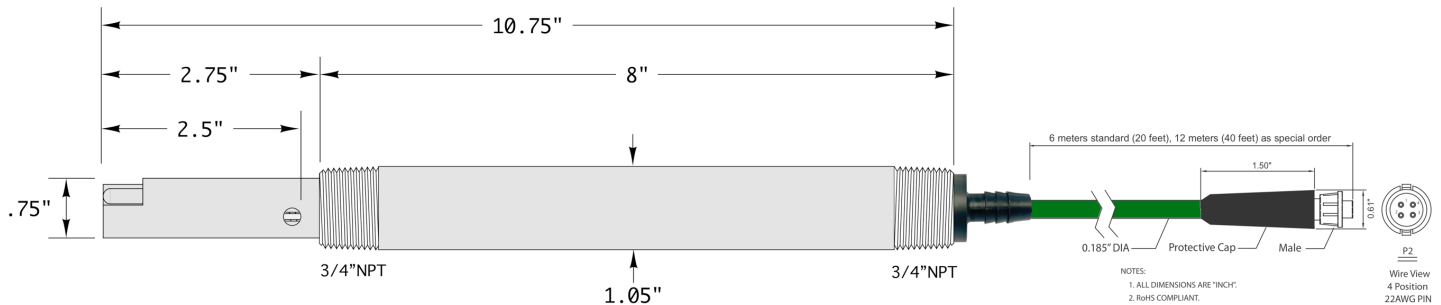


AST52 Compact K=10.0/cm Smart Digital *HiQDT* MODBUS Conductivity Sensors for Inline, Immersion & Submersible Use



Smart Digital HiQDT MODBUS RTU AST52 sensor has short insertion depth footprint for K=10.0/cm cell constant with extensive customizability for materials of construction of insulator, electrodes & sensor body with 3/4" MNPT front threaded process connections

- Smart Digital Conductivity Sensors with Isolated RS-485 MODBUS RTU interfaces directly with any suitable PLC
- Windows software for configuration, calibration and testing of *HiQDT* smart digital sensors is provided free of charge
 - **Sensor stores temperature & cell constant calibrations including days in use since they were performed**
- Dual EPDM O-ring seals ensure sensor reliability (Viton, AFLAS & Kalrez Optional). Front seal absorbs the brunt of chemical attack, allowing the rear O-ring to operate in a protected environment, and insure continued sealing.
- Automatic Temperature Compensation (ATC) with fast responding & accurate Pt1000 temperature element sealed with conductive potting into inner electrode to ensure reliable temperature compensation, especially for inline use.
- Double 3/4" MNPT threaded for immersion/submersion or inline style installation in standard CPVC configuration
 - Max 500 psig with optional 316SS threaded configuration with 1"-1" MNPT CPVC or KYNAR nipple
- **Measure from 2,000-200,000 $\mu\text{S/cm}$ in standard range mode & 20,000-1,000,000 $\mu\text{S/cm}$ in high range mode**
 - **Toggleing between standard range and high range modes while sensor is in use is done by changing the range mode scaling factor register with handheld communicator, Windows software or customer PLC**
- Standard wetted materials of construction 316SS for electrodes & thermowell and CPVC for sensor body and insulator
 - Optional electrode materials of construction are titanium, Monel & Hastelloy C-276 (others upon request)
 - Optional insulator materials of construction are TEFLON (PTFE) or PEEK available as Special Orders
 - Optional material of construction for front threads is 316SS for high pressure & temperature configurations
- Computed units available are salinity (PSU) and selectable total dissolved solids (TDS) units of NaCl, 442 or KCl
 - Other computed units are available as special order options upon request (inquire to factory for details).
- Cable length 20 feet standard terminated with quick-disconnect waterproof & corrosion-resistant NEMA 6P rated snap connector. Max 3,280 feet (1,000 meters) total cable length with 12VDC power supply employed.
- Waterproofing sealing option for completely submersible installation without the use of an immersion rod or standpipe.
 - Available in polypropylene (PP) and CPVC with integral vinyl or NORPRENE sealing hoses factory installed.

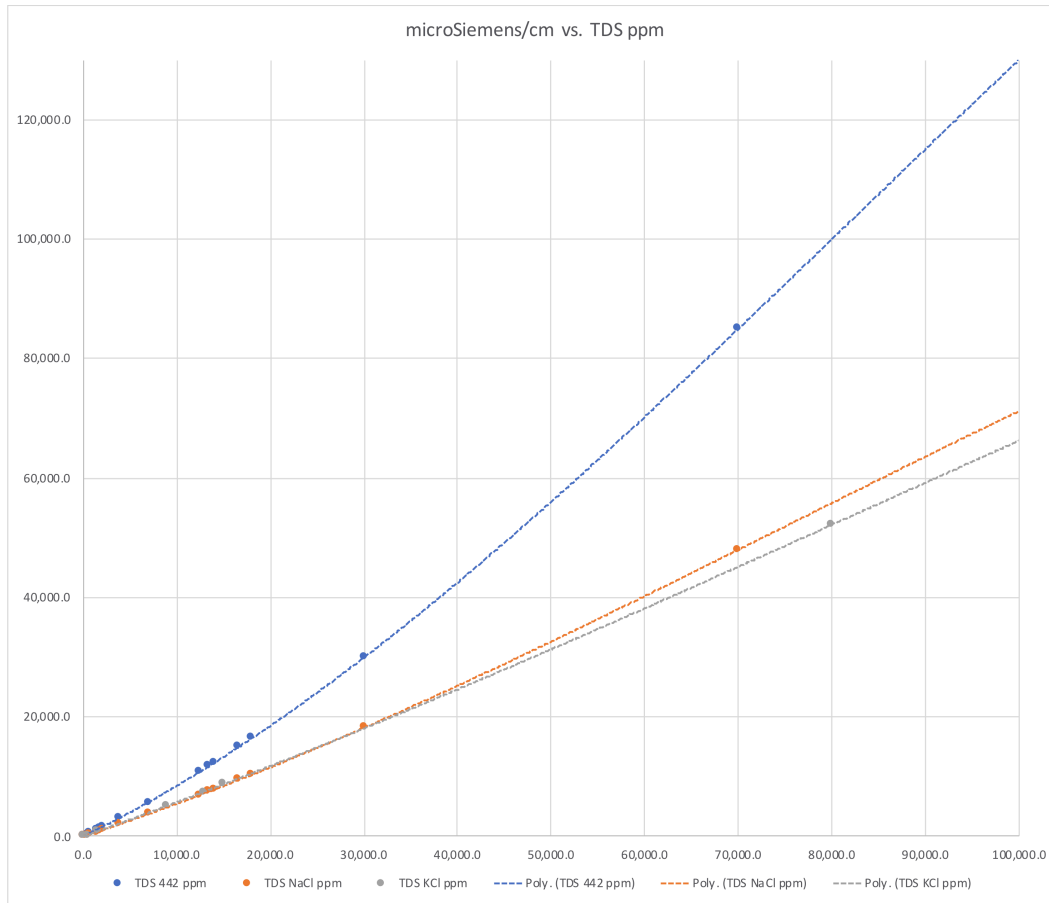


AST52 Smart *HiQDT* MODBUS RTU Conductivity Sensor Specs

Measurement Range:	2,000-200,000 $\mu\text{S/cm}$ (2-200 mS/cm) in standard range mode 20,000-1,000,000 $\mu\text{S/cm}$ (20-1,000 mS/cm) in high range mode
Operating Temperature:	-35 to +95 °C (-31 to +203 °F) for AST52 with CPVC insulator ** -35 to +120 °C (-31 to +248 °F) for AST52 with TEFLON insulator ** -35 to +150 °C (-31 to +302 °F) for AST52 with PEEK insulator **
Operating Pressure with CPVC Sensor Body:	Max 80 psig @ 95°C with CPVC Insulator
Operating Pressure with 316SS Sensor Body:	Max 100 psig @ 95°C or Max 500 psig @ 50°C with CPVC Insulator Max 100 psig @ 120°C or Max 500 psig @ 80°C with TEFLON Insulator Max 100 psig @ 150°C or Max 500 psig @ 100°C with PEEK Insulator
Process Connections Standard Config:	3/4" MNPT for both Front & Rear Threads in Standard Configuration
Process Connections Hi-Temp/Pressure Config:	3/4" MNPT for Front 316SS & 1" MNPT for Rear CPVC/KYNAR Threads
Wetted Materials of Construction:	
Insulator:	CPVC Standard; TEFLON (PTFE) or PEEK as Special Order Options
O-Rings:	EPDM (Standard); Viton/Aflas/Kalrez as Special Order Options; Redundant
Electrodes:	316SS Standard; Titanium, Monel, Hast C-276 as Special Order Options
Front Sensor Body:	CPVC for Standard Config; 316SS for Hi-Temp & Pressure Configurations
Rear Sensor Body Hi-Temp/Pressure:	CPVC or KYNAR (PVDF) → 1"-1" MNPT nipple (8 inches long)
Temperature Element:	Pt1000 temperature sensor (included standard, required for all <i>HiQDT</i> sensors)
Temperature Input Range:	-40 to +210 °C (-31 to +410 °F) $\pm 0.3^\circ\text{C}$ Limited by actual sensor specs **
Cell Constant Available for AST52:	K = 10.0/cm Only
Cable Length Limits:	Standard 20 feet (6 meters), Max 3,280 feet (1,000 meters) with 12VDC supply
End of Cable Terminations:	4-pole waterproof & corrosion-resistant NEMA 6P rated HiQ4M snap connector
Storage and Shelf-Life:	One (1) year from date of dispatch from factory when stored at ambient.
Dimensional Details:	See following pages for drawing of each particular cell constant configuration.
Submersible Assemblies:	WPA, WPB, WPC Polypro (PP) Waterproofing Options for 316SS Sensor Body WPG & WPH CPVC Waterproofing Options for CPVC Sensor Body
Sealing Hose Options:	Braid reinforced vinyl tubing available for both WPB & WPH options High-Temperature Resistant NORPRENE tubing available only for WPB option

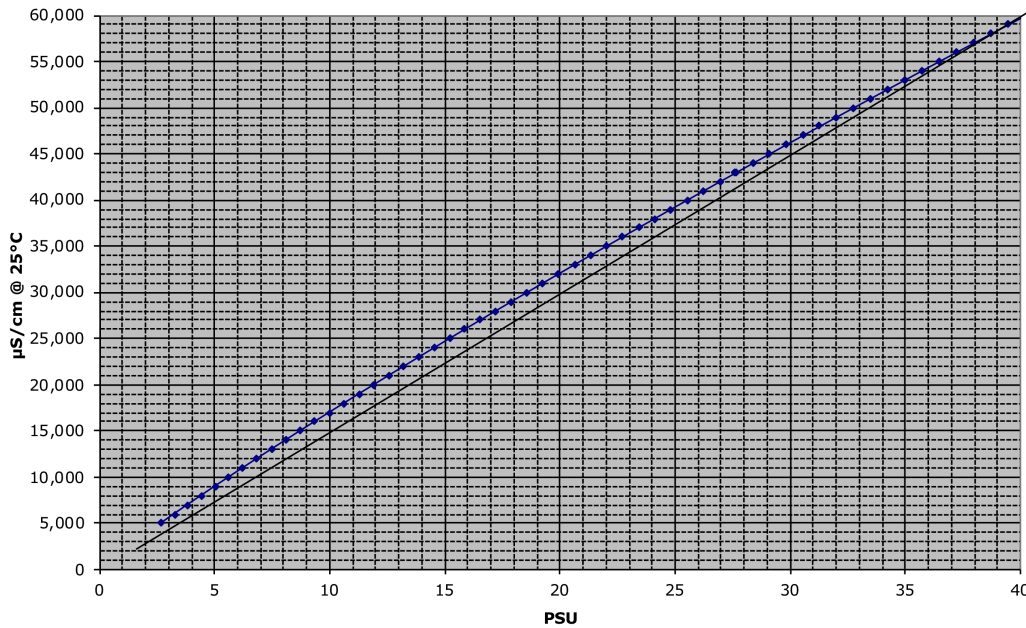
** Contact factory for applications where the measurement is below 0°C prior to specifying sensor for project or commissioning.
Max conductivity for each °C shown below assumes typical 2% per °C compensation coefficient is used. Lower bound for each conductivity range indicates lowest conductivity that should be measured with that particular range mode for the given temperature.

Range Mode of AST52 Sensor	Full Range of Raw Conductivity Input	Temperature Compensated Conductivity Range @ 25°C	Temperature Compensated Conductivity Range @ 75°C	Temperature Compensated Conductivity Range @ 125°C
Standard Range	2,000-200,000 $\mu\text{S/cm}$	2,000-200,000 $\mu\text{S/cm}$	1,000-100,000 $\mu\text{S/cm}$	667-66,667 $\mu\text{S/cm}$
High Range	20,000-2,000,000 $\mu\text{S/cm}$	20,000-1,000,000 $\mu\text{S/cm}$	10,000-1,000,000 $\mu\text{S/cm}$	6,667-666,667 $\mu\text{S/cm}$



Total dissolved solids are computed from the measured conductivity. Curves defining relationship between measured conductivity and user selectable total dissolved solid (TDS) of NaCl, KCl or 442 preprogrammed into sensor with full range of 0 to 100,000 ppm. Curves for other TDS units for other salt mixtures available upon request as special orders (minimum order quantity may apply).

μS/cm @ 25°C vs PSU



The salinity units are computed from the measured conductivity. The curves that define the relationship between the measured conductivity and computed salinity in PSU are preprogrammed into the sensor. Full range available is 0.000 to 50.000 PSU

Technical Specs for Smart Digital MODBUS RTU *HiQDT* AST52 K=10.0/cm High Cell Constant Contacting Conductivity Sensors

BENEFITS OF SMART DIGITAL HiQDT MODBUS CONTACTING CONDUCTIVITY SENSORS

- **Integral RS-485 MODBUS RTU interfaces all-modern PLC controllers & data acquisition systems.**
- **Communicator provides easy management of field installations** without the cost of a mating transmitter. This is ideal for locations where a local display is not necessary or possible due to installation limitations.
- **Windows software for setup and calibration of HiQDT conductivity sensors is free allowing for easy and low-cost field commissioning for setup & pre-calibration of sensors** without the cost of a transmitter. Ideal for installation locations where a local display is not needed or possible due to site specific needs.
- **Intelligent management of sensor calibrations and service life-cycle** for efficient commissioning & maintenance. All aspects of installation are completely portable from the shop to the field site location.
- **The 'Days in Use' since calibration was performed is stored** allowing for optimal maintenance planning.
- **All digital sensors ensure** reliable operation even in noisy process environments.
- **No degradation in digital output** even with very long cable runs. **Max of 1,000 meters (3,280 feet) with 12VDC power** supply to support for remote installation sites and consolidation of collected data.
- Bridging connections & modifying installations easily without loss of signal quality with **NEMA 6P & IP67 rated quick disconnect waterproof and corrosion-resistant dual snap connector**. Simple plug and play operation for intelligent maintenance planning & smart management of sensor installations and stocking.
- **Low-cost snap digital extension cables** facilitate consolidation of very many HiQDT sensors outputs into one panel enclosure where very many remote field installations can all be conveniently all viewed at once.
- **All Extension cables for HiQ & HiQDT sensors are intercompatible**. Uniform extension cables minimize stocking. Separate field installation guide details available options to commission & exchange sensors.

Mechanical & Thermal

Electrical

Housing:	CPVC Standard with 316SS/PVDF Optional	Operating VDC:	8.0 to 13.0 VDC at sensor board
Mounting:	Inline, Immersion or Submersible as per sensor installation scheme	Power Supply:	Isolated & Regulated 9V or 12V DC
Rating:	Fully submersible and waterproof without the use of immersion tube (a.k.a. standpipe)	Current draw:	Max 35mA Absolute, Typical ~25mA
Connector:	NEMA 6P rated HiQ4M male snap connector for HiQDT snap extension cables; Extension cables for 3TX-HiQ platform can also be used for HiQDT type smart digital sensors as well	Conductivity	2-200 mS/cm standard range mode
Max Cable:	Up to 3,280 feet (1,000 meters) using 22 AWG leads when employing 12VDC power supply	Ranges:	20-1,000 mS/cm high range mode
Temp.:	Inline max per sensor specs; Submersible Use limited to Max 85°C for all sensor models	Temp Sensor:	Integral Platinum 1000Ω TC Element
Pressure:	Up to 500 psig when 316SS Body is used	Temp Range:	-40 to +210°C ±0.3°C <i>(limited by actual sensor specifications)</i> Max Temp is +85°C at sensor board (submersible)
Weight:	Per Sensor, Typically 0.5-2.5 kg (1.0-4.5 lbs)	Temp. Comp.:	Automatic for all measurements
Dimensions:	Minimum size is 3/4" MNPT for inline installations; Minimum length is 11-12 inches without waterproofing seal with max of about 16-17 inches when the longest type WPB/WPH waterproofing seal is installed	Digital Output:	Isolated RS-485 MODBUS RTU
		Baud rate:	9600 or 19,200 kbps (selectable)
		Compatibility:	For use with ASTI HiQDT Handheld or ASTI HiQDT Windows software or any PLC with isolated RS-485 input that can serve as a MODBUS RTU master to HiQDT sensor slave
		CE mark:	EN61326A





HiQDT SMART DIGITAL CONDUCTIVITY SENSOR FEATURES & BASIC USAGE

The smart digital HiQDT conductivity sensor with integral RS-485 MODBUS RTU communications allows for a simple and fully portable installation. The sensor may be calibrated anywhere (lab, shop or field) and interfaced with any data acquisition or control system in the field via the RS-485 MODBUS RTU output. Temperature & cell constant calibrations can be done with sensor left in service if grab sample adjustments are desired to agree with reference values. Waterproof and corrosion-resistant NEMA 6P HiQ4M snap connectors come standard for easy seamless hot-swap of sensors from service for cleaning, recalibration and other maintenance requirements as well as eventual replacement in time.

SENSOR SERIAL NUMBER, ITEM NUMBER & TOTAL TIME IN FIELD SERVICE

Systematic tracking is achieved with factory digitally stamped serial number and item number as well as the build date of sensor. The internal clock on the HiQDT sensor board is incremented when sensor is continuous energized for one-hour period to monitor the total number of days in active field service. If the sensor is disconnected the incrementing of the time in service will stop. When the sensor is energized the incrementing of time in service will once again resume. The number of days in service is always the actual real-time total usage. The total days in use is shown in days and equally accurate for continuous or intermittent service such that the time in service is accurate even if the sensor is taken in & out of use for cleaning & re-calibration and/or swapped between different installations. The total time in service since each calibration was performed is shown when the 'View' key is pressed for 3 to 5 seconds in the given calibration LED mode.

CALIBRATION OF HiQDT MODBUS RTU CONTACTING CONDUCTIVITY SENSORS

- Calibrate modes of the HiQDT Windows software & handheld communicator allows for the following adjustments:
 - Temperature offset adjustment (typically only required at initial time of commissioning)
 - Dry in air zero calibration in 'Offset' calibrate mode (typically only required at initial time of commissioning)
 - 'Slope' calibration adjusts conductivity to grab sample or standard to give the effective apparent cell constant
- Calibration values are stored inside the HiQDT smart digital conductivity sensor in EEPROM such that sensor can be powered down or moved without loss of calibration resulting in a true plug and play low maintenance installation.
- Grab sample offset type calibration is done with sensor left in service after stabilized. A grab sample is analyzed offline by the preferred method. The inline field reading is made to agree with any grab sample analysis. The value of the sensor installed in service is adjusted in gain calibration mode to agree with the reference determined value.

COMPUTED UNITS BASED UPON MEASURED CONDUCTIVITY

Units of measure are native conductivity expressed as either $\mu\text{S}/\text{cm}$ or mS/cm for all cell constants depending upon particular range of interest. Computed units of salinity available from 0.000 to 50.000 PSU and user selectable computed units of total dissolved solids (TDS) for NaCl, KCl or 442 available from 0 to 100,000 ppm. Other computed units are available on a special-order basis (minimum order quantities may apply for any special computed unit requests).

IMPORTANT NOTE FOR POWERING HiQDT SMART DIGITAL SENSORS

- Although RS-485 MODBUS RTU communications from HiQDT conductivity sensors is isolated, the mating PLC serving as MODBUS Master should still have an isolated RS-485 input port for ensure best results in field use.
 - The power source that energizes sensor should be isolated (dedicated & separate from all other devices) or
 - DC/DC isolator can be added to the existing power supply employed to accomplish the same net result as having a dedicated and isolated 9V or 12V to DC power source.

NOTES ON ADJUSTABLE SMOOTHING DAMPENER & OUTPUT DELAY:

- Dampener LED when HiQDT conductivity sensor is connected allows for display & modification of the variable that is used to set the number of seconds used for the smoothing dampener and delay from boot to send the output values
- For intermittent operation, it is recommended to set this dampener & output delay variable to a low number in order to minimize power consumption while from battery power sources and maximize sampling time of process output



MODBUS RTU setup of HiQDT sensor is available to enable all functionality detailed below:

READ-ONLY Data	Core Process Value Description	READ-ONLY Data	Analytic Sensor Value Description
Calibrated & Temperature Compensated Conductivity & Temperature for HiQDT AST52 Smart Sensors	<u>K=10.0/cm Standard Range Mode</u> 0-200,000 µS/cm (0-200 mS/cm) <u>K=10.0/cm Standard Range Mode</u> 0-2,000,000 µS/cm (0-2,000 mS/cm) All cell constants have temperature range of -40.0 to +210.0 °C	Sensor Serial Number	Unique Serial Number Designation: YY.M-A.DD **
Computed Values	Salinity 0.000-50.000 PSU sent as 0 to 50,000 TDS 0-100,000 ppm sent as 0 to 50,000	Sensor Diagnostics	Sensor Item Number Software Revision Max Temp in Use Min Temp in Use Hours in Field Use
Raw Process Values	Same as the calibrated and temperature compensated conductivity and temperature for each cell constant configuration. Max recommended temperature compensated conductivity range depends upon cell constant, range mode and temperature.	Calibration Values	Temperature Offset Hours since Temp Offset Cal Zero Dry in Air Offset Hours since Dry in Air Zero Offset Cal Cell Constant Standard Range Cal Time since Standard Range Cal Cell Constant High Range Cal Time since High Range Cal

** Serial number format YY is the last digits of year M is month with A=Oct, B= Nov & C=Dec A is a letter from A to Z (as permissible) DD is value from 0 to 255

READ/WRITE Type	Adjustable Calibration Description	READ/WRITE Type	Adjustable Parameter Description
Offset Adjust Temperature	Calibrated Temperature Value Limit ±25.0 °C * from raw value	Reset Calibrations	Will reset all user adjustable sensor calibrations back to factory default values
Zero Dry in Air Offset	Conductivity Reading Adjusted to Zero for dry in air condition	Dampener & Delay from Boot	Time averaging of process value 1, 2, 3, 4, 5, 8, 10, 15, 20 or 30 Seconds
Wet Gain Calibration to determine effective apparent cell constant	Calibrated Conductivity Value ±70% from nominal cell constant	Step Change	Increment value for stepwise calibration on the handheld communicator: 0.05, 0.10, 0.20, 0.5, 1.0 or 2.0 %
Range Mode	Standard Range or High Range Mode operation is selectable while sensor is in operation.	Special - Temp Compensation	0.00 to 9.99 % per degree Celsius (Default 2.10%)

NOTE 1: All MODBUS devices on network must use the same baudrate and have a unique node address. Handheld Communicator (HHC) is MODBUS master while all HiQDT sensors are MODBUS slaves. To interface HHC with HiQDT sensor, either removed it from the network, or else bypass with a bridge box with switch scheme. Access any given HiQDT sensor on the MODBUS network with HHC is possible if the existing MODBUS master is disconnected or powered down. If node of HiQDT sensor is not known, use Widows Software or HHC search feature to find it. Please see HiQDT installation guide and HiQDT controller manual for additional recommendations & details about commissioning, calibration and troubleshooting.

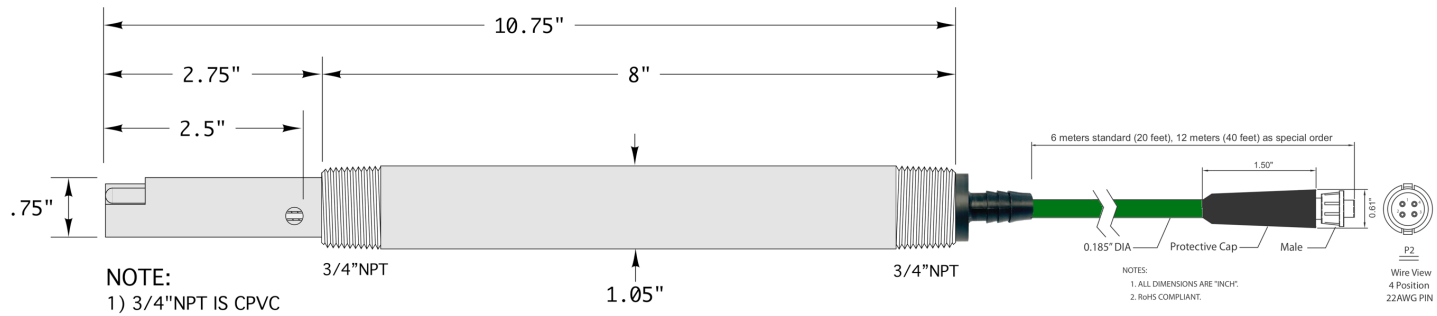
NOTE 2: Access to **READ** values in *Core Process Value Column* gained through MODBUS function code (04).

NOTE 3: Access to **READ** parameters in the *Analytic Sensor Value Column, Adjustable Calibration Column & Adjustable Parameters Column* gained through MODBUS function code (03).

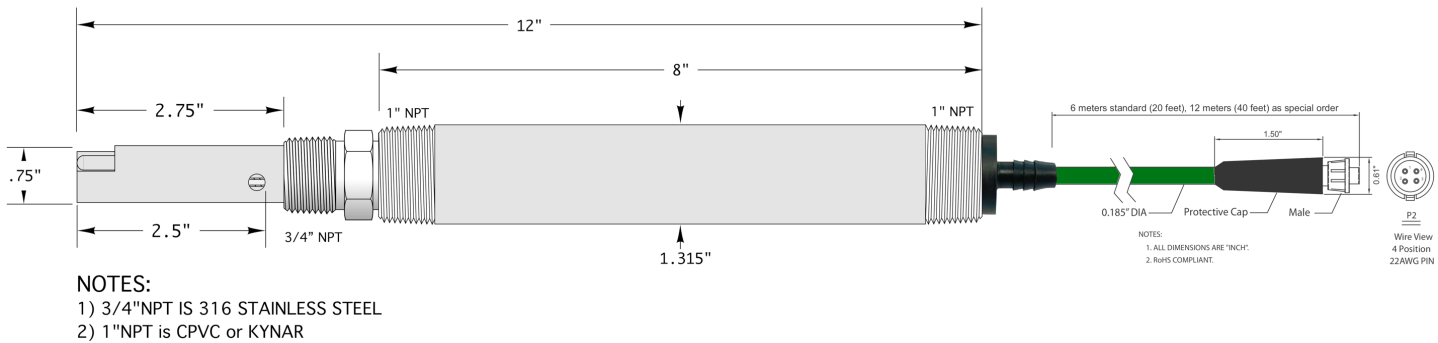
NOTE 4: Access to **WRITE** parameters in the *Analytic Sensor Value Column, Adjustable Calibration Column & Adjustable Parameters Column* gained through MODBUS function code (16).

Last Revised September 17, 2020

Dimension Details for *HiQDT* AST52 Smart Conductivity Sensors



The smart digital *HiQDT* MODBUS RTU sensor has a **standard configuration** of 316SS electrodes with CPVC insulator and body. The 316SS electrodes are not visible as they are located inside of the two bored holes that go along the length of the insulator and are purged by the two corresponding vent holes on each side. The exposed 316SS thermowell is, however, visible which provide for fast temperature measurement to ensure accuracy conductivity values at any process condition. In standard configuration electrodes are available in Titanium, Monel & Hast C-276 materials of construction as special order options (thermowell is CPVC when these alternate materials of construction are used for the electrodes).



For the **high pressure and/or high temperature configurations** the 3/4" MNPT front threads are 316SS materials of construction. For configurations suitable for use at high pressures and/or high temperatures rear threads are 1" MNPT instead of 3/4" MNPT with the rear sensor body having either the CPVC or KYNAR (PVDF) material of construction using an eight (8) inch long nipple. For high pressure and/or temperature configurations material of construction for insulator can be TEFLON (PTFE) or PEEK instead of CPVC (available as special order option with associated MOQ).

INSTALLATION NOTES:

- 1) The sensors may be installed at any orientation as desired. Care should be taken that the installation scheme is such that the measuring cell is always completely full at all times (no entrapped air bubbles or times when this part of the line is dry).
- 2) For batch operations where the tank is drained, installation with the sensor tip to the top of the tank (inverted style) is preferred.
- 3) For inline installations, the vent hole should be entirely in the path of flow and unobstructed by the compression fitting to ensure that the sample in the measuring cell is representative of the process fluid at all times. Alternatively, if the vent hole cannot be installed to be entirely in the flow the tip should be installed into the direction of flow typically at an elbow in the piping.
- 4) For low-flow installations please contact the factory for additional assistance. Custom insertion depth may be available for selected sensor configurations as special order options upon request.
- 5) Dimensions for all drawings are in inches.