

Appendix 7A

Turbidity Report



Ros an Mhíl Harbour Development

Water Quality and Turbidity Monitoring Report

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Background

Project Overview

The Department of Agriculture, Food and the Marine (DAFM) commissioned a deep-water quay development at Ros an Mhíl Harbour, Co. Galway, Ireland.

Project Area

The site is located in the townland of Ros an Mhíl Fishery Harbour Centre (FHC) on the North East shore of Cashla Bay near the village of Ros an Mhíl, which is situated 1km from the harbour. Ros an Mhíl FHC is in the Connemara area of County Galway. The development area is situated at Ross an Mhíl, Connemara, Co. Galway, Ireland (see **Error! Reference source not found.-1**).

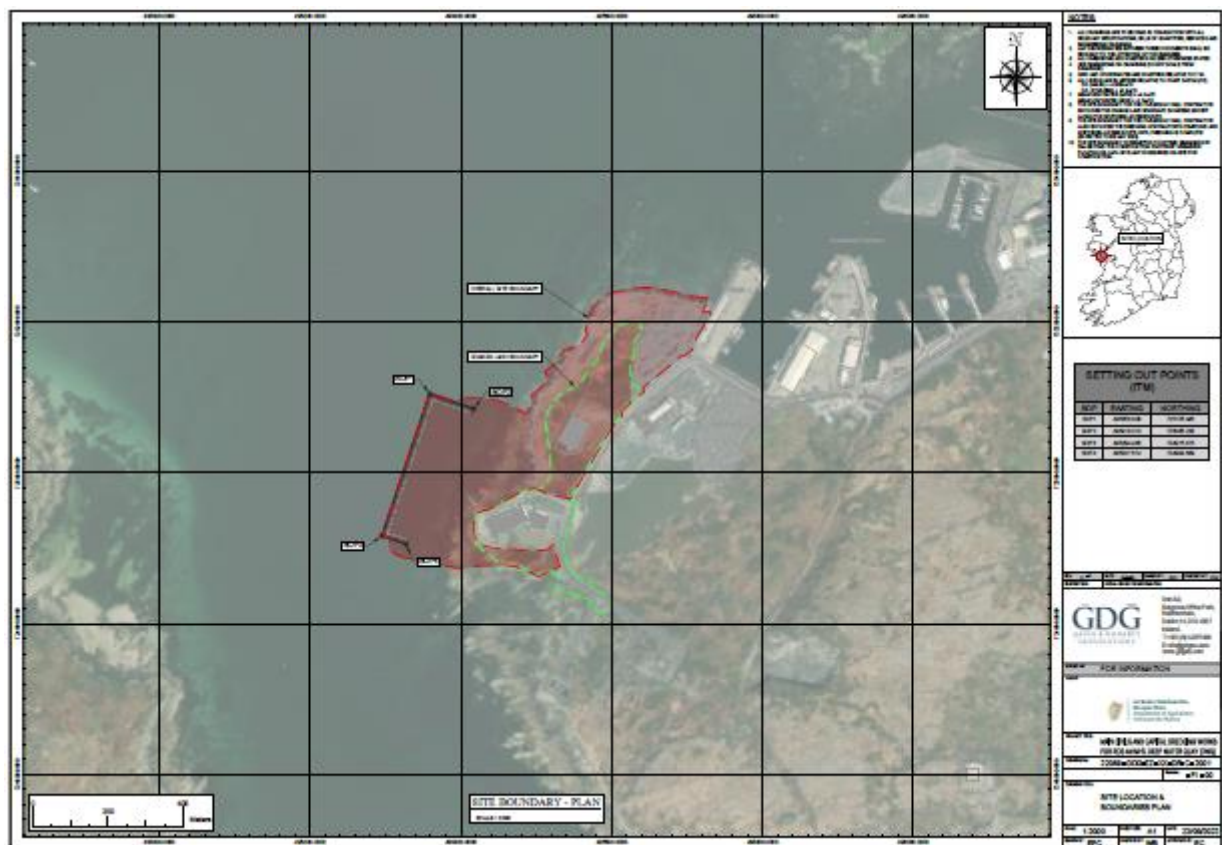


Figure 0-1 Ros an Mhíl Site Boundary Plan

Water Quality and Turbidity Monitoring

The project Environmental Impact Statement (EIS) (Mott MacDonald, 2017) proposed that “no mitigation measures are required to offset impacts on water quality during dredging activities” as “previous monitoring during these activities in Rossaveel Harbour has indicated that there was no significant correlation between dredging activities and the fluctuation in water quality” and no water

quality monitoring conditions formed part of the planning permission granted to the project by Galway County Council in 2018.

The planning permission granted to the project by Galway County Council in 2018 states that “the construction of the development shall be managed in accordance with a Construction Management Plan”.

As part of the project requirements a Construction Environment Management Plan was developed by the successful contractor, Ward & Burke Ltd. (Ward & Burke, 2024), which sets out the following water quality and turbidity monitoring requirements:

Water Quality Monitoring

Monitoring of any discharge will typically be carried out weekly by the site team to ensure no impact on the local system. Frequency may be varied subject to the level of activity and prevailing weather conditions to meet the perceived risk at the given time. All temporary ponds will be within the site boundary, following completion of the requirement any silts will be tested and removed from site in a suitable manner.

Properties identified as sensitive receptors during the construction phase will be shown on a drawing. Where identified as required, monitoring will be ongoing throughout the construction phase, frequency will be based on forthcoming work activities, timing and location of sensitive receptors.

Turbidity Monitoring

A compact, durable and lightweight HydroLab MS5 probe containing a self-cleaning turbidity sensor, LDO dissolved oxygen sensor, a temperature sensor and a conductivity sensor. The measurement range for the turbidity sensor shall be 0-3000NTU with a resolution of 0.1NTU for <400NTU and 1NTU for values >400NTU. The measurement range for the LDO sensor shall be 0-20 mg/l with a resolution of 0.01mg/l. The MS 5 unit shall record internally in addition to data output.

Probe to be mounted on a moored Toroidal buoy (1350 mm in diameter) with galvanised steel/aluminium superstructure with baffle light and have a telemetry system to relay data to a shore location

Each of the fixed stations shall be capable of relaying data on a half hourly basis back to a terrestrial monitoring station located at Rossaveel FHC. The monitoring station shall include a data logging system with real time visual display of the transmitted data. When turbidity or dissolved oxygen levels exceeded the threshold levels outlined (20NTU for turbidity and 6mg/l for DO) the system shall output text messages to Employer and the Harbour Master. ”

To meet these requirements, two buoys were deployed at the project site from 14th March 2023 to 12th July 2024.

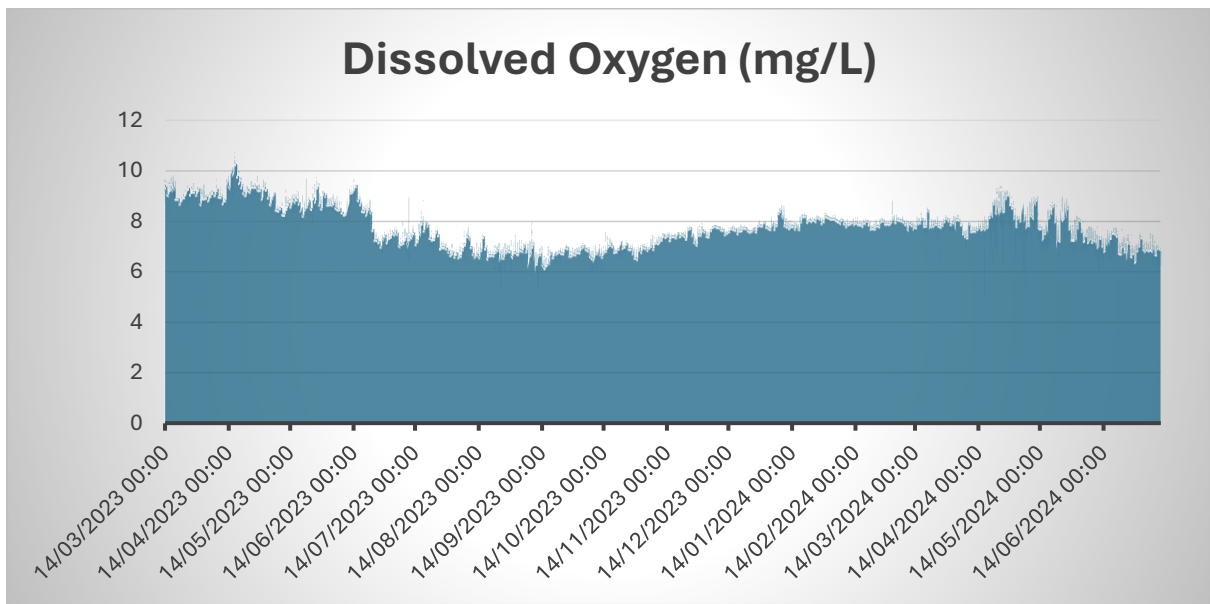
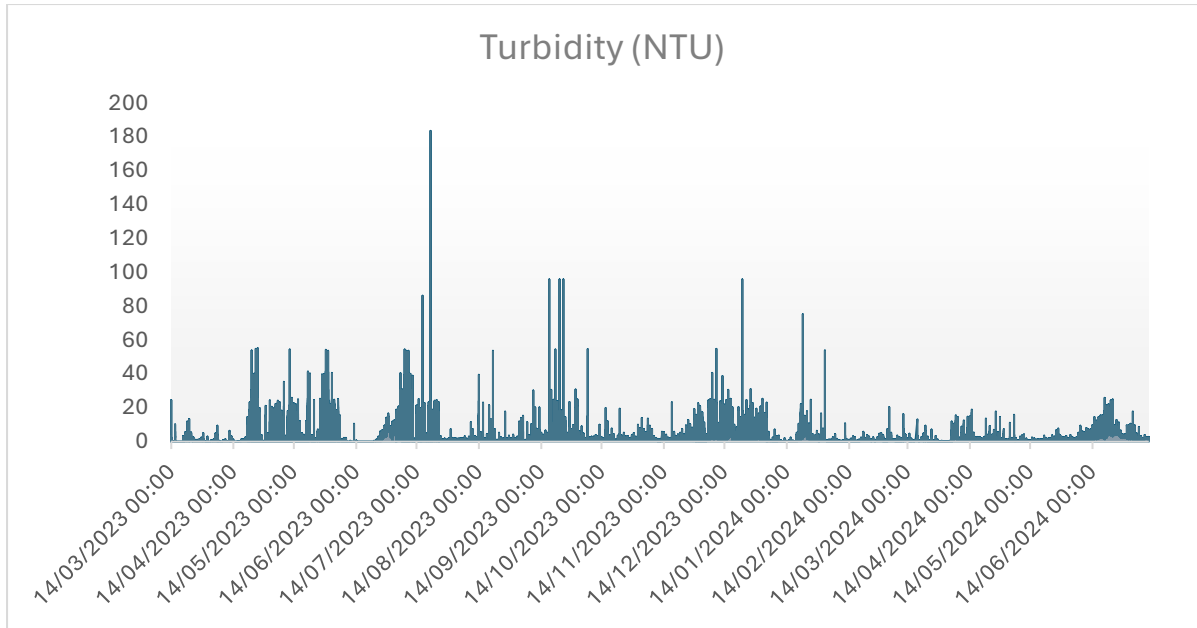
This report describes the water quality monitoring effort and results.



The following are graphs pulled from the raw data of the water quality monitoring Buoys that were installed for the Rossaveel DWQ project. These display the Turbidity and Dissolved Oxygen which were monitored as part of the requirements of the contract.

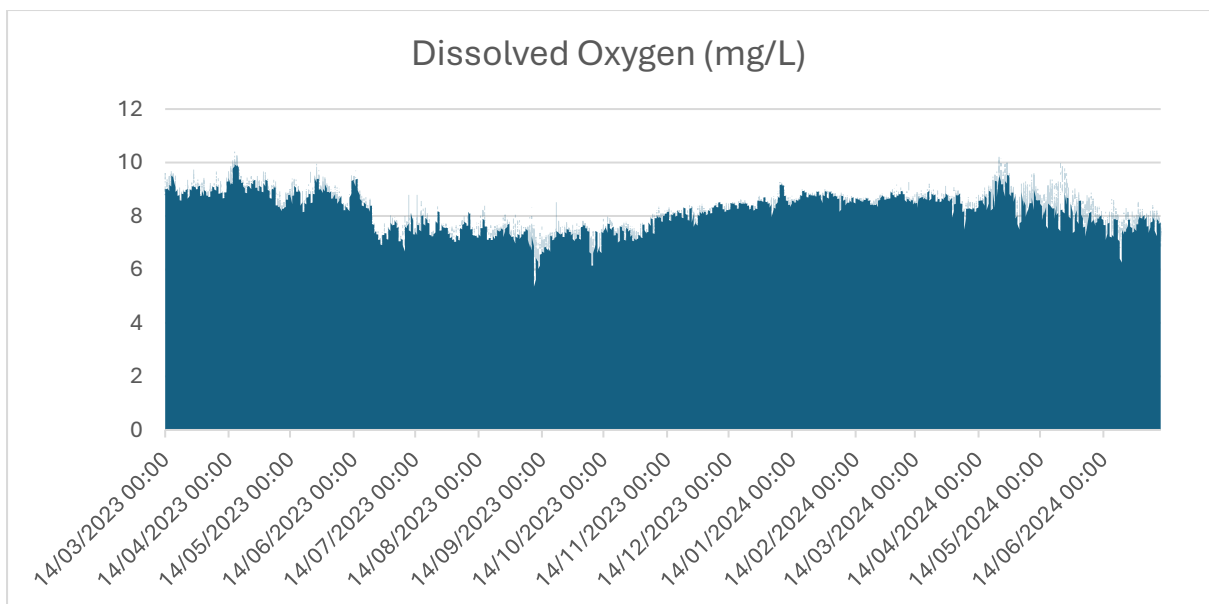
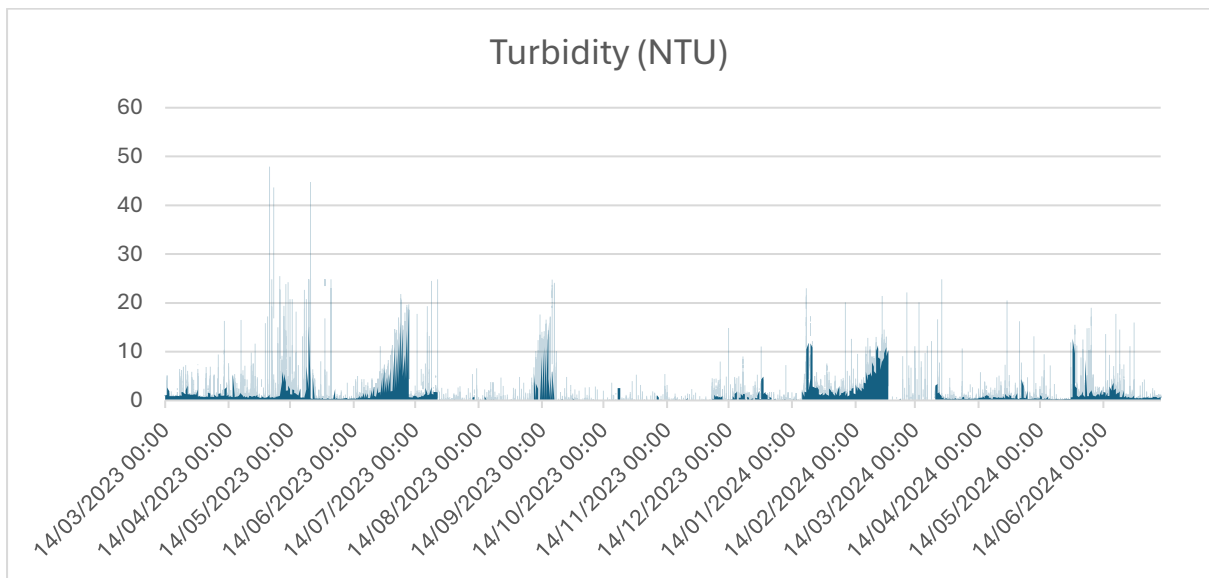
Data Buoy 01

Logger tag:	SP01 Rossaveel
Logger description:	SP01 Water Quality Sonde
Logger group:	Ward & Burke
Description:	Rossaveel
Serial number:	16779949
From:	14/03/2023 11:30
To:	12/07/2024 12:00
Latitude:	53.2631
Longitude:	-9.568614



Data Buoy 02

Logger tag: SP02 Rossaveel
SP02 Water Quality
Logger description: Sonde
Logger group: Ward & Burke Rossaveel
Description:
Serial number: 16779100
From: 14/03/2023 11:00
To: 12/07/2024 12:00
Latitude: 53.267281
Longitude: -9.568247



	Document Reference: GR-SLS-01	Rev No. 01	Author: EB Approved: VB
	General Report SHEET		

Survey:	Ward & Burke/ JFC Rossaveil	Date: 14/03/23
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Location:	SP01	
Site ID:	SP01	
Logger ID:	16779949	
Time:	11:39 (0 GMT)	

Comments: Logging every 15 minutes.
--

Alarm thresholds: 20NTU & above for Turbidity &
6mg/l & below for Dissolved Oxygen

Logged Values at installation:
Turbidity=0NTU, EC=46,088uS/cm , DO=8.76mg/l, Temp=7.79C



Date: 14/03/23

	Document Reference: GR-SLS-01	Rev No. 01	Author: EB Approved: VB
	General Report SHEET		

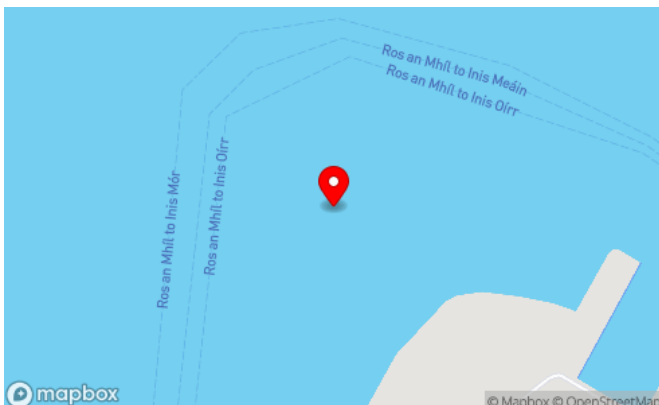
Survey:	Rossaveel - Ward & Burke /JFC Marine	Date: 14/03/23
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Location:	SP02	
Site ID:	SP02	
Logger ID:	16779100	
Time:	10:50 (0 GMT)	

Comments: Logging interval every 15 mins

Alarm thresholds: 20NTU & above for Turbidity &
6mg/l & below for Dissolved Oxygen

Logged values at installation
Turbidity=0.839 NTU, EC=43,546uS/cm , DO=8.98mg/l, Temp=7.56C



Date: 14/03/23



Aqua TROLL® Multiparameter Sondes

THE AQUA TROLL 500 AND 600 ARE FULLY CUSTOMIZABLE MULTIPARAMETER SONDES WITH INTERCHANGEABLE SENSORS AND A SMARTPHONE INTERFACE THAT DELIVERS ACCURATE DATA AND ENABLES SIMPLIFIED CALIBRATION, PANORAMIC DATA VIEW AND REPORT CREATION.

These flexible instruments are ideal for spot-checking and profiling applications when paired with a Wireless TROLL Com, or for long-term monitoring when used with VuLink telemetry and HydroVu data services. Rugged in groundwater and corrosion resistant in surface water, they each feature four smart-sensor ports, a convenient, onboard LCD screen that indicates sensor status, and a sub-2-inch antifouling wiper to ensure data accuracy.

Our sensor portfolio for both instruments includes RDO® dissolved oxygen, pH/ORP, turbidity, conductivity, temperature and pressure. Available in vented and non-vented options.

COLLECT DATA YOU CAN TRUST WITH EQUIPMENT DESIGNED TO BE RELIABLE, COST EFFECTIVE AND EASY TO USE.



AVAILABLE PARAMETERS (MEASURED WITH INTERCHANGEABLE SENSORS)

- RDO® Optical Dissolved Oxygen
- Actual and specific conductivity
- pH/ORP
- Salinity
- Total dissolved solids (TDS)
- Resistivity
- Density
- Turbidity
- Temperature and pressure
- Ion Selective Electrodes
- Fluorometers

APPLICATIONS

- LAKE, STREAM AND WETLAND MONITORING
- STORMWATER MANAGEMENT
- COASTAL DEPLOYMENTS
- DAM MONITORING
- LOW-FLOW GROUNDWATER SAMPLING
- REMEDIATION AND MINE WATER MONITORING
- SURFACE WATER SPOT SAMPLING AND PROFILING
- AQUACULTURE

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1-970-498-1500 (U.S.A. and international)

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June 2022

THE AQUA TROLL 500 AND 600 ARE DESIGNED TO ADDRESS COMMON PROBLEMS WITH MULTIPARAMETER MONITORING INSTRUMENTATION. BOTH OFFER

A SHARED ECOSYSTEM

Reduce complexity and cost with equipment that works together. All Aqua TROLL products use the same ecosystem—from handheld to cable to communication.

3D FACTORY CALIBRATION

In-Situ performs a multi-point factory calibration on every sensor, to ensure that the sensor is linear across its full range and simplify calibration for the user.

LOW-MAINTENANCE DEPLOYMENT

Keep labor and equipment costs down with advanced sub-2-inch passive and active antifouling on all sensors and 9+ month battery life.

ENHANCED RELIABILITY

In-Situ equipment is designed to withstand use in the harshest environments. Features designed to prevent breakage or failure include:

- Interlocking sensors for greater stability
- Titanium restrictor
- Fully potted sensors
- Redundant SD card storage
- Multi-chamber design

BUILT-IN ERROR PREVENTION

Prevent the most common damage or loss with:

- Spring-loaded screws that keep screws in place
- Slip-clutch wiper to prevent motor damage
- Smart sensors that fit in any port
- Wet-mate connectors that prevent water damage
- Anti-roll bumpers to keep equipment stationary

MINI CALIBRATION CUP

These sondes use only 50 mL of calibration solution for both rinsing and calibration, reducing the calibration cost by 5x over traditional methods and saving thousands of dollars in calibration solution per year.

FAST-RESPONSE SENSORS

Aqua TROLL sensors were designed to support spot-checking and profiling applications where sensor response time is critical. The temperature sensor uses an extended thermistor and insulated barriers; RDO® has optional fast-response formulation; and a round bulb increases surface area and improves response time on the pH sensor.

UPGRADE FROM AQUA TROLL 500 TO 600 IF YOU NEED...

- **INTERNAL BATTERY POWER**
2 Alkaline D-cell batteries to provide internal power to the instrument for continuous deployment (9-12 months depending on logging rates and wiper) without external power
- **INTERNAL LOGGING**
Ability to record data logs to internal memory of the sonde
- **MICRO SD CARD FOR BACKUP LOGGING**
Record backup logs to the micro SD card to have a second data source in case something happens to the onboard memory (flooded instrument, etc.)
- **HIGHER MAXIMUM DEPLOYMENT DEPTH RATING**
Up to 200M with the Aqua TROLL 600 (up to 100M with the Aqua TROLL 500)





GENERAL	AQUA TROLL 600 MULTIPARAMETER SONDE	AQUA TROLL 500 MULTIPARAMETER SONDE
OPERATING TEMPERATURE (NON-FREEZING)	-5 to 50° C (23 to 122° F) ISE: Ammonium & Nitrate 0 to 40° C ; Chloride 0 to 50° C	
STORAGE TEMPERATURE	Components w/o fluid: -40° C to 65° C (non-freezing water); pH/ORP: -5° C to 65° C; Ammonium/Nitrate: 0 to 40 ° C; Chloride: 0 to 50° C	
DIMENSIONS	4.7 cm (1.85 in.) OD x 60.2 cm (23.7 in.) (includes connector) With bail: 72.9 cm (28.7 in.)	Length: 46 cm (18.145") (includes connector). With bail: 59 cm (23.25") Diameter: 4.7 cm (1.860")
WETTED MATERIALS	PC, PC alloy, Delrin™, Santoprene™, Inconel™, Viton™, Titanium, Platinum, Ceramic, Nylon	PC, PC alloy, Delrin, Santoprene, Inconel, Viton, Titanium, Platinum, Ceramic, Nylon, PVC, Graphite
WEIGHT	1.45 kg / 3.2 lbs (includes all sensors, batteries, and bail)	0.978 kg / 2.15 lbs. (includes instrument, sensors, restrictor and bumpers)
MAX PRESSURE RATING	Up to 350 PSI	Up to 150 PSI
OUTPUT OPTIONS	RS-485/MODBUS, SDI-12, Bluetooth®	
READING RATES	1 reading every 2 seconds	
DATA LOGGING	50 logs (defined, scheduled to run, or stored)	Use external datalogger or telemetry
LOGGING MODES	Linear, Linear Average, Event	N/A
LOGGING RATE	1 minute to 99 hours	N/A
ENVIRONMENTAL RATING	IP68 with all sensors and cable attached IP67 without the sensors or cable attached	
INTERNAL MEMORY¹ MICRO SD CARD²	16 MB; 8+ GB micro SD card included, user replaceable	N/A
INTERNAL POWER BATTERY LIFE³	2 internal user-replaceable Alkaline D batteries >6 months typical with wiping; >9 months typical with no wiping	N/A
EXTERNAL POWER VOLTAGE EXTERNAL POWER CURRENT⁴	8-36 VDC (not required for normal operation); Sleep: 0.10 mA typical Measurement: 16 mA typical, 45 mA max	
HEX SCREW DRIVER	0.050", 1.3 mm	
COMMUNICATION DEVICE	TROLL Com or Wireless TROLL Com	
CABLE OPTIONS	Vented or non-vented polyurethane or vented Tefzel®	
LCD DISPLAY	Integrated display shows status of sonde, sensor ports, data log, battery and connectivity.	Integrated display shows status of sonde, sensor ports, power voltage and connectivity, enable/disable BT.
SOFTWARE	Android™: VuSitu through Google Play and Amazon® App Store iOS: VuSitu through Apple® App Store, Windows: Win-Situ 5 Data Services: HydroVu	
INTERFACE	Android 4.4, requires Bluetooth 2.0; Win-Situ 5 Software	
CERTIFICATIONS	CE, FCC, WEEE, RoHS Compliant	

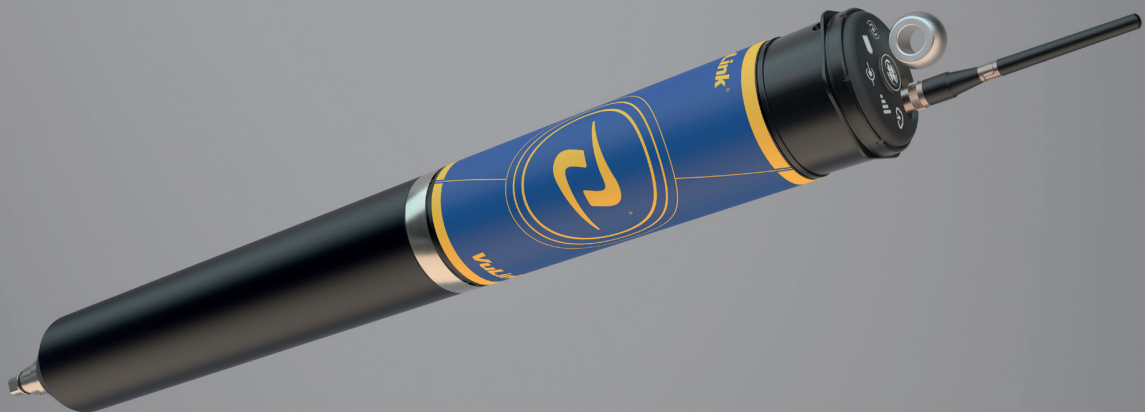
WARRANTY: 2 year – Sonde, RDO and Sensor Cap, Temperature/Conductivity, Temperature Only, Turbidity, Chlorophyll a, Phycocyanin (BGA-PC), Phycoerythrin (BGA-PE), Rhodamine WT, Wiper; 1 year – pH/ORP, Chloride ISE, Accessories; 90 Days – Nitrate and Ammonium ISE Sensors; See warranty policy (www.in-situ.com/warranty) for full details.



SENSOR	ACCURACY	RANGE	RESOLUTION/ PRECISION	RESPONSE TIME	UNITS OF MEASURE	METHODOLOGY
TEMPERATURE ⁵	± 0.1° C	-5 to 50° C (23 to 122° F)	0.01° C	T63<2s, T90<15s, 95<30s	Celsius or Fahrenheit	EPA 170.1
BAROMETRIC PRESSURE	± 1.0 mbars	300 to 1,100 mbar	0.1 mbar	T63<1s, T90<1s, T95<1s	Pressure: psi, kPa, bar, mbar, inHg, mmHg	Silicon strain gauge
pH ⁶	±0.1 pH unit or better	0 to 14 pH units	0.01 pH	T63<3s, T90<15s, 95<30s	pH, mV	Std. Methods 4500-H+/ EPA 150.2
ORP ⁷	±5 mV	±1,400 mV	0.1 mV	T63<3s, T90<15s, 95<30s	mV	Std. Methods 2580
CONDUCTIVITY ⁸	±0.5% of reading plus 1 µS/cm from 0 to 100,000 µS/cm; ±1.0% of reading from 100,000 to 200,000 µS/cm; ±2.0% of reading from 200,000 to 350,000 µS/cm	0 to 350,000 µS/cm	0.1 µS/cm	T63<1s, T90<3s, T95<5s	Actual conductivity (µS/cm, mS/cm); Specific conductivity (µS/cm, mS/cm); Salinity (PSU); Total dissolved solids (ppt, ppm); Resistivity (Ohms-cm); Density (g/cm3)	Std. Methods 2510/ EPA 120.1 ±1,400 mV
TDS (DERIVED FROM CONDUCTIVITY AND TEMP)	-	0 to 350 ppt	0.1 ppt	--	ppt, ppm	--
SALINITY (DERIVED FROM CONDUCTIVITY AND TEMP)	--	0 to 350 PSU	0.1 PSU	--	PSU, ppt	Std. Methods 2520B
RUGGED DISSOLVED OXYGEN (RDO) WITH RDO-X ⁹ OR RDO FAST CAP	±0.1 mg/L ±2% of reading	0 to 20 mg/L 20 to 60 mg/L	0.01 mg/L	RDO-X: T63<15s, T90<45s, T95<60s Fast Cap: T63<3s, T90<30s, T95<45s	mg/L, % saturation, ppm	EPA-approved In-Situ Methods: 1002-8-2009, 1003-8-2009, 1004-8-2009
TURBIDITY	±2% of reading or ±0.5 NTU, FNU, whichever is greater	0 - 4,000 NTU 0 - 1,500 mg/L	0.01 NTU (0 - 1,000); 0.1 NTU (1,000 - 4,000) 0.1 mg/L	T63<1s, T90<1s, T95<1s	NTU, FNU ppt, mg/L	ISO 7027
TSS (DERIVED FROM TURBIDITY) ¹⁰	--	0 to 1,500 mg/L	0.1 mg/L	--	ppt, mg/L	--
AMMONIUM (NH4 + -N) ^{11, 12} RATED TO 25 m DEPTH -Unionized Ammonia, Total Ammonia (derived from Ammonium & pH sensor)	±10% or ±2 mg/L w.i.g. (specs valid for freshwater)	0 to 10,000 mg/L as N	0.01 mg/L	T63<1s, T90<10s, T95<30s	mg/L, ppm, mV	--
		0 to 10,000 mg/L as N	0.01 mg/L	--	mg/L, ppm	--
NITRATE (NO3 -- N) ⁸ RATED TO 25 m DEPTH	±10% or ±2 mg/L w.i.g. (specs valid for freshwater)	0 to 40,000 mg/L as N	0.01 mg/L	T63<1s, T90<1s, T95<1s	mg/L, ppm, mV	Std. Methods 4500 Cl- D
CHLORIDE (CL-) ⁸	±10% or ±2 mg/L w.i.g. (specs valid for freshwater)	0 to 150,000 mg/L as Cl	0.01 mg/L	T63<1s, T90<1s, T95<1s	mg/L, ppm, mV	Std. Methods 4500 Cl- D
PRESSURE (OPTIONAL) ¹⁰	±0.1% FS from -5 to 50°C	AQUA TROLL 500 Non-Vented or Vented 9.0 m (30ft) (Burst: 27 m; 90 ft) 30 m (100 ft) (Burst: 40 m; 130 ft) 76 m (250 ft) (Burst: 107 m; 350 ft) 100 m (325 ft) - Burst: 200 m (650 ft.) AQUA TROLL 600 Non-Vented or Vented 9.0 m (30ft) (Burst: 27 m; 90 ft) 30 m (100 ft) (Burst: 40 m; 130 ft) 76 m (250 ft) (Burst: 107 m; 350 ft) 200 m (650 ft) (Burst: 229 m; 750 ft)	0.01% full scale	T63<1s, T90<1s, T95<1s	Pressure: psi, kPa, bar, mbar, inHg, mmHg Level: in, ft, mm, cm, m, cmH2O, inH2O	Piezoresistive; Ceramic

SENSOR	LINEARITY	INSTRUMENT DETECTION LIMIT	RANGE	DISPLAY RESOLUTION	RESPONSE TIME	DEFAULT UNIT(S)	DERIVED PARAMETERS
Chlorophyll a	R2>0.999 for serial dilutions of Chl a in MeOH across full range	0.1 µg/L Chl a in MeOH	0-100 RFU 0-1000 µg/L	0.001 RFU	T63<1s, T90<1s, T95<1s	RFU	Chlorophyll a concentration Chlorophyll a cell count
Phycocyanin (BGA-PC)	R2>0.999 for serial dilutions of PC standard across full range	1.0 µg/L PC standard	0-100 RFU 0-1000 µg/L	0.001 RFU	T63<1s, T90<1s, T95<1s	RFU	Phycocyanin Concentration
Phycoerythrin (BGA-PE)	R2>0.999 for serial dilutions of PE standard across full range	0.5 µg/L PE standard	0-100 RFU 0-1000 µg/L	0.001 RFU	T63<1s, T90<1s, T95<1s	RFU	Phycoerythrin Concentration
FDOM	R2>0.999 for serial dilutions of Quinine Sulfate across full range	0.5 µg/L Quinine Sulfate	0-100 RFU 0-3000 µg/L	0.001 RFU	T63<1s, T90<1s, T95<1s	RFU	FDOM Concentration CDOM Concentration
Crude Oil	R2>0.999 for serial dilutions of PTSA across full range	1.0 µg/L PTSA ¹³	0-100 RFU 0-3000 µg/L	0.001 RFU	T63<1s, T90<1s, T95<1s	RFU	Crude Oil Concentration
Rhodamine WT	R2>0.999 for serial dilutions of RWT across full range	0.5 µg/L Rhodamine WT	0-100 RFU 0-1000 µg/L	0.001 RFU	T63<1s, T90<1s, T95<1s	RFU, µg/L	
Fluorescein WT	R2>0.999 for serial dilutions of FWT across full range	0.2 µg/L Fluorescein WT	0-100 RFU 0-500 µg/L	0.001 RFU	T63<1s, T90<1s, T95<1s	RFU, µg/L	

NOTES: ¹For 30 parameters >100,000 data records, > 3 years at 15 min. interval. A single data record includes timestamp, temperature, RDO, pH, ORP, turbidity and conductivity logged in Linear or Linear Average mode. ²Log data recorded to SD card in comma delimited variable (CSV) file format. Greater than 32 GB not supported. ³Logging all sensors at 15 min interval on 2 D Alkaline batteries. Battery life dependent on site conditions and wiping. ⁴Dependent on display and wiping. ⁵Typical system response with instrument, sensors and restrictor when changing approximately 15°C in moderate flow. ⁶Response time at thermal equilibrium. ⁷Accuracy from calibration standard @ 25C, response-at thermal equilibrium immediately following calibration measuring from air to +400 mV. ⁸Accuracy at calibration points. ⁹RDO sensor full range 0-60 mg/L, 0-600% sat. EPA-approved method under the Alternate Test Procedure Process. ¹⁰User-defined reference. ¹¹Between 2 calibration points immediately following proper conditioning and calibration. Varies on site conditions and environmental interferents. See sensor summary sheet for potential interferences. ¹²Average response; can be longer with increasing concentrations of ammonium. ¹³Typical performance across full temperature and pressure calibrated range. ¹⁴Extended warranty option for sonde only (1 to 3 year extension for up to 5 years total). Specifications are subject to change without notice.



VuLink Data Logger and Telemetry

VULINK IS A GLOBAL CELLULAR AND SATELLITE TELEMETRY DEVICE THAT WILL CHANGE THE WAY YOU THINK ABOUT REMOTE MONITORING. OUR TURNKEY SOLUTION IS EASY TO SET UP, WORKS FROM ANYWHERE, AND DELIVERS LONG-LASTING POWER. SO, YOU NEVER HAVE TO WORRY ABOUT YOUR EQUIPMENT OR YOUR DATA.

ONE-PRESS SETUP

- VuLink autodetects any In-Situ device with one button press or scheduled report. Icons indicate battery life, instrument connection, network connection and HydroVu connection.

EXPANDED COVERAGE

- VuLink is truly global, offering cellular coverage across multiple networks. Future proof your system for decades with 4G LTE Category M1/NB-IoT technology, while ensuring backwards compatibility with quad-band 2G coverage.
- VuLink is also the first in-well Iridium satellite device featuring customized data compression and low power usage to lengthen battery replacement cycles.

FREE GLOBAL CELLULAR DATA

- VuLink offers free cellular data for life, right out of the box, no set up required. See back for details.

EXTENDED LIFE

- VuLink offers two-to-five times the battery life of similar devices. M1 and NB-IoT offer extraordinary power savings. And at faster reporting rates, VuLink offers exponential savings - more than two years of battery life at 15-minute reporting intervals.
- Say good-bye to custom, expensive batteries - VuLink uses off-the-shelf alkaline and lithium D cell batteries.



Applications:

- CONTINUOUS GROUNDWATER MONITORING
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- SALT WATER INTRUSION MONITORING
- STORMWATER MONITORING
- REMEDIATION
- WASTE MANAGEMENT
- IRRIGATION
- MINING WATER MANAGEMENT
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1-970-498-1500 (U.S.A. and international)

ELECTRICAL	CELLULAR	SATELLITE
BATTERY	3 x D cell (1.5V - 3.6V) Alkaline / Li-SOCl ₂ [Lithium Thionyl Chloride] / Li-MnO ₂ [Lithium Manganese Dioxide] supported. Li-MnO₂ [Lithium Manganese Dioxide] recommended for best performance	
OPERATION TIME (24 hour reporting, Li-MnO ₂)	Up to 12 years*	Up to 3 years*
OPERATION TIME (24 hour reporting, Alkaline)	Up to 3 years*	Up to 1 year*
OPERATION TIME (hourly reporting, Li-MnO ₂)	Up to 2 years*	Up to 6 months*
CLOCK ACCURACY	Less than 1 minute drift per year with ability to synchronize to network provided time for accuracy +/- 1 second	
NETWORK COMMUNICATION	CELLULAR	SATELLITE
NETWORK TYPE	4G LTE Category M1 (LTE-M) / NB-IoT (Narrow Band) with 2G fallback	Iridium Short Burst Data
BANDS	LTE Global - B1(2100), B2(1900), B3(1800), B4(AWS1700), B5(850), B8(900), B12(700), B13(700), B18(800), B19(800), B20(800), B28(700) Verizon - B4(AWS1700), B13(700) 2G Quadband - B2(1900), B3(1800), B5(850), B8(900)	N/A
PROTOCOLS	HTTPS (HydroVu), SMS (alarms)	HydroVu
DATA PROVIDER	Built-in free** global roaming (see Network List Addendum for details: in-situ.com/VuLinkNetworks), additional single 4FF slot for 3rd party SIM support	Iridium Short Burst Data
ANTENNA	SMA-M connector	
GPS	Up to 3m accuracy, built-in antenna	
FILE FORMAT (non-HydroVu)	CSV	N/A
REMOTE SETUP	Supported	
MECHANICAL	CELLULAR	SATELLITE
DIAMETER	1.85 in / 47 mm	
LENGTH	19.1 in / 485 mm	
WEIGHT	2.2 lb / 1.0 kg (with included alkaline batteries and carabiner, excluding antenna)	
MATERIALS	Ryton (housing), PVC (battery cover), Titanium (Twistlock connector, eyebolt), 316 Stainless Steel (carabiner), Silicone (keypad cover), Brass (SMA antenna connector), Polycarbonate (label), Viton (O-rings)	
STORAGE TEMPERATURE	-20°C to 60°C	
OPERATING TEMPERATURE	-20°C to 50°C (Li-SOCl ₂ /Li-MnO ₂), 5°C - 40°C (Alkaline)	
INGRESS PROTECTION	Device: IP68 System: Up to IP68 per antenna specification	
INSTRUMENT COMMUNICATION	CELLULAR	SATELLITE
PROTOCOLS	Modbus over RS-485, Pulse low/high frequencies (max 40 kHz)	
CONNECTORS	1 In-Situ Twistlock (supports multiple instruments via Rugged Cable Splitter, TROLL Net Hub, or Load-Bearing Universal Adapter)	
SIMULTANEOUS CONNECTIONS	Up to 8 instruments (total maximum of 75mA provided to connected instruments at 16V)	
VENTING	Built-in on all models, no desiccant required	
BAROMETRIC COMPENSATION	Built-in on all models for automatic compensation of non-vented level readings	
BAROMETER ACCURACY	+/- 1 hPa	
ALARMS	Configurable based on instrument readings and device parameters, second reading/reporting schedule available when in alarm state	
POWER	Total maximum of 75mA provided to connected instruments at 16V (intended typically to power a single instrument)	
SETUP	CELLULAR	SATELLITE
WIRELESS SETUP	Supported via Bluetooth Low Energy	
LOGGING RATE	1 minute to 7 days	
TRANSMISSION RATE	5 minutes to 7 days	
MEMORY	512 MB (soldered to circuit board)	
WARRANTY	2 YEAR	

www.in-situ.com

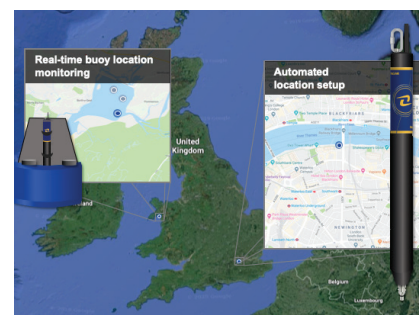
* Measured at a temperature of 23°C, LTE-M network connectivity, internally-powered instrument

** Free up to 1 transmission of 6 data points per day for life of instrument, additional plans can be purchased at hydrovu.com

1-800-446-7488 (toll-free in U.S.A. and Canada) • 1-970-498-1500 (U.S.A. and international)

221 East Lincoln Avenue, Fort Collins, CO 80524 USA

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Continuous GPS - HydroVu uses VuLink's GPS to automatically locate and mark devices on maps, syncing devices and locations, increasing data quality, and making it easier to track free-floating buoys.



Encrypted Connections - VuLink with HydroVu offers SSL encryption of your data, and VuLink can password protect all local connections to prevent backdoor access.



Free Global Cellular Data - VuLink and HydroVu offer free data up to 1 transmission for 24 data points per day. Additional plans can be purchased at Hydrovu.com. No more worrying about provisioning SIM cards and checking multiple systems for data usage. VuLink works with all LTE networks that support LTE-M1/NB-IoT. For a complete list visit in-situ.com/VuLinkNetworks.

Expanded Connectivity - VuLink also can read high frequency and low frequency pulse inputs, configured in VuSitu. And the device's new **Load-Bearing Universal Adapter** can connect to anything.



MARINE

Ø1250mm Gannet Navigation Buoy

The G1250 Gannet Navigation Buoy has a large visual daymark with a nominal focal height of 2m. The Gannet buoy has a modular design with a unique central core steel arrangement connecting the lifting eyes to the mooring eyes for superior strength and durability. It's manufactured using marine grade (UV Stabilised) polyethylene material.

The central core design includes two mooring eyes fitted with a unique replaceable bushing system, extending the operational life of the buoy. The use of a twin bridal mooring provides greater stability and mooring flexibility when used in locations with fast water currents. The centre core is fitted with two lifting eyes for ease of manoeuvrability during installation or servicing.

Available in all the IALA recommended colours and configurations with optional daymark cone or can shape.

Certification

- Manufactured to ISO 9001:2015 quality assurance systems
- Full Certification to EN 1090 CE Marking of Steel
- We are a member of IALA (Association of Marine Aids to Navigation and lighthouse Authorities)
- Our buoys and lanterns are manufactured in accordance with IALA guidelines



JFC MARINE

Weir Road, Tuam, Co. Galway,
H54 RX46, Ireland

Tel. +353 93 24066
Email: info@jfcmarine.com

www.jfcmarine.com

Product Features

Features and Benefits:

- Manufactured from marine grade (UV stabilised) virgin polyethylene.
- Solid ballast plate adding extra protection to the underside of the buoy hull.
- Reduced hydrodynamic drag and the watch circle (swing radius).
- 316 Grade stainless steel top mark handrail.
- Fitted with two large lifting eyes for ease of installation and during maintenance.
- Mooring eyes (bridal system) for increased stability in harsh marine environments.
- Mooring eyes fitted with replaceable sacrificial wear bushings.
- Stands upright on the deck of vessel for ease of storage on site.
- Modular design making it easier to replace damaged parts if necessary.
- Replaceable sacrificial anodes for corrosion protection.
- Open central core for data applications available.
- All JFC Marine Buoys are manufactured using 100% recyclable material.

Product Code	G1250
Description	Ø1250 Gannet Navigation Buoy
Diameter	Ø1250mm
Nominal Focal Height	2000mm
Nominal Height	3100mm
Nominal Draft	470mm
Nominal Weight	280kg
Top Marks	In accordance with IALA Maritime Buoyage System
Colours	In accordance with IALA Maritime Buoyage System
Life Expectancy	Up to 20 years
Lantern Options	Self-Contained Lanterns, lantern only options on request

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MARINE
Aids To Navigation

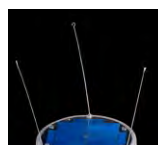
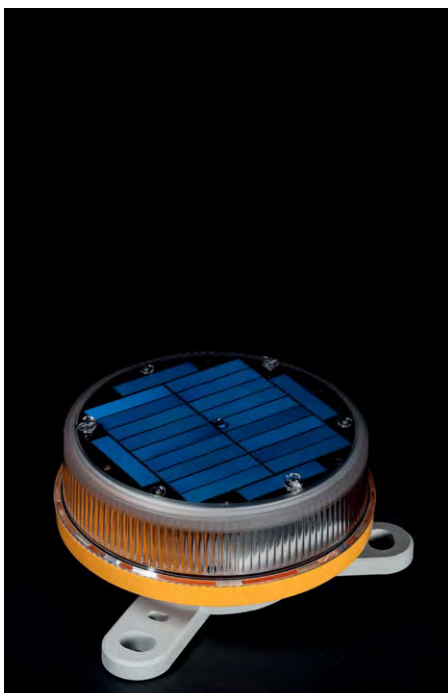
www.jfcmarine.com

M660

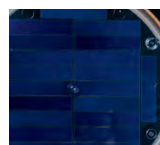
Self-contained LED lantern for buoys and minor beacons, up to 4 NM Range

The M660 is a high-performance, long life, easy-to-use and cost effective self-contained solar LED marine lantern. The M660 features a Li-ion battery pack that extends the service life of the lantern up to eight years. M660 has four different mounting options and can be programmed and controlled with Bluetooth® Control. To view performance in your installation location, visit Marine Selector Tool at www.carmanahmarine.com/selector.

- Standard IALA colours Red, Green, White, Yellow, Blue
- Ventilated battery compartment
- Adjustable intensity and range
- Vertical divergence > 8° (FWHM)
- High-efficiency solar cells. Maximum Power Point Tracking (MPPT) for optimal energy collection
- Premium grade UV resistant, polycarbonate/polysiloxane co-polymer body and lens material
- IP 68 rated. O-ring sealing with waterproof vent. Battery case is also IP68 (duration under test)
- Li-ion battery, optional dual pack
- Programmable with Bluetooth® Control and IR-Programmer
- Optional ON/OFF switch, external charger and charging port



Bird Deterrents
Stainless steel as standard.



Solar Modules
High-efficiency cells. Maximum Power Point Tracking (MPPT) for optimal energy collection.



Li-ion
Replaceable Li-ion battery pack with extreme temperature range and up to 8-year life expectancy.



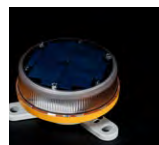
Colour Indicator
Protective bumper indicates LED colour.



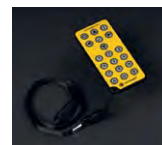
Installation
Four different mounting options Dual bolt circles standard (150 and 200 mm, 3 holes). Two pole mounting options.



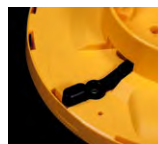
Pole Mount
Pole mount by removing adapter. 2.5" or 6 cm diameter and smaller and 4" or 10 cm diameter (nominal, sched. 40)



Bluetooth® Control
Lantern can be programmed and battery status checked up to 50 meters distance with an app for Android and iOS.

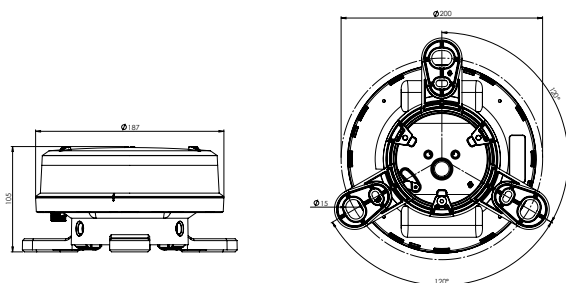


IR Controller
Set intensity, change flash code, check battery status, set ship mode and turn lantern off with optional IR (Infrared) controller.



External Switch
An optional external switch can be installed.

Technical Specification M660



Optical performance

Maximum fixed intensity

40 cd 42 cd 71 cd 52 cd 18 cd

NOTE: Peak IALA intensity dependent on location. To view performance in your installation location, visit www.carmanahmarine.com/selector.

Main Technical Specification

Lens visual/Mechanical diameter	177 mm
Lens material	UV stabilized Polycarbonate
Light source	High Power Light Emitting Diode (LED)
Vertical divergence	>8° (FWHM)
Solar module	High efficiency cells; MPPT
Battery	Li-ion (IEC 61233)
Degree of ingress protection	IP 68
Weight	0.8 kg
Overall height (excl. bird deterrents)	105 mm
Installation (adapter)	3 x M6 on 150mm and 3 x M12 on 200mm
Installation (pole mount)	3 x #10-14 60mm or 73mm diameter

Order Overview M660

Option matrix

M660 Switched	ON/OFF switch
M660 Unswitched	No ON/OFF switch
M660 Dual Battery	Dual Battery Pack
M660 Charge Port	With Charge Port

Accessories

69934	660 Bird Deterrent – Single
79848	Spare adapter (incl. screws)
79273	Optional switch
79399	660 Battery Replacement Pack
69885	660 International Wall Charger Assembly
69899	IR (Infrared) Programmer
38334	660 Standard Bolt Kit
79400	660 Dual Battery Replacement Pack

Product codes

Colour	M660 unswitched	M660 switched	M660 dual battery	M660 charge port
red	M660R	M660R-S	M660R-2B	M660R-C
green	M660G	M660G-S	M660G-2B	M660G-C
white	M660W	M660W-S	M660W-2B	M660W-C
yellow	M660Y	M660Y-S	M660Y-2B	M660Y-C
blue	M660B	M660B-S	M660B-2B	M660B-C

Product code example: M660RSC2B

- **M660R** is Sabik/Carmanah code for M660 in red
- with a selection of switched with charge port and dual battery

Calibration Report

Instrument Aqua TROLL 500
Serial Number 712568
Created 21/02/2023

Sensor **RDO**

Serial Number 988135
Last Calibrated 21/02/2023

Calibration Details

Slope 1
Offset -0.04 mg/L

Calibration point 100%

Concentration 8.91 mg/L
Pre Measurement 90.39 %Sat
Post Measurement 100.00 %Sat
Temperature 15.54 °C
Barometric Pressure 1,004.6 mbar

Calibration point 0%

Concentration 0.05 mg/L
Pre Measurement 0.51 %Sat
Post Measurement 0.00 %Sat
Temperature 13.78 °C

Pre Measurement

RDO Concentration 0.00 mg/L

Post Measurement

RDO Concentration 0.00 mg/L

Sensor **Turbidity**

Serial Number 981341
Last Calibrated 21/02/2023

Calibration Details

Slope 0.9747449
Offset 0.82 NTU

Calibration Point 1

Pre Measurement 9.42 NTU
Post Measurement 10.00 NTU

Calibration Point 2

Pre Measurement 101.73 NTU
Post Measurement 100.00 NTU

Sensor	Conductivity
Serial Number	671222
Last Calibrated	21/02/2023

Calibration Details

TDS Conversion Factor (ppm)	0.65
Cell Constant	0.986
Reference Temperature	25.00 °C

Pre Measurement

Actual Conductivity	1,063.8 µS/cm
Specific Conductivity	1,355.6 µS/cm

Post Measurement

Actual Conductivity	1,108.9 µS/cm
Specific Conductivity	1,413.0 µS/cm

Calibration Report

Instrument Aqua TROLL 500
Serial Number 712609
Created 21/02/2023

Sensor **RDO**

Serial Number 988433
Last Calibrated 21/02/2023

Calibration Details

Slope 1
Offset -0.06 mg/L

Calibration point 100%

Concentration 8.97 mg/L
Pre Measurement 92.67 %Sat
Post Measurement 100.00 %Sat
Temperature 16.48 °C
Barometric Pressure 1,005.5 mbar

Calibration point 0%

Concentration 0.10 mg/L
Pre Measurement 0.98 %Sat
Post Measurement 0.00 %Sat
Temperature 14.22 °C

Pre Measurement

RDO Concentration 0.00 mg/L

Post Measurement

RDO Concentration 0.00 mg/L

Sensor **Turbidity**

Serial Number 981300
Last Calibrated 21/02/2023

Calibration Details

Slope 0.9663901
Offset 0.11 NTU

Calibration Point 1

Pre Measurement 10.25 NTU
Post Measurement 10.00 NTU

Calibration Point 2

Pre Measurement 102.92 NTU
Post Measurement 100.00 NTU

Sensor	Conductivity
Serial Number	667257
Last Calibrated	21/02/2023

Calibration Details

TDS Conversion Factor (ppm)	0.65
Cell Constant	0.897
Reference Temperature	25.00 °C

Pre Measurement

Actual Conductivity	1,140.7 µS/cm
Specific Conductivity	1,468.2 µS/cm

Post Measurement

Actual Conductivity	1,097.8 µS/cm
Specific Conductivity	1,413.0 µS/cm

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