# N1040i Indicator
# Communication Protocol – V10x

## 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 indicator.

### 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 = D̄:   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 | ALrF | Diferential alarm reference.. Range: **SPLL** to **SPHL**  (or the sensor span), |

| 0001 | PV | Read: Process Variable. Write: Not allowed. In case of temperature reading, the value read is always multiplied by 10, independently of **dPPo** value. |
|---|---|---|
| 0002 | Reserved | Internal use |
| 0003 | Reserved | Internal use |
| 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 indicator. If V1.00, the read value will be 100. Write: not allowed. |
| 0008 | ID | Read: indicator identification number: **68** 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. |
| 0011~0015 | Reserved | Internal use. |
| 0016 | FrEq | Mains frequency. 0→ 60 Hz; 1→ 50 Hz; |
| 0017 | Reserved | |
| 0018 | FLtr | PV digital filter gain. Range: 0 – 20 |
| 0019 | Reserved | Internal use. |
| 0020 | SP1E | Controls the presence of the parameter SPA1 in the indicator operation cycle. 0→ Disables (hides SPA1); 1→ Enables (shows SPA1); |
| 0021 | SP2E | Controls the presence of the parameter SPA2 in the indicator operation cycle. 0→ Disables (hides SPA2); 1→ Enables (shows SPA2); |
| 0022 | Reserved | Internal use. |
| 0023 | Serial number H | Serial number first four digits. Write: no allowed. Read: 0 to 9999. |
| 0024 | Serial number L | Serial number last four digits. Write: no allowed. Read: 0 to 9999. |
| 0025 | Reserved | Internal use. |
| 0026 | inLL | Defines the minimum PV indication value for analog input types (used to scale the analog inputs). |
| 0027 | inHL | Defines the indication higher limit of the PV indication (used to scale the analog inputs). |
| 0028 | Reserved | Internal use. |

| | | |
|---|---|---|
| 0029 | oFFS | PV offset. Range: from inLL to inHL. |
| 0030 | dP.Po | PV decimal point position Range: 0 to 3 0→X.XXX; 1→XX.XX; 2→XXX.X; 3→XXXX |
| 0031 | SP.A1 | Alarm 1 Setpoint. |
| 0032 | SP.A2 | Alarm 2 Setpoint. |
| 0033 | Reserved | Internal use. |
| 0034 | Reserved | Internal use. |
| 0035 | FuA1 | Alarm function. Range: 0 to 6 0→oFF; 1→Lo; 2→Hi; 3→diF; |
| 0036 | FuA2 | 4→diFL; 5→diFH; 6→iErr; |
| 0037~0038 | Reserved | Internal use. |
| 0039 | HYA1 | Alarm 1 hysteresis. Range: 0 to 9999 |
| 0040 | HYA2 | Alarm 2 hysteresis. Range: 0 to 9999 |
| 0041 | Reserved | Internal use. |
| 0042 | Reserved | Internal use. |
| 0043 | tYPE | 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 7 0→1200; 1→2400; 2→4800; 3→9600; 4→19200; 5→32400; 6→57600; 7→115200. |
| 0046~0049 | Reserved | Internal use. |
| 0050 | bLA1 | Blocks the alarm when the indicator is energized. |
| 0051 | bLA2 | When enabled, the alarm will not be active at power-up, waiting for PV (Process Variable) to reach a non-alarm situation. From this point on the alarm will be free to actuate should a new alarm situation occur. 0→ no initial blocking; 1→ initial blocking enabled. |
| 0052 | Reserved | Internal use. |
| 0053 | Reserved | Internal use. |
| 0054 | Key | Key simulation. 1→ Key press **P** 2→ Key press ▲ 4→ Key press ▼ 8→ Key press < 9→ Key press **P** (go to next level of parameters. |
| 0055~0059 | Reserved | Internal use. |
| 0060 | rEtr | Temperature unit. Range: 0 to 1. 8→ 0~20 mA 9→ 4~20 mA |
| 0061~0066 | Reserved | Internal use. |
| 0067 | uniE | Temperature unit. Range: 0 to 1 0→°C; 1→°F. |
| 0068~0074 | Reserved | Internal use. |
| 0075 | Calibration PV First | Enter the low input value currently applied in the PV input for calibration purposes. |
| 0076 | Calibration PV End | Enter the high input value currently applied in the PV input for calibration purposes. |
| 0077 | Reserved | Internal use. |
| 0078 | Reserved | Internal use. |

| | | |
|---|---|---|
| 0079 | rtLL | Retransmission low limit of PV. |
| 0088 | rtHL | Retransmission high limit of PV. |
| 0081 | FLSh | Allows visual signalization of an alarm occurrence by flashing the indication of PV in the operation level. 0→ Disables 1→ Enables |
| 0082~0085 | Reserved | Internal use. |
| 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 3. Check instruction manual for further details. |
| 0089 | PrtY | Serial communication parity. Range: 0 to 2. 0 - > No parity; 1 - > Even parity; 2 - > Odd parity; |

## 1.4 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 0~4 – Reserved bit 5 - Alarm 1 power-up inhibit (0-no; 1-yes) bit 6 - Alarm 2 power-up inhibit (0-no; 1-yes) bit 7~8 - Reserved bit 9 - Unit (0-°C; 1-°F) bit 10~15 - 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-noo; 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-não; 1-sim) bit 7~15 - Reserved |

**Table 2** - Values of Status Words

Writing to a digital output is only allowed if the corresponding alarm is configured as "oFF".

| Coil Status | Output description |
|---|---|
| 0 | Output 1 Status 1 (ALM1) |
| 1 | Output 1 Status 2 (ALM2) |

## 1.5 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 indicator to discard the packet, not sending any reply to the master.

After receiving an error-free packet, the indicator 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 (the value 80H is added to the response).

If a WRITE command sends an out-of-range value to a parameter, the indicator 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 indicator ignores broadcast READ commands; the indicator 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