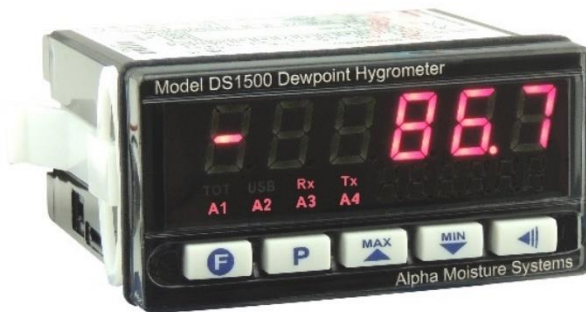Alpha Moisture Systems

DS1500 Dewpoint Hygrometer Display
RS485 / MODBUS RTU Comms

3184 DS1500 Modbus Comms - User Manual

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Contents

1   Introduction

The RS485 serial interface of the DS1500 Dewpoint Hygrometer Display offers the flexibility to address as many as 247 indicators within a network, enabling remote communication with a host computer or master controller.

MODBUS RTU, a communication protocol continues to maintain its status as one of the foremost choices in industrial automation. This manual explains how to configure the MODBUS RTU comms over RS485 Interface on the DS1500.

1.1   Explanation of Warning and Note Symbols used

Local health and safety regulations should be observed as should the safety critical warnings and notes highlighted in this user manual.

WARNING	
⚠️	Danger to personnel and/ or damage to equipment

NOTE	
ℹ️	Additional information

1.2   Safety Information and Warnings   ⚠️

These safety instructions and guidelines must be followed.

The **DS1500** is designed to be connected to hazardous electric voltages (90-250V). The power supply must be protected by a **3 amp** fuse. **The DS1500 must be earthed**.

Check to establish that all wiring and connections are not damaged. If damage is observed to any electrical wiring or damage to the apparatus, they must not be connected to the power supply but returned to the supplier for rectification.

Before powering up the unit, check that the connections at the back of the unit have been wired correctly. Observe the wiring diagram in **Section 5, pages 14/15.**

Also refer to the wiring schematics in the **DS1500 Dewpoint Hygrometer Display Manual – Section 6. Document Reference No. 3173.**

Do not connect the **DS1500** to the power supply until it is in a permanent position.

Risk of electric shock - Do not open any part of the **DS1500** whilst connected to the power supply.

Remove the power supply and isolate before any maintenance is carried out.

The power supply terminals and associated internal circuitry are isolated from all other parts of the equipment in accordance with EN61010-1 for connection to a category II supply (pollution degree2).

Any terminals or wiring connected to the input or outputs, which are accessible in normal operation, must only be connected to signals complying with the requirements for Safety Extra Low Voltage (SELV) circuits.

Hazardous voltages may be present on instrument terminals. The equipment must be installed by suitably qualified personnel and the instrument must be mounted in a position that provides protection behind the panel to at least IP20.

Ignoring this safety information can result in severe personal injury and/or damage to the unit. The product specifications **must not** be exceeded at any time as this may cause damage to the apparatus or cause risk of damage or fire.

Ensure that the **DS1500** does not come into direct contact with water or any other liquids.

Cleaning:

Disconnect the power supply first. To maintain the instrument, never use harsh abrasive cleaners or solvents. Wipe the instrument only with a soft cloth slightly dampened with warm soapy water.

Maintenance:

There are no serviceable parts in a DS1500 – For more advice contact Alpha Moisture Systems.

1.3   Warranty

The DS1500 is supplied with a one-year warranty from the date of purchase. This warranty is subject to the proper operational use of the instrument and following the information provided in this User Manual. The instrument should not be repaired without prior inspection or authorisation by Alpha Moisture Systems or an authorised distributor. Any unauthorised alteration or misuse may invalidate the instrument warranty.

NOTE
Please retain the original equipment packaging so the DS1500 can be returned to Alpha Moisture Systems or your authorised distributor if required.

2   RS485 Interface

- Compatible line signals with RS485 standard.

- 2-wire connection between the master and up to 31 slave indicators in bus topology.
  You can reach up to 247 nodes by using multiple output converters.

- Maximum communication distance: 1000 meters.

- The RS485 signals are:

    D1 = D : Bidirectional data line;

    D0 = $\overline{D}$: Bidirectional inverted data line;

    C = GND : Optional link that improves communication performance.

2.1 General Characteristics

- Optically isolated serial interface.

- Programmable Baud Rate: 1200, 2400, 4800, ***9600**, 19200, 38400, 57600 or

    115200 bps. ***** = Factory Default

- Data Bits: 8.

- Parity: None or even.

- Stop Bits: 1.

2.2 Communication Protocol

The MODBUS RTU slave protocol is supported, available in most SCADA software on the market.

All configurable parameters can be accessed (for reading or writing) through the Registers Table. In Broadcast mode, it is also allowed to write to the Registers, using the address 0.

The available Modbus commands are:

    03 - Read Holding Register

    05 - Force Single Coil (Force Digital Output state)

    06 - Preset Single Register

The registers are arranged in a table in such a way that several registers can be read in the same request.

3   Configuration of Serial Communication Parameters

Two parameters must be configured in the device for serial communication:

bAud: Baud Rate. All devices have the same Baud Rate.

AdrES: Device communication address. Each device must have an exclusive address.

3.1 Holding Registers

Equivalent to Holding Registers (reference 4XXXX).

The Holding Registers are the internal indicator parameters. From address 12, all registers can be written and read. Up to this address, most registers are read-only. It is necessary to check each case.

Holding Registers	Parameter	Register Description
0000	PV	Read: Process variable. Write: Not allowed. Range: The minimum value is the value set in **InLoL**. The maximum value is the configured value in **InHIL**. The decimal point position depends on the **dPPoS** screen.
0001	PV min	Read: Minimum value of PV. Write: Not allowed.
0002	PV max	Read: Maximum value of PV. Write: Not allowed.
0003	PV	Read: Process variable. Write: Not allowed. Maximum range: 0 a 120000.
0004	Display Value	Read: Current display value. Write: Not allowed.

		Maximum range: -31000 a 31000. The range depends of the showed display.
0005	Display Number	Read: Current display number. Write: Not allowed.

0006	Status
	Word 1
		Read: Digital Inputs and Alarms (high part) and
		Hardware type (low part).
		Write: Not allowed.
		Range: 0000h to FFFFh.
		Value format: XXYYh, when:
		XX: Hardware type.
		   bit 0 – Alarm 1;
		   bit 1 – Alarm 2;
		   bit 2 – Alarm 3;
		   bit 3 – Alarm 4;
		   bit 4 – Analog output;
		   bit 5 – RS 485;
		   bit 6 – Reserved;
		   bit 7 – Reserved.
		YY: Digital inputs and alarms states.
		   bit 0 – Alarm 1 state: 0 → Inactive; 1 → Active;
		   bit 1 – Alarm 2 state: 0 → Inactive; 1 → Active;
		   bit 2 – Alarm 3 state: 0 → Inactive; 1 → Active;
		   bit 3 – Alarm 4 state: 0 → Inactive; 1 → Active;
		   bit 4 – Digital Input: 0 → Inactive; 1 → Active;
		   bit 5 – Reserved;
		   bit 6 – Reserved;
		   bit 7 – Reserved.

0007	Software Version	Read: Software version. Write: Not allowed. Read values: If the equipment version is V1.00, for example, the value read is 100.
0008	ID	Read: Identification device number. Write: Not allowed. Read values: 3 – N1500. Other values: Special devices.
0009	Status Word 2	Read: Indicator status bits. Write: Not allowed. Read value: Verify each bit: bit 0 – Sensor error; bit 1 – Cable error; bit 2 – Underflow; bit 3 – Overflow; bit 4 – Reserved; bit 5 – Alarm 1 power-up inhibit (0 → No; 1 → Yes);

		bit 6 – Alarm 2 power-up inhibit (0 → No; 1 → Yes); bit 7 – Alarm 3 power-up inhibit (0 → No; 1 → Yes); bit 8 – Alarm 4 power-up inhibit (0 → No; 1 → Yes); bit 9 – Unit (0 → °C; 1 → °F); bit 10 – Reserved; bit 11 – Output 1 state; bit 12 – Output 2 state; bit 13 – Output 3 state; bit 14 – Output 4 state; bit 15 – Output 5 state.
0010	Special Command	Special function command. Write: Value **0** → Tare reset; Value **5** → Hold and Peak-hold clean; Value **10** → Maximum and minimum clean; Value **15** → Tare.
0011	dP.PoS	Decimal point position of PV. Range: 0 to 5. 0 → XXXXX; 1 → XXXXX.X; 2 → XXXX.XX; 3 → XXX.XXX; 4 → XX.XXXX; 5 → X.XXXXX.
0012	F.Func	F key Function. Standard Model: 0 → oFF; 1 → HoLd; 2 → rESEt; 3 → PHoLd.
0013	di9.In	Digital Input Function. Standard Model : 0 → oFF; 1 → HoLd; 2 → rESEt; 3 → PHoLd.
0014	FILtr	Input digital filter. Range: 0 to 60.
0015	oFSEt	Input Offset value. Range: From InLoL to InHIL.
0016	SCALE	SCALE parameter condition. 0 → Configurable indication from – 31000 to + 31000. 1 → Configurable indication from 0 to + 60000.

		$2 \rightarrow$ Configurable indication from 0 to +120000.
0017	5root	Input Square Root. Range: 0 to 1. $0 \rightarrow$ No; $1 \rightarrow$ Yes.
0018	out.Er	4-20mA analog output on error condition. $0 \rightarrow$ Down; $1 \rightarrow$ Up.
0019	AL.rEF	Alarm Reference. Range: From LnLoL to InHl L.
0020	Out.tY	Retransmission type of PV. Range: 0 to 1. $0 \rightarrow$ 4 a 20mA retransmission; $1 \rightarrow$ 0 a 20mA retransmission .
0021	SP.AL I	Alarm 1 Preset. The minimum value is InLoL set for not differential alarm or (InLoL - InHl L) for differential alarm. The maximum value is in InHl L set for not differential alarm or (InHl L - InLoL) if differential alarm.
0022	SP.AL2	Alarm 2 Preset. Range: Same as SPAL I or dFAL I.
0023	SP.AL3	Alarm 3 Preset. Range: Same as SPAL I or dFAL I.
0024	SP.AL4	Alarm 4 Preset. Range: Same as SPAL I or dFAL I.
0025	Fu.AL I	Alarm 1 Function. Range: 0 to 7. $0 \rightarrow$ oFF; $1 \rightarrow$ I Err; $2 \rightarrow$ Lo; $3 \rightarrow$ HI ; $4 \rightarrow$ dI F.Lo; $5 \rightarrow$ dI F.HI ; $6 \rightarrow$ dI F.oU $7 \rightarrow$ dI F.I n
0026	Fu.AL2	Alarm 2 Function. Range: Same as FuAL I.
0027	Fu.AL3	Alarm 3 Function. Range: Same as FuAL I.
0028	Fu.AL4	Alarm 4 Function. Range: Same as FuAL I.
0029	bL.AL I	Alarm 1 power-up inhibit.

		Range: 0 a 1. 0 → No; 1 → Yes.
0030	bL.AL2	Alarm 2 power-up inhibit. Range: Same as bLAL1.
0031	bL.AL3	Alarm 3 power-up inhibit. Range: Same as bLAL1.
0032	bL.AL4	Alarm 4 power-up inhibit. Range: Same as bLAL1.
0033	HY.AL1	Alarm 1 Hysteresis (engineering unit). Range: 1 to span do sensor.
0034	HY.AL2	Alarm 2 Hysteresis (engineering unit). Range: Same as HYAL1.
0035	HY.AL3	Alarm 3 Hysteresis (engineering unit). Range: Same as HYAL1.
0036	HY.AL4	Alarm 4 Hysteresis (engineering unit). Range: Same as HYAL1.
0037	IntYP	Input sensor type Input list for the standard model. Range: 0 to 27. 0 → tc J; 1 → tc K; 2 → tc T; 3 → tc E; 4 → tc N; 5 → tc R; 6 → tc S; 7 → tc B; 8 → Pt100; 9 → 0 to 50mV; 10 → 0 to 5V; 11 → 0 to 10V; 12 → 0 to 50mV (custom linearization); 13 → 0 to 5V (custom linearization); 14 → 0 to 10V (custom linearization); 24 → 0 to 20mA; 25 → 4 to 20mV; 26 → 0 to 20mA (custom linearization); 27 → 4 to 20mV (custom linearization);
038	unl t	Temperature Unit. Range: 0 to 1. 0 → °C; 1 → °F. Not available on LC model.
0039	In.LoL	Indication Low limit. Range: The minimum value depends of input type

		configured in **InƐ YP** and the maximum is in **I nHI L** configured.

0040	**I nHI L**	Indication High limit. Range: From **I nLoL** to the input maximum configured in **InƐ YP**.
0041	**AdrES**	Slave address. Range: 1 to 247.
0042	**bAud**	Communication Baud Rate. Range: 0 to 7. 0 → 1200; 1 → 2400; 2 → 4800; 3 → 9600; Factory Default. 4 → 19200; 5 → 38400; 6 → 57600; 7 → 115200; 8 a 15 repeat baud rates from 1200 to 115200, but with invert polarity.
0043	Serial Number High	Serial Number (High Display). Range: 0 to 9999. Read only.
0044	Serial Number Low	Serial Number (Low Display). Range: 0 to 9999. Read only.
0045	-	Reserved.
0046	**AL It I**	Alarm 1 Time 1 of timer. Range: 0 to 6500 sec. See operation manual for details.
0047	**AL It2**	Alarm 1 Time 2 of timer (in seconds). Range: Same as **AL It I**.
0048	**AL2t I**	Alarm 2 Time 1 of timer (in seconds). Range: Same as **AL It I**.
0049	**AL2t2**	Alarm 2 Time 2 of timer (in seconds). Range: Same as **AL It I**.
0050	**AL3t I**	Alarm 3 Time 1 of timer (in seconds). Range: Same as **AL It I**.
0051	**AL3t2**	Alarm 3 Time 2 of timer (in seconds). Range: Same as **AL It I**.
0052	**AL4t I**	Alarm 4 Time 1 of timer (in seconds). Range: Same as **AL It I**.
0053	**AL4t2**	Alarm 4 Time 2 of timer (in seconds). Range: Same as **AL It I**.

0054	oU.LoL	**Low Limit for Analog Retransmission** – Defines the PV value that results in a 4mA (or 0mA) analog output current.
0055	oU.HI L	**High Limit for Analog Retransmission** – Defines the PV value that results in a 20mA analog output current.
	-	Reserved
	-	Reserved
	-	Reserved
	-	Reserved
	-	Reserved
	-	Reserved
0061 to 0090	I nP.0 I to I nP.30	Custom linearization value.
0091 to 0120	out.0 I to out.30	Value to be displayed in point of custom linearization

Table 1 – Registers Table

3.2 Digital Output States

Equivalent to *Coil Status* (reference 0XXXX).
The digital output states are basically the Boolean status of the respective digital outputs.

The Read allows the actual state of digital outputs, regardless of their function.

Writing to an output bit is only possible if the output has no function assigned to it (the output is configured to "OFF" in alarm cycle). See Table 2.

Coil Status	Output Description
1	Alarm 1 Output status
2	Alarm 2 Output status
3	Alarm 3 Output status
4	Alarm 4 Output status

Table 2 – Digital output states

4 Exception Responses – Error Conditions

The **MODBUS RTU** protocol checks the CRC in the data blocks received. If there is a CRC error at reception, no response will be sent to the master. For commands received without error a consistency of command and requested registers is made. If invalid, an exception response is sent with the corresponding error code. In exception responses, the field corresponding to the Modbus command in the response is summed as 80H.

If a write command sends a value outside the allowed range, the maximum value allowed for this parameter is forced, returning that value as a response.

Broadcast READ commands are ignored by the indicator and there is no response. It is only possible to WRITE in broadcast mode.

Error Code	Error Description
01	Invalid Command or non-existent
02	Invalid Register Number or out of range
03	Invalid Register Quantity or out of range

Table 3 – Error codes

5 RS485 / MODBUS RTU Wiring Location at the rear of the DS1500

Please also refer to the DS1500 Dewpoint Hygrometer Display Manual – Section 9: Document Reference No. 3173 for further information.
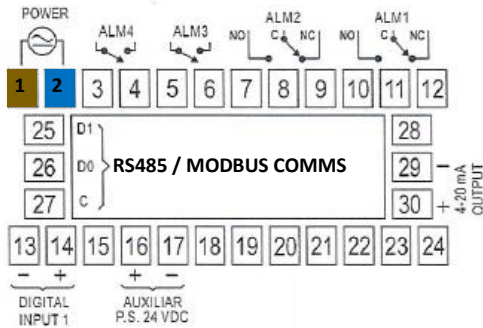
D1	Bidirectional data line	Terminal 25
D0	Inverted bidirectional data line	Terminal 26
C	Optional connection. Improves communication performance for long cable runs.	Terminal 27