



Product introduction

This sensor consists of a humidity sensing element and a porous material with a known water retention (moisture release) curve. When the porous material reaches moisture equilibrium with the surrounding soil, the humidity sensor measures the moisture content of the porous material and converts it into soil water potential based on the water retention curve.

The measurement range of the sensor depends on the pore size distribution of the porous material. It is mainly used for in-situ measurement and monitoring of soil water potential, which can be further used to estimate important soil hydraulic properties such as soil moisture content and hydraulic conductivity.

The sensor is primarily designed to measure soil water potential, which represents the energy required

to extract a unit amount of water from the soil under isothermal conditions. The unit is kPa.

When the soil is fully saturated, the soil water potential is 0 kPa.

When the soil moisture content is below saturation, the soil water potential becomes negative.

The drier the soil, the more negative the soil water potential.

In plant water requirement studies, soil moisture content alone cannot accurately indicate the availability of water to plants. Soil water potential is the most reliable indicator for evaluating soil drought stress and water availability.

NBL-S-WPS Technical Specifications

Soil Water Potential Sensor Specification	
Parameter	DC 5-24V
Power Supply	8mA@12V DC
Current Consumption	RS485
Communication	9600bps
Baud Rate	-1500.0~-10.0kPa
Measurement Range	±1%
Accuracy	0 to 60°C (Measurements below freezing point may not be accurate.)
Operating Temperature	Black Epoxy Resin

Features

- Stable signal with high accuracy
- Wide measurement range and excellent linearity
- Corrosion-resistant, waterproof, safe and reliable
- Easy installation and operation with long-distance signal transmission

- Low power consumption for continuous long-term monitoring

Wiring

(1) When Used with Our Weather Station

Simply connect the sensor to the corresponding interface on the weather station.

(2) Standalone Sensor Wiring

Wire Color	Function
Red	Power +
Black	Power – (GND)
Yellow	RS485 A (+)
Blue	RS485 B (–)

Installation and Measurement

Determine the installation depth and location of the soil water potential sensor.

Collect soil from the installation site and mix it with water to form a slurry.

Completely coat the porous sensing part of the sensor with the prepared soil slurry.

Insert the coated sensor into the installation position. Backfill the soil and compact it carefully.



Before coating with soil slurry → After coating with soil slurry

MODBUS Communication Protocol

Communication Parameters

Baud Rate: 9600 bps

Data Bits: 8

Parity: None

Minimum communication interval: 1000 ms

【1】 Write Device Address

Command Request

00 10 Address CRC16(5 bytes)

Response

00 10 CRC16(4 bytes)

Notes

1.The address field must always be 00 when writing a new device address.

2.Address occupies one byte and ranges from 0–255.

Example:

Request

00 10 01 BD C0

Response

00 10 00 7C

【2】 Read Device Address Command

Request

00 20 CRC16(4 bytes)

Response

00 20 Address CRC16(5 bytes)

Notes

The address occupies one byte with a valid range of 0–255.

Example:

Request

00 20 00 68

Response

00 20 01 A9 C0

A. Read Real-Time Data

Assume the device address is 0x01.

Valid device address range: 1–254

Address 0 is reserved as the broadcast address.

Request**01 03 00 00 00 01 25 CA**

Item	Description	Offset	Bytes	Remarks
1	Device Address	0	1	Unique device address
2	Function Code	1	1	Fixed value: 0x03
3	Start Register Address	2	3	First register to read
4	Number of Registers	5	1	Number of registers
5	CRC16	6	2	Low byte first

Response:**01 03 02 xx xx CRC16**

Item	Description	Offset	Bytes	Remarks
1	Address	0	1	Device address
2	Function Code	1	1	Read (0x03)
3	Data Length	2	1	Number of data bytes
4	Data	3	2	Soil water potential value
5	CRC16	5	2	Low byte first

B. Data frames returned by the device:

Communication example (retrieving sensor data):

01 03 00 00 00 01 25 CA**Response****01 03 02 FF 17 E2 F8**

FF 17 is the soil water potential value.

It is stored as a signed hexadecimal integer.

Convert it to decimal:

FF17 → -233

The actual soil water potential is obtained by dividing by 10:

-233 ÷ 10 = -23.3 kPa

Therefore,

Soil Water Potential = -23.3 kPa

Precautions

1. Please check whether the package is intact and verify that the product model matches your order.
2. Do not connect or disconnect the wiring while the power is on.
3. Verify all wiring before applying power.
4. Cable length may affect the output signal. Do not modify the factory-installed wiring or internal components without authorization. If cable extension or modification is required, please contact the manufacturer.

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