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SCOPE OF MANUAL

The purpose of this document is to provide an overview of the installation, wiring and basic configuration of the DXN Portable Ultrasonic flow meter. For more detailed information, see the DXN Portable User Manual, which can be downloaded at www.badgermeter.com.

IMPORTANT

Read this manual carefully before attempting any installation or operation. Keep the manual accessible for future reference.

Typographic Conventions

- Items on the software screens that you will be asked to select or choose by clicking a button, highlighting, checking a box or another similar means are in **bold** text and capitalized in the manual.
Example: Press **Delete Site Logs**.
- Names of tabs, pages, options, boxes, columns and fields are *italicized*. In most cases, first letters will be capitalized.
Example: The *Low Flow Limit* is the minimum flow rate at which the meter gives reliable readings.
- Messages and special markings are shown in quotation marks.
Example: "Lock EWF Fail" displays in the text area.

Unpacking and Inspection

Upon opening the shipping container, visually inspect the product and applicable accessories for any physical damage such as scratches, loose or broken parts, or any other sign of damage that may have occurred during shipment.

NOTE: If damage is found, request an inspection by the carrier's agent within 48 hours of delivery and file a claim with the carrier. A claim for equipment damage in transit is the sole responsibility of the purchaser.

SAFETY

Terminology and Symbols



Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing death or serious personal injury.



Indicates a hazardous situation, which, if not avoided, could result in severe personal injury or death.



Indicates a hazardous situation, which, if not avoided, is estimated to be capable of causing minor or moderate personal injury or damage to property.

PRE-INSTALLATION CHECKLIST

1. Read this Quick Start Manual in its entirety.
2. Charged Battery—Charge the battery for four hours with the unit turned off.
3. Tools (not included with the DXN flow meter)
 - a. Nut driver (5/16") or flat-head screwdriver.
 - b. Permanent marker or other utensil that will make a visible mark on the pipe.
 - c. Tape (for larger pipe configurations, Z-mode).
 - d. Scissors (for larger pipe configurations, Z-mode).
 - e. Cloth or paper towels
4. Select a proper transducer mounting site— In general, select a mounting location in the piping system with a minimum of 10 pipe diameters of straight pipe upstream and 5 diameters of straight pipe downstream. For example, if the nominal pipe size is 10 inches, a straight section of pipe at least 150 inches (100 inches upstream and 50 inches downstream) is required for accurate measurements. Additional lengths are needed for piping systems with valves, reducers or pipes bends/elbows that are out of plane. See *Table 1* for additional configurations and length requirements.

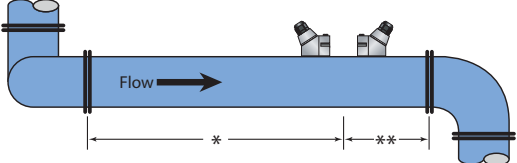
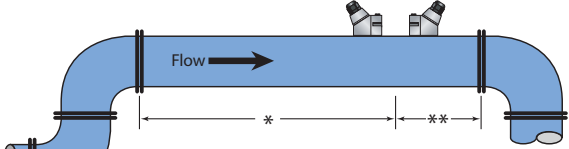
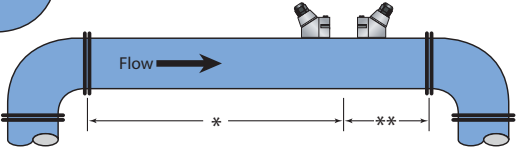
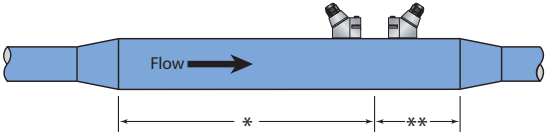
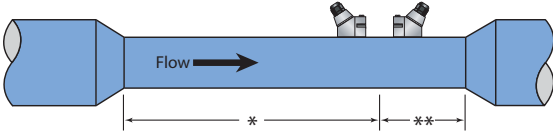
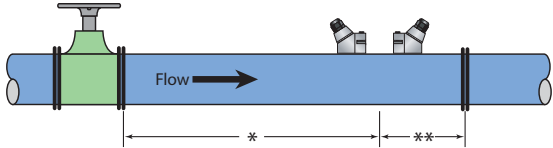
| Piping Configuration and Transducer Positioning | Upstream Pipe Diameters | Downstream Pipe Diameters |
|---|-------------------------|---------------------------|
|  | 24 | 5 |
|  | 14 | 5 |
|  | 10 | 5 |
|  | 10 | 5 |
|  | 10 | 5 |
|  | 24 | 5 |

Table 1: Transducer locations configurations

5. Prepare area where transducers will be mounted—The pipe surface where the transducers are to be mounted must be clean and dry. Remove scale, rust or loose paint to provide 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.
6. Do not attach the transducers to the pipe until the unit is programmed.

MENU CONVENTIONS

The DXN uses a *Group > Page* layout for navigation. The tabbed menu tree provides access to all controls and settings using a Group Tab name > Page name.

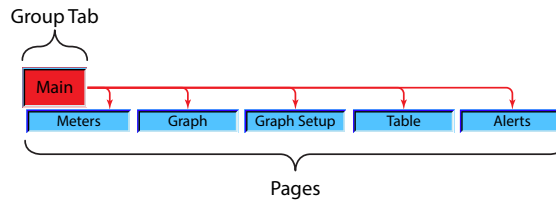


Figure 1: Page layout navigation

Main Screen

The DXN main screen contains all the controls needed to manipulate the user interface. The meter uses buttons, drop-down menus and scroll bars to configure meter functions.

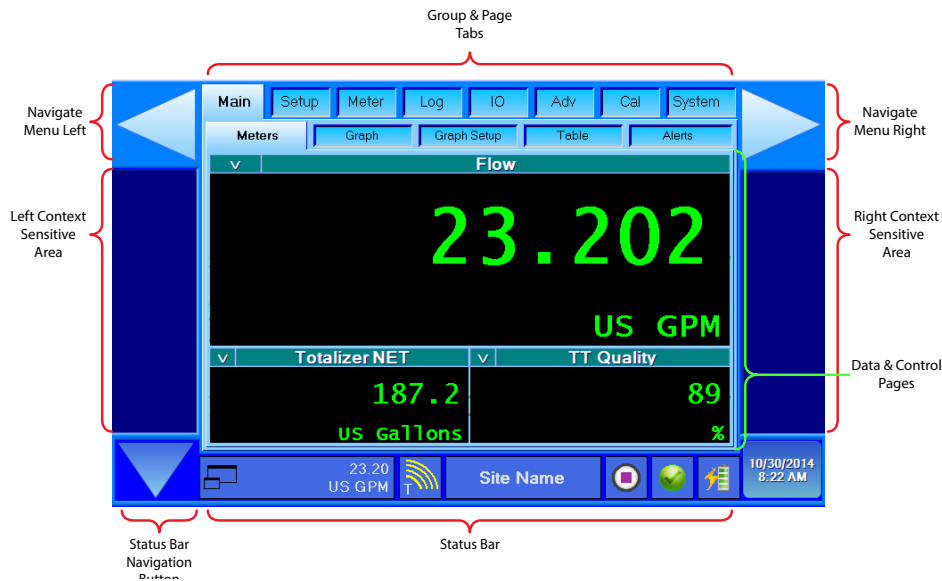


Figure 2: Main menu screen

The status bar arrow key, in the bottom left corner, controls which status bars are displayed. Each press of the arrow key scrolls to the next control or display.

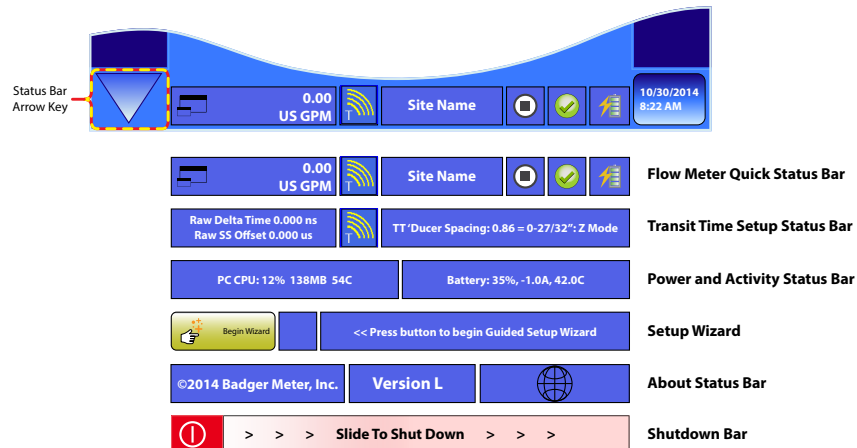


Figure 3: Status bars

The Quick Status Bar also has a segment that does double duty as a button that functions as a toggle as well.



Figure 4: Status bar button

The right segment of the Quick Status Bar has shortcuts leading to some of the most referenced menu screens.

| | |
|--|--|
| | The Battery icon brings up the System > Power screen showing real time battery condition. |
| | The Communications icon brings up the System > Comm screen showing continuous data being output to the active serial port. |
| | The Data logger shortcut reveals the Log > Setup control screen allowing quick access to the data logger controls. |

INSTALLATION

This section provides step-by-step procedures for commissioning the DXN flow meter.

NOTE: Some programming is required to correctly mount the transducers and to set process variables for proper acoustic conduction.

1. Turn on the flow meter by pressing the **Power On** switch on top of the unit.
2. Upon boot-up, there will be a screen presenting three different icons. Press the **Flow Meter** icon.
3. The next screen displays three startup methods. Use the descriptions below to choose the option that is most useful. There is a timeout of 15 seconds to make a selection before the unit uses the startup method currently selected.

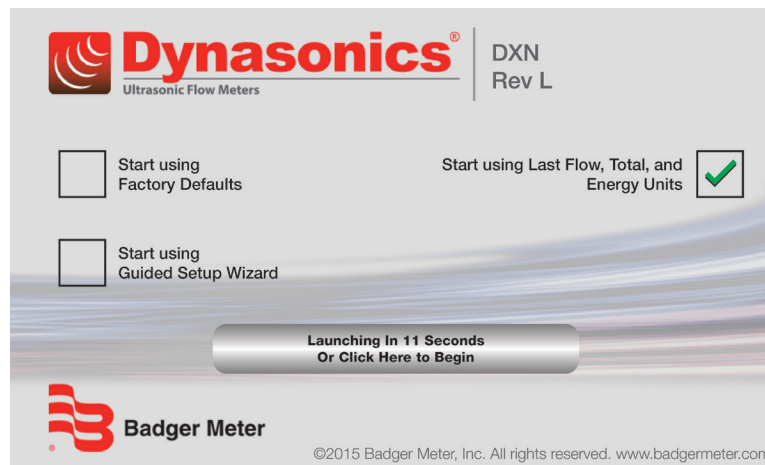


Figure 5: Startup methods

- *Start using Factory Defaults* starts the meter using the factory loaded settings.
- *Start using Guided Setup Wizard* allows for the fastest commissioning of the portable device. It is a step-by-step wizard that asks questions about the process and environment. Upon completion of the steps, the meter will be configured for a particular site.
- *Start using last Flow, Total and Energy Units* applies to users who have already programmed the DXN flow meter at some point. The unit will recall the last known configuration, and use the same flow, total and energy units that were programmed. This helps save some setup time, if the various test site locations have the same flow parameters.

4. Navigate to the *Setup>Site* tab to create a site location that—after complete programming—will be stored for later use.

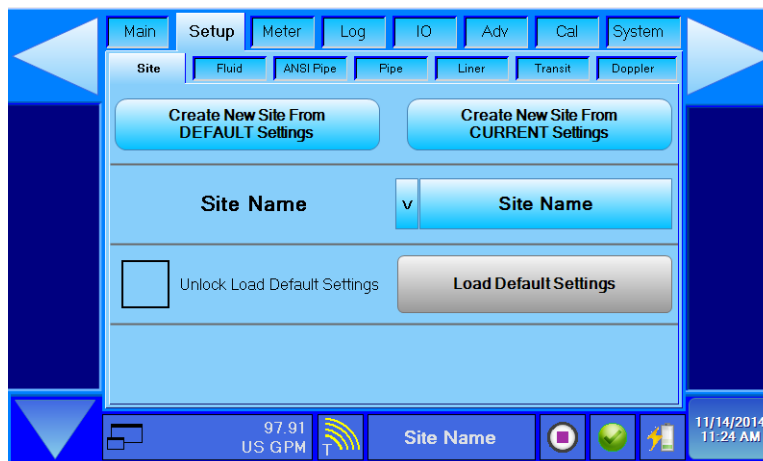


Figure 6: Site setup

5. Create a new site for the location to be checked.
- Create a site for each location where flow will be measured. This will allow for quicker setup times, as the unit can store over 300 site names while storing all the setup variables for each site.
 - To access a previously configured site, navigate to the *Setup>Site* tab and select a site from the *Site Name* pull-down list.
6. Navigate to the *Setup>Fluid* tab to set up fluid characteristics.

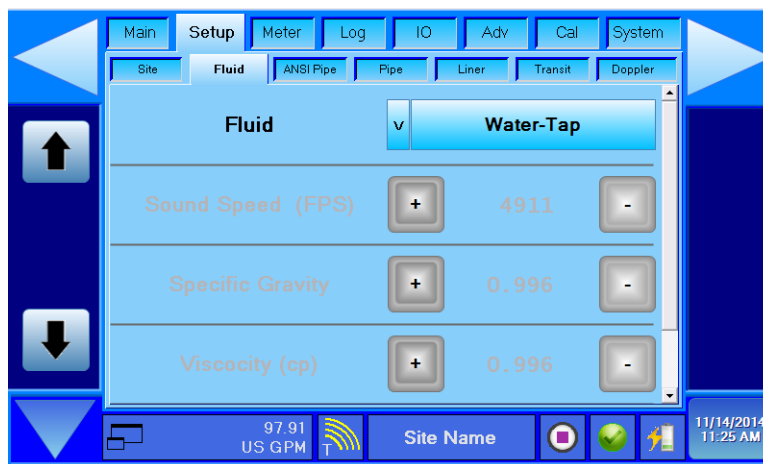


Figure 7: Fluid setup

7. Select a fluid type from the pull-down list. If the process fluid is not shown in the list, use the **Custom Fluid** option at the bottom of the list and enter the fluid properties (sound speed, specific gravity, viscosity and specific heat capacity) before moving onto the next step.

8. Navigate to the *Setup>ANSI Pipe* tab to set up piping characteristics.

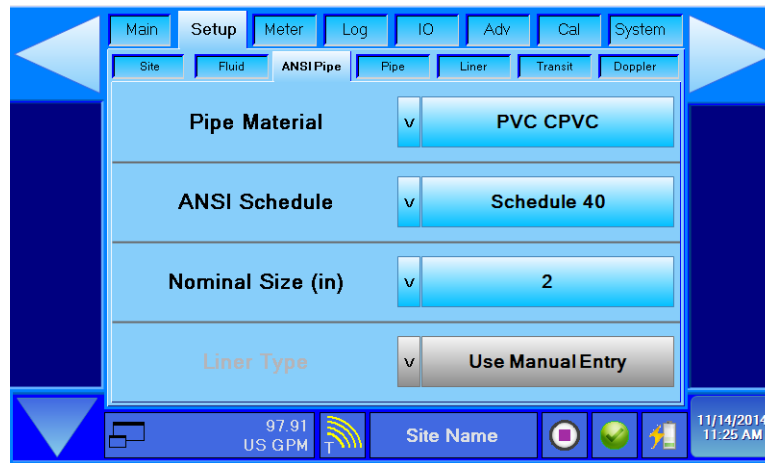


Figure 8: ANSI pipe setup

9. From the pull-down lists, select *Pipe Material*, *ANSI Schedule/Class* and *Nominal Size*. Select the most appropriate options for a given field. Fill in this page to the best of your knowledge. If all these fields are entered, skip to step 10.
 - a. If any of the characteristics are unknown, select the **Use Manual Entry** option, then navigate to the *Setup>Pipe* tab to finish the piping characteristics configuration. Pipe material, outer diameter and pipe wall thickness are entered here.

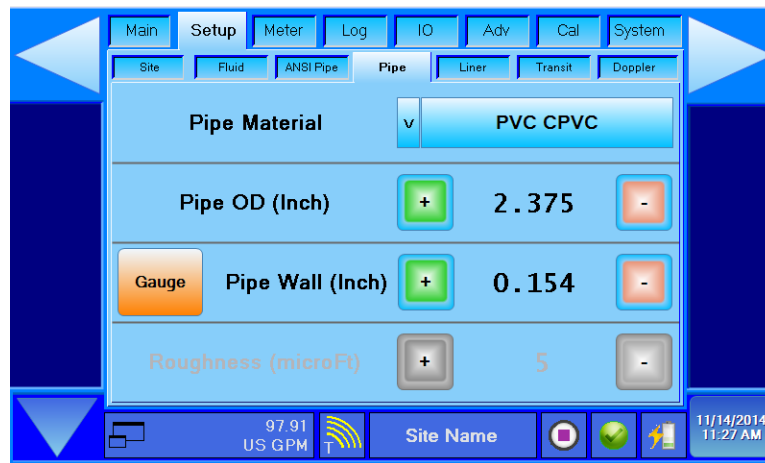


Figure 9: Pipe page allowing manual entry

- b. Enter a pipe wall thickness or use the *Gauge* button (coupled with the wall thickness transducer set) to obtain and program the wall thickness. See the complete user manual for more details.

10. Navigate to the *Setup>Liner* page to program pipe liner type and thickness. If the pipe has no liner, skip to step 13.



Figure 10: Liner setup

11. From the *Liner Material* pull-down list, select a liner that fits the liner type as closely as possible.

12. Enter the liner thickness, if applicable, in the next field.

13. Navigate to the *Setup>Transit* tab to program transducer characteristics and mounting methods. It is not required to install both the transit time and Doppler transducers.

- If little to no particulates are present, transit time measurements will yield the most accurate reading.
- High amounts of particulates or gas bubbles may require the use of the Doppler transducers.
- If you are not sure of the particulate content, install both.

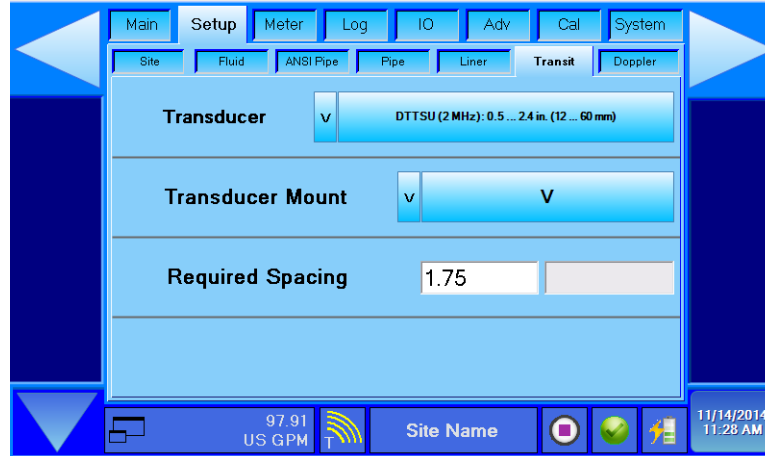


Figure 11: Transit setup

- To program transit time transducers, from the *Transducer* pull-down list, select the transducer type. See *Table 2 on page 12* for the proper transit time transducer selection. To program Doppler transducers, skip to step 13.
- From the *Transducer Mount* pull-down list, select a mounting method most appropriate for the application. See *Table 2 on page 12* for the most suitable mounting method.

| Transducer Mount | Transducer | Pipe Material | Pipe Size |
|------------------|----------------|---------------------|-------------------------------|
| W-Mount | DTTN/DTTH/DTTR | Plastic (all types) | 2...4 in. (50...100 mm) |
| | | Ductile Iron | Not recommended |
| | DTTL | Plastic (all types) | 8...16 in. (203...406 mm) |
| | | Ductile Iron | Not recommended |
| V-Mount | DTTN/DTTH/DTTR | Plastic (all types) | 4...12 in. (203...406 mm) |
| | | Copper | 4...30 in. (100...750 mm) |
| | | Ductile Iron | 2...12 in. (50...300 mm) |
| | DTTL | Plastic (all types) | 16...48 in. (406...1220 mm) |
| | | Carbon Steel | 16...36 in. (406...915 mm) |
| | | Copper | 16...48 in. (406...1220 mm) |
| Z-Mount | DTTN/DTTH/DTTR | Plastic (all types) | >30 in. (>750 mm) |
| | | Carbon Steel | >12 in. (>300 mm) |
| | | Copper | >30 in. (>750 mm) |
| | | Ductile Iron | >12 in. (>300 mm) |
| | DTTL | Plastic (all types) | >48 in. (>1220 mm) |
| | | Carbon Steel | >36 in. (>915 mm) |
| | | Copper | >48 in. (>1220 mm) |
| | | Ductile Iron | >30 in. (>750 mm) |
| W-Mount | DTTSU | Plastic (all types) | 0.5...0.75 in. (12.7...19 mm) |
| V-Mount | | Galvanized | Not recommended |
| | | Plastic (all types) | 0.75...2.4 in. (19...61 mm) |
| | | Galvanized | 0.5...2.4 in. (12.7...61 mm) |

Table 2: Transducer mount, type, pipe size and material

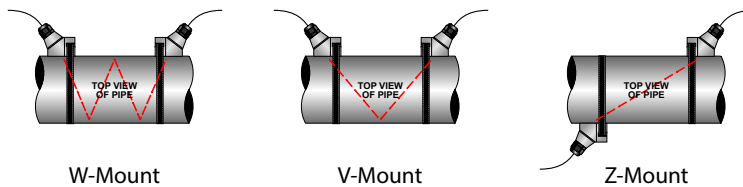


Figure 12: Mounting modes

NOTE: When step 13b is complete, the *Required Spacing* field will display a value. This is the value to which the two different transducers will be spaced on the piping. For DTTR, DTTN, DTTH or DTTL transducer types, the spacing between the two should be at their alignment marks. See Figure 13 and Figure 14.

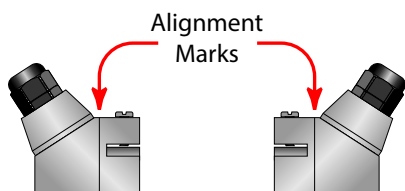


Figure 13: Transducer alignment marks for DTTN, DTTH, DTTL

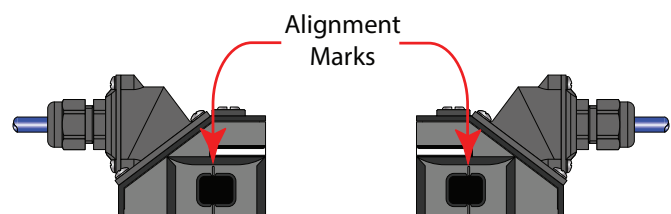
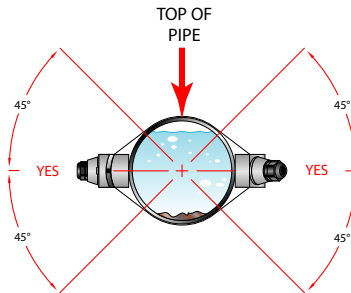


Figure 14: Transducer alignment marks for DTTR

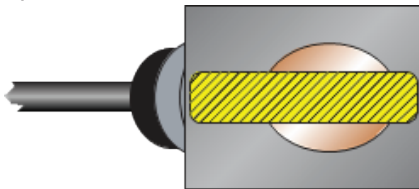
14. Mount the transducers on the prepared pipe.

For DTTR, DTTN, DTTL and DTTH Transducers:

- a. Locate and place the upstream transducer so that there is adequate straight run of piping for the line size.



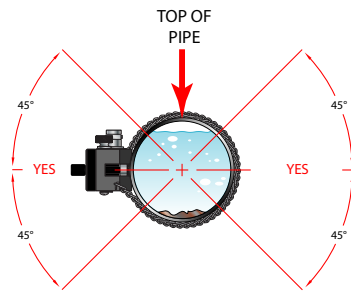
- b. Apply a single, 1/2 in. (12 mm) wide by approximately 1/8 in. (6 mm) thick bead of acoustic couplant grease to the upstream transducer and secure the transducer to the pipe with a mounting strap.



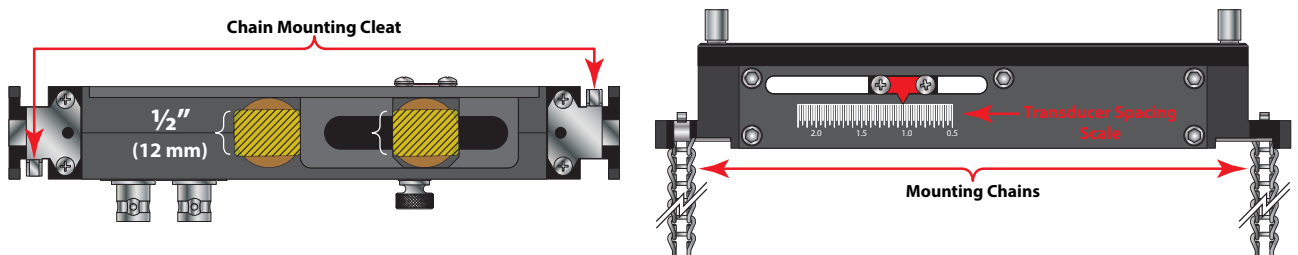
- c. Apply acoustic couplant grease, similar to the step above, to the downstream transducer and press it into the pipe using hand pressure.
- d. Space the transducers, using the alignment marks, according to the recommended values found during programming. Secure the transducers with the mounting straps.

For DTTSU Transducers:

- a. Locate the upstream transducer of the track assembly (immovable one), so that there is adequate straight run of piping for the line size.



- b. Set the downstream transducer spacing to the value found in *Setup>Transit* and use the thumbscrew to lock it in place.
- c. Apply a single 1/2 in. (12 mm) wide by approximately 1/8 in. (6 mm) thick bead of acoustic couplant grease to the face of each transducer and secure the transducers to the pipe with the attachment chains.

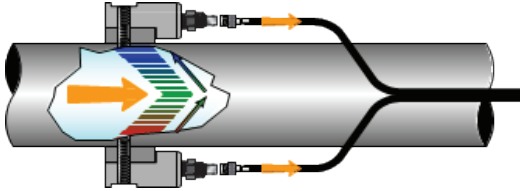


- d. Tighten the two thumbscrews on the top of the unit evenly, so that the acoustic coupling grease begins to flow out from the edges of the transducer and from the gap between the transducer and the pipe. Do not overtighten.

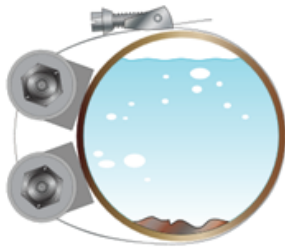
15. For Doppler transducers, go to *Setup>Doppler* to set up the transducers. Mount the transducers to the pipe.

For DT94 Transducers:

- a. Select a mounting location on the piping system with a minimum of 10 pipe diameters ($10 \times$ the pipe inside diameter) of straight pipe upstream and 5 straight diameters downstream. See *Table 1 on page 6* for additional configurations
- b. Apply a single 1/2 in. (12 mm) wide by approximately 1/8 in. (6 mm) thick bead of acoustic couplant grease to both transducers and secure them to the pipe 180 degrees apart using a mounting strap (see the figure below). Make sure that the transducer cable is pointing in the downstream direction.

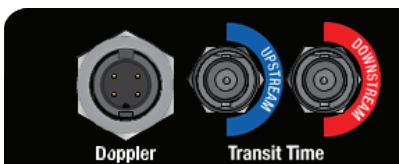


- c. Where a high amount of particulates is expected, mounting the transducers side-by-side may allow enough sound reflection for the Doppler function to work. See the figure below for an example.



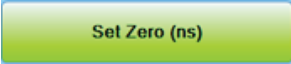
16. Connect the transducers to the DXN meter.

- a. Route the transducer cables from the transducer mounting location back to the DXN meter enclosure, avoiding locations near high voltage supply wires.
- b. Connect the transit time transducer wires to the appropriate BNC and/or connect the Doppler transducers to the 4-pin Doppler transducer plug. Both connections are on top of the meter enclosure.



VERIFYING AND ZEROING

1. Verify that the signal quality of the transducer is greater than 10%. Spacing adjustments may be necessary to improve signal quality.
2. Sound speed and zero offsets must be applied. After verifying correct installation, navigate to the *Cal > Transit* tab.
 - a. First, apply the zero flow offset. Make sure no flow is going through the piping. This will correct for any error in calculation for false flow readings. Press the **Set Zero(ns)** to apply the offset.

A rectangular button with a green-to-yellow gradient background and a thin blue border. The text "Set Zero (ns)" is centered in a black, sans-serif font.

- b. Then, apply the sound speed offset. This will correct for minor calculation errors for piping and fluid ultrasonic sound speeds. Press **Soundspeed Offset (us)** to apply the offset.

A rectangular button with a green-to-yellow gradient background and a thin blue border. The text "Soundspeed Offset (us)" is centered in a black, sans-serif font.

3. The flow metering system is ready for use. For more detailed explanations and for advanced functions of the flow meter, see the DXN Portable user manual. A copy of it can be downloaded from www.badgermeter.com.

Control. Manage. Optimize.

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