# Novus – Produtos Eletrônicos Ltda.

Communication Protocol V1.3x

N1500 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 conexion 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:
    - D: Bidirectional data line.
    - $\overline{D}$: Bidirectional inverted data line.
    - GND: Optional conexion which left communication better.

**General Characteristics**

- Optically isolated serial interface
- Programmable baud rate: 1200, 2400, 4800, 9600 or 19200bps.
- Data Bits: 8
- Parity: Nenhuma
- Stop Bits: 1

**Communication Protocol**

The MOSBUS RTU slave is implemented, available in more SCADA softwares 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:

**bRud**: Baud rate. All devices with same baud rate.

**RdrES**: Device communication address. Each device must have an exclusive address.

**Holding Registers**

Equivalent to the registers referência 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 | Descrição do Registrador |
|---|---|---|
| 0000 | PV | Read: Process variable. <br> Write: not allowed. <br> Range: the minimum value is in *InLoL* seted and the maximum value is in *InH iL* seted and the decimal point position depends of *dPPoS*. |
| 0001 | PV min | Read: Minimum value of PV <br> Write: not allowed. |
| 0002 | PV max | Read: Maximum value of PV <br> Write: not allowed. |
| 0003 | - | Reserved |
| 0004 | Valor Tela | Read: Current display value. <br> Write: Current display value. <br> Range: -1999 to 9999. <br> The range depends of the showed display. |

| | | |
|---|---|---|
| 0005 | Display Number | Read: Current display Number. <br> Write: not allowed. <br> Range: 0000h to 060Ch <br> Display number format: XXYYh, when: <br> XX→number of display cycle <br> YY→number of display (see display fluxogram). |
| 0006 | Status Word 1 | Read: Digital Inputs and Alarms (high part) and Hardware type (low part). <br> Write: not allowed. <br> Range: 0000h to FFFFh <br> Value format: XXYYh, when: <br> XX: Hardware type <br> 0→without optionals; <br> 1→ alarms 3 and 4 optionals; <br> 2→digital input optional. <br> YY: digital inputs and alarms states <br> bit 0 - Alarme 1 state: 0→inactive; 1→active <br> bit 1 - Alarme 2 state: 0→inactive; 1→active <br> bit 2 - Alarme 3 state: 0→inactive; 1→active <br> bit 3 - Alarme 4 state: 0→inactive; 1→active <br> bit 4 - Digital Input: 0→inactive; 1→active <br> bit 5 – reserved <br> bit 6 – reserved <br> bit 7 – reserved |
| 0007 | Software Version | Read: Software version. <br> Write: not allowed. <br> Readed values: If the version is V1.00, for example, will be read 100. |
| 0008 | ID | Read: Identification device Number. <br> Write: not allowed. <br> Readed values: <br> 1 – N1100/N2000;  3 – N1500. <br> Other values: special devices. |
| 0009 | Status Word 2 | Read: Indicator status bits. <br> Write: not allowed. <br> Readed value: verify each bit: <br> bit 0 – reserved <br> bit 1 – reserved <br> bit 2 – reserved <br> bit 3 – reserved <br> bit 4 – reserved <br> bit 5 – Alarm 1 power-up inhibit (0-no; 1-yes) <br> bit 6 – Alarm 2 power-up inhibit (0-no; 1- yes) <br> bit 7 – Alarm 3 power-up inhibit (0-no; 1- yes) <br> bit 8 – Alarm 4 power-up inhibit (0-no; 1- yes) <br> bit 9 – Unit (0-°C; 1-°F) <br> bit 10 – reserved <br> bit 11 – Output 1 state <br> bit 12 – Output 2 state <br> bit 13 – Output 3 state <br> bit 14 – Output 4 state <br> bit 15 – Output 5 state |
| 0010 | Special Command | Special function command. <br> Write: Value 0 – Tare reset; Value 5 – Hold and Peak-hold clean; Value 10 – Maximum and minimum clean. |
| 0011 | dPPoS | Decimal point position of PV. Range: 0 to 3 <br> 0→X.XXX; 1→XX.XX; 2→XXX.X; 3→XXXX |
| 0012 | FFunc | F key Function. Range: 0 to 5 <br> 0→oFF; 1→Hold; 2→RLoFF; 3→rESEt; 4→PHoLd; 5→tArE |
| 0013 | d iG in | Digital Input Function. Range: 0 to 5 <br> 0→oFF; 1→Hold; 2→RLoFF; 3→rESEt; 4→PHoLd; 5→tArE |
| 0014 | F iLtr | Input digital filter. <br> Range: 0 to 20. Defalut value: 4 |
| 0015 | oFSEt | Input Offset value. <br> Range: from *InLoL* to *InH iL* |
| 0016 | SCRLE | Indication Scale factor. Range: 0 to 1 <br> 0→scalex1; 1→scalex10 |
| 0017 | Sroot | Input Square Root. Range: 0 to 1 <br> 0→no; 1→yes |
| 0018 | - | Reserved |

| 0019 | RLrEF | Alarme Reference. Range: from InLoL to InHiL |
|------|-------|-------------|
| 0020 | outtY | Retransmision type of PV. Range: 0 to 1<br>0→ 4 a 20mA retransmision; 1→0 a 20mA retransmision |
| 0021 | SPRL 1 Or dFRL 1 | Alarm 1 Preset. Range: the minimum value is in InLoL seted for not differential alarm or ( InLoL - InHiL ) for differential alarm; The maximum value is in InHiL seted for not differential alarm or ( InHiL - InLoL ) if differential alarm. |
| 0022 | SPRL2 Or dFRL2 | Alarm 2 Preset<br>Range: same as SPRL 1 or dFRL 1. |
| 0023 | SPRL3 Or dFRL3 | Alarme 3 Preset<br>Range: same as SPRL 1 or dFRL 1. |
| 0024 | SPRL4 or dFRL4 | Alarme 4 Preset<br>Range: same as SPRL 1 or dFRL 1. |
| 0025 | FuRL 1 | Alarm 1 Function. Range: 0 to 6<br>0→oFF; 1→iErr; 2→Lo; 3→Hi;<br>4→diFL; 5→diFH; 6→diF. |
| 0026 | FuRL2 | Alarm 2 Function<br>Range: same as FuRL 1. |
| 0027 | FuRL3 | Alarm 3 Function<br>Range: same as FuRL 1. |
| 0028 | FuRL4 | Alarm 4 Function<br>Range: same as FuRL 1. |
| 0029 | bLRL 1 | Alarm 1 power-up inhibit. Range: 0 a 1<br>0→não; 1→sim. |
| 0030 | bLRL2 | Alarm 2 power-up inhibit<br>Range: same as bLRL 1. |
| 0031 | bLRL3 | Alarm 3 power-up inhibit<br>Range: same as bLRL 1. |
| 0032 | bLRL4 | Alarm 4 power-up inhibit<br>Range: same as bLRL 1. |
| 0033 | HYRL 1 | Alarm 1 Hysteresis (engineering unit)<br>Range: 0 to span do sensor |
| 0034 | HYRL2 | Alarm 2 Hysteresis (engineering unit)<br>Range: same as HYRL 1. |
| 0035 | HYRL3 | Alarm 3 Hysteresis (engineering unit)<br>Range: same as HYRL 1. |
| 0036 | HYRL4 | Alarm 4 Hysteresis (engineering unit)<br>Range: same as HYRL 1. |
| 0037 | IntYP | Input sensor type<br>Range: 0 to 22.<br>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(degree decimal); 9→Pt100(degree unit); 10→Lin J; 11→Lin K; 12→Lin T; 13→Lin E; 14→Lin N; 15→Lin R; 16→Lin S; 17→Lin B; 18→Lin Pt100 degree decimal; 19→Lin Pt100; 20→0-50mV; 21→4-20mA; 22→0-5V |
| 0038 | unIt | Temperature Unit. Range: 0 to 1<br>0→°C; 1→°F. |
| 0039 | InLoL | Indication Low limit.<br>Range: the minimum value depends of input type configured in IntYP and the maximum is in InHiL seted. |
| 0040 | InHiL | Indication High limit.<br>Range: from InLoL to the input maximum configured in IntYP. |
| 0041 | RdrES | Slave address<br>Range: 1 to 247 |
| 0042 | bRud | Communication Baud Rate. Range: 0 to 4<br>0→1200;1→2400;2→4800;3→9600; 4→19200 |
| 0043 | Serial Number High | Serial Number (High Display)<br>Range: 0 to 9999. Read only |
| 0044 | Serial Number Low | Serial Numbe (Low Display)<br>Range: 0 to 9999. Read only |
| 0045 | Key | Remote action of pressed key. Range: 0 to 9<br>1→◻; 2→▲; 4→▼; 8→BACK; 9→BACK and ◻. |
| 0046 | RL It 1 | Alarm 1 Time 1 of timer. Range: 0 to 6500sec<br>See operation manual for details. |

| 0047 | RL It2 | Alarm 1 Time 2 of timer (in seconds)<br>Range: same as RL It 1. |
|------|-------|-------------|
| 0048 | RL2t 1 | Alarm 2 Time 1 of timer (in seconds)<br>Range: same as RL It 1. |
| 0049 | RL2t2 | Alarm 2 Time 2 of timer (in seconds)<br>Range: same as RL It 1. |
| 0050 | RL3t 1 | Alarm 3 Time 1 of timer (in seconds)<br>Range: same as RL It 1. |
| 0051 | RL3t2 | Alarm 3 Time 2 of timer (in seconds)<br>Range: same as RL It 1. |
| 0052 | RL4t 1 | Alarm 4 Time 1 of timer (in seconds)<br>Range: same as RL It 1. |
| 0053 | RL4t2 | Alarm 4 Time 2 of timer (in seconds)<br>Range: same as RL It 1. |
| - | | Reserved |
| - | | Reserved. |
| - | | Reserved. |
| - | | Reserved. |
| - | | Reserved. |
| - | | Reserved. |
| - | | Reserved. |
| 0061 | InP.01 | Custom linearization first value. |
| 0062 | InP.02 | Custom linearization point #02 |
| 0063 | InP.03 | Custom linearization point #03 |
| 0064 | InP.04 | Custom linearization point #04 |
| 0065 | InP.05 | Custom linearization point #05 |
| 0066 | InP.06 | Custom linearization point #06 |
| 0067 | InP.07 | Custom linearization point #07 |
| 0068 | InP.08 | Custom linearization point #08 |
| 0069 | InP.09 | Custom linearization point #09 |
| 0070 | InP.10 | Custom linearization point #10 |
| 0071 | InP.11 | Custom linearization point #11 |
| 0072 | InP.12 | Custom linearization point #12 |
| 0073 | InP.13 | Custom linearization point #13 |
| 0074 | InP.14 | Custom linearization point #14 |
| 0075 | InP.15 | Custom linearization point #15 |
| 0076 | InP.16 | Custom linearization point #16 |
| 0077 | InP.17 | Custom linearization point #17 |
| 0078 | InP.18 | Custom linearization point #18 |
| 0079 | InP.19 | Custom linearization point #19 |
| 0080 | InP.20 | Custom linearization point #20 |
| 0081 | out.01 | Value to be displayed in point #01 of custom linearization (in engineering units) |
| 0082 | out.02 | Value to be displayed in point #02 of custom linearization |
| 0083 | out.03 | Value to be displayed in point #03 of custom linearization |
| 0084 | out.04 | Value to be displayed in point #04 of custom linearization |
| 0085 | out.05 | Value to be displayed in point #05 of custom linearization |
| 0086 | out.06 | Value to be displayed in point #06 of custom linearization |
| 0087 | out.07 | Value to be displayed in point #07 of custom linearization |
| 0088 | out.08 | Value to be displayed in point #08 of custom linearization |
| 0089 | out.09 | Value to be displayed in point #09 of custom linearization |
| 0090 | out.10 | Value to be displayed in point #10 of custom linearization |
| 0091 | out.11 | Value to be displayed in point #11 of custom linearization |
| 0092 | out.12 | Value to be displayed in point #12 of custom linearization |
| 0093 | out.13 | Value to be displayed in point #13 of custom linearization |
| 0094 | out.14 | Value to be displayed in point #14 of custom linearization |
| 0095 | out.15 | Value to be displayed in point #15 of custom linearization |
| 0096 | out.16 | Value to be displayed in point #16 of custom linearization |
| 0097 | out.17 | Value to be displayed in point #17 of custom linearization |
| 0098 | out.18 | Value to be displayed in point #18 of custom linearization |
| 0099 | out.19 | Value to be displayed in point #19 of custom linearization |
| 0100 | out.20 | Value to be displayed in point #20 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 |

**Exceptions - 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.

If a write command sends a out-of-range value to a parameter, the indicator clamp the value to the parameter range limits, replying with a value which reflects these limits (maximum or minimum value allowed for the parameter).

Broadcast read commands are ignored by the indicator; only broadcast write commands are processed.

| Error Code | Error Description |
|---|---|
| 81h | Invalid command |
| 82h | Invalid register number or out of range |
| 83h | Invalid register quantity or out of range |