

THERMATEL® Enhanced Model TA2 Software v2.x

Installation and Operating Manual

Thermal

Dispersion

Mass Flow

Meter



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.

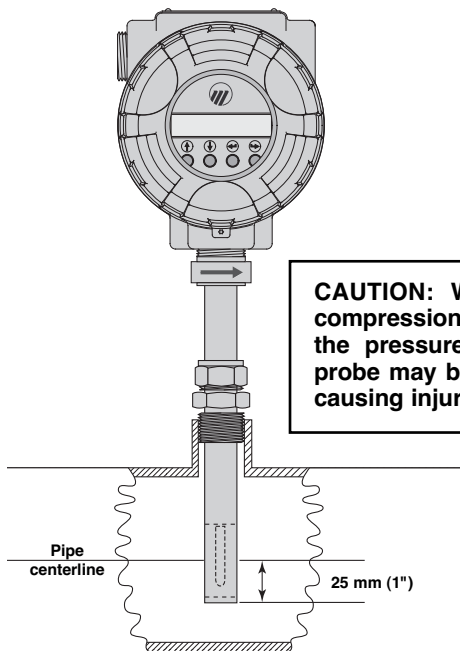


These units are in conformity with the provisions of:

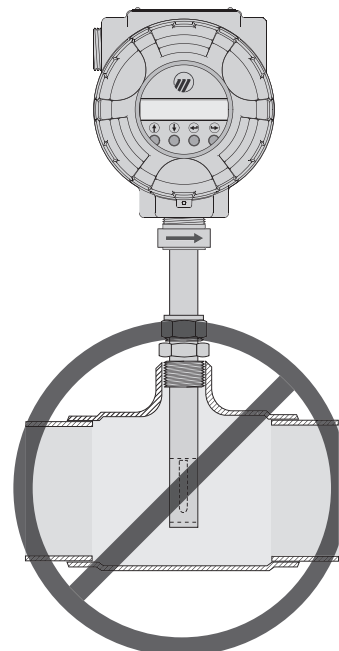
1. The EMC Directive: 2004/108/EC. The units have been tested to EN 61326: 1997 + A1 + A2.
2. Directive 94/9/EC for Equipment or protective system for use in potentially explosive atmospheres. EC-type examination certificate number ISSeP10ATEX046X – flameproof enclosure. Standards applied EN60079-0:2009 and EN60079-1:2007
3. The PED directive 97/23/EC (pressure equipment directive). Safety accessories per category IV module H1.
4. Special conditions for safe use: symbol X
 - The temperature class T6 if this apparatus may be affected if the temperature of the measured fluid or process exceeds 55 °C.
 - The values of the flameproof joints are detailed in the drawings listed reference 99-7198.



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.



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 repositioning 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.

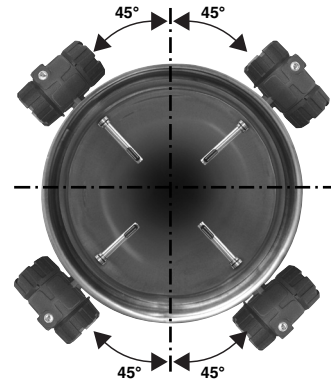
The TA2 flow measurement is based on a fully developed turbulent flow profile in a pipe with the specified inner diameter. Accuracy will be affected if these conditions are not obtained. Installing the probe in a tee is not recommended as the flow profile and the flow area are distorted.

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.

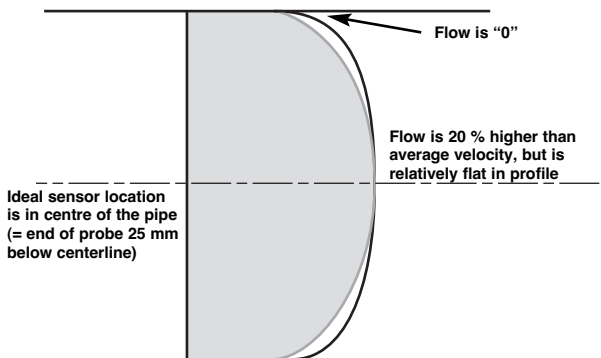
The TA2 with an insertion probe provides a point measurement and assumes that the velocity profile (see figures below) is uniform over the entire width of the pipe or duct. The user has the ability to compensate the flow measurements based upon flow profile considerations under the Advanced Configuration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

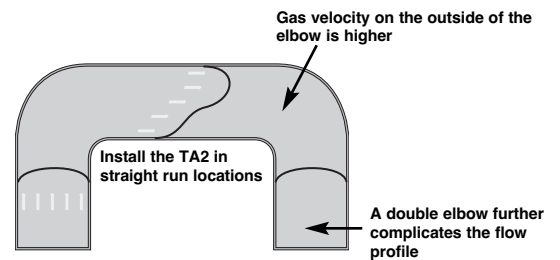
Install the TA2 sensor at a 45° angle to minimize moisture drip. Use of different TA2's as shown is recommended to optimize the accuracy in a larger pipe dia.



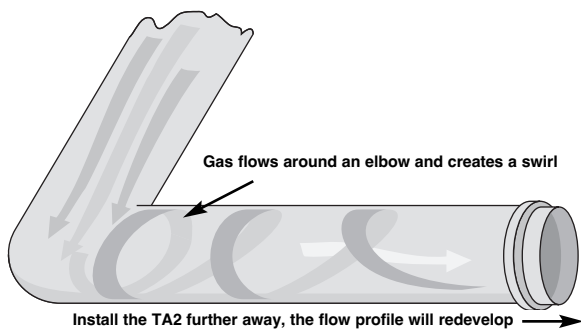
Flow profiles



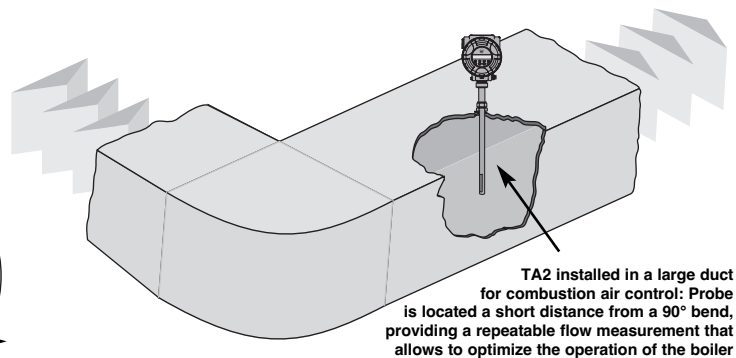
Turbulent flow profile



Flow profile following single elbow

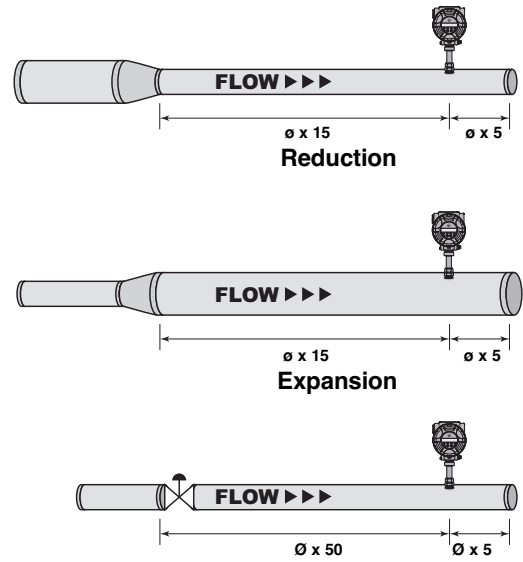
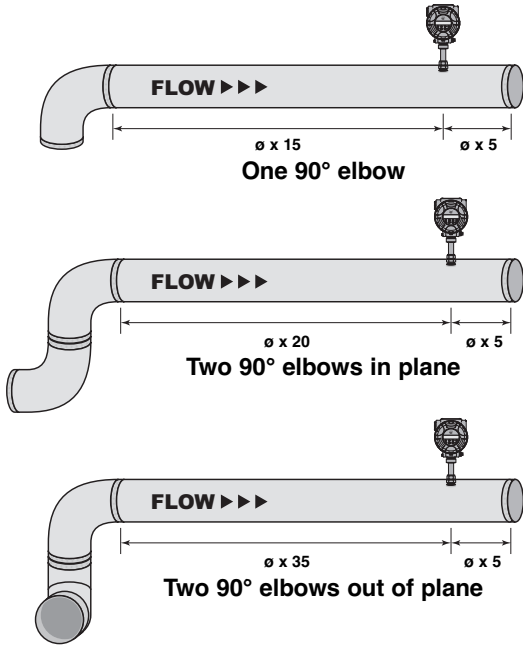


Swirl patterns in a pipe



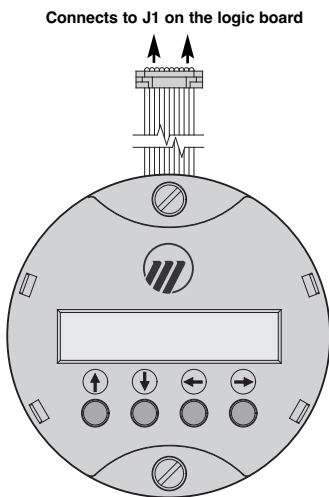
Probe in a duct downstream of elbow

Mounting recommendations



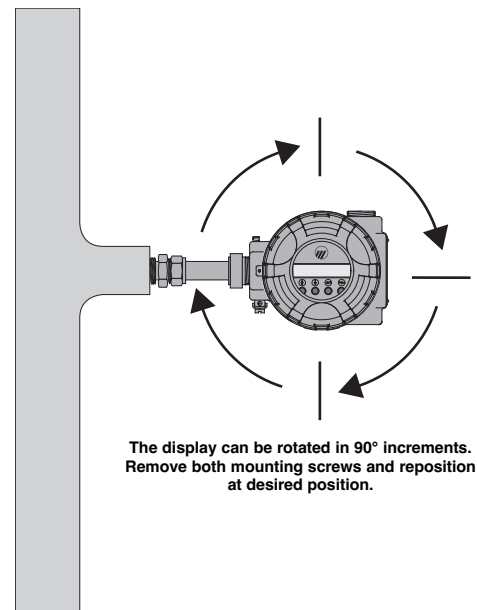
Control Valve - It is recommended that control valves be installed downstream of the flow meter

Display



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

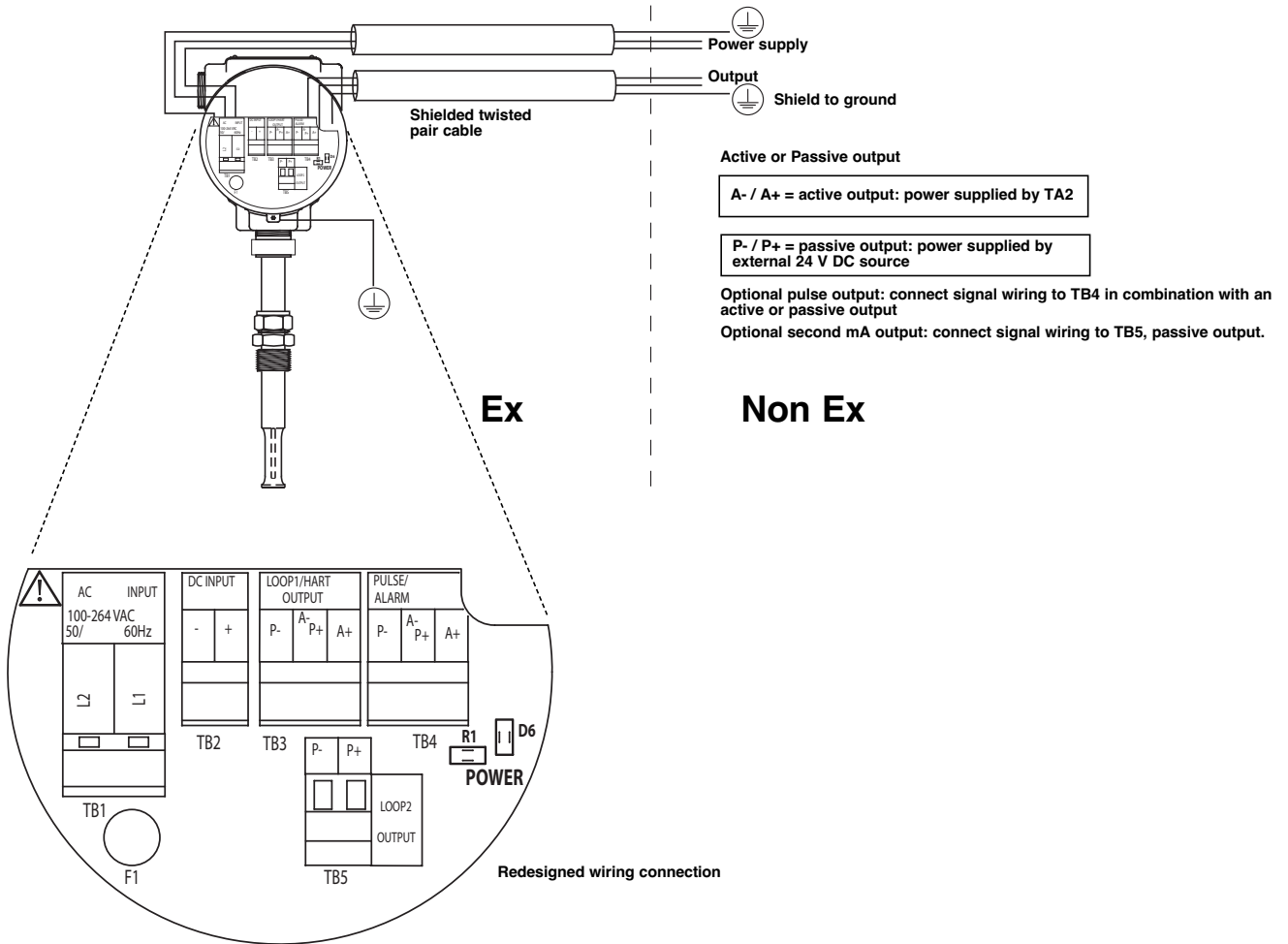
CAUTION: Switch power off when connecting/disconnecting the display



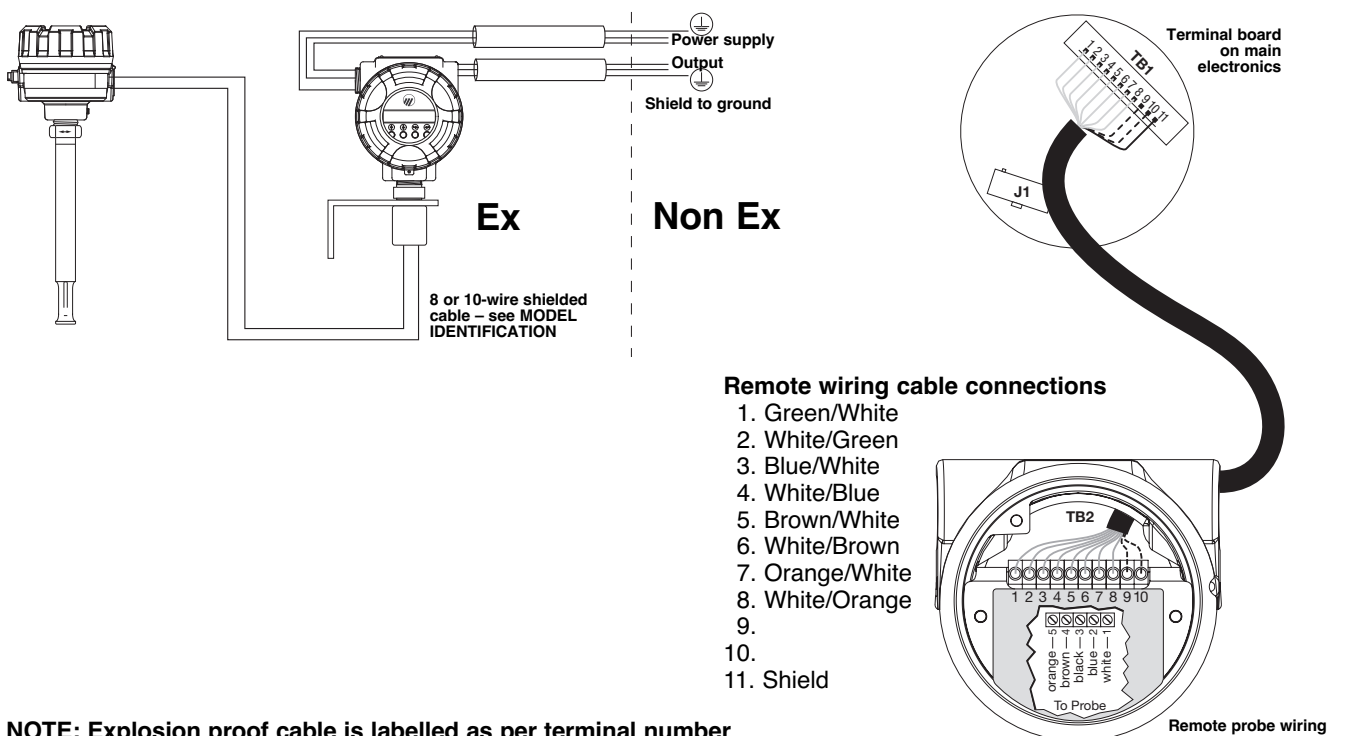
WIRING

CAUTION: In hazardous 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.

Integral electronics



Remote electronics

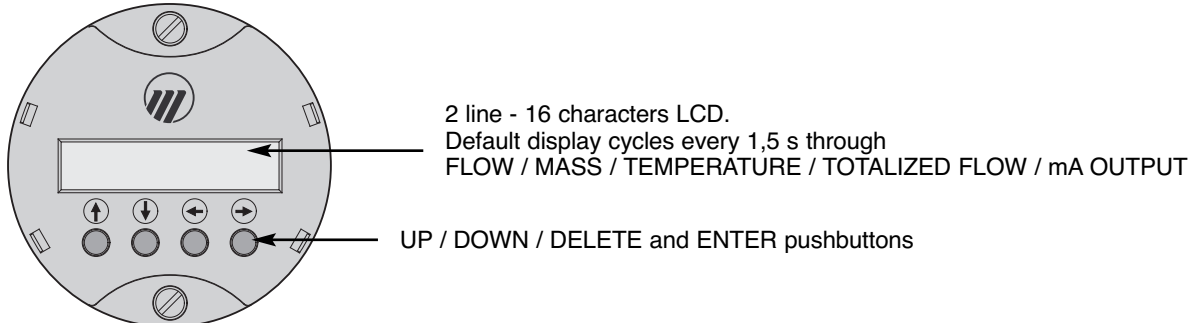


NOTE: Explosion proof cable is labelled as per terminal number

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.



Keys	Comment
↑ (Up)	Scroll to the previous selection/menu in the list or increase a value (behind decimal/negative values show “-”) or scroll forward through graphical characters or digits. If held down; the characters scroll until the pushbutton is released.
↓ (Down)	Scroll to the next selection/menu in the list or decrease a value (behind decimal/negative values show “-”) or scroll backward through graphical characters. If held down; the characters scroll until the pushbutton is released.
← (Delete)	Moves back one level to the previous higher branch or menu level without changes or moves the cursor to the left to delete an entry.
→ (Enter)	Enters into the lower level branch. Accepts the selection and returns to the menu traversal mode. 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» «PRB PASSWD REQ'D»	User password required 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 «PROV CONFIG» menu-selection

Display	Item	Action
«CHANGE PASSWORD» → to select	Change password	Enter old password «ENTER OLD PASSWORD» 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» → to select	Probe parameters	Scroll through entries (factors are provided with the new probe)

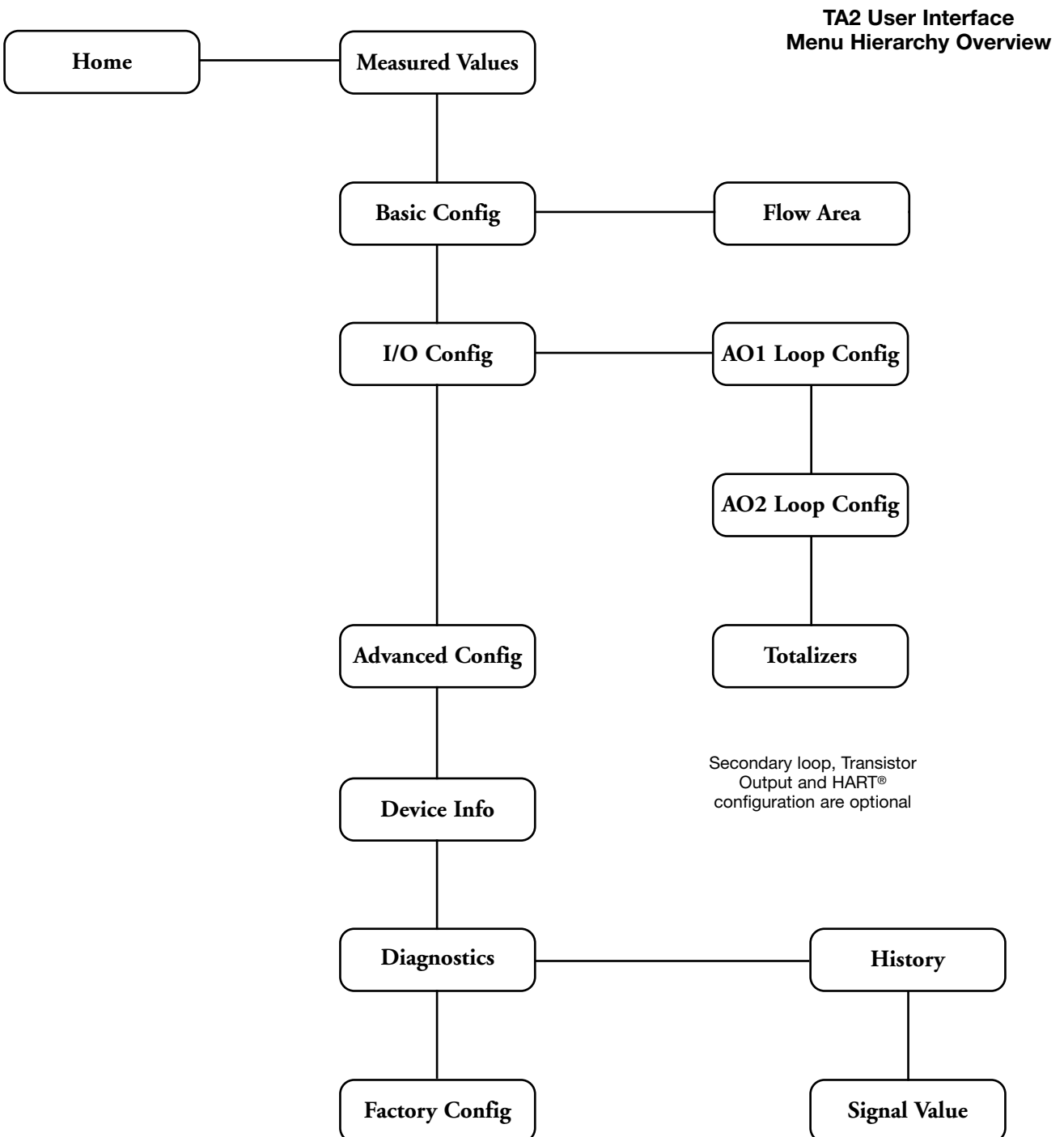
Password forgotten/lost – consult factory for assistance, your password can be recovered via the encrypted value displayed when the Password is asked for (see Access Menu).

CONFIGURATION

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



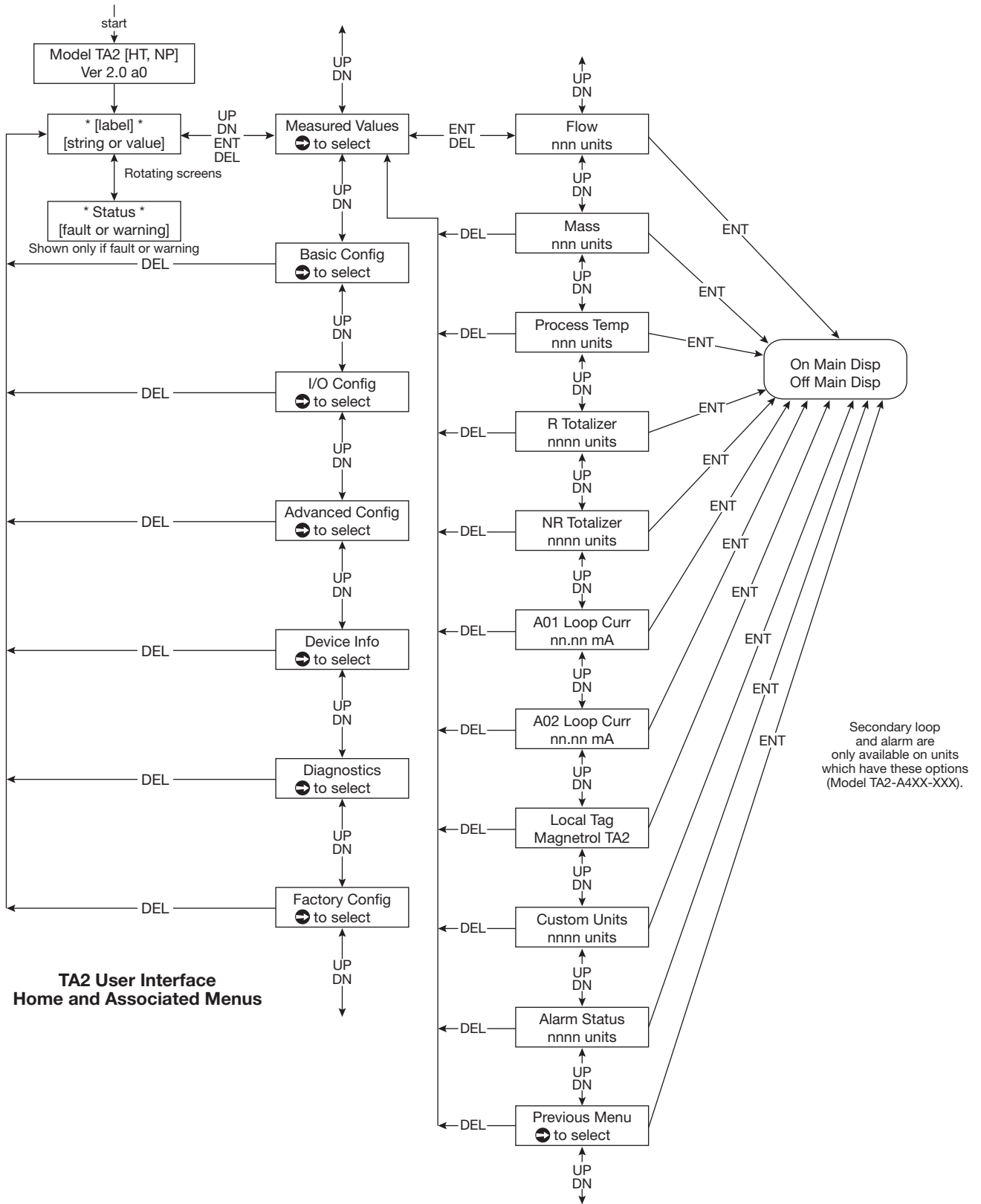
CONFIGURATION

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 Nm ³ /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 Nm ³ » ↓ → 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 Nm ³ » ↓ → 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
«AQ1 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 →	
«AQ2 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

CONFIGURATION



CONFIGURATION

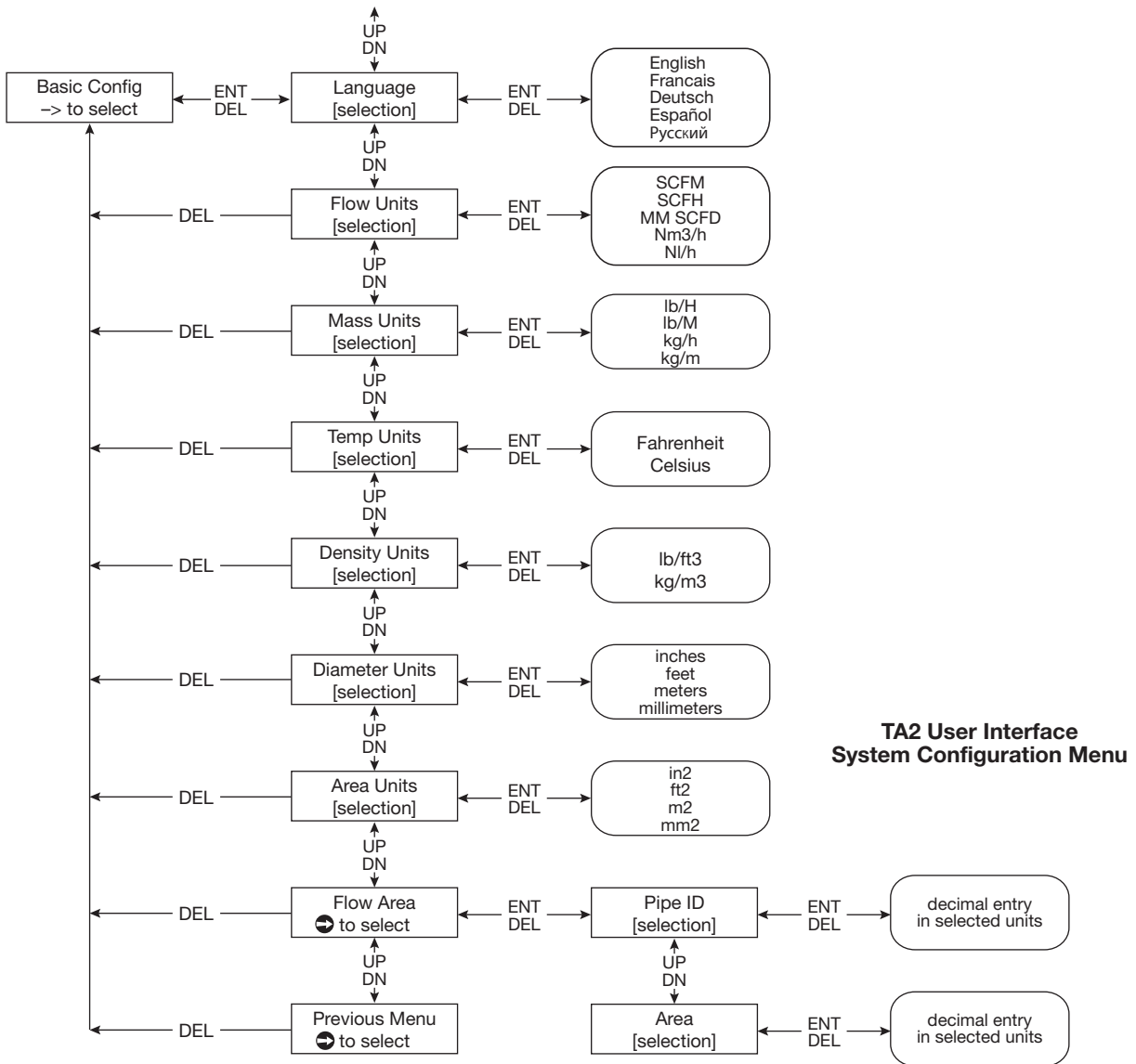
Basic Configuration Menu

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» → to select	Language	Press ↑ or ↓ to scroll between selections; press →	Choice of English «ENGLISH», French «FRANCAIS», German «DEUTSCH», Spanish «ESPAÑOL» or Russian «РУССКИЙ»
«FLOW UNITS M ³ /H» → to select	Flow Units	Press ↑ or ↓ to scroll between selections; press →	Choice of standard cubic feet per minute «SCFM», standard cubic feet per hour «SCFH», million standard cubic feet per day «MMSCFD», normal cubic meters per hour «NM ³ /H», normal liters per hour «NL/H»
«MASS UNITS KG/H» → to select	Mass Units	Press ↑ or ↓ to scroll between selections; press →	Choice of pounds per minute «LBS/M», pounds per hour «LBS/H», kilograms per minute «KG/M», kilograms per hour «KG/H»
«TEMP UNITS CELSIUS» → to select	Temperature Units	Press ↑ or ↓ to scroll between selections; press →	Choice of «FAHRENHEIT», «CELSIUS»
«DENSITY UNITS KG/M ³ » → to select	Density Units	Press ↑ or ↓ to scroll between selections; press →	Choice of pounds per cubic foot «LB/FT ³ », kilograms per cubic meter «KG/M ³ »
«DIAMETER UNITS MM» → to select	Diameter Units	Press ↑ or ↓ to scroll between selections; press →	Choice of inches «INCHES», feet «FEET», meters «METERS», millimeters «MILLIMETERS»
«AREA UNITS M ² » → to select	Area Units	Press ↑ or ↓ to scroll between selections; press →	Choice of square inches «IN ² », square feet «FT ² », meters squared «M ² », millimeters squared «MM ² »
«FLOW AREA → TO SELECT» → 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» xxx units	Enter the inside diameter (if circular), press → to accept or press ↑ or ↓
		Area «AREA» xxx units	The cross sectional area is calculated based on the diameter. If rectangular enter the flow area
«PREVIOUS MENU» → TO SELECT» → to select			Returns to previous menu or cycle through System Configuration

CONFIGURATION



CONFIGURATION

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 «RD1 LOOP», press →.

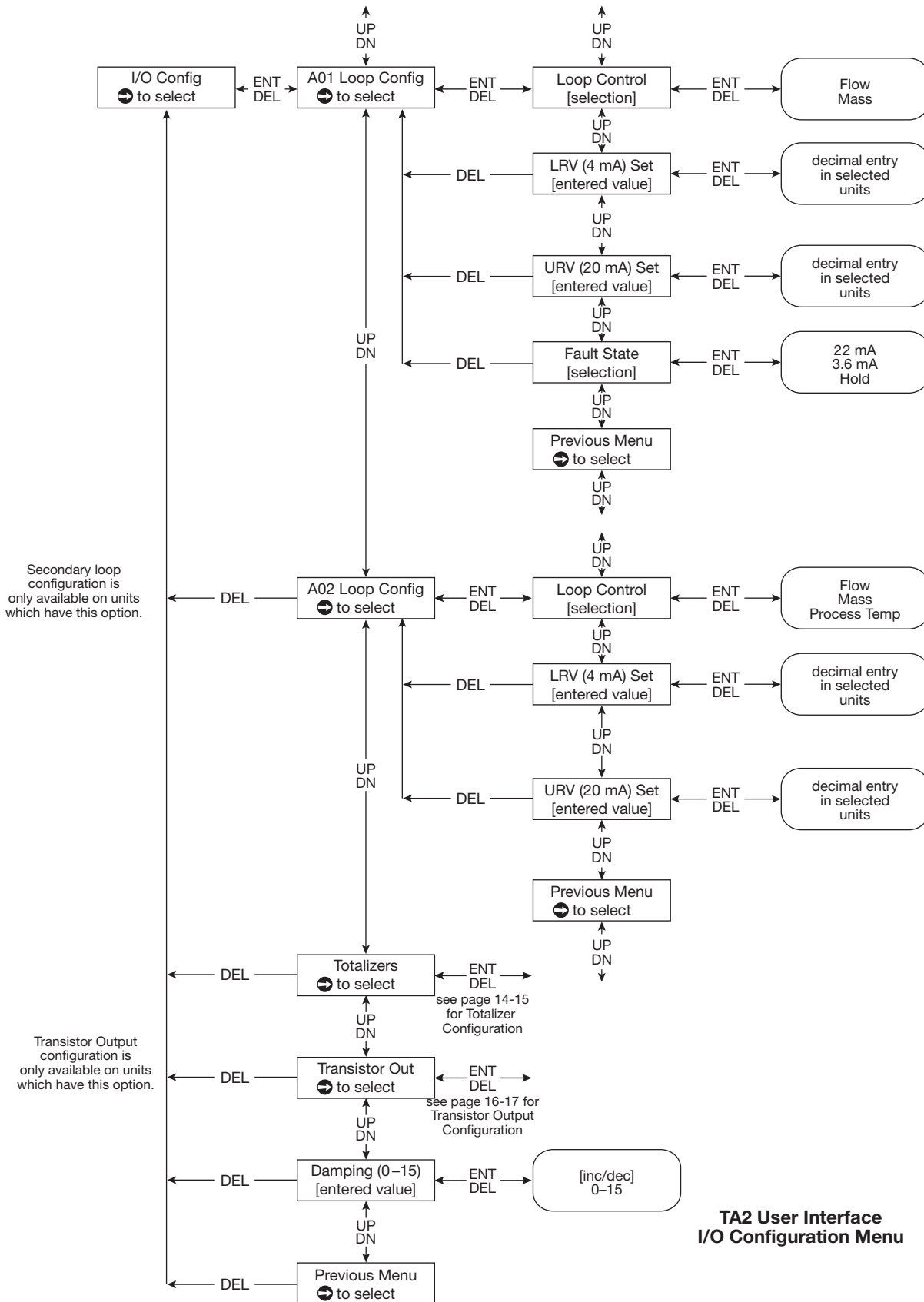
Display	Item	Action	Comments
«LOOP CONTROL FLOW» → to select	Controlled by flow	Press ↑ or ↓ to cycle between options	Choice is Flow «FLOW» or Mass «MASS»
«LRV (4 mA) SET XXXXX UNITS» → to select	4 mA set point xxxxx units	Set mA point using keypad	Enter value for 4 mA point. Units are based upon selection «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», «3.5 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 «RD2 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

CONFIGURATION



CONFIGURATION

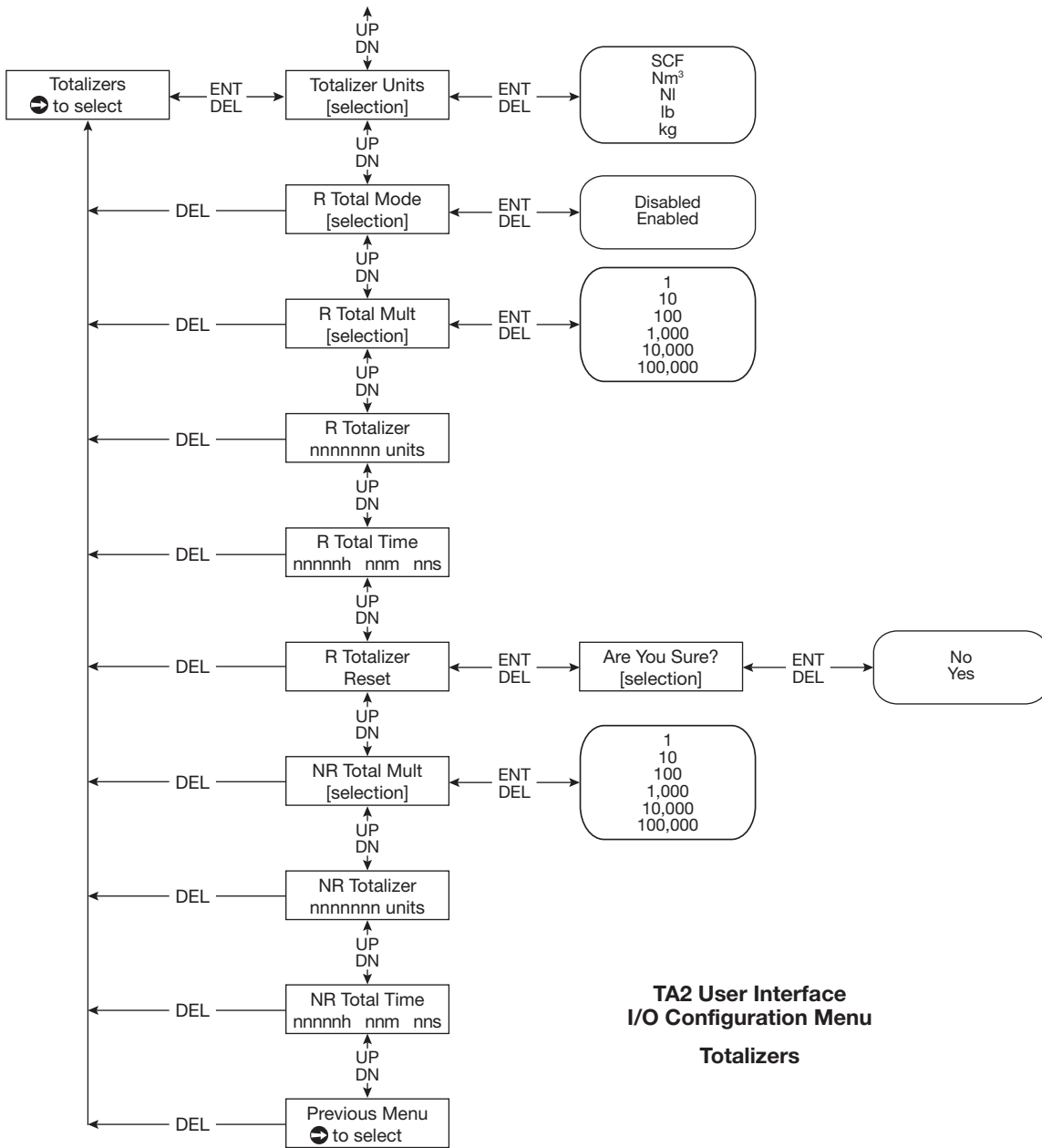
Totalizer

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

CONFIGURATION



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

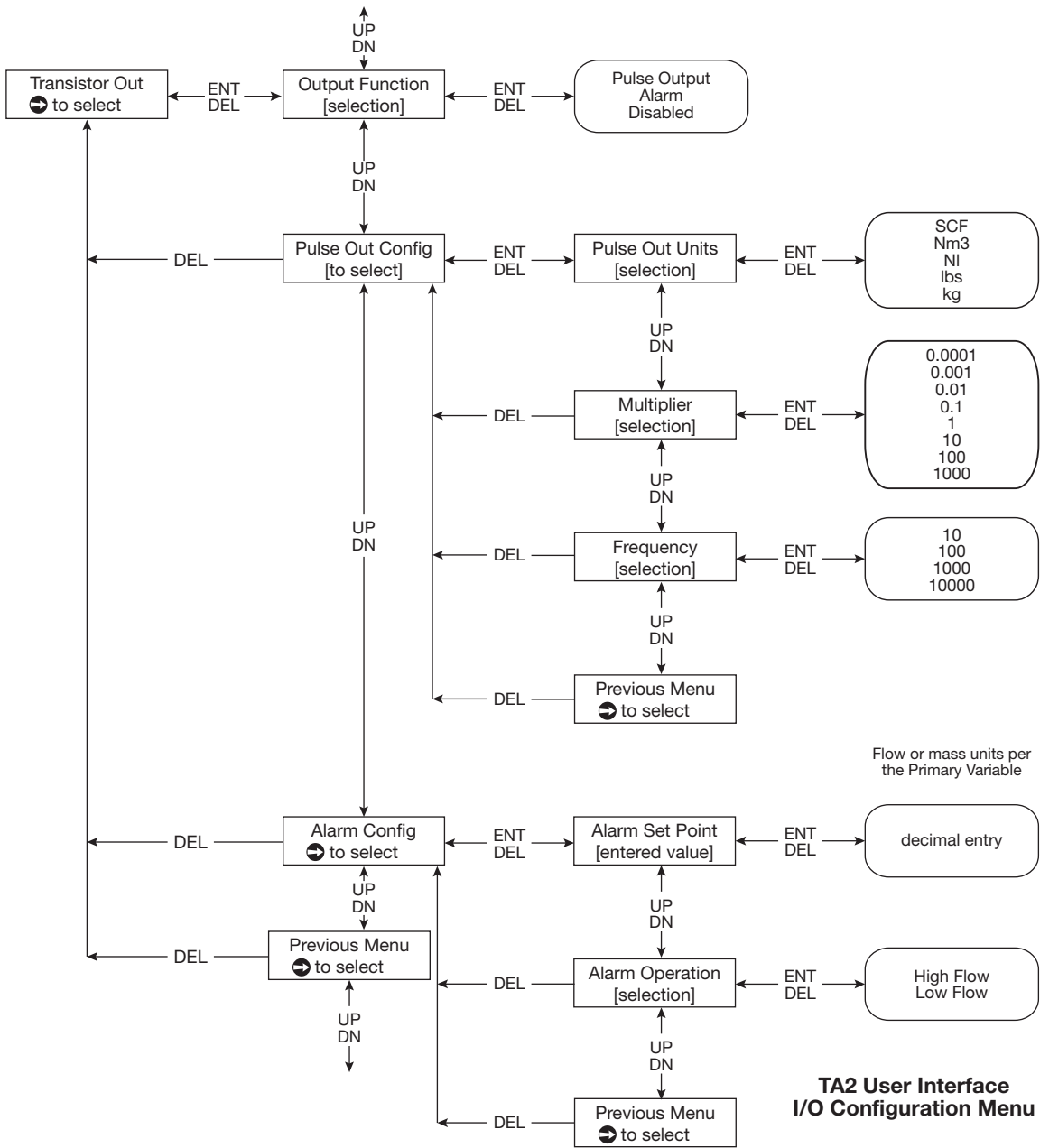
CONFIGURATION

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 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

CONFIGURATION



CONFIGURATION

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 →.

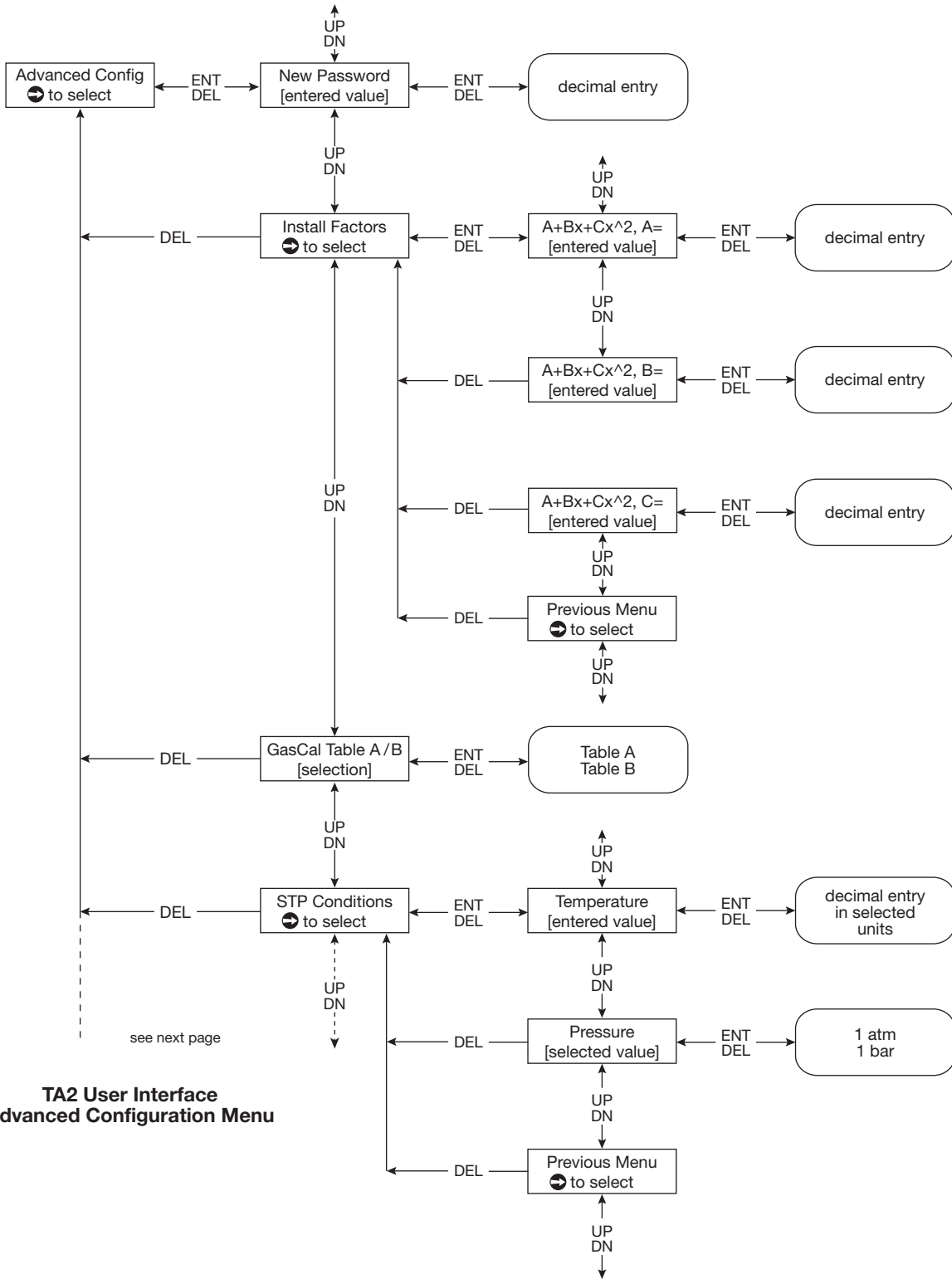
Display	Item	Action	Comments
«NEW PASSWORD → TO SELECT» → to select	Change password	Enter New Password	Change the instrument password
«INSTALL FACTORS → TO SELECT» → to select	Install factors	Enter new values for A, B & C	Permits user to adjust flow measurement.*
«GASCAL TABLE A/B → TO SELECT» → to select	Gas calibration	↑ or ↓ to choose A or B	Allows selection for 2 different gasses or 2 different ranges for the same gas
«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/R Trim AD1 → 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/R Trim AD2 → 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:

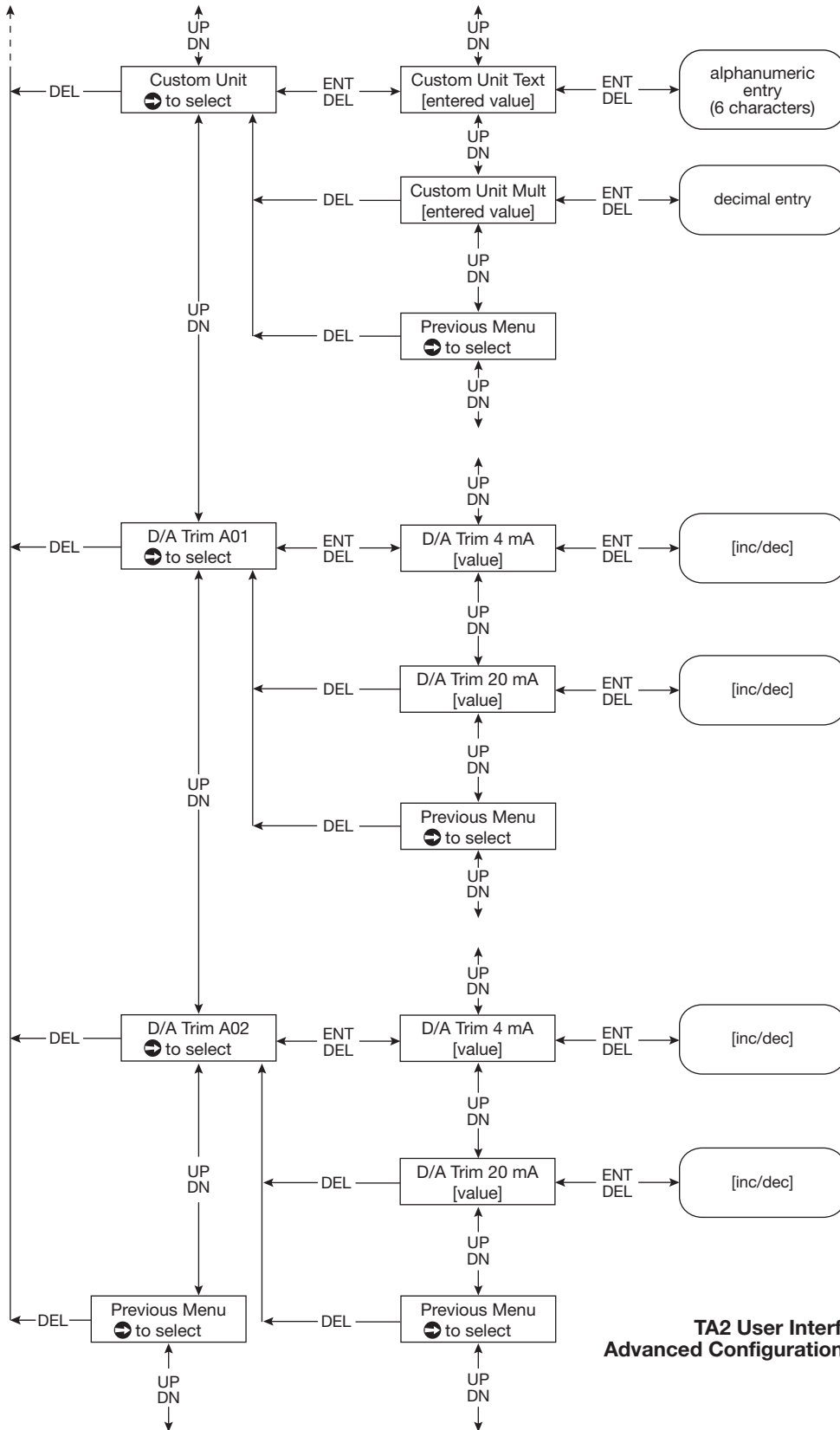
$$\text{Corrected flow} = A + Bv + Cv^2$$

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.

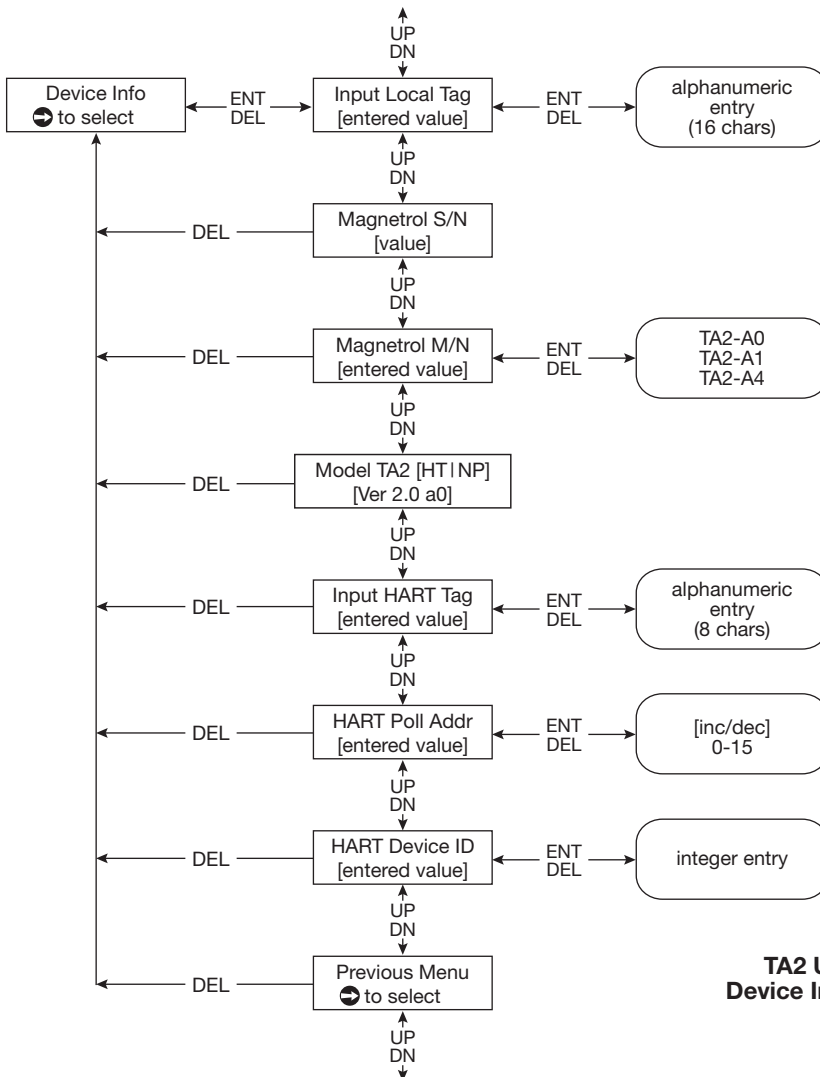
**TA2 User Interface
Advanced Configuration Menu (cont)**

CONFIGURATION

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 Address	Press → to add the address	Number from 0 to 15. Enter 0 for a single installation. 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.

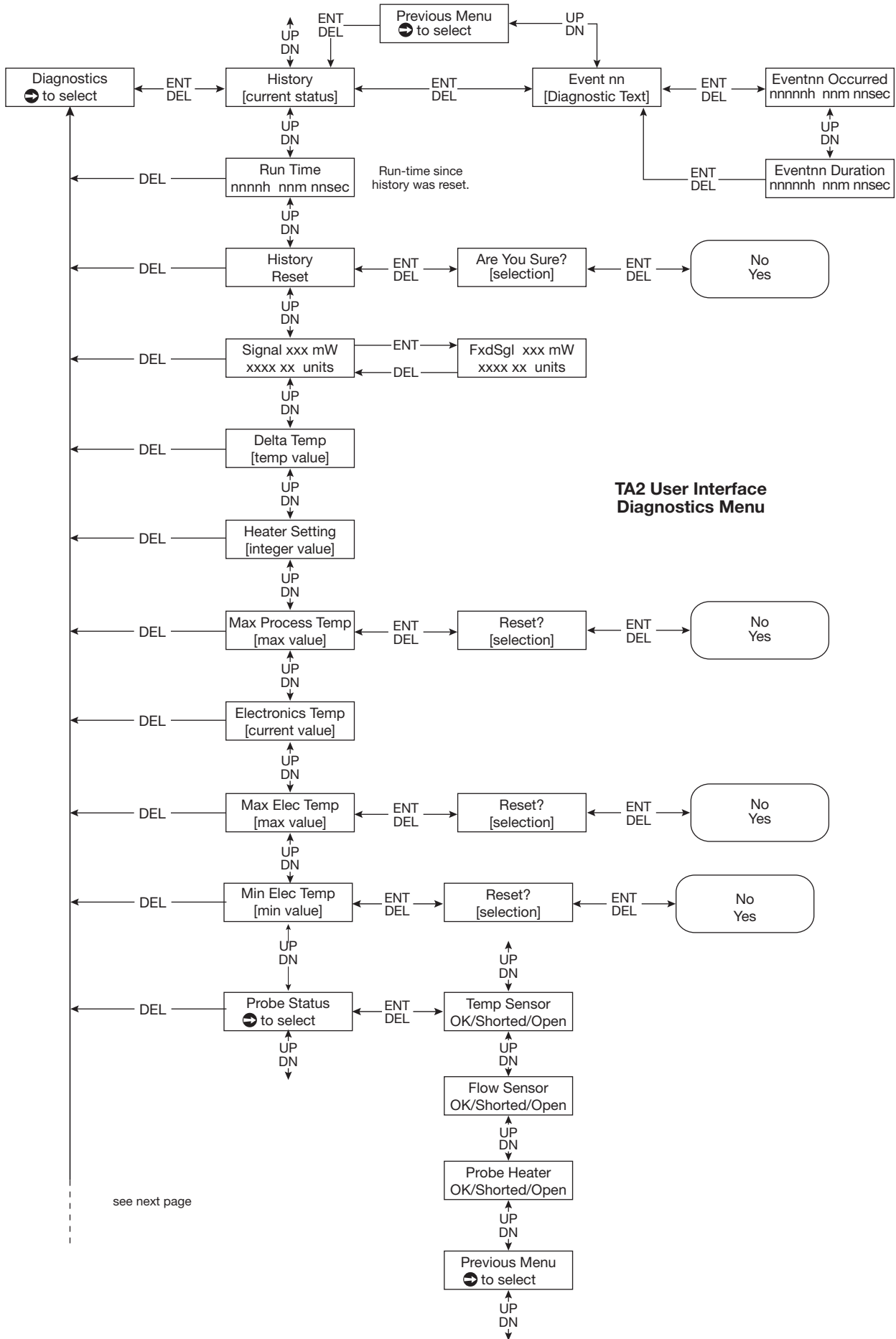
**TA2 User Interface
Device Information Menu**

CONFIGURATION

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 ELEC TEMP»	Recorded minimum temperature	Press → to reset the minimum recorded temperature	Displays the minimum temperature in the housing
«PROBE STATUS → TO SELECT» → 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.

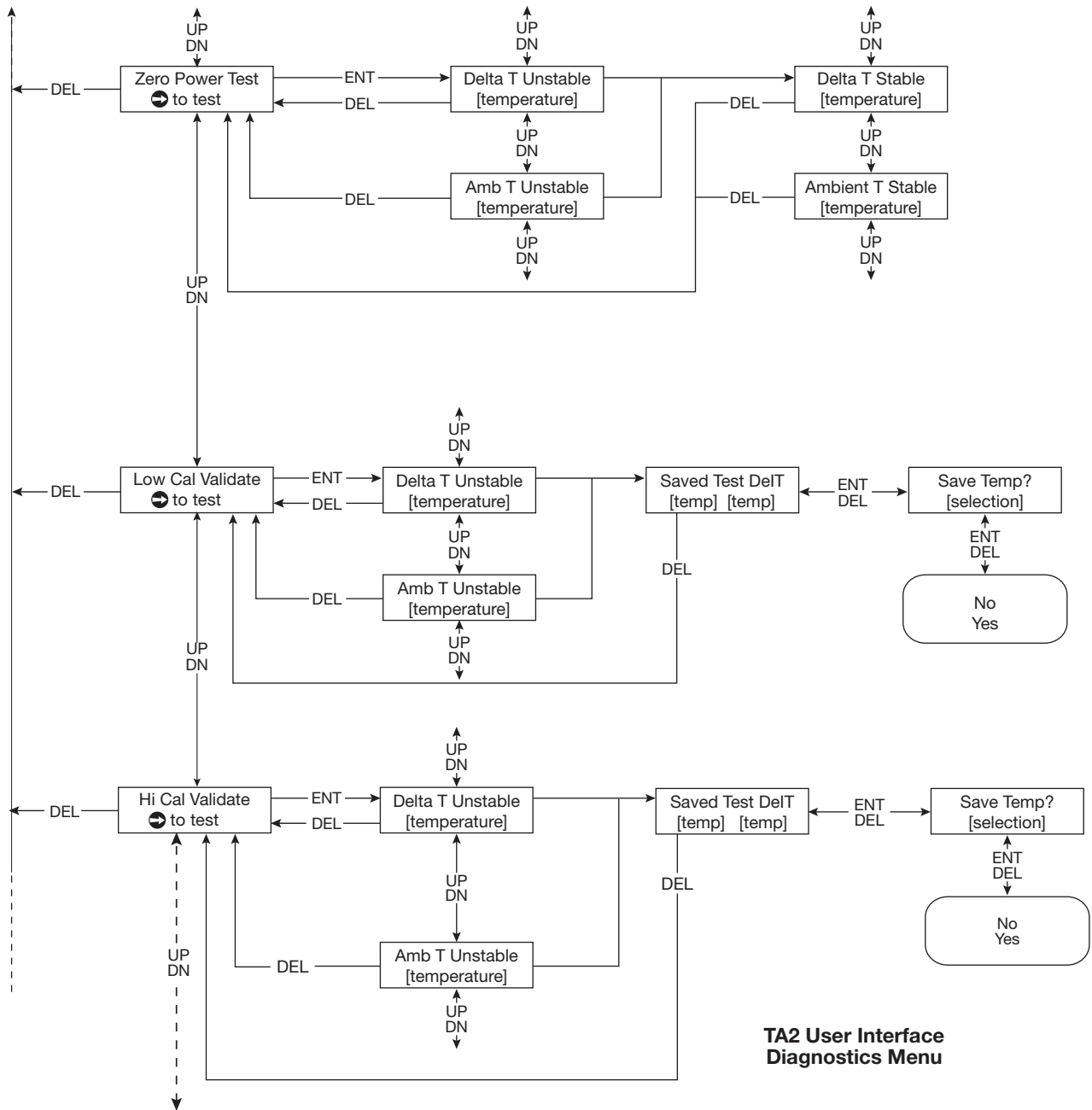


CONFIGURATION

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 → TO TEST» → to select			Output signals will be disabled and the heater turned off. Temperature difference between the sensors will be shown.
«LOW CAL VALIDATE → TO TEST» → 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 → TO SELECT» → to select	Hi calibration validation	Press → to display temperature differences	



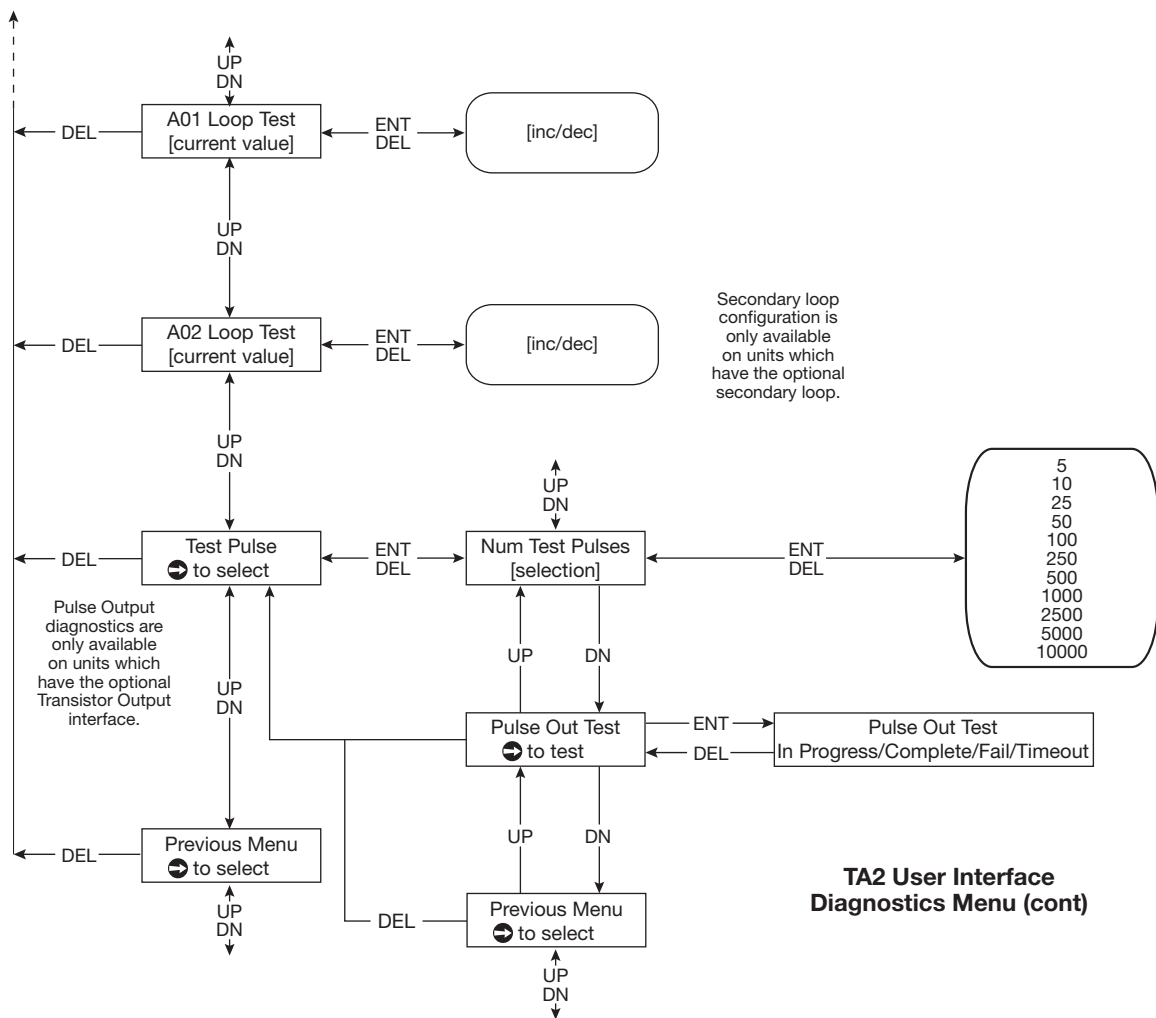
TA2 User Interface Diagnostics Menu

CONFIGURATION

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.



CONFIGURATION

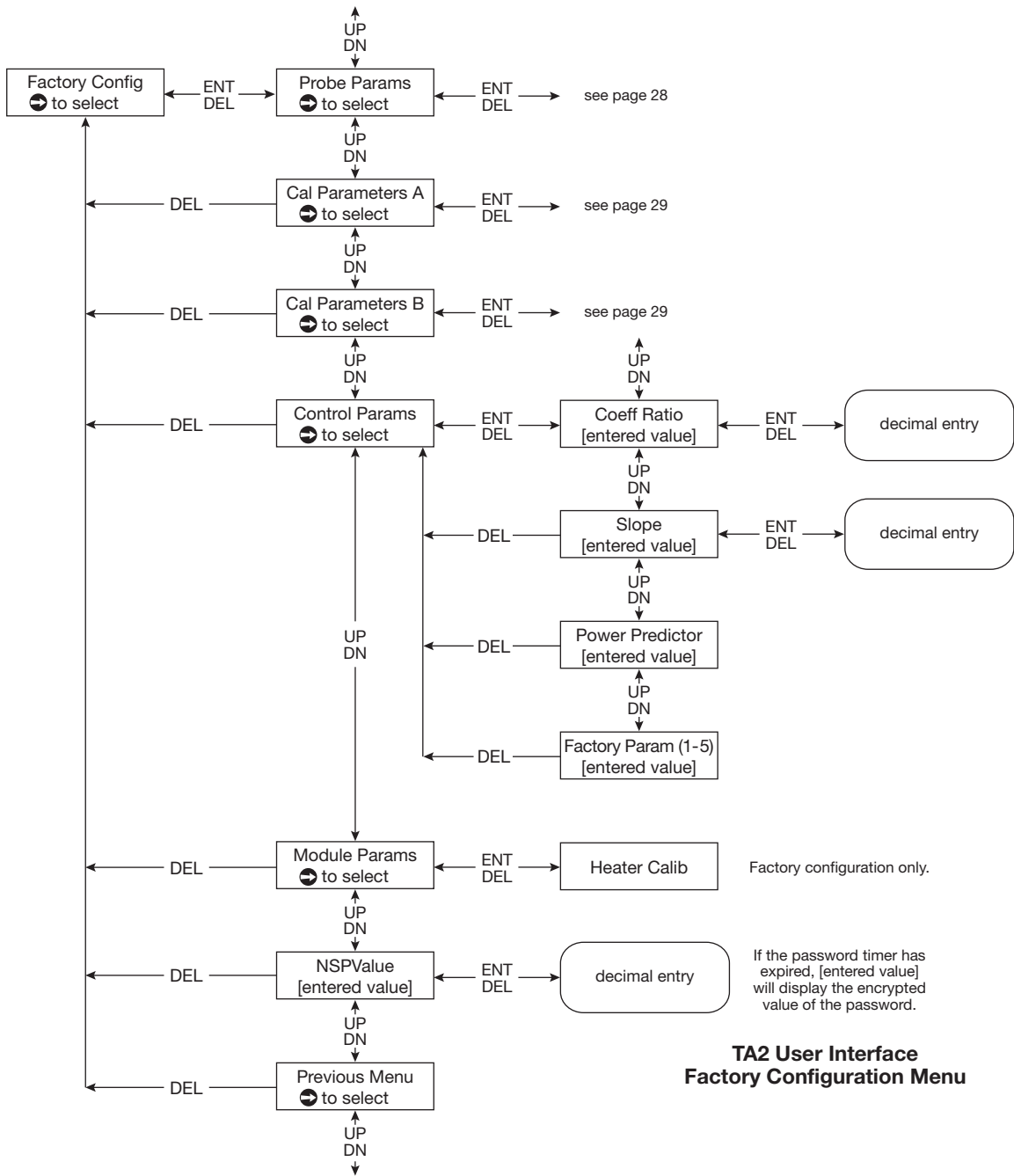
Factory Configuration

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 → TO SELECT» → to select	Probe parameters	↑ or ↓ to scroll through entries	These factors will require changing if probe is replaced.
«CAL PARAMETERS A → TO SELECT» → 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 → TO SELECT» → 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 → TO SELECT» → 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 → TO SELECT» → 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 → TO SELECT» → to select	Previous menu		Returns to previous menu or cycle through Factory Configuration.



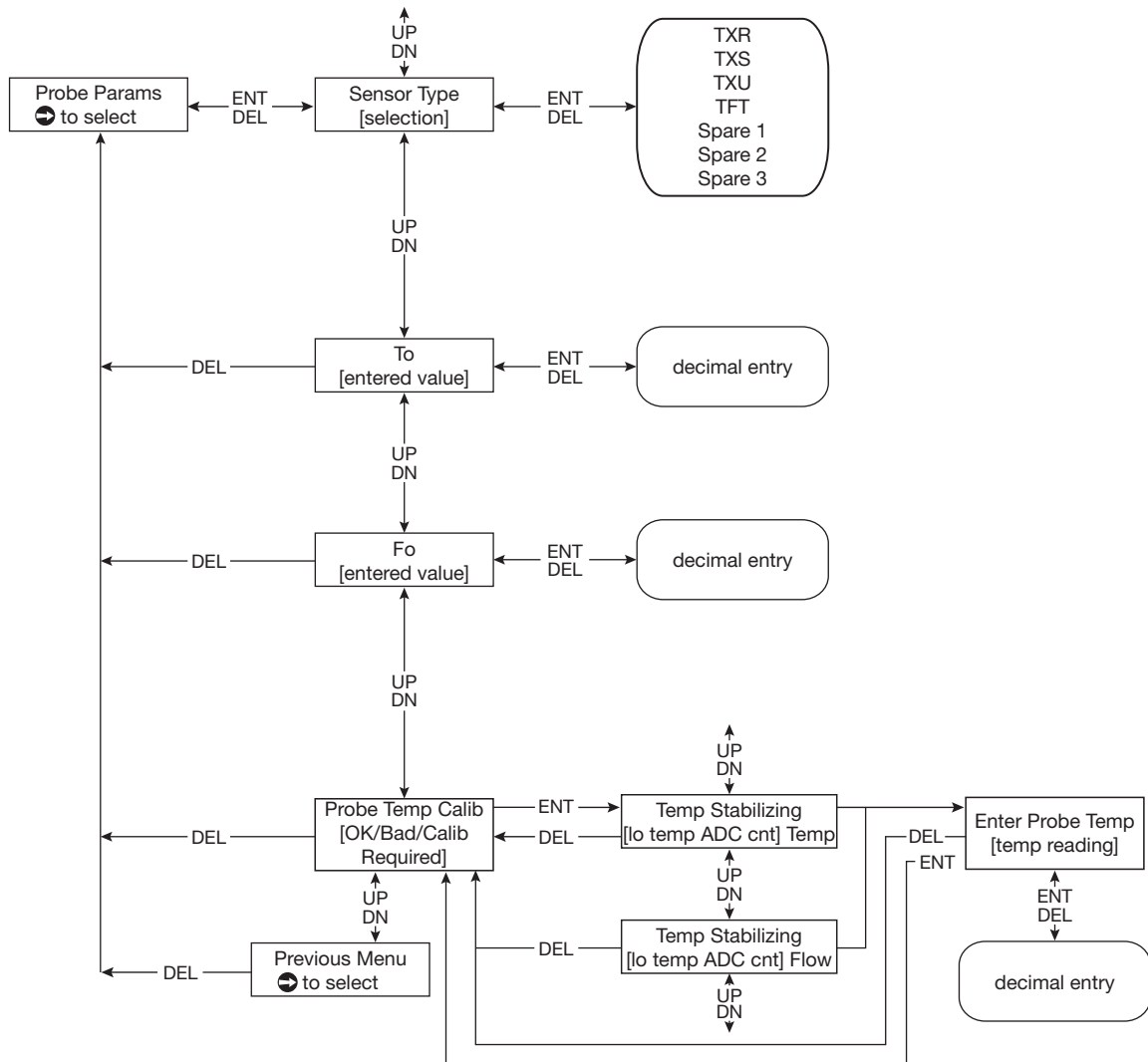
**TA2 User Interface
Factory Configuration Menu**

CONFIGURATION

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
«T0»			Calibration parameter determined when calibrating the RTD's
«F0»	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**

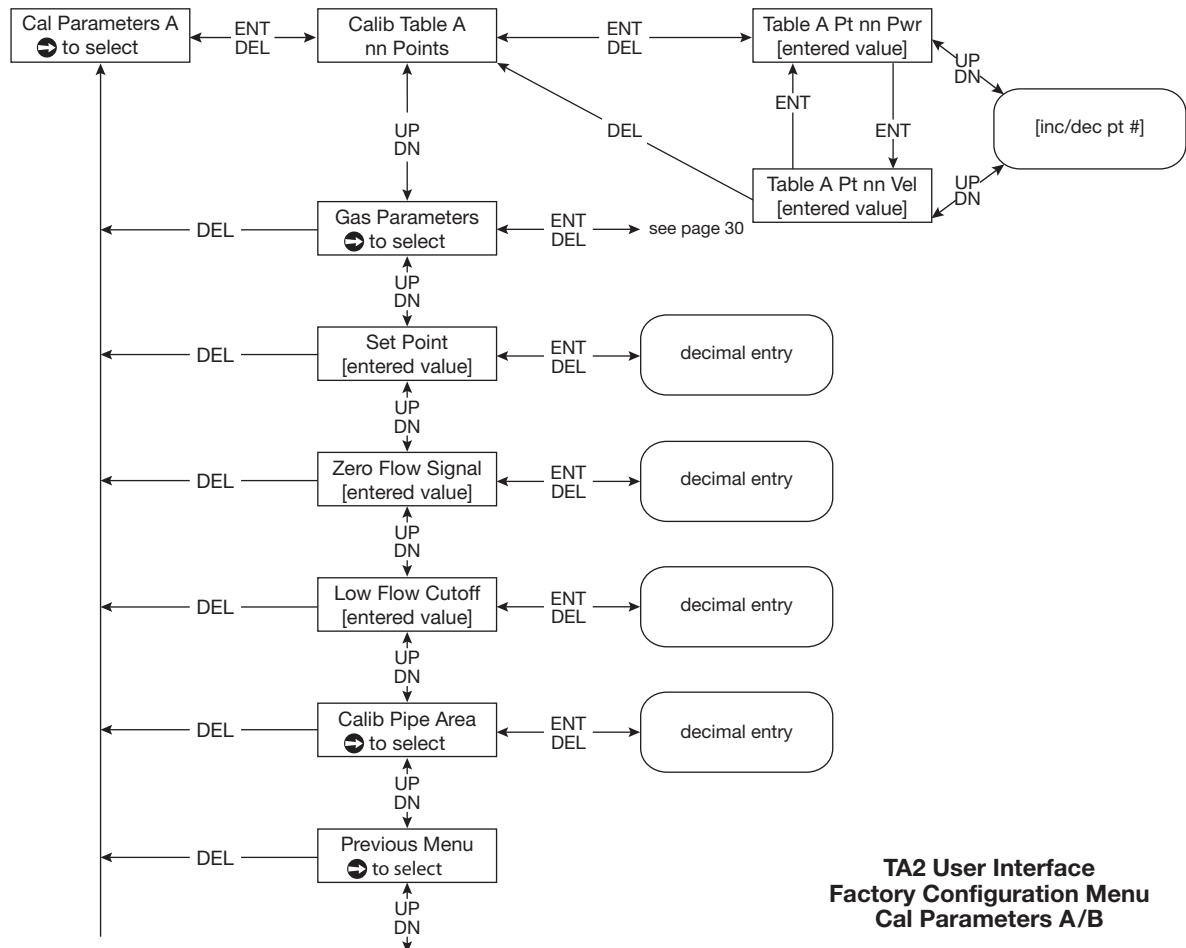
CONFIGURATION

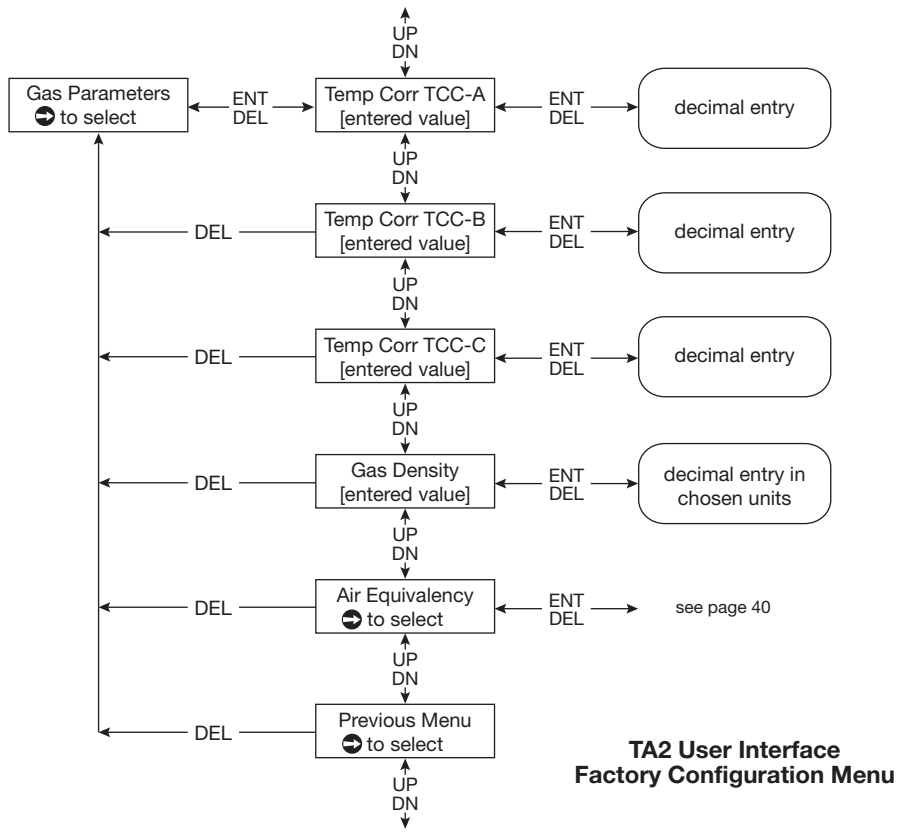
Calibration parameters

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 NN POINTS»	Calibration table respective gas		Provides actual calibration data points
«GAS PARAMETERS → TO SELECT» → 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» → to select	Temperature difference	Only to be changed by Magnetrol	Indicates temperature difference the device is attempting to maintain
«ZERO FLOW SIGNAL» → to select	Zero flow data point		Used to adjust data point for application specific related issues
«LOW FLOW CUTOFF» → 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» → TO SELECT» → to select	Previous menu		Returns to previous menu





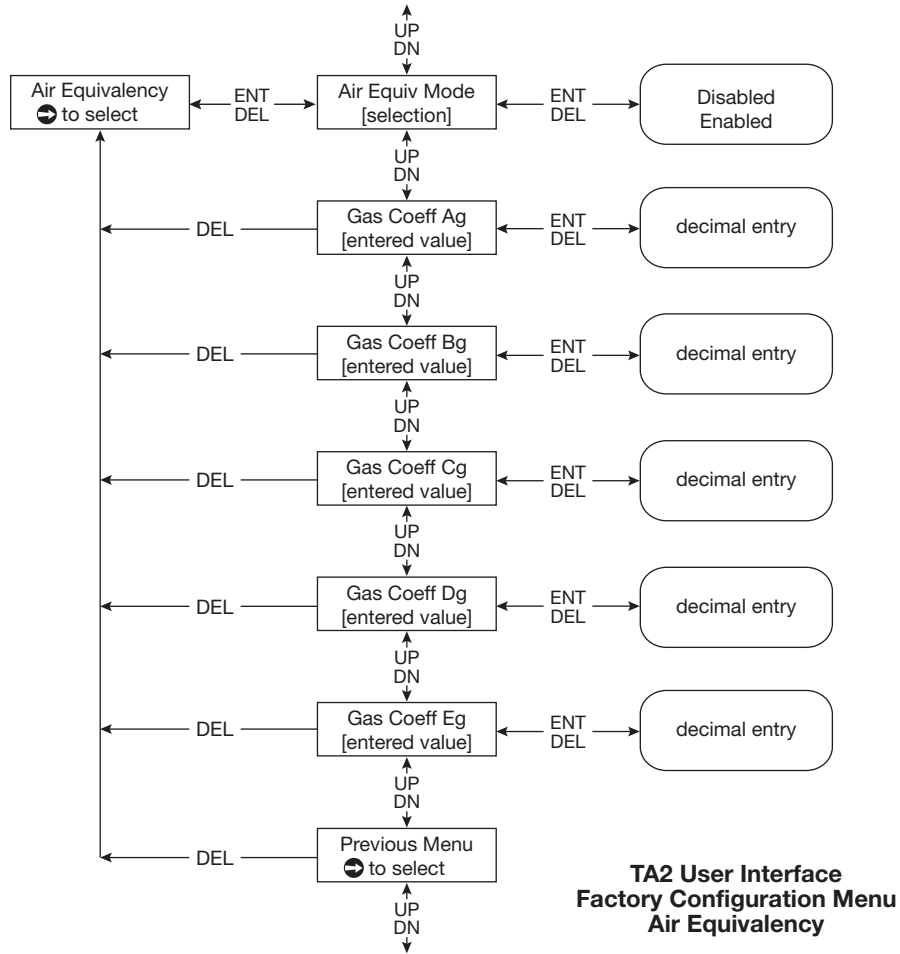
Gas Parameters menu exists for both Gas A and Gas B

CONFIGURATION

Air equivalency

To access «AIR EQUIVALENCY», press →.

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

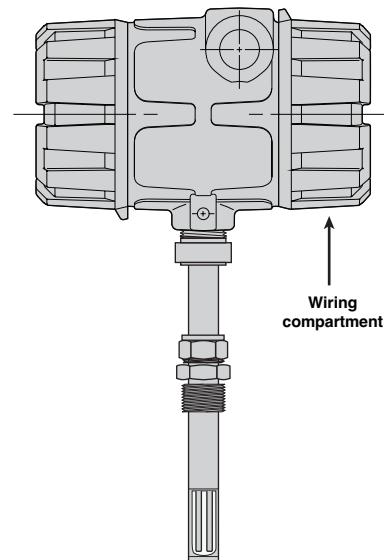
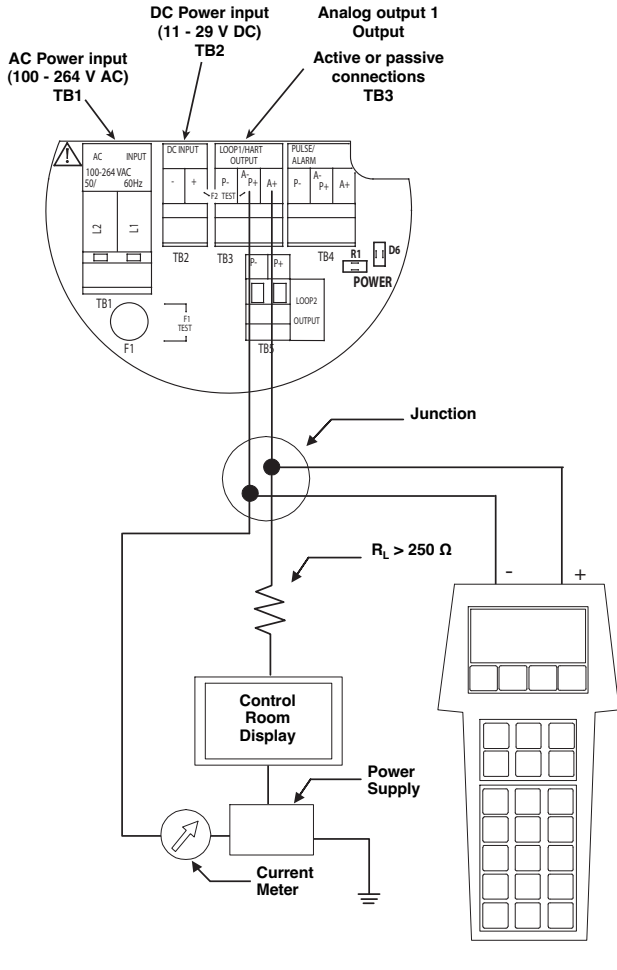


Air Equivalency menu exists for both Gas A and Gas B

CONFIGURATION USING HART®

CONNECTIONS

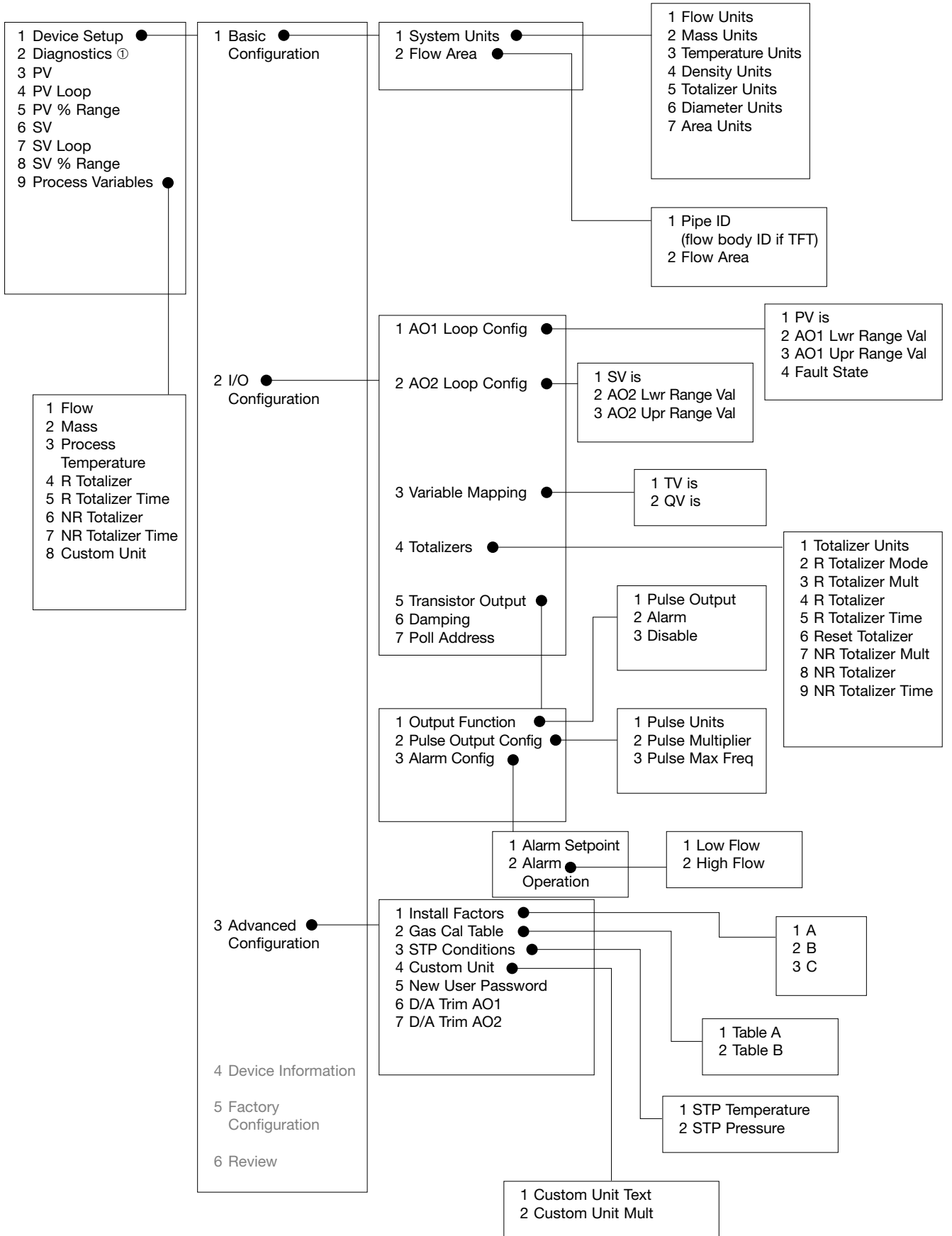
IMPORTANT: The digital HART® communication is superimposed on the 4-20 mA output and requires a min. load resistance of 250 Ω and a max load resistance of 1000 Ω.



To confirm HART® handheld communications, attach the unit as shown in the illustration. If the communicator reads GENER-IC 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

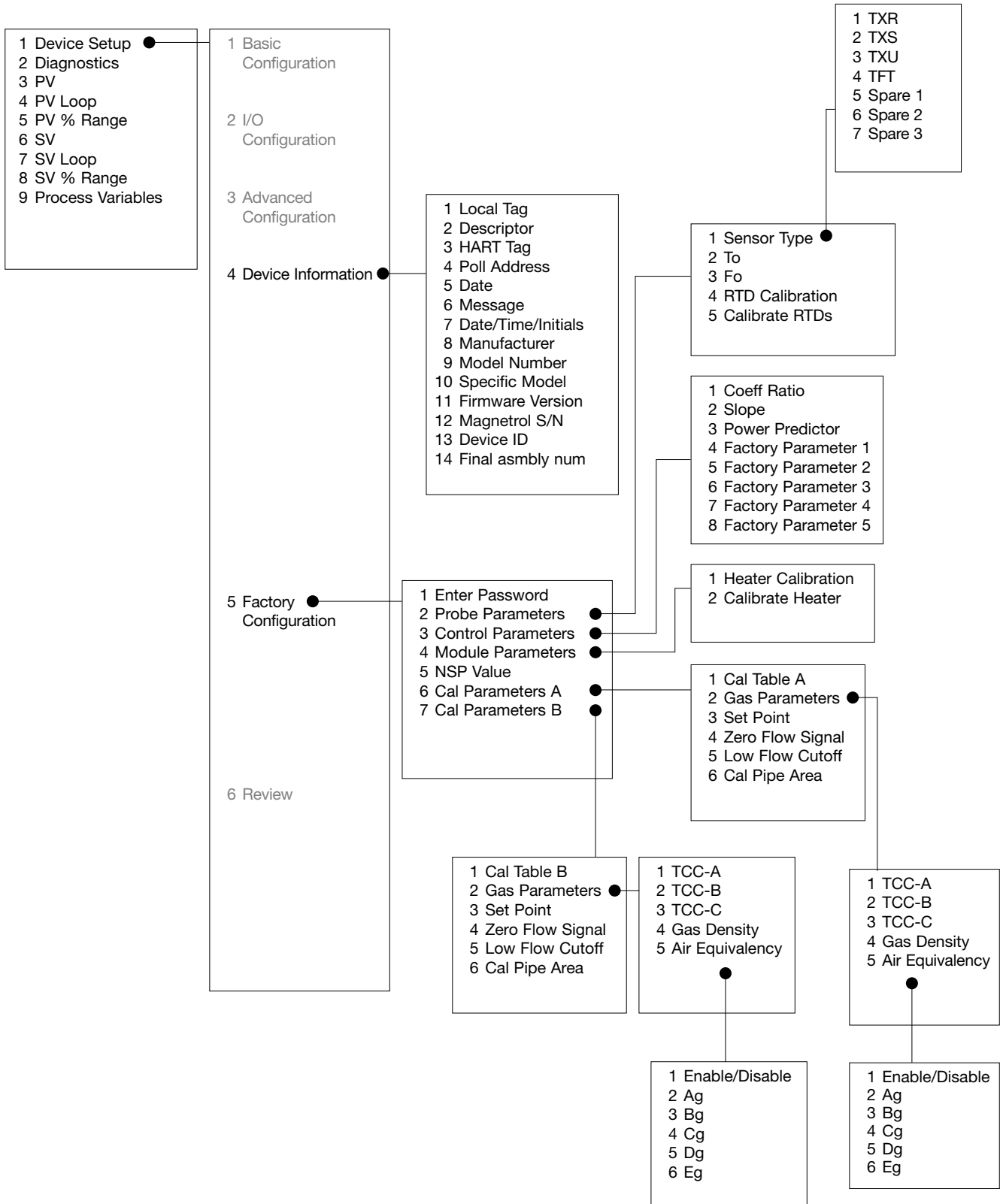
HART Version	HCF Release Date	Compatible with TA2 Software
Dev V1 DD V1	March 2010	Version 2.0a0

HART® MENU



① See page 36.

HART® MENU



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 assembly 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

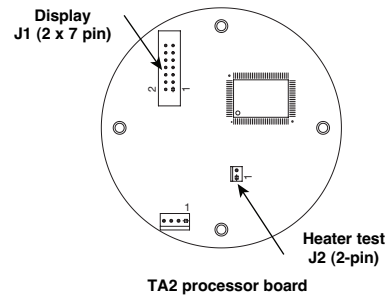
DIAGNOSTICS TEST

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.



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. This test should be performed either 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. These values should match within 0,15 °C when test performed in a water bath. Temperature difference under flowing gas may be as high as 0,5 °C depending upon flow rate. If greater than this value, 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 PACTware™. During the test, the display (or HART® or PACTware™) 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.



Troubleshooting

Symptom	Problem	Solution
No output signal 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. 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 occurred 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 occurred 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 logic 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
Low flow measurement	Measured velocity is between the low flow cutoff value and minimum velocity. Flow measurements are possible. Currently flow rate is forced to zero. If nuisance warnings occur, this can effectively be disabled by increasing the Zero Flow Signal under Factory Config/Cal Parameters A. See section 2.5.16.	Vel < LowFlowLmt
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 Req'd
		AO2 Loop Trim Req'd
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, Display Module, and the Power Loop Board 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 on the wiring side with the display module, power loop board and processor board contained in the electronics compartment.
3. Remove appropriate cover.
4. If removing boards in the electronics 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 calibration table 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.

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

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.
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.

RTD calibration

If either the probe or the logic 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.

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 adjust 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 Nm/h which the unit will operate (Nm/h equals the Nm³/h divided by the flow area of the test section in square meter).
 - 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 PACTware™, 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 Nm/h (normal meter/hour). This is equivalent to the flow rate in Nm³/h divided by the flow area in square meter. Convert from other units of measurement as necessary. Use Magnetrol STP conditions of 21 °C and 1 Atmosphere.
 - c. Enter the Power and the corresponding Mass Velocity into the TA2. This is easily performed using PACTware™ 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®/PACTware™ 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 logic PC board 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.

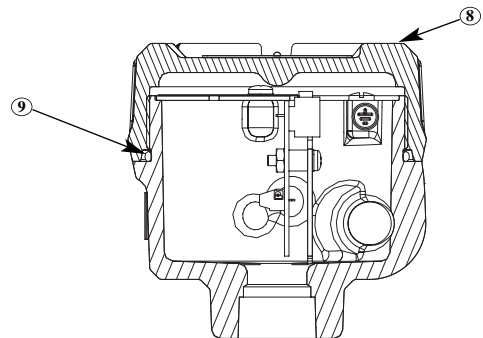
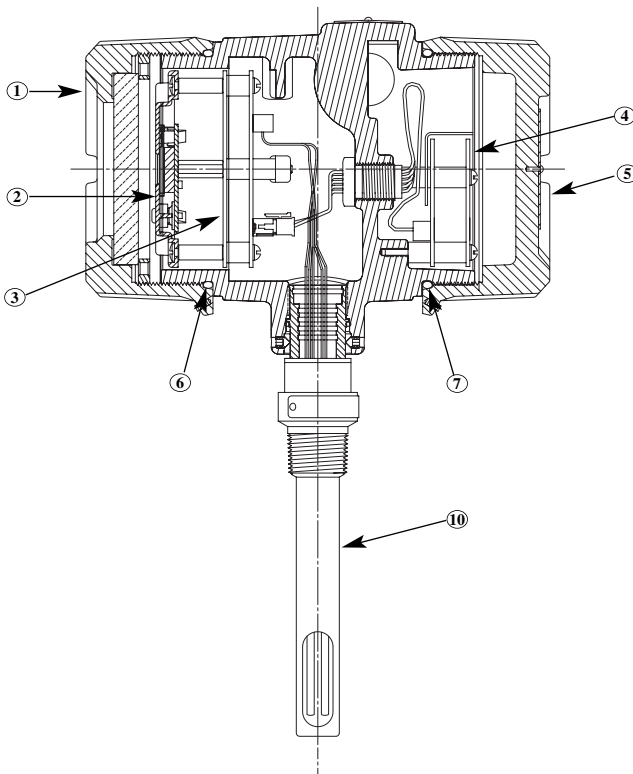
IMPORTANT NOTICE: See nameplate, always provide complete partn° and serial n° when ordering spares.

Partn°: T A 2 [] [] [] [] [] [] [] [] [] []

Serial n°: []

Digit in partn°: X 1 2 3 [] [] [] [] [] [] [] [] [] [] [] []

↳ X = product with a specific customer requirement



(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
4	3 or 4	089-7261-003

(4) Wiring PC board	
Digit 5	Replacement part
1	089-7260-001
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	not applicable
4	004-9193-003

(9) "O" ring	
Digit 9	Replacement part
3	not applicable
4	012-2201-237

SPECIFICATIONS

Electronics specifications

Description		Specification
Power supply		11,6 – 30 V DC (11,6 V DC for integral electronics only) 100 – 264 V AC, 50-60 Hz
Power consumption		DC = 6,8 watts, AC = 7 VA typical, 11,9 VA maximum
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 - NIST traceable
Damping		Adjustable 0-15 s time constant
Diagnostic Alarm		Adjustable 3,6 mA, 22 mA or Hold last output
User Interface		4-button keypad and/or HART® communicator
Pulse Output		Active connection – 24 V DC Power, 150 mA Passive connection – 2,5 to 60 V DC Power, 1,5 A
Alarm Output		Active connection – 24 V DC Power, 100 mA Passive connection – 2,5 to 60 V DC Power, 1 A
Display		2-line x 16-character backlit LCD
Displayed values		Flow (eg. Nm ³ /h, NI/h) and/or mass flow (eg. kg/h) and/or temperature (°C/°F) and/or loop current (mA) and/or totalized flow (eg. Nm ³ /h, NI/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 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: 88,4 %. 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

Performance

Description		Specification
Turn down ratio		100:1 typical (depending upon calibration)
Flow range	Max	0,05 - 250 Nm/s (10 - 50,000 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 2 s
Remote electronics		Max 60 m or 150 m, depending on cable used - for longer lengths, consult factory
Ambient temperature		-40 °C to +80 °C (-40 °F to +176 °F) (ATEX up to +55 °C (+130 °F)) Display: -30 °C to +80 °C (-22 °F to +176 °F)
Operating temperature effect		± 0,04 % per °C
Humidity		0-99 %, non-condensing
Electromagnetic Compatibility		Meets CE requirements (EN 61326: 1997 + A1 + A2)

Probe specifications

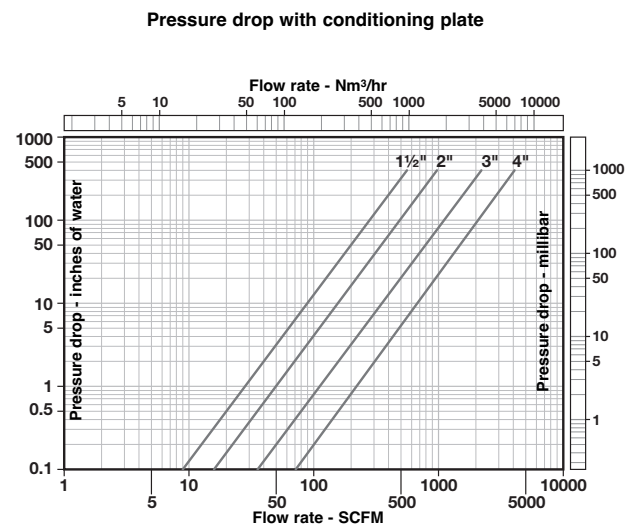
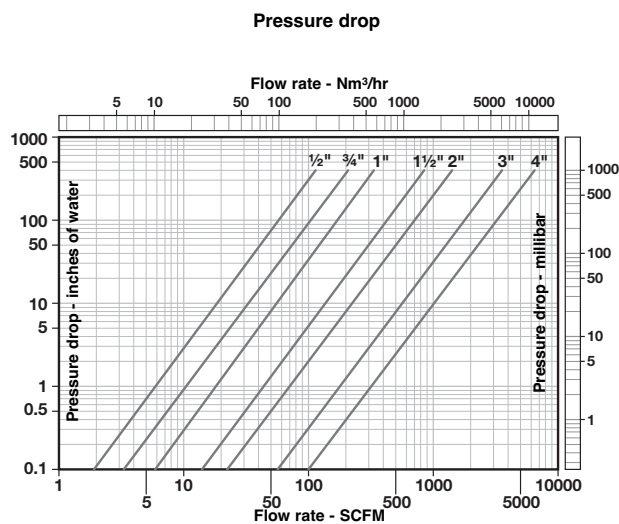
Description	Insertion probe	Sensor with flow body
Materials – wetted parts	316/316L (1.4401/1.4404) or Hastelloy® C (2.4819)	Sensor: 316/316L (1.4401/1.4404) Flow body: stainless steel or carbon steel
Mounting	Threaded, compression fitting, ANSI-EN (DIN) flanged or with Retractable probe assembly	Threaded 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) -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 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) 94,8 bar @ +200 °C (1375 psi @ +400 °F) – direct insertion 75,9 bar @ +200 °C (1100 psi @ +400 °F) – with flow body	

SPECIFICATIONS

Flow body sizing

The following table is a general guide on flow sizing. Contact your Magnetrol contact for specific application information.

Code	Size	Max flow rate					
		Air, N ₂ , O ₂	Natural Gas, Methane	Digester Gas	Propane	Hydrogen	CO ₂ , Argon
0	1/2"	145 Nm ³ /h 85 SCFM	100 Nm ³ /h 60 SCFM	100 Nm ³ /h 60 SCFM	50 Nm ³ /h 30 SCFM	35 Nm ³ /h 20 SCFM	140 Nm ³ /h 80 SCFM
1	3/4"	275 Nm ³ /h 160 SCFM	195 Nm ³ /h 115 SCFM	195 Nm ³ /h 115 SCFM	95 Nm ³ /h 55 SCFM	70 Nm ³ /h 40 SCFM	250 Nm ³ /h 150 SCFM
2	1"	460 Nm ³ /h 270 SCFM	320 Nm ³ /h 190 SCFM	320 Nm ³ /h 190 SCFM	160 Nm ³ /h 95 SCFM	115 Nm ³ /h 65 SCFM	435 Nm ³ /h 255 SCFM
3	1 1/2"	1120 Nm ³ /h 660 SCFM	780 Nm ³ /h 460 SCFM	780 Nm ³ /h 460 SCFM	390 Nm ³ /h 230 SCFM	275 Nm ³ /h 160 SCFM	1060 Nm ³ /h 625 SCFM
4	2"	1640 Nm ³ /h 965 SCFM	1160 Nm ³ /h 680 SCFM	1160 Nm ³ /h 680 SCFM	600 Nm ³ /h 350 SCFM	450 Nm ³ /h 265 SCFM	1560 Nm ³ /h 920 SCFM
5	3"	4580 Nm ³ /h 2700 SCFM	3210 Nm ³ /h 1890 SCFM	3210 Nm ³ /h 1890 SCFM	1170 Nm ³ /h 690 SCFM	1230 Nm ³ /h 730 SCFM	4360 Nm ³ /h 2565 SCFM
6	4"	8260 Nm ³ /h 4860 SCFM	5780 Nm ³ /h 3400 SCFM	5780 Nm ³ /h 3400 SCFM	2090 Nm ³ /h 1230 SCFM	2225 Nm ³ /h 1310 SCFM	7845 Nm ³ /h 4620 SCFM



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.

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: code: **070-3004-002**
 - portable display module – code: **089-5219-002**
 - retractable probe assembly (RPA) – for code see page 49
 - valve and compression fitting – code: **089-5218-001** (for more details see page 49)
 - duct mounting bracket – code: **089-7247-001** (for more details see page 49).
5. Free of charge: Magnetrol master C.D. with TA2 DTM (PACT^{ware}™) - code: **090-BE59-200** (included in each order)

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
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

ACTUAL GAS CALIBRATION

For TA2 with insertion probe

0	Special. Specify medium separately
1	Air
2	Nitrogen
3	Hydrogen
4	Natural gas

5	Methane
6	Digester gas
7	Propane
8	Oxygen

For TA2 with sensor with flow body

A	Special. Specify medium separately
B	Air
C	Nitrogen
D	Hydrogen
E	Natural gas

F	Methane
G	Digester gas
H	Propane
J	Oxygen

AIR EQUIVALENCY CALIBRATION

Air equivalency values are available for various gases, consult factory for gases and flow rates.

9	For TA2 with insertion probe
K	For TA2 with sensor with flow body

MOUNTING/APPROVAL

3	Integral, ATEX II 2 G Ex d IIC T6 Gb, flameproof enclosure
4	Remote ^① , ATEX II 2 G Ex d IIC T6 Gb, flameproof enclosure

^① Bracket for electronics and probe housing included
For weatherproof, consult factory

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 Thematel® Enhanced Model TA2 mass flow insertion probe

BASIC MODEL NUMBER

T	M	R	Thematel® TA2 Mass Flow probe - 3/4" diameter
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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 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 (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 (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) see page 49
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 Thematel® Enhanced Model TA2 mass flow insertion probe

X = product with a specific customer requirement

MODEL IDENTIFICATION

2. Code for Thermate!® Enhanced Model TA2 sensor with flow body

BASIC MODEL NUMBER

T F T	Thermate!® 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 - ϕ size and connection

0	1	1/2"	NPT
1	1	3/4"	NPT
2	1	1"	NPT
3	1	1 1/2"	NPT
4	1	2"	NPT

FLANGED FLOW BODY - ϕ 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 \geq 1 1/2"

T
F
T

0
0
0
complete code for Thermate!® Enhanced Model TA2 sensor with flow body

X = product with a specific customer requirement

3. Code for connecting cable remote mount Thermate!® 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 60 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 6 0	max 60 m (196 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

MODEL IDENTIFICATION

4. 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	- 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

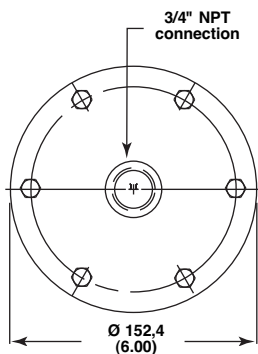
0 2 5	min 25 cm (9.84")
1 8 0	max 180 cm (70.87")



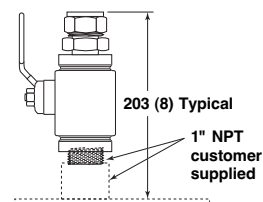
4. Code for other options

When ordered separately:

Process Conn. Size	Compression fitting in 316 (1.4401) stainless steel	
	Teflon ferrules Max. 6,90 bar (100 psi)	Stainless steel ferrules Max. 103 bar @ +20 °C (1500 psi @ +70 °F) 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

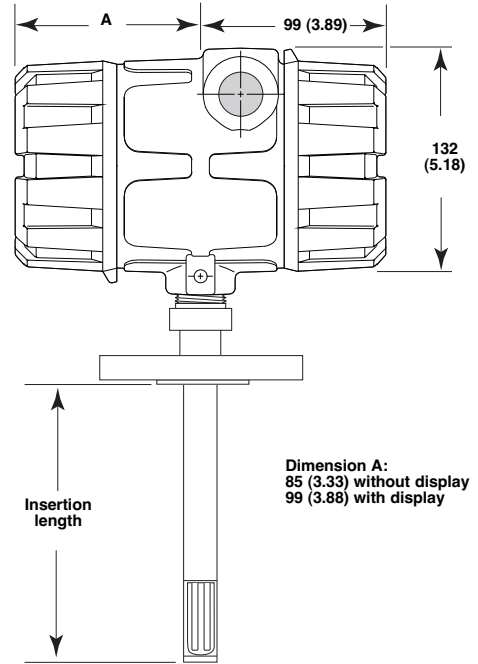
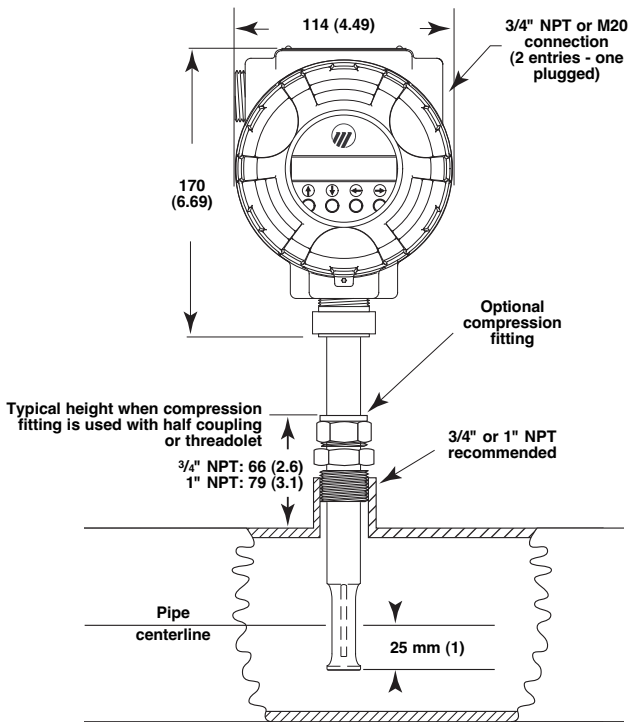


Duct mounting bracket with 3/4" NPT
code **089-7247-001** or
089-7247-002 (includes mounting hardware)

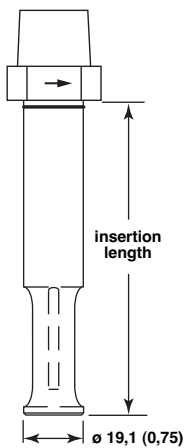
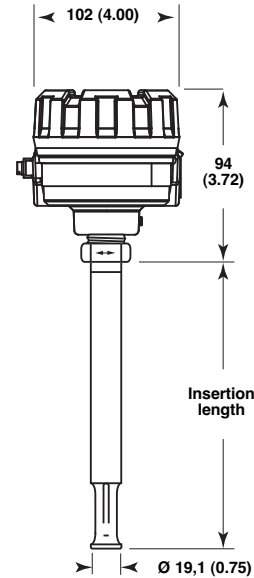
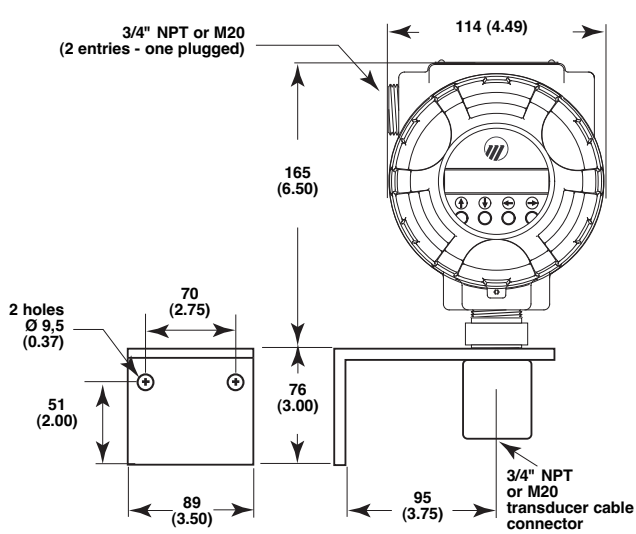


1" NPT ball valve in 316 SST with
compression fitting (TFE ferrules)
code: **089-5218-001**

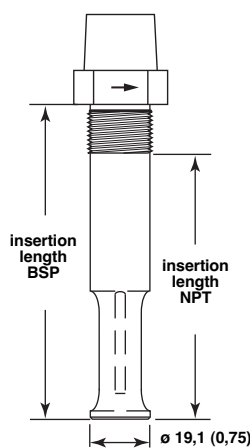
Integral Mount TA2



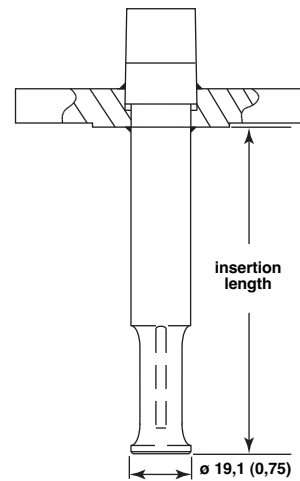
Remote Mount TA2



TMR for mounting with compression fitting

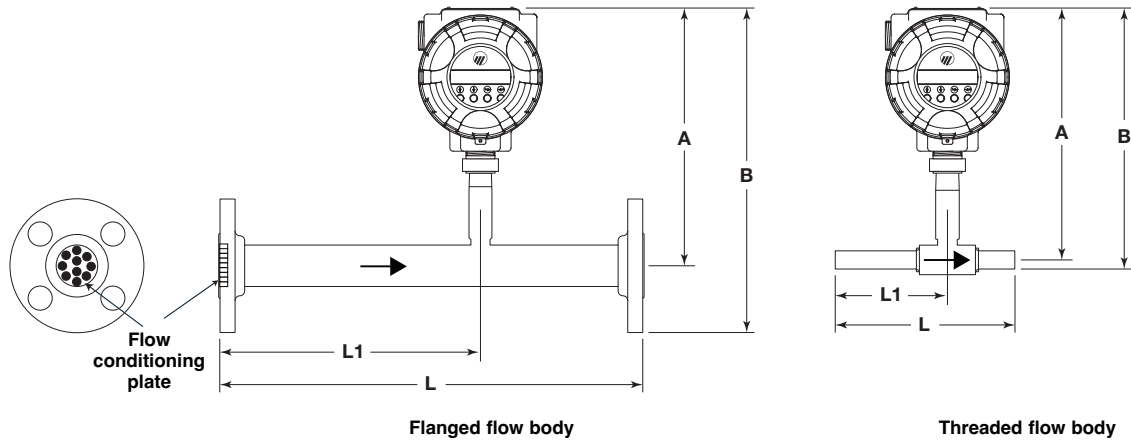


TMR with threaded connection



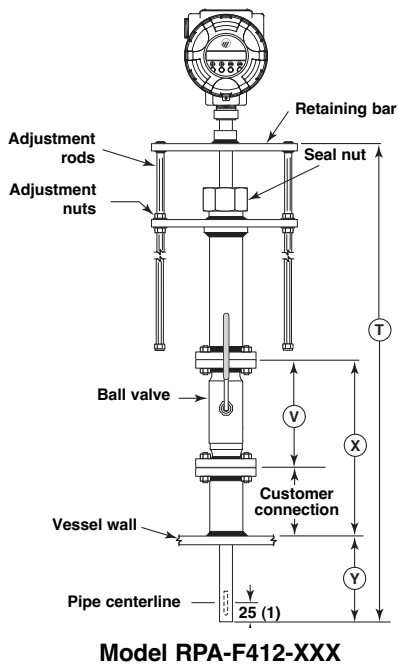
TMR with flanged connection

DIMENSIONS IN mm (inches)

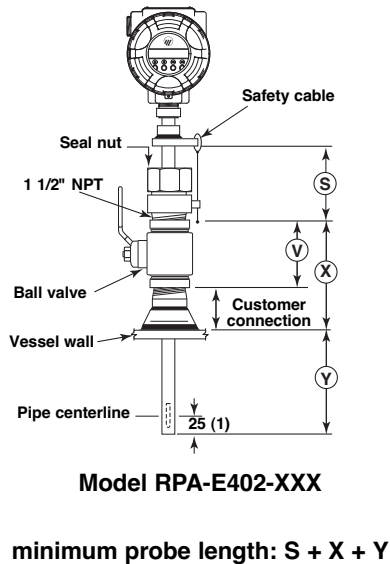


Code	Size	Length (L)		L1		Height to Centerline (A) mm (inches)	Overall Height (B)	
		With Flow Conditioning mm (inches)	Without Flow Conditioning mm (inches)	With Flow Conditioning mm (inches)	Without Flow Conditioning mm (inches)		NPT-F mm (inches)	Flange mm (inches)
0	1/2"	203 (8) ^①	—	127 (5) ^①	—	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.



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



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

Ball Valve Dimensions*	
Size	V
1 1/2" NPT	112 (4.4)
1 1/2" 150# flange	165 (6.5)
1 1/2" 300# flange	191 (7.5)

*Dimension of ball valve if supplied by the factory.

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.

UNDER RESERVE OF MODIFICATIONS

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