Modbus Quick Start Guide

Professional FW Version 6.2

Modbus is a serial communication protocol. The HydraProbe specifically uses Modbus RTU over RS485 protocol. RTU stands for remote terminal unit meaning it will be connected to a supervisory computer such as a logger. The physical connection uses the RS485 electrical connection. Protocol specifics can be found at https://modbus.org.

Model Numbers

Version Part # Suffix	
02	Professional, w/25 ft. cable
04	Professional, w/50 ft. cable
06	Professional, w/100 ft. cable

Power

Power Requirements	9 to 16 VDC (12VDC Ideal)
Power Consumption	<10 mA Idle, 30 mA for 2s Active

Wiring

Red Wire	+ Power Input
Black Wire	Ground
White Wire	Modbus A
Green Wire	Modbus B

Communication Settings

Baud Rate	9600
Data Bits	8
Parity	None
Stop Bits	1
Flow Control	None

Addressing

Each Modbus sensor must have its own unique address. The default address is “1”.

Request Readings

To read data from the HydraProbe use function code 03, “read holding registers”. Data is stored as 32-bit floating point with big endian word order. Parameters are stored over 2 Modbus registers so you must read a minimum of two registers at a time to get a full 32-bit value.

Return Stored Reading

Returns reading from last measurement.

Modbus Register Address	Description
10	Soil Moisture (wfv)
12	Soil Temperature (C)
14	Soil Temperature (F)
16	Bulk EC (Temperature Corrected) (S/m)
18	Bulk EC (S/m)
20	Pore Water EC (S/m)
22	Real Dielectric Permittivity
24	Imaginary Dielectric Permittivity
26	Imaginary Dielectric Permittivity (Temperature Corrected)
28	Dielectric Loss Tangent
30	Diode Temperature (C)

Take a Reading and Return Value

Takes a reading then returns the value. Can take up to 2 seconds.

Modbus Register Address	Description
110	Soil Moisture (wfv)
112	Soil Temperature (C)
114	Soil Temperature (F)
116	Bulk EC (Temperature Corrected) (S/m)
118	Bulk EC (S/m)
120	Pore Water EC (S/m)
122	Real Dielectric Permittivity
124	Imaginary Dielectric Permittivity
126	Imaginary Dielectric Permittivity (Temperature Corrected)
128	Dielectric Loss Tangent
130	Diode Temperature (C)

Return Last Reading and Take New Reading

Returns reading from last measurement then takes a new reading. Sensor will be unresponsive for up to 1 second while taking the measurement.

Modbus Register Address	Description
210	Soil Moisture (wfv)

212	Soil Temperature (C)
214	Soil Temperature (F)
216	Bulk EC (Temperature Corrected) (S/m)
218	Bulk EC (S/m)
220	Pore Water EC (S/m)
222	Real Dielectric Permittivity
224	Imaginary Dielectric Permittivity
226	Imaginary Dielectric Permittivity (Temperature Corrected)
228	Dielectric Loss Tangent
230	Diode Temperature (C)

Configuration

To read data from the HydraProbe use function code 03, "read holding registers.

Description	Modbus Register Address	Number of Registers	Type	Writeable
Serial number	1020	8	Ascii	N
Firmware version	1070	3	Ascii	N
Model number	1016	2	Ascii	N

Pore Water Offset

To read data from the HydraProbe use function code 03, "read holding registers.
To write data to the HydraProbe use function code 16, "write holding registers".

Description	Modbus Register Address	Number of Registers	Type	Writeable
Read/Write Pore Water Offset	1112	2	32bit float big endian	Y
Reset Pore Water Offset to default 3.4	1115	1	n/a	Y

Calibration

The following extended command will change the coefficients in one of two general formulas that translate the real dielectric permittivity to soil moisture. In many cases, the HydraProbe will not need to be recalibrated. The default General calibration has been heavily reviewed and will provide reasonable accuracy for most applications. If you need to change the calibration or if a custom calibration is required, we recommend referring to the HydraProbe user manual for more information.

To read data from the HydraProbe use function code 03, "read holding registers.
To write data to the HydraProbe use function code 16, "write holding registers".

Description	Modbus Register Address	Number of Registers	Type	Writeable
Calibration soil type G – General O – Organic R – Rockwool C – Custom 1 K – Custom 2	1009	2	Ascii	Y
Coefficient A	1100	2	32bit float big endian	Y
Coefficient B	1102	2	32bit float big endian	Y
Coefficient C	1104	2	32bit float big endian	Y
Coefficient D	1106	2	32bit float big endian	Y
Coefficient E	1108	2	32bit float big endian	Y
Coefficient F	1110	2	32bit float big endian	Y
Reset all coefficients to default	1114	1	n/a	Y

Accuracy and Ranges

Parameter	
Soil moisture for inorganic mineral soils	Accuracy*: +/- 0.01 WFV for most soils (m^3,m^{-3}) +/- <0.03 for fine textured soil (typical) Range: From Complete Dry to Full Saturation (0% to 100% of saturation)
Bulk EC	Accuracy: +/- 2.0% or 0.02 S/m Whichever is greater Range: 0 to 1.0 S/m
Temperature	Accuracy: +/- 0.3 °C Range: -40 to 75 °C
Inter-Sensor Variability	+/- 0.012 WFV (typical)
Pore Water EC	Hilhorst Equation, depends on soil conditions

*****Accuracy of soil moisture depends on the soil and is highly variable.