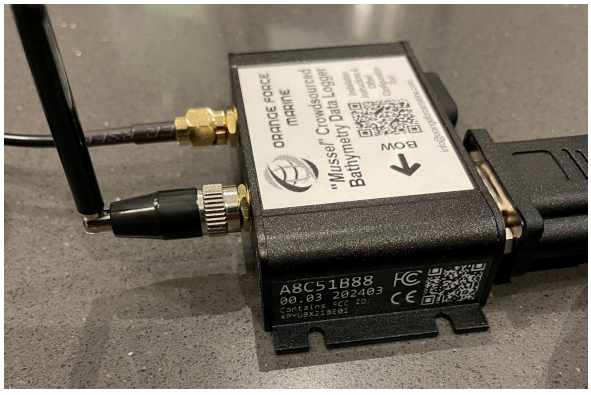
"*Mussel*" Crowdsourced Bathymetry Data Logging Kit
Installation & Operating Instructions

TOOLS AND MATERIALS

- NMEA 2000 Tee, or open port on NMEA 2000 backbone (required)
- Measuring Tape (metric or imperial - required)
- Cable (zip) Ties (for securing wiring - required)
- Double Sided Tape / Velcro (if necessary for installation - optional)
- Notebook & Pen/Pencil (if completing vessel offset worksheet manually - optional)
- Camera (for recording final installation pictures - optional)
- Chartplotter Operations Manual (if necessary - optional)

INSTALLATION

1) **Pre-Plan optimal mounting location for Mussel Kit onboard the vessel**
    a) Consider:
        i) Horizontal (Flat surface) mounting location;
        ii) As near as possible to the vessel's Centreline and Center of Gravity;
        iii) Near a window for good signal reception for GPS receiver and cellular transmissions;
        iv) Sufficient space for routing of wiring and viewing status lights;
        v) Wiring distance to the NMEA 2000 backbone;
        vi) Dry location (inside cabin or console).



2) Secure Mussel Kit in chosen location

a) Use double sided tape, velcro or temporary adhesive on the base of the mounting bracket to affix the Mussel kit to a flat surface;

b) Ensure orientation of the kit in X (Longitudinal), Y (Transverse), and Z (Vertical) directions to ensure quality Inertial Motion Unit (IMU) readings;

BOW

PORT

STARBOARD

STERN

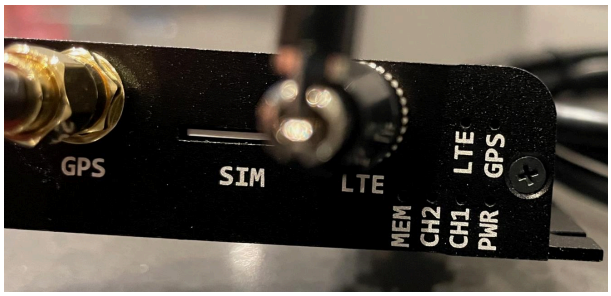
c) Route and affix (magnetic or via double sided tape / velcro) the GPS receiver to a location near a window for good reception.

3) Connect to the NMEA 2000 Backbone

a) Ensure the navigation suite and NMEA 2000 backbone is powered off;
b) Plug the Mussel's NMEA 2000 Mini-C type connector into an open port or add a Tee connector (not included with kit) to the backbone;
   i) In accordance with NMEA 2000 system protocols, ensure that the Tee is installed within the NMEA 2000 Terminators;
c) Route and secure wires (with cable ties) to prevent strain on connections.

4) Power Up System

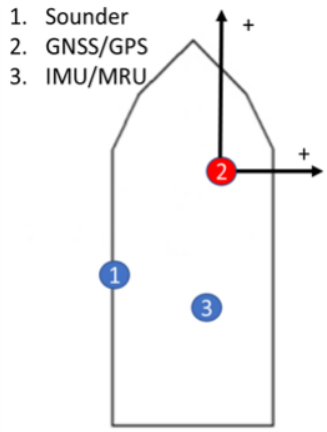
a) Activate the NMEA 2000 network;
b) Switch on navigation system chartplotters and sensors;
c) Verify lights on the Mussel Kit:
   i) Power (Solid Green)
   ii) Ch 1 light (Red Flashing when receiving signals)
   iii) Ch 2 light (Off)
   iv) GPS
      (1) Blinking Blue when fix obtained
      (2) Solid Blue when searching for satellites
   v) LTE / Cellular (Solid Blue only when transmitting)
   vi) MEM / Memory (Red Flashing when writing to SD Card)

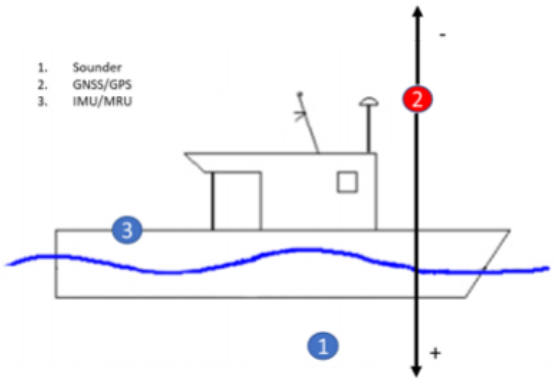


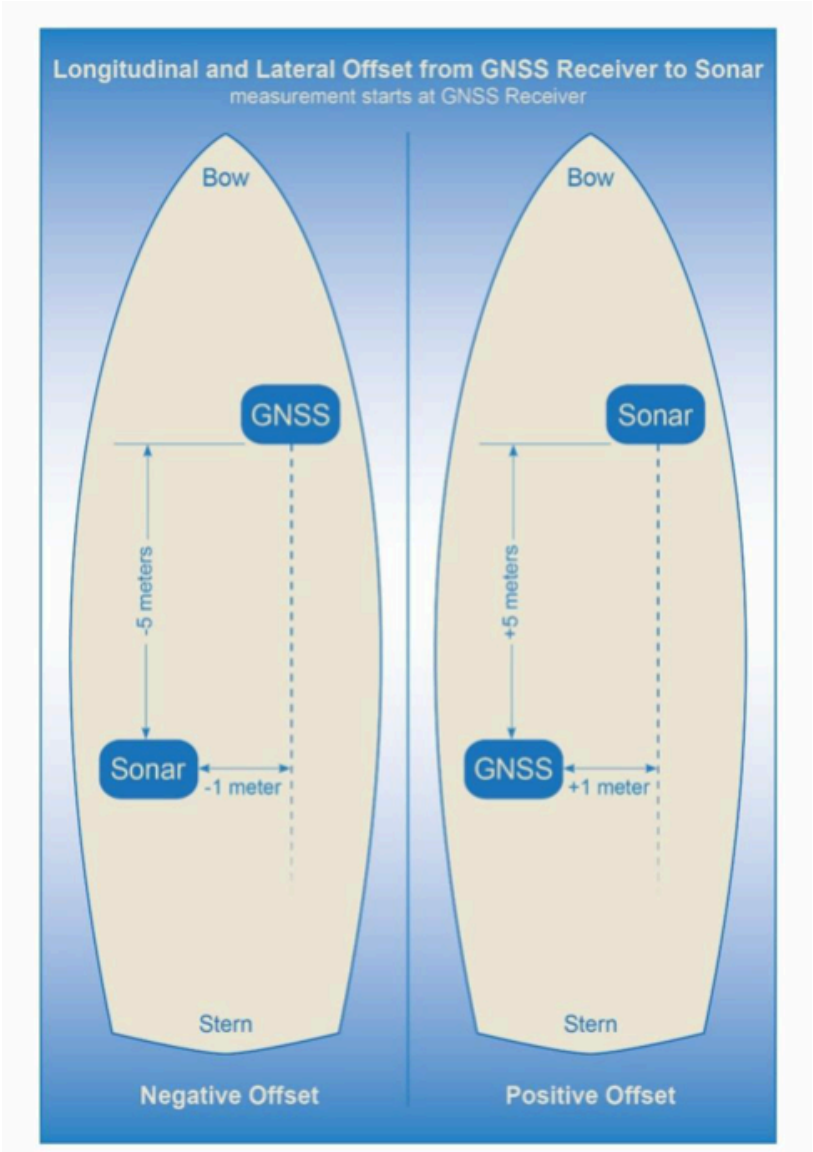
5) **Verify Chartplotter Output of NMEA 2000 / NMEA 0183 signals**
    a) Network output settings vary in chartplotter model (refer to manuals or menus on the unit);
    b) Ensure the chartplotter is outputting the NMEA 2000 Parameter Group Numbers (PGNs) or NMEA 0183 Sentences
        i) Specifically for Water Depth ($DPT on NMEA 0183, PGN 128267)
    c) Verify how the depth is measured in the chartplotter:
        i) Below Transducer?
        ii) Below Keel?
        iii) In Salt Water / Fresh Water
        iv) Sound Velocity (most are 1500 m/s, fresh water correction to 1482 m/s)

6) **Collect Vessel Details for Metadata**
    a) See Annex A - Vessel Data & Offset Worksheet
    b) Use QR code (on Mussel kit label or below) to proceed to Vessel Offset page on Orange Force Marine's website:

7) **Measure Offsets**
    a) Referencing against the vessel's organic GPS antenna (<u>not</u> the Mussel Kit GPS receiver);
    b) Measure distances Longitudinally (Forward and Aft), Laterally/Transversely (Port and Starboard) and Vertically from GPS to the:
        i) Mussel Kit (IMU internal)
        ii) Echosounder Transducer
    c) Distances should be recorded in Meters (m)
        i) Google provides a good means of unit conversions if needed;
    d) Follow the Positive (+) and Negative (-) direction protocols:


1. Sounder
2. GNSS/GPS
3. IMU/MRU
+
+
1
2
3


1. Sounder
2. GNSS/GPS
3. IMU/MRU
-
+
1
2
3


Longitudinal and Lateral Offset from GNSS Receiver to Sonar
measurement starts at GNSS Receiver
Bow
GNSS
-5 meters
Sonar
-1 meter
Stern
Negative Offset
Bow
Sonar
+5 meters
GNSS
+1 meter
Stern
Positive Offset

8) **Contact OFM to ensure that the vessel is connecting to the Cloud**
    a) Verify the system is connecting to cloud based server and transmitting data;
    b) Verify the system is outputting depth and position records (ensures valid data is being recorded and collected);
    c) Verify that the configuration file and firmware is up-to-date and correct.

OPERATION

Provide guidance and instructions to the vessel operators

DO:

d) Watch for lights to confirm operation *(otherwise leave the unit alone!);*
e) Ensure that all wire connections (NMEA DB9 cable, cellular antenna, GPS antenna) are tight;
f) Ensure that wires are not pinched, twisted, folded or pulled inadvertently;
g) Keep the unit and area dry and free from water;
h) Go about regular business and sailing - no need to modify operating practices.

DON'T:

a) Don't place anything on top of the unit (*to ensure signal transmissions and protect the cellular antenna from mechanical damage*);
b) Don't attempt to remove the SD Card or SIM card without Orange Force Marine's specific instructions (*damage may occur, especially if unit is powered up*);
c) Don't power up or operate the unit without the cellular antenna attached (*damage may occur*);
d) Don't change the angle or orientation of the Mussel Kit after installation (*this affects the IMU calculations*);

ANNEX A - Vessel MetDadata and Offset Worksheet

May be completed manually using the table below or electronically via Orange Force Marine's website: https://www.orangeforcemarine.com/crowdsourced-bathymetry

Follow the instructions and complete the worksheet.			
Important Points			
1. All measurements are using the GNSS antenna as the Central Reference Point			
2. All measurements are in meters			
3. Positions in relation to GNSS, to starboard or forward or down are positive; to port or aft or up are negative			
Data Element	**Field Format**	**Data**	**Instructions**
Data logger ID	alphanumeric		Obtain serial number from top left of device sticker on the left hand side of the logger. 
Configuration Effective Date	dd-mmm-yy		Enter the date measurements taken
Date of last use for this configuration	dd-mmm-yy		Leave blank if the first time measuring. If there are changes enter the date of the change for the end date and
Vessel Type	number from the list		Select from the following list:
			1 Recreational - Sailing
			2 Recreational - Power
			3 Emergency Service
			4 Government
			5 Research
			6 Commercial - Sailing

			7 Commercial - Cargo
			8 Commercial - Fishing
			9 Recreational - Other
			10 Commercial - Survey
			11 Commercial - Tug
			12 Commercial - Tour
			13 Ferry Service
			14 Commercial - Other
Vessel Name	alphanumeric		Enter the vessel name
Vessel Length	dddd.dd	m	Enter the vessel's Length Over All (LOA)
Vessel Breadth	dddd.dd	m	Enter the vessel Breadth (width overall)
Vessel Draught	dddd.dd	m	Enter the vessel's keel depth (keel draught at standard loading)
Vessel Unique Identifier	"IMO" or "MMSI"		Select IMO, MMSI or Registration number to identify the vessel
Vessel ID Number	##########		Enter the appropriate MMSI number, IMO number or Registration number
Sounder Make	alphanumeric		Enter the manufacturer (Raymarine; Furuno, Garmin, Hummingbird, etc)
Sounder model	alphanumeric		Enter the model number or name
Sounder draft	ddd.dd	m	Enter the distance from waterline to sounder
GNSS Make	alphanumeric		Enter the manufacturer
GNSS Model	alphanumeric		Enter the model

Central Reference Point	system setting	GNSS	All measurements should be made from the GNSS antenna
Longitudinal Offset from GNSS to Sounder	dddd.dddd		See Step 7 in the Installation Instructions
Lateral Offset from GNSS to Sounder			
Vertical Offset From GNSS to Sounder			
Longitudinal Offset from GNSS to Mussel Kit			
Lateral Offset from GNSS to Mussel Kit			
Vertical Offset From GNSS to Mussel Kit			
Sounder draft applied	True or False		Indicate if your vessel equipment applies the draft for storing the data, not displaying the data.
Sound speed applied	True or False		Indicate if your vessel equipment applies the sound speed for storing the data not displaying the data.
Calculation Surface Sound Velocity	numeric	1500	Identify the custom sound velocity for the inspection area. - Default for salt water is 1500 m/s
Vessel Equipment Sound Velocity	numeric	1500	Default is 1500 m/s unless changed on the equipment configuration
Number of Transmitters	system setting	1	defaults to 1 due to single beam echosounder

Number of Receivers	system setting	1	defaults to 1 due to single beam echosounder
Position offsets applied	True or False		Indicates if the GNSS position data has the offsets applied for storage, not display
Geodetic Datum EPSG Code	system setting		Insert if known, otherwise leave blank (ie. 4326 for Great Lakes area)
Geographical Area	select a number from the list	7	Identify the area of survey from the list:
			1 Lake Ontario
			2 Lake Erie
			3 Lake Huron
			4 Lake Michigan
			5 Lake Superior
			6 St Lawrence Seaway
			7 - Other
Comments			Enter relevant comments regarding the vessel configuration

Any questions can be directed to Orange Force Marine staff at:
+1(226) 376-0494 or +1 (905) 409-7354 or info@orangeforcemarine.com