



FLO-PRO™

Model 202 PVM

OPERATOR'S MANUAL



Professional single-axis electromagnetic velocity measurement for streams, sewers, and open channels

AM-202-UM-001 • Revision A – Initial Commercial Release

We simplify professional flow measurement. • Measure with Confidence.



Welcome

Thank you for choosing the Aqua-Magnetics® FLO-PRO™ Model 202 PVM. The FLO-PRO is a professional portable electromagnetic velocity measurement system designed for engineers, municipalities, utilities, environmental professionals, and contractors. Its fully submersible single-axis velocity sensor provides accurate point-velocity measurements for stream profiling, sewer flow measurements, and other open-channel applications.

This Operator's Manual explains installation, operation, maintenance, calibration, and recommended field measurement techniques for the FLO-PRO.

DOCUMENT IDENTIFICATION FLO-PRO™ Model 202 PVM • AM-202-UM-001 • Revision A – Initial Commercial Release



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Section 1 – Introduction

1.1 Product Overview

The FLO-PRO™ Model 202 PVM is a portable single-axis electromagnetic point-velocity measurement system. The compact submersible velocity sensor is positioned in the flow and aligned with the direction of water movement to obtain accurate instantaneous velocity measurements.

1.2 Typical Applications

Stormwater runoff investigations

Open-channel flow studies

Streams and rivers

Irrigation canals

Wastewater channels

Culvert evaluations

Flood investigations

Hydraulic engineering studies

1.3 System Components

Component	Purpose
Electronics Control Unit (ECU)	Signal processing, Wi-Fi, and system control
FLO-PRO™ Velocity Sensor	Single-axis electromagnetic point-velocity measurement
Universal Sensor Mount	Attaches sensor to positioning/wading rod
Sensor Cable	Connects submersible sensor to ECU
Battery System	Portable power
FLO-View™	Browser-based interface
PrecisionTow™	Individual factory calibration

ENGINEERING INSIGHT

The FLO-PRO combines a compact submersible electromagnetic velocity sensor with the same Aqua-Magnetics electronics and FLO-View™ browser-based interface used across the product platform. Proper sensor alignment with the direction of flow is essential because the FLO-PRO measures velocity along a single sensing axis.

Section 2 – Safety

2.1 Introduction

The FLO-PRO™ Model 202 PVM is intended for professional use in streams, sewers, stormwater systems, wastewater channels, irrigation canals, and other open-channel environments. While the instrument is simple to operate, field conditions can present significant hazards. The operator is responsible for evaluating site conditions and following all applicable safety procedures.

2.2 Safety Signal Words

Signal Word	Meaning
DANGER	Will result in death or serious injury if not avoided.
WARNING	Could result in death or serious injury.
CAUTION	May result in minor injury or equipment damage.
NOTICE	Important operating information.

2.3 General Safety

Read this manual before use. Inspect the instrument before each deployment. Never operate damaged equipment.

2.4 Water Hazards

Evaluate water depth, current, footing, weather, and escape routes before approaching the measurement location. Never enter flood waters or rapidly rising streams.

2.5 Traffic Hazards

Use high-visibility PPE and appropriate traffic control whenever working adjacent to roadways.

2.6 Confined Spaces

Do not enter permit-required confined spaces unless all applicable procedures, permits, monitoring, and rescue requirements have been satisfied.

2.7 Battery Safety

Use only approved batteries and chargers. Do not short battery terminals or expose batteries to excessive heat.

2.8 Instrument Handling

Do not lift the instrument by the sensor cable. Avoid striking the velocity sensor or electrodes against rocks, concrete, pipe walls, or other hard surfaces.

2.9 PPE

Appropriate PPE may include safety glasses, gloves, safety footwear, a high-visibility vest, hard hat, and a personal flotation device when required.

2.10 Safe Operating Practices

Inspect the instrument, verify battery charge, connect to FLO-View™, assess the site, keep the ECU above the waterline, and maintain awareness of changing conditions.



BEST PRACTICE

Whenever practical, perform measurements from a stable location using an appropriate wading or positioning rod. Do not enter flowing water when conditions are unsafe.

ENGINEERING INSIGHT

Because the FLO-PRO is a single-axis instrument, correct sensor alignment is part of good field technique. Establish a safe, stable position before concentrating on sensor orientation and measurement location.

Section 3 – Product Overview

3.1 System Overview

The FLO-PRO™ Model 202 PVM is a complete portable velocity measurement system consisting of the Electronics Control Unit (ECU), a fully submersible single-axis electromagnetic velocity sensor and cable, universal sensor mount, rechargeable battery system, and FLO-View™ browser-based software.



Figure 3-1. FLO-PRO™ Model 202 PVM system.

3.2 Major Components

Item	Component	Function
1	Electronics Control Unit (ECU)	Processes signals and hosts FLO-View™
2	FLO-PRO™ Velocity Sensor	Measures single-axis water velocity
3	Universal Sensor Mount	Attaches sensor to positioning rod
4	Sensor Cable	Connects sensor to ECU
5	Shoulder Strap	Supports ECU during field use
6	Battery Pack	Portable 12 V power
7	Battery Charger	Recharges battery pack

3.3 Electronics Control Unit

The ECU contains the excitation electronics, signal conditioning, Cortex M0 processor, Wi-Fi module, power management circuitry, and the embedded FLO-View™ web server. The FLO-PRO uses the same electronics and software platform as the FLO-DETECTOR, with signal processing configured for its single-axis velocity sensor.

3.4 FLO-PRO™ Velocity Sensor

The FLO-PRO velocity sensor is a compact, fully submersible electromagnetic transducer with a durable polyurethane body and carbon electrodes. It has no moving measuring components and is designed for point-velocity measurements in streams, sewers, and open channels.

3.5 Single-Axis Measurement

The FLO-PRO measures the component of water velocity along one sensing axis. For best accuracy, orient the sensor with its measurement axis aligned with the direction of flow. Rotational misalignment causes the measured velocity to be lower than the true forward velocity.

3.6 Sensor Mounting and Positioning

The universal sensor mount allows the FLO-PRO velocity sensor to be attached to an appropriate wading or positioning rod. Secure mounting helps maintain sensor depth and alignment during profiling measurements.

3.7 Battery System

The FLO-PRO uses a rechargeable DeWalt® compatible lithium-ion battery. Batteries are easily exchanged in the field to maximize operating time.

3.8 FLO-View™

FLO-View™ is hosted directly on the ECU and accessed through a standard web browser using Wi-Fi Direct. No application download or internet connection is required.

ENGINEERING INSIGHT

The FLO-PRO should be viewed as a complete measurement system rather than only a sensor. Its submersible electromagnetic transducer, FLO-View™ interface, and PrecisionTow™ calibration work together to simplify professional point-velocity and flow measurements.

Section 4 – Theory of Operation

4.1 Introduction

The FLO-PRO™ Model 202 PVM measures water velocity using a single-axis electromagnetic velocity transducer. The system contains no moving measuring components and determines velocity electronically.

4.2 Electromagnetic Measurement Principle

When conductive water moves through the controlled magnetic field generated by the FLO-PRO velocity sensor, a voltage proportional to the component of velocity along the sensing axis is induced at the electrodes. These low-level signals are amplified, filtered, digitized, and processed by the Electronics Control Unit.



Figure 4-1. FLO-PRO™ single-axis electromagnetic velocity sensor.

4.3 Single-Axis Sensor Alignment

The FLO-PRO measures velocity along a single sensing axis. Accurate measurements require the sensor to be aligned with the direction of flow. As the sensor is rotated away from the flow direction, the measured component decreases.

Figure 4-2. Single-axis sensor aligned with flow versus rotated sensor showing reduced measured component.

4.4 Velocity Measurement

The sensor produces an electrical signal proportional to water velocity along its measurement axis. The ECU conditions and processes this signal continuously and sends the live velocity value to FLO-View™.



Figure 4-3. FLO-PRO™ sensor measurement axis and flow direction.

4.5 Displayed Velocity

The Electronics Control Unit continuously computes and displays the measured point velocity from the single-axis sensor signal.

$$\text{Measured Velocity} = \text{Velocity Component Along Sensor Axis}$$

The live velocity is displayed in FLO-View™ together with the selected engineering units, battery information, and applicable flow-calculation fields.

4.6 Signal Processing

The Electronics Control Unit performs excitation control, low-noise amplification, analog filtering, analog-to-digital conversion, digital filtering, battery monitoring, and wireless communication. Processing occurs continuously in real time.

Figure 4-4. FLO-PRO™ signal processing block diagram.

4.7 Why Sensor Alignment Matters

Ensures the sensing axis follows the direction of flow

Reduces cosine error from rotational misalignment

Improves repeatability between operators

Supports accurate stream and sewer profiling

Allows consistent point-velocity measurements across a cross section

ENGINEERING INSIGHT

The FLO-PRO is designed for accurate single-axis measurements. Proper alignment with the direction of flow, correct sensor depth, stable positioning, and representative site selection are essential for high-quality results.

CHAPTER SUMMARY

The FLO-PRO velocity sensor, FLO-View™, and PrecisionTow™ calibration combine to form a complete measurement system. The single-axis electromagnetic architecture provides a simple, rugged approach to professional stream, sewer, and open-channel velocity measurements.

Section 5 – Package Contents

5.1 Introduction

Carefully inspect the shipping container upon receipt. If shipping damage is observed, notify the carrier immediately. Verify that all standard components are present before placing the instrument into service.



Figure 5-1. FLO-PRO™ system reference.

5.2 Standard Package Contents

Item	Description	Qty	Verify
1	Electronics Control Unit (ECU)	1	☐
2	FLO-PRO™ Velocity Sensor	1	☐
3	8 ft Sensor Cable	1	☐
4	Universal Sensor Mount	1	☐
5	Shoulder Strap	1	☐
6	12 V DeWalt® Compatible Battery	2	☐
7	Battery Charger	1	☐
8	Operator's Manual	1	☐
9	Calibration Certificate	1	☐

10	Carrying Case	1	☐
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5.3 Initial Inspection

Inspect the sensor head for shipping damage.

Verify that the electrodes are clean and undamaged.

Inspect the sensor cable and connectors.

Verify the bubble level is intact.

Confirm battery packs and charger are included.

Review the calibration certificate.

5.4 Missing or Damaged Items

If any components are missing or damaged, retain all packing materials and contact Aqua-Magnetics before placing the instrument into service.

NOTICE

Do not discard the shipping container until the instrument has been inspected and all components have been accounted for.

ENGINEERING INSIGHT

Every FLO-PRO is individually calibrated using the PrecisionTow™ process before shipment. The calibration certificate supplied with the instrument documents the calibration of that specific serial number.

Section 6 – Specifications

6.1 General

The following specifications apply to the FLO-PRO™ Model 202 PVM under normal operating conditions.

Velocity Transducer

Parameter	Specification
Measurement Method	Electromagnetic, single axis
Velocity Range	0–20 ft/s (0–6.09 m/s)
Accuracy	±2% of reading
Zero Stability	±0.05 ft/s (±0.015 m/s)
Resolution	0.01
Body Material	Black polyurethane, Shore 70D
Ingress Protection	IP68 (Velocity Sensor)
Electrodes	Carbon
Cable	8 ft (2.44 m)

Electronics

Parameter	Specification
Main Processor	ARM Cortex M0 (SAMD21)
Wireless	802.11 b/g/n Wi-Fi
User Interface	FLO-View™ browser-based interface
Communications	Wi-Fi Direct

Power

Parameter	Specification
Battery	12 V DeWalt® compatible Li-ion
Charging	External battery charger
Field Operation	Hot-swappable battery packs

Mechanical

Parameter	Specification
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Sensor Dimensions	1.25 in high × 2.38 in long
Sensor Mount	Universal mount included
ECU Support	61 in × 1.5 in shoulder strap

6.2 Recommended Operating Conditions

Keep the Electronics Control Unit above the waterline.

Fully submerge the FLO-PRO velocity sensor at the desired measurement point.

Align the sensor measurement axis with the direction of flow.

Allow readings to stabilize before recording measurements.

ENGINEERING INSIGHT

Published specifications describe instrument performance. Measurement quality also depends on representative site selection, proper sensor alignment and depth, and good field technique.

Section 7 – Assembly & Getting Started

7.1 Introduction

This section describes assembly of the FLO-PRO™ Model 202 PVM and preparation for field operation.

7.2 Unpack the Instrument

Remove all components from the carrying case and verify that the package contents match Section 5. Inspect for visible damage before assembly.

Figure 7-1 Placeholder: Open carrying case.

7.3 Install the Battery

Slide a fully charged DeWalt® compatible battery into the rear battery mount until the latch engages. Verify the battery is secure.

Figure 7-2 Placeholder: Battery installation.

7.4 Connect the Sensor

Connect the FLO-PRO™ Velocity Sensor cable to the ECU. Tighten the connector until fully seated. Do not overtighten.

Figure 7-3 Placeholder: Sensor cable connection.

7.5 Attach the Sensor to a Positioning Rod

Use the supplied universal sensor mount to secure the FLO-PRO sensor to an appropriate wading or positioning rod. Verify the sensor is secure and can be aligned with the direction of flow.

Figure 7-4 Placeholder: Universal sensor mount.

7.6 Position the ECU

Use the shoulder strap or another secure method to keep the ECU above the waterline and accessible during measurements.

Figure 7-5 Placeholder: ECU positioning.

7.7 Power On

Press the power switch. Allow the ECU to complete startup before attempting to connect.

7.8 Connect to FLO-View™

Using a phone or tablet, connect to the FLO-PRO Wi-Fi network. Open a web browser and navigate to the FLO-View™ interface. No application installation or internet connection is required.

Figure 7-6 Placeholder: FLO-View home screen.

7.9 Pre-Measurement Check

Verify battery status, sensor communication, live velocity display, sensor mounting, and correct alignment before collecting measurements.

FIELD CHECKLIST

Battery fully charged



Sensor cable connected

Sensor securely mounted

FLO-View connected

Calibration certificate current

Sensor clean and free of debris

BEST PRACTICE

Complete assembly and verify communication before approaching the measurement location. This reduces setup time and distractions near flowing water.

ENGINEERING INSIGHT

The FLO-PRO was engineered to simplify professional velocity measurement. Its compact submersible sensor and FLO-View™ interface allow operators to move efficiently between stream, sewer, and open-channel measurement points.

Section 8 – FLO-View™ Software

8.1 Overview

FLO-View™ is the browser-based user interface for the FLO-PRO™. The application is hosted directly on the Electronics Control Unit (ECU) and accessed over Wi-Fi Direct using a standard web browser. No application download, software installation, or internet connection is required.

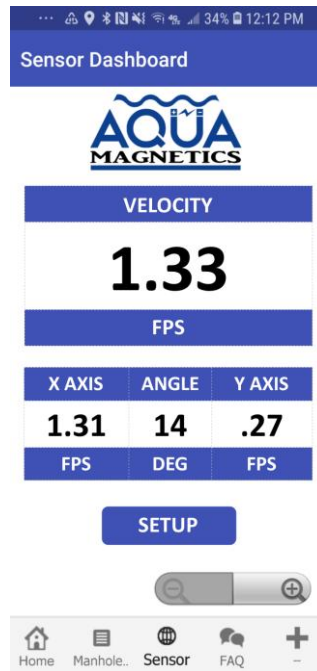


Figure 8-1. FLO-View™ main screen.

8.2 Connecting to FLO-View™

Install a charged battery and power on the ECU.

On the mobile device, open Wi-Fi settings.

Connect to the FLO-PRO Wi-Fi network.

Open a supported web browser.

Navigate to the FLO-View™ interface.

Confirm that live velocity data is displayed.

8.3 Main Screen

Display Item	Description
Velocity	Primary displayed point velocity
Flow	Calculated flow when using applicable profiling/flow functions
Measurement Inputs	Stream or sewer parameters as applicable

Engineering Units	Selected velocity and flow units
Battery Status	Remaining battery capacity
System Information	Instrument and firmware information
Connection Status	Communication with ECU

8.4 Measurement Units

FLO-View™ supports selectable engineering units. Changing display units does not affect the underlying measurement.

8.5 Live Measurements

Velocity values are updated continuously. Allow readings to stabilize before recording results. Natural fluctuations caused by turbulence are normal and should not be interpreted as instrument error.

8.6 Settings

Velocity units

Display preferences

System information

Firmware version

Battery information

8.7 Disconnecting

Close the browser when finished. Power off the ECU after completing field measurements to conserve battery power.

TROUBLESHOOTING

Problem	Corrective Action
Cannot connect to Wi-Fi	Verify ECU is powered on and battery is charged.
No live velocity displayed	Check sensor cable connection and sensor condition.
Browser page unavailable	Reconnect to FLO-PRO Wi-Fi and refresh the browser.

ENGINEERING INSIGHT

Hosting FLO-View™ on the ECU eliminates application installation, simplifies device compatibility, and allows virtually any modern phone, tablet, or computer with a web browser to operate the FLO-PRO.

Section 9 – Field Measurement Techniques

9.1 Objective

The objective of every measurement is to obtain a representative point velocity. The quality of the final measurement depends on site selection, sensor depth, sensor alignment, and operator technique as much as instrument performance.

9.2 Selecting a Measurement Location

Whenever practical, select a straight reach of channel with uniform flow and stable water surface conditions.

Uniform flow with minimal turbulence

Straight channel section

Good operator access

Stable footing

Minimal floating debris

Avoid measurements immediately downstream of culvert outlets, bridge piers, hydraulic jumps, sharp bends, or large obstructions unless these conditions are the subject of the investigation.

Figure 9-1 Good versus poor measurement locations.

9.3 Sensor Position and Alignment

Fully submerge the FLO-PRO velocity sensor at the desired measurement point. Align the sensor measurement axis with the local direction of flow and keep the sensor steady while the reading stabilizes.



Figure 9-2. Typical FLO-PRO™ stream measurement positioning.

9.4 Stabilizing the Reading

Hold the instrument steady.

Allow the displayed velocity to stabilize.

Observe natural fluctuations caused by turbulence.

Record the representative value.

9.5 Typical Applications

Application	Recommended Practice
Streams and Rivers	Profile representative points across a stable cross section; align the sensor with local flow.
Stormwater Channels	Avoid splash zones and hydraulic jumps immediately below structures.
Sewers	Use consistent point locations and sensor alignment when profiling the flow area.
Wastewater Channels	Keep the sensor free of floating debris and grease.
Irrigation Canals	Measure away from gates and control structures where flow becomes uniform.

9.6 Wind, Waves, and Debris

Strong currents, turbulence, floating debris, and air entrainment can influence a point-velocity measurement. Observe site conditions before taking measurements and relocate if debris repeatedly contacts the sensor.

9.7 Common Operator Errors

Error	Result
Measuring in turbulent water	Non-representative velocity
Sensor misaligned with flow	Measured velocity reads low
Inconsistent sensor depth	Reduced repeatability
Ignoring site conditions	Poor quality data

BEST PRACTICE

Observe the flow before taking a measurement and align the sensor with the local direction of water movement. When profiling a stream or sewer, use a consistent measurement procedure at each point.

ENGINEERING INSIGHT

The FLO-PRO is a single-axis instrument. Accurate results depend on proper sensor alignment in addition to representative site selection, correct measurement depth, and careful observation.

CHAPTER SUMMARY

Professional flow measurements begin with professional field technique. By combining good hydraulic judgment with the accurate, fully submersible FLO-PRO™ velocity sensor, operators can obtain fast, repeatable, and dependable point-velocity measurements.

Section 10 – Maintenance

10.1 Routine Maintenance

The FLO-PRO requires minimal routine maintenance. Clean the sensor after each use and inspect the instrument before deployment.

10.2 After Each Use

Rinse sensor with clean water.

Remove debris from electrodes.

Dry ECU and cable.

Recharge battery.

10.3 Periodic Inspection

Inspect cable and connectors.

Inspect sensor body and electrodes.

Check battery contacts.

Review calibration due date.

10.4 Storage

Store the instrument clean and dry inside its carrying case. Remove the battery for long-term storage.

Section 11 – Troubleshooting

11.1 Overview

Most operational issues can be resolved through inspection of power, cable connections, and FLO-View™ communications.

COMMON PROBLEMS

No power – Verify battery installation and charge.

No sensor data – Inspect cable and connector.

Cannot connect to FLO-View™ – Reconnect to Wi-Fi and restart ECU.

Unstable readings – Verify representative flow conditions, full sensor submersion, correct alignment, and clean electrodes.

SERVICE

If problems persist, contact Aqua-Magnetics technical support.

Section 12 – Calibration

12.1 PrecisionTow™

Every FLO-PRO is individually calibrated using the PrecisionTow™ process before shipment.

12.2 Recalibration

Annual factory recalibration is recommended or as required by your quality program.

12.3 Field Verification

Inspect electrodes.

Verify FLO-View™ operation.

Review calibration certificate.

Section 13 – Service

13.1 Factory Service

Contact Aqua-Magnetics before returning an instrument for evaluation or repair.

13.2 Before Shipment

Clean instrument.

Remove accessories not required.

Package securely.

Include problem description and serial number.

Section 14 – Warranty

14.1 Limited Warranty

Aqua-Magnetics warrants the FLO-PRO against defects in materials and workmanship for the published warranty period.

14.2 Exclusions

Accidental damage

Unauthorized modification

Improper use

Normal wear items

14.3 Warranty Service

Contact Aqua-Magnetics for warranty evaluation before returning equipment.





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