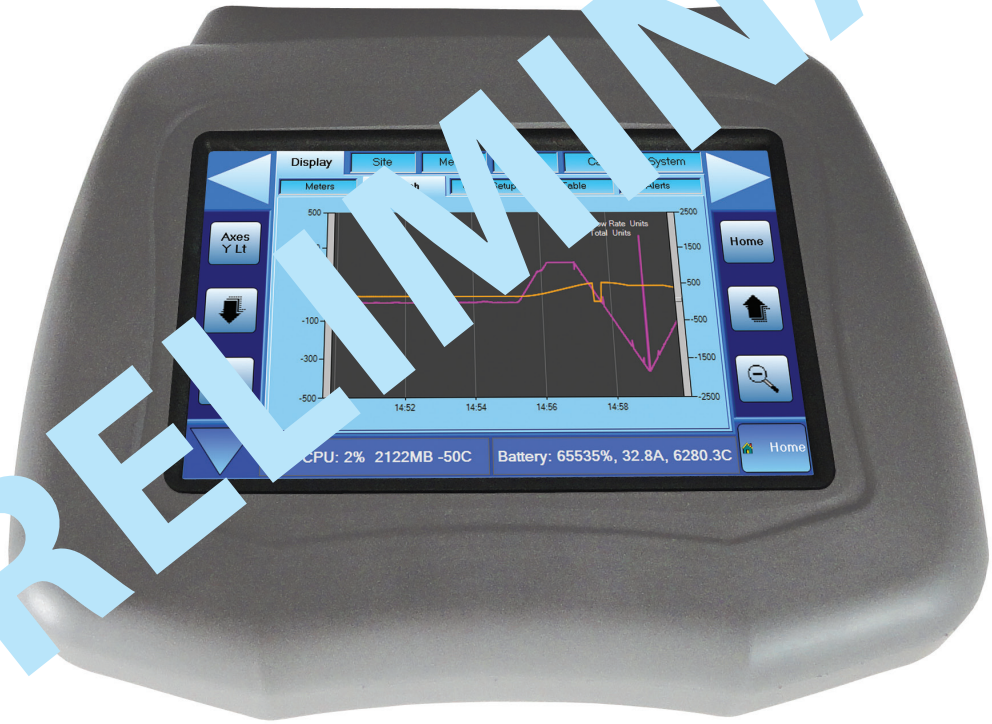
Dynasonics®

Operator's Manual

DXN™

Portable Ultrasonic Measurement System



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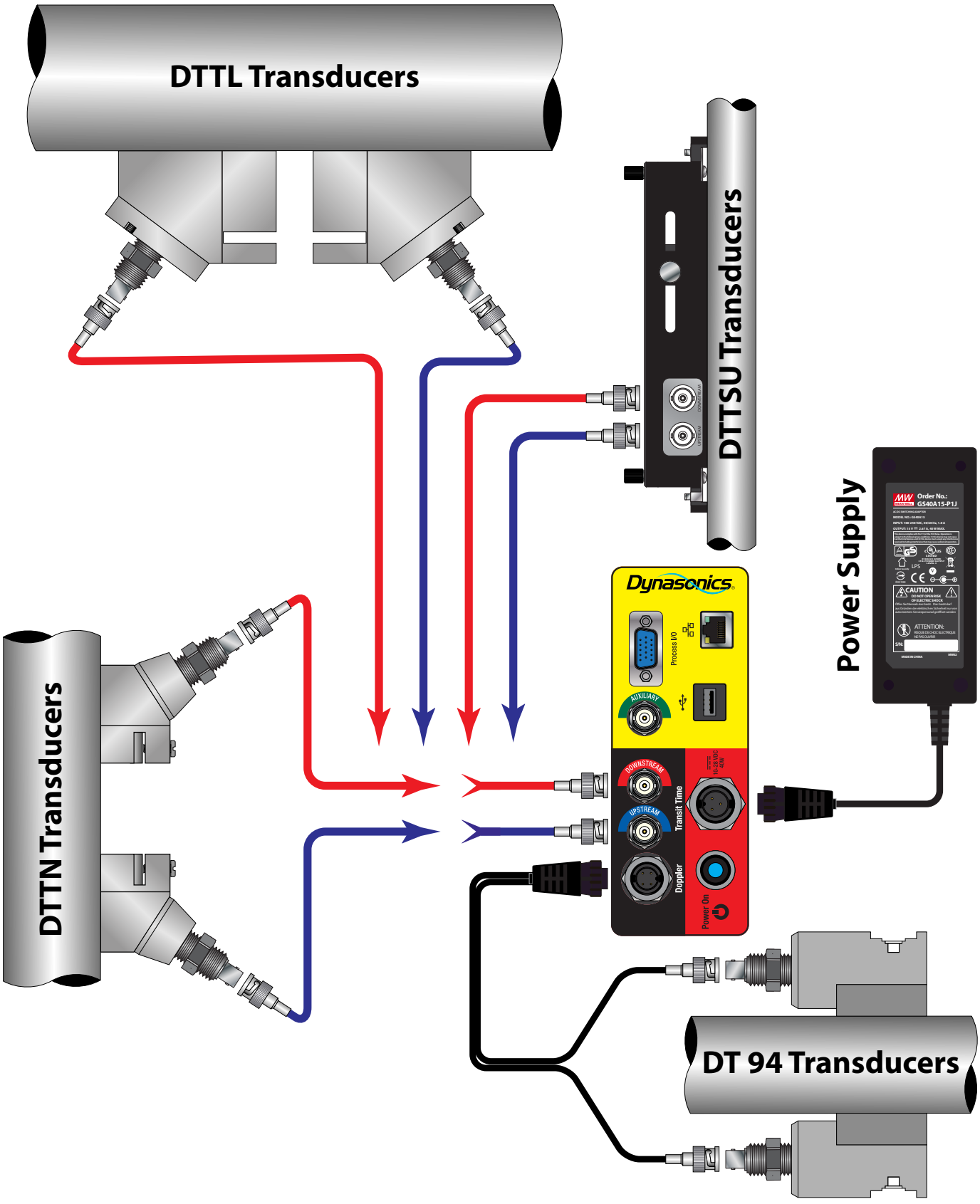


DXN Transducer - Connection Diagram

QUICK-START OPERATING INSTRUCTIONS

This manual contains detailed operating instructions for all aspects of the DXN instrument. The following condensed instructions are provided to assist the operator in getting the instrument started up and running as quickly as possible. This pertains to basic operation only. If specific instrument features are to be used or if the installer is unfamiliar with this type of instrument, refer to the appropriate section in the manual for complete details.

TRANSDUCER LOCATION

1) In general, select a mounting location on the piping system with a minimum of **10** pipe diameters (10 × the pipe inside diameter) of straight pipe upstream and **5** straight diameters downstream. See ***Table Q.1*** for additional configurations.
2) If the application requires DTTN or DTTL transit time transducers select a mounting method for the transducers based on pipe size and liquid characteristics. See ***Table 3.8***. Transit time transducer configurations are illustrated in ***Figure Q.1*** below.

NOTE: *Transit time setups require information supplied by the DXN meter itself so it will be necessary to power on the unit, at least temporarily, to obtain the setup information.*

3) For transit time operation enter the following data into the DXN transmitter via the touchscreen software utility:

1. Transducer mounting method
2. Pipe O.D. (Outside Diameter)
3. Pipe wall thickness
4. Pipe material
5. Pipe sound speed*
6. Pipe relative roughness*
7. Pipe liner thickness
8. Pipe liner material
9. Fluid type
10. Fluid sound speed*
11. Fluid viscosity*
12. Fluid specific gravity*

* Nominal values for these parameters are included within the DXN operating system. The nominal values may be used as they appear or may be modified if the exact system values are known.

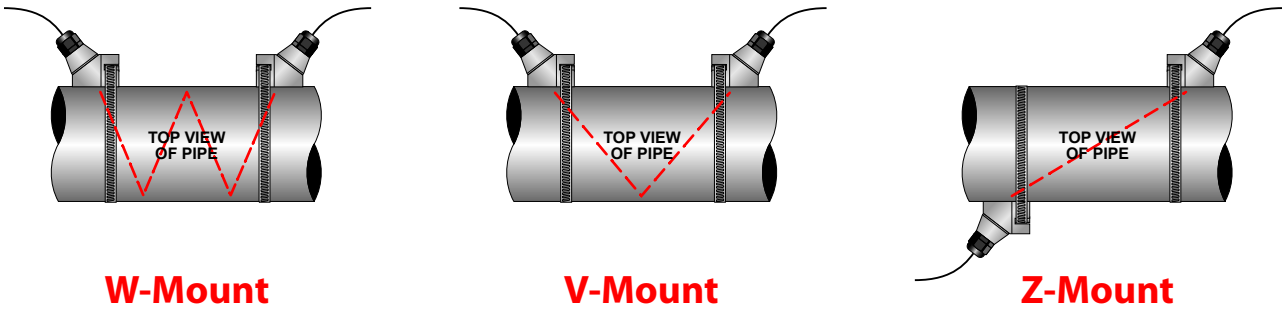


FIGURE Q.1 - TRANSIT TIME TRANSDUCER MOUNTING CONFIGURATIONS

4) Record the value calculated and displayed as **Required Spacing** in the **Site Group ► Transit Page**.

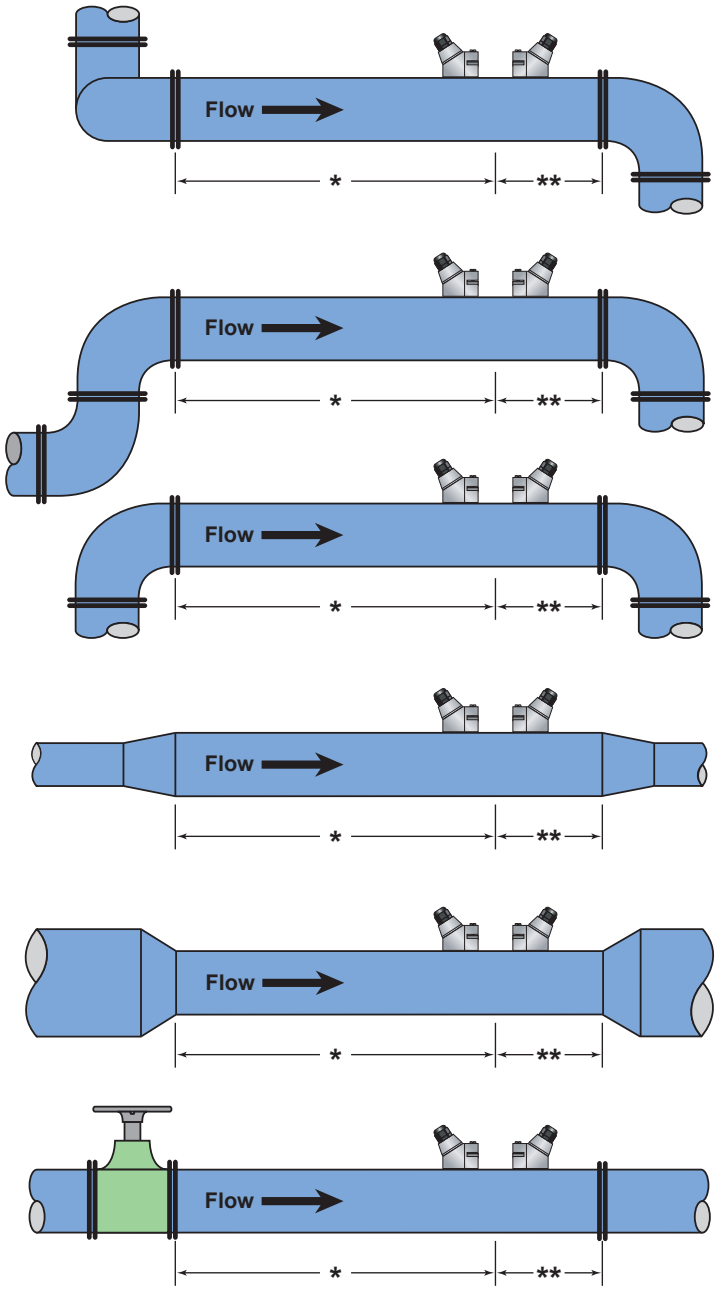
Piping Configuration and Transducer Positioning	Upstream Pipe Diameters *	Downstream Pipe Diameters **
	24	5
	14	5
	10	5
	10	5
	10	5
	24	5

TABLE Q.1 - PIPING CONFIGURATION AND TRANSDUCER POSITIONING

PIPE PREPARATION AND TRANSDUCER MOUNTING

DTTN and DTTL Transit Time Transducers

1) During this procedure the flow meter's signal quality value should be observed. This value is available on the DXN **Display Tab ► Meters Page** where "TT Signal Quality" is one of the parameters that can be shown.
2) The pipe surface where the transducers are to be mounted must be clean and dry. Remove scale, rust or loose paint to ensure satisfactory acoustic conduction. Wire brushing the rough surfaces of pipes to smooth bare metal may also be useful. Plastic pipes do not require preparation other than cleaning.
3) Apply a single ½" (12 mm) wide by approximately ⅛" thick bead of acoustic couplant grease to the upstream transducer and secure it to the pipe with a mounting strap.
4) Apply acoustic couplant grease to the downstream transducer and press it onto the pipe using hand pressure at the calculated lineal distance.
5) Space the transducers according to the recommended values found during programming. Secure the transducers with the mounting straps at these locations.

DTTSU Universal Small Pipe Transit Time Transducers

1) During this procedure the flow meter's signal quality value should be observed. This value is available on the DXN **Display Tab ► Meters Page** where "TT Signal Quality" is one of the parameters that can be shown.
2) The pipe surface where the transducers are to be mounted must be clean and dry. Remove scale, rust or loose paint to ensure satisfactory acoustic conduction. Wire brushing the rough surfaces of pipes to smooth bare metal may also be useful. Plastic pipes do not require preparation other than cleaning.
3) Set the downstream transducer spacing to the value found on the **Site Group ► Transit Page**.
4) Apply a single ½" (12 mm) wide by approximately ⅛" thick bead of acoustic couplant grease to the face of each transducer and secure it to the pipe with attachment chains.
5) Tighten the two thumb screws evenly so that the acoustic coupling grease begins to flow out from the edges of the transducer and from the gap between the transducer and the pipe. **Do not over tighten**.

NOTE: *All DTTSU transducers use* ***V-****Mount configuration.*

DT94 Doppler Transducers

1) In general, select a mounting location on the piping system with a minimum of 10 pipe diameters (10 × the pipe inside diameter) of straight pipe upstream and 5 straight diameters downstream. See ***Table Q.1*** for additional configurations.
2) The pipe surface, where the transducers are to be mounted, must be clean and dry. Remove scale, rust or loose paint to ensure satisfactory acoustic conduction. Wire brushing the rough surfaces of pipes to smooth bare metal may also be useful. Plastic pipes do not require preparation other than cleaning.

3) Apply a single ½" (12 mm) wide by approximately 1/8" thick bead of acoustic couplant grease to both transducers and secure them to the pipe 180° apart using a mounting strap. Ensure that the transducer cable is pointing in the downstream direction.

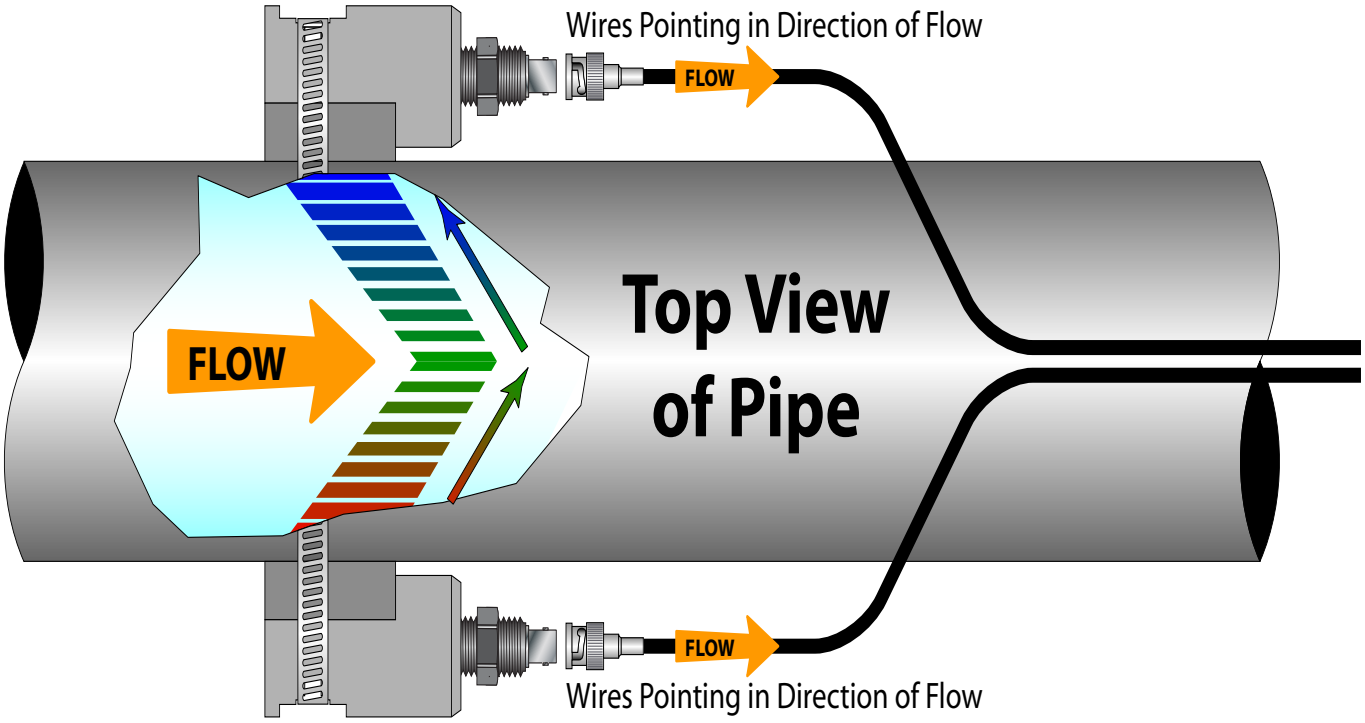


FIGURE Q.2 - DOPPLER TRANSDUCER MOUNTING

TRANSDUCER CONNECTIONS

1) Route the transducer cables from the transducer mounting location back to the DXN enclosure, avoiding locations near high voltage supply wires.
2) Connect the transit time transducer wires to the appropriate BNC or connect the Doppler transducers to the 4-pin Doppler transducer plug. Both connections are on the end of the DXN enclosure.

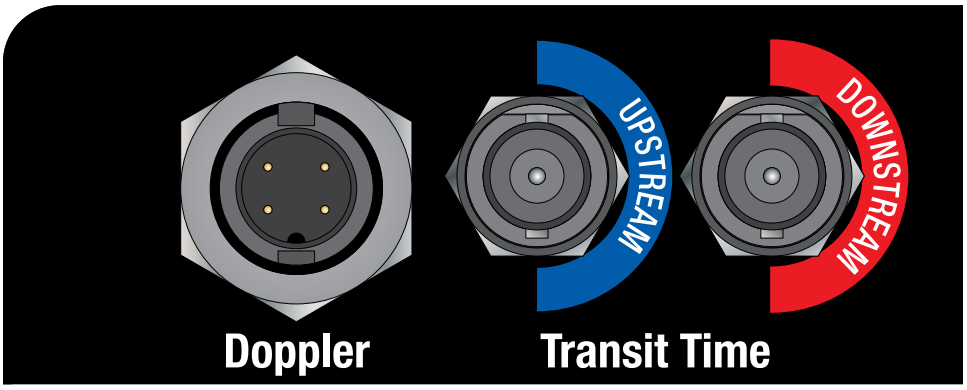


FIGURE Q.3 - TRANSDUCER CONNECTIONS

NOTE: *Transit time transducer wires go in opposite directions when DTTN or DTTL transducers are used (See Figure Q.1). DT94 Doppler transducer wires both go in the direction of flow. (See Figure Q.2)*

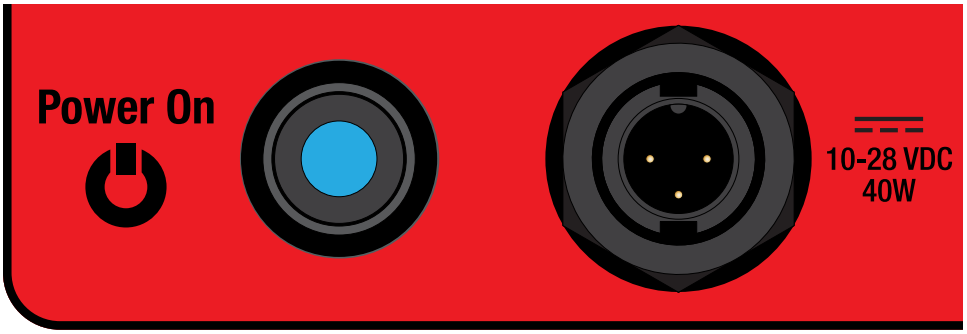


FIGURE Q.4 - POWER SWITCH AND CHARGING CONNECTION

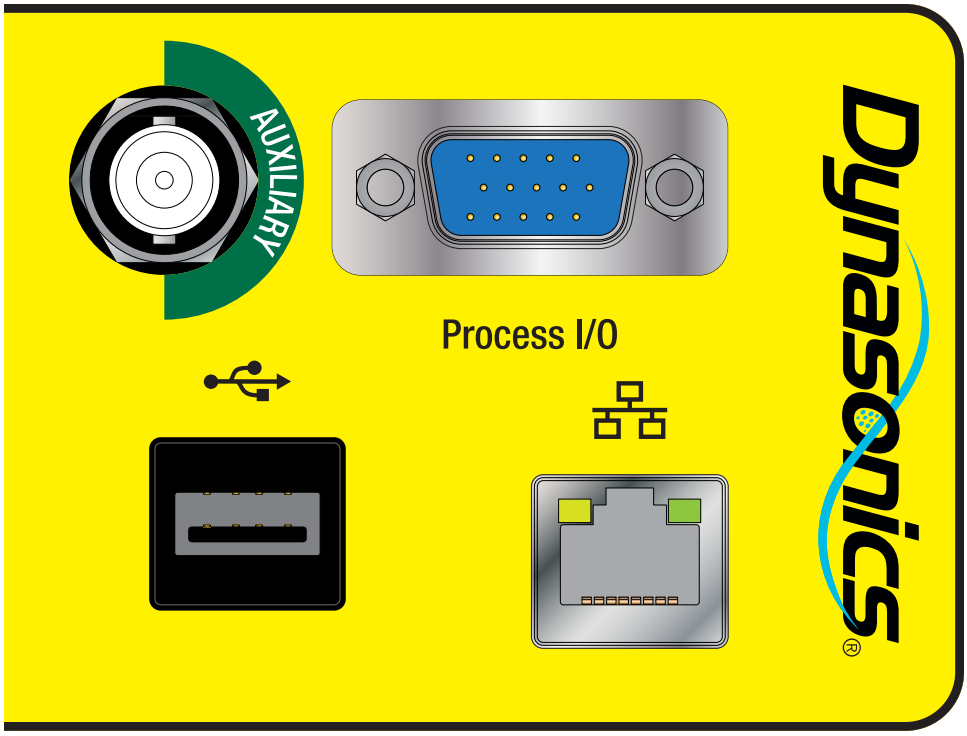


FIGURE Q.5 -THICKNESS GAGE (AUXILIARY) CONNECTION

STARTUP

INITIAL SETTINGS AND POWER UP

1) Apply power to the transmitter by pressing the “Power On” button.
2) Verify that **Signal Quality** is greater than 5.0 %.

1 - INTRODUCTION

GENERAL

The DXN portable ultrasonic flow meter is designed to measure the fluid velocity of liquid within a closed conduit. The transducers are a non-contacting, clamp-on type, which will provide benefits of non-fouling operation and ease of installation.

In transit time mode the flow meter utilizes two transducers that function as both ultrasonic transmitters and receivers. The transducers are clamped on the outside of a closed pipe **at a specific distance from each other**. The transducers can be mounted in **V-**Mount where the sound transverses the pipe two times, **W-**Mount where the sound transverses the pipe four times, or in **Z-**Mount where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once. The selection of mounting method is based on pipe and liquid characteristics, which both have an effect on how much signal is generated. The flow meter operates by alternately transmitting and receiving a frequency modulated burst of sound energy between the two transducers and measuring the time interval that it takes for sound to travel between the two transducers. The difference in the time interval measured is directly related to the velocity of the liquid in the pipe.

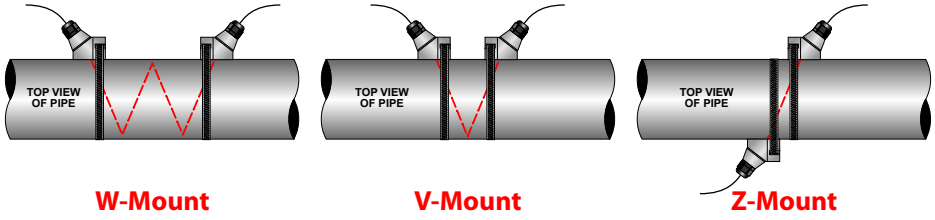


FIGURE 1.1 - ULTRASOUND PROPAGATION

APPLICATION VERSATILITY

The DXN flow meter can be successfully applied on a wide range of metering applications because the meter has both transit time and Doppler capabilities. The full range of fluids from ultrapure to thick slurries can be measured. The simple-to-program transmitter allows the standard product to be used on pipe sizes ranging from ½ inch to 100 inches (12 mm to 2540 mm)*. A wide variety of liquid applications can be accommodated.

ultrapure liquids	**cooling water**	**potable water**	**river water**
chemicals	**plant effluent**	**sewage**	**sludge**

Because the transducers are non-contacting and have no moving parts, the flow meter is not affected by system pressure, fouling or wear. Standard transducers, DTTN, DTTL and DTTSU are rated for a pipe surface temperature of -40 to +250 °F (-40 to +121 °C).

DT94 Doppler transducers have a temperature range of -40 to +212 °F (-40 to +100 °C).

*All ½" to 2" DTTSU small pipe transducers sets require the transmitter be configured for 2 MHz. DTTL transducers require the use of the 500 KHz transmission frequency. The transmission frequency is selectable using the touchscreen interface.

User Interface Features

2-Level Tabbed Menu:

- Group Tabs contain a group of Page Tabs and Interface Pages
- The user can navigate to Page Tabs sequentially by the Navigate Left or Navigate Right buttons
- The user can activate any Group Tab or Page Tab by single finger press.
- Certain Page Tabs can be pressed or double pressed for additional functionality.
- Interface Page can contain meters, user entry controls, graphs, etc.

Smart Status Bars:

- Status Bars contain Status Items that show and control helpful transmitter functions such as showing flow or controlling data logging.
- The user can navigate Status Bars sequentially only with the Status Bar Navigation Button
- Certain Status Items can be double clicked for addition functionality. Often times they can automatically navigate to a Page Tab.
- Status Bars include Quickview, Power Status, Shutdown, Sensor Positioning, etc...

CE COMPLIANCE

The DXN transmitter conforms to CISPR 11 (EN 55011) standards. See the CE Compliance drawings in the ***Appendix*** of this manual.

DATA INTEGRITY

Non-volatile flash memory retains all user-entered configuration values in memory for several years at 77 °F (25 °C), even if power is lost or turned off. Password protection is provided as part of the Security Settings **System ► Miscellaneous** and prevents inadvertent configuration changes or totalizer resets.

PRODUCT IDENTIFICATION

The serial number and complete model number of the transmitter are located on the bottom surface of the transmitter's body. Should technical assistance be required, please provide the Customer Service Department with this information.

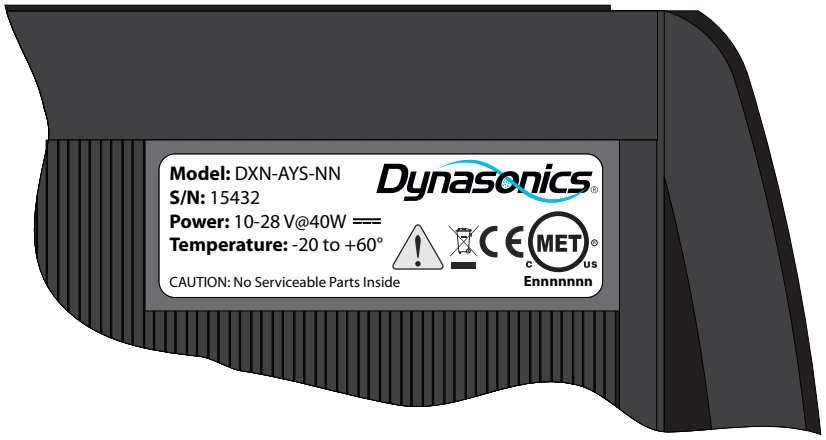


FIGURE 1.2 - SERIAL NUMBER LOCATION

Caution - Do not use sharp objects on the display as damage will occur.

2 - SOFTWARE

The DXN uses a sophisticated touch screen user interface to control all functions. The tabbed menu tree provides access to all controls and settings within two layers of menus. Large easy to read touchscreen buttons allow for gloved operation in inclement weather.

CONVENTIONS

When navigating the DXN menus this manual will specify first the **Group Tab** name and then the **Page** as shown below.

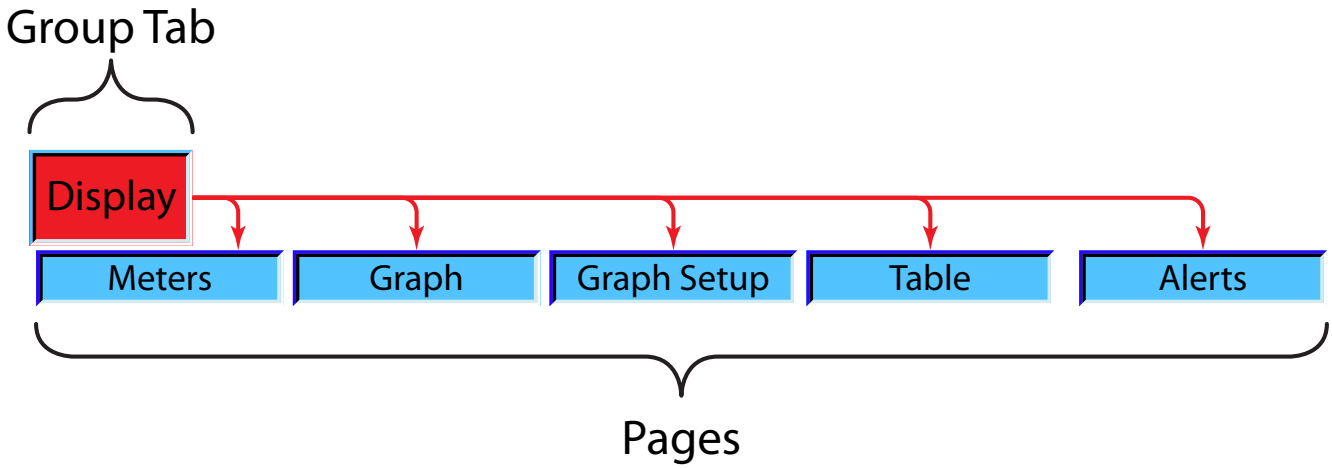


FIGURE 2.1 - GROUP/PAGE CONVENTION

A typical reference would look like the following:

Display Tab ► Meters Page

Upon startup of the instrument using the back panel power button, the system will display a series of splash, progress, and information screens.

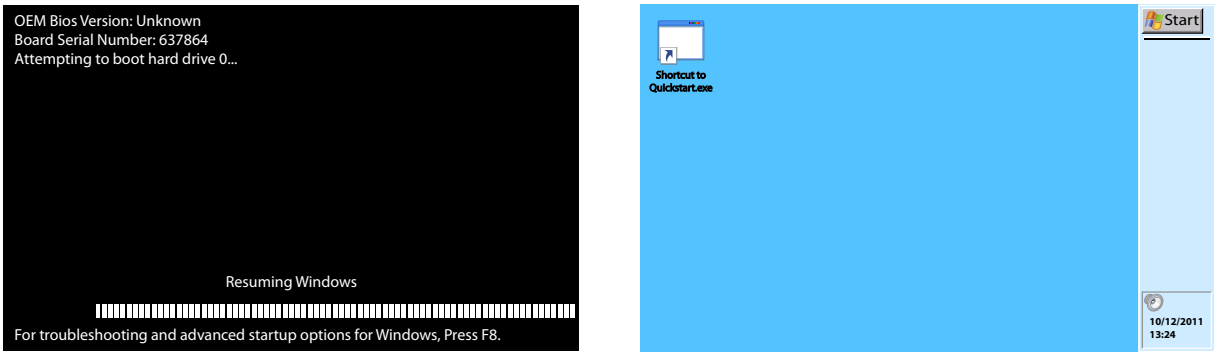


FIGURE 2.2 - STARTUP SCREEN EXAMPLES

The user screens consists of controls, status icons, and data display areas similar to most found on personal computers. Detailed description of interface functions are found throughout this manual.

DXN Data and Controls Layout

FIGURE 2.3 - MAIN USER SCREEN LAYOUT

CONTROLS

The DXN uses many of the same software controls as common windows based graphical user interfaces. The following describes the controls and how they are used.

Text Box

The text box provides space for the user to enter various pieces of data such as the "Create New Site" button. When the text box button is pressed a Qwerty keyboard pop's up allowing text and/or numbers to be entered.

FIGURE 2.4 - TEXT BOX

FIGURE 2.5 - ALPHA NUMERIC KEYPAD

On/Off Check Box

This control allows the user to turn on or off a function. A box with a check mark in it indicates the function is on and the function is off when the check mark is absent.

FIGURE 2.6 - CHECK BOX STATES

When an item is changed, the control will change to orange while the settings are updated.

FIGURE 2.7 - CHECK BOX TRANSITION

Buttons

Button controls work in a similar manner to a push-button switch and generally starts or stops some function.

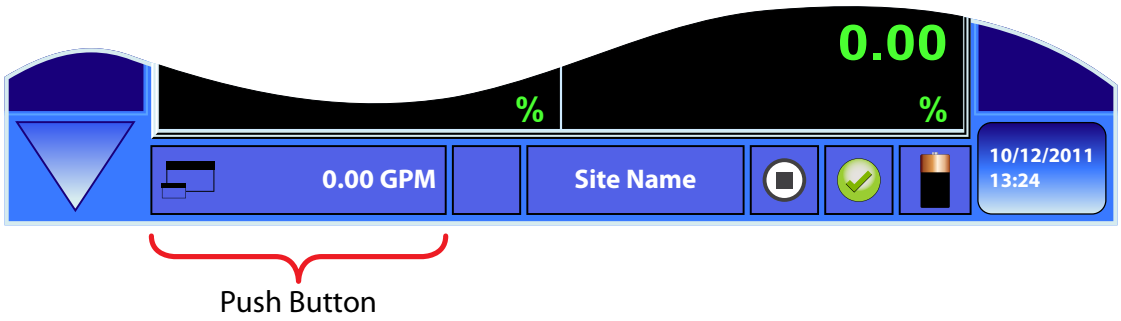


FIGURE 2.8 - PUSH BUTTON CONTROL

Shut Down Slider

The shutdown slider allows the DXN to be turned off without having to press and hold the physical On/Off button. To use the shutdown slider simply touch the red button on the left hand side of the screen and drag it to the right until it snaps to the right hand screen stop.

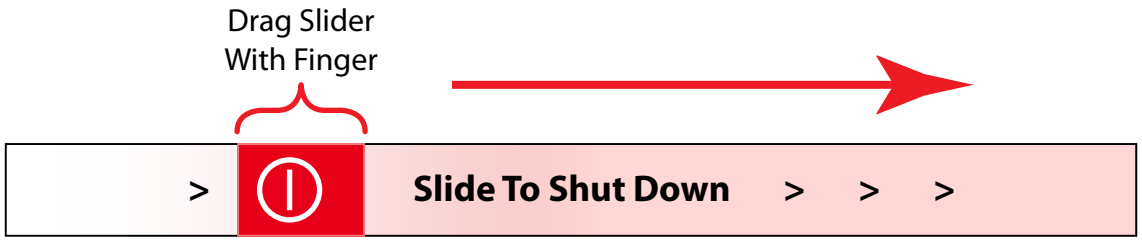


FIGURE 2.9 - SHUT DOWN SLIDER

Increment/Decrement Control

The + (increment) and – (decrement) buttons are used to enter numeric data, OR upon double-clicking the numerical value area, a keypad will pop up allowing direct numeric data entry:

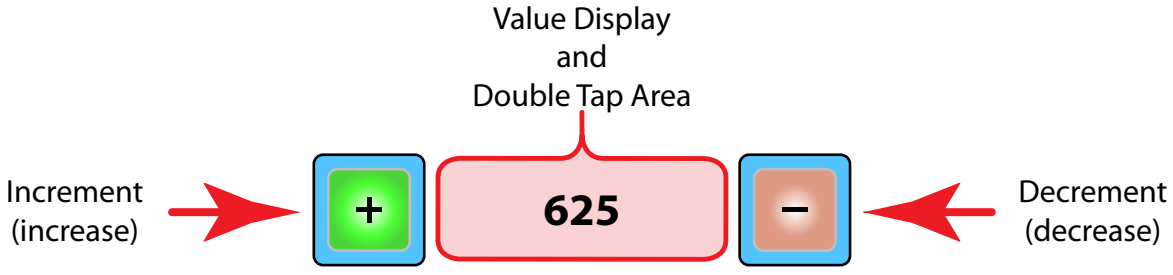


FIGURE 2.10 - INCREMENT/DECREMENT CONTROL

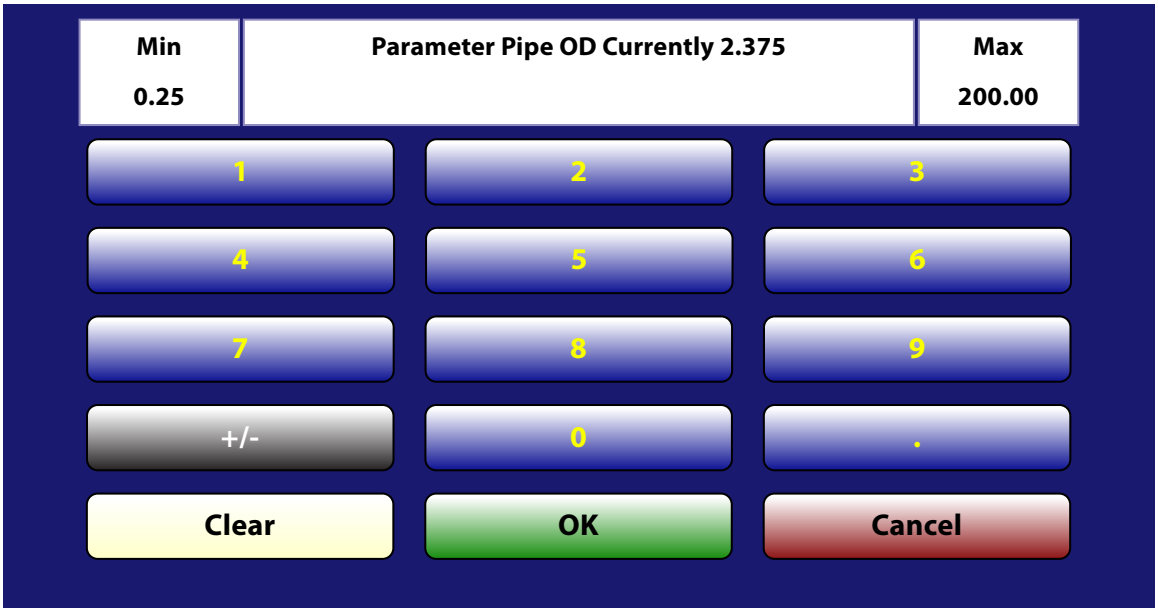


FIGURE 2.11 - NUMERIC INPUT CONTROL

Min, Max, parameters are all shown. Clear starts over and cancel closes without changes. Click OK to store. Keypad will disappear.

Combo Box

Combo boxes function as a list of alternate items that can be chosen during setup. The combo box presents as a bar with text and a downward pointing arrow directly to the left indicating the control has a selection list.

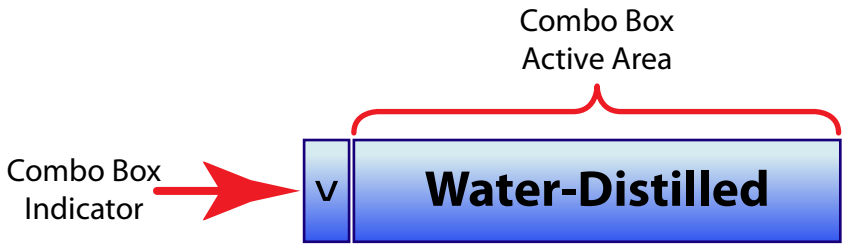


FIGURE 2.12 - RETRACTED COMBO BOX

When the combo box's active area is touched the box will expand showing the available choices for that parameter.

Home Button

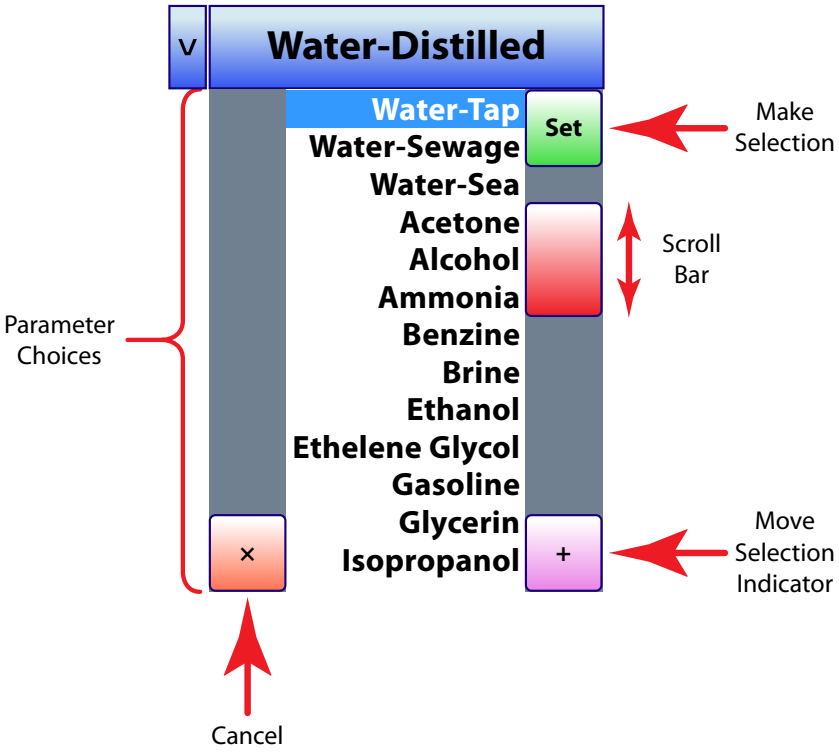


FIGURE 2.13 - COMBO BOX WITH SCROLL BAR

The + plus button moves the blue highlights area up or down depending on the original position of the highlight. Once the correct choice has been highlighted in blue use the set Set button to lock in the selection. If no change is desired use the cancel × button to exit the combo box without making any changes.

If the dropdown list of parameters is too large to be contained in one combo box length a scroll bar will be visible allowing the list to be scrolled up or down.

Site Group

Create Page

FIGURE 3.2 - SITE PAGE CONFIGURATION

Entry Units -- Programming Unit Selection (Choice)

English (Inches)
Metric (Millimeters)

Installs a global measurement standard into the memory of the instrument. The choices are either **English** or **Metric** units.

Select **English** if all configurations (pipe sizes, etc.) are to be made in inches. Select **Metric** if the meter is to be configured in millimeters.

The **English/Metric** selection will also configure the DXN to display sound speeds in pipe materials and liquids as either feet per second (**FPS**) or meters per second (**MPS**), respectively.

IMPORTANT!: *If the **Entry Units** choice has been changed from **English** to **Metric** or from **Metric** to **English**, the entry must be saved by doing a power down and then a power up in order for the DXN to initiate the change in operating units. Failure to save and reset the instrument will lead to improper transducer spacing calculations and an instrument that may not measure properly.*

Fluid Page

Select the "Site Group Tab" from the Group bar at the top of the screen. When the Site pages appear select the first fluid page to enter information about the type of fluid to be used.

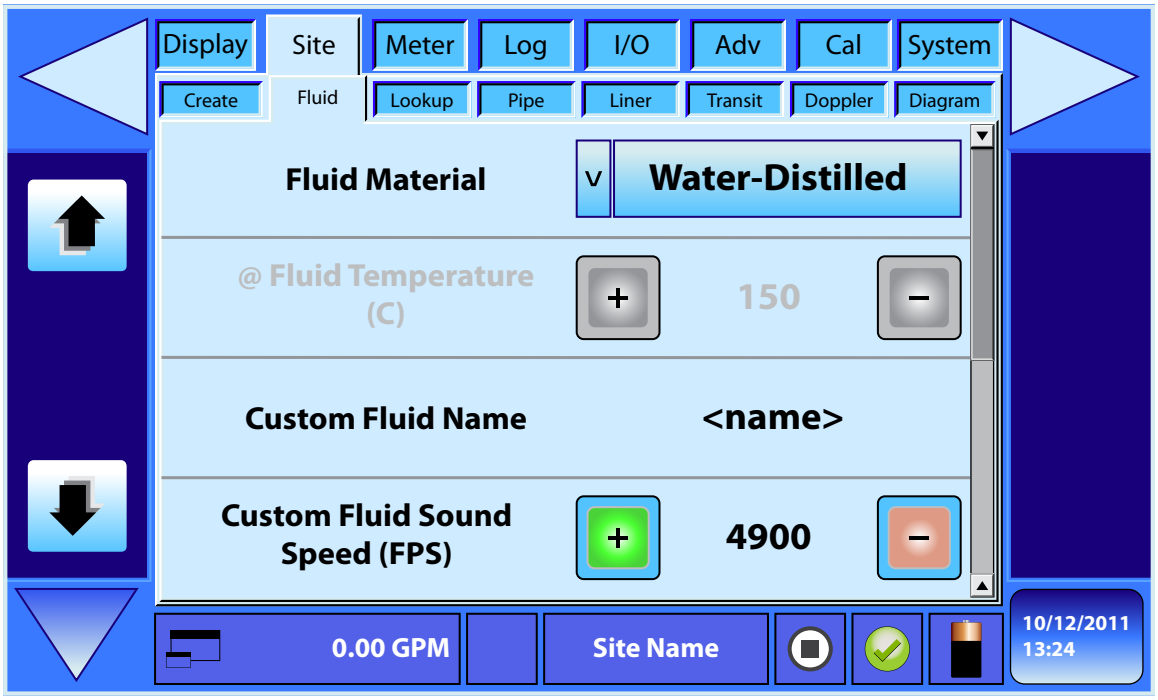


FIGURE 3.3 - TRANSIT TIME FLUID SELECTION

Fluid Material -- Fluid Material (Choice)

Choose the pipe material from the combo box dropdown.

Water Tap	(WATER)	Ethanol	(ETHANOL)	Oil Diesel	(DIESEL)
Sewage-Raw	(SEWAGE)	Ethylene Glycol	(ETH-GLYC)	Oil Hydraulic [Petro-based]	(HYD OIL)
Acetone	(ACETONE)	Gasoline	(GASOLINE)	Oil Lubricating	(LUBE OIL)
Alcohol	(ALCOHOL)	Glycerin	(GLYCERIN)	Oil Motor [SAE 20/30]	(MTR OIL)
Ammonia	(AMMONIA)	Isopropyl Alcohol	(ISO-ALC)	Water Distilled	(WATR-DST)
Benzene	(BENZENE)	Kerosene	(KEROSENE)	Water Sea	(WATR-SEA)
Brine	(BRINE)	Methanol	(METHANOL)	Other	(OTHER)

TABLE 3.1 - FLUID MATERIAL CHOICES

This list is provided as an example. Additional liquids are added periodically. Select the appropriate liquid from the list or select **Other** if the liquid is not listed.

If a fluid material was chosen from the **Fluid Material** list, a nominal value for speed of sound in that material will be automatically loaded. If the actual sound speed is known for the specific fluid system and that value varies from the automatically loaded value, the value can be revised.

Fluid Temperature -- The Measured Fluid Temperature (Value)

Custom Fluid Name - User Defined Fluid Name (Entry)

Custom Fluid Sound Speed -- Speed of Sound for the Custom Fluid (Value)

Allows adjustments to be made to the speed of sound entry for fluids not found in the standard list. If the **Entry Units** value was set to **English**, the entry is in **FPS** (feet per second). **Metric** entries are made in **MPS** (meters per second).

If **Other** was chosen as **Fluid Material**, a **Custom Fluid Sound Speed** will need to be entered. A list of alternate fluids and their associated sound speeds is located in the ***Appendix*** located at the back of this manual.

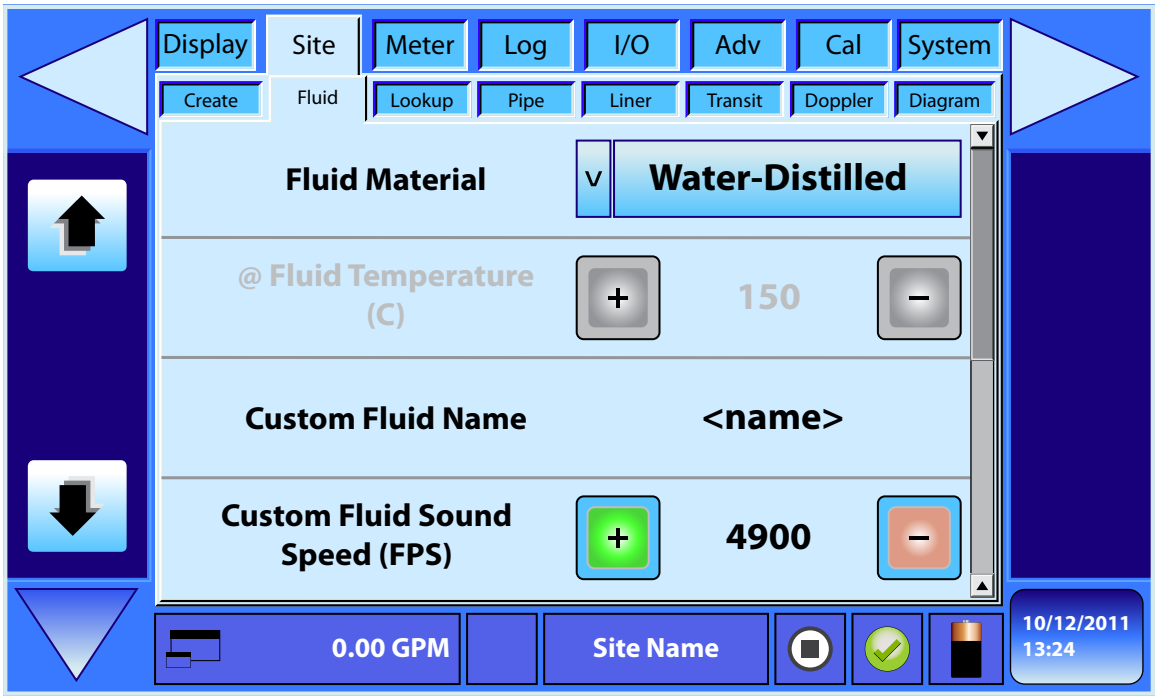


FIGURE 3.4 - CUSTOM FLUID PARAMETERS

Custom Fluid Specific Gravity -- Fluid Specific Gravity Entry (Value)

Allows adjustments to be made to the specific gravity (density relative to water) of the liquid.

The specific gravity is utilized in the Reynolds correction algorithm. It is also utilized if mass flow measurement units are selected for rate or total.

If a fluid was chosen from the **Fluid Material** list, a nominal value for specific gravity in that media will be automatically loaded. If the actual specific gravity is known for the application fluid and that value varies from the automatically loaded value, the value can be revised.

If **Other** was chosen as **Fluid Material**, a **Custom Fluid Specific Gravity** may need to be entered if mass flows are to be calculated. A list of alternate fluids and their associated specific gravities is located in the ***Appendix*** of this manual.

Fluid Viscosity -- Absolute Viscosity of the Fluid (Value - cP)

Allows adjustments to be made to the absolute viscosity of the liquid in centipoise.

DXN flow meters utilize pipe size, viscosity and specific gravity to calculate Reynolds numbers. Since the Reynolds number influences flow profile, the DXN has to compensate for the relatively high velocities at the pipe center during transitional or laminar flow conditions. The entry of **Fluid Viscosity** is utilized in the calculation of Reynolds and the resultant compensation values.

If a fluid was chosen from the **Fluid Material** list, a nominal value for viscosity in that media will be automatically loaded. If the actual viscosity is known for the application fluid and that value varies from the automatically loaded value, the value can be revised.

If **Other** was chosen as **Fluid Material**, then a **Fluid Viscosity** must also be entered. A list of alternate fluids and their associated viscosities is located in the ***Appendix*** of this manual.

Sound Speed Temperature Coefficient

Fluid Specific Heat Capacity - (Value)

Allows adjustments to be made to the specific heat capacity of the liquid.

If a fluid was chosen from the **Fluid Material** list, a default specific heat will be automatically loaded. If the actual specific heat of the liquid is known or it differs from the default value, the value can be revised. See ***Tables 3.2, 3.3,*** and ***3.4*** for specific values. Enter a value that is the mean of both pipes.

Specific Heat Capacity for Water		
Temperature		Specific Heat BTU/lb °F
°F	°C	
32-212	0-100	1.00
250	121	1.02
300	149	1.03
350	177	1.05

TABLE 3.2 - SPECIFIC HEAT CAPACITY VALUES FOR WATER

Specific Heat Capacity Values for Common Fluids			
Fluid	Temperature		Specific Heat BTU/lb °F
	°F	°C	
Ethanol	32	0	0.65
Methanol	54	12	0.60
Brine	32	0	0.71
Brine	60	15	0.72
Sea Water	63	17	0.94

TABLE 3.3 - SPECIFIC HEAT CAPACITY VALUES FOR OTHER COMMON FLUIDS

Specific Heat Capacity BTU/lb °F								
Temperature		Ethylene Glycol Solution (% by Volume)						
°F	°C	25	30	40	50	60	65	100
-40	-40	n/a	n/a	n/a	n/a	0.68	0.70	n/a
0	-17.8	n/a	n/a	0.83	0.78	0.72	0.70	0.54
40	4.4	0.91	0.89	0.845	0.80	0.75	0.72	0.56
80	26.7	0.92	0.90	0.86	0.82	0.77	0.74	0.59
120	84.9	0.93	0.92	0.88	0.83	0.79	0.77	0.61
160	71.1	0.94	0.93	0.89	0.85	0.81	0.79	0.64
200	93.3	0.95	0.94	0.91	0.87	0.83	0.81	0.66
240	115.6	n/a	n/a	n/a	n/a	n/a	0.83	0.69

TABLE 3.4- SPECIFIC HEAT CAPACITY VALUES FOR ETHYLENE GLYCOL/WATER

For preliminary testing the only parameter that must be entered is the fluid sound speed using the increment and decrement controls.

Pipe Page

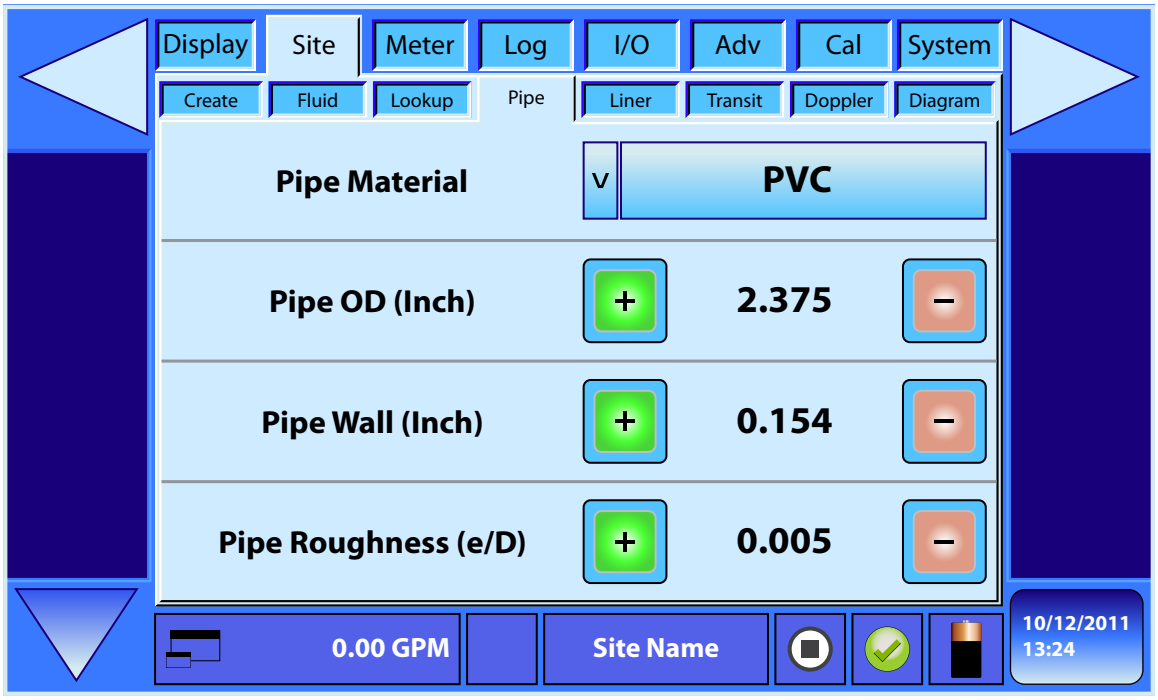


FIGURE 3.5 - PIPE PAGE

The first parameter is the Pipe Material. The combo box associated with the pipe material has a selection of the most common pipe materials in use. Choosing a standard pipe material from the dropdown list will automatically enter the sound speed for the pipe and the pipe roughness.

Pipe Material -- Pipe Material Selection (Choice)

Choose the pipe material from the combo box dropdown.

Acrylic	(ACRYLIC)	Glass Pyrex	(PYREX)	St Steel 304/316	(SS 316)
Aluminum	(ALUMINUM)	Nylon	(NYLON)	St Steel 410	(SS 410)
Brass (Naval)	(BRASS)	HD Polyethylene	(HDPE)	St Steel 430	(SS 430)
Carbon Steel	(CARB ST)	LD Polyethylene	(LDPE)	PFA	(PFA)
Cast Iron	(CAST IRN)	Polypropylene	(POLYPRO)	Titanium	(TITANIUM)
Copper	(COPPER)	PVC CPVC	(PVC/CPVC)	Asbestos	(ASBESTOS)
Ductile Iron	(DCTL IRN)	PVDF	(PVDF)	Other	(OTHER)
Fiberglass-Epoxy	(FBRGLASS)	St Steel 302/303	(SS 303)		

TABLE 3.5 - PIPE MATERIAL CHOICES

This list is provided as an example. Additional pipe materials are added periodically. Select the appropriate pipe material from the list or select **Other** if the material is not listed.

If a pipe material was chosen from the **Pipe Material** list, a nominal value for speed of sound in that material will be automatically loaded. If the actual sound speed is known for the application piping system and that value varies from the automatically loaded value, the value can be revised.

If **Other** was chosen as **Pipe Material**, then a **Pipe Sound Speed** must also be entered.

Pipe OD -- Pipe Outside Diameter (Numeric Value)

Next enter the Pipe OD (outside diameter). If the actual pipe OD is unknown there are tables at the back of this manual listing common pipe types and schedules that can be consulted.

Enter the pipe outside diameter in inches if **English** was selected as **Entry Units**; in millimeters if **Metric** was selected.

NOTE: *Charts listing popular pipe sizes have been included in the* ***Appendix*** *of this manual. Correct entries for pipe O.D. and pipe wall thickness are critical to obtaining accurate flow measurement readings.*

Pipe Wall Thickness -- Pipe Wall Thickness (Numeric Value)

The Pipe Wall Thickness is the value of the actual pipe wall thickness excluding any liner that may be present.

NOTE: *Accurate values for Pipe OD and Pipe Wall Thickness are necessary for accurate computation of the volumetric flow rate. Without accurate pipe data, flow rates will be in error by the difference between the actual pipe cross sectional area and the area calculated using the incorrect pipe OD and/or pipe wall thickness values.*

If the pipe has a roughness value that differs from standard for the pipe type, the custom value can be entered using the Pipe Roughness controls.

Enter the pipe wall thickness in inches if **English** was selected as **Entry Units**; in millimeters if **Metric** was selected.

NOTE: *Charts listing popular pipe sizes have been included in the* ***Appendix*** *of this manual. Correct entries for pipe O.D. and pipe wall thickness are critical to obtaining accurate flow measurement readings.*

Pipe Sound Speed -- Speed of Sound in the Pipe Material (Value)

Allows adjustments to be made to the speed of sound value, shear or transverse wave, for the pipe wall. If the **Entry Units** value was set to **English**, the entry is in **FPS** (feet per second). **Metric** entries are made in **MPS** (meters per second).

Pipe Roughness -- Pipe Material Relative Roughness (Value)

The DXN provides flow profile compensation in its flow measurement calculation. The ratio of average surface imperfection as it relates to the pipe internal diameter is used in this compensation algorithm and is found by using the following formula:

$$Pipe\ R = \frac{Linear\ RMS\ Measurement\ of\ the\ Pipes\ Internal\ Wall\ Surface}{Inside\ Diameter\ of\ the\ Pipe}$$

If a pipe material was chosen from the **Pipe Material** list, a nominal value for relative roughness in that material will be automatically loaded. If the actual roughness is known for the application piping system and that value varies from the automatically loaded value, the value can be revised.

Liner Page

FIGURE 3.6 - LINER PAGE

If the pipe has a liner, enter the pipe liner thickness. Enter this value in inches if **English** was selected as **Entry Units**; in millimeters if **Metric** was selected.

Liner Material (Choice)

Choose the pipe liner material from the combo box dropdown.

Tar Epoxy	(TAR EPXY)	HD Polyethylene	(HDPE)
Rubber	(RUBBER)	LD Polyethylene	(LDPE)
Mortar	(MORTAR)	Teflon (PFA)	(TEFLON)
Polypropylene	(POLYPRO)	Ebonite	(EBONITE)
Polystyrene	(POLYSTY)	Other	(OTHER)

TABLE 3.6 - LINER MATERIAL CHOICES

This following list is provided as an example. Additional materials are added periodically. Select the appropriate material from the list or select **Other** if the liner material is not listed.

If a liner was chosen from the **Liner Material** list, a nominal value for speed of sound in that media will be automatically loaded. If the actual sound speed rate is known for the pipe liner and that value varies from the automatically loaded value, the value can be revised.

Liner Wall Thickness - (Requires Numeric Value)

Enter the liner wall thickness in inches if **English** was selected as **Entry Units**; in millimeters if **Metric** was selected.

NOTE: *if a liner is present an accurate value for Liner Wall Thickness is necessary for accurate computation of the volumetric flow rate. Without accurate liner data flow rates will be in error by the difference between the actual pipe cross sectional area and the aera calculated using the incorrect pipe liner thickness.*

Liner Sound Speed -- Speed of Sound in the Pipe Liner (Value)

Allows adjustments to be made to the speed of sound value, shear or transverse wave, for the pipe wall. If the **Entry Units** value was set to **English**, the entry is in **FPS** (feet per second). **Metric** entries are made in **MPS** (meters per second).

Liner Roughness -- Liner Material Relative Roughness (Value)

The DXN provides flow profile compensation in its flow measurement calculation. The ratio of average surface imperfection as it relates to the pipe internal diameter is used in this compensation and is found by using the following formula:

$$Liner\ R = \frac{Linear\ RMS\ Measurement\ of\ the\ Liners\ Internal\ Wall\ Surface}{Inside\ Diameter\ of\ the\ Liner}$$

If a liner material was chosen from the **Liner Material** list, a nominal value for relative roughness in that material will be automatically loaded. If the actual roughness is known for the application liner and that value varies from the automatically loaded value, the value can be revised.

Transit Page

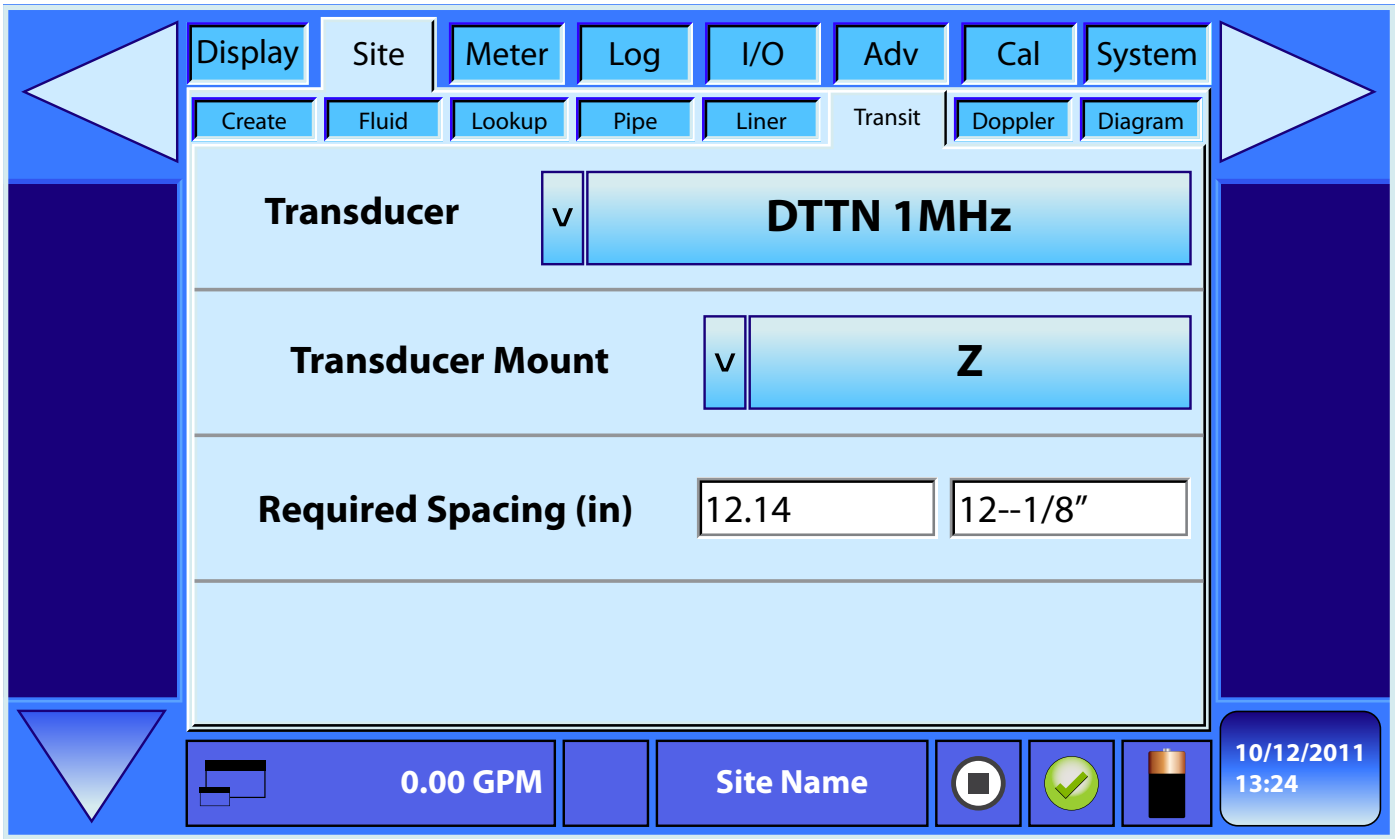


FIGURE 3.7 - TRANSIT PAGE

Transducer - Transducer Type and Frequency (Choice)

DTTN 1MHz	Standard Transducers	DTTN 0.5 MHz	Large Pipe Transducers
DTTH 1MHz	High Temperature Transducers	DTTSU 2MHz	Small Pipe Transducers

TABLE 3.7 TRANSDUCER TYPES AND FREQUENCIES

Transducer transmission frequencies are specific to the type of transducer and the size of pipe. In general the DTTL 500 KHz transducers are used for pipes greater than 24 inches (600 mm). DTTN and DTTH, 1 MHz transducers, are for intermediate sized pipes between 2 inches (50 mm) and 24 inches (600 mm). The DTTSU uses a 2 MHz transmission frequency and is used for pipe sizes between ½ inch (13 mm) and 2 inches (50 mm).

Transducer Mount -- Transducer Mounting Method (Choice)

Selects the mounting orientation for the transducers. The selection of an appropriate mounting orientation is based on pipe and liquid characteristics.

DXN transit time flow meters can be used with three different transducer types: DTTN, DTTL, and DTTSU. Meters that utilize the DTTN or DTTL transducer sets consist of two separate sensors that function as both ultrasonic transmitters and receivers. DTTSU transducers integrates both sensors into one assembly and

requires the separation of the transmit/receive modules be adjusted to the spacing value found using the DXN software. DTTN and DTTL transducers are clamped on the outside of a closed pipe at a specific distance from each other.

The DTTN and DTTL transducers can be mounted in:

W-Mount where the sound traverses the pipe four times. This mounting method produces the best relative travel time values but the weakest signal strength.
V-Mount where the sound traverses the pipe twice. **V**-Mount is a compromise between travel time and signal strength.
Z-Mount where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once. **Z**-Mount will yield the best signal strength but the smallest relative travel time.

See Table 3.8 for transducer mounting mode selection starting points.

The DTTSU small pipe transducers are always set up in **V**-Mount where the sound traverses the pipe twice.

<table>
<tr><th>Transducer Mount Mode</th><th>Pipe Material</th><th>Pipe Size</th><th>Liquid Composition</th></tr>
<tr><td rowspan="6">W-Mount</td><td>Plastic (all types)</td><td rowspan="4">2-4 in. (50-100 mm)</td><td rowspan="16">Low TSS; non-aerated</td></tr>
<tr><td>Carbon Steel</td></tr>
<tr><td>Stainless Steel</td></tr>
<tr><td>Copper</td></tr>
<tr><td>Ductile Iron</td><td rowspan="2">Not recommended</td></tr>
<tr><td>Cast Iron</td></tr>
<tr><td rowspan="6">V-Mount</td><td>Plastic (all types)</td><td rowspan="3">4-12 in. (100-300 mm)</td></tr>
<tr><td>Carbon Steel</td></tr>
<tr><td>Stainless Steel</td></tr>
<tr><td>Copper</td><td>4-30 in. (100-750 mm)</td></tr>
<tr><td>Ductile Iron</td><td rowspan="2">2-12 in. (50-300 mm)</td></tr>
<tr><td>Cast Iron</td></tr>
<tr><td rowspan="6">Z-Mount</td><td>Plastic (all types)</td><td>> 30 in. (> 750 mm)</td></tr>
<tr><td>Carbon Steel</td><td rowspan="2">> 12 in. (> 300 mm)</td></tr>
<tr><td>Stainless Steel</td></tr>
<tr><td>Copper</td><td>> 30 in. (> 750 mm)</td></tr>
<tr><td>Ductile Iron</td><td rowspan="2">> 12 in. (> 300 mm)</td></tr>
<tr><td>Cast Iron</td></tr>
<tr><td colspan="4">TSS = Total Suspended Solids</td></tr>
</table>

TABLE 3.8 - STARTING POINT TRANSDUCER MOUNTING MODES — DTTN, DTTL, AND DTTH

Required Spacing -- Transducer Spacing Calculation (Value)

NOTE: *This value is calculated by the firmware after all pipe parameters have been entered. The spacing value only pertains to DTTN, DTTL, and DTTH transducer sets.*

This value represents the one-dimensional linear measurement between the transducers (the upstream/ downstream measurement that runs parallel to the pipe). The value is in inches if **English** was selected as **Entry Units**; in millimeters if **Metric** was selected. This measurement is taken between the lines which are scribed into the side of the transducer blocks.

If the transducers are being mounted using the transducer track assembly (DTTN only), a measuring scale is etched into the track. Place one transducer at 0 and the other at the appropriate measurement.

Doppler Page

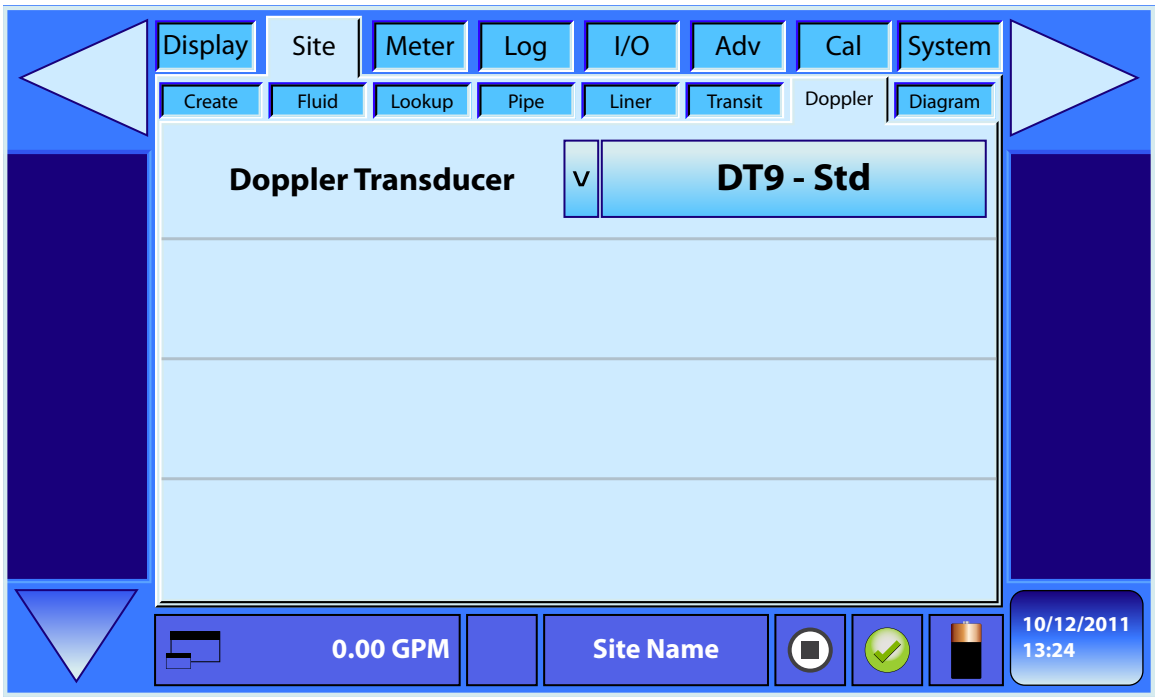


FIGURE 3.8 - DOPPLER TRANSDUCER SELECTION

If the Doppler measuring mode is to be used, the proper Doppler transducers must be chosen. At this time the DT94 series transducers are the only Doppler transducers supported.

Meter Group

Select the "Meter Group Tab" from the Group bar at the top of the screen. When the Meter pages appear select the flow page to enter information about the flow units to be used.

Flow Page

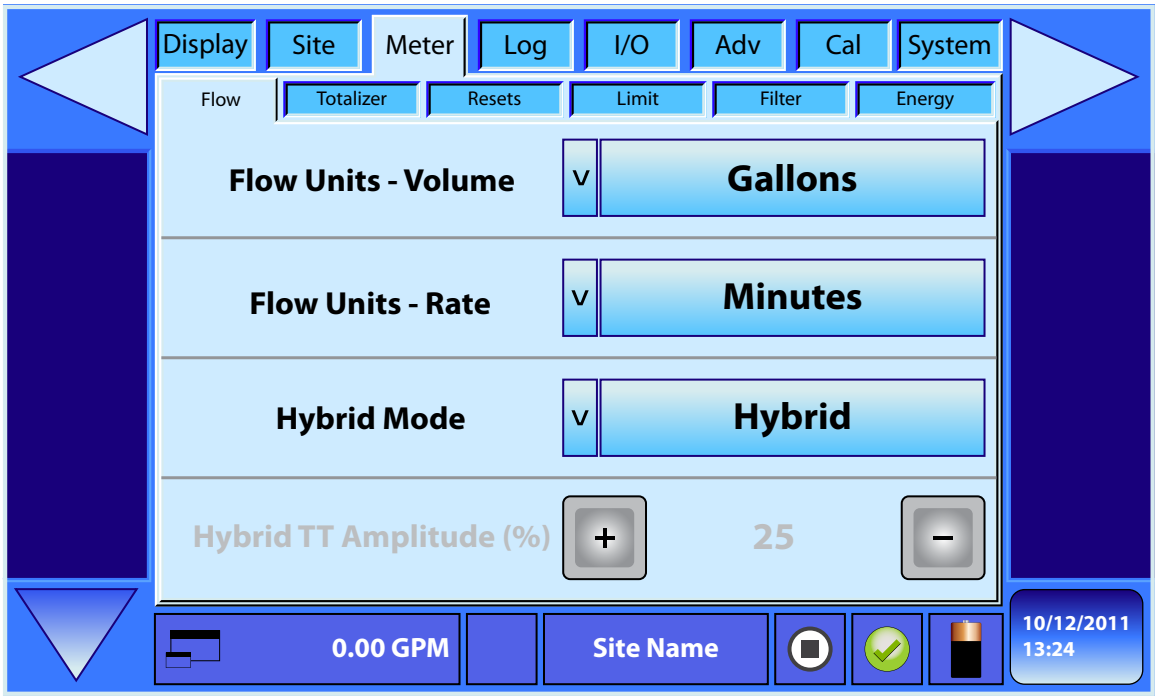


FIGURE 4.1 - FLOW UNITS SETUP

Flow Units -- Engineering Units for Flow Rate (Choice)

Gallons	(Gallons)	Pounds	(LB)
Liters	(Liters)	Kilograms	(KG)
Millions of Gallons	(MGal)	British Thermal Units	(BTU)
Cubic Feet	(Cubic Ft)	Thousands of BTUs	(MBTU)
Cubic Meters	(Cubic Me)	Millions of BTUs	(MMBTU)
Acre Feet	(Acre Ft)	Tons	(TON)
Oil Barrels	(Oil Barr) [42 Gallons]	Kilojoule	(kJ)
Liquid Barrels	(Liq Barr) [31.5 Gallons]	Kilowatt	(kW)
Feet	(Feet)	Megawatt	(MW)
Meters	(Meters)		

TABLE 4.1 - FLOW UNITS

Select a desired engineering unit for flow rate measurements.

Flow Interval -- Time Interval for Flow Rate (Choice)

The flow interval can be any of the following:

Seconds
Minutes
Hours
Days

Select a desired time unit for flow rate measurements.

Hybrid Mode -- The Type of Ultrasonic Signal The Transmitter Generates (Choice)

The Transmission Mode can be any of the following:

Transit Time
Doppler
Hybrid

Total Page

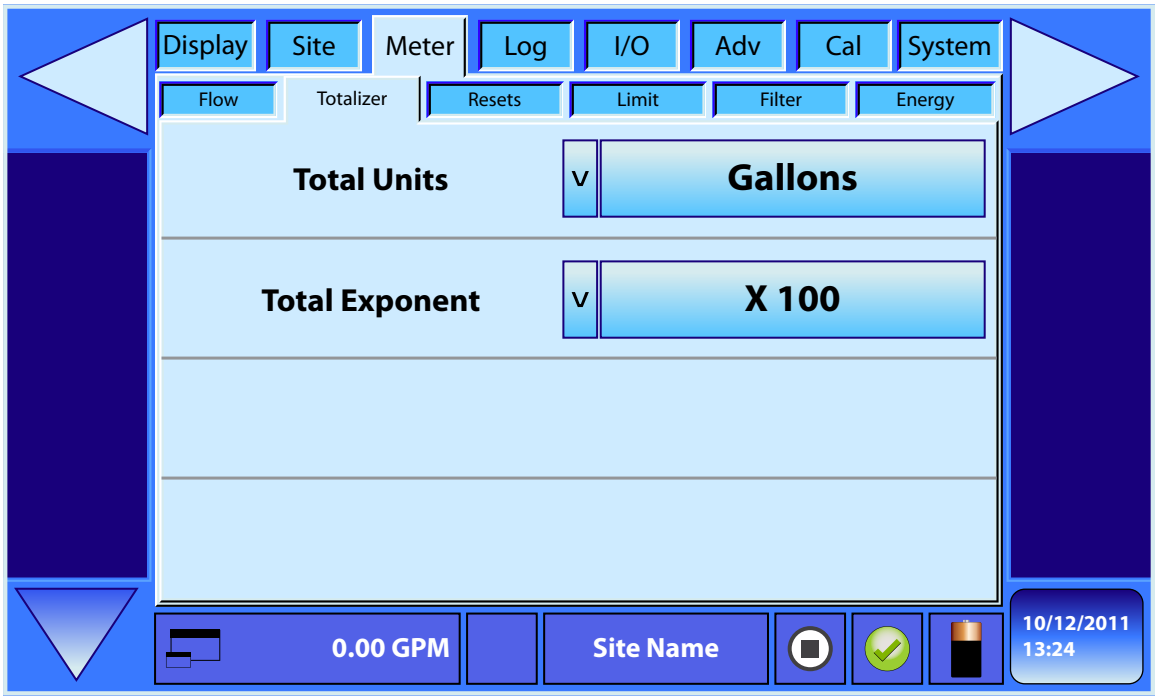


FIGURE 4.2 - TOTALIZER SETUPS

Total Units -- Totalizer Units

Gallons	(Gallons)	Pounds	(LB)
Liters	(Liters)	Kilograms	(KG)
Millions of Gallons	(MGal)	British Thermal Units	(BTU)
Cubic Feet	(Cubic Ft)	Thousands of BTUs	(MBTU)
Cubic Meters	(Cubic Me)	Millions of BTUs	(MMBTU)
Acre Feet	(Acre Ft)	Tons	(TON)
Oil Barrels	(Oil Barr) [42 Gallons]	Kilojoule	(kJ)
Liquid Barrels	(Liq Barr) [31.5 Gallons]	Kilowatt	(kW)
Feet	(Feet)	Megawatt	(MW)
Meters	(Meters)		

TABLE 4.2 - TOTALIZER UNITS

Select a desired engineering unit for flow accumulator (totalizer) measurements.

Total Exponent -- Flow Totalizer Exponent Value (Choice)

Utilized for setting the flow totalizer exponent. This feature is useful for accommodating a very large accumulated flow or to increase totalizer resolution when flows are small (displaying fractions of whole barrels, gallons, etc.) The exponent is a $\times 10^n$ multiplier, where "n" can be from –1 (× 0.1) to +6 (× 1,000,000). ***Table 4.3*** should be referenced for valid entries and their influence on the display.

Totalizer Multiplier
× 0.1 (÷10)
× 1 (no multiplier)
× 10
× 100
× 1,000
× 10,000
× 100,000
× 1,000,000

TABLE 4.3 - EXPONENT VALUES

Limits Page

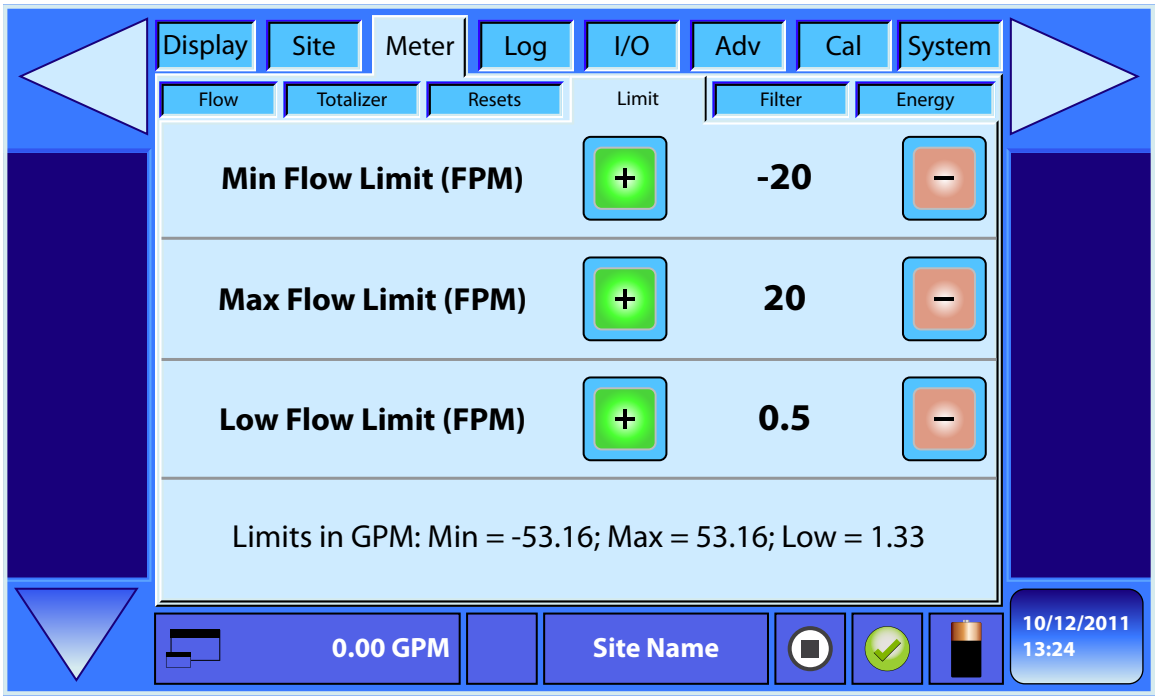


FIGURE 4.3 - LIMIT VALUE SETTINGS

Min Flow Limit -- Minimum Flow Rate Settings (Value)

A minimum rate setting is entered to establish filter software settings and the lowest rate value that will be displayed. Volumetric entries will be in the Flow Units selected in the **Meter Group > Flow Page**. For unidirectional measurements, set **Min Flow Limit** to zero. For bidirectional measurements, set **Min Flow Limit** to the highest negative (reverse) flow rate expected in the piping system.

NOTE: *The flow meter will not display a flow rate at flows less than the* ***Min Flow Limit*** *value. As a result, if the* ***Min Flow Limit*** *is set to a value greater than zero, the flow meter will display the* ***Min Flow Limit*** *value, even if the actual flow/energy rate is less than the* ***Min Flow Limit****.*

For example, if the ***Min Flow Limit*** *is set to 25 and the actual rate is 0, the display will indicate 25. Another example, if the* ***Min Flow Limit*** *is set to -100 and the actual flow is -200, the meter will indicate -100. This can be a problem if the meter* ***Min Flow Limit*** *is set to a value greater than zero because at flows below the* ***Min Flow Limit the rate display will show zero flow, but the totalizer which is not affected by the Min Flow Limit setting will keep totalizing.***

Max Flow Limit -- Maximum Flow Rate Settings (Value)

A maximum volumetric flow rate setting is entered to establish filter software settings. Volumetric entries will be in the Rate Units selected in the **Meter Group > Flow Page**. For unidirectional measurements, set **Max Flow Limit** to the highest (positive) flow rate expected in the piping system. For bidirectional measurements, set **Max Flow Limit** to the highest (positive) flow rate expected in the piping system.

Low Flow Limit -- Low Flow Cut-off (Value 0 to 100%)

A **Low Flow Limit** entry is provided to allow very low flow rates (that can be present when pumps are off and valves are closed) to be displayed as zero flow. Typical values that should be entered are between 1.0% and 5.0% of the flow range between **Min Flow Limit** and **Max Flow Limit**.

Substitute Flow -- Substitute Flow (Value -1000 to 1000)

Substitute Flow is a value that the analog outputs and the flow rate display will indicate when an error condition in the flow meter occurs. The typical setting for this entry is a value that will make the instrument display zero flow during an error condition.

Substitute flow is set as a percentage between **Min Flow Limit** and **Max Flow Limit**. In a unidirectional system, this value is typically set to zero to indicate zero flow while in an error condition. In a bidirectional system, the percentage can be set such that zero is displayed in a error condition. To calculate where to set the substitute flow value in a bidirectional system, perform the following calculation:

$$Substitute\ Flow = 100 - \frac{100 \times Maximum\ Flow}{Maximum\ Flow - Minimum\ Flow}$$

TABLE 4.4 lists some typical settings to achieve "Zero" with respect to **Min Flow Limit** and **Max Flow Limit** settings.

Min Flow Limit	Max Flow Limit	Substitute Flow	Display Reading During Errors
0.0	1,000.0	0.0	0.000
-500.0	500.0	50.0	0.000
-100.0	200.0	33.3	0.000
0.0	1,000.0	-5.0*	-50.00

TABLE 4.4 - SAMPLE SUBSTITUTE FLOW READINGS

5 - TRANSDUCER MOUNTING

In transit time mode the flow meter utilizes two transducers that function as both ultrasonic transmitters and receivers. The transducers are clamped on the outside of a closed pipe **at a specific distance from each other**. The transducers can be mounted in **V-**Mount where the sound transverses the pipe two times, **W-**Mount where the sound transverses the pipe four times, or in **Z-**Mount where the transducers are mounted on opposite sides of the pipe and the sound crosses the pipe once. The selection of mounting method is based on pipe and liquid characteristics which both have an effect on how much signal is generated. The flow meter operates by alternately transmitting and receiving a frequency modulated burst of sound energy between the two transducers and measuring the time interval that it takes for sound to travel between the two transducers. The difference in the time interval measured is directly related to the velocity of the liquid in the pipe.

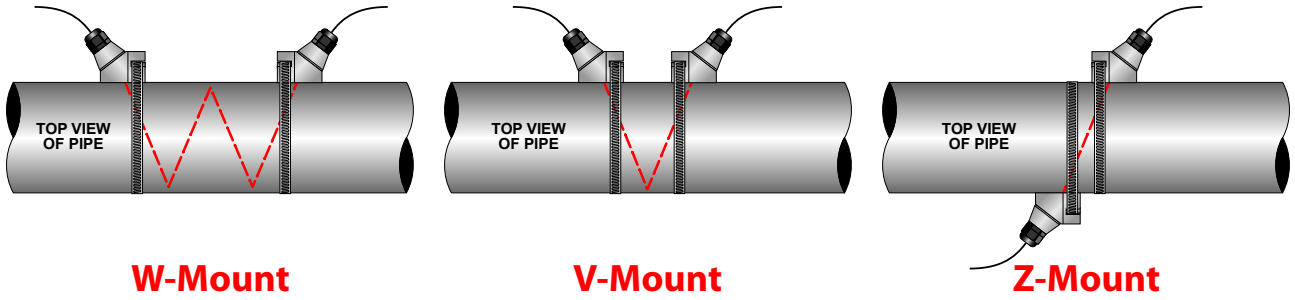


FIGURE 3.1 - TRANSIT TIME ULTRASOUND TRANSMISSION

Pipe Preparation

After selecting an optimal mounting location and successfully determining the proper transducer spacing the transducers may now be mounted onto the pipe.

Before the transducers are mounted onto the pipe surface, an area slightly larger than the flat surface of each transducer must be cleaned of all rust, scale and moisture. For pipes with rough surfaces, such as ductile iron pipe, it is recommended that the pipe surface be wire brushed to a shiny finish. Paint and other coatings, if not flaked or bubbled, need not be removed. Plastic pipes typically do not require surface preparation other than soap and water cleaning.

Transit Time Transducers

The DTTN and DTTL transducers must be properly oriented and spaced on the pipe to provide optimum reliability and performance. On horizontal pipes, when **Z**-Mount is required, the transducers should be mounted 180 radial degrees from one another and at least 45 degrees from the top-dead-center and bottom-dead-center of the pipe. See ***Figure 5.2***. Also see **Z**-Mount Transducer Installation. On vertical pipes the orientation is not critical.

The spacing between the transducers is measured between the two spacing marks on the sides of the transducers. These marks are approximately 0.75" (19 mm) back from the nose of the DTTN transducers, and 1.2" (30 mm) back from the nose of the DTTL transducers. See ***Figure 5.1***.

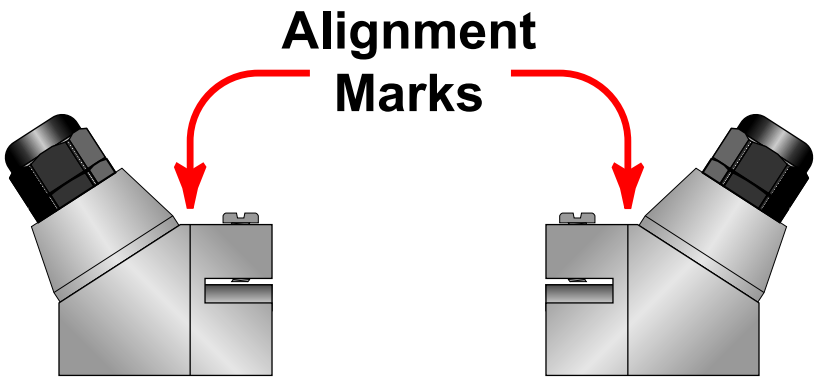


FIGURE 5.1 - TRANSDUCER ALIGNMENT MARKS

DTTSU transducers should be mounted with the cable exiting within ±45 degrees of the side of a horizontal pipe. See ***Figure 5.2***. On vertical pipes the orientation does not apply.

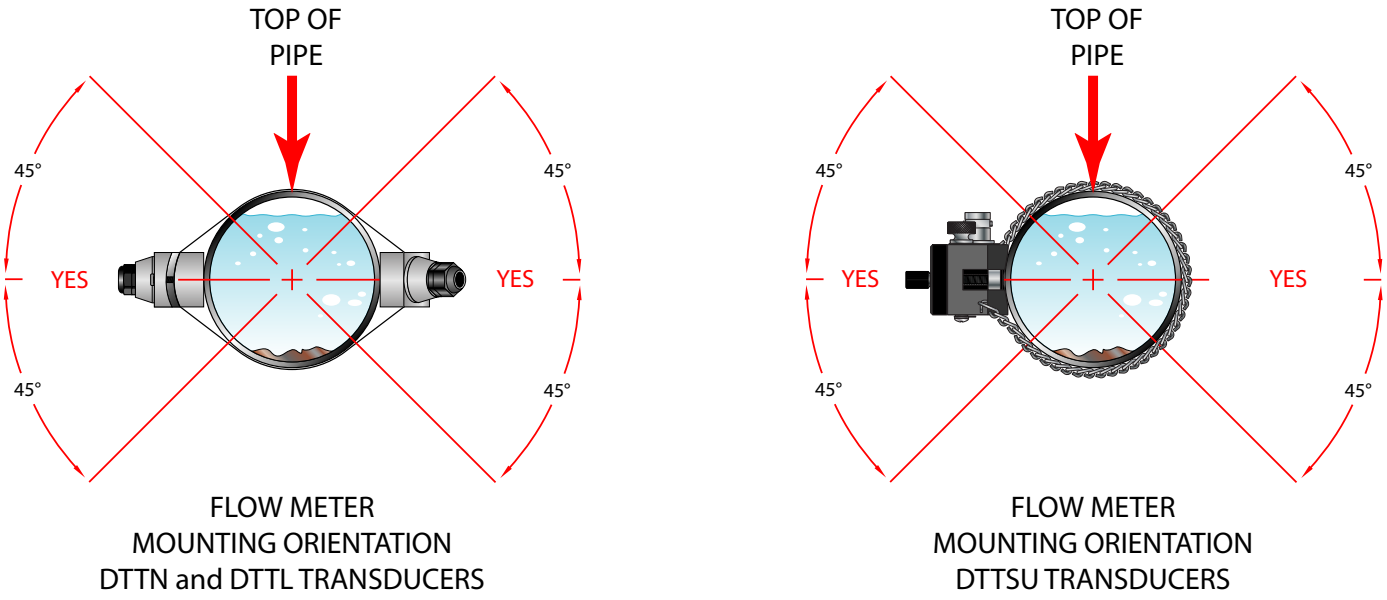


FIGURE 5.2 - TRANSDUCER ORIENTATION — HORIZONTAL PIPES

Application of Couplant

For DTTN and DTTL transducers, place a single bead of couplant, approximately ½ inch (12 mm) wide, on the flat face of the transducer. See ***Figure 5.3***. Generally, a silicone-based grease is used as an acoustic couplant, but any grease-like substance that is rated not to "flow" at the temperature that the pipe may operate at will be acceptable.

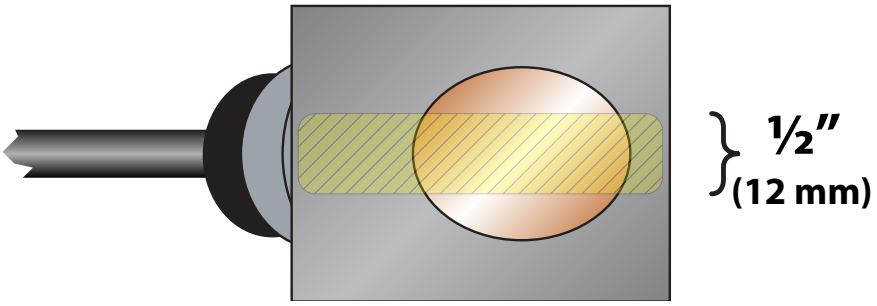


FIGURE 5.3 - APPLICATION OF COUPLANT

Transducer Positioning

1) Place the upstream transducer in position and secure with a mounting strap. Straps should be placed in the arched groove on the end of the transducer. A screw is provided to help hold the transducer onto the strap. Verify that the transducer is true to the pipe and adjust as necessary. Tighten the transducer strap securely.
2) Place the downstream transducer on the pipe at the calculated transducer spacing. See ***Figure 5.4***. Apply firm hand pressure. If signal strength is greater than 5, secure the transducer at this location. If the signal strength is not 5 or greater, using firm hand pressure slowly move the transducer both towards and away from the upstream transducer while observing signal strength.

NOTE: *Signal strength readings update only every few seconds, so it is advisable to move the transducer ⅛", wait, see if signal is increasing or decreasing and then repeat until the highest level is achieved.*

Signal strength can be displayed on the DXN's display. Clamp the transducer at the position where the highest signal strength is observed. The factory default signal strength setting is 5,

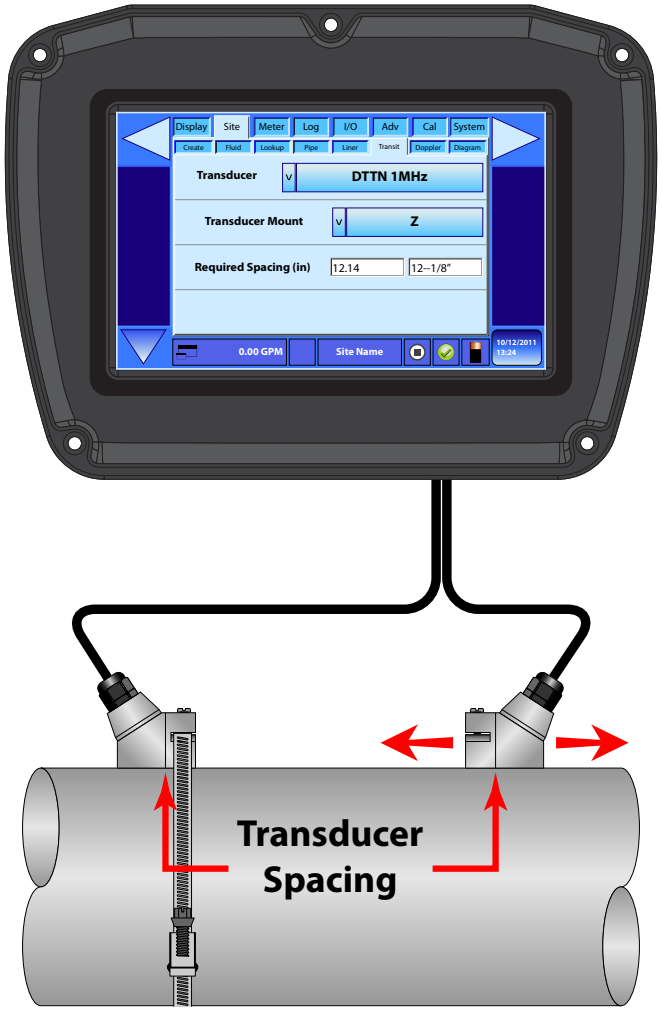


FIGURE 5.4 - TRANSDUCER SPACING

however there are many application specific conditions that may prevent the signal strength from attaining this level. For the DXN, signal levels much less than 5 will probably not be acceptable for reliable readings.

3) If after adjustment of the transducers the signal strength does not rise to above 5, then an alternate transducer mounting method should be selected. If the mounting method was **W**-Mount, then re-configure the transmitter for **V**-Mount, move the downstream transducer to the new spacing distance.

NOTE: *As a rule, the DTTL should be used on pipes 24" and larger and not used for application on a pipe smaller than 4". Consider application of the DTTL transducers on pipes smaller than 24" if there are less quantifiable aspects such as - sludge, tuberculation, scale, rubber liners, plastic liners, thick mortar liners, gas bubbles, suspended solids, emulsions, and smaller pipes that are perhaps partially buried where a **V**-Mount is required/desired, etc.*

DTTSU SMALL PIPE TRANSDUCER INSTALLATION

TheDTTSU small pipe transducers are adjustable for pipe sizes between ½" (12 mm) and 2" (50 mm). Do not attempt to mount a DTTSU transducer onto a pipe that is either too large or too small for the transducer.

NOTE: *All DTTSU transducers use a 2 MHz transmission frequency and V-Mount configuration.*

DTTSU installation consists of the following steps:

1) Determine the transducer spacing required using the DXN and using the scale on the side of the DTTSU transducers set the spacing. See ***Figure 5.5.***
2) On horizontal pipes, mount the transducer in an orientation such that the cable exits at ±45 degrees from the side of the pipe. Do not mount with the cable exiting on either the top or bottom of the pipe. On vertical pipes the orientation does not matter. See ***Figure 2.2***.

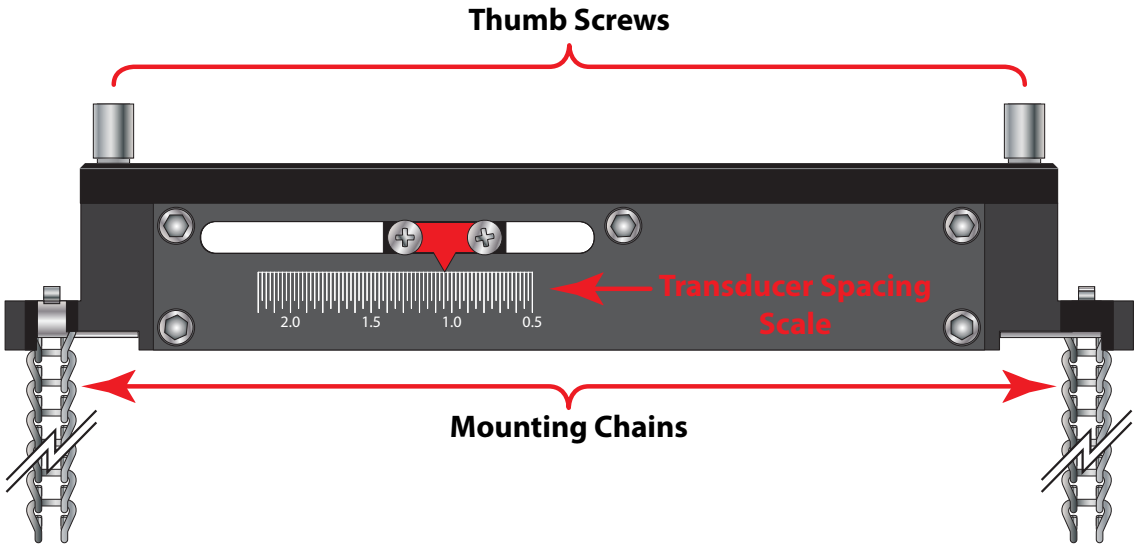


FIGURE 5.5 - TRANSDUCER SPACING SCALE — DTTSU TRANSDUCERS

3) Wrap the mounting chains around the pipe and secure the chains to their respective mounting cleats.

NOTE: *The chains do not need to be taught at this point. Any slack in the chains will be removed when the thumb screws are adjusted.*

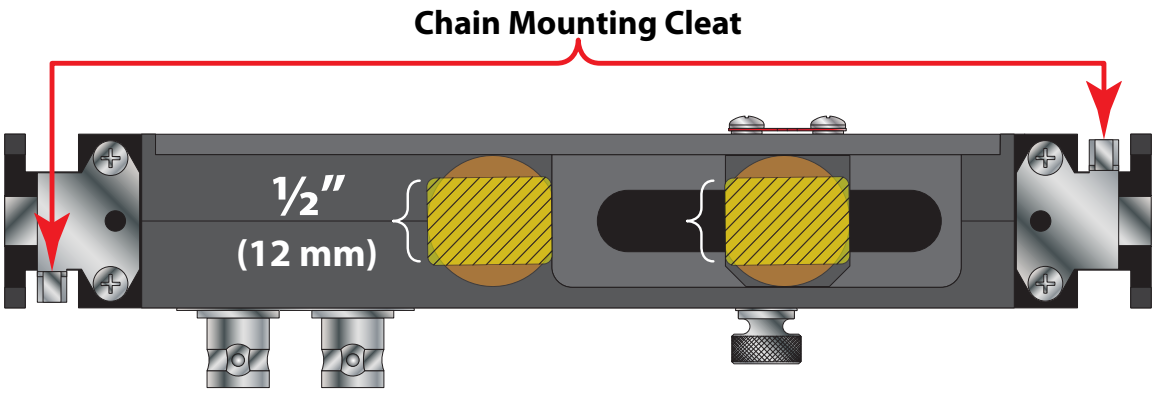


FIGURE 5.6 - APPLICATION OF ACOUSTIC COUPLANT — DTTSU TRANSDUCERS

4) Finger tighten the thumb screws so that the acoustic coupling grease begins to flow out from the under the transducer **Do not over tighten**.
5) If signal strength is less than 5, remount the transducer at another location on the piping system.

NOTE: *If a DTTSU small pipe transducer was purchased separately from the DXN meter, the following configuration procedure is required.*

FIGURE 5.7 - DTTSU TRANSDUCER - MOUNTED

MOUNTING TRANSDUCERS IN Z-MOUNT CONFIGURATION

Installation on larger pipes requires careful measurements of the linear and radial placement of the DTTN or DTTL transducers. Failure to properly orient and place the transducers on the pipe may lead to weak signal strength and/or inaccurate readings. This section details a method for properly locating the transducers on larger pipes. This method requires a roll of paper such as freezer paper or wrapping paper, masking tape and a marking device.

1) Wrap the paper around the pipe in the manner shown in ***Figure 5.8***. Align the paper ends to within ¼ inch (6 mm).
2) Mark the intersection of the two ends of the paper to indicate the circumference. Remove the template and spread it out on a flat surface. Fold the template in half, bisecting the circumference. See ***Figure 5.9***.
3) Crease the paper at the fold line. Mark the crease. Place a mark on the pipe where one of the transducers will be located. See ***Figure 5.2*** for acceptable radial orientations. Wrap the template back around the pipe, placing the beginning of the paper and one corner in the location of the mark. Move to the other side of the pipe and mark the pipe at the ends of the crease. Measure from the end of the crease (directly across the pipe from the first transducer location) the dimension derived in ***Step 2***, Transducer Spacing. Mark this location on the pipe.
4) The two marks on the pipe are now properly aligned and measured.

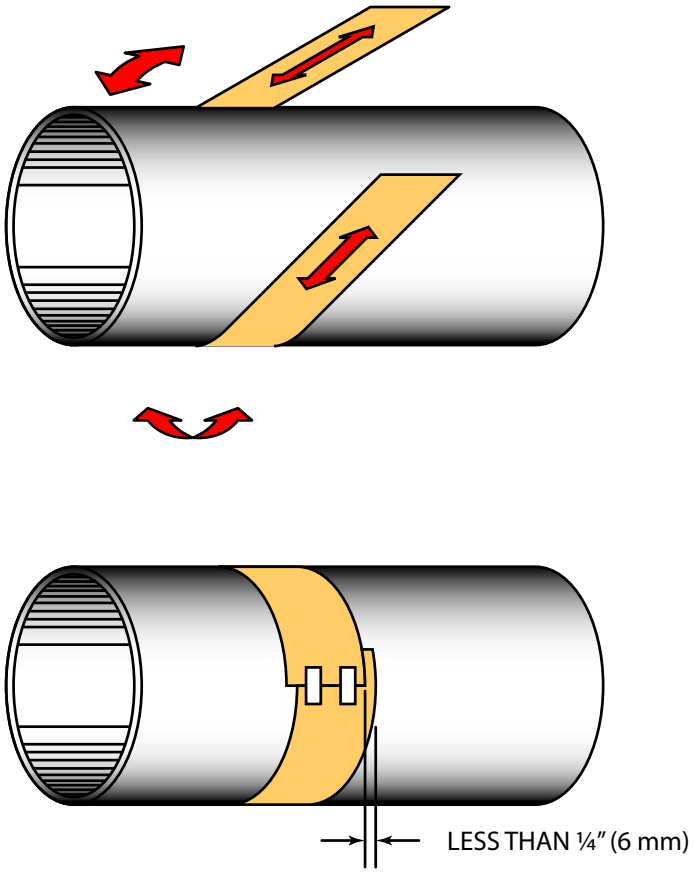


FIGURE 5.8 - PAPER TEMPLATE PLACEMENT

If access to the bottom of the pipe prohibits the wrapping of the paper around the circumference, cut a piece of paper ½ the circumference of the pipe and lay it over the top of the pipe. The length of ½ the circumference can be found by:

½ Circumference = Pipe O.D. × 1.57

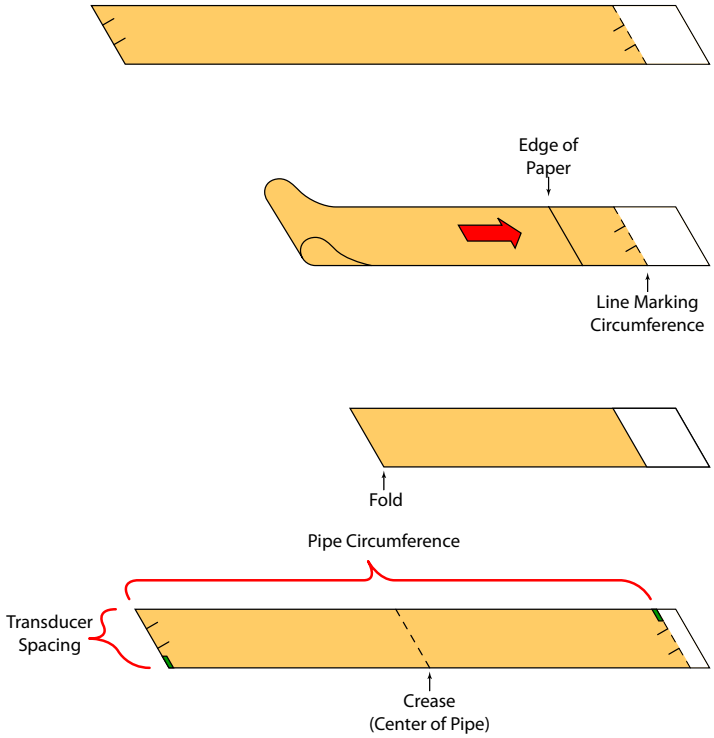


FIGURE 5.9 - BISECTING THE PIPE CIRCUMFERENCE

The transducer spacing is the same as found in the Transducer Positioning section.

Mark opposite corners of the paper on the pipe. Apply transducers to these two marks.

5) For DTTN and DTTL transducers, place a single bead of couplant, approximately ½ inch (12 mm) thick, on the flat face of the transducer. See ***Figure 5.3***. Generally, a silicone-based grease is used as an acoustic couplant, but any good quality grease-like substance that is rated to not "flow" at the temperature that the pipe may operate at will be acceptable.

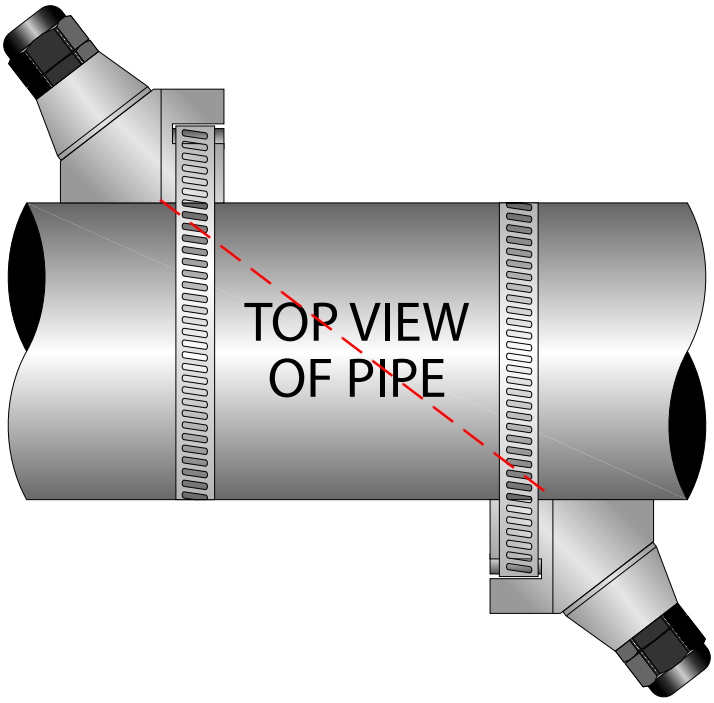


FIGURE 5.10 - Z-MOUNT TRANSDUCER PLACEMENT

6) Place the upstream transducer in position and secure with a stainless steel strap or other fastening device. Straps should be placed in the arched groove on the end of the transducer. A screw is provided to help hold the transducer onto the strap. Verify that the transducer is true to the pipe, adjust as necessary. Tighten transducer strap securely. Larger pipes may require more than one strap to reach the circumference of the pipe.

7) Place the downstream transducer on the pipe at the calculated transducer spacing. See ***Figure 5.4***. Using firm hand pressure, slowly move the transducer both towards and away from the upstream transducer while observing signal strength. Clamp the transducer at the position where the highest signal strength is observed. Signal strength of between 5 and 98 is acceptable. The factory default signal strength setting is 5, however there are many application specific conditions that may prevent the signal strength from attaining this level.

   A minimum signal strength of 5 is acceptable as long as this signal level is maintained under all flow conditions.
   On certain pipes, a slight twist to the transducer may cause signal strength to rise to acceptable levels.

8) Certain pipe and liquid characteristics may cause signal strength to rise to greater than 98. The problem with operating a DXN with very high signal strength is that the signals may saturate the input amplifiers and cause erratic readings. Strategies for lowering signal strength would be changing the transducer mounting method to the next longest transmission path. For example, if there is excessive signal strength and the transducers are mounted in a **Z**-Mount, try changing to **V**-Mount or **W**-Mount. Finally you can also move one transducer slightly off line with the other transducer to lower signal strength.

9) Secure the transducer with a stainless steel strap or other fastener.

MOUNTING TRACK INSTALLATION

1) A convenient transducer mounting track can be used for pipes that have outside diameters between 2 and 10 inches (50 and 250 mm). If the pipe is outside of that range, select a **V**-Mount or **Z**-Mount mounting method.
2) Install the single mounting rail on the side of the pipe with the stainless steel bands provided. Do not mount it on the top or bottom of the pipe. Orientation on vertical pipe is not critical. Ensure that the track is parallel to the pipe and that all four mounting feet are touching the pipe.

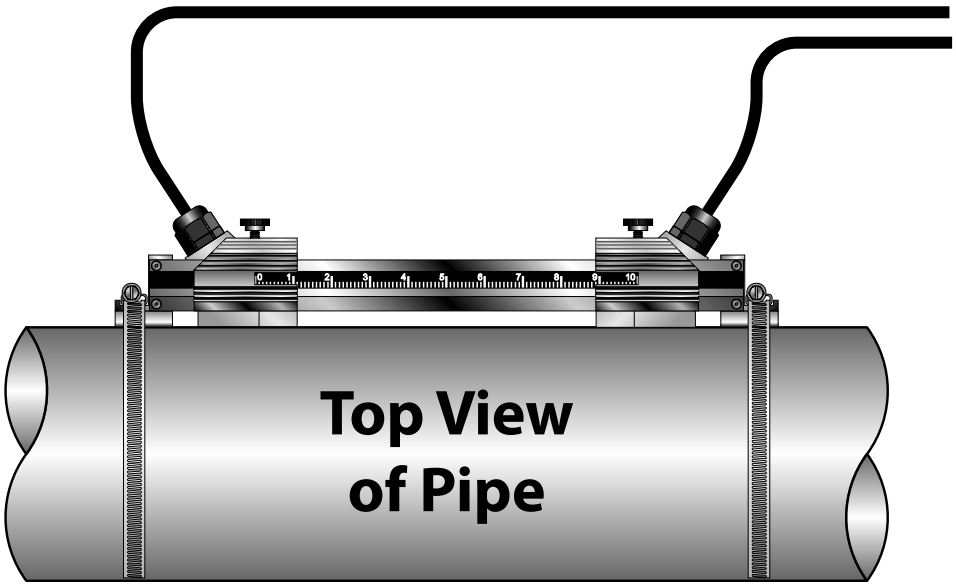


FIGURE 5.11 - MOUNTING TRACK INSTALLATION

3) Slide the two transducer clamp brackets towards the center mark on the mounting rail.
4) Place a single bead of couplant, approximately ½ inch (12 mm) thick, on the flat face of the transducer. See ***Figure 5.3***.
5) Place the first transducer in between the mounting rails near the zero point on the scale. Slide the clamp over the transducer. Adjust the clamp/transducer such that the notch in the clamp aligns with zero on the scale. See ***Figure 5.9***.
6) Secure with the thumb screw. Ensure that the screw rests in the counter bore on the top of the transducer. (Excessive pressure is not required. Apply just enough pressure so that the couplant fills the gap between the pipe and transducer.)
7) Place the second transducer in between the mounting rails near the dimension derived in the transducer spacing section. Read the dimension on the mounting rail scale. Slide the transducer clamp over the transducer and secure with the thumb screw.

Doppler Installation

Doppler transducers should be mounted on the pipe 180° apart and facing each other on the pipe, with the cables on the downstream side of the transducers. If the pipe is horizontal, the preferred mounting orientation is 3 and 9 o'clock, with 12 o'clock being the top of the pipe. ***See Figure 5.10***. Orientation on vertical pipes does not matter.

NOTE: *Doppler transducers may be mounted on the same pipe as transit time transducers without encountering acoustic cross-talk.*

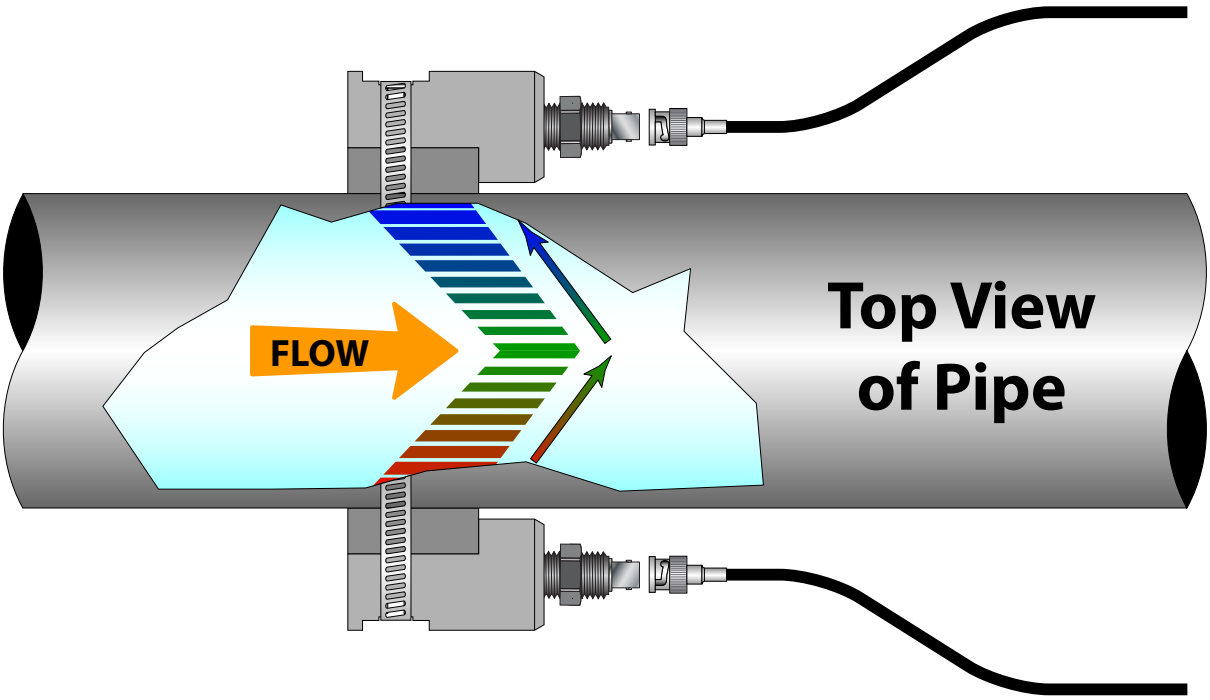


FIGURE 5.12 - DOPPLER TRANSDUCER PLACEMENT

PROCEDURE:

1) Large pipe installations utilize stainless steel straps to secure the transducers to the outside of the pipe. The DXN system is shipped with four 36" (900 mm) straps, which are suitable for pipes up to 39" (1000 mm) diameter. Select the proper number of transducer straps to allow a complete strap to go around the circumference of the pipe.
2) Wrap the strap around the pipe in the area where the transducers are to be mounted. Leave the strap loose enough to allow the transducers to be placed underneath. If multiple straps are being used, it can be beneficial to wrap electrical tape around all but one strap connection to secure the strap worm screws in place.
3) Spread an even layer of coupling compound, approximately ⅛" (3 mm) thick by ½" (12 mm) wide, to the bottom flat face of the two transducers.
4) Place each transducer under the strap with the flat face – amber plastic window – positioned towards the pipe. The notch on the back of the transducer will provide a mounting surface for the strap. The transducer cables must be facing in the same direction and in the downstream direction for proper operation.

NOTE: *Large pipes may require two people for this procedure.*

5) Tighten the strap strong enough to hold the transducers in place, but not so tight that all of the couplant squeezes out of the gap between the transducer face and pipe. Ensure that the transducers are squarely aligned on the pipe and 180° apart.
6) Route the transducer cables back to the area where the transmitter will be, avoiding high voltage cable trays and conduits.

NOTE: *Where a high amount of particulates are expected mounting the transducers "side-by-side" may allow enough sound reflection for the Doppler function to work.*

NOTE: *Low particulate content may sometimes be overcome by mounting the Doppler transducers downstream of a pipe elbow. A better solution to a low particulate fluid would be switching over to transit time measurements.*

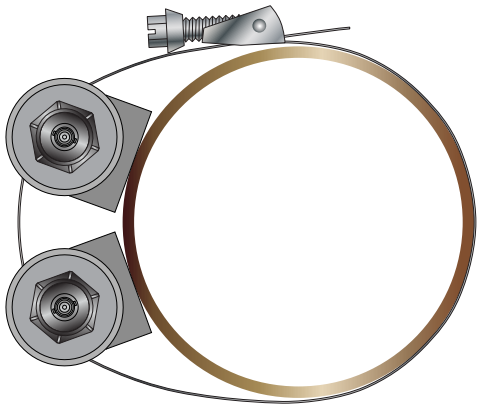


FIGURE 5.13 - SIDE-BY-SIDE DOPPLER MOUNTING

Mounting Straps

The most economical way to affix transducers to a pipe is by the use of adjustable mounting straps. Individual straps in both 36" (915 mm) and 72" (1830 mm) are available from Dynasonics. See ***Figure 5.12***. The straps can be connected together to make a continuous length. Small pipe transducer installations do not utilize straps, but use an integral clamping mechanism built into the transducer.

Pipe Size	36" Straps Required*
1" to 9" (25 mm to 225 mm)	1
10" to 19" (250 mm to 480 mm)	2
20" to 29" (500 mm to 740 mm)	3
30" to 39" (760 mm to 1000 mm)	4

* The above table indicates the number of straps required to mount one transducer. For transit time installations two transducers must be mounted.

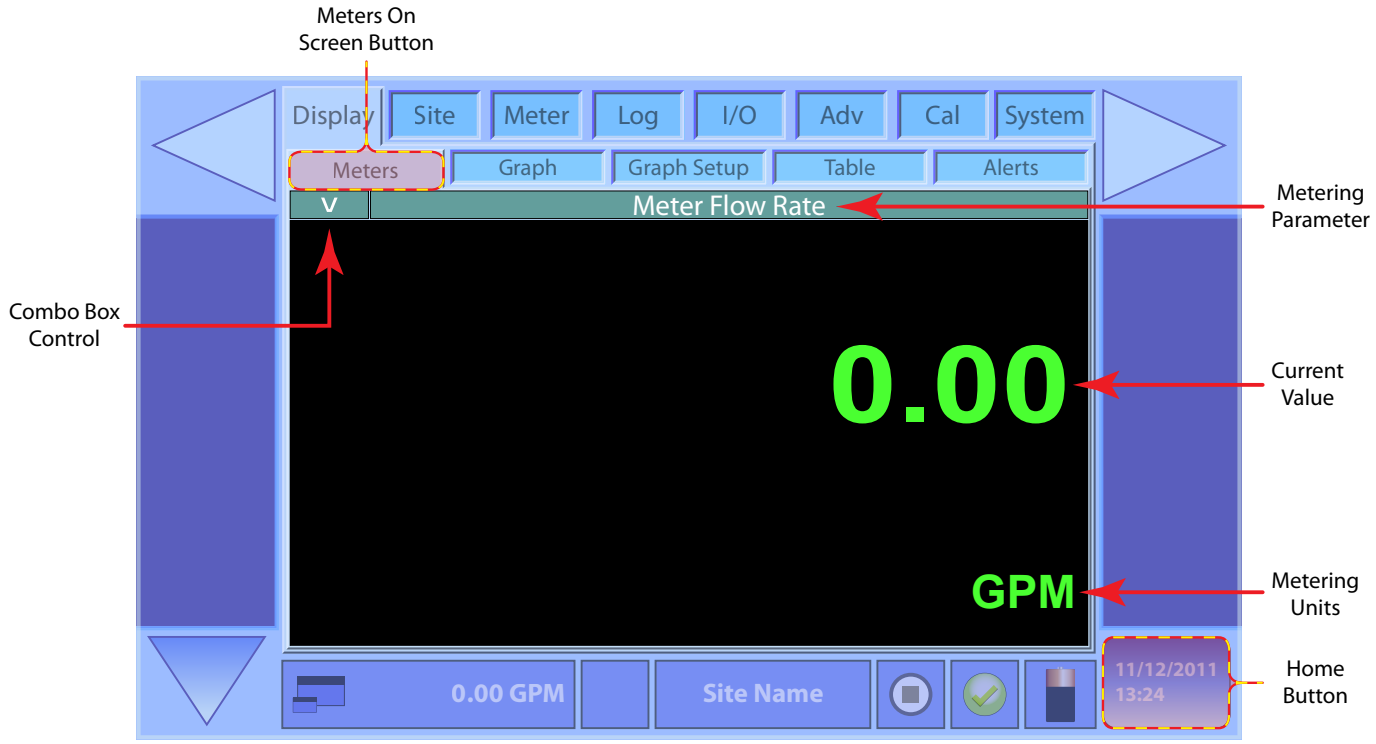
Doppler transducers are mounted either opposite each other or side-by-side and considered a single transducer for calculating the number of straps required.

TABLE 5.1 - STRAPS REQUIRED VS. PIPE SIZE

DISPLAY GROUP

Meters

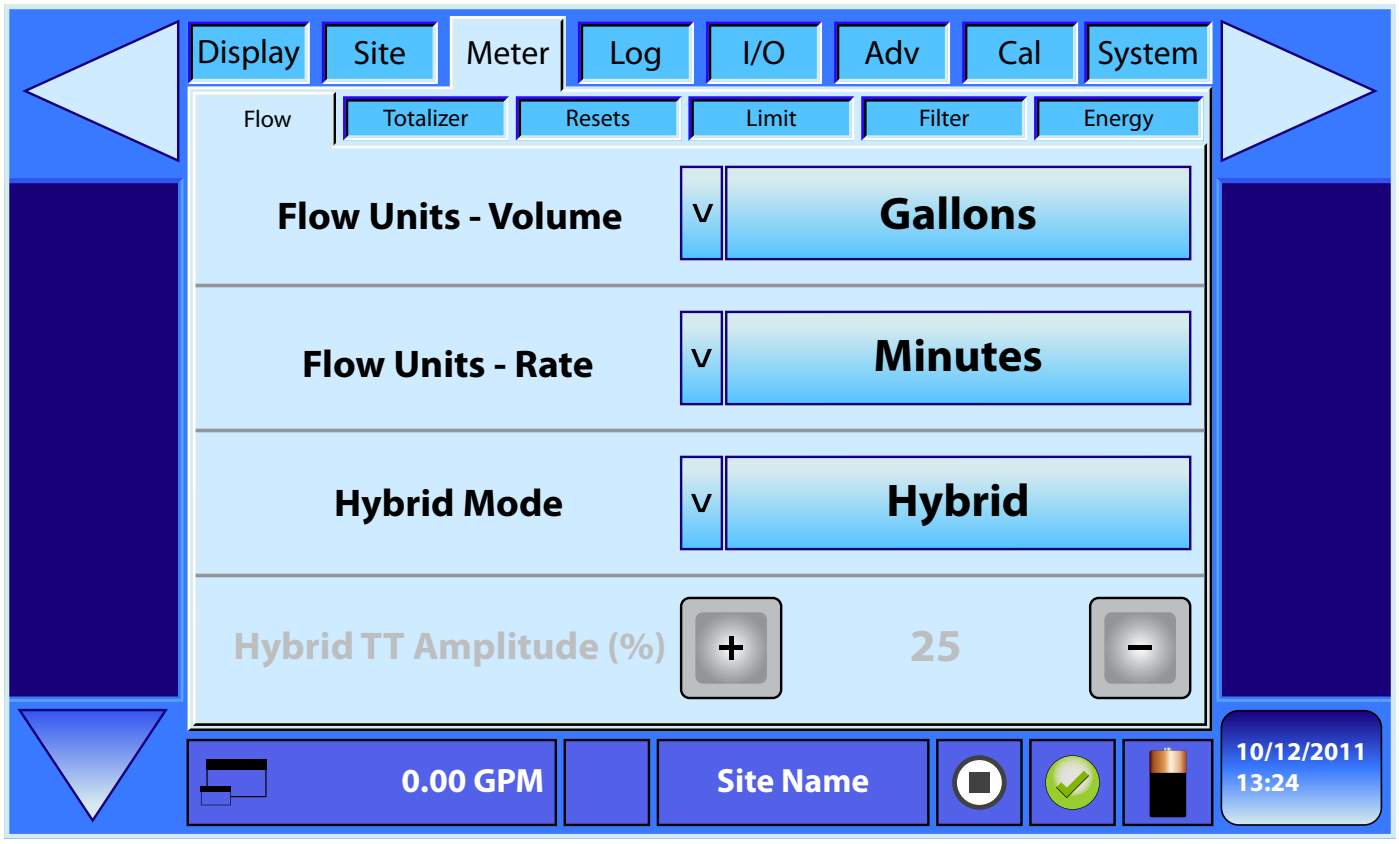
The “Home” display is to show meters that can indicated almost any of the system data.

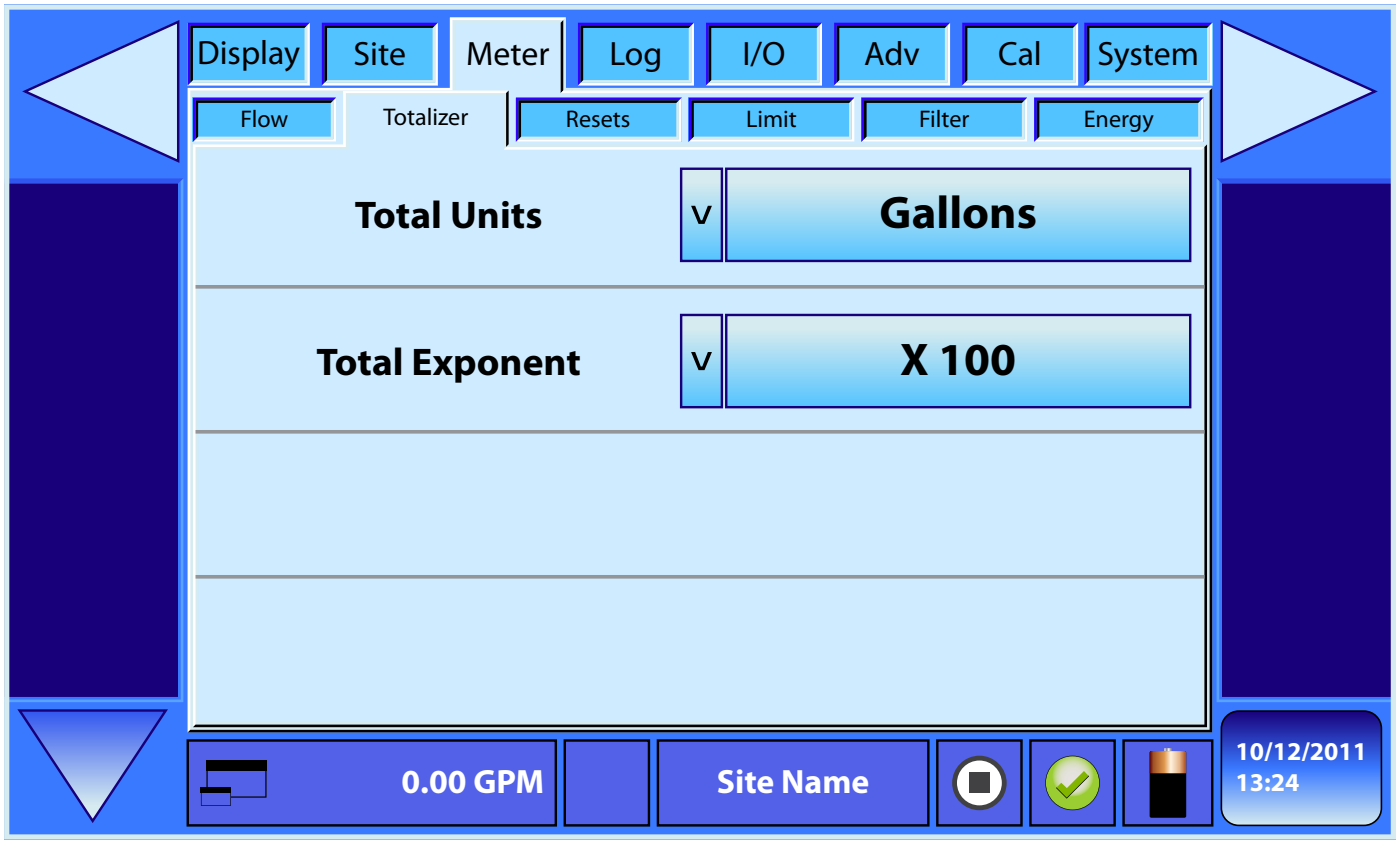


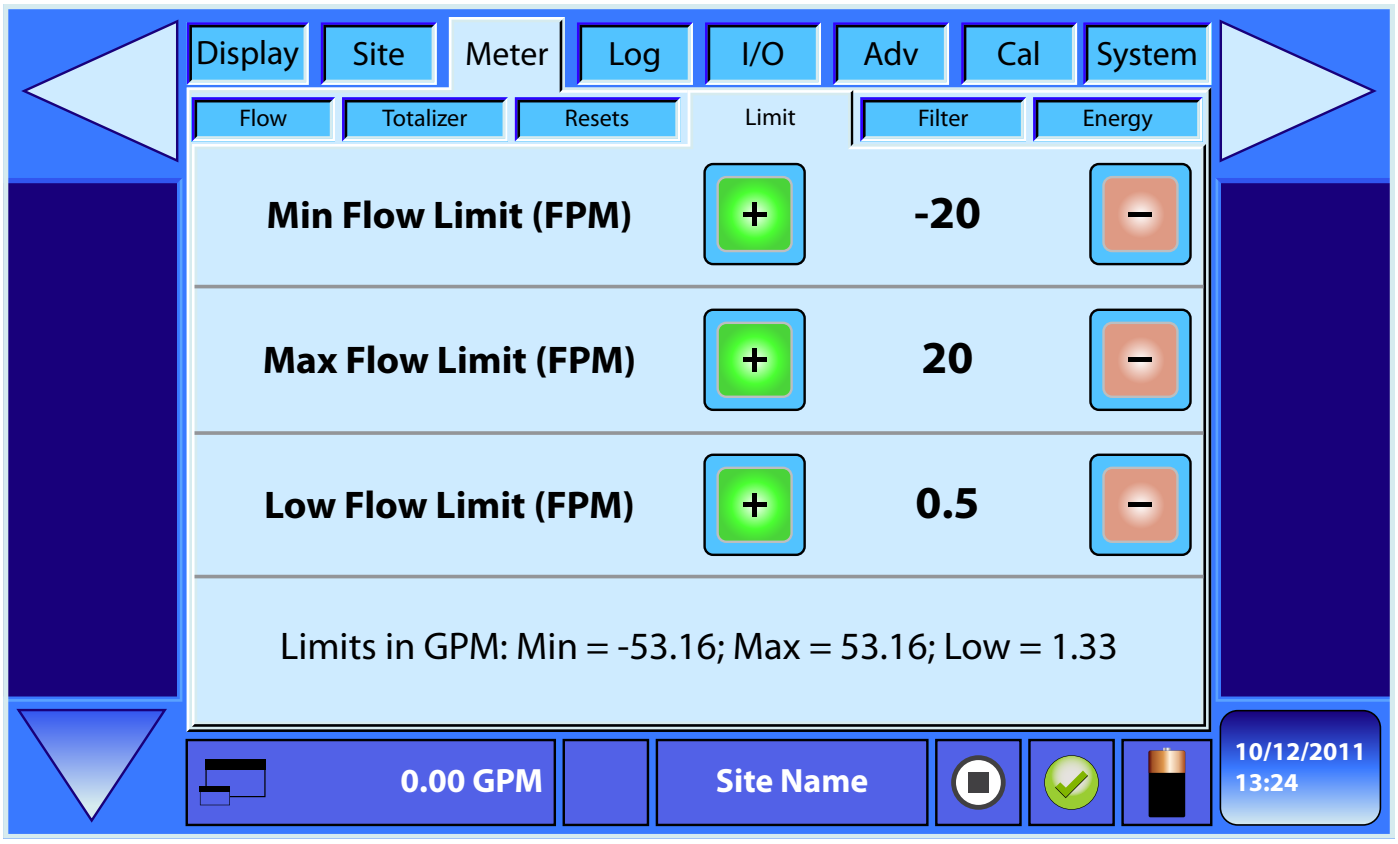
Double click “Meters” tab to change # of meters on screen at a time.
Double click Maximize Screen symbol in Status Bar to Min/Max Meters Page.
Metering Parameter can be changed by single click of “Metering Parameter” shaded area.

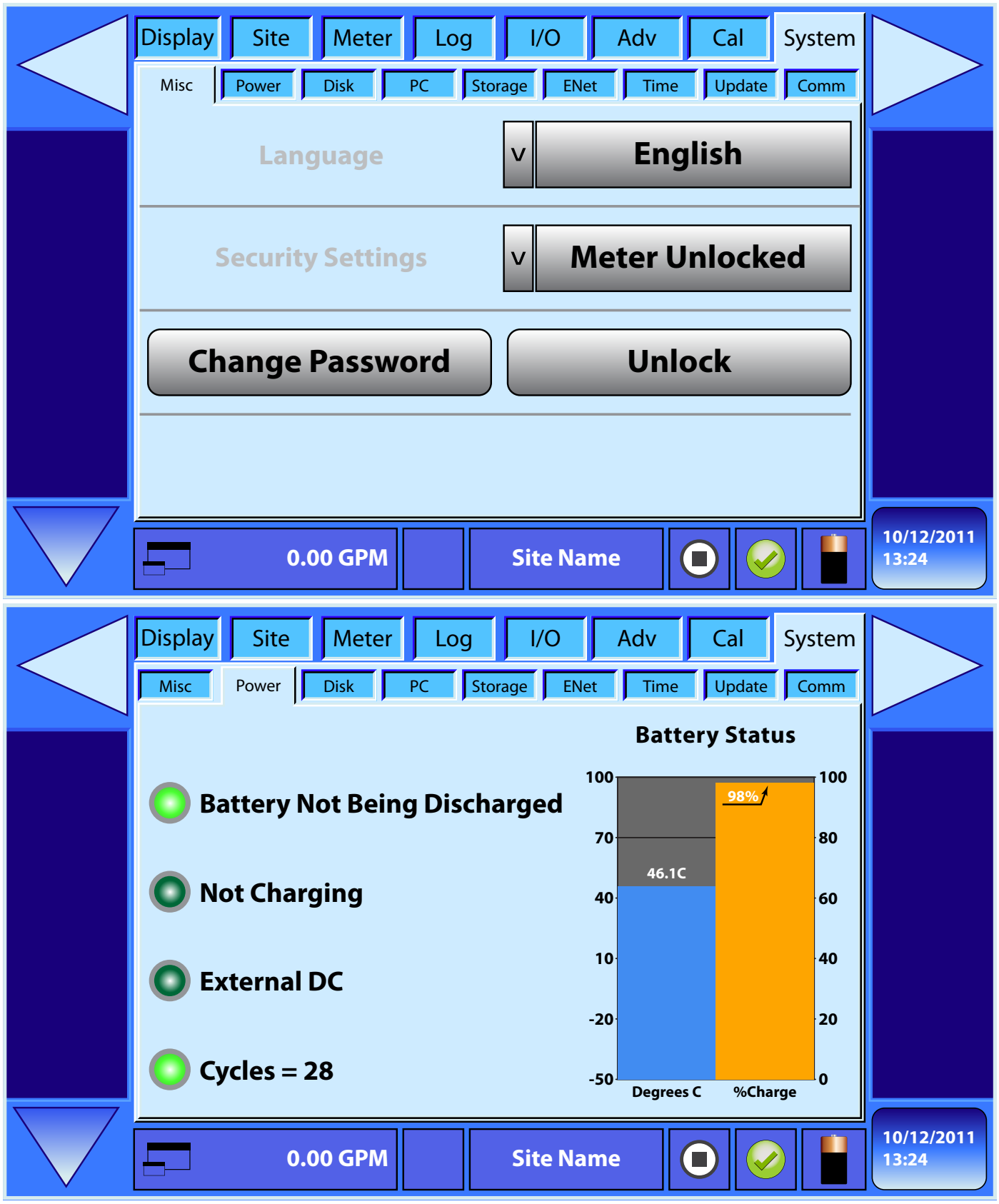
Currently 1, 3, or 4 meters can be on the screen at a time. Currently this is selected by double-tapping the “Meters” tab.


Display
Site
Meter
Log
I/O
Adv
Cal
System
Meters
Graph
Graph Setup
Table
Alerts
Meter Flow Rate
0.00
GPM
0.00 GPM
Site Name
10/12/2011
13:24


Display
Site
Meter
Log
I/O
Adv
Cal
System
Flow
Totalizer
Resets
Limit
Filter
Energy
Flow Units - Volume
v
Gallons
Flow Units - Rate
v
Minutes
Hybrid Mode
v
Hybrid
Hybrid TT Amplitude (%)
+
25
–
0.00 GPM
Site Name
10/12/2011
13:24


Display
Site
Meter
Log
I/O
Adv
Cal
System
Flow
Totalizer
Resets
Limit
Filter
Energy
Total Units
v
Gallons
Total Exponent
v
X 100
0.00 GPM
Site Name
10/12/2011
13:24


Display
Site
Meter
Log
I/O
Adv
Cal
System
Flow
Totalizer
Resets
Limit
Filter
Energy
Min Flow Limit (FPM)
+
-20
−
Max Flow Limit (FPM)
+
20
−
Low Flow Limit (FPM)
+
0.5
−
Limits in GPM: Min = -53.16; Max = 53.16; Low = 1.33
0.00 GPM
Site Name
10/12/2011
13:24



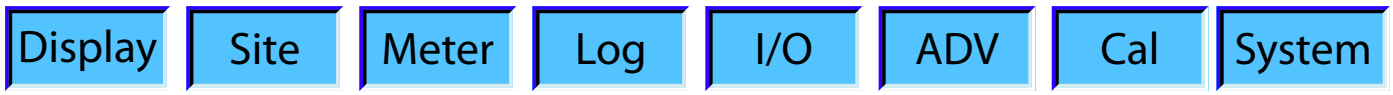
This shows battery status, etc. Graphs with temperature and % Charge.

Cycle Count is shown.

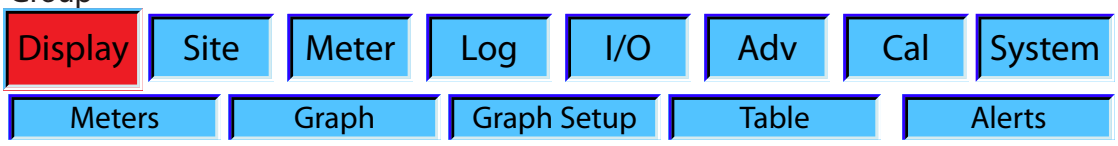
Time to end of battery, time to full charge.

TABBED MENU TREE

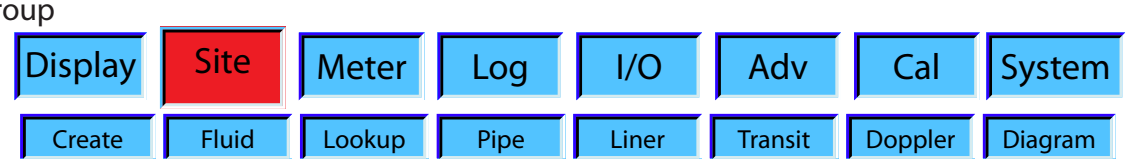
The meter controls are laid out in a hierarchal menu structure using the Group - Page format. If at any time the user looses track of the current position in the menu, there is a convenient “Go Home” button that takes the user back to the Home screen.



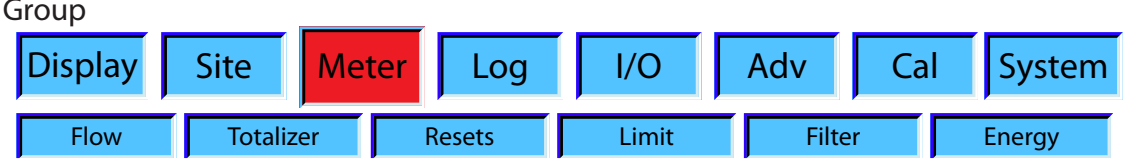
Display Group



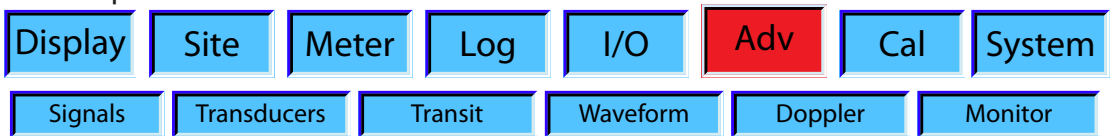
Site Group



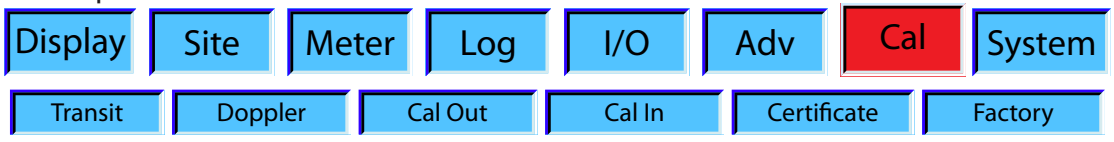
Meter Group



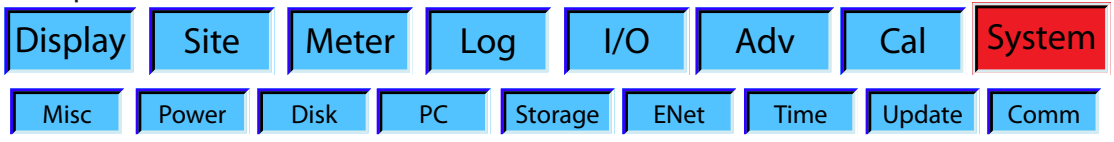
Advanced Group



Calibrate Group



System Group



Software Upgrades

1) The upgrade is supplied as a self extracting zip file and must be expanded on a PC before it can be loaded into the DXN. Double-click on the ***Filename.exe*** file to start the extraction process.
2) When the extraction process is complete copy the files to a USB thumb drive.
3) Start the DXN and allow it to get to the Display ► Meters screen.
4) Insert the thumb drive into the USB port on the rear of the DXN.
5) From the Display ► Meters screen press the System tab on the far right of the display.
6) From the System screen select the Update page (System ► Update).
7) Press the "Quit Meter to Manage / Update" button.
8) Press the "Start Updater" button.
9) Press the "Unlock" button (Step 1: Unlock System (reboot)
10) There will be a small panel in the center of the screen asking if it is OK to reboot. Remove the thumb drive and then press the "OK" button
11) After the reboot there will be a screen with a grayed out button that says "Insert USB Update Drive". When the update drive is inserted the grayed out button will change to "Start Updater". Press the "Start Updater button".
12) The meter should now be back on the update screen. Press "Copy" (Step 2: Copy Updated Files). When the copy process is complete the green "Copy" light will be illuminated. There should also be a text message in the message area to the right that says "Updated xx Files" where xx represents some number of files.
13) Press "Update DSP" (Step 3: Update DSP). The text area to the right will show a series of status messages that will end with "! Successful Update ! Exiting Reprogramming Mode".

NOTE: *If the process "hangs-up" press the "Update DSP" button a second time which should clear the hang.*

NOTE: *The process may take a few minutes to complete. When the process is complete the scroll bars in the message area should be used to verify that the updating process has terminated with the "****! Successful Update ! Exiting Reprogramming Mode"****.*

14) Remove the thumb drive and press the "Lock" (Step 4: Lock System (reboot). If the error message "Lock EWF Fail" appears in the text area press the "Restart System" button immediately below the text area to reboot. When the meter returns to the screen that had the grayed out "Insert USB Update Drive" press the "Start Flowmeter" button to resume normal operations.

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- Updates,
- Supplements,
- Internet-based services, and
- Support services

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- Print Services,
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  (iii) download the software to licensed devices and use it on them.

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http://www.microsoft.com/windowsxp/downloads/updates/sp2/docs/privacy.mspx.

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b. Computer Information. The following features use Internet protocols, which send to the appropriate systems computer information, such as your Internet protocol address, the type of operating system, browser and name and version of the software you are using, and the language code of the device where you installed the software. Microsoft uses this information to make the Internet-based services available to you.

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- **Digital Certificates.** The software uses digital certificates. These digital certificates confirm the identity of Internet users sending X.509 standard encrypted information. The software retrieves certificates and updates certificate revocation lists. These security features operate only when you use the Internet.

- **Auto Root Update.** The Auto Root Update feature updates the list of trusted certificate authorities. You can switch off the Auto Root Update feature.
- Windows Media Player. When you use Windows Media Player, it checks with Microsoft for

    - Compatible online music services in your region;

    - New versions of the player; and

    - Codecs if your device does not have the correct ones for playing content. You can switch off this feature. For more information, go to:
    http://microsoft.com/windows/windowsmedia/mp10/privacy.aspx.

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- **Anything related to the software, services, content (including code) on third party internet sites, or third party programs; and**

- **Claims for breach of contract, breach of warranty, guarantee or condition, strict liability, negligence, or other tort to the extent permitted by applicable law.**

It also applies even if Microsoft should have been aware of the possibility of the damages. The above limitation may not apply to you because your country may not allow the exclusion or limitation of incidental, consequential or other damages.

13. **Export Restrictions.** The software is subject to United States export laws and regulations. You must comply with all domestic and international export laws and regulations that apply to the software. These laws include restrictions on destinations, end users and end use. For additional information, see www.microsoft.com/exporting.

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