



Quanta[®]

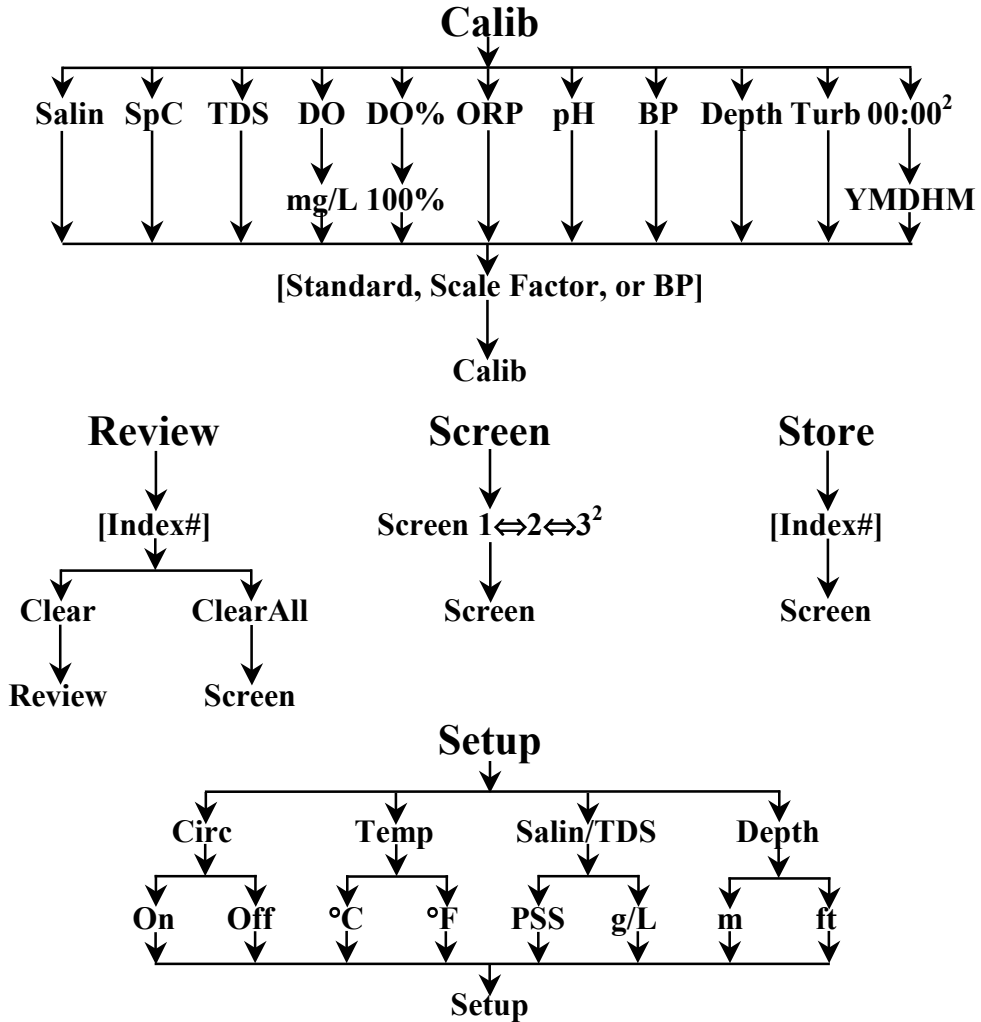
Water Quality Monitoring System

**Operating Manual
February 2002
(Revision C)**

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Quanta Display Operations Tree



Notes:

1. Pressing the **Esc ∞** key always exits to the previous operation level except at the top level where it toggles the circulator on or off.
2. RTC calibration (**Calib → 00:00**) and **Screen 3** are only available if the RTC/PC-Dump option is installed.
3. If the RTC/PC-Dump option is installed, pressing and holding the **Esc ∞** key down during power-up causes the Quanta Display to enter PC-Dump mode.

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1 INTRODUCTION

1.1 Foreword

The Hydrolab Quanta Water Quality Monitoring System includes a sensor package (the Transmitter) and an optional data package (the Display). For this manual, the Quanta System will refer to the combination of the Transmitter and the Display.

The Quanta Transmitter includes sensors for temperature, pH, dissolved oxygen (DO), specific conductance (SpC), depth, oxidation-reduction potential (ORP), turbidity, salinity, and total dissolved solids (TDS). In-situ measurements can be made in lakes, rivers, streams, process pipes, bays, estuaries, tanks, aquaria, sewers, or other large or small water bodies. Highly portable and field-worthy, it can be used for profiling, sampling, and long- or short-term monitoring. The Transmitter can be connected to the Display or any SDI-12 receiving device, including data loggers, data collection platforms, and other monitoring instruments.

The Quanta Display includes battery power and a liquid-crystal screen for viewing up to five parameters at one time. The Display is also used for configuring and calibrating the sensors and can store up to 200 data frames. The Display's RTC/PC-Dump option stamps each data frame with date-time and dumps all data frames in a comma-separated value (CSV) format for easy import into spreadsheet or database programs.

1.2 Specifications

Performance Specifications

	Range	Accuracy	Resolution
Temperature	-5°C to 50°C	±0.2°C	0.01°C
Dissolved Oxygen	0 to 50 mg/L	±0.2 mg/L ≤ 20 mg/L ±0.6 mg/L > 20 mg/L	0.01 mg/L
Specific Conductance	0 to 100 mS/cm	±1% of reading ±1 count	4 digits
pH	2 to 12 units	±0.2 units	0.01 units
ORP	-999 to 999 mV	±25 mV	1 mV
Vented Depth (10m)	0 to 10 m	±0.003 m (±0.01 ft)	0.001 m
Depth (25m)	0 to 25 m	±0.1 m	0.1 m
Depth (100m)	0 to 100 m	±0.3 m	0.1 m
Turbidity	0 to 1000 NTU	±5% of reading ±1 NTU	0.1 NTU < 100 NTU 1 NTU ≥ 100 NTU
Salinity	0 to 70 PSS	±1% of reading ±1 count	0.01 PSS

Instrument Specifications

Quanta Transmitter

Diameter:	7.6 cm (3 in)
Length:	22.9cm (9 in)
Weight:	1.2 kg (2.6 lbs)
Maximum Submersion:	100 m (328 ft)
Operating Temperature (non-freezing):	-5°C to 50°C
Operating Voltage Range:	7 to 14 VDC

Quanta Transmitter

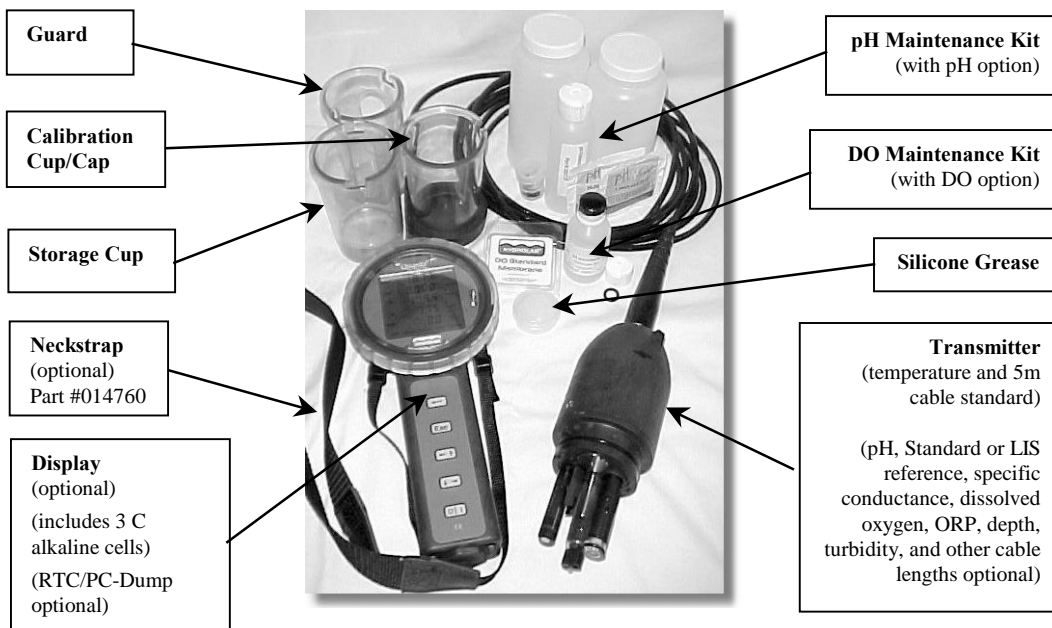
SDI-12 Standby Current (@+12VDC, without turbidity):	< 350 μ A
SDI-12 Standby Current (@+12VDC, with turbidity):	< 700 μ A
Operating Current (circulator off @+12VDC, without turbidity):	< 40 mA
Operating Current (circulator off @+12VDC, with turbidity):	< 90 mA
Operating Current (circulator on @+12VDC, without turbidity):	< 90 mA
Operating Current (circulator on @+12VDC, with turbidity):	< 140 mA

Quanta Display

Screen Size (diagonal):	8.9 cm (3.5 in)
Width (screen section):	12.7 cm (5 in)
Width (handle section):	6.4 cm (2.5 in)
Length:	26.9cm (10.6in)
Weight (with batteries):	0.95 kg (2.1 lbs)
Operating Temperature (non-freezing):	-5°C to 50°C
Batteries:	3 C Alkaline
Battery Life (circulator on, without turbidity):	> 20 hours
Battery Life (circulator on, with turbidity):	> 13 hours
Memory (1 frame stores all parameter values):	200 data frames (Non-volatile FLASH)
Waterproof Rating:	NEMA 6 (IP67)
Real-Time Clock Life	> 10 years
Real-Time Clock Accuracy (@ 25°C)	\pm 2 minutes per month

1.3 Components

The following picture identifies the main components of a Quanta System. The Quanta System is a configurable product and not all components shown are included with every system.



The Quanta System ships in a custom reusable box and also includes this manual and MSDS datasheets. If the Transmitter includes the optional Vented Depth, the cable also includes a dryer assembly. If the Display includes the optional RTC/PC-Dump, the Quanta Display/PC Interface Cable is also included. Optional accessories, not shown, are a Secchi Disk (part #014180), a Backpack (part #014770), a FlowCell (part #014200), an SDI-12 Interface Adapter (part #014190), and Turbidity Quick-Cal Cube™ (part #014250).

1.4 Assembly

1.4.1 Quanta System Assembly

To assemble your Quanta System, simply uncap the Display connector and connect the Transmitter cable connector to the Display connector. These connectors are keyed for proper alignment (don't force them). The retaining ring will make a 'click' when rotated to the correct position to capture the connectors.

Press the Display's **O|I** key (on/off) and the LCD shows the Display and Transmitter software revisions. The LCD's index digits (see Section 2.1.2) count up from 'L0' up to 'L9' as the Display searches SDI-12 addresses for the Transmitter. After finding the Transmitter's SDI-12 address(es), the LCD's parameter digits show the Display and Transmitter software revisions and the index digits count up as the Display interrogates for Transmitter configuration. After a few seconds, the LCD begins showing current Transmitter data. If not, please refer to Section 7.

Notes:

- The Display and Transmitters software revisions show as '*d A.B*', '*S C.D*', and '*U E.F*' where '*d*' is the Display's software revision, '*S*' is the Transmitter's software revision for non-turbidity measurements, and '*U*' is the Transmitter's software revision for turbidity measurements.

1.4.2 Transmitter/SDI-12 Datalogger Assembly

To assemble your Transmitter to your SDI-12 datalogger, simply connect the Transmitter cable connector to the SDI-12 Interface Adapter connector. These connectors are keyed for proper alignment (don't force them). The retaining ring will make a 'click' when rotated to the correct position to capture the connectors. With power off, connect the bare wires at the end of the SDI-12 Interface Adapter to the appropriate connections on your SDI-12 datalogger. The label on the SDI-12 Interface Adapter shows its wire colors/SDI-12 functions. Please consult your datalogger manual for its connection details.

To test the SDI-12 communications, apply power to the datalogger and enter its transparent mode. Issue the '*aI*' command, where '*a*' is the Transmitter's SDI-12 address, to request the identification of the Transmitter. A properly connected Transmitter will respond with its address, manufacturer name, product name, and SDI-12 revision. If not, please refer to Section 7. Section 6 contains complete details on the Transmitter's SDI-12 capabilities.

Notes:

- All five wires (three grounds) must be connected for correct SDI-12 operation.

- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, '*a*' refers to the SDI-12 address for all parameters except turbidity and '*b*' refers to the SDI-12 address for turbidity.

1.5 Introductory Exercise

1.5.1 Calibrating Specific Conductance using the Display

Assemble the Quanta System as described in Section 1.4.1. Turn on the System by pressing the Display's **O|I** (on/off) key. If the circulator is on, press the **Esc** ∞ (escape/circulator) key (or **Esc** key on early production models) to toggle the circulator off, so that it doesn't splash your calibration standard.

Next, install the Calibration Cup on the Transmitter. With the Transmitter sensors pointing up (towards the ceiling), fill the Calibration Cup with a specific conductance calibration standard. Wait for the specific conductance readings to stabilize in the calibration solution, which may require one or two minutes.

After power-up, the Display's **Screen** icon, in the lower center of the screen, is blinking. Press either of the **←↑** or **↓→** (arrow) keys to cause **Calib** (calibrate) to blink instead of **Screen**. Press the **↵** (enter) key to select calibration. Use the **←↑** or **↓→** keys to cause **SpC** (specific conductance) to blink, and press the **↵** key.

Next, use the **←↑** or **↓→** keys to raise or lower the specific conductance reading to match the calibration standard in mS/cm. Press the **↵** key to finish calibration of specific conductance. If the Transmitter accepts the calibration, the Display returns to the **Calib** screen. If the Transmitter rejects the calibration, the Display LCD shows '**FAIL**' before returning to the **Calib** screen. Press **Esc** ∞ to return to the real-time data screen. Now, check the specific conductance value to confirm calibration.

1.5.2 Calibrating Specific Conductance with an SDI-12 Datalogger

Assemble the Transmitter and SDI-12 datalogger as described in Section 1.4.2. Using the datalogger's transparent mode, issue the '*aX1!*' command to turn the Transmitter's sensors on. If the circulator is on, issue the '*aXSS0!*' command to turn the circulator off, so that it doesn't splash your calibration standard.

Next, install the Calibration Cup on the Transmitter. With the Transmitter sensors pointing up (toward the ceiling), fill the Calibration Cup with a specific conductance calibration standard. Wait for the specific conductance readings to stabilize in the calibration solution, which may require one or two minutes. Monitor the current specific conductance value by issuing the '*aR0!*' command repeatedly. The specific conductance value is the third data value displayed in the SDI-12 response.

Issue the '*aXCC+value!*' command, with *value* being the numeric value of the calibration standard in mS/cm, to finish the calibration of specific conductance. Now, issue the '*aR0!*' command and

check the specific conductance value to confirm calibration. Finally, issue the 'aX0!' command to turn the Transmitter's sensors off and, if needed, issue the 'aXSS1!' command to turn the circulator back on.

Notes:

- Both the sensors and the circulator must be turned on for the circulator to operate.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, 'a' refers to the SDI-12 address for all parameters except turbidity and 'b' refers to the SDI-12 address for turbidity.

1.6 Important Note

Although you have now performed the basic operations available on the Quanta System and/or Quanta Transmitter/SDI-12 datalogger, please read Sections 2 and 3 to discover the Quanta System's other features and Sections 3 and 6 to discover the Quanta Transmitter's other SDI-12 capabilities. Be sure to read Section 3, since only a well-maintained and carefully calibrated instrument will provide quality data.

2 QUANTA DISPLAY

2.1 Components

The following picture identifies the main components of a Quanta Display.



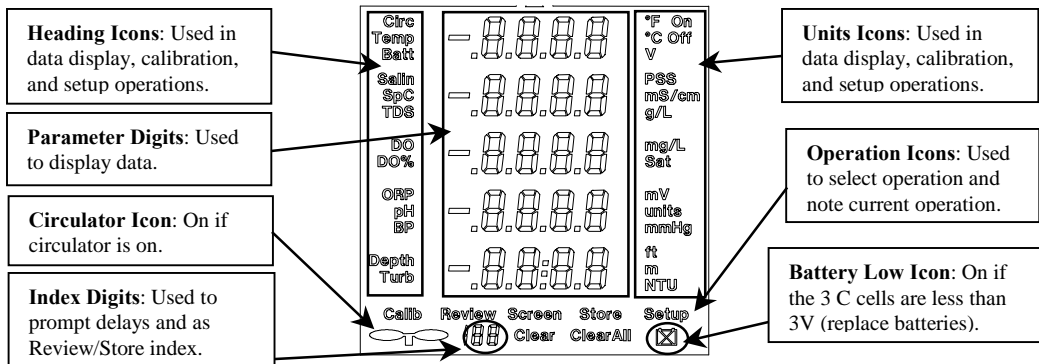
2.1.1 Contrast Control

The Contrast Control is accessed by pressing the Lens down slightly and twisting counterclockwise to disengage the bayonet. Adjust the Contrast Control to suit lighting conditions, thermal conditions, and personal preference. Reattach the Lens by first insuring the o-ring is in the groove around the outside of the Lens. Then align the bayonet, press down slightly, and twist clockwise until you feel the bayonet engage.

Warning: If the o-ring is on the main housing when the Lens is installed, the Display will not properly seal. Severe damage to the Display can occur if water leaks into the main housing.

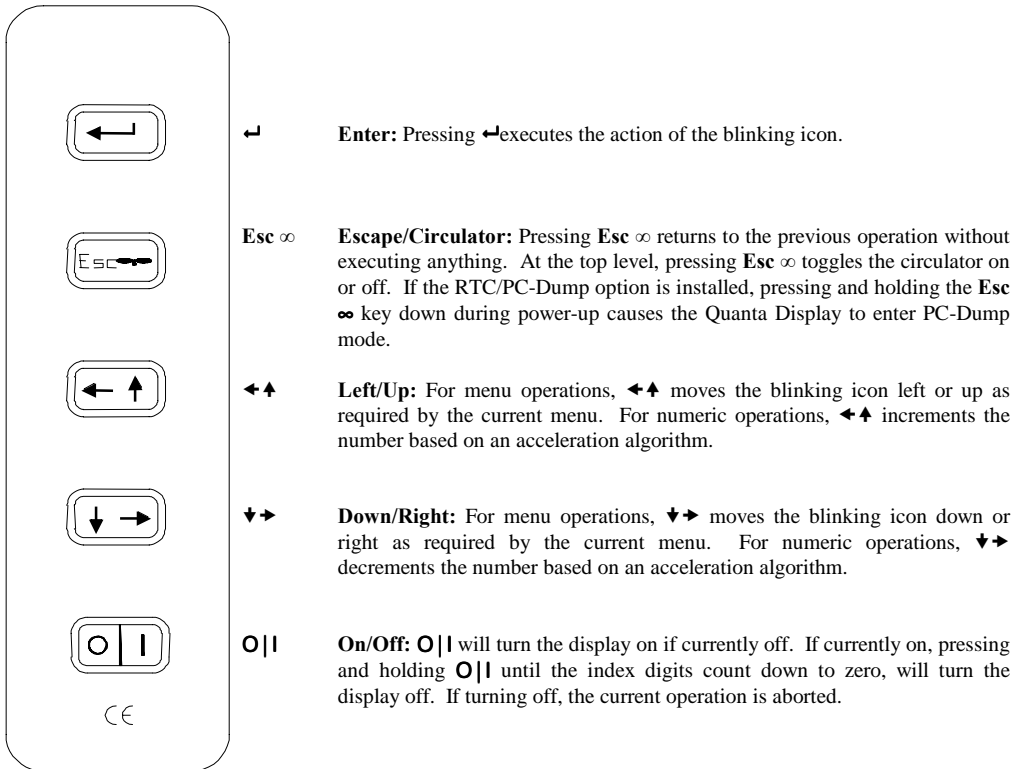
2.1.2 LCD

The Display's LCD provides all the visual information for the Quanta System. The following picture shows all the segments used in operating the Quanta Display.



2.1.3 Keypad

The Quanta Display only uses five keys and their functions are defined as follows:



Note: Each key press produces an audible tone for user feedback.

2.1.4 Batteries

To access the batteries, remove the Battery Cap using a coin. Tilt the Display and the three spent C cells will easily slide out. Inspect the o-ring and o-ring surface and clean if necessary. Insert three brand-new alkaline C cells, positive terminal first and reattach the Battery Cap using a coin. The Display may turn on as a result of battery installation, but this is normal.

Note:

- Changing batteries does not affect stored data frames or the real-time clock. Data frames are stored in non-volatile FLASH memory and do not require batteries for data retention. The RTC/PC-Dump option includes a lithium battery for maintaining the real-time clock.
- Hydrolab recommends high-quality alkaline batteries to provide the maximum operating time. Other C cells can be used (i.e., rechargeable NiCad, rechargeable NiMH, etc.), but

shorter operating time may result. All three C cells must be of the same type and brand and total battery voltage must not exceed 5V.

- Without turbidity installed, the Quanta System provides at least 20 hours of continuous operation at 20°C on one set of brand-new Duracell® brand alkaline C cells.
- With turbidity installed, the Quanta System provides at least 13 hours of continuous operation at 20°C on one set of brand-new Duracell® brand alkaline C cells.
- Derate 25% for operation at 0°C.
- Dispose of spent cells properly.

2.1.5 Neckstrap

The optional Neckstrap (part #014760) is installed on the Display using two ‘D’ rings in the ‘ears’ located on the back of the main housing. To install, place the ‘D’ rings in the strap loops and align with the holes in the ‘ears’ on the main housing. Squeeze shut with a pair of large needle-nose pliers. Wear the Display with Neckstrap and adjust the buckles until comfortable.

Warning: The ‘D’ rings and/or ‘ears’ may breakaway during a sharp tug on the Display. This breakaway is a safety feature. The operator must use extreme caution while using the Neckstrap to prevent injury to the neck or from loss of balance.

2.1.6 RTC/PC-Dump

The optional RTC/PC-Dump is factory installed inside the Display. If installed, the bottom row in the Parameter Digits shows “CL:PC” during display of the software revisions at power-up. The RTC/PC-Dump option stamps each data frame with date-time and dumps all data frames in a comma-separated value (CSV) format for easy import into spreadsheet or database programs.

Note:

- The real-time clock maintains date-time through 31-Dec 2099 23:59:59, including leap years.
- Daylight Savings Time is not supported.

If the RTC/PC-Dump option is purchased, the Quanta Display/PC Interface Cable is also included. During PC-Dump, the 4-pin male connector attaches to the connector on the Quanta Display and the 9-pin female ‘D’ connector plugs into PC RS232 port with a 9-pin male ‘D’ connector.

2.2 Operations

After power-up, the Heading Icons, Parameter Digits, and Units Icons display real-time data provided a Transmitter is connected. Also, the top row of Operation Icons is on with the **Screen** icon blinking. The Circulator and Battery Low icons show the circulator and battery status on this and all other operation screens. **Exception:** During data review, the Circulator icon shows the circulator state at the time the data was stored.

By pressing the ◀▲ or ▼▶ keys, the blinking moves to a different icon. If you press ◀, you select the operation associated with the blinking icon. Using the ◀▲, ▼▶, and ◀ keys, to move to and select an operation is called selecting the operation. If you accidentally select an undesired operation, press **Esc** ∞ to return to the previous operation.

Note:

- If no Transmitter is connected, the Parameter Digits show dashes.
- See the inside front cover of this manual for a graphical Operations Tree.
- The Display automatically powers off if no keys are pressed for 30 minutes.

2.2.1 Screen

After power-up, the Heading Icons, Parameter Digits, and Units Icons display real-time data containing temperature, specific conductance, DO (mg/L), pH, and depth. This screen is called **Screen 1**.

Selecting the **Screen** icon toggles the real-time display to show battery voltage, salinity or TDS, DO (%Saturation), ORP, and turbidity. This screen is called **Screen 2**.

Selecting the **Screen** icon again toggles the real-time display to show day, month, year, hours, and minutes. This screen is called **Screen 3**. Selecting the **Screen** icon again toggles the real-time display back to **Screen 1**.

Screen 1 can be configured to display temperature in °C or °F and depth in m or ft. **Screen 2** can be configured to display salinity or TDS. Section 2.2.2 describes these Setup operations.

Note:

- If no Transmitter is connected, the Parameter Digits show dashes.
- If the Transmitter was purchased without one or more parameters, then the missing parameters' heading, digits, and units are blank.
- If the Display was purchased without the RTC/PC-Dump option, **Screen 3** is not displayed and selecting the **Screen** icon from **Screen 2** toggles the real-time display back to **Screen 1**.
- **Screen 3** displays real-time clock data as day, month, year, hour, and minute. Seconds are not displayed, but are included with PC-Dump data. The hours and minutes are in 24-hour format (00:00 – 23:59). The months are represented as:

<u>Month</u>	<u>Display</u>	<u>Month</u>	<u>Display</u>
January	-0000	July	-0000
February	-0000	August	-0000
March	-0000	September	-0000
April	-0000	October	-0000
May	-0000	November	-0000
June	-0000	December	-0000

2.2.2 Setup

Selecting the **Setup** icon allows setup, or configuration, of circulator state, temperature units, salinity or TDS display, and depth units. After selecting **Setup**, only the **Setup** icon will remain lit from the Operation Icons and the Parameter Digits will blank. The Headings Icons display the configurable options and the Units Icons will display the current setup.

From the displayed Headings Icons, select the configuration to be changed. Now, all Headings and Units Icons except the selected one will blank. The Units icons show the configuration options available. After selecting the configuration desired, the Display returns to the **Setup** screen.

The following configurations are available:

Setup	Default	Alternate
Circulator	On	Off
Temperature	°C	°F
Salinity/TDS	Salinity in PSS	TDS in g/L
Depth	m	ft

Notes:

- All configurations are stored in the Transmitter and retrieved by the Display during power-up.
- Pressing **Esc** ∞ while displaying **Screen 1**, **Screen 2**, or **Screen 3** will toggle the circulator state without accessing **Setup**.

2.2.3 Calib

Selecting the **Calib** icon allows calibration of salinity, specific conductance, TDS scale factor, DO, ORP, pH, barometric pressure (BP), depth, turbidity, and date-time. After selecting **Calib**, only the **Calib** icon will remain lit from the Operation Icons and the Parameter Digits and the Units Icons will blank. The Headings Icons will display the items that can be calibrated.

From the displayed Headings Icons, select the item to be calibrated. Now, all Headings and Units Icons except the selected one will blank. The Parameter Digits show the current value for the item selected. Press the **←↑** or **↓→** keys to change the numeric value to match the calibration standard. Once the value is correct, press the **↵** key to send the updated calibration value to the Transmitter or Display. If the Transmitter or Display accepts the calibration, the Display returns to the **Calib** screen. If the Transmitter or Display rejects the calibration, the Display LCD shows ‘**FAIL**’ before returning to the **Calib** screen. Press **Esc** ∞ to return to **Screen 1**. Now, review **Screen 1**, **Screen 2**, and/or **Screen 3** to confirm calibration.

Some calibrations require multiple values. After updating the first value and pressing **↵**, the second value starts blinking. Update it and press **↵**. Repeat for all values to complete calibration.

The following calibrations are available:

Calibration	First Value	Second Value	Third Value	Fourth Value	Fifth Value
Salinity	PSS	-	-	-	-
Specific Conductance	mS/cm	-	-	-	-
TDS	Scale Factor (0.64 default)	-	-	-	-
DO/BP	mg/L	mmHg	-	-	-
DO%/BP	100% (fixed)	mmHg	-	-	-

Calibration	First Value	Second Value	Third Value	Fourth Value	Fifth Value
ORP	mV	-	-	-	-
pH	units	-	-	-	-
Barometric Pressure (BP)	mmHg	-	-	-	-
Depth	m or ft	-	-	-	-
Turbidity	NTU	-	-	-	-
Date-Time	Year	Month	Day	Hour	Minute

Notes:

- Holding the ←↑ or ↓→ keys causes the numeric rate of change to accelerate.
- Calibrating salinity or specific conductance causes calibration of salinity, specific conductance, and TDS.
- Calibrating TDS only changes the TDS scale factor.
- Calibrating DO mg/L or DO %Saturation causes calibration of DO mg/L, DO %Saturation, and barometric pressure.
- Calibrating barometric pressure updates the barometric pressure used in calculating DO %Saturation without changing the DO calibration.
- pH is a two-point calibration. A pH standard between 6.8 and 7.2 is treated as the “zero” and all other values are treated as the “slope”. First calibrate “zero”, then calibrate “slope”.
- Turbidity is a two-point calibration. A turbidity standard of 0.0 is treated as the “zero” and all other values are treated as the “slope”. First calibrate “zero”, then calibrate “slope”.
- If the RTC/PC-Dump option was purchased, date-time calibration sets the real-time clock inside the Display and seconds are set to ‘00’.

2.2.4 Store

Selecting the **Store** icon causes the Display to capture the current real-time data frame for storage to its non-volatile FLASH memory. A data frame includes all current data values and circulator state on **Screen 1**, **Screen 2**, and **Screen 3**. After selecting **Store**, only the **Store** icon remains lit from the Operation Icons. The Headings Icons, Parameter Digits, and the Units Icons toggle between **Screen 1** and **Screen 2** and show the data frame to be stored. The Index Digits show the index of the location where the data frame is to be stored.

If the data frame is correct, note the index for later reference and press ← to store the data frame and return to **Screen 1**. Press Esc ∞ to return to **Screen 1** without storing the data frame.

Note:

- The Display can store up to 200 data frames ranging from index ‘00’ to ‘199’.
- An index of ‘--’ is displayed in the Index Digits if the memory is full.
- ‘FAIL’ will be momentarily displayed in the Parameter Digits if the data frame could not be stored, most likely due to a full memory.
- If the RTC/PC-Dump option was not purchased, **Screen 3** is not stored with the data frame.
- **Screen 3** is not displayed during **Store** to allow easier data frame verification.

2.2.5 Review

Selecting the **Review** icon causes the Display to display data frames previously stored using the **Store** operation. After selecting **Review**, only the **Review** icon remains lit from the Operation Icons. The Headings Icons, Parameter Digits, and the Units Icons toggle between **Screen 1**, **Screen 2**, and **Screen 3** for the data frame with the lowest index. The blinking Index Digits show the index of the displayed data frame.

Press the **←↑** or **↓→** keys to review other data frames. Press **Esc ∞** to return to **Screen 1**. Pressing **↵** selects the indexed data frame for erasure using the **Clear** operation. All data frames can be erased using the **ClearAll** operation.

Note:

- When at the highest or lowest index, pressing the **←↑** or **↓→** keys cause the Display to respectively “wrap-around” to the lowest or highest index.
- If no data frames are stored when **Review** is selected, ‘--’ will appear in the Index Digits and the Parameter Digits will be blank.
- If the Display was purchased without the RTC/PC-Dump option, **Screen 3** is not displayed.

2.2.5.1 Clear and ClearAll

From the Review operation, pressing **↵** causes the Index Digits to stop blinking and the **Clear** and **ClearAll** icons to appear. Selecting the **Clear** icon causes the Display to erase the indexed data frame and return to the **Review** operation indexed to the next data frame. If the erased indexed data frame was the last data frame, the Display will return to **Screen 1**.

Selecting the **ClearAll** icon causes the display to erase all data frames and return to **Screen 1**.

Warning: Exercise extreme caution when accessing the **ClearAll** operation. There is no undo operation and up to 200 valuable data frames could be lost!

2.2.6 PC-Dump

The PC-Dump feature dumps all data frames in a CSV format for easy import into spreadsheet or database programs. A PC is required with an available 9-pin ‘D’ male RS232 COM port and must be loaded with serial communications software (e.g., HyperTerminal[®]).

Note:

- The PC-Dump feature is only available if the RTC/PC-Dump option was purchased.

To setup PC-Dump, turn the PC on and launch the communications software. Configure the communications software to use the available COM port and configure the COM properties to:

<u>Port Settings</u>	<u>Value</u>
Bits per second	1200
Data bits	7
Parity	Even
Stop bits	1
Flow-control	None

Connect the 9-pin 'D' female RS232 connector on the Quanta Display/PC Interface cable to the available 9-pin 'D' male RS232 COM port. With the Quanta Display off, connect the 4-pin male connector on the Quanta Display/PC Interface cable to the 4-pin female connector on the Quanta Display.

To enter PC-Dump mode, make sure the Quanta Display is off. Press and hold the **Esc ∞** key, then press the **O||** key. When all segments on the LCD are on, release the **Esc ∞** key. The Parameter Digits display "OPEN CSV FILE PUSH ESC" confirming PC-Dump mode.

Start capture text in the serial communications software. To easily import into spreadsheets (e.g., Excel[®]), give the capture text file a ".CSV" extension.

Press the **Esc ∞** key to start the data transfer. The Parameter Digits display "DISP -- PC" to confirm transfer in progress. The Display transmits a header line containing column labels for all possible data values. Next, the Display transmits a data line for each data frame stored. If a data frame is empty, no data line is transmitted. During transmission, the Index Digits update to reflect the index of the data frame currently being transmitted. The Parameter Digits display "SAVE CSV FILE PUSH ESC" after all data has been transmitted.

Stop capture text in the serial communications software. Press the **Esc ∞** key and the Display powers down.

From the file manager, double-click the captured text file with the ".CSV" extension to launch your spreadsheet program and open the file. Alternately, within the spreadsheet's file open operation, select file type of text files (i.e., *.csv) and open the captured text file with the ".CSV" extension. The resulting worksheet contains a copy of the Quanta Display's memory and is ready for analysis.

If using Microsoft Windows[®] and HyperTerminal[®]:

- Microsoft Windows[®] includes serial communications software called HyperTerminal[®]. The HyperTerminal[®] folder can be opened from the *Desktop* via *Start:Programs:Accessories:HyperTerminal*. Double-click on the *Hypertrm.exe* icon to launch HyperTerminal[®].
- The available COM port is selected under the *File:Properties* menu and choosing the *Connect using* option. The port settings are accessed via the *Configure* button under the *Connect using* option.
- If you change COM port settings, you generally have to *Disconnect* and *Connect* for the new settings to take effect.
- The COM port selection and settings can be saved and opened under *File* menu.
- The text capture function is started and stopped under the *Transfer:Capture Text...* menu.

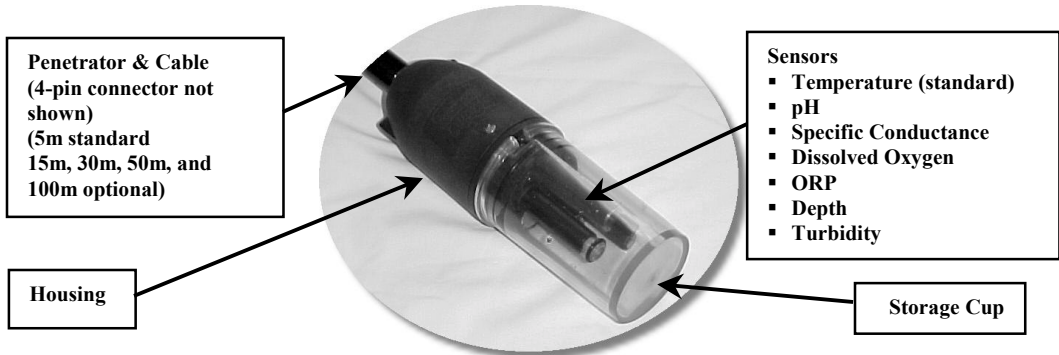
2.3 Display Care

The Display should be kept as clean as possible, especially of grit and grease. Wash the Display with soap and water as needed. The Display should be stored between -5°C and 50°C.

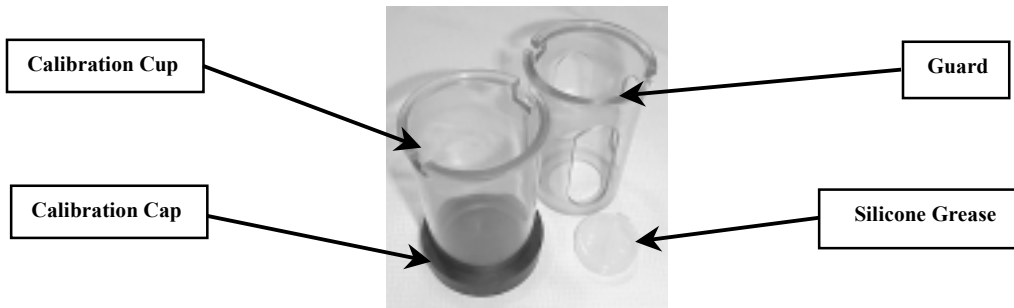
3 QUANTA TRANSMITTER

3.1 Components

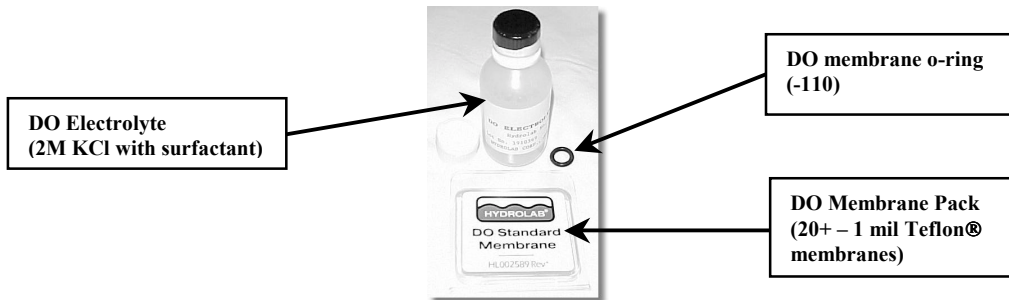
The following pictures identify the main components of a Quanta Transmitter and maintenance items supplied with each Quanta Transmitter.



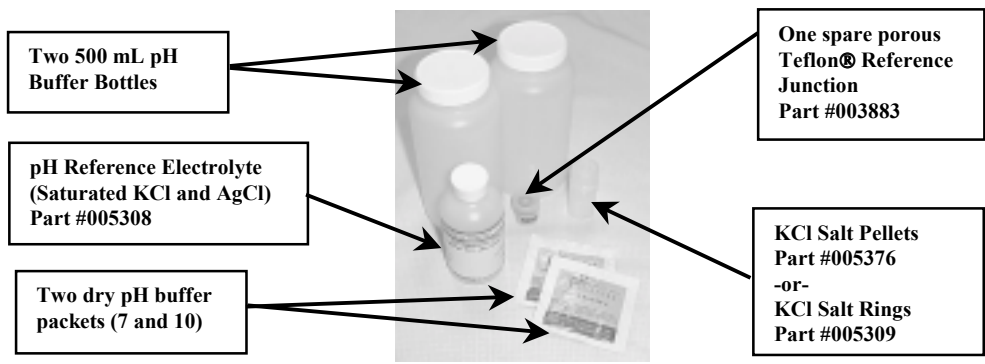
Quanta Transmitter



Standard Maintenance Items

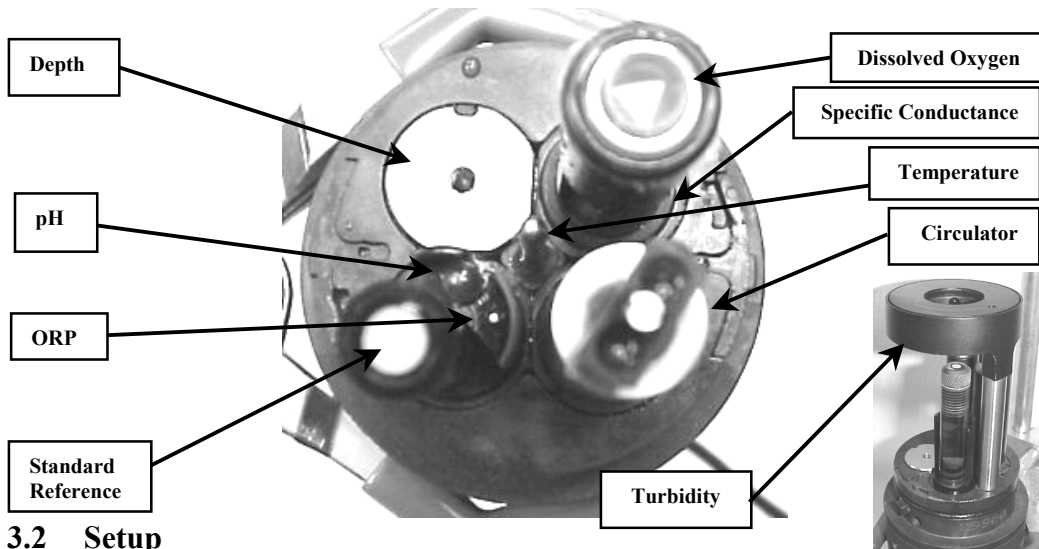


Dissolved Oxygen Maintenance Items (only with DO option)



pH Maintenance Items (only with pH option)

Only temperature is standard on all Transmitters. All other sensors are optional and, if not purchased, are replaced with a sensor plug filling the unused locations. Please consult the following picture showing the sensor array for a fully configured Transmitter.



3.2 Setup

The Transmitter can be setup, or configured, for circulator state, temperature units, salinity or TDS output, depth units, SDI-12 address, and SDI-12 delay. The setup can be changed via the Display or an SDI-12 datalogger.

3.2.1 Setup with Display

See Section 2.2.2 for setup of the Transmitter with the Display.

Note:

- The SDI-12 address and the SDI-12 delay cannot be changed via the Display.

3.2.2 Setup with SDI-12 Datalogger

If using an SDI-12 datalogger for setup, you must enter transparent mode. Please see your datalogger manual for instructions on how to use transparent mode.

The following configurations are available:

Setup	Default	Alternate(s)
Circulator	On	Off
Temperature	°C	°F
Salinity/TDS	Salinity in PSS	TDS in g/L
Depth	m	ft
SDI-12 Address	0	1 to 9
SDI-12 Delay	30 seconds	5 to 994 seconds

Notes:

- All configurations are stored in a nonvolatile memory in the Transmitter.

Within the datalogger's transparent mode, issue the SDI-12 commands to the Transmitter from the following table:

Setup	Options	SDI-12 Command
Circulator	On	'aXSS1!'
	Off	'aXSS0!'
Temperature	°C	'aXTC!'
	°F	'aXTF!'
Salinity/TDS	Salinity in PSS	'aXSTS!'
	TDS in g/L	'aXSTT!'
Depth	m	'aXDM!'
	ft	'aXDF!'
SDI-12 Address	<i>c</i>	'aAc!'
	<i>d</i> (0 to 9)	'bAd!'
SDI-12 Delay	<i>ddd</i>	'aXLddd!'
	(005 to 994)	'bXLddd!'

Notes:

- Both the sensors and the circulator must be turned on for the circulator to operate.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, 'a' refers to the SDI-12 address for all parameters except turbidity and 'b' refers to the SDI-12 address for turbidity.

3.3 Circulator

The Transmitters are optionally equipped with a circulator to assist with reliable dissolved oxygen measurements. The circulator also continuously supplies fresh sample to all sensors, and tends to keep the sensors clean by sweeping debris away. The circulator also speeds sensor response by ensuring rapid temperature equilibration.

From **Screen 1** or **Screen 2** on the Display, press **Esc** ∞ to toggle the circulator state. Alternately, select **Setup, Circ, and On** or **Off** to set the circulator state. From an SDI-12 datalogger, issue the ‘aXSS0!’ command to turn the circulator off and the ‘aXSS1!’ command to turn the circulator on.

Remember to turn the circulator on during field deployment. Generally, the circulator should be on except during calibration.

Notes:

- The circulator’s impeller (part #005306), impeller screw (part #005307), and impeller bearing (part #003594) are non-warranty consumables, which require regular replacement.
- In SDI-12 operation, both the sensors and the circulator must be turned on for the circulator to operate. The sensors are automatically turned on with standard SDI-12 measurement commands. The ‘aX1!’ and ‘aX0’ commands are available to force the sensors on and off through the transparent mode.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter’s factory default SDI-12 address is ‘0’ for all parameters except turbidity and ‘1’ for turbidity. In this manual, ‘a’ refers to the SDI-12 address for all parameters except turbidity and ‘b’ refers to the SDI-12 address for turbidity.

3.4 Calibration

Fundamentally, the Transmitter is calibrated by pouring a calibration standard into the calibration cup or by immersing the entire Transmitter in a bucket of standard. Then, watching the readings for the parameter to be calibrated. When the readings stabilize, send the calibration information to the Transmitter via the Display or SDI-12 datalogger. Then confirm the data calibration.

Note: You may notice that the Transmitter has built-in checks for calibration acceptance. If for any reason you cannot complete calibration for any parameter, the Transmitter will continue to use the calibration from the last time that particular parameter was calibrated successfully. However, you should try to determine why the Transmitter did not accept the new calibration (faulty sensor, bad standard, low battery, mistyped standard value, incorrect units, etc.).

3.4.1 Calibration with the Display

If the circulator is on, press the **Esc** ∞ key to toggle the circulator off, so that it doesn’t splash your calibration standard. Place the sensors in the appropriate calibration standard for the parameter being calibrated. Monitor the parameter’s stability on **Screen 1** and/or **Screen 2**, select **Calib**, then the item to calibrate. Enter the one or two values as required to complete calibration. If the Transmitter rejects the calibration, the Display LCD shows ‘FAIL’ before returning to the **Calib**

screen. Return to **Screen 1** and/or **Screen 2** to confirm calibration. See Section 2.2.3 for details on using the Display to perform calibrations.

The following table details what can be calibrated with the Display.

Calibration	First Value	Second Value
Salinity	PSS	-
Specific Conductance	mS/cm	-
TDS	Scale Factor (0.64 default)	-
DO/BP	mg/L	mmHg
DO%/BP	100% (fixed)	mmHg
ORP	mV	-
pH	units	-
Barometric Pressure (BP)	mmHg	-
Depth	m or ft	-
Turbidity	NTU	-

3.4.2 Calibration with an SDI-12 Datalogger

If using an SDI-12 datalogger for calibration, you must enter transparent mode. Please see your datalogger manual for instructions on how to use transparent mode.

Within the datalogger's transparent mode, issue the 'aX1!' command to turn the Transmitter's non-turbidity sensors on and, if turbidity installed, issue the 'bX1!' command to turn the turbidity sensor on. If the circulator is on, issue the 'aXSS0!' command to turn the circulator off, so that it doesn't splash your calibration standard.

Repeatedly issue the 'aR0!' and 'aR1!' commands and, if turbidity installed, the 'bR0!' command to monitor the stability of the parameter being calibrated. Once stable, issue the 'cXCd+value!' command with 'c' being the SDI-12 address, 'd' the code letter of item to calibrate and 'value' being the numeric value of the calibration standard. Again, issue the 'aR0!' and 'aR1!' commands and, if turbidity installed, the 'bR0!' command to confirm calibration.

Finally, issue the 'aX0!' command and, if turbidity installed, the 'bX0' command to turn the Transmitter's sensors off and, if needed, issue the 'aXSS1!' command to turn the circulator back on.

The following table details the SDI-12 calibration commands available.

Calibration	SDI-12 Command	Units for value
Salinity	'aXCS+value!'	PSS
Specific Conductance	'aXCC+value!'	mS/cm
TDS	'aXCt+value!'	Scale Factor (0.64 default)
DO (must calibrate BP first!)	'aXCO+value!'	mg/L

Calibration	SDI-12 Command	Units for <i>value</i>
DO%	'aXC%+value!'	mmHg
ORP	'aXCR+value!'	mV
pH	'aXCP+value!'	units
Barometric Pressure (BP)	'aXCB+value!'	mmHg
Depth	'aXCD+value!'	m or ft (per depth setup)
Turbidity	'bXCT+value!'	NTU

Notes:

- Both the sensors and the circulator must be turned on for the circulator to operate.
- If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses. All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity. In this manual, 'a' refers to the SDI-12 address for all parameters except turbidity and 'b' refers to the SDI-12 address for turbidity.

3.4.3 Calibration Preparation

The following is a general outline of the steps required to calibrate all the sensors:

- **Select a calibration standard whose value is near that of your field samples.**
- Remove the Storage Cup from the Transmitter.
- **Clean and prepare the sensors** as detailed in Sections 3.4.4 through 3.4.9.
- Attach the Calibration Cup.
- Using the Calibration Cap, thoroughly **rinse the sensors several times** by half-filling the calibration cup **with deionized water** and shaking the Transmitter to make sure each sensor is free from contaminants that might alter your calibration standard.



- In a similar manner, **rinse the sensors twice with a small portion of the calibration standard**, each time discarding the rinse.



- With the Transmitter sensors pointing up (toward the ceiling), **fill the Calibration Cup with the calibration standard**. See Sections 3.4.4 through 3.4.8 for sensor specific details.



- **Complete the calibration as per Sections 3.4.1 and/or 3.4.2.**
- Finally, **discard used calibration standards** appropriately. Do not attempt to reuse calibration standards.

Warning: Sensor preparation is probably the most important action you can take to maintain or improve the quality of your field measurements. A contaminated, worn-out, or damaged sensor simply will not produce a reliable reading. It is well worth your time to set up a routine in which all sensors are serviced frequently and then allowed to rest in tap water overnight before calibration.

Generally, you should calibrate all Quanta parameters as often as your accuracy requirements dictate. If you want exceptionally accurate data, you must calibrate frequently. Calibration requirements also vary with deployment conditions – in very turbid or biologically-active waters, for instance, generally require more frequent calibrations than do cleaner waters

Notes:

- The optional turbidity sensor has a rotating sealed shaft to make maintenance of other sensors easier. With the storage cup, calibration cup, and guard removed, the turbidity sensor rotates $\approx 135^\circ$ in each direction before engaging the internal stop. This feature makes maintenance of the other sensors easier. After maintenance of these other sensors, insure the turbidity sensor is rotated back to the nominal position before reinstalling the storage cup, calibration cup, or guard. **Do not use excessive force or sensor will break!**

3.4.4 Temperature

Cleaning and Preparation

- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- Rinse with water.

Calibration Standard

- Factory-set and no recalibration required.

3.4.5 Specific Conductance, Salinity, and TDS

Cleaning and Preparation

- **Clean the oval measurement cell** on the specific conductance sensor with a small, non-abrasive brush or cotton swab.
- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- **Rinse with water.**

Calibration Standard

- Pour the specific conductance or salinity standard to within a centimeter of the top of the cup.
- Make sure there are **no bubbles** in the measurement cell of the specific conductance sensor.

Notes:

- TDS measurements are based on specific conductance and a user defined scale factor. For TDS calibrations, first calibrate specific conductance, then calibrate the Transmitter with a site-specific scale factor. The factory default scale factor is 0.64 g/L / mS/cm.

3.4.6 Dissolved Oxygen %Saturation and mg/L

Cleaning and Preparation

- Remove the o-ring securing the DO membrane.
- Shake out the old electrolyte and rinse with fresh DO electrolyte.
- Refill with fresh DO electrolyte until there is a perceptible meniscus of electrolyte rising above the entire electrode surface of the sensor.
- Make sure there are **no bubbles** in the electrolyte.



- Hold one end of a new membrane against the body of the DO sensor with your thumb and with a smooth, firm motion, stretch the other end of the membrane over the sensor surface and hold it in place with your index finger.
- Secure the membrane with the o-ring.
- Make sure there are **no wrinkles in the membrane or bubbles** in the electrolyte.
- Trim away the excess membrane extending below the o-ring.
- Ideally, let the sensor soak overnight to allow the membrane to relax to its final shape.



DO %Saturation Calibration Standard (Saturated-Air Method)

- Fill the Calibration Cup with deionized or tap water (specific conductance less than 0.5 mS/cm) until the water is just level with the o-ring used to secure the membrane.
- Carefully remove any water droplets from the membrane with the corner of a tissue.
- Turn the black calibration cup cover upside down (concave upward) and lay it over the top of the Calibration Cup.
- Determine the barometric pressure for entry as the calibration standard. See Section 5.1.3 for computation details on barometric pressure.

Notes:

- Calibration of DO %Saturation also calibrates DO mg/L.
- DO can also be calibrated in a well-stirred bucket of temperature-stable, air-saturated water. This situation more closely resembles the actual field measurement conditions, but is more difficult to accomplish reliably. Be sure the circulator is turned on when calibrating in a water bath.

DO mg/L Calibration Standard (Known Concentration Method)

- Immerse the sensor in a water bath for which the DO concentration in mg/L is known (for instance by Winkler titration). This calibration method is more difficult to perform than the saturated-air method.
- Make sure the circulator is turned on.
- Determine the barometric pressure for entry as the calibration standard. See Section 5.1.3 for computation details on barometric pressure.

Notes:

- Calibration of DO mg/L also calibrates DO% Saturation.
- If there is a change in barometric pressure after calibration (for instance, if barometric pressure drops as you move the calibrated Transmitter to a higher elevation for deployment), the readings for DO %Saturation will not be correct. You must enter a new barometric pressure. However, the readings for DO mg/L will be correct regardless of changes in barometric pressure.

3.4.7 pH and ORP (Redox)

Cleaning and Preparation of pH

- If the pH sensor is obviously coated with oil, sediment, or biological growth, clean the glass with a very clean, soft, non-scratching cloth wet with rubbing alcohol (a cotton ball will do).
- Rinse with tap water.

Cleaning and Preparation of ORP

- If the platinum band at the tip of the ORP sensor gets dirty and/or discolored, polish it with a clean cloth and a very mild abrasive, such as toothpaste; or use a fine polishing strip.
- Rinse with water.
- Soak the sensor overnight in tap water to allow the platinum surface to restabilize.

Cleaning and Preparation of Standard Reference

- Gently pull the entire reference sleeve away from the Transmitter. The reference sleeve is the clear blue tube with a porous Teflon[®] Reference Junction attached.
- Discard the old electrolyte from the reference sleeve.
- Drop two KCl salt pellets (#005376) or two KCl salt rings (#005309) into the reference sleeve.
- Refill the sleeve to the top with reference electrolyte.
- With the Transmitter sensors pointed toward the floor, push the full reference sleeve back onto its mount until the sleeve has just covered the first o-ring located on the mount (just behind the silver electrode).
- Turn the Transmitter so that the sensors point toward the ceiling and push the sleeve the rest of the way onto its mount.
- Rinse with tap water.



Notes:

- **The porous Teflon® Reference Junction is the most important part of the pH and ORP performance.** Make sure it is clean and passes electrolyte readily. If not, replace it with the spare provided with the pH option. Replacement Reference Junctions are part #003883.
- When seating the reference sleeve, **trapped air and excess electrolyte is purged.** This **purging flushes and cleans the porous Teflon® Reference Junction.**
- The Standard Reference is designed for waters with specific conductances ≥ 0.2 mS/cm. For measurements in waters with specific conductances < 0.2 mS/cm, Hydrolab offers the LISRef as a factory installed option to improve measurements in very low-ionic strength waters.

Cleaning and Preparation of Low-Ionic Strength Reference (LISRef)

- **Remove the plastic LISRef soaking cap. Save the cap!**
- Inspect the LISRef sensor tip.
- If necessary, rinse with soapy water to remove visible contamination and rinse with tap water.
- If necessary, wipe with a cloth soaked in rubbing alcohol to remove oils and grease and rinse with tap water.
- Following cleaning, fill the plastic LISRef soaking cap with reference electrolyte, reinstall over the LISRef tip, and soak overnight.
- **Remove the plastic LISRef soaking cap before calibration or field use. Save the cap!**

Notes:

- **The LISRef Reference is the most important part of the pH and ORP performance.**
- **Whenever the Quanta Transmitter is not in use, fill the plastic LISRef soaking cap with reference electrolyte and reinstall over the LISRef tip.**
- The LISRef Reference is designed for low-ionic strength waters. During normal use, the LISRef Reference is consumed and cannot be rebuilt. Replacement LISRef tips are part #003333.
- For measurements in waters with specific conductances ≥ 0.2 mS/cm, the Standard Reference is preferred due to lower purchase and maintenance costs. Hydrolab offers the Standard Reference as a factory installed option.

Calibration Standard

- Pour the pH or ORP standard to within a centimeter of the top of the cup.

Notes:

- pH is a two-point calibration. A pH standard between 6.8 and 7.2 is treated as the “zero” and all other values are treated as the “slope”. First calibrate “zero”, then calibrate “slope”.

3.4.8 Depth

Cleaning and Preparation

- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- Rinse with water.

Calibration Standard

- Enter zero for the standard at the water's surface.

Notes:

- If the depth is known by another method, such as a carefully-marked cable, type the actual depth value as the standard when calibrating.
- The density of water varies with its specific conductance. Depth readings are corrected for specific conductance. See Section 5.3 for details.
- Recheck the 10m vented depth option for sensor drift with a precision pressure gauge at least once a month. A ‘zero’ drift is quickly corrected through calibration, but a ‘slope’ drift requires factory recalibration. Factory calibration includes characterization over temperature and pressure. Contact Hydrolab’s Customer Service for the current recalibration price and scheduling of a factory recalibration.

3.4.9 Turbidity

Cleaning and Preparation

- Soap or rubbing alcohol may be used to remove grease, oil, or biological material.
- Use a non-abrasive, lint-free cloth to clean the quartz glass tube. Scratched glass reduces the sensor’s accuracy.
- Rinse with water.

Calibration Standards

- Calibrate turbidity with primary standards (‘turbid-free’ water, Formazin, and/or polystyrene beads) and check with a secondary standard (Quick-Cal Cube™).
- Use ‘turbid-free’ water to calibrate the “zero”.
- Use Formazin and/or polystyrene beads to calibrate the “slope”.
- Primary standards must completely fill the optical area of the turbidity sensor plus ¼” (6 mm) of standard on both sides of the PVC body by filling the calibration cup to the top. Alternately, pour ≈1-¼” (32 mm) of standard into the storage cup and place the inverted sensors into the standard with bayonets disengaged.
- After calibration with primary standards, the value of the optional Quick-Cal Cube™ secondary standard, if used, must be determined and recorded for each individual instrument. The Quick-Cal Cube™ value is determined by removing the storage/calibration cups, wiping the optical areas, both sensor and cube, clean and dry with a non-abrasive, lint-

free cloth, and placing the ceramic glass cube into the turbidity sensor's optical area. Align the Quick-Cal Cube™'s pin with the turbidity sensor's recessed hole and, for optimum repeatability, rotate the Quick-Cal Cube™ clockwise to remove mechanical play in the pin/hole.

- To test for drift between primary calibrations, reinstall the Quick-Cal Cube™.



Notes:

- 'Turbid-free' water is available for purchase from chemical supply houses. However, it is far less expensive to make by passing reagent-grade water through a 0.1 µm or smaller filter.
- Formazin and polystyrene beads are primary standards as defined by the EPA. Quick-Cal Cubes™ are secondary standards, which must be rechecked, and value recorded, after each primary standard calibration with each instrument. However, Quick-Cal Cubes™ save resources, both time and money, by allowing inexpensive and frequent calibration checks between permit and/or standard operating procedure required primary calibrations.
- Formazin requires daily preparation.
- Polystyrene beads are instrumentation specific and beads formulated for one instrument design often read differently on a different instrument design. Hydrolab has polystyrene beads formulated for the Quanta Turbidity sensor. Please contact Customer Service or www.hydrolab.com for ordering information.
- When using liquid standards, insure no bubbles in the optical area. The optical properties of bubbles affect the turbidity calibration. Gentle agitation easily dislodges bubbles.
- When using Quick-Cal Cube™ standards, insure no water droplets in the optical area. The optical properties of water droplets affect the calibration check. Remove droplets with a non-abrasive, lint-free cloth.
- Turbidity is a two-point calibration. A turbidity standard of 0.0 is treated as the "zero" and all other values are treated as the "slope". First calibrate "zero", then calibrate "slope".

3.5 Care of the Transmitter

In addition to normal sensor maintenance, clean the Transmitter with soap and water. **During storage or transportation, always use the calibration cup/cap or the storage cup filled with a ¼" of tap water to protect the sensors from damage and drying out.** Never deploy the

Transmitter without the guard protecting the sensors. Always rinse the Transmitter with clean water soon after returning from deployment.

3.6 Care of the Cable

Protect the cable from abrasion, unnecessary tension, repetitive flexure (fatigue), and bending over sharp corners (like the edge of the side of a boat). Excessive weight added to the Transmitter greatly increases the possibility of cable breakage.

When not in use, the cables should be clean, dry, and coiled at a 12” or greater diameter.

3.6.1 Dryer Assembly

With purchase of the optional Vented Depth, the Transmitter’s cable upgrades to a vented cable with a dryer assembly. The dryer assembly uses a GORE-TEX® patch to reach equilibrium between the gases inside the dryer, vented cable, and Transmitter housing and the gases outside the dryer assembly. This equilibrium allows the vented depth sensor to remove measurement errors caused by changing barometric pressure.

The GORE-TEX® patch also prevents water from entering the dryer, vented cable, and housing. However, water vapor is also a gas and, if not removed, liquid water condensates within the dryer, vented cable, and housing. Water condensation prevents proper vent operation (inaccurate Vented Depth) and damages the Transmitter’s internal circuitry (non-warranty).

To prevent water condensation, the dryer assembly includes desiccants to absorb water vapor. These desiccants have a limited capacity and require regular maintenance. An indicator is included inside the dryer and can be viewed through the clear dryer housing. If dark blue, the desiccants do not need to be replaced. However, if light pink or purple, the desiccants need to be replaced.

To replace desiccants:

- Unscrew dryer nut on the cable gland seal nearest the 4 pin connector.
- Unscrew the dryer cap and pull cap away from dryer housing. Take care not to stress wire connections to the terminal strip.
- Remove and properly discard spent desiccants.
- Install fresh desiccants.
- Reinstall dryer cap. Be sure to not pinch desiccants or wires or stress wire connections.
- Reinstall dryer nut.

3.7 Secchi Disk

The Secchi Disk is an option that can be added to the Transmitter. To install, simply thread the cable through the slot on the Secchi Disk, slide the Secchi Disk down to the top of the Transmitter, and thread onto the penetrator fitting.

3.8 FlowCell

For process or pump-through situations, the FlowCell is an option that can be added to the Transmitter so that the system does not have to be submerged in the water being studied.

To install, remove the storage cup and attach the FlowCell to the Transmitter. Connect ½” tubing to the inlet barb fitting (furthest from the Transmitter housing) and ½” tubing to the outlet barb

fitting (nearest to the Transmitter housing). Then connect the inlet and outlet as appropriate to the system being monitored. Filter debris from the inlet. Don't exceed a pumping rate of about 1.5 liters per minute. This maximum rate flushes the contents of the FlowCell about eight times per minute. If possible, lay the Transmitter on its side. Bubbles will tend to float away from the sensors and out the outlet on the side of the FlowCell.

Warning: Do not pressurize the FlowCell or its feed line above 15 PSIG! Higher pressures could result in serious and/or fatal injury and/or damage to the FlowCell! If pressures greater than 15 PSIG are possible, use an appropriate pressure regulator installed by qualified personnel.

Warning: Remove pressure before disconnecting the Transmitter from the FlowCell! Failure to do so could result in serious or fatal injury and/or damage to the Transmitter and/or FlowCell!

3.9 Additional Weight

The Transmitter has a negative buoyancy of approximately 1 pound. Some high flow conditions require additional weight to sink the Transmitter.

Three user methods to add weight are:

Location	Dimensions
Annular Ring around Cable/above Transmitter	1-1/4" – 12UNF-2B thread or Internal Ø > 1.25"
Fishing Line through main housing 'ears' (use 25 pound monofilament line)	Line Ø < 0.1"
Baseball Bat Weight(s) (Slide down cable to top of Transmitter)	External Ø < 3" Internal Ø > 1.25"

Notes:

- **Do not add more than 10 pounds of weight** and use as small a weight as needed.
- Excessive and/or unnecessary tension on the cable will result in premature non-warranty cable failure.

4 DEPLOYMENT

4.1 Long-term

If using the Transmitter in open water, try to locate the Transmitter so that any available protection is utilized. For instance, in a swiftly flowing river, anchor the Transmitter to the downstream side of a bridge piling so that floating debris will strike the piling, not the Transmitter. Likewise, in a recreational lake deployment, use a marking buoy that will not attract the attention of vandals.

Try to fix the Transmitter in an upright or on-side position, and avoid areas that might see deep deposits of sand, gravel, or silt in the case of a heavy rainfall event. Being caught in water that is icing over can also cause the loss of the Transmitter.

Take similar precautions with the Cable to protect it from floating debris, navigation, and vandals.

Always make sure the sensors are protected with the Guard.

Some sensors cannot remain in calibration for long periods in certain situations. For instance, a DO sensor may become hopelessly fouled after just a few days in a warm, shallow, biologically-active lake. Likewise, a reference electrode's performance will begin to deteriorate quickly in a flowing stream of low ionic-strength water. On the other hand, if the only parameters being measured are temperature and conductivity, the Transmitter can be left for long periods. Deployment time can be judged by making periodic (i.e., daily) measurements of sensitive parameters with another instrument. The day on which the spot-measurements and the logged data begin to diverge significantly may be considered the maximum deployment time for that particular water and season.

The wrapping of the Guard with a fine mesh nylon material or fine copper mesh (.050") can prevent premature fouling of the sensors and should be tried on a case by case basis.

4.2 Short-term

Generally, short-term deployment implies hand-held operation. Just follow common sense; for instance, don't lower the Transmitter into the water without attaching a Guard. Watch out for hazards such as outboard motor propellers.

If necessary, add weight to the Transmitter for sinking in high flow situations. See Section 3.9 for more details.

4.3 Pressure Extremes

The Transmitter's maximum depth depends on the depth sensor option purchased. The following table shows the maximum depths:

<u>Depth Option</u>	<u>Maximum Depth</u>
No Depth	100m (328 ft)
10m Vented	20m (65 ft)
25m	50m (164 ft)
100m	100m (328 ft)

The Display has a NEMA 6/IP 67 rating. Except during maintenance, keep the Lens and Battery Cap installed.

4.4 Temperature Extremes

The Quanta System's operating temperature range is -5°C to 50°C (23°F to 113°F) non-freezing. Exposure of the Transmitter or Display to temperatures outside of this range might result in mechanical damage or faulty electronic performance. The latter may be very subtle.

4.5 Data Transmission Lines

If you are adding transmission cable to your Transmitter Cable, the added cable must be large enough to carry the operating current and transmit data without distortion. For up to a total of 100m (328 ft) of cable, a pair of twisted shielded #26 AWG wires is suitable for data transmission and a pair of #18 AWG must be used for the power wires. The shield should be attached with the ground wire on pin 4.

The Transmitter cable pin-out is as follows:

Pin Number	Function	Internal Wire Colors
1	+12VDC	Brown
2	Ground	Red
3	SDI-12 Data	Orange
4	Ground	Yellow & Bare Wire

The Transmitter cable connector is Conxall part #3282-4PG-528. It mates to Conxall part #5282-4SG-5XX for cable-to-cable applications or Conxall part #4282-4SG-3XX for panel mount applications. Details on Conxall's Multi-Con-X[®] connectors can be found at www.conxall.com.

4.6 Quanta Display/PC Interface Cable

The Quanta Display/PC Interface cable is intended for indoor use only. The 4-pin male connector is Conxall part #3282-4PG-528 and the 9-pin 'D' female connector is compatible with RS232 industry standard 9-pin 'D' male connectors. The Quanta Display/PC Interface cable pin-out is as follows:

4-pin Male	9-pin Female	Function
Pin 1	-	Transmitter Power
Pin 2	Pin 5	Ground
Pin 3	Pin 2	RXD-
Pin 4	Shell	Shield
-	Pin 3	TXD-
-	Pins 1, 4, & 6 (tied together)	CD, DTR, & DSR
-	Pin 7 & 8 (tied together)	RTS & CTS
-	Pin 9	RI

5 TECHNICAL NOTES

5.1 Dissolved Oxygen

5.1.1 Oxygen Solubility in Water

The function used to calculate oxygen solubility is based on the oxygen solubility vs. temperature data from Table 4500-O found in the 19th Edition of *Standard Methods for the Examination of Water and Wastewater*.

5.1.2 Salinity Correction of DO mg/L

The function used to calculate oxygen solubility is based on the oxygen solubility vs. chlorinity data from Table 4500-O found in the 19th Edition of *Standard Methods for the Examination of Water and Wastewater*.

Note:

- DO %Saturation is not a function of solubility, and has no salinity or temperature correction.

5.1.3 Barometric Pressure Functions

Local barometric pressure, BP , in mmHg can be estimated using:

$$BP = 760 - 2.5(A_{ft}/100) \quad \text{or} \quad BP = 760 - 2.5(A_m/30.5)$$

where ' A_{ft} ' is the local altitude above sea level in feet and ' A_m ' is the local altitude above sea level in meters.

If using the local weather bureau BP, remember these numbers are corrected to sea level. To calculate the uncorrected atmospheric pressure BP' , use one of the following functions:

$$BP' = BP - 2.5(A_{ft}/100) \quad \text{or} \quad BP' = BP - 2.5(A_m/30.5)$$

Local barometric pressure in mbar (BP_{mbar}) can be converted to local barometric pressure in mmHg (BP_{mmHg}) using:

$$BP_{mmHg} = 0.75 \times BP_{mbar}$$

5.2 Specific Conductance, Salinity, and TDS

5.2.1 Specific Conductance Temperature Correction

Temperature correction of conductivity to produce specific conductance is based on the temperature correction formulas and factors of Table 3 in *ISO 7888-1985 Water Quality – Determination of Electrical Conductivity*. This temperature correction is normalized to 25°C

Because total dissolved solids (TDS) is calculated from the specific conductance reading, it also has the above correction.

5.2.2 Salinity Calculation

The method used to calculate salinity from conductivity is found in 2520B the 19th Edition of *Standard Methods for the Examination of Water and Wastewater*. This method is also commonly

referred to at the Practical Salinity Scale or UNESCO method. This method uses conductivity, not specific conductance, and includes its own temperature correction normalized to 15°C.

5.2.3 Total Dissolved Solids (TDS) Calculation

TDS is calculated from specific conductance as:

$$\text{TDS} = \text{C} \times \text{Scale Factor}$$

where TDS is total dissolved solids in g/L,
C is specific conductance in mS/cm,
and Scale Factor is user defined.

The default scale factor is 0.64 from Water Chemistry, by Snoeyink and Jenkins. If more site-specific information is available, then enter the site-specific TDS scale factor as per Section 3.4.

5.3 Depth Correction for Specific Conductance

The density of water, and hence its ability to “create” pressure, increases with specific conductance. Therefore, if a depth transducer is calibrated for fresh water, the depth reading must be reduced for measurements made in salt waters. The raw depth readings are multiplied by the following correction:

$$F(C) = 1 - 0.03(C/52)$$

where C is the measured specific conductance in mS/cm.

In effect, no correction is made at zero specific conductance, and depth readings are reduced by 3% at 52 mS/cm, the specific conductance of sea water.

5.4 CE Testing

The Quanta System has been tested and complies with CE requirements in effect at time of manufacture. A copy of the Quanta’s current Certificate of Compliance is available on request.

5.5 Turbidity

Hydrolab’s Quanta Turbidity option is compliant with GLI Method 2, an EPA approved method, and ISO 7027:1999(E). GLI Method 2 is recognized by EPA as an approved method in Section 141.74 of the Federal Register Vol. 59 No. 232 (December 5, 1994). Reprints of both the GLI Method 2 documentation and the Federal Register reference are available on request.

The Quanta’s turbidity sensor, circuitry, software, and Quick-Cal Cubes™ were developed as a joint venture between Hydrolab Corporation and GLI International, Inc. and are protected by U.S. Patents #5,059,811 and #5,140,168. Other patents are pending.

6 SDI-12 INTERFACE

SDI-12 is an industry-originated, serial digital interface bus designed to allow an operator to connect a wide variety of transducers (meteorological, hydrological, water quality, etc.) to a single SDI-12 datalogger with a single cable bus.

The Quanta Transmitter is compatible with SDI-12 V1.3 approved by the SDI-12 Support Group in November 1999. A copy of the specification can be found at www.sdi-12.org.

The optional SDI-12 Interface Adapter is required to operate the Transmitter with an SDI-12 Datalogger.

6.1 SDI-12 Interface Adapter

A label on the SDI-12 Interface Adapter contains the pinout repeated in the following table:

Pin Number	Wire Color	SDI-12 Function
1	Brown	+12VDC
2	Red	Ground
3	Orange	SDI-12 Data
4	Yellow	Ground
Shield	Bare Wire	Ground

Consult the SDI-12 datalogger manual for information on how to connect the SDI-12 Interface Adapter.

Note:

- All five wires (three grounds) must be connected for correct SDI-12 operation.

6.2 SDI-12 Command Summary

The following table is a summary of the SDI-12 user commands supported by the Transmitter. For more details on correct use, consult the SDI-12 V1.3 specification or the appropriate section of this manual.

Command	Response	Description
<i>a!</i>	<i>a</i> <crLf>	Address Acknowledge
<i>b!</i>	<i>b</i> <crLf>	
<i>a!</i>	<i>a</i> 13HydrolabQuanta2.2-serial number<crLf>	Identify
<i>b!</i>	<i>a</i> 13HydrolabQTTurb1.2<crLf>	
<i>aAc!</i>	<i>c</i> <crLf>	Change address from <i>a</i> to <i>c</i> or from <i>b</i> to <i>d</i>
<i>bAd!</i>	<i>d</i> <crLf>	
<i>aM!</i>	<i>adddn</i> <crLf>	Measure: <i>n</i> values in <i>ddd</i> seconds.
<i>bM!</i>	<i>bdddn</i> <crLf>	
<i>aMC!</i>	<i>adddn</i> <crLf>	Measure: <i>n</i> values in <i>ddd</i> seconds. Report data with CRC.
<i>bMC!</i>	<i>bdddn</i> <crLf>	
<i>aDx!</i>	<i>aSvalueSvalue... CCC</i> <crLf>	Report data. CRC (CCC) added if MC or CC.
<i>bDx!</i>	<i>bSvalueSvalue... CCC</i> <crLf>	

Command	Response	Description
<i>aRx!</i>	<i>aSvalueSvalue...<crLf></i>	Report continuous data.
<i>bRx!</i>	<i>bSvalueSvalue...<crLf></i>	
<i>aRCx!</i>	<i>aSvalueSvalue... CCC<crLf></i>	Report continuous data with CRC.
<i>bRCx!</i>	<i>bSvalueSvalue... CCC<crLf></i>	
<i>aC!</i>	<i>addnn<crLf></i>	Concurrent Measure: <i>nn</i> values in <i>ddd</i> seconds.
<i>bC!</i>	<i>bdddnn<crLf></i>	
<i>aCC!</i>	<i>addnn<crLf></i>	Concurrent Measure: <i>nn</i> values in <i>ddd</i> seconds. Report data with CRC.
<i>bCC!</i>	<i>bdddnn<crLf></i>	
<i>aXT<C F>!</i>	<i>aXT<C F><crLf></i>	Change temperature units
<i>aXT!</i>	<i>a<C F><crLf></i>	Report temperature units
<i>aXD<M F>!</i>	<i>aXD<M F><crLf></i>	Change depth units
<i>aXD!</i>	<i>a<M F><crLf></i>	Report depth units
<i>aXST<S T>!</i>	<i>aXST<S T><crLf></i>	Set salinity or TDS
<i>aXST!</i>	<i>a<S T><crLf></i>	Report salinity or TDS
<i>aXL!</i>	<i>aXLddd<crLf></i>	Report delay, <i>ddd</i> seconds
<i>bXL!</i>	<i>bXLddd<crLf></i>	
<i>aXLddd!</i>	<i>aXLddd<crLf></i>	Change delay, <i>ddd</i> seconds
<i>bXLddd!</i>	<i>bXLddd<crLf></i>	
<i>aX1!</i>	<i>aX1<crLf></i>	Sensors on
<i>bX1!</i>	<i>bX1<crLf></i>	
<i>aX0!</i>	<i>aX0<crLf></i>	Sensors off
<i>bX0!</i>	<i>bX0<crLf></i>	
<i>aXSS1!</i>	<i>aXSS1<crLf></i>	Circulator on
<i>aXSS0!</i>	<i>aXSS0<crLf></i>	Circulator off
<i>aXSS!</i>	<i>a<1 0><crLf></i>	Report circulator state
<i>aXC<P C S % O R D B t>Svalue!</i>	<i>aXC<P C S % O R D B t>Svalue<crLf></i>	Calibrate parameter
<i>bXCTSvalue!</i>	<i>bXCTSvalue<crLf></i>	Calibrate turbidity
<i>aXSN!</i>	<i>aserialnumber<crLf></i>	Report Transmitter serial number
<i>aXSs!</i>	<i>aserialnumber<crLf></i>	Report depth serial number
<i>aXSm!</i>	<i>adate<crLf></i>	Report date of manufacture (MMDDYY)
<i>aXV!</i>	<i>a+v+v+v+v+v+v+v+v+BP+ScaleFactor<crLf></i>	Verify parameter: 0=OK, 1=Cal, 2=Ovr, 3=Udr, 4=ADC, 5=N/A
<i>bXV!</i>	<i>b+v+v<crLf></i>	

Notes:

- **If equipped with the turbidity option, the Transmitter will occupy two SDI-12 addresses.** All parameters except turbidity are on one SDI-12 address and turbidity is on another SDI-12 address.
- **The Transmitter's factory default SDI-12 address is '0' for all parameters except turbidity and '1' for turbidity.** In this manual, 'a' refers to the SDI-12 address for all parameters except turbidity and 'b' refers to the SDI-12 address for turbidity.
- **Data Format for D and R commands on SDI-12 address 'a' is temperature, pH, specific conductance, salinity or TDS, DO %Saturation, DO mg/L, ORP, depth, and battery.**
- **Data Format for D and R commands on SDI-12 address 'b' is turbidity and battery.**
- Previous measurements must be in the data buffer before running a parameter calibration.
- Total number of characters in a command must be less than 12.
- For calibrate command (XC) on SDI-12 address 'a', P is pH, C is specific conductance, S is salinity or TDS, % is DO %Saturation, O is DO mg/L, R is ORP, D is depth, B is barometric pressure, and t is TDS scale factor.

7 TROUBLESHOOTING

7.1 The Display will not turn on.

- Are the batteries installed correctly? (See Section 2.1.4)
- Are the batteries good?

7.2 The Display will not show readings.

- Is the Transmitter connected?
- Is the contrast adjusted properly? (See Section 2.1.1)
- Are all connectors mated properly?

7.3 Measurements seem wrong.

- Are the sensors maintained and calibrated properly? (See Section 3.4.)
- Are the units (°C or °F, m or ft, Salinity or TDS) displayed correct? (See Section 3.2)

7.4 SDI-12 will not communicate.

- Recheck your connections. (See Section 6.1)
- Review the SDI-12 datalogger connection instructions.
- Is the SDI-12 address in the command correct? (See Section 6.2)
- Is the 12V battery good?

7.5 Water in the Transmitter

- Disassemble the Transmitter at an ESD workstation by removing the two flat blade retaining screws. As you remove the two retaining screws, be sure that the Bottom Cap is not pointed at anyone, since the internal pressure caused by the water leakage may blow the Bottom Cap out of the Transmitter body. Rinse the circuit board with distilled water and blow dry with a hair dryer. Clean and light grease o-rings before reassembly.
- Please contact Hydrolab Customer Service if you ever have a leakage problem, even if you are sure you have repaired the Transmitter.

7.6 Water in the Display

- Disassemble the Display at an ESD workstation by removing the Lens, Battery Cap, batteries, and four Phillips retaining screws above and below the LCD. Rinse the circuit board with distilled water and blow dry with a hair dryer. Clean and light grease o-rings before reassembly.
- Please contact Hydrolab Customer Service if you ever have a leakage problem, even if you are sure you have repaired the Display.

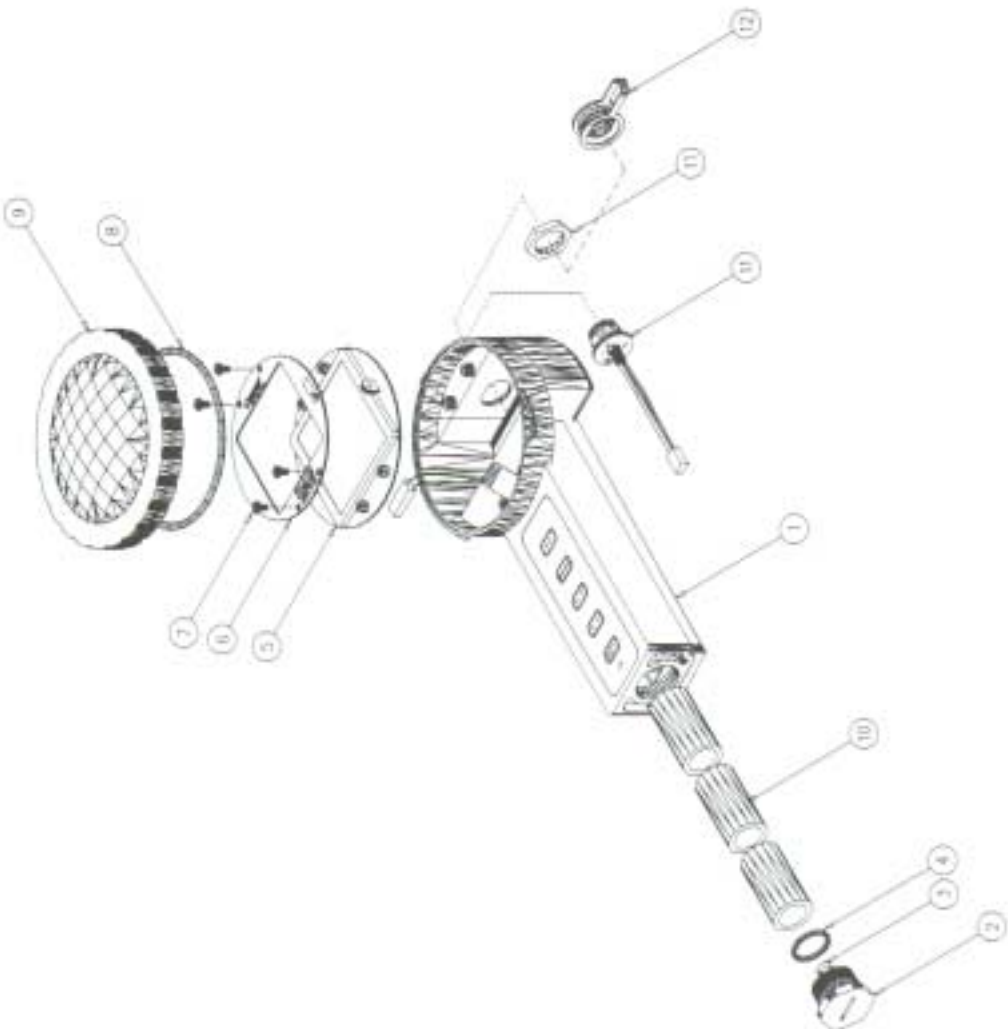
8 BILLS OF MATERIAL/EXPLODED DIAGRAMS

8.1 Quanta Display

ITEM #	QTY	PART #	DESCRIPTION
1	1	004489	Case Subassembly, Quanta Display
2	1	004497	Battery Cap Subassembly, Quanta Display (was 04490)
3	1	003894	Spring, Battery Cap, Quanta Display
4	1	003991	O-ring, 1-911, Silicone, 50 Durometer (was 003978, 0.118 x 0.866 Buna-N)
5	1	006316	Board Assembly, Quanta Display
6	1	004488	Panel/Label Subassembly, Quanta Display
7	4	003971	Screw, #6 x 5/8, Panhead, Sheetmetal
8	1	003968	O-ring, 3.984 x .156, Buna-N, 70 Durometer
9	1	003884	Lens, Quanta Display
10	3	000679	"C" Cell Battery
11	1	003906	Harness, Quanta Display
12	1	003873	Connector Cap, Quanta Display

OPTIONAL FEATURES

OF1a	1	006320	Board Assembly, Quanta Display RTC (not shown)
OF1b	1	014230	Cable, Quanta Display/PC Interface (not shown)



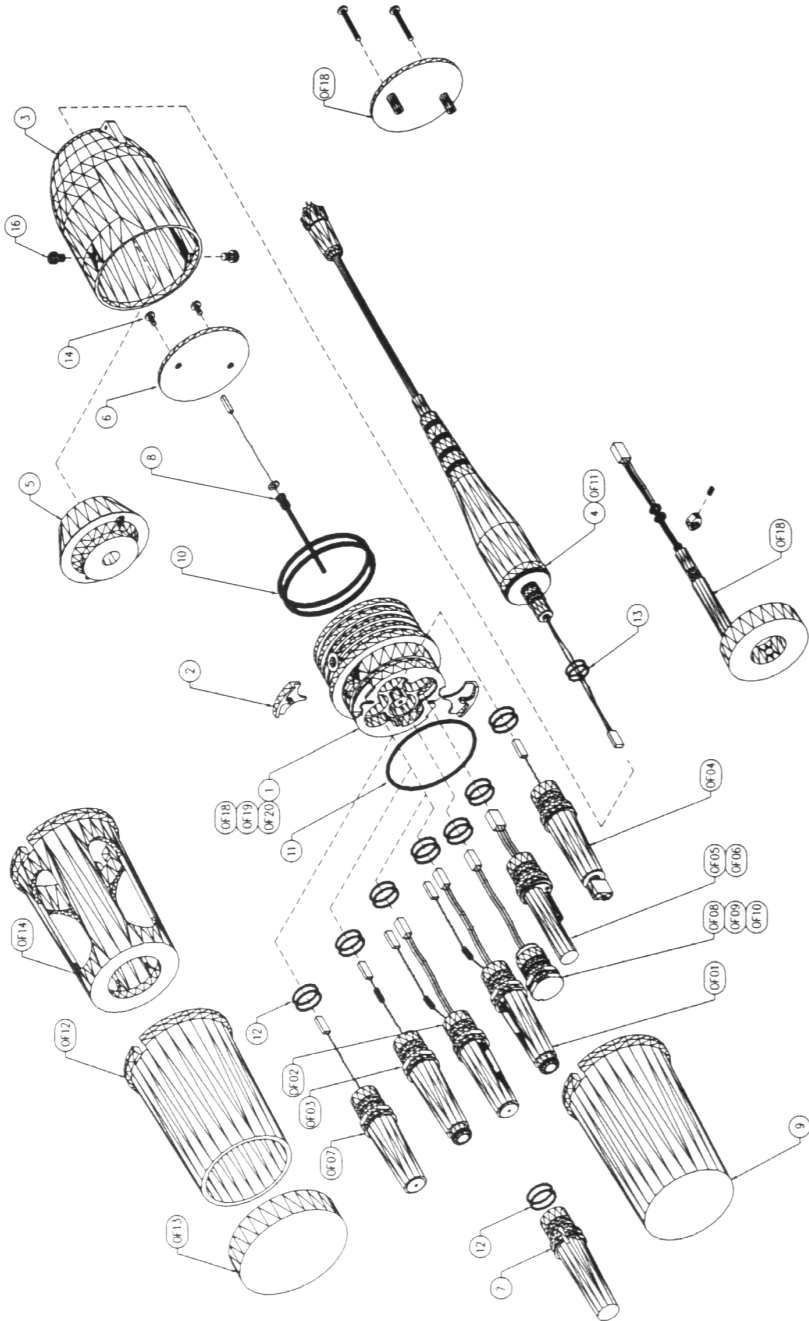
8.2 Quanta Transmitter

ITEM #	QTY	PART #	DESCRIPTION
1	1	003963	Bottom Cap, Quanta Transmitter, Metric (was 003791, small bayonet
-32)
2	2	003793	Retainer, Probe, Quanta Transmitter
3	1	003788	Housing, Quanta Transmitter
4	1	018XXX	Penetrator, Non-Vented, Quanta Transmitter
5	1	003877	Nut/Weight, Quanta Transmitter
6	1	006310	Board Assembly, Quanta Transmitter
7	1	003880	Probe Plug, Quanta Transmitter
8	1	004165	Probe Assembly, Temperature
9	1	005200	Storage Cup, Quanta Transmitter (was 003795, small bayonet)
10	2	003860	O-ring, -230, Buna-N, 70 Durometer
11	1	000335	O-ring, -141, Buna-N, 70 Durometer
12	8	000085	O-ring, -016, Buna-N, 70 Durometer (was 003947, 77-614)
13	2	000467	O-ring, -013
14	2	003971	Screw, #6 x 5/8, Panhead, Sheetmetal (was 003988, #4-40 or 000078, #6-32)
15	2	-	- (was 000080, lockwasher)
16	2	003964	Screw, M4 x 0.7 x 7mm, 316SS (was 003878, #10-32)
17	1	003099	Quanta Manual (Not Shown)
18	1	002497	MSDS Packet (Not Shown)
19	1	014720	Quanta Basic Maintenance Kit (Not Shown)
20	1	003879	Box, Quanta (Not Shown)

ITEM # QTY PART # DESCRIPTION

OPTIONAL FEATURES

OF01	1	004484	Probe Assembly, Conductivity/DO, Quanta Transmitter
OF02	1	004451	Probe Assembly, Conductivity/pH Return, Quanta Transmitter
OF03	1	004486	Probe Assembly, Dissolved Oxygen Only, Quanta Transmitter
OF04	1	004508	Probe Assembly, Circulator, Quanta Transmitter (was 004450)
OF05	1	004453	Probe Assembly, pH/ORP/Reference, Quanta Transmitter
OF06	1	004452	Probe Assembly, pH/Reference, Quanta Transmitter
OF07	1	004487	Probe Assembly, pH Return, Quanta Transmitter
OF08	1	003901	Transducer, 10 Meter, Vented, Quanta Transmitter
OF09	1	003902	Transducer, 25 Meter, Quanta Transmitter
OF10	1	003903	Transducer, 100 Meter, Quanta Transmitter
OF11	1	019XXX	Penetrator, Vented, Quanta Transmitter
OF12	1	005202	Calibration Cup, Quanta Transmitter (was 003796, small bayonet)
OF13	1	000465	Calibration Cup Cap
OF14	1	005201	Sensor Guard, Quanta Transmitter (was 003885, small bayonet)
OF15	1	014740	Quanta Basic/DO/pH Maintenance Kit (Not Shown)
OF16	1	014750	Quanta Basic/pH Maintenance Kit (Not Shown)
OF17	1	014730	Quanta Basic/DO Maintenance Kit (Not Shown)
OF18	2	002295	O-ring, -009, Buna-N, 70 Durometer
	1	002935	Set Screw, #6-32 x 3/16, 18-8 SS
	1	004507	PA, Quanta Turbidity
	1	005272	Conn, 8PF, 2x4 Housing
	2	005292	Screw, #6 x 1, Self-tap, 18-8 SS
	1	005295	Bottom Cap, Mod Turb, Quanta
	1	005316	Retainer, Turbidity, Quanta
	1	006319	Board Assembly, Quanta Turbidity
OF19	1	006501	PA, Quanta LISRef (Not Shown) (Replacement LISRef sensor tip is 003333)
	1	006503	Bottom Cap, Mod LISRef, Quanta
OF19a	1	002896	Transducer, 25m, Quanta LISRef (Not Shown)
OF19b	1	002897	Transducer, 100m, Quanta LISRef (Not Shown)
OF19c	1	002899	Transducer, 10m, Vented, Quanta LISRef (Not Shown)
OF20	1	005296	Bottom Cap, Mod Turb/LISRef, Quanta (Not Shown)



SERVICE and LIMITED 3-YEAR WARRANTY

THIS WARRANTY IS EXPRESSLY MADE BY HYDROLAB CORPORATION AND ACCEPTED BY PURCHASER IN LIEU OF ALL OTHER WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, WHETHER WRITTEN OR ORAL, EXPRESS OR IMPLIED, OR STATUTORY. HYDROLAB DOES NOT ASSUME ANY OTHER LIABILITIES IN CONNECTION WITH ANY PRODUCT.

WHAT IS COVERED

This warranty statement applies to the Quanta Transmitter and Quanta Display.

All new Hydrolab Quanta Transmitters and Quanta Displays are warranted by Hydrolab against defects in materials and workmanship for 3 years from date of invoice. Our obligation to repair or to replace products, including dissolved oxygen sensors, does not apply to those that have been consumed through normal use.

WHAT IS NOT COVERED

This warranty does not apply to products or parts thereof which may be used or connected to Hydrolab equipment but which are not manufactured by Hydrolab. This warranty specifically excludes batteries of any type and all other items, such as calibration solutions, which carry shelf lives.

This warranty does not apply to products or parts thereof which have been altered or repaired outside of a Hydrolab factory or other authorized service center, or products damaged by improper installation or application, or subjected to misused, abuse, neglect or accident.

WHAT WE WILL DO

During the warranty period, we will repair or, at our option, replace at no charge a product that proves to be defective provided that you return the product, shipping prepaid, to Hydrolab. Hydrolab's liability and obligations in connection with any defects in materials and workmanship are expressly limited to repair or replacement, and your sole and exclusive remedy in the event of such defects shall be repair or replacement.

Hydrolab's obligations under this warranty are conditional upon it receiving prompt written notice of claimed defects within the warranty period and its obligations are expressly limited to repair or replacement as stated above.

WHAT WILL WE NOT DO

Hydrolab shall not be liable for any contingent, incidental, or consequential damage or expense incurred by you or others due to partial or complete inoperability of its products for any reason whatsoever or due to any inaccurate information generated by its products. Hydrolab's obligations and your remedies are limited as described above.

Products are sold on the basis of specifications applicable at the time of sale. Hydrolab Corporation shall have no obligation to modify or update products once sold.

WARRANTY AND SERVICE INFORMATION

If you have any questions concerning this warranty, please call Hydrolab by telephone, fax, letter, or e-mail, at Hydrolab Corporation 8700 Cameron Road, Suite 100, Austin, Texas, 78754, USA; telephone: 800-949-3766 or 512-832-8832; fax: 512-832-8839; e-mail: techsupport@hydrolab.com.

Should you be advised by Hydrolab to return an item, a returned materials authorization number (RMA Number) will be issued. The RMA number must be shown on the Service Memorandum, the address label of each shipping carton, and any correspondence related to the equipment returned for repair.

Please carefully pack your equipment in its original shipping case (or other protective package) to avoid in-transit damage. Such damage is not covered by warranty, so we suggest that you insure the shipment. We also recommend that the entire instrument, including the battery pack and charger (when applicable), be returned unless a particular faulty component has been clearly isolated.

Send the instrument and a complete Service Memorandum to Hydrolab, using the address shown on the Service Memorandum.

Whether or not the unit is under warranty, it is your responsibility to pay shipping charges for delivery to Hydrolab.