

# MODBUS

## COMMUNICATION PROTOCOL OF MW-04 MASS CONVERTER:

MODBUS RTU

MODBUS TCP

MODBUS RTU over TCP

## SOFTWARE MANUAL

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# 1. GENERAL INFORMATION

Modbus protocol implemented in MW-04 mass converter can be applied when serial connector RS485 (Modbus RTU) or Ethernet (Modbus TCP and MODBUS RTU over TCP) are used.

# 2. MASS CONVERTER SETTINGS AND CONFIGURATION

To configure MW-04 mass converter settings for communication via **Modbus** protocol run “**MWManager**” PC software and go to **<Parameters / Communication / Devices/Interfaces>** submenu. For detailed description of settings configuration read “**MWManager**” user manual.

# 3. IMPLEMENTED FUNCTIONS

Modbus communication is based on 4 functions:

- 03 (0x03) Read Holding Registers – reading holding register.
- 04 (0x04) Read Input Registers – reading input register.
- 06 (0x06) Write Single 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 CDAB. e.g. if R30001 register has the value of 0x72B0 and R30002 register has the value of 0x3E68, then after conversion to 0X3E6872B0 float the result is 0.227. 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 |
|-------------------------|--------|----------------|---------------|-----------|
| Platform 1 mass         | 0      | 30001          | 2             | float     |
| Platform 1 tare         | 2      | 30003          | 2             | float     |
| Platform 1 unit         | 4      | 30005          | 1             | word      |
| Platform 1 status       | 5      | 30006          | 1             | word      |
| Platform 1 LO threshold | 6      | 30007          | 2             | float     |
| Platform 2 mass         | 8      | 30009          | 2             | float     |

|                                |    |       |   |       |
|--------------------------------|----|-------|---|-------|
| Platform 2 tare                | 10 | 30011 | 2 | float |
| Platform 2 unit                | 12 | 30013 | 1 | word  |
| Platform 2 status              | 13 | 30014 | 1 | word  |
| Platform 2 LO threshold        | 14 | 30015 | 2 | float |
| Platform 3 mass                | 16 | 30017 | 2 | float |
| Platform 3 tare                | 18 | 30019 | 2 | float |
| Platform 3 unit                | 20 | 30021 | 1 | word  |
| Platform 3 status              | 21 | 30022 | 1 | word  |
| Platform 3 LO threshold        | 22 | 30023 | 2 | float |
| Platform 4 mass                | 24 | 30025 | 2 | float |
| Platform 4 tare                | 26 | 30027 | 2 | float |
| Platform 4 unit                | 28 | 30029 | 1 | word  |
| Platform 4 status              | 29 | 30030 | 1 | word  |
| Platform 4 LO threshold        | 30 | 30031 | 2 | float |
| Input status                   | 33 | 30034 | 1 | word  |
| Pl. 1 min                      | 34 | 30035 | 2 | float |
| Pl. 1 max                      | 36 | 30037 | 2 | float |
| Pl. 1 fast dosing threshold    | 38 | 30039 | 2 | float |
| Pl. 1 precise dosing threshold | 40 | 30041 | 1 | float |
| Pl. 1 adjustment status        | 50 | 30051 | 1 | word  |
| Pl. 1 dosing status            | 51 | 30052 | 1 | word  |
| Pl. 2 dosing status            | 52 | 30053 | 1 | word  |
| Pl. 2 dosing status            | 53 | 30054 | 1 | word  |
| Pl. 2 dosing status            | 54 | 30055 | 1 | word  |
| Pl. 2 adjustment status        | 55 | 30056 | 1 | word  |
| Pl. 3 adjustment status        | 56 | 30057 | 1 | word  |
| Pl. 4 adjustment status        | 57 | 30058 | 1 | word  |
| Pl. 2 min                      | 58 | 30059 | 2 | float |
| Pl. 2 max                      | 60 | 30061 | 2 | float |
| Pl. 2 fast dosing threshold    | 62 | 30063 | 2 | float |
| Pl. 2 precise dosing threshold | 64 | 30065 | 1 | float |
| Pl. 2 min                      | 66 | 30067 | 2 | float |
| Pl. 2 max                      | 68 | 30069 | 2 | float |
| Pl. 3 fast dosing threshold    | 70 | 30071 | 2 | float |

|                                |    |       |   |       |
|--------------------------------|----|-------|---|-------|
| Pl. 3 precise dosing threshold | 72 | 30073 | 1 | float |
| Pl. 4 min                      | 74 | 30075 | 2 | float |
| Pl. 4 max                      | 76 | 30077 | 2 | float |
| Pl. 4 fast dosing threshold    | 78 | 30079 | 2 | float |
| Pl. 4 precise dosing threshold | 80 | 30081 | 1 | float |

## 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 form:

| 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].

**Platform 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.

**Input state** – bitmask of module inputs. 8 least significant bits represent the weighing module inputs state.

**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    |

The weighing module inputs number 1, 2 and 3 are in high state.

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

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

**X fast dosing threshold** - response: fast dosing threshold value (in adjustment unit).

**X precise dosing threshold** - response: slow dosing (precise dosing) threshold value in adjustment unit.

*X - weighing platform number*

**Adjustment status** – determines status of the weighing platform (x)

| HEX value |   |
|-----------|---|
| 0x00      | Process finished correctly                                  |
| 0x01      | Start mass/adjustment coefficient determination in progress |
| 0x02      | Range exceeded  |
| 0x03      | Time exceeded   |
| 0x04      | Process aborted   |
| 0x05      | Awaiting for data   |

**(x) dosing status**– determines dosing process status of the weighing platform  
(x)

| HEX value   |                    |
|-------------|--------------------|
| <b>0x00</b> | Process disabled   |
| <b>0x01</b> | Dosing in progress |
| <b>0x02</b> | Process stopped    |
| <b>0x03</b> | Process finished   |

### 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     |
| Fast dosing threshold    | 512    | 40513          | 2             | float     |
| Precise dosing threshold | 514    | 40515          | 1             | float     |
| Adjustment weight mass   | 524    | 40525          | 1             | float     |

### 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               |
| 5       | Process start                   |
| 6       | Process stop                    |
| 8       | Start mass determination        |
| 9       | Adjustment factor determination |
| 10      | Adjustment parameters record    |





**Example:**

Writing the register with 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.

|   |   |
|---|---|
|  | <b><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></b> |
|  | <b><i>Parameters of the basic command refer to the weighing platform specified in the HOLDING 40503 register.</i></b>   |

**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 outputs status                          |
| 3       | Setting MIN threshold value                     |
| 4       | Setting MAX threshold value                     |
| 5       | Setting fast dosing threshold                   |
| 6       | Setting precise dosing threshold                |
| 9       | Adjustment weight mass                          |

|   |  |
|---|--|
|  | <b><i>Complex command requires setting address of respective parameter (from 40503 to 40525 – refer to: HOLDING table).</i></b>  |
|  | <b><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></b> |

**Example:**

Sending tare of 1.0 value to the scale.

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 least significant bytes – 0x0000.

40504 – tare value, two most significant bytes – 0x3F80.

The registers are written using 16 (0x10) preset 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 (1-4).

**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 module.

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    |

After conversion to HEX it is 0x05.

Executing the command requires writing 2 holding registers:

40502 – command with parameter - value 0x04 - which is output state record.

40507 – output mask 0x05.

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

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

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

**Fast dosing threshold**- complex command parameter: fast dosing threshold value (in adjustment unit).

**Precise dosing threshold**- complex command parameters: precise dosing threshold value (in adjustment unit).

**Adjustment weight mass**- complex command parameter: MAX threshold value (in an adjustment unit).



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