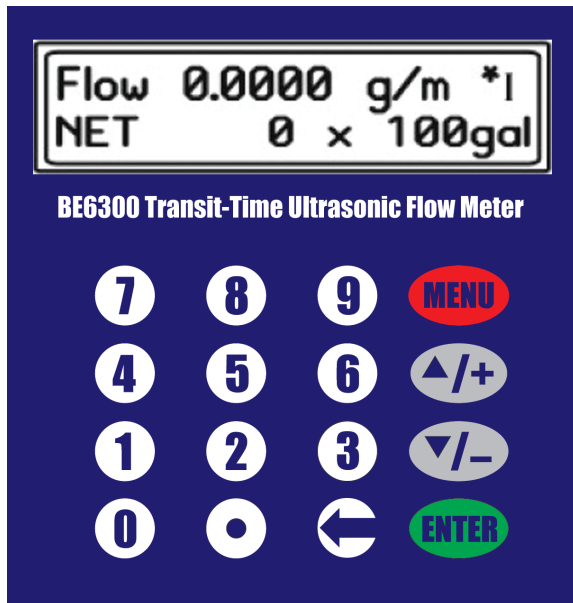
The user can enter into specific windows using the MENU key followed by a 2-digit code. So, for example, in order to go to M13 window, this is the window for inputting the inner diameter of the pipe, press MENU 1 3

(3) Rapid Programing Setup

1. Press MENU 1 1 to enter M11 window, input pipe outer diameter, press **ENT**.
2. Press ▼/- to enter M12 window, input wall thickness and press **ENT**.
3. Press ▼/- to enter M14 window and press **ENT** ▼/- or ▲/+ to scroll to select pipe material, and press ENT.
4. Press ▼/- to enter M16 window and **ENT** ▼/- or ▲/+ to scroll to select liner material, and press **ENT**.
5. Press ▼/- to enter M20 window and **ENT** ▼/- or ▲/+ to scroll to select fluid type, and press ENT.
6. Press ▼/- to enter M23 window and **ENT** ▼/- or ▲/+ to scroll select the transducer type, and press **ENT**.
7. Press ▼/- to enter M24 window and **ENT** ▼/- or ▲/+ to scroll select the transducer mounting method, and press **ENT**.
8. Press ▼/- to enter M25 window, which will display the correct transducer spacing (the distance between the front edges of the transducers).
9. Press MENU 0 1, the flow rate and the velocity of the flow will be displayed upon completion of the gain adjusting process.

(4) Transducer Spacing

The distance is measured between the front edges of both transducers. After all the parameters have been set, the distance is shown in window no. M25.

(5) Transducer Mounting Methods

Clamp-on Sensors
There are two mounting methods, 'V' and 'Z'.

Usually the V method is used as standard because it provides longer signal path and therefore more accurate measurement of flow velocity. It is recommended for pipes sizes between 0.5~16" (15-400mm). Special attention should be given when mounting transducers to ensure that sensors are aligned in direct line and along the center of the pipe and the transducer mounting line should be aligned.
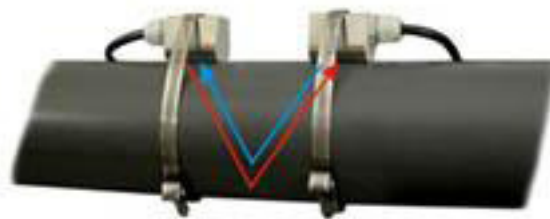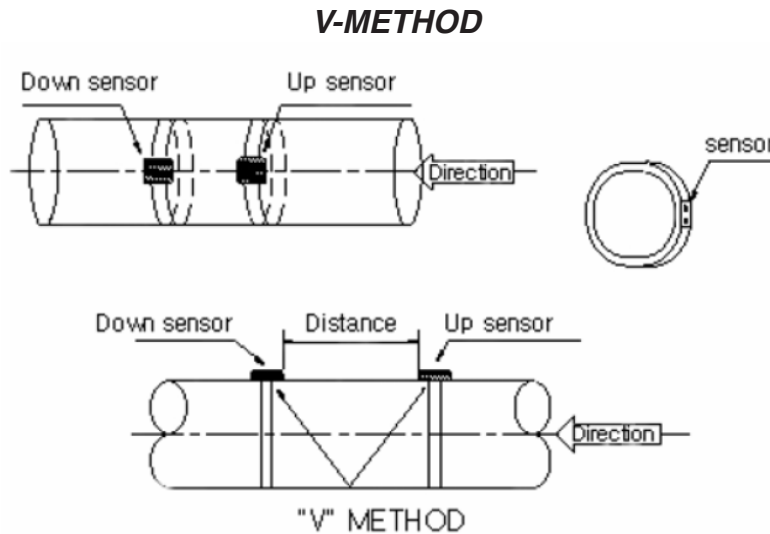
V-METHOD

The Z method is recommended for >10" (250mm) pipes or when the flow condition is bad because of scale built up inside the pipe, entrained air bubbles, too thick liner, etc. which can induce a lot of noise into signal. Using this method, the signal is dispersed in a straight path reducing the possibility of noise induction.

Z METHOD
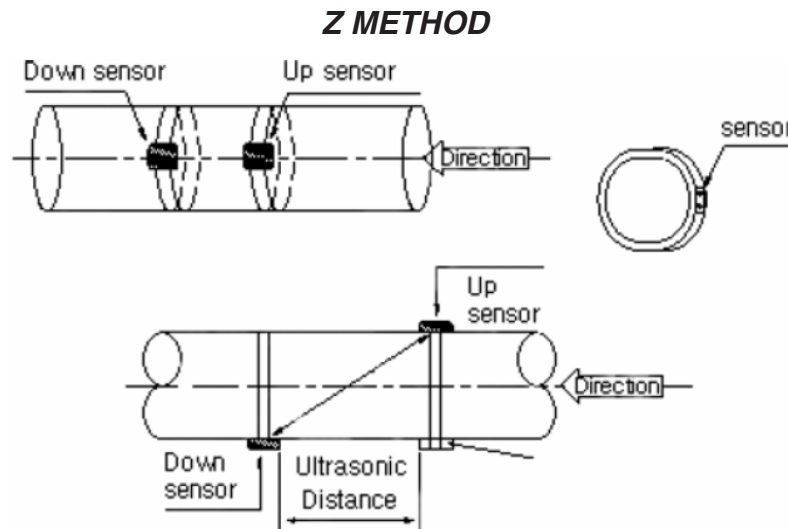
The user can verify whether the mounting is done correctly or not by checking the received signal strength, total travel time, time difference and rate of travel time, which are described below;

(1) Signal Strength & Quality - MENU 90
The signal strength is indicated by a number between 0.00 ~ 99.9. 0.00 means no signal received and 99.9 means the signal strength is at the maximum. It should be larger than 60.0 for normal operation. The signal quality Q is indicated by a number between 0.00 ~ 99.9. 0.00 indicates that the signal is at its lowest level and 99.9 the highest. It should be at least 60.00 for normal operation.

(2) Total Travel Time and Delta Time - MENU 93
The measurement is taken based on the total travel time and the time difference. Under normal working conditions the Delta time should not fluctuate beyond +-20%. If continuous violent fluctuation or fluctuations over +- 20% occur stability has been compromised and adjustments must be made. Review and adjust the transducer installation and the initial setup parameters M10 - M29.

(3) Time Rate (TOM/TOS* 100) - MENU 91
This is used to confirm whether the transducers are located with the correct interval. This should indicate 100 ±3%.

(6) Selecting a Location for Transducer Mounting

1. Locate the transducers downstream from the center of the longest available straight run. A location ten pipe diameters or greater downstream from the nearest bend will provide the best flow profile conditions.
2. Do not install the transducers downstream from a throttling valve, a mixing tank, the discharge of a positive displacement pump or any other equipment that could possibly aerate the liquid. The best location will be as free as possible from flow disturbances, vibration, sources of heat, noise, or radiated energy.
3. Avoid mounting the transducers on a section of pipe with any external scale. Remove all scale, rust, loose paint etc., from the location. Do not mount the transducers on a surface aberration (e.g., pipe seam, etc.).
4. Do not mount transducers from different ultrasonic flow meters on the same pipe. Also, do not run the transducer cables in common bundles with cables from communication equipment, other electronic systems or any type of ultrasonic equipment. You can run these cables through a common conduit ONLY if they originate at the same flowmeter.
5. Never mount transducers under water, unless you order submersible units and you install them in accordance with factory instructions.
6. Avoid mounting transducers on the top or bottom of a pipe. The ideal placement is either the nine o'clock or three o'clock position for Reflect Mode, or one transducer at nine o'clock and the other at three o'clock for Direct Mode. Mounting on a vertical pipe is recommended only if flow is in the upward direction.

Preparing the Pipe Surface

1. Pick a mounting location with the longest straight run. You must have easy access to at least one side of your pipe. The mounting location must remain full, even at zero flow.
2. Decide on your mounting mode (Z or V). Use V Mode whenever possible.
3. After receiving the spacing dimensions from the Installation Menu, prepare the pipe surface. Degrease the surface, if necessary, and remove any grit, corrosion, rust, loose paint, etc. Use abrasive material provided to create a clean contact surface for the transducers.
4. Refer to the next sections for illustrated instructions on how to locate each area to be cleaned and how to use each mounting option.
5. Install transducers in accordance with instructions in the manual and the appropriate installation drawings.
6. Apply a 1/4" wide bead of couplant edge-to-edge down the center of the emitting surface of the transducers.
7. Follow the instructions in the manual for installing the transducers.
8. For permanent applications allow the RTV type couplant to cure. It cures at room temperature upon exposure to moisture in the air. During the cure, it releases acetic acid (vinegar like odor). It reaches full cure within 24 hours.
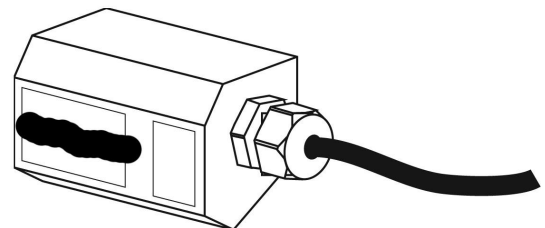
Apply 1/4" bead of couplant
to emitting surface.

(7) Optional Data Logger Setup

Logger Includes: SD card Interface, SD Memory Card, Connection Cable, SD USB Memory Card Reader. **Make Sure SD Card Is Formatted For FAT32**
(1) Logger Program Setup / Logger Status

1. Enter menu 50 to enable data logger and then select desired records to store.
2. Set Start Time, Interval and Log Times enter menu 51.   By setting the Start Time to **:**:**, the instrument will start logging instantly. If you set it to 22:00:00, it will start log time at 22:00:00. The minimum logging interval is 1 second and the maximum is 24 hours. Set the Log Times to 1-9998 to limit the amount of logs or set it to 9999 (equal to infinity), this will set the BE6300 to continual recording data.
3. Enter menu 52 select 0. Internal SerBus.
4. Check LED Status for normal operation and for saving data. The red LED on the interface will flash according to diagram below. If the logger's data status is normal the log file (print.txt) will be created and accessible through the SD card.

LOGGGER LED STATUS	LOGGER DATA STATUS
LED will blink ON for .2 sec then OFF for .8 sec	Normal Operation
ON for 1 Second	Saving Data
Always ON, Check To Make Sure SD Card Is Formatted For FAT32 Also Log Interval Could Be Set For 1 Sec.	Possible Error
Always OFF, Check To Make Sure SD Card Is Inserted Correctly, Read/View bellow. Also Check Power.	Error

(2) Logger Cable Connection / SD Connection
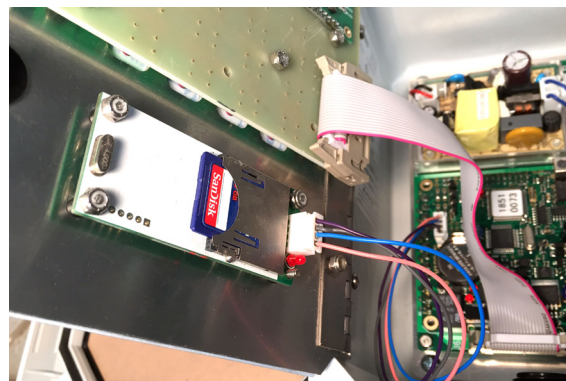
PIN	DESCRIPTION
1	3.6 v
2	GROUND
3	NOT CONNECTED
4	DATA INPUT

HOW TO INSERT SD CARD
Slide the SD Card in to the Interface pin side down.
Card is secure once clicked in place.

HOW TO REMOVE SD CARD
Push and release SD card; once you hear a click the SD card will back out of the interface for removal.

III. Display Windows

1. Summary

The user can enter display windows following the instruction given in Chapter II.

MENU	FLOW TOTALIZER/DISPLAY	MENU	OPTION SETUP	MENU	ENERGY METER MENU
00	Flow Rate/Net Totalizer	40	Damping	80	Batch Trigger Select
01	Flow Rate/Velocity	41	Low Flow Cutoff Val.	81	Flow Batch Controller
02	Flow Rate/POS Totalizer	42	Set Zero	82	Date Totalizer
03	Flow Rate/NEG Totalizer	43	Reset Zero	83	Automatic Amending
04	Date Time/Flow Rate	44	Manual Zero Point	84	Energy Unit Select
05	Energy Flow Rate/Energy Totalizer	45	Scale Factor	85	Temperature Select
06	AI1, AI2 (Analog Inputs)	46	Network IDN	86	Specific Heat
07	AI3, AI4 (Analog Inputs)	47	System Lock	87	Energy Totalizer ON/OFF
08		48	Entry to Calib. Data	88	Energy Multiplier
09	Net Flow Today	49	Serial Port Traffic	89	Temperature Diff.
MENU	**INITIAL SETUP**	**MENU**	**OUTPUT/INPUT SETUP**	8.	Heat Meter is On
10	Pipe Outer Perimeter	50	Data Logger Option	**MENU**	**DIAGNOSTICS**
11	Pipe Outer Diameter	51	Data Logger Setup	90	Strength + Quality
12	Pipe Wall Thickness	52	Send Log- Data To	91	TOM/TOS*100
13	Pipe Inner Diameter	53	Analog Input AI5	92	Fluid Sound Velocity
14	Pipe Material	54	OCT Pulse Width	93	Total Time, Delta Time
15	Pipe Sound Velocity	55	CL Mode Select	94	Reynolds No, Profile
16	Liner Material	56	CL 4mA Output Value	95	ETP ETN
17	Liner Sound Velocity	57	CL 20mA Output Value	**MENU**	**OTHERS**
18	Liner Thickness	58	CL Checkup (mA)	+0	Power ON/OFF Time
19	Inside ABS Thickness	59	CL Current Output	+1	Total Work Time
20	Fluid Type	60	Date and Time	+2	Last Power Off Time
21	Fluid Sound Velocity	61	Software Version and ESN	+3	Last Flow Rate
22	Fluid Viscosity	62	RS-485/RS-232 Setup	+4	ON/OFF Times
23	Transducer Type	63	Select Comm Protocol	+5	Calculator :input X=
24	Transducer Mounting	64	AI3 Value Range	+6	Media Vel. Threshold
25	Transducer Spacing	65	AI4 Value Range	+7	Total Flow for Month
26	Default Settings	66	AI5 Value Range	+8	Total Flow This Year
27	Save/Load Parameters	67	FO Frequency Range	+9	No-Ready Timer
28	Holding for Poor Signal	68	Low FO Flow Rate		
29	Empty Pipe Setup	69	High FO Flow Rate		
2A	Maximum Flow Rate	70	LCD Backlight Option		
MENU	FLOW UNIT SETUP	71	LCD Contrast		
30	Measurement Unit in	72	Working Timer		
31	Flow Rate Unit	73	#1 Alarm Low Value		
32	Totalizer Unit	74	#1 Alarm High Value		
33	Totalizer Multiplier	75	2# Alarm Low Value		
34	NET Totalizer	76	2# Alarm High Value		
35	POS Totalizer	77	77 Beeper Setup		
36	NEG Totalizer	78	OCT Output Setup		
37	Totalizer Reset	79	Relay Output Setup		
38	Manual Totalizer				
39	Language Selection				
3.	Segmental LCD				

2. Menu Descriptions

(1) Flow/Totalizer Display Menu

FLOW RATE / NET TOTALIZER (M00)

Description: This window is only for display. The selection of the unit is made in M31 and M32 windows. If the NET totalizer is unselected, the value shown in the window is replaced by the totalizer last time. Add the negative totalizer to the positive totalizer to get the net totalizer.

FLOW RATE / FLOW VELOCITY (M01)

Description: This window is only for display. The selection of the unit is made in M31 and M32 windows.

FLOW RATE / POSITIVE TOTALIZER (M02)

Description: This window is only for display. The selection of the unit is made in M31. If the POS totalizer is unselected, the value shown in the window is replaced by the POS totalizer last time.

FLOW RATE / NEGATIVE TOTALIZER (M03)

Description: This window is only for display. The selection of the unit is made in M31 and M32 windows. If the NET totalizer is unselected, the value shown in the window is replaced by the totalizer last time. Add the negative totalizer to the positive totalizer to get the net totalizer.

DATE AND TIME / FLOW RATE (M04)

Description: This window is only for display. This window is for displaying current date, time and flow rate. The time and date can be entered in M60.

ENERGY / TOTAL ENERGY (M05)

Description: This window is only for display. This window shows energy flow and the totalizer. Details on measuring energy are described in "Energy Measurement".

TEMPERATURE INPUT T1 AND T2 (M06)

Description: This window is only for display. Displays pt100 platinum resistor value and corresponding temperature value.

ANALOG INPUT AI3 AND AI4 (M07)

Description: This window is only for display. This window shows analog inputs AI3 and AI4 in currents that represent temperature, pressure or liquid level, etc.

SYSTEM ERROR CODES (M08)

Description: This window is only for display. It shows the status of operation and corresponding status or error) code. There are several error codes, whose implications and solutions are discussed in "ERROR SEARCHING".

NET FLOW TODAY (M09)

Description: This window is only for display. This window displays the net totalizer of the day.

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(2) Initial Setup Menu

PIPE OUTER PERIMETER (M10)

Description: Input the outer perimeter of the pipe. If the outer diameter is available, please ignore this value and input the outer diameter of the pipe in M11.

Press **ENT,** use keypad numbers to enter size then press **ENT.**

PIPE OUTER DIAMETER (M11)

Description: Input the outer diameter directly or input the outer perimeter in M10. The value should be between 3/8 inch and 240 inches (10mm and 6,000mm). Attention: Either outer diameter or outer perimeter is ok.

Press **ENT,** use keypad numbers to enter size then press **ENT.**

PIPE WALL THICKNESS (M12)

Description: Input the pipe wall thickness, if available, or skip this and go into M13.

Press **ENT,** use keypad numbers to enter size then press **ENT.**

INNER DIAMETER (M13)

Description: Input the inner diameter. If you have input other diameter or outer perimeter and wall thickness, skip this window. Either the wall thickness or the inner diameter is ok.

Press **ENT,** use keypad numbers to enter size then press **ENT.**

PIPE MATERIAL (M14)

Description: You can select one of the following materials from the list provided; If '9. Other', you must input the corresponding sound velocity of the material in M15.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

        CHOICES:
        0. Carbon Steel   5. PVC
        1. Stainless Steel   6. Aluminum
        2. Cast Iron   7. Asbestos
        3. Ductile Iron   8. Fiber Glass- Epoxy
        4. Copper   9. Other

PIPE SOUND VELOCITY (M15)

Description: Use this menu only when '9. Other' is selected in M14. This menu is not activated if

'9. Other' is not selected in M14.
Press **ENT,** use keypad numbers to enter velocity then press **ENT.**

LINER MATERIAL (M16)
Description: You can select one of the following materials from the list provided. If '11. Other', you must input the corresponding sound velocity of the material in Liner Sound Velocity (M17).

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

CHOICES:
0. None, No Liner	6. Polystyrene
1. Tar Epoxy	7. Polyester
2. Rubber	8. Polyethylene
3. Mortar	9. Ebonite
4. Polypropylene	10. Teflon
5. Polystrol	11. Other

LINER SOUND VELOCITY (M17)
Description: Use this menu only when '11. Other' is selected in Liner Material (M16).

Press **ENT,** use keypad numbers to enter velocity then press **ENT.**

LINER THICKNESS (M18)
Description: Only when a liner is selected in M16, this menu will be activated.

Press **ENT,** use keypad numbers to enter size then press **ENT.**

INSIDE ABS THICKNESS (M19)
Description: Input ABS roughness coefficient.
Not used. Reserved for future use.

FLUID (M20)
Description: You can select one of the following fluids from the list provided. If '8. Other Liquid' is selected; input the corresponding sound velocity of the fluid in M21.

CHOICES:
0. Water (General)	8. Other Liquid
1. Sea Water	9. Diesel Oil
2. Kerosene	10. Castor Oil
3. Gasoline	11. Peanut Oil
4. Fuel Oil	12. Gasoline #90
5. Crude Oil	13. Gasoline #93
6. Propane (-45°C)	14. Alcohol
7. Butane (0°C)	15. Water (125°C)

FLUID SOUND VELOCITY (M21)
Description: Enter the sound velocity of the fluid you chose in M20. This is activated only when '8. Other' is selected in M20.

Press **ENT,** use keypad numbers to enter velocity then press **ENT.**

FLUID VISCOSITY (M22)
Description: Enter the viscosity of the fluid you chose in M20. This is activated only when '8. Other' is selected in M20.

Press **ENT,** use keypad numbers to enter viscosity then press **ENT.**

TRANSDUCER TYPE (M23)
Description: Select one of the transducer types from the list provided. If you select '3. User's Own Type, you should enter a group of transducer parameters such as Wedge Degree, Sound Wedge Velocity, Wedge Distance and Wedge Time Delay. If you Select '13. P-Type, you should enter a group of transducer parameters such as probe angle, Motionless Fluid, Air Line Spacing and Wedge Time Delay.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

CHOICES:
0. Standard-M
1. Insertion Type C
2. Standard-S
3. User Type
4. Standard-B
5. Insertion B(45)
6. Standard-L
7. JH-Polysonics
8. Standard-HS
9. Standard-HM
10. Standard-M1
11. Standard-S1
12. Standard–L1
13. PI-Type
14. FS410 (FUJI)
15. FS510 (FUJI)
16. Clamp-on TM-1
17. Insertion TC-1
18. Clamp-on TS-1
19. Clamp-on TS-2
20. Clamp-on TL-1
21. Insertion TLC-2
22. Clamp-on M2
23. Clamp-on L2

TRANSDUCER MOUNTING (M24)
Description: Select one of the transducer mounting types from the list provided;

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

CHOICES:
1. V
2. Z
3. N (small pipe)
4. W (small pipe)

TRANSDUCER SPACING (M25)

Description: This window is only for display of the transducer mounting distance that was calculated based on the parameters input in the foregoing menus. The distance is between the front edges of the transducers.

Press **ENT,** use keypad numbers to enter transducer spacing then press **ENT.**

DEFAULT SETTINGS (M26)

Description: All parameters are saved to 0. Use RAM Settings, this is only temporary storage and will reset to any defaults parameters once power has been removed. After setting up/ adjusting any parameters use the 1. Solidify Settings option. This will save the parameters to the internal memory, and retain the parameters after power loss.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

SAVE/LOAD PARAMETERS (M27)

Description: Save or load up to nine different pipe parameter configurations.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT** ▼ **/- or** ▲ **/+** to save or load parameters**.**

EXAMPLES:
1. 25mm, PI-Type   5. 325mm, V ,PVC
2. 15mm, PI-Type   6. 80mm, V , Carbon Stc
3. 12.83mm, PI-Type   7. 25mm, V , Stainless
4. 3. 219mm, Z, Carbon S   8. 400mm, V , PVC
5. 259mm, Z , Carbon S

HOLD ON POOR SIGNAL (M28)

Description: Select "Yes" to hold the last good flow signal displayed if the flow meter experiences a poor signal condition. This function will allow continued data calculation without interruption.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

EMPTY PIPE SETUP (M29)

Description: This value is used to solve the problem of the empty pipe. Even when the pipe is empty, the flow meter will show "Normal Working" for the signals that are transmitted and reflected through the pipe wall. In order to avoid this, set the lowest signal strength threshold to about 30~40, below which the system stop measurement because the pipe is deemed to be empty.

MEASUREMENT UNITS
Description: The default is English. The following options are provided;

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**
　　CHOICES:
　　0. Metric
　　1. English

FLOW RATE UNIT (M31)
Description: The following flow units and time units are available:

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

　　CHOICES:
　　1. US Gallon (Gal)
　　2. UK Gallon (IGL)
　　3. Million US Gallon
　　4. Cubic Feet (cf)
　　5. US Oil Barrel (OB)
　　6. UK Oil Barrel (IB)
　　7. Cubic Meter (m3)
　　8. Liter (l)

TOTALIZER UNITS (M32)
Description: Select totalizer units. The available unit options are the same as those found in M31. The user can select units as required. Factory default is US Gallon (Gal).

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

　　CHOICES:
　　1. US Gallon (Gal)
　　2. UK Gallon (IGL)
　　3. Million US Gallon
　　4. Cubic Feet (cf)
　　5. US Oil Barrel (OB)
　　6. UK Oil Barrel (IB)
　　7. Cubic Meter (m3)
　　8. Liter (l)

TOTALIZER MULTIPLIER (M33)
Description: The totalizer multiplier acts as the function to increase the totalizer indicating range. Meanwhile, the totalizer multiplier can be applied to the positive totalizer, negative totalizer and net totalizer at the same time. The following options are available; Factory default factor is 6. X1000.

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

CHOICES:

0.	X 0.001 (1E-3)	4.	X10
1.	X 0.01	5.	X100
2.	X0.1	6.	X1000
3.	X1	7.	X10000 (1E+4)

ON/OFF NET TOTALIZER (M34)

Description: On/off net totalizer. "ON" indicates that the totalizer is turned on, while "OFF" indicates it is turned off. When it is turned off, the net totalizer display in M00 will not change. Factory default is "ON".

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

CHOICES:
1. On
2. Off

ON/OFF POSITIVE TOTALIZER (M35)

Description: On/off positive totalizer. "ON" indicates the flowmeter starts to totalize the value. When it is turned off, the positive totalizer displays M02 won't change. Factory default is "ON".

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

CHOICES:
1. On
2. Off

ON/OFF NEGATIVE TOTALIZER (M36)

Description: On/off negative totalizer. "ON" indicates the flowmeter starts to totalize the value. When it is turned off, the negative totalizer displays M03 won't change. Factory default is "ON".

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

CHOICES:
1. On
2. Off

TOTALIZER RESET? (M37)

Description: Totalizer reset;

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

CHOICES:
1. Yes
2. No

MANUAL TOTALIZER (M38)

Description: The manual totalizer is a separate totalizer. Press [ENTER] to start, and press [ENTER] to stop it. It is used for flow measurement and calculation

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**
   CHOICES:
   1. Yes
   2. No

LANGUAGE (M39)

Description: Select the language for the displayed text.

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

   CHOICES:
   1. ENGLISH
   2. ZHONG WEN
   3. ITALIAN

DAMPING (M40)

Description: The damping factor ranges from 0~999 seconds. 0 indicates no damping; 999 indicate the maximum damping. Damping function is used to display the data smoothly. To large of a coefficient will cause the measurement to appear delayed on the display. Its principle is the same as that in a single-section RC filter. The damping factor value corresponds to the circuit time constant. Usually a damping factor of 3 to 10 is recommended in applications.

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

LOW FLOW CUTOFF (M41)

Description: Low Flow Cutoff is used to make the system display as "0" value at lower and smaller flows to avoid any inefficiency in totalizing. For instance, if the cutoff value is set as 0.01 ft/s (0.03 m/s), system will take all the measured flow values of ±0.01 ft/s (0.03 m/s) as "0". Usually 0.03 is recommended in most applications.

Press **ENT ▼/- or ▲/+,** to make selection then press **ENT.**

SET ZERO (M42)

Description: When the fluid is in the static state, the displayed value is called "Zero Point". When "Zero Point" is not at zero in the flowmeter, the difference is going to be added into the actual flow values and measurement differences will occur in the flow meter.

Set Zero must be carried out after the transducers are installed and the flow inside the pipe is in the absolute static state (no liquid movement in the pipe). Thus, the "Zero Point" resulting from different pipe mounting locations and parameters can be eliminated. The measuring accuracy at low flow is enhanced consequently.

Press **ENT**; wait for the processing instructions at the bottom right corner to reach 0. Set zero within the existing flow may cause the flow to be displayed as "0". If so, it can be recovered via M43.

RESET ZERO (M43)
Description: elect "YES"; reset "Zero Point" which was set by the user.

Press **ENT** ▾ **/- or** ▴ **/+,** to make selection then press **ENT.**

MANUAL ZERO POINT (M44)
Description: This method is not commonly used. It is only suitable for experienced operators to set zero under conditions where it is not preferable to use other methods. Enter the value manually to add to the measured value to
obtain the actual value.

Press **ENT,** use keypad numbers to enter selection then press **ENT.**

> EXAMPLE:
> Actual Measured Value = 1101 g/m
> Value Deviation = 44 g/m
> Displayed Value = 1057 g/m
> Normally, set this value as "0

SCALE FACTOR (M45)
Description: The scale factor is used to modify the measurement results. Factory default is 1. The user can enter a numerical value other than "1" according to calibration results.

Press **ENT,** use keypad numbers to enter factor then press **ENT.**

NETWORK IDN (M46)
Description: Input system identifying code, these numbers can be selected from 0 ~ 65535 except that 13 (0DH ENTER), 10(0AH New Line), 42(2AH *) and 38(26H&). System IDN is used to identify a unit in network.

Press **ENT,** use keypad numbers to enter IDN then press **ENT.**

SYSTEM LOCK (M47)
Description: Once the system is locked, any modification is prohibited in the system. However, the parameter is readable, so as to protect proper operation of the instrument. "Unlock" by the password only. The password is composed of 1 to 4 numbers. (Please contact us if the password is forgotten)

Press **ENT,** use keypad numbers to enter password then press **ENT.**

ENTRY TO CALIB. DATA (M48)
Description: By using this function, the non-linearity of flow metered will be corrected. The user will select two to twelve points in order to adjust the linearity to user actual conditions.

Press **ENT,** use keypad numbers to enter password then press **ENT.**

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(3) Output/Input Setup Menu

DATA LOGGER OPTION (M50)
Description: Turns On/OFF internal data logger. If ON is selected, 22 logging options appear.

Logging Data Options: Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

    CHOICES:
    1. ON
    2. OFF

Datalogger Selection: Press **ENT** ▼ **/- or** ▲ **/+,** to make ON/OFFselection then press **ENT.**

    CHOICES:
    1. Date and Time
    2. System Status
    3. Current Window
    4. Signal Strength
    5. Flow Rate
    6. Velocity
    7. NET Totalizer
    8. POS Totalizer
    9. NEG Totalizer
    10. Energy Flow Rate
    11. Energy NET Total

DATA LOGGER SETUP (M51)
Description: Input Start Time, Interval and Duration. If you set the Start Time as **:**:**, the instrument will start logging from now on. If you set it to 23:10:10,
it will start logging from 23:10:10. If the Interval is set to **:**:**, the logging will never stop. The minimum logging interval is 1 second and the maximum is 24 hours.

Press **ENT,** use keypad numbers to enter times then press **ENT** to move to the next selection.

    SELECTIONS:
    1. START TIME

2. INTERVAL
3. LOG TIMES

SEND LOG-DATA TO (M52)
Description: Send logging data to the internal SerBus or to the RS-485 line.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

    CHOICES:
    1. Internal SerBus
    2. Send To RS-485

ANALOG INPUT AI5 (M53)
Description: This window is only for display. Displays the electric current of AI5 and its corresponding parameters such as temperature, pressure or level.

OCT PULSE WIDTH (M54)
Description: Pulse width of open collector totalizer output pulse. Width ranges from 6mS to 1000mS.

Press **ENT,** use keypad numbers to enter value then press **ENT.**

CURRENT OUTPUT SELECTION (M55)
Description: Select analog output mode.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

    CHOICES:
0. 4-20mA	5. 0-4-20mA
1. 0-20Ma	6. 20-0-20mA
2. 0-20mA Via RS-232	7. 4-20mA vs. Vel.
3. 4-20mA vs. Sound	8. 4-20mA vs. Energy
4. 20-4-20mA	

CL 4mA or 0 mA Output Value (M56)
Description: Use this window to set the flow value to 4mA or 0mA. The flow unit is the same that was set at M31.

Press **ENT,** use keypad numbers to enter password then press **ENT.**

CL 20 mA Output Value (M57)
Description: Use this window to set the flow value to 20mA. The flow unit is the same that was set at M31.

Press **ENT,** use keypad numbers to enter password then press **ENT.**

CL CHECKUP (M58)

Description: Check if the current loop has been calibrated before leaving the factory. Press ENT, move □or □separately to display 0mA, 4mA till 24mA, and at the same time, check with an ammeter to verify that CL output terminals No. 31 and 32 agree with the displayed values. It is necessary to re-calibrate the CL if over the permitted tolerance. For more information, refer to Chapter 3 - Operating Instructions. Section 3.29-Analog Output Calibration.

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

CL CURRENT OUTPUT (M59)

Description: This window is only for display. Display CL current output. The display of 10.0000mA indicates that CL current output value is 10.0000mA. If the difference between displaying value and CL output value is too large, the current loop then needs to be re-calibrated accordingly.

DATE AND TIME SETUP (M60)

Description: Date and time modifications are made. The format for setting time setting is 24hours. Press ENT, wait until">" appears. The modification can then be made.

Press **ENT,** use keypad numbers to enter password then press **ENT.**

SOFTWARE VERSION ESN (M61)

Description: This window is only for display. Displays the electronic serial number (ESN) of the instrument. This ESN is the only one assigned to each BE6300 series flow meter ready to leave the factory. The factory uses it for files setup and for management by the user.

SERIAL PORT SETUP (M62)

Description: To set serial port properties. The first information is bit rate and can be 300, 600, 1200, 240, 4800, 9600, 14,400 or 19,200 baud. The second information is data bit and it can be either 7 or 8. The third information is parity and can be either None, Even or Odd. And the fourth information is stop bit and can be 1, 1.5 or 2.

For Baud, Parity and Data Bits; Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT** to move to next selection.

SELECT COMM PROTOCOL (M63)

Description: Select Communication Protocol

Press **ENT** ▼ **/- or** ▲ **/+,** to make selection then press **ENT.**

        EXAMPLES:
        MODBUS ASCII+ TDS7
        MODBUS RTU Only

AI3 VALUE RANGE (M64)

Description: To input scale range of temperature, pressure or level for the analog input of 4-20mA. For example, the value 0 might represent 4mA and 100 might represent 20mA.

Press **ENT**, use keypad numbers to enter 4mA value. Push **ENT**, use keypad numbers to enter 20mA value then press **ENT**.

AI4 VALUE RANGE (M65)
Description: same as (M64)
AI5 VALUE RANGE (M66)
Description: same as (M64)

FREQUENCY OUTPUT SIGNAL FREQUENCY RANGE (M67)
Description: To input low (12-9999Hz) and high (12-9999Hz) frequency for the output. Make sure to set OCT to output frequency signal in order to output frequency signal.

Press **ENT**, use keypad numbers to enter Low FO Freq. Push **ENT,** use keypad numbers to enter High FO Freq, then **ENT.**

FLOW VALUE OF LOW FREQUENCY OUTPUT (M68)
Description: To input flow rate value for the low frequency point.

Press **ENT,** use keypad numbers to enter Low FO Flow Rate then press **ENT.**

FLOW VALUE OF HIGH FREQUENCY OUTPUT (M69)
Description: To input flow rate value for the high frequency point.

Press **ENT,** use keypad numbers to enter High FO Flow Rate then press **ENT.**

LCD BACK LIGHT CONTROLLER (M70)
Description: LCD backlight can be controlled using this window. Time can be set in seconds with a range of 0-60000 seconds

Press **ENT,** use keypad numbers to enter Seconds then press **ENT.**

LCD CONTRAST CONTROLLER (M71)
Description: To control the LCD contrast. Press ENT and adjust the number using up or down keys, and press ENT again to confirm.

Press **ENT,** use keypad numbers to enter contrast then press **ENT.**

WORKING TIMER (M72)
Description: Display the totalized working hours of the unit since last reset. It is displayed by HH:MM:SS. If it is necessary to reset it, press ENT and select "YES".

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

    CHOICES:
    1. NO
    2. YES

#1 ALARM LOW VALUE (M73)
Description: Input the low value of alarm. When the value falls under this value, it will cause the alarm to be output using hardware OCT or relay as set in M78 and M79.

Press **ENT,** use keypad numbers to enter value of Low alarm then press **ENT.**

#1 ALARM HIGH VALUE (M74)
Description: Input the high value of alarm. When the value exceeds this value, it will cause the alarm to be output using hardware OCT or relay as set in M78 and M79.

Press **ENT,** use keypad numbers to enter value of High alarm then press **ENT.**

#2 ALARM LOW VALUE (M75)
Description: Input the low value of alarm. When the value falls under this value, it will cause the alarm to be output using hardware OCT or relay as set in M78 and M79.

Press **ENT,** use keypad numbers to enter value of Low alarm then press **ENT.**

#2 ALARM HIGH VALUE (M76)
Description: Input the high value of alarm. When the value exceeds this value, it will cause the alarm to be output using hardware OCT or relay as set in M78 and M79.

Press **ENT,** use keypad numbers to enter value of High alarm then press **ENT.**

BEEPER SETUP (M77)
Description: The following sources can be selected to set off the buzzer.

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

    CHOICES:
    1. No Signal
    2. Poor Signal
    3. Not Ready(No*R)
    4. Reverse Flow
    5. AO over 100%
    6. FO over 120%
    7. Alarm #1
    8. Reverse Alarm #2
    9. Batch Controller
    10. POS Int Pulse

11. NEG Int Pulse
12. NET Int Pulse
13. Energy POS Pulse

OCT OUTPUT SETUP (M78)
Description: Set the system to put hardware OCT output when one of the following sources occurs

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

CHOICES:
1. No Signal
2. Poor Signal
3. Not Ready(No*R)
4. Reverse Flow
5. AO over 100%
6. FO over 120%
7. Alarm #1
8. Reverse Alarm #2
9. Batch Controller
10. POS Int Pulse
11. NEG Int Pulse
12. NET Int Pulse
13. Energy POS Pulse

RELAY OUTPUT SETEP (M79)
Description: Set the system to put Relay output when one of the following sources occurs:

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

CHOICES:
1. No Signal
2. Poor Signal
3. Not Ready(No*R)
4. Reverse Flow
5. AO over 100%
6. FO over 120%
7. Alarm #1
8. Reverse Alarm #2
9. Batch Controller
10. POS Int Pulse
11. NEG Int Pulse
12. NET Int Pulse
13. Energy POS Pulse

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(4) Energy Meter Setup Menu

BATCH TRIGGER SELECT (M80)
Description: Set the system to enble Relay output when one of the following sources occurs

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

> CHOICES:
> 1. Key Pressing
> 2. Serial Port
> 3. AI3 Rising Edge
> 4. AI3 Falling Edge
> 5. AI4 Rising Edge
> 6. AI4 Falling Edge
> 7. AI5 Rising Edge
> 8. AI5 Falling Edge
> 9. Timer-Periodical
> 10. Timer-daily

FLOW BATCH CONTROLLER (M81)
Description: The internal batch controller in the system is able to control the input signals through keypad or analog input. Output signals can be transmitted through OCT or relay. The flow batch value can be modified in this
window. The screen will enter the batch control display as soon as the modification is completed.

Press **ENT,** use keypad numbers to enter value then press **ENT.**

DATA TOTALIZER (M82)
Description: In this window, it is possible to review the historical flow data totalizer for any day for the last 64 days, any month for last 64 months and any year for last 5 years. Press ENT, use UP or DOWN key to review totalizer in days, months and years. Use UP or DOWN key to review the flow total for a specific day, month or year.

For instance, to display the flow total for May 17, 2005, the display "-----------" at the upper right corner of thescreen indicates that it was working properly the whole day. On the contrary, if "G" is displayed, it indicates that the instrument gain was adjusted at least once. Probably it was offline once on that day. If "H" is displayed, it indicates that poor signal was detected at least once. Also, it indicates that the operation was interrupted or problems occurred in the installation. For details, please refer to Chapter 5 – Error Diagnoses

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

> CHOICES:
> 1. Browse by Day

2. Browse by Month
3. Browse by Year

AUTOMATIC FLOW AMEND(M83)

Description: With the function of automatic flow correction, the flow lost in an offline session can be estimated and automatically adjusted. The estimate is based on the average value, which is obtained from flow rate before going offline and flow measured after going online the next time, multiplied times the time period that the meter was offline. Select "No" to cancel this function.

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

ENERGY UNIT SELECTION (M84)

Description: Select energy unit. The default is GJ.

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

    CHOICES:
    1. Giga Joule (GJ)
    2. Kilocalorie (Kc)
    3. KWh
    4. BTU

TEMPERATURE SELECT (M85)

Description: Select the sources for temperature signals when measuring energy.

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

    CHOICES:
    1. From T1, T2
    2. From AI3, AI4

SPECIFIC HEAT SELECT (M86)

Description: Select one of the following 2 kinds of specific heat. Normally, 0.004186 GJ/ m3o C (=1000 kcal/ m3o C). Use M+9 to check the current temperature and calorie.

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

    CHOICES:
    1. GB
    2. Fixed Specific Heat

ENERGY TOTLER ON/OFF (M87)

Description: Turn on/off the energy totalizing function.

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

    CHOICES:

ON
OFF

ENERGY TOTALIZE MULTIPLIER (M88)

Description: Select the energy totalize multiplier. 10-4 – 106 (E-4 – E-6)

Press **ENT** ▼**/- or** ▲**/+,** to make selection then press **ENT.**

CHOICES:
1. X0.0001   (E-4)   6. X10 (E1)
2. X0.001 (E-3)   7. X100 (E2)
3. X0.01 (E-2)   8. X1,000 (E3)
4. X0.1 (E-1)   9. X10,000 (E4)
5. X1 (E0)   10. X100,000 (E5)
                         11. X1,000,000 (E6)

TEMPERATURE DIFFERENCE (M89)

Press **ENT,** use keypad numbers to enter value then press **ENT.**

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(5) Diagnostics Setup Menu

STRENGTH + QUALITY (M90)

Description: This window is only for display. Display the measured signal strength and signal quality Q value upstream and downstream. Signal strength is indicated from 00.0~99.9. A reading of 00.0 indicates no signal detected, while 99.9 indicates maximum signal strength. Normally the signal strength should be > 60.0. Signal Quality Q is indicated 00~99. Energy Totalizer ON/OFF

TOM/TOS*100 (M91)

Description: This window is only for display. Display the ratio between the actual measured transmit time and the calculated transmit time according to customer's requirement. Normally the ratio should be 100 ±3%. If the difference is too large, the user should check if the parameters are entered correctly, especially the sound velocity of the fluid and the installation of the transducers. This data is of no use before the system is ready.

FLUID SOUND VELOCITY (M92)

Description: This window is only for display. Display the measured fluid sound velocity. Normally this value should be approximately equal to the entered value in M21. If the difference is too large, it probably results from an incorrect value entered in M21 or improper installation of the transducers.

TOTAL TIME AND DELTA TIME (M93)

Description: This window is only for display. Display the measured ultrasonic average time (unit: µS) and delta time of the upstream and downstream (unit: nS) time. The velocity calculation in

BE6300 ultrasonic flowmeter is based on the two readings; especially the delta time will best indicate if the instrument is running steadily.

Normally the fluctuation in the ration of the delta time should be lower than 20%; otherwise, the system maynot run steadily. It is, then, necessary to check if the transducers are installed properly or if the parameters have been entered correctly.

REYNOLDS NUMBER AND PROFILE (M94)
Description: This window is only for display. Displays the Reynolds number that is calculated by the system and the factor that is set currently by the system. Normally this scaling factor is the average of line and surface velocity factor inside the pipe.

+ & - HEAT QUANITY TOTALIZER & CYCLES DISPLAY STATUS (M95)
Description: This window is only for display. 8 sec display of interval cycles: flow/totalizer displays (M00-M09, the signal and quality display (M90) and the + &- heat quality totalizer (M95).

        DISPLAYED VALUES IN CYCLE:
        M95 + & - Heat Quality Totalizer
        M00 Flow Rate/Net Totalizer
        M01 Flow Rate/Velocity
        M02 Flow Rate/POS Totalizer
        M03 Flow Rate/NEG Totalizer
        M04 Date Time/Flow Rate
        M05 EFR/E.T
        M06 T1/T2 (Temperature Input)
        M07 A1/A2 (Analog Input)
        M08 System Error Code
        M90 Net Flow Today

(6) Other Options Setup Menu

POWER ON/OFF TIME (M+0)
Description: To view the power on/off time and flow rate for the last 64 update times to obtain the offline time period and the corresponding flow rate. Enter the window, press ENT to display the last update before the last 64 times of on/off time and flow rate values. "ON" on right hand indicates that time power is on; "00" on the upper left corner indicates "00-07-18 12:40:12" the date time; flow rate is displayed in the lower right corner.

Press **ENT ▼/- or ▲/+,** to review.

TOTAL WORKING HOURS (M+1)
Description: With this function, it is possible to view the total working hours since the flowmeter left the factory. The figure in the above indicates that the total working hours since the flowmeter left the factory is 340 hours 48 minutes and 26 seconds.

Press **ENT** ▼/- **or** ▲/+, to review.

LAST POWER OFF TIME (M+2)
Description: This window is only for display. Display the last power off time.

LAST FLOW RATE (M+3)
Description: This window is only for display. Displays the last flow rate.

ON/OFF TIMES (M+4)
Description: This window is only for display. Displays how many time the unit has been powered up.

CALCULATOR (M+5)
Description: This window is a calculator which has the ability of functional operation. How to use: Input the first parameter X, and then select an operator. If this operation has a second parameter, then input the second parameter Y and put the result of the operation in X. For example, To calculate 1+2, press [MENU] [+] [5] [1] [ENT]. After selecting "+" operator by using [UP/+] key, press [ENT] [2] [ENT]. This calculator also has register function, which can be selected by operator selection.

Note: The calculator can be used even when the meter is operating. The measurement result of the meter will not be affected by the calculation.

MEDIA SOUND VELOCITY THRESHOLD (M+6)
Description: Displays the threshold value of the sound velocity that will trigger the alarm. Namely if the measured sound velocity should be different from the sound velocity stored in the instrument by more than this threshold value. An alarm signal will be generated and transmitted as OCT or relay output.

Press **ENT,** use keypad numbers to enter threshold value then press **ENT.**

TOTAL FLOW FOR MONTH (M+7)
Description: Net totalizer for this month

TOTAL FLOW THIS YEAR (M+8)
Description: Net totalizer for this year

IV. Trouble Shooting

With highly reliable design, the BE6300 ultrasonic flowmeter has a low failure rate. However, problems may occur as a result of unskillful handling, setting errors or working in an extremely undesirable working condition. For this reason, the meter is equipped with a self-diagnostic function. Problems detected are displayed in time order in code form on the upper right corner of the LCD screen. Hardware malfunctions, though generally checked after power is on, can also be detected (part of them) while the device is working normally. Information about "stop working" problems caused by wrong settings or undesirable working\ conditions can also be displayed, so users can locate the problems quickly and solve the problems according to the solutions offered in the following two tables in time.

There are two kinds of error displayed in BE6300:

1. Error messages are displayed during self-test after the power is switched on. After entering the measurement mode, if there is an error, "*F" will be displayed at the top left corner of the screen. Check the information being displayed and take specific steps according to the following tables. If problems persist, contact your BE6300 distributor.
2. Errors about the specific signal received or wrong settings can be displayed by the M08 window in error code form. Errors and solutions are listed in the following tables;

1. Power-On self-test information, Causes and Solutions

LCD DISPLAY	CAUSE	SOLUTION
CPU or Interruption error	Main CPU is wrong	Restart
Handshaking Error	Hardware handle wrong, system will reset	Restart
PRN	Over Printer wrong or wrong connection.	Examine printer or cable
ROM Parity Error	System ROM illegal or in error	Contact the manufacturer
SCPU Fatal Error	Fatal error in sub CPU circuit	Restart or contact the manufacturer
Stored Data Error	Stored Data Error	Restart the instrument or contact the manufacturer
System RAM Error	System RAM has problems	Restart or contact the manufacturer
Time or Batt Error	System time chip error	Restart or contact the manufacturer
Timer Slow Error Timer Fast Error	System clock is wrong	contact the manufacturer
When Pressing the keys, no response from screen, no display or disorderly display	Mis-operation, poor cable contact on the panel	Soft Reset. Check whether the cables on the panel are contacted well

2. Error Code Causes and Solutions (M08)

CODE	M08 DISPLAY	CAUSE	SOLUTION
*R	System Normal	System operates normally	Contact the manufacturer
*J	SCPU Fatal Error	Hardware failure	Contact the manufacturer
*I	Signal Not Detected	* No signal received * A poor contact between sensor and the pipe, or too little couplant applied. * The sensor has not been installed properly. * Too much scale formation in the inside wall. * New Liner	* Make sure the sensor is close to the pipe. Use sufficient couplant. * Make sure no rust, stain, and no oil paint on the pipe surface. Use flat file clean to clean the pipe surface. * Check the original settings. * You can clean the couplant or change the pipe. But under normal conditions, you can try to change the measuring point. * Wait until the liner is saturated and solidified.
*H	Low Signal Strength Poor Signal Quality	* Poor Signal Quality * The above mentioned causes are applicable here.	* The above mentioned solutions are applicable here.
*E	Current loop over 20mA (Ignore it if the measuring process don't use current output)	* 4-20mA current loop overflow over 120% * Wrong current loop output settings.	* Recheck the settings(see M58 in the manual) or make sure the actual flow is not too big.
*F	See above table named Power-On self-test information, Causes and Solutions	* Self-checking error * Perpetual hardware failure	* Restart the device and observe the information, contact the company. * Contact the company
*G	Adjusting Gain=>S1 Adjusting Gain=>S2 Adjusting Gain=>S3 Adjusting Gain=>S4 (Displayed in M00, M01, M02, M03 windows	* These all 4 steps mean that the machine is going through the gain adjustment process, preparing for the normal measurement. If the machine stops on S1 or S2, or shifts between S1 and S2, it means that the received signal is too low or the waveform is not so good. The reasons may include all the above mentioned causes.	
*K	Empty pipe, M29 menu settings	No liquid in the pipe or wrong Settings.	* If there is liquid in the pipe, input "0" in the M29 menu.

3. 4-20 mA Output Calibration

How to calibrate the analog output

In general, there is no need to calibrate the analogue output since it has been calibrated in factory. However, when conducting current loop calibration, if you find the current value shown in M58 differs from the actual current shown in the ammeter, you do need to recalibrate the analogue output.

Calibration Steps:

1. First, put the flow meter into calibration mode. Press **MENU** ▼/- **0 ENT**, enter password ''4213068'', and press **ENT** again.
2. Then, connect a precise ammeter to the current loop.
3. Press **MENU** ▼/- **1 ENT** to calibrate the current loop 4 mA output. Read the ammeter.
   If the reading is not 4mA, use ▲/+ or ▼/- to adjust the output current until the ammeter reads 4.00mA.
4. Press **ENT** again to calibrate 20mA output, similar to the above step.
5. Press **MENU** ▼/- **0 ENT** to save the results in the internal non-volatile EEPROM.

Appendix

Appendix 1. Sound Velocity and Viscosity of Liquids

LIQUID	SOUND VELOCITY (m/s)	VISCOSITY (mm2/s)	LIQUID	SOUND VELOCITY (m/s)	VISCOSITY (mm2/s)
Water 20ºC	1482	1.0	Glycerin	1923	1180
Water 50ºC	1543	0.55	Gas	1250	0.80
Water 75ºC	1554	0.39	66# Gas	1171	
Water 100ºC	1543	0.29	80# Gas	1139	
Water 125ºC	1511	0.25	0# Gas	1385	
Water 150ºC	1466	0.21	Benzene	1330	
Water 175ºC	1401	0.18	Ethyl Benzene	1340	
Water 200ºC	1333	0.15	Toluene	1170	0.69
Water 225ºC	1249	0.14	Tetra Chloromethane	938	
Acetone	1190		Petroleum	1290	
Carbinol	1121		Pine Oil	1280	
Ethanol	1168		Cloroethylene	1050	0.82
Alcohol	1440	1.5	Ketone	1310	
Acetaldehyde	1180		Glycol	1620	
Arachis oil	1472		Castor Oil	1502	

Appendix 2. Sound Velocity for Various Common Materials

Pipe Material

PIPE MATERIAL	SOUND VELOCITY (m/s)
Steel	3206
ABS	2286
Aluminum	3048
Brass	2270
Cast Iron	2460
Bronze	2270
Fiber, Glass-Epoxy	3430
Glass	3276
Polyethylene	1950
PVC	2540
PTFE	1450
Rubber	1600
Steel	3206
ABS	2286
Aluminum	3048

Liner Material

LINER MATERIAL	SOUND VELOCITY (m/s)
PTFE	1225
Titanium	3150
Cement	4190

Bitumen	2540
Porcelain Enamel	2540
Glass	5970
Plastic	2280
Polyethylene	1600

Appendix 3. Sound Velocity in Water

(1 ATM) at Different Temperatures

t	v	t	v	t	v	t	v	t	v
0	1402.3	25	1496.6	50	1542.5	75	1555.1
1	1407.3	26	1499.2	51	1543.5	76	1555.0
2	1412.2	27	1501.8	52	1544.6	77	1544.9
3	1416.9	28	1504.3	53	1545.5	78	1554.8
4	1421.6	29	1506.7	54	1546.4	79	1554.6
5	1426.1	30	1509.0	55	1547.3	80	1554.4
6	1430.5	31	1511.3	56	1548.1	81	1554.2
7	1434.8	32	1513.5	57	1548.9	82	1553.9
8	1439.1	33	1515.7	58	1549.6	83	1553.6
9	1443.2	34	1517.7	59	1550.3	84	1553.2
10	1447.2	35	1519.7	60	1550.9	85	1552.8
11	1451.1	36	1521.7	61	1551.5	86	1552.4
12	1454.9	37	1523.5	62	1552.0	87	1552.0
13	1458.7	38	1525.3	63	1552.5	88	1551.5
14	1462.3	39	1527.1	64	1553.0	89	1551.0
15	1465.8	40	1528.8	65	1553.4	90	1550.4
16	1469.3	41	1530.4	66	1553.7	91	1549.8
17	1472.7	42	1532.0	67	1554.0	92	1549.2
18	1476.0	43	1533.5	68	1554.3	93	1548.5
19	1479.1	44	1534.9	69	1554.5	94	1547.5
20	1482.3	45	1536.3	70	1554.7	95	1547.1
21	1485.3	46	1537.7	71	1554.9	96	1546.3
22	1488.2	47	1538.9	72	1555.0	97	1545.6
23	1491.1	48	1540.2	73	1555.0	98	1544.7
24	1493.9	49	1541.3	74	1555.1	99	1543.9

Please refer to the sound velocity of other fluids and materials, please contact the factory.

Calculation of Sound Velocity (C0) in Fresh Water:

Co=1557 - 0.0245(74-t)2(m/s) where, "t" is water temperature (oC)

Calculation of Sound Velocity (C1) in Sea Water:

C1=C0+1.39S where, "C0" is the sound velocity in fresh water, "S" is the salinity of the sea water (%)

Appendix 4. Pipe Dimensions and Weights

Nominal Pipe size (inch)	OD Inch	Schedule Designations	Wall inch		ID inch
1/8	0.0405	10		10S	0.049
		STD	40	40S	0.068
		XS	80	80S	0.095
1/4	0.540	10		10S	0.065
		STD	40	40S	0.088
		XS	80	80S	0.119
3/8	0.675	10		10S	0.065
		STD	40	40S	0.091
		XS	80	80S	0.126
1/2	0.840	5		5S	0.065
		10		10S	0.083
		STD	40	40S	0.109
		XS	80	80S	0.147
		160			0.188
		XX			0.294
3/4	1.050	5		5S	0.065
		10		10S	0.083
		STD	40	40S	0.113
		XS	80	80S	0.154
		160			0.219
		XX			0.308
1	1.315	5		5S	0.065
		10		10S	0.109
		STD	40	40S	0.133
		XS	80	80S	0.179
		160			0.250
		XX			0.358
1-1/4	1.660	5		5S	0.065
		10		10S	0.109
		STD	40	40S	0.140
		XS	80	80S	0.191
		160			0.250
		XX			0.382
1-1/2	1.900	5		5S	0.065
		10		10S	0.109
		STD	40	40S	0.145
		XS	80	80S	0.200
		160			0.281
		XX			0.400

Appendix 4. Pipe Dimensions and Weights

Nominal Pipe size (inch)	OD Inch	Schedule Designations		Wall inch	ID inch
2	2.375	5			5S 0.065
		10			10S 0.109
		STD	40		40S 0.154
		XS	80		80S 0.218
		160			0.344
		XX			0.436
2-1/2	2.875	5			5S 0.083
		10			10S 0.120
		STD	40		40S 0.203
		XS	80		80S 0.276
		160			0.375
		XX			0.552
3	3.500	5			5S 0.083
		10			10S 0.120
		STD	40		40S 0.216
		XS	80		80S 0.300
		160			0.438
		XX			0.600
3-1/2	4.000	5			5S 0.083
		10			10S 0.120
		STD			40S 0.226
		XS	40		80S 0.318
		160	80		0.636
		XX			
4	4.500	5			5S 0.083
		10			10S 0.120
					0.156
					0.188
		STD	40		40S 0.237
		XS	80		80S 0.337
		120			0.438
		160			0.531
		XX			0.674
4-1/2	5.000	STD	40		40S 0.247
		XS	80		80S 0.355
		XX			0.710
5	5.563	5			5S 0.109
		10			10S 0.134
		STD	40		40S 0.258
		XS	80		80S 0.375
		120			0.500
		160			0.625
		XX			0.750

Appendix 4. Pipe Dimensions and Weights

Nominal Pipe size (inch)	OD Inch	Schedule Designations			Wall inch	ID inch
6	6.625	5		5S		0.109
		10		10S		0.134
						0.188
		STD	40	40S		0.280
		XS	80	80S		0.432
		120				0.562
		160				0.719
		XX				0.864
7	7.625	STD	40	40S		0.301
		XS	80	80S		0.500
		XX				0.875
8	8.625			5S		0.109
		10		10S		0.148
		20				0.250
		30				0.277
		STD	40	40S		0.322
		60				0.406
		XS	80	80S		0.500
		100				0.594
		120				0.719
		140				0.812
		160				0.875
		XX				0.906
9	9.625	STD	40	40S		0.342
		XS	80	80S		0.500
		XX				0.875
10	10.750			5S		0.134
				10S		0.165
						0.188
		20				0.250
		30				0.307
		STD	40	40S		0.365
		XS	80	80S		0.500
		80				0.594
		100				0.719
		120				0.844
		140				1.000
		160				1.125
11	11.750	STD	40	40S		0.375
		XS	80	80S		0.500
		XX				0.875

Appendix 4. Pipe Dimensions and Weights

Nominal Pipe size (inch)	OD Inch	Schedule Designations		Wall inch	ID inch
12	12.750			5S	
				10S	
		20			
		30			
		STD		40S	
		40			
		XS		80S	
		60			
		100			
		120			
		140			
		160			
14	14.000			10S	
		10			
		20			
		STD		40S	
		40			
		XS		80S	
		60			
		80			
		100			
		120			
		140			
		160			
16	16.000			10S	
		10			
		20			
		STD		40S	
		XS		80S	
		60			
		80			
		100			
		120			
		140			
		160			

Appendix 4. Pipe Dimensions and Weights

Nominal Pipe size (inch)	OD Inch	Schedule Designations			Wall inch	ID inch
18	18.000			10S		
		10				
		20		40S		
		STD		80S		
		XS				
		60				
		80				
		100				
		120				
		140				
		160		10S		
20	20.000					
		10				
		STD		40S		
		XS		80S		
		40				
		60				
		80				
		100				
		120				
		140				
		160				
22	22.000	5		10S		0.218
			10			0.250
		STD	20	40S		0.375
		XS	30	80S		0.500
		60				0.875
		80				1.125
		100				1.375
		120				1.625
		140				1.875
		160				2.125
24	24.000	10		10S		0.250
		STD	20	40S		0.375
		XS		80S		0.500
		30				0.562
		40				0.688
		60				0.969
		80				1.219
		100				1.531
		120				1.812
		140				2.062
		160				2.344
26	26.000		10			0.312
		STD		40S		0.375
		XS		80S		0.500

Appendix 4. Pipe Dimensions and Weights

Nominal Pipe size (inch)	OD Inch	Schedule Designations	Wall inch		ID inch
28	28.000		10		0.312
		STD		40S	0.375
		XS	20	80S	0.500
			30		0.625
30	30.000		10		0.312
		STD		40S	0.375
			20	80S	0.500
			30		0.625
32	32.000		10		0.312
		STD			0.375
			20		0.500
			30		0.625
			40		0.688
34	34.000		10		0.312
		STD			0.375
			20		0.500
			30		0.625
			40		0.688
36	36.000		10		0.312
		STD		40S	0.375
		XS		80S	0.500
42	42.000	STD		40S	0.500
		XS		80S	0.625
			30		0.750
			40		0.500
48	48.000	STD		40S	0.375
		XS		80S	0.500

Ductile Iron Pipe Classes
Standard Classes (Inside Diameters)

Size (in.)	Outside Diameter (in.)	Class 50	Class 51	Class 52	Class 53	Class 54	Class 55	Class 56	Cement Lining	
									**Std. Thickness	**Dbl. Thickness
3	3.96	---	3.46	3.40	3.34	3.28	3.22	3.16	.125	.250
4	4.80	---	4.28	4.22	4.16	4.10	4.04	3.98		
6	6.90	6.40	6.34	6.28	6.22	6.16	6.10	6.04		
8	9.05	8.51	8.45	8.39	8.33	8.27	8.21	8.15		
10	11.10	10.52	10.46	10.40	10.34	10.28	10.22	10.16		
12	13.20	12.58	12.52	12.46	12.40	12.34	12.28	12.22		
14	15.30	14.64	14.58	14.52	14.46	14.40	14.34	14.26	.1875	.375
16	17.40	16.72	16.66	16.60	16.54	16.48	16.42	16.36		
18	19.50	18.60	18.74	18.68	18.62	18.56	18.50	18.44		
20	21.60	20.88	20.82	20.76	20.70	20.64	20.58	20.52		
24	25.80	25.04	24.98	24.92	24.86	24.80	24.74	24.68		
30	32.00	31.22	31.14	31.06	30.98	30.90	30.82	30.74	.250	.500
36	38.30	37.44	37.34	37.06	37.14	37.04	36.94	36.84		
42	44.50	43.56	43.44	43.32	43.20	43.08	42.96	42.84		
48	50.80	49.78	49.64	49.50	49.36	49.22	49.08	48.94		
54	57.10	55.96	55.80	55.64	55.48	55.32	55.16	55.00		

Cast Iron Pipe Classes
Standard Classes

Nom. Pipe Size (in.)	CLASS A		CLASS B		CLASS C		CLASS D		CLASS E		CLASS F		CLASS G		CLASS H	
	O.D. (in.)	I.D. (in)	O.D. (in.)	I.D. (in)	O.D. (in.)	I.D. (in)	O.D. (in.)	I.D. (in)	O.D. (in.)	I.D. (in)	O.D. (in.)	I.D. (in)	O.D. (in.)	I.D. (in)	O.D. (in.)	I.D. (in)
3	3.80	3.02	3.96	3.12	3.96	3.06	3.96	3.00	---	---	---	---	---	---	---	---
4	4.80	3.96	5.00	4.10	5.00	4.04	5.00	3.96	---	---	---	---	---	---	---	---
6	6.90	6.02	7.10	6.14	7.10	6.08	7.10	6.00	7.22	6.06	7.22	6.00	7.38	6.08	7.38	6.00
8	9.05	8.13	9.05	8.03	9.30	8.18	9.30	8.10	9.42	8.10	9.42	8.10	9.60	8.10	9.60	8.00
10	11.10	10.10	11.10	9.96	11.40	10.16	11.40	10.04	11.60	10.12	11.60	10.00	11.84	10.12	11.84	10.00
12	13.20	12.12	13.20	11.96	13.50	12.14	13.50	12.00	13.78	12.14	13.78	12.00	14.08	12.14	14.06	12.00
14	15.30	14.16	15.30	13.98	15.65	14.17	15.65	14.01	15.98	14.18	15.98	14.00	16.32	14.18	16.32	14.00
16	17.40	16.20	17.40	16.00	17.80	16.20	17.80	16.02	18.16	16.20	18.16	16.00	18.54	16.18	18.54	16.00
18	19.50	18.22	19.50	18.00	19.92	18.18	19.92	18.00	20.34	18.20	20.34	18.00	20.78	18.22	20.78	18.00
20	21.60	20.26	21.60	20.00	22.06	20.22	22.06	20.00	22.54	20.24	22.54	20.00	23.02	20.24	23.02	20.00
24	25.80	24.28	25.80	24.02	26.32	24.22	26.32	24.00	26.90	24.28	26.90	24.00	27.76	24.26	27.76	24.00
30	31.74	29.98	32.00	29.94	32.40	30.00	32.74	30.00	33.10	30.00	33.46	30.00	---	---	---	---
36	37.96	35.98	38.30	36.00	38.70	35.98	39.16	36.00	39.60	36.00	40.04	36.00	---	---	---	---
42	44.20	42.00	44.50	41.94	45.10	42.02	45.58	42.02	---	---	---	---	---	---	---	---
48	50.50	47.98	50.80	47.96	51.40	47.96	51.98	48.00	---	---	---	---	---	---	---	---
54	56.66	53.96	57.10	54.00	57.80	54.00	58.40	53.94	---	---	---	---	---	---	---	---
60	62.80	60.02	63.40	60.06	64.20	60.20	64.82	60.06	---	---	---	---	---	---	---	---
72	75.34	72.10	76.00	72.10	76.88	72.10	---	---	---	---	---	---	---	---	---	---
84	87.54	84.10	88.54	84.10	---	---	---	---	---	---	---	---	---	---	---	---