N1050

Register Table for Serial Communication V1.1x A

1. SERIAL COMMUNICATION

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

1.1 COMMUNICATION INTERFACE

- Compatible signals with RS485 standard.
- 2-wire connection between the master and up to 31 slave indicators in bus topology. It is possible to address 247 nodes with multiple outputs converters.
- Maximum communication distance: 1000 meters.
- The RS485 signals are:

D1	Bidirectional data line.
D0	Bidirectional inverted data line.
C	Optional connection that improves communication performance.

1.2 GENERAL FEATURES

- Serial interface optical isolation.
- Programmable Baud Rate: 1200 to 115.200.
- Data bits: 8.
- Parity: None.
- Stop Bits: 1.

1.3 COMMUNICATION PROTOCOL

The device supports the MODBUS RTU slave protocol, available in most of the SCADA software found the market.

All configurable parameters of the indicator can be accessed (read and/or written) through registers presented in the Register Table. It is also possible to write in Broadcast mode by using 0 address.

The available Modbus commands available are the following:

03	*Read Holding Register* (Reading Registers).
05	*Write Single Coil* (Force Digital Output status).
06	*Write Single Register* (Writing in Registers).

The registers are presented in a table, so that it is possible to read several registers with one request.

2. CONFIGURATION OF SERIAL COMMUNICATION

To use the serial communication, you must set 2 parameters:

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

Addr: Communication address of the controller. Each controller must have a unique address.

3. REGISTER TABLE

Registers are the internal parameters of the controller. Each parameter in the table is a 16-bit word with a signal represented in addition to 2.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
0	SP	Read: Active control SP (main SP, from ramp and soak, or remote SP). Write: To main SP. Range: From SPLL to SPHL.
1	PV	Read: Process variable. Write: Not allowed. Range: From SPLL to SPHL. The dP.Po register provides the position of the decimal point.
2	MV	Read: Output power in automatic or manual mode. Write: Not allowed. See address 29. Range: 0 from 1000 (0.0 to 100.0 %).
6	Display value	Read: Current value shown on the display. Write: Current value shown on the display. Range: -1999 to 9999. The range depends on the parameter shown.
8	Firmware Version	Controller firmware version. If V1.00, the read value will be 100. Write: Not allowed.
9	ID	Controller identification number. Write: Not allowed. Valor: 208 (D0h).
10	Serial number	First four digits of the serial number. Write: Not allowed.
11	Serial number	Last four digits of the serial number. Write: Not allowed.
12	Status Word 1	Read: Status bits. See **Table 2**. Write: Not allowed.
13	Status Word 2	Read: Status bits. See **Table 2**. Write: Not allowed.
14	Status Word 3	Read: Status bits. See **Table 2**. Write: Not allowed.
18	Act	Control action. Values: 0 → Reverse. 1 → Direct.
19	AtUn	Auto tune. Values: 0 → oFF. 1 → FASt. 2 → FULL.
20	ir	Integral Rate (in repetition/min). Range: 0 to 3000 (0.00 to 30.00).
21	dt	Derivative Time (in seconds). Range: 0 to 250.
22	Pb	Proportional Band (in percentage). Range: 0 to 5000 (0.0 to 500.0).
23	Ct	Cycle Time (PWM in seconds). Range: 5 to 1000 (0.5 to 100.0).
25	HySt	Control Hysteresis ON/OFF. Range: 0 to SPHL - SPLL
26	SFSt	Soft Start time (in seconds). Range: 0 to 9999.
29	SP	Control Setpoint (Prompt Setpoint). Range: From SPLL to SPHL.

Register Table for Serial Communication V1.1x A

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
30	out1	Function of the I/O channel. See **Table 4**. I/O availability depends on the controller model.
31	out2	
32	out3	
33	out4	
34	iE.ou	Value of the control output value in case of sensor error. Range: 0 to 1000 (0.0 to 100.0 %).
35	Lbdt	Open Resistance Detection (Loop break detection).
39	Fu.A1	Alarm function. See **Table 5**.
40	Fu.A2	
43	SP.A1	Alarm Setpoint. Range: The minimum value for non-differential alarm is SPLL or SPLL – SPHL for differential alarm.
44	SP.A2	
47	SP1.E	Allows the respective alarm Setpoint to appear in the Operational Cycle.
48	SP2.E	
51	HY.A1	Alarm hysteresis. Range: 0 to (SPHL – SPLL).
52	HY.A2	
55	bL.A1	Alarm initial blocking. Values: 0 → NO. 1 → YES.
56	bL.A2	
67	FLSH	Allows the display to flash in case of alarm.
71	tYPE	Input type. Range: 0 to 3. 0 → (J) -110 to 950 °C / -166 to 1742 °F 1 → (K) -150 to 1370 °C / -238 to 2498 °F 2 → (T) -160 to 400 °C / -256 to 752 °F 3 → (S) -50 to 1760 °C / -58 to 3200 °F 4 → (Pt100) -200 to 850 °C / -328 to 1562 °F
72	un it	Temperature unit. Values: 0 → °C. 1 → °F.
73	dP.Po	PV Decimal Point Position. Values: 2 to 3. 2 > XXX.X; 3 > XXXX
74	FLtr	Analog input filter (in seconds). Range: 0 to 300.
75	SP.LL	Setpoint lower limit. Range: The minimum value depends on the input type selected in tYPE for SPHL (see operation manual).
76	SP.HL	Setpoint higher limit. Range: The minimum value is SPLL and the maximum value depends on the input type selected in tYPE (see operation manual).
77	oFFS	Offset PV. Range: From SPLL to SPHL.
78	Addr	Slave communication address. Range: 1 to 247.
79	bAud	Communication Baud Rate. Values: 0 to 7. 0 → 1200 1 → 2400 2 → 4800 3 → 9600 4 → 19200 5 → 32400 6 → 57600 7 → 115200
80	PrtY	Serial communication parity. Values: 0 → No parity. 1 → Even parity. 2 → Odd parity.
84	RUN	Activate control. Values: 0 → NO. 1 → YES.
85	RUN.E	Enables the RUN screen in the Main cycle. Values: 0 → NO. 1 → YES.
86	Ctr	Enables automatic control. Values: 0 → Manual. 1 → Automatic.
87	CrtE	Enables Ctr screen in the Main cycle.
88	MV	MV value when Ctr at 0.
89	P.SEG	Program segment running.
90	t.SEG	Remaining time of running segment.
92	t.tb	Time base for the timer. Values: 0 → MM:SS. 1 → HH:MM.
95	t1	Timer 1. Range: 0 to 5999.
96	t2	Timer 2. Range: 0 to 5999.
97	t1.E	Enables Timer 1 editing in the Main cycle.

Register Table for Serial Communication V1.1x A

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
98	t.Str	Timer start mode. Values: 0 → OFF. 1 → SP. 2 → F. 3 → RUN.
99	t.End	T1 output behavior at the end of T1. Values: 0 → OFF. 1 → ON.
100	t.dir	Direction of timing from T1. 1 → Progressive counting, starting at zero. 0 → Time Countdown.
101	t.RUN	RUN behavior at the end of the timer. Values: 0 → OFF. 1 → ON.
102	Pr.tb	Time base for the Ramp and Soak program. Values: 0 → MM:SS. 1 → HH:MM.
103	H.PrG	Enables F key function.
107	Prot	Protection level.
112	RESt	Restore factory calibration.
113	CJ	Cold junction temperature.
117	Tecla	Press the remote action key. 1 → P Key. 2 → (▲) UP Key. 4 → (▼) DOWN Key. 8 → (◄) BACK Key. 9 → P and BACK Keys.
118	Pr n	Program being edited.
119	E Pr	Program running.
120	Pr R	**Resume Program** Function. Values: 0 → ProG. 1 → P.SEG. 2 → t.SEG. 3 → oFF.
123	P.E1	Alarm event of segment 1 of program 1.
124	P.E2	Alarm event of segment 2 of program 1.
125	P.E3	Alarm event of segment 3 of program 1.
126	P.E4	Alarm event of segment 4 of program 1.
127	P.E1	Alarm event of segment 1 of program 2.
128	P.E2	Alarm event of segment 2 of program 2.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
129	P.E3	Alarm event of segment 3 of program 2.
130	P.E4	Alarm event of segment 4 of program 3.
131	P.E1	Alarm event of segment 1 of program 3.
132	P.E2	Alarm event of segment 2 of program 3.
133	P.E3	Alarm event of segment 3 of program 3.
134	P.E4	Alarm event of segment 4 of program 3.
135	P.E1	Alarm event of segment 1 of program 4.
136	P.E2	Alarm event of segment 2 of program 4.
137	P.E3	Alarm event of segment 3 of program 4.
138	P.E4	Alarm event of segment 4 of program 4.
139	P.E1	Alarm event of segment 1 of program 5.
140	P.E2	Alarm event of segment 2 of program 5.
141	P.E3	Alarm event of segment 3 of program 5.
142	P.E4	Alarm event of segment 4 of program 5.
143	P.toL	Tolerance for program 1.
144	LP	Program link 1.
145	P.t1	Time of segment 1 of program 1.
146	P.t2	Time of segment 2 of program 1.
147	P.t3	Time of segment 3 of program 1.
148	P.t4	Time of segment 4 of program 1.
149	P.SP0	Initial SP of program 1.
150	P.SP1	Final SP of segment 1.
151	P.SP2	Final SP of segment 2.
152	P.SP3	Final SP of segment 3.
153	P.SP4	Final SP of segment 4.
154	P.toL	Tolerance for program 2.
155	LP	Program link 2.
156	P.t1	Time of segment 1 of program 2.
157	P.t2	Time of segment 2 of program 2.
158	P.t3	Time of segment 3 of program 2.
159	P.t4	Time of segment 4 of program 2.
160	P.SP0	Initial SP of program 2.
161	P.SP1	Final SP of segment 1.
162	P.SP2	Final SP of segment 2.
163	P.SP3	Final SP of segment 3.
164	P.SP4	Final SP of segment 4.
165	P.toL	Tolerance for program 3.
166	LP	Program link 3.
167	P.t1	Time of segment 1 of program 3.

HOLDING REGISTERS	PARAMETER	REGISTER DESCRIPTION
168	P.t2	Time of segment 2 of program 3.
169	P.t3	Time of segment 3 of program 3.
170	P.t4	Time of segment 4 of program 3.
171	P.SP0	Initial SP of program 3.
172	P.SP1	Final SP of segment 1.
173	P.SP2	Final SP of segment 2.
174	P.SP3	Final SP of segment 3.
175	P.SP4	Final SP of segment 4.
176	P.toL	Tolerance for program 4.
177	LP	Program link 4.
178	P.t1	Time of segment 1 of program 4.
179	P.t2	Time of segment 2 of program 4.
180	P.t3	Time of segment 3 of program 4.
181	P.t4	Time of segment 4 of program 4.
182	P.SP0	Initial SP of program 4.
183	P.SP1	Final SP of segment 1.
184	P.SP2	Final SP of segment 2.
185	P.SP3	Final SP of segment 3.
186	P.SP4	Final SP of segment 4.
187	P.toL	Tolerance for program 5.
188	LP	Program link 5.
189	P.t1	Time of segment 1 of program 5.
190	P.t2	Time of segment 2 of program 5.
191	P.t3	Time of segment 3 of program 5.
192	P.t4	Time of segment 4 of program 5.
193	P.SP0	Initial SP of program 5.
194	P.SP1	Final SP of segment 1.
195	P.SP2	Final SP of segment 2.
196	P.SP3	Final SP of segment 3.
197	P.SP4	Final SP of segment 4.

Table 1 – Registers table

4. STATUS WORD

REGISTER	VALUE FORMATION
Status Word 1 Alarms information	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 – Reserved bit 5 – Reserved bit 6 – Reserved 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
Status Word 2 Information on the current configuration	bit 0 – Automatic (0 → Manual; 1 → Automatic) bit 1 – Run (0 → Stop; 1 → Run) bit 2 – Control action (0 → Reverse; 1 → Direct) bit 3 – Reserved bit 4 – Auto-tune (0 → No; 1 → Yes) bit 5 – Alarm 1: Activation inhibition (0 → No; 1 → Yes) bit 6 – Alarm 2: Activation inhibition (0 → No; 1 → Yes) bit 7 – Reserved bit 8 – Reserved 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 – Reserved
Status Word 3 Error flags	bit 0 – PV conversion is too low (0 → No; 1 → Yes) bit 1 – Negative conversion after calibration (0 → No; 1 → Yes) bit 2 – PV conversion is too high (0 → No; 1 → Yes) bit 3 – Linearization limit exceeded (0 → No; 1 → Yes) bit 4 – Pt100 cable resistance is too high (0 → No; 1 → Yes) bit 5 – Auto-Zero conversion is out of range (0 → No; 1 → Yes) bit 6 – Reserved bit 7 – Cold junction conversion is out of range (0 → No; 1 → Yes) 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 – Read values for Word Status

Writing to the digital output bits is only possible when the outputs are set to OFF in the I/O configuration on the controller.

COIL STATUS	OUTPUT DESCRIPTION
1	Output Status 1 (I/O1).
2	Output Status 2 (I/O2).
3	Output Status 3 (I/O3).
4	Output Status 4 (I/O4).

Table 3 – Output description

5. EXCEPTION RESPONSES – ERROR CONDITIONS

When receiving a command, CRC verification will be performed on the received data block.

Receiving errors are detected by the CRC, causing the controller to discard the packet and send no response to the master.

After receiving an error-free packet, the controller will process the packet, checking whether the request is valid or not, and send an error message in case of an invalid request. Response frames containing error codes have the most significant bit of the Modbus command set.

If a WRITING command sends an out-of-range value for a parameter, the controller will set the value for the parameter range limits, responding with a value that reflects those same limits (maximum or minimum allowed value for the parameter).

Broadcast read commands are ignored by the controller and there will be no response. You can only write in Broadcast mode.

ERROR CODES	ERROR DESCRIPTION
01	Invalid command.
02	Register number invalid or out of range.
03	Number of registers invalid or out of range.

Table 4 – Error codes in the exception response

6. SETTING I/O PARAMETERS

I/O FUNCTION	CODE		I/O TYPE
Digital Output off	**0**	OFF	Digital Output
PWM Control Output	**1**	Ctrl	Digital Output
Alarm 1 Output	**2**	A1	Digital Output
Alarm 2 Output	**3**	A2	Digital Output
Alarm 1 or Alarm 2	**4**	A1.A2	Digital Output
Timer T1	**5**	t1	Digital Output
Timer T2	**6**	t2	Digital Output
Time interval of function LBD (*Loop break detection*)	**7**	Lbd	Digital Output

Table 5 – Setting I/O parameters

7. SETTING ALARM PARAMETERS

I/O FUNCTION	CODE	
No function	**0**	OFF
Minimum value alarm	**1**	Lo
Maximum value alarm	**2**	Hi
Differential alarm	**3**	diF
Minimum differential alarm	**4**	diF.L
Maximum differential alarm	**5**	diF.H
Open sensor alarm	**6**	i.Err
Event alarm (Ramps and Soaks)	**7**	rS

Table 06 – Alarms configuration