

Doppler Ultrasonic Flow Meter User Manual



ATO-RSDOPL-N01-1

1. Product Overview

Doppler flow meters measure flow velocity by calculating frequency changes based on the Doppler effect, and can also measure water level and water temperature. The housing is made of ABS engineering plastic, which is durable, impact-resistant, and provides effective waterproof sealing. It features RS485 communication capabilities for remote data transmission, offering excellent stability and reliability. Compact, highly accurate, lightweight, and with a wide measurement range, it can distinguish flow direction, track flow rates in different directions, and calculate the net forward flow. It is suitable for fluid velocity measurement applications across various industries. It is widely used for measurement and monitoring in open channels, rivers, and partially filled pipelines.

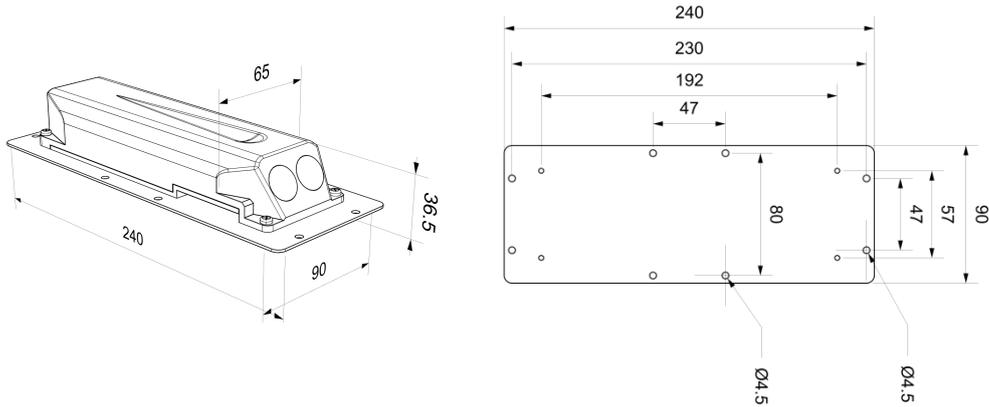
1.1. Features

- Utilizes the ModBus-RTU communication protocol and communicates via RS-485.
- Made with high-quality gas-conducting cables that can withstand year-round immersion in water.
- Multi-layered protective design, offering high protection.
- The equipment features an all-electronic design, with a wide input voltage range, low power consumption, and no mechanical components.
- It can distinguish the direction of water flow and calculate positive cumulative flow, negative cumulative flow, and net flow.

1.2. Technical Specifications

Supply voltage	DC10~30V
Power consumption	Standbycurrent:72mA/12V,measurecurrent126mA/12V
Flow rate	Measurement range: 0.03~10m/s
	Measurement accuracy: $\pm 1.0\% \pm 1\text{cm/s}$ (@0.03~5m/s)
Water depth	Measurement range:0.03~5m
	Measurement accuracy:0.3% $\pm 0.5\text{cm}$
Temperature	Range: -10°C~60°C
	Measurement accuracy: $\pm 1^\circ\text{C}$
Instantaneous flow range	0~99.99m ³
Cumulative traffic range	0.1-999999m ³
Measurement interval	Configurable; default is 3s (min duration is 2s)
Interface type	RS485 (ModBus-RTU)
Operating temp	-10-60°C
Protection level	IP68

2. Product Dimensions



3. Installation Instructions

3.1 Pre-installation Inspection

Equipment List:

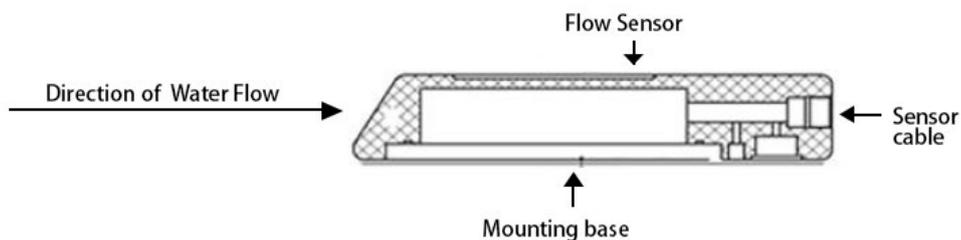
- One Doppler flow meter
- Certificate of Conformity, Warranty Card

3.2 Wiring Instructions

Red line	PowersupplyDC10-30V+
Black line	PowersupplyDC10-30V-
Yellow line	485A
Blue line	485B

3.3 Installation Notes

Ensure that the unit is installed at least 20 cm below the minimum water level, and no less than 5 cm below it, to prevent it from being exposed above the water surface. The Doppler flowmeter mounting plate is equipped with M5 screw holes for securing the flowmeter. Installation diagram:



Consider whether there are branches, weeds, rocks, or high concentrations of silt in the installation site. If debris is present, it is best to install a screening grid in front of the Doppler current meter to filter the water near the device. Clean the equipment promptly to ensure that no foreign objects obstruct the sensor components. Install the sensor horizontally 20 cm below the channel's normal water level, avoiding areas prone to siltation or aquatic vegetation, and try to avoid stagnant water zones near the banks. The sensor should be oriented to face the flow. The sensor cable's vent tube must remain exposed, and the cable must not be kinked to ensure measurement accuracy.

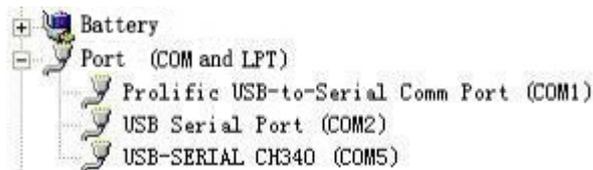
4. Pre-installation Configuration

4.1. Software Selection

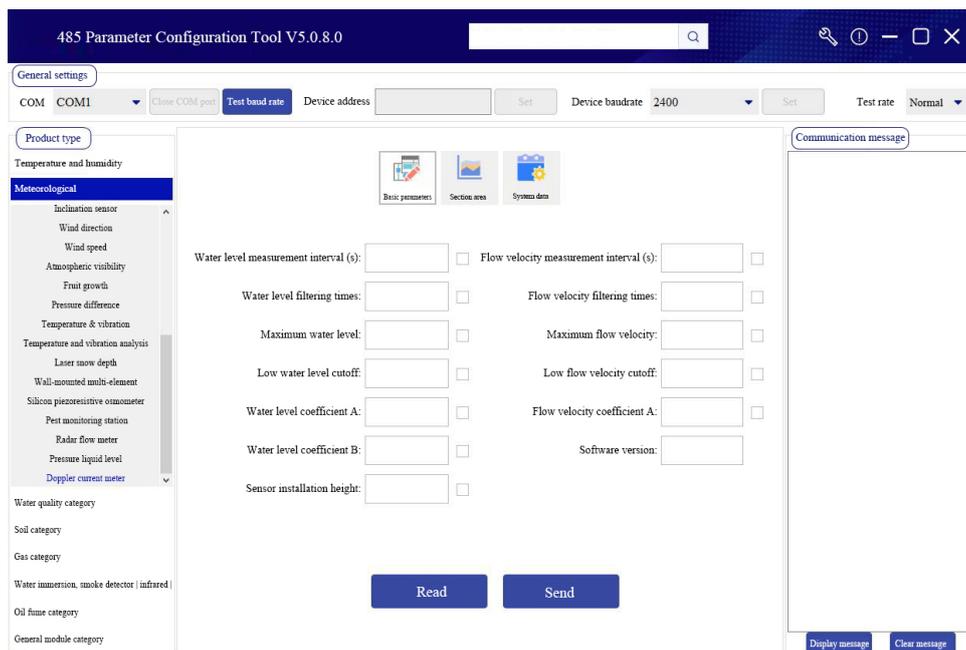
Open the data package, select “Debugging Software” > “485 Parameter Configuration Software,” locate the file, and open it.

4.2. Parameter Settings

Select the correct COM port (check the COM ports under “My Computer > Properties > Device Manager > Ports”). The image below lists the driver names for several different 485 converters.



Connect a single device and power it on. Click “Test Baud Rate” in the software, and the software will detect the device's current baud rate and address. The default baud rate is 4800 bps, and the default address is 0x01. Modify the address and baud rate as needed, and you can also check the device's current operational status. If the test fails, please recheck the device wiring and ensure the 485 driver is installed. The figure below shows the system data page, where you can view the data collected by the device in real time.



The image below shows the Basic Parameters page, where you can configure the device's basic settings.

Water Level Measurement Interval (s): The time interval between water level measurements.

Flow Rate Measurement Interval (s): The time interval between flow rate measurements.

Water Level Filtering Iterations: The number of times the measured water level value is filtered. A higher value results in more stable data, but it also increases the wait time before stable and accurate data is obtained.

Number of flow rate filtrations: The number of times the measured flow rate is filtered. The higher this value, the more stable the data; however, the longer it takes to obtain stable and accurate data.

Maximum water level: The highest water level measured. If a measured water level exceeds this set value, the data will be discarded and not included in the calculation.

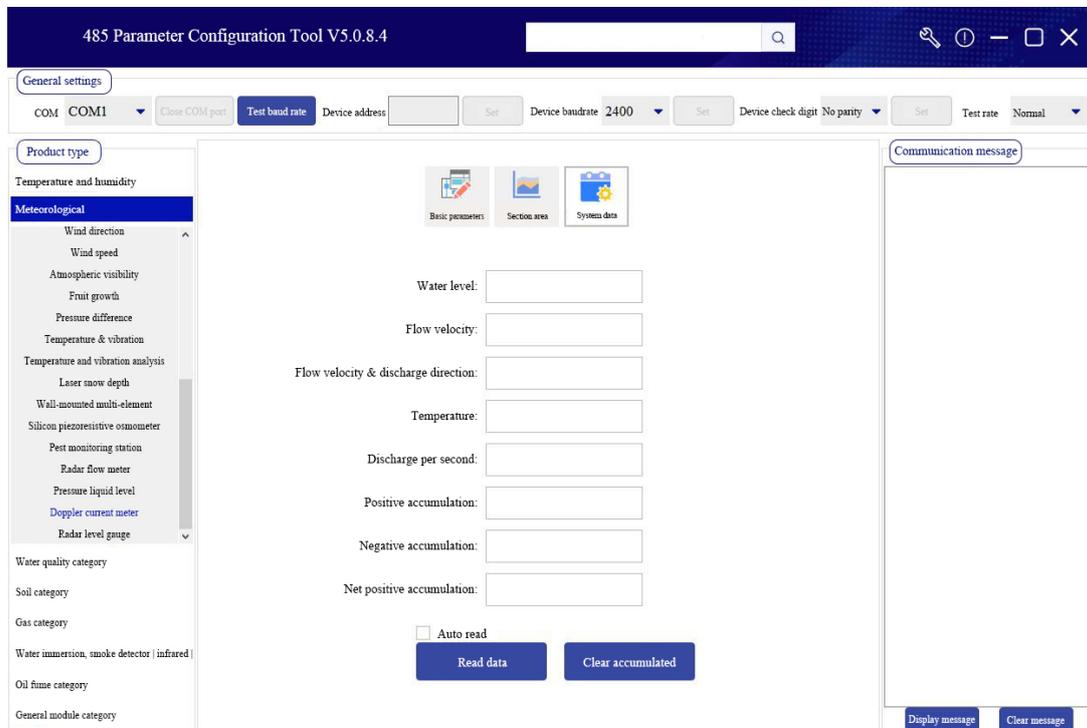
Maximum flow rate: The highest flow rate measured. If a measured flow rate exceeds this set value, the data will be discarded and not included in the calculation.

Low Water Level Cutoff: When the measured water level falls below the set value, that data point is discarded and excluded from calculations. Low Flow Rate Cutoff: When the measured flow rate falls below the set value, that data point is discarded and excluded from calculations.

Water Level Coefficients A and B: Parameters used for water level calibration.

Flow Velocity Coefficients A: Parameters used for flow velocity calibration.

Sensor Installation Height: The distance between the sensor's installation position and the bottom of the water. This data affects flow rate calculations. Software Version: The software version of the device.



The figure below shows the Cross-sectional Area page, which is used to set the cross-sectional parameters for channels or pipes; these parameters affect flow rate calculations. Silt Depth: If there is silt at the bottom, this parameter must be set, as it affects flow rate calculations.

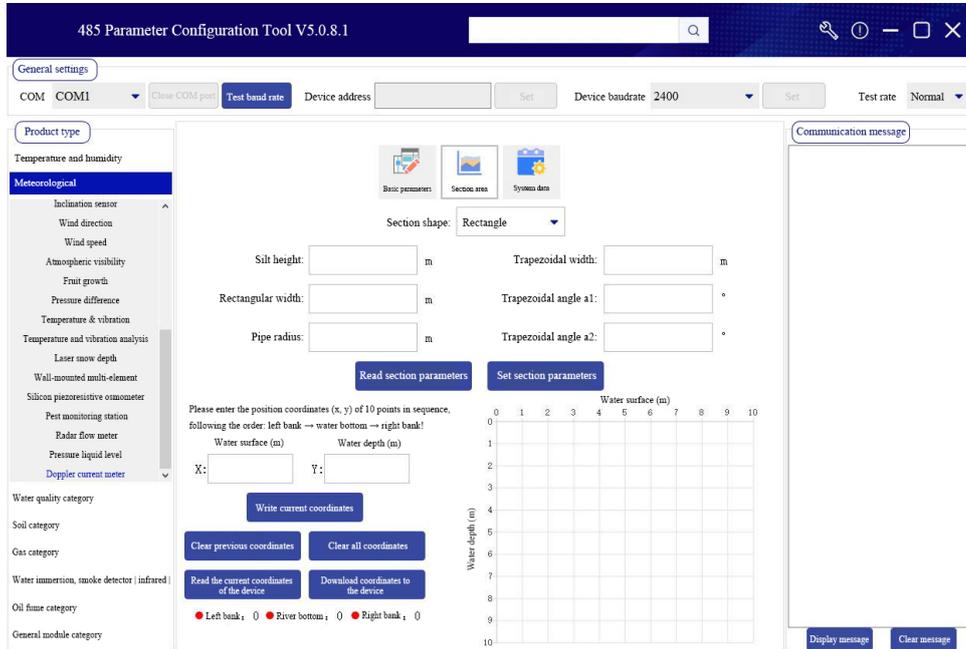
Cross-Section Shape: After selecting the corresponding shape, the software will calculate the cross-sectional area based on the parameters for that specific shape listed below.

Rectangular Width, Pipe Radius, Trapezoidal Width, Trapezoidal Angle a1, Trapezoidal Angle a2: These are the specific parameters corresponding to each shape.

Read Cross-Section Parameters: Retrieve pre-configured parameters.

Set Cross-Section Parameters: Send the parameters to be modified to the device.

The lower section of the page is for irregular cross-section settings. You can enter coordinates in the order of left bank–water bottom–right bank. Ten coordinates must be entered for each location, for a total of 30 points. After entering the corresponding coordinates in the X and Y fields, click “Write Current Coordinates” to view the connecting lines between the points in the coordinate system on the right. Once the settings are complete, click “Download Coordinates to Device.”



5. Communication Protocol

5.1 Basic Communication Parameters

Coding	8-bit binary
Data Bit	8 bit
Parity Bit	None
Stop Bit	1 bit
Error Check	CRC (Redundant cyclic code)
Baud Rate	2400–115,200 (selectable), default 4800

5.2 Data Frame Format Definition

The Modbus-RTU communication protocol is used, with the following format:

Header (≥4 bytes) Data field = N bytes
 Address code = 1 byte Error check = 16-bit CRC code
 Function code = 1 byte Trailer (≥4 bytes)

Address code: The transmitter’s address, which is unique within the communication network (factory default: 0x01).

Function code: Indicates the function of the command sent by the host; this transmitter uses function codes 0x03 (read register data) and 0x06. (Write data to a single register).

Data field: The data field contains the actual communication data.

Note that the high byte of the 16-bit data is first! CRC code: A two-byte checksum.

Host inquiry frame structure

Address code	Function code	Register start address	Register length	Lower-order check digit	High-order check digit
1 byte	1 byte	2 bytes	2 bytes	1 byte	1 byte

Structure of a slave response frame:

Address code	Function code	Num of valid bytes	Data zone 1	2nd data zone	Data zone N	Check digit
1 byte	1 byte	1 byte	2 bytes	2 bytes	2 bytes	2 bytes

5.3 Register Address

Register address (hexadecimal)	Content	Data Type	Support Function Code
0000H-0001H	Water level (m)	Float	0x03/0x04
0002H-0003H	Flow velocity (m/s)	Float	0x03/0x04
0004H-0005H	Temp (°C)	Float	0x03/0x04
0006H-0007H	Flow rate (m³/s)	Float	0x03/0x04
0008H-0009H	Cumulative total (m³)	Float	0x03/0x04
000AH-000BH	Cumulative deficit (m³)	Float	0x03/0x04
000CH-000DH	Net total (m³)	Float	0x03/0x04
000EH	Flow Direction 1 - Forward direction 00 01 -1 - Reverse direction 00FF 0 - No flow 0000	INT8S	0x03/0x04
000FH	Flow Direction 1 - Forward direction 00 01 -1 - Reverse direction FFFF 0 - No flow 0000	INT16S	0x03/0x04
0050H	Clear data (Write AA55 to clear data)	INT16U	0x06
0051H	Online status of the sensor	INT8U	0x03/0x04
0100H	Flow measurement interval	INT16U	0x03/0x04/0x06
0101H	Num of water level filters	INT16U	0x03/0x04/0x06
0102H-0103H	Max flow velocity	Float	0x03/0x04/0x10
0104H-0105H	Low-flow resection	Float	0x03/0x04/0x10

0106H-0107H	Velocity coefficient A	Float	0x03/0x04/0x10
0110H	Water level sensing interval	INT16U	0x03/0x04/0x06
0111H	Num of water level filters	INT16U	0x03/0x04/0x06
0112H-0113H	Max water level (m)	Float	0x03/0x04/0x10
0114H-0115H	Low-level resection	Float	0x03/0x04/0x10
0116H-0117H	Water level coefficient A	Float	0x03/0x04/0x10
0118H-0119H	Water level coefficient B	Float	0x03/0x04/0x10
011AH-011BH	Sensor mounting height	Float	0x03/0x04/0x10
011CH-011DH	latitude	Float	0x03/0x04/0x10
0200H	Cross-sectional shape 0: Rectangular 1: Circular 2: Trapezoidal 4: Irregular	INT16U	0x03/0x04/0x06
0201H-0202H	Silt depth (m)	Float	0x03/0x04/0x10
0203H-0204H	Rectangle width (m)	Float	0x03/0x04/0x10
0205H-0206H	Round pipe radius (m)	Float	0x03/0x04/0x10
0207H-0208H	Trapezoidal width (m)	Float	0x03/0x04/0x10
0209H-020AH	Trapezoidalanglea1	Float	0x03/0x04/0x10
020BH-020CH	Trapezoidalanglea2	Float	0x03/0x04/0x10
07D0H	ModBus address	INT8U	0x03/0x04/0x06
07D1H	Baud rate 0 represents 2400 1 represents 4800 2 represents 9600 3 represents 19200 4 represents 38400 5 represents 57600 6 represents 115200	INT8U	0x03/0x04/0x06
07D5H	Software version	INT16U	0x03/0x04
07D6H	Hardware version	INT16U	0x03/0x04

5.4 Examples of Communication Protocols and Explanations

Read the real-time value from device address 0x01

Polling frame (hexadecimal):

Address code	Function code	Register start address	Register length	Lower byte of the check code	High byte of the check code
0x01	0x03	0x00 0x04	0x00 0x02	0x85	0xCA

Response frame (hexadecimal):

Address code	Function code	No. of valid bytes	Data zone 1	2nd data zone	Check digit
0x01	0x03	0x04	0x41 0x70	0x28 0xF6	0x71 0x92

Calculation of the actual real-time value

417028F6 ==> Float-to-character conversion ==> Real-time value = 15.010000

6. Important Notes

Warning: Risk of personal injury. This equipment must not be used as a safety device or emergency stop device, nor for any other purpose where equipment failure could result in personal injury.

Restrictions on Use: Use only for the intended, authorized purposes. Consult the technical manual before installation, operation, or maintenance.

Failure to follow these guidelines may result in death or serious injury.