BLUE DRAGON TECHNOLOGY

C610OIW

ONLINE OIL-IN-WATER ANALYZER

Operation, Installation & Maintenance Manual

Blue Dragon Water & Environmental Analysis Series

Document No. BD-C610OIW-MAN-EN | Revision B | 31 July 2026

For trained installation, operation, and maintenance personnel

Document Control

This manual consolidates the approved Blue Dragon product configuration, the available OEM controller manual, the sensor technical data, and the manufacturer's application and maintenance guidance. Project-specific items such as the instrument box, flow-through tank dimensions, and full Modbus register map may be supplied separately with the order.

Field	Details
Product	Blue Dragon C610OIW Online Oil-in-Water Analyzer
Document	Operation, Installation & Maintenance Manual
Document number	BD-C610OIW-MAN-EN
Revision	B - Public release
Release date	31 July 2026
Language	English
Product family	Blue Dragon Water & Environmental Analysis Series
Standard configuration	0-150 ppm; 365 nm UV fluorescence; self-wiping sensor; controller + sensor system
Standard warranty	12 months, subject to the sales contract

Revision History

Revision	Date	Description	Prepared by
A	22 July 2026	Initial Blue Dragon manual incorporating OEM manual, sensor data, and technical clarifications.	Blue Dragon Technology
B	31 July 2026	Public release: replaced internal draft blocks with generic installation and connection schematics; clarified performance terminology and order-specific documentation.	Blue Dragon Technology

IMPORTANT	The C610OIW is an online monitoring and process-control instrument. It is not a certified laboratory reference method. UV fluorescence response depends on oil type and the water matrix; site-specific calibration with representative samples is recommended when quantitative agreement with a laboratory method is required.

Contents

1. About This Manual

1.1 Purpose

This manual provides the information required to receive, install, commission, operate, calibrate, maintain, and troubleshoot the Blue Dragon C610OIW Online Oil-in-Water Analyzer. It covers the standard controller and 0-150 ppm self-wiping sensor package, plus guidance for optional immersion, flow-through, and instrument-box installations.

1.2 Intended Audience

- Instrumentation and electrical technicians responsible for installation and wiring.
- Process, environmental, and operations personnel responsible for online monitoring.
- Laboratory or quality personnel supporting site calibration and comparison samples.
- Maintenance personnel responsible for optical-window cleaning, wiper replacement, and routine inspection.

1.3 Terminology

Term	Meaning
OIW	Oil in water.
ppm	Parts per million, the standard display unit of the C610OIW.
UV fluorescence	Optical measurement method in which hydrocarbons are excited by ultraviolet light and the emitted fluorescence is measured.
T90	Time required for the indicated value to reach 90% of the final response after a step change.
LRV / URV	Lower and upper range values used to scale the 4-20 mA output.
Representative sample	A site sample that reasonably represents the oil type, water chemistry, suspended solids, salinity, and process conditions to be monitored.
Flow-through tank	An overflow-type chamber through which a sample passes while the sensor is installed in a low-pressure measuring zone.

2. Safety Information

WARNING	The standard C610OIW is non-explosion-proof and is intended for safe-area installation only. Do not install the controller or sensor in a classified hazardous area unless a separately engineered and certified solution has been approved by the responsible site authority.

2.1 Electrical Safety

- Installation and servicing shall be performed by qualified personnel in accordance with local electrical codes and site procedures.
- The controller is powered from 110-220 V AC and has no dedicated front-panel power switch. Provide an accessible external disconnect and correctly rated overcurrent protection.
- Isolate AC power before opening the controller, connecting or disconnecting the sensor, or modifying wiring.
- Connect protective earth before energizing the analyzer. Do not use signal ground as protective earth.
- Keep mains wiring separated from sensor, 4-20 mA, and RS485 wiring to reduce noise and prevent unsafe contact.

2.2 Process and Sample Safety

- Review the sample for pressure, temperature, toxicity, flammability, corrosiveness, and biological hazards before installation or maintenance.
- The standard sensor operating temperature is 0-50 degC. Although an optional flow-through chamber may be rated for sample temperatures up to 60 degC, the sensor temperature limit governs unless a project-specific approval states otherwise.
- For pressurized samples, reduce pressure before the flow-through tank. The overflow chamber is intended to remain essentially unpressurized.
- Depressurize, drain, and flush sample equipment before opening the flow-through tank or removing the sensor.

2.3 Chemical Compatibility

- The standard sensor body is 316L(Ti) stainless steel. High-salinity applications require technical review and may require a custom titanium-alloy housing.
- Avoid organic-solvent environments unless the OEM has confirmed compatible seals, O-rings, and sealing compounds.
- Surfactants, process chemicals, and cleaning agents can alter fluorescence response or damage seals. Verify compatibility before use.

2.4 Measurement Safety and Limitations

CAUTION	Do not use an unverified online reading as the sole basis for environmental compliance, custody transfer, or a safety-critical shutdown. Establish a site calibration and comparison program appropriate to the application.

3. Product Overview

3.1 Description

The Blue Dragon C610OIW is a complete online oil-in-water monitoring system consisting of a digital self-wiping UV fluorescence sensor and a local controller/transmitter. The analyzer measures ppm-level oil response in industrial water streams, displays the current value, and communicates with plant control systems using 4-20 mA, RS485/Modbus RTU, and two configurable relays.

The standard C610OIW sensor uses a 365 nm excitation wavelength and detects fluorescence near 465 nm. This configuration is intended for dirty or turbid wastewater, produced water, refinery wastewater, and heavier oil or crude-oil applications where ppm-level trend detection and contamination alerts are required.

3.2 Intended Applications

- Refinery oily wastewater and separator-effluent trend monitoring.
- Produced-water monitoring in oil-field and related process applications.
- Petrochemical and general industrial wastewater monitoring.
- Oil contamination alarms in process water and treatment systems.
- Treatment-performance and environmental-discharge trend monitoring where site calibration and independent reference checks are established.

3.3 Applications Requiring a Different Sensor

NOTE	For clear, clean water with very low oil content, light or refined oils, surface-water monitoring, discharge outlets requiring ppb-level sensitivity, or BTEX-oriented measurements, a 255 nm low-range fluorescence sensor is generally more suitable than the standard C610OIW 365 nm ppm sensor.

3.4 System Architecture

Measurement point	Local analyzer	Plant interface
Self-wiping UV fluorescence sensor - immersion or flow-through - 10 m standard cable	C610OIW controller/transmitter - display and setup - calibration - alarm and output configuration	4-20 mA -> PLC/DCS RS485/Modbus RTU -> SCADA/PLC/PC Two relays -> alarm/control

Figure 1. Functional system architecture.

3.5 Standard Supply and Options

Category	Items
Standard supply	Controller/transmitter; 0-150 ppm self-wiping sensor; 10 m sensor cable; product manual; factory test report.
Project-specific / optional	Flow-through tank; instrument box or analyzer cabinet; sample pretreatment system; extended sensor cable; mounting bracket; calibration solution or reagent kit; spare wiper kit; custom titanium-alloy housing for high salinity.
Recommended spares	Nitrile rubber wiper element/brush surface and a spare sensor cable. These are the parts identified as most prone to wear or damage.

4. Measurement Principle and Performance

4.1 UV Fluorescence Principle

The sensor illuminates the sample with ultraviolet light at 365 nm. Fluorescent components associated with heavier oils and crude-oil fractions emit light near 465 nm. The optical system measures this emission and converts the response to an oil-in-water indication in ppm.

Different oils do not fluoresce equally. Therefore, the analyzer is inherently strongest as a rapid online trend monitor and contamination alarm. Quantitative agreement with an extraction or laboratory method requires site-specific calibration using the actual oil and water matrix.

4.2 Performance Characteristics

Parameter	Standard C610OIW specification	Qualification / note
Measurement range	0-150 ppm	Standard Blue Dragon configuration.
Measurement principle	UV fluorescence	365 nm excitation; approximately 465 nm emission.
Reference-solution accuracy	+/-5% of measured value	Specified in quinine sulfate reference solution; not a universal accuracy claim for every oil and water matrix.
Linearity	R2 > 0.999	Reference-condition specification.
Resolution	0.01 ppm	Display / sensor specification.
Response time	T90 < 50 s	Depends on sample transport, installation, and mixing.
Detection limit	Oil dependent	No universal value is specified.
Repeatability	Oil dependent	No universal value is specified.
Long-term drift	Optical drift is minimal	Maintain a clean optical window and replace the wiper element as required.

IMPORTANT	The reference-solution accuracy and linearity figures are tied to the factory reference solution. They shall not be presented as guaranteed performance for every crude oil, mineral oil, refined oil, emulsion, or wastewater matrix.

4.3 Interferences and Matrix Effects

Condition	Expected effect	Recommended action
Different oil types	Fluorescence response can vary greatly. Light oils generally respond better to 255 nm excitation; heavy oils/crude oils are better suited to 365 nm.	Use representative site calibration. Confirm sensor selection during application review.
Turbidity	Fluorescence is less affected than absorption methods, but very high turbidity can affect performance. Values above about 500 NTU are not recommended.	Use a flow-through arrangement, improve sample conditioning, or review a different measurement approach.
Suspended solids	Low levels generally have limited effect; high levels can scatter light, foul the window, and destabilize readings.	Increase wiping frequency, clean the window, and consider settling/conditioning without changing the oil fraction.
Bubbles or foam	Bubbles on the optical window can significantly distort or interrupt readings.	Install to prevent gas accumulation; use an overflow chamber or debubbling arrangement.

Condition	Expected effect	Recommended action
Unstable oil-water mixture	An unstable distribution of droplets causes genuine concentration variation at the sensor.	Improve sampling and mixing; compare readings only under consistent hydraulic conditions.
High salinity	May require a custom titanium-alloy housing.	Provide salinity/chloride data during application review.
Surfactants / chemicals	Can change fluorescence, emulsification, or seal compatibility.	Review the chemical list and provide SDS information before selection.
Organic solvents	Standard seals may be unsuitable.	Avoid unless custom sealing compounds/O-rings are approved.

5. Technical Specifications

5.1 Sensor

Parameter	Specification
Model configuration	C610OIW 0-150 ppm self-wiping UV fluorescence sensor
Excitation / emission	365 nm excitation / approximately 465 nm emission
Sensor temperature range	0-50 degC
Maximum immersion depth	30 m
Pressure tolerance	Up to 4 bar sensor-body tolerance; installation design and seals govern actual use
Ingress protection	IP68
Digital interface	RS485, Modbus protocol
Sensor power	0.6 W, self-wiping version; DC 5-12 V; power supply capacity >500 mA
Dimensions	Diameter 45 mm x 190.8 mm
Cable	10 m standard; customizable
Calibration	Zero-point, one-point, or two-point
Body material	316L(Ti) stainless steel; custom titanium alloy may be required for high salinity
Wiper material	Nitrile rubber
Default wiping interval	30 minutes
Adjustable wiping interval	10-60 minutes
Wiper motor expected life	Greater than 5 years under stated operating conditions
Wiper element replacement	Every 3-6 months, depending on fouling and service conditions

5.2 Controller / Transmitter

Parameter	Specification
Enclosure dimensions	144 x 144 x 115 mm
Display area	77 x 53 mm
Weight	Approximately 0.8 kg
Operating temperature	0-55 degC
Humidity	<=80% RH, non-condensing
Enclosure material / rating	ABS, IP55
Power supply	110-220 V AC
Outputs	One 4-20 mA output; host RS485/Modbus RTU; two relays

Parameter	Specification
Pressure compensation	Built-in atmospheric pressure compensation, 50-115 kPa, as provided by the controller platform
Mounting	Wall or panel mounting
Industrial protection	Install inside an instrument box or analyzer cabinet where the environment exceeds the controller rating

CAUTION	The controller is IP55, not IP68. Install it in a protected location. Outdoor, washdown, marine, or corrosive service generally requires an appropriate instrument box selected for the project.

5.3 Items Not Fixed by the Base Product

Item	Status
Relay contact rating	Use the rating on the supplied controller nameplate or project wiring drawing. Do not assume a rating from this manual.
Flow-through tank dimensions and flow rate	Project-specific. Supplied drawing and instructions govern.
Instrument-box material and IP rating	Project-specific option.
Complete Modbus register map and byte order	Use the protocol file supplied with the order. A basic read-frame example is provided in this manual.
Site calibration points	Application-specific and based on the expected operating range and reference method.

6. Receiving, Inspection, and Storage

6.1 Receiving Inspection

1. Inspect the shipping container for impact, water entry, or other transport damage before opening.
2. Verify the controller, self-wiping sensor, 10 m cable, manual, and factory test report against the packing list.
3. Check the sensor body, optical window, wiper arm, cable jacket, connector, and controller enclosure for damage.
4. Confirm that the model and serial numbers on the product labels and factory test report match the order.
5. Report shortages or damage before installation. Retain packaging for return or warranty evaluation.

6.2 Storage

- Store the controller and sensor indoors in clean, dry packaging.
- Protect the optical window and wiper from impact, dust, and direct sunlight.
- Do not sharply bend, crush, or suspend the sensor by its cable.
- Before long-term storage after use, clean and dry the sensor and flow chamber.

7. Installation Planning

7.1 Application Review

Before selecting an installation method, record the expected oil type, concentration range, turbidity, suspended-solids content, salinity, sample temperature, line pressure, presence of bubbles or foam, chemical additives, hazardous-area classification, and the laboratory method used for comparison.

NOTE	A site application questionnaire is provided in Appendix F. Complete it before ordering an instrument box, flow-through tank, custom housing, or sample pretreatment system.

7.2 Selecting the Installation Method

Installation	Use when	Advantages	Key cautions
Immersion	Open tanks, channels, sumps, basins, or vessels with representative mixing and safe access.	Simple installation; no sample transport lag.	Avoid walls, sediment, floating oil layers, bubbles, and stagnant zones.
Flow-through tank	Pressurized lines, controlled bypass samples, difficult access, or applications needing stable hydraulic conditions.	Easier maintenance and calibration; can reduce bubbles and provide a consistent sample zone.	Pressure must be reduced before the overflow chamber; preserve representative oil distribution.
Instrument-box package	Outdoor or industrial environments where the IP55 controller needs additional protection.	Integrated controller, terminals, and optional flow-through hardware.	Cabinet material, IP rating, ventilation, heating, and sun protection are project-specific.

7.3 Sensor Location

- Select a point that is representative of the process, not merely the easiest location to access.
- Ensure continuous wetting of the optical face during normal operation.
- Keep the sensor away from walls, the tank bottom, large solids, chemical injection points, air entrainment, and dead zones.
- Orient the optical face so bubbles and sediment are unlikely to collect on it.
- Provide sufficient clearance for the wiper to move freely and for the sensor to be removed safely.

7.4 Controller Location

- Install in a safe area within the 0-55 degC and <=80% RH controller limits.
- Protect from direct rain, washdown, condensation, corrosive vapours, vibration, and direct solar heating.
- Provide working clearance for wiring and access to the front panel.
- Use an instrument box where the local environment is beyond the IP55 controller rating.

8. Mechanical Installation

8.1 Controller Mounting

The controller can be wall-mounted or panel-mounted. Use the final mechanical drawing supplied with the controller to prepare mounting holes or a panel cut-out. The nominal enclosure dimensions are 144 x 144 x 115 mm.

1. De-energize the installation and confirm that the mounting surface is rigid, flat, and suitable for the environment.
2. Locate the controller so the display and keys can be viewed and operated safely.
3. Allow cable bend radius and sufficient rear clearance for terminals and glands.
4. Mount the controller without distorting the enclosure. Restore seals and covers after wiring.

8.2 Immersion Sensor Installation

1. Install a suitable bracket, rail, or suspension assembly that supports the sensor body without loading the cable.
2. Lower the sensor to the selected measuring depth. The maximum published water depth is 30 m.
3. Orient the optical face and wiper so bubbles, sediment, and debris do not collect on the window.
4. Secure the cable with strain relief. Do not allow it to rub against sharp edges or moving equipment.
5. Verify that the wiper can rotate through its full path without obstruction.

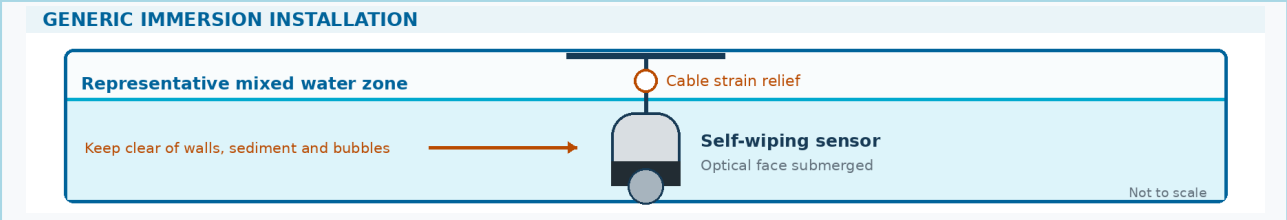

Figure 2. Generic immersion arrangement. Final mounting hardware and dimensions are project-specific.

8.3 Flow-Through Tank Installation

An optional overflow-type flow-through tank can be used. The sensor body can tolerate up to 4 bar, but the measuring chamber is intended to remain pressure-free. Reduce and control sample pressure upstream of the tank.

1. Install the flow-through tank upright and accessible for cleaning and sensor removal.
2. Connect the sample inlet so the chamber fills smoothly without impinging directly on the optical window.
3. Provide a free, unrestricted overflow or outlet to maintain an essentially unpressurized chamber.
4. Provide safe drainage and, where required, a sample return or disposal connection.
5. Set flow high enough to refresh the sample while avoiding bubbles, turbulence, and separation. Use the project-specific drawing and instructions for the final flow requirement.
6. Do not expose the sensor above 50 degC unless specifically approved, even if the chamber hardware is rated up to 60 degC.

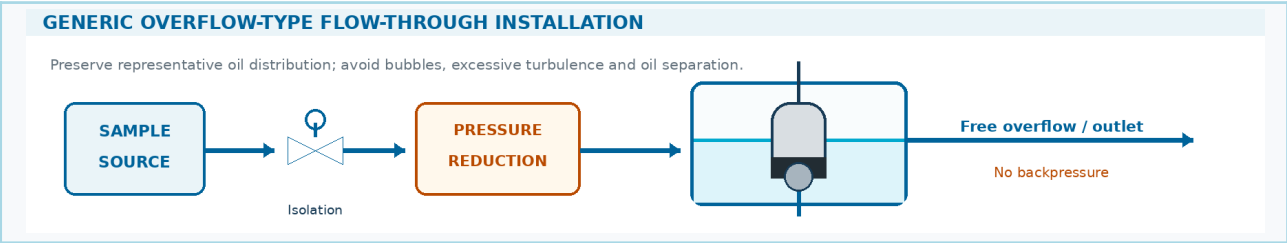

Figure 3. Generic overflow-type flow-through installation. Final materials, dimensions, and sample flow rate are project-specific.

8.4 Instrument Box

The controller may be installed inside an instrument box or analyzer cabinet. The material, protection rating, dimensions, viewing window, terminal blocks, cable glands, power isolation, surge protection, ventilation, heating, and sunshade are selected for the project environment.

Important: Do not claim an enclosure IP rating unless it is stated on the final instrument-box nameplate or drawing. The base controller remains IP55.

9. Electrical Installation

9.1 General Requirements

- Isolate all power before wiring.
- Use cable glands and conductors appropriate for the site environment and electrical code.
- Route sensor/communication cables separately from mains and high-current switching conductors.
- Terminate the cable shield as specified by the project wiring drawing. Avoid uncontrolled multiple shield earth points.
- Check all terminal labels on the supplied English wiring panel before energizing.

9.2 Controller Terminal Assignments

No.	Terminal	Function	Notes
1	AC(N)	AC power neutral	
2	AC(L)	AC power line	110-220 V AC
3	PE / EGND	Protective earth	Connect before energizing
4	Relay 1 NC	Relay 1 normally closed contact	Contact rating per nameplate/drawing
5	Relay 1 COM	Relay 1 common	
6	Relay 1 NO	Relay 1 normally open contact	
7	Relay 2 NC	Relay 2 normally closed contact	Contact rating per nameplate/drawing
8	Relay 2 COM	Relay 2 common	
9	Relay 2 NO	Relay 2 normally open contact	
10	+5 V	Auxiliary sensor power	Use only when specified for the connected sensor
11	Sensor GND	Sensor power / signal ground	Black sensor wire
12	Sensor 485A	Sensor RS485 A	Green sensor wire
13	Sensor 485B	Sensor RS485 B	White sensor wire
14	+12 V	Sensor power supply	C610OIW red VCC normally uses the factory-designated 5-12 V supply; verify supplied wiring label
15	mA-	4-20 mA output negative	
16	mA+	4-20 mA output positive	Scale in controller menu
17	Host 485A	Host Modbus RS485 A	To PLC/DCS/PC
18	Host 485B	Host Modbus RS485 B	To PLC/DCS/PC
19	Host GND	Host communication reference / ground	Do not substitute for protective earth

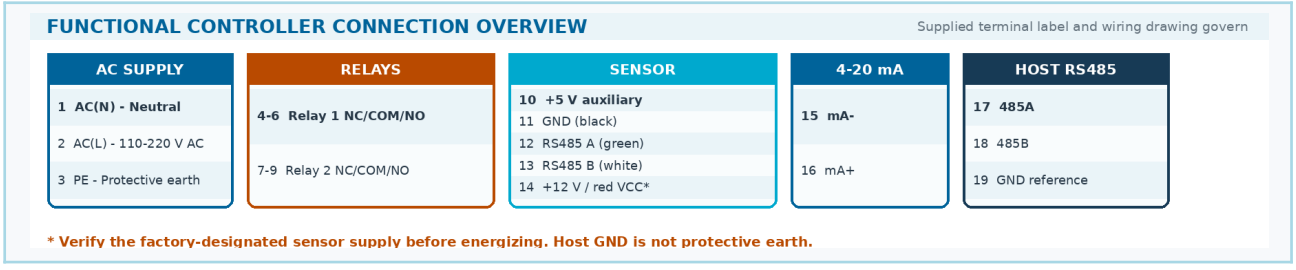

Figure 4. Functional controller connection overview. The supplied terminal label and order-specific wiring drawing govern.

9.3 Sensor Cable Colour Code

Wire colour	Function	Typical controller connection
Black	GND	Terminal 11 - Sensor GND
Green	RS485 A	Terminal 12 - Sensor 485A
White	RS485 B	Terminal 13 - Sensor 485B
Red	VCC	Factory-designated 5-12 V sensor supply; normally terminal 14 for the C610OIW package
Bare / brown	Shield	Terminate according to the supplied project wiring drawing

WARNING Connect or disconnect the sensor only when controller power is OFF. Incorrect sensor-power selection can damage the sensor or controller.

9.4 4-20 mA Output

Configure the lower and upper range values from the controller 4-20 mA menu. For a conventional linear output, 4 mA represents the LRV and 20 mA represents the URV. For the standard full range, a common configuration is 4 mA = 0 ppm and 20 mA = 150 ppm.

NOTE Verify whether the receiving input is active or passive and confirm loop wiring against the project drawing. Do not assume the controller can power every loop arrangement.

9.5 Relays

The controller provides two changeover relays. Configure alarm or control logic through the Alarm and Relay menus. The contact rating is not fixed in the source documentation; use the rating printed on the controller or supplied wiring drawing. Use interposing relays where the connected load exceeds the controller rating or where additional isolation is required.

10. Start-up and Commissioning

10.1 Pre-energization Checks

1. Confirm the controller and sensor model, range, serial numbers, and supply voltage.
2. Verify protective earth, AC line/neutral, sensor wiring, 4-20 mA polarity, RS485 polarity, and relay wiring.
3. Confirm that the sensor optical face and wiper are clean and unobstructed.
4. Verify that the sensor is continuously wetted or that the flow-through tank is operating without bubbles or excessive turbulence.
5. Confirm that the controller is installed in a safe area and protected from the environment.

10.2 Power-up

The controller has no dedicated main power switch. When the external AC supply is energized, the controller starts automatically, scans the sensor connection, identifies the connected sensor, and enters measurement mode.

CAUTION	If the controller does not identify the sensor, switch off power before checking the VCC, GND, and RS485 wiring.

10.3 Initial Commissioning Sequence

1. Allow the sensor and sample condition to stabilize.
2. Confirm that the display shows oil-in-water in ppm and that the temperature indication is plausible.
3. Set date/time and engineering-unit preferences where supported by the firmware.
4. Configure the measurement range and 4-20 mA scaling.
5. Set alarm thresholds and relay actions.
6. Configure host Modbus address and communications parameters using the protocol supplied with the order.
7. Set the self-wiping interval. Begin with the 30-minute default; adjust between 10 and 60 minutes according to fouling conditions.
8. Perform a site calibration or baseline verification before placing the reading into operational service.
9. Record the configuration and baseline readings on the commissioning checklist in Appendix D.

11. User Interface and Operation

11.1 Main Measurement Display

The main screen displays the current oil-in-water value in ppm. Depending on firmware configuration, temperature and barometric/pressure information may also be shown. Status indications should be reviewed during commissioning so operators understand normal, alarm, and fault states.

11.2 Front-Panel Keys

Key	Typical function
ESC / Setup	Enter or exit the setup menu; move back one level; cancel or leave an edit.
SHIFT	Move the cursor or select the digit/field to edit. On some firmware, this key may provide a calibration or secondary-menu function.
UP	Scroll upward or increase the selected value.
DOWN	Scroll downward or decrease the selected value.
ENTER	Accept a selection or value and move to the next field.

NOTE	Controller firmware and key legends can vary. The on-screen prompts and the supplied front-panel label take precedence over generic key descriptions.

11.3 Setup Menu

The controller platform provides menu functions for barometric settings, calibration, 4-20 mA output, salinity-related settings, alarms, relay configuration, and reset. Only use features applicable to the C610OIW sensor and the installed project configuration.

WARNING	Do not use generic controller functions intended for other sensor types. Resetting or changing unrelated sensor parameters can invalidate the configuration.

12. Calibration and Verification

12.1 Calibration Strategy

The sensor is factory calibrated using quinine sulfate solution. This verifies the optical response and provides a repeatable factory baseline. Quinine sulfate is not the same as the oil present in every process. For the most meaningful site result, calibrate or correlate the analyzer using representative process water and the customer's chosen laboratory method.

IMPORTANT	A site calibration is specific to the oil type, water matrix, sample preparation, and laboratory method used. It does not establish universal equivalence with other oils or methods.

12.2 Selecting a Calibration Method

Method	Recommended use	Comments
Zero adjustment	A clean-water or low-oil condition is available and the sensor shows an elevated baseline.	Use a zero solution or site water verified to contain negligible oil. Ensure the matrix is appropriate.
One-point calibration	Routine field calibration with a representative sample.	Generally recommended by the manufacturer for actual applications.
Two-point calibration	Standard-solution testing or when both a low and a higher reference point are available.	Use two stable, well-characterized points that bracket the normal operating range where practical.

12.3 Preparation for Site Calibration

1. Define the purpose of calibration: trend alignment, alarm threshold, or closer agreement with a laboratory method.
2. Collect a representative sample from the same hydraulic condition seen by the online sensor.
3. Prevent oil separation, evaporation, contamination, or changes in droplet distribution between online reading and laboratory handling.
4. Determine the reference concentration using the customer's selected laboratory method.
5. Clean the optical window and confirm that bubbles are absent before capturing calibration values.

12.4 One-Point Calibration Procedure

1. From the setup menu, select Calibration and choose 1-point calibration.
2. Enter the reference concentration using SHIFT and UP/DOWN, then confirm with ENTER.
3. Place the sensor in the representative sample or confirm that the online sample condition matches the reference sample.
4. Wait until the displayed value is stable. A few minutes may be required depending on sample transport and mixing.
5. Press ENTER to capture the sensor response. The controller calculates the calibration slope and reports success or failure.
6. If calibration fails, the controller returns to the previous parameters. Check sample stability, entered concentration, fouling, bubbles, and sensor condition before repeating.
7. Record the calibration in Appendix E.

12.5 Two-Point Calibration Procedure

1. Select 2-point calibration from the calibration menu.
2. Use a zero or low reference as the first point where appropriate.
3. Rinse or transition the sensor to the second representative reference and allow the reading to stabilize.
4. Enter and capture the second point. Choose site-specific values that reflect the normal operating range; there is no universal 0-150 ppm pair for every application.
5. Confirm successful calibration and verify the result with an independent sample.

12.6 Verification and Frequency

Verify performance after installation, after significant process changes, after sensor cleaning or wiper replacement, when readings no longer agree with process evidence, and at a frequency established by site experience. The manufacturer does not specify a universal calibration interval because oil type and fouling conditions vary.

Trigger	Required response
Initial commissioning	Establish a representative baseline and complete site calibration or verification.
Change in oil type, process chemistry, or water matrix	Reassess sensor suitability and repeat representative calibration.
After optical cleaning or wiper replacement	Verify baseline and response before returning to operational service.
Unexpected drift or disagreement with process evidence	Inspect bubbles/fouling and compare with a representative laboratory sample.
Routine interval established by site experience	Document the check and retain calibration records.

13. Self-Wiping System

13.1 Operation

The integrated wiper passes across the optical window to reduce fouling. The default cleaning interval is 30 minutes. The controller allows adjustment from 10 to 60 minutes according to actual service conditions.

13.2 Selecting the Wiping Interval

Condition	Suggested starting approach
Relatively clean water	30-60 minute interval, followed by inspection and adjustment.
Moderate fouling or suspended solids	15-30 minute interval.
Rapid optical fouling	10-15 minute interval, plus review of installation and sample conditioning.

NOTE	These are practical starting points, not fixed OEM requirements. Confirm the interval by inspecting the optical window and reviewing reading stability.

13.3 Wiper Maintenance

- Wiper material: nitrile rubber.
- Expected internal wiper-motor life: greater than 5 years under stated service conditions.
- Replace the rubber brush/wiper surface every 3-6 months, or sooner if worn, hardened, swollen, torn, or ineffective.
- Treat the rubber wiper element as a consumable.
- The controller does not directly display a wiper fault. The sensor protocol can generate error codes; monitor these through the sensor Modbus interface where implemented.

CAUTION	A moving wiper does not guarantee a clean optical window. Inspect the window physically during scheduled maintenance and whenever readings become unstable or biased.

14. Outputs and Communications

14.1 4-20 mA

The controller provides one analog current output. Configure the LRV and URV in the 4-20 mA menu. Verify the output at 4 mA, a mid-scale point, and 20 mA during commissioning using a calibrated meter or receiving-system input diagnostic.

14.2 Relays

Use the Alarm and Relay menus to assign thresholds and actions. Consider using one relay for a high oil indication and the second for a high-high or general analyzer fault, subject to the available firmware functions. Final logic should be documented in the project control narrative.

14.3 Host RS485 / Modbus RTU

The controller responds to Modbus RTU commands for measurement export. The base manual provides the following example using device address 0x01, function code 0x03, start address 0x2600, and six registers.

Frame	Hexadecimal bytes	Meaning
Request	01 03 26 00 00 06 CE 80	Read six holding registers starting at 0x2600.
Response structure	01 03 0C [Data1: 4 bytes] [Data2: 4 bytes] [Temp: 4 bytes] [CRC: 2 bytes]	Data1 = OIW value in ppm; Data2 = 0 for the OIW sensor; Temp = temperature.

IMPORTANT	The available source manual does not specify data byte order, floating-point encoding, all register addresses, or all error-code registers. Use the complete Modbus protocol supplied with the order and verify values during commissioning.

15. Routine Maintenance

15.1 Maintenance Schedule

Interval	Task	Acceptance criteria / action
Each shift / daily	Review reading stability, alarms, sample flow, bubbles, and visible fouling.	Investigate sudden changes that do not match the process.
Weekly or site-defined	Inspect flow path, drain/overflow, cable strain relief, and optical window condition.	Clean if deposits or films are visible.
Monthly	Check wiper operation, 4-20 mA trend, communication status, and enclosure condition.	Correct wiring, moisture, or fouling issues.
Every 3-6 months	Replace nitrile rubber wiper element/brush surface.	Shorten interval in abrasive, dirty, or chemically aggressive service.
Site-defined	Verify or calibrate against representative samples and the chosen laboratory method.	Record result and calibration parameters.
Annually	Inspect terminals, protective earth, cable condition, instrument box seals, and spare parts.	Replace damaged cable or seals; confirm documentation and backup configuration.

15.2 Cleaning the Sensor

1. Isolate power and make the sample safe before removing or handling the sensor.
2. Rinse loose contamination with clean water compatible with the process.
3. Clean the optical window gently using a soft, non-abrasive cloth or swab and a site-approved cleaning solution.
4. Do not scratch the optical window or bend the wiper arm.
5. Rinse away cleaning residue and inspect seals, cable, wiper, and optical face.
6. Reinstall, restore sample conditions, and verify the baseline before returning to service.

CAUTION	The source documentation does not specify a universal cleaning chemical. Select cleaning agents only after reviewing the oil, deposits, sensor materials, seals, and site chemical-safety requirements.

15.3 Recommended Spares

Spare	Recommendation
Nitrile rubber wiper elements / brush surfaces	Keep at least enough for one year of the planned 3-6 month replacement cycle.
Sensor cable	Keep one spare where cable damage would cause significant downtime.
Project-specific seals / O-rings	Stock only the materials approved for the application.
Controller / sensor	Consider a strategic spare for critical installations or remote sites.

16. Troubleshooting

Symptom	Possible cause	Corrective action
Controller does not power up	No AC supply; external fuse/disconnect open; incorrect line/neutral; internal fault.	Isolate power, verify 110-220 V AC and protective earth, inspect external protection, then contact service if unresolved.
Sensor not recognized	Sensor connected while energized; wrong VCC terminal; open cable; reversed RS485; loose terminal.	Power off, verify cable colours and supplied wiring label, inspect continuity and terminals, then restart.
Reading unstable	Bubbles/foam; unstable oil-water mixture; turbulent flow; solids; electrical noise.	Remove bubbles, stabilize sample hydraulics, relocate sensor, clean the window, separate signal wiring from mains.
Reading gradually increases without process change	Optical fouling; worn wiper; baseline drift; sample change.	Inspect and clean window, verify wiper, compare with representative sample, perform zero/site calibration if justified.
Reading lower than expected	Oil type has weak 365 nm response; poor sample representativeness; incorrect site calibration; oil separation upstream.	Review oil type and sensor selection, improve sampling, repeat representative calibration, compare with lab method.
Reading higher than expected	Different oil response; bubbles/solids on window; contaminated zero; calibration error.	Inspect window, remove bubbles, verify reference sample and calibration entry.
Calibration fails	Unstable reading; incorrect reference value; contaminated standard; fouling; sensor fault.	Stabilize sample, verify reference, clean sensor, repeat. Restore prior parameters if failure persists.
4-20 mA incorrect	Wrong scaling; polarity; loop type; open circuit; receiving input configuration.	Check LRV/URV, polarity, loop continuity, and PLC/DCS input configuration.
Modbus no response	Wrong address/baud/parity; A/B reversed; missing reference/termination; incorrect register request.	Use supplied protocol, confirm settings and wiring, test locally, then integrate into PLC/SCADA.
Wiper ineffective	Rubber element worn; wiper obstructed; motor or sensor fault.	Isolate power, inspect and replace wiper element, check sensor error codes, contact service if motor does not operate.

17. Shutdown, Storage, and Disposal

17.1 Temporary Shutdown

1. Record the final reading, alarms, and configuration.
2. Isolate AC power using the external disconnect.
3. Make the process safe, stop sample flow, depressurize, drain, and flush as required.
4. Remove, clean, and dry the sensor if it will not remain continuously wetted in a suitable condition.
5. Protect cable ends, optical window, and wiper from contamination and impact.

17.2 Disposal

Dispose of electronic components, metals, cables, contaminated cleaning materials, and process residues in accordance with local regulations and site environmental procedures. Decontaminate equipment before shipment or disposal.

18. Warranty and Technical Support

The standard Blue Dragon warranty period is 12 months, subject to the terms of the sales contract. The nitrile rubber wiper element is a wear-prone consumable. Warranty evaluation may require the model, serial number, factory test report, installation details, calibration records, process conditions, photographs, and a description of the fault.

For technical support, contact Blue Dragon Technology or the authorized distributor through the support channels listed at bluedragontechnology.com.

NOTE	Specifications, firmware, wiring labels, and optional assemblies can change. The nameplate, project drawings, factory test report, and order-specific documentation supplied with the analyzer take precedence where they differ from this general manual.

Appendix A. Quick Start Checklist

Step	Check
1	Confirm safe-area installation and suitable controller protection.
2	Verify model, 0-150 ppm range, serial numbers, and standard package.
3	Mount controller and sensor / flow-through tank.
4	Power OFF: connect protective earth, AC, sensor VCC/GND/RS485, outputs, and relays.
5	Energize external disconnect and confirm automatic sensor recognition.
6	Confirm ppm display, temperature, sample flow, absence of bubbles, and wiper clearance.
7	Set 4-20 mA range, alarms, relays, Modbus, and 30-minute initial wiping interval.
8	Perform representative baseline verification or site calibration.
9	Record commissioning data and place the analyzer into service.

Appendix B. Controller Key Reference

Key	Short-press / typical use
ESC / Setup	Enter/exit menu, move back, cancel an edit.
SHIFT	Move cursor or select a field/digit; secondary function depends on firmware.
UP	Scroll up or increase value.
DOWN	Scroll down or decrease value.
ENTER	Accept setting/value and continue.

Appendix C. Communications Record

Parameter	Site setting
Controller Modbus address	
Baud rate	
Parity / stop bits	
4-20 mA LRV	
4-20 mA URV	
Relay 1 function / setpoint	
Relay 2 function / setpoint	
PLC/DCS tag	
Complete protocol document revision	

Appendix D. Commissioning Checklist

Item	Result / value	Initials / date
Model / serial number		
Installation location		
Installation type: immersion / flow-through / cabinet		
Safe-area classification confirmed		
Protective earth and AC supply checked		
Sensor wiring and cable condition checked		
Optical window and wiper inspected		
No bubbles / stable sample flow confirmed		
4-20 mA verified at low / mid / high		
Modbus communication verified		
Alarm / relay actions tested		
Wiping interval set		
Site baseline / calibration completed		
Factory test report filed		

Appendix E. Calibration Record

Date	Oil / sample description	Reference method and result	Online reading before	Calibration type / points	Online reading after	Technician

Appendix F. Application Data Sheet

Application parameter	Site information
Industry / process	
Monitoring objective: trend / alarm / process control / comparison	
Oil type: crude / heavy / mineral / refined / mixed / unknown	
Expected normal and maximum concentration	
Turbidity (NTU)	
Suspended solids / sludge	
Bubbles / foam / gas release	
Sample stability / emulsion condition	
Salinity / chloride	
Surfactants, solvents, or process chemicals	
Sample temperature	
Line pressure	
Installation preference	
Hazardous-area classification	
Laboratory reference method	
Required outputs / alarms / communications	
Instrument box / flow-through tank requirements	

Appendix G. Maintenance Log

Date	Inspection / maintenance performed	Wiper element replaced?	Calibration / verification result	Technician

Appendix H. Order-Specific Documentation

Depending on the ordered configuration, the controlled documentation package may include the following items:

- Product nameplate information and the serial-number-specific factory test report.
- Final controller terminal label or order-specific wiring drawing.
- Project-specific immersion mounting drawing, where mounting hardware is supplied.
- Flow-through tank drawing, materials, dimensions, connections, and recommended sample flow rate.
- Instrument-box or analyzer-cabinet drawing, including material, protection rating, internal wiring, and environmental provisions.
- Complete Modbus protocol, byte order, supported registers, and available sensor error-code information.
- Approved calibration accessories, spare-parts list, and project-specific commissioning records, where included in the order. Where order-specific documents differ from this general manual, the order-specific documents take precedence.