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IMPORTANT NOTE: This instrument is manufactured and calibrated to meet product specifications. Please read this manual carefully before installation and operation. Any unauthorized repairs or modifications may result in a suspension of the warranty.

Available in Adobe Acrobat pdf format
CONNECTIONS

Charger and IO
QZ02L Plug Connector
not supplied
Sensor
see pg. 28
USB

not supplied

Charger or optional Break-out Box pg. 27
KEYPAD SYSTEM

The MantaRay uses a menu system. Arrows show the four directions to leave a menu box. Pressing a corresponding keypad arrow will move to the next item in the direction shown. Move the cursor (underline) under numerals and increase or decrease numerals with the ↑ and ↓ keys.

To store calibration values permanently (even through power interruptions), press ✓.

BATTERY

- A built-in rechargeable NiMH battery supplies power for 48 hours continuous operation when fully charged.
- Display brightness is adjustable to conserve power.
- The MantaRay will switch off automatically when the battery is fully discharged.
- Full charge requires approximately 6 to 9 hours charging.
- Sleep mode extends battery life for long term data logging (30 days for 5 minute logging).

CHARGING BATTERY

A 16V AC-DC power module is supplied for battery charging and continuous use. Full charge requires 6-9 hours when fully drained. Solid battery icon and/or full charge adapter icon indicates when battery is fully charged.
**ICONS**

1. ![Message waiting icon](image1)  
   Message waiting. Press ⬆️.

2. ![Data logging off icon](image2)  
   Data logging off.

3. ![Data logging on icon](image3)  
   Data logging on.

4. ![USB file download icon](image4)  
   USB file download.

5. ![File download completed icon](image5)  
   File download completed.

6. ![Download Error icon](image6)  
   Download Error.

7. ![Echo OK icon](image7)  
   Echo OK.

8. ![No Echo icon](image8)  
   No Echo.

9. ![Battery status icon](image9)  
   Battery status / charging icon.

10. ![External Battery Source icon](image10)  
    External Battery Source.

11. ![Full charge powered by 16V adapter icon](image11)  
    Full charge powered by 16V adapter.

12. ![Sleep mode icon](image12)  
    Sleep mode icon indicates that MantaRay is running in sleep mode. The icon appears only during the wake cycle when the display is fully lit.
**MAIN DISPLAY**

The main display shows the units selected from the Units/Mode menu, Flow or Velocity rate being measured, TOTALIZER and RELAY states. The MantaRay will start-up with this display.

**MESSAGE ICON**

Press from the main display to view temperature measurement, status of the data logger battery and error/warning messages provided by the instrument. The Message Icon will appear on the main display if error messages are being generated by the instrument. Press ✓ to return to the main display.

**STATUS**

Press from the MAIN display to view instrument status.

- **Velocity**: Will be displayed in ft/sec or m/sec.
- **Level**: Is displayed in the selected units.
- **Tot**: Displays the current totalizer reading.
- **Signal Cutoff**: Adjust the setting in percent to suppress flow readings at zero flow when fluid swirling or pipe vibration may cause the instrument to continue reading. Example: Signal Cutoff at 5% will force the display and outputs to zero when signal strength drops below 5%.
- **Signal Strength**: Displays percentage of signal being received by the ultrasonic sensor.
- **EC**: Displays level measurement Echo Confidence.
- **Relays 1 2**: Energized relays will display with reversed font eg: ☑
24 HR LOG

Press ◀️ from the MAIN display to view a formatted flow report from instruments with a built-in data logger. Press ◀️ to pan through Level, Velocity and Flow summaries. Press ◄ to scroll down one day or repeatedly to scroll to a specific date. Up to 365 days can be stored. Newest date will overwrite the oldest. Press ✔️ to return to the main display.

PASSWORD

The Password (a number from 0000 to 9999) prevents unauthorized access to the Calibration menu.

From the Main display press ◀️ to get to Password. Factory default password is 0000 and if it has not been changed press ✔️ to proceed to the Menu Selections screen.

If a password is required, press ◀️ to place the cursor under the first digit and ◄ or ◆ to set the number, then ◀️ to the second digit, etc. Press ◀️ or ✔️ to proceed to the Menu Selections screen.

A new password can be stored by going to Special Functions/New Password.
UNITS/MODE

From **Mode** press the ‹键 and then the ↑ or ↓ to select Flow, Velocity or Level. Flow mode displays the flow rate in engineering units (e.g. gpm, litres/sec, etc.) Press the ✓ to store your selection then the ↓ to the next menu item.

From **Linear** press the ‹ key and then the ↑ or ↓ to select your units of measurement. Press the ✓ to store your selection.

Press the ↓ key to move the › symbol to each subsequent menu item and the ✓ to save your selections.

Note: the volume selection "bbl" denotes U.S. barrels.

**Temperature** press ‹ then ↑ ↓ to select C or F.

Press ‹ or ✓ to return to the Menu Selections screen.
CALIBRATION

Press ↓ to Calibration and ↑ to enter. Use ↓ or ↑ to position ↓ before each menu item and ↑ to enter. When settings are completed press ✓ to store and return to the Calibration menu.

20mA Flo

Press ↑ and enter the flow rate value for 20mA.

[5V Flo]
[OFF]

Note: Analogue output can be selected as 4-20mA or 0-5V in Special Functions.

4mA Flo

Press ↑ and enter the flow rate value for 4mA.

[0V Flo]
[OFF]

Lvl Offset

Optional for QZ02L sensor (use for mud or silt conditions). Press ↑ and enter an offset to level measurement. Set to 0.00 when sensor mounted on floor of channel. When sensor is mounted above the floor of the channel enter the distance between channel floor and bottom of sensor. Maximum offset is ± 36” (914 mm).

Note: 4mA is not affected by Lvl Offset settings. 4mA is the bottom of the channel or pipe.

Min Vel

Press ↑ and enter a minimum velocity cutoff. Forward and reverse velocities less than Min Vel will be forced to zero.

Damping

Increase damping to stabilize readings under turbulent flow readings or to reject spurious level readings. Decrease for faster response to changes in flow.

Press ✓ from the Calibration display to return to Menu Selections.
**CHANNEL SETUP**

**Round**  
Select Round for open pipes. Set Max Height to the inner diameter of the pipe.

**Rectangle**  
Select Rectangle for rectangular channels. Enter the channel width.

**Trapezoid**  
Select Trapezoid for trapezoidal shaped channels. Specify the Width and Slope of the channel as shown in the following illustration.

**Egg**  
Select Egg for Egg shaped channels. Enter the Max Height of the channel.
CUSTOM CHANNELS

Reset Data  Old data MUST be removed before entering data for a new channel. Press \( \text{⇧} \) then press \( \text{⇧} \) to \( \text{,Yes} \) and press \( \text{✓} \) to clear old data.

Max Height  Enter the maximum height of the channel.

Division    Divide the maximum height into equal increments (maximum of 40) and enter this division value (example 1”, 1 cm etc.)

Increment # Enter the increment number if you want to edit a previous entry or to skip entering widths for some levels (Note: The custom channel will interpolate widths between entry points).

Width      Enter the measured width of the channel at the level shown (Note: To enter 0 width you must press \( \text{⇧} \) and then \( \text{✓} \) to store a 0 width data point).

Level      Displays the level of the channel for each increment and width entry.

---Custom Channel-----
Type Custom
Reset Data No
Max Height 0.75 ft
Division 0.05 ft
Increment # 0
Width 0.000 ft
Level 0.000 ft

Note:

Custom channel data in equal width increments with variable height measurements must be converted to the format shown above using the “Channel Data Translator” PC software.
RELAY PARAMETERS

Relay
Press † and ‡ to select a relay (2 relays).

Function
Press † or ‡ to select Off, Pulse, Flow, Velocity or Level.

Flow
On Position the cursor under the numerals and press † or ‡ to set
digits to the relay On set point.
Off set digits to the Off set point.

Pulse
Press † and set digits to the flow volume per relay pulse. Use
this feature for remote samplers, chlorinators or totalizers.
Minimum time between pulses is 2.25 seconds and pulse
duration is 350 milliseconds.

Return to Relay and enter settings for each relay.

Velocity
On Position the cursor under the numerals and press † or ‡ to set
digits to the relay On set point.
Off set digits to the Off set point.

Level
On Position the cursor under the numerals and press † or ‡ to set
digits to the relay On set point.
Off set digits to the Off set point.
LOE mode Specify the state of the relay for loss of echo condition:
Off, On or Hold.

Press ✓ to return to Menu Selections
DATA LOGGING

Setup

Select Data Logging from Menu Selections.

Log Site ID Enter a number from 00 to 99. The site ID will become part of the downloaded file name to help distinguish downloads from different instruments. Press \checkmark to store the setting.

Mode Select Velocity, LVT, Level or Flow. Press \checkmark to store the setting.

Set Date Press \uparrow or \downarrow to scroll and select Month, Day and Year. Press \checkmark to store the setting.

Set Time Press \uparrow or \downarrow to select the current time in Hours, Minutes and Seconds. Press \checkmark to store the setting.

Interval Press \uparrow or \downarrow to select the logging interval. Press \checkmark to store the setting.

Log Stop, Start or Delete the log file. Press \uparrow or \downarrow to Delete and \checkmark to delete the log file. Press \uparrow or \downarrow to Start and \checkmark to start the logger.

Note: You MUST delete old log and start a new log AFTER having set changes to Log Site ID, Mode and/or Interval for those changes to be applied to the log file.

View 24-hr formatted Reports on the MantaRay display. Press \leftarrow from the MAIN display to view a formatted flow report from instruments with a built-in data logger. Press \leftarrow to pan through Level, Velocity and Flow summaries. Press \downarrow to scroll down one day or repeatedly to scroll to a specific date. Up to 365 days can be stored. Newest date will overwrite the oldest. Press \checkmark to return to the main display.
**RETRIEVE LOG FILE**

Plug a USB Flash Memory Drive (not supplied by Greyline) into the USB output cable from the instrument. The instrument display will show the USB file download icon until the log file is transferred to the memory card and then display file download completed icon. The USB flash drive may be removed.

Download file names will appear in this format:

```
AVFM__00A.LOG
```

Tag is set according to the Log Site ID entered in the instrument Data Logging menu.

Download letter will be A for the first download from an instrument. B for the second, then C etc. At the letter Z a - character will appear indicating that the maximum number of downloads for that instrument are on the USB flash drive. Older files can be erased or moved from the flash memory drive or a new memory drive can be used.

**OPENING LOG FILES**

Install Greyline Logger on your PC or laptop. Refer to the Help menu in the program for detailed instructions.

Select File/Open/Instrument Log (.log) to open the log file from your USB flash drive.
**SPECIAL FUNCTIONS**

<table>
<thead>
<tr>
<th>Language</th>
<th>Select English, French or Spanish</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Out</td>
<td>Select 4-20mA, 0-5V or OFF mode for the analog output.</td>
</tr>
<tr>
<td>Backlight</td>
<td>Select High, Medium or Low for continuous backlight.</td>
</tr>
<tr>
<td>Reset Totalizer</td>
<td>Press and select Yes to erase and restart the totalizer at zero.</td>
</tr>
<tr>
<td>Negative Totals</td>
<td>Select Yes to have reverse flow readings deducted from the totalizer. Select No to totalize forward flow only and ignore reverse flow.</td>
</tr>
<tr>
<td>Flo Direction</td>
<td>Select On to enable flow direction measurement. Select Off to disable flow direction measurement. Select Invert to invert the sense of the flow measurement.</td>
</tr>
<tr>
<td>Cal Constant</td>
<td>Scales the velocity (&amp; Flow) reading. Set to 1.000 for QZ02L sensor.</td>
</tr>
<tr>
<td>Restore Defaults</td>
<td>Select Yes and press ✓ to erase all user settings and return the instrument to factory default settings.</td>
</tr>
<tr>
<td>New Password</td>
<td>Select any number from 0000 to 9999 and press ✓. Default setting of 0000 will allow direct access to the calibration menus. Setting of any password greater than 0000 will require the password to be entered to access the calibration menus.</td>
</tr>
</tbody>
</table>

Press ✓ to return to Menu Selections.
# MantaRay Portable Area-Velocity Flow Meter

## SIMULATION

Exercises the 4-20mA (0-5V) outputs, digital display and control relays.

<table>
<thead>
<tr>
<th>Test</th>
<th>Actual</th>
</tr>
</thead>
<tbody>
<tr>
<td>Level</td>
<td>0.00in</td>
</tr>
<tr>
<td>Velocity</td>
<td>10ft/s</td>
</tr>
<tr>
<td>Flow</td>
<td>1982.88USG/m</td>
</tr>
<tr>
<td>4-20mA Flow</td>
<td>20.00</td>
</tr>
<tr>
<td>Relays</td>
<td>1-2</td>
</tr>
</tbody>
</table>

**Test** Select Maximum and press ✓ to simulate maximum Flow, Level and Velocity and to output 20mA (5V) to the analog channels.

Select Minimum and press ✓ to simulate minimum Flow, Level and Velocity and to output 4mA (0V) to the analog channels.

To simulate an intermediate Flow, Level and Velocity set Test to Actual and then enter a value for the Level and Velocity. The Flow calculation, analog outputs and control relays will respond to the simulated values.
INSTALLATION - SENSOR LOCATION

1. Choose a sensor mounting location where silt or deposits are least likely to accumulate.

2. For best results flow should be evenly distributed across the channel and relatively free of turbulence. (The MantaRay is very effective at averaging level and velocity readings in turbulent conditions, but best accuracy and response time is achieved with evenly distributed flow.)

3. Avoid vertical drops, obstructions or elbows immediately up and downstream from the sensor. Locate the QZ02L sensor at least 10 times maximum Head (level) and 10 times the channel width from these flow disturbances.

4. The QZ02L submerged level-velocity sensor requires a minimum water level of 1 in. (25.4 mm).

QZ02L VELOCITY-LEVEL SENSOR MOUNTING

Mount the QZ02L sensor with the stainless steel bracket and hardware supplied. Ensure that the sensor is parallel to the water surface (check with a level). Mount with the tapered end of the sensor pointing upstream and the sensor cable pointing downstream.

Clip or tie wrap the sensor cable securely to the pipe or channel wall.

Note: The mounting bracket is designed to release the sensor if weeds or rags are caught by the sensor.
OPTIONAL PIPE BAND MOUNTING WITH QZ02L SENSOR

Install the stainless steel pipe band with the sensor mounting bracket at the invert (bottom) of the pipe. Ensure that the sensor bracket is parallel to the water surface (check with a level). Mount so the tapered end of the sensor will point upstream and the sensor cable will point downstream. (Turn the ¼” adjustment nut clockwise to expand the bracket and secure to the pipe wall by friction fit.)

Insert the sensor into the mounting bracket and tie-wrap the sensor cable securely to the pipe band using the holes provided.

OPTIONAL QZ02L-DP VELOCITY SENSOR MOUNTING

Mount the velocity sensor at or near the bottom of the channel or pipe in a position where it will be continuously submerged. The QZ02L-DP velocity sensor does not have to be parallel to the water surface. Position where silt or solids will not build-up on the sensor.

CLEANING

Cleaning is not required as a part of normal maintenance.
APPLICATIONS HOTLINE

For applications assistance, advice or information on any Greyline Instrument contact your Sales Representative, write to Greyline or phone the Applications Hotline below:

United States: Tel: 315-788-9500 Fax: 315-764-0419
Canada: Tel: 613-938-8956 Fax: 613-938-4857
Toll Free: 888-473-9546
Email: info@greyline.com
Web Site: www.greyline.com

Greyline Instruments Inc.

Canada
16456 Sixsmith Drive
Long Sault, Ont. K0C 1P0

USA:
105 Water Street
Massena, NY 13662
**PRODUCT RETURN PROCEDURE**

Instruments may be returned to Greyline for service or warranty repair.

1. **Obtain an RMA Number from Greyline** -
   Before shipping a product to the factory please contact Greyline by telephone, fax or email to obtain an RMA number (Returned Merchandise Authorization). This ensures fast service and correct billing or credit.

   When you contact Greyline please have the following information available:
   1. Model number / Software Version
   2. Serial number
   3. Date of Purchase
   4. Reason for return (description of fault or modification required)
   5. Your name, company name, address and phone number

2. **Clean the Sensor/Product** -
   Important: unclean products will not be serviced and will be returned to the sender at their expense.
   1. Rinse sensor and cable to remove debris.
   2. If the sensor has been exposed to sewage, immerse both sensor and cable in a solution of 1 part household bleach (Javex, Clorox etc.) to 20 parts water for 5 minutes. Important: do not immerse open end of sensor cable.
   3. Dry with paper towels and pack sensor and cable in a sealed plastic bag.
   4. Wipe the outside of the enclosure to remove dirt or deposits.
   5. Return to Greyline for service.

3. **Ship to Greyline** -
   After obtaining an RMA number please ship the product to the appropriate address below:

<table>
<thead>
<tr>
<th>Canadian and International Customers:</th>
<th>USA Customers:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Greyline Instruments Inc.</td>
<td>Greyline Instruments Inc.</td>
</tr>
<tr>
<td>16456 Sixsmith Drive</td>
<td>204 150th Avenue</td>
</tr>
<tr>
<td>Long Sault, Ont. K0C 1P0</td>
<td>Madeira Beach, FL 33708</td>
</tr>
</tbody>
</table>

   RMA# RMA#
**AREA-VELOCITY FLOW DATA SHEET**

| Contact: ___________________________ | Title/Dept.: ___________________________ |
| Company: ___________________________ | Project: ___________________________ |
| Address: ___________________________ | ___________________________ |
| Tel: ___________________________ | Fax: ___________________________ |

**SENSOR:**

| Model/Type: ___________________________ | Cable Length: ___________________________ |
| Elec. Class: ___________________________ | Type of Pump: ___________________________ |
| Distance from nearest Pump, Controlling Valve, Orifice or open Discharge: ___________________________ |

**INSTRUMENT:**

| Model/Type: ___________________________ | Power Input: ___________________________ |
| Calibrated Range: ___________________________ | Indication: ___________________________ |
| Operating Temp.: ___________________________ | Alarm: ___________________________ |
| Enclosure Class: ___________________________ | Pulse/Unit: ___________________________ |
| Elec. Class: ___________________________ | Output: ___________________________ |

**SERVICE CONDITIONS:**

| Pipe ID: ___________________________ | % Solids: ___________________________ |
| Pipe Mat'l: ___________________________ |  |  |
| Fluid: ___________________________ | Material Build-up: ___________________________ |
| Oper. Flow: ___________________________ | Vibration: ___________________________ |
| Max. Flow: ___________________________ | Max. Pressure: ___________________________ |
| Min. Flow: ___________________________ | Max. Temp: ___________________________ |

Notes / Sketch Pipe Run:

By: ___________________________ Date: ___________________________
LIMITED WARRANTY

Greyline Instruments warrants, to the original purchaser, its products to be free from defects in material and workmanship for a period of one year from date of invoice. Greyline will replace or repair, free of charge, any Greyline product if it has been proven to be defective within the warranty period. This warranty does not cover any expenses incurred in the removal and re-installation of the product.

If a product manufactured by Greyline should prove defective within the first year, return it freight prepaid to Greyline Instruments along with a copy of your invoice.

This warranty does not cover damages due to improper installation or handling, acts of nature, or unauthorized service. Modifications to or tampering with any part shall void this warranty. This warranty does not cover any equipment used in connection with the product or consequential damages due to a defect in the product.

All implied warranties are limited to the duration of this warranty. This is the complete warranty by Greyline and no other warranty is valid against Greyline. Some states do not allow limitations on how long an implied warranty lasts or limitation of incidental or consequential damages, so the above limitations or exclusions may not apply to you.

This warranty gives you specific legal rights, and you may also have other rights which vary from state to state.

Greyline Instruments Inc.
SS PIPE MOUNTING BAND – OPTION VSJ

Use optional VSJ stainless steel Pipe Mounting Bands for easy Sensor installation in round pipes.

Each Pipe Band includes:
- Band Adjustment Jack allowing ±0.5” (13 mm) adjustment from the nominal band size
- Stainless steel bracket for Sensor mounting
- Pre-drilled for tie wraps (included) to secure Sensor cable

**Code** | **Band Size**
--- | ---
VSJ6 | 6”/150 mm ID pipes
VSJ8 | 8”/200 mm ID pipes
VSJ10 | 10”/250 mm ID pipes
VSJ12 | 12”/300 mm ID pipes
VSJ14 | 14”/350 mm ID pipes
VSJ15 | 15”/375 mm ID pipes
VSJ16 | 16”/400 mm ID pipes
VSJ18 | 18”/450 mm ID pipes
VSJ20 | 20”/500 mm ID pipes
VSJ24 | 24”/600 mm ID pipes
VSJ30 | 30”/750 mm ID pipes
VSJ32-40 | 32-40” / 800-1000 mm ID pipes
VSJ42-54 | 42-54” / 1100-1375 mm ID pipes
VSJ56-72 | 56-72” / 1400-1800 mm ID pipes

Mounting Instructions:

Install the stainless steel pipe band with the sensor mounting bracket at the invert (bottom) of the pipe. Ensure that the sensor bracket is parallel to the water surface (check with a level). Mount so the tapered end of the sensor will point upstream and the sensor cable will point downstream. Turn the ¼” adjusting nut clockwise to expand the bracket and secure to the pipe wall by friction fit.

Insert the sensor into the mounting bracket and tie wrap the sensor cable securely to the stainless steel pipe band.
BREAK-OUT BOX

1. EXT. BATT. –
2. EXT. BATT. +
3. RELAY 1
4. RELAY 1
5. RELAY 2
6. RELAY 2
7. 4-20 +
8. 4-20 –
9. CHARGER +
10. CHARGER –

NEMA 4X / IP66
DUST TIGHT / SPLASH PROOF
MantaRay Portable Area-Velocity Flow Meter

**SPECIFICATIONS**

- **Channel Types:** Round pipe, Rectangular, trapezoid, egg or custom shapes
- **Electronics Enclosure:** Watertight, airtight, dust proof (IP 67) polycarbonate
- **Operating Temp. (Electronics):** -5° to 140°F (-20° to 60°C)
- **Accuracy:**
  - Level: ±0.25% of Range.
  - Velocity: ±2% of Reading.
  - Repeatability and Linearity: ±0.1%
- **Display:** White, backlit matrix - displays flow rate, totalizer, relay states, operating mode and calibration menu
- **Programming:** built-in 5-key calibrator with English, French or Spanish language selection
- **Battery:** internal rechargeable NiMH. 12VDC, 10,000 mAh
- **Battery Charger:** 4.2A (70W Max), 100-240VAC 50/60Hz input, UL and CE listed
- **Outputs/Communications:** 4-20mA, 500 ohm or 0-5VDC (100 mA) by menu selection
  - 2 solid-state Relays, 32V AC/DC max., rated 400mA; programmable for flow proportional pulse (sampler/totalizer), flow and/or level alarm
- **Breakout Box:** Connections for charger input, external battery input, 2 relays, 4-20mA (0-5V)
- **Electrical Surge Protection:** Sensor, 4-20mA outputs and AC power input
- **Data Logger:** Programmable 2-million point data capacity, time and date stamped plus formatted flow reports including Total, Average, Minimum, Maximum and times of occurrence. Includes USB output to Flash Drives
- **Logger Intervals:** programmable 10, 30 sec, 1, 2, 5, 10, 15, 30, 60 min
- **Software:** Greyline Logger for Windows. Graph and data table presentation, level/velocity to flow conversion, exports data to Excel™, exports graphs
- **Approximate Shipping Weight:** 15 lbs. (6.8 kg)

**Velocity/Level Sensor QZ02L**

- **Velocity Measurement Range:** 0.1 to 10 ft/sec (0.03 to 3.05 m/sec)
- **Level Measurement Range:** Minimum Head: 1 in (25.4 mm). Maximum Head: 15 ft. (4.5 m)
- **Operating Temperature:** 5 to 150°F (-15 to 65°C)
- **Exposed Materials:** PVC, polyurethane, epoxy
- **Sensor Cable:** 25 ft. (7.6 m) submersible polyurethane jacket, shielded, 3 coaxial
- **Sensor Mounting:** includes MB-QZ stainless steel mounting bracket
- **Temperature Compensation:** Automatic, continuous