GE
Measurement & Control

Flow

PT900

User's Manual

Jun 2016

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PT900

Portable Ultrasonic Liquid Flow meter

User's Manual

Jun. 2016

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Information Paragraphs

Note: *These paragraphs provide information that provides a deeper understanding of the situation, but is not essential to the proper completion of the instructions.*

IMPORTANT: *These paragraphs provide information that emphasizes instructions that are essential to proper setup of the equipment. Failure to follow these instructions carefully may cause unreliable performance.*

CAUTION! This symbol indicates a risk of potential minor personal injury and/or severe damage to the equipment, unless these instructions are followed carefully.

WARNING! This symbol indicates a risk of potential serious personal injury, unless these instructions are followed carefully.

Safety Issues

WARNING! It is the responsibility of the user to make sure all local, county, state and national codes, regulations, rules and laws related to safety and safe operating conditions are met for each installation. The safety of any system incorporating the equipment is the responsibility of the assembler of the system.

WARNING! It is the responsibility of the user to make sure the PWR, Hart, Modbus and IO cable can meet the cable spec, which is described in Appendix A.

Auxiliary Equipment

Local Safety Standards

The user must make sure that he operates all auxiliary equipment in accordance with local codes, standards, regulations, or laws applicable to safety.

Working Area

WARNING! Auxiliary equipment may have both manual and automatic modes of operation. As equipment can move suddenly and without warning, do not enter the work cell of this equipment during automatic operation, and do not enter the work envelope of this equipment during manual operation. If you do, serious injury can result.

WARNING! Make sure that power to the auxiliary equipment is turned OFF and locked out before you perform maintenance procedures or service on the equipment.

Paragraphes d'informations

Remarque: *Ces paragraphes fournissent des informations à même de faciliter la compréhension de la situation, mais n'est pas indispensable à la bonne utilisation des instructions.*

IMPORTANT: *Ces paragraphes fournissent des informations qui mettent l'accent sur les instructions qui sont essentielles à une configuration correcte de l'équipement. Le non-respect de ces instructions peut entraîner une dégradation des performances.*

ATTENTION! Ce symbole indique un risque potentiel mineur de blessure aux personnes et / ou de sérieux dommages à l'équipement, à moins que ces instructions soient rigoureusement suivies.

ATTENTION! Ce symbole indique un risque potentiel grave de blessures aux personnes, à moins que ces instructions sont soient rigoureusement.

Questions de sécurité

ATTENTION! Il est de la responsabilité de l'utilisateur de s'assurer que tous les règlements, codes et lois locaux, nationaux et européens relatifs à la sécurité et aux conditions d'exploitation en toute sécurité soient respectés pour chaque installation. La sécurité de tout système intégrant l'équipement est de la responsabilité de celui qui l'assemble.

ATTENTION! Il est de la responsabilité de l'utilisateur de s'assurer que les câbles d'alimentation, Hart, Modbus et Entrées/Sorties répondent à la spécification décrite à l'annexe A.

Matériel auxiliaire

Standards de sécurité locaux

L'utilisateur doit s'assurer que les équipements auxiliaires utilisés sont en tout point conforme aux codes, standards et réglementations relatifs à la sécurité.

Zone de travail

ATTENTION! Les équipements auxiliaires peuvent avoir à la fois des modes de fonctionnement manuel et automatique. Comme l'équipement peut bouger brusquement et sans signe préalable, ne pas entrer dans la zone de travail de ce dernier pendant le fonctionnement automatique, et ne pas s'en approcher de trop près pendant le fonctionnement manuel. Si vous le faites, cela peut entraîner de graves blessures.

ATTENTION! Assurez-vous que l'alimentation de l'équipement auxiliaire est éteinte et verrouillée avant d'effectuer toute opération de maintenance ou d'entretien de l'équipement.

Qualification of Personnel

Make sure that all personnel have manufacturer-approved training applicable to the auxiliary equipment.

Personal Safety Equipment

Make sure that operators and maintenance personnel have all safety equipment applicable to the auxiliary equipment. Examples include safety glasses, protective headgear, safety shoes, etc.

Unauthorized Operation

Make sure that unauthorized personnel cannot gain access to the operation of the equipment.

Environmental Compliance

Waste Electrical and Electronic Equipment (WEEE) Directive

GE Measurement & Control is an active participant in Europe's *Waste Electrical and Electronic Equipment* (WEEE) take-back initiative, directive 2002/96/EC.

The equipment that you bought has required the extraction and use of natural resources for its production. It may contain hazardous substances that could impact health and the environment.

In order to avoid the dissemination of those substances in our environment and to diminish the pressure on the natural resources, we encourage you to use the appropriate take-back systems. Those systems will reuse or recycle most of the materials of your end life equipment in a sound way.

The crossed-out wheeled bin symbol invites you to use those systems.

If you need more information on the collection, reuse and recycling systems, please contact your local or regional waste administration.

Visit **http://www.ge-mcs.com/en/about-us/environmental-health-and-safety/1741-weee-reg.html** for take-back instructions and more information about this initiative.

Caution:
This device complies with Part 15 of the FCC Rules / Industry Canada licence-exempt RSS standard(s). Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

Le présent appareil est conforme aux CNR d'Industrie Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions suivantes : (1) l'appareil ne doit pas produire de brouillage, et (2) l'utilisateur de l'appareil doit accepter tout brouillage radioélectrique subi, même si le brouillage est susceptible d'en compromettre le fonctionnement.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.

Under Industry Canada regulations, this radio transmitter may only operate using an antenna of a type and maximum (or lesser) gain approved for the transmitter by Industry Canada. To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Conformément à la réglementation d'Industrie Canada, le présent émetteur radio peut fonctionner avec une antenne d'un type et d'un gain maximal (ou inférieur) approuvé pour l'émetteur par Industrie Canada. Dans le but de réduire les risques de brouillage radioélectrique à l'intention des autres utilisateurs, il faut choisir le type d'antenne et son gain de sorte que la puissance isotrope rayonnée équivalente (p.i.r.e.) ne dépasse pas l'intensité nécessaire à l'établissement d'une communication

satisfaisante.

This device complies with Industry Canada's licence-exempt RSSs. Operation is subject to the following two conditions:

(1) This device may not cause interference; and

(2) This device must accept any interference, including interference that may cause undesired operation of the device.

MPE Reminding

To satisfy FCC / IC RF exposure requirements, a separation distance of 20 cm or more should be maintained between the antenna of this device and persons during device operation.
To ensure compliance, operations at closer than this distance is not recommended.

Les antennes installées doivent être situées de facon à ce que la population ne puisse y être exposée à une distance de moin de 20 cm. Installer les antennes de facon à ce que le personnel ne puisse approcher à 20 cm ou moins de la position centrale de l' antenne.
La FCC des éltats-unis stipule que cet appareil doit être en tout temps éloigné d'au moins 20 cm des personnes pendant son functionnement.

CHAPTER 1. INTRODUCTION

1.1 OVERVIEW

Thank you for purchasing the PT900 ultrasonic flow meter. PT900 is a portable transmitter for measurement of liquids phase product. It's designed for the industrial market including water, wastewater, steel, campus energy etc. PT900 will utilize a new electronics platform and industrial design to make it extremely simple to install and use in the field.

The PT900 consists of a transmitter with electronics, CRR transducers system including the new clamp-on fixture and cable.

The PT900 system will also have optional accessories including a thickness gauge, clamp-on temperature transmitters, and a fixture for up to 48". PT900 system will connect via Bluetooth to a separate display (tablet) for programming.

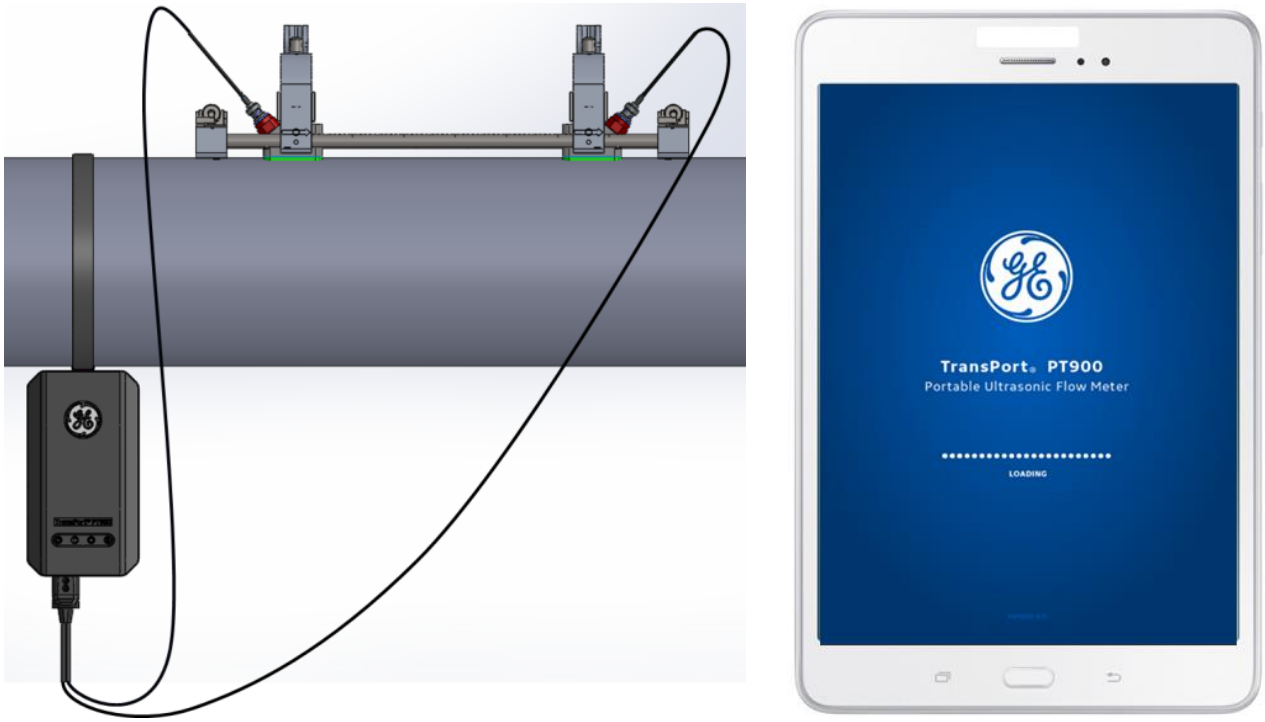


Figure 1: PT900 system (Pipe Mounting)

1.2 Theory of Operation

1.2.1 Transit-Time Flow Measurement

In this method, two transducers serve as both ultrasonic signal generators and receivers. They are in acoustic communication with each other, meaning the second transducer can receive ultrasonic signals transmitted by the first transducer and vice versa.

In operation, each transducer functions as a transmitter, generating a certain number of acoustic pulses, and then as a receiver for an identical number of pulses. The time interval between transmission and reception of the ultrasonic signals is measured in both directions. When the liquid in the pipe is not flowing, the transit-time downstream equals the transit-time upstream. When the liquid is flowing, the transit-time downstream is less than the transit-time upstream.

The difference between the downstream and upstream transit times is proportional to the velocity of the flowing liquid, and its sign indicates the direction of flow.

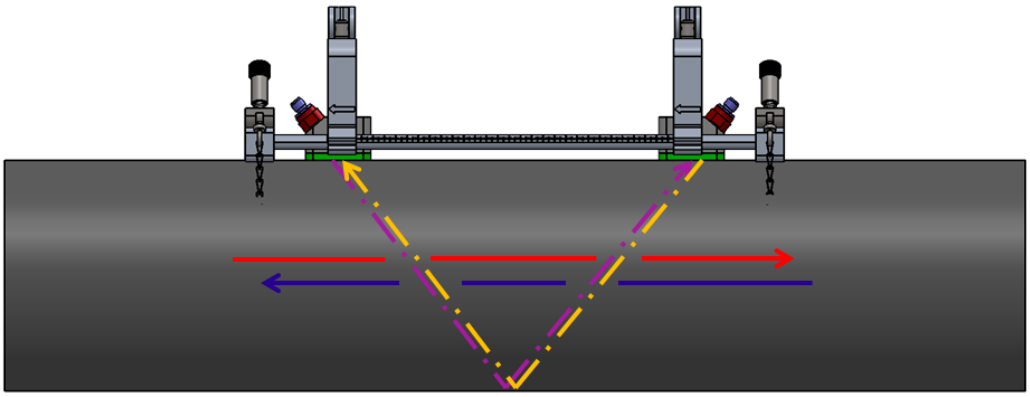


Figure 2: Flow and Transducer Paths (Dual Traverse)

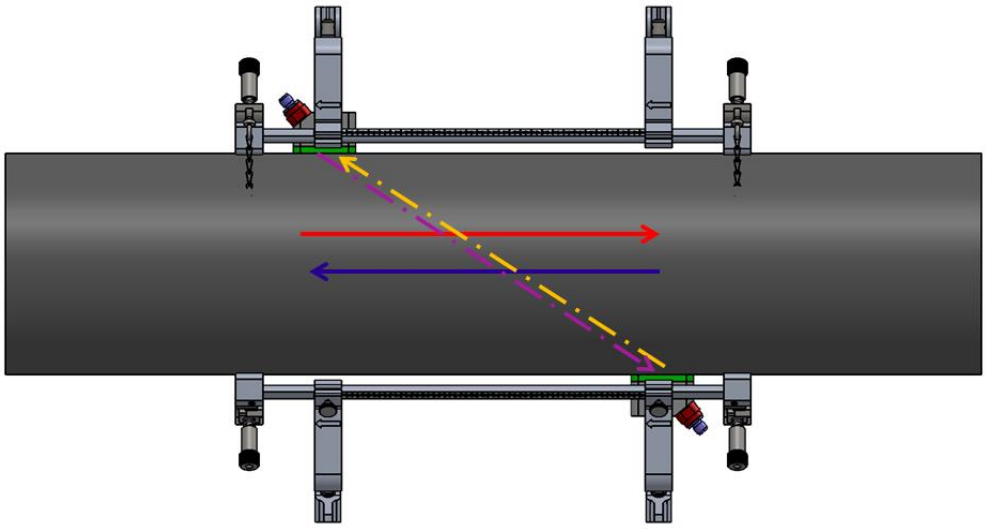


Figure 3: Flow and Transducer Paths (Single Traverse)

CHAPTER 2. INSTALLATION

2.1 Introduction

To ensure safe and reliable operation of the PT900, the system must be installed in accordance with the established guidelines. Those guidelines, explained in detail in this chapter, include the following topics:

- Unpacking the PT900 system
- Installing the electronics enclosure
- Installing the clamp-on fixture and transducer system
- Wiring the electronics enclosure

WARNING! The PT900 flow transmitter can measure the flow rate of many fluids, some of which are potentially hazardous. The importance of proper safety practices cannot be overemphasized.

Be sure to follow all applicable local safety codes and regulations for installing electrical equipment and working with hazardous fluids or flow conditions. Consult company safety personnel or local safety authorities to verify the safety of any procedure or practice.

ATTENTION EUROPEAN CUSTOMERS! To meet CE Mark and UL Mark requirements, all cables ~~must be installed as described in "**Wiring Cable Spec and Requirement**" on page 157~~.

2.2 UNPACKING THE PT900 SYSTEM

Before removing the PT900 system from the carrier case, please inspect the flow meter. Each instrument manufactured by GE Measurement & Control is warranted to be free from defects in material and workmanship. Before discarding any of the packing materials, account for all components and documentation listed on the packing slip. If anything is missing or damaged, contact GE Customer Care immediately for assistance.

Please note that your PT900 system may come in different configuration based on your selection, so the packing list could be a little different, below is the typical packing list:

10. One PT900 electronics
20. One Battery Pack
30. One AC power adaptor
40. One Power cord
50. One soft strap with metal clip for pipe mounting of PT900
60. One magnet clamp
70. One SD card with user manual and calibration sheet
80. Two transducers with couplant
90. One transducer cable
100. One clamp-on fixture
110. Two clamping fixture mounting chains
120. One OD tape
130. One thickness gauge
140. Quick installation guide
150. Calibration Sheet

Figure 4: Standard Packing List

2.3 MOUNT THE PORTABLE TRANSMITTER

The PT900 portable transmitter is housed in a plastic enclosure suitable for indoor or outdoor use, it can be put in the hard case or be clamped onto the pipe, or be mounted by a magnet clamp, See *Figure 5* below for the three different mounting,

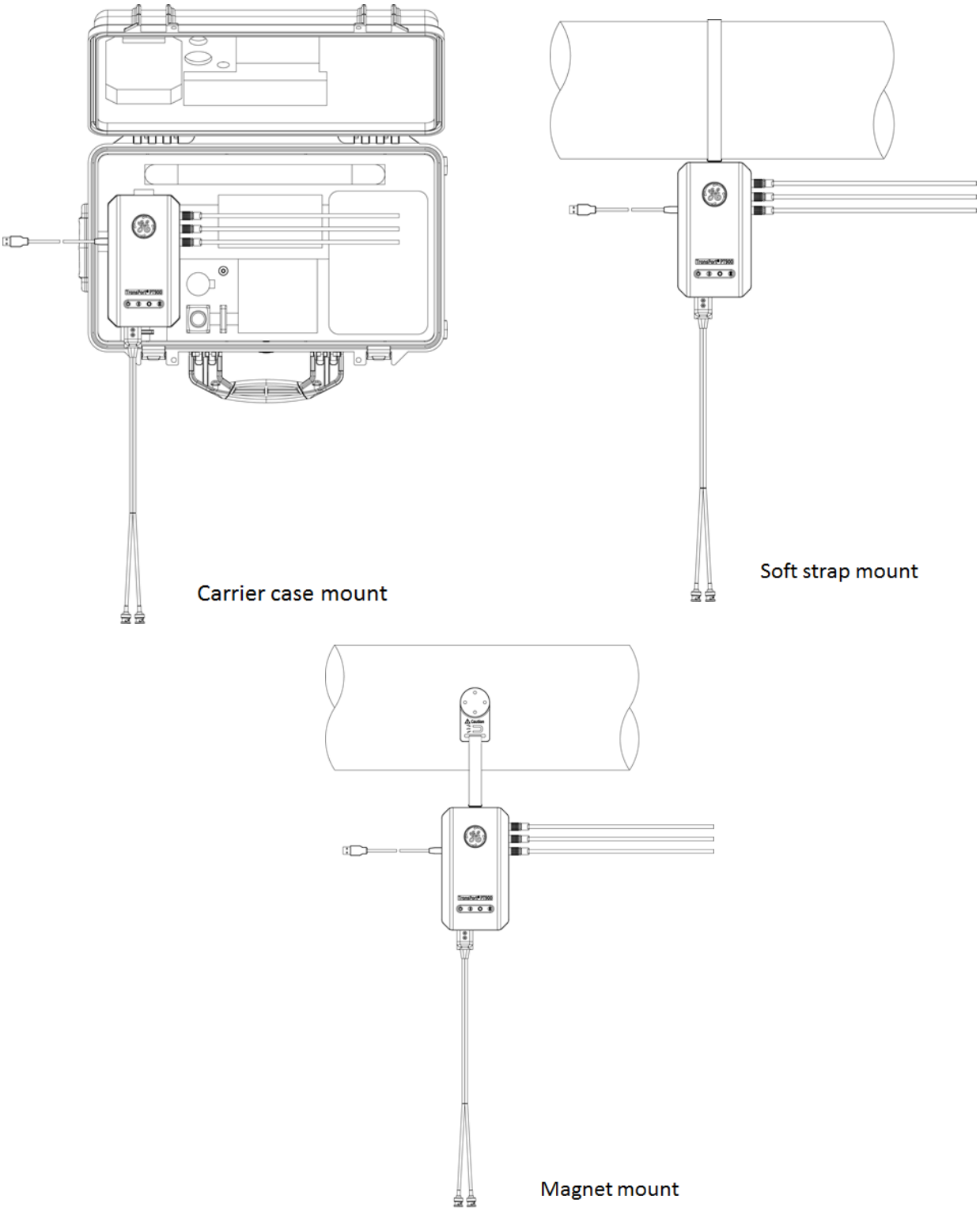


Figure 5: PT900 Electronics Mounting

2.4 INSTALLING PT900 CLAMP-ON FIXTURE

[Include any steps for unboxing and pre-assembly if necessary. Also there needs to be a section in the manual that pertains to batteries, wiring, APP installation and necessary software/hardware platforms for installation purposes. Other sections can be noted in PT878 manual.]

2.4.1 Mounting the Bracket

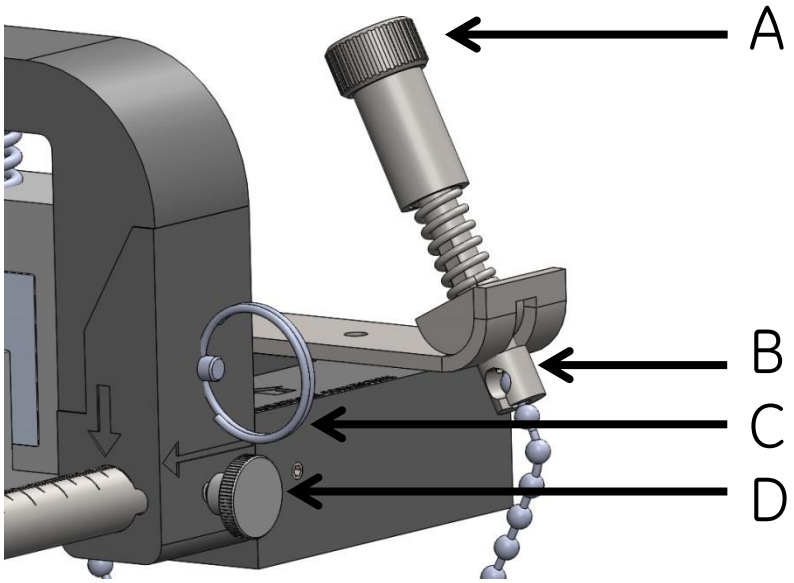


Figure 6: Pre-Assembly Process

Before mounting, check that the screw mechanisms (chain mechanism screws) that are pre-attached to the end pieces (end flats) are unscrewed to their full potential [A] and that the last joint in the chain is secured within the chain mechanism screw slot on both sides of the fixture [B]. It is highly recommended that the pin is engaged securing the bottom portion of the clamp mechanism to the top portion [C] and that the thumb screw is tightened on the movable clamp [D] so that no motion is allowed throughout the mounting process.

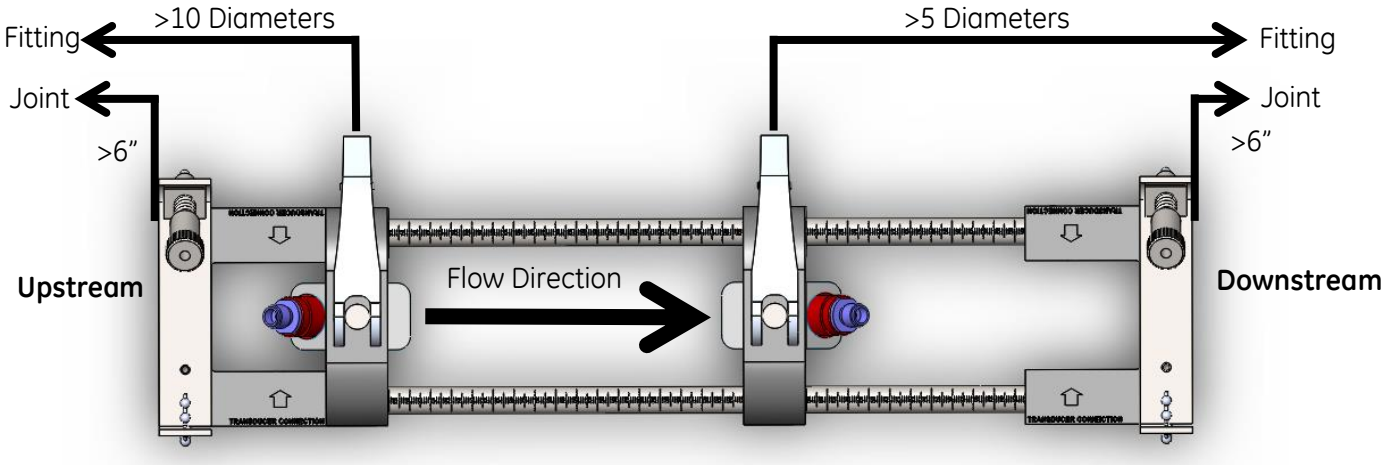


Figure 7: Distance Parameters

Adjust the bracket position so that the closest end flat rests at the preferred distance from inlet/outlet/joint/fitting of the pipe.

IMPORTANT: There must be allotted a straight run of at least 10 diameters (nominal pipe diameters) before the upstream transducer and, preferably, at least 5 diameters after the downstream transducer. A clearance of at least 6in should be provided from the edge of each end flat to the nearest joint/welding/flange. Please see figure 2.2 for clarification.

Place the fixture so that minimal effort is required to maintain the fixture position (e.g. even if horizontal positioning is eventually preferred, place the bracket on top of the pipe for mounting). Check that the pipe rests in the small slot cutout on the bottom edge of the end flats.

Note: Make sure to mount the bracket with the final orientation in mind so that the markings on the rail rod can be easily read.

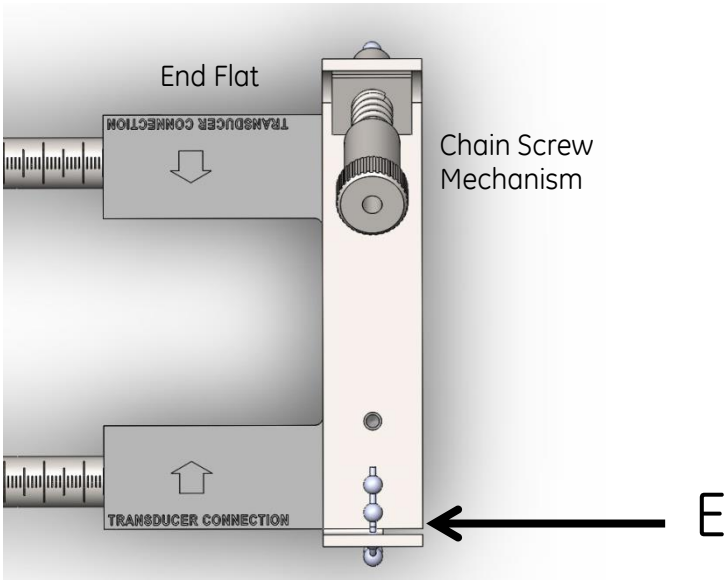


Figure 8: Chain Connection

While holding the end flat closest to the pivotal inlet/outlet/joint/fitting, loop the metal chain around the pipe so that it wraps all the way around. Pull the chain firmly, without compromising the brackets position, and force the chain to slide into the small slot located at the opposite side of the end flat from the chain mechanism screw [E].

Repeat this process for the opposite chain so that the bracket is firmly mounted but has enough leeway to be able to adjust bracket alignments.

Adjust the bracket into the preferred orientation on the pipe. Re-center the end flats on the pipe using the small slot cutout on the bottom edge of the end flats as a tangent-to-pipe indicator. (Level may be necessary, depending on accuracy required, to verify that the bracket is aligned down the center of the pipe.)

Once aligned, tighten the chains by twisting the nut on top of both chain mechanisms' screws until the chain is tight enough to resist the bracket's movement [A, Figure 2.1]. Verify that this extra restraint did not affect the center alignment. If this is the case, loosen the nuts, realign, and tighten the screws until the bracket is aligned and secured tightly.

2.4.2 Installing the Transducers Bracket

Before installing the transducers, the transducer holder must be attached to the transducer. In many cases, the transducer holder will already be installed when shipped. If this is the case, skip to section 2.4.3 for installation of the transducers.

Screw the plunger mechanism into the bottom, central hole of the transducer holder until the first thread can just barely be seen above the top lip of the holder.

In order to attach the transducers to their holder, slide the holder onto the top of the transducer so that the circle slots near the top of the transducer sides are closely aligned with the filled holes on the side of the transducer holder.

Screw the hex socket set screws from the transducer housing into the holes of the transducer. Once tightened, these screws will lock the housing into place. See Figure 2.4 for clarification.

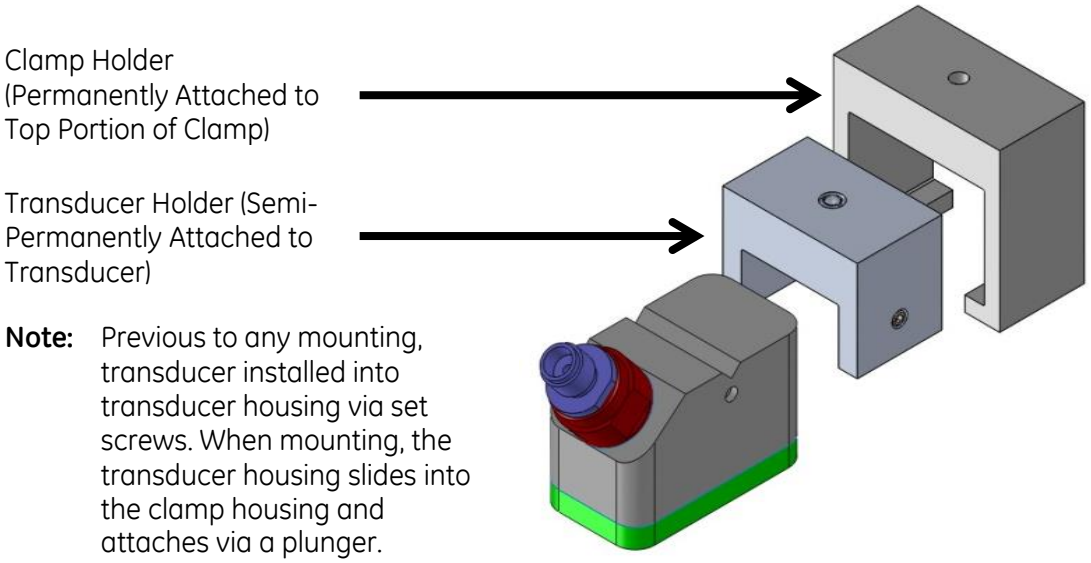


Figure 9: Transducer Assembly

2.4.3 Installing the Transducers

If necessary, unscrew the thumb screw on the movable clamp to permit axial positioning.

Position the movable bottom clamp so that it rests at the measurement marking matching that of the preferred axial distance. Measurement markings should be read on the side of the clamp indicated by the arrows.

Note: Distance between transducers vary based on pipe dimensions, number of traverses, wall thickness, etc. APP can automatically calculate distance and help to position the transducer at a preferred distance for optimal signal quality (described further in Chapter 3.6.5).

Tighten the thumb screw to lock movable clamp into place while being cautious not to adjust set axial positioning.

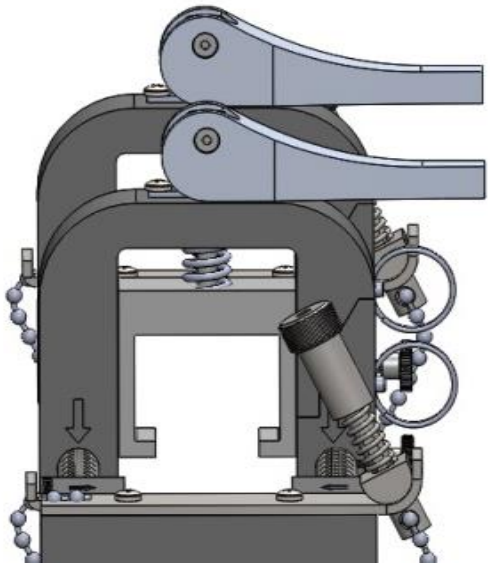


Figure 10: Loaded Cam

Adjust the cam on both clamps into the loaded position so that the clamp holder rests in its furthest radial position from the pipe (Figure 10).

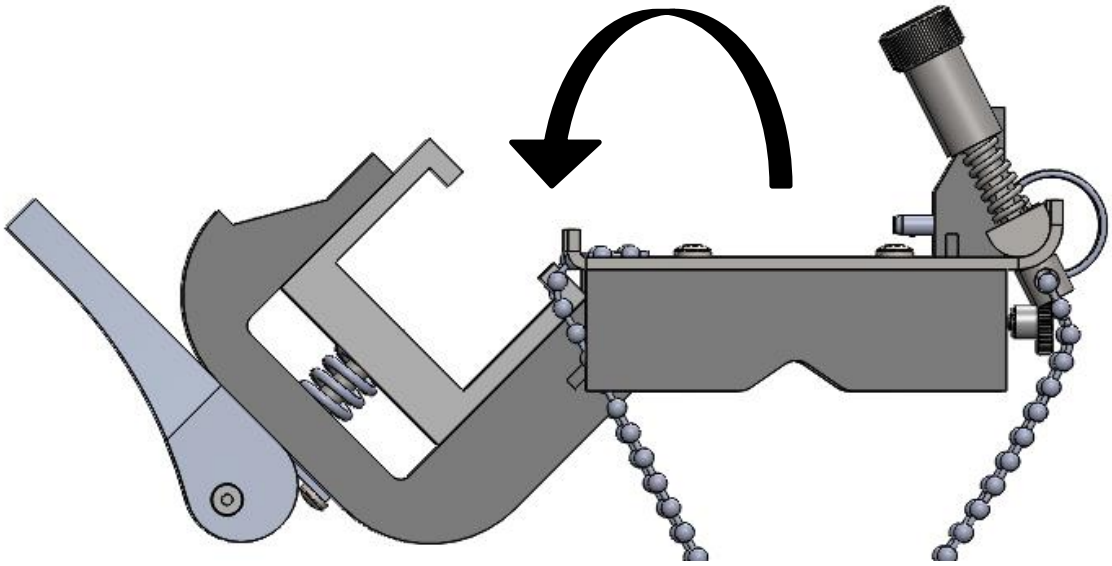


Figure 11: Clamp "Assembly" Position

Release the pin on both clamps so the top portion of the clamp can swing down freely, allowing easy access for transducer installation (Figure 11).

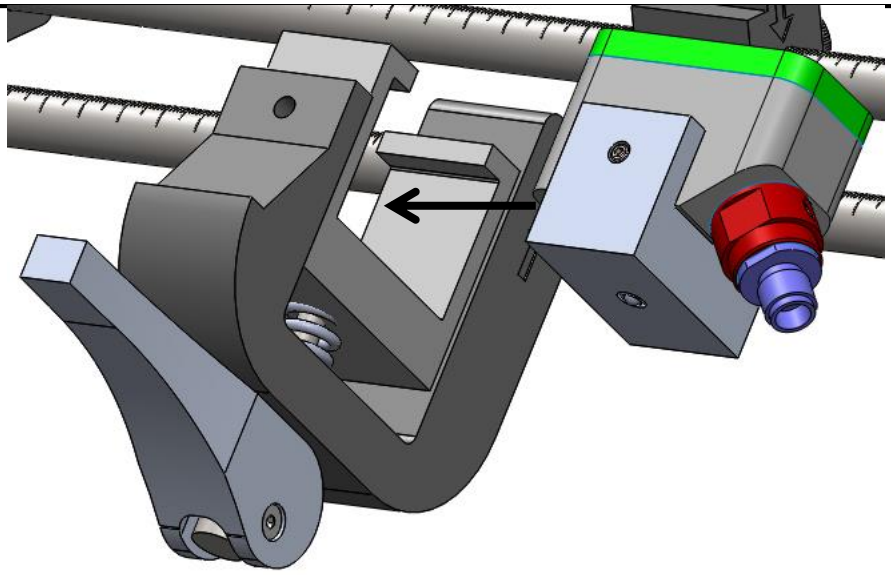


Figure 12: Transducer Insertion

Slide both transducers, already locked into the transducer housing, into the clamp housing until the plunger from the top of the transducer housing snaps into its position on the bottom of the clamp housing (Figure 12).

IMPORTANT: Slide the transducers into place with an orientation so that the wire connector is pointed away from the opposing clamp. In other words, the wire connectors should be oriented in opposite directions. The arrows on the end flats help to indicate the wire connector direction if needed.

Apply proper coupling to both of the transducer bottoms to help remove air impurities from readings and supply a more fluent contact with the pipe.

Note: Water based lubricant is not recommended for heated, long term, or multiple traverse measurements.

Swing both of the top portions of the clamp back into alignment with the clamp bottom and lock them back into place by sliding the pin through the hole on the side of the top portion into the hole on the side of the bottom clamp.

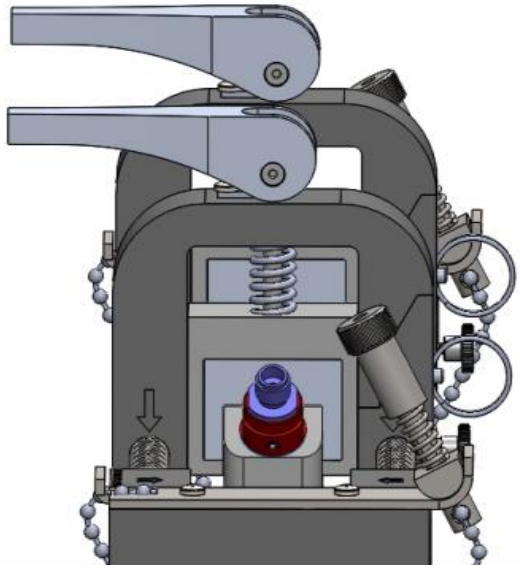


Figure 13: Released Cam

Release the cam so that the transducer is forced towards the pipe to make a firm contact surface for measurement (Figure 13).

Caution! While releasing the cam, make sure that you are not making any contact with the clamp surface. Potential that stored energy acting on cam will cause cam to make hard contact with clamp face. Objects or body parts in between contact faces could result in minor injuries.

2.5 MAKING ELECTRICAL CONNECTIONS

! ATTENTION EUROPEAN CUSTOMERS!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, CE Mark Compliance.

This section contains instruction for making all the necessary electrical connections to the AT600 flow meter. Refer to *Figure 22* for the complete wiring diagram of the unit.

IMPORTANT:
Expect for the transducer connector, all electrical connectors are stored in their terminal blocks during shipment and may be removed from the enclosure for more convenient wiring. Feed the cables through the cable gland holes on the bottom of the enclosure, attach the wires to the appropriate connectors and plug the connectors back into their terminal blocks.

Once the AT600 is completely wired, proceed to Chapter 3, Initial Setup, to configure the unit for operation.

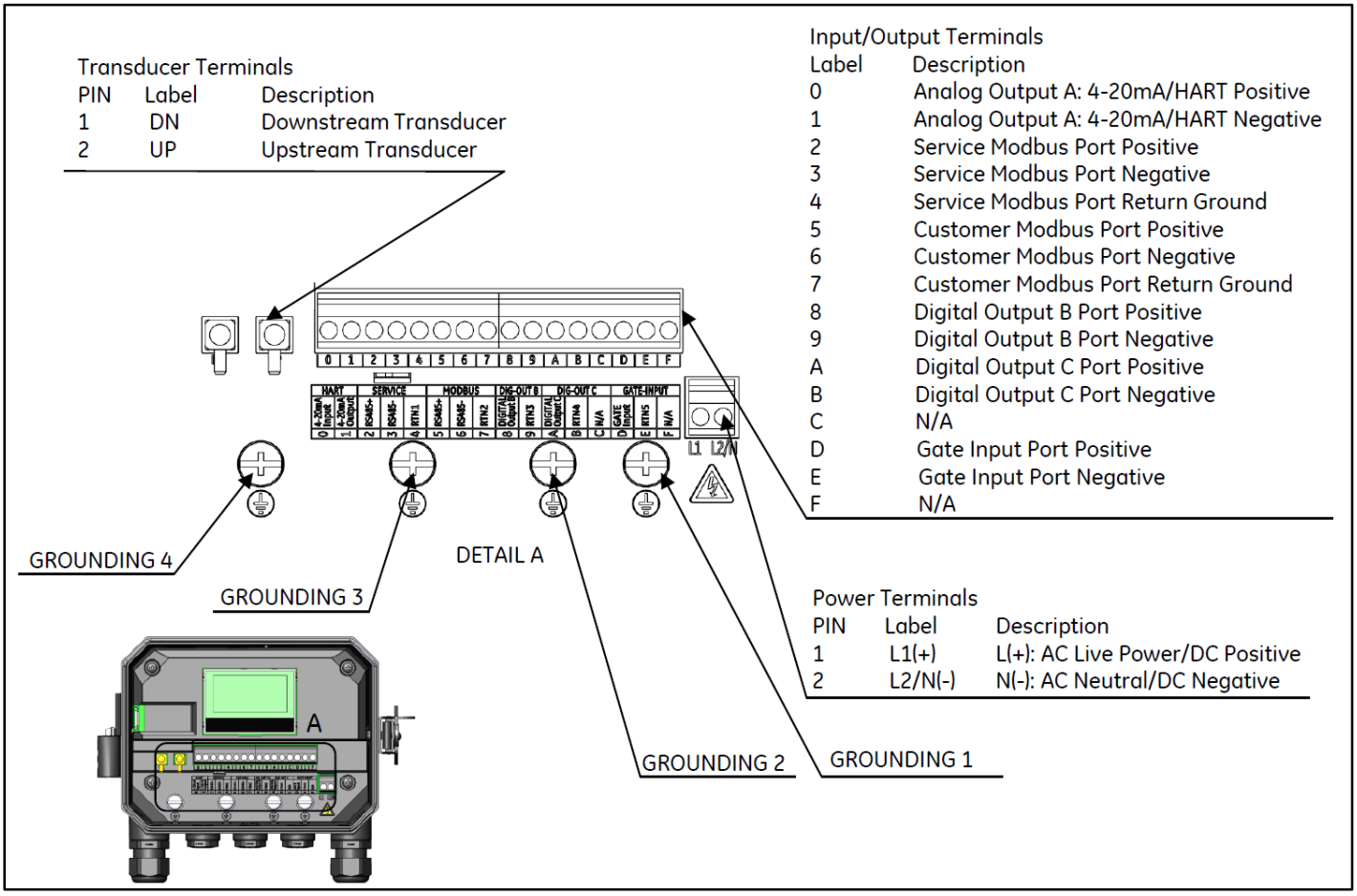


Figure 14: Wiring Diagram

Note that HART or MODBUS communication are optional selections for the AT600 electronics and must be chosen at the time of ordering.
To lead the wiring cables into the enclosure, power lines, transducer line and I/O lines are distributed to different gland holes.

Refer to Appendix A.2 for cable criteria. Be sure to select the cable to connect the meter only to the specified cables.

Refer to *Figure 23* for cable gland usage definition. If no cables feed through the cable clamp holes, it must be blocked with the gland-insert provided together with meter.

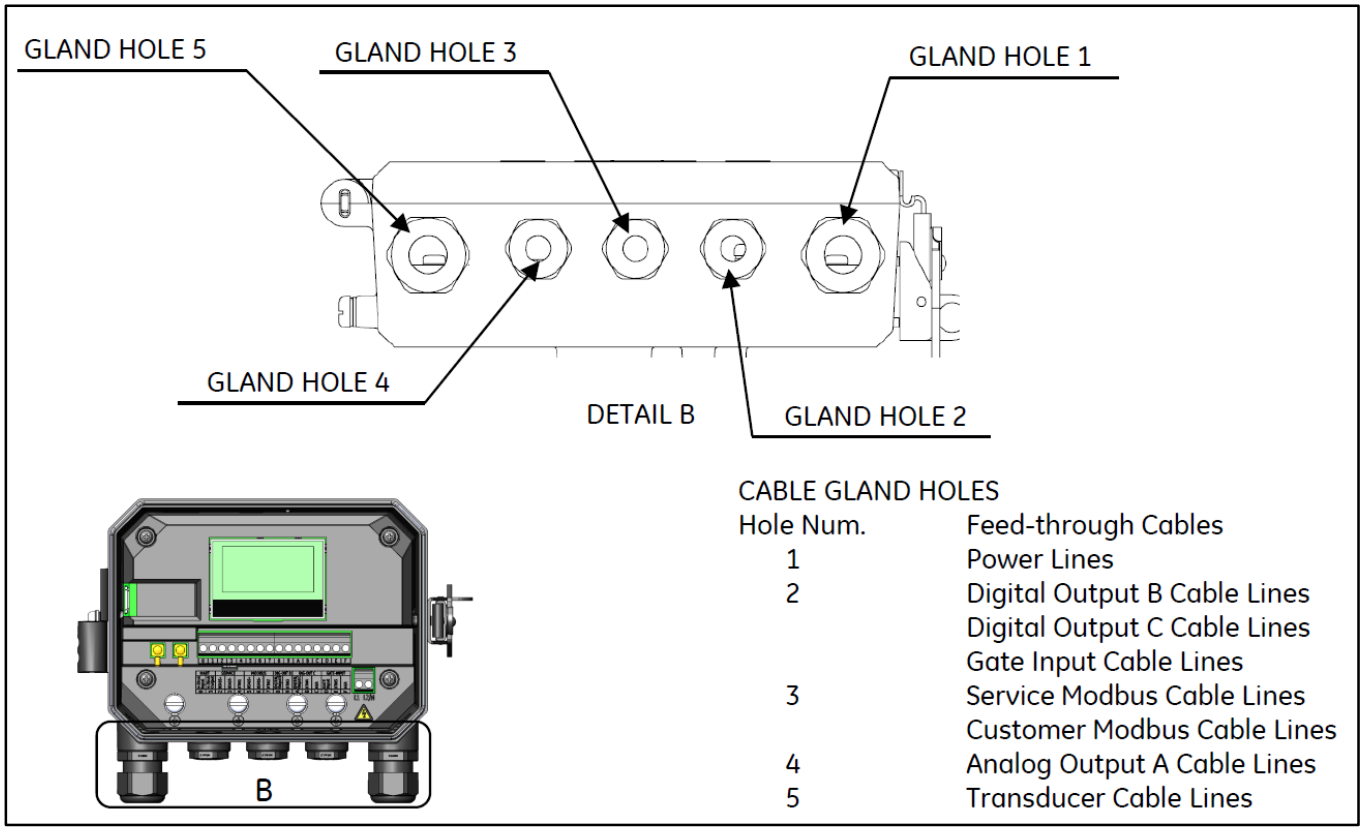


Figure 15: Gland Usage Definition

2.5.1 Wiring the Line Power

!ATTENTION EUROPEAN CUSTOMERS!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, CE Mark Compliance.

The AT600 may be ordered from operation with power inputs of 85-264 VAC, or 12-28 VDC. The label on the shroud inside the electronics enclosure, lists the required line voltage. Be sure to connect the meter only to the specified line voltage.

Refer to *Figure 16* below for power inputs of the meter.

Note: For compliance with the European Union's Low Voltage Directive (LV Directive 2006/95/EC), this unit requires and external power disconnect device such as a switch or circuit breaker. The disconnect device must be marked as such, clearly visible, directly accessible, and located within 1.8 m (6 ft) of the AT600.

Refer to *Figure 14* to locate terminal block and connect the line power as follows:

WARNING! Improper connection of the line power leads or connecting the meter to the incorrect line voltage will damage the unit. It will also result in hazardous voltages at the flowcell and associated piping and within the electronics console.

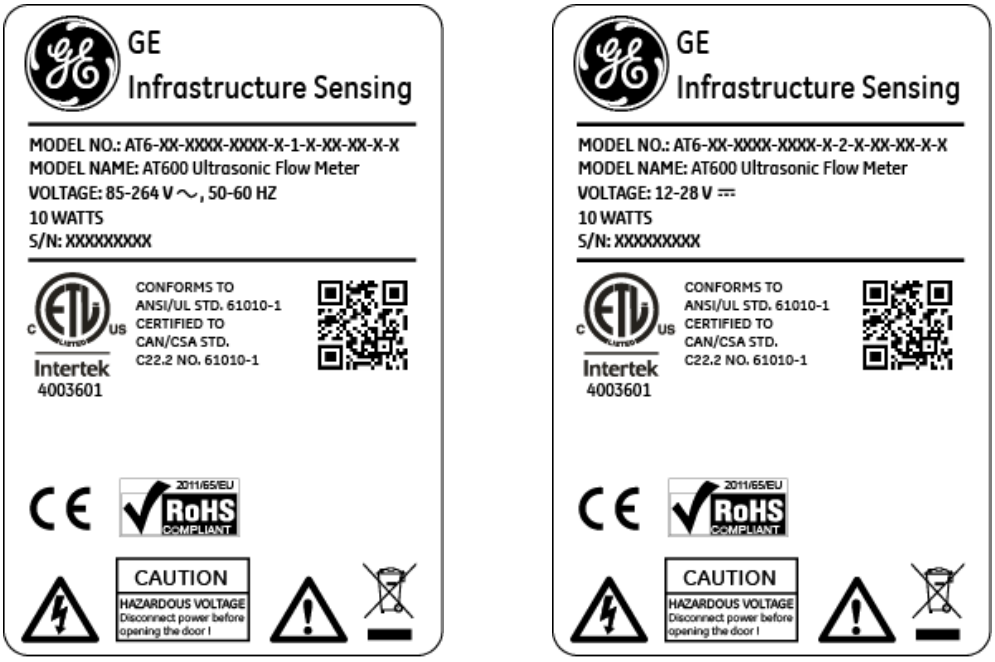


Figure 16: Meter SN Label (AC and DC Version)

Wiring the Line Power (cont.):

1. Strip 1/4" of insulation from the end of the power and neutral or line leads (or the positive and negative DC power leads), and 1/2" from the end of the ground lead.

2. Connect the ground lead to the internal ground connection (GROUNDING 1) located on the bottom panel of the enclosure (See *Figure 14*).

   IMPORTANT: *The incoming ground lead must be connected to the internal ground connection.*

3. Connect the neutral or line lead (or the negative – DC power lead) to L2/N(-) and the line power lead (or the positive +DC power lead) to L1(+) as shown in *Figure 14*.

   IMPORTANT: *Do not remove the existing PC board ground wire or the cover ground wire.*

2.5.2 Wiring the Transducers

!ATTENTION EUROPEAN CUSTOMERS!
To meet CE Mark requirements, all cables must be installed as described in Appendix A, CE Mark Compliance.

Wiring a typical AT600 ultrasonic liquid flow meter system requires interconnection of the following components:

- A pair of transducers installed inside of fixture;
- The electronics console

To wire the transducers, complete the following steps:

WARNING! Before connecting the transducer, take them to a safe area and discharge any static build-up by shorting the center conductor of the transducer cables to the metal shield on the cable connector.

1. Locate the transducer cables and connect them to the two transducers.

2. Connect the cable connector with yellow "DN" jacket on the cable to DN and connect cable connector with white "UP" jacket on the cable to UP as shown in *Figure 14*. Then, secure the cable gland.

3. Make vertical insertion during cable connector is plugged into the receptacle to avoid connector destroy.

2.5.3 Wiring System Ground

Proper system ground must be connected to AT600 Meter. Refer to *Figure 17* to locate the system ground screw. This ground screw must be connected to a safe ground in the field.

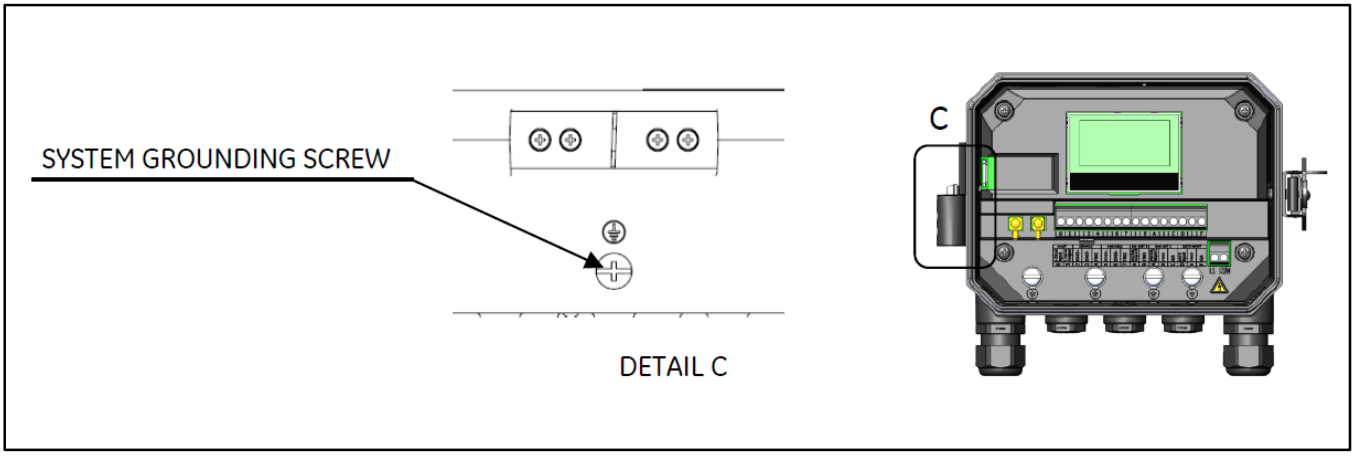


Figure 17: System Grounding Screw

2.5.4 Wiring Analog Output/HART Communication

The standard configuration of the AT600 flow meter includes one isolated 0/4-20mA analog output. Connections to this output may be made with standard twisted-pair wiring. The current loop impedance for this circuit must not exceed 600 ohms.

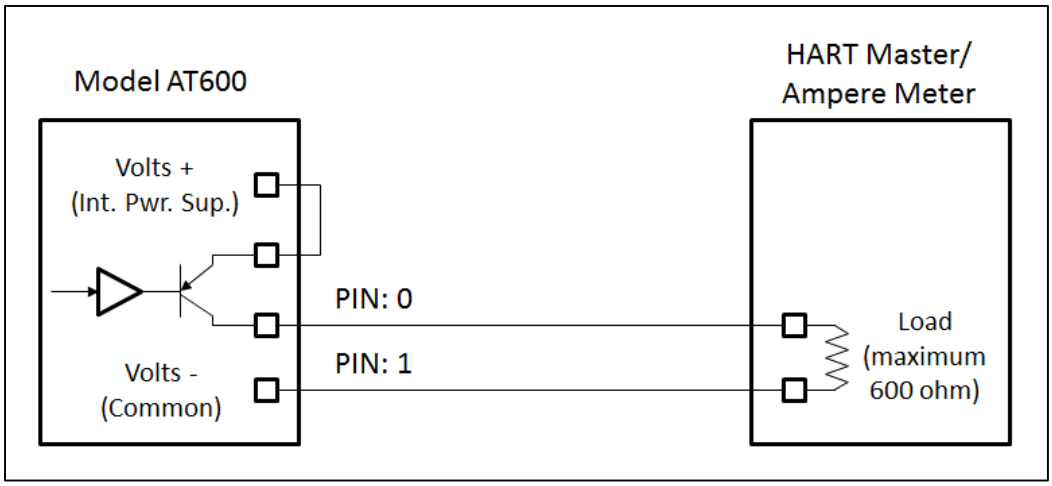


Figure 18: Analog Output/HART Communication

To wire the analog output, complete the following steps:

1. Disconnect the main power to the unit and open the enclosure.

2. Install the required cable gland in the chosen gland hole on the bottom of the enclosure.

3. Refer to *Figure 14* for the location of terminal block I/O and wire the terminal block as shown. Secure the cable clamp.

The standard port is only 0/4-20mA analog output, but the HART communication is optional upon request.

Note: Analog Output is active mode. Do not supply a 24V supply to this circuit. The circuit is powered by the flow meter.

Note: Prior to use, the analog output must be set up and calibrated. Proceed to the next section to continue the initial wiring of the unit.

Note: When in meter configuration, the analog output will go to 3.6 mA. After exiting from configuration mode, the meter will go leave 3.6mA.

2.5.5 Wiring Modbus Communication

The AT600 is equipped optionally Modbus communication port. The port is a two-wire, half-duplex RS485 interface. The standard AT600 disables the Modbus communication. Proceed to the appropriate configuration for menu instructions to activate the Modbus communication.

To wiring Modbus RS485 serial port, refer to *Figure 14* and complete the following steps:

1. Disconnect the main power to the unit.
2. Install the required cable clamp in the chosen gland hole on the side of the electronics enclosure.
3. Feed one end of the cable through the gland hole, wire it to terminal block and secure the cable gland as shown in *Figure 23*.

2.5.6 Wiring Frequency/Totalizer/Alarm Output

The AT600 can accommodate up to 2 channels of totalizer/frequency/alarm outputs. Each totalizer/frequency/alarm can be configured as totalizer, frequency or alarm output by software setting. Refer to 3.6.4 section for output setting.

Each totalizer/frequency/alarm output requires two wires. Wire this terminal block in accordance with the pin number assignments shown in *Figure 19*. *Figure 19* shows sample wiring diagrams of totalizer/frequency/alarm output circuit.

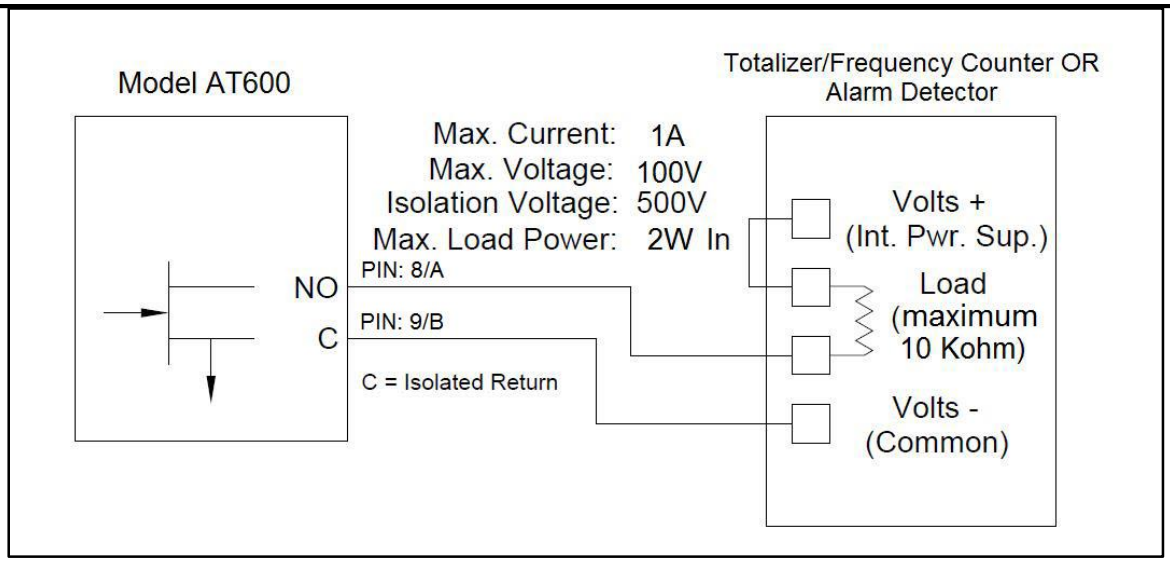


Figure 19: Totalizer/Frequency/Alarm Output Wiring

2.5.7 Wiring Gate Input

The AT600 provides a Gate Contact Input port. This port is designed to start/stop the totalizer. During normal measurement mode, operator can start the totalizer functionality by clicking the switch. And if operator wants to stop the totalizer, another switching ON/OFF action is to stop the totalizer.

Refer to *Figure 20* below for wiring Gate Input port.

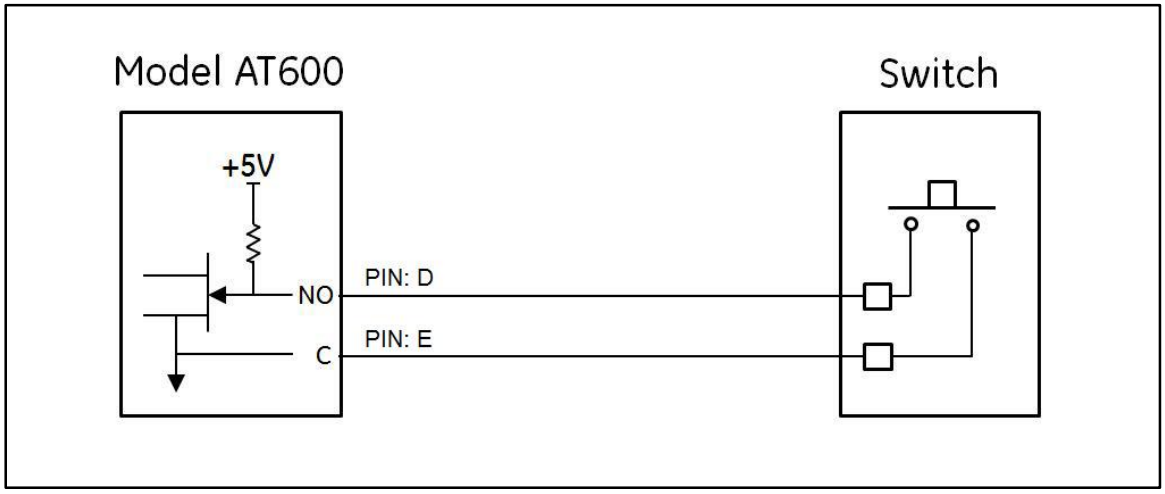


Figure 20: Gate Input Wiring

CHAPTER 3. INITIAL SETUP AND PROGRAMMING

3.1 INTRODUCTION

This chapter provides instructions for programming the PT900 flow meter via APP to place it into operation. Before the PT900 begin taking measurements, the User Preferences, Inputs/Outputs, and Sensor setup must be entered and tested. All these items could be accessed via side bar menu at the top left. The basic function structure could be summarized in below map.

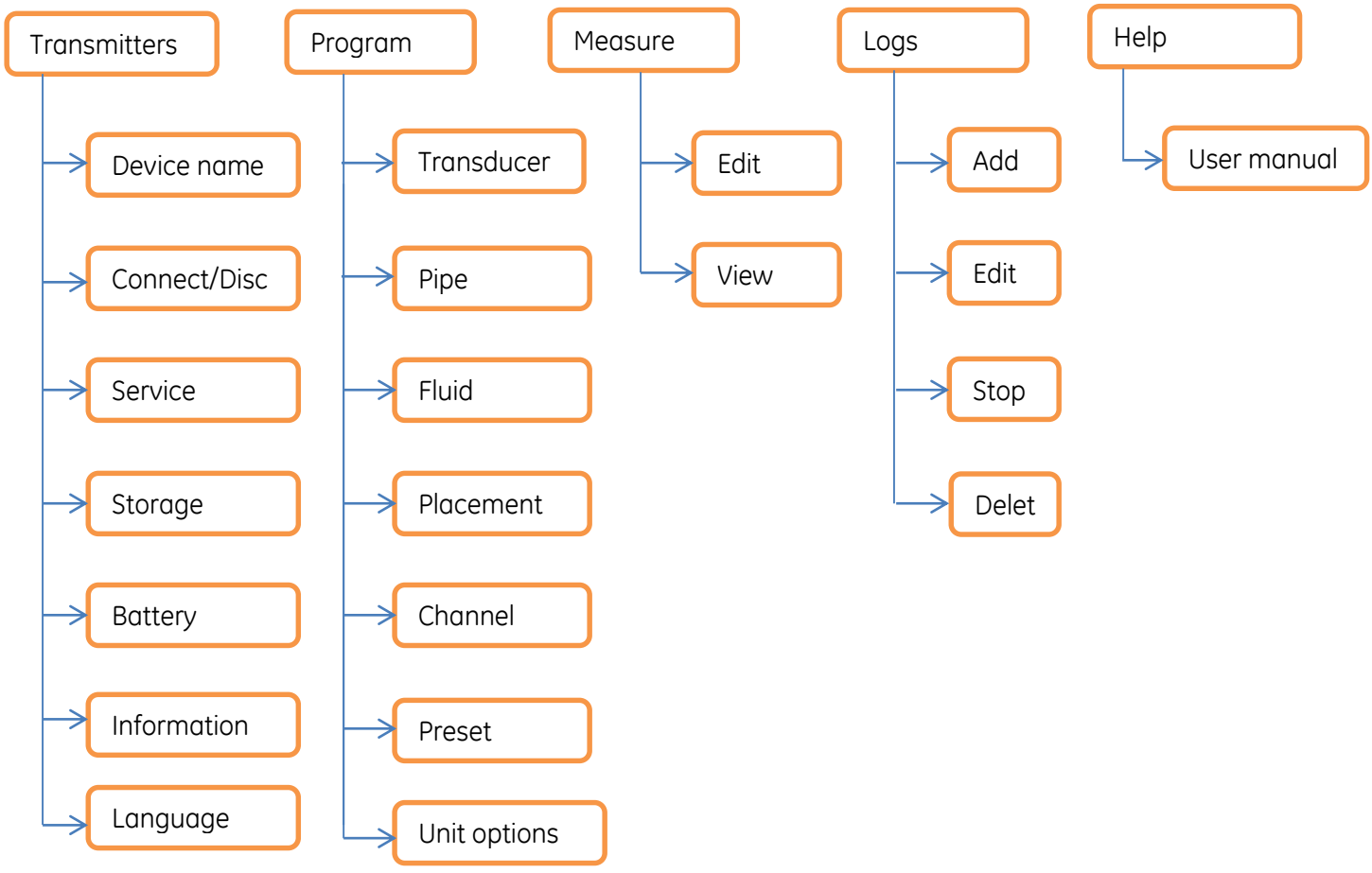


Figure 21: APP High Level Map

3.2 CHARGE THE PT900 AND TABLET

Firstly, please make sure PT900 transmitter and tablet is charged. AC adaptor could be found in the attached box. If any of them could not be powered on, please consult GE representative or www.gemeasurement.com for help.

3.3 DOWNLOAD APP ONTO TABLET

If the tablet is not pre-installed the application, please download the installation package from GE website, or contact with local sales agent for help.

If the installation package is acquired, please download it to tablet via USB connection. And click install it like normal Android application.

3.4 PT900 APP SETUP

Find and click the icon below will start up the PT900 application.

Figure 22: PT900 APP icon

After the PT900 APP is activated, the initial screen display like figure 23.

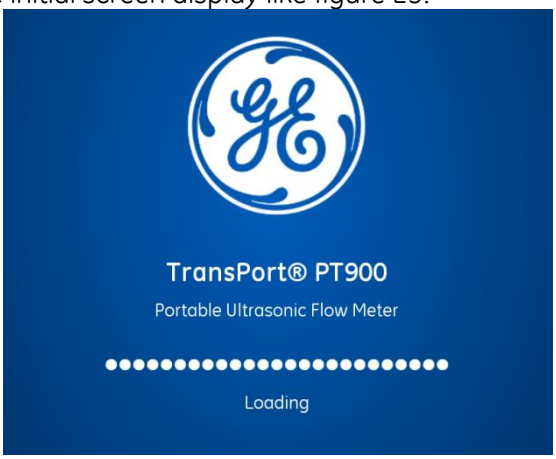


Figure 23: PT900 APP loading screen

After the loading screen, the default connection interface will be displayed as below.

- If the user prefers to simulate the operation without actual device connection, please click the **WORK_OFFLINE** to choose offline mode.
- On the otherwise, if the user prefers to connect the actual device, please click **Scan**, and all the available devices will be searched via BLUETOOTH and displayed as figure 24.

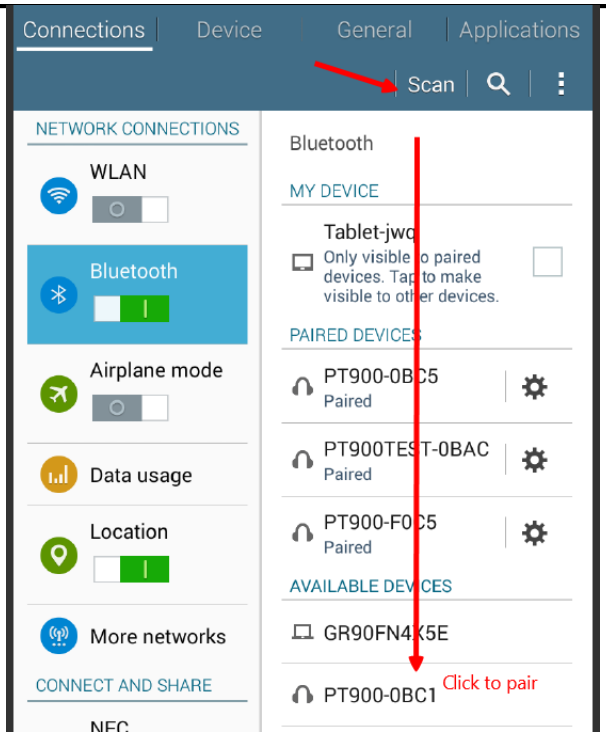


Figure 24: PT900 APP scan screen

IMPORTANT: As a common protocol, blue tooth could be preinstalled in kinds of devices. But our APP would filter the surrounding potential devices and only display the device which name is prefixed by "**PT900"**.

Click **BACK** button of the tablet, it will back to PT900 application and all available flowmeter devices will be listed like figure 25. Click the target device will activate pairing operation between the tablet and PT900 flowmeter.

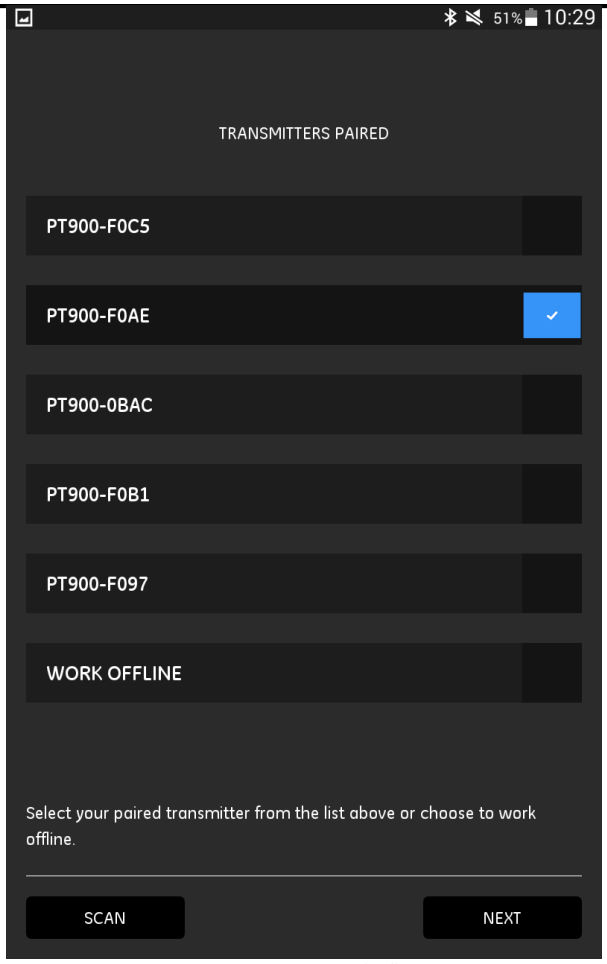


Figure 25: Pairing with flowmeter

3.5 FIRST TIME IN APP SCREEN

If “pairing” succeed, a real connection between the tablet and field device has been setup. Click the NEXT button will turn to the operation menu which is displayed as figure 26.

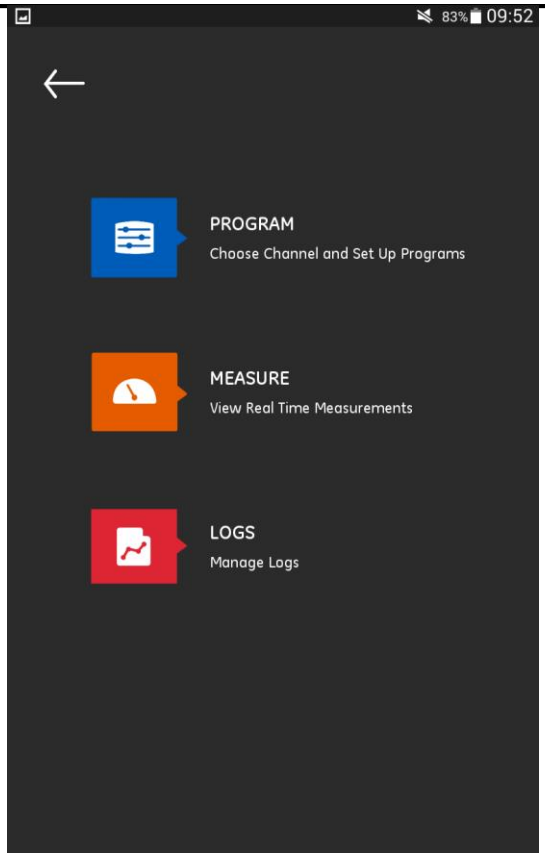


Figure 26: PT900 main menu

- **PROGRAM** is used for choosing a channel and setting up the configuration.
- **MEASURE** is used for viewing the real time measurements, error reports and diagnostics information.
- **LOGS** are used for setup log file and managing logs stored in transmitter.

3.6 HOW TO PROGRAM

Program option enables the user to set up each channel to measure the flow. PT900 supports two channels to measure at most, channel 1 and channel 2. They are programmed individually. And the program information could be saved as PRESETS file.

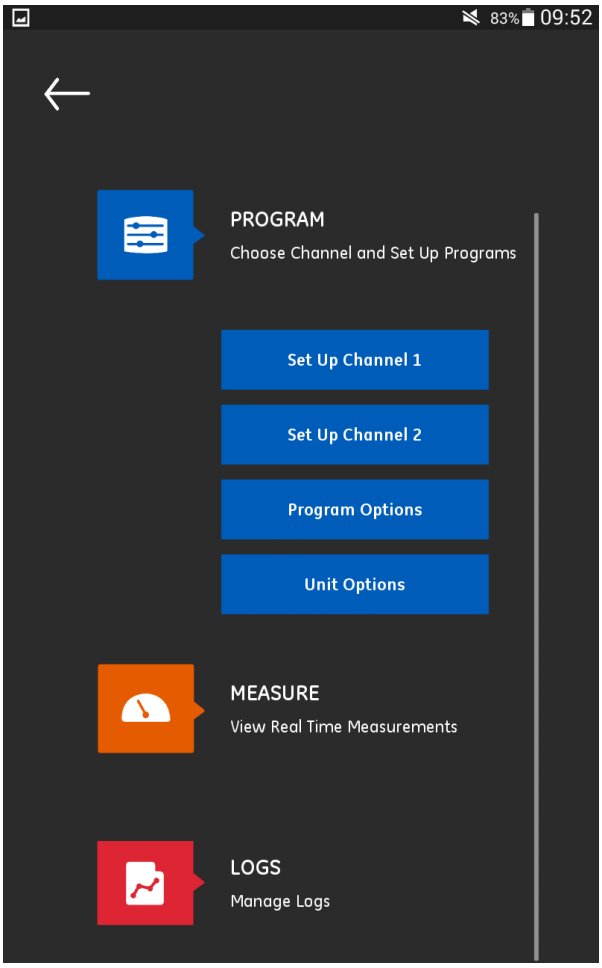


Figure 27: PROGRAM drop down menu

3.6.1 How to set up a channel

There are four main function blocks need to be configured to set up a channel.

- PIPE
- FLUID
- TRANSDUCERS
- PLACEMENT

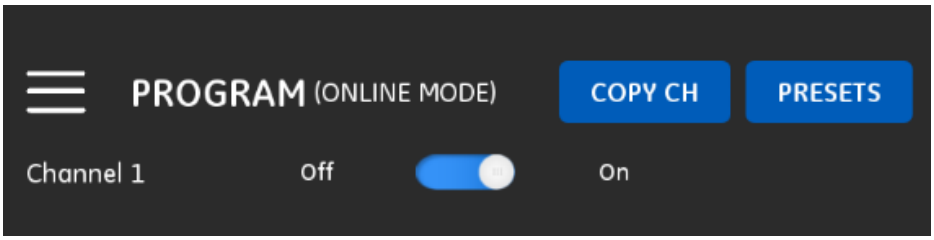


Figure 28: PROGRAM top bar menu

Take Channel 1 as an example, in the top bar, three items could be used in below method.

- Turn the channel from **Off** to **On**, all buttons will turn into edit-enable state. Or else, all data would turn into

not editable state.

- Click **COPY CH**, all program data of another CHANNEL will be copied to current CHANNEL. In this example, it will copy CHANNAL 2 data to CHANNEL 1 for easy configuration.
- Click **PRESETS** button, all programmed data of current CHANNEL will be saved to a file in PT900 transmitter. And these data file will be recalled for later use. These files could be got through USB link and upload to same sites use.

3.6.2 How to set up PIPE

The PIPE option allows the user to define the pipe material and corresponding sound speed in it. These items vary from the different pipe selection.

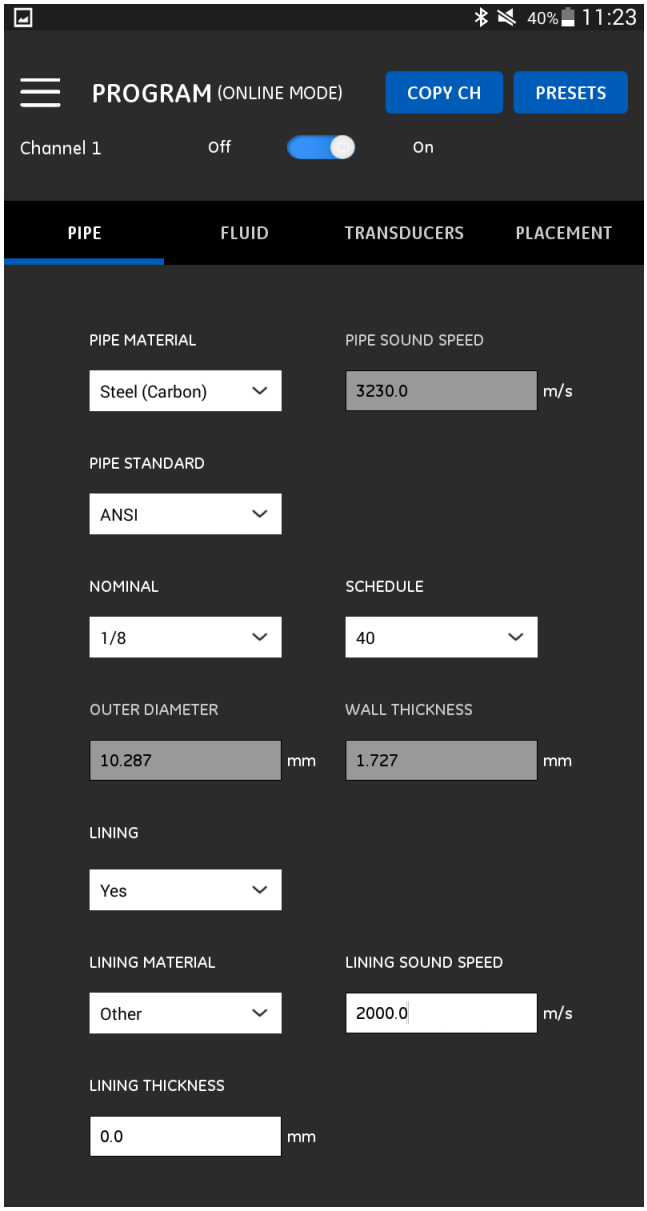


Figure 29: PROGRAM PIPE setup

3.6.2.1 PIPE material

From the drop down list, user could select all available material for the pipe. Below table lists materials supported by PT900 transmitter.

Name	Pipe Material
Other	Any material
Steel (Carbon)	Carbon Steel
Steel (Stainless)	Stainless Steel
Iron (Duct)	Duct Iron
Iron (Cast)	Cast Iron
Copper	Cuprum
Aluminum	Aluminum
Brass	Brass
30% Nickel	30% Nickel Copper Alloy
10% Nickel	10% Nickel Copper Alloy
Glass (Pyrex)	Pyrex Glass
Glass (Flint)	Flint Glass
Glass (Crown)	Crown Glass
Plastic (Nylon)	Nylon Plastic
Plastic (Polye)	Polyethylene
Plastic (Polyp)	Polypropylene
Plastic (PVC)	Polyvinyl chloride
Plastic (Acryl)	Acrylic Plastics

- The **PIPE SOUND SPEED** varies from different pipe material. If **OTHER** is selected, **PIPE SOUND SPEED** should be edited by user itself.

3.6.2.2 PIPE parameter

- If **PIPE MATERIAL** is steel related and **PIPE STANDARD** is ANSI, **NOMINAL** and **SCHEDULE** need to be selected from drop down list.
- If **PIPE MATERIAL** is not steel related, **PIPE STANDARD** item will disappear.
- The **OUTDER DIAMETER** item defines the outside diameter of the pipe.
- The **WALL THICKNESS** item defines the wall thickness of the pipe.
- The measurement units shown depend on the choices user has made in **Unit Options**.

3.6.2.3 LINING

The user should select YES if there is lining inside the pipe wall. In this condition, **LINING MATERIAL** and **LINING THICKNESS** need to be edited, which also affect the time of transmit.

- There are 7 kinds of lining material.

Name	Lining Material
Other	Other
Tar Epoxy	Tar Epoxy
Pyrex Glass	Pyrex Glass
Asbestos Cement	Asbestos Cement
Mortar	Mortar

Rubber	Rubber
Teflon	Teflon

- Lining sound speed varies from different lining material selection. If **OTHER** is selected as **LINING MATERIAL**, **LINING SOUND SPEED** should be edited by user.

3.6.3 How to set up FLUID

Different fluid has different physical property, for example, sound speed and kinematic viscosity. To measure the flow velocity accurately, user must edit the fluid parameter before use.

The FLUID option allows the user to set up the fluid parameter inside the pipe.

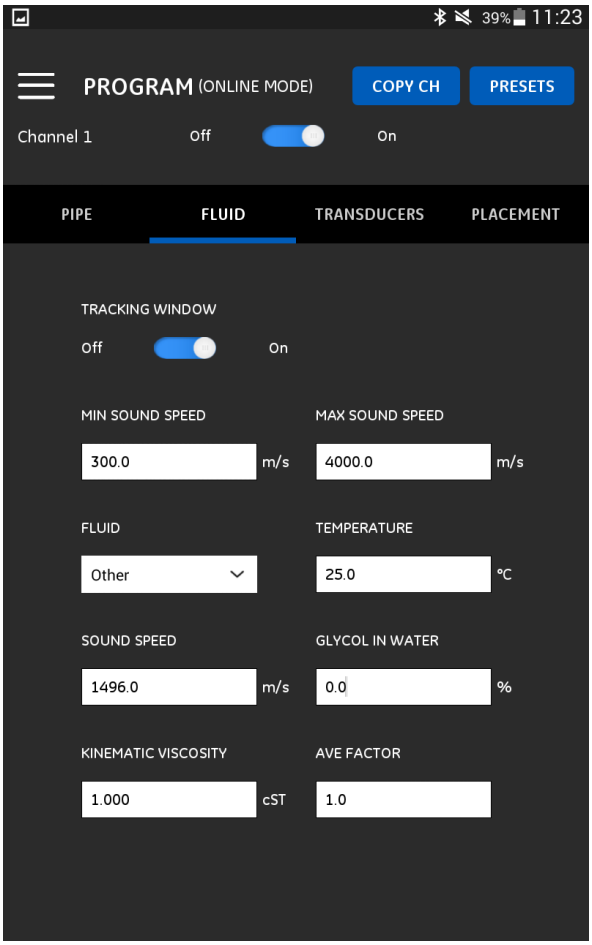


Figure 30: PROGRAM FLUID setup

- The **TRACKING WINDOW** are used to detect the receive signal when the user are unsure of the fluid sound speed. (Default operation is “Off”)
- If **TRACKING WINDOW** is ON, MAX and MIN SOUND SPEED of fluid is required to edit by user.
- If **FLUID** inside the pipe is water or water related, sound speed is constant.
- If **FLUID** inside the pipe is other, sound speed is required to be edit by user.
- Note, supported FLUID type and speeds vary with the user selection of **TRACKING WINDOW** and the **ENERGY**

SWITCH option. Please check below table for detail.

	Tracking Windows Off	**Tracking Windows On**
Energy Off	Other	Other
	Water	Water
	Sea Water	Oil
	Oil (22°C)	
	Crude Oil	
	Lube Oil (X200)	
	Oil	
	Methanol	
	Ethanol	
	LN2 (-199°C)	
	Freon (R-12)	
Energy On	Other	Other
	Water	Water
	Water/Glycol	Water/Glycol

- The **TEMPERATURE** item is also required because sound speed is sensitive to temperature.
- The **KINEMATIC VISCOSITY** item is required to define the fluid property.
- The **AVE FACTOR** item is required to define the calculation percentage of current channel.

3.6.4 How to set up transducer

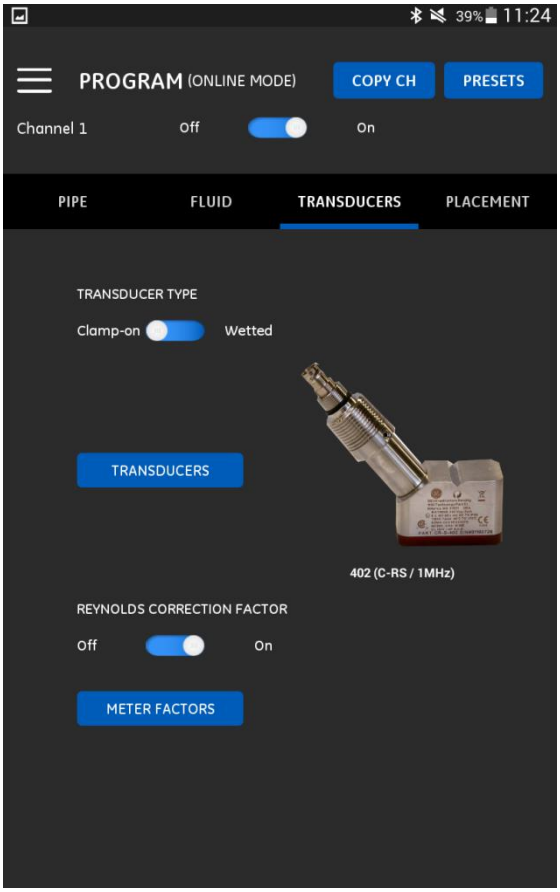


Figure 31: PROGRAM TRANSDUCER setup

3.6.4.1 Transducer type

Transducer option enables the user to define the transducer type which has relation with the mounting method, Wetted or Clamp-on.

Note, please refer to the liquid transducer installation guide for additional information about transducers and configurations.

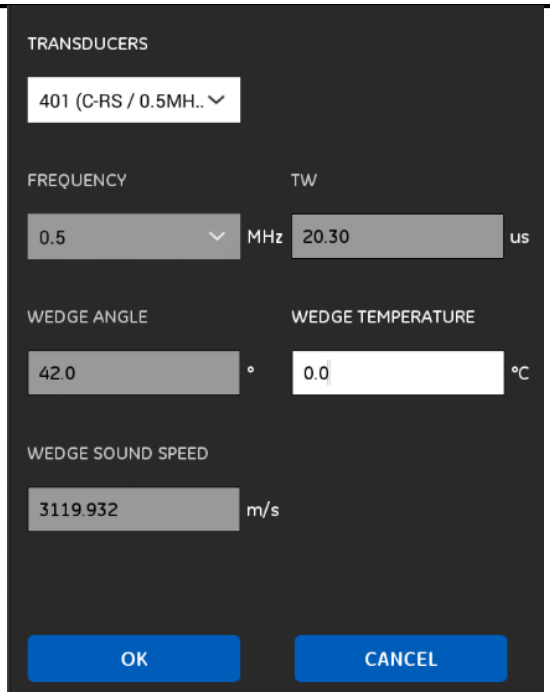


Figure 32: PROGRAM TRANSDUCER setup list

- The **TRANSDUCERS** drop-down list varies, depending on whether the user selected **Wetted** or **Clamp-on TRANSDUCER TYPE**. Please refer to **Appendix E** for all kinds of supported transducer type.
- If user have selected a standard transducer, the PT900 APP will display programmed with the needed parameters.
- If user have selected a special application transducer "Other", all parameters need to be edited.
- The **FREQUENCY** option defines to transmit a signal at a frequency to which the transducer can respond. The drop-down list consists five options, ranging from 0.25MHz to 4MHz.
- The **TW** option defines the time delay, which is actually the time the transducer signal spends travelling through the transducer and cable. The PT900 calculates the flow rate from the upstream and downstream transit times in the fluid, so the **TW** must be subtracted out for an accurate measurement. The factory supplies the time delay on a sheet of paper inside the transducer case.
- If user have selected **Clamp-On** transducer, three more inputs are required: **WEDGE ANGLE**, **WEDGE TEMPERATURE** and **WEDGE SOUND SPEED**. But if transducer is standard, **WEDGE ANGLE** and **WEDGE SOUND SPEED** is supplied by PT900. Only **WEDGE TEMPERATURE** needs to be input.

3.6.4.2 REYNOLDS Correction Factor

If the user turn the **REYNOLDS CORRECTION FACTOR** to ON, this correction factor will be effective in most application, including all those that utilize clamp-on transducers. It makes a small adjustment to the flow rate reported by the PT900. Reynolds Correction is necessary, as the velocity of the fluid measured along a diametrical path must be related to the total area average velocity over the entire pipe cross-section.

3.6.4.3 Meter Factor

Click the **METER FACTORS** button, a menu will pop up like below.

Figure 33: PROGRAM TRANSDUCER Meter Factor

- The **CALIBRATE FACTOR** is used to calibrate or adjust the readings of the PT900 to another flow reference.
- If **K FACTOR** is **SINGLE**, a single multiplier is required to be applied to the flow rate reported by the PT900. Generally, if the customer has enabled the Reynolds Correction factor, the correction factor should be set to 1.00. Otherwise, the typical factor is between 0.5 and 2.00.
- If **CALIBRATE FACTOR** is **On** and **K FACOTR** is **TABLE**, a table is required to edit. This function allows the user to "curve fit" velocity calibration multiple data points (from several different data sources or flow variables) to the flow rate reported by the PT900 flow meter.

Edit KFactor Table		
Number of rows		0
	Data Source	KFactor
1		
2		
3		
4		
5		
6		
OK		Cancel

3.6.5 How to set up PLACEMENT

The **PLACEMENT** option allows the user to define the mounting method of the transducer. This option depends on the **TRANSDUCER TYPE** in **TRANSDUCER** option.

3.6.5.1 TRAVERSE

- If transducer is **WETTED** mounting, two kinds of information are listed below **TRAVERSES**:

- PATH LENGTH
- AXIAL LENGTH

- If transducer is **CLAMP-ON** mounting, mounting is listed in specific graphics. There are 6 kinds of TRAVERSES in clamp-on mounting.

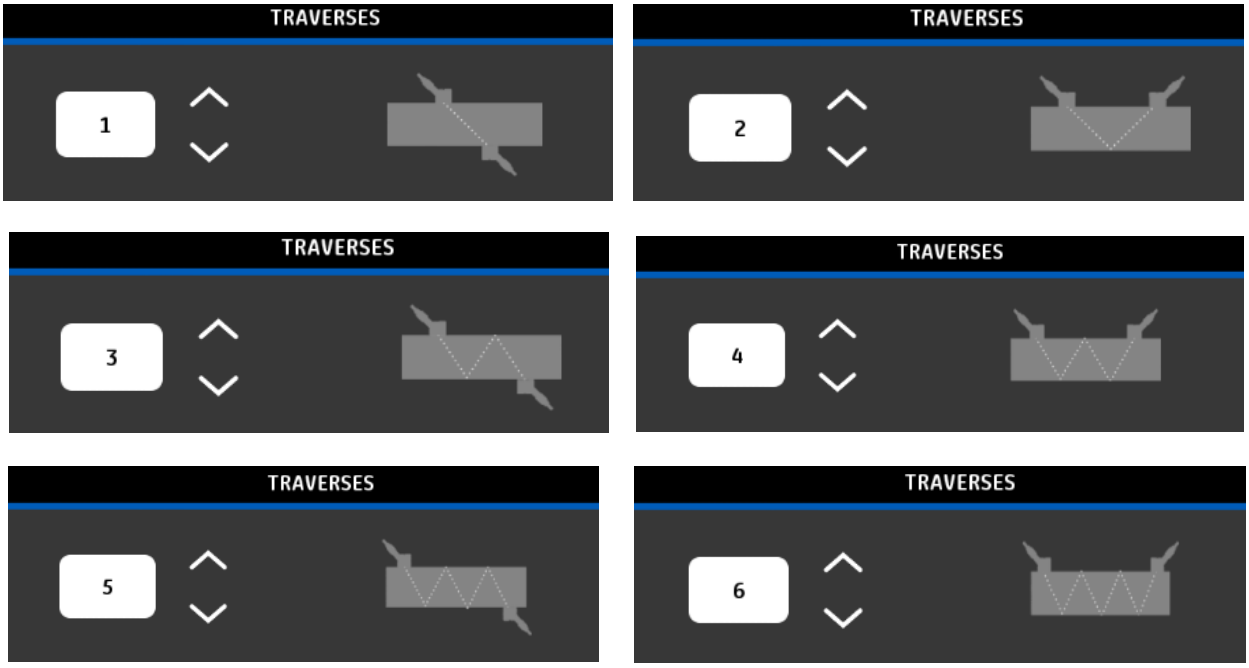


Figure 34: PROGRAM CLAMP-ON Traverse

3.6.5.2 TRANSDUCER SPACING

This item allows the user to check the distance between up and down transducer. It's not an editable value, and it would be calculated by click **SAVE & TEST** button.

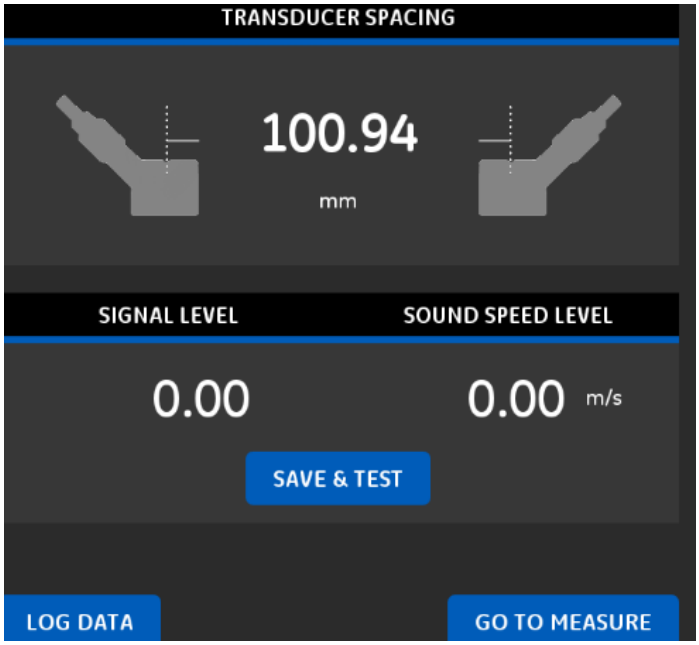


Figure 35: PROGRAM Transducer spacing

After programmed all tabs PIPE, FLUID, TRANSDUCER and PLACEMENT, click **GO TO MEASUREMENT** button, the screen would switch to measurement. Or click **LOG DATA** button to log data.

3.6.6 How to set program options

From the side menu, click the “Program Options” under PROGRAM item. The screen would switch to program option.

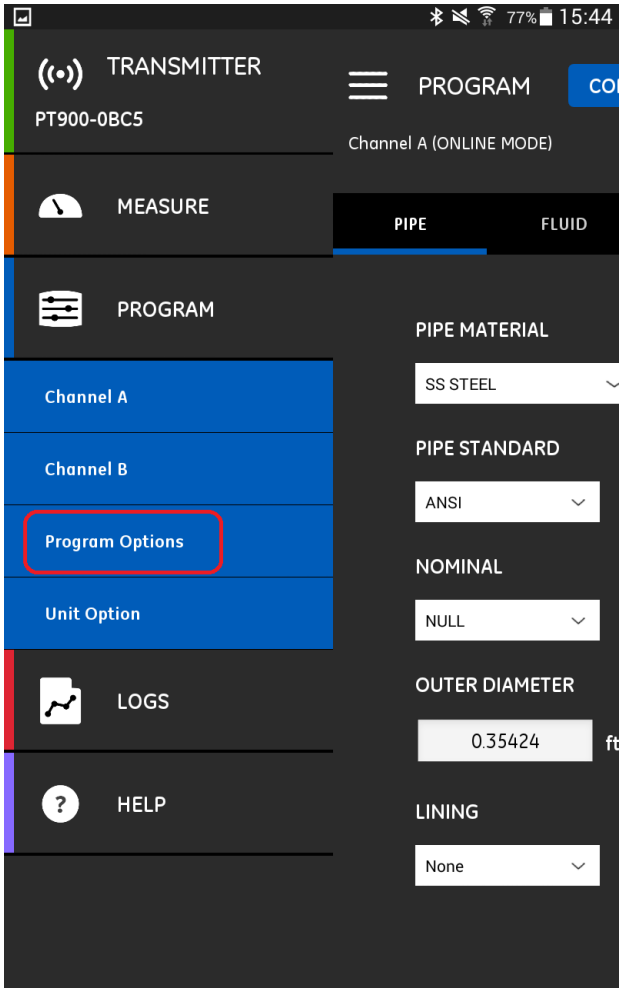


Figure 36: Program Option

3.6.6.1 How to set up ENERGY option

The first item in Program Option is **ENERGY**. The **ENERGY** option enables the user to calculate the energy of a system based on the temperature at a supply point, the temperature at a return point, and the flow of fluid through the system.

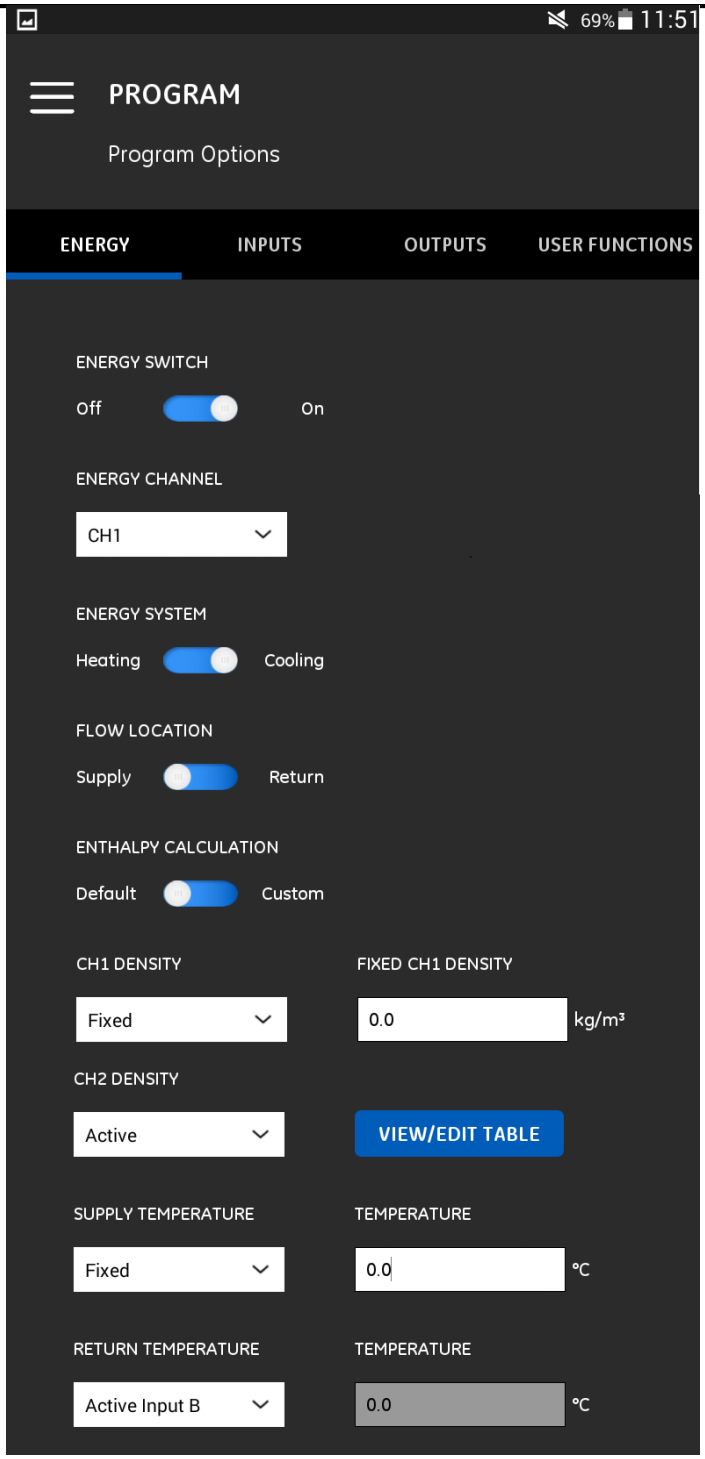


Figure 37: PROGRAM OPTION Energy setup

- The first prompt is **ENERGY SWITCH** on/off. If turn it to **OFF**, the energy measurement option would be disabled.
- If turn the **ENERGY SWITCH** ON, there are three channels for energy measurement to choose. And the drops down items in **ENERGY CHANNEL** are CH1, CH2, and Average channel.
- Via **ENERGY SYSTEM**, user is enabled to set the measurement system as HEATING or COOLING system.

- Via **FLOW LOCATION**, user is enabled to set if to measure the flow at the point of supply or return.
- Via **ENTHALPY CALCULATION**, user is enabled to decide if to use the default or custom method for energy calculations. If Custom is chosen, a table would be enabled to enter the fluid enthalpy and temperature. At most 10 groups of value could be edited.

Custom Enthalpy		
Number of rows		0 v
	Temperature (°C)	Enthalpy (KJ/kg/C)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
OK		Cancel

- Via **CH1 DENSITY**, the user is enabled to configure which source, a fixed value or variable value for fluid density, will be used for measurement in channel 1.
    - If "Fixed" is selected, a fixed fluid density would be required to input.
    - If "Active" is selected, a table would be highlighted and required to be edited like below table.

Density		
Number of rows		0 v
	Temperature (°C)	Density(kg/m^3)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
OK		Cancel

- Via **CH2 DENSITY**, the same to CH1 DENSITY, the user is enabled to configure which source, a fixed value or variable value for fluid density, will be used for measurement in channel 2.
- Via **SUPPLY TEMPERATURE**, the user is required to select a fixed or an active supply.
    - If "Fixed" is selected, a desired temperature would be required.
    - If "Active" is selected, source A or B should also be selected.

- Via **RETURN TEMPERATURE**, the user is required to select a fixed or an active value.
    - If “Fixed” is selected, a desired temperature would be required.
    - If “Active” is selected, source A or B should also be selected.
- **Note**: if Supply temperature is Active Input A, it would not be selected in Return Temperature. The same to Active input B.

3.6.6.2 How to set up INPUTS option

The ANALOG Input option enables the user to specify the parameters for energy supply temperature, energy return temperature or general purpose while temperature is fixed. And the function scroll down option is based on the energy option.

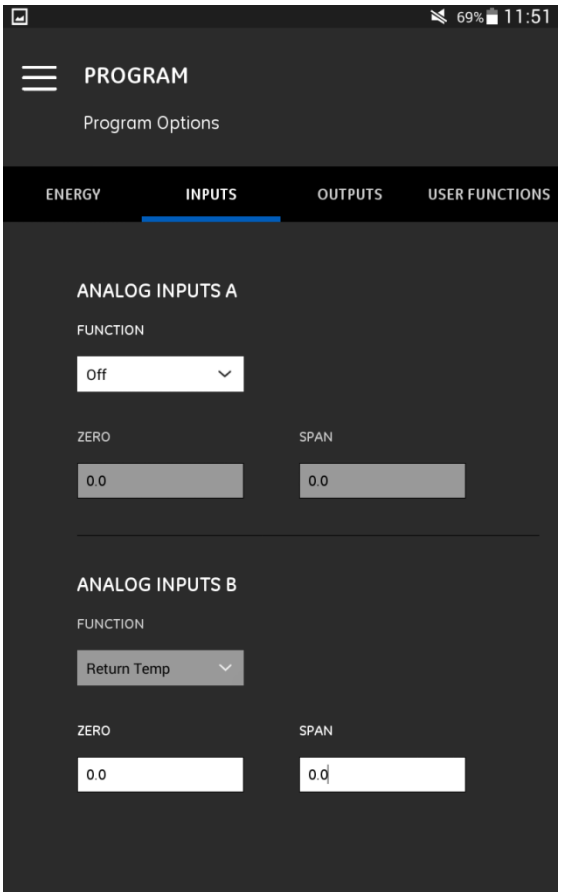


Figure 38: PROGRAM OPTION Inputs setup

- In ENERGY tab, if ACTIVE INPUT A is selected as SUPPLY TEMPERATURE or RETURN TEMPERATURE, the ANALOG INPUTS A FUNCTION would be set default as Supply Temp or Return Temp without change. And the corresponding ZERO and SPAN value is required to edit.
- In ENERGY tab, if ACTIVE INPUT A is not selected as SUPPLY TEMPERATURE or RETURN TEMPERATURE, the ANALOG INPUTS A FUNCTION would be set default as OFF. But from drop-down menu, the FUNCTION could be changed.
    - If FUNCTION is OFF, the ZERO and SPAN are not required.

- If FUNCTION is General Purpose, CH1 Temperature or CH2 Temperature, the ZERO and SPAN are required to be edited.

- ANALOG INPUTS B is same to ANALOG INPUTS A.

3.6.6.3 How to set up OUTPUTS option

3.6.6.3.1 How to Set up ANALOG OUTPUTS option

The ANALOG OUTPUTS option enables the user to specify the information to set up the ANALOG output parameters.

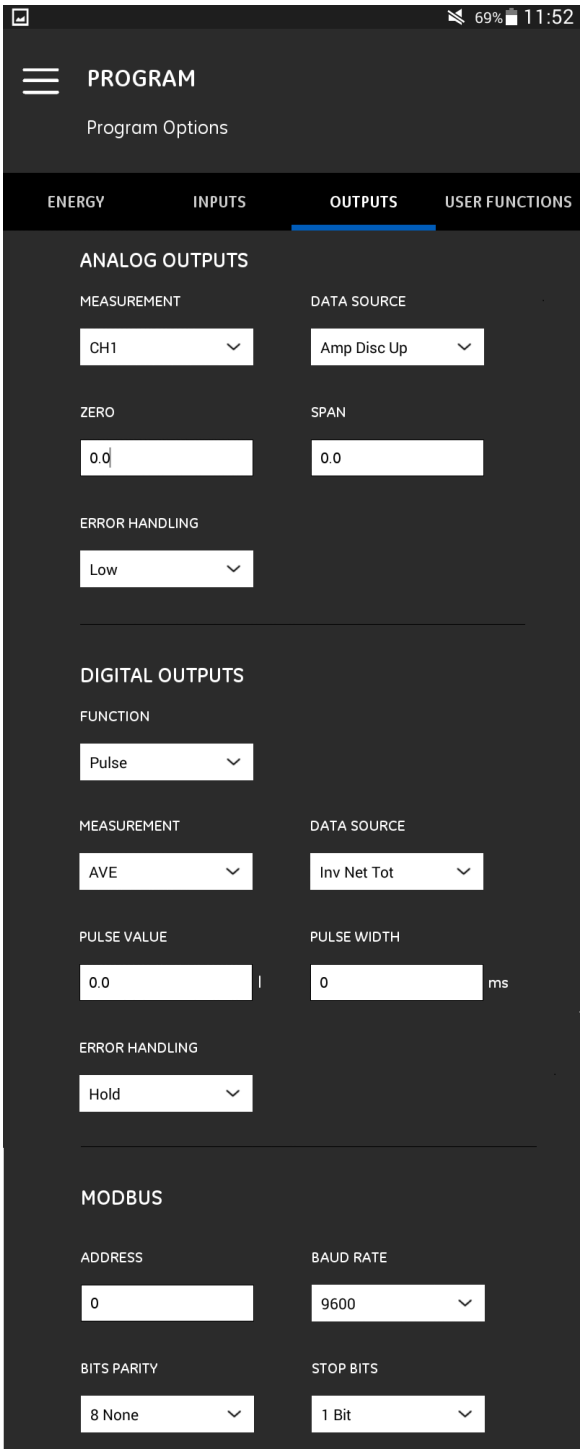


Figure 39: PROGRAM OPTION Outputs setup

- First, please select CHANNEL information via **MEASUREMENT**. Totally 4 channels are supported.
    - CH1, channel 1
    - CH2, channel 2
    - AVE, average channel
    - User, user function list
- Via **DATA SOURCE**, user could specify different data source for the ANALOG OUTPUT. To check all kinds of the data source, please refer to **Appendix D**. Measure Type.
- Via **ZERO**, user could edit the zero (base) value for the analogue output. This value represents the 4mA output.
- Via **SPAN**, user could edit the span (full) value for the analogue output. This value represents the 20mA output.
- Via **ERROR HANDLING**, user could select how the PT900 will handle the analogue outputs in the event of a fault condition. The meter offers four alternatives:
    - Low (force output 3.6mA)
    - High (force output 21mA)
    - Hold (hold the current value)
    - Other (customer edited **ERROR VALUE**)

3.6.6.3.2 How to Set up DIGITAL OUTPUTS option

Scroll down the ANALOG OUTPUTS, the DIGITAL OUTPUTS option would appear and it enables the user to set up parameters necessary for a digital output.

There are five choices for user to select the output function:

- Off
- Pulse
- Frequency
- Alarm
- Gate

1. If **Off** is selected, user will not be able to access any other parameters in this option.
2. If **Pulse** is selected, the flow meter will output a square wave pulse for each unit of flow that passes through the pipeline.
    - Specify the channel first via **MEASUREMENT**, and then select the **DATA SOURCE** from below 6 choices in drop down menu.
        - Batch Forward Totalizer
        - Batch Reverse Totalizer
        - Batch Net Totalizer
        - Inventory Forward Totalizer
        - Inventory Reverse Totalizer
        - Inventory Net Totalizer

- Next, **PULSE VALUE** and **PULSE WIDTH** are required to be input as desired value. And the two inputs vary with the different data source selection.
- Finally, **ERROR HANDLING** is required to be selected how the PT900 will handle the analogue outputs in the event of a fault condition. In the drop down list, two choices are offered for alternatives:
    - Hold (hold the current value)
    - Stop (stop output)

3. If **Frequency** is selected, user should
    - Select the **MEASUREMENT** channel and **DATA SOURCE** first and for detail please refer to **Appendix D**. **Measure Type**.
    - Next, **BASE VALUE** and **FULL VALUE** should be edited as the minimum and maximum value of the selected data source.
    - In addition, **FULL FREQUENCY** should also be edited, which corresponds to the frequency of FULL VALUE.
    - Finally, **ERROR HANDLING** is also required for the case of a fault condition. In drop down list, four choices are offered for alternatives:
        - Low (force output at 0 kHz)
        - High (force output at 10kHz)
        - Hold (hold the last good value)
        - Other (customer edited **ERROR VALUE**)
4. If **Alarm** is selected,
    - Firstly user should select the **MEASUREMENT** channel and **DATA SOURCE** like Frequency. Please refer to Appendix D. **Measure Type**.
    - Next, **ALARM STATE** supports two alternatives
        - Normal (Normally open, close for alarm)
        - Fail Safe (Close)
    - **ALARM TYPE** should be selected from the drop down menu.
        - Low (No alarm if measurement is greater than the threshold, alarm if measurement is less than or equal to the threshold)
        - High (No alarm if measurement is less than the threshold, alarm if measurement is greater than or equal to the threshold)
        - Fault (No alarm if no errors, alarm if errors.)
    - The **ALARM VALUE** is the threshold that trips the alarm, which corresponds to the value of ALARM TYPE.

5. If Gate is selected, no more items need to be chosen.

   Note: Gate is used to synchronize the totalizer with the meter calibration system. The gate stops and starts the meter totalizer, so that the customer could compare the totalizer figure with the measured volume of water in the weight tank.

3.6.6.3.3 How to Set up MODBUS option

The PT900 transmitter supports the MODBUS digital communication. To set up the Modbus, below parameter need to be configured.

- ADDRESS (Default is 1)
- BAUD RATE (Default is 115200)
- BITS PARITY (Default is 8 None)
- STOP BITS (Default is 1 Bit)

3.6.6.4 How to set up USER FUNCTIONS option

User Functions enable the user to program mathematical equations on each measurement. The user could also use any parameter in the meter to calculate a different parameter.

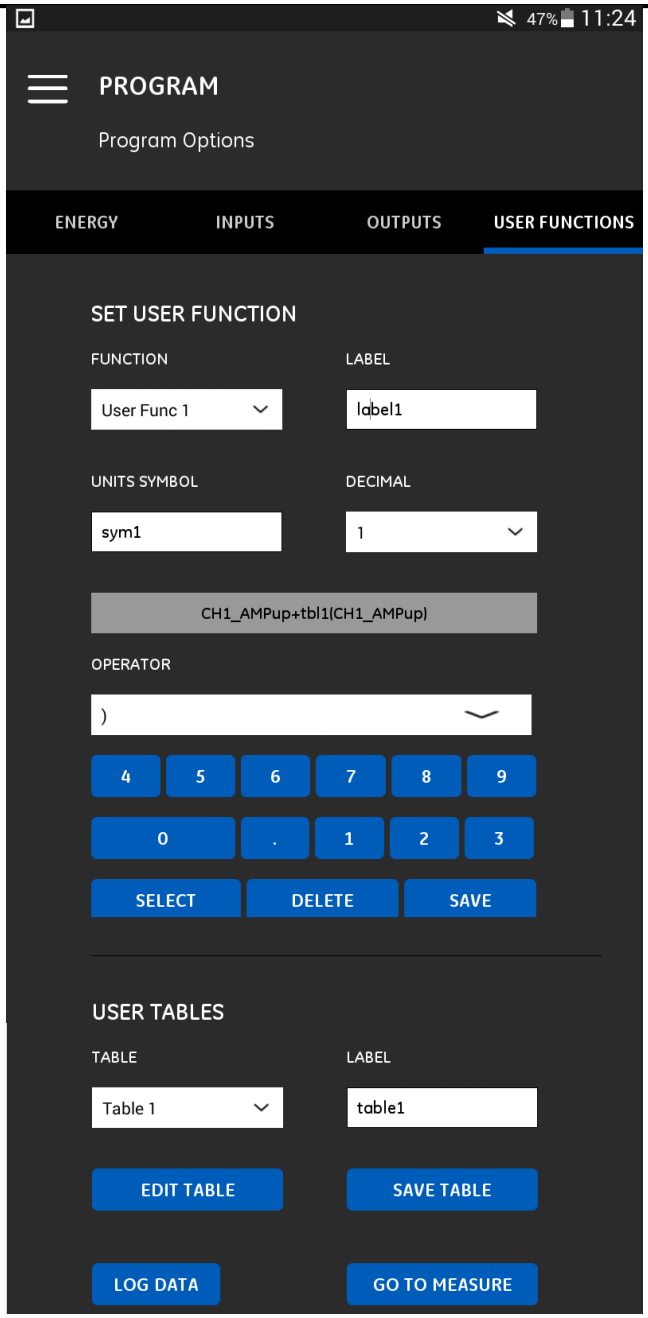


Figure 40: PROGRAM OPTIONS User Function setup

1. SET USER FUNCTION

   - First, select the **FUNCTION** number, 1 through 5 from drop down list.
   - Second, create a **LABEL** for the function. The label corresponds to the measurement type, i.e., velocity or temperature.
   - Third, create a name for **UNITS SYMBOL**, which corresponds to the measurement units, i.e., feet/sec or degrees F for velocity or temperature.
   - Fourth, select the number of **DECIMAL**. There are 5 choices from drop down list, range from 0 to 4.
   - Finally, it turns to compile the function itself.

- Click the **OPERATOR**, select a math syntax from 25 drop down lists.

+	-	*	/	^
(	)	E	**MODE**	exp
abs	inv	ln	log	sqrt
sin	cos	tan	asin	acos
atan	tbl1	tbl2	tbl3	tbl4

- Click the **MODE** sysmbol in the middle of the OPERATOR drop down list, user is enabled to select the desired data source from the desired channel.
- The tbl1/tbl2/tbl3/tbl4 symbol indicates the USER TABLE edited by user itself.
- Click **SELECT** button to confirm and click **DELETE** button to cancel the input.

- When all function is entered, click **SAVE** button, the function would be saved.

2. USER TABLES

- First, select TABLE number, 1 through 4 from drop down list.
- Second, create a LABEL for the table.
- Third, click the **EDIT TABLE** button to compile the table.

USER TABLES		
Number of rows	0 v	
	X	Y
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
OK		Cancel

- Finally, click the **SAVE TABLE** button to save the table.

3. After all modification, click **LOG DATA** button will switch to **LOG** function. Or click **GO TO MEASURE** button will switch to **MEASURE** function.

3.6.7 How to change UNIT

All measurement units shown in different screen depends on the choices user have made in the **UNIT OPTION** interface. Enter the side bar menu from any function, select the **Unit Options** item in the **PROGRAM** drop down list, the **UNIT OPTIONS** menu would pop up in the middle of the screen.

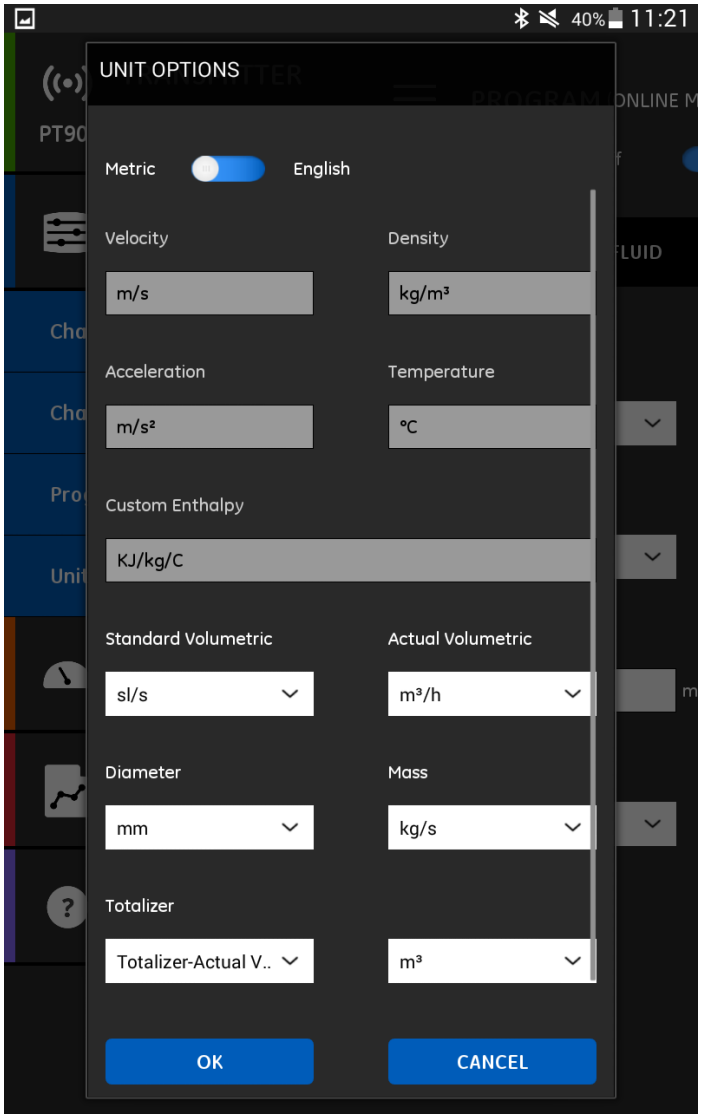


Figure 41: PROGRAM UNIT OPTION setup

- First, please select either **English** or **Metric** units as global measurement units for the PT900 transmitter. The selected units then become the default settings for every measurement that has the option for metric/English units.
- Scroll down the pop up menu, all items would be displayed. Some measurement unit is set as default and would not be changed, such as Velocity, so it's in grey. Some measurement unit is enabled to change, such as volumetric, so the drop down list is enabled to change.
- Finally, please don't forget to click **OK** button to save the modification. Or click the **CANCEL** button to desert the modification.

3.7 HOW TO MEASURE

The PT900 is a transit-time ultrasonic flowmeter. When ultrasonic pulses are transmitted through a moving liquid, the pulses that travel in the same direction as the fluid flow (downstream) travel slightly faster than the pulses that travel against the flow (upstream). The PT900 uses various digital signal processing techniques, including cross-correlation, to determine transit times and then uses the transit times to calculate flow velocity.

With this time-different technique, flow velocity would be calculated accurately. During this signal processing, many related variables could be measured. And all these variables are useful to monitor the working status of the PT900 and the field instrument.

So PT900 application provides user a powerful function to monitor all different variables in real-time. From the side bar menu, select the  **MEASURE** option, variable measurement results would be showed like below figure 42.

All value displayed is the real-time measurement. But if system is **OFFLINE**, the value would always be the last got number when previous **ONLINE**.

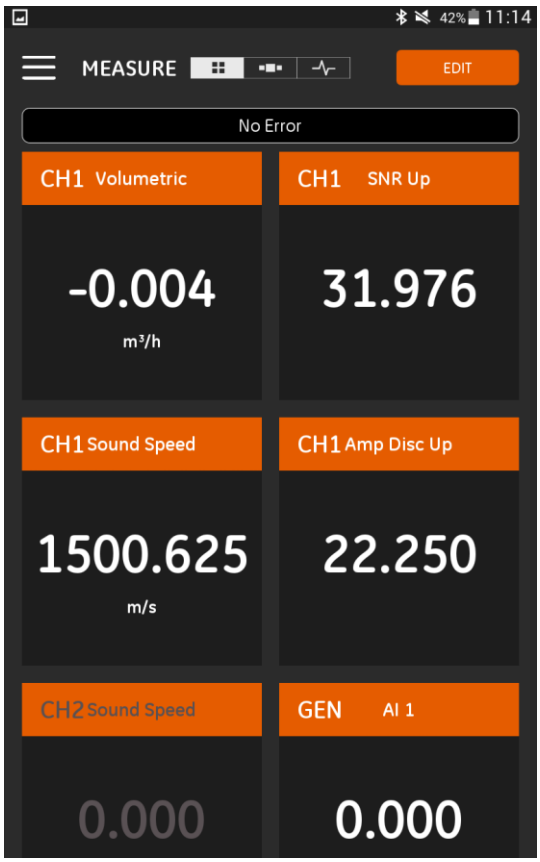


Figure 42: MEASUREMENT default display

3.7.1 Set up measurement

PT900 application enables the user to monitor at most 10 different variables at the same time. Click the **EDIT** button on the top right of the measurement screen, the application would switch to measurement set up screen.

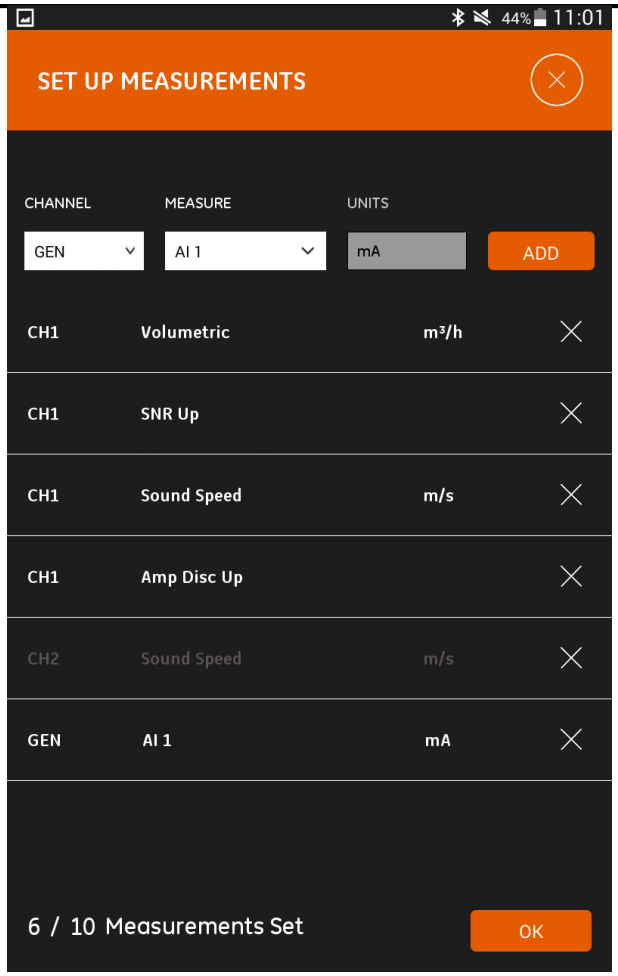


Figure 43: MEASUREMENT Setup

- First, please select **CHANNEL**. There are 4 choices in the drop down list.

  CH1/CH2/AVE/GEN

- Different **CHANNEL** support different **MEASURE** items. To check all kinds of the measure items, please refer to Appendix D. Measure Type.
- The **UNITS** option is a read-only item. It displays the current unit of the selected **MEASURE** item. To change the default unit, please check the **Unit Options** item in **Chapter 3.6.6**.
- Click **ADD** button, the selected **MEASURE** item would be added in real-time measurement list.
- In the measurement list, click ✕ button, the selected item would be deleted.
- In the left bottom, current list number/total list number would be displayed. At most 10 variables would be monitored at the same time.
- Click the **OK** button, the application would go to the measurement monitor screen.

3.7.2 View the measurement

Take below figure as example, user just open the CH1 and close CH2 in **PROGRAM** option. And no AI is connected in GENERAL channel.

3.7.2.1 Multi-measurement

The default measurement screen is multi-measurement, which means all measure items would be displayed in one page with scroll down operation. And the indication of this display model is the highlighted  icon in the top middle.

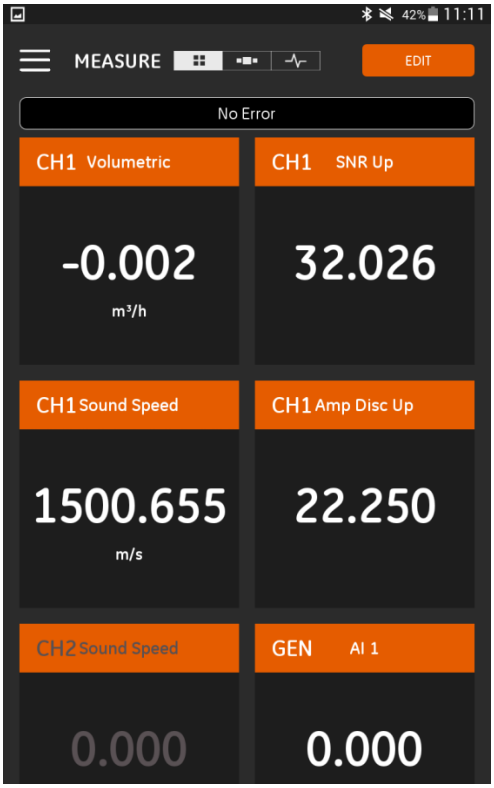


Figure 44: MEASUREMENT Multi-display

- Click the **EDIT** button in the top right corner, the application will go back to measurement set up screen.
- Below the title and display model bar is the error status box. If system works fine, **No Error** is displayed as upon figure. If certain error occurs, the error information would be displayed and flashing in red background.

3.7.2.2 One-measurement

Click the  icon, the application will switch to one-measurement display model, which means only one measurement would be displayed once and all other measurements should be switched by flip-over.

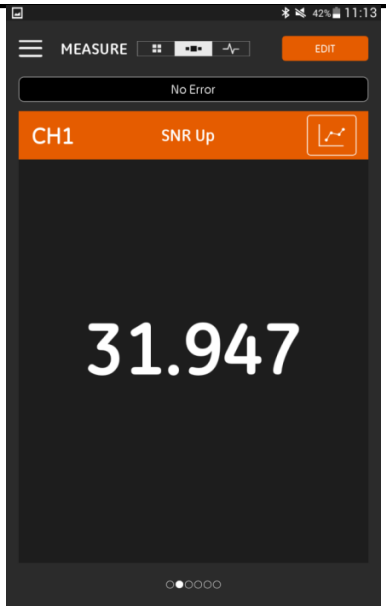


Figure 45: MEASUREMENT One-display

- The default one-measurement display is the value of the real-time measurement number like figure 45.
- Click the  icon in the top right corner, the display will switch to **GRAPH** mode. Like below figure, all the historical value of this measurement would be displayed in graph.

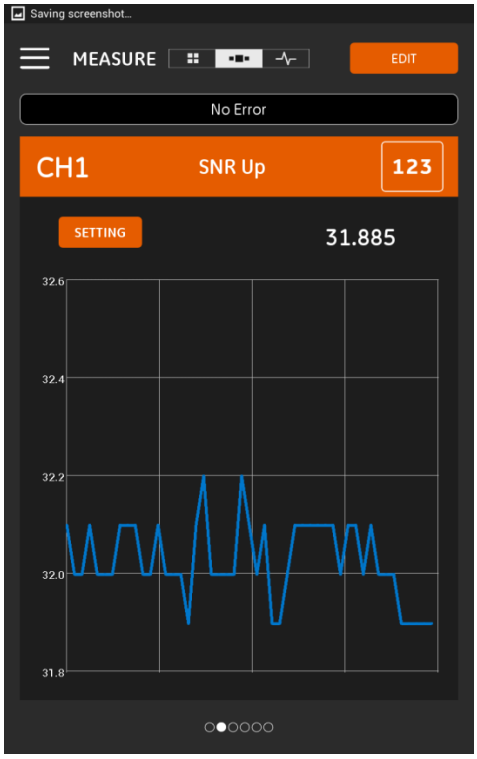


Figure 46: MEASUREMENT Graph display

- For the same operation, click the  icon in the **GRAPH** mode, the display will go back to **NUMBER** mode.
- In **GRAPH** mode, click the **SETTING** button, the user would be enabled to edit the min and max limitation of the graph display.

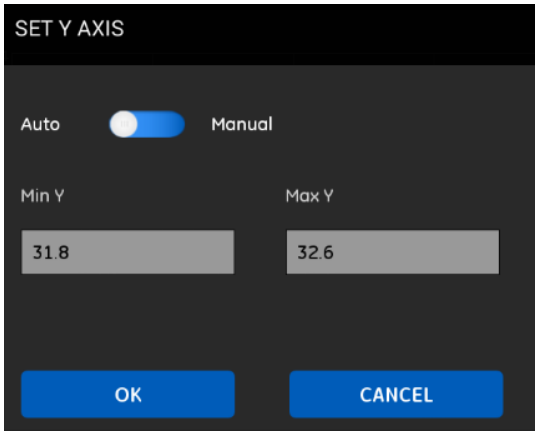


Figure 47: MEASUREMENT Graph Setting

- In upon figure, switch to **Manual** option, the min and max Y edit box would be enabled. After edit, click **OK** button, the edited value will take effect.

3.7.2.3 Diagnostic

Some key measurements are analysed to verify the system working status. These verifications are summarized in DIAGNOSTIC function. And the diagnostic result is showed after click the  icon in the top middle of the measure screen.

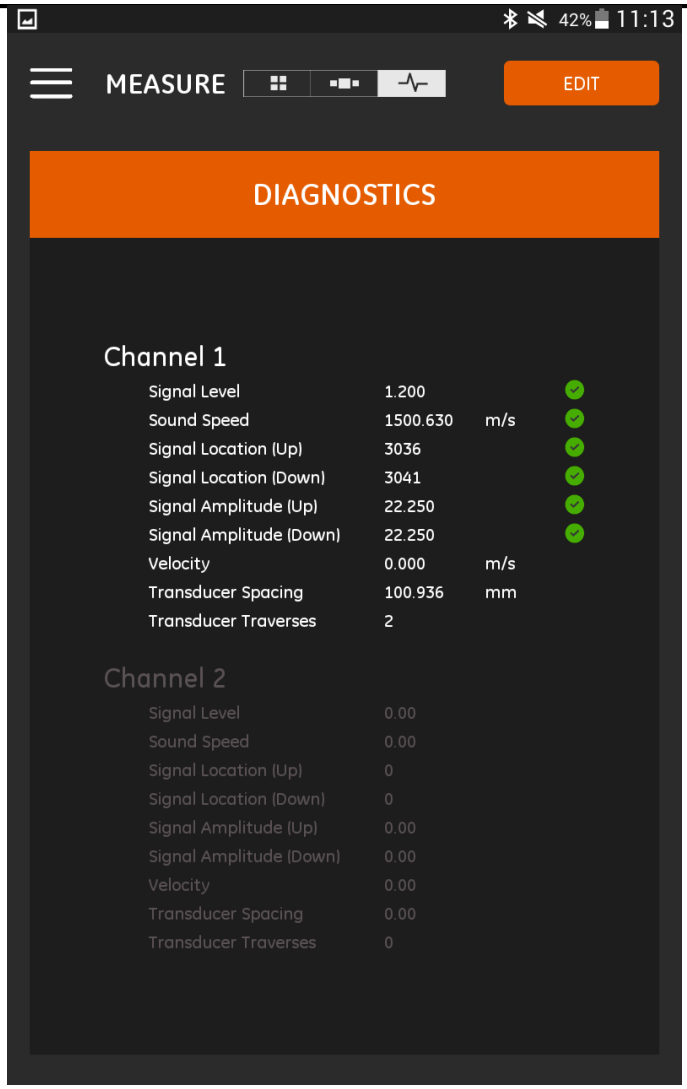


Figure 48: MEASUREMENT Diagnostic

In figure 48, channel 1 is active and channel 2 is inactive. And all the working status of channel 1 is good. No error is report.

3.8 HOW TO LOG

The PT900 transmitter supports a powerful and flexible data logging function. Diagnostic and measurement data could be recorded into the file. With these log data, all working status and information could be present to the user.

- Totally 4 channels are provided to be log:
    - CHANNEL 1 (34 variables)
    - CHANNEL 2 (34 variables)
    - AVERAGE CHANNEL (12 variables)
    - GENERAL CHANNEL (10 variables)
- Please check **Appendix D** for all variables in different channel.
- Start time and date, end time and date, and time interval should be selected to define the logging property.
- Log data is recorded in .CSV format and saved in an embedded SD card. So log data could be read in all kinds of text editor. And the log file could only be accessed via USB connection.
- The frequency of the time interval, the length of the logging run, and the number of logs affect the total memory occupied by LOG files. All memory used and left could be get in the **TRANSMITTER STORAGE** item.

3.8.1 ADD LOG

LOG function could be accessed from side bar menu or PROGRAM function. If user enter log screen first time, it's empty and a message would pop up.

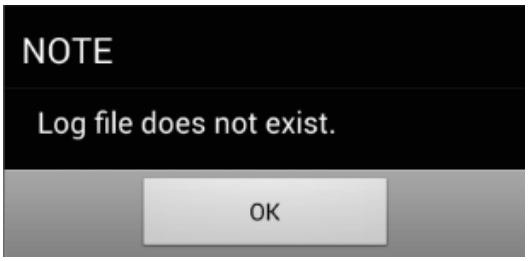


Figure 49: First time enter LOG

By clicking the ADD button at the left bottom, user would be enabled to create a desired log file.

***Note**: firstly please synchronize the PT900 transmitter time with tablet time by clicking **DATE & TIME** button in **TRANSMITTER** function.*

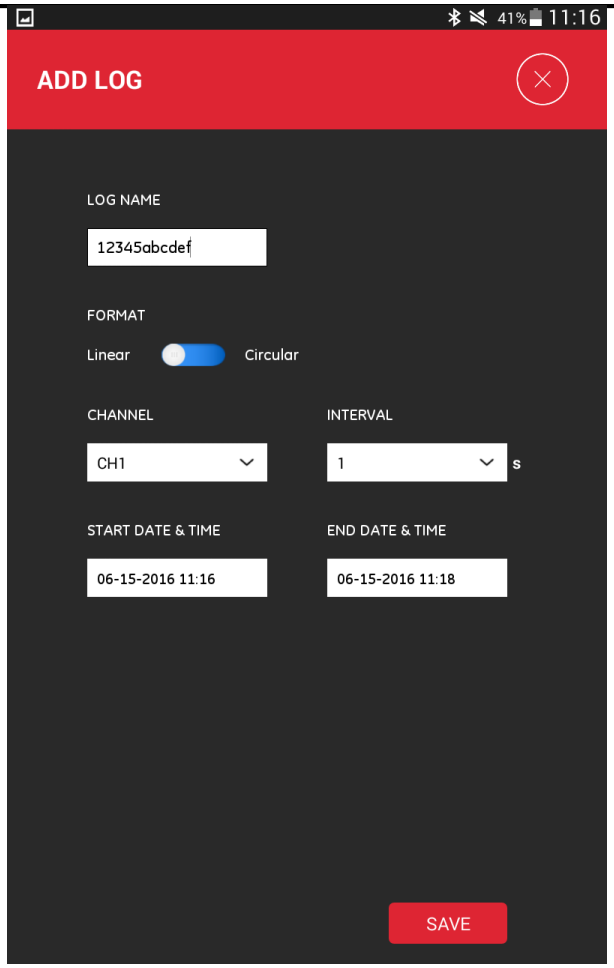


Figure 50: Add Log

- Log name, format, channel, interval, start date and time, end date and time should be edited. Click **SAVE** button, the log file would be scheduled in the PT900 transmitter.

Parameter	Drop down items	Description
LOG NAME		11 characters in most
FORMAT	Linear	Record all items one by one between the start time and end time.
	Circular	Record 100 items in most. If there are more than 100 items between the start time and end time, new record will replace the oldest ones.
CHANNEL	CH1	Channel 1, 34 variables in all
	CH2	Channel 2, 34 variables in all
	AVE	Average Channel, 12 variables in all
	GEN	General Channel, 10 variables in all
INTERVAL	1~20s	The interval between two records, the unit is second.
START DATE &TIME	Date and time	Start point
END DATE & TIME	Date and time	End point

- Only if the start time arrives, PT900 transmitter will start the desired log.
- END TIME should be bigger than START TIME. Or else error message would pop up.

***Note**, in theory, there is no upper limit for log number and log length. But it is physically limited to the capacity and operation property of the SD card, which is embedded inside the PT900 transmitter. So please be careful to choose the long time logging with short interval.*

3.8.2 STOP and DELETE LOG

In the main interface of log function, all log items and log status could be listed like figure 51. PT900 application provides user the function to change the status of log file, or manage the log files which is located in PT900 meter. There are 3 statuses for a log file, pending, running, and stopped.

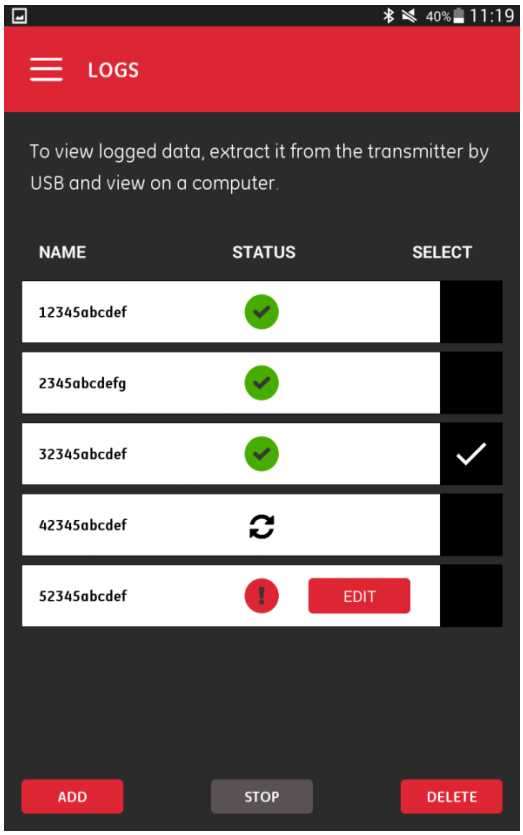


Figure 51: Log list

- The icon  means current log is still in pending status, which means start time is not arrived. In this status, the log could be **EDIT**, **DELETE** and **STOP**.

- The icon  means current log finished. And user could read the final log file via USB connection to PT900 flowmeter. In this status, the log could be **DELETE** from the PT900 transmitter embedded SD card.

- The icon  means current log is running. In this status, the log file could be **STOP** before end time is arrived.

  Upon information could be summarized in below table.

Icon	Status	Function enabled		
		EDIT	DELETE	STOP
	pending	√	√	√

	Stopped	x	√	x
	Running	x	x	√

***Note**, before click the EDIT/DELTE/STOP button, please select the object item with icon first.*

3.8.3 EDIT LOG

If user dislikes the configuration of certain pending log file, **EDIT** function is provided. Select the object pending file, click the EDIT button, the application would switch to log edit screen.

***Note**, only pending log could be edited.*

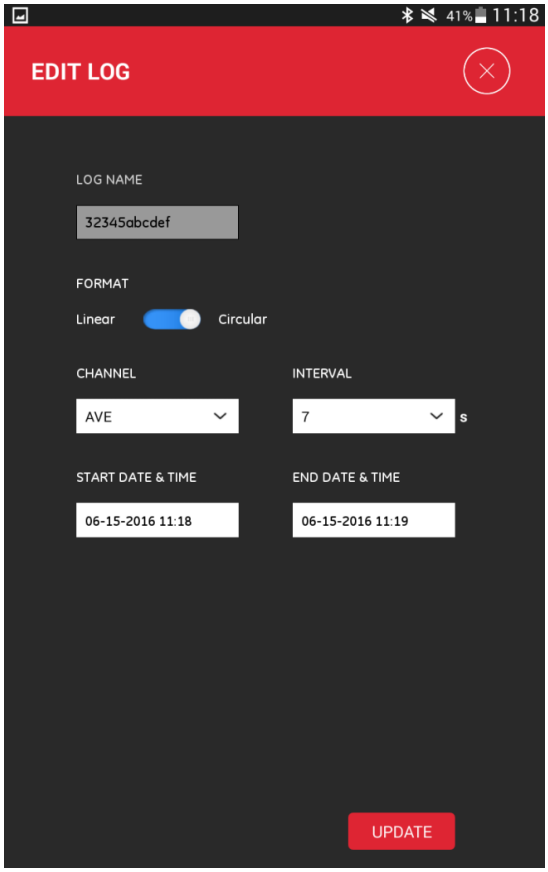


Figure 52: Edit Log

- In log edit screen, except log name, all parameters could be modified.
- After modification, click **UPDATE** button, all configurations will be saved.

3.9 HOW TO CONFIG TRANSMITTER

The APP also offers the selection to configure the PT900 transmitter. Launch the side bar menu from any sub-function. Click the **TRANSMITTER** icon on the top, then APP will redirect to transmitter configure menu.

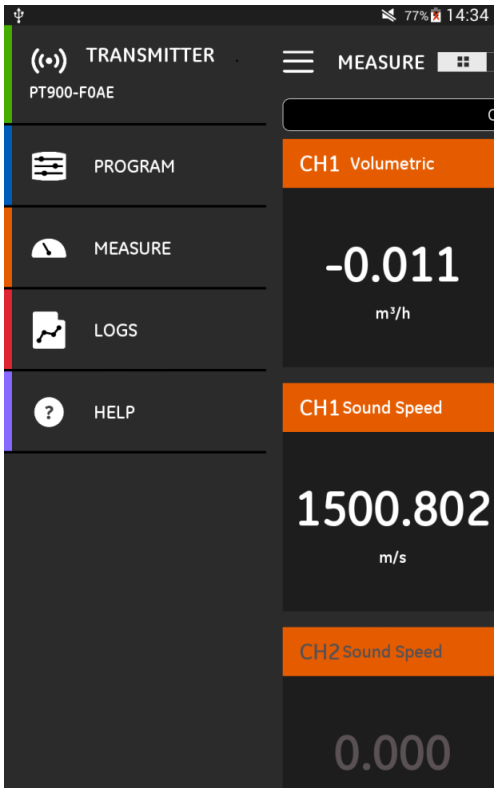


Figure 53: Side bar menu

If a PT900 flowmeter is connected by APP via Bluetooth, the TRANSMITTER option gives user the device information about the PT900 meter, battery and storage usage. If connection is OFFLINE, the information would be unavailable.

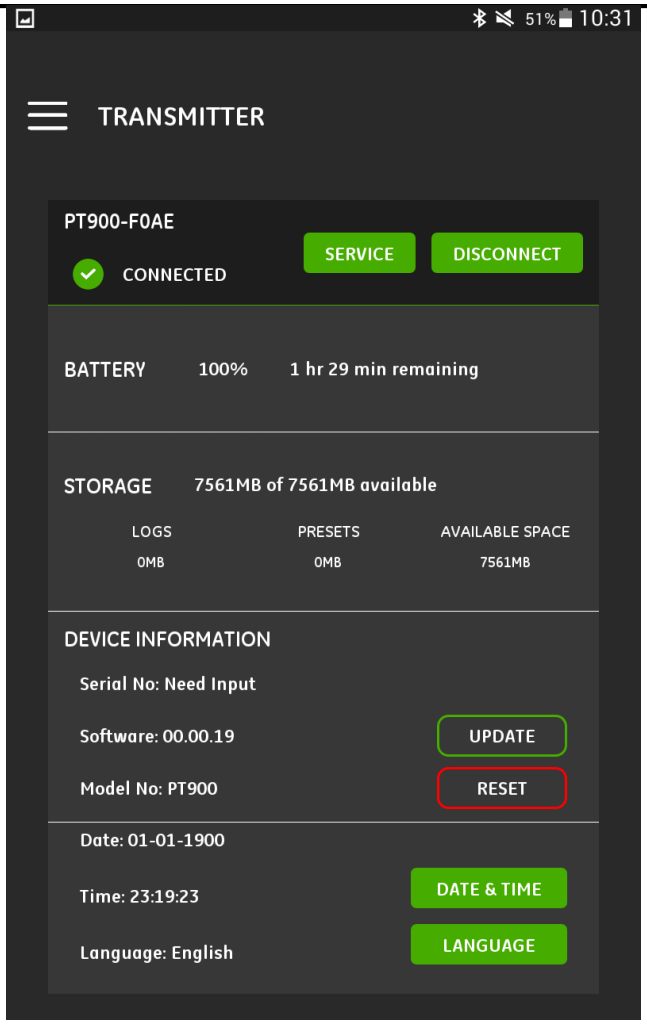


Figure 54: Transmitter Online

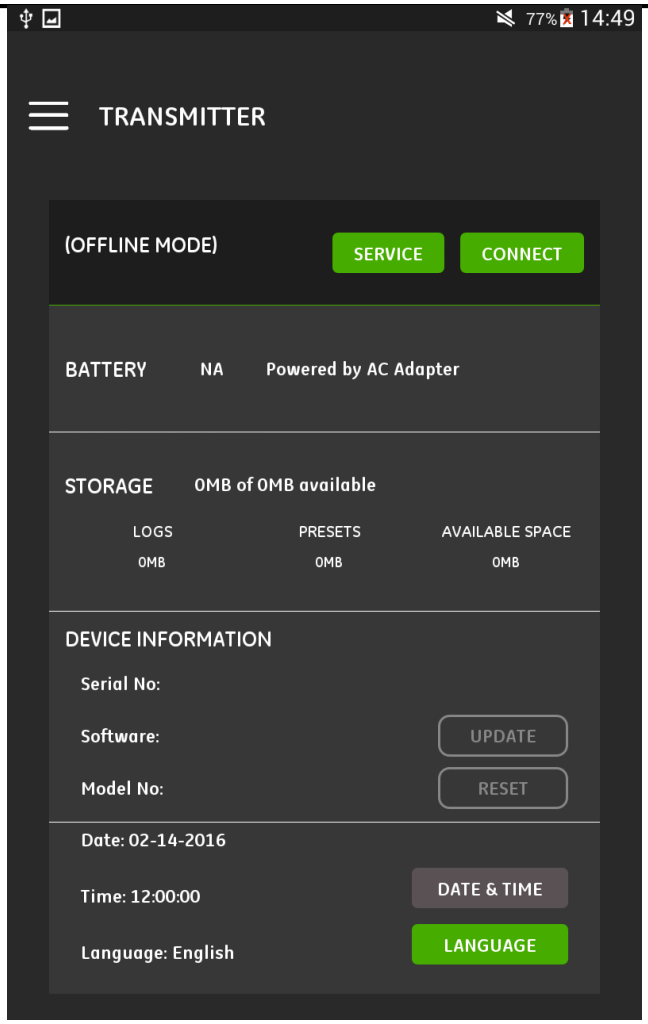


Figure 55: Transmitter Offline

- **CONNECT/DISCONNECT** button enables the user to connect a PT900 meter in OFFLINE MODE, or disconnect the connected PT900 meter.
- **SERVICE** button shows the user more configure function about PT900 meter.
- The PT900 flowmeter is a portable device, and the battery capacity is an important parameter and it could be read in percentage here. As shown in figure 55, in OFFLINE MODE, It would be unavailable.
- The PT900 flowmeter contains an embedded SD card, which saves much important information during the measurement and operation. The current **STORAGE** status could also be read and subdivide into LOG/PERSETS/AVAILABLE SPACE. As shown in figure 55, in OFFLINE MODE, It would be unavailable too.
- The PT900 flowmeter Serial No, firmware version, Model No could also be read. If firmware needed to be update, please firstly put the new image into the SD card via USB connection, and then click **UPDATE** button. The firmware in PT900 would be updated.

  ***Note**: the transmitter will not be available while firmware is updating. After updating, the transmitter will be restarted. And the connection will be offline, please reconnect again. In OFFLINE MODE, It would be unavailable.*

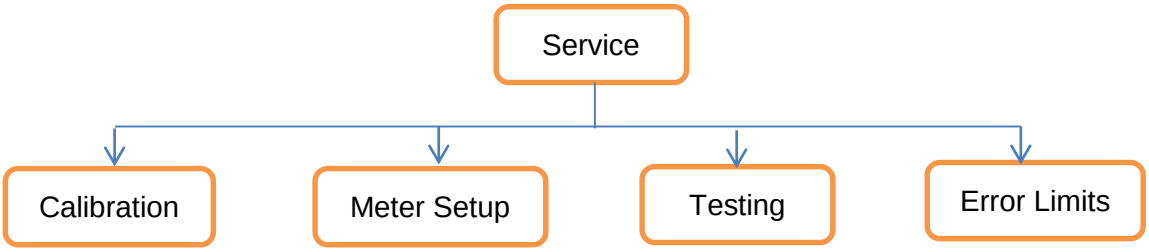
- **RESET** button enables the user to reset the PT900 flow meter remotely.

***Note**: Reset the meter will erase PRESETS and LOGS. But all factory calibrated data will be kept. After reset, PT900 connection will be offline, please reconnect again. A warning message will pop up to remind the user. In OFFLINE MODE, It would be unavailable.*

- The transmitter RTC time could be set up via **DATE & TIME** button. It will be synchronized to tablet time.
- The APP language could be set up via **LANGUAGE** button. Totally 13 languages are supported.
    - ENGLISH
    - 中文
    - Deutsch
    - 日本語
    - Italiano
    - Français
    - Nederlands
    - 한국어
    - Svenska
    - Русский
    - CASTELLANO
    - Português
    - ESPAÑOL

3.9.1 How to configure transmitter SERVICE

There are four function blocks listed under service function.



3.9.2 How to Calibration transmitter

The **CALIBRATION** option allows the user to calibrate the analogue output and inputs.

***Note**, first of all, please make sure current a transmitter is connected. If work state is off-line, calibration would not be accessed successfully.*

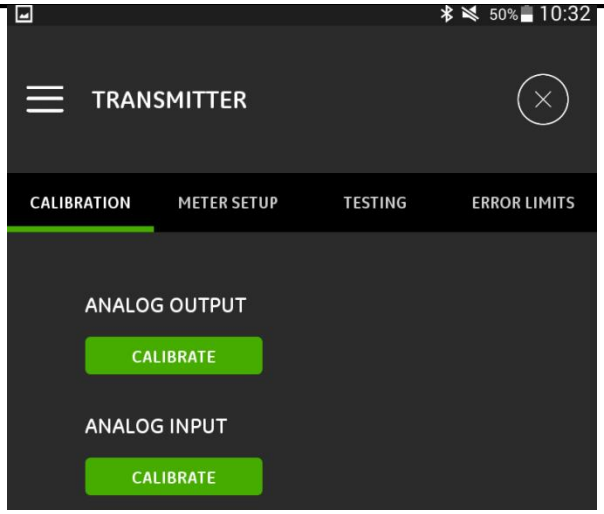


Figure 56: TRANSMITTER Calibration

- **Analog output**, click the **CALIBRATION** button, a pop up menu would display like figure 57 and 58. The calibration procedure consists of calibrating the analog output zero point (4mA) (figure 57) and then calibrating the full scale point (20mA) (figure 58). The edited value is the actual value derived from an ammeter or digital voltmeter.

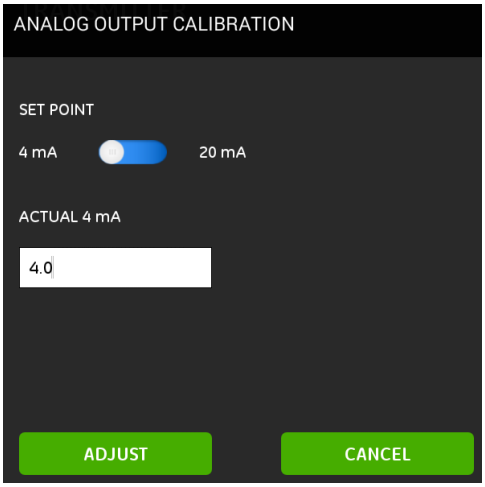


Figure 57: AO Zero calibration

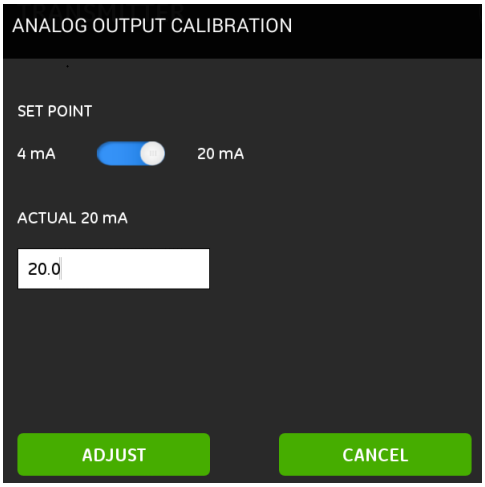


Figure 58: AO Span calibration

Click **ADJUST** button will transfer the value to the meter. Click **CANCEL** would discard the input.

- **Analog Input**, click the **CALIBRATION** button, a pop up menu would display. There are two channels for analog input, channel AI1 and channel AI2. The calibration procedure consists of calibrating the analog input zero point (4mA) and then calibrating the full scale point (20mA). Calibrating the analog inputs requires use of a current source. Like below map.

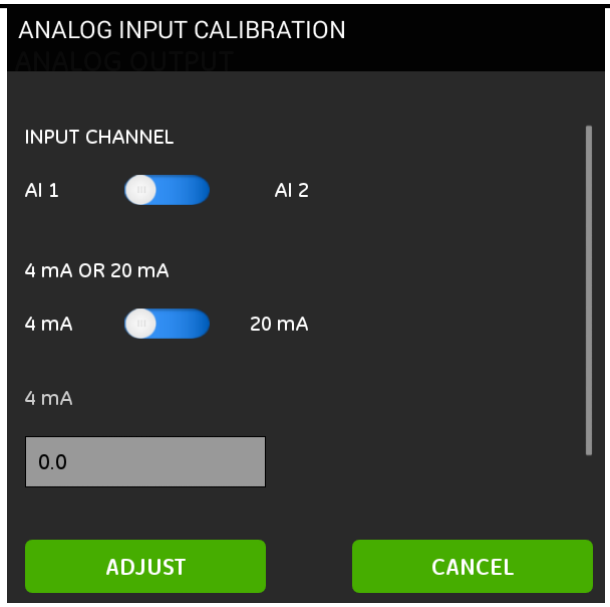


Figure 59: AI Calibration

Click **ADJUST** button will transfer the value to the meter. Click **CANCEL** would discard the input.

3.9.3 How to Setup Meter

The **METER SETUP** option enables the user to set parameters that affect the transducer signal of PT900. There are 8 parameters need to be configured.

- TOTALIZER
- RESPONSE TIME
- POWER SAVING MODE
- POWER SAVING TIME
- PEAK DETECTION METHOD
- PEAK THRESHOLDS
- DELTA T OFFSET
- ZERO CUTOFF

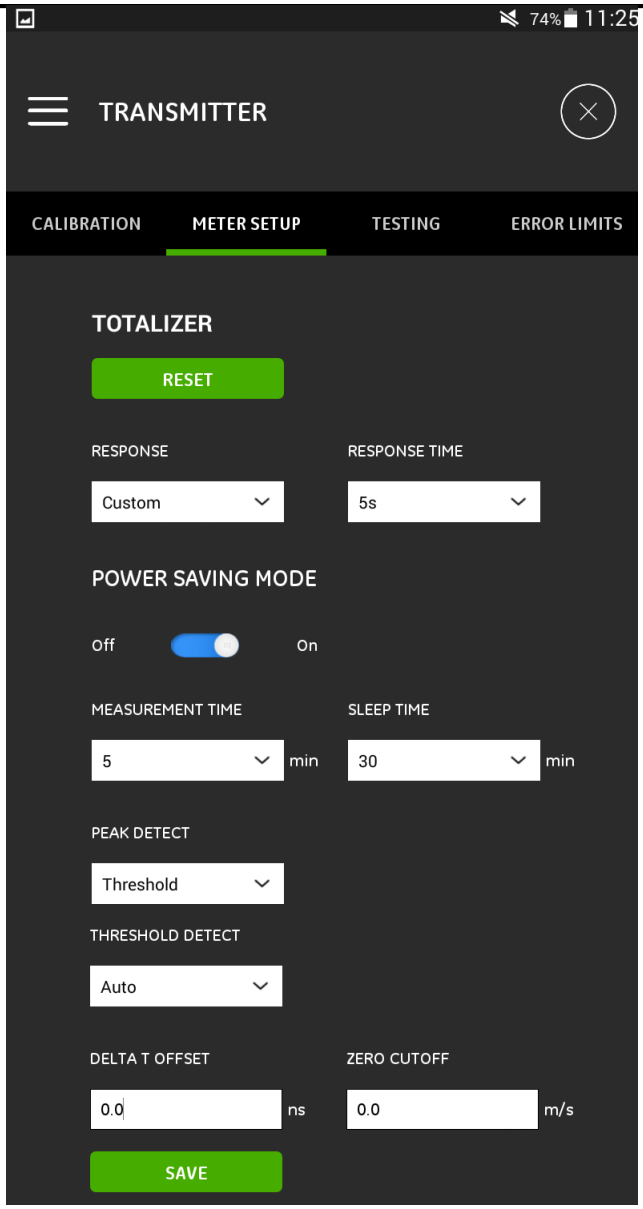


Figure 60: Transmitter setup

- The **TOTALIZER** option enables the customer to reset the value of different totalizer to 0. Please note, all 12 kinds of totalizer value from below list will be reset together if **RESET** button is clicked.

    - Ch1 Forward Totalizer
    - Ch1 Reverse Totalizer
    - Ch1 Net Totalizer
    - Ch1 Totalizer Time
    - Ch2 Forward Totalizer
    - Ch2 Reverse Totalizer
    - Ch2 Net Totalizer
    - Ch2 Totalizer Time
    - Com Forward Totalizer
    - Com Reverse Totalizer
    - Com Net Totalizer
    - Com Totalizer Time

- The **RESPONSE** option enables the user to configure the time interval between two measurements.
    - If Custom is selected, there are 10 selections in the drop down list.
      1s/2s/5s/10s/30s/60s/100s/200s/300s/500s
    - If Fast is selected, the default time interval between two measurements is 1 second.

- The **POWER SAVING MODE** switches the PT900 transmitter into a power saving measurement mode. If turn on the power saving mode, **MEASUREMENT TIME** and **SLEEP TIME** need to be configured.
    - **MEASUREMENT TIME** supports 5 selections, 5min/10min/20min/30min/60min.
    - **SLEEP TIME** supports 8 selections, 30min/60min/90min/120min/150min/180min/210min/240min.
    - If MEASUREMENT TIME is 5 min, and SLEEP TIME is 30 min, the PT900 transmitter would measure for 5 minutes and sleep for 30 minutes in alternation.

- The **PEAK DETECT** option enables the user to check the method to identify the peak of the received signal. The PT900 transmitter supports two different methods, **PEAK** method and **THRESHOLD** method.
    - In the PEAK method, the peak is identified by testing a derivative of the signal. The peak method is more reliable in identifying the signal in dynamic conditions.
    - In the THRESHOLD method, the peak is identified as the point where the signal crosses a threshold that is a percentage of the maximum signal detected. The threshold method is more reliable in marginal signal conditions.

- If THRESHOLD method is selected in PEAK DETECT, the **THRESHOLD DETECT** is also need to be configured. There are two methods that THRESHOLD DETECT supports, **Auto** and **Manual**.
    - In Auto method, threshold would be detected by transmitter automatically.
    - In Manual method, minimum and maximum threshold percentage (available from 0 to 100) need to be input. And peak percentage is also required.

- The **DELTA T OFFSET** is the difference between the upstream and downstream transit time of the transducer. And the delta-T offset value should normally be set to zero.

- The **ZERO CUTOFF** enables the user to set the offset near "zero" flow. Near a zero flow rate, the PT900's readings may fluctuate due to small offsets caused by thermal drift or similar factors. To force a Zero display reading, when there is minimal flow, enter a zero cut-off value is required.

- Finally, don't forget to click the **SAVE** button.

3.9.4 How to test meter

The TEST option enables the customer to ensure that the PT900 is performing properly. Two test methods are supported:

- Watchdog Test
- Wave Snapshot.

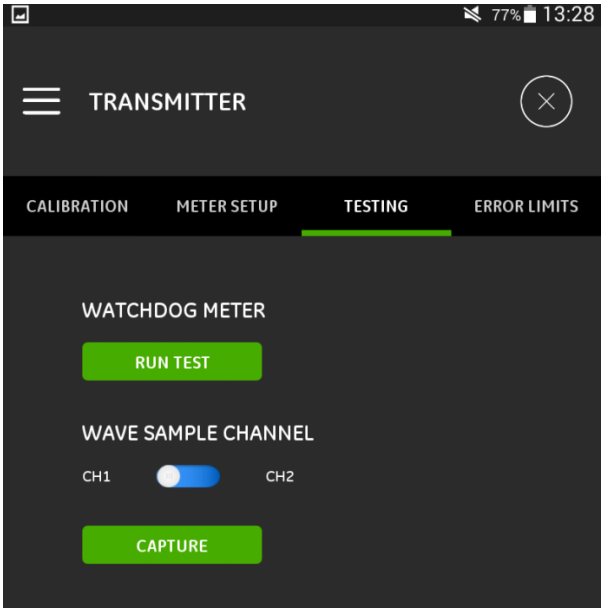


Figure 61: Transmitter Testing

3.9.4.1 Testing the Watchdog Timer Circuit

The PT900 transmitter includes a watchdog timer circuit. If a software error causes the meter to stop responding, this circuit automatically resets the transmitter. A properly functioning PT900 restarts if the customer runs the Watchdog Test. A warning message will display like below figure.

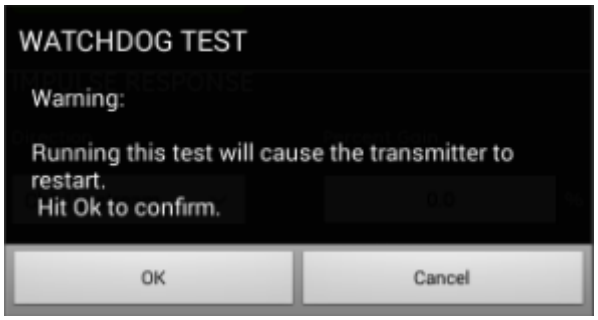


Figure 62: Transmitter Watchdog Test warning

***Note**, the PT900 transmitter will be disconnected after reset, so please reconnect via blue-tooth again before further use.*

3.9.4.2 Testing with Capture WAVE SNAPSHOT

The **CAPTURE** option allows the user to capture received signals to a figure. From the figure 63, user could check the trend of the signal variation. PT900 transmitter support two channels, so please select **CH1** or **CH2** firstly.

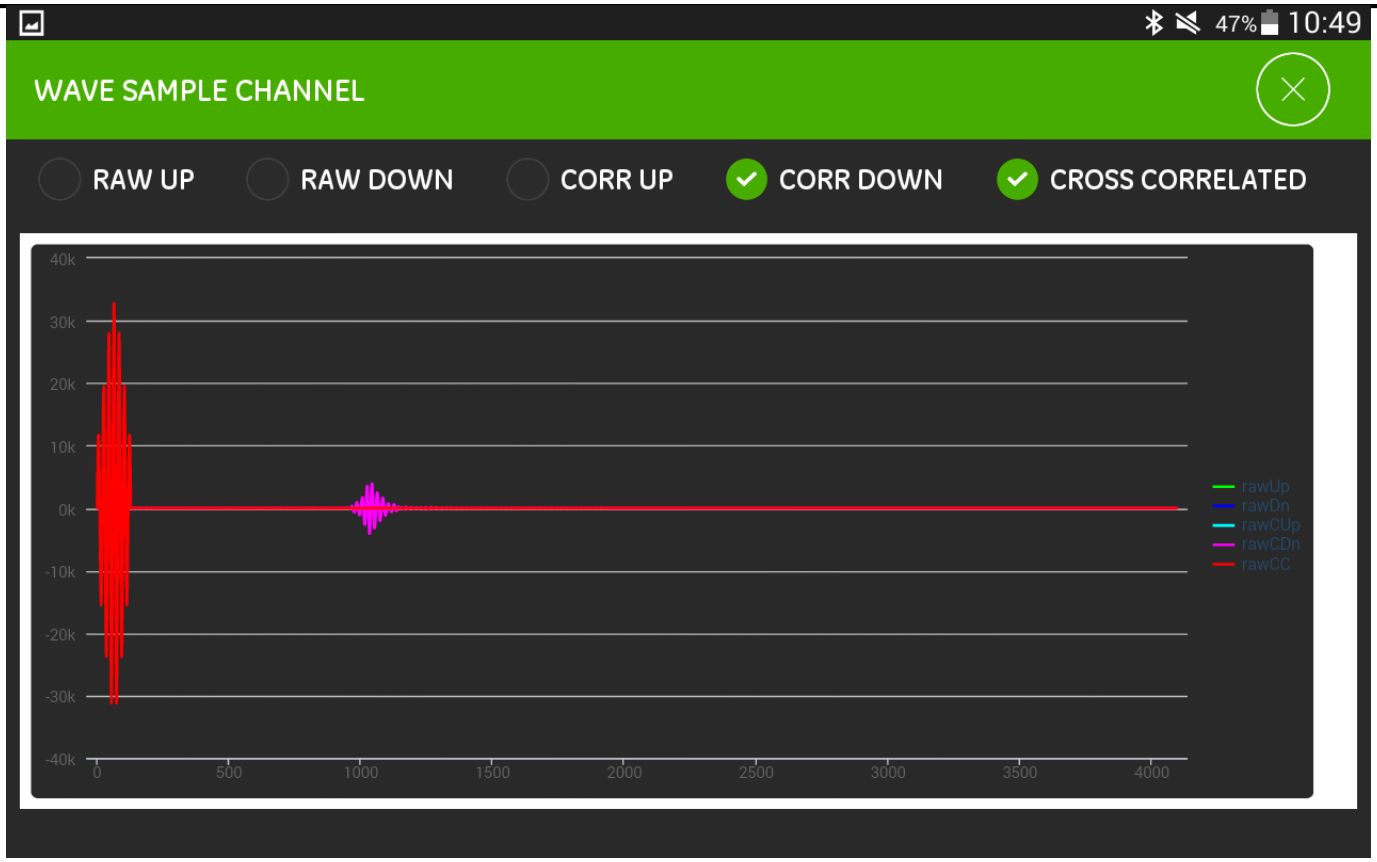


Figure 63: Transmitter Wave snapshot example

The SNAPSHOT captures 5 groups of raw signal, RAW UP, RAW DOWN, CORR UP, CORR DOWN and CROSS CORRELATED. In addition, the figure could be zoom in and zoom out for detail.

3.9.5 How to Set ERROR LIMITS

The **ERROR LIMITS** option enables the user to set limits for an incoming signal. When the signal falls outside the programmed limits, an error indication will appear in **MEASUREMENT**.

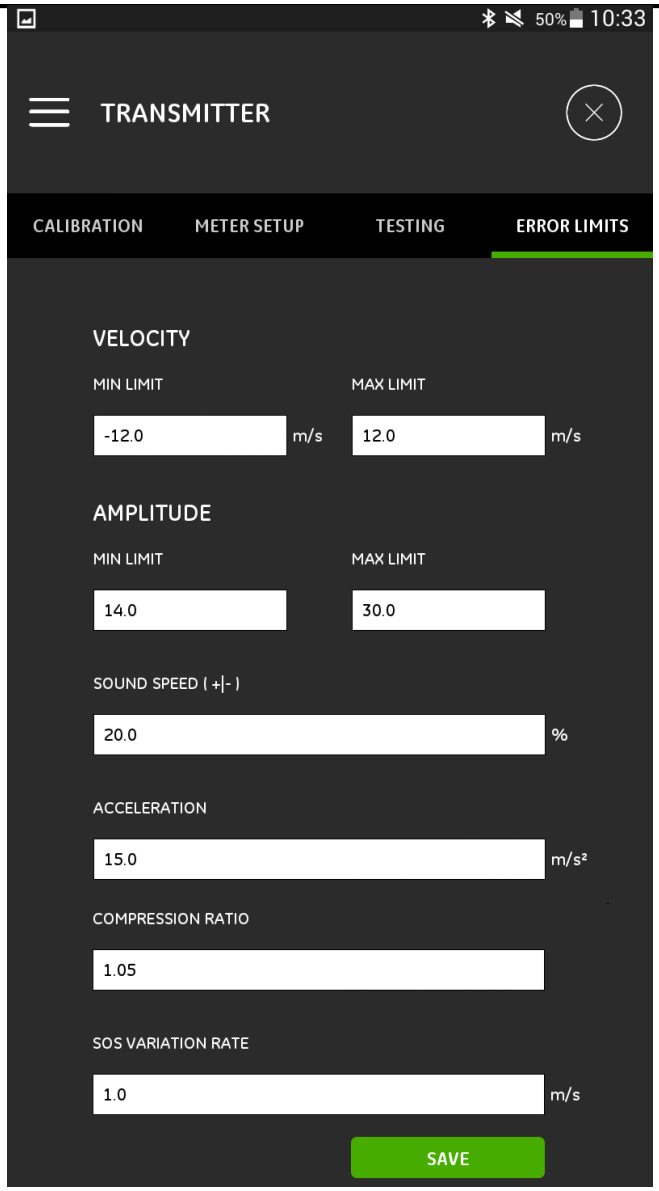


Figure 64: Transmitter Error Limits Setup

- First, low and high **VELOCITY** limits are required to be input. If measured velocity falls outside these limits, the VELOCITY RANGE error message appears in measurement screen.
- Second, low and high limits for the **AMPLITUDE** discriminator are required to be input. The amplitude discriminator measures the size of the transducer signal sent from the PT900. If the signal falls outside these limits, the AMPLITUDE ERROR message appears.
- Third, the acceptable limits for the **SOUND SPEED**, which based on conditions in customer's particular system, are required. The SOUND SPEED ERROR message appears if the fluid sound speed exceeds that entered in the FLUID option of the PROGRAM menu by more than this percentage. The default value is 20% of the nominal sound speed.
- Fourth, the **ACCELERATION** limit for detecting cycle skipping is required. The CYCLE SKIP ERROR message appears if the velocity changes by more than this limit from one reading to the next.

- Fifth, the **COMPRESSION RATIO** limit for detecting the ratio of correlation peak value and secondary peak value is required. The SIGNAL QUALITY ERROR message appears if the compression ratio beyond this limit.
- Sixth, the **SOUND SPEED VARIATION RATE** limit for detecting the variation of sound speed is required. The SOUND SPEED ERROR message appears if sound speed varies beyond this limit.
- Each of upon items has a range limit, if the input value beyond the limitation, an error message will occur like figure 65.

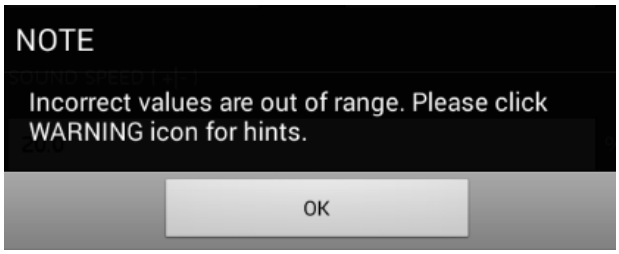


Figure 65: Error Limits range warning

  - Click the  icon on top menu, detail information would be displayed to help the user correct the error input. Below is an example, click ✕ will exit the pop up message.

Figure 66: Error limits range warning example

- Finally, please don't forget to click **SAVE** button.

3.10 HELP

HELP enables the customer to check the user manual and quick start guide. HELP could be selected via side menu.

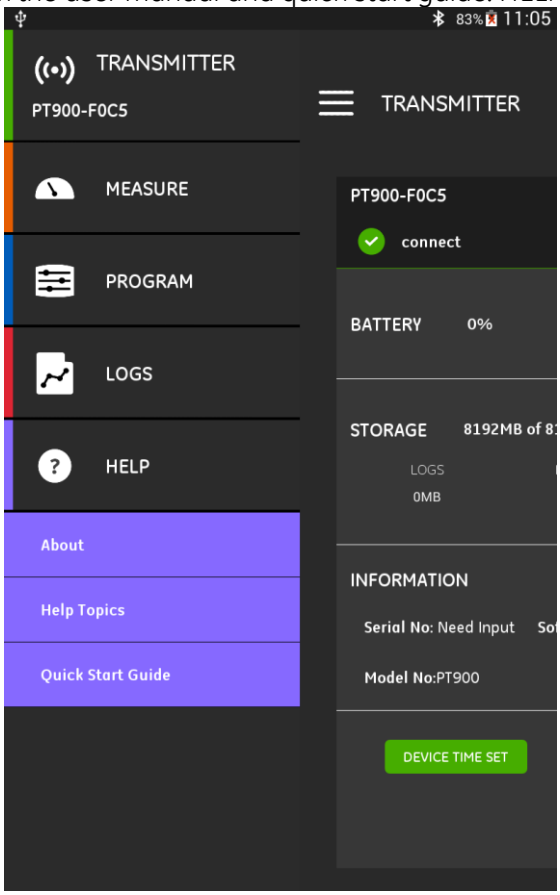


Figure 67: PT900 APP Help main menu

3.10.1 About

About gives user a brief description about PT900 flow meter, the name, label, version and manufacture information. By clicking the hyperlink www.gemeasurement.com, a website would be open and richer information would be showed.

Figure 68: Help about information

3.10.2 Help Topics

User could find the interested information from below topics.

1. What type of tablet may I use with the PT900 Applications?
2. Where can I get the PT900 application?
3. To update to the latest version of the PT900 APP, do I need to update both my APP and PT900 firmware?
4. I cannot connect to the PT900 transmitter with my tablet. What am I doing wrong?
5. Can someone connect to the PT900 transmitter with Bluetooth without the PT900 APP and damage my transmitter?
6. Can I work offline and save my settings before connecting to a transmitter?
7. How many PRESETs can the meter save?
8. Can I connect to more than one PT900 transmitter at a time with my APP?
9. How do I determine the material of my pipe?
10. How do I determine the SNSP of my pipe?
11. How do I determine the outer diameter of my pipe?
12. How do I determine the wall thickness of my pipe?
13. What is a pipe lining and how do I know if my pipe has a lining?
14. Do I need to turn on tracking windows? If yes, when do I turn on tracking windows?
15. If I do not know the fluid, what do I use for a sound speed?
16. How do I determine the Kinematic Viscosity of my fluid?
17. What is the difference between a wetted transducer and a clamp-on transducer?
18. What transducer should I use for my pipe?
19. How do I determine the type of transducer that I have?
20. What is wedge temperature and what temperature should I use?
21. What is Reynolds Correction Factor and should it be programmed on or off?
22. What is Calibration Factor and should it be programmed on or off?
23. What is traverse?
24. How many traverses should I use to install my transducers?
25. What is transducer spacing and how do I measure it?
26. What is signal level?
27. What is an acceptable value for signal level?
28. The meter is giving me a sound speed level. How do I know if the value is good or not?
29. What is the difference between a batch total and an inventory total?
30. What is Standard Volumetric?
31. What are the diagnostics and what do they mean?
32. Do the diagnostic values update if the meter is showing an error code?
33. What are the error codes, what is the cause? How do you fix them?
34. Can you adjust the range in the graph?
35. What is the energy switch for?
36. What is the energy channel AVE for?
37. How do I know if my system is a heating or cooling system?
38. Does it make a difference if I put the flow measurement on the supply or return side?
39. What is Enthalpy?
40. How do I know if I should be using a default or custom enthalpy value?
41. What is General Purpose for the analog inputs?
42. What is a user function?
43. What is a user table?
44. STOPPED AT TRANSMITTER (COULD NOT REVIEW WHILE OFFLINE)

Please contact sales representative for other topics.

3.10.3 Quick Start Guide

Quick Start Guide gives user a general instruction about how to use flow meter and APP.
Please watch the installation videos on website www.gemeasurement.com/PT900 firstly. And begin the operation in below brief steps.

1. Check the PT900 transmitter and the tablet before use.
2. Load application onto tablet from either the SD card within PT900 flow meter or our website showed upon.
3. Turn on transmitter by holding down the power button for more than two seconds. The light of green power LED indicates successfully power on.
4. Open the PT900 APP in Tablet.
5. Connect APP to the transmitter via Bluetooth communication.
6. Change to the desired unit option and program the meter with correct pipe, fluid, transducer and placement information.
7. Install transducers onto the pipe with the spacing information got from APP.
8. Set display to desired values and view flow rate.
9. Continue with other operations, such as energy measurement or data log.

CHAPTER 4. ERROR CODES AND TROUBLESHOOTING

4.1 ERROR DISPLAY IN THE MEASUREMENT

In MEASURE interface, the top middle line of the APP displays top priority error message during operation. This line, called the Error Line, includes two parts: Error Channel and Error String. The Error channel indicates the error occurs in which channel, while the Error string gives a detailed description of the error information

4.1.1 Error Channel

Error Channel	Error Header
Channel 1	CH1
Channel 2	CH2
Meter	No specified channel

4.1.2 Flow Error String

Flow errors are errors in the course of making a flow measurement. These errors can be caused by disturbances in the fluid, such as excessive particles in the flow stream or extreme temperature gradients. The errors could also be caused by an empty pipe or other such issue with the fluid itself. Flow errors are typically not caused by a malfunction of the flow measurement device, but by an issue with the fluid itself.

4.1.2.1 Low Signal

Problem: Poor ultrasonic signal strength or the signal exceeds the limit via the *Program;*

Cause: When SNR is less that the value of "Signal Low Limits" or the signal cannot be found when the flow is started, the Low Signal error will occur. Poor signal strength may be caused by a defective cable, a flowcell problem, a defective transducer or a problem in electronic console. A signal that exceeds the programmed limits is probably caused by the entry of an improper value in the menu *Transmitter → Service → Error Limits → Signal Low limits ;*

Action: Check the components listed above (Refer to 4.2 Diagnostics). Also check the inputted value in the menu *Transmitter → Service → Error Limits → Signal Low limits;*

4.1.2.2 Sound Speed Error

Problem: The sound speed exceeds the limits programmed in the menu *Transmitter → Service → Error Limits → SOUND SPEED +- limits;*

Cause: When the measured sound speed is out of the limit of sound speed, it will cause this error. The error may be caused by incorrect programming, poor flow conditions and poor transducer orientation;

Action: Correct the programming errors. Refer to 4.2 Diagnostics, to correct the flowcell and/or transducer problems. . Also check the inputted value in the menu *Transmitter → Service → Error Limits → SOUND SPEED +- limits;*

4.1.2.3 Velocity Range

Problem: The velocity exceeds the limits programmed in the menu *Transmitter → Service → Error Limits → Velocity MIN/MAX LIMIT;*

Cause: When the measured velocity is out of the limit of velocity, it will cause this error. The error may be caused by improper programming data, poor flow conditions and/or excessive turbulence;

Action: Make sure the actual flow rate is within the programmed limits. Also, check the entered value in the menu *Transmitter → Service → Error Limits → Velocity MIN/MAX LIMIT*. Refer to 4.2 Diagnostics, to correct the flowcell and/or transducer problems.

4.1.2.4 Signal Quality

Problem: The signal quality is outside the limits programmed in the menu *Transmitter → Service → Error Limits → Correlation Peak;*

Cause: The peak of the upstream or downstream correlation signals has fallen below the correlation peak limit, as set in the menu *Program → Advanced → Error Limits → Correlation Peak*. This may be caused by a flowcell or electrical problem.

Action: Check for sources of electrical interference and verify the integrity of the electronics console by temporarily substituting a test flowcell that is known to be good. Check the transducers and relocate them, if necessary. See 4.2 Diagnostics, for instructions.

4.1.2.5 Amplitude Error

Problem: The signal amplitude exceeds the limits programmed in the menu *Transmitter → Service → Error Limits →Amp Disc Min/Max;*

Cause: Solid or liquid particulates may be present in the flowcell. Poor coupling for the clamp-on transducers;

Action: Refer to 4.2 Diagnostics, to correct any flowcell problems;

4.1.2.6 Cycle Skip

Problem: The acceleration exceeds the limits programmed in the menu *Transmitter → Service → Error Limits →Acceleration;*

Cause: This condition is usually caused by poor flow conditions or improper transducer alignment;

Action: Refer to 4.2 Diagnostics, to correct any flowcell and/or transducer problems

4.2 DIAGNOSTICS

4.2.1 Introduction

This section explains how to troubleshoot the PT900 if problems arise with the electronics enclosure, the flowcell, or the transducers. Indications of a possible problem include:

- Display of an error message on the tablet measure screen.
- Erratic flow readings
- Readings of doubtful accuracy (i.e., readings that are not consistent with readings from another flow measuring device connected to the same process).

If any of the above conditions occurs, proceed with the instructions presented in this chapter.

4.2.2 Flowcell Problems

If preliminary troubleshooting with the *Error Code* indicates a possible flowcell problem, proceed with this section. Flowcell problems fall into two categories: *fluid problems* or *pipe problems*. Read the following sections carefully to determine if the problem is indeed related to the flowcell. If the instructions in this section fail to resolve the problem, contact GE for assistance.

4.2.2.1 Fluid Problems

Most fluid-related problems result from a failure to observe the flow meter system installation instructions. Refer to Chapter 2, Installation, to correct any installation problems.

If the physical installation of the system meets the recommended specifications, it is possible that the fluid itself may be preventing accurate flow rate measurements. The fluid being measured must meet the following requirements:

1. *The fluid must be homogeneous, single-phase, relatively clean and flowing steadily*.

   Although a low level of entrained particles may have little effect on the operation of the PT900, excessive amounts of solid or gas particles will absorb or disperse the ultrasound signals. This interference with the ultrasound transmissions through the fluid will cause inaccurate flow rate measurements. In addition, temperature gradients in the fluid flow may result in erratic or inaccurate flow rate readings.

2. *The fluid must not cavitate near the flowcell*.

   Fluids with a high vapor pressure may cavitate near or in the flowcell. This causes problems resulting from gas bubbles in the fluid. Cavitation can usually be controlled through proper installation design.

3. *The fluid must not excessively attenuate ultrasound signals*.

   Some fluids, particularly those that are very viscous, readily absorb ultrasound energy. In such a case, an error code message will appear on the display screen to indicate that the ultrasonic signal strength is insufficient for reliable measurements.

4. *The fluid sound speed must not vary excessively*.

   The PT900 will tolerate relatively large changes in the fluid sound speed, as may be caused by variations in fluid composition and/or temperature. However, such changes must occur slowly. Rapid fluctuations in the fluid sound speed to a value that is considerably different from that programmed into the PT900, will result in erratic or inaccurate flow rate readings. Refer to "*Chapter 3, Initial Setup and Programming"* and make sure that the appropriate sound speed is programmed into the meter.

4.2.2.2 Pipe Problems

Pipe-related problems may result either from a failure to observe the installation instructions, as described in Chapter 2, or from improper programming of the meter. By far, the most common pipe problems are the following:

1. The collection of material at the transducer location(s).

   Accumulated debris at the transducer location(s) will interfere with transmission of the ultrasound signals. As a result, accurate flow rate measurements are not possible. Realignment of the flowcell or transducers often cures such problems, and in some cases, transducers that protrude into the flow stream may be used. Refer to Chapter 2, Installation, for more details on proper installation practices.

2. *Inaccurate pipe measurements.*

   The accuracy of the flow rate measurements is no better than the accuracy of the programmed pipe dimensions. For a flowcell supplied by GE, the correct data will be included in the documentation. For other flowcells, measure the pipe wall thickness and diameter with the same accuracy desired in the flow rate

readings. Also, check the pipe for dents, eccentricity, weld deformity, straightness and other factors that may cause inaccurate readings. Refer to Chapter 3, Initial Setup, for instructions on programming the pipe data.

In addition to the actual pipe dimensions, the path length (P) and the axial dimension (L), based on the actual transducer mounting locations, must be accurately programmed into the flow meter. For a GE Sensing flowcell, this data will be included with the documentation for the system. If the transducers are mounted onto an existing pipe, these dimensions must be precisely measured.

3. *The inside of the pipe or flowcell must be relatively clean.*

   Excessive buildup of scale, rust or debris will interfere with flow measurement. Generally, a thin coating or a solid well-adhered build up on the pipe wall will not cause problems. Loose scale and thick coatings (such as tar or oil) will interfere with ultrasound transmission and may result in incorrect or unreliable measurements.

4.2.3 Transducer Problems

Ultrasonic transducers are rugged, reliable devices. However, they are subject to physical damage from mishandling and chemical attack. The following list of potential problems is grouped according to transducer type. Contact GE if you cannot solve a transducer-related problem.

4.2.4 Bluetooth Connection Problems

The communication between transmitter and tablet is based on Bluetooth, which is a wireless protocol. So if the distance between the transmitter and tablet is too big or they are blocked by some solid thing, such as a big wall, the communication will be bad. In this case, some false negatives would occur. Please move your body to near the transmitter first.

CHAPTER 5. COMMUNICATION

5.1 MODBUS

5.1.1 Introduce

In general, the PT900 flow meter follows the standard Modbus communications protocol defined by the reference MODBUS APPLICATION PROTOCOL SPECIFICATION V1.1b. This specification is available at www.modbus.org on the Internet. With this reference as a guide, an operator could use any Modbus master to communicate with the flow meter.

Listed below are two limits of this implementation:

1. The PT900 supports only four of the standard function codes. These are Read Holding Registers (0x03), Read Input Registers (0x04), Write Multiple Registers (0x10), and Read File Record (0x14).

2. The flow meter needs a 15 ms gap between Modbus requests. The prime objective of the flow meter is to measure flow and drive the output, so the Modbus server has a low priority.

5.1.2 MODBUS Map

	Register (in Hex)	Register (in Decimal)	Access Level	Description	RO/RW	Format
100	100	256	User	Product Short Tag	RW	CHAR * 16
	108	264	User	Product Long Tag	RW	CHAR * 32
	118	280	User	eAI1Label	RW	CHAR * 16
	120	288	User	eAI2Label	RW	CHAR * 16
	128	296	User	eLogName	RW	CHAR * 16
	130	304	User	Product Electronical serial number	RW	CHAR * 16
	138	312	User	Product fixture serial number	RW	CHAR * 16
	140	320	User	Product transducer1 serial number	RW	CHAR * 16
	148	328	User	Product transducer2 serial number	RW	CHAR * 16
	150	336	User	Product transducer3 serial number	RW	CHAR * 16
	158	344	User	Product transducer4 serial number	RW	CHAR * 16
	160	352	User	eUserFunc1Lable	RW	CHAR * 8
	164	356	User	eUserFunc2Lable	RW	CHAR * 8
	168	360	User	eUserFunc3Lable	RW	CHAR * 8
	16C	364	User	eUserFunc4Lable	RW	CHAR * 8
	170	368	User	eUserFunc5Lable	RW	CHAR * 8
	174	372	User	eUserFunc1Unit	RW	CHAR * 8
	178	376	User	eUserFunc2Unit	RW	CHAR * 8
	17C	380	User	eUserFunc3Unit	RW	CHAR * 8
	180	384	User	eUserFunc4Unit	RW	CHAR * 8
	184	388	User	eUserFunc5Unit	RW	CHAR * 8
	188	392	User	eTabALable	RW	CHAR * 8
	18C	396	User	eTabBLable	RW	CHAR * 8

	190	400	User	eTabCLable	RW	CHAR * 8
	194	404	User	eTabDLable	RW	CHAR * 8
	198	408	User	eUserFunc1	RW	CHAR * 32
	1A8	424	User	eUserFunc2	RW	CHAR * 32
	1B8	440	User	eUserFunc3	RW	CHAR * 32
	1C8	456	User	eUserFunc4	RW	CHAR * 32
	1D8	472	User	eUserFunc5	RW	CHAR * 32
	1E8	488	User	eCharRESV1	RW	CHAR * 8
	1EC	492	User	eCharRESV2	RW	CHAR * 8
	1F0	496	User	eCharRESV3	RW	CHAR * 8
	1F4	500	User	eCharRESV4	RW	CHAR * 8
300	300	768	RO	Main Hardware version	RO	CHAR * 8
	304	772	RO	Option Hardware version	RO	CHAR * 8
	308	776	RO	Main Software version	RO	CHAR * 8
500	500	1280	User	Global Unit group 1 for Actual Volumetric	RW	INT32
	502	1282	User	Global Unit group 2 for Day	RW	INT32
	504	1284	User	Global Unit group 3 for dB	RW	INT32
	506	1286	User	Global Unit group 4 for Density	RW	INT32
	508	1288	User	Global Unit group 5 for Diamention	RW	INT32
	50A	1290	User	Global Unit group 6 for Hz	RW	INT32
	50C	1292	User	Global Unit group 7 for Viscosity	RW	INT32
	50E	1294	User	Global Unit group 8 for mA	RW	INT32
	510	1296	User	Global Unit group 9 for Mass	RW	INT32
	512	1298	User	Global Unit group 10 for Milli Second	RW	INT32
	514	1300	User	Global Unit group 11 for Nano Second	RW	INT32
	516	1302	User	Global Unit group 12 for Percent	RW	INT32
	518	1304	User	Global Unit group 13 for Second	RW	INT32
	51A	1306	User	Global Unit group 14 for Standard Volumetric	RW	INT32
	51C	1308	User	Global Unit group 15 for Therm	RW	INT32
	51E	1310	User	Global Unit group 16 for Totalizer time	RW	INT32
	520	1312	User	Global Unit group 17 for Totalizer	RW	INT32
	522	1314	User	Global Unit group 18 for Unitless	RW	INT32
	524	1316	User	Global Unit group 19 for Micro Second	RW	INT32
	526	1318	User	Global Unit group 20 for Velocity	RW	INT32
	528	1320	User	Global Unit group 21 for Accelaration	RW	INT32
	52A	1322	User	Global Unit group 22 for Energy	RW	INT32
	52C	1324	User	Global Unit group 22 for Energy	RW	INT32
	52E	1326	User	Global Unit for reserve 1	RW	INT32
	530	1328	User	Global Unit for reserve 2	RW	INT32
540	540	1344	Viewer	Batch request command	RW	INT32
	542	1346	User	inventory request command	RW	INT32
	544	1348	Viewer	system request password	RW	INT32
	546	1350	Viewer	system request command	RW	INT32
	548	1352	Viewer	system update command	RW	INT32
700	700	1792	RO	System Reported error	RO	INT32
	702	1794	RO	System Error Bitmap	RO	INT32
	704	1796	RO	System Startup error Bitmap	RO	INT32
	706	1798	RO	System Flow Ch1 error Bitmap	RO	INT32

	708	1800	RO	System Flow Ch2 error Bitmap	RO	INT32
	70A	1802	RO	System Device error Bitmap	RO	INT32
	70C	1804	RO	System Warning Bitmap	RO	INT32
720	720	1824	RO	System Power Status	RO	INT32
	722	1826	RO	battery status: charging, discharging	RO	INT32
	724	1828	RO	remaining battery capacity (%)	RO	INT32
	726	1830	RO	remaining battery life (minutes).	RO	INT32
	728	1832	RO	remaining time until Battery reaches full charge	RO	INT32
	72A	1834	RO	the cell-pack's internal temperature (°C)	RO	INT32
	72C	1836	RO	the cell-pack voltage (mV)	RO	INT32
	72E	1838	RO	the current being supplied	RO	INT32
	730	1840	RO	eSystemRESV1	RO	INT32
	732	1842	RO	eSystemRESV1	RO	INT32
	734	1844	RO	eSystemRESV1	RO	INT32
C00	C00	3072	User	Analog Out Error Handling Value	RW	(IEEE 32 bit)
	C02	3074	User	Analog Out Test Value (Percent of Span)	RW	(IEEE 32 bit)
	C04	3076	User	Analog Out Zero Value	RW	(IEEE 32 bit)
	C06	3078	User	Analog Out Span Value	RW	(IEEE 32 bit)
	C08	3080	User	Analog Out Base Value	RW	(IEEE 32 bit)
	C0A	3082	User	Analog Out Full Value	RW	(IEEE 32 bit)
C40	C40	3136	User	Digital Out 1 Pulse Value	RW	(IEEE 32 bit)
	C42	3138	User	Digital Out 1 Frequency Base Value	RW	(IEEE 32 bit)
	C44	3140	User	Digital Out 1 Frequency Full Value	RW	(IEEE 32 bit)
	C46	3142	User	Digital Out 1 Alarm Value	RW	(IEEE 32 bit)
D00	D00	3328	User	Analog Out Mode	RW	INT32
	D02	3330	User	Analog Out Type	RW	INT32
	D04	3332	User	Digital Out 1 Mode	RW	INT32
	D06	3334	User	Digital Out 1 Type	RW	INT32
D20	D20	3360	User	Analog Out Measurement Type	RW	INT32
	D22	3362	User	Analog Out Error Handling	RW	INT32
D40	D40	3392	User	Digital Out 1 Pulse Measurement Type	RW	INT32
	D42	3394	User	Digital Out 1 Pulse Test Value	RW	INT32
	D44	3396	User	Digital Out 1 Pulse Error Handling	RW	INT32
	D46	3398	User	Digital Out 1 Pulse Time	RW	INT32
D60	D60	3424	User	Digital Out 1 Frequency Measurement Type	RW	INT32
	D62	3426	User	Digital Out 1 Test Frequency Value	RW	INT32
	D64	3428	User	Digital Out 1 Frequency Error Handling	RW	INT32
	D66	3430	User	Digital Out 1 Frequency Error Handling Value	RW	INT32
	D68	3432	User	Digital Out 1 Frequency Full Frequency	RW	INT32
D80	D80	3456	User	Digital Out 1 Alarm Measurement Type	RW	INT32
	D82	3458	User	Digital Out 1 Alarm Test Value	RW	INT32
	D84	3460	User	Digital Out 1 Alarm State	RW	INT32
	D86	3462	User	Digital Out 1 Alarm Type	RW	INT32
E00	E00	3584	RO	Analog Out Measurement Value	RO	(IEEE 32 bit)
	E02	3586	RO	Digital Out 1 Pulse Measurement Value	RO	(IEEE 32 bit)
	E04	3588	RO	Digital Out 1 Frequency Measurement Value	RO	(IEEE 32 bit)
	E06	3590	RO	Digital Out 1 Alarm Measurement Value	RO	(IEEE 32 bit)
1000	1000	4096	User	eTabAX1	RW	(IEEE 32 bit)

	1002	4098	User	eTabAX2	RW	(IEEE 32 bit)
	1004	4100	User	eTabAX3	RW	(IEEE 32 bit)
	1006	4102	User	eTabAX4	RW	(IEEE 32 bit)
	1008	4104	User	eTabAX5	RW	(IEEE 32 bit)
	100A	4106	User	eTabAX6	RW	(IEEE 32 bit)
	100C	4108	User	eTabAX7	RW	(IEEE 32 bit)
	100E	4110	User	eTabAX8	RW	(IEEE 32 bit)
	1010	4112	User	eTabAX9	RW	(IEEE 32 bit)
	1012	4114	User	eTabAX10	RW	(IEEE 32 bit)
1020	1020	4128	User	eTabAY1	RW	(IEEE 32 bit)
	1022	4130	User	eTabAY2	RW	(IEEE 32 bit)
	1024	4132	User	eTabAY3	RW	(IEEE 32 bit)
	1026	4134	User	eTabAY4	RW	(IEEE 32 bit)
	1028	4136	User	eTabAY5	RW	(IEEE 32 bit)
	102A	4138	User	eTabAY6	RW	(IEEE 32 bit)
	102C	4140	User	eTabAY7	RW	(IEEE 32 bit)
	102E	4142	User	eTabAY8	RW	(IEEE 32 bit)
	1030	4144	User	eTabAY9	RW	(IEEE 32 bit)
	1032	4146	User	eTabAY10	RW	(IEEE 32 bit)
1040	1040	4160	User	eTabBX1	RW	(IEEE 32 bit)
	1042	4162	User	eTabBX2	RW	(IEEE 32 bit)
	1044	4164	User	eTabBX3	RW	(IEEE 32 bit)
	1046	4166	User	eTabBX4	RW	(IEEE 32 bit)
	1048	4168	User	eTabBX5	RW	(IEEE 32 bit)
	104A	4170	User	eTabBX6	RW	(IEEE 32 bit)
	104C	4172	User	eTabBX7	RW	(IEEE 32 bit)
	104E	4174	User	eTabBX8	RW	(IEEE 32 bit)
	1050	4176	User	eTabBX9	RW	(IEEE 32 bit)
	1052	4178	User	eTabBX10	RW	(IEEE 32 bit)
1060	1060	4192	User	eTabBY1	RW	(IEEE 32 bit)
	1062	4194	User	eTabBY2	RW	(IEEE 32 bit)
	1064	4196	User	eTabBY3	RW	(IEEE 32 bit)
	1066	4198	User	eTabBY4	RW	(IEEE 32 bit)
	1068	4200	User	eTabBY5	RW	(IEEE 32 bit)
	106A	4202	User	eTabBY6	RW	(IEEE 32 bit)
	106C	4204	User	eTabBY7	RW	(IEEE 32 bit)
	106E	4206	User	eTabBY8	RW	(IEEE 32 bit)
	1070	4208	User	eTabBY9	RW	(IEEE 32 bit)
	1072	4210	User	eTabBY10	RW	(IEEE 32 bit)
1080	1080	4224	User	eTabCX1	RW	(IEEE 32 bit)
	1082	4226	User	eTabCX2	RW	(IEEE 32 bit)
	1084	4228	User	eTabCX3	RW	(IEEE 32 bit)
	1086	4230	User	eTabCX4	RW	(IEEE 32 bit)
	1088	4232	User	eTabCX5	RW	(IEEE 32 bit)
	108A	4234	User	eTabCX6	RW	(IEEE 32 bit)
	108C	4236	User	eTabCX7	RW	(IEEE 32 bit)
	108E	4238	User	eTabCX8	RW	(IEEE 32 bit)
	1090	4240	User	eTabCX9	RW	(IEEE 32 bit)

	1092	4242	User	eTabCX10	RW	(IEEE 32 bit)
10A0	10A0	4256	User	eTabCY1	RW	(IEEE 32 bit)
	10A2	4258	User	eTabCY2	RW	(IEEE 32 bit)
	10A4	4260	User	eTabCY3	RW	(IEEE 32 bit)
	10A6	4262	User	eTabCY4	RW	(IEEE 32 bit)
	10A8	4264	User	eTabCY5	RW	(IEEE 32 bit)
	10AA	4266	User	eTabCY6	RW	(IEEE 32 bit)
	10AC	4268	User	eTabCY7	RW	(IEEE 32 bit)
	10AE	4270	User	eTabCY8	RW	(IEEE 32 bit)
	10B0	4272	User	eTabCY9	RW	(IEEE 32 bit)
	10B2	4274	User	eTabCY10	RW	(IEEE 32 bit)
10C0	10C0	4288	User	eTabDX1	RW	(IEEE 32 bit)
	10C2	4290	User	eTabDX2	RW	(IEEE 32 bit)
	10C4	4292	User	eTabDX3	RW	(IEEE 32 bit)
	10C6	4294	User	eTabDX4	RW	(IEEE 32 bit)
	10C8	4296	User	eTabDX5	RW	(IEEE 32 bit)
	10CA	4298	User	eTabDX6	RW	(IEEE 32 bit)
	10CC	4300	User	eTabDX7	RW	(IEEE 32 bit)
	10CE	4302	User	eTabDX8	RW	(IEEE 32 bit)
	10D0	4304	User	eTabDX9	RW	(IEEE 32 bit)
	10D2	4306	User	eTabDX10	RW	(IEEE 32 bit)
10E0	10E0	4320	User	eTabDY1	RW	(IEEE 32 bit)
	10E2	4322	User	eTabDY2	RW	(IEEE 32 bit)
	10E4	4324	User	eTabDY3	RW	(IEEE 32 bit)
	10E6	4326	User	eTabDY4	RW	(IEEE 32 bit)
	10E8	4328	User	eTabDY5	RW	(IEEE 32 bit)
	10EA	4330	User	eTabDY6	RW	(IEEE 32 bit)
	10EC	4332	User	eTabDY7	RW	(IEEE 32 bit)
	10EE	4334	User	eTabDY8	RW	(IEEE 32 bit)
	10F0	4336	User	eTabDY9	RW	(IEEE 32 bit)
	10F2	4338	User	eTabDY10	RW	(IEEE 32 bit)
1100	1100	4352	User	eUserFunc1Decimal	RW	INT32
	1102	4354	User	eUserFunc2Decimal	RW	INT32
	1104	4356	User	eUserFunc3Decimal	RW	INT32
	1106	4358	User	eUserFunc4Decimal	RW	INT32
	1108	4360	User	eUserFunc5Decimal	RW	INT32
	110A	4362	User	eTabAPoint	RW	INT32
	110C	4364	User	eTabBPoint	RW	INT32
	110E	4366	User	eTabCPoint	RW	INT32
	1110	4368	User	eTabDPoint	RW	INT32
	1112	4370	User	eCurrUserFunc	RW	INT32
	1114	4372	User	eCurrTable	RW	INT32
	1116	4374	User	eUserFuncValid	RW	INT32
1200	1200	4608	RO	eUserFunc1	RO	(IEEE 32 bit)
	1202	4610	RO	eUserFunc2	RO	(IEEE 32 bit)
	1204	4612	RO	eUserFunc3	RO	(IEEE 32 bit)
	1206	4614	RO	eUserFunc4	RO	(IEEE 32 bit)
	1208	4616	RO	eUserFunc5	RO	(IEEE 32 bit)

1300	1300	4864	RO	eUserFuncValid	RO	INT32
1500	1500	5376	User	PC MODBUS baud rate	RW	INT32
	1502	5378	User	PC MODBUS parity	RW	INT32
	1504	5380	User	PC MODBUS stop bits	RW	INT32
	1506	5382	User	PC MODBUS meter addr	RW	INT32
1540	1540	5440	Viewer	Log control / status	RW	INT32
	1542	5442	Viewer	Log interval	RW	INT32
	1544	5444	Viewer	Logging time	RW	INT32
	1546	5446	Viewer	Number of variables to log	RW	INT32
	1548	5448	Viewer	eLogChannel	RW	INT32
	154A	5450	Viewer	eLogFormat	RW	INT32
	154C	5452	Viewer	eLogStartDate	RW	INT32
	154E	5454	Viewer	eLogEndtDate	RW	INT32
	1550	5456	Viewer	eLogStartTime	RW	INT32
	1552	5458	Viewer	eLogEndtTime	RW	INT32
1580	1580	5504	Viewer	variable address array	RW	INT32
15C0	15C0	5568	Viewer	Variable unit code array	RW	INT32
1740	1740	5952	RO	Number of records	RO	INT32
2000	2000	8192	User	channel 1 composite factor	RW	(IEEE 32 bit)
	2002	8194	User	channel 2 composite factor	RW	(IEEE 32 bit)
20C0	20C0	8384	User	Correlation peak low limit	RW	(IEEE 32 bit)
	20C2	8386	User	Acceleration Limit	RW	(IEEE 32 bit)
	20C4	8388	User	Velocity Low limit - Used for Volumetric low limit	RW	(IEEE 32 bit)
	20C6		User	Velocity High limit - Used for Volumetric High limit	RW	(IEEE 32 bit)
	20C8	8392	User	Amplitude discriminator min limit	RW	(IEEE 32 bit)
	20CA	8394	User	Amplitude discriminator max limit	RW	(IEEE 32 bit)
	20CC	8396	User	Soundspeed Plus minus limit	RW	(IEEE 32 bit)
	20CE	8398	User	signal low limit	RW	(IEEE 32 bit)
	20D0	8400	User	ePcr	RW	(IEEE 32 bit)
	20D2	8402	User	eSOSVariationRate	RW	(IEEE 32 bit)
	20D4	8404	Viewer	ePercentGain	RW	(IEEE 32 bit)
	20D6	8406	User	the maximum threshold	RW	(IEEE 32 bit)
	20D8	8408	User	the minimum threshold	RW	(IEEE 32 bit)
20E0	20E0	8416	User	Zero Cutoff	RW	(IEEE 32 bit)
	20E2	8418	User	DeltaT Offset	RW	(IEEE 32 bit)
	20E4	8420	User	the inputted threshold under manual mode	RW	(IEEE 32 bit)
2100	2100	8448	User	Enable Ch1	RW	INT32
	2102	8450	User	Enable Ch2	RW	INT32
	2104	8452	Viewer	eImpulseResponse	RW	INT32
	2106	8454	Viewer	eImpulseRespCmd	RW	INT32
	2108	8456	User	define how to find the peak of the correlation signal	RW	INT32
	210A	8458	User	define how to search the threshold	RW	INT32
21C0	21C0	8640	User	Response Time	RW	INT32
	21C2	8642	User	Response	RW	INT32
	21C4	8644	User	Response	RW	INT32
2200	2200	8704	RO	Velocity	RO	(IEEE 32 bit)
	2202	8706	RO	Volumetric	RO	(IEEE 32 bit)
	2204	8708	RO	Standard Volumetric	RO	(IEEE 32 bit)

	2206	8710	RO	Mass Flow	RO	(IEEE 32 bit)
	2208	8712	RO	TransitTime	RO	(IEEE 32 bit)
2240	2240	8768	RO	Batch fwd totals	RO	(IEEE 32 bit)
	2242	8770	RO	Batch rev totals	RO	(IEEE 32 bit)
	2244	8772	RO	Batch net totals	RO	(IEEE 32 bit)
	2246	8774	RO	Batch totals time	RO	(IEEE 32 bit)
	2248	8776	RO	inventory fwd totals	RO	(IEEE 32 bit)
	224A	8778	RO	inventory rev totals	RO	(IEEE 32 bit)
	224C	8780	RO	inventory net totals	RO	(IEEE 32 bit)
	224E	8782	RO	inventory totals time	RO	(IEEE 32 bit)
2400	2400	9216	User	Pipe Inner Diameter	RW	(IEEE 32 bit)
	2402	9218	User	Pipe Outer Diameter	RW	(IEEE 32 bit)
	2404	9220	User	Pipe Wall Thickness	RW	(IEEE 32 bit)
	2406	9222	User	Pipe Soundspeed	RW	(IEEE 32 bit)
	2408	9224	User	Lining Thickness	RW	(IEEE 32 bit)
	240A	9226	User	Lining Soundspeed	RW	(IEEE 32 bit)
	240C	9228	User	XDR wedge angle	RW	(IEEE 32 bit)
	240E	9230	User	XDR wedge time	RW	(IEEE 32 bit)
	2410	9232	User	Wedge Sound speed	RW	(IEEE 32 bit)
	2412	9234	User	Fluid Sound speed	RW	(IEEE 32 bit)
	2414	9236	User	Fluid Sound speed Min	RW	(IEEE 32 bit)
	2416	9238	User	Fluid Sound speed Max	RW	(IEEE 32 bit)
	2418	9240	User	Fluid Static Density	RW	(IEEE 32 bit)
	241A	9242	User	Fluid Reference Density	RW	(IEEE 32 bit)
	241C	9244	User	Fluid Temperature	RW	(IEEE 32 bit)
	241E	9246	User	XDR space	RW	(IEEE 32 bit)
	2420	9248	User	Calibration Factor	RW	(IEEE 32 bit)
	2422	9250	User	Kinematic Viscosity	RW	(IEEE 32 bit)
	2424	9252	User	XDR Temperature	RW	(IEEE 32 bit)
	2426	9254	User	eCh1Goycol	RW	(IEEE 32 bit)
2440	2440	9280	User	MultiK Velocity 1	RW	(IEEE 32 bit)
	2442	9282	User	MultiK Velocity 2	RW	(IEEE 32 bit)
	2444	9284	User	MultiK Velocity 3	RW	(IEEE 32 bit)
	2446	9286	User	MultiK Velocity 4	RW	(IEEE 32 bit)
	2448	9288	User	MultiK Velocity 5	RW	(IEEE 32 bit)
	244A	9290	User	MultiK Velocity 6	RW	(IEEE 32 bit)
2460	2460	9312	User	MultiK Velocity KFactor1	RW	(IEEE 32 bit)
	2462	9314	User	MultiK Velocity KFactor2	RW	(IEEE 32 bit)
	2464	9316	User	MultiK Velocity KFactor3	RW	(IEEE 32 bit)
	2466	9318	User	MultiK Velocity KFactor4	RW	(IEEE 32 bit)
	2468	9320	User	MultiK Velocity KFactor5	RW	(IEEE 32 bit)
	246A	9322	User	MultiK Velocity KFactor6	RW	(IEEE 32 bit)
2480	2480	9344	User	MultiK Reynolds 1	RW	(IEEE 32 bit)
	2482	9346	User	MultiK Reynolds 2	RW	(IEEE 32 bit)
	2484	9348	User	MultiK Reynolds 3	RW	(IEEE 32 bit)
	2486	9350	User	MultiK Reynolds 4	RW	(IEEE 32 bit)
	2488	9352	User	MultiK Reynolds 5	RW	(IEEE 32 bit)
	248A	9354	User	MultiK Reynolds 6	RW	(IEEE 32 bit)

24A0	24A0	9376	User	MultiK Reynolds KFactor1	RW	(IEEE 32 bit)
	24A2	9378	User	MultiK Reynolds KFactor2	RW	(IEEE 32 bit)
	24A4	9380	User	MultiK Reynolds KFactor3	RW	(IEEE 32 bit)
	24A6	9382	User	MultiK Reynolds KFactor4	RW	(IEEE 32 bit)
	24A8	9384	User	MultiK Reynolds KFactor5	RW	(IEEE 32 bit)
	24AA	9386	User	MultiK Reynolds KFactor6	RW	(IEEE 32 bit)
24C0	24C0	9408	User	eCh1DensityX1	RW	(IEEE 32 bit)
	24C2	9410	User	eCh1DensityX2	RW	(IEEE 32 bit)
	24C4	9412	User	eCh1DensityX3	RW	(IEEE 32 bit)
	24C6	9414	User	eCh1DensityX4	RW	(IEEE 32 bit)
	24C8	9416	User	eCh1DensityX5	RW	(IEEE 32 bit)
	24CA	9418	User	eCh1DensityX6	RW	(IEEE 32 bit)
	24CC	9420	User	eCh1DensityX7	RW	(IEEE 32 bit)
	24CE	9422	User	eCh1DensityX8	RW	(IEEE 32 bit)
	24D0	9424	User	eCh1DensityX9	RW	(IEEE 32 bit)
	24D2	9426	User	eCh1DensityX10	RW	(IEEE 32 bit)
24E0	24E0	9440	User	eCh1DensityFactor1	RW	(IEEE 32 bit)
	24E2	9442	User	eCh1DensityFactor2	RW	(IEEE 32 bit)
	24E4	9444	User	eCh1DensityFactor3	RW	(IEEE 32 bit)
	24E6	9446	User	eCh1DensityFactor4	RW	(IEEE 32 bit)
	24E8	9448	User	eCh1DensityFactor5	RW	(IEEE 32 bit)
	24EA	9450	User	eCh1DensityFactor6	RW	(IEEE 32 bit)
	24EC	9452	User	eCh1DensityFactor7	RW	(IEEE 32 bit)
	24EE	9454	User	eCh1DensityFactor8	RW	(IEEE 32 bit)
	24F0	9456	User	eCh1DensityFactor9	RW	(IEEE 32 bit)
	24F2	9458	User	eCh1DensityFactor10	RW	(IEEE 32 bit)
2500	2500	9472	User	Pipe Material	RW	INT32
	2502	9474	User	Lining Material	RW	INT32
	2504	9476	User	XDR Type	RW	INT32
	2506	9478	User	XDR frequency	RW	INT32
	2508	9480	User	XDR wedge type	RW	INT32
	250A	9482	User	Fluid Type	RW	INT32
	250C	9484	User	Lining existence	RW	INT32
	250E	9486	User	Traverse number	RW	INT32
	2510	9488	User	Couplant type	RW	INT32
2540	2540	9536	User	Enable Reynolds Correction	RW	INT32
	2542	9538	User	Enable Active MultiK	RW	INT32
	2544	9540	User	MultiK Type	RW	INT32
	2546	9542	User	MultiK Pairs	RW	INT32
	2548	9544	User	eCh1Density	RW	INT32
	254A	9546	User	eCh1DensityPairs	RW	INT32
2580	2580	9600	User	Peak%	RW	INT32
	2582	9602	User	Min Peak%	RW	INT32
	2584	9604	User	Max Peak%	RW	INT32
	2586	9606	User	Enable Tracking Windows	RW	INT32
2600	2600	9728	RO	Velocity	RO	(IEEE 32 bit)
	2602	9730	RO	Volumetric	RO	(IEEE 32 bit)
	2604	9732	RO	Standard Volumetric	RO	(IEEE 32 bit)

	2606	9734	RO	Mass Flow	RO	(IEEE 32 bit)
2640	2640	9792	RO	Batch fwd totals	RO	(IEEE 32 bit)
	2642	9794	RO	Batch rev totals	RO	(IEEE 32 bit)
	2644	9796	RO	Batch net totals	RO	(IEEE 32 bit)
	2646	9798	RO	Batch totals time	RO	(IEEE 32 bit)
	2648	9800	RO	inventory fwd totals	RO	(IEEE 32 bit)
	264A	9802	RO	inventory rev totals	RO	(IEEE 32 bit)
	264C	9804	RO	inventory net totals	RO	(IEEE 32 bit)
	264E	9806	RO	inventory totals time	RO	(IEEE 32 bit)
2680	2680	9856	RO	Transit Time Up	RO	(IEEE 32 bit)
	2682	9858	RO	Transit Time Dn	RO	(IEEE 32 bit)
	2684	9860	RO	DeltaT	RO	(IEEE 32 bit)
	2686	9862	RO	Up Signal Quality	RO	(IEEE 32 bit)
	2688	9864	RO	Dn Signal Quality	RO	(IEEE 32 bit)
	268A	9866	RO	Up Amp Disc	RO	(IEEE 32 bit)
	268C	9868	RO	Dn Amp Disc	RO	(IEEE 32 bit)
	268E	9870	RO	SNR on UP channel	RO	(IEEE 32 bit)
	2690	9872	RO	SNR on DOWN channel	RO	(IEEE 32 bit)
	2692	9874	RO	Time in buffer on Up channel	RO	(IEEE 32 bit)
	2694	9876	RO	Time in buffer on Dn channel	RO	(IEEE 32 bit)
	2696	9878	RO	Signal Gain Up	RO	(IEEE 32 bit)
	2698	9880	RO	Signal Gain Down	RO	(IEEE 32 bit)
	269A	9882	RO	Partial Corrolatoin Ratio Up	RO	(IEEE 32 bit)
	269C	9884	RO	Partial Corrolatoin Ratio Dn	RO	(IEEE 32 bit)
26C0	26C0	9920	RO	Sound Speed	RO	(IEEE 32 bit)
	26C2	9922	RO	Current Reynolds Number	RO	(IEEE 32 bit)
	26C4	9924	RO	Current Correction Factor	RO	(IEEE 32 bit)
	26C6	9926	RO	Path Length P	RO	(IEEE 32 bit)
	26C8	9928	RO	Axial Length L	RO	(IEEE 32 bit)
2700	2700	9984	RO	Up +- Peak	RO	INT32
	2702	9986	RO	Dn +- Peak	RO	INT32
	2704	9988	RO	dynamic threshold on UP channel	RO	INT32
	2706	9990	RO	dynamic threshold on DOWN channel	RO	INT32
2800	2800	10240	User	Pipe Inner Diameter	RW	(IEEE 32 bit)
	2802	10242	User	Pipe Outer Diameter	RW	(IEEE 32 bit)
	2804	10244	User	Pipe Wall Thickness	RW	(IEEE 32 bit)
	2806	10246	User	Pipe Soundspeed	RW	(IEEE 32 bit)
	2808	10248	User	Lining Thickness	RW	(IEEE 32 bit)
	280A	10250	User	Lining Soundspeed	RW	(IEEE 32 bit)
	280C	10252	User	XDR wedge angle	RW	(IEEE 32 bit)
	280E	10254	User	XDR wedge time	RW	(IEEE 32 bit)
	2810	10256	User	Wedge Sound speed	RW	(IEEE 32 bit)
	2812	10258	User	Fluid Sound speed	RW	(IEEE 32 bit)
	2814	10260	User	Fluid Sound speed Min	RW	(IEEE 32 bit)
	2816	10262	User	Fluid Sound speed Max	RW	(IEEE 32 bit)
	2818	10264	User	Fluid Static Density	RW	(IEEE 32 bit)
	281A	10266	User	Fluid Reference Density	RW	(IEEE 32 bit)
	281C	10268	User	Fluid Temperature	RW	(IEEE 32 bit)

	281E	10270	User	XDR space	RW	(IEEE 32 bit)
	2820	10272	User	Calibration Factor	RW	(IEEE 32 bit)
	2822	10274	User	Kinematic Viscosity	RW	(IEEE 32 bit)
	2824	10276	User	XDR Temperature	RW	(IEEE 32 bit)
	2826	10278	User	eCh2Goycol	RW	(IEEE 32 bit)
2840	2840	10304	User	MultiK Velocity 1	RW	(IEEE 32 bit)
	2842	10306	User	MultiK Velocity 2	RW	(IEEE 32 bit)
	2844	10308	User	MultiK Velocity 3	RW	(IEEE 32 bit)
	2846	10310	User	MultiK Velocity 4	RW	(IEEE 32 bit)
	2848	10312	User	MultiK Velocity 5	RW	(IEEE 32 bit)
	284A	10314	User	MultiK Velocity 6	RW	(IEEE 32 bit)
2860	2860	10336	User	MultiK Velocity KFactor1	RW	(IEEE 32 bit)
	2862	10338	User	MultiK Velocity KFactor2	RW	(IEEE 32 bit)
	2864	10340	User	MultiK Velocity KFactor3	RW	(IEEE 32 bit)
	2866	10342	User	MultiK Velocity KFactor4	RW	(IEEE 32 bit)
	2868	10344	User	MultiK Velocity KFactor5	RW	(IEEE 32 bit)
	286A	10346	User	MultiK Velocity KFactor6	RW	(IEEE 32 bit)
2880	2880	10368	User	MultiK Reynolds 1	RW	(IEEE 32 bit)
	2882	10370	User	MultiK Reynolds 2	RW	(IEEE 32 bit)
	2884	10372	User	MultiK Reynolds 3	RW	(IEEE 32 bit)
	2886	10374	User	MultiK Reynolds 4	RW	(IEEE 32 bit)
	2888	10376	User	MultiK Reynolds 5	RW	(IEEE 32 bit)
	288A	10378	User	MultiK Reynolds 6	RW	(IEEE 32 bit)
28A0	28A0	10400	User	MultiK Reynolds KFactor1	RW	(IEEE 32 bit)
	28A2	10402	User	MultiK Reynolds KFactor2	RW	(IEEE 32 bit)
	28A4	10404	User	MultiK Reynolds KFactor3	RW	(IEEE 32 bit)
	28A6	10406	User	MultiK Reynolds KFactor4	RW	(IEEE 32 bit)
	28A8	10408	User	MultiK Reynolds KFactor5	RW	(IEEE 32 bit)
	28AA	10410	User	MultiK Reynolds KFactor6	RW	(IEEE 32 bit)
28C0	28C0	10432	User	eCh2DensityX1	RW	(IEEE 32 bit)
	28C2	10434	User	eCh2DensityX2	RW	(IEEE 32 bit)
	28C4	10436	User	eCh2DensityX3	RW	(IEEE 32 bit)
	28C6	10438	User	eCh2DensityX4	RW	(IEEE 32 bit)
	28C8	10440	User	eCh2DensityX5	RW	(IEEE 32 bit)
	28CA	10442	User	eCh2DensityX6	RW	(IEEE 32 bit)
	28CC	10444	User	eCh2DensityX7	RW	(IEEE 32 bit)
	28CE	10446	User	eCh2DensityX8	RW	(IEEE 32 bit)
	28D0	10448	User	eCh2DensityX9	RW	(IEEE 32 bit)
	28D2	10450	User	eCh2DensityX10	RW	(IEEE 32 bit)
28E0	28E0	10464	User	eCh2DensityFactor1	RW	(IEEE 32 bit)
	28E2	10466	User	eCh2DensityFactor2	RW	(IEEE 32 bit)
	28E4	10468	User	eCh2DensityFactor3	RW	(IEEE 32 bit)
	28E6	10470	User	eCh2DensityFactor4	RW	(IEEE 32 bit)
	28E8	10472	User	eCh2DensityFactor5	RW	(IEEE 32 bit)
	28EA	10474	User	eCh2DensityFactor6	RW	(IEEE 32 bit)
	28EC	10476	User	eCh2DensityFactor7	RW	(IEEE 32 bit)
	28EE	10478	User	eCh2DensityFactor8	RW	(IEEE 32 bit)
	28F0	10480	User	eCh2DensityFactor9	RW	(IEEE 32 bit)

	28F2	10482	User	eCh2DensityFactor10	RW	(IEEE 32 bit)
2900	2900	10496	User	Pipe Material	RW	INT32
	2902	10498	User	Lining Material	RW	INT32
	2904	10500	User	XDR Type	RW	INT32
	2906	10502	User	XDR frequency	RW	INT32
	2908	10504	User	XDR wedge type	RW	INT32
	290A	10506	User	Fluid Type	RW	INT32
	290C	10508	User	Lining existence	RW	INT32
	290E	10510	User	Traverse number	RW	INT32
	2910	10512	User	Couplant type	RW	INT32
2940	2940	10560	User	Enable Reynolds Correction	RW	INT32
	2942	10562	User	Enable Active MultiK	RW	INT32
	2944	10564	User	MultiK Type	RW	INT32
	2946	10566	User	MultiK Pairs	RW	INT32
	2948	10568	User	eCh2Density	RW	INT32
	294A	10570	User	eCh2DensityPairs	RW	INT32
2980	2980	10624	User	Peak%	RW	INT32
	2982	10626	User	Min Peak%	RW	INT32
	2984	10628	User	Max Peak%	RW	INT32
	2986	10630	User	Enable Tracking Windows	RW	INT32
2A00	2A00	10752	RO	Velocity	RO	(IEEE 32 bit)
	2A02	10754	RO	Volumetric	RO	(IEEE 32 bit)
	2A04	10756	RO	Standard Volumetric	RO	(IEEE 32 bit)
	2A06	10758	RO	Mass Flow	RO	(IEEE 32 bit)
2A40	2A40	10816	RO	Batch fwd totals	RO	(IEEE 32 bit)
	2A42	10818	RO	Batch rev totals	RO	(IEEE 32 bit)
	2A44	10820	RO	Batch net totals	RO	(IEEE 32 bit)
	2A46	10822	RO	Batch totals time	RO	(IEEE 32 bit)
	2A48	10824	RO	inventory fwd totals	RO	(IEEE 32 bit)
	2A4A	10826	RO	inventory rev totals	RO	(IEEE 32 bit)
	2A4C	10828	RO	inventory net totals	RO	(IEEE 32 bit)
	2A4E	10830	RO	inventory totals time	RO	(IEEE 32 bit)
2A80	2A80	10880	RO	Transit Time Up	RO	(IEEE 32 bit)
	2A82	10882	RO	Transit Time Dn	RO	(IEEE 32 bit)
	2A84	10884	RO	DeltaT	RO	(IEEE 32 bit)
	2A86	10886	RO	Up Signal Quality	RO	(IEEE 32 bit)
	2A88	10888	RO	Dn Signal Quality	RO	(IEEE 32 bit)
	2A8A	10890	RO	Up Amp Disc	RO	(IEEE 32 bit)
	2A8C	10892	RO	Dn Amp Disc	RO	(IEEE 32 bit)
	2A8E	10894	RO	SNR on UP channel	RO	(IEEE 32 bit)
	2A90	10896	RO	SNR on DOWN channel	RO	(IEEE 32 bit)
	2A92	10898	RO	Time in buffer on Up channel	RO	(IEEE 32 bit)
	2A94	10900	RO	Time in buffer on Dn channel	RO	(IEEE 32 bit)
	2A96	10902	RO	Signal Gain Up	RO	(IEEE 32 bit)
	2A98	10904	RO	Signal Gain Down	RO	(IEEE 32 bit)
	2A9A	10906	RO	Partial Corrolatoin Ratio Up	RO	(IEEE 32 bit)
	2A9C	10908	RO	Partial Corrolatoin Ratio Dn	RO	(IEEE 32 bit)
2AC0	2AC0	10944	RO	Sound Speed	RO	(IEEE 32 bit)

	2AC2	10946	RO	Current Reynolds Number	RO	(IEEE 32 bit)
	2AC4	10948	RO	Current Correction Factor	RO	(IEEE 32 bit)
	2AC6	10950	RO	Path Length P	RO	(IEEE 32 bit)
	2AC8	10952	RO	Axial Length L	RO	(IEEE 32 bit)
2B00	2B00	11008	RO	Up +- Peak	RO	INT32
	2B02	11010	RO	Dn +- Peak	RO	INT32
	2B04	11012	RO	dynamic threshold on UP channel	RO	INT32
	2B06	11014	RO	dynamic threshold on DOWN channel	RO	INT32
3000	3000	12288	User	eSupplyTempLow	RW	(IEEE 32 bit)
	3002	12290	User	eEnergyRRWRESV1	RW	(IEEE 32 bit)
	3004	12292	User	eReturnTempLow	RW	(IEEE 32 bit)
	3006	12294	User	eEnergyRRWRESV2	RW	(IEEE 32 bit)
	3008	12296	User	Analog Input 1 Base Value	RW	(IEEE 32 bit)
	300A	12298	User	Analog Input 1 Full Value	RW	(IEEE 32 bit)
	300C	12300	User	Analog Input 2 Base Value	RW	(IEEE 32 bit)
	300E	12302	User	Analog Input 2 Full Value	RW	(IEEE 32 bit)
	3010	12304	User	Analog Input 1 Zero Cali Value	RW	(IEEE 32 bit)
	3012	12306	User	Analog Input 1 Span Cali Value	RW	(IEEE 32 bit)
	3014	12308	User	Analog Input 2 Zero Cali Value	RW	(IEEE 32 bit)
	3016	12310	User	Analog Input 2 Span Cali Value	RW	(IEEE 32 bit)
30C0	30C0	12480	User	eEnergyX1	RW	(IEEE 32 bit)
	30C2	12482	User	eEnergyX2	RW	(IEEE 32 bit)
	30C4	12484	User	eEnergyX3	RW	(IEEE 32 bit)
	30C6	12486	User	eEnergyX4	RW	(IEEE 32 bit)
	30C8	12488	User	eEnergyX5	RW	(IEEE 32 bit)
	30CA	12490	User	eEnergyX6	RW	(IEEE 32 bit)
	30CC	12492	User	eEnergyX7	RW	(IEEE 32 bit)
	30CE	12494	User	eEnergyX8	RW	(IEEE 32 bit)
	30D0	12496	User	eEnergyX9	RW	(IEEE 32 bit)
	30D2	12498	User	eEnergyX10	RW	(IEEE 32 bit)
30E0	30E0	12512	User	eEnergyFactor1	RW	(IEEE 32 bit)
	30E2	12514	User	eEnergyFactor2	RW	(IEEE 32 bit)
	30E4	12516	User	eEnergyFactor3	RW	(IEEE 32 bit)
	30E6	12518	User	eEnergyFactor4	RW	(IEEE 32 bit)
	30E8	12520	User	eEnergyFactor5	RW	(IEEE 32 bit)
	30EA	12522	User	eEnergyFactor6	RW	(IEEE 32 bit)
	30EC	12524	User	eEnergyFactor7	RW	(IEEE 32 bit)
	30EE	12526	User	eEnergyFactor8	RW	(IEEE 32 bit)
	30F0	12528	User	eEnergyFactor9	RW	(IEEE 32 bit)
	30F2	12530	User	eEnergyFactor10	RW	(IEEE 32 bit)
3100	3100	12544	User	eEnergyEnable	RW	INT32
	3102	12546	User	eEnergySystem	RW	INT32
	3104	12548	User	eFlowMeasure	RW	INT32
	3106	12550	User	eEnthalpyCalc	RW	INT32
	3108	12552	User	eSupplyTemp	RW	INT32
	310A	12554	User	eReturnTemp	RW	INT32
	310C	12556	User	eEnergyIRWRSEV1	RW	INT32
	310E	12558	User	eAI1Function	RW	INT32

	3110	12560	User	eEnergyIRWRSEV2	RW	INT32
	3112	12562	User	eAI1Function	RW	INT32
	3114	12564	User	eEnergyChannel	RW	INT32
	3116	12566	User	eEnergyPoint	RW	INT32
	3118	12568	User	eAI1KPairs	RW	INT32
	311A	12570	User	eAI1KPairs	RW	INT32
	311C	12572	User	eExtPwrEnable	RW	INT32
	311E	12574	User	enable power saving mode(long battery mode)	RW	INT32
	3120	12576	User	Measurement Time during power saving mode	RW	INT32
	3122	12578	User	Sleep Time during power saving mode	RW	INT32
3200	3200	12800	RO	eAI1Current	RO	(IEEE 32 bit)
	3202	12802	RO	eAI2Current	RO	(IEEE 32 bit)
	3204	12804	RO	eAI1Val	RO	(IEEE 32 bit)
	3206	12806	RO	eAI1Val	RO	(IEEE 32 bit)
	3208	12808	RO	eEnergy	RO	(IEEE 32 bit)
3300	3300	13056	RO	eAI1Sample	RO	INT32
	3302	13058	RO	eAI2Sample	RO	INT32
3D00	3D00	15616	Viewer	Factory command register	RW	INT32
3F00	3F00	16128	RO	System password	RO	INT32

5.2 BLUETOOTH

5.2.1 Introduce

PT900 use Bluetooth protocol to communicate between flow meter and tablet. To protect the product and user data safety, a private protocol is structured based on common Bluetooth 4.0 protocol.

And PT900 flow meter does not support display screen and keypad, so it cannot use **Numeric Comparison** and **Passkey Entry.** For the limited communication method between flow meter and tablet, Bluetooth **Secure Simple Pairing (SSP) Mode** with **Just Work Pairing Method** is adopted.

For the detail of Bluetooth communication mode, please check **BLUETOOTH SPEC 4.0**.

APPENDIX A. SPECIFICATIONS

A.1 Operation and Performance

Fluid Types
Liquids: Acoustically conductive fluids, including most clean liquids, and many liquids with limited amounts of entranced solids or gas bubbles.

Flow Measurement
Patented Correlation Transit-Time™ mode.

Meter Sizes
Standard: 2 to 24 in. (50 to 600 mm)
Optional: up to 300 in. (7500mm) available upon request.

Accuracy
±1% of reading with calibration (2 ft/s and greater)
Need accuracy statement below 2 ft/s

Final installation assumes a fully developed flow profile (typically 10 diameters upstream and 5 diameters downstream of straight pipe run) and single phase fluids. Applications with piping arrangements that induce swirl (e.g., two out-of-plane elbows) may require additional straight run or flow conditioning.

Calibration Fluid: Water

Repeatability
±0.2% of reading

Range (Bidirectional)
0.1 to 40 ft/s (0.03 to 12.19 m/s)

Range ability (Overall)
400:1

A.2 Meter Body/Transducer

Meter Body Materials
PC/ABS+TPE over-molding

PT9 Transducer System and Material
CRR Transducer body: Stainless Steel (ASTM A304)
Fixture body: ??

CF-LP Transducer System and Material
CF-LP Transducer body: Stainless Steel (ASTM A316)
Fixture body: Aluminum (ASTM AL6061)
Please contact sales representative for other transducers.

Meter Temperature Ranges
-4°F to 131°F (–20° to 55°C)

PT9 Transducer Temperature Ranges
–40°F to 302°F (–40° to 150°C)

CF-LP Transducer Temperature Ranges
–40°F to 302°F (–40° to 150°C)
Please contact sales representative for other transducers.

Humidity Range
Up to 90% R.H.
Please contact sales representative for tropicalization the unit for 100% R.H.

Altitude Range
Up to 2000 meters maximum;

PT9 Transducer Cables
7.6 meters (25 ft) RG316 coaxial cable.
Temperature Range is –40° to 302°F (–40° to 150°C)

Wiring Cable Spec and Requirement
Cable diameter range for PWR connection: 7 to 12mm, refer to Gland Hole 1 on *Figure 23*;
Cable diameter range for Hart, Modbus and I/O connection: 5 to 8mm, refer to Gland Hole 2,3 and 4 on *Figure 23*;
Temperature range of cable for PWR, Hart, Modbus and IO connection: 14° to 185°F (–10° to 85°C);
The cable should meet the CE and UL standard below:
Conductor cross section solid range: 0.2 $mm^2$to 2.5 mm^2
Conductor cross section stranded range: 0.2 $mm^2$to 2.5 mm^2
Conductor cross section stranded, with ferrule without plastic sleeve range: 0.25 $mm^2$to 1 mm^2
Conductor cross section stranded, with ferrule with plastic sleeve range: 0.25 $mm^2$to 1 mm
Conductor cross section AWG/kcmil range: 20 to 26
AWG according to UL/CUL range: 20 to 28

Cable Fixing Requirement and Gland Torque

Refer to *Figure 23* for the Gland Hole position.
To make a reliable IP67 sealing performance of the enclosure during cabling, the gland must be tightened well, below torque value is a reference to make a reliable NEMA 4X/IP67 sealing between cable and gland:
Operation torque for Gland Hole 1 and 5: 2.7 N.M
Operation torque for Gland Hole 2, 3 and 4: 2.5 N.M

A.3 Electronics

Enclosures

PC/ABS + TPE Over-molding with rubbery feeling

Weatherproof

Enclosures: IP65
Please contact sales representative for other transducers.

Electronics Classifications

CE (EMC Directive) IEC 61326-1:2012, IEC 61326-2-3:2012, LVD 2006/95/EC, EN 61010-1 2010)
ETL (UL61010-1, CSA 22.2 No 61010.1, No. 142, FCC part 15, CISPR 11)
WEEE Compliance
ROHS Compliance

> **Note:** The electronics package includes an installed battery which shall only be replaced at a GE Service center. Replacement involves de-soldering battery contacts, which could lead to a breach of Functional Safety. Please contact GE Service to get this battery replaced.

Display Languages

English/Chinese/German/French/Italian/Japanese/Portuguese/Russian/Spanish
The meter will be set into the language requested by customer before shipping to customer.

Inputs/Outputs

Standard: One analog output*, service (RS485) output, two digital outputs***, one gate input;
Option A: One analog output* with HART**, service (RS485) output, two digital outputs***, one gate input;
Option B: One analog output*, service (RS485) output, one Modbus (RS485) output, two digital outputs***, one gate input;

*Analog output is NAMUR NE43 compliant
**HART is compliant with Protocol of Version 7
***Digital Outputs are programmable as either pulse, frequency, alarm, or control outputs. Digital outputs will be configured into the output mode as requested by customer before shipping to customer.

APPENDIX B. DATA RECORDS

B.1 Service Record

Whenever any service procedure is performed on the PT900 flow meter, the details of the service should be recorded in this appendix. An accurate service history of the meter can prove very helpful in troubleshooting any future problems.

B.1.1 Data Entry

Record the complete and detailed service data for the PT900 in the below table. Make additional copies of the table as needed.

Date	Description of Service Performed	Performed

B.2 Initial Settings

The values for the initial measurement settings immediately after initial installation of the meter and verification of proper operation should be entered below.

Parameter	Initial Value
Pipe OD	
Pipe ID	
Pipe Wall Thickness	
Pipe Material	
Pipe Sound speed	
Lining Thickness	
Lining Material	
Transducer ID	
Transducer Frequency	
Transducer Wedge Type	
Transducer Wedge Angle	
Transducer Wedge SOS	
Transducer TW	
Traverses	
Fluid Type	
Fluid SOS	
Fluid Minimum SOS	
Fluid Maximum SOS	
Fluid Temperature	
Transducer Spacing	

B.3 Diagnostic Parameters

The values for the diagnostic parameters immediately after initial installation of the meter and verification of proper operation should be entered below. These initial values can then be compared to current values to help diagnose any future malfunction of the system.

Parameter	Initial Value
Velocity	
Actual Volumetric	
Standardized Volumetric	
Fwd. Batch Totals	
Rev Batch Totals	
Net Batch Totals	
Batch Totalizer Time	
Fwd. Inventory Totals	
Rev Inventory Totals	
Net Inventory Totals	
Inventory Totalizer Time	
Mass Flow	
Sound Speed	
Reynolds	
Kfactor	
Transit Time Up	
Transit Time Dn	
DeltaT	

Up Signal Quality	
Dn Signal Quality	
Up Amp Disc	
Dn Amp Disc	
SNR Up	
SNR Dn	
ActiveTW Up	
ActiveTW Dn	
Gain Up	
Gain Dn	
Error Status	
Reported Error	
Up Peak	
Down Peak	
Peak % Up	
Peak % Down	

APPENDIX C. MENU MAP

APPENDIX D. MEASURE TYPE

D.1 CHANNEL 1

1	AmpDiscUp
2	AmpDiscDn
3	BatchFwdTotal
4	BatchRevTotal
5	BatchNetTotal
6	BatchTotalTime
7	DeltaT
8	GainUp
9	GainDn
10	InventoryFwdTotal
11	InventoryRevTotal
12	InventoryNetTotal
13	InventoryTotalTime
14	MassFlow
15	MultiKKfactor
16	PCRUp
17	PCRDn
18	PeakUp
19	PeakDn
20	PeakPctUp
21	PeakPctDn
22	ReynoldsKfactor
23	SNRUp
24	SNRDn
25	SoundSpeed
26	SignalQualityUp
27	SignalQualityDn
28	StandardVolumetric
29	TransitTimeUp
30	TransitTimeDn
31	ActiveTWUp
32	ActiveTWDn
33	Velocity
34	Volumetric

D.2 CHANNEL 2

1	AmpDiscUp
2	AmpDiscDn
3	BatchFwdTotal

4	BatchRevTotal
5	BatchNetTotal
6	BatchTotalTime
7	DeltaT
8	GainUp
9	GainDn
10	InventoryFwdTotal
11	InventoryRevTotal
12	InventoryNetTotal
13	InventoryTotalTime
14	MassFlow
15	MultiKKfactor
16	PCRUp
17	PCRDn
18	PeakUp
19	PeakDn
20	PeakPctUp
21	PeakPctDn
22	ReynoldsKfactor
23	SNRUp
24	SNRDn
25	SoundSpeed
26	SignalQualityUp
27	SignalQualityDn
28	StandardVolumetric
29	TransitTimeUp
30	TransitTimeDn
31	ActiveTWUp
32	ActiveTWDn
33	Velocity
34	Volumetric

D.3 CHANNEL AVERAGE

1	BatchFwdTotal
2	BatchRevTotal
3	BatchNetTotal
4	BatchTotalTime
5	InventoryFwdTotal
6	InventoryRevTotal
7	InventoryNetTotal
8	InventoryTotalTime
9	MassFlow
10	StandardVolumetric
11	Velocity

12	Volumetric

D.4 CHANNEL GENERAL

1	AI 1 Current
2	AI 2 Current
3	AI 1 Value
4	AI 2 Value
5	Energy
6	User Function 1
7	User Function 2
8	User Function 3
9	User Function 4
10	User Function 5

APPENDIX E. TRANSDUCER TYPE

Transducer Number	Transducer Name
10	C-PT-N/0.5MHz
11	C-PT-N/2MHz
12	C-PT-H/0.5MHz
13	C-PT-H/1MHz
14	C-PT-M/2MHz
15	C-PT-H/0.5MHz
16	C-PT-H/1MHz
17	C-PT-H/2MHz
23	CF-LP-H/4MHz
24	CF-LP-N/4MHz
31	CF-WL/2MHz
401	C-RS/0.5MHz
402	C-RS/1MHz
403	C-RS/2 MHz
407	UTXDR/2MHz
408	UTXDR/4MHz
505	C-RR/0.5MHz
510	C-RR/1MHz
520	C-RR/2MHz
601	C-AT/0.5MHz
602	C-AT/1MHz
603	C-AT/2MHz