

N1200

Communication Protocol – V10x

1. SERIAL COMMUNICATION

1.1 COMMUNICATION INTERFACE

The optional serial interface RS485 allows to address up to 247 controllers 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 multidrop 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 115200 bps.
- Data Bits: 8
- Parity: None, Even or Odd.
- Stop Bits: 1

Communication Protocol

The MOSBUS RTU slave is implemented, available in most SCADA softwares in the market.

All configurable parameters can be accessed (for reading or writing) 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
- 16 - Preset Multiple Registers (Block write to multiple holding registers)

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.

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


Prty: Paraty.

1.3 REGISTERS TABLE

Equivalent to the registers referenced as 4XXXX.

The holding registers are basically a list of the internal indicator parameters. All registers above address 12 can be read or written. 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	Active SP	Read: Active control SP (main SP, from ramp and soak or from remote SP). Write: to main SP Range: from SPLL to SPHL .
0001	PV	Read: Process Variable. Write: Not allowed. Range: Minimum value is the one configured in SPLL and the maximum value is the one configured in SPHL . Decimal point position depends on dPPo value. In case of temperature reading, the value read is always multiplied by 10, independently of dPPo value.
0002	MV	Read: Output Power in automatic or manual mode. Write: Not allowed. See address 28. Range: 0 to 1000 (0.0 to 100.0%).
0003	Remote SP type	Read/Write: Selected input type for remote SP. Range: 0 to 3
0004	Display value	Read: Current value shown on display. Write: Current value shown on display. Range: -1999 to 9999. The range depends on the displayed parameter.

0005	Prompt index	Read: Current prompt position in the parameters flowchart. Write: not allowed. Range: 0000h to 060Ch Prompt number format: XXYYh, where: XX→menu cycle number (check item 4 - INSTALLATION/CONNECTIONS) YY→prompt number (index).
0006	Status Word 1	Read: Status bits. See table 2. Write: not allowed.
0007	Software Version	Read: The firmware version of controller. If V1.00, the read value will be 100. Write: not allowed.
0008	ID	Read: controller identification number. Write: not allowed. Values: 1 – N1100; 2 - N2000; 3 - N1500; 48 - 1200 Other values: special instruments.
0009	Status Word 2	Read: Status bits. See table 2. Write: not allowed.
0010	Status Word 3	Read: Status bits. See table 2. Write: not allowed.
0011	Ir	Integral Rate (in repetitions/min) Range: 0 to 9999 (0.00 to 99.99)
0012	dEt	Derivative Time (in seconds). Range: 0 to 3000 (0.0 to 300.0)
0013	Pb	Proportional Band (in percentage) Range: 0 to 5000 (0.0 to 500.0)
0014	tBAS	Read/Write: Time base for the ramp and soak programs. Range: 0 – 1 (seconds/minutes)
0015	ct	Cycle Time (PWM, in seconds) Range: 5 to 1000 (0.5 to 100.0)
0016	FrEQ	Read/Write: Mains frequency. Range: 0 – 1 (60/50Hz)
0017	HYSct	On/Off Control Hysteresis (in selected type engineering unit). Range: 0 to SPLL - SPLL
0018	FLtr	Read/Write: PV digital filter gain. Range: 0 – 20
0019	ouLL	Output Low Limit (minimum output power) Range: 0 to 1000 (0.0 to 100.0%).
0020	ouHL	Output High Limit (minimum output power) Range: 0 to 1000 (0.0 to 100.0%).
0021	RuEn	N2000 only. Auto/Man key Enable –  1 → Key enabled 0 → Key disabled
0022	FFunc	N2000 only. F key function. 0 → Not used. 7 → Controller start/stop. 8 → Select remote SP. 9 → Ramp and soak hold. 10 → Enable ramp and soak profile 1.
0023	Serial number H	Serial Number High (Upper display). Range: 0 to 9999. Read only
0024	Serial number L	Serial Number Low (Lower display). Range: 0 to 9999. Read only
0025	SV	Control Setpoint (Prompt Setpoint). Range: from SPLL to SPHL .
0026	SPLL	Setpoint Low limit. Range: minimum value depends on the input type selected in tYPE (see Table 1) to SPHL .
0027	SPHL	Setpoint High limit. Range: minimum value is SPLL and maximum depends on the input type selected in tYPE (see Table 1).
0028	Reserved	Internal use.
0029	oFFS	PV offset Range: from SPLL to SPHL .
0030	dPPo	PV decimal point position Range: 0 to 3 0→0.000; 1→00.00; 2→000.0; 3→0000
0031	SPR1	Alarm 1 Setpoint. Range: The minimum value is at SPLL for non-differential alarm or SPLL - SPLH for differential alarm The maximum value is at SPHL for non-differential alarm or at SPHL - SPLL for differential alarm.
0032	SPR2	Alarm 2 Setpoint. Range: same as in SPR1 .
0033	SPR3	Alarm 3 Setpoint. Range: same as in SPR1 .
0034	SPR4	Alarm 4 Setpoint. Range: same as in SPR1 .
0035	FuR1	Alarm 1 Function. Range: 0 to 8 0→ oFF ; 1→ IErr ; 2→ rS ; 3→ rFA1 ; 4→ Lo ; 5→ H1 ; 6→ dIFL ; 7→ dIFH ; 8→ dIF .
0036	FuR2	Alarm 2 Function. Range: same as in FuR1 .
0037	FuR3	Alarm 3 Function. Range: same as in FuR1 .
0038	FuR4	Alarm 4 Function. Range: same as in FuR1 .
0039	HYA1	Alarm 1 Hysteresis. Range: 0 to 9999 (0.00 to 99.99%)

0040	HYA2	Alarm 2 Hysteresis. Range: same as in HYA 1 .
0041	HYA3	Alarm 3 Hysteresis. Range: same as in HYA 1 .
0042	HYA4	Alarm 4 Hysteresis. Range: same as in HYA 1 .
0043	TYPE	PV input type Range: 0 to 22. See operation manual.
0044	Addr	Communication slave address Range: 1 to 247
0045	bAud	Communication Baud-Rate. Range: 0 to 4 0→1200;1→2400;2→4800;3→9600; 4→19200
0046	Auto	Control Mode. Range: 0→manual; 1→automatic.
0047	run	Enable control. Range: 0→no; 1→yes.
0048	Act	Control action. Range: 0→direct; 1→reverse.
0049	Actun	Auto tune enable. Range: 0→no; 1→yes.
0050	bLA 1	Alarm 1 power-up inhibit. Range: 0→no; 1→yes.
0051	bLA2	Alarm 2 power-up inhibit Range: same as in bLA 1 .
0052	bLA3	Alarm 3 power-up inhibit Range: same as in bLA 1 .
0053	bLA4	Alarm 4 power-up inhibit Range: same as in bLA 1 .
0054	Key	Key press remote action. Range: 0 to 9 1→; 2→; 4→; 8→; 9→ e .
0055	rSLl	Remote Setpoint Low limit Range: Minimum value depends on the input type selected in TYPE , and maximum value is in rSHL .
0056	rSHL	Remote Setpoint High limit Range: Minimum value is in rSLl , and maximum depends on the input type selected in TYPE .
0057	io 1	IO 1 Function. Range: 0 to 5 Refer to operation manual for more details.
0058	io 2	IO 2 Function. Range: 0 to 5 Refer to operation manual for more details.
0059	io 3	IO 3 Function. Range: 0 to 10 Refer to operation manual for more details.
0060	io 4	IO 4 Function. Range: 0 to 10 Refer to operation manual for more details.
0061	io 5	IO 5 Function. Range: 0 to 16 Refer to operation manual for more details.
0062	A It 1	Alarm 1 Time 1. Range: 0 to 6500s Refer to operation manual for more details.
0063	A It 2	Alarm 1 Time 2 (in seconds) Range: same as in A It 1 .
0064	A2t 1	Alarm 2 Time 1 (in seconds) Range: same as in A It 1 .
0065	A2t 2	Alarm 2 Time 2 (in seconds) Range: same as in A It 1 .
0066	SFS t	Soft-Start time (in seconds) Range: 0 to 9999
0067	un It	Temperature unit. Range: 0 to 1 0→°C; 1→°F.
0068	bIAS	Bias. Range: -100 to +100%.
0069	io 6	N2000 only. IO 6 Function. Allowed values: 0, 6, 7, 8, 9 and 10. Refer to operation manual for more details.
0070	R&S Segment	Ramp and Soak segment being executed (read only). Range: 0 to 9
0071	Pr n	Ramp and Soak segment to be viewed or edited. Range: 1 to 20
0072	Pr n	Ramp and Soak segment to be executed Range: 0 to 20
0073	Remaining time R&S	Indicates the remaining time of the Ramp and Soak segment.
0074	Sqr t	Square root of a linear input. Range: 0→Disable;1→Enable.
0075	Calibration PV Low	Enter the low input value currently applied in the PV input for calibration purposes.
0076	Calibration PV High	Enter the high input value currently applied in the PV input for calibration purposes.
0077	Calib. remote SP Low	Enter the low input value currently applied in the remote setpoint input for calibration purposes.
0078	Calib. remote SP High	Enter the high input value currently applied in the remote setpoint input for calibration purposes.
0079	r tLL	Retransmission low limit
0080	r tHL	Retransmission high limit
0081	FLSh	Enables the top display blinking as a function of the selected alarm. Range: 0 to 15. Check instruction manual for further details.
0082	A3t 1	Time 1 of the alarm 3 timing (in seconds) Range: same as in A It 1 .
0083	A3t 2	Time 2 of the alarm 3 timing (in seconds) Range: same as in A It 2 .

0084	A4t 1	Time 1 of the alarm 4 timing (in seconds) Range: same as in A It 1 .
0085	A4t 2	Time 2 of the alarm 4 timing (in seconds) Range: same as in A It 2 .
0086	rSt r	Restores original default calibration. Range: 0 to 1; 0-> do not restore; 1-> restore calibration
0087	-	Internal use
0088	Prot	Password protection level. Range: 1 to 7. Check instruction manual for further details.
0089	Pr tY	Serial communication parity. Range: 0 to 2. 0-> no parity; 1 -> even parity; 2 -> odd parity;
0090	Reserved	Internal use
0091	Reserved	Internal use
0092	Reserved	Internal use
0093	Reserved	Internal use
0094	Reserved	Internal use
0095	Reserved	Internal use
0096	Reserved	Internal use
0097	Reserved	Internal use
0098	ErSP	Enables remote setpoint. Range: 0 to 1. 0 -> Remote setpoint depends on I/O configuration 1 -> Force remote setpoint
0099	Reserved	Internal use
0100	PE 1	Segment 1 Event of R&S Program 1. Range: 0 to 15. Check table 6 of the instruction manual.
0101	PE 2	Segment 2 Event of R&S Program 1. Range: same as in PE 1
0102	PE 3	Segment 3 Event of R&S Program 1. Range: same as in PE 1 .
0103	PE 4	Segment 4 Event of R&S Program 1. Range: same as in PE 1 .
0104	PE 5	Segment 5 Event of R&S Program 1. Range: same as in PE 1 .
0105	PE 6	Segment 6 Event of R&S Program 1. Range: same as in PE 1 .
0106	PE 7	Segment 7 Event of R&S Program 1. Range: same as in PE 1 .
0107	PE 8	Segment 8 Event of R&S Program 1. Range: same as in PE 1 .
0108	PE 9	Segment 9 Event of R&S Program 1. Range: same as in PE 1 .
0109	PE 1	Segment 1 Event of R&S Program 2. Range: same as in PE 1 of Program 1.
0110	PE 2	Segment 2 Event of R&S Program 2. Range: same as in PE 1 .
0111	PE 3	Segment 3 Event of R&S Program 2. Range: same as in PE 1 .
0112	PE 4	Segment 4 Event of R&S Program 2. Range: same as in PE 1 .
0113	PE 5	Segment 5 Event of R&S Program 2. Range: same as in PE 1 .
0114	PE 6	Segment 6 Event of R&S Program 2. Range: same as in PE 1 .
0115	PE 7	Segment 7 Event of R&S Program 2. Range: same as in PE 1 .
0116	PE 8	Segment 8 Event of R&S Program 2. Range: same as in PE 1 .
0117	PE 9	Segment 9 Event of R&S Program 2. Range: same as in PE 1 .
0119	PE 1	Segment 1 Event of R&S Program 3. Range: same as in PE 1 of Program 1.
0120	PE 2	Segment 2 Event of R&S Program 3. Range: same as in PE 1 .
0118	PE 3	Segment 3 Event of R&S Program 3. Range: same as in PE 1 .
0121	PE 4	Segment 4 Event of R&S Program 3. Range: same as in PE 1 .
0122	PE 5	Segment 5 Event of R&S Program 3. Range: same as in PE 1 .
0123	PE 6	Segment 6 Event of R&S Program 3. Range: same as in PE 1 .
0124	PE 7	Segment 7 Event of R&S Program 3. Range: same as in PE 1 .
0125	PE 8	Segment 8 Event of R&S Program 3. Range: same as in PE 1 .
0126	PE 9	Segment 9 Event of R&S Program 3. Range: same as in PE 1 .
0127	PE 1	Segment 1 Event of R&S Program 4. Range: same as in PE 1 of Program 1.

Register	Value format
Status Word 1	bit 0 – Alarm 1 (0-inactive; 1-active) bit 1 – Alarm 2 (0-inactive; 1-active) bit 2 – Alarm 3 (0-inactive; 1-active) bit 3 – Alarm 4 (0-inactive; 1-active) bit 4 – Input 0 – I/O 5 (0- inactive; 1- active) bit 5 – Input 1 – I/O 3 (0- inactive; 1- active) bit 6 – Input 2 – I/O 4 (0- inactive; 1- active) bit 7 – Reserved bit 8 – Hardware detection value bit 9 – Hardware detection value bit 10 – Reserved bit 11 – Reserved bit 12 – Reserved bit 13 – Reserved bit 14 – Reserved bit 15 – Reserved
Status Word 2	bit 0 – Automatic (0- manual; 1- automatic) bit 1 – Run (0-stop; 1-run) bit 2 – Control Action (0-direct; 1-reverse) bit 3 – Reserved bit 4 – Auto-tune (0-no; 1-yes) 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 status bit 12 – Output 2 status bit 13 – Output 3 status bit 14 – Output 4 status bit 15 – Output 5 status
Status Word 3	bit 0 – Very low PV conversion (0-no; 1-yes) bit 1 – Negative conversion after calibration (0-no; 1-yes) bit 2 – Very high PV conversion (0-no; 1-yes) bit 3 – Exceeded linearization limit (0-no; 1-yes) bit 4 – Very high Pt100 cable resistance (0-no; 1-yes) bit 5 – Self zero conversion out of range (0-no; 1-yes) bit 6 – Self span conversion out of range (0-no; 1-yes) bit 7 – Reserved bit 8 – Reserved bit 9 – Reserved bit 10 – Reserved bit 11 – Reserved bit 12 – Reserved bit 13 – Reserved bit 14 – Reserved bit 15 – Reserved

Table 2: Values of Status Words

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	Output 1 Status (I/O1)
2	Output 2 Status (I/O2)
3	Output 3 Status (I/O3)
4	Output 4 Status (I/O4)
5	Output 5 Status (I/O5)

Exception Responses – Error Conditions

The MODBUS RTU protocol checks the CRC in the data blocks received.

Reception errors are detected by the CRC, causing the controller to discard the packet, not sending any reply to the master.

After receiving an error-free packet, the controller processes the packet and verifies whether the request is valid or not, sending back an exception error code in case of an invalid request. Response frames containing error codes have the most significant bit of the Modbus command set.

If a WRITE command sends an out-of-range value to a parameter, the controller will clamp the value to the parameter range limits, replying with a value that reflects these limits (maximum or minimum value allowed for the parameter).

The controller ignores broadcast READ commands; the controller processes only broadcast WRITE commands.

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

Table 3 – Exception response error codes