

Communication Protocol V2.3x A
N1500 / N1500LC / N1500G Indicator

1. SERIAL COMMUNICATION

1.1 COMMUNICATION INTERFACE

The optional serial interface RS485 allows to address up to 247 indicators in a network communicating remotely with a host computer or master controller.

RS485 Interface

- compatible line signals with RS485 standard
- 2 wire connection from master to up to 31 slaves indicators in a multi drop bus. It is possible address 247 nodes with multiple outputs converters.
- Maximum communication distance: 1000 meters
- The RS485 signals are:

D1 = D: Bidirectional data line.
D0 = \bar{D} : Bidirectional inverted data line.
C = GND: Optional connection which left communication better.

General Characteristics

- Optically isolated serial interface
- Programmable baud rate: 1200, 2400, 4800, 9600, 19200, 38400, 57600 or 115200bps.
- Data Bits: 8
- Parity: None or even.
- Stop Bits: 1

Communication Protocol

The MOSBUS RTU slave is implemented, available in more SCADA software's in the market.

All configurable parameters can be accessed (readed or writed) through the Registers Table. Broadcast commands are supported as well (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.

1.2 CONFIGURATION OF SERIAL COMMUNICATION PARAMETERS

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

bAud: Baud rate. All devices with same baud rate.

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

Holding Registers

Equivalent to the registers reference 4XXXX.

The holding registers are basically a list of the internal indicator parameters. All registers above address 12 can be writed and readed. The registers up to this address in more are read only. Please verify each case. Each table parameter is a 16 bits two complement signed word.

Holding Registers	Parameter	Register Description
0000	PV	Read: Process variable. Write: not allowed. Range: the minimum value is in <i>inLoL</i> set and the maximum value is in <i>inHiL</i> set and the decimal point position depends of <i>dPPoS</i> .
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 62000.

0004	Display Value	Read: Current display value. Write: Current display value. 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: XYYYh, 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. Readed values: If the version is V1.00, for example, will be read 100.
0008	ID	Read: Identification device Number. Write: not allowed. Readed values: 1 - N1100/N2000; 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	<i>dPPoS</i>	Decimal point position of PV. Range: 0 to 4 0→XXXXX; 1→XXXX.X; 2→XXX.XX; 3→XX.XXX; 4→X.XXXX
0012	<i>FFunc</i>	F key Function. Standard Model : 0→oFF; 1→HoLd; 2→ rESEt; 3→PHoLd LC Model: 0→oFF; 1→HoLd; 2→ rESEt; 3→PHoLd; 4→H i; 5→ L o; 6→zEr o

0013	dIGIn	Digital Input Function. Standard Model : 0→oFF; 1→HoLd; 2→ rESEt; 3→;PHoLd; LC Model: 0→oFF; 1→HoLd; 2→ rESEt; 3→;PHoLd; 4→H I; 5→ Lo; 6→;tArE;
0014	FILtEr	Input digital filter. Range: 0 to 60.
0015	oFFSEt	Input Offset value. Range: from <i>inLoL</i> to <i>inHiL</i>
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	outEr	4-20mA analog output on error condition. 0→down; 1→up
0019	ALrEF	Alarm Reference. Range: from <i>inLoL</i> to <i>inHiL</i>
0020	outTY	Retransmission type of PV. Range: 0 to 1 0→ 4 a 20mA retransmission; 1→0 a 20mA retransmission
0021	SPAL 1	Alarm 1 Preset. Range: the minimum value is in <i>inLoL</i> set for not differential alarm or (<i>inLoL</i> - <i>inHiL</i>) for differential alarm; The maximum value is in <i>inHiL</i> set for not differential alarm or (<i>inHiL</i> - <i>inLoL</i>) if differential alarm.
0022	SPAL 2	Alarm 2 Preset Range: same as <i>SPAL 1</i> or <i>dFAL 1</i> .
0023	SPAL 3	Alarm 3 Preset Range: same as <i>SPAL 1</i> or <i>dFAL 1</i> .
0024	SPAL 4	Alarm 4 Preset Range: same as <i>SPAL 1</i> or <i>dFAL 1</i> .
0025	FuAL 1	Alarm 1 Function. Range: 0 to 6 0→oFF; 1→ !Err; 2→Lo; 3→H I; 4→d iFL; 5→d iFH; 6→d iF.
0026	FuAL 2	Alarm 2 Function Range: same as <i>FuAL 1</i> .
0027	FuAL 3	Alarm 3 Function Range: same as <i>FuAL 1</i> .
0028	FuAL 4	Alarm 4 Function Range: same as <i>FuAL 1</i> .
0029	bLAL 1	Alarm 1 power-up inhibit. Range: 0 a 1 0→no; 1→yes.
0030	bLAL 2	Alarm 2 power-up inhibit Range: same as <i>bLAL 1</i> .
0031	bLAL 3	Alarm 3 power-up inhibit Range: same as <i>bLAL 1</i> .
0032	bLAL 4	Alarm 4 power-up inhibit Range: same as <i>bLAL 1</i> .
0033	HYAL 1	Alarm 1 Hysteresis (engineering unit) Range: 0 to span do sensor
0034	HYAL 2	Alarm 2 Hysteresis (engineering unit) Range: same as <i>HYAL 1</i> .
0035	HYAL 3	Alarm 3 Hysteresis (engineering unit) Range: same as <i>HYAL 1</i> .
0036	HYAL 4	Alarm 4 Hysteresis (engineering unit) Range: same as <i>HYAL 1</i> .

0037	inTYP	Input sensor type - Standard model (types 0 to 22): 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); 15→ Lin J; 16→ Lin K; 17→ Lin T; 18→ Lin E; 19→ Lin N; 20→ Lin R; 21→ Lin S; 22→ Lin B; 23→ Lin Pt100; 24→ 0 to 20mA; 25→ 4 to 20mV; 26→ 0 to 20mA (custom linearization); 27→ 4 to 20mV (custom linearization); LC - Load Cell model (types 0 to 9): 0→ 0 to 20mV; 1→ -20 to 20mV; 2→ 0 to 50mV; 3→ 0 to 20mV (custom linearization); 4→ -20 to 20mV (custom linearization); 5→ 0 to 50mV (custom linearization); 6→ 0 to 20mA; 7→ 4 to 20mV; 8→ 0 to 20mA (custom linearization); 9→ 4 to 20mV (custom linearization);
0038	unIt	Temperature Unit. Range: 0 to 1 0→°C; 1→°F. Not available on LC model.
0039	inLoL	Indication Low limit. Range: the minimum value depends of input type configured in <i>inTYP</i> and the maximum is in <i>inHiL</i> seted.
0040	inHiL	Indication High limit. Range: from <i>inLoL</i> to the input maximum configured in <i>inTYP</i> .
0041	AdRES	Slave address Range: 1 to 247
0042	baud	Communication Baud Rate. Range: 0 to 4 0→1200; 1→2400; 2→4800; 3→9600; 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	ALIt 1	Alarm 1 Time 1 of timer. Range: 0 to 6500sec See operation manual for details.
0047	ALIt 2	Alarm 1 Time 2 of timer (in seconds) Range: same as <i>ALIt 1</i> .
0048	AL2t 1	Alarm 2 Time 1 of timer (in seconds) Range: same as <i>ALIt 1</i> .

0049	<i>RL2t2</i>	Alarm 2 Time 2 of timer (in seconds) Range: same as <i>RL1t1</i> .
0050	<i>RL3t1</i>	Alarm 3 Time 1 of timer (in seconds) Range: same as <i>RL1t1</i> .
0051	<i>RL3t2</i>	Alarm 3 Time 2 of timer (in seconds) Range: same as <i>RL1t1</i> .
0052	<i>RL4t1</i>	Alarm 4 Time 1 of timer (in seconds) Range: same as <i>RL1t1</i> .
0053	<i>RL4t2</i>	Alarm 4 Time 2 of timer (in seconds) Range: same as <i>RL1t1</i> .
0054	<i>oULLoL</i>	Low Limit for Analog Retransmission – Defines the PV value that results in a 4mA (or 0mA) analog output current.
0055	<i>oUHL</i>	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>inP.01</i> to <i>inP.30</i>	Custom linearization value.
0091 to 0120	<i>out.01</i> to <i>out.30</i>	Value to be displayed in point of custom linearization

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).

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

1.3 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