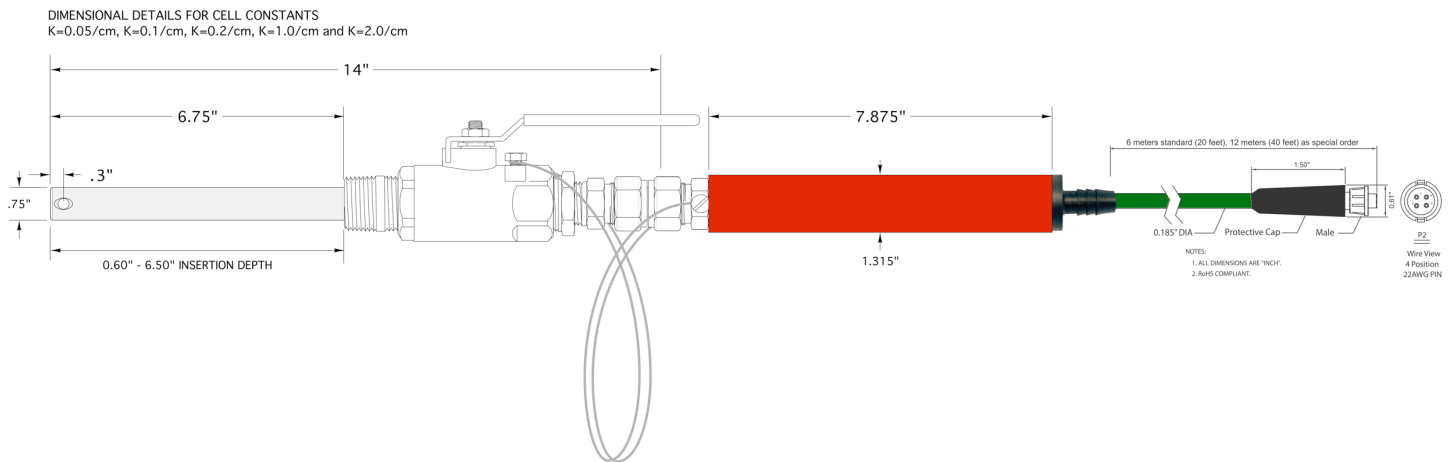


## AST40 Smart MODBUS RTU Contacting Conductivity Sensors for HOT-TAP Valve Retractable Field Installations



*Drawing valid for K= 0.05, 0.10, 0.20, 0.50, 1.0 & 2.0 /cm cells. Position of vent hole & associated insertion depth differs for low cells of K= 0.01 & 0.02 /cm & high cells K= 5.0, 10.0 & 20.0 /cm. Please inquire to factory for drawings of these alternate cell constants. Smaller valve retractable assembly configuration employing 3/4" MNPT full port ball valve with 1/2" O.D. sensor available upon request.*

- 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**
  - **Separate wet cell constant for standard and high range modes for best accuracy in any measuring mode**
- Adjustable insertion depth for HOT-TAP valve retractable installation is achieved with 3/4" MNPT compression fitting
  - Max pressure up to 150 psig while actively inserting or removing sensor depending upon exact configuration
- Wetted metal material of construction is 316 stainless steel standard. Inquire to factory for alternate materials.
- Insulator material of construction is PEEK for 3/4" O.D. sensors and TEFLON for 1/2" O.D. sensors.
- Double redundant O-ring seals ensure reliability in long-term continuous measurements. Only the process side O-ring is in contact with the stream so that the back O-ring maintains reliable sealing, free from chemical attack.
- 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.
- **Available in cell constants from K=0.01/cm up to K=20.0/cm to support all possible measurements ranges**
- Computed units for standard/high range modes are salinity (PSU) and total dissolved solids (TDS) NaCl, KCl or 442
  - Other computed units are available as special order option upon request (inquire to factory for details)
- Computed units for ultralow range mode are resistivity (MΩ) using either linear or special ultrapure water ATC
- 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
- When interfaced with ASTI supplied controller cell constant & range mode are automatically handled in all respects.



## AST40 Smart *HiQDT* MODBUS RTU Conductivity Sensor Specs

<b>Measurement Range:</b>	Dependent Upon Cell Constant & Range Mode (see following page) *
<b>Operating Temperature:</b>	-35 to +205 °C (-31 to +401 °F) for Inline Installations **
<b>Operating Pressure:</b>	Max 400 psig @ 100°C or 250 psig @ 205°C <u>when sensor is stationary</u> Up to Max 150 psig when sensor is actively inserted or removed from service Min 50 psig rating valid for all supported temperatures & installation conditions
<b>Process Connections:</b>	1"MNPT 316SS Ball Valve Standard; ¾"MNPT 316SS Ball Valve Optional
<b>Wetted Materials of Construction:</b>	
Insulator:	PEEK for ¾" O.D. sensors   TEFLON for ½" O.D. sensors
Sensor Body:	CPVC or KYNAR (PVDF) → 1"NPT nipple 8 inches long to house electronics
O-Rings:	EPDM (Standard); Viton, AFLAS or KALREZ (OPTIONAL); Redundant
Electrodes:	316SS Standard; Titanium, Monel, Hast C-276 and other upon request optional
Compression Fitting:	¾" MNPT 316SS Standard (Inquire to Factory for Alternate Options)
<b>Temperature Element:</b>	Pt1000 temperature sensor (included standard, required for all <i>HiQDT</i> sensors)
<b>Temperature Input Range:</b>	-40 to +210 °C (-31 to +410 °F) ±0.3°C Limited by sensor specs & install **
<b>Cell Constants Available for AST40:</b>	<b>Low</b> Cell Constants      K= 0.01 & 0.02 /cm <b>Main</b> Cell Constants      K= 0.05, 0.10, 0.20, 0.50, 1.0 & 2.0 /cm <b>High</b> Cell Constants      K= 5.0, 10.0, 20.0 /cm
<b>Cable Length Limits:</b>	Standard 20 feet (6 meters), Max 3,280 feet (1,000 meters) with 12VDC supply
<b>End of Cable Terminations:</b>	4-pole waterproof & corrosion-resistant NEMA 6P rated HiQ4M snap connector
<b>Storage and Shelf-Life:</b>	One (1) year from date of dispatch from factory when stored at ambient.
<b>Insertion Depths for HOT-TAP Installs:</b>	<b>Low</b> Cell Constants      2.30 to 6.50 inches <b>Main</b> Cell Constants      0.53 to 6.50 inches <b>High</b> Cell Constants      3.30 to 6.50 inches
<b>Dimensional Details:</b>	Overall length will not exceed 32 inches when sensor fully retracted.

\* Contact factory to confirm that your desired measurement range is suitable for the chosen cell constant & mating instrument.

\*\* Contact factory for applications where the measurement is below 0°C prior to specifying sensor for project or commissioning.



## Tables of Available Cell Constants & Associated Range Modes

### STANDARD RANGE MODE \* - in microSiemens/cm

Range Scaling Factor		Max Temp. Compensated Conductivity using 2% per °C Coefficient				
200						
Cell Constant (K)	Max Raw Input Limit	Resolution	Lowest Recommended Measurement @ 25°C	@ 25 °C	@ 75 °C	@ 125°C
0.01	200	0.004	2	200	100	66.67
0.02	400	0.008	4	400	200	133.33
0.05	1,000	0.02	10	1,000	500	333.33
0.10	2,000	0.04	20	2,000	1,000	666.67
0.20	4,000	0.08	40	4,000	2,000	1,333.33
0.50	10,000	0.2	100	10,000	5,000	33,333.33
1.00	20,000	0.4	200	20,000	10,000	66,666.67
2.00	40,000	0.8	400	40,000	20,000	13,333.33
5.00	100,000	2	1,000	100,000	50,000	33,333.33
10.00	200,000	4	2,000	200,000	100,000	66,666.67
20.00	400,000	8	4,000	400,000	200,000	133,333.33

### HIGH RANGE MODE \* - in microSiemens/cm

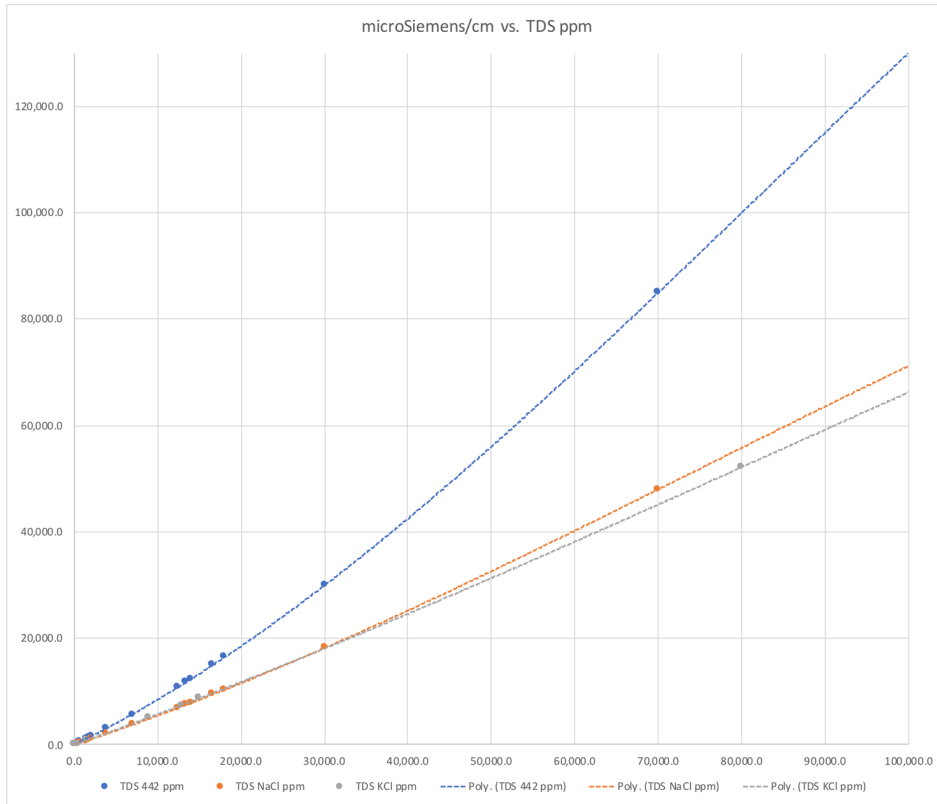
Range Scaling Factor		Max Temp. Compensated Conductivity using 2% per °C Coefficient				
2,000						
Cell Constant (K)	Max Raw Input Limit	Resolution	Lowest Recommended Measurement @ 25°C	@ 25 °C to 75°C	@ 125°C	@ 175°C
0.01	2,000	0.04	20	1000	666.67	500
0.02	4,000	0.08	40	2,000	1,333.33	1,000
0.05	10,000	0.2	100	5,000	3,333.33	2,500
0.10	20,000	0.4	200	10,000	6,666.67	5,000
0.20	40,000	0.8	400	20,000	13,333.33	10,000
0.50	100,000	2	1,000	50,000	33,333.33	25,000
1.00	200,000	4	2,000	100,000	66,666.67	50,000
2.00	400,000	8	4,000	200,000	133,333.33	100,000
5.00	1,000,000	20	10,000	500,000	333,333.33	250,000
10.00	2,000,000	40	20,000	1,000,000	666,666.67	500,000
20.00	4,000,000	80	40,000	2,000,000	1,333,333.33	1,000,000

\* **Sensor can toggle between standard/high range mode range mode while in use.** Standard/high range mode sensor is one configuration and associated sensor board hardware. Ultralow range mode sensor is a different configuration and associated sensor board. While you can toggle between standard and high range modes you cannot toggle between the standard/high and ultralow modes since these are two different sensor boards. Two slope calibrations are stored in dual mode standard/high sensors; slope low is used for the standard mode and slope high for the high mode. Slope calibrations are automatically assigned based upon range mode in use for sensor at time when calibration is performed. The ultralow range mode only uses the single low slope (slope high is unused).

### ULTRA-LOW RANGE MODE - in microSiemens/cm

Range Scaling Factor		Max Temp. Compensated Conductivity using 2% per °C Coefficient				
2						
Cell Constant (K)	Max Raw Input Limit	Resolution	Lowest Recommended Measurement @ 25°C	@ 25°C	@ 75°C	@ 125°C
0.01	2	0.00004	0.02	2	1	0.667
0.02	4	0.00008	0.04	4	2	1.333
0.05	10	0.0002	0.1	10	5	3.333
0.10	20	0.0004	0.2	20	10	6.667
0.20	40	0.0008	0.4	40	20	13.333
0.50	100	0.002	1.0	100	50	33.333
1.00	200	0.004	2.0	200	100	66.667
2.00	400	0.008	4.0	400	200	133.33
5.00	1,000	0.02	10.0	1,000	500	333.33
10.00	2,000	0.04	20.0	2,000	1,000	666.67
20.00	4,000	0.08	40.0	4,000	2,000	1,333.33

# Computed Units of Salinity (PSU) & Total Dissolved Solids (TDS) NaCl, 442 & KCl for Standard & High Range Modes



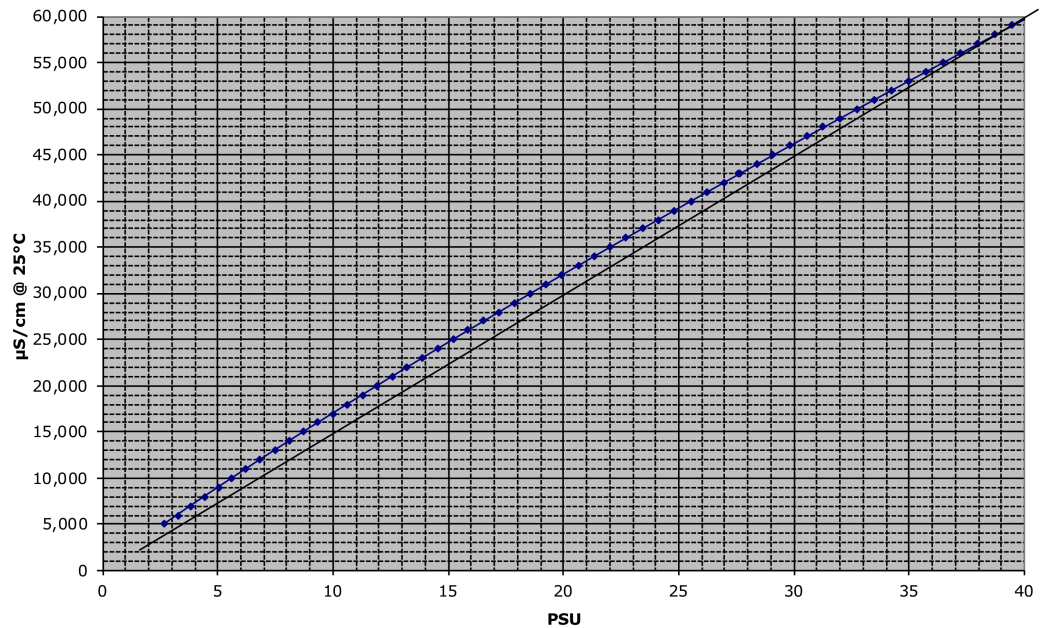
Total dissolved solids (TDS) units are computed from measured conductivity. The curves that define relationship between the measured conductivity and user selectable total dissolved solid (TDS) units of NaCl, KCl or 442 are preprogrammed into sensor with full range of 0 to 100,000 ppm. The actual usable range may be limited by the choice of cell constant and range mode in which the sensor is operated.

Other types of total dissolved solids (TDS) for other electrolytes or electrolyte mixtures can be programmed into the sensor on a special order basis (minimum order requirements apply for such special programming requests). Inquire to the factory if you have need for such special TDS units for your smart digital HiQDT MODBUS RTU conductivity sensors.

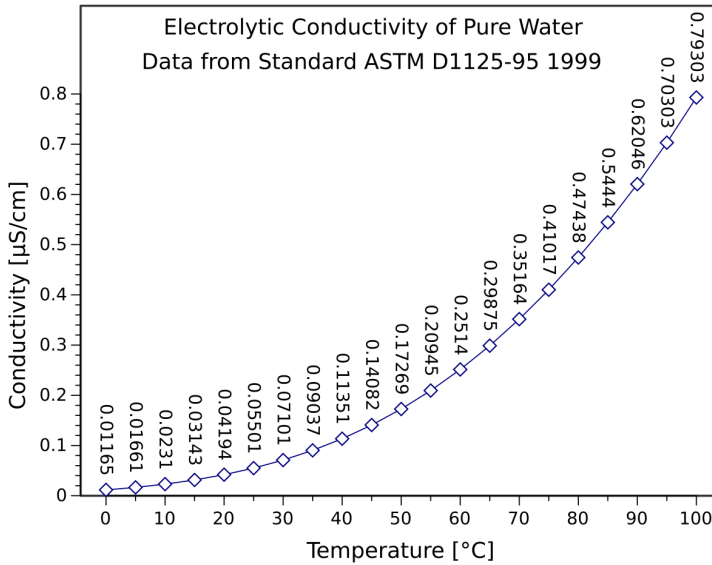
**Salinity computed from measured conductivity.** Curves for relationship between measured conductivity and the computed salinity in PSU are preprogrammed into the sensor with a full range of 0.000 to 50.000 PSU.

The actual supported range may be limited by cell constant & range mode used). Contact the factory to determine the most suitable sensor model and cell constant configuration for your desired salinity range of interest.

µS/cm @ 25°C vs PSU



## Ultralow Range Conductivity Sensors for Ultrapure Water (UPW)



The conductivity of pure water varies significantly with temperature in a well defined but non-linear fashion as detailed in the graph to left. This behavior is preprogrammed into the HiQDT-CON-L MODBUS RTU conductivity sensors for the automatic temperature compensation feature to make it suitable for ultrapure water (UPW) type applications.

Although the recommended cell constant for performing conductivity measurement in UPW is  $K=0.01/cm$  for best resolution and lower bounds of measurement there may be situations where this  $K=0.01/cm$  cell constant cannot be used for the planned installation location because of limitations such as piping arrangement and low-flow. The higher cell constants of  $K=0.05/cm$  or  $K=0.10/cm$  can be used instead in such cases albeit they require the sample to be at a higher temperature to ensure best results. Table below details recommended minimum temperature for various cell constants for use in UPW. The minimum temperature for UPW measurement for each cell is determined based upon the lowest absolute conductivity value for which the cell constant is recommended & temperature at which this conductivity occurs for UPW. Resistivity are computed units are the inverse of the measured conductivity value.

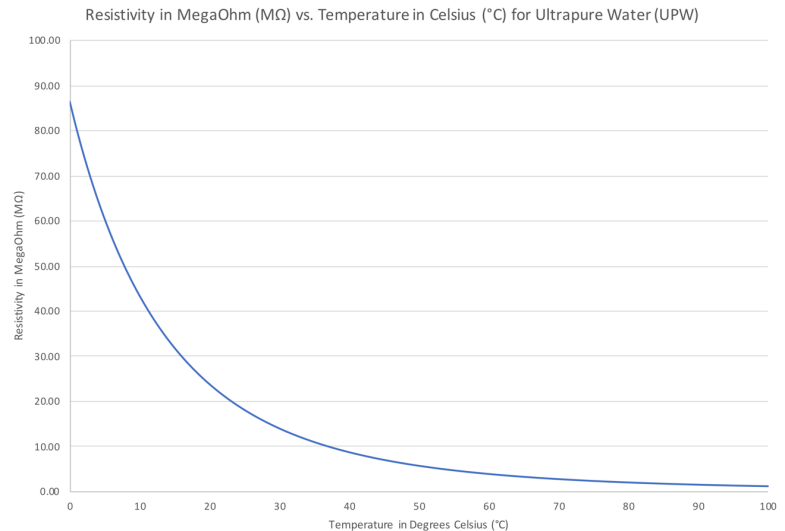
### ULTRA-LOW RANGE MODE - MicroSiemens/cm unless otherwise indicated

Range Scaling Factor					
2					
Cell Constant (K)	Raw Max Input @ 25°C	Resolution	Lowest Recommended Absolute Measurement	Minimum Temp °C *	Absolute MegaOhm (MΩ) @ Min Recommended °C *
0.01	2	0.00004	0.02	8	50
0.05	10	0.0002	0.1	40	10
0.10	20	0.0004	0.2	55	5

\* Minimum recommended temperature is conductivity of UPW which is 1% of ultralow range mode for the given cell and the associated MegaOhm units. Measurements can be performed below the recommended minimum temperature with an associated higher uncertainty for those situations.

For ultralow range conductivity sensors the 5<sup>th</sup> read input register (30005) sends the computed resistivity MegaOhm (MΩ) using the user defined linear automatic temperature compensation (ATC) while the 6<sup>th</sup> read input register (30006) sends computed resistivity MegaOhm (MΩ) using the special non-linear ultrapure water style automatic temperature compensation. The resistivity values sent as 0 to 50,000 steps corresponding to 0.000-50.000 MegaOhm (MΩ) for both the 5<sup>th</sup> (30005) & 6<sup>th</sup> (30006) read input registers. Theoretical temperature compensated resistivity value can never go above 18.18 MegaOhm (MΩ) for uncontaminated pure water since this is the ideal value at 25 degrees Celsius.

Temperature compensated conductivity & resistivity referenced back to the 25 °C for all ATC. Ultrapure water with no contaminants has value of 0.055 µS/cm conductivity or 18.18 MΩ in resistivity. Common units for measurement of pure water is resistivity (MΩ) MegaOhm due to high resolution & convenient scaling in the low conductivity levels. Temperature compensated conductivity and computed resistivity values sent for the ultralow range mode smart digital HiQDT-CON-L style MODBUS RTU conductivity sensors as well as the raw conductivity.

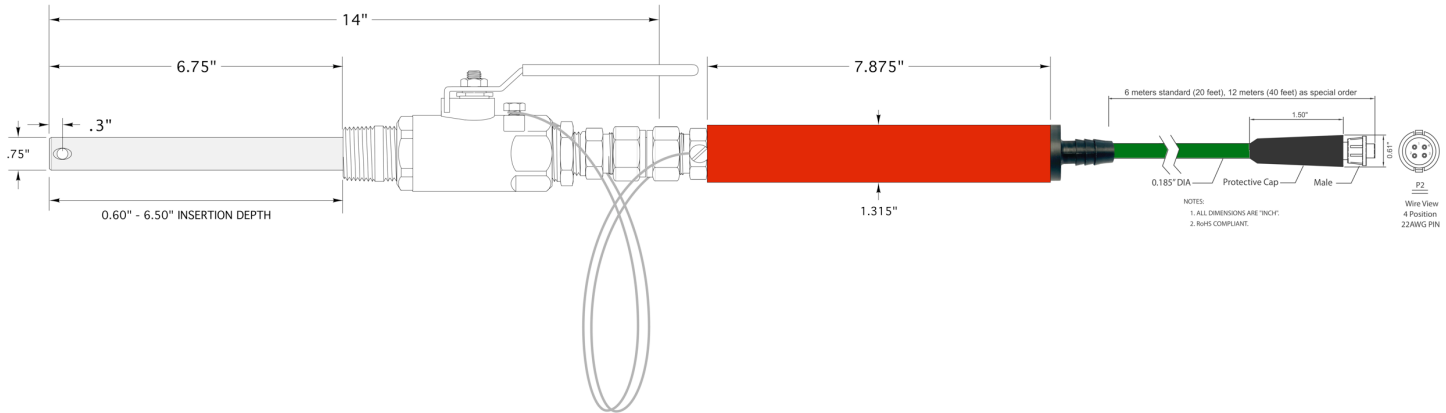


Graph above shows relationship between the resistivity of pure water at various temperatures. Computed resistivity MegaOhm (MΩ) units are the inverse of measured conductivity and so are the mirror image of the conductivity at various temperatures for ultrapure water (UPW). The graph above shows absolute raw resistivity at various temperatures. Resistivity values sent include ATC referencing reading to 25 °C state.

## Dimension Details for AST40 Valve Retractable Smart Sensors

DIMENSIONAL DETAILS FOR CELL CONSTANTS

K=0.05/cm, K=0.1/cm, K=0.2/cm, K=1.0/cm and K=2.0/cm



### **LOW CELL CONSTANTS K= 0.01 & 0.02 /cm**

The cell constants 0.01/cm & 0.02/cm are typically used for measurement in deionized (DI) water, reverse osmosis (RO) water, distilled & demineralized water as well as other types of low conductivity applications in the ultralow range mode. For situations when K=0.01/cm & K=0.02/cm cell cannot fit into the process line (typically because minimum insertion depth to vent hole cannot be supported) then cell constant K=0.05/cm or K=0.10/cm can be used instead provided the temperature profile is suitable to support it. These cells are also available in the standard & high range modes to support selected ranges best served by this configuration.

### **MAIN CELL CONSTANTS K= 0.05, 0.10, 0.20, 0.50, 1.0 & 2.0 /cm**

Cell constants from 0.05/cm to 2.0/cm are suitable for most general purpose measurements. Selection of whether to use the standard or high range mode is chosen as most appropriate for the expected typical, min and max conductivity of the measured process media. For certain applications use of these cells in the ultralow range mode is the best choice for the expected conductivity of interest.

### **HIGH CELL CONSTANTS K= 5.0, 10.0 & 20.0 /cm**

Cells constants 5.0/cm, 10.0/cm and 20.0/cm are typically only used the main cell constants cannot support the max required conductivity measurement in the high range mode. Depending upon the exact conductivity range required these high cell constants are typically used in either the standard or high range modes. For some very special situations they can also be used in the ultralow range modes but this is not the most typical type of configuration for these high cells.

### **GENERAL INSTALLATION NOTES:**

- 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).
- For batch operations where the tank is drained, installation with the sensor tip to the top of the tank (inverted style) is preferred.
- 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.
- 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. If sensor is ordered with the optional compression fitting, then the insertion depth can be supported as detailed above for each cell constant configuration type.
- Dimensions for all drawings are in inches.



## Technical Specifications for Smart *HiQDT* AST40 MODBUS RTU Conductivity Sensors with Cell Constants **K=0.01/cm to K=20.0/cm**

### 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 or KYNAR (PVDF) for Rear Nipple	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 Range:	See Conductivity Range Table on Page 2 for Each Cell Constant Type
Max Cable:	Up to 3,280 feet (1,000 meters) using 22 AWG leads when employing 12VDC power supply	Temp Sensor:	Integral Platinum 1000Ω TC Element
Temp.:	Inline max per sensor specs; Submersible Use limited to Max 85°C for all sensor models	Temp Range:	-40 to +210°C ±0.3°C <i>(limited by actual sensor specifications)</i>
Pressure:	Max 400 psig with compression fitting	Temp. Comp.:	Automatic for all measurements
Weight:	Per Sensor, Typically 1.0-2.5 kg (2.2-5.5 lbs)	Digital Output:	Isolated RS-485 MODBUS RTU
Dimensions:	Minimum line size is 3/4" MNPT for HOT-TAP valve retractable installations; Max length is 32 inches when sensor is full retracted from process	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  $\text{mS}/\text{cm}$  for all cell constants depending upon particular range of interest. For standard and high range modes computed units of salinity from 0.000 to 50.000 PSU and user selectable computed units of total dissolved solids (TDS) of NaCl, KCl or 442 available from 0 to 100,000 ppm. The actual min and max for computed units may be limited by cell constant and range mode used for sensor configuration. For the ultralow range modes the computed units of resistivity are available from 0.000 to 20.000 MegaOhms ( $\text{M}\Omega$ ) with a resolution of 0.001  $\text{M}\Omega$  through the entire range for the ultralow optimized sensors. Resistivity is computed both using standard linear user defined temperature compensation as well as special non-linear preprogrammed ultrapure water (UPW) temperature compensation. **Contact factory for assistance if measurement of ultrapure water is planned.**

### **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 AST40  <b>Page 3 table shows ALL ranges &amp; cell constants. A few selected cells &amp; ranges are shown for illustration purposes to right.</b>  Computed Values	<u>K=0.01/cm Ultralow Range</u> Range 0-2 μS/cm   0-20,000 MΩ  <u>K=0.1/cm Standard &amp; High Range</u> Range 0-2,000 μS/cm & 0-20,000 μS/cm  <u>K=1.0/cm Standard &amp; High Range</u> Range 0-20,000 μS/cm & 0-200,000 μS/cm  <u>K=10.0/cm Standard &amp; High Range</u> Range 0-200,000 μS/cm & 0-2,00,000 μS/cm  All cell constants have temperature range of -40.0 to +210.0 °C  Salinity 0.000-50.000 PSU sent as 0 to 50,000 TDS 0-100,000 ppm sent as 0 to 50,000  MegaOhm (MΩ) resistivity units sent with 0.001 resolution through entirety of range.	Sensor Serial Number   Sensor Diagnostics	Unique Serial Number Designation: YY.M-A.DDD **   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) DDD is value from 0 to 255

READ/WRITE Type	Adjustable Calibration Description	READ/WRITE Type	Adjustable Parameter Description
Offset Adjust Temperature	<b>Calibrated Temperature Value Limit ±25.0 °C * from raw value</b>	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 <b>±70% from nominal cell constant</b>	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 & have a unique node. Handheld Communicator (HHC) is MODBUS master while HiQDT sensors are MODBUS slaves. To interface HHC with HiQDT sensor, either remove from network, or else bypass with a bridge box with switch scheme. Access to any HiQDT sensor on MODBUS network with HHC is possible if existing MODBUS master is disconnected or powered down. If node of HiQDT sensor is unknown, use Widows Software or HHC node search feature to find it. Please see HiQDT installation guide and HiQDT controller manual for additional recommendations & details.

**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).

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