RS-485 Quick Start Guide

Professional FW Version 6

RS-485 is a serial communication standard. It is commonly used in control systems to communicate between devices over long distances, up to 4,000 ft of cable. RS-485 is reliable and robust over longer distances but it does draw more power than comparable communication protocols such as SDI-12. RS-485 allows for multiple devices to be connected to a single bus. Each device on the bus has a unique address and can be addressed individually or as a group. Different RS-485 sensors may have specific requirements and commands unique to their functionality.

Older versions of HydraProbe firmware may have different commands, contact Stevens Water for more information.

Power	**Requirements**	9 to 16 VDC (12VDC Ideal)
	Consumption	2.5 mA Idle, 25 mA for 2s Active
Wiring	**Red**	+ Power Input
	Black	Ground
	White	Data inverting Signal Negative (-) A
	Green	Data non-inverting Signal Positive (+) B
Communication	**Baud Rate**	9600
	Data Bits	8
	Parity	None
	Stop Bits	1

How To Use:

Using RS-485 involves setting up a master-slave communication system between devices. The master device (logger) sends requests to the slave device (HydraProbe) to read or write data, and the slave devices respond with the requested data. The basic steps to use RS-485 are below:

1. Set up the physical connection: Connect the devices using the appropriate physical interface.

2. Set up the RS-485 communication parameters: Configure the baud rate, parity, data bits, and stop bits to match the settings of both the master and slave devices. All commands sent must end with a “Carriage Return” “Line Feed” pair.

3. Assign RS-485 addresses: Assign a unique address to each slave device on the network. Devices can be addressed as a group by using the broadcast address “///” or individually.

4. Follow the instructions for the logger you want to use or develop your own RS-485 application: There are different libraries and software tools available to simplify the development of RS-485 applications, depending on the programming language or platform used.

5. Test: Test the communication between the devices and make any necessary adjustments to the application or settings.

Addressing

The first three characters of any command or response on RS-485 is the sensor address. Lowercase ‘aaa’ is used to represent the address. Each RS-485 sensor must have its own unique address. The default address is “000”.

RS-485 Command	Response	Description	Access Level
aaaXR_AD	<Current Address>	Read Address	Read Only
aaaXW_AD_<New Address>	<New Address>	Write Address	Write Only

Identification

RS-485 Command	Response	Description	Access Level
aaaXR_SN	aaa<Serial Number>	Read Serial Number	Read Only
aaaXR_FV	aaa<Firmware Version>	Read Firmware Version	Read Only
aaaXR_MN	aaa<Model Number>	Read Model Number	Read Only

Measurement

RS-485 Command	Response	Description	Access Level
aaaTR	-	Request Measurement	Read Only
aaaT<0-1>	aaa<values>	Read Measurement Set 0 or 1	Read Only
aaaXR_T<0-1>	aaa<values>	Read Parameters in Measurement Set 0 or 1	Read Only
aaaXR_QM	aaa<X/0>	Read Quick Mode Selection X – Quick Mode Disabled 0 – Quick Mode Enabled	Read Only
aaaXW_QM_X	aaaX	Disable Quick Mode	Write Only
aaaXW_QM_0	aaa0	Enable Quick Mode	Write Only

The following tables list the values and units:

Selector Order	Parameter	Unit
F	Soil Moisture	Water fraction by Volume (wfv)
G	Soil Temperature	Celsius (C)
H	Soil Temperature	Fahrenheit (F)
I	Bulk EC (Temperature Corrected)	Siemens/Meter (S/m)
J	Bulk EC	Siemens/Meter (S/m)
K	Pore Water EC	Siemens/Meter (S/m)
L	Real Dielectric Permittivity	-
M	Imaginary Dielectric Permittivity	-
N	Imaginary Dielectric Permittivity (Temperature corrected)	-
O	Dielectric Loss Tangent	-
P	Diode Temperature	Celsius (C)

RS485 Measurement Sets									
Command	**P1**	**P2**	**P3**	**P4**	**P5**	**P6**	**P7**	**P8**	**P9**
T0, Transmit Set 0	F	I	G	H	J	L	M	K	O
T1, Transmit Set 1	L	M	N	O	P				

Pore Water Offset

RS-485 Command	Response	Description	Access Level
aaaXR_PWOS	aaa<Current Offset>	Read Pore Water Offset	Read Only
aaaXW_PWOS_<New Offset>	aaa<New Offset>	Write Pore Water Offset	Write Only
aaaXD_PWOS	aaa+3.4	Reset Pore Water Offset to default 3.4	Write Only

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.

RS-485 Command	Response	Description	Access Level
aaaXR_SOIL	aaa<G/O/R/C/K>	Get current calibration soil type G – General O – Organic R – Rockwool C – Custom 1	Read Only

		K – Custom 2	
aaaXW_SOIL_<New Soil Type>	aaa<G/O/R/C/K>	Write calibration soil type G – General O – Organic R – Rockwool C – Custom 1 K – Custom 2	Write Only
aaaXR_COEFA	aaa<A>	Read coefficient A	Read Only
aaaXR_COEFB	aaa<B>	Read coefficient B	Read Only
aaaXR_COEFC	aaa<C>	Read coefficient C	Read Only
aaaXR_COEFD	aaa<D>	Read coefficient D	Read Only
aaaXR_COEFE	aaa<E>	Read coefficient E	Read Only
aaaXR_COEFF	aaa<F>	Read coefficient F	Read Only
aaaXR_COEF	aaa<A><B><C><D><E><F>	Read all coefficients	Read Only
aaaXW_COEFA_<A>	aaa<A>	Write coefficient A	Write Only
aaaXW_COEFB_<B>	aaa<B>	Write coefficient B	Write Only
aaaXW_COEFC_<C>	aaa<C>	Write coefficient C	Write Only
aaaXW_COEFD_<D>	aaa<D>	Write coefficient D	Write Only
aaaXW_COEFE_<E>	aaa<E>	Write coefficient E	Write Only
aaaXW_COEFF_<F>	aaa<F>	Write coefficient F	Write Only
aaaXD_COEF	aaa<A><B><C><D><E><F>	Reset all coefficient to default	Write Only

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 1.5 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.

Model Numbers

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