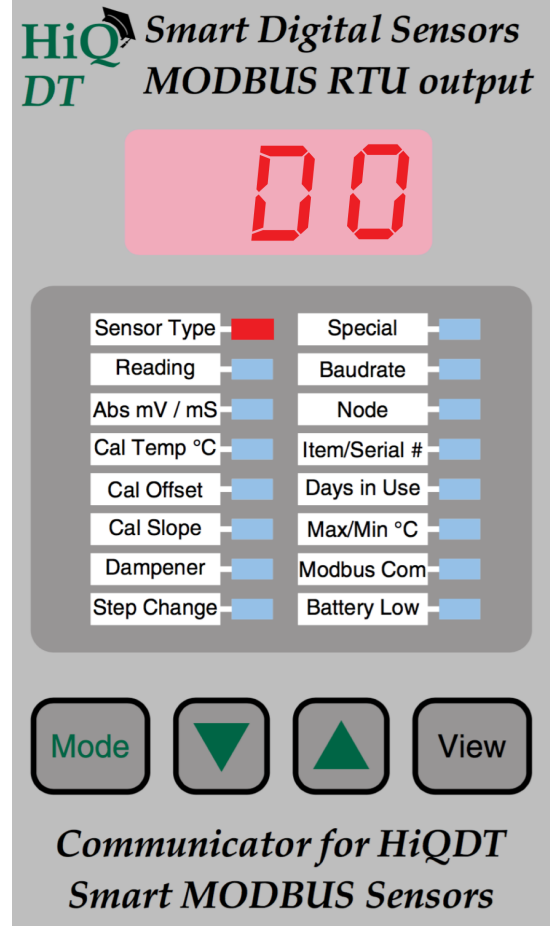


Communicator for *HiQDT* Digital Dissolved Oxygen Sensors

- Lightweight portable 9V battery powered communicator to calibrate & configure **HiQDT smart digital sensors with MODBUS RTU output** at any location desired while still retaining all values stored in non-volatile EEPROM for hot-swap portability when installed back into field service
- The following values are stored in non-volatile EEPROM memory inside the sensor board for complete installation portability & hot-swap use:
 - Offset calibration for temp. & days since time of calibration
 - Slope calibration for DO cell & days since time of calibration
 - Salinity in PSU used to compute accurate percent saturation
 - Factory set Sensor Serial & Item Number for traceability
 - The max & min °C in service & total time in use (energized)
- Node scanning feature for ease of finding address on connected sensor
- Node changing feature allows for any sensor to be used for any channel
- The calibration values themselves and time since that 'Cal' was last performed are displayed using 'View' key in the various Cal LED modes
- Intelligent software on HiQDT communicator auto-detects sensor type connected & loads the appropriate options such that one communicator can interface all possible types of HiQDT smart digital MODBUS sensors
- **MODBUS RTU read/write for all info on handheld communicator to acquire measured DO ppm & temperature, computed % Saturation, calibrations & analytics for connected HiQDT smart digital dissolved oxygen sensor for intelligent remote management & troubleshooting**
- Quick disconnect cables to 1,000 meters (3,280 feet); NEMA 6P & IP67 rated waterproof HiQ4M & HiQ4F snap connectors for rugged field use
- Input Data Ranges & Max Resolution for DO Measurements:
 - DO range from 0.00 to 150.00 ppm & 0.0 to 1,500.0%
 - Resolution 0.01 ppm and 0.1% saturation
 - Supported operating temperature range of -5 to +65 °C
- **Dissolved oxygen sensor calibration is performed dry in air such that no wet solutions of kind are required to calibrate the DO sensor.**
- Salinity correction is performed from user entered PSU value to ensure correct reading in the percent (%) saturation units for freshwater or brine
- Automatic Temperature Compensation (ATC) from -5 to 65 °C
- Ideal for both continuous as well as portable spot field measurements



Programming

Handheld communicator (HHC) has 3-digit display & 16 LEDs to show readings & analytic data as well as to calibrate and configure sensor. Programming is done by 4 key front panel. 'Mode' key used to toggle and navigate to each LED. 'Up' or 'Down' buttons scroll available options & adjust values. 'Mode' key is used to make selections and save entries. 'View' key provides additional information for the given LED mode (see table for details on use of 'View').

TECHNICAL SPECIFICATIONS FOR HiQDT CALIBRATOR & CONFIGURATOR

Mechanical

Housing: ABS
 Mounting: Handheld
 IP Class: Housing IP40
 Connector: HiQ4M female for HiQ4M sensor male snap
 Temp.: Usage -15 to +50 °C (Storage -35 to +75 °C)
 Weight: 130 grams with battery (4.6 ounces)
 100 grams without battery (3.5 ounces)
 Dimensions: D 26 x W 60 x H 120 mm (1.0" X 2.4" X 4.7")

** Number of seconds until auto shutdown starts from when sensor is disconnected from HHC*

Electrical

Supply: 9V battery (Alkaline or Lithium)
 Consumption: ~30 mA with HiQDT sensor "On"
 Battery Life: ~15 hrs Alkaline or ~30 hrs Lithium
 Auto shutdown after 25 seconds * without communication
 Smart Digital AST-DO-UNIVERSAL Galvanic Dissolved Oxygen Sensors
 9600 or 19,200 kbps (selectable)
 EN61326A




BENEFITS OF AST-DO-UNIVERSAL SMART DIGITAL HiQDT MODBUS RTU 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.
- **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.
- **Days in use** value is stamped for calibrations that are performed. This allows for predictive scheduling of maintenance in the PLC to ensure the accurate measurement in the field based upon user defined criteria.
- **All digital sensors ensure** reliable operation even in noisy process environments unlike analog sensors.
- **No degradation in digital output** even with very long cable runs **up to max of 1,000 meters (3,280 feet)**
- 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.
- **Intelligent HiQDT handheld communicator software identifies type of sensor connected & autoloads** correct features. There exists no possibility of accidentally using the wrong set of options or settings.
- **All Extension cables for HiQDT sensors are inter-compatible**. Uniform extension cables minimize stocking. Separate field installation guide details available options to commission & exchange sensors.

SENSORS FOR USE WITH SMART DIGITAL HiQDT WITH RS-485 MODBUS RTU OUTPUT

- **Rugged Industrial AST-DO-UNIVERSAL Galvanic Dissolved Oxygen Sensors** for inline, immersion, submersible, twist lock, sanitary, HOT-TAP retractable installations are available in HiQDT configuration
- **Waterproofing Option "A", "B", "C", "G", "H" or "IT" is recommended for any HiQDT smart digital sensor** with integral 4-20mA scalable output configuration for immersion or fully submersible use.

TECHNICAL SPECIFICATIONS FOR HiQDT DIGITAL SENSORS WITH RS-485

Mechanical & Thermal		Electrical	
Housing:	DELTRIN & RYTON	Operating VDC:	7.0 to 13.0 VDC at sensor board
Mounting:	Inline, Immersion, Submersible, Sanitary & HOT-TAP as per sensor specifications	Power Supply:	Isolated & Regulated 9V or 12V DC
Rating:	Fully submersible and waterproof without the use of immersion tube with WPB/WPH	Current draw:	Max 20mA Absolute (Typical 15mA)
Connector:	NEMA 6P rated HiQ4M male snap connectors for HiQDT snap extension cables; Extension cables for 3TX-HiQ platform can be used for HiQDT type smart digital sensors as well	DO Range:	0 to 150 ppm (0.01ppm resolution) 0 to 1,500 percent (%) saturation computed with a resolution of 0.1%
Max Cable:	Up to 3,280 feet (1,000 meters) using 22 AWG leads and 12VDC power supply	Temp Sensor:	Integral Platinum 1000Ω TC Element
Temp.:	Max 50°C all AST-DO-UNIVERSAL sensors	Temp Range:	-5 to +65 °C (+23 to +149 °F) <i>for HiQDT-DO sensor in actual field use</i>
Weight:	Per Sensor, Typically 0.5 to 2 kilograms	Temp. Comp.:	Automatic for all measurements
Dimensions:	Per Sensor, Minimum size is 3/4" MNPT for inline installations, Min length is 8.0 inches with max of about 12 inches with WPB/WPH	Digital Output:	Non-Isolated RS-485 MODBUS RTU
		Compatibility:	For use with HiQDT Handheld Communicator or else any customer PLC with isolated RS-485 input that accepts MODBUS RTU slaves
		CE mark:	EN61326A
<i>Recommended Option:</i>	<i>All dissolved oxygen (DO) sensors for outdoor or fully submersible installations should have a suitable WPA/WPB/WPC/WPG/WPH/WPIT sealing invoked to ensure max sensor lifetime</i>		



INTELLIGENT HANDHELD COMMUNICATOR (HHC) FOR FIELD CALIBRATION, CONFIGURATION, SPOT MEASUREMENT & TROUBLESHOOTING OF HiQDT SMART DIGITAL RS485 MODBUS RTU SENSORS

LABEL ON LED	Parameter	Description & Method to Access	Range	Default
Sensor Type	Measurement type	Load options for connected sensor 'View' key shows software revision	pH or ORP or DO or ISE or CON (autodetected)	Per Type
Reading****	Process Parameter****	Display current calibrated value <i>See Display Features for more detailed explanation of how to use this LED mode</i>	0.0 to 150.0 ppm* 0 to 1,500 percent (%) saturation* Use 'View' key to show % sat	Per Measured Solution
Absolute mV	Process Parameter	Display the absolute mV value from connector dissolved oxygen sensor	0 to +250 (Negative mV values are not possible for galvanic DO cell)	Per Sensor & Media
Cal Temp.	Offset calibration of temperature in °C**	Adjust temp reading up & down 'View' key shows current temp cal.	±25.0 °C * from raw value	0.0
Cal Offset	Not Used for DO Measurements	N/A	N/A	N/A
Cal Slope	Defines span (gain) for DO Sensor**	mV per DO ppm units 'View' key shows current slope	0.70 to 6.00 mV per ppm unit	1.60
Dampener	Smoothing dampener & output delay***	Sets number of seconds to be used for dampener for process value(s)	1, 2, 3, 4, 5, 8, 10, 15, 20 or 30 Seconds	10 - Dampen 1 - Delay
Step Change	Sensitivity for 'Up' & 'Down' buttons	mV increment for each time the 'Up' or 'Down' button is depressed	Choices: 0.05, 0.10, 0.20, 0.5, 1.0 or 2.0	0.10
Special	Salinity to compute % saturation value	User entered salinity value in PSU to compute percent (%) saturation value	0.0 to 50.0 PSU	0.0
Baudrate	Sets Baudrate for Com	Toggle between 9600 or 19,200 kbps	9600 or 19,200 kbps	Per Network
Node	Sets Address for Com	Chose a unique address on network	From 001 to 247	Per Sensor
Item/Serial #	Sensor Item Number & Sensor Serial Number	Item Number defines sensor model; 'View' shows Serial Number which is the unique traceable identifier	Item # from 1-9,999 with >999 shown in sequence; Serial # per HiQDT Serial Number Scheme	Per Sensor
Days in Use	Total time HiQDT sensor is energized	Increments time in use after dispatch from factory to track sensor lifetime & predictive maintenance purposes	0-65,535 in units of days (>999 displayed flashing) Within ±2% accuracy	Per Sensor Field Use
Max/Min °C	Displays max & Min Temp in field use	The max temp in field use is shown; Push 'View' button for min temp	-40 to +210 °C *	Per Sensor Field Use

* Negative values are always shown as flashing.

COLOR NOTES: Parameters in light **light green** are defined by factory at dispatch time or determined from field use. Parameters in **grey** can be adjusted as desired. Parameters in **dark green** are obtained from wet calibrations done with HiQDT sensor in the field.

- * **HHC display maxes out at 99.9 for reading for DO ppm (actual max to 150) and 999 for DO % saturation (actual max to 1,500)**
- ** **Holding the 'View' key for 3 to 5 seconds in this LED mode shows the 'Days in Use' SINCE this calibration was performed**
- ** **Holding BOTH the 'View' AND 'Up' keys for 3 to 5 seconds in this LED mode will reset all calibration values back to default**
- *** **Holding the 'View' key for 3 to 5 seconds allows for the delay from boot value to be shown as well as adjusted**
- **** **Holding both 'Up' & 'Mode' keys shows software rev or both 'Down' & 'Mode' keys shows build date in Reading LED mode**
- ***** **User Adjustable Timeout Feature: Press 'Down' + 'View' in 'Reading' mode to set minutes before automatic shutoff occurs**

NOTE ON DISSOLVED OXYGEN SENSORS WHEN VALUES ARE GREATER THAN 99.9 ppm or 999 % Saturation:

When the ppm value exceeds 99.9 it will not be shown (actual max value supported in output is 150ppm). When the computed percent (%) saturation value exceeds 999 it will not be shown on display (actual max value supported in output is 1,500%).

NOTE ON HiQDT SMART DIGITAL DO SENSOR SLOPE CALIBRATION:

The HiQDT smart digital dissolved oxygen sensors will always have just a single slope and no offset. No offset calibration is required for the true galvanic cell since it has a true zero (0mV at 0ppm). The use of just a single slope is possible since the response of the industrial AST-DO-UNIVERSAL dissolved oxygen (DO) smart digital sensor with MODBUS RTU digital output is linear throughout the entire range defined by the mV per ppm slope calibration to define the effective span.

'Modbus Com' & 'Battery Low' LED

- The "Modbus Com" LED is illuminated briefly each time that a communication packet is sent or received.
- The "Battery Low" LED will at first flash as warning & then illuminate continuously when the 9V battery should be replaced.
 - **MUST Change 9V battery when LED is illuminated to ensure valid readings and calibrations**

HiQDT DIGITAL DISSOLVED OXYGEN SENSOR FEATURES & BASIC USAGE

The smart digital HiQDT dissolved oxygen sensors with integral MODBUS RTU output allows for simple & fully portable installation scheme. 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 communications. The temperature offset calibration can be done with sensor left in service to agree with a reference value for an external measurement device (please see calibration instructions). Waterproof and corrosion-resistant NEMA 6P HiQ4M snap connector comes standard for easy seamless hot-swap of sensors from service for cleaning, recalibration, rebuilding of the galvanic cell (change-out of the electrolyte and DO membrane) & other maintenance tasks as may be required as well as eventual replacement of sensor in time.

SETUP OF HIQDT RS-485 MODBUS RTU SENSOR TO HANDHELD COMMUNICATOR (HHC)

1. **Instructions for node scanning and changing node found on page 8.**
2. Press the 'Mode' button to turn on HHC. The HHC will attempt to communicate with the last used baudrate and node address. If either no sensor is connected or available at the last used baudrate and node address then three dashes "---" are shown on display. If no buttons are pressed for 25 seconds from this state the HHC will automatically turn itself off to conserve battery life.
 - a. If previous baudrate and node address are valid for connected sensor the HHC will automatically load all relevant LED options and addressable parameters for that sensor type.
3. Pressing 'Mode' button navigates to 'Node' LED mode. Use 'Up' & 'Down' keys to scroll to node of the connected sensor. Node information is typically found on label of sensor. If this information is not available, the HiQDT Windows software can be used scan the sensor in question to determine the current node address. The baudrate and node address of the HiQDT sensors can only be changed by the Windows software. When the desired node address is reached press the 'Mode' key enter the value.
 - a. Default node for pH sensors is 1, ORP sensors is 2 Wide-Range ORP sensors is 3 & DO sensors is 4. If multiple sensors of the same type are used on one MODBUS RTU network the node address for each same type of sensor must differ from default to ensure that node is a unique and valid address.
4. If baudrate needs to be adjusted (9600 or 19,200 kbps) then the HHC automatically navigates to this LED mode next.
5. HHC will return back to the reading mode after selecting node & baudrate. If the selections are valid then process reading is shown otherwise three dashes "---" are shown.
6. Press 'Mode' button after reading LED to toggle to sensor type LED which shows type of sensor that is connected.



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

Systematic tracking achieved with factory stamped sensor serial and item number. The internal clock on the HiQDT sensor board is incremented when energized 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.



IMPORTANT NOTE BEFORE PERFORMING CALIBRATIONS:

The time averaging dampener is always on even when performing calibrations. It can be desirable to adjust dampener to a short value when performing calibrations to make the calibration process quicker and then reset the dampener back to a higher value before reinstalling the sensor back into continuous use in field service (be sure to remember this last step!)

TEMPERATURE CALIBRATION INSTRUCTIONS

The temperature is calibrated by pushing the 'Up' or 'Down' buttons when in the temperature display (°C) mode. *

** Negative values shown as flashing.*

CALIBRATION OF HiQDT SMART DIGITAL DO SENSORS WITH HANDHELD COMMUNICATOR

1. Use the 'Mode' button to toggle to 'Cal Slope' LED.
2. Use 'Up' and 'Down' keys until the display reads 'CaL'.
3. Press the 'Mode' button to invoke the automatic calibration routine. The display will show 'YES'. Press the 'Mode' button to complete the auto-calibration. The HHC will return back to the 'Reading' LED mode upon completion.
 - a. The HiQDT-DO smart digital MODBUS RTU dissolved oxygen sensor automatically computes the dissolved oxygen ppm levels that constitutes the 100% saturation condition to perform a dry in air calibration including the measured current temperature as well as the user entered barometric pressure.
 - b. When you complete the autocalibration the percent saturation reading will be 100 percent (%) saturation. The percent saturation units can be seen by pressing the 'View' key in the 'Reading' LED mode.
4. All calibration values are stored inside the HiQDT smart digital pH sensor in EEPROM such that sensor can be powered down or moved without loss of calibration values resulting in a true plug and play measurement system with seamless hot-swap of sensor in field.
5. Results of the performed HiQDT-DO sensor calibration can be viewed by pressing the 'View' key in the 'Cal Slope' LED mode. The units are mV per DO ppm for the slope value used throughout the entirety of the range.

DISSOLVED OXYGEN (DO) CALIBRATION INSTRUCTIONS FOR HiQDT DIGITAL SENSORS

The AST-DO-UNIVERSAL galvanic dissolved oxygen sensors do not require any offset calibration as they have a true 0mV potential at 0ppm dissolved oxygen. Accordingly, the 'Offset' LED is skipped on handheld communicator when toggling through the LED modes. Calibration of the dissolved oxygen sensor is then only performed in the 'Slope' LED mode. Removing the DO sensor from service and allow sufficient time for temperature & sensor reading to be quite stable to ensure a good gain calibration result. The slope calibration (a.k.a. gain) is performed when the sensor is clean & dry and exposed to only air. If the relative humidity is not 100% suspend the sensor in air over a source of water for best results. Be sure to wait a sufficient time until the sensor reading is quite stable before performing the span (slope) calibration. The days in use since the calibration was last performed is saved in sensor EEPROM and accessible via RS-485 MODBUS RTU.

IMPORTANT: Perform precise temperature calibration before slope (a.k.a. gain) calibration on DO sensor.

The correct 100% saturation value at any temperature from -5 to +50°C is programmed in the HiQDT-DO sensor board software allowing for a fully automated calibration procedure.

TEMPERATURE CALIBRATION INSTRUCTIONS

The temperature is calibrated by pushing the 'Up' or 'Down' buttons when in the temperature display (°C) mode. *

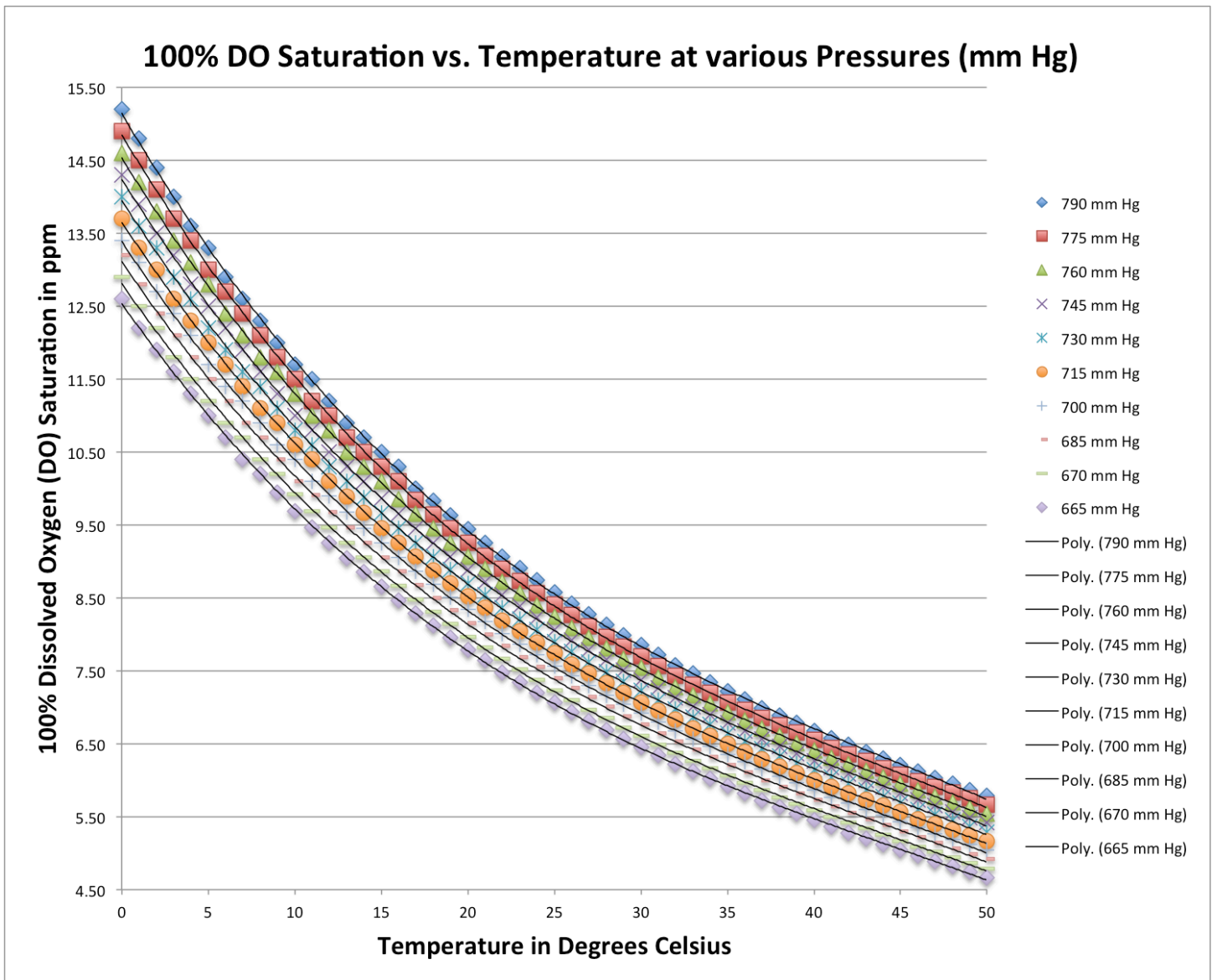
** Negative values shown as flashing.*

!! IMPORTANT NOTE FOR POWERING HiQDT SMART DIGITAL SENSORS !!

- The RS-485 MODBUS RTU digital output from the HiQDT smart digital sensors is non-isolated.
 - Power source that energizes sensor should be isolated (dedicated & separate from all other devices) or
 - DC/DC converter/isolator can be added to the existing power supply employed to accomplish the same net result as having a dedicated separate 9V to 12V DC power source.
 - Device that will serve as RS-485 MODBUS RTU master should have an isolated serial input port

Automatic Calculation of Theoretical 100% Dissolved Oxygen Saturation at any Temperature & Pressure for Accurate Calibration & Measurement

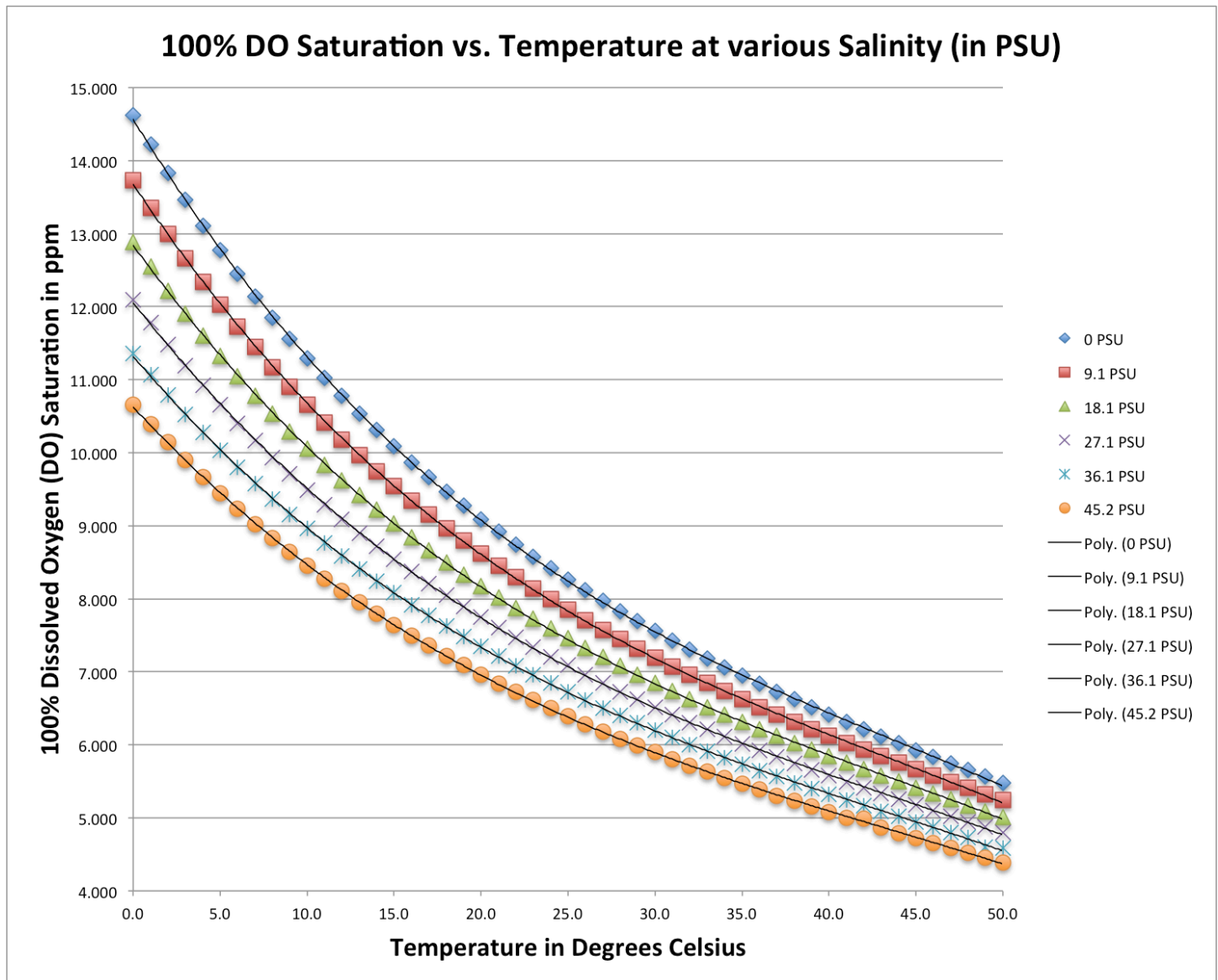
The HiQDT-DO sensor has preprogrammed the correct 100% dissolved oxygen saturation levels valid at any temperature and pressure. This is important for two main purposes: 1) to ensure accurate calibration of the sensor which is performed dry in air and 2) when the percent (%) saturation is displayed and output for purposes of monitoring and control. The graph below demonstrate the impact of both temperature and pressure on the dissolved oxygen (DO) ppm levels that constitute 100% saturation condition.



For the calibration function, either the field condition should be 100% relative humidity for best accuracy or else the sensor should be suspended dry in air but over a water source to simulate locally the 100% relative humidity condition. The water molecule in air (humidity) is then saturated with oxygen in manner that can be fully described by the ambient temperature and pressure as shown above. When placed into service, the galvanic DO sensor will measure the ppm levels at the installation depth. To convert this measured ppm value into percent (%) saturation the HiQDT-DO sensor uses the internally stored curve visualization above.

Automatic Calculation of Theoretical 100% Dissolved Oxygen Saturation at any Temperature & Pressure for Accurate Calibration & Measurement

The HiQDT-DO has preprogrammed the correct 100% dissolved oxygen saturation levels valid at not only any temperature and pressure but also corrected for salinity. This is important for applications where not only fresh water will be present but also for brackish and salt water sources in variable amounts. The graph below demonstrates the impact of salinity on the dissolved oxygen (DO) ppm levels that constitute 100% saturation condition at the nominal 760mm pressure condition. For simplicity of visualization just one set of curves is shown although the analyzer can perform this compensation any temperature, pressure or salinity.



This salinity correction is only required as a correction to the computation of the % saturation from the measured DO ppm levels for the inline measurement. Since the calibration is done dry in air, salinity correction is not required for this part of operation. Since the impact of salinity is considerable as shown in the graph above, it must be corrected carefully at any level of salinity and temperature. The salinity value in standard PSU (PPT) units can be entered into the HiQDT-DO sensor to perform this correction. The value of the salinity can be determined by a handheld meter or else monitoring continuously using a conductivity transmitter from which one can readily convert into common salinity units.

NOTES ON ADJUSTABLE SMOOTHING DAMPENER & OUTPUT DELAY:

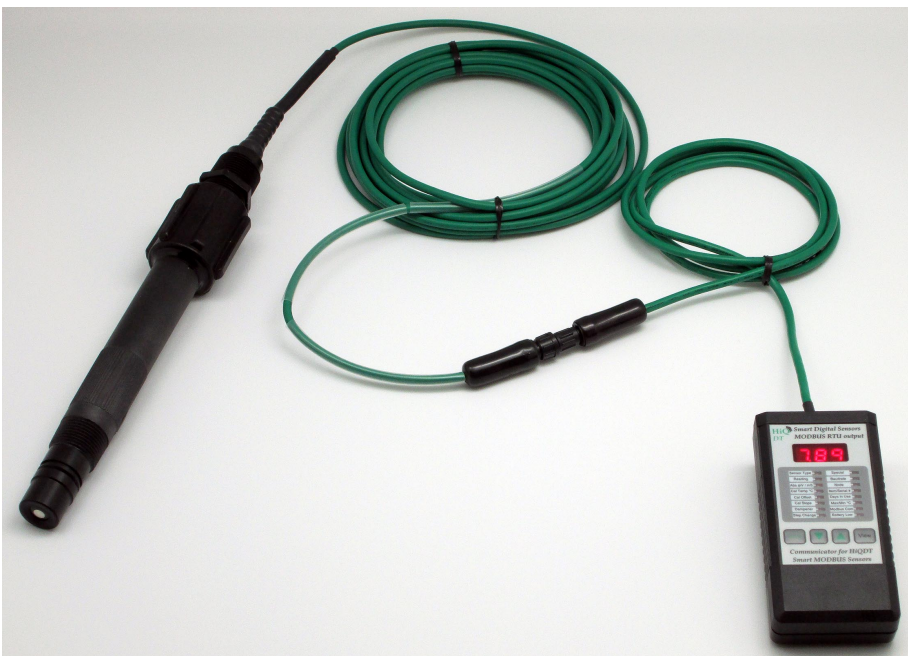
- Dampener LED when HiQDT-DO sensor is connected allows for display and modification of the variable that is used to set the number of seconds used for the smoothing dampener and delay from boot to send the output values
- For intermittent operation, it is recommended to set this dampener & output delay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

DISPLAY FEATURES AVAILABLE USING THE 'VIEW' KEY

- In 'Node' mode press 'View' key to invoke the node scanning feature (see green instructions below for details). *
- In 'Baud Rate' mode press 'View' key for 3 to 5 seconds to invoke node changing mode. **
- In 'Sensor Type' LED mode, the software revision for the connected sensor is shown when the 'View' key is pressed.
- In 'Reading' LED mode, the displayed units are ppm. Pressing 'View' key returns reading in percent (%) saturation units. The computation of the percent (%) saturation units is preprogrammed in HiQDT smart digital MODBUS RTU dissolved oxygen (DO) sensors at the factory including corrections for the air pressure, temperature and salinity.
 - To view the percent (%) saturation excluding the salinity hold 'View' key for 3 to 5 seconds. This percent (%) saturation excluding the salinity is the one to be used when sensor is dry in air during calibration procedure.
- In 'Cal Temp.' LED mode, the offset in °C * for current temp calibration is shown when the 'View' key is pressed.
- In 'Cal Slope' LED mode, the current slope for the connected HiQDT dissolved oxygen sensor is shown when the 'View' key is pressed in mV per DO ppm units.
 - Days since this calibration performed shown by holding 'View' in the 'Cal' mode for 3 to 5 seconds. **If BOTH 'View' & 'Up' pressed for 3 to 5 seconds in any 'Cal' mode will reset all calibrations back to factory default**

* Initial node of '0' will be shown (press 'Mode' when node address is '0' to exit scan mode). Select starting address for scan with 'Up' or 'Down' keys. Node address scrolled in increments of 10. For example, pressing 'Up' key gives address of 1→10→20→30... and so forth while pressing 'Down' key gives addresses of →240→230→220... and so forth. Press 'Mode' to begin scan. Scanning is always performed in an ascending fashion. Scan will stop when sensor is found. Sensor type for node address found displayed flashing with node address. Press 'Mode' to select this node and you will enter 'Reading' mode. Press 'View' to continue scanning. If no sensors found when address 247 is reached, then 'Err' is displayed. Press 'Mode' to resume scan and repeat these procedures.

** Select the current node for the attached sensor. If the current node is not known use the node scanning feature to determine it. When in the 'Baud Rate' LED mode, hold the 'View' key for at least 3 seconds to initiate the node changing mode. The current node of the sensor will be shown and the 'Sensor Type' and 'Node' LED will flash. If the 'Mode' key is pressed immediately after entering this node changing mode, then no change to the address will be made since the address displayed will equal the current node address. Use 'Up' and 'Down' keys to adjust the node to the modified address if desired. Press 'Mode' key to enter the new node address selected with 'Up' & 'Down' keys.



Submersible configuration of smart digital HiQDT dissolved oxygen sensor with WPC sealing is shown to the left connected to the handheld communicator (HHC). The integral 9V battery in the HHC powers both the connected sensor interfaced with the waterproof NEMA 6P rated snap connector as well as the electronics itself. All operations required for setup, configuration, calibration and reviewing analytics is possible from the HHC to support any type of field installation using just the sensor, handheld communicator and mating MODBUS RTU master device. The MODBUS RTU master can be any suitable PLC, SCADA or data acquisition device rated for the installation location.



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 Process Values for HiQDT-DO	Calibrated DO ppm value with range 0.00 to 150.00 sent as 0 to 15,000 Calibrated DO % saturation with range 0.0 to 1,500.0 % sent as 0 to 15,000 Calibrated temp with the range -40.0 to +210.0 °C sent as 0 to 2,5000	Connected Sensor Type	1 - HiQDT-pH 2 - HiQDT-ORP Standard Range 3 - HiQDT-ORP Wide Range 4 - HiQDT-DO (Dissolved Oxygen) 5 - HiQDT-ISE (Ion Selective) 6 - HiQDT-CON (EC Standard/High) 7 - HiQDT-CON-L (EC Ultralow)
Raw Process Values	Absolute {Raw} mV value with range 0 to +250 sent as 0 to 25,000 (Aux Column in Windows Datalogger)	Sensor Serial Number Sensor Diagnostics	Unique Serial Number Designation: YY.M-AA.DDD ** Sensor Item Number Software Revision Max Temp in Use Min Temp in Use Days in Field Use
	<i>NOTE: Dissolved oxygen values are always automatically temperature compensated.</i>	Calibration Values	Temperature Offset Days since Temp Offset Cal mV per DO ppm Slope Days since DO Cell Calibration

** Serial format YY is last digits of year; M is month with A=Oct, B= Nov & C=Dec; AA is letter(s) from A to nY (as permissible); DDD is value from 0 to 255

READ/WRITE Type	Adjustable Calibration Description	READ/WRITE Type	Adjustable Parameter Description
Offset Adjust Temperature	Calibrated Temperature Value ±25.0 °C * from raw value	Reset Calibrations	Will reset all user adjustable sensor calibrations back to factory default values
Adjust Dissolved Oxygen (DO) Galvanic Cell Working Slope	0.70 to 6.00 mV per DO ppm Max 250mV input yielding max of 150.00 ppm 1,500.0 % Saturation <i>NOTE: Actual max measured DO ppm is limited by slope of sensor. For example, if calibrated slope is 2.00 mV per DO ppm, then the actual max will be 125ppm instead of 150ppm.</i>	Dampener	Time averaging of process value 1, 2, 3, 4, 5, 8, 10, 15, 20 or 30 Seconds <i>NOTE: Dampener setting is the basis for the setting for the autocalibration in the factory supplied HiQDT controller. The minimum time to complete the autobuffer calibration is always at least the dampener settings plus two seconds. This should be considered if fast autobuffer calibration is important.</i>
Reset Calibrations	Resets all user adjustable sensor calibrations back to factory default	Delay from Boot	Time until process values are sent from boot 1, 2, 3, 4, 5, 8, 10, 15, 20 or 30 Seconds

* Negative values shown as flashing.

NOTE 0: The maximum supported temperature for all fully submersed HiQDT dissolved oxygen sensors is 65°C absolute.

NOTE 1: For communication to be successful all MODBUS devices on the network must use the same baudrate and have a unique node address assigned. The handheld communicator is a MODBUS master whereas all HiQDT sensors are MODBUS slaves. In order for the handheld communicator to be interfaced with the HiQDT sensor, that sensor must either be removed from the network, or else bypassed by means of a suitable bridge box scheme. It is also possible to access any given HiQDT sensor on the MODBUS network if the existing MODBUS master is disconnected or powered down. If the node of the HiQDT sensor to be interfaced is not known, please use the Windows software to determine the current node address and modify if it should be necessary to ensure a valid & unique node address setting on the network. 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 Modified April 23, 2021 | Revision 8