

## PRINCIPLE OF OPERATION

The TB82PH pH/ORP/pION FOUNDATION Fieldbus Transmitter provides on-line measurement of liquid properties in industrial environments using an advanced microprocessor-based technology. Transmitter power and digital communication based on the FOUNDATION Fieldbus protocol is provided by fieldbus wiring. The TB82PH transmitter can be installed indoors or outside due to its IP65 and NEMA 4X environmental enclosure ratings. Cable glands for field wiring ensure adequate sealing barriers to ambient conditions while maintaining the environmental ratings of the transmitter.

The Human Machine Interface (HMI), shown in Figure 2, consists of a tactile keypad having four universal keys, one hidden key, and a custom LCD. The LCD has a three and one-half digit numeric region that displays the process variable, a six-digit alphanumeric region that displays secondary information and programming prompts, and several status-indicating and programming icons. Each of the four universal keys is located under a set of icons. In each of the instrument modes and states, one icon over a given key will be illuminated and will represent that key's function. These assignments vary and depend upon the programming mode or state the transmitter is currently occupying. In addition to the key assignments, text strings located in the six character alphanumeric field are used as programming prompts.

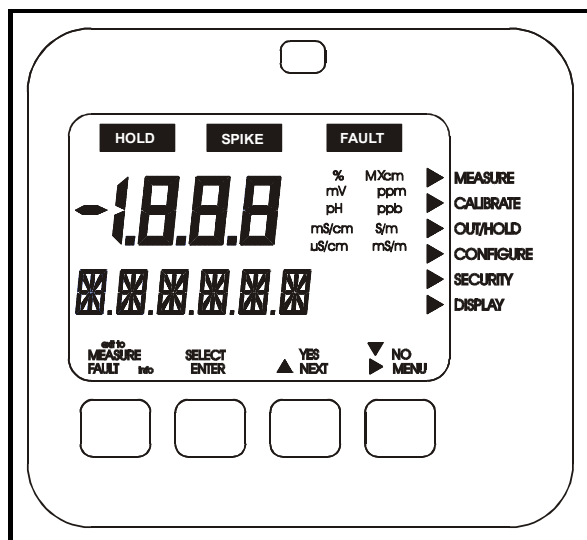


Figure 2 – TB82PH HMI

The signal conditioning circuitry contained in the transmitter is designed to process the high-impedance, galvanic signal generated by glass electrode pH sensors. This circuit processes the sensor signal into a format that is transferred to a secondary circuit. The secondary circuit uses a microprocessor to compute the precise primary

variable compensating for the combined effects of circuit tolerances, sensor calibration information, and temperature effects. Permanent memory stores transmitter and sensor specific information such as:

- Non-modifiable data such as the serial number, the UID (Unique Identifier), the manufacturer's name and device type, the hardware and software version of the electronics.
- Modifiable data such as transmitter configuration information, sensor calibration data, and security passwords.

The sensor and all electronic parts are galvanically isolated from the transmitter body. This isolation is verified at the factory using a Dielectric Strength Test.

The instrument consists of three functional circuits that have been divided into three unique Printed Circuit Board (PCB) assemblies:

- Signal Conditioning Input Assembly
- Microprocessor/Display Assembly
- Power Supply/Communication Assembly

A block diagram representing the electronic functional areas is shown in Figure 3. The flow of information starts from the sensor input and moves through the transmitter to the FOUNDATION Fieldbus interface that produces a digital signal compliant with FOUNDATION Fieldbus specification (IEC-61158-2 - see Supplementary Documentation). The digital communication and HMI capabilities provide for remote or local access to transmitter parameters for configuration and maintenance operations.

The fieldbus furnishes transmitter power and can be configured as a point-to-point, tree, Daisy Chain, or Trunk/Spurs network. Modulating the base quiescent current generates the communication signals. The quiescent current value is used as a reference in order to establish the number of devices that can be installed on a single bus line.

Data is transmitted over the bus using the digital, bit-synchronous Manchester II coding at a baud rate of 31.25 kbit/sec. Figure 4 shows an example of a typical bus configuration using ABB's FIO100 interface module.

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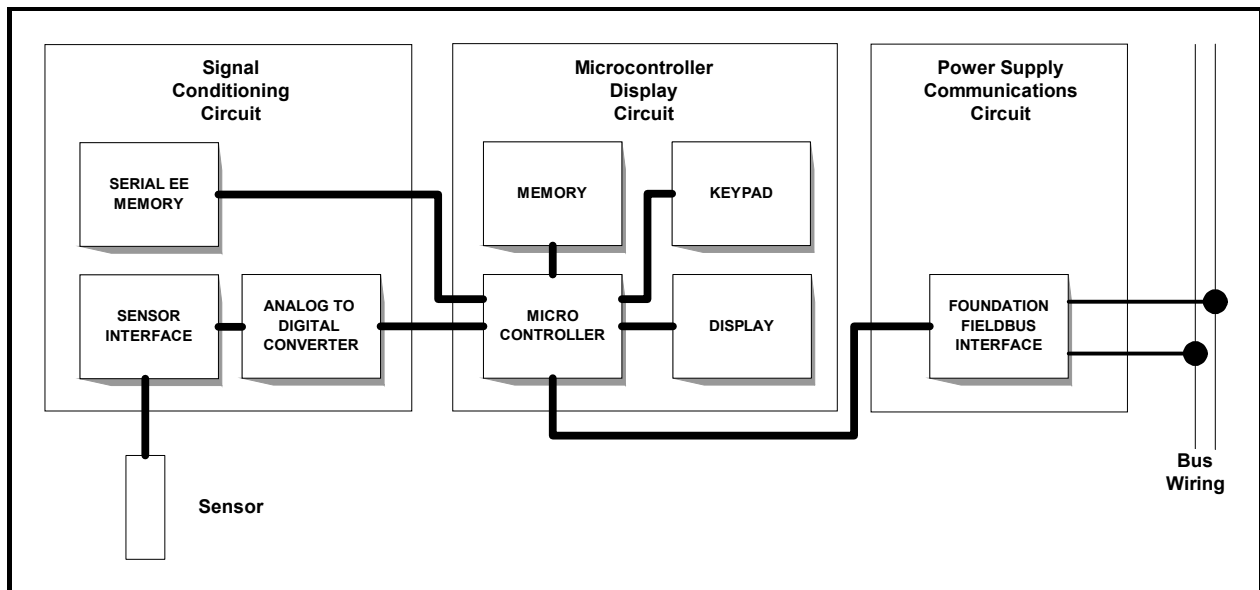


Figure 3 – Functional Block Diagram for FOUNDATION Fieldbus

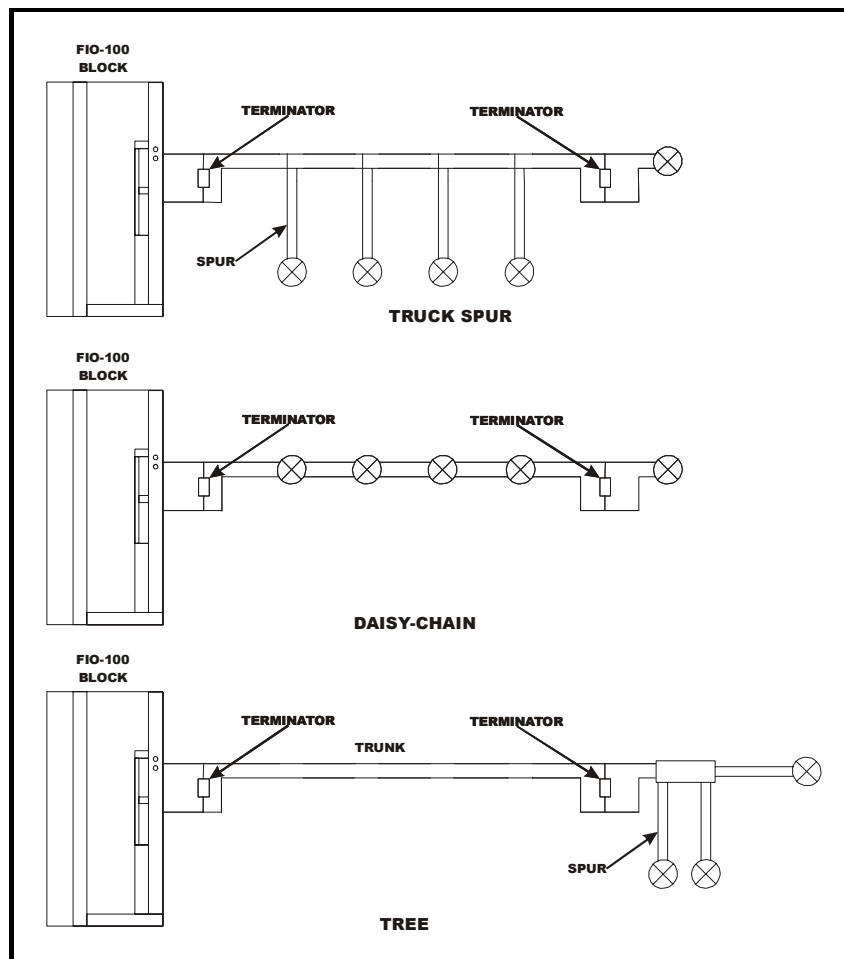


Figure 4 – Typical Bus Configurations

# INSTALLATION

Besides the normal precautions for storage and handling of electronic equipment, the transmitter contains static sensitive devices. Since semiconductors can be damaged by the direct discharge of static electricity, avoid contact with terminal block conductors and electronic components on the circuit board.

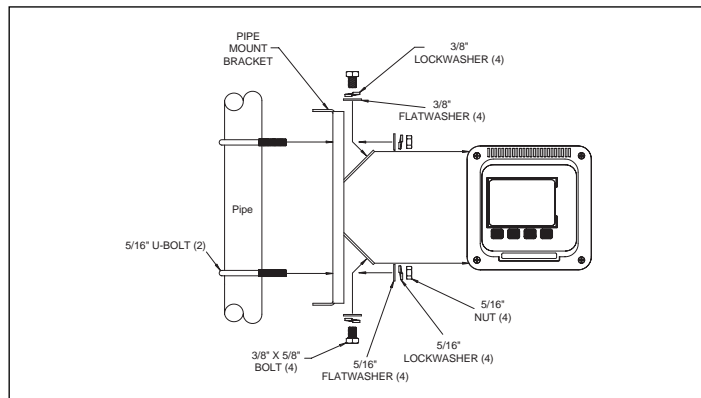
When mounting the transmitter, choose a location that has ample clearance for the removal of the front bezel and rear cover. The location should provide easy access for maintenance procedures and not be in a highly corrosive environment. Excessive mechanical vibrations and shocks as well as relay and power switches should not be in the immediate area. Signal wiring should not be placed in conduit or open trays that contain power wiring for heavy electrical equipment. Field wiring should meet wiring practices appropriate for fieldbus devices (See Supplementary Documentation).

The transmitter can be pipe, hinge, wall or panel mounted. Use the appropriate figure below to assist in the mechanical installation of the transmitter.

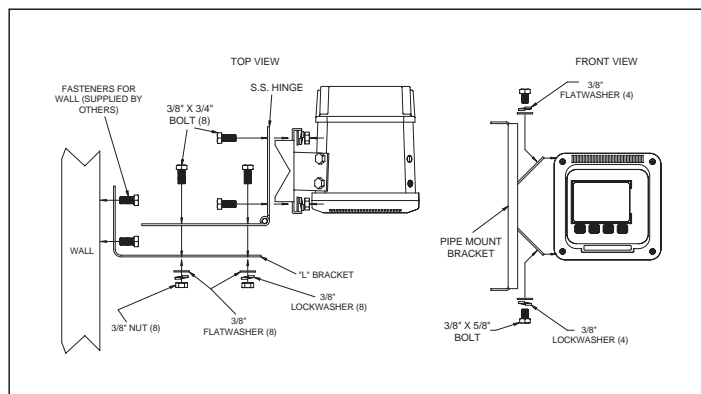


## Warning.

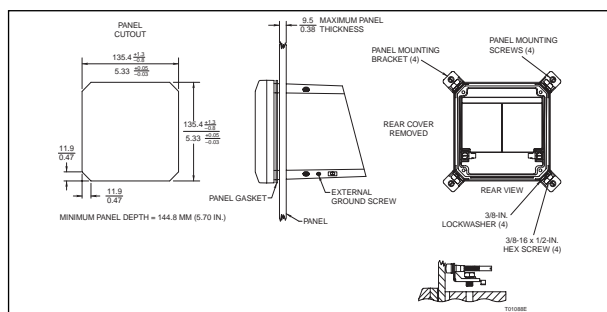
For installation in Hazardous Areas, i.e. areas with danger of fire and/or explosion, irrespective of the protection mode used, the installation must be carried out in accordance with local authority regulations. Ensure also that the temperature of the transmitter does not exceed the value indicated in the Safety Marking plate.



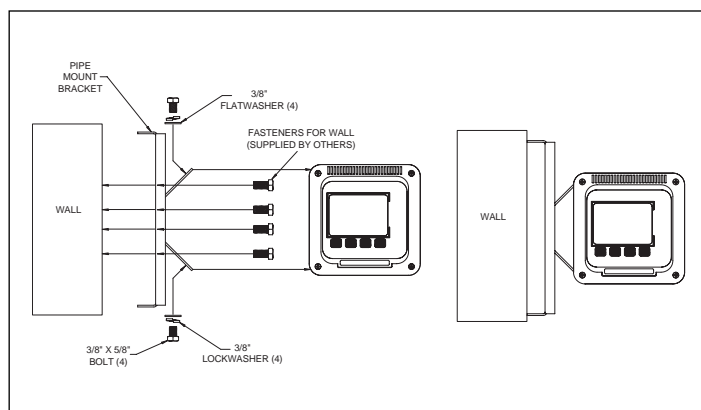
**Figure 5 – Pipe Mounting Detail**



**Figure 6 – Hinge Mounting Detail**



**Figure 8 – Panel Mounting Detail**



**Figure 7 – Wall Mounting Detail**

## ELECTRICAL CONNECTIONS



### Warning.

Use this equipment only in those classes of hazardous locations listed on the nameplate. Uses in other hazardous locations can lead to unsafe conditions that can injure personnel and damage equipment.

The bus powers the transmitter; thus, power and fieldbus signals share the same pair of wires. Separate conduit for power and sensor wiring is encouraged. Prior to entering the instrument housing, terminate rigid conduit and install a short length of flexible conduit to reduce stress to the housing. Signal wiring must not come in close proximity to high-power equipment or to cabling from such equipment. Wiring must be in accordance to the applicable local codes and fieldbus requirements (see Supplementary Documentation). Bus cabling must conform to IEC 61158-2.

The terminal blocks located in the rear of the transmitter accept wire sizes from 12 to 24 AWG. Pin-style terminals should be used for all connections. The terminal block label identifies all electrical connections and should be followed when wiring the transmitter. Observance to polarity is not required; however, polarity indications have been provided for consistence. Voltage requirements are listed in the Specifications and must be observed. Ensure the power supply that provides bus power is compliant with IEC 61158-2.

Normal grounding practice is to terminate all grounds in the control room side, in which case the field side of the screen should be adequately protected to avoid contact with metallic objects. For bus-powered systems, the grounding of the shield should be close to the power supply unit. For IS systems, the grounding should be at the safety barrier earth connection. The transmitter case should be grounded. Ground connections are provided internally (in the terminal compartment) and externally.

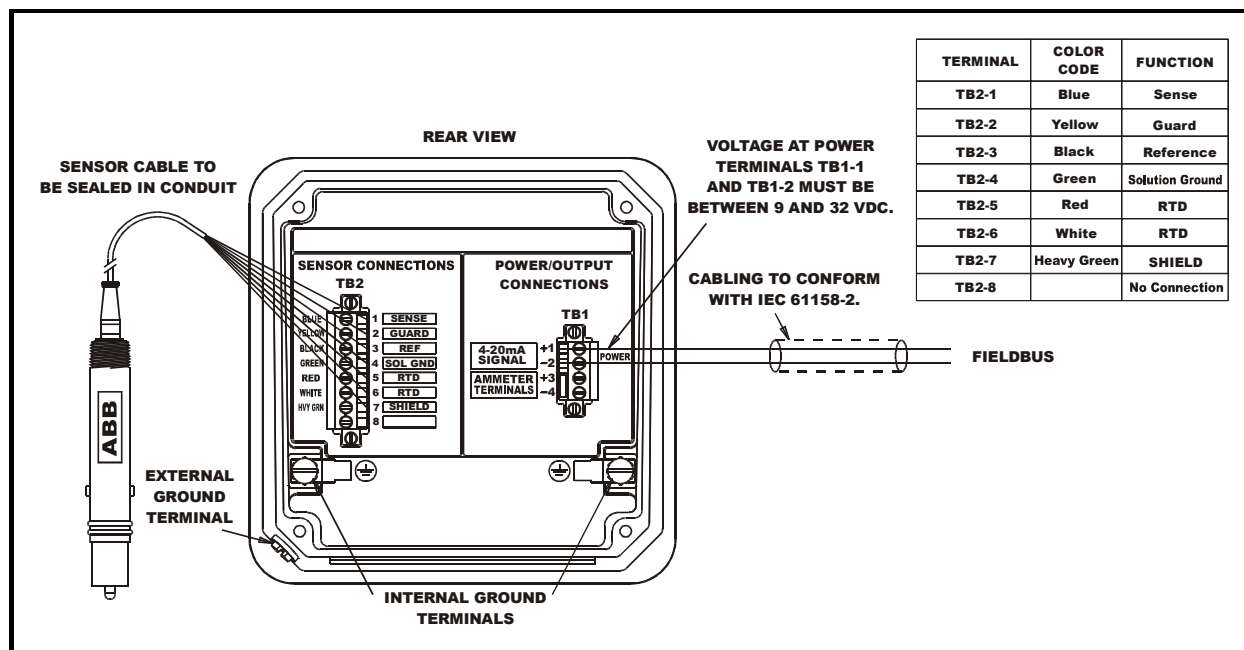


Figure 5 – Sensor and Power Wiring

## ... ELECTRICAL CONNECTIONS

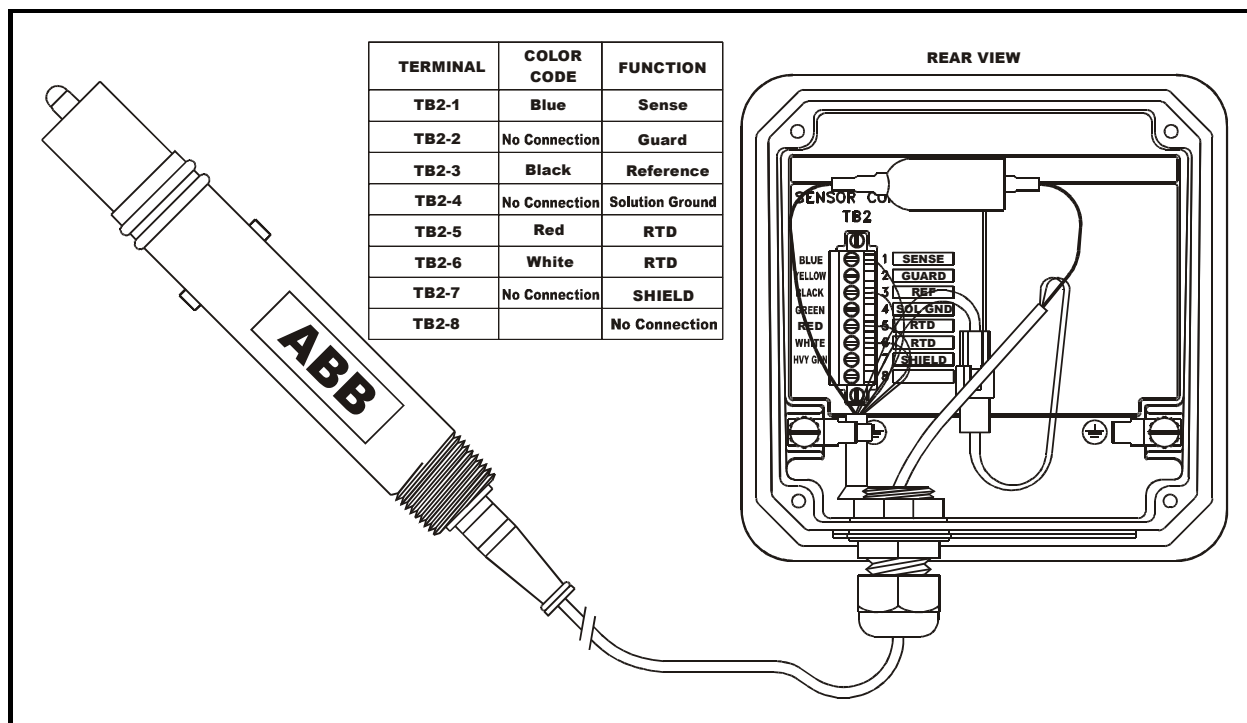


Figure 6 – BNC Adapter Sensor Connections

To ensure fault-free communication, the bus must be properly terminated at both ends. Only approved bus terminators must be used for intrinsically safe circuits. The specific noise immunity and emitted interference are only guaranteed when bus screening is fully effective (e.g., ensuring that screening is maintained through any existing junction boxes.) Appropriate equi-potential bonding must be provided to avoid differences in potential among the individual plant components.

Two hundred fifty-five addresses per segment are allowed.

- Addresses from 0 to 15 are reserved for group addressing and Data Link (DL) use.
- Addresses from 16 to 247 are reserved for devices.
- Addresses from 248 to 251 are non-visitor addresses used as defaults for devices using address assignments.
- Addresses from 252 to 255 are visitor addresses used for temporary (handheld) devices.

The number of transmitters or devices that can be connected to a bus is also dependent on the transmitters'/devices' power consumption, the type of cable, number of spurs, total cable length of the bus, and intrinsically safe requirements.

The table below lists some considerations that have been identified by the FOUNDATION Fieldbus Organization.

Parameters	Specification	
Data Rate	31.25 Kbits/s	
Type	Voltage	
Topology	Bus/tree	
Bus Power	DC	
Intrinsically Safe	No	Yes
Max Nr of devices (1)	32	6
Max cable length (2)	1900 m	
Max spurs length (3)	120 m	

Notes:

- 1) The number of devices is dependent on several physical parameters (e.g., power consumption, bus cable, device IS parameters, etc.).
- 2) Length includes bus and all spurs lengths.
- 3) The maximum Spur length with one device is 120 m; 30 m less for each addition device.

For further information on FOUNDATION Fieldbus installations, see Supplementary Documentation list at the beginning of this manual.

## LOCAL HMI OPERATING PROCEDURES

The TB82PH pH/ORP/pION FF Transmitter has seven main operating modes: Measure, Calibrate, Output/Hold, Configure, Security, Secondary Display and Utility. Within each mode, several programming states containing functions specific to the related mode are available.

Using a patented HMI, programming or accessing information from the transmitter's front panel is quick and easy. The LCD contains nine regions that provide the user with information on the process variable, engineering units, mode of operation, fault indication, secondary variable, and function key assignment (see Figure 2). The primary process variable is displayed in the three and one-half digit region. The Engineering Unit region supports this region. These display regions are active in all modes of operation; however, some programming states also use these regions for data entry.

The secondary variable is displayed in the six-character region. This display region is used for displaying secondary and fault information in the Measure Mode and textual prompting in all other modes.

Due to the limited number of characters supported by the secondary display, many of the prompts take the form of a text abbreviation (see Glossary of Programming Text Prompts for a list of abbreviations.) The secondary display region is active in all modes of operation.

A five-button, tactile keypad is located on the front panel of the instrument. Four of the buttons are embossed to easily show their location. A fifth, hidden button located at the top, center of the keypad provides access to functions that are infrequently used. The embossed keys do not have a pre-assigned function. Icons are energized over the key to indicate their function. If a key does not have an icon energized above its location, this key does not have a function and will not initiate an action when pressed. The first table below lists all key functions.

The Measure Mode is the normal operating mode of the transmitter and is the default mode upon power-up. The Measure Mode is the starting point for entry into other modes of operation. Each mode contains a unique set of transmitter functions or states. These modes and their related functions are listed in the second table below.

Icon	Key Function
Exit to MEASURE	Escapes back to the Measure Mode from all other modes or programming states of operation. This function is not available in the Measure Mode.
FAULT Info	Accesses information on diagnostic problem or error conditions. Displays this information as a short text string and code. This function is only available in the Measure Mode.
SELECT	Selects the mode or programming state of operation shown in the secondary display region.
ENTER	Stores configured items and data into memory.
NEXT	Increments through a series of programming states.
YES	Affirms the action that is about to take place.
NO	Denies the action that is about to take place.
MENU	Increments through the modes of operation.
▲	Increases numeric values or moves through a series of parameters.
▶	Moves the flashing data entry value one space to the right.
▼	Decreases numeric values or moves through a series of parameters.

Mode	Function
Measure	Used to display the process and secondary variables – the normal operating mode for the transmitter.
Calibrate	Used to calibrate input devices (i.e., the process and temperature sensors).
Out/Hold	Used for viewing critical parameters found in the Transducer and Analog Input Function Blocks.
Configure	Used to configure transmitter functions such as temperature compensation, temperature sensor type, and measurement electrode type.
Security	Used to enter password protection for the Calibrate and Configure Modes.
Display	Used to select the variable that will be shown in the secondary display region when the transmitter is in the Measure Mode.