

MODBUS RTU

COMMUNICATION PROTOCOL:
PUE C32 Weighing Indicator

SOFTWARE MANUAL

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RADWAG
RADWAG WAGI ELEKTRONICZNE
ZAAWANSOWANE TECHNOLOGIE WAGOWE

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1. GENERAL INFORMATION

Modbus RTU protocol implemented in the indicator can be applied when RS232 serial connector is used (1 master - 1 slave).

2. WEIGHING INDICATOR SETTINGS - CONFIGURATION

To set indicator communication via Modbus RTU protocol go to **<SETUP / Peripherals / Modbus RTU>**. For detailed description of settings configuration read „**PUE C32 Indicator**” user manual.

3. IMPLEMENTED FUNCTIONS

Modbus RTU communication is based on 4 functions:

- 03 (0x03) Read Holding Registers – reading input register.
- 04 (0x04) Read Input Registers – reading holding register.
- 06 (0x06) Write Holding Register – writing single holding register.
- 16 (0x10) Write Multiple Registers – writing multiple holding registers.

4. DATA STRUCTURE

All registers are 2-byte type (WORD). Floating point data (such as mass and tare) are stored in 2 consecutive registers and are FLOAT-type data. If the first register consists of 2 AB bytes and the other of 2 CD bytes, then FLOAT value is HEX ABCD, e.g. if R30001 register has the value of 0x3E68 and R30002 register has the value of 0x72B0, then after conversion to 0X3E6872B0 float the result is 0.227.

The lot number also consists of 2 bytes and has a LONG string. As in the FLOAT case, the data is structured in the following way: AB (first register) CD (second register). 0x0043DE21 example after conversion to decimal value is 447777. The lot number can only be numerical. Other characters are skipped.

Other registers must be read as HEX values.

5. MEMORY MAP

5.1. INPUT Registers (Read-Only)

| Register | Offset | Modbus address | Length [WORD] | Data type |
|------------------------------|--------|----------------|---------------|-----------|
| Mass | 0 | 30001 | 2 | float |
| Tare | 2 | 30003 | 2 | float |
| Unit | 4 | 30005 | 1 | word |
| Status | 5 | 30006 | 1 | word |
| LO threshold | 6 | 30007 | 2 | float |
| Process status (Stop, Start) | 32 | 30033 | 1 | word |
| Inputs status | 33 | 30034 | 1 | word |
| Min | 34 | 30035 | 2 | float |
| Max | 36 | 30037 | 2 | float |
| Lot number | 42 | 30043 | 2 | long |
| Operator | 44 | 30045 | 1 | word |
| Product | 45 | 30046 | 1 | word |
| Customer | 46 | 30047 | 1 | word |
| Packaging | 47 | 30048 | 1 | word |
| Formulation | 50 | 30051 | 1 | word |
| Dosing process | 51 | 30052 | 1 | word |

5.2. INPUT Registers

Mass – response: mass value of a given platform in current unit

Tare – response: tare value of a given platform in adjustment unit

Unit – determines currently displayed mass unit of a given platform

| Bit No. | Unit |
|---------|---------------|
| 0 | gram [g] |
| 1 | kilogram [kg] |
| 2 | carat [ct] |
| 3 | pound [lb] |
| 4 | ounce [oz] |
| 5 | Newton [N] |

Example:

Read HEX value: 0x02. Binary:

| B1/7 | B1/6 | B1/5 | B1/4 | B1/3 | B1/2 | B1/1 | B1/0 | B0/7 | B0/6 | B0/5 | B0/4 | B0/3 | B0/2 | B0/1 | B0/0 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |

The unit of the weighing instrument is kilogram [kg].

Status – determines weighing instrument status

| Status bits | |
|-------------|---|
| 0 | Measurement correct (weighing instrument does not report an error). |
| 1 | Measurement stable. |
| 2 | Weighing instrument indicates zero. |
| 3 | Weighing instrument is tared. |
| 4 | Weighing instrument is in II weighing range. |
| 5 | Weighing instrument is in III weighing range. |
| 6 | Weighing instrument reports NULL error. |
| 7 | Weighing instrument reports LH error. |
| 8 | Weighing instrument reports FULL error. |

Example:

Read HEX value: 0x13

| B1/7 | B1/6 | B1/5 | B1/4 | B1/3 | B1/2 | B1/1 | B1/0 | B0/7 | B0/6 | B0/5 | B0/4 | B0/3 | B0/2 | B0/1 | B0/0 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 1 | 1 |

The weighing instrument does not report any error, measurement stable in II weighing range.

LO threshold - response: **LO** threshold value in adjustment unit.

Process status – determines dosing or formulations process status:

- 0x00 – process disabled
- 0x01 – process stopped
- 0x02 – process aborted
- 0x03 – process finished

Input state – bitmask of indicator inputs. The first 4 least significant bits represent weighing terminal inputs.

Example:

Read HEX value: 0x000B

| B1/7 | B1/6 | B1/5 | B1/4 | B1/3 | B1/2 | B1/1 | B1/0 | B0/7 | B0/6 | B0/5 | B0/4 | B0/3 | B0/2 | B0/1 | B0/0 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 | 1 |

Inputs 1, 2 and 3 of the weighing indicator take high state.

MIN - response: **MIN** threshold value (in current unit).

MAX - response: **MAX** threshold value (in current unit).

Lot number – response: lot number. Only numerical values are accepted! All other characters are skipped.

Operator – response: code of logged in operator.

Product – response: code of selected product.

Customer – response: code of selected customer.

Packaging – response: code of selected packaging.

Formulation – response: code of selected formulation.

Dosing process– response: code of selected dosing process.

5.3. HOLDING Registers (Read/Write)

| Variable | Offset | Modbus address | Length [WORD] | Data type |
|------------------------|--------|----------------|---------------|-----------|
| Command | 500 | 40501 | 1 | word |
| Command with parameter | 501 | 40502 | 1 | word |
| Platform | 502 | 40503 | 1 | word |
| Tare | 503 | 40504 | 2 | float |
| LO threshold | 505 | 40506 | 2 | float |
| Output state | 507 | 40508 | 1 | word |
| Min | 508 | 40509 | 2 | float |
| Max | 510 | 40511 | 2 | float |
| Lot number | 516 | 40517 | 2 | long |
| Operator | 518 | 40519 | 1 | word |
| Product | 519 | 40520 | 1 | word |
| Customer | 520 | 40521 | 1 | word |

| | | | | |
|----------------------------|-----|-------|---|------|
| Packaging | 521 | 40522 | 1 | word |
| Source warehouse | 522 | 40523 | 1 | word |
| Target warehouse | 523 | 40524 | 1 | word |
| Formulation/Dosing process | 524 | 40525 | 1 | word |

5.4. HOLDING Registers

Basic command – writing the register with respective value triggers the following actions:


| Bit No. | Operation |
|---------|-------------------|
| 0 | Zero the platform |
| 1 | Tare the platform |
| 2 | Delete statistics |
| 3 | Save/Print |
| 4 | Process start |
| 5 | Process stop |

Example:

Record of the register by value 0x02

| B1/7 | B1/6 | B1/5 | B1/4 | B1/3 | B1/2 | B1/1 | B1/0 | B0/7 | B0/6 | B0/5 | B0/4 | B0/3 | B0/2 | B0/1 | B0/0 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 |



This causes balance taring.

| | |
|---|--|
|  | <p><i>A command is executed once upon detecting that its bit has been set. If the command is to be executed more than once, it is necessary to zero the bit first, and reset it to the required value next.</i></p> |
|---|--|

Complex command – setting a respective value results with performance of a given task, see the table:

| Bit No. | Operation |
|---------|---|
| 0 | Setting tare value for a given platform |
| 1 | Setting LO threshold value for a given platform |
| 2 | Setting lot number |
| 3 | Setting outputs status |
| 4 | Operator selection |

| | |
|----|-----------------------------|
| 5 | Product selection |
| 6 | Packaging selection |
| 7 | Setting MIN threshold value |
| 8 | Customer selection |
| 9 | Source warehouse selection |
| 10 | Target warehouse selection |
| 11 | Dosing process selection |
| 12 | Setting MAX threshold value |

| | |
|---|--|
|  | <i>Complex command requires setting address of respective parameter (from 40503 to 40525 – refer to: HOLDING table).</i> |
|  | <i>A command with a parameter is executed once when its bit setting is detected. If the command is to be executed more than once, it is necessary to zero the bit first, and reset it to the required value next.</i> |

Example– sending tare value of 1.0 to the balance

Executing the command requires writing 3 holding registers:

40502 – command with parameter - value 0x01 - which is tare setting.

Float-type 1.0 value after conversion to HEX has the following format: 0x3F800000.

Holding registers feature the following values written:

40503 – tare value, two most significant bytes – 0x3F80

40504 - tare value, two least significant bytes – 0x0000

The registers are written using 16 (0x10) multiple holding registers function. As a result, a tare value of 1.0 is set on the balance.

Platform – complex command parameter: weighing platform number (for this balance version it is always 1)

Tare – complex command parameter: tare value (in an adjustment unit).

LO threshold – complex command parameter: LO threshold value (in an adjustment unit).

Outputs status – complex command parameter: status of weighing indicator and communication module outputs.

Example:

Setting high state for output 1 and 3 of the weighing indicator.

Output mask:

| B1/7 | B1/6 | B1/5 | B1/4 | B1/3 | B1/2 | B1/1 | B1/0 | B0/7 | B0/6 | B0/5 | B0/4 | B0/3 | B0/2 | B0/1 | B0/0 |
|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|------|
| 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 1 |

Upon conversion to HEX the result is 0x05

Executing the command requires writing 2 holding registers:

40502 – command with parameter - value 0x08 – which is output state record.

40507 – output mask 0x05.

The registers are written using 16 (0x10) preset multiple registers function. As a result, outputs 1 and 3 take high state.

MIN – complex command parameter: MIN threshold value (in the unit set for the active working mode).

MAX – complex command parameter: MAX threshold value (in the unit set for the active working mode).

Lot number – complex command parameter: lot number.
Only numerical values are accepted! All other characters are skipped.

Operator – complex command parameter: Operator's code.

Product – complex command parameter: Product code.

Customer – complex command parameter: Customer's code.

Packaging – complex command parameter: Packaging code.

Formulation – complex command parameter: Formulation code.

Dosing process – complex command parameter: Dosing process code.



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