

transit time
ultrasonic
flowmeter

Sono-Trak™ Operation & Maintenance Manual

ST-30



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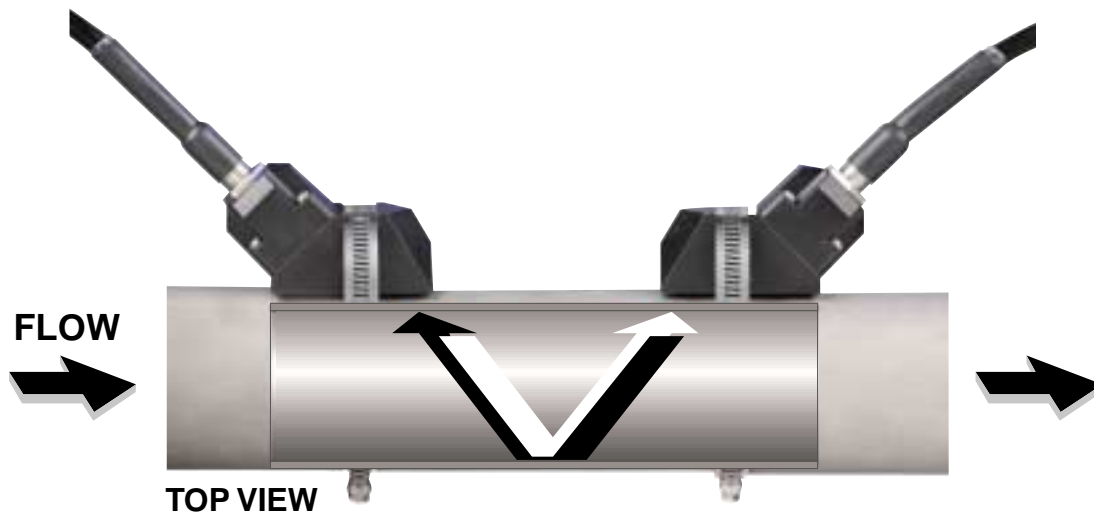
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..... Notes, which appear before procedures.



..... Cautions, which appear before procedures.



- Signal moving upstream:
 Upstream velocity = speed of sound - fluid velocity
- Signal moving downstream:
 Downstream velocity = speed of sound + fluid velocity

How the Sono-Trak Measures Flow

The Sono-Trak clamp-on, transit time ultrasonic flowmeter uses two water-tight transducers, which operate as both transmitters and receivers. The transducers are mounted on the outside of process pipe, with one transducer upstream and one downstream. Installation is non-intrusive, as no sensor is inserted into the pipe.

The upstream transducer (UT) sends a high frequency ultrasonic wave to the downstream transducer (DT). Likewise, the DT sends a signal back to the UT. With no flow, the time for the signal to travel between DT and UT is the same. However, with flow, the signal moving in the direction of flow travels faster than the signal moving against flow. The difference in transit time is determined by advanced digital signal processing, which uses a “dual time base” technique that allows for extremely accurate measurements of time. The difference in transit time is used to calculate the fluid velocity. Once the fluid velocity is determined, it is multiplied by the area of the pipe to calculate the flow rate.

Performance Specifications

Accuracy

± 0.5% of Rate (Factory tested)

Factory test reference conditions: Water at 70 °F at flow velocities > 1 ft/s in a 6" stainless steel pipe.

± 1-2% of Rate (Typical field installations)

Field performance is dependant on the accuracy of the pipe internal diameter and wall thickness measurements, as well as straight run conditions.

Repeatability

± 0.1% of rate

Response Time

0.3 to 30 seconds

Physical Specifications

Materials

Wetted Parts..... None

Transducer Housing

250 °F Delrin®/Ultem®/Stainless steel;
NEMA 6 (IP68)

400 °F Torlon®/Vespal®/Stainless steel;
NEMA 6 (IP68)

Electronics Housing Reinforced polycarbonate with
stainless steel hardware.
NEMA 4X (IP65)

Sensor Cables Polyurethane armored coaxial

Clamps..... Stainless steel

Cable Length

Standard.....25 ft (7.6 m)

Options50 ft (15.2 m)

.....75 ft (22.8 m)

Custom76 ft – 1000 ft (23.1 m – 304.8 m)

Maximum Transducer Cable Length

1000 ft (304.8 m)

Cable Connection

Standard.....Standard submersible

Mounting

TransducerExternal, adjustable clamp

ElectronicsRemote wall

European CE Mark (June 2000)

Light Industrial: Emissions EN 55011 Class A

Heavy Industrial: Immunity EN 50082-2:95

Low Voltage Directive IEC 1010-1

CSA Approval (Pending)

Class I Div II Groups A,B,C,D

Class II, III, Div 2 Groups F & G

FM Approval (Pending)

Class I Div II Groups A,B,C,D

Class II, III, Div 2 Groups F & G

Operating Specifications

Applied Pipeline Sizes

2 to 100 in. (50 to 2540 mm)

Measurable Fluids

Most common liquids from waste water to petrochemical products.

Measurable Flow Velocities

– 40 to 40 ft/s (– 12 to 12 m/s)

Process Temperature Limit

Standard.....–40 to 250 °F (–40 to 121 °C)
High Temp Option.....–40 to 400 °F (–40 to 205 °C)

Ambient Temperature Limit

– 40 to 140 °F (– 40 to 60 °C)

Ambient Humidity Limit

Up to 95% RH, non-condensing

Process Pressure Limit

Not applicable

Power Requirements

Field configurable for AC or DC operation:
12-24 VDC
115 VAC, 50/60 Hz (+/- 10%)
230 VAC, 50/60 Hz (+/- 10%)

Power Consumption

Less than 5 watts

Standard Interface

LCD backlit display with 8-character large numeric and 8-character small alphanumeric. Four button menu-driven EZ-Logic interface for programming.

Flow Units

User-selectable from gallons, liters, cubic feet, Mgals, cubic meters, oil barrels, liquid barrels, feet, meters, pounds and kilograms.

Time Units

User-selectable from seconds, minutes, hours, and days.

Energy Units (RTD Module)

User-selectable from BTU, tons, calories and watts.

Standard Input/Output

Infrared serial interface allows access to all configuration and data recording features. (Requires optional IR serial adapter accessory for PC and optional Windows® 95/98/NT compatible software.)

Optional Input/Output Modules

A maximum of two outputs can be selected. All input/output modules are optically isolated up to 2,500 volts against ground loops and electrical surges.

4-20 mA Output

Configurable as a 2-wire active or passive transmitter, 800 Ω maximum resistance.

Frequency Output

Open collector, 0-10,000 Hz, 20 mA maximum (50% duty cycle).

Dual Relay Output

Two SPDT form C contacts independently controlled; 175 V, 1/4 A switch, 1 A carry current, 0.2 Ω resistance. Used for batching, high/low flow alarms, empty pipe detection, and error indication.

RS485 Communication

Used to network up to 100 units together in a master/slave configuration using built-in software. Supports 57.6 KB communications, up to 1000 feet.

RS232 Communication

Used to monitor flow information. Supports up to 57.6 KB communications.

Dual RTD

Accepts two 1000 Ω RTD inputs for BTU measurement. (Does not include RTD's.)

Data Logger

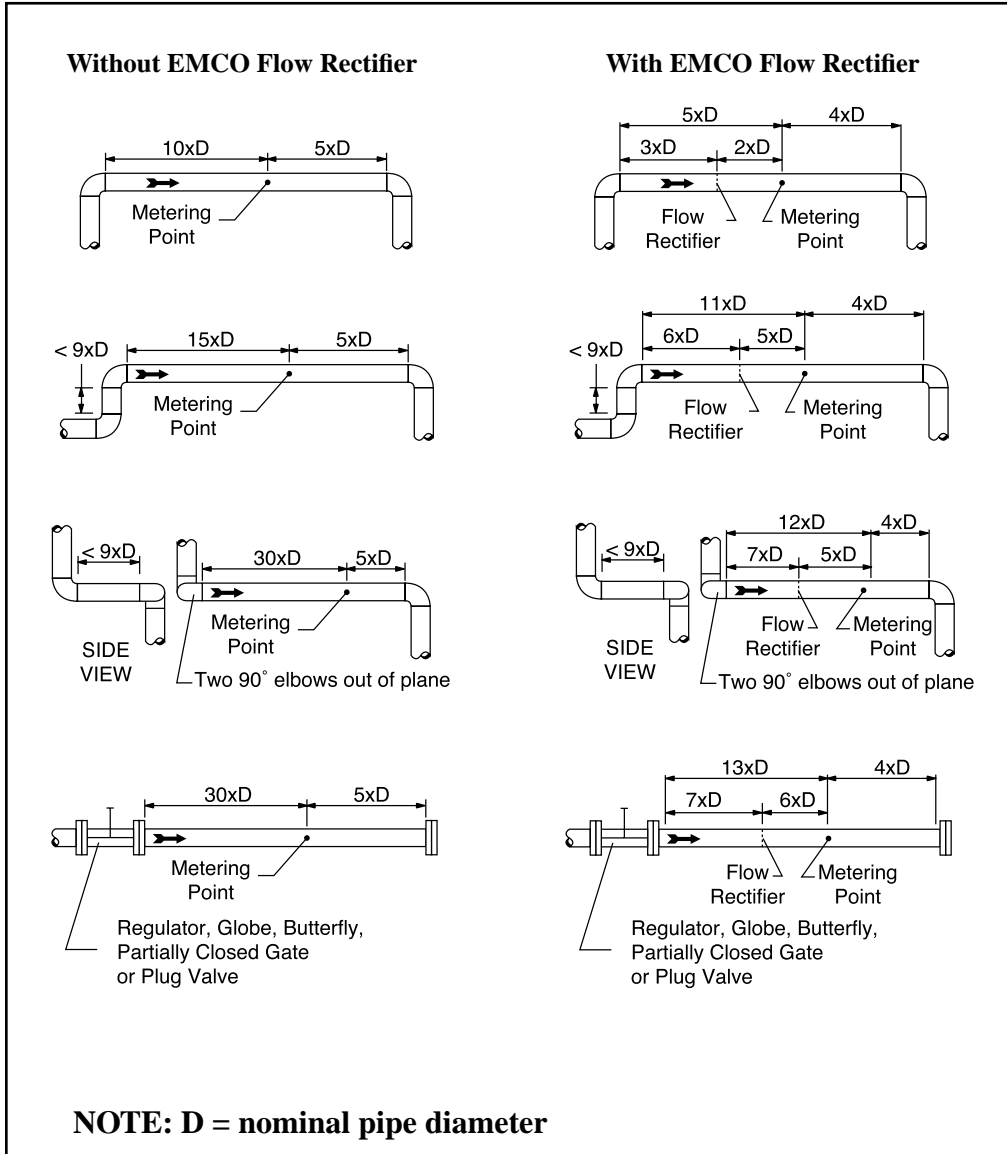
Nonvolatile storage of 100,000 time/date stamped data points, selectable from 1-1,000 seconds. Internal clock/calendar with battery. "Hot-swappable" module can be changed during normal operation. Connects to PC serial port for data retrieval.

SELECTING THE BEST LOCATION



Straight Run Requirements

The straight run requirement for this meter is 10 diameters upstream and 5 diameters downstream. Accurate results can be achieved with straight run of 5 diameters upstream and 3 diameters downstream. Upstream valves and other piping configurations may require more straight run. Consult your EMCO representative or the factory about your specific application.



Transducer Mounting

Vertical.....The recommended flow direction in a vertical pipe is upwards.

HorizontalTransducer should be mounted on a horizontal pipe in the areas shown.

Zero Point Adjustment

For best accuracy, a zero point setting must be made with a full pipe at no flow during initial start-up.

Air/Gas Entrapment

Excess gas entrapment can scatter or reflect the sound wave, causing inaccurate measurement. Allowable air/gas entrapment is 2%.

Pipe Material

The property of the pipe material can affect the performance of the meter.

PIPE MATERIAL TABLE

Good Results	Caution Needed	Do Not Use On
Most metallic	Cast Iron	Cement
Plastic	Lined Pipes	Pipes with internal deposits or severe corrosion

Sonic Wave Forms

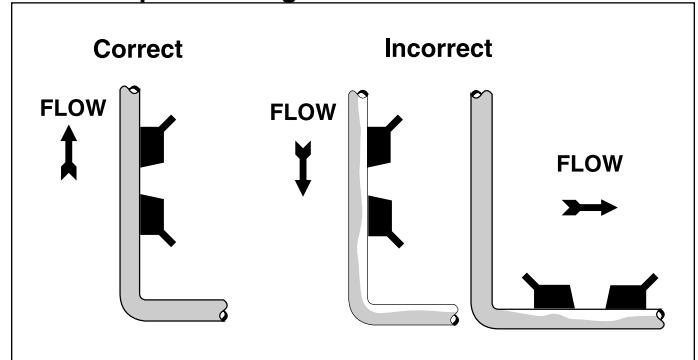
To obtain the best possible signal strength, the following mounting options are recommended:

- 2" to 2.5" (DN50 to DN65)“W”
- 3" to 12" (DN80 to DN300)“V”
- 14" to 100" (DN350 to DN2500)“Z”

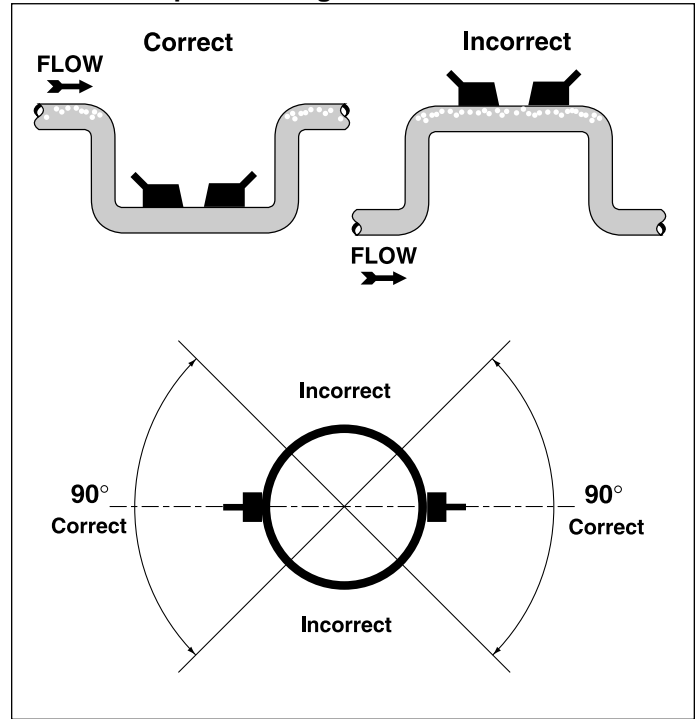
Transducer Spacing

Transducer spacing is dependent upon pipe size and is calculated automatically during set-up.

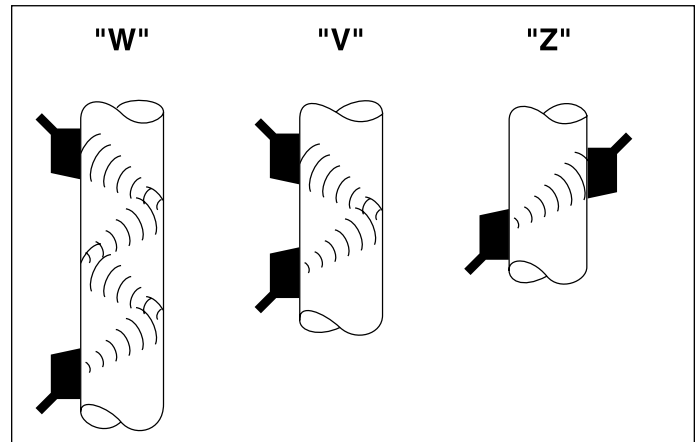
Vertical Pipe Mounting



Horizontal Pipe Mounting



Sonic Wave Forms



**TRANSDUCER SPACING
COARSE SPACING GUIDELINES**



Note:

1. 2"-12" Spacing is for (SCH 40) Carbon Steel Pipes



Note:

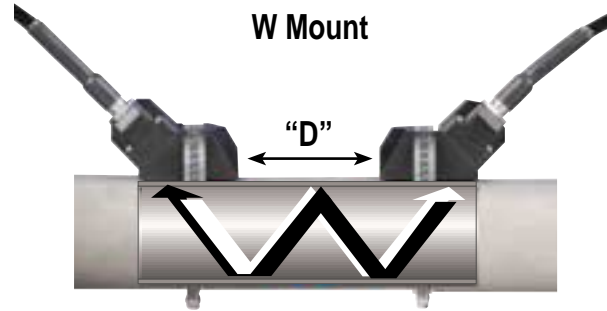
2. 14"-36" spacing is for (STD SCH) Carbon Steel Pipes

Pipe Sizes (inches)	Mounting Distance "D" (inches)		
	W	V	Z
2	2.19	—	—
2.5	3.19	—	—
3	4.39	1.50	—
3.5	5.35	2.00	—
4	6.30	2.51	—
5	8.34	3.57	—
6	10.37	4.65	—
8	—	6.65	—
10	—	8.81	4.08
12	—	10.82	5.19
14	—	11.90	5.65
16	—	13.79	6.60
18	—	15.68	7.54
20	—	17.56	8.48
22	—	19.45	9.43
24	—	—	10.37
26	—	—	11.37
28	—	—	12.25
30	—	—	13.25
32	—	—	14.25
34	—	—	15.00
36	—	—	16.00

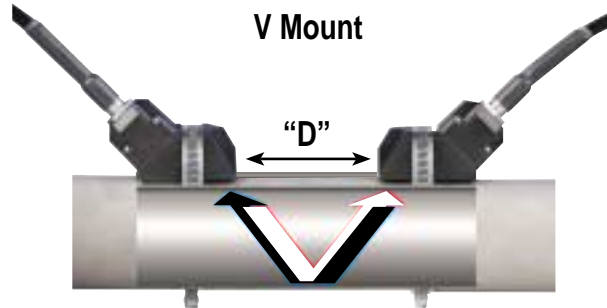


Note:

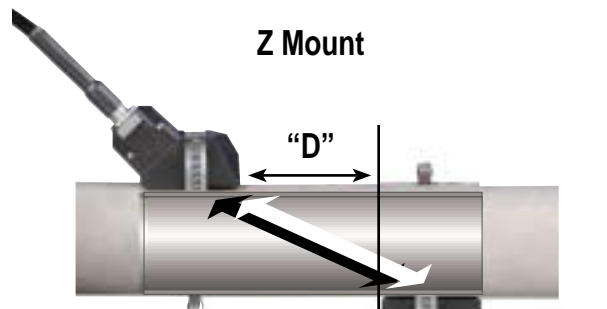
1. For pipes larger than 36 inches, transducer spacing is calculated after the pipe data is entered into the electronics.



TOP VIEW



TOP VIEW



TOP VIEW

Transducer Spacing

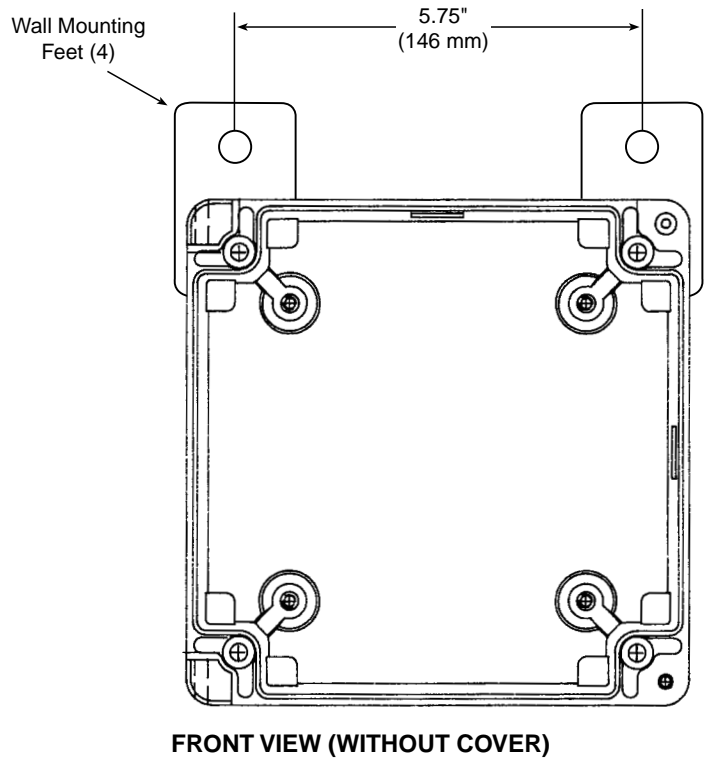
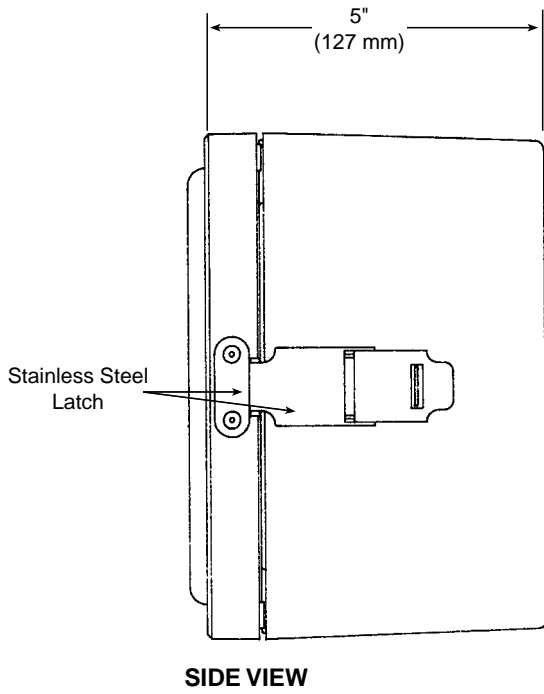
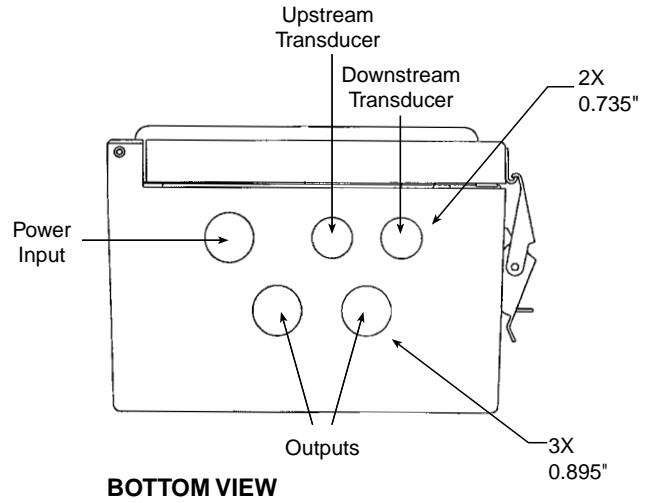
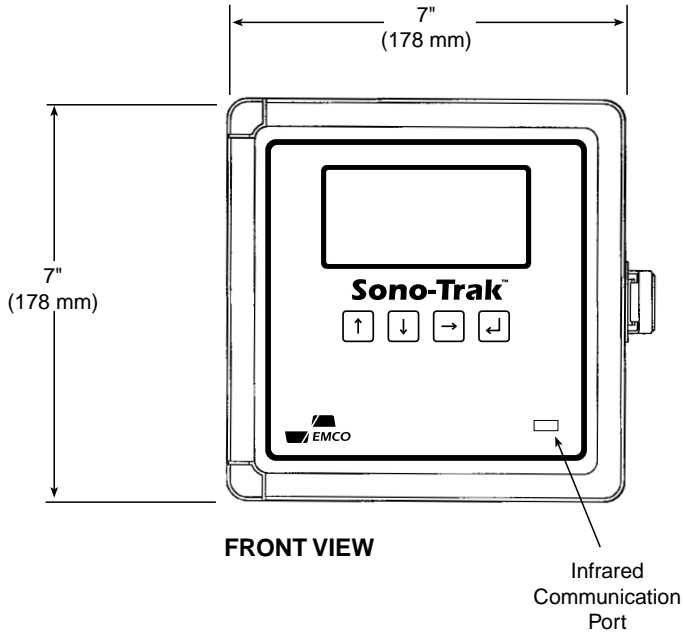
Fine Spacing Guidelines

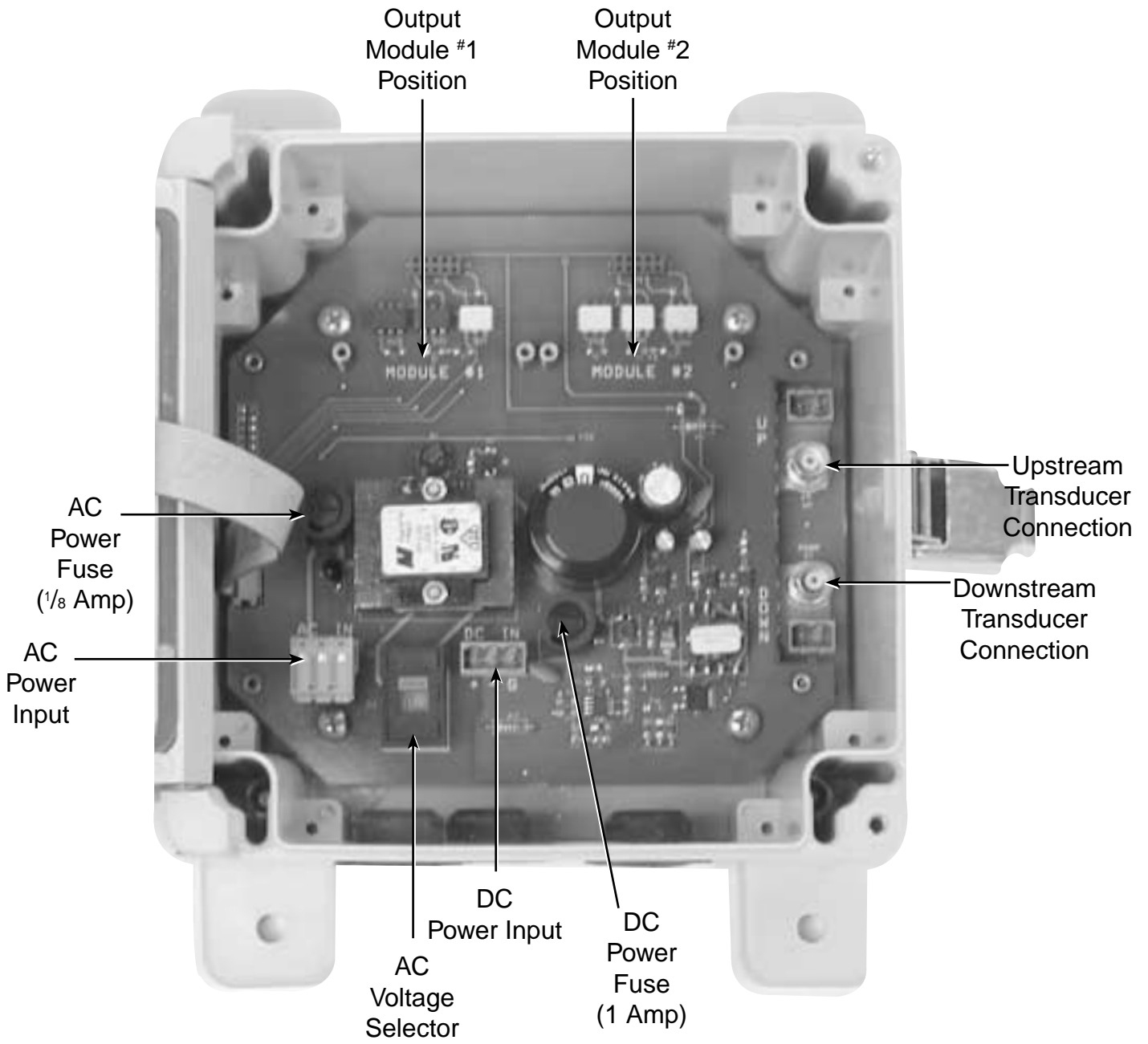
The exact transducer spacing “D” will be calculated by the electronics after pipe data is entered.



If the mounting distance calculated by the electronics is more than 0.25 inches different from the table, remove one transducer, re-apply the acoustic coupling grease and then reinstall the transducer using the new calculated distance.

Electronics






Power Supply Wiring


The Sono-Trak can be field configured for AC or DC power inputs. Use the supplied connector for wiring all power inputs. For AC power inputs, check that the AC voltage selector setting matches the AC line input voltage.

For DC power inputs, the power supply will need to provide 300 mA for 12 VDC operation or 150 mA for 24 VDC operation.



Sono-Trak™

EMCO Transit Time Ultrasonic Flowmeter




WARNING:


- Read operating instructions prior to installation and use.
- Disconnect unit from power prior to service.


AC POWER CONNECTION

	115 VAC	230 VAC
1	Line	Line 1
2	Neutral	Line 2
3	Ground	Ground



AC Voltage
Selector






AC Power Wires
(14-22 Gage)

DC POWER CONNECTION

	12 to 24 VDC
1	(+) positive
2	(-) negative
3	Unused



DC Power Wires
(14-22 Gage)

OPTIONAL I/O MODULE INSTALLATION

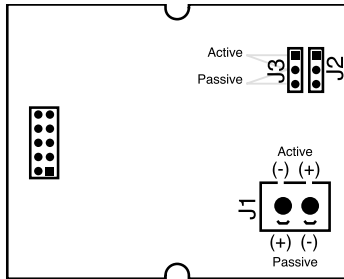
You do not need to disconnect unit from power when installing or removing any modules.

Insert module connector into empty I/O port connector and press in gently to seat. Secure module in place with supplied screws.

Label P/N 460250

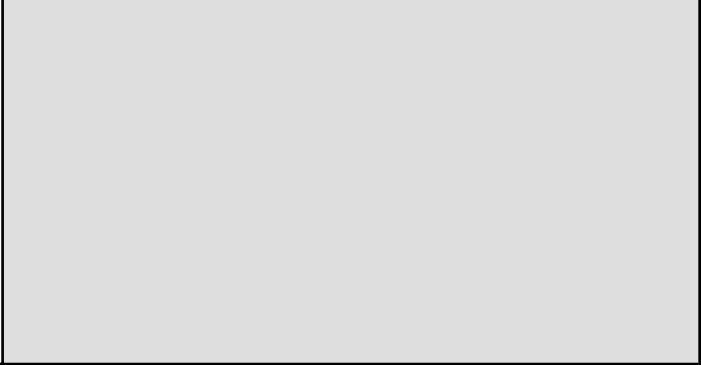
Output Module Wiring

4-20 mA Output

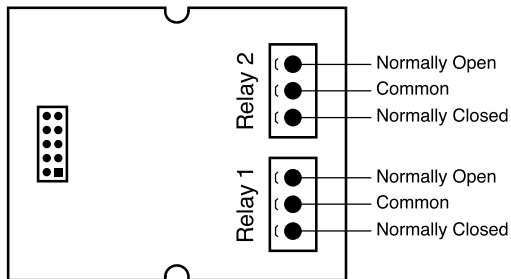


- Factory setting is 'active' output
- 'Passive' output setting requires external 24 VDC power.

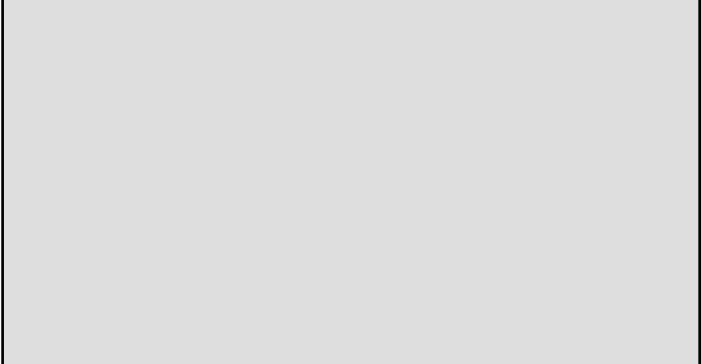
Frequency Output



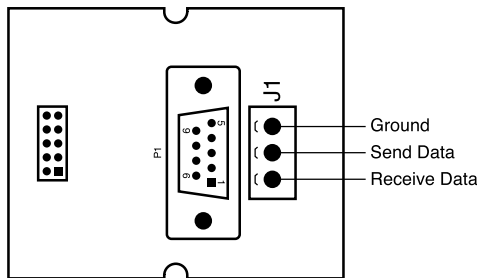
Dual Relay Output



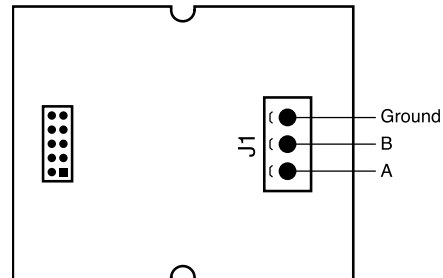
Dual RTD Output



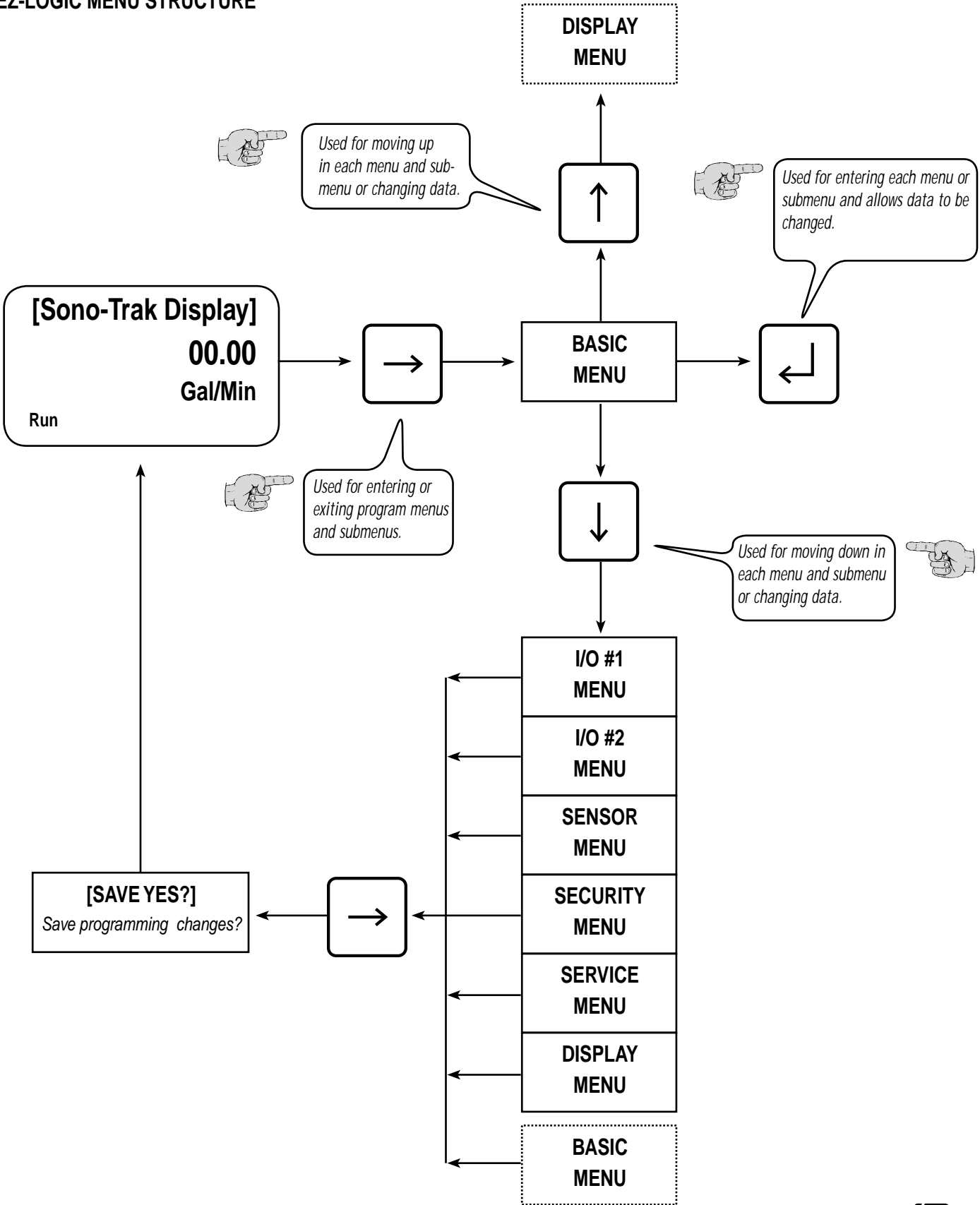
RS 232 Output



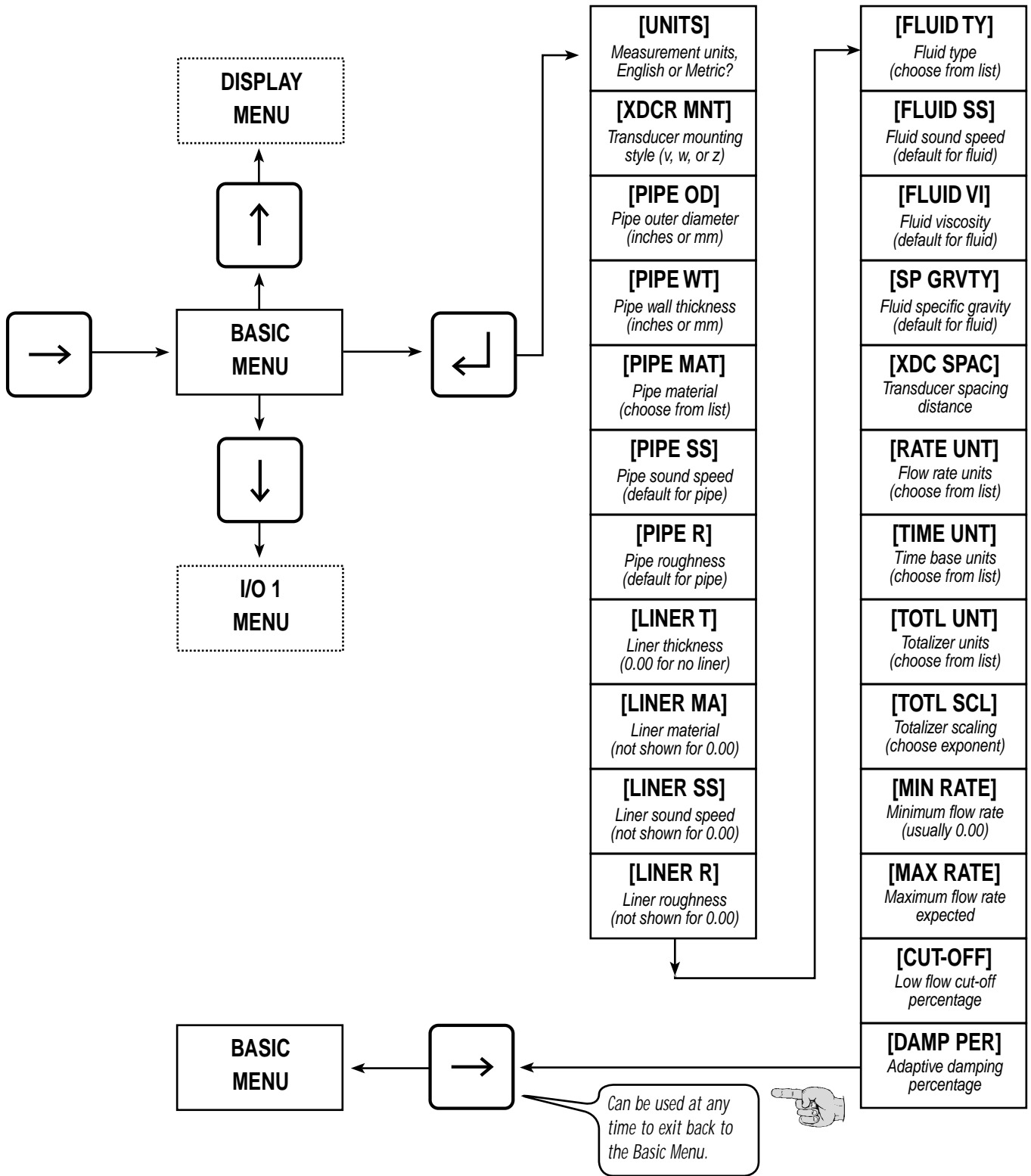
RS 485 Output






EZ-LOGIC MENU STRUCTURE





EZ-LOGIC BASIC MENU



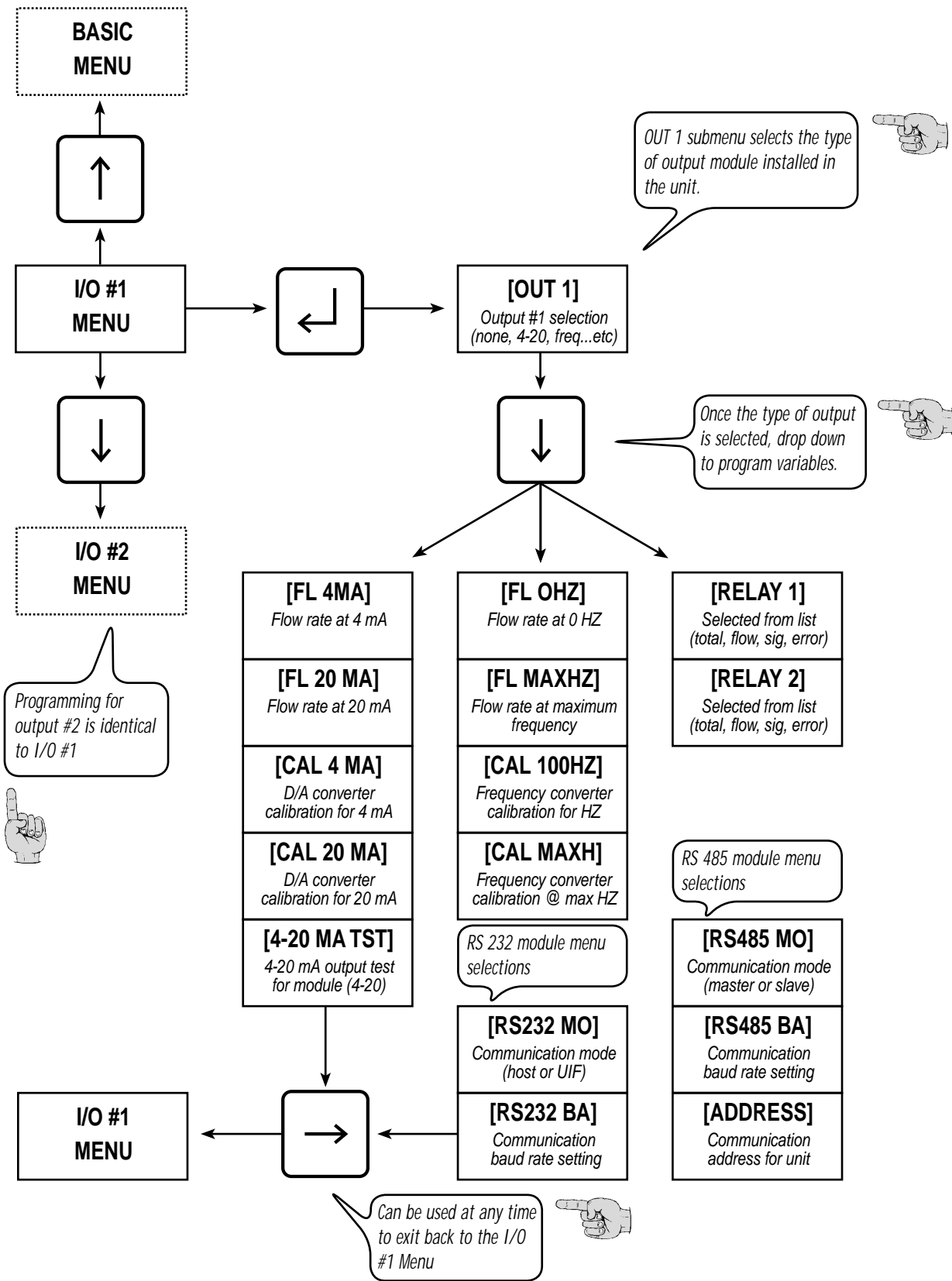
BASIC MENU SELECTIONS

Menu Item	Description	Selections	Factory Settings
UNITS	Flow measurement units	English or Metric	English
XDCR MNT	Transducer mounting style	W, V, or Z	V
PIPE OD	Pipe outside diameter	Inches or millimeters	6.625
PIPE WT	Pipe wall thickness	Inches or millimeters	0.135
PIPE MAT	Pipe material	Stainless Steel Carbon Steel Hastelloy C Cast Iron, Ductile Iron Copper, Brass, Aluminum PVC, PVDF, LDPE, HDPE, Polypropylene Fiberglass Other	Stainless
PIPE SS	Pipe material speed of sound	Default from material	10234 ft/sec
PIPE R	Pipe material roughness	Default from material	0.00015 in
LINER T	Liner thickness	Inches or millimeters	0.000 in.
LINER MA	Liner material selection (only displayed if liner thickness is not 0.000)	Rubber, Teflon, Ebonite, Tar Epoxy, Mortar (cement), Polyester, Neoprene, Linatex, Polyethylene, Polypropylene Other	N/A for 0.000 in. 
LINER SS	Liner material speed of sound (only displayed if liner thickness is not 0.000)	Default from material	N/A for 0.000 in. 
LINER R	Liner material roughness (only displayed if liner thickness is not 0.000)	Default from material	N/A for 0.000 in. 
FLUID TY	Fluid type	Water, Sea Water, Glycol, 50/50 Glycol/Water, Milk, Alcohol, Butane, Crude Oil, Fuel oil #2, Gasoline, Kerosene, Propane, Other	Water
FLUID SS	Fluid speed of sound	Default from fluid type	4863 ft/sec
FLUID VI	Fluid viscosity	Default from fluid type	0.9 cP

BASIC MENU SELECTIONS (Continued)




Menu Item	Description	Selections	Factory Settings
SP GRVTY	Fluid specific gravity	Default from fluid type	1.000
XDC SPAC	Transducer spacing distance	Inches or millimeters	4.06 in.
RATE UNT	Flow rate engineering units	Gallons, Liters, Mgal, Cubic Feet, Cubic Meters, Acre Feet, Oil Barrels, Liquid Barrels, Pounds, Kilograms, Feet, Meters	Gallons
TIME UNT	Time base engineering units	Second, Minute, Hour, Day	Minute
TOTL UNT	Totalizer engineering units	Gallons, Liters, Mgal, Cubic Feet, Cubic Meters, Acre Feet, Oil Barrels, Liquid Barrels, Pounds, Kilograms	Gallons
TOTL SCL	Totalizer scaling factor (in exponential notation) 	E-1 = (total x 0.1) E0 = (total x 1) E1 = (total x 10) E2 = (total x 100) E3 = (total x 1,000) E4 = (total x 10,000) E5 = (total x 100,000) E6 = (total x 1,000,000)	E0
MIN RATE	Minimum flow rate	Usually set to 0.0 Can also be set to a negative value for bi-directional flows.	0.0 gallons/min
MAX RATE	Maximum flow rate (Does not set any output scaling) 	Set to maximum expected flow rate.	2000.0 gallons/min
CUT-OFF	Low flow cut-off percentage	Setting is a (%) of the maximum flow rate.	1.5 %
DAMP PER	Adaptive dampening percentage	0-100%	80 %

EZ-LOGIC OUTPUT MENUS





OUTPUT MENU SELECTIONS

4-20 Output Module

Menu Item	Description	Selections	Factory Settings
FL 4MA	Flow rate setting at 4mA.	Usually set to 0.0 (can also be set to a negative value for bi-directional flows)	0.0
FL 20MA	Flow rate setting at 20mA.	Set to maximum desired flow rate.	2000.0
CAL 4MA	D/A converter calibration. Sets the number of counts the microprocessor must send to the current output circuit to generate 4mA.	Can be adjusted in the field if needed.  (operates only while in this display)	164
CAL 20MA	D/A converter calibration. Sets the number of counts the microprocessor must send to the current output circuit to generate 20mA.	Can be adjusted in the field if needed.  (operates only while in this display)	3833
4- 20 TST	4–20mA forced output test. Simulates a 4-20mA signal from the module. Can be used to check scaling of receiving electronics.	4mA to 20mA (1mA increments)  (operates only while in this display)	4

Frequency Output Module

Menu Item	Description	Selections	Factory Settings
FL 0HZ	Flow rate at 0Hz	Usually set to 0.0 (can also be set to a negative value for bi-directional flows)	0.0
FL MAXHZ	Flow rate at maximum frequency setting. (see frequency module for jumper selections 0-1,000, or 0-10,000Hz)	Set to maximum desired flow rate.	2000.0
CAL 100H	Frequency converter calibration for 10Hz or 100Hz. (dependant on jumper settings on module) 10 Hz for 0-1,000Hz scaling. 100 Hz for 0-10,000 Hz scaling.	Can be adjusted in field if needed.  (operates only while in this display)	
CAL MAXH	Frequency converter calibration for maximum frequency. (dependant on jumper settings on module)	Can be adjusted in field if needed.  (operates only while in this display)	

OUTPUT MENU SELECTIONS

Dual Relay Output Module

Menu Item	Description	Selections	Factory Settings
RELAY 1	Relay output #1 settings	None, Totalizer, Flow, Signal Strength, Errors (see sections listed below for programming)	None

[Relay 1]

TOTALIZE	Relay #1 set to the totalizer.		
TOT MULT	Totalizer Relay #1 output scaling multiplier.	0-32,000	0

[Relay 1]

FLOW	Relay #1 set to a high and low flow range.		
ON <	Flow rate setting for the relay output to turn "on". (Can be used as a high or low flow alarm)	Set By Customer (can also be set to a negative value for bi-directional flows)	0.0
OFF >	Flow rate setting for the relay output to turn "off". (Can be used as a high or low flow alarm)	Set by customer. (can also be set to a negative value for bi-directional flows)	0.0

OUTPUT MENU SELECTIONS**Dual Relay Output Module**

Menu Item	Description	Selections	Factory Settings
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[Relay 1]

SIG STR	Relay #1 set to a high and low transducer signal strength range.		
ON <	Transducer signal strength % setting for the relay output to turn "on". (Can be used as an empty pipe detection alarm)	0.0 to 100.0% (Set by customer)	0.0%
OFF >	Transducer signal strength % setting for the relay output to turn "off". (Can be used as an empty pipe detection alarm)	0.0 to 100.0% (Set by customer)	0.0%

[Relay 1]

ERRORS	Relay #1 to turn "on" if any errors are detected by the program.		
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[Relay 2]

Programming for Relay Output #2 is identical to Relay Output #1.

OUTPUT MENU SELECTIONS

BTU Output Module

Menu Item	Description	Selections	Factory Settings
RTD1 A	Calibration coefficient "A" for RTD input #1.		
RTD1 B	Calibration coefficient "B" for RTD input #1.		
RTD2 A	Calibration coefficient "A" for RTD input #2.		
RTD2 B	Calibration coefficient "B" for RTD input #2.		

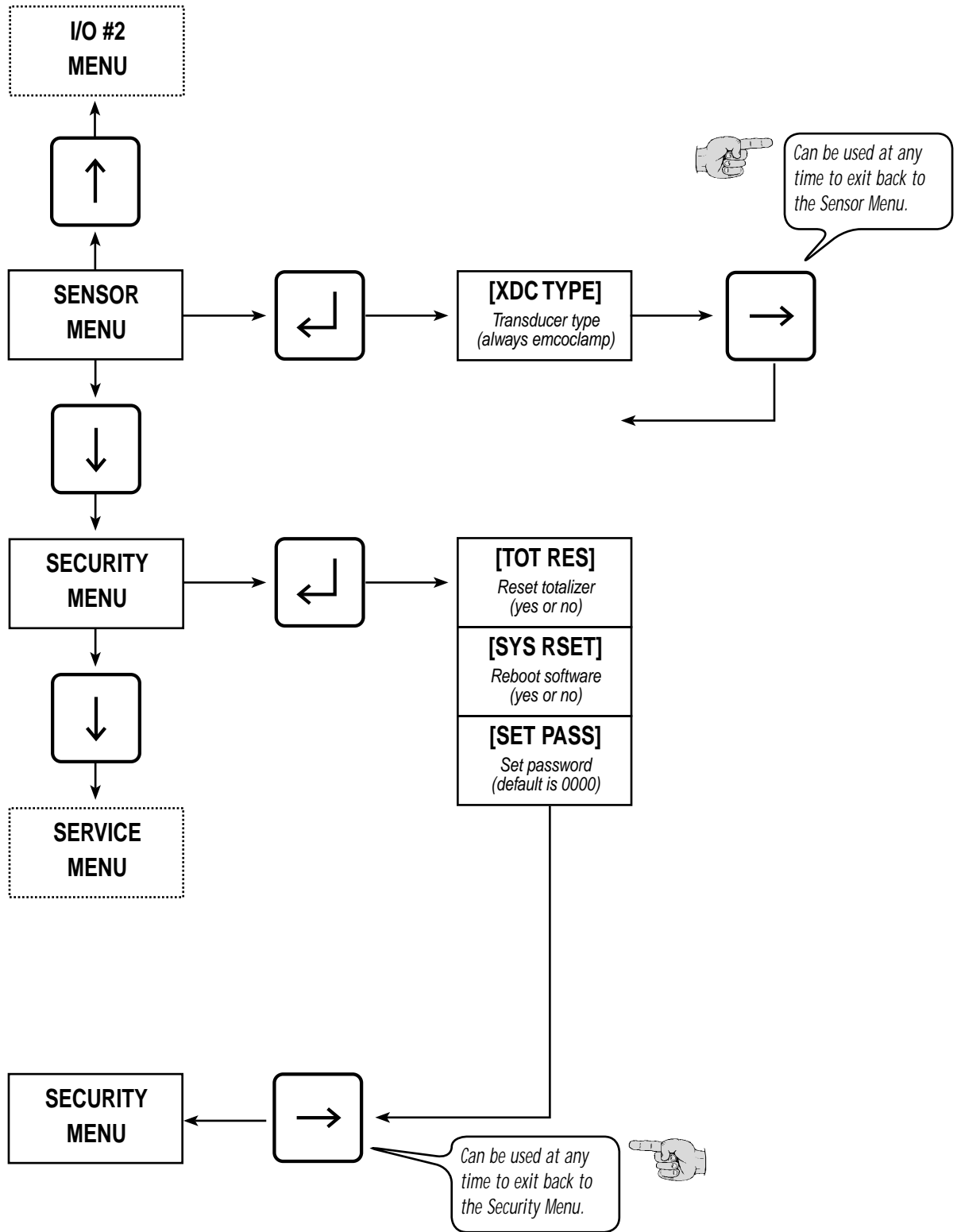
RS232 Output Module

Menu Item	Description	Selections	Factory Settings
RS232 MO	Communication mode (can be set to host or debug communications)	Host or UIF	Host
RS232 BA	Communication baud rate for the module.	19200 9600 2400 1200	9600


RS485 Output Module

Menu Item	Description	Selections	Factory Settings
RS485 MO	Communication mode (can be set to master or slave communications)	Master or Slave	Slave
RS485 BA	Communication baud rate for the module.	19200 9600 2400 1200	9600
SLAVES	Number of other electronics connected together using RS485 communications.	1 up to 8	1



EZ-LOGIC SENSOR MENU



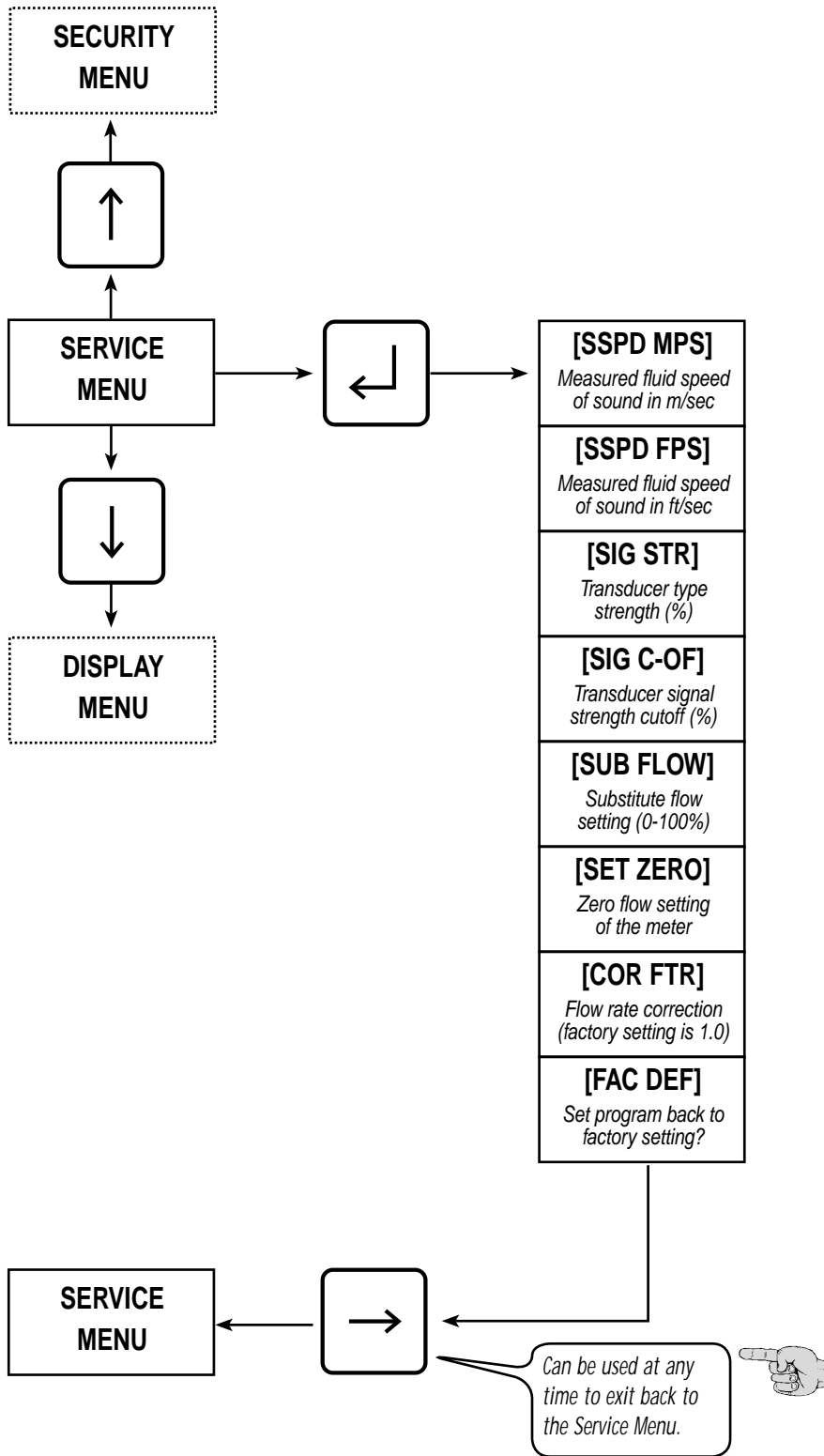
SENSOR MENU SELECTIONS

Menu Item	Description	Selections	Factory Settings
XDC Type	Transducer Type	Emcoclamp Dryspool Wetspool	Emcoclamp (Never change) 



SECURITY MENU SELECTIONS

Menu Item	Description	Selections	Factory Settings
TOT RES	Totalizer reset (Used to set the totalizer back to 0.00)	Yes or no	No
SYS RSET	Reboot software (Used to reset the electronics)  (Once "Yes" is selected, wait for 5 seconds and the electronics will reset)	Yes or no	No
SET PASS	Set program password (Used to protect program settings and totalizer)	Value set by user	0 (no protection) 

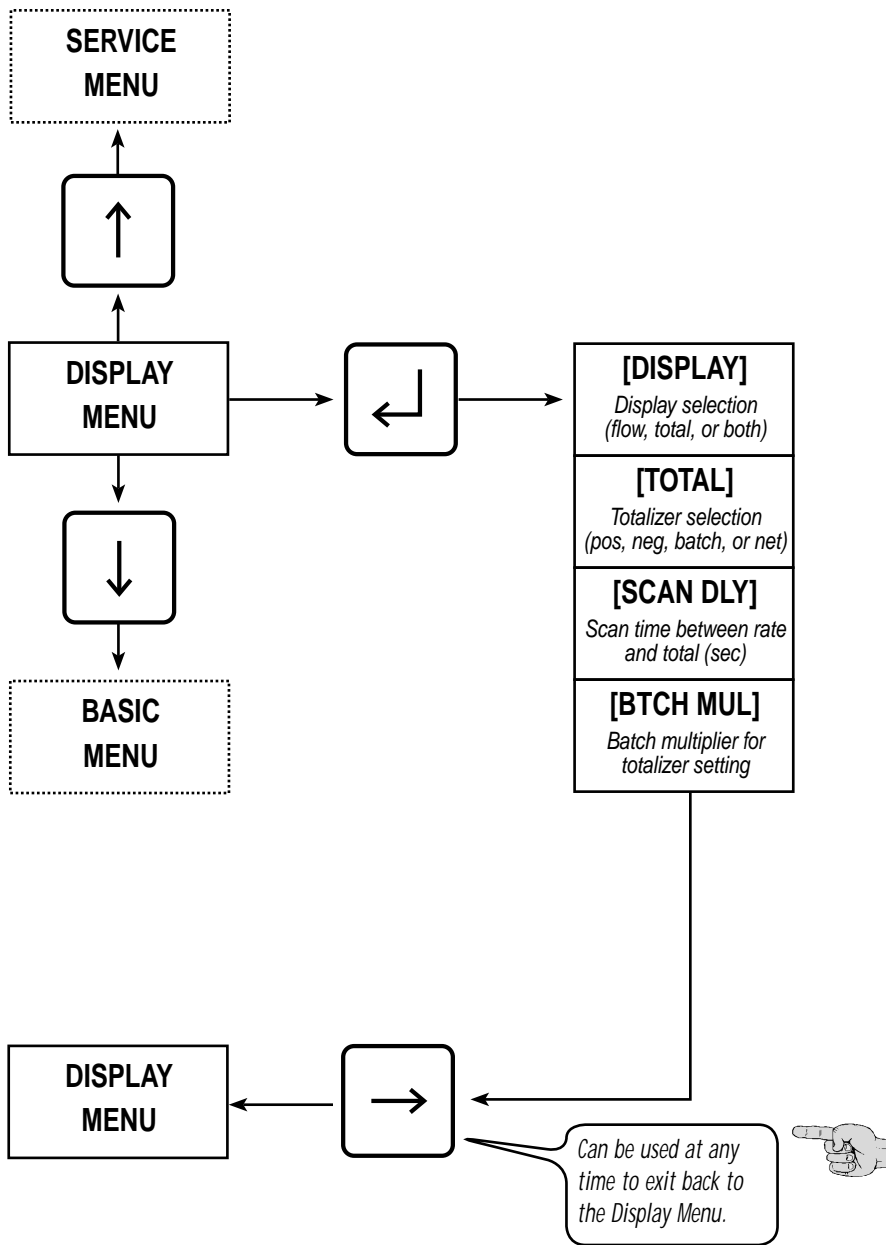
EZ-LOGIC SERVICE MENU



SERVICE MENU SELECTIONS

Menu Item	Description	Selections	Factory Settings
SSPD MPS	Measured fluid speed of sound in m /sec	No selections. Displayed value only.	N/A
SSPD FPS	Measured fluid speed of sound in ft /sec	No selections. Displayed value only.	N/A
SIG STR	Measured transducer signal strength percentage (0.5 to 98%)	No selections. Displayed value only.	N/A
SIG C-OF	Transducer signal strength cutoff percentage. Meter will read 0.00 if signal strength from transducer is below this value.	Usually not set below 1.0%	1%
SUB FLOW	Substitute flow setting for display and output simulation. (% of max flow in Basic Menu)  (Requires system restart in the Security Menu to simulate)	0-100%	0
SET ZERO	Zero flow setting for the meter. Used to improve low flow accuracy.  (should only be done at no flow)	Yes or no	No
COR FTR	Flow rate correction factor	0.5 – 1.5	1.000
FAC DEF	Sets programming back to factory default settings.	Yes or no	No

EZ-LOGIC DISPLAY MENU

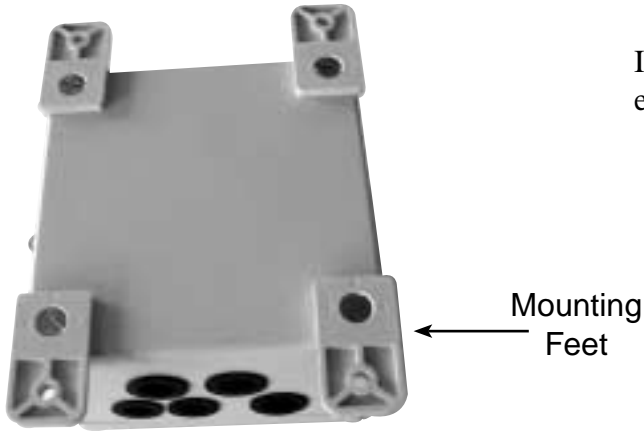


DISPLAY MENU SELECTIONS

Menu Item	Description	Selections	Factory Settings
DISPLAY	Display variable selection	Flow, Total, or Both	Both
TOTAL	Totalizer variable selection	Positive, Negative, Batch, or Net	Positive
SCAN DLY	Scan delay time between flow rate and total	1-10 seconds	5 seconds
BTCH MUL	Batch multiplier for totalizer settings (Only used for Relay Output)	1 –32000	1

W, V MOUNTING

STEP 1.



Install the four mounting feet supplied with the electronics enclosure.

STEP 2.

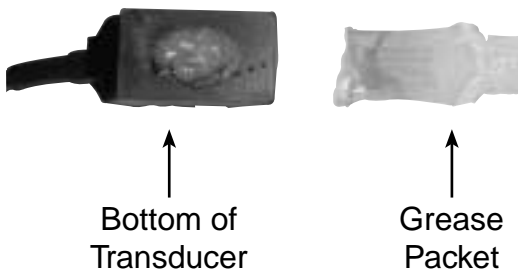


Apply power to the electronics and program for your specific application. The electronics will calculate the transducer spacing distance for step 6 in the Basic Menu section.




If power cannot be supplied during installation, the “coarse spacing” chart can be used on page 7, but you must check the spacing after the electronics are programmed.

STEP 3.



Using the supplied “pillow packs” of grease, apply one pack of grease to the lens of one of the transducers.

W, V MOUNTING

 Review page 6. for proper transducer orientation.

STEP 4.



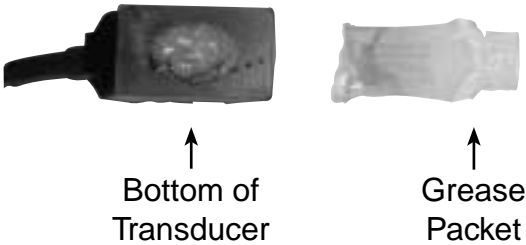
TOP VIEW OF PIPE

Attach the first transducer to the pipe using the quick-release clamp. For pipes larger than 12", the clamps should be connected together in order to wrap around the pipe. Tighten the clamp to prevent the transducer from moving.



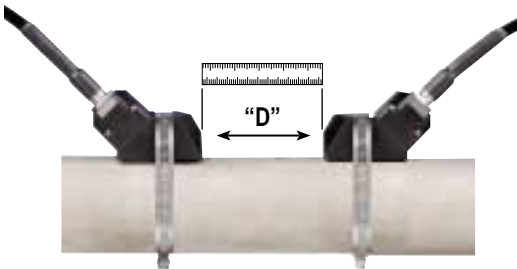
The clamp should be placed directly on the surface of the pipe and not over any insulation.

STEP 5.



Apply one pack of grease to the lens of the second transducer.

STEP 6.



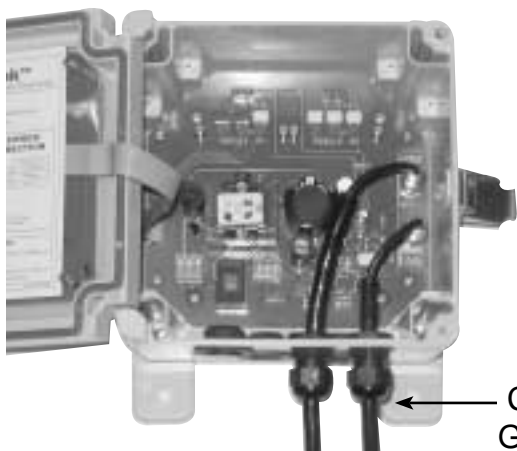
TOP VIEW OF PIPE

Attach the second transducer to the pipe. The transducers should be spaced "D" distance apart. Spacing distance is calculated by the electronics in the Basic Menu.



It is easier if the spacing distance is measured and marked on the pipe before installing the second transducer.

STEP 7.



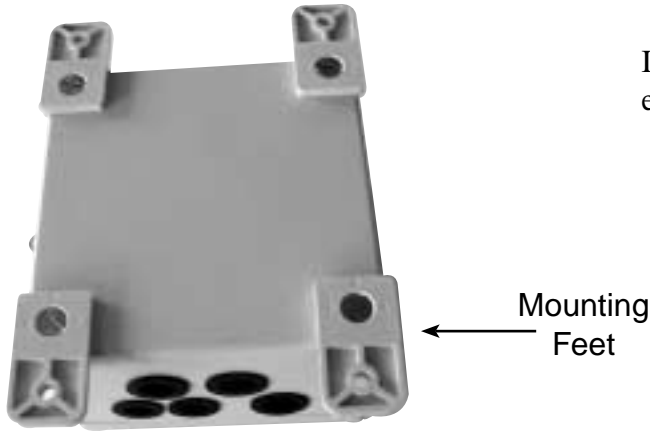
Connect transducer cables to the electronics using the cable glands and BNC connectors. Use the cable gland backing nuts to hold the glands to the enclosure.



Tighten the cable glands to prevent the cable from being pulled out of the enclosure.

Z MOUNTING

STEP 1.



Install the four mounting feet supplied with the electronics enclosure.

STEP 2.

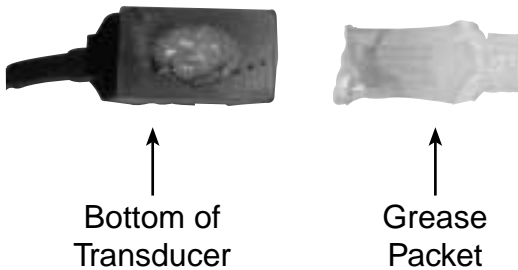


Apply power to the electronics and program for your specific application. The electronics will calculate the transducer spacing distance for step 6 in the Basic Menu section.




If power cannot be supplied during installation, the “coarse spacing” chart can be used on page 7, but you must check the spacing after the electronics are programmed.

STEP 3.



Using the supplied “pillow packs” of grease, apply one pack of grease to the lens of one of the transducers.

Z MOUNTING

 Review page 6. for proper transducer orientation.

STEP 4.



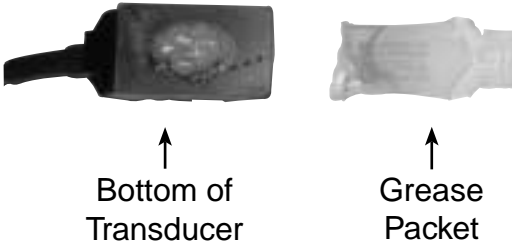
TOP VIEW OF PIPE

Attach the first transducer to the pipe using the quick-release clamp. For pipes larger than 12", the clamps should be connected together in order to wrap around the pipe. Tighten the clamp to prevent the transducer from moving.



The clamp should be placed directly on the surface of the pipe and not over any insulation.

STEP 5.

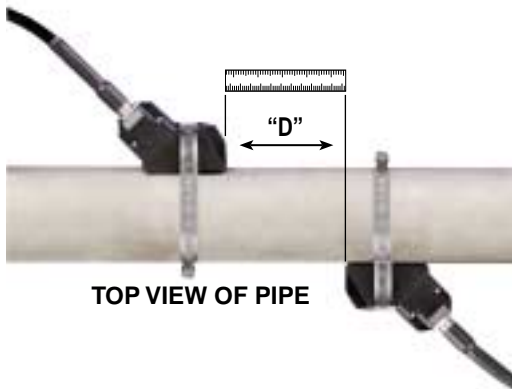


Bottom of Transducer

Grease Packet

Apply one pack of grease to the lens of the second transducer.

STEP 6.



TOP VIEW OF PIPE

Attach the second transducer to the pipe. The transducers should be spaced "D" distance apart. Spacing distance is calculated by the electronics in the Basic Menu.



It is easier if the spacing distance is measured and marked on the pipe before installing the second transducer. Review page 6 and 7 for proper mounting of "Z" configuration.

STEP 7.



Cable Glands

Connect transducer cables to the electronics using the cable glands and BNC connectors. Use the cable gland backing nuts to hold the glands to the enclosure.



Tighten the cable glands to prevent the cable from being pulled out of the enclosure.

SONO-TRAK MODEL CODE

Category	Description	Suffix Codes
Electronics	2 line backlit display with 4 button keypad ¹	ST-30
I/O Port 1	None 4-20 mA Output Frequency Output Dual Relay Output (Dry Contact) Dual RTD Input (limit 1 per unit) ² Data Logger (limit 1 per unit) ³ RS 232 Interface ³ RS 485 Interface ³	-N -A -F -R -BTU -DL -RS2 -RS4
I/O Port 2	None 4-20 mA Output Frequency Output Dual Relay Output (Dry Contact) Dual RTD Input (limit 1 per unit) ² Data Logger (limit 1 per unit) ³ RS 232 Interface ³ RS 485 Interface ³	-N -A -F -R -BTU -DL -RS2 -RS4
Process Temperature	-40 to 250° F (-40 to 120° C) -40 to 400° F (-40 to 205° C)	-250 -400
Transducers	Submersible	-1
Cable Length⁴	25' (7.6 m) 50' (15.2 m) 75' (22.8 m) 76 – 1000' (23.1 m – 304.8 m) (specify length)	-25 -50 -75 -xx
Pipe Clamp	2 – 12" (50 – 300 mm) 14 – 24" (350 – 600 mm) 26 – 36" (650 – 900 mm) 38 – 100" (950 – 2540 mm) (specify pipe size)	-12 -24 -36 -xx

Example

ST-30-A-N-250-1-25-12



Notes:

1. ST-30 electronics are wall mounted.
2. BTU option does not include RTD's.
3. Includes Windows® communication software program.
4. Cable length is per transducer (2 provided).

Approvals:

- CE
- FM Class I Div 2 (A, B, C, D)
- CSA Class I Div 2 (A, B, C, D)

- Available June 2000
- Pending
- Pending

ACCESSORIES

Description	Part Number
Windows® communication software for IR Port/RS232/RS485 modules	600110
Infrared serial communicator for wireless PC interface	1-800-138
Transducer cable conduit adapter ¾" NPT (requires 2 pieces)	340790

SPARE MODULES/ ELECTRONICS

Description	Part Number
4-20 mA Output	011148
Frequency/Pulse Output	011154
Dual Relay Output (Dry Contact)	011155
Dual RTD Input (limit 1 per unit)	011153
Data Logger (limit 1 per unit)	011164
RS 232 Interface	011151
RS 485 Interface	011156
Display Board	011146
Microprocessor Board	011145
Power Supply Board	011147

SPARE PARTS

Description	Part Number
Acoustic coupling grease (3oz)	1-685-163
Pipe clamps for 2 to 12 " (50 – 300 mm OD) (Requires 2 clamps)	1-410-635
Pipe clamps for 14 to 24" (350 – 600 mm OD) (Requires 4 clamps)	1-410-635
Pipe clamps for 26 to 36" (650 – 900 mm) (Requires 2 each)	1-410-642
Mounting feet for electronics	1-630-348
Sono-Trak I/O Manual	990632

STANDARD ANSI PIPE DATA

Identification					
Steel					
Nominal Pipe Sizes (inches)	Outside Diameter (inches)	Wall Thickness Designation	Sched. No.	Stainless Steel Sched.	Wall Thickness (inches)
2	2.375	—	—	5S	.065
		—	—	10S	.109
		STD	40	40S	.154
		XS	80	80S	.218
2.5	2.875	—	—	5S	.083
		—	—	10S	.120
3	3.500	—	—	5S	.083
		—	—	10S	.120
		STD	40	40S	.216
		XS	80	80S	.318
4	4.500	—	—	5S	.083
		—	—	10S	.120
		STD	40	40S	.226
		XS	80	80S	.300
5	5.536	—	—	5S	.083
		—	—	10S	.134
		STD	40	40S	.258
		XS	80	80S	.300
6	6.625	—	—	5S	.109
		—	—	10S	.134
		STD	40	40S	.258
		XS	80	80S	.432
8	8.625	—	—	5S	.109
		—	—	10S	.148
		—	20	—	.250
		—	30	—	.277
		STD	40	40S	.322
		—	60	—	.406
		XS	80	80S	.500
		—	—	—	—
10	10.750	—	—	5S	.134
		—	—	10S	.165
		—	20	—	.250
		—	30	—	.307
		STD	40	40S	.365
		—	60	80S	.500
		XS	80	XS	.594
		—	—	—	—

STANDARD ANSI PIPE DATA (Continued)

Nominal Pipe Sizes (inches)	Outside Diameter (inches)	Identification		Stainless Steel Sched.	Wall Thickness (inches)
		Wall Thickness Designation	Sched. No.		
12	12.750	—	—	5S	.156
		—	—	10S	.165
		—	20	—	.250
		—	30	—	.330
		STD	—	40S	.375
		—	40	—	.406
		XS	—	80S	.500
		—	60	—	.562
—	80	—	.688		
14	14.000	—	—	5S	.156
		—	—	10S	.188
		—	10	—	.250
		—	20	—	.312
		STD	30	—	.375
		XS	40	—	.438
		—	—	—	.500
		XXS	60	—	.594
—	—	—	.625		
—	80	—	.750		
16	16.000	—	—	5S	.156
		—	—	10S	.188
		—	10	—	.250
		—	20	—	.312
		STD	30	—	.375
		—	40	—	.500
		XS	60	—	.656
		—	80	—	.844
18	18.000	—	—	5S	.165
		—	—	10S	.188
		—	10	—	.250
		—	20	—	.312
		STD	—	—	.375
		—	30	—	.438
		XS	—	—	.500
		—	40	—	.562
—	60	—	.750		
—	80	—	.938		

STANDARD ANSI PIPE DATA (Continued)

Nominal Pipe Sizes (inches)	Outside Diameter (inches)	Identification		Stainless Steel Sched.	Wall Thickness (inches)
		Wall Thickness Designation	Sched. No.		
20	20.000	—	—	5S	.188
		—	—	10S	.218
		—	10	—	.250
		STD	20	—	.375
		XS	30	—	.500
		—	40	—	.594
		—	60	—	.812
		—	80	—	1.301
22	22.000	—	—	5S	.188
		—	—	10S	.218
		—	10	—	.250
		STD	20	—	.375
		XS	30	—	.500
		—	60	—	.875
		—	80	—	1.301
		24	24.000	—	—
—	10			10S	.250
STD	—			—	.375
XS	20			—	.500
—	30			—	.562
—	40			—	.688
—	60			—	.969
—	80			—	1.219
26	26.000	—	10	—	.312
		STD	—	—	.375
		XS	20	—	.500
28	28.000	—	10	—	.312
		STD	—	—	.375
		XS	20	—	.500
		—	30	—	.625
30	30.000	—	—	5S	.250
		—	10	10S	.312
		STD	—	—	.375
		XS	20	—	.500
		—	30	—	.625
		—	40	—	.750

STANDARD ANSI PIPE DATA (Continued)

Nominal Pipe Sizes (inches)	Outside Diameter (inches)	Identification		Stainless Steel Sched.	Wall Thickness (inches)
		Wall Thickness Designation	Sched. No.		
32	32.000	—	10	—	.312
		STD	—	—	.375
		XS	20	—	.500
		—	30	—	.625
		—	40	—	.688
34	34.000	—	10	—	.344
		STD	—	—	.375
		XS	20	—	.500
		—	30	—	.625
		—	40	—	.688
36	36.000	—	10	—	.312
		STD	—	—	.375
		XS	20	—	.500
		—	30	—	.625
42	42.000	—	40	—	.750
		STD	—	—	.375
		XS	20	—	.500
		—	30	—	.625
		—	40	—	.750
48	48.000	STD	—	—	.375
		XS	—	—	.500

STANDARD CAST IRON PIPE



O.D. = Outside Diameter

W.T. = Wall Thickness

Nominal Pipe Sizes (inches)	Class A O.D.	Class A W.T.	Class B O.D.	Class B W.T.	Class C O.D.	Class C W.T.	Class D O.D.	Class C W.T.
3	3.80	0.39	3.96	0.42	3.96	0.45	3.96	0.48
4	4.80	0.42	5.00	0.45	5.00	0.40	5.00	0.52
6	6.90	0.44	7.10	0.48	7.10	0.51	7.10	0.55
8	9.05	0.46	9.05	0.51	9.30	0.56	9.30	0.60
10	11.10	0.50	11.10	0.57	11.40	0.62	11.42	0.68
12	13.20	0.54	13.20	0.62	13.50	0.68	13.50	0.75
14	15.30	0.57	15.30	0.66	15.65	0.74	15.65	0.82
16	7.40	0.60	17.40	0.70	17.80	0.80	17.80	0.89
18	19.50	0.64	19.50	0.75	19.92	0.87	19.92	0.96
20	21.60	0.67	21.60	0.80	22.06	0.92	22.06	1.03
24	25.80	0.76	25.80	0.89	26.32	1.05	26.32	1.16
30	31.74	0.88	32.00	1.03	32.40	1.20	32.74	1.37
32	37.96	0.99	38.30	1.15	38.70	1.36	39.16	1.58
42	44.20	1.10	44.50	1.28	45.10	1.54	45.58	1.78
48	50.50	1.26	50.80	1.42	51.40	1.71	51.98	1.99
54	56.66	1.35	57.10	1.55	57.80	1.90	58.40	2.23
60	62.80	1.39	63.40	1.67	64.20	2.00	64.82	2.38
72	75.34	1.62	76.00	1.95	76.88	2.39		
84	87.54	1.72	88.54	2.22				

Nominal Pipe Sizes (inches)	Class E O.D.	Class E W.T.	Class E O.D.	Class E W.T.	Class G O.D.	Class G W.T.	Class H O.D.	Class H W.T.
3								
4								
6	7.22	.58	7.22	0.61	7.38	0.65	7.38	0.69
8	9.42	0.66	9.42	0.66	9.60	0.75	9.60	0.80
10	11.60	0.74	11.60	0.80	11.84	0.86	11.84	0.92
12	13.78	0.82	13.78	0.89	14.08	.097	14.08	1.04
14	15.98	0.90	15.98	0.99	16.32	1.07	16.32	1.16
16	18.16	0.90	18.16	1.08	18.54	1.18	18.54	1.27
18	20.34	1.07	20.34	1.17	20.78	1.28	20.78	1.39
20	22.54	1.15	22.54	1.27	23.02	1.39	23.02	1.51
24	26.90	1.31	26.90	1.45	27.76	1.75	27.76	1.88
30	33.10	1.55	33.46	1.73				
32	39.60	1.80	40.04	2.02				
42								
48								
54								
60								
72								
84								

STANDARD DUCTILE IRON PIPE


Nominal Pipe Sizes (inches)	Outside Diameter (inches)	Pipe Wall Thickness		
		Class 50	Class 51	Class 52
3	3.96		0.25	0.28
4	4.80		0.26	0.29
6	6.90	0.25	0.28	0.31
8	9.05	0.27	0.30	0.33
10	11.10	0.29	0.32	0.35
12	13.20	0.31	0.34	0.37
14	15.30	0.33	0.36	0.39
16	17.40	0.34	0.37	0.40
18	19.50	0.35	0.38	0.41
20	21.60	0.36	0.39	0.42
24	25.80	0.38	0.41	0.44

Nominal Pipe Sizes (inches)	Outside Diameter (inches)	Pipe Wall Thickness			
		Class 53	Class 54	Class 55	Class 56
3	3.96	0.31	0.43	0.37	0.40
4	4.80	0.32	0.35	0.38	0.41
6	6.90	0.34	0.37	0.40	0.43
8	9.05	0.36	0.39	0.42	0.45
10	11.10	0.38	0.44	0.47	
12	13.20	0.40	0.43	0.46	0.49
14	15.30	0.42	0.45	0.48	0.51
16	17.40	0.43	0.46	0.49	0.52
18	19.50	0.44	0.47	0.50	0.53
20	21.60	0.45	0.48	0.51	0.54
24	25.80	0.47	0.50	0.53	0.56
30	32.00	0.51	0.55	0.59	0.63
36	38.30	0.58	0.63	0.68	0.73
42	44.50	0.65	0.71	0.77	0.83
48	50.80	0.72	0.79	0.86	0.93
54	57.10	0.81	0.89	0.97	1.05

TROUBLE SHOOTING CHART

Problem	Possible Reason	Solutions
Blank Display	<ol style="list-style-type: none"> 1. Insufficient supply voltage. 2. AC voltage selector set incorrectly. 3. Blown power input fuse. 	<ol style="list-style-type: none"> 1. Using a multimeter, verify supply voltage on the power supply board is live. 2. Check AC input voltage selector is set for AC supply voltage. 3. Remove AC or DC input fuse and visually inspect.
No flow reading (Transducer signal strength < 1.5%)	<ol style="list-style-type: none"> 1. Empty pipe. 2. Transducers not connected. 3. Transducer acoustic coupling grease not used. 4. Transducer spacing distance is not correct. 5. Transducer mounting style is not providing a strong enough signal. 6. Application problem. 	<ol style="list-style-type: none"> 1. Verify that the pipe is full of fluid. 2. Verify that the transducer cables are connected to the electronics. 3. Visually check that transducers have been mounted using grease. 4. Re-check transducer spacing distance calculated by the electronics. 5. Re-mount transducers in "Z" configuration to provide maximum signal strength. 6. Consult factory with application information.
No flow reading (Transducer signal strength > 1.5%)	<ol style="list-style-type: none"> 1. No flow in pipe. 2. Low flow cutoff set too high. 	<ol style="list-style-type: none"> 1. Verify that the pipe has flow. 2. Check program setting of the low flow cutoff in the Basic Menu.
Displayed measurement is not accurate (Transducer signal strength < 97%)	<ol style="list-style-type: none"> 1. Negative flow rate displayed. 2. Programming incorrect. 3. Insufficient straight-run piping. 4. Zero setting of meter was not correct. 5. Reference measurement may not be accurate 	<ol style="list-style-type: none"> 1. Verify direction of flow and then swap transducer cable connections to correct flow reading. 2. Verify pipe dimensions, material and fluid information is programmed correctly in the Basic Menu. 3. Consult piping guideline section for appropriate straight-run examples. 4. At no flow conditions, "zero" the meter in the Service Menu. 5. Consult factory with application information.
Displayed measurement is not accurate (Transducer signal strength > 97%)	<ol style="list-style-type: none"> 1. Transducer signal strength too high. Input signal is being "clipped" off by electronics. 	<ol style="list-style-type: none"> 1. Re-mount transducers in "W" configuration to reduce signal strength. (Electronics programming must be changed to calculate new transducer mounting distance for "W" configuration).
Output signal Inaccurate. (4-20mA, Frequency, Dual Relay)	<ol style="list-style-type: none"> 1. Basic programming incorrect. 2. Output programming incorrect. 3. Calibration factors have been changed. 	<ol style="list-style-type: none"> 1. Verify pipe dimensions, material and fluid information is programmed correctly in the Basic Menu. 2. Verify that the output module installed in the electronics has been correctly programmed in the Output Menu. 3. Check the module calibration factors in the Output Menu using a multimeter.
Unstable flow signal	<ol style="list-style-type: none"> 1. Insufficient straight-run piping. 2. Dampening set too low for application. 3. Too much air in fluid. 	<ol style="list-style-type: none"> 1. Consult piping guideline section for appropriate straight-run examples. 2. Increase the adaptive dampening in the Basic Menu. 3. Try another section of pipe for better results.

TROUBLE SHOOTING CHART (Continued)

Problem	Error Code	Definition
<p>Error code displayed</p>  <p>(All displayed error codes require a system reset or changes in programming)</p>	<ol style="list-style-type: none"> 1. Error 1001 2. Error 1002 3. Error 3001 4. Error 3002 5. Error 3003 6. Error 3004 7. Error 3005 8. Error 3006 9. Error 4001 	<ol style="list-style-type: none"> 1. System tables changed 2. System configuration changed 3. Invalid hardware configuration 4. Invalid system configuration 5. Invalid strategy file 6. Invalid calibration data 7. Invalid speed of sound calibration data 8. Bad system tables 9. Flash memory full (cannot store configuration)

Terms and Conditions of Warranty

"SELLER" shall refer to Engineering Measurements Company and subsidiaries.

SELLER warrants that its services and products, including those furnished by SELLER for maintenance, modification and overhaul, at time of delivery or performance, are free of defects in workmanship and material and fit for the uses set forth in SELLER's catalog or in contract specifications under the normal use and service for which they are intended. This warranty is conditioned upon the Application Data furnished by BUYER to SELLER. Application of the products for conditions not accurately disclosed and documented to SELLER in the Application Data voids this warranty.

The entire warranty obligation of SELLER is limited to the repair or replacement, at SELLER's option, of products or parts (examination of which shall disclose to SELLER's satisfaction that it is defective) returned, transportation prepaid, to SELLER's plant, properly identified, within one (1) year for Turbine, Piston, Helix, Magnetic and Coriolis flowmeters, Gate Valves, Temperature Transmitters and Pressure Transmitters, or within two (2) years for all other products (unless otherwise noted) after the shipment from either the plant or the distributor, whichever date is later (unless stated otherwise in the SELLER's Proposal/Acceptance). BUYER must obtain the approval of SELLER and a return authorization number prior to shipment. Certification as to initial date of installation must accompany material returned for warranty repair. Warranty does not apply to products or parts not manufactured by SELLER, and SELLER shall not be responsible for the expense of removal or installation of any defective, repaired or replaced part, or for transportation to or from its plant.

BUYER assumes the risk and expense of equipment returned to SELLER, which must be clearly identified, and instructions must be furnished by BUYER for reshipment to BUYER of repaired or replaced equipment.

Alteration or removal of serial numbers or other identification marks renders this warranty void. Adjustments under this warranty will not be permitted on products or components which have been abused, altered, improperly handled or installed, or units which have not been operated in accordance with SELLER's instructions, or when the product or part is damaged during the warranty period due to causes other than ordinary wear and tear to the product including, but not limited to, accidents, transportation, neglect, misuse, use of the product for any purpose other than that for which it was designed, or Acts of God.

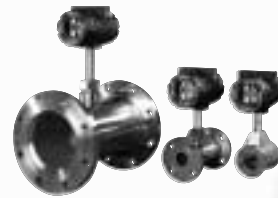
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Providing innovative flowmeter products and services for over three decades . . .

Engineering Measurements Company (EMCO) is a long established manufacturer of precision flowmeters for liquid, gas, and steam applications for commerce and industry. Manufacturing under an ISO 9001 certified quality system, which includes extensive flow calibration capability, engineering, applications, and service, underpins a world-wide sales and service organization totally focused on providing the best flowmeters and customer service in the industry.

- ▶ Manufacturing is housed in a modern plant located in Longmont, Colorado
- ▶ Modern clean-room, mechanized assembly equipment, and computer based testing ensure the highest quality product
- ▶ Trained professional flow specialists and technicians offer timely customer assistance
- ▶ Factory trained and certified field technicians provide product support services



Vortex PhD™ Inline Vortex



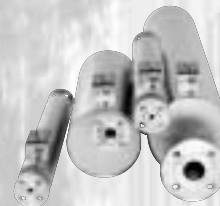
V-Bar™
Insertion
Vortex



Turbo-Bar™
Insertion
Turbine



MAGFLO® Electromagnetic



Coriolis Mass



PDH Helix



Sono-Trak™



PDP Piston



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Engineering Measurements Company

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