N1020

Communication Protocol V10x A

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

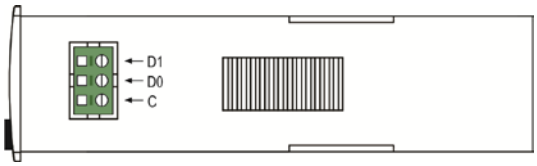
- Compatible line signals with RS485 standard;
- 3 wire connection from master to up to 31 slaves indicators in a multidrop bus. It is possible address 247 nodes with multiple outputs converters;
- Maximum communication distance: 1000 meters.
- The RS485 signal are:

D1 = D: Bidirectional data line.
D0 = $\overline{D}$: 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 and 115200 bps.
- Data Bits: 8
- Parity: None, Even or Odd.
- Stop Bits: 1

1.2 CONNECTIONS



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 Register.

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

1.3 CONFIGURATION OF SERIAL COMMUNICATION PARAMETERS

Three 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: Parity.

1.4 REGISTERS TABLE

Equivalent to the registers referenced as 4X.

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	Reserved	
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 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: 65 Write: not allowed.
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	**dt**	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	Reserved	
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	**HYSt**	On/Off Control Hysteresis (in selected type engineering unit). Range: 0 to **SPHL** - **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 %).
0021~0022	Reserved	
0023	Serial Number High	Write: Not allowed. First four digits of Serial Number. Range: 0 to 9999. Read only
0024	Serial Number Low	Write: No allowed. Last four digits of Serial Number. Range: 0 to 9999. Read only
0025	SP	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→X.XXX; 1→XX.XX; 2→XXX.X; 3→XXXX
0031	SPA 1	Alarm 1 Setpoint. Range: Between SPLL and SPHL for non-differential alarm or at SPHL - SPLL for differential alarm.
0032	SPA2	Alarm 2 Setpoint. Range: same as in SPA 1.
0033~0034	Reserved	
0035	FuA 1	Alarm 1 Function. Range: 0 to 8 0→oFF; 1→Lo; 2→H 1; 3→d 1F;4→d 1FL; 5→d 1FH; 6→t.On; 7→t.End; 8→Err;
0036	FuA2	Alarm 2 Function. Range: same as in FUA 1.
0037~0038	Reserved	
0039	HyA 1	Alarm 1 Hysteresis. Range: 0 to 9999 (0.00 to 99.99%)
0040	HyA2	Alarm 2 Hysteresis. Range: same as in HyA 1.
0041~0042	Reserved	
0043	tyPE	PV input type Range: 0 to 9. See operation manual.
0044	Addr	Communication slave address. Range: 1 to 247
0045	bAud	Communication Baud-Rate. Range: 0 to 7 0→1200;1→2400;2→4800;3→9600; 4→19200; 5→32400; 6→57600; 7→115200.
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	Atun	Auto tune enable. Range: 0 to 5 0→FAST; 1→FULL; 2→SELF; 3→ RSLF; 4→TGHT.
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.
0052~0053	Reserved	
0054	Key	Key press remote action. Range: 0 to 9 1→ P; 2→⏶; 4→⏷; 8→ F
0055~0061	Reserved	
0062	A 1t 1	Alarm 1 Time 1. Range: 0 to 6500s Refer to Table 4 for more details.
0063	A 1t2	Alarm 1 Time 2 (in seconds) Range: same as in A 1t 1.
0064	A2t 1	Alarm 2 Time 1 (in seconds) Range: same as in A 1t 1.
0065	A2t2	Alarm 2 Time 2 (in seconds) Range: same as in A 1t 1.
0066	SFSt	Soft-Start time (in seconds) Range: 0 to 9999
0067	un 1t	Temperature unit. Range: 0 to 1 0→°C; 1→°F.
0068	Reserved	
0069	tEco	*Timer End Controller* Off. Range: 0 to 1 0→ Disabled; 1→ Enable.
0070~0080	Reserved	
0081	FLSh	Enables the top display blinking as a function of the selected alarm. Range: 0 to 1 0→ Disabled; 1→ Enable.
0082	OUt 1	Output 1 function. Range: 0 to 4 0→oFF; 1→ctrL; 2→A 1; 3→A2; 4→A 1A2.
0083	OUt2	Output 2 function. Range: 0 to 4 0→oFF; 1→ctrL; 2→A 1; 3→A2; 4→A 1A2.
0084~0085	Reserved	
0086	rStr	Restores original default calibration. Range: 0 to 1. 0→do not restore; 1→ restore calibration
0087	Reserved	Internal use
0088	Prot	Password protection level. Range: 1 to 5. Check instruction manual for further details.
0089	PrtY	Serial communication parity. Range: 0 to 2. 0→no parity; 1→ even; 2→ odd;

1.5 STATUS WORDS

Register	Value Format
Status Word 1	bit 0 - Alarm 1 (0-inactive; 1-active) bit 1 - Alarm 2 (0-inactive; 1-active) bit 2 ~ 7 - Reserved bit 8 - Hardware detection value bit 9 - Hardware detection value bit 10 ~15 - Reserved
Status Word 2	bit 0 - Automatic (0- manual; 1- automatic) bit 1 - Run (0-stop; 1-run) bit 2 - Control Action 1 (0-direct; 1 reverse) bit 3 - Reserved bit 4 - Auto-tune (0-no; 1-yes) bit 5 - Alarm 1 power-up inhibit 1 (0-no; 1-yes) bit 6 - Alarm 1 power-up inhibit 2 (0-no; 1-yes) bit 7 - 8 - Reserved bit 9 - Unit (0-°C; 1-°F) bit 10 - Reserved bit 11 - Output 1 status bit 12 - Output 2 status bit 13 - 14 - 15 - Reserved
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 ~ 15 - Reserved

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

1.6 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 or inexistent
02	Invalid Register Number or out of range
03	Invalid Register Quantity or out of range

Table 3 – Exception response error codes