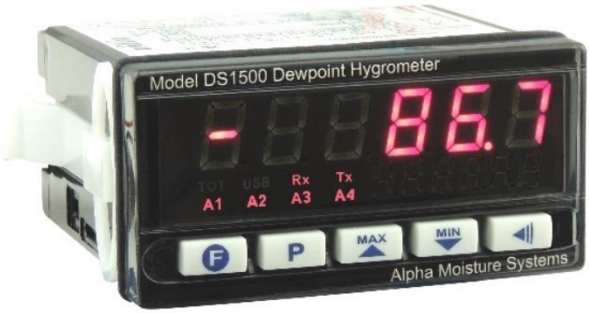
Alpha Moisture Systems

DS1500 Dewpoint Hygrometer Display for AMT, AMT-Ex and PDT Transmitters.

RS485 / MODBUS RTU Comms Included.

3191 DS1500 User Manual



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Contents

1 Introduction

This User Manual is only for use with the instrument supplied. All information required for the safe and proper operational use of the instrument is contained here. Make sure you read and understand the information and instructions in this User Manual before using the instrument. Failure to operate the instrument as directed in this User Manual may:

- Impair the inbuilt safety protection offered by the instrument
- Expose personnel to risk of injury
- Cause damage to and/or impair the function of the instrument
- Invalidate the instrument warranty

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	
	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.

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 diagrams in Section 6.2 & 6.3, pages 15 & 16.

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.

1.4 Instrument Description

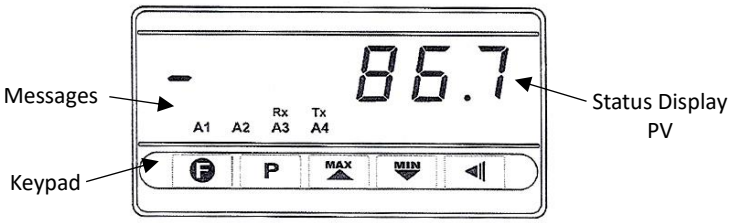
DS1500 is a digital dewpoint hygrometer display which accepts a large variety of input signals and sensors**. It is fully compatible with Alpha Moisture Systems' AMT, AMT-Ex and PDT Dewpoint Transmitters**. A six-digit LED display shows measured value and all programming parameters.

Instrument configuration is achieved from the keypad, without any hardware change. Thus, the selection of input type and alarms modes, besides other special functions, are accessed and defined from the front keypad.

Some of the features are:

- Customized indications.
- 24 Vdc power supply for remote transmitter excitation.
- Memory for **maximum** and **minimum** values.
- **Hold** and **Peak Hold** functions.
- Digital input.
- Increasing or decreasing display.
- Process Variable (PV) retransmission in 0-20 mA or 4-20 mA.
- RS485 / MODBUS RTU serial communication.
- 4 alarm relays – 2 x change over, 2 x normally open (NO).

1.5 General arrangement of the front panel



Status Display: Shows the process variable (PV) and the programming prompts.

Indicators A1, A2, A3, and **A4**: Show active alarms.

Indicators Rx and **Tx**: Indicate RS485 (MODBUS) communication line is active.

FUNCTION key: This special function key is used for preprogrammed functions as explained in the special function key section of this manual.

PROGRAM key: This key is used to access different displays with the programmable parameters of the device.

UP / MAX and DOWN / MIN key: These keys are used to increase and decrease parameters values. These keys are also used to display maximum and minimum values stored in memory.

BACK key: This key is used to go back to the previous parameter displayed in the menu level.

These parameters are divided in five levels (or groups) of parameters which we will refer to as LEVELS.

LEVEL	ACCESS
1 – Work	Free access
2 – Alarms	Reserved access
3 – Functions	
4 – Configuration	
5 – Customized Linearization	
6 – Calibration	

The work level has free access. All other levels require a certain combination of keystrokes to be accessed. The combination is:

P and ◀‖ keys pressed simultaneously

Once within a level, just press P to move to the subsequent parameters of this level. At the end of each level the display will go back to the work level.

Note: To access the calibration level, however, it is required to press the keys P and ◀‖ simultaneously for 10 seconds. The first parameter in this level is presented (*I n.LoC*) indicating that the calibration level is enabled.

After reaching the intended prompt just press the MIN or MAX keys to change this parameter accordingly. All changes are recorded in non-volatile memory as we move to next prompt. After 25 seconds with no key pressed the digital panel meter will return to the measuring level (work level).

2 QUICK START Guide

To get started quickly, there is no need to go through all the menus on the DS1500 at this stage. The DS1500 has been configured to order specifications.

Follow these step-by-step instructions below for a fast set up and quick start to measuring.

1. Unpack the Control Unit and Transmitter only when they are ready to be installed.
2. Read the safety instructions in **Section 1.1 and 1.2, pages 5 and 6**
3. Make a location for the DS1500. For dimensions see **Section 10, page 24**
4. Make ready and seal all pipework for sampling
5. Unpack and wire up the DS1500 display unit, see **Section 6.2/6.3, pages 15/16** **DO NOT** power up at this stage
6. Unpack and very carefully insert the transmitter into the Transmitter/Sensor holder and connect to the DS1500 display unit
7. Purge the gas to be sampled through all pipework and sensor holder
8. Re-check all connections and wiring - NOW power up the DS1500

The screen will now look like this for example:

(*In this case we have used the value -86.7 in °C unit*)

9. If the display is still changing, allow this to settle before taking final reading.

NOTE	
	Time to settle can vary between a few minutes and several hours dependant on the condition of the sample tubing on start-up. Time can be affected by for example, temperature, pressure, sample moisture content and other factors. Take a final reading when the display is static.

10. If alarms are to be set at this stage see **Section 3** below**.**

3 Setting up Alarms

The DS1500 Dewpoint Hygrometer Display has 4 alarm outputs.
Each alarm has a corresponding LED message in the front panel to indicate alarm status.

3.1 Alarm Functions

The alarms can be set to operate in seven different modes. These modes are shown in **Table 2, page 11** and described below. The alarm can also be set as 'disabled'.

• Break alarm – *I Err*
The break alarm is triggered whenever the input sensor breaks or is badly connected.

• Low alarm - *Lo*
The alarm relay is triggered whenever the measured value is below the alarm set point.

• High alarm - *H i*
The alarm relay is triggered whenever the measured value is above the alarm set point.

• Differential low – *d iF.Lo*
Deviation alarm. Alarm relay is triggered whenever the difference (deviation) between the Process Variable and the reference value (*RLrEF*) is lower than the

values defined in SP.AL. For this function, the triggering point is defined as: (ALrEF – SP.AL)

• Differential High – dIF.HI
Deviation alarm. Alarm relay is triggered when the difference (deviation) between the Process Variable value and the reference value (ALrEF) is greater than the value defined in SPAL. For this function, the triggering point is defined as: (ALrEF + SP.AL)

• Differential (or Band) out of range – dIF.ou
Deviation alarm. Alarm relay is triggered when the difference (deviation) between the Process Variable value and the reference value (ALrEF) has its modulus greater than the value configured in SPAL. For this function, the triggering point is defined as: (ALrEF – SP.AL) **and** (ALrEF + SP.AL)

• Differential (or Band) within range – dIF.In
Deviation alarm. Alarm relay is triggered when the difference (deviation) between the Process Variable value and the reference value (ALrEF) has its modulus lower than the value defined in SPAL. For this function, the triggering points are defined as: (ALrEF – SP.AL) **and** (ALrEF + SP.AL)

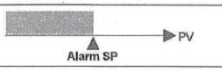
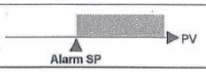
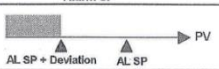
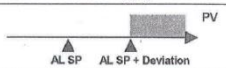
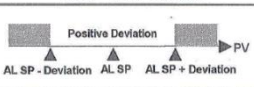
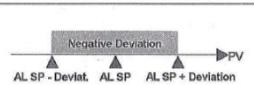
TYPE	PROMPT	ACTION
Disabled	oFF	Alarm is inactive
Break Alarm (*input* **Error**)	tErr	Alarm will go ON if sensor breaks
Low Alarm (**Low**)	Lo	
High Alarm (**High**)	HI	
Differential Low (***diff**erential* **Low**)	dIFLo	
Differential High (***diff**erential* **High**)	dIFHI	
Differential out of range (***differential out***)	dIF.ou	
Differential within range (***diff**erential* ***Within***)	dIF. In	

Table 2 – Alarm functions

3.1 Alarm Timer

The alarms can be configured to perform timing functions. The configuration allows the alarm output to be delayed, or to deliver a single pulse or a train of pulses. The delay, the pulse width and the period are defined by the user.

Table 3 below shows these advanced functions. Times T1 and T2 can be programmed from 0 to 6500 seconds and are define during configuration (**see ALARM LEVEL section on page 18**). Programming 0 (zero) in the timer parameters T1 and T2 disables the timer function.

The LEDs associated with the alarm always light up when the alarm condition occurs, regardless of the current state of the output relay, which may be de-energized momentarily due to a time delay.

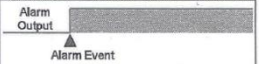
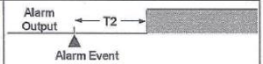
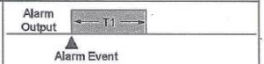
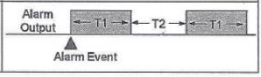
ADVANCED FUNCTION	T1	T2	ACTION
Normal Operation	0	0	
Delayed	0	1 s to 6500 s	
Pulse	1 s to 6500 s	0	
Oscillator	1 s to 6500 s	1 s to 6500 s	

Table 3 – Timer alarm functions

3.2 Alarm Initial Blocking

The **Initial Blocking** option inhibits the alarm from being recognized if an alarm condition is present when the controller is first energized. The alarm will be triggered only after the occurrence of a non-alarm condition followed by a new occurrence for the alarm.
The Initial Blocking is disabled for the **Break Alarm** function.

4 Special Functions

Maximum and Minimum

The digital panel meter memorizes the measured maximum and minimum values (peak and valley). These two values are shown when pressing the **MAX** or **MIN** keys.

Pressing both keys simultaneously will clear the memory for a new peak and valley detection.

Special Function Key and Digital Input

The [F] key (special function key) in the frontal panel and the optional digital input can execute special functions according to the user selection shows how to activate the digital input. The special functions for the [F] key and for the digital input are explained as it follows.

• HoLd – Freeze measured value

The **Hold** function freezes the measured value showed in the display. This function is toggled each time the [F] key is pressed, or the digital input is selected. Whenever the digital panel meter is in the **Hold** mode a HoLd message is briefly displayed to show the operator that the displayed value is the frozen value and not the current input reading.

• PHoLd – Maximum value

The Peak Hold function shows the maximum value measured since the last time the [F] key was pressed, or the digital input activated.
Each activation of the [F] key or digital input triggers a new **Peak Hold** level and the display resets with a new peak value.

• rSt – Clears maximum and minimum

This function works the same way as the **MAX** and **MIN** keys pressed simultaneously, as explained in the **Maximum and Minimum** section above.

If this rSt function is programmed, every touch of the [F] key or activation of the digital input will clear the memory and a new level of maximum and minimum values memorization will start.

5 Process Variable Retransmission

As an option, the digital panel meter can be supplied with an isolated 0-20 mA or 4-20 mA analog output for Process Variable (PV) retransmission. Available at the back panel terminals 29 and 30. When this option is available, retransmission will be always active, so that the user will not be required to turn it on or off.

The PV values that define the scale of the 0 mA / 4 mA to 20 mA retransmission can be programmed by the user in the **high and low output limits** (Ou.LoL and Ou.HiL), at configuration level. High and low limits can be freely programmed, even with a low limit higher than high limit, resulting in a reversed retransmission signal (decreasing signal when PV increases).

For a voltage output signal, an external shunt (calibrated resistor) should be installed at the analog output terminals.

5.1 Auxiliary 24 VDC Power Supply – Auxiliary P.S.

The digital panel meter provides a voltage power supply of 24 Vdc to excite field transmitters with 25 mA current maximum capacity.
Available at the back panel terminals 16 and 17.

6 Installation

The digital panel meter is designed to be panel mounted. Remove the two plastic fixing clamps from the instrument, insert the unit into the panel cut-out and slide firmly the fixing clamps from the rear against the panel.

6.1 Installation Recommendations

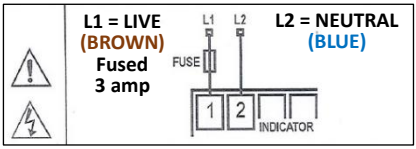
- Input signal wires should be laid out away from power lines and preferably inside grounded conduits.
- Instrument mains (line) supply should be suitable for this purpose and should not be shared.
- In controlling and monitoring applications, consequences of any system failure must be considered in advance.

  The internal alarm relay does not warrant total protection.

- Use of RC filters (47 R and 100 nF, serial) are highly recommended when driving solenoids, contactor coils or other inductive loads.

6.2 Electrical Connections for wiring a 2 wire AMT or PDT Dewpoint Transmitter

The input signals and power connections are shown in Figure 1a.



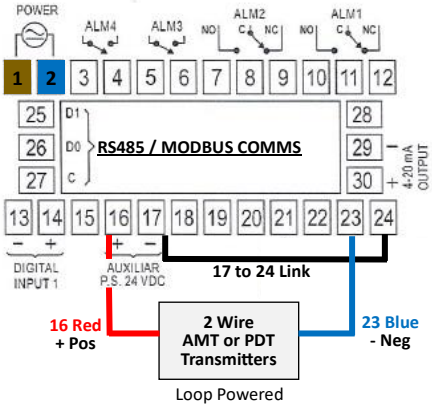
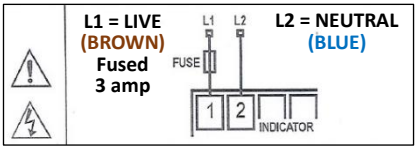
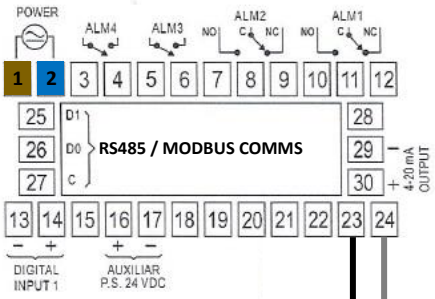


Figure 1a – Back panel terminals

The maximum size of the protective fuse is **3A** and, together with the power switch, it should be easily accessible and close to the DS1500. The power switch should be marked with a label indicating it will turn OFF the voltage to the DS1500.

6.3 Electrical Connections for wiring a 3-wire AMT-Ex Dewpoint Transmitter





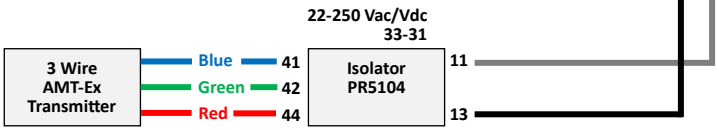


Figure 1b – Back panel terminals

Figures 1a and 1b shows the connections for 4-20 mA transmitter powered by the 24 V power supply of the DS1500 Dewpoint Hygrometer Display.

6.4 Analog Output

The **DS1500** can deliver either 0-20 mA or 4-20 mA analog output, depending on how the instrument is configured. The output is available at terminals **29** and **30**.

7 Programming the DS1500 Dewpoint Hygrometer Display

7.1 Work Level

This is the first level. At power up the digital panel meter will display the Process Variable (PV). The alarm triggering points are also displayed at this level (alarm Setpoints).

To advance in this level simply press [P] .

8.8.8.8.8.	**PV measurement.** Shows the measured variable. For 4-20 mA inputs the display shows the values defined in the I n.LoL and I n.HI L parameters. With the **hold** function programmed the display shows the frozen variable and alternates with the message HoLd. Likewise, with Peak Hold function programmed the high limit is displayed with the P.HoLd prompt alternately. Should any fault situation occur the DS1500 display will display an error message which can be identified at the **Troubleshooting section on pages 21/22.**
AL.rEF	**Differential Alarm Reference Value.** This prompt is shown only when there is an alarm programmed with differential function. This value is used as a reference for differential alarms triggering.
SP.AL 1 SP.AL2 SP.AL3 SP.AL4	**Alarms Setpoints 1, 2, 3 and 4**. Defines the operation point of each alarm programmed with Lo or H i functions. When an alarm is programmed with a differential function, the alarm setpoint value represents the deviation value of the alarm relative to the reference AL.rEF.

7.2 Alarm Level

Fu.AL 1 Fu.AL2 Fu.AL3 Fu.AL4	**Alarm Function** - Defines functions for the alarms 1, 2, 3 and 4, configured in **Alarm Functions section on pages 10/11 and 18** oFF Alarm off I Err Broken or Shorted Sensor Lo Low value H i High value d iF.Lo Differential low d iF.H i Differential high d iF.ou Differential outside the range d iFI n Differential within range.
HY.AL 1 HY.AL2	**Alarm Hysteresis.** This is the difference from the measured value to the point where the alarm is

HY.AL3 HY.AL4	turned ON and OFF.
bL.AL 1 bL.AL2 bL.AL3 bL.AL4	**Alarm Blocking.** Should any alarm condition occur, the alarms can be individually disabled when energizing the digital panel meter.
AL 1t 1 AL 1t2 AL2t 1 AL2t2 AL3t 1 AL3t2 AL4t 1 AL4t2	**Alarm Timer**. The user can set delayed, momentary, or sequential alarms by configuring times T1 and T2 according to **Table – Sequence of Levels and Parameters on Page 21.** To disable this function just set zero for T1 and T2.

7.3 Function Level

F.Func	(F) KEY FUNCTION. Defines functions for the (F) key. The available options are: oFF Key not used. HoLd Hold PV. rSt Resets Peak and Valley (MAX and values). P_HoL Peak Hold. These functions are described in detail in the **Special Function Key and Digital Input Section on page 13 section.**
d i9.I n	Digital Input Function. Defines the function for the digital input. The available functions are the same as for key: oFF - HoLd - rSt - PHoLd These functions are described in detail in the **Special Function Key and Digital Input Section on page 13 section.**
F iLtr	**Input Digital Filter**. Adjustable from 0 to 60, this is used to reduce instability of the measured value. 0 means the filter is off and 60 means maximum filtering. The higher the filter value, the slower the response.
oFSEt	**Display Offset**. This a value which is added to the PV to offset any measurement deviation or sensor

	error. The offset is shown in the programmed engineering unit. For °F measurements the null reference is at 32 °F.
bAud	**Baud Rate.** Serial digital communication speed in **kbps.** Programmable: 1.2, 2.4, 4.8, 9.6, 19.2, 38.4, 57.6, 115.2 (no parity). 1.2P, 2.4P, 4.8P, 9.6P, 19.2P, 38.4P, 57.6P and 115.2P (with EVEN parity).
AdrES	**Communication Address.** A number that identifies the instrument in a multidrop network.

7.4 Configuration Level

✱ = Factory Set – Do Not Adjust

In.tYP	**Input type.** Selects the input signal or sensor type to be connected to the PV terminals. Refer to Table 1 for options. ✱ Changing the input type causes all other parameters related to PV and alarms to be changed as well, therefore, this parameter shall be the first to be set.
dP.PoS	**Decimal point position**. Defines the decimal point position in the displayed value. ***Continued next page…*** It is displayed when linear input types 0-50 mV, 0-5V, 0-10 V, 0-20 mA or 4-20 mA are selected at the In.tYP prompt.

✱ = Factory Set – Do Not Adjust

S.root	✱ **Square root.** This prompt is only shown when input types 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA are selected at the In.tYP prompt. Set YES and the square root will be applied to the measured value within the limits programmed in In.LoL and inH iL. The display will show the low limit (In.LoL) value should the input signal be below 1 % of the range.
ScALE	✱ **Scale**. Defines the indication range for linear inputs (0-50 mV, 0-5 V, 0-10 V, 0-20 mA and 4-20 mA). 0 Configurable indication from – 31000 to + 31000. 1 Configurable indication from 0 to + 60000. 2 Configurable indication from 0 to +120000. Only

	even values will be displayed (resolution is not improved). The selected scale affects values of PV, alarm setpoints and Offset.
In.LoL	**Input low limit**. Sets the low limit for input type 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA. The range created may have increasing or decreasing behaviour in relation to the input signal behaviour.
In.HiL	**Input high limit**. Sets the high limit for input type 0-50 mV, 0-5 V, 0-10 V, 0-20 mA or 4-20 mA. The range created may have increasing or decreasing behaviour in relation to the input signal behaviour.
Out.ty	**Analog output type**. Selects the analogue output type to either 0-20 mA or 4-20 mA.
Ou.LoL	**Low limit for analogue retransmission**. Defines the PV value that results in a 4 mA (or 0 mA) analogue output current.
Ou.HiL	**High limit for analogue retransmission**. Defines the PV value that results in a 20-mA analogue output current.
Out.Er	**4-20 mA output behaviour in case of failures**. Defines the output as 4-20 mA when there is an error in the indication. **do** Applies a value < 4 mA. **UP** Applies a value > 20 mA

7.5 Table – Sequence of Levels and Parameters

This table shows the sequence of levels and parameters presented in the display. There are parameters that must be defined for each alarm available.

Work Level	Alarm Level	Function Level	Config Level	Customised Linearisation Level	Calibration Level
8.8.8.8.	# Fu.AL 1	F.FunC	In.tyP	InP.01 - InP.30	In.LoC
AL.rEF	# dF.AL 1	d iS.I n	dP.PoS	Out.01 - out.30	In.HI C
# SP.AL 1	# HY.AL 1	F iLtr	Unit		Ou.LoC
	# bL.AL 1	oFSEt	Sroot		Ou.HI C
	# AL. It 1	bAud	ScALE		CJ Lo
	# AL. It2	AdrES	In.LoL		H.tYPE
			In.HiL		
			Out.ty		
			Ou.LoL		
			Ou.HiL		

			Out.Er		

Parameters that require definition for each available alarm.

8 Troubleshooting

Connection errors or improper configuration will result in malfunctioning of the digital panel meter. Carefully revise all cable connections and programming parameters before operating the unit.
Some error messages will help the user identify potential problems.

Message	Possible Problem
uuuuu	Measured value is above the value allowed for the selected sensor or above the configured input signal limit.
nnnnn	Measured value is below the value allowed for the selected sensor or below the configured input signal limit.
-----	Open input. No sensor is connected, or the sensor is broken.
Err 1	Pt100 cable resistance is too high, or the sensor is badly connected.

Different messages other than the ones above should be reported to the manufacturer. Please inform the serial number if this should occur. The serial number can be viewed at the display by pressing the ◀‖ key for about 3 seconds. The software version of the instrument can be viewed at the time the unit is powered.
When not properly configured, the instrument may show false error messages, particularly those related to the type of input selected.

8.1 Special Recommendations

Should the digital panel meter be repaired, some special handling care should be taken. The device must be withdrawn from the case and immediately placed in an anti-static wrap; protected from heat and humidity.

9 Serial Communication – RS485 / MODBUS RTU

The digital panel meter can be supplied with an asynchronous RS485 digital communication interface for master-slave connection to a host computer (master). The digital panel meter works as a slave only and all commands are started by the computer which sends a request to the slave address.
The addressed unit processes the command and sends back the answer.
Broadcast commands (addressed to all units in a multidrop network) are accepted but no response is generated.

Features

- RS485 compatibility with two-wire bus from the host to up to 31 slaves in a multidrop network topology.
- Up to 247 units can be addressed by the MODBUS RTU protocol.
- Maximum network distance: 1000 m.
- Disconnection time: Maximum of 2 ms after the delivery of the last byte.
- Communication signals electrically isolated from the rest of the instrument.
- Baud rate: 1200, 2400, 4800, *9600, 19200, 38400 or 57600 bps. *=Default.
- Time to start response transmission: 100 ms maximum delay after acknowledging the command.
- Protocol: MODBUS (RTU)

Two parameters must be configured to use the serial communication interface: Communications Baud Rate (**bAud**) and the Communication Address (**AdrES**).

9.1 RS485 Interface: Electrical Connection

- 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	Bidirectional data line	Terminal 25
D0	Inverted bidirectional data line	Terminal 26
C	Optional connection. Improves communication performance for long cable runs.	Terminal 27

9.2 General Characteristics

- Optically isolated serial interface.
- Programmable Baud Rate: 1200, 2400, 4800, ***9600**, 19200, 38400, 57600 or 115200 bps. *** = Factory Default**
- Data Bits: 8, without parity.
- Parity: None or even.
- Stop Bits: 1.

9.3 Reduced Registers Table for Serial Communication

Communication Protocol
The MOSBUS RTU slave is implemented. All configurable parameters can be accessed for reading or writing through the communication port. Broadcast commands are supported as well (address 0).
The available Modbus commands are:

01 – Read Coils	*05 – Write Single Coil*
03 - Read Holding Register	*06 - Write Single Register*

9.4 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.

9.5 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.

9.6 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 → XXXX.X; 2 → XXX.XX; 3 → XX.XXX; 4 → X.XXXX; 5 → .XXXXX.
0012	F.Func	F key Function. Standard Model: 0 → oFF; 1 → HoLd; 2 → rESEt; 3 → PHoLd.
0013	di.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 → Configurable indication from 0 to +120000.
0017	Sroot	Input Square Root. Range: 0 to 1. 0 → No; 1 → Yes.

0018	out.Er	4-20mA analog output on error condition. 0 → Down; 1 → Up.
0019	AL.rEF	Alarm Reference. Range: From LnLoL to InHIL.
0020	Out.tY	Retransmission type of PV. Range: 0 to 1. 0 → 4 a 20mA retransmission; 1 → 0 a 20mA retransmission .
0021	SP.AL 1	Alarm 1 Preset. The minimum value is InLoL set for not differential alarm or (InLoL - InHIL) for differential alarm. The maximum value is in InHIL set for not differential alarm or (InHIL - InLoL) if differential alarm.
0022	SP.AL2	Alarm 2 Preset. Range: Same as SPAL 1 or dFAL 1.
0023	SP.AL3	Alarm 3 Preset. Range: Same as SPAL 1 or dFAL 1.
0024	SP.AL4	Alarm 4 Preset. Range: Same as SPAL 1 or dFAL 1.
0025	Fu.AL 1	Alarm 1 Function. Range: 0 to 7. 0 → oFF; 1 →I Err; 2 → Lo; 3 → HI ; 4 → dI F.Lo; 5 → dI F.HI ; 6 → dI F.oU 7 → dI F.In
0026	Fu.AL2	Alarm 2 Function. Range: Same as FuAL 1.
0027	Fu.AL3	Alarm 3 Function. Range: Same as FuAL 1.
0028	Fu.AL4	Alarm 4 Function. Range: Same as FuAL 1.
0029	bL.AL 1	Alarm 1 power-up inhibit. Range: 0 a 1. 0 → No; 1 → Yes.
0030	bL.AL2	Alarm 2 power-up inhibit.

		Range: Same as bLAL 1.
0031	bL.AL3	Alarm 3 power-up inhibit. Range: Same as bLAL 1.
0032	bL.AL4	Alarm 4 power-up inhibit. Range: Same as bLAL 1.
0033	HY.AL 1	Alarm 1 Hysteresis (engineering unit). Range: 1 to span do sensor.
0034	HY.AL2	Alarm 2 Hysteresis (engineering unit). Range: Same as HYAL 1.
0035	HY.AL3	Alarm 3 Hysteresis (engineering unit). Range: Same as HYAL 1.
0036	HY.AL4	Alarm 4 Hysteresis (engineering unit). Range: Same as HYAL 1.
0037	I nEYP	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	unI t	Temperature Unit. Range: 0 to 1. 0 → °C; 1 → °F. Not available on LC model.
0039	I n.LoL	Indication Low limit. Range: The minimum value depends of input type configured in I nEYP 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 I nEYP.
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 1	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 1.
0048	AL2t 1	Alarm 2 Time 1 of timer (in seconds). Range: Same as AL It 1.
0049	AL2t2	Alarm 2 Time 2 of timer (in seconds). Range: Same as AL It 1.
0050	AL3t 1	Alarm 3 Time 1 of timer (in seconds). Range: Same as AL It 1.
0051	AL3t2	Alarm 3 Time 2 of timer (in seconds). Range: Same as AL It 1.
0052	AL4t 1	Alarm 4 Time 1 of timer (in seconds). Range: Same as AL It 1.
0053	AL4t2	Alarm 4 Time 2 of timer (in seconds). Range: Same as AL It 1.
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.01 to I nP.30	Custom linearization value.
0091 to 0120	out.01 to out.30	Value to be displayed in point of custom linearization

Table 1 – Registers Table

9.7 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

9.8 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.

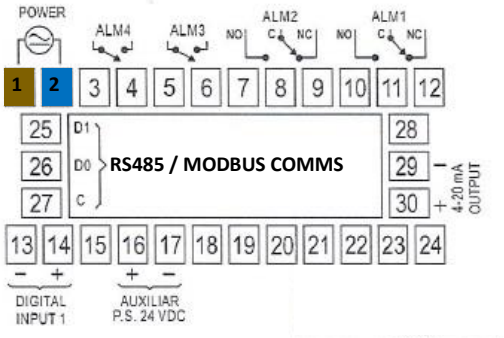
If a write command sends a value outside the allowed range, the maximum value allowed for this parameter is forced, returning that value as a response.

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

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



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

10 Specifications

Dimensions: ..... 48 x 96 x 92 mm (1/8 DIN)
Weight:.....250 g
Panel Cut-Out: ..... 45 x 93 mm (+0.5 -0.0 mm)
Power: ..... 100 to 240 Vac/dc ±10 %, 50/60 Hz
Optional 24 V: ..... 12 to 24 Vdc / 24 Vac (-10 % / +20 %)
Max. Consumption: ..... 7.5 VA

Environmental Conditions:
Operating temperature: ..... 5 to 50 °C
Maximum RH: ..... 80 % up to 30 °C
..... for temperatures above 30 °C, decrease 3 % per °C
..... installation category II, pollution degree 2, altitude < 2000 m

Input ..... Keyboard selection of input type (refer to **Table 2**)
Internal resolution: ..... 128000 levels

Display resolution:
Other measures ..... 1 / 0.1 / 0.01 / 0.001 / 0.0001
Input sample rate: ..... 15 per second, 4-20 mA
Accuracy: ..... mA, 0.2 % of span
Input impedance: .....4-20 mA: 15 Ω (+2 Vdc @ 20 mA)
Pt100 measurement: ..... DIN 43760 standard (α = 0.00385)
Excitation current: .....cable resistance compensation
Analog Output: ..... 0-20 mA or 4-20 mA, 500 Ω max.
..... 4000 levels, Isolated
Relay Output:..... ALM1, ALM2: SPDT 3 A / 240 Vac (3 A / 30 Vdc Res.)
..... ALM3, ALM4: SPST-NO: 1.5 A / 250 Vac (3 A / 30 Vdc Res.)
Auxiliary Power Supply: ..... 24 Vdc, ±10 %; 25 mA
EMC: ..... EN 61326-1:1997 and EN 61326-1/A1:1998
Safety: ..... EN61010-1:1993 and EN61010-1/A2:1995
Specific Connections for Type Fork Terminals of 6.3mm.
Frontal Panel: ..... IP65, polycarbonate UL94 V-2
Housing: ..... IP20, ABS + PC UL94 V-0
Start-Up: .....3 seconds after power up
Certifications: .....CE, UKCA
Warranty:.....12 months