# THERMATEL®
# Enhanced Model TA2
**Software v2.x**

**Installation and Operating Manual**


*Thermal*

*Dispersion*

*Mass Flow*

*Meter*

Magnetrol®

## UNPACKING

Unpack the instrument carefully. Make sure all components have been removed from the foam protection. Inspect all components for damage. Report any concealed damage to the carrier within 24 hours. Check the contents of the carton/crates against the packing slip and report any discrepancies to Magnetrol. Check the nameplate model number to be sure it agrees with the packing slip and purchase order. Check and record the serial number for future reference when ordering parts.

CE 0038 0344

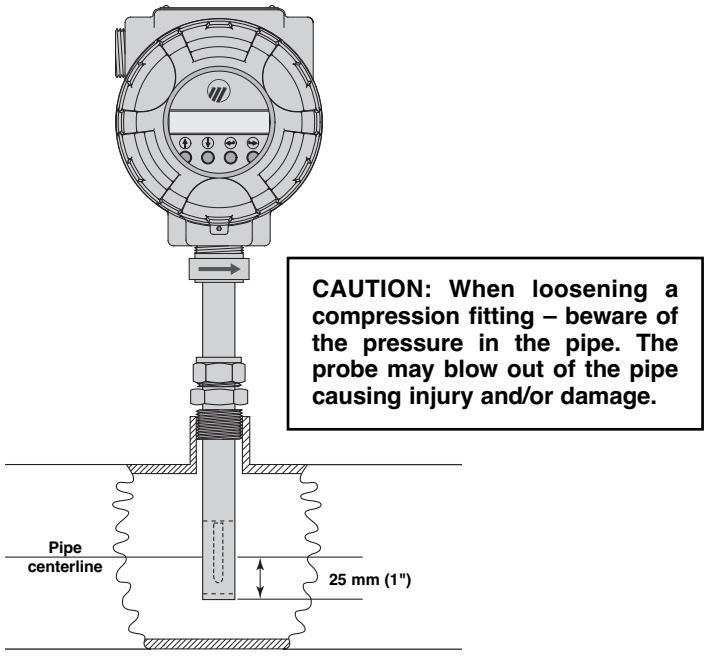
These units are in compliance with:

1. The EMC directive 2014/32/EU. The units have been tested to EN61326:1997+A1+A2.
2. The ATEX directive 2014/34/EU. EC-type Examination number ISSeP10ATEX046X (Ex d) or ISSeP12ATEX010X (Ex d+ib). Standards applied: EN60079-0:2009, EN60079-1: 2007, EN60079-11:2007 and EN60079-26:2007.
3. The PED directive 97/23/EC (pressure equipment directive). Safety accessories per category IV module H1.


## SPECIAL CONDITIONS FOR ATEX/IECEx SAFE USE

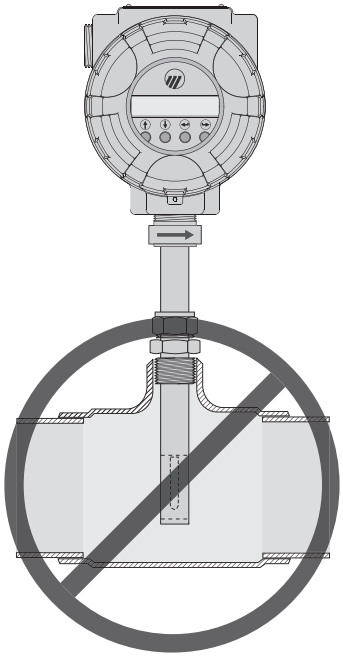
- The temperature class of the unit may be affected if the temperature of the measured fluid exceeds 55°C.
- The values of the flameproof joints are detailed in the drawings listed reference 99-7198.
- For model Ex d +ib requires a power supply of which the short circuit will not exceed 25A or the supply will have a fuse with a breaking capacity of 1500A.

## MOUNTING




**CAUTION: When loosening a compression fitting – beware of the pressure in the pipe. The probe may blow out of the pipe causing injury and/or damage.**

See Appendix A for recommended straight run and flow conditioning plate installation details (if applicable).



**Probe installation into a tee fitting is not recommended**

## Recommended probe installation

Proper installation of the probe in the pipe or duct is essential for accurate air or gas flow measurement. Normal procedures for installing any type of flow element should be followed.

A flow arrow is etched on the sides of the probe to designate flow direction. The instrument is calibrated with the flow in this direction. Ensure that the flow arrow is aligned in the direction of flow. The instrument is unable to recognize flow direction if inserted with the flow arrow in the wrong direction.

It may be necessary to rotate the head of the instrument to view the display while maintaining the proper flow orientation.

It is generally recommended that the sensor be located in the center of the pipe. This location provides less sensitivity to changes in flow profile. Sensors mounted through compression fittings have the ability to field adjust the sensor to the desired location.

Various methods of mounting the probe include compression fittings, threads, and flanged connections. Refer to probe model numbers. The insertion probe can be installed through a compression fitting. The use of a bored-through fitting with 3⁄4" or 1" NPT connection for 3⁄4" outside diameter tube is recommended.

The use of Teflon® ferrules should be considered if repeated reposition of the sensor is considered. The stainless steel ferrule can only be tightened once as it makes a permanent indentation on the probe. If using a compression fitting with stainless steel ferrules, ensure that the probe is in the desired location before tightening.

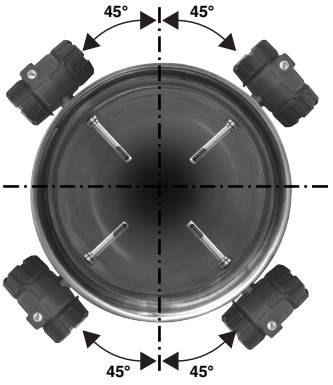
The TA2 flow measurement is based on a fully developed turbulent flow profile in a pipe with the specified inner diameter. Accuracy will be affected if these conditions are not obtained. Installing the probe in a tee is not recommended as the flow profile and the flow area are distorted.

For applications where it is desirable to install or remove the probe without having to shut down the process, Magnetrol's Retractable Probe Assembly (RPA) can be utilized.

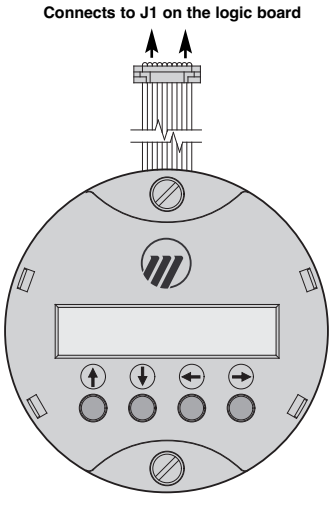
The TA2 with an insertion probe provides a point measurement and assumes that the velocity profile (see figures below) is uniform over the entire width of the pipe or duct. The user has the ability to compensate the flow measurements based upon flow profile considerations under the Advanced Configuration section of the software.

**NOTE: Do not install the probe in locations where condensed moisture can be present. The unit may cause a false high flow indication. In some cases heat tracing or insulation of the pipe must be considered to avoid moisture condensation.**

Install the TA2 sensor at a 45° angle to minimize moisture drip. Use of different TA2's as shown is recommended to optimize the accuracy in a larger pipe dia.

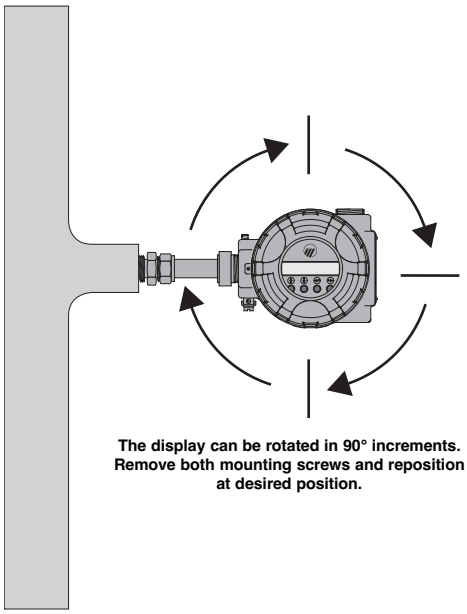



## Display




The TA2 has a plug in display (ordered with the unit or separately).

**CAUTION: Switch power off when connecting/disconnecting the display**



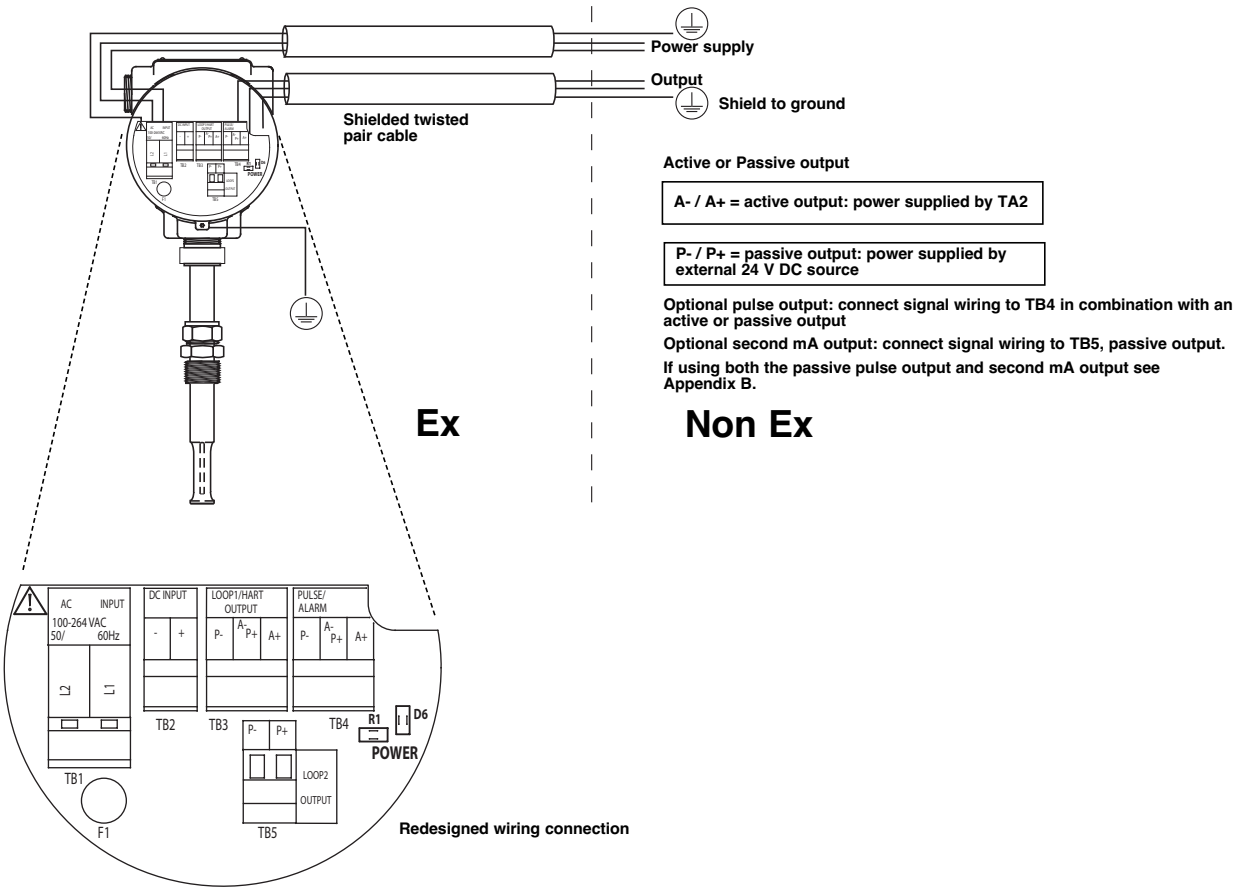
The display can be rotated in 90° increments. Remove both mounting screws and reposition at desired position.

## WIRING

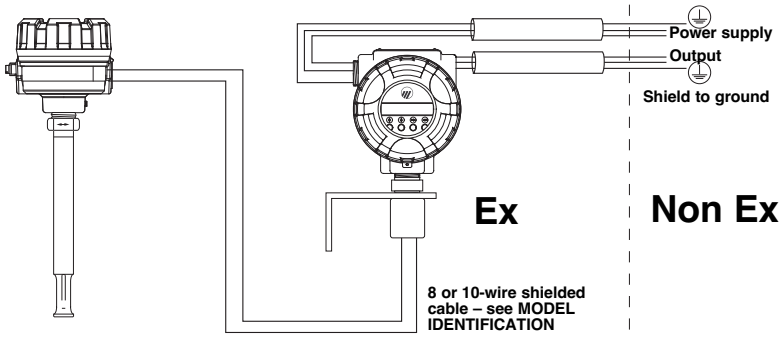
**CAUTION: In harzardous area, do NOT power the unit until the cable gland is sealed and the housing cover of the wiring compartment is screwed down securely / housing locking screw is fastened – disabling the removal of the cover.**

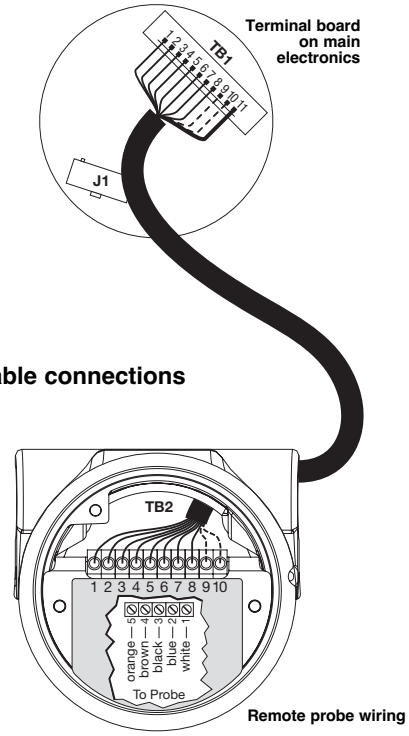
**NOTE: Wiring for Ex d and Ex d +i is identical. This means that for use in Zone 0 an Ex d device has to use Ex d cabling.**

### Integral electronics



## Remote electronics




**Remote wiring cable connections**

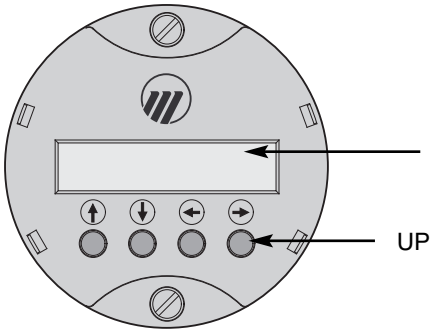
1. Green/White
2. White/Green
3. Blue/White
4. White/Blue
5. Brown/White
6. White/Brown
7. Orange/White
8. White/Orange
9. 
10. 
11. Shield

**NOTE: Explosion proof cable is labelled as per terminal number**

## CONFIGURATION

**IMPORTANT: TA2 units are pre-configured from factory (as per order specifications). Only modify configuration settings in case needed.**

**NOTE: When power is first applied to the TA2 there is an initialization period for the sensor to reach stabilization. During this time the TA2 will output a 4 mA signal and the display (if provided) will read «Initializing TA2». Only after the sensor has stabilized and a valid flow measurement is obtained will the display show a flow measurement, the output signal will be active and the totalizer will begin counting.**



2 line - 16 characters LCD.
Default display cycles every 1,5 s through
FLOW / MASS / TEMPERATURE / TOTALIZED FLOW / mA OUTPUT

UP / DOWN / BACK and ENTER pushbuttons

| Keys | Comment |
|---|---|
| ↑ (Up) | Scroll to the previous selection/menu in the list or<br>increase a value (behind decimal/negative values show "-") or<br>scroll forward through graphical characters or digits.<br>If held down; the characters scroll until the pushbutton is released. |
| ↓ (Down) | Scroll to the next selection/menu in the list or<br>decrease a value (behind decimal/negative values show "-") or<br>scroll backward through graphical characters.<br>If held down; the characters scroll until the pushbutton is released. |
| ← (Back) | Moves back one level to the previous higher branch or menu level without changes or<br>moves the cursor to the left to delete an entry. |
| → (Enter) | Enters into the lower level branch.<br>Accepts the selection and returns to the menu traversal mode.<br>Moves the cursor to the right to quit/save a selection (cursor must be in a blank position). |

### PASSWORD

**Access Menu**

When attempting to enter a selection setting, the unit will display:

| Display | Item | Action |
|---|---|---|
| «USR PASSWD REQ'D»<br>«PRB PASSWD REQ'D» | User password required<br>Probe password required* | Unit shows an encrypted value. Enter "0" (factory default password or any modified user password (001 - 255)) |

* only needed when original probe was replaced – factory default is "0"

**Select a new Password**

Move to «ADV CONFIG» menu-selection

| Display | Item | Action |
|---|---|---|
| «CHANGE PASSWORD»<br>→ to select | Change password | Enter old password «ENTER OLD PASSWORD»<br>Enter new password «ENTER NEW PASSWORD» (any value between 001 - 255) |

**Add new Password for probe replacement**

Move to «Factory Config» menu-selection

| Display | Item | Action |
|---|---|---|
| «PROBE PARAMS»<br>→ to select | Probe parameters | Scroll through entries (factors are provided with the new probe) |

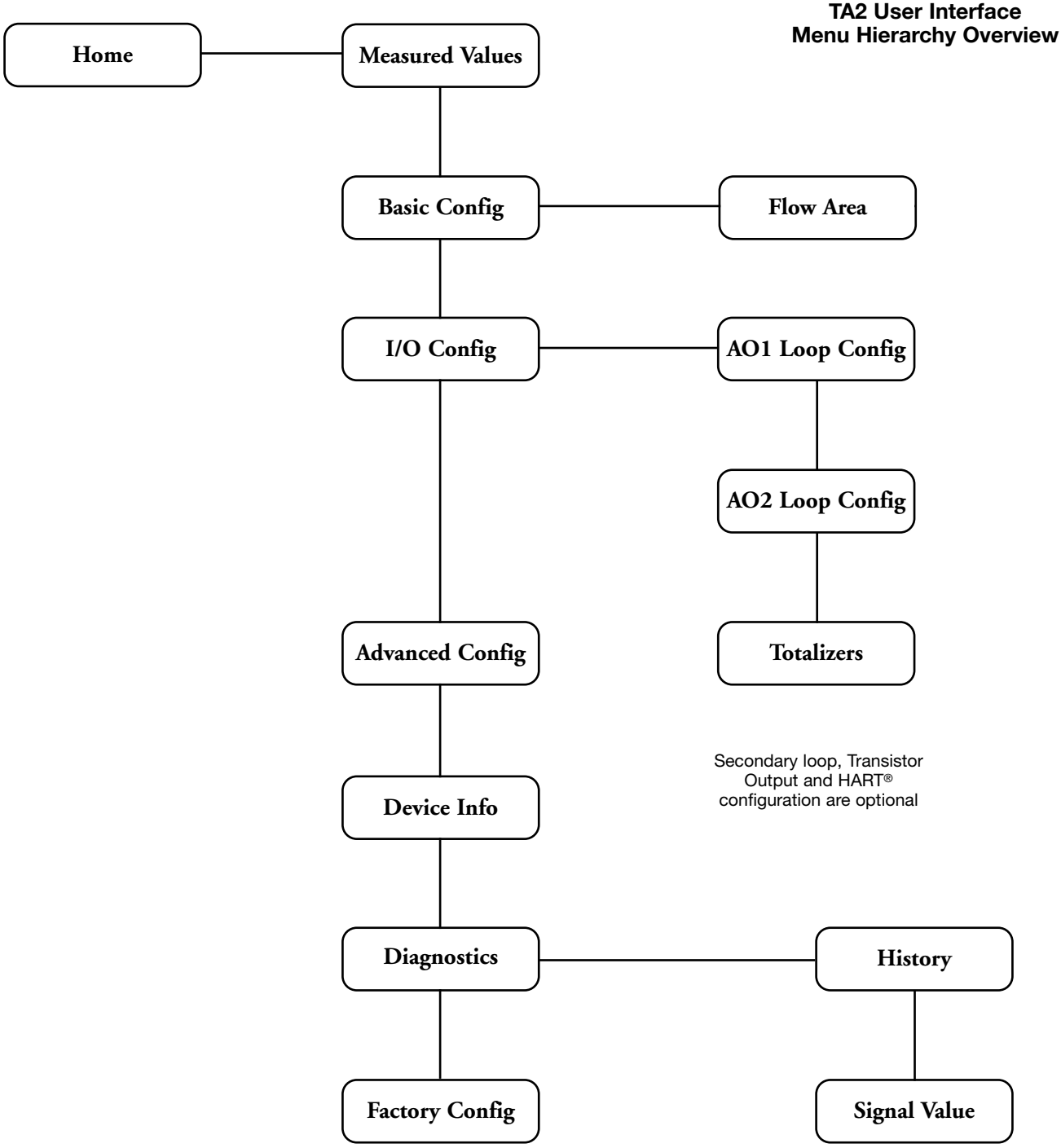
**Password forgotten/lost –** consult factory for assistance, your password can be recooped via the encrypted value displayed when the Password is asked for (see Access Menu).

### Main Menu

The main menu is used to access the various subroutines. From the Run mode, press any key to enter the Main Menu. The following chart defines the various selections available.

| Display | Item | Action if → is pressed |
|---|---|---|
| «Measured Values» ↕ | Measured values | Enter Measured Values menu |
| «Basic Config» ↕ | System configuration | Enter System Configuration menu |
| «I/O Config» ↕ | I/O configuration | Enter Input/Output Configuration menu |
| «Adv Config» ↕ | Advanced configuration | Enter Advanced Configuration menu |
| «Device Info» ↕ | Device information | Enter Device Information menu |
| «Diagnostics» ↕ | Diagnostics | Enter Diagnostic menu |
| «Factory Config» ↕ | Factory configuration | Enter Factory Configuration menu |

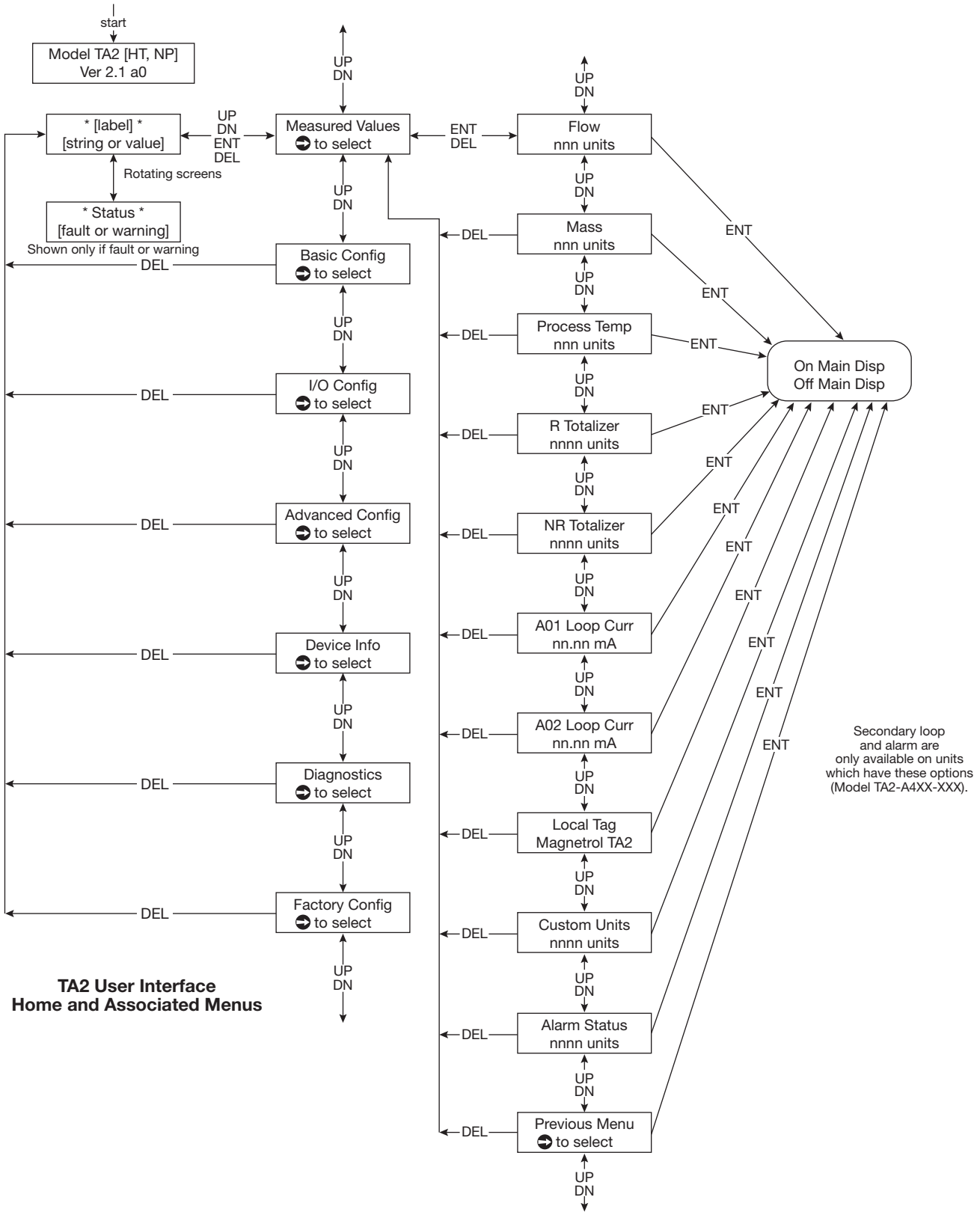
**TA2 User Interface**
**Menu Hierarchy Overview**



## Measured Values

The Measured Values menu is used to display the current values measured by the TA2 and determine which parameters will be shown on the display during run mode. Enter this section by pressing → when «Measured Values ↕ » is displayed from the Main Menu.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Flow Nm3/h» ↕ → to select | Volume Flow | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | |
| «Mass kg/h» ↕ → to select | Mass Flow | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | |
| «Process Temp Celsius» ↕ → to select | Temperature | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | Temperature measurements are not accurate at velocity below 0,25 Nm/s |
| «R Totalizer Nm3» ↕ → to select | Totalized data | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | Resetable totalized data |
| «NR Totalizer Nm3» ↕ → to select | Totalized data | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | Non resetable totalized data |
| «AO1 Loop Curr mA» ↕ → to select | Loop current 1 | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | |
| «AO2 Loop Curr mA» ↕ → to select | Loop current 2 | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | Only available as an option |
| «Local Tag» ↕ → to select | Device tag name | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | |
| «Custom Units» ↕ → to select | Customized units | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | |
| «Alarm Status Disabled» ↕ → to select | Alarm status | Press ↑ or ↓ to cycle between On main display «On Main Display» and Off Main Display «Off Main Display»; press → | Only available as an option |
| «Previous Menu → to select» ↕ → to select | Previous Menu | | Returns to previous menu |



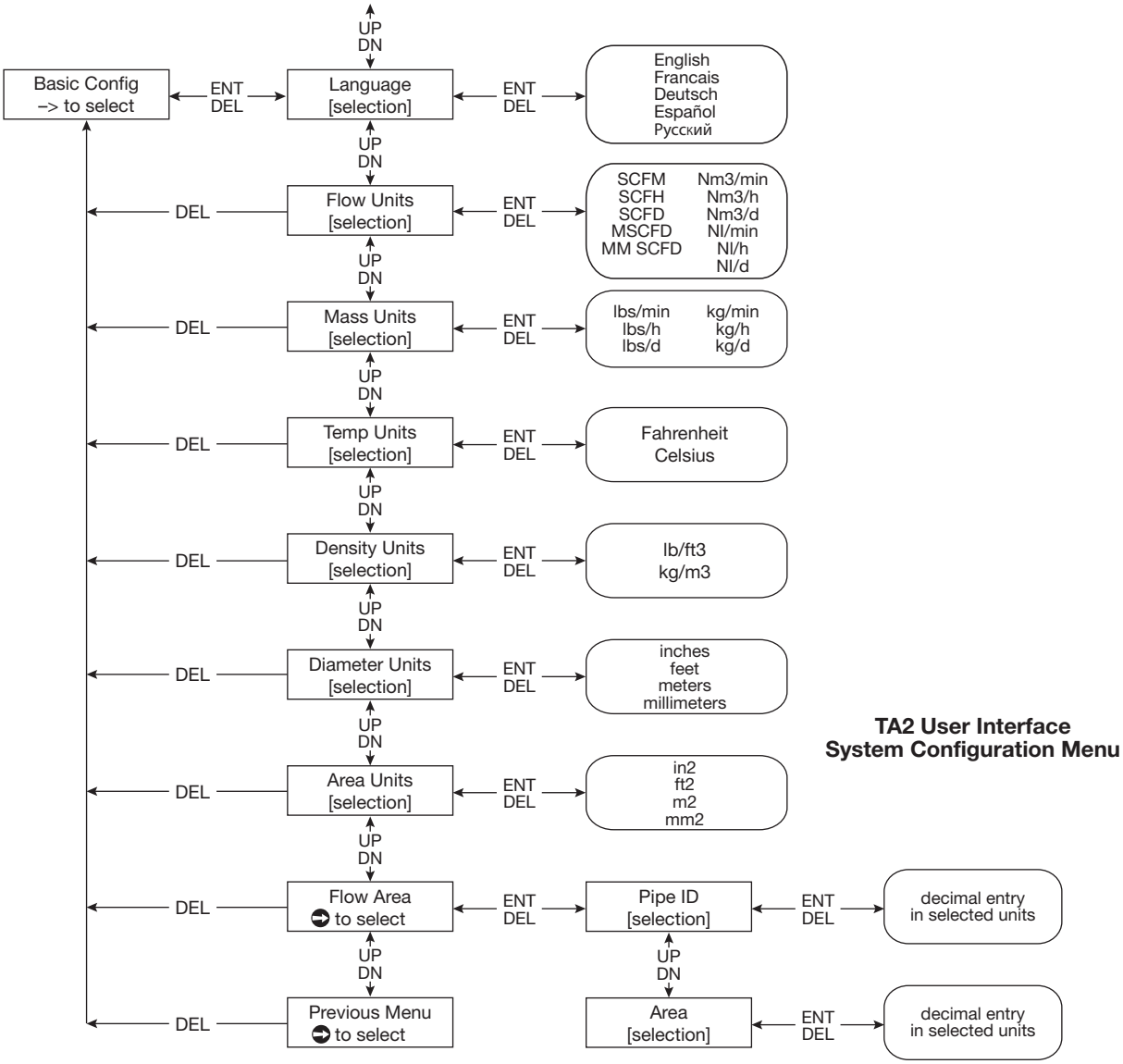

**TA2 User Interface**
**Home and Associated Menus**

**Basic Configuration Menu**

The Basic Configuration menu is used to select the display units and enter specific information for the application. Access this section by pushing → when Basic Config is displayed from the Main Menu.

To calculate the flow or mass, it is necessary to accurately enter the inside area of the pipe or duct. If the pipe or duct is circular, simply enter the value of the inside diameter; the cross sectional area of the pipe is automatically calculated. If the duct is rectangular, skip over the entry of diameter, and directly enter the cross sectional area in the area section. The instrument will then back calculate an equivalent diameter.

| Display | Item | Action | Comments |
|---|---|---|---|
| «LANGUAGE»<br>→ to select | Language | Press ↑ or ↓ to scroll between selections; press → | Choice of English «ENGLISH», French «FRANÇAIS», German «DEUTSCH», Spanish «ESPAÑOL» or Russian «Русский» |
| «FLOW UNITS<br>NM3/H»<br>→ to select | Flow Units | Press ↑ or ↓ to scroll between selections; press → | Choice of standard cubic feet per minute «SCFM» / per hour «SCFH» / per day «SCFD», thousand standard cubic feet per day «MSCFD», million standard cubic feet per day «MM SCFD», normal cubic meters per minute «NM3/MIN» / per hour «NM3/H» / per day «NM3/D», normal liters per minute «NL/MIN» / per hour «NL/H» / per day «NL/D». For other units, the ***Custom Unit*** feature can be used in the Advanced Configuration Menu |
| «MASS UNITS<br>KG/H»<br>→ to select | Mass Units | Press ↑ or ↓ to scroll between selections; press → | Choice of pounds per minute «LBS/MIN» / per hour «LBS/H» / per day «LBS/D», kilograms per minute «KG/MIN» / per hour «KG/H» / per day «KG/D». For other units, the ***Custom Unit*** feature can be used in the Advanced Configuration Menu |
| «TEMP UNITS<br>CELSIUS»<br>→ to select | Temperature Units | Press ↑ or ↓ to scroll between selections; press → | Choice of «FAHRENHEIT», «CELSIUS» |
| «DENSITY UNITS<br>KG/M3»<br>→ to select | Density Units | Press ↑ or ↓ to scroll between selections; press → | Choice of pounds per cubic foot «LB/FT3», kilograms per cubic meter «KG/M3» |
| «DIAMETER UNITS<br>MM»<br>→ to select | Diameter Units | Press ↑ or ↓ to scroll between selections; press → | Choice of inches «INCHES», feet «FEET», meters «METERS», millimeters «MILLIMETERS» |
| «AREA UNITS<br>M2»<br>→ to select | Area Units | Press ↑ or ↓ to scroll between selections; press → | Choice of square inches «IN2», square feet «FT2», meters squared «M2», millimeters squared «MM2» |
| «FLOW AREA<br>→ TO SELECT»<br>→ to select | Flow Area | Press ↑ or ↓ to scroll between selections; press → | Enter the cross sectional area of the pipe or duct, or the inside diameter |
| | | Diameter «DIAMETER»<br>xxx units | Enter the inside diameter (if circular), press → to accept or press ↑ or ↓ |
| | | Area «AREA»<br>xxx units | The cross sectional area is calculated based on the diameter. If rectangular enter the flow area |
| «PREVIOUS MENU<br>→ TO SELECT»<br>→ to select | | | Returns to previous menu or cycle through System Configuration |




**TA2 User Interface**
**System Configuration Menu**

### I/O Configuration Menu

The I/O Configuration menu is used to set up the operations of 4–20 mA output, the totalizer, and the pulse/alarm output. Access this section by pushing → when «I/O Config» is displayed.

#### 4-20 mA

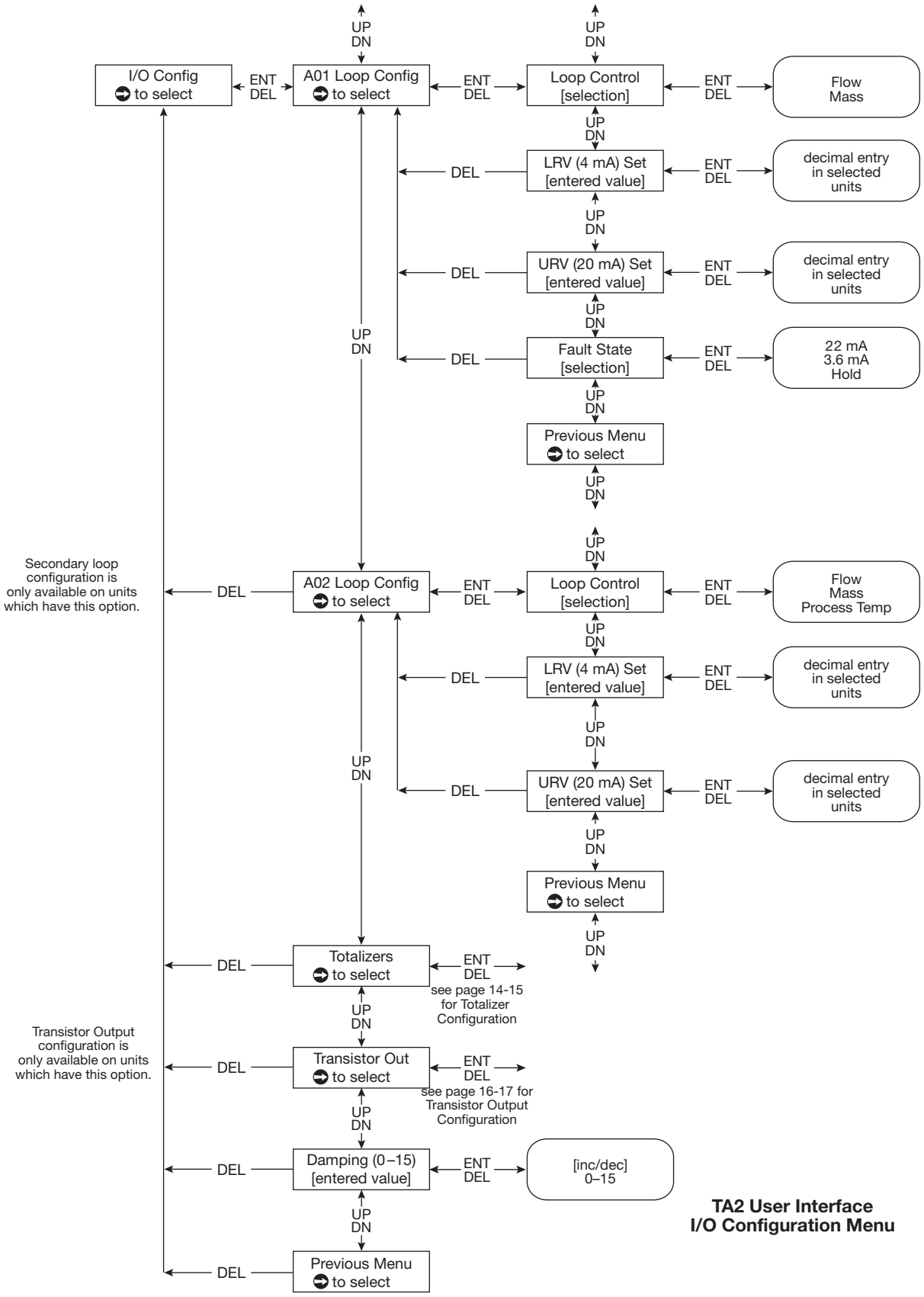
To access the 4-20 mA signal, scroll ↑ or ↓ until the display shows «AO1 Loop», press →.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Loop Control Flow» → to select | Controlled by flow | Press ↑ or ↓ to cycle between options | Choice is Flow «Flow» or Mass «Mass» |
| «LRV (4 mA) Set xxxxx units» → to select | 4 mA set point xxxxx units | Set mA point using keypad | Enter value for 4 mA point. Units are based upon selection «Loop Control» |
| «URV (20 mA) Set xxxx units» → to select | 20 mA set point xxxxx units | Set mA point using keypad | Enter value for 20 mA point |
| «Fault State xx mA» → to select | Fault mode xx mA | Press ↑ or ↓ to cycle between «22 mA», «3.6 mA» or «Hold» | Select status of 4-20 mA loop in event of fault |
| «Previous Menu → to select» → to select | Previous menu | | Returns to previous menu |

#### 4-20 mA, Optional loop

To access the 4-20 mA signal, scroll ↑ or ↓ until the display shows «AO2 Loop», press →.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Loop Control Flow» → to select | Controlled by flow | Press ↑ or ↓ to cycle between options | Choice is Flow «Flow», Mass «Mass» or Process Temperature «Process Temp» |
| «LRV (4 mA) Set xxxxx units» → to select | 4 mA set point xxxxx units | Set mA point using keypad | Enter value for 4 mA point. Units are based upon selection «Loop Control» |
| «URV (20 mA) Set xxxx units» → to select | 20 mA set point xxxxx units | Set mA point using keypad | Enter value for 20 mA point |
| «Previous Menu → to select» → to select | Previous menu | | Returns to previous menu |



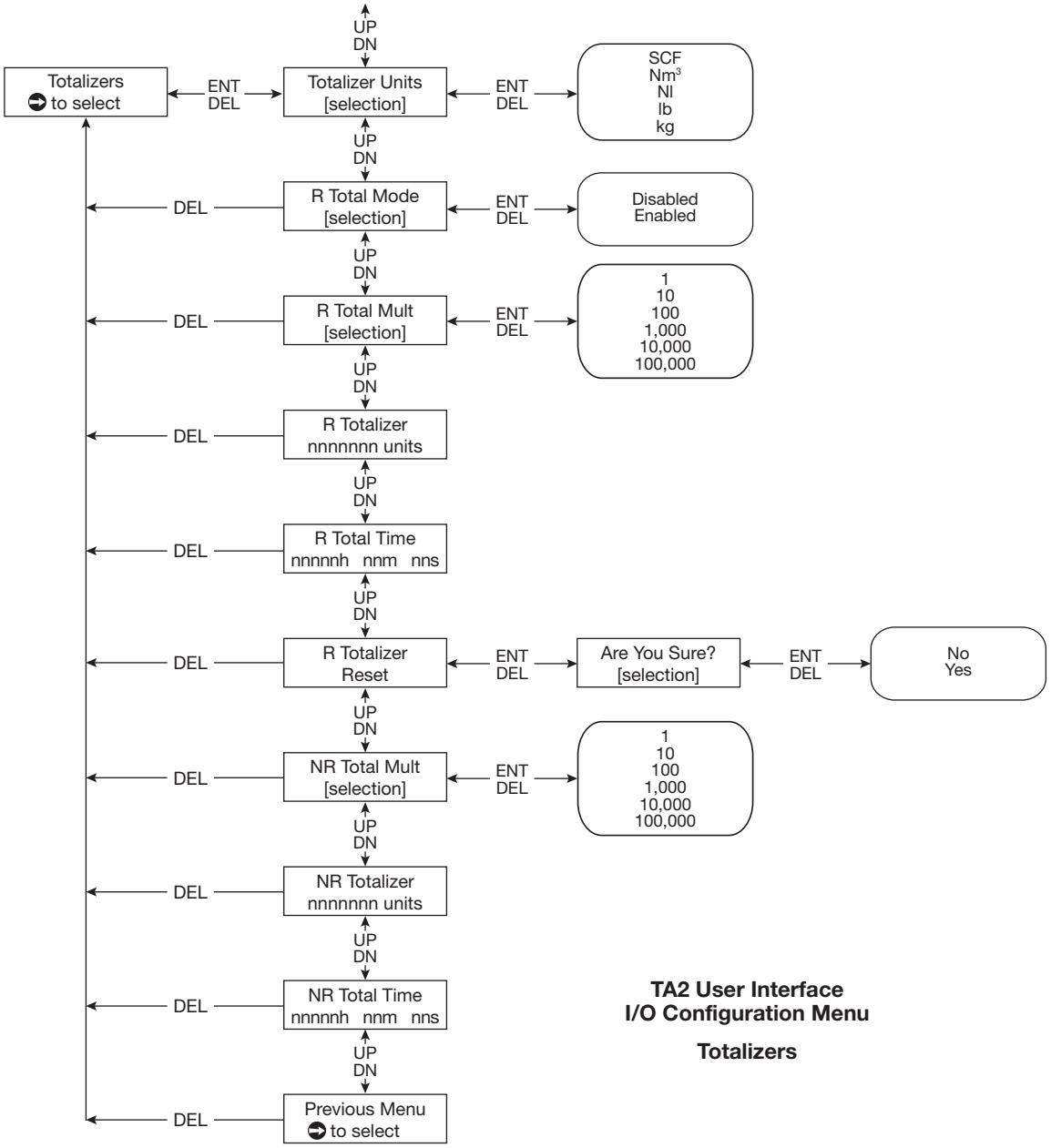

**TA2 User Interface**
**I/O Configuration Menu**

**Totalizer**

The totalizer maintains a continuous, running total of the flow in selectable units. It also provides elapsed time since the last totalizer reset. The totalizer utilises eeprom memory, eliminating the need for a battery backup. The totalizer can be reset to zero via the software configuration menu or by the HART communication. When power is interrupted, the totalizer will restore to its last saved value.

To configure the Totalizer operation, scroll ↑ or ↓ until the display shows «TOTALIZER», press →.

| Display | Item | Action | Comments |
|---|---|---|---|
| «TOTALIZER UNITS» → to select | Totalizer mode disabled | Press ↑ or ↓ to scroll through the options | Permits selection of the units for both resettable and non resettable totalizers |
| «R TOTAL MODE» → to select | Resettable mode enabled | Press ↑ or ↓ to scroll through the options | Enable or disable «R TOTAL MODE» |
| «R TOTAL MULT» → to select | Sets a multiplier | Press ↑ or ↓ to scroll through the options | Permits use of a multiplier |
| «R TOTALIZER» → to select | | | Read only screen displaying the present value of the resettable totalizer |
| «R TOTAL TIME» → to select | | | Read only screen displaying the elapsed time since resettable totalizer was reset |
| «R TOTALIZER RESET» → to select | Resets total flow and elapsed time | Second change «ARE YOU SURE»; press ↑ or ↓ | Select «YES» or «NO» for resetting |
| «NR TOTAL MULT» → to select | Sets a multiplier for the non-resettable totalizer | Press ↑ or ↓ to scroll through the options | Permits use of a multiplier |
| «NR TOTALIZER» → to select | | | Read only screen displaying the present value of the non-resettable totalizer |
| «NR TOTAL TIME» → to select | | | Read only screen displaying the elapsed time since non-resettable totalizer was reset |
| «PREVIOUS MENU → TO SELECT» → to select | Previous menu | | Returns to previous menu |




**TA2 User Interface**
**I/O Configuration Menu**

**Totalizers**

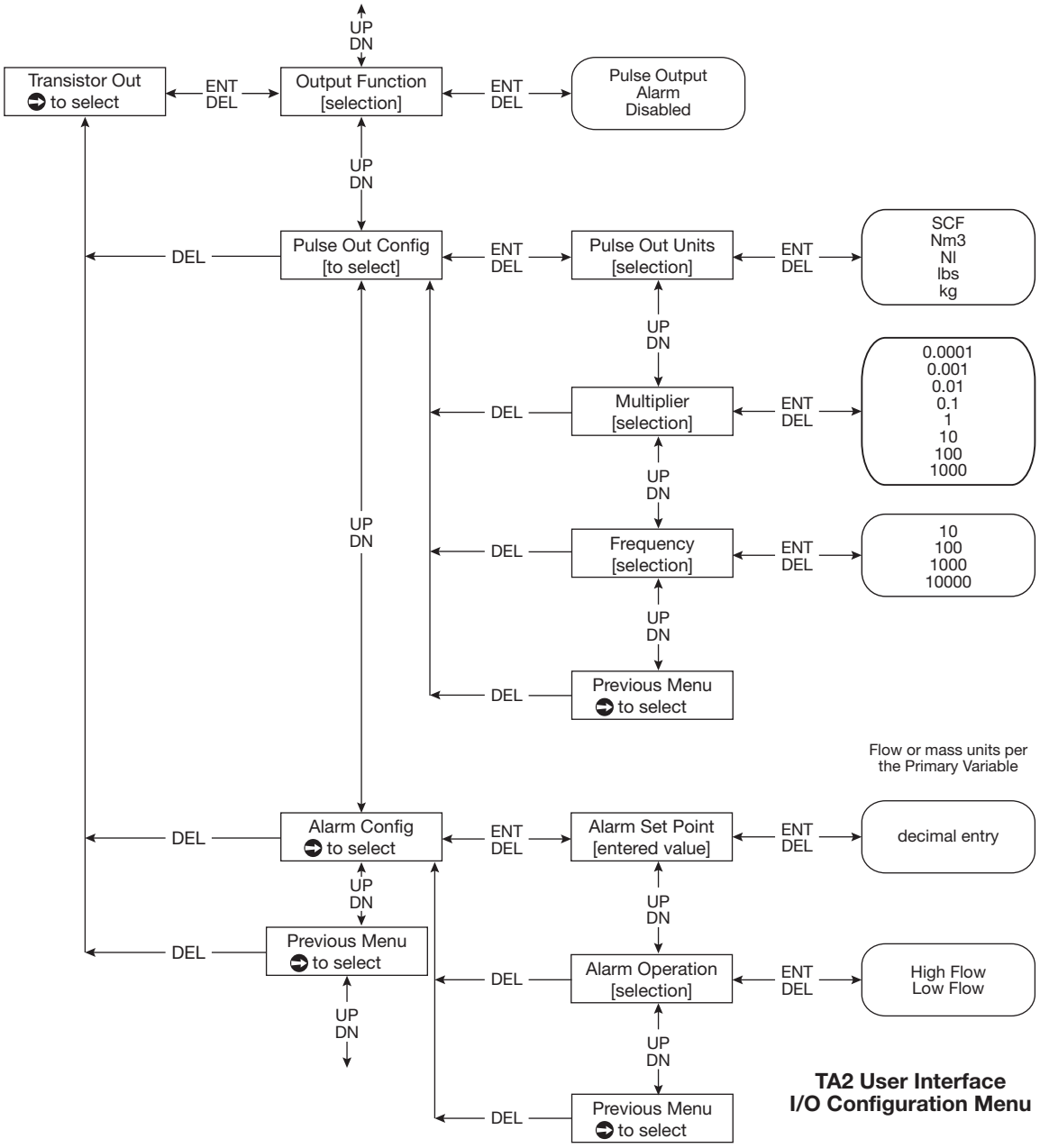
**Transistor output**

The optional transistor output can be configured to provide a pulse output proportional to the flow rate or an alarm indication where the output can serve as a low flow or a high flow alarm indication. When used as a pulse output a multiplier factor can be applied. A selection of maximum frequency ensures that the pulse output from the TA2 does not exceed the maximum allowable frequency of any external counter. The default is 10 KHz.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Output Function» → to select | Output function disabled | Press ↑ or ↓ to scroll through the options | Can be set up for «Pulse Output», «Alarm» or «Disabled» |
| «Pulse Out Config → to select» → to select | Pulse Output Configuration | | Pulse rate calculation example: see appendix C |
| | | «Pulse Output Units» | Choice between Standard Cubic Feet «SCF», Normal cubic meters «Nm3», Normal liters «Nl», pounds «LB» or kilograms «KG» Press →; press ↑ or ↓ to scroll through the options |
| | | «Multiplier XXXX» | Lowest 0.0001; highest 1000 Press →; press ↑ or ↓ to scroll through the options |
| | | Frequency output «Frequency XXXX» | Should match the maximum input frequency of the external counter/totalizer. Press → to confirm |
| | | Return to previous menu «Previous Menu», press → to confirm | |
| «Alarm Config → to select» → to select | Alarm configuration | Press ↑ or ↓ to scroll | |
| | | «Alarm Set Point XXXX» | Enter the set point. Units will be the same as chosen in AO1. Press → to confirm |
| | | «Alarm Operation» → to select | Choice between «Low Flow» or «High Flow», press → to confirm |
| | | «Previous Menu → to select» → to select | Returns to previous menu |
| «Previous Menu → to select» → to select | Previous menu | | Returns to previous menu |

**Damping**

Increasing the Damping will smooth the TA2 display and the loop output. This may be used in cases when turbulence is causing fluctuations in the measurement.
The damping value is expressed in time constants. A one-second time constant means that with a step change in flow, the measured flow value will reach approximately 63 % of the new value in one second and approximately 99 % of the new value in five seconds. The lower limit is 0 which means no damping (other than the inherent response time of the sensor); the upper limit is 15 seconds.



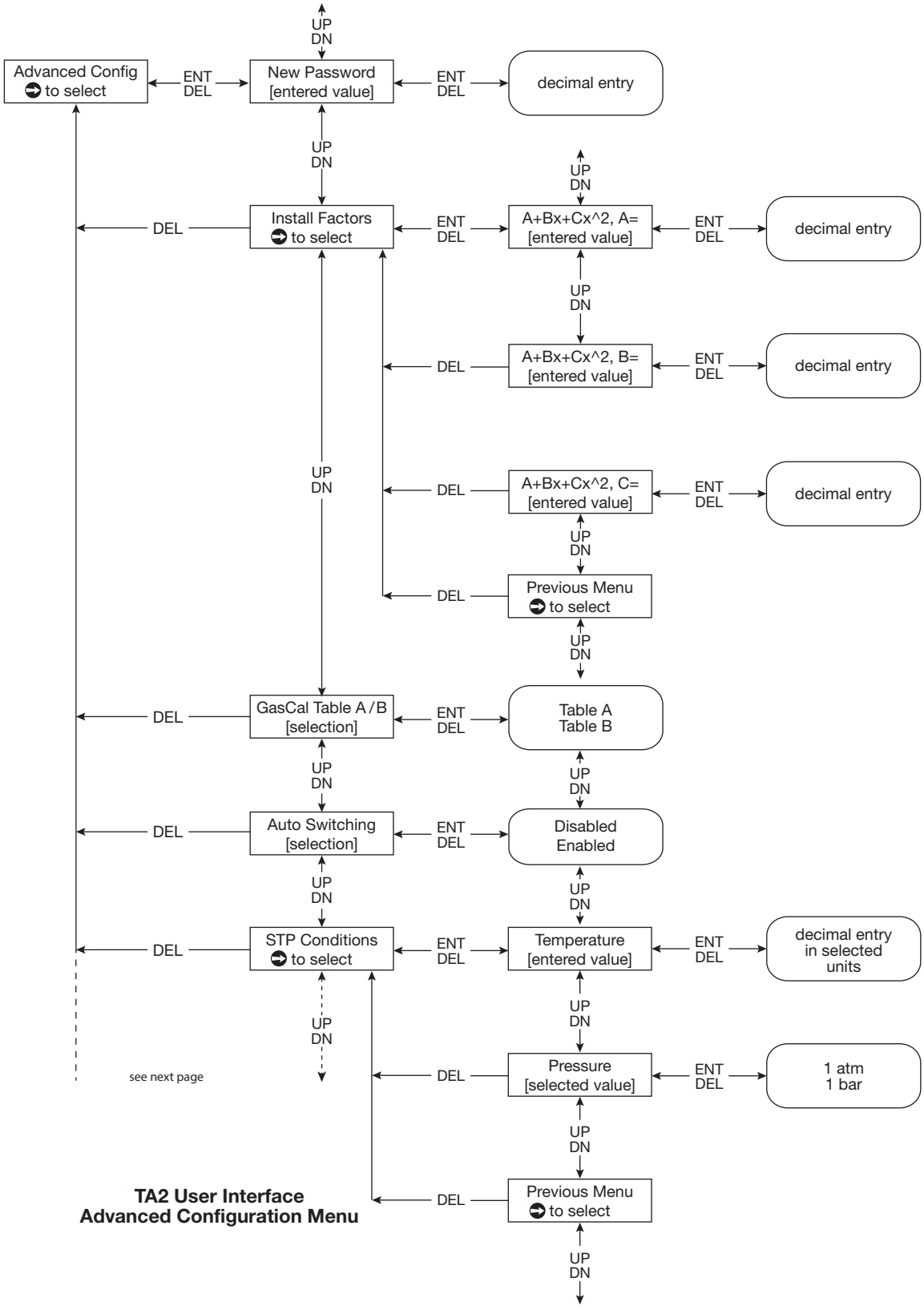

**TA2 User Interface**
**I/O Configuration Menu**

### Advanced Configuration

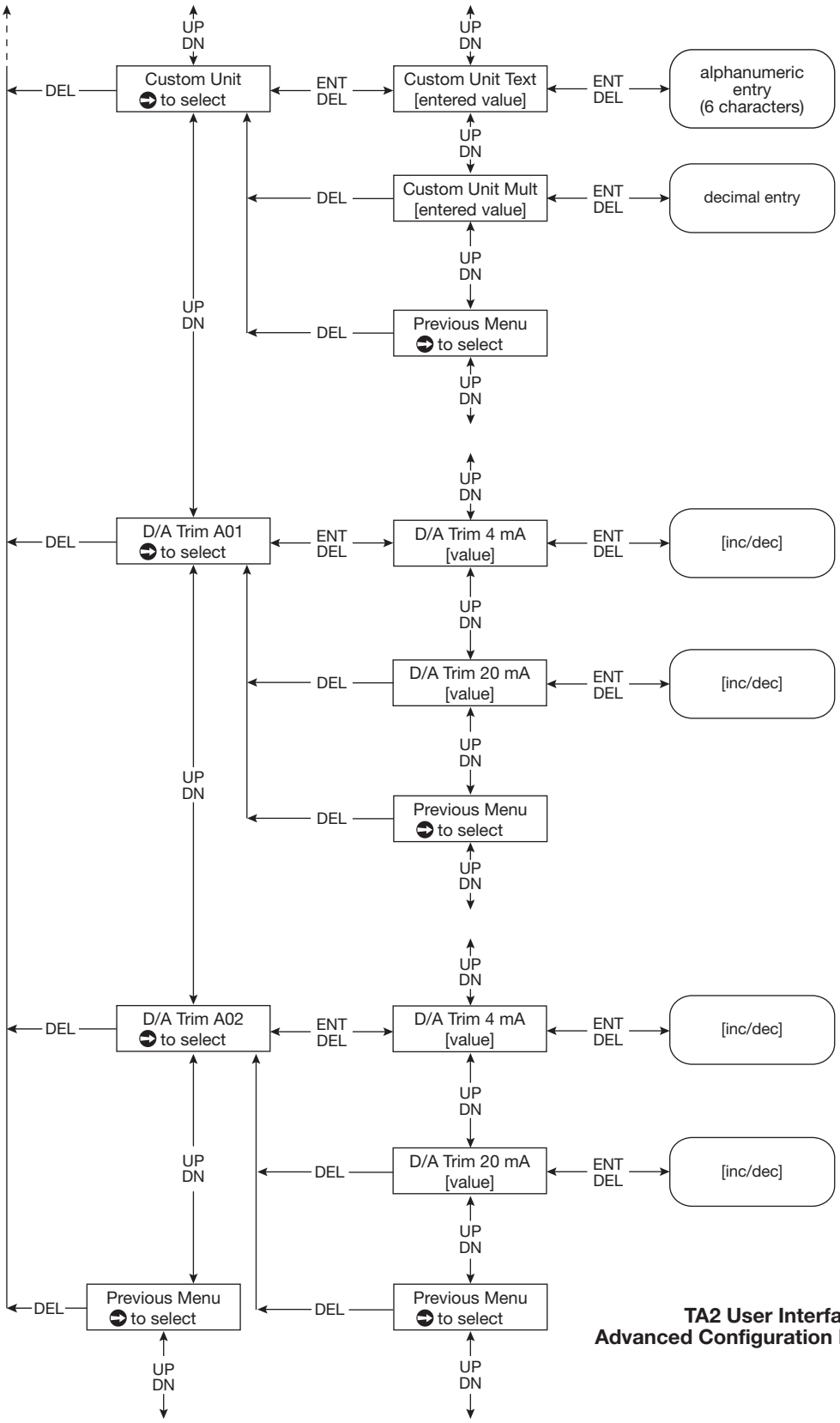
The Advanced configuration menu sets advance parameters not normally used in the operation of the instrument. To access Advanced Configuration, scroll ↑ or ↓ until the display shows «Adv Config», press →.

| Display | Item | Action | Comments |
|---|---|---|---|
| «New Password → to select» → to select | Change password | Enter New Password | Change the instrument password |
| «Install Factors → to select» → to select | Install factors | Enter new values for A, B & C | Permits user to adjust flow measurement* |
| «GasCal Table A/B → to select» → to select | Gas calibration | ↑ or ↓ to choose A or B | Allows selection for 2 different gasses or 2 different ranges for the same gas |
| «Auto Switching → to select» → to select | Allow automatic switching between a low flow Table A and a high flow Table B. | ↑ or ↓ to choose Disabled/Enabled | It is necessary to have a dual calibration and distinct flow rate differences between tables in order to perform switching function. |
| «STP Conditions → to select» → to select | Standard temperature and pressure conditions | Enter value for Standard Temperature and select Standard Pressure value | Permits user to change STP (Standard Temperature and Pressure) conditions |
| «Custom Unit → to select» → to select | Customised input | Press ↑ or ↓, then → to enter option | |
| | | «Custom Units Text», enter max 6 characters | Allows the user to create any desired units of flow measurement |
| | | «Custom Units Mult» | Allows the user to calculate the «Custom Unit» value |
| | | «Previous Menu → to select» → to select | Return to previous menu |
| «D/A Trim A01 → to select» → to select | | Press ↑ or ↓, then → to enter and adjust 4 mA or 20 mA point | Allows to fine tune the 4mA and 20 mA points for the first gas or first range using the ↑ or ↓ |
| «D/A Trim A02 → to select» → to select | | Press ↑ or ↓, then → to enter and adjust 4 mA or 20 mA point | Allows to fine tune the 4mA and 20 mA points for the second gas or second range using the ↑ or ↓ |
| «Previous Menu → to select» → to select | Previous menu | | Returns to previous menu |

* **Installation factor:** Changes in flow profile will affect the measurements of the TA2. Advanced users have the ability to adjust the measurements for changes in flow profile using a polynomial relationship in the form of:
Corrected flow = $A+Bv+Cv^2$
v = velocity in SFPM (Standard feet/min.). Contact Magnetrol for calculations to determine these factors.
The default is B = 1; and A and C = 0. To use the correction factor, develop a relationship between the flow measured by the TA2 and the flow measured by a second flowmeter. Curve fit the second order polynomial (above) using the output of the TA2 and the output of the second flowmeter for corrected flow. Then enter the appropriate values in the Advanced Configuration menu.




**TA2 User Interface**
**Advanced Configuration Menu**



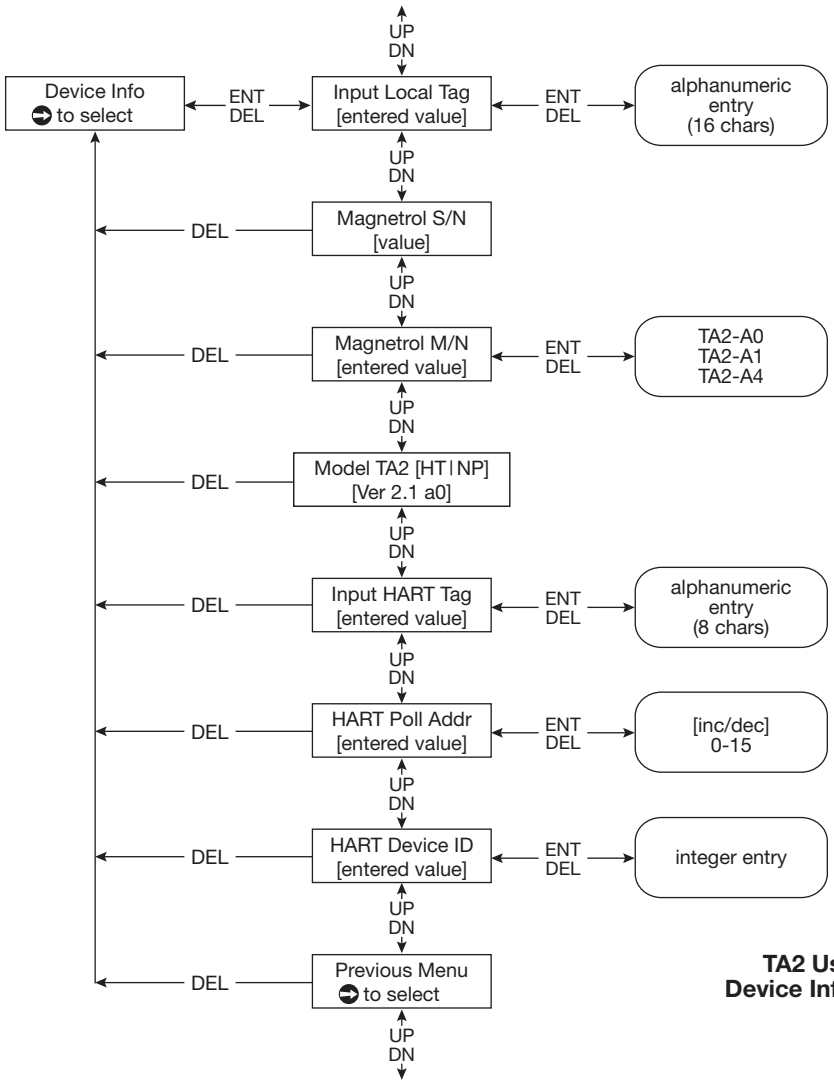

Secondary loop configuration is only available on units which have this option.

**TA2 User Interface**
**Advanced Configuration Menu (cont)**

## Device information

The menu is used to display information about the device.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Input Local Tag» | Magnetrol TA2 | Press ➔ to change the tag | The default can be changed to describe the application or transmitter number. Max.16 characters |
| «Magnetrol S/N» | Magnetrol serial number | | This number is needed if information on the device is needed in the future. |
| «Magnetrol M/N» | Magnetrol Model number | | Displays the number that is used by the firmware. |
| «Model TA2 [ ]» | Firmware version | | Displays the firmware version used. |
| «Input HART Tag» | HART Tag | Press ➔ to add HART Tag | Max. 8 digits and only visible on units with HART. |
| «HART Poll Addr» | HART Poll Adress | Press ➔ to add the address | Number from 0 to 15. Enter 0 for a single installation. Enter 1-15 for a multi-drop installation. Default value is 0. Only visible on units with HART. |
| «HART Device ID» | HART identification number | Press ➔ to add identification number | Required for units with HART. Only visible on units with HART |
| «Previous Menu ➔ to select» ➔ to select | Previous menu | | Returns to previous menu |



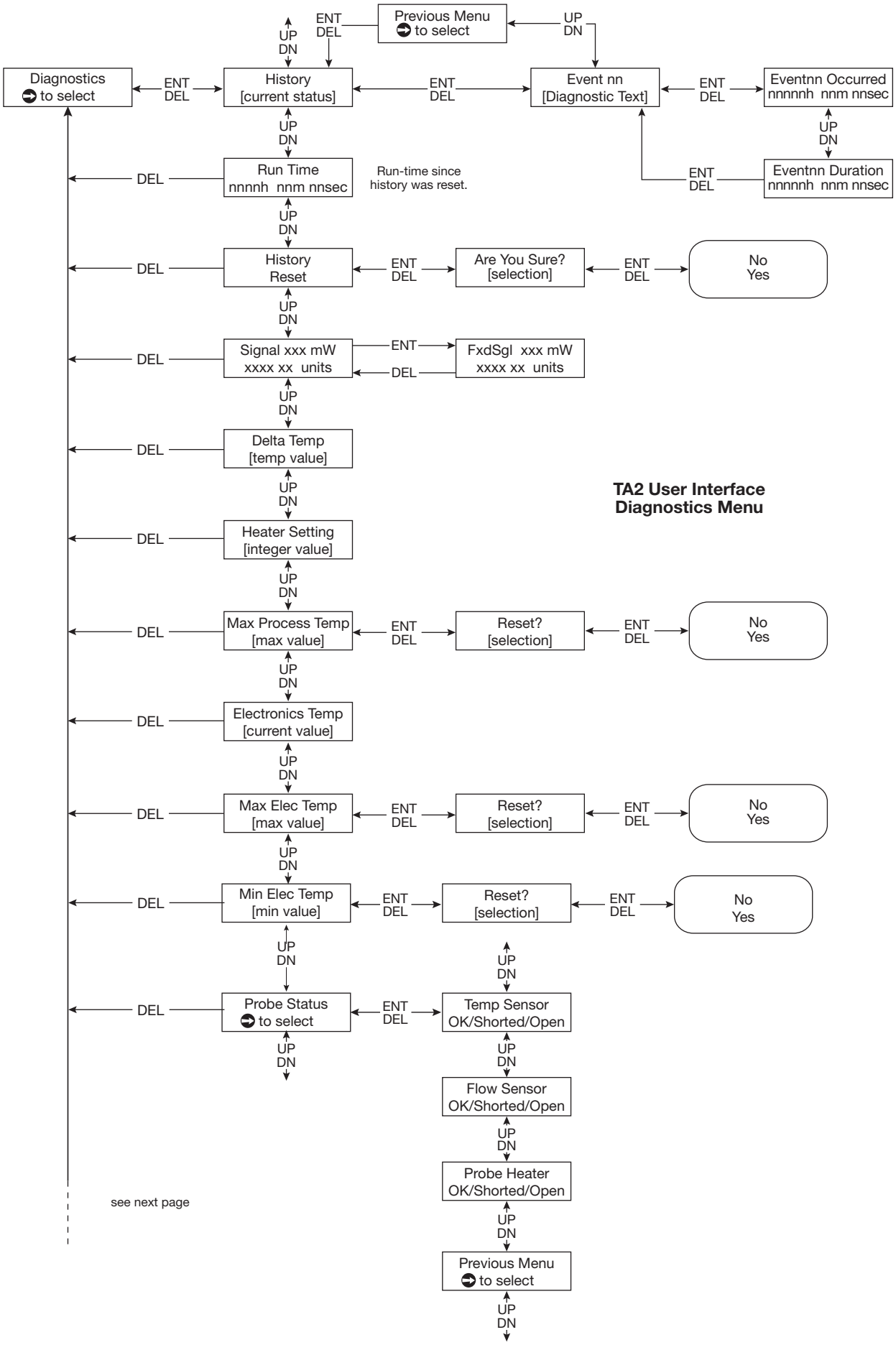

HART configuration is available on units which have HART on the primary loop.

**TA2 User Interface**
**Device Information Menu**

### Diagnostics Menu

The «Diagnostics» menu contains both informational items and diagnostic screens that can assist in obtaining information on the operation of the unit and troubleshooting if faults or warnings occur.

| Display | Item | Action | Comments |
|---|---|---|---|
| «History» | History | Press → to view diagnostics | Each event is indicated with an event number. The most recent event is shown first |
| «Run Time» | | | Elapsed time since «History» was last reset |
| «History Reset» | Resetting history log | Press → to reset | |
| «Signal» | Live signal reading | Press → to view «Fixed Signal». Then pressing ↑ or ↓ permits to change the signal. | Provides a mW reading and the calculated flow rate |
| «Delta Temp» | Temperature difference | | Displays the temperature difference between the 2 RTD's |
| «Heater Settings» | Current value | | Current value as sent to the heater |
| «Max Process Temp» | Maximum process temperature | Press → to reset the recorded temperature | Displays the maximum temperature recorded by the sensor |
| «Electronics Temp» | Electronics temperature | | Displays current temperature in the enclosure |
| «Max Elec Temp» | Recorded maximum temperature | Press → to reset the maximum recorded temperature | Displays the maximum temperature in the housing |
| «Min Elect Temp» | Recorded minimum temperature | Press → to reset the minimum recorded temperature | Displays the minimum temperature in the housing |
| «Probe Status<br>→ to select»<br>→ to select | Probe status | | «OK» means the probe is operational, «Shorted» or «Open» means there is a problem. Consult Magnetrol if a problem is noted. |

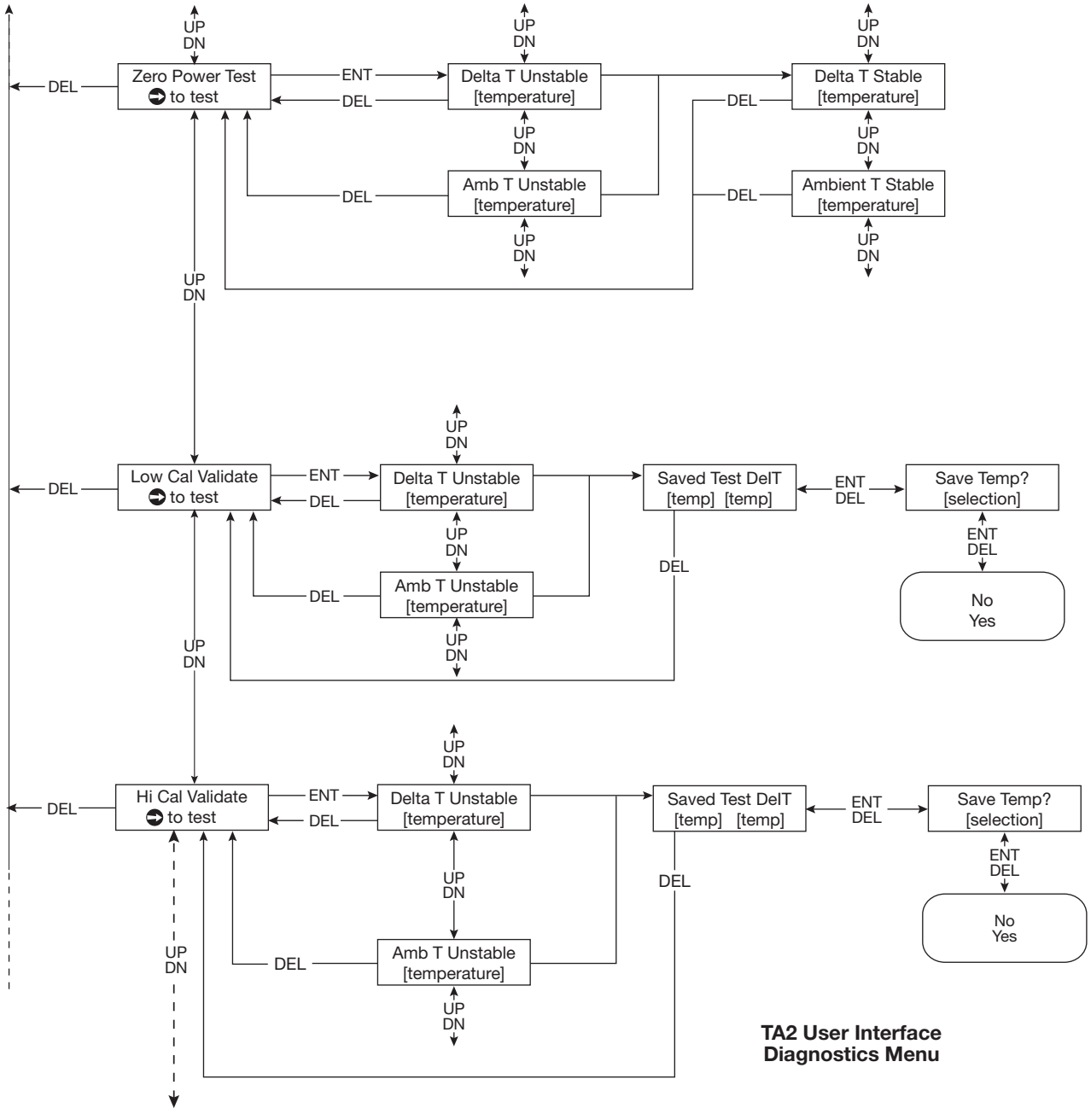



**TA2 User Interface**
**Diagnostics Menu**

### Diagnostics Menu

The «Diagnostics» menu contains both informational items and diagnostic screens that can assist in obtaining information on the operation of the unit and troubleshooting if faults or warnings occur.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Zero Power Test<br>→ to test»<br>→ to select | | | Output signals will be disabled and the heater turned off. Temperature difference between the sensors will be shown. |
| «Low Cal Validate<br>→ to test»<br>→ to select | Low calibration validation | Press → to display temperature differences | Verifies that the heat transfer characteristics have not changed and the unit is still within calibration. |
| «Hi Cal Validate<br>→ to select»<br>→ to select | Hi calibration validation | Press → to display temperature differences | |

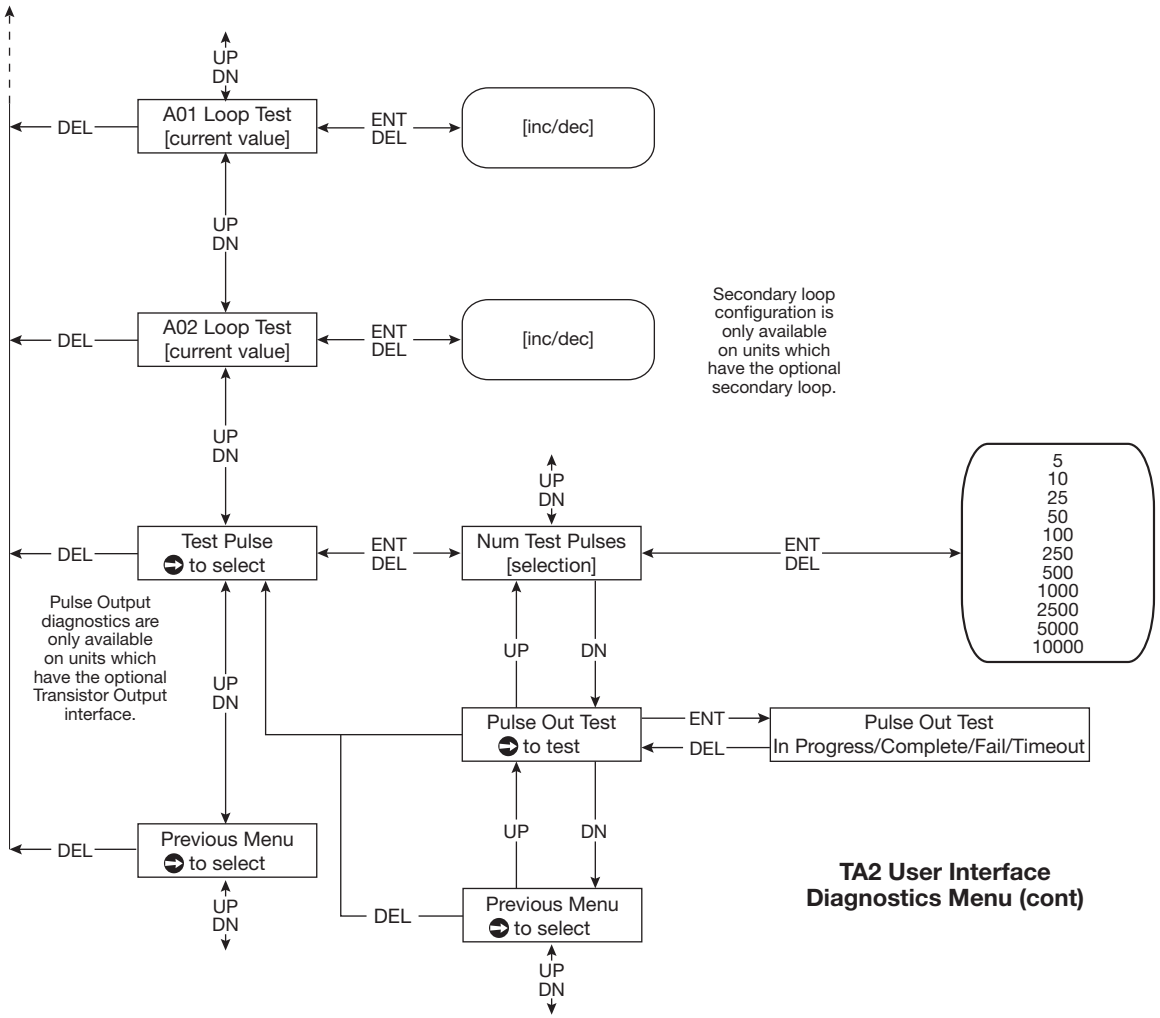



**TA2 User Interface Diagnostics Menu**

## Diagnostics Menu

The «DIAGNOSTICS» menu contains both informational items and diagnostic screens that can assist in obtaining information on the operation of the unit and troubleshooting if faults or warnings occur.

| Display | Item | Action | Comments |
|---|---|---|---|
| «A01 LOOP TEST» → to select | mA Value output | ↑ or ↓ to change output signal | |
| «A02 LOOP TEST» → to select | mA Value output | ↑ or ↓ to change output signal | Only shown on units that have the optional second mA loop. |
| «TEST PULSE → TO SELECT» → to select | Pulse output signal | ↑ or ↓ to set the number of pulses; then → to confirm. Press → to conduct test. | When the test is completed the number of pulses will be shown. Press two times → to return to previous menu. The device will «TIME OUT» and return to normal operation after 5 minutes. |




**TA2 User Interface Diagnostics Menu (cont)**

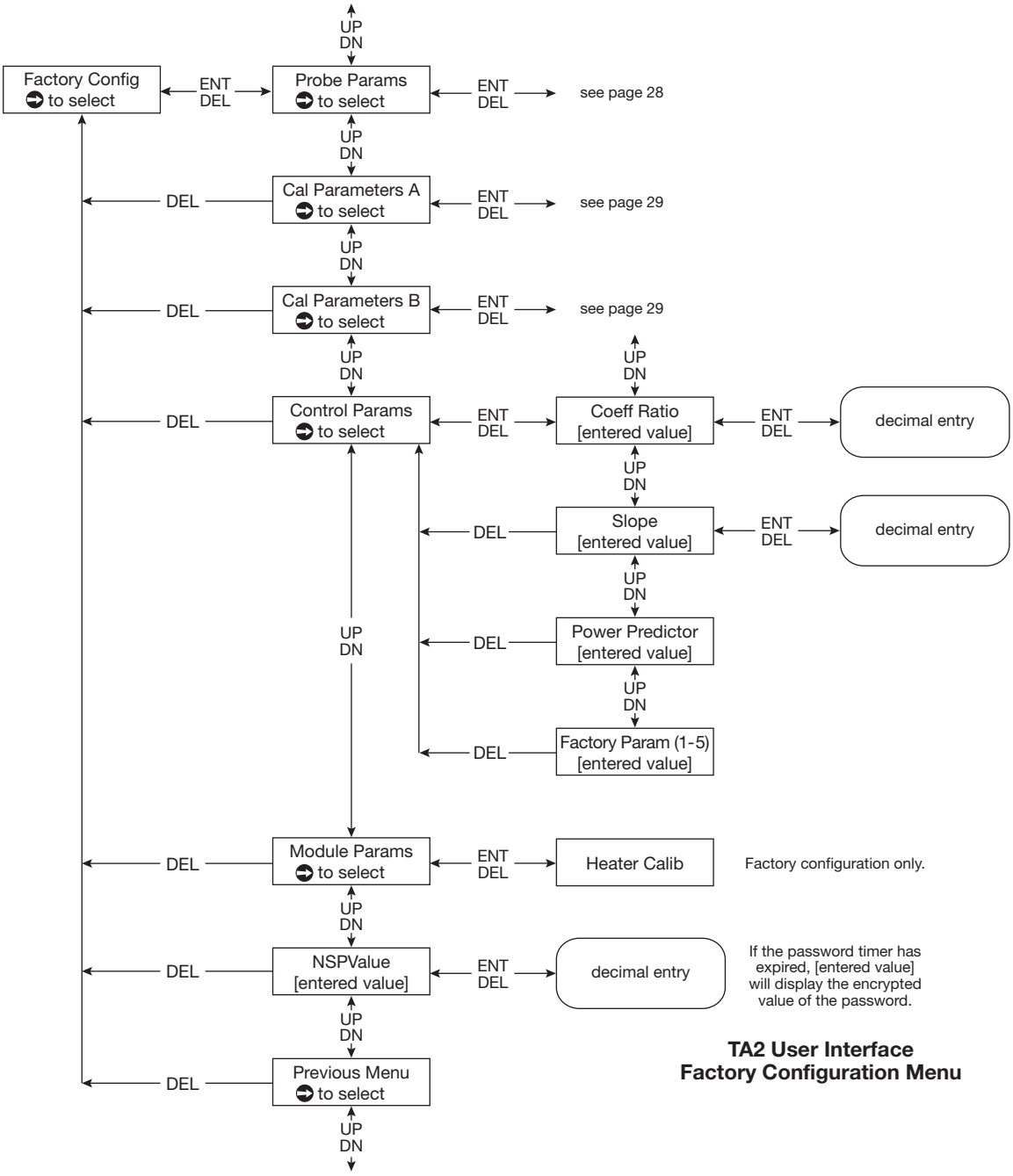
### Factory Configuration

The Factory Configuration is used during initial calibration of the instrument; access to this section is generally only required for review of the information.

To access Factory Configurations, scroll ↑ or ↓ until the display shows «Factory Config», press →.

Replacement of either the probe or the logic circuit board will require re-entry of calibration data. A replacement probe will be accompanied with a new calibration certificate which will provide the new calibration information. Replacement of the logic circuit board will require re-entry of the original calibration data from the initial calibration certificate.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Probe Params<br>→ to select»<br>→ to select | Probe parameters | ↑ or ↓ to scroll through entries | These factors will require changing if probe is replaced. |
| «Cal Parameters A<br>→ to select»<br>→ to select | Parameters gas A | ↑ or ↓ to scroll through entries and compare against data on the calibration certificate | These factors will require changing if probe is replaced. |
| «Cal Parameters B<br>→ to select»<br>→ to select | Parameters gas B or second range | ↑ or ↓ to scroll through entries and compare against data on the calibration certificate | These factors will require changing if probe is replaced. |
| «Control Parameters<br>→ to select»<br>→ to select | Control parameters | ↑ or ↓ to scroll through entries and compare against data on Calibration Certificate | These factors will require changing if probe is replaced. |
| «Module Params<br>→ to select»<br>→ to select | Module parameters | Scroll through entries | These are factory set values and should not be changed. |
| «NSP Value» | Password | | Set by Magnetrol |
| «Previous menu<br>→ to select»<br>→ to select | Previous menu | | Returns to previous menu or cycle through Factory Configuration. |

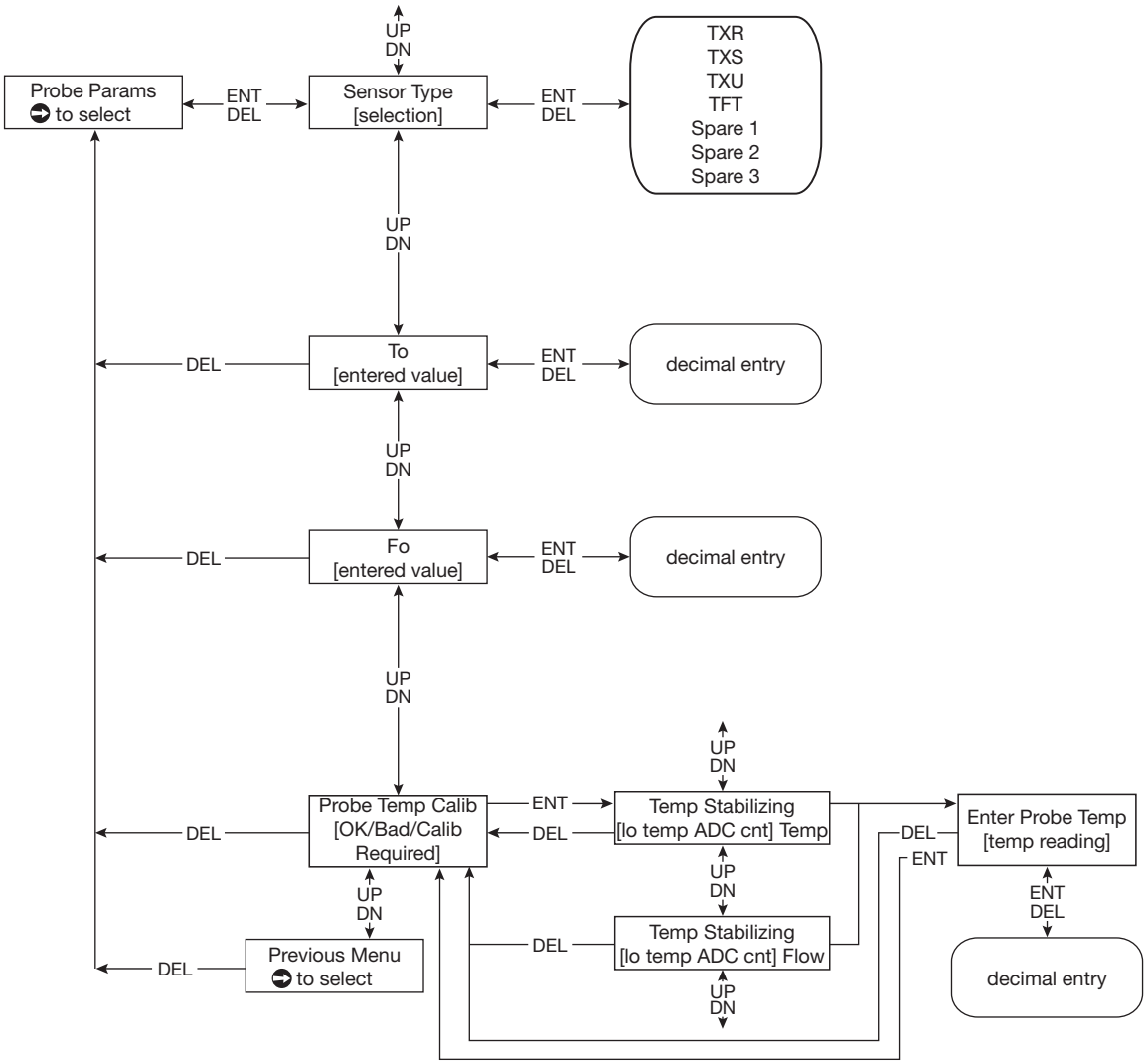



**TA2 User Interface**
**Factory Configuration Menu**

### Probe parameters

To access Probe parameters first enter Factory Configuration, then ↑ or ↓ until the display shows «Probe Params», press → to enter.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Sensor Type» → to enter | Sensor type | ↑ or ↓ to select type | «TXR», «TXS», «TXU», «TFT», «Spare 1», «Spare 2», «Spare 3» can be selected |
| «To» | | | Calibration parameter determined when calibrating the RTD's |
| «Fo» | Low calibration validation | Press → to display temperature differences | Calibration parameter determined when calibrating the RTD's |
| «Probe Temp Calib» | Hi calibration validation | Press → to display temperature differences | Used during calibration of the RTD's |
| «Previous Menu → TO SELECT» → to select | Previous menu | | Returns to previous menu |



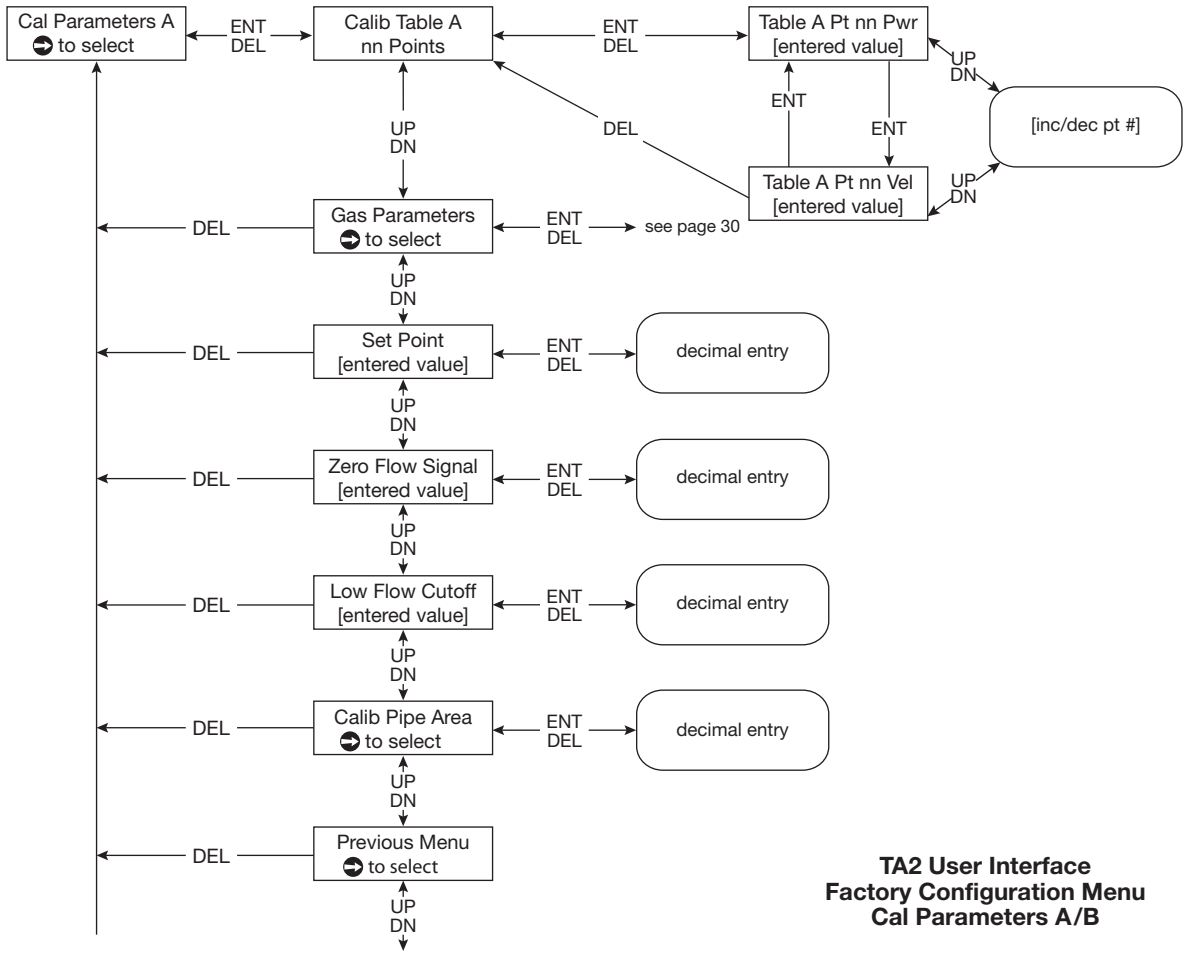

**TA2 User Interface**
**Factory Configuration Menu**
**Probe Parameters**

### Calibration parameters

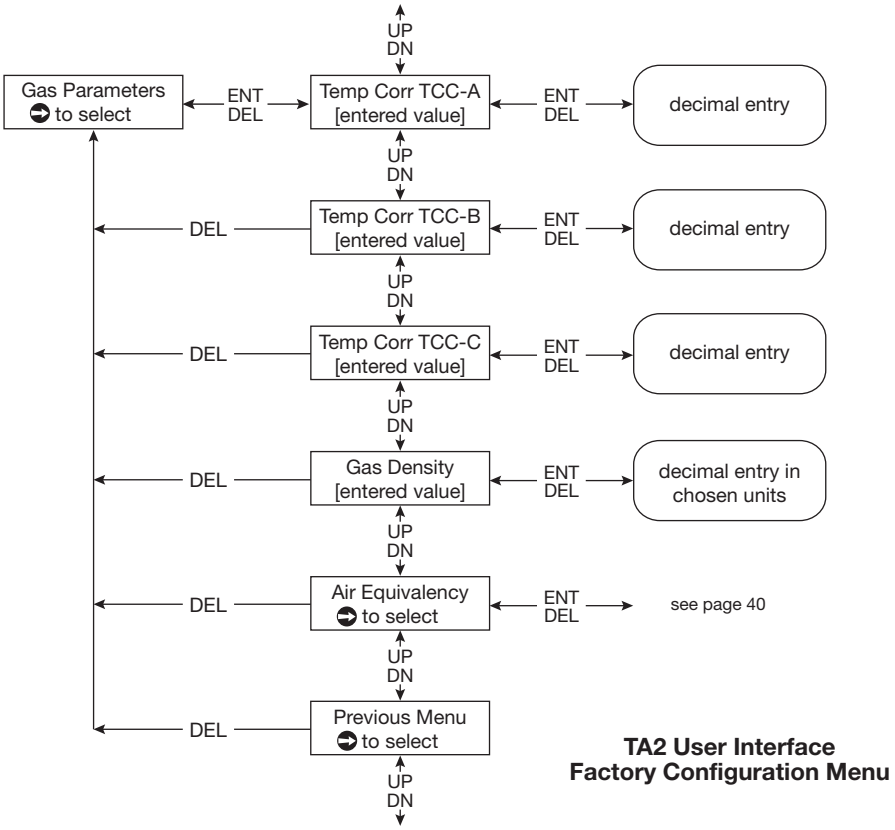
There are two separate menus for calibration parameters titled «Cal Parameters A» and «Cal Parameters B». These two different sets of calibration are used when the TA2 is calibrated on two gases or two different ranges. If the unit is calibrated for air, then only «Cal Parameters A» is used. If calibrated for a different gas then the calibration parameters for the specified gas is contained in «Cal Parameters A», the air calibration is contained in «Cal Parameters B».

«Cal Parameters A» and «Cal Parameters B» have an identical menu structure.

| Display | Item | Action | Comments |
|---|---|---|---|
| «Calib Table A<br>Nn Points» | Calibration table respective gas | | Provides actual calibration data points |
| «Gas Parameters<br>→ to select»<br>→ to select | | ↑ or ↓ to scroll through parameters | |
| | | «Temp Corr TCC-A», «Temp Corr TCC-B», «Temp Corr TCC-C» | Gas specific factors for temperature compensation |
| | | «Gas density» | Provides gas density at STP conditions |
| | | «Air equivalency» | Factors relating the relationship of the gas flow to the flow of air |
| «Set Point»<br>→ to select | Temperature difference | Only to be changed by Magnetrol | Indicates temperature difference the device is attempting to maintain |
| «Zero Flow Signal»<br>→ to select | Zero flow data point | | Used to adjust data point for application specific related issues |
| «Low Flow Cutoff»<br>→ to select | Low flow limit | Enter the limiting value using ↑ or ↓. Confirm by pressing two times →. | Flow rates below this value will be ignored. |
| «Calib Pipe Area» | Calibration of the pipe area | Enter the flow area using ↑ or ↓. Confirm by pressing two times →. | |
| «Previous Menu<br>→ to select»<br>→ to select | Previous menu | | Returns to previous menu |




**TA2 User Interface**
**Factory Configuration Menu**
**Cal Parameters A/B**



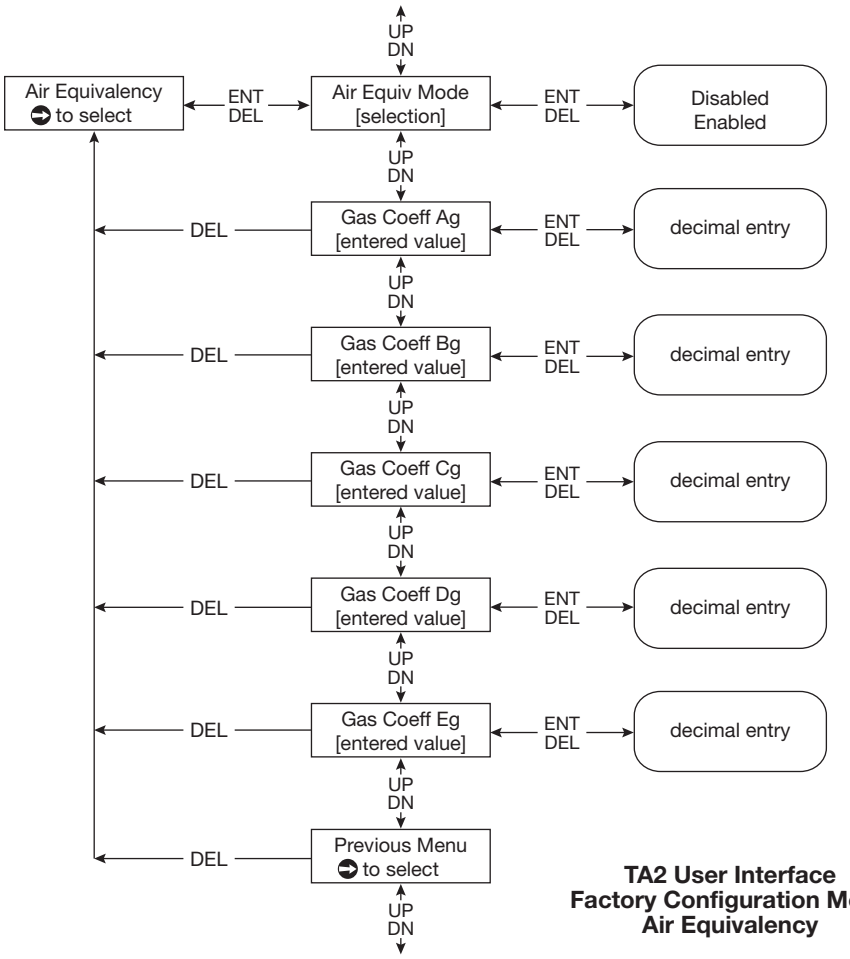

**TA2 User Interface**
**Factory Configuration Menu**

Gas Parameters menu exists for both Gas A and Gas B

## Air equivalency

To access «AIR EQUIVALENCY», press ➔.

| Display | Item | Action | Comments |
|---|---|---|---|
| «AIR EQUIV MODE»<br>➔ to enter | Air equivalency mode | ↑ or ↓ to enable or disable the mode | |
| «GAS COEFF AG»<br>To<br>«GAS COEFF EG»<br>➔ to enter | | Enter values using ↑ or ↓ | Polynomal equation used: $A+Bv+Cv^2+Dv^3+Ev^4$ where v is mass velocity. Contact Magnetrol for factors. |

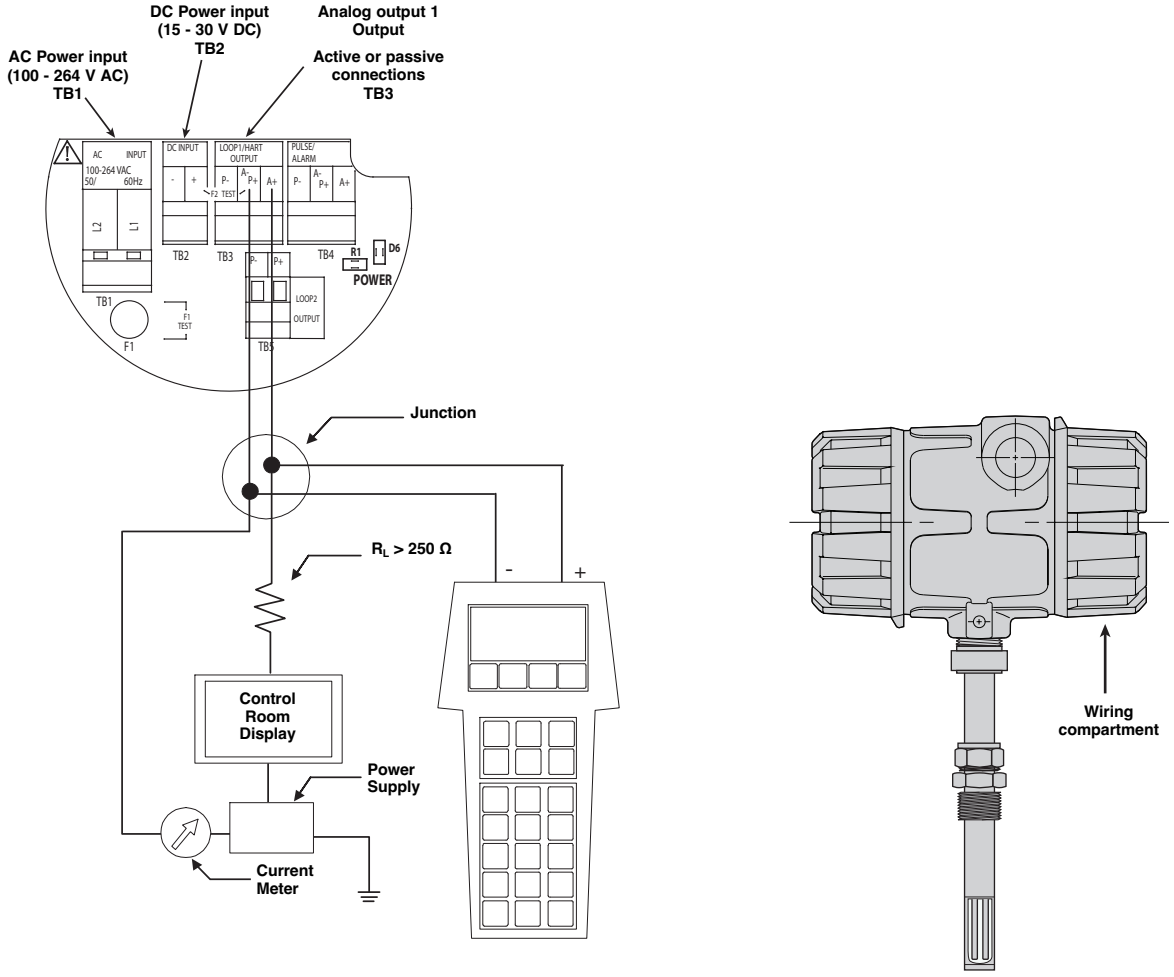



**TA2 User Interface**
**Factory Configuration Menu**
**Air Equivalency**

Air Equivalency menu exists for both Gas A and Gas B

## CONNECTIONS

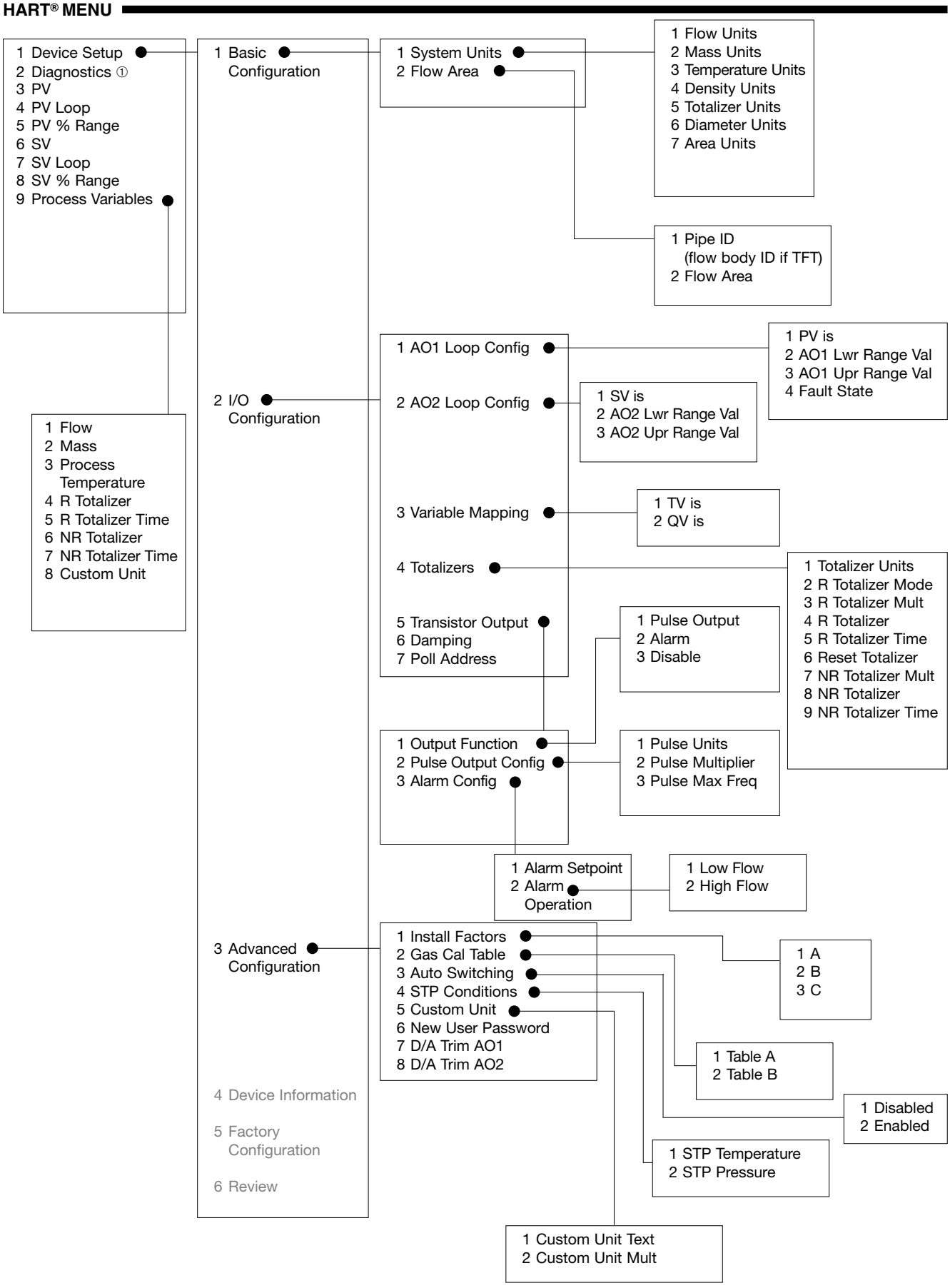
**IMPORTANT**: The digital HART® communication is superimposed on the 4-20 mA output and requires a min. load resistance of 250 Ω and a max load resistance of 1000 Ω.




To confirm HART® handheld communications, attach the unit as shown in the illustration. If the communicator reads GENERIC on the first two lines, then the HART® handheld does not contain the current DDs (Device Descriptions) for the TA2 meter. Contact your local HART® Service Center

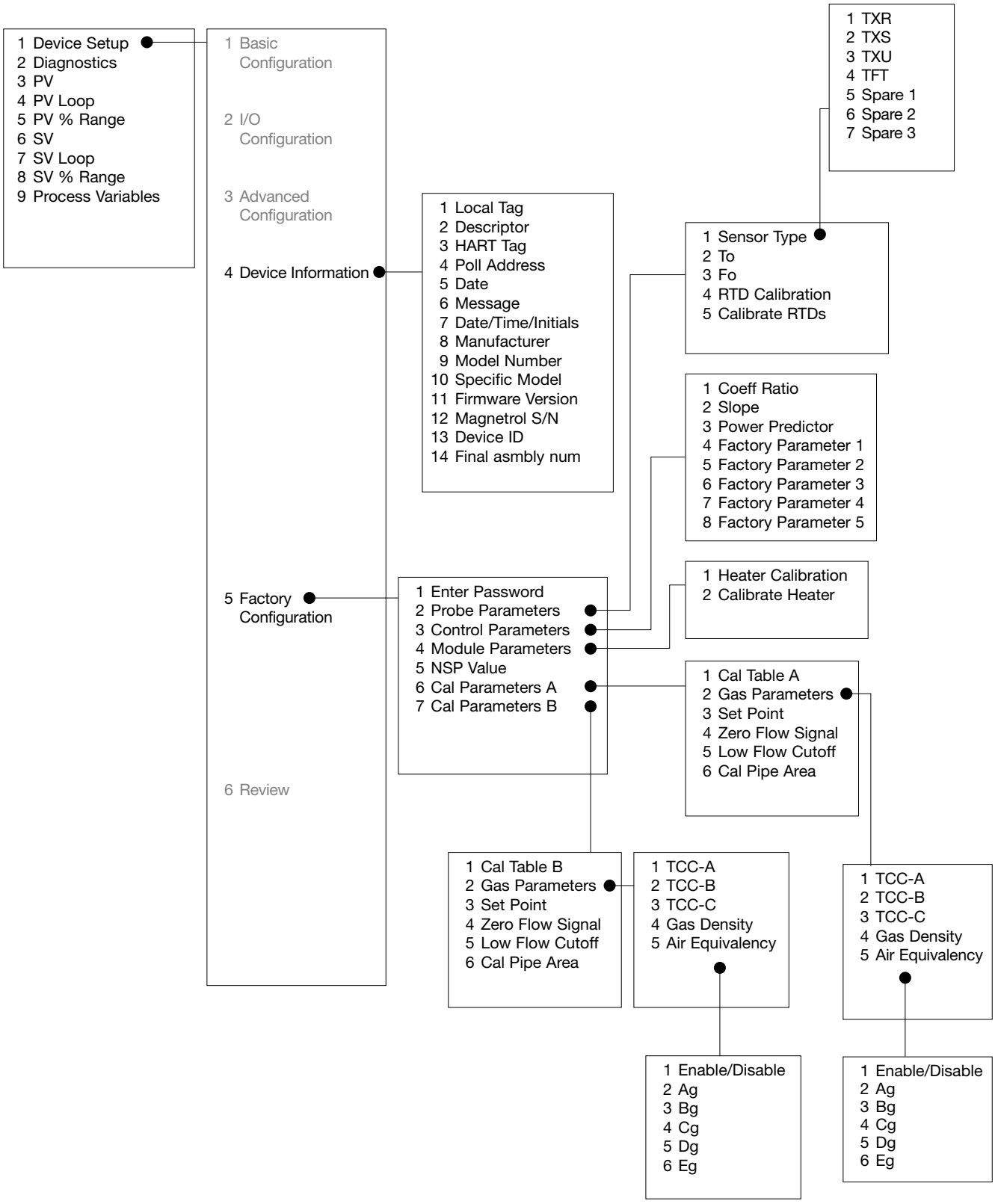
| HART Version | HCF Release Date | Compatible with TA2 Software |
|---|---|---|
| Dev V2 DD V1 | January 2015 | Version 2.1a0 |

## HART® MENU

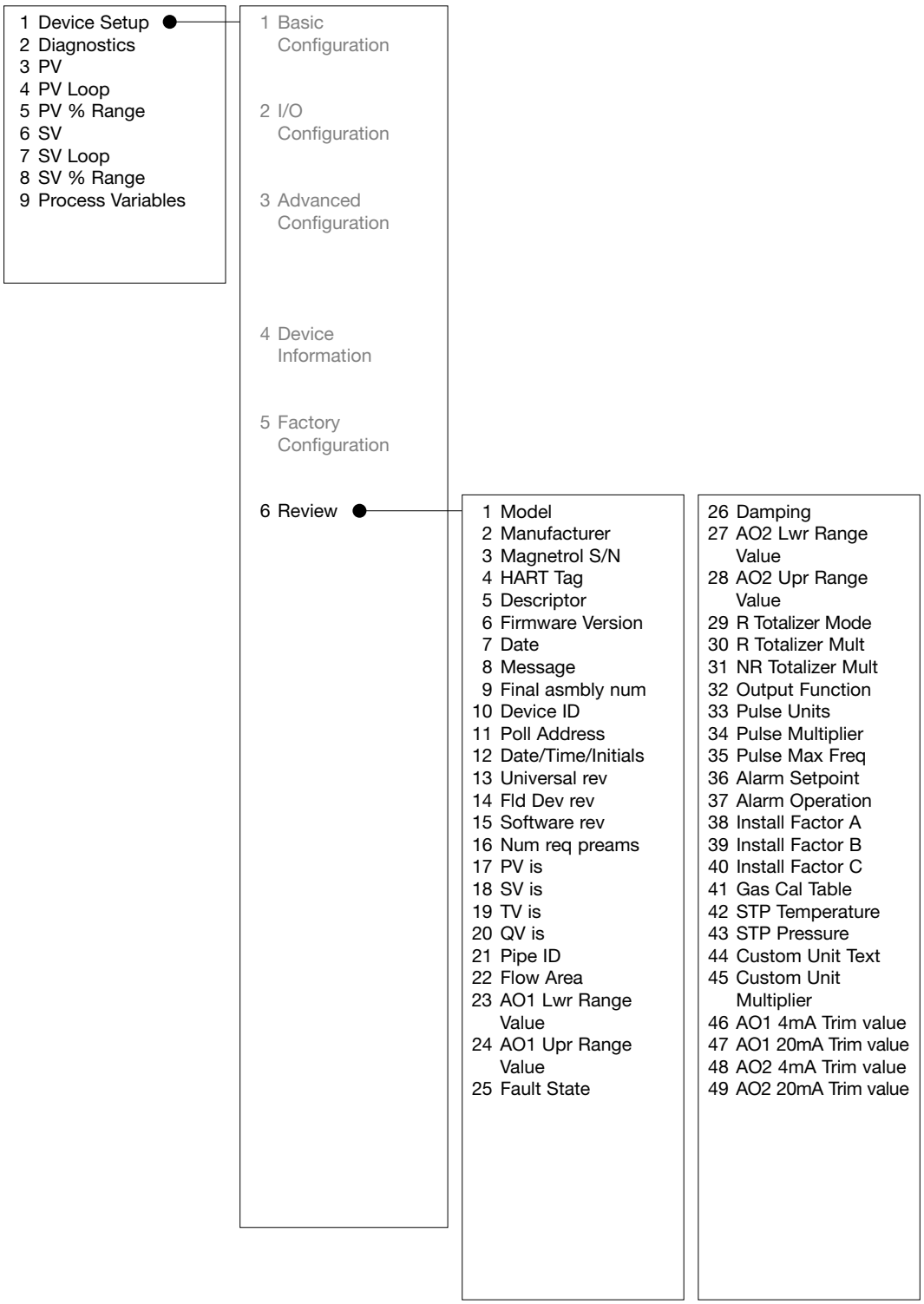



① See page 36.

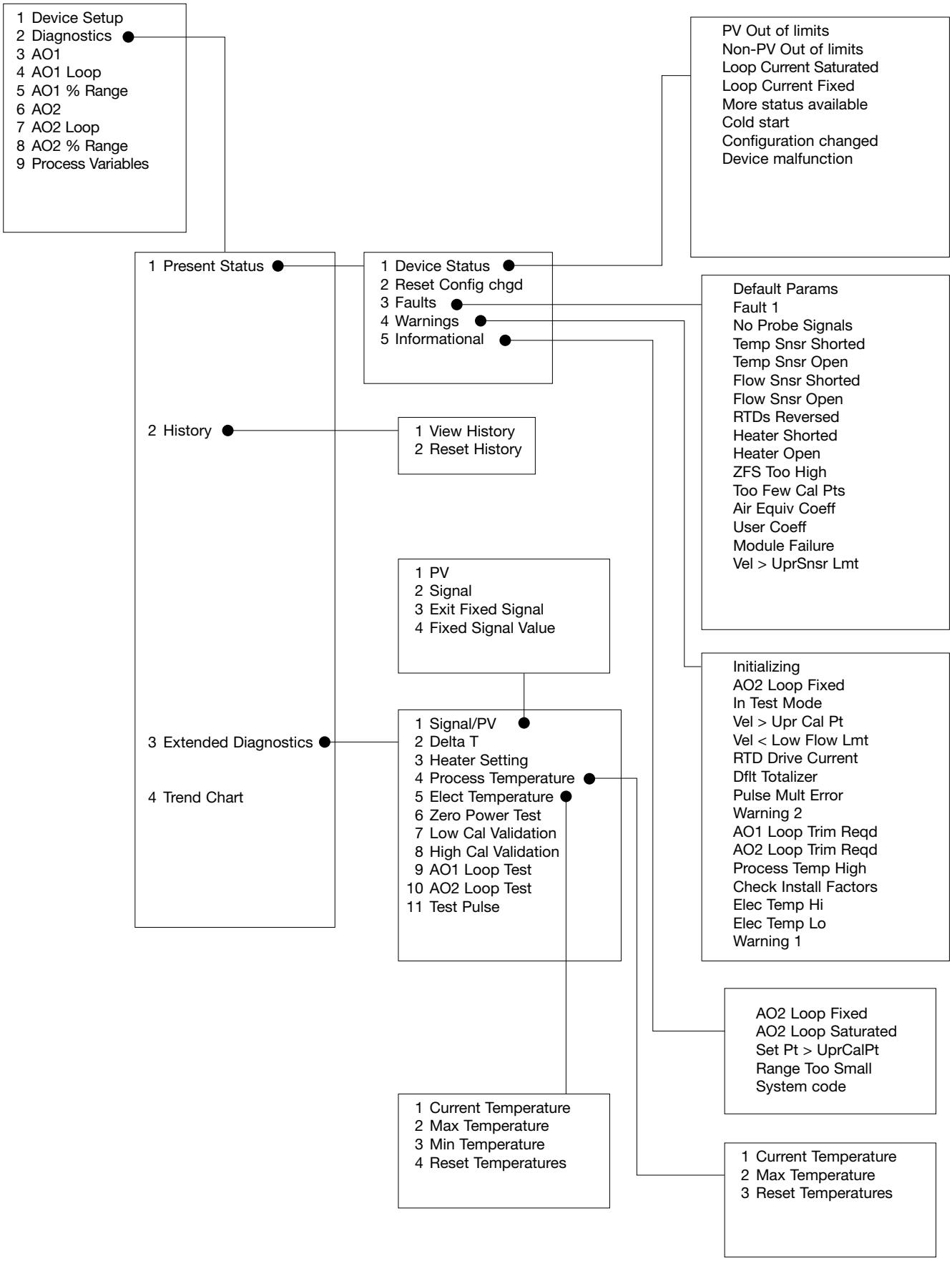
## HART® MENU


1 Device Setup
2 Diagnostics
3 PV
4 PV Loop
5 PV % Range
6 SV
7 SV Loop
8 SV % Range
9 Process Variables
1 Basic Configuration
2 I/O Configuration
3 Advanced Configuration
4 Device Information
5 Factory Configuration
6 Review
1 Local Tag
2 Descriptor
3 HART Tag
4 Poll Address
5 Date
6 Message
7 Date/Time/Initials
8 Manufacturer
9 Model Number
10 Specific Model
11 Firmware Version
12 Magnetrol S/N
13 Device ID
14 Final asmbly num
1 Enter Password
2 Probe Parameters
3 Control Parameters
4 Module Parameters
5 NSP Value
6 Cal Parameters A
7 Cal Parameters B
1 Sensor Type
2 To
3 Fo
4 RTD Calibration
5 Calibrate RTDs
1 TXR
2 TXS
3 TXU
4 TFT
5 Spare 1
6 Spare 2
7 Spare 3
1 Coeff Ratio
2 Slope
3 Power Predictor
4 Factory Parameter 1
5 Factory Parameter 2
6 Factory Parameter 3
7 Factory Parameter 4
8 Factory Parameter 5
1 Heater Calibration
2 Calibrate Heater
1 Cal Table A
2 Gas Parameters
3 Set Point
4 Zero Flow Signal
5 Low Flow Cutoff
6 Cal Pipe Area
1 Cal Table B
2 Gas Parameters
3 Set Point
4 Zero Flow Signal
5 Low Flow Cutoff
6 Cal Pipe Area
1 TCC-A
2 TCC-B
3 TCC-C
4 Gas Density
5 Air Equivalency
1 TCC-A
2 TCC-B
3 TCC-C
4 Gas Density
5 Air Equivalency
1 Enable/Disable
2 Ag
3 Bg
4 Cg
5 Dg
6 Eg
1 Enable/Disable
2 Ag
3 Bg
4 Cg
5 Dg
6 Eg

## HART® MENU


1 Device Setup
2 Diagnostics
3 PV
4 PV Loop
5 PV % Range
6 SV
7 SV Loop
8 SV % Range
9 Process Variables
1 Basic Configuration
2 I/O Configuration
3 Advanced Configuration
4 Device Information
5 Factory Configuration
6 Review
1 Model
2 Manufacturer
3 Magnetrol S/N
4 HART Tag
5 Descriptor
6 Firmware Version
7 Date
8 Message
9 Final asmbly num
10 Device ID
11 Poll Address
12 Date/Time/Initials
13 Universal rev
14 Fld Dev rev
15 Software rev
16 Num req preams
17 PV is
18 SV is
19 TV is
20 QV is
21 Pipe ID
22 Flow Area
23 AO1 Lwr Range Value
24 AO1 Upr Range Value
25 Fault State
26 Damping
27 AO2 Lwr Range Value
28 AO2 Upr Range Value
29 R Totalizer Mode
30 R Totalizer Mult
31 NR Totalizer Mult
32 Output Function
33 Pulse Units
34 Pulse Multiplier
35 Pulse Max Freq
36 Alarm Setpoint
37 Alarm Operation
38 Install Factor A
39 Install Factor B
40 Install Factor C
41 Gas Cal Table
42 STP Temperature
43 STP Pressure
44 Custom Unit Text
45 Custom Unit Multiplier
46 AO1 4mA Trim value
47 AO1 20mA Trim value
48 AO2 4mA Trim value
49 AO2 20mA Trim value

## HART® MENU


1 Device Setup
2 Diagnostics
3 AO1
4 AO1 Loop
5 AO1 % Range
6 AO2
7 AO2 Loop
8 AO2 % Range
9 Process Variables
PV Out of limits
Non-PV Out of limits
Loop Current Saturated
Loop Current Fixed
More status available
Cold start
Configuration changed
Device malfunction
1 Present Status
1 Device Status
2 Reset Config chgd
3 Faults
4 Warnings
5 Informational
Default Params
Fault 1
No Probe Signals
Temp Snsr Shorted
Temp Snsr Open
Flow Snsr Shorted
Flow Snsr Open
RTDs Reversed
Heater Shorted
Heater Open
ZFS Too High
Too Few Cal Pts
Air Equiv Coeff
User Coeff
Module Failure
Vel > UprSnsr Lmt
2 History
1 View History
2 Reset History
1 PV
2 Signal
3 Exit Fixed Signal
4 Fixed Signal Value
Initializing
AO2 Loop Fixed
In Test Mode
Vel > Upr Cal Pt
Vel < Low Flow Lmt
RTD Drive Current
Dflt Totalizer
Pulse Mult Error
Warning 2
AO1 Loop Trim Reqd
AO2 Loop Trim Reqd
Process Temp High
Check Install Factors
Elec Temp Hi
Elec Temp Lo
Warning 1
3 Extended Diagnostics
1 Signal/PV
2 Delta T
3 Heater Setting
4 Process Temperature
5 Elect Temperature
6 Zero Power Test
7 Low Cal Validation
8 High Cal Validation
9 AO1 Loop Test
10 AO2 Loop Test
11 Test Pulse
4 Trend Chart
AO2 Loop Fixed
AO2 Loop Saturated
Set Pt > UprCalPt
Range Too Small
System code
1 Current Temperature
2 Max Temperature
3 Min Temperature
4 Reset Temperatures
1 Current Temperature
2 Max Temperature
3 Reset Temperatures

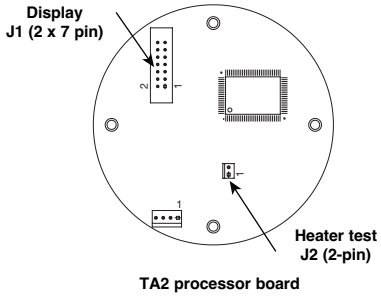
## DIAGNOSTICS TEST

The TA2 has several diagnostics tests which may be routinely performed. When conducting these tests, the reported flow rate will be zero.

### Heater setting

The amount of current flowing to the heater is displayed under Diagnostics/Heater Setting. This value can be verified by connecting a multi-meter across the Heater Bypass terminals (J2. This board can be accessed by opening the cover and removing the display module.

The measured value should match the value shown on the display. Any difference between the two values indicates that the heater calibration is incorrect. If the heater circuit is open, a nominal current value will be displayed, but the measured current will be zero.



TA2 processor board

### Zero power test

This test checks that the resistances of the RTDs have not changed. The heater is turned off and the temperature difference between the two sensors is compared. The test should be performed in a water bath (preferred) or under flowing conditions. Conducting this test in still air will cause the test to time out and provide inconclusive results.

The temperature difference between the two sensors is displayed. Typical values will match within 0.15 °C. Temperature difference may be as high as 0.5 °C depending upon test conditions. If greater than this value, contact the factory as drift in the RTDs may have occurred.

### Calibration verification procedure

The TA2 measures heat transfer. These procedures are designed to permit the user to verify the calibration by checking the heat transfer characteristics of the sensor. If the heat transfer characteristics are approximately the same when the test is conducted compared with when the same data was collected at the factory during the initial calibration, the unit remains in calibration.

The procedure is performed under two different sets of conditions. Both tests should be conducted at “room temperature”; approximately +21 °C to +30 °C (+70 °F to +85 °F). The test can be performed using the keypad and display, HART®, or PACT*ware*™ through the Diagnostics menu. During the test, the display (or HART® or PACT*ware*™) will provide an indication of the measured temperature difference and if the Delta T measurement is stable.

Low Flow Validate—Simulates a low flow condition.

1. Cover sensor tips to isolate from air currents. During the test, the heater power is set and the Delta T (temperature difference) between the two RTDs is measured.
2. After completion of the test, the value of the temperature difference measured during the test is compared against the previously stored value. (The original value obtained when the units were initially calibrated can be found on the original calibration certificate.)
3. The value from the test should compare with the stored (or original calibration value) within 1,5 °C. This variation in part is due to potential variations of the ambient temperature during the test and differences in test methods.

High Flow Validate—Simulates a high flow condition.

1. Support the TA2 vertically in a water bath. See picture below. During the test, the heater power is set and the Delta T (temperature difference) between the two RTDs is measured.
2. After completion of the test, the value of the temperature difference measured during the test is compared against the stored value. (The original value obtained when the units were initially calibrated can be found on the original calibration certificate.)
3. The value from the test should compare with the stored (or original calibration value) within 1,5 °C. This variation in part is due to potential variations of the ambient temperature during the test and differences in test methods.

If the temperature difference measured during the test is greater than the recommended temperature difference indicated above in item “3”, then the overall accuracy of the TA2 may be affected. Contact Magnetrol Technical support.

Watch the video for this procedure at www.magnetrol.com/thermalmassflow.

## Troubleshooting

| Symptom | Problem | Solution |
|---|---|---|
| **No output signal<br>No display** | No input power | Verify that LED D6 on the input wiring board is on. If not, check wiring connections. Check F1 test and F2 test to check fuses protecting input wiring. |
| **No output signal** | 4–20 mA output not operational | Verify that 4–20 mA connections are made to the correct terminals on TB3. |
| **Flow measurement on display is correct but output signal always 4 mA** | HART poll address is not 0 | Change HART Poll Address to 0. |
| **Totalizer not operating** | Totalizer is disabled | Ensure that the totalizer operation is enabled. |
| **Flow is measured under a no flow condition** | Increased heat transfer. This can occur under no flow with increased pressure. | Increase the low flow cutoff to a value greater than the displayed flow rate.<br>The TA2 will ignore readings lower than this value. Optionally, increase the zero flow signal to match the value indicated under signal value. |
| **Flow rate too high or too low** | Instrument configuration does not match actual application | Check values entered for flow area under basic configuration. Check if install factors are entered under advanced configuration. Check STP conditions under advanced configuration. |
| | Buildup on sensor | Depending on type and size of buildup, flow readings may either increase or decrease. Clean sensor. |
| **Flow rate too high** | Flow profile considerations | The TA2 assumes a specific fully developed flow profile. User can correct for variations in flow profile using the install factors found under advanced configuration |
| **Flow rate too high, output spiking** | Moisture in the gas | Condensed moisture will cool the sensor more than gas flow. This will temporarily indicate a higher than expected flow rate. |

## Error messages

The TA2 Mass Flow Meter utilizes a 3-level hierarchy for reporting diagnostics information: FAULTS, WARNINGS, and INFORMATION. Faults and Warnings can be reviewed on the rotating screen in the Home menu. These screens capture only current conditions. Historic diagnostic information can be viewed in the HISTORY screen of the Diagnostics Menu.

**FAULT:** The highest level in the hierarchy of diagnostics. A Fault indicates a defect or failure in the circuitry or software, or a calibration condition that makes reliable measurement impossible. The mA value defaults to 3.6 mA, 22 mA, or HOLD and a message is displayed on the rotating screen. Further error information can be obtained by reviewing the Diagnostic Menu screen.

**WARNING:** This is the second level in the hierarchy of diagnostics. A Warning indicates conditions that are not fatal but may affect the measurement. A message will appear on the Home (rotating) screen when a Warning is detected but will not affect the output current. Further error information can be obtained by reviewing the Diagnostic Menu screens.

**INFORMATION:** This is the lowest level in the hierarchy of diagnostics. Information messages are for conditions that provide operational factors that are not critical to the measurement. Further error information can be obtained by reviewing the Diagnostics Menu.

## Error messages

### FAULT

| Diagnostic | Fault Description/Corrective Action | LCD Message |
|---|---|---|
| Non-Volatile Memory corruption | Partial corruption of the Non-Volatile memory stored in the EEPROM. Data may revert to Default conditions. Re-verify that all calibration and configuration factors in the TA2 match the calibration certificate. | Default Params |
| No signal from Probe | There is no signal from the sensor. Check the wiring between the probe and the electronics. | No Probe Signals |
| Temperature Sensor Failure | A short has occured in the RTD measuring the process temperature or in the interconnecting wiring (if remote electronics). Check wiring to the probe. | TempSnsr Shorted |
| Temperature Sensor Failure | There is an open circuit in the RTD measuring the process temperature or in the interconnecting wiring (if remote electronics). Check wiring to the probe. | Temp Sensor Open |
| Flow Sensor Failure | A short has occured in the RTD measuring the heated sensor or in the interconnecting wiring (if remote electronics). Check wiring to the probe. | FlowSnsr Shorted |
| Flow Sensor Failure | There is an open circuit in the RTDs measuring the heated sensor or in the interconnecting wiring (if remote electronics). Check wiring to the probe. | Flow Sensor Open |
| RTDs Reversed | The wiring connecting the RTDs is reversed. Check probe wiring or interconnecting cable (if remote electronics) | RTDs Reversed |
| Heater Shorted | The heater has developed a short either in the probe or in the interconnecting cable (if remote electronics). Check probe wiring. | Heater Shorted |
| Heater Open | There is an open circuit in the wiring going to the heater. Check wiring. Also, check if the two-pin jumper is missing. | Heater Open |
| Zero Flow Signal is too high | Zero Flow Signal (power) is greater than second data point in the Calibration Table. Check value entered under Factory Config/Cal Parameters/Zero Flow Signal. | ZFS Too High |
| Too Few Calibration Points | The calibration table does not contain sufficient number of data points for the flow range. Minimum of ten points is required. | Too Few Cal Pts |
| Air Equivalency Coefficients incorrect | The Air Equivalency factors used result in a non-monotonically increasing curve over the operating range. Check factors. | Air Equiv Coeffs Bad |
| Install Factors incorrect | Install factors entered under Advanced Configuration result in a non-monotonically increasing curve. Check factors. | User Instl Coeffs Bad |
| Module Failure | No readings received from the ADCs, or the values out of range. Indicates failure of Analog to Digital converters. Requires replacement of processor board or return of unit to factory. | Module Failure |
| Velocity is greater than the Upper Sensor Limit | The velocity is greater than established values. Contact Magnetrol. | Vel > UprSnsrLmt |

## Error messages

### WARNING MESSAGES

| Diagnostic | Warning Description | LCD Message |
|---|---|---|
| Initialising | Initialisation in progress. The TA2 will begin making flow readings at completion of cycle. | Initializing |
| AO2 Loop current fixed | The second 4–20 mA loop (AO2) is not responding. The mA signal may be saturated at 20.5 mA or may be fixed and non-responsive. Check informational messages. | AO2 Loop Fixed |
| TA2 is running diagnostics test | The operator has put the TA2 into one of several diagnostics tests. The mA output is 4 mA. | In Test Mode |
| Velocity too high | The Flow rate exceeds the calibration range of the instrument. Instrument will continue to operate. Accuracy is uncertain; flow measurements will be repeatable. | Vel > Upr Cal Pt |
| RTD drift | The RTD drive circuit current has drifted since last calibration. The drift is outside expected range. The TA2 has compensated for the drift, continued drift may affect accuracy. Repeatability will remain. | RTD Drive Ckt |
| Totalizer Error | There is an error in the Totalizer operation—the Totalizer and Elapsed Time indicator are reset to 0. | Dflt Totalizer |
| Pulse Multiplier Error | The maximum pulse output exceeds the maximum frequency selected. Increase the Pulse Multiplier. | Pulse Mult Error |
| Current loop(s) require trimming | The D/A Trim values are factory defaults. Perform D/A Trim of AO1 or AO2 under Advanced Configuration menu. | AO1 Loop Trim Reqd |
| | | AO2 Loop Trim Reqd |
| Temperature Limit Exceeded | The temperature measured by the sensor exceeds the rated temperature. Continued operation will damage sensor. | Process Temp Hi |
| Install Factor Error | Check and recalculate the install factors. This message may occur if the units of measurement were changed after install factors were entered. | Check Inst Factors |
| Electronic Temperature Exceeded | The temperature of the microprocessor board is above +176° F (+80° C) or below –40° F (–40° C) | Elec Temp Hi |
| | | Elec Temp Lo |

### INFORMATION MESSAGES

| Diagnostic | Information Description | LCD Message |
|---|---|---|
| AO2 Loop not responding | The second 4–20 mA loop (AO2) is fixed and not responding. Check mA output. This informational message will also be activated if the second mA loop output is saturated at 20.5 mA. Check I/O Config/AO2 Loop Config/LRV and URV. | AO2 Loop Fixed |
| AO2 Loop Saturated | The second 4–20 mA loop (AO2) is saturated at 20.5 mA. Check I/O Config/AO2 Loop Config/URV. | AO2 Loop Saturated |
| Upper Range Value Error | The Upper Range Value is greater than the Upper Calibration Point. | SetPt > UprCalPt |
| Insufficient Span | The URV (Upper Range Value) is too close to the LRV (Lower Range Value). Increase separation. | SetPts Too Close |
| System Warning | Non-fatal firmware exception. Advise Magnetrol with system code number. | System Code |

## Circuit board replacement

The input wiring board and display module can be replaced without any effect on the performance and operation of the TA2. The processor board contains the calibration information and is matched with the probe. If this circuit board is replaced, re-entry of all the original calibration and configuration information is required. This information is contained on the calibration certificate which can be supplied by MAGNETROL. Use of PACT*ware*™ is recommended for re-entry of this data.

1. Make sure the power source is turned off.
2. The input wiring board is contained in the rear compartment where the input voltage wiring comes into. The display module, power loop board and processor board are contained in the front compartment.
3. Remove appropriate cover.
4. If removing boards in the front compartment:
   a. Remove and unplug the display module if provided.
   b. Remove the two hex head fasteners using a 1⁄4" socket. This will remove the electronics module containing the processor board and the power loop board.
   c. Unplug the electrical connection at J1 of the power loop board.
   d. Probe wiring connections are made to TB1 on the same side of the power loop circuit board.
   e. Connect the probe wires as indicated:

   **Integral Electronics**

| Wire Color | Connection on TB1 |
|---|---|
| Orange | 8 |
| Brown | 7 |
| Black | 3 |
| Blue | 2 |
| White | 1 |

   **Remote Electronics**—see page 5.

   f. Reattach the electrical connection to J1.
   g. Reassemble the circuit boards in the enclosure. Make sure that the probe wiring does not get pinched between the standoffs on the circuit board and the attachment lugs in the housing.
   h. Reinstall the display module if provided.
5. If replacing the input wiring board, loosen screws, and remove the electrical connection to J1 on the rear of the circuit board.
   i. Attach electrical connections to J1 on new circuit board and reassemble.
6. Re-install the cover.
7. Apply power to the instrument.
8. Proceed to section RTD calibration on page 42.

## Probe replacement

The probe and processor board are calibrated together to form a matched set. If a probe needs to be replaced, Magnetrol will provide a new calibration certificate. The user will be required to re-enter the data from this certificate into the instrument. Use of PACT*ware*™ is recommended for re-entry of this data. A new serial number will be designated to the replacement probe.

**Integral Electronics**

1. Make sure the power source is off.
2. Access the power loop circuit board following procedure in previous section circuit board replacement.
3. Disconnect wiring to the probe.
4. Loosen the two set screws at the base of the housing. One serves as a rotational lock, the other secures the head into place.
5. Unthread the probe.
6. Thread in a new probe.
7. Connect the probe wires to the power loop board as indicated in previous section, step “4.e”.
8. Reassemble the electronics following previous section circuit board replacement.
9. Align the enclosure with the desired probe position, making sure that the flow arrow indicates the direction of flow.
10. Retighten the two set screws.
11. Reapply power.
12. Proceed to section RTD calibration on page 42.

**Remote Electronics**

1. Make sure the power source is off.
2. Remove cover of remote electronics housing.
3. Remove bezel.
4. Disconnect the wires from the probe at terminal TB1.
5. Loosen the two set screws at the base of the housing. One serves as a rotational lock, the other secures the head into place.
6. Unthread the probe.
7. Thread in a new probe.
8. Connect the probe wires to Terminal TB1 as shown in the figure on page 5.

| Wire Color | Terminal Connection on TB1 |
|---|---|
| White | 1 |
| Blue | 2 |
| Black | 3 |
| Brown | 4 |
| Orange | 5 |

9. Retighten the two set screws.
10. Re-assemble the bezel and install cover.
11. Reapply power.
12. Proceed to section RTD calibration on page 42.

## Replacement calibration

### RTD calibration

If either the probe or the processor board is replaced in the field, calibration of the RTDs in the probe will return the TA2 to like-new performance. NOTE: If this procedure is not followed, the accuracy will be affected; however, very repeatable flow measurements will be obtained.

Locate the sensor vertically in a water bath with an accurate temperature sensor directly adjacent to the probe tips. It is preferable that the water is stirred during the calibration to ensure the TA2 pins and temperature probe are at the same temperature. Using the keypad and display, select «Factory Config\Probe Params\Probe Temp Calib» and then press the → key. The device will dynamically display the To/Fo readings over a period of time. After 3 minutes, and if the readings are stable enough, the display automatically changes to request entry of a password (126) followed by the ambient water temperature. After the temperature is entered, the device will display if the calibration is OK. The device then automatically resets itself for normal operation. A similar procedure exists for the DD and DTM.

### Set point adjustment

A new set point must be calculated to complete the reconfiguration.

1. Place the probe in ambient temperature air where there is no flow across the sensor. This can be accomplished by wrapping the sensor tip with a piece of paper.
2. Go into «Diagnostics\Signal». Allow time for the signal to stabilize to within ±1 mW and record the new signal.
3. Calculate a new set point by using the following formula: New set point = set point x (zero flow signal ÷ new signal)
   If replacing the probe, use the set point and zero flow signal (ZFS) shown on the new calibration certificate that came with the probe.
   If replacing the processor board, use the set point and ZFS on the original calibration certificate. If the original calibration certificate is not available, contact Magnetrol with the serial number of the unit found on the nameplate. New signal is the value measured under step 2.

**NOTE: If the TA2 is calibrated for a gas other than air, there are two ZFS values on the certificate. One is for air and the other is for the particular gas. Use the ZFS for air when making the adjustment in air.**

4. Enter this new set point into the TA2 instead of the value on the calibration certificate under «Factory Config\Cal Parameters A\Set Point».
5. Return to the signal screen, similar to step 2, ensuring there is no flow over the sensor. The signal value should now agree with the original ZFS within 1 %. If desired, steps 2 through 5 can be repeated.

## Flow recalibration

Calibration of the TA2 requires a flow bench or other method for determining the flow rate. Using this procedure, the user can re-calibrate the unit himself or use a local flow calibration facility rather than returning the unit to the factory for recalibration. With an insertion probe, it is not necessary to calibrate in the same size pipe as the unit is installed in. The TA2 has internal scale-up factors which adjusts the data from the calibration pipe size to the installation pipe size.

Calibration requires the TA2 sensor to be positioned in a test section; the test section should have a sufficient upstream and downstream straight run to ensure the formation of a fully developed flow profile. Calibration should be performed using the same gas which the unit is calibrated for. Optionally, an air equivalency calibration can be performed. In this case, calibrate in air and contact the factory for air equivalency factors and equivalent air calibration rate.

Recalibration Procedure:

1. Select the set point; this is the temperature in degrees Celsius which the TA2 maintains between the two sensors. If the unit is re-calibrated for the same application, then it is probably not necessary to change the original value. If it becomes necessary to change the set point due to change in the calibration velocity or the type of gas:
   a. Record the set point under «Factory Config\Cal Parameters (A or B)\Set Point».
   b. Determine the maximum velocity in SFPM which the unit will operate (SFPM equals the SCFM divided by the flow area of the test section in square feet).
   c. Install the probe in the test section and flow gas that is equivalent to the maximum velocity in the calibration range.
   d. Using the display, HART, or PACT*ware*™, obtain the signal value in mW from the Diagnostics menu.
   e. Calculate a new set point using the formula: New set point = old set point x (800/measured signal (mW)). 800 mW is the desired maximum power rating for the TA2.
   f. Enter new set point in TA2 under «Factory Configuration\Cal Parameters (A or B)\Set Point».
2. Convert the flow rate in the application to the flow rate in the test section using the formula:
   Flow in test section = application flow x (flow area of test section/flow area of application)
   a. Allow a flow of a known amount of gas through the test section, recording flow rate and TA2 signal (mW). A minimum of 10 and a maximum of 30 data points including a zero flow value should be obtained. One data point should be taken at a flow rate approximately 20 % greater than the expected operating range. The higher the number of data points, the better the overall accuracy of the instrument.
   b. Convert the flow rate in the test section to mass velocity in SFPM. Use Magnetrol STP conditions of 70 °F and 1 Atmosphere (14.69 psia).
   c. Enter the Power and the corresponding Mass Velocity into the TA2. This is easily performed using PACT*ware*™ but can also be entered directly into the TA2 using the display and keypad or using HART. These values should be entered in increasing order to ensure a monotonically increasing curve.
   Note password of 126 is required for entry of calibration data. (Contact Magnetrol if issues using this password.)
   d. After completion of entry of the calibration data, check the display/HART®/PACT*ware*™ for the number of points accepted (or table length). If this number is less than the actual number of data points entered, then there is an error in the entry of the calibration data. Ensure that the data is entered so the curve is monotonically increasing. The values of mass velocity and power should always be increasing over the calibration range.
   e. A Fault message will occur if there are fewer than 10 calibration data points in the calibration table.
3. Enter the flow area of the calibration test section. Units of measurement are the same as selected under Basic Config menu. This value is used in calculating the scale-up factor between the calibration test section and the installation.

## REPLACEMENT PARTS

**NOTE: Replacement of the processor board / electronic module or the sensor requires entry of configuration data from the Calibration Certificate.**

**CAUTION: EXPLOSION HAZARD**
**Do not disconnect equipment unless power has been switched off or the area is known to be non-hazardous.**

**Partn°:** T A 2 – – – – – – – –

**Digit in partn°:** X 1 2 3 – 4 5 6 7 – 8 9 10

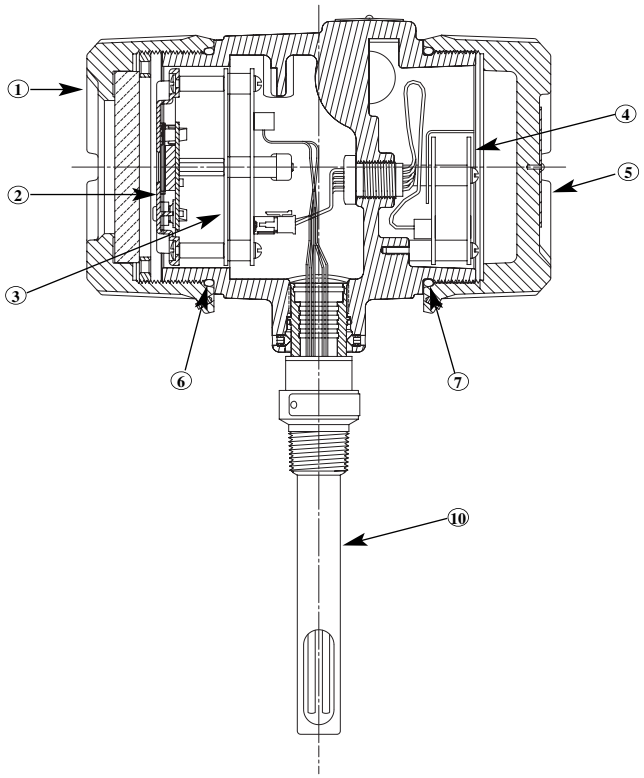
**X** = product with a specific customer requirement

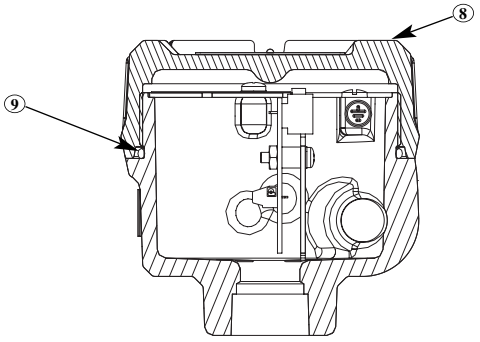
**Serial n°:** – – – – – – – – – – –

See nameplate, always provide complete partn° and serial n° when ordering spares.

## EXPEDITE SHIP PLAN (ESP)

Several parts are available for quick shipment, within max. 1 week after factory receipt of purchase order, through the Expedite Ship Plan (ESP).
Parts covered by ESP service are conveniently grey coded in the selection tables.




| (1) Housing cover | |
|---|---|
| **Digit 6** | **Replacement part** |
| 0 | 004-9197-007 |
| B | 036-4411-001 |

| (2) Display module | |
|---|---|
| **Digit 6** | **Replacement part** |
| 0 | not applicable |
| B | Z30-3614-001 |

| (3) Electronic module | | |
|---|---|---|
| **Digit 5** | **Digit 9** | **Replacement part** |
| 1 | 3 or 4 | 089-7261-002 |
| | E or F | 089-7261-005 |
| 2 | 3 or 4 | 089-7263-001 |
| 4 | 3 or 4 | 089-7261-003 |
| | E or F | 089-7261-006 |

| (4) Wiring PC board | |
|---|---|
| **Digit 5** | **Replacement part** |
| 1 | 089-7260-001 |
| 2 | 089-7262-001 |
| 4 | 089-7260-002 |

| | **Replacement part** |
|---|---|
| **(5) Housing cover** | 004-9206-010 |
| **(6) "O"-ring** | 012-2201-240 |
| **(7) "O"-ring** | 012-2201-240 |
| **(10) Sensor** | consult factory |

| (8) Housing cover | |
|---|---|
| **Digit 9** | **Replacement part** |
| 3 or E | not applicable |
| 4 or F | 004-9225-002 |

| (9) "O" ring | |
|---|---|
| **Digit 9** | **Replacement part** |
| 3 or E | not applicable |
| 4 or F | 012-2201-237 |

## SPECIFICATIONS

### Electronics specifications

| *Description* | | *Specification* |
|---|---|---|
| Power supply | | 15 – 30 V DC<br>100 – 264 V AC, 50-60 Hz |
| Power consumption | | DC = 9 W max - AC = 20 VA max |
| Output | | 4-20 mA with HART®, FOUNDATION fieldbus™ H1 |
| Analog Output | Active | 4-20 mA isolated (3,8 – 20,5 mA useable as per NAMUR NE 43) - max 1000 Ω loop resistance |
| | Passive | 4-20 mA isolated (3,8 – 20,5 mA useable as per NAMUR NE 43) - max loop resistance depending power supply |
| Resolution | Analog | 0,01 mA |
| | Display | 0,01 Nm/s |
| Calibration | | Pre-calibrated from factory - ISO 17025 and NIST traceable |
| Damping | | Adjustable 0-15 s time constant |
| Diagnostic Alarm | | Adjustable 3,6 mA, 22 mA or Hold last output |
| User Interface | | HART® communicator, AMS® or PACT*ware*™, FOUNDATION fieldbus™ and/or 4-button keypad |
| Pulse Output | | Active connection – 24 V DC Power, 150 mA<br>Passive connection – 2,5 to 60 V DC Power, 1,5 A |
| Alarm Output | | Active connection – 24 V DC Power, 100 mA<br>Passive connection – 2,5 to 60 V DC Power, 1 A |
| Display | | 2-line x 16-character backlit LCD |
| Displayed values | | Flow (eg. Nm³/h, Nl/h) and/or mass flow (eg. kg/h) and/or temperature (°C/°F) and/or loop current (mA) and/or totalized flow (eg. Nm³/h, Nl/h) |
| Menu Language | | English, French, German, Spanish, Russian |
| Housing Material | | IP 66, Aluminium A 356 (< 0,2 % copper) dual compartment |
| Approvals | | ATEX II 2 G Ex d IIC T6 Gb, flameproof enclosure<br>ATEX II 1/2 G Ex d +ib / d [ib] IIC T4 Ga/Gb, flameproof enclosure<br>IEC Ex d IIC T6 Gb, flameproof enclosure<br>Temperature class decreases for process temperatures above +55 °C (+130 °F)<br>Other approvals are available, consult factory for more details |
| SIL (Safety Integrity Level) | | Functional safety to SIL1 as 1oo1 / SIL2 as 1oo2 in accordance to IEC 61508 – SFF: 88,3 %.<br>Full FMEDA report and declaration sheets available at request |
| Shock/Vibration Class | | ANSI/ISA-S71.03 Class SA1 (Shock), ANSI/ISA-S71.03 Class VC2 (Vibration) |
| Net weight | | 3,3 kg (7.3 lbs) – electronics with 25 cm threaded probe |
| Foundation Fieldbus™ specifications | ITK version | 5.2 |
| | H1 device class | Link Master (LAS) – selectable ON/OFF |
| | Function blocks | 1 x RB, 5 x AI, 1 x IT, 1 x TB and 1 x PID |
| | Execution time | AI = 15 ms, PID = 20 ms, IT = 30 ms |
| | Quiescent current draw | 15 mA |
| | DD/CFF files | Available at www.fieldbus.org |

### Performance

| *Description* | | *Specification* |
|---|---|---|
| Turn down ratio | | 100:1 typical (depending upon calibration) |
| Flow range | Max | 0,05 - 275 Nm/s (10 - 54,000 SFPM) reference of air at STP conditions |
| | Min | 0,05 - 2,5 Nm/s (10 - 500 SFPM) reference of air at STP conditions |
| Linearity | | Included in flow accuracy |
| Accuracy | Flow | ± 1 % of reading + 0,5 % of calibrated full scale |
| | Temperature | ± 1 °C (2 °F) |
| Repeatability | | ± 0,5 % of reading |
| Response time | | Time constant of 1 to 3 s |
| Remote electronics | | Max 45 m or 150 m, depending on cable used |
| Ambient temperature | | -40 °C to +80 °C (-40 °F to +176 °F)<br>(ATEX up to +55 °C (+130 °F), IEC up to +70 °C (+160 °F))<br>Display: -30 °C to +80 °C (-22 °F to +176 °F) |
| Operating temperature effect | | ± 0,04 % of reading per °C |
| Humidity | | 0-99 %, non-condensing |
| Electromagnetic Compatibility | | Meets CE requirements (EN 61326) |

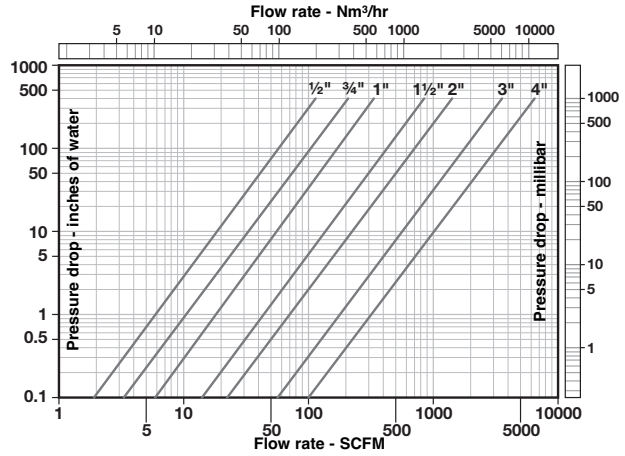
### Probe specifications

| *Description* | *Insertion probe* | *Sensor with flow body* |
|---|---|---|
| Materials – wetted parts | 316/316L (1.4401/1.4404) or Hastelloy® C (2.4819) | Sensor: 316/316L (1.4401/1.4404)<br>Flow body: stainless steel or carbon steel |
| Mounting | Threaded, compression fitting, ANSI-EN (DIN) flanged or with Retractable probe assembly | Threaded or flanged |
| Probe length | From 7 cm up to 253 cm (2.6" up to 99.9") | Flow body sizes from 1/2" up to 4" |
| Max process temperature | Integral electronics: -45 °C up to +120 °C (-50 °F up to +250 °F)<br>-45 °C up to +200 °C (-50 °F up to +400 °F) with 100 mm (4") longer probe serving as heat extension between the electronics and the compression fitting<br>Remote electronics: -45 °C up to +200 °C (-50 °F up to +400 °F) | |
| Max pressure rating | 103 bar @ +20 °C (1500 psi @ +70 °F)<br>94,8 bar @ +200 °C (1375 psi @ +400 °F) – direct insertion<br>75,9 bar @ +200 °C (1100 psi @ +400 °F) – with flow body | |

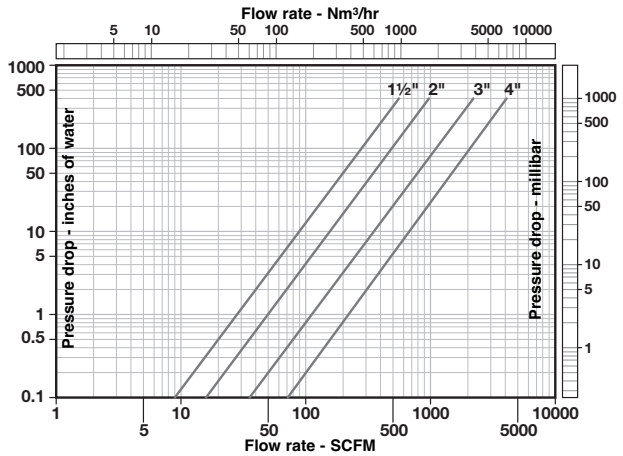
## SPECIFICATIONS

### Pressure drop for sensors with flow body

**Pressure drop**

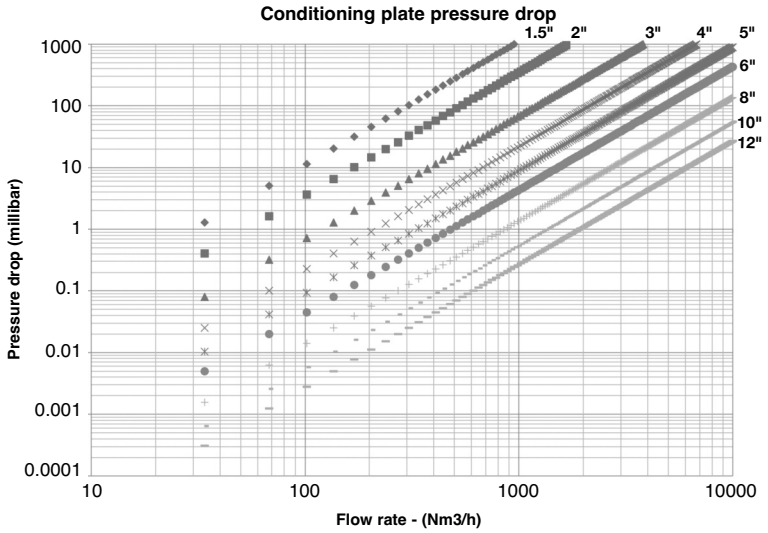



**Pressure drop with conditioning plate**




Pressure drop is based on air at +20 °C (+70 °F) and 1 atmosphere (density = 1,2 kg/m³ or 0.075 lb/ft³). For other gases, pressure or temperatures, estimate pressure drop by multiplying value from chart by actual density in kg/m³ (at operating conditions) divided by 1,2.

### Pressure drop for flow conditioning plates for use with insertion probes




## MODEL IDENTIFICATION

**A complete measuring system consists of:**

1. Thermatel® TA2 mass flow electronics.
   Thermatel® TA2 mass flow meters require an application report for performing pre-calibration from factory. Ask your Magnetrol® contact for assistance when specifying a device.
2. Thermatel® TA2 mass flow insertion probe or Thermatel® TA2 mass flow sensor with flow body.
3. Connecting cable for remote mount Thermatel® TA2 mass flow meters.
4. Options:
   - MACTek Viator USB HART® interface: order code: **070-3004-002**
   - portable display module – order code: **089-5219-002** (for more details see page 49)
   - flow conditioning plate for use with insertion probes – for order code see page 48
   - retractable probe assembly (RPA) – for order code see page 49
   - valve with compression fitting – order code: **089-5218-001** (for more details see page 49)
5. Free of charge: TA2 DTM (PACT*ware*™) can be downloaded from www.magnetrol.com

## MODEL IDENTIFICATION

**1. Code for Thermatel® Enhanced Model TA2 mass flow meter**

BASIC MODEL NUMBER

| | |
|---|---|
| T A 2 - A | Thermatel® TA2 mass flow meter |

OUTPUT

| | |
|---|---|
| 1 | 4-20 mA with HART® communication |
| 2 | FOUNDATION fieldbus™ communication |
| 4 | 4-20 mA with HART® communication, Pulse/Alarm, second mA output |

ACCESSORIES

| | |
|---|---|
| 0 0 | Blind transmitter (can receive the plug-in display as future option) |
| B 0 | Plug-in digital display and keypad |

CALIBRATION

**For TA2 with insertion probe**

| | **Actual gas calibration** |
|---|---|
| 0 | Special①. Specify medium separately |
| 1 | Air |
| 2 | Nitrogen |
| 3 | Hydrogen |
| 4 | Natural gas |
| 6 | Digester gas |
| 7 | Propane |
| 8 | Oxygen |
| | **Air equivalency / Correlation** |
| 5 | Gas correlation① |
| 9 | Air equivalency① |

**For TA2 with sensor with flow body**

| | **Actual gas calibration** |
|---|---|
| A | Special①. Specify medium separately |
| B | Air |
| C | Nitrogen |
| D | Hydrogen |
| E | Natural gas |
| G | Digester gas |
| H | Propane |
| J | Oxygen |
| | **Air equivalency / Correlation** |
| F | Gas correlation① |
| K | Air equivalency① |

① Consult factory for approval.

MOUNTING/APPROVAL①

| | |
|---|---|
| 3 | Integral, ATEX II 2 G Ex d IIC T6 Gb, flameproof enclosure |
| 4 | Remote②, ATEX II 2 G Ex d IIC T6 Gb, flameproof enclosure |
| E | Integral, ATEX II 1/2 G Ex d +ib / d [ib] IIC T4 Ga/Gb, flameproof enclosure |
| F | Remote②, ATEX II 1/2 G Ex d +ib / d [ib] IIC T4 Ga/Gb, flameproof enclosure |

① Codes E & F not available with FOUNDATION fieldbus™ output.
For weatherproof, consult factory.
② Bracket for electronics and probe housing included.

HOUSING / CABLE ENTRY

| | |
|---|---|
| 1 | IP 66, Cast aluminium, M20 x 1,5 cable entry (2 entries - 1 plugged) |
| 0 | IP 66, Cast aluminium, 3/4" NPT cable entry (2 entries - 1 plugged) |

T A 2 – A _ _ 0 – _ _ _ **complete code for Thermatel® Enhanced Model TA2 mass flow meter**

→ X = product with a specific customer requirement

## MODEL IDENTIFICATION

**2. code for Thermatel® Enhanced Model TA2 mass flow insertion probe**

BASIC MODEL NUMBER

| | |
|---|---|
| T M R | Thermatel® TA2 Mass Flow probe - 3/4" diameter |

MATERIALS OF CONSTRUCTION

| | |
|---|---|
| A | 316/316L (1.4401/14404) stainless steel |
| B | Hastelloy® C (2.4819) - not available with 316 (1.4401) stainless steel compression fitting |

PROCESS CONNECTION

| | |
|---|---|
| 0 0 A | Designed for use with compression fitting – min. 11 cm insertion length<br>Compression fitting not included |

**Threaded with 316 (1.4401) stainless steel compression fitting included**

| | |
|---|---|
| 0 3 A | 3/4" NPT compression fitting with Teflon ferrules (max. 6,90 bar) |
| 0 4 A | 3/4" NPT compression fitting with stainless steel ferrules<br>(max. 103 bar @ +20 °C, max. 94,8 bar @ +200 °C) |
| 0 5 A | 1" NPT compression fitting with Teflon ferrules (max. 6,90 bar) |
| 0 6 A | 1" NPT compression fitting with stainless steel ferrules<br>(max. 103 bar @ +20 °C, max. 94,8 bar @ +200 °C) |

**Threaded**

| | |
|---|---|
| 1 1 A | 3/4" NPT - default selection in combination with a retractable probe assembly (RPA) |
| 2 1 A | 1" NPT |
| 2 2 A | 1" BSP (G 1") |

**ANSI flanges**

| | | |
|---|---|---|
| 2 3 A | 1" | 150 lbs ANSI RF |
| 2 4 A | 1" | 300 lbs ANSI RF |
| 3 3 A | 1 1/2" | 150 lbs ANSI RF |
| 3 4 A | 1 1/2" | 300 lbs ANSI RF |
| 4 3 A | 2" | 150 lbs ANSI RF |
| 4 4 A | 2" | 300 lbs ANSI RF |

**EN (DIN) flanges**

| | | | |
|---|---|---|---|
| B B A | DN 25 | PN 16/25/40 | EN 1092-1 Type A |
| C B A | DN 40 | PN 16/25/40 | EN 1092-1 Type A |
| D A A | DN 50 | PN 16 | EN 1092-1 Type A |
| D B A | DN 50 | PN 25/40 | EN 1092-1 Type A |

INSERTION LENGTH - consider process connections

**Min probe length**

| | |
|---|---|
| 0 0 7 | 7 cm (2.6") fixed length - for NPT threaded and flanged |
| 0 0 9 | 9 cm (3.5") fixed length - for BSP threaded |

**Selectable probe length - specify per cm (0.39") increment**

| | | |
|---|---|---|
| 0 0 9 | min. 9 cm (3.5") | - for NPT threaded and flanged |
| 0 1 1 | min. 11 cm (4.5") | - for BSP threaded and compression fitting |
| 0 2 5 | min. 25 cm (10") | - for use with RPA (Retractable Probe Assembly) |
| 2 5 3 | max. 253 cm (99.9") | - for all probe connections |

T M R _ _ _ A _ _ _ **complete code for Thermatel® Enhanced Model TA2 mass flow insertion probe**

X = product with a specific customer requirement

## MODEL IDENTIFICATION

**2. Code for Thermatel® Enhanced Model TA2 sensor with flow body**

BASIC MODEL NUMBER

| | |
|---|---|
| T F T | Thermatel® TA2 sensor with mass flow body |

MATERIALS OF CONSTRUCTION

| | |
|---|---|
| A | 316/316L (1.4401/1.4404) stainless steel body and sensor |
| 1 | Carbon steel body / stainless steel sensor |

THREADED FLOW BODY - ø size and connection

| | | |
|---|---|---|
| 0 1 | 1/2" | NPT-M |
| 1 1 | 3/4" | NPT-M |
| 2 1 | 1" | NPT-M |
| 3 1 | 1 1/2" | NPT-M |
| 4 1 | 2" | NPT-M |

FLANGED FLOW BODY - ø size and connection

| | | |
|---|---|---|
| 0 3 | 1/2" | 150 lbs ANSI RF |
| 1 3 | 3/4" | 150 lbs ANSI RF |
| 2 3 | 1" | 150 lbs ANSI RF |
| 3 3 | 1 1/2" | 150 lbs ANSI RF |
| 4 3 | 2" | 150 lbs ANSI RF |
| 5 3 | 3" | 150 lbs ANSI RF |
| 6 3 | 4" | 150 lbs ANSI RF |

FLOW CONDITIONING PLATE

| | |
|---|---|
| A | None |
| B | Stainless steel flow conditioning plate - For flow body sizes ≥ 1 1/2" |

[ ] T F T [ ][ ][ ][ ] 0 0 0 **complete code for Thermatel® Enhanced Model TA2 sensor with flow body**

→ X = product with a specific customer requirement

**3. Code for connecting cable remote mount Thermatel® Enhanced Model TA2 mass flow meter**

| | |
|---|---|
| 0 3 7 – 3 3 1 4 | Connecting cable for non-hazardous area - 8 wire shielded instrument cable (max 45 m) |
| 0 3 7 – 3 3 2 0 | Connecting cable for non-hazardous area - 10 wire shielded instrument cable (max 150 m) |
| 0 0 9 – 8 2 7 0 | Connecting cable for ATEX flameproof enclosure - 8 wire shielded instrument cable (max 150 m) |

CABLE LENGTH - specify per m (3.28 ft) increment

| | |
|---|---|
| 0 0 3 | min 3 m (9.84 ft) length |
| 0 4 5 | max 45 m (148 ft) length (for 037-3314-xxx cable) |
| 1 5 0 | max 150 m (492 ft) length (for 037-3320-xxx and 009-8270-xxx cable) |

0 [ ][ ] [ ][ ][ ][ ] [ ][ ][ ] **complete code for connecting cable**

**4. Code for flow conditioning plate for use with insertion probes**

| Part Number | Description |
|---|---|
| 004-8986-001 | 4" 316 stainless steel |
| 004-8986-002 | 4" carbon steel |
| 004-8986-003 | 4" PVC |
| 004-8986-004 | 5" 316 stainless steel |
| 004-8986-005 | 5" carbon steel |
| 004-8986-006 | 5" PVC |
| 004-8986-007 | 6" 316 stainless steel |
| 004-8986-008 | 6" carbon steel |
| 004-8986-009 | 6" PVC |

| Part Number | Description |
|---|---|
| 004-8986-010 | 8" 316 stainless steel |
| 004-8986-011 | 8" carbon steel |
| 004-8986-012 | 8" PVC |
| 004-8986-013 | 10" 316 stainless steel |
| 004-8986-014 | 10" carbon steel |
| 004-8986-015 | 10" PVC |
| 004-8986-016 | 12" 316 stainless steel |
| 004-8986-017 | 12" carbon steel |
| 004-8986-018 | 12" PVC |

### 5. Code for retractable probe assembly

BASIC MODEL NUMBER

| | |
|---|---|
| R P A | Retractable probe assembly |

DESIGN TYPE

| | |
|---|---|
| E | Low pressure - up to 5,5 bar (80 psi) |
| F | High pressure - up to 300 lbs service |

MATERIALS OF CONSTRUCTION

| | |
|---|---|
| 1 | Carbon steel with 316 SST (1.4401) seal gland |
| 4 | 316 SST (1.4401) |

PROCESS CONNECTION

| | | |
|---|---|---|
| 0 | 1 1/2" NPT-M | – not available for RPA-E1 |
| 1 | 1 1/2" - 150 lbs RF flange | |
| 2 | 1 1/2" - 300 lbs RF flange | |

BALL VALVE

| | | |
|---|---|---|
| 0 | No ball valve supplied | |
| 1 | Carbon steel ball valve | – select material code 1 |
| 2 | Stainless steel ball valve | – select material code 4 |

PROBE LENGTH

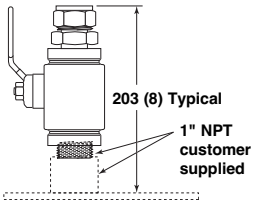
| | |
|---|---|
| 0 2 5 | min 25 cm (9.84") |
| 1 8 0 | max 180 cm (70.87") |

R P A [ ][ ][ ][ ] [ ][ ][ ] **complete code for retractable probe assembly**

→ X = product with a specific customer requirement

### 6. Code for other options

| **When ordered separately:** | | |
|---|---|---|
| **Process Conn. Size** | **Compression fitting in 316 (1.4401) stainless steel** | |
| | **Teflon ferrules**<br>Max. 6,90 bar (100 psi) | **Stainless steel ferrules**<br>Max. 103 bar @ +20 °C (1500 psi @ +70 °F)<br>Max. 94,8 bar @ +200 °C (1375 psi @ +400 °F) |
| 1" NPT | code: **011-4719-009** | code: **011-4719-007** |
| 3/4" NPT | code: **011-4719-008** | code: **011-4719-006** |




1" NPT ball valve in 316 SST with compression fitting (TFE ferrules)
code: **089-5218-001**

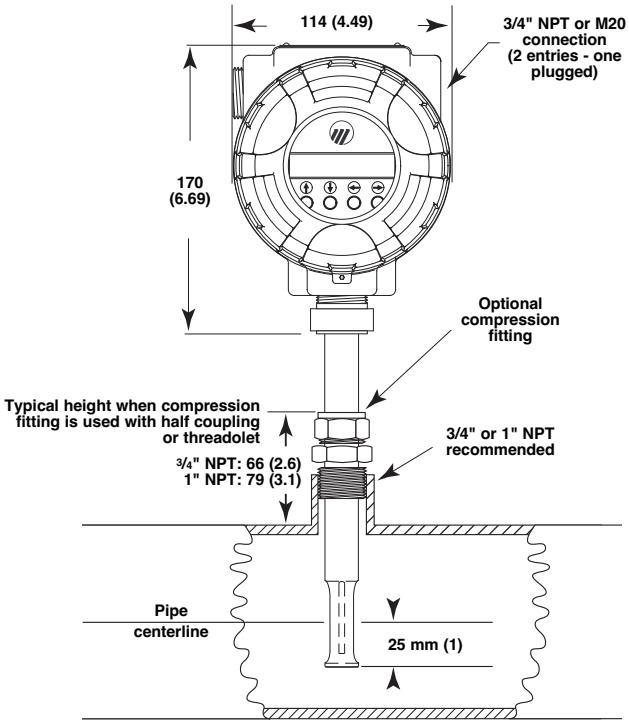
**Portable display module**

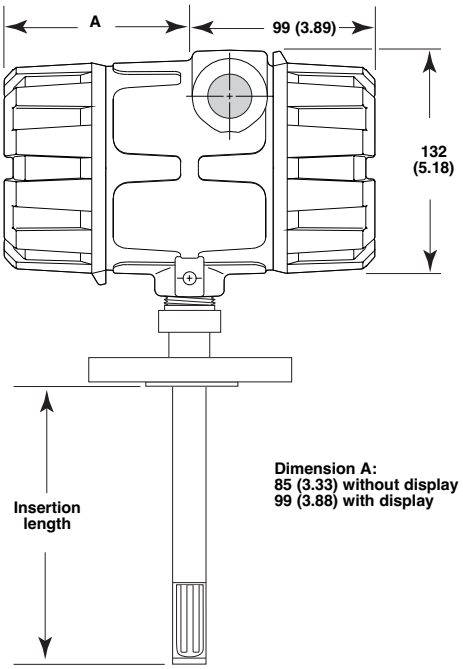
A portable display module for configuration and diagnosis of multiple units is available (code **089-5219-002**). This portable module plugs into the electronics in the same manner as the normal display and uses the same software menu. This module permits the user to reduce installation cost by having one display module with keypad for multiple TA2 units.

Usage of the display module requires that the housing cover be removed during use and thus may not be useable in hazardous areas. In these cases, the HART® option should be utilised.

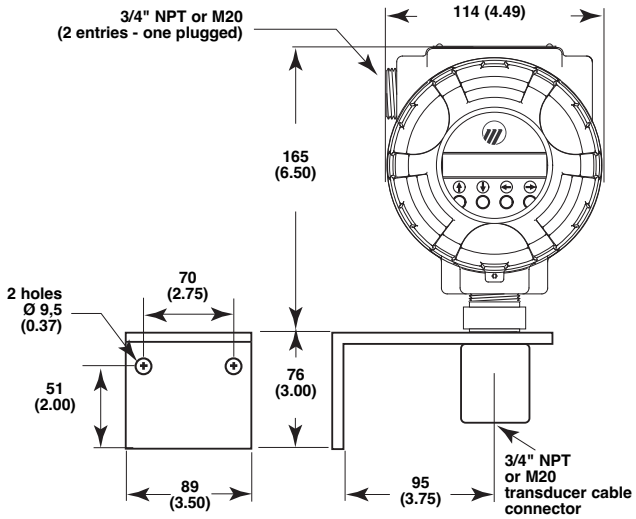
## DIMENSIONS IN mm (inches)

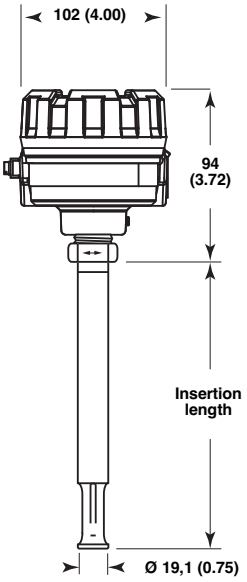
### Integral Mount TA2

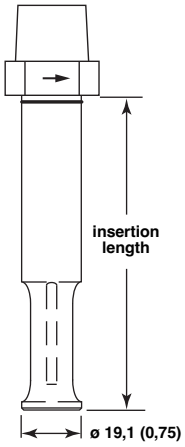


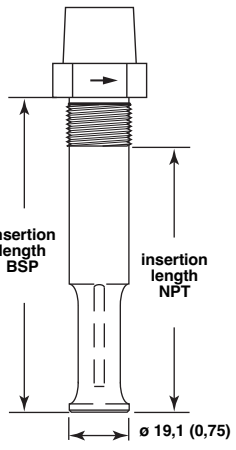

### Remote Mount TA2



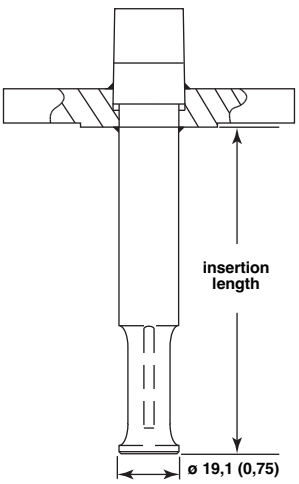




TMR for mounting with compression fitting

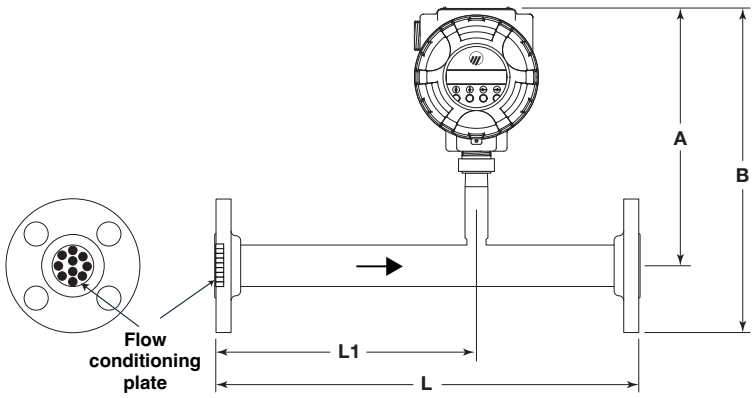



TMR with threaded connection

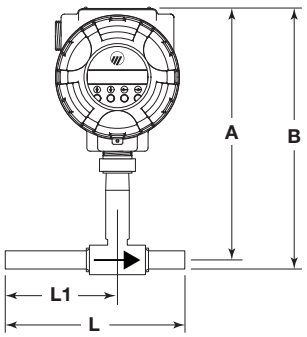



TMR with flanged connection

## DIMENSIONS IN mm (inches)



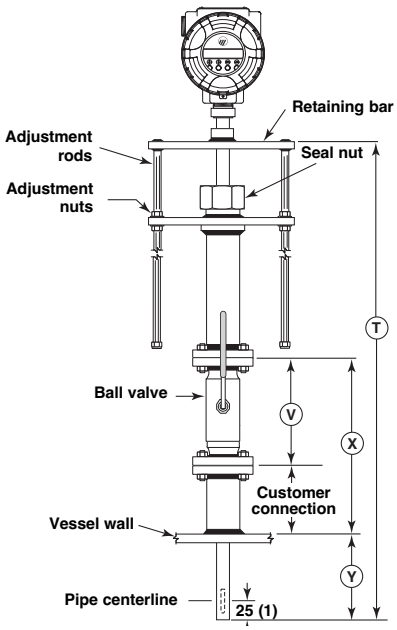

Flanged flow body




Threaded flow body

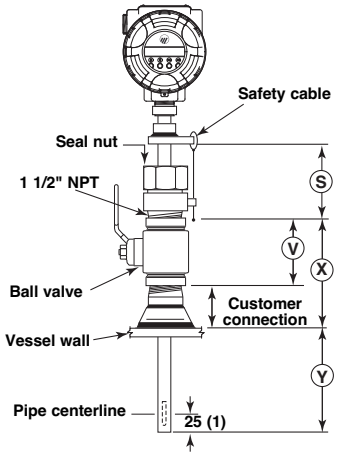
| Code | Size | Length (L) | | L1 | | Height to Centerline (A) mm (inches) | Overall Height (B) | |
|---|---|---|---|---|---|---|---|---|
| | | With Flow Conditioning mm (inches) | Without Flow Conditioning mm (inches) | With Flow Conditioning mm (inches) | Without Flow Conditioning mm (inches) | | NPT-M mm (inches) | Flange mm (inches) |
| 0 | 1/2" | 203 (8)① | — | 127 (5)① | — | 203 (8.0) | 214 (8.4) | 248 (9.7) |
| 1 | 3/4" | 286 (11.25)① | — | 191 (7.5)① | — | 203 (8.0) | 217 (8.5) | 251 (9.9) |
| 2 | 1" | 381 (15)① | — | 254 (10)① | — | 203 (8.0) | 220 (8.7) | 257 (10.1) |
| 3 | 1 1/2" | 495 (19.5) | 191 (7.5) | 305 (12) | 95 (3.75) | 211 (8.3) | 235 (9.3) | 274 (10.8) |
| 4 | 2" | 660 (26) | 191 (7.5) | 406 (16) | 95 (3.75) | 241 (9.5) | 272 (10.7) | 318 (12.5) |
| 5 | 3" | 991 (39) | 254 (10) | 610 (24) | 127 (5) | 241 (9.5) | N/A | 337 (13.3) |
| 6 | 4" | 1321 (52) | 305 (12) | 914 (36) | 152 (6) | 241 (9.5) | N/A | 356 (14.0) |

① The upstream length in pipe sizes < 1 1/2" dia. is sufficient to create the flow conditioning effect without need for a flow conditioning plate.




**Model RPA-F412-XXX**

**minimum probe length: T = 2 (X + Y)**




**Model RPA-E402-XXX**

**minimum probe length: S + X + Y**

| S Dimension | |
|---|---|
| Threaded connection | 102 (4.00) |
| Flanged connection | 127 (5.00) |

| Ball Valve Dimensions* | |
|---|---|
| Size | V |
| 1½" NPT | 112 (4.4) |
| 1½" 150# flange | 165 (6.5) |
| 1½" 300# flange | 191 (7.5) |

*Dimension of ball valve if supplied by the factory.

## APPENDIX A

The flow measurement of the TA2 assumes that the end of the probe is 25 mm (1”) past the centreline and the presence of a fully developed flow profile. See figure A.

As gas flows in a pipe or duct, the flow profile will change with obstructions and changes in flow direction. As the gas flows around an elbow, the momentum causes the gas velocity on the outside of the elbow to increase and the velocity on the inside to decrease. See figure B.

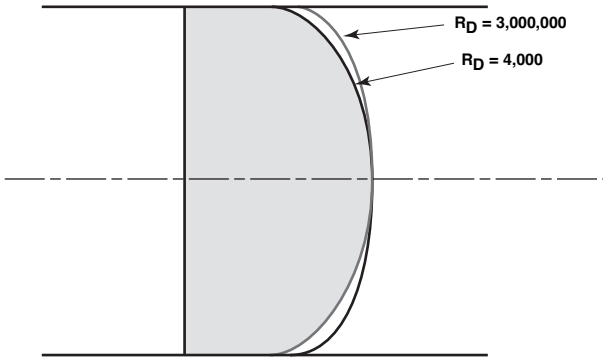



**Figure A**

**Turbulent flow profile**

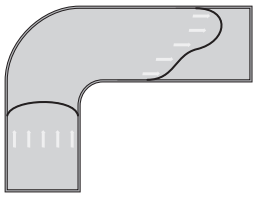
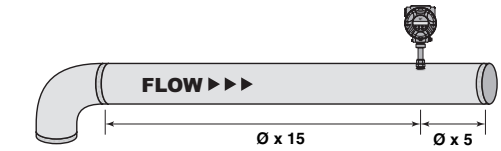


**Figure B**

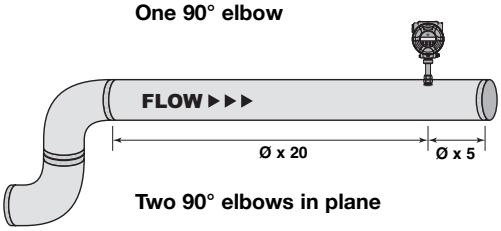
**Flow profile following single elbow**

Figure C indicates the minimum recommended straight run distances required to obtain the desired fully developed flow profile. If these straight-run distances are not available, the overall accuracy of the flow measurement will be affected; however, the repeatability of the measurement will be maintained.

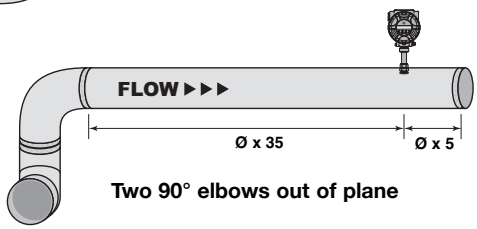
The user has the ability to enter correction factors to compensate for non-ideal flow profile conditions.



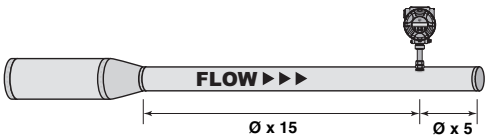

**One 90° elbow**



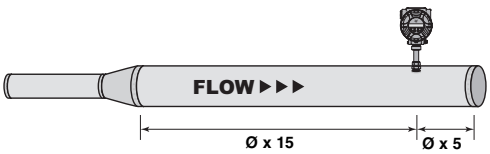

**Two 90° elbows in plane**



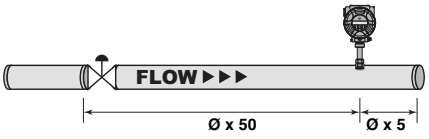

**Two 90° elbows out of plane**




**Reduction**




**Expansion**




**Control Valve -** It is recommended that control valves be installed downstream of the flow meter

**Figure C – Probe Installations**

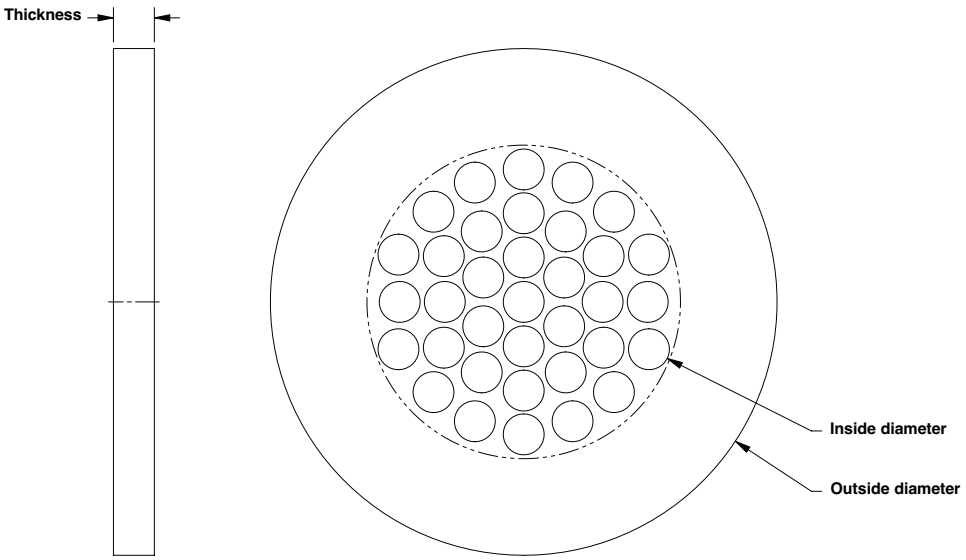
## APPENDIX A

**Conditioning plates**

Flow conditioning plates may be provided in applications where limited straight run is available. Plates are available in flow body type sensor designs (TFT) from 1.5" to 4" pipes. Plates may be purchased separately for pipe sizes 4" to 12" when using insertion probes (TXR).

The plate should be installed 2-5 diameters downstream of the nearest obstruction, change in pipe inside diameter or change in flow direction. For TXR designs, the insertion probe can be installed 8 pipe diameters downstream of the plate with 5 diameters required downstream of the TXR. For TFT designs with the plate at the entrance, the downstream is provided in the length of the TFT.

Plates are to be fitted with gaskets (customer supplied) in between flanges. If plates are not included and recommended straight run is not adhered to, the TA2 will provide repeatable measurement and the installation factors can be utilized.



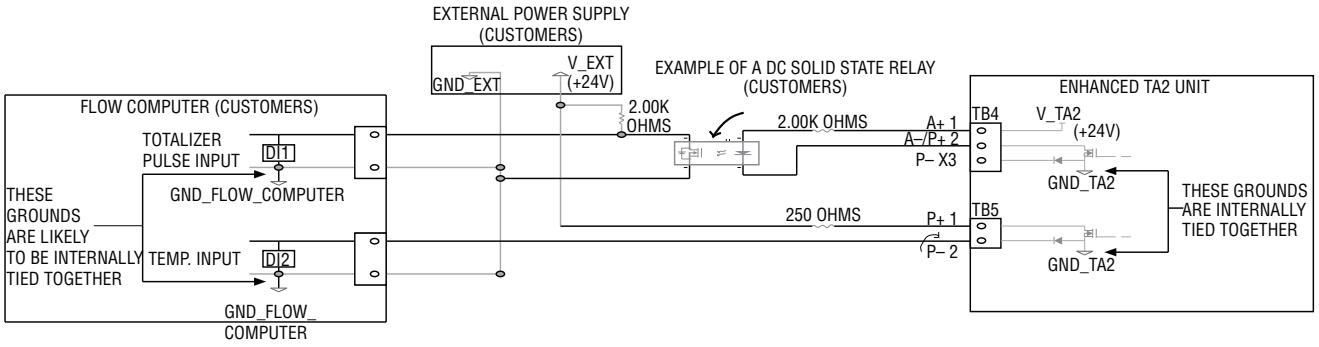

| Part Number | Description | OD mm (inch) | ID mm (inch) | Thickness mm (inch) |
|---|---|---|---|---|
| 004-8986-001 | 4" 316 stainless steel | 157,2 (6.19) | 97,3 (3.83) | 12,7 (0.50) |
| 004-8986-002 | 4" carbon steel | 157,2 (6.19) | 97,3 (3.83) | 12,7 (0.50) |
| 004-8986-003 | 4" PVC | 157,2 (6.19) | 97,3 (3.83) | 12,7 (0.50) |
| 004-8986-004 | 5" 316 stainless steel | 185,7 (7.31) | 122,2 (4.81) | 16 (0.63) |
| 004-8986-005 | 5" carbon steel | 185,7 (7.31) | 122,2 (4.81) | 16 (0.63) |
| 004-8986-006 | 5" PVC | 185,7 (7.31) | 122,2 (4.81) | 16 (0.63) |
| 004-8986-007 | 6" 316 stainless steel | 215,9 (8.50) | 146,3 (5.76) | 19,1 (0.75) |
| 004-8986-008 | 6" carbon steel | 215,9 (8.50) | 146,3 (5.76) | 19,1 (0.75) |
| 004-8986-009 | 6" PVC | 215,9 (8.50) | 146,3 (5.76) | 19,1 (0.75) |
| 004-8986-010 | 8" 316 stainless steel | 269,7 (10.62) | 193,7 (7.63) | 25,4 (1.00) |
| 004-8986-011 | 8" carbon steel | 269,7 (10.62) | 193,7 (7.63) | 25,4 (1.00) |
| 004-8986-012 | 8" PVC | 269,7 (10.62) | 193,7 (7.63) | 25,4 (1.00) |
| 004-8986-013 | 10" 316 stainless steel | 323,9 (12.75) | 242,9 (9.56) | 31,8 (1.25) |
| 004-8986-014 | 10" carbon steel | 323,9 (12.75) | 242,9 (9.56) | 31,8 (1.25) |
| 004-8986-015 | 10" PVC | 323,9 (12.75) | 242,9 (9.56) | 31,8 (1.25) |
| 004-8986-016 | 12" 316 stainless steel | 381 (15.00) | 288,9 (11.37) | 38,1 (1.50) |
| 004-8986-017 | 12" carbon steel | 381 (15.00) | 288,9 (11.37) | 38,1 (1.50) |
| 004-8986-018 | 12" PVC | 381 (15.00) | 288,9 (11.37) | 38,1 (1.50) |

### TA2 Mass Flow Meter – Using both Pulse and 2nd mA connections

The pulse output and second mA output (commonly used for temperature) in the TA2 share a common ground. They are isolated from the remaining input and output connections of the instrument.

A flow computer or other receiving device may have common ground for the various input signals. This may cause difficulties when using both the TA2 pulse and second mA output with an external power supply or the power supply in the flow computer. Magnetrol refers to the use of a separate power supply as a passive connection from the TA2 as compared to an active connection where the TA2 provides power for the output signal (sometimes referred to as self-powered).

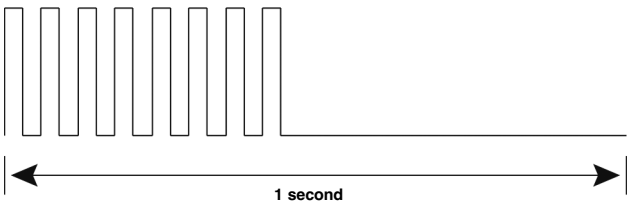
Isolation problems may be encountered if the user wants to connect both the passive pulse output and the second mA output (always passive connection) from the TA2 to a flow computer or other input device with common grounds. The attached illustration shows a recommended solution using a solid state relay between the flow computer and the active TA2 pulse output.



## APPENDIX C

**Enhanced TA2 Pulse Output**

The Enhanced TA2 has an option for providing a pulse output. The Pulse is an open collector output; the output can be either a powered (active) connection or a passive connection using an external power supply. With an active output the voltage will go from 0 to 24 VDC (± 10%) with each pulse. The voltage on the passive connection will depend on the power supply used.




One pulse will correspond to a specific amount of flow. There are several factors which need to be configured to obtain the desired operation.

Multiplier: The multiplier value is a factor which relates the amount of flow per pulse. For instance a factor of 0.01 with units set to $Nm^3$ means that each pulse will correspond to 0.01 $Nm^3$ or conversely there will be 100 pulses for every $Nm^3$.

Frequency: Represents the maximum frequency of the pulses. This is selectable from 10 to 10,000 Hz. This value should not exceed the maximum input rate of the device receiving the pulses. If the actual pulse output based on the flow measurement exceeds the maximum frequency selected a Warning Message indicating “Pulse Multiplier error” will appear on the display and be communicated over HART. The pulse width is fixed based on the value selected. For instance with a selected maximum frequency of 1,000 each pulse occur every 1/1000 seconds (1 ms). Each pulse is a square wave with a 50% duty cycle; half of each pulse width is on with voltage applied and half off with no voltage. This results in a pulse width of 0.0005 seconds (0.5 ms). The pulses are transmitted at a fixed rate for a fraction of a second with no pulses for the remaining time.

When configuring the frequency, calculate the pulse rate by using a Time Factor which is equivalent to the number of seconds in the time period. If flow rate is in units/minute the Time Factor = 60; if the flow rate is in units/hour the Time Factor = 3600.

The formula for determining the pulse rate is:

**Pulse rate = Flow rate/(Time Factor * multiplier)**

Example:

Flow rate = 200 $Nm^3/h$

Time factor = 3600

Multiplier = 0.0001 (0.0001 $Nm^3/h$/pulse)

The frequency will be equal to 200/(3600 * 0.0001) = 555 Hz and the maximum frequency can be set to either 1000 or 10.000.

# IMPORTANT

## SERVICE POLICY

Owners of Magnetrol products may request the return of a control; or, any part of a control for complete rebuilding or replacement. They will be rebuilt or replaced promptly. Magnetrol International will repair or replace the control, at no cost to the purchaser, (or owner) ***other than transportation cost*** if:

a. Returned within the warranty period; and,
b. The factory inspection finds the cause of the malfunction to be defective material or workmanship.

If the trouble is the result of conditions beyond our control; or, is **NOT** covered by the warranty, there will be charges for labour and the parts required to rebuild or replace the equipment.
In some cases, it may be expedient to ship replacement parts; or, in extreme cases a complete new control, to replace the original equipment before it is returned. If this is desired, notify the factory of both the model and serial numbers of the control to be replaced. In such cases, credit for the materials returned, will be determined on the basis of the applicability of our warranty.
No claims for misapplication, labour, direct or consequential damage will be allowed.

## RETURNED MATERIAL PROCEDURE

So that we may efficiently process any materials that are returned, it is essential that a “Return Material Authorisation” (RMA) form will be obtained from the factory. It is mandatory that this form will be attached to each material returned. This form is available through Magnetrol’s local representative or by contacting the factory. Please supply the following information:

1. Purchaser Name
2. Description of Material
3. Serial Number and Ref Number
4. Desired Action
5. Reason for Return
6. Process details

Any unit that was used in a process must be properly cleaned in accordance with the proper health and safety standards applicable by the owner, before it is returned to the factory.
A material Safety Data Sheet (MSDS) must be attached at the outside of the transport crate or box.
All shipments returned to the factory must be by prepaid transportation. Magnetrol ***will not accept*** collect shipments.
All replacements will be shipped Ex Works.

BULLETIN N°: BE 54-631.2
EFFECTIVE: MAY 2015
SUPERSEDES: October 2012



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