

PERFORMANCE  
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SMARTER

# Configuration manual

## 4116 / 4511

### *Modbus RTU configuration of 4116 Universal transmitter*



TEMPERATURE | I.S. INTERFACES | COMMUNICATION INTERFACES | MULTIFUNCTIONAL | ISOLATION | DISPLAY

No. 4116MCM103-UK  
For 4511 devices from ser. no. 141590001

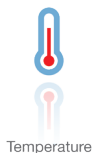
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Our range of temperature transmitters and sensors provides the highest level of signal integrity from the measurement point to your control system. You can convert industrial process temperature signals to analog, bus or digital communications using a highly reliable point-to-point solution with a fast response time, automatic self-calibration, sensor error detection, low drift, and top EMC performance in any environment.



We deliver the safest signals by validating our products against the toughest safety standards. Through our commitment to innovation, we have made pioneering achievements in developing I.S. interfaces with SIL 2 Full Assessment that are both efficient and cost-effective. Our comprehensive range of analog and digital intrinsically safe isolation barriers offers multifunctional inputs and outputs, making PR an easy-to-implement site standard. Our backplanes further simplify large installations and provide seamless integration to standard DCS systems.



We provide inexpensive, easy-to-use, future-ready communication interfaces that can access your PR installed base of products. All the interfaces are detachable, have a built-in display for readout of process values and diagnostics, and can be configured via push-buttons. Product specific functionality includes communication via Modbus and Bluetooth and remote access using our PR Process Supervisor (PPS) application, available for iOS and Android.



Our unique range of single devices covering multiple applications is easily deployable as your site standard. Having one variant that applies to a broad range of applications can reduce your installation time and training, and greatly simplify spare parts management at your facilities. Our devices are designed for long-term signal accuracy, low power consumption, immunity to electrical noise and simple programming.



Our compact, fast, high-quality 6 mm isolators are based on microprocessor technology to provide exceptional performance and EMC-immunity for dedicated applications at a very low total cost of ownership. They can be stacked both vertically and horizontally with no air gap separation between units required.



Our display range is characterized by its flexibility and stability. The devices meet nearly every demand for display readout of process signals, and have universal input and power supply capabilities. They provide a real-time measurement of your process value no matter the industry, and are engineered to provide a user-friendly and reliable relay of information, even in demanding environments.

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# Introduction

## This configuration manual

contains the necessary information for configuring a PR 4116 device which is connected to a PR 4511 Modbus RTU enabler.

## Modbus is a “master-slave” system,

where the “master” communicates with one or multiple “slaves”.

The master typically is a PLC (Programmable Logic Controller), DCS (Distributed Control System), HMI (Human Machine Interface), RTU (Remote Terminal Unit) or PC.

The three most common Modbus versions used are: MODBUS ASCII, MODBUS RTU and MODBUS/TCP.

In Modbus RTU, data is coded in binary, and requires only one communication byte per data byte. This is ideal for use over multi-drop RS485 networks, at speeds up to 115,200 bps.

The most common speeds are 9,600 bps and 19,200 bps.

Modbus RTU is the most widely used industrial protocol and is supported by the 4511.

## Modbus RTU

To communicate with a slave device, the master sends a message containing:

### Device Address - Function Code - Data - Error Check

**The Device Address** is a number from 0 to 247.

Messages sent to address 0 (broadcast messages) will be accepted by all slaves, but numbers 1-247 are addresses of specific devices. With the exception of broadcast messages, a slave device always responds to a Modbus message so the master knows the message was received.

## 4511 Supported Modbus function codes

| Command                  | Function code |
|--------------------------|---------------|
| Read Holding Registers   | 03            |
| Read Input Registers     | 04            |
| Write Single Register    | 06            |
| Diagnostics              | 08            |
| Write Multiple Registers | 16            |

**The Function Code** defines the command that the slave device is to execute, such as read data, accept data, report status. Some function codes have sub-function codes.

**The Data** defines addresses in the device’s memory map for read functions, contains data values to be written into the device’s memory, or contains other information needed to carry out the function requested.

**The Error Check** is a 16-bit numeric value representing the Cyclic Redundancy Check (CRC).

## Maximum number of registers which can be read or written at once

For a read command, the limit is 8 registers at a baud rate up to 38,400 bps, 16 registers @ 57,800 bps and 32 registers @ 115,200 bps.

For a write command, the limit is 123 registers at baud rates up to 115,200 bps.

## 4511 Modbus parameter settings

|                                |   |
|--------------------------------|---|
| Automatic Baudrate Detection:  | Can be configured YES or <b>NO</b>                        |
| Supported baudrates:           | 2400, 4800, 9600, <b>19.2k</b> , 38.4k, 57.6k, 115.2k bps |
| Parity Mode:                   | <b>Even</b> , Odd or None parity                          |
| Stop Bits:                     | <b>1</b> or 2 stop bits                                   |
| Response delay:                | 0...1000 ms ( <b>0 ms = default</b> )                     |
| Modbus slave addressing range: | 1 - 247 ( <b>247 = default address</b> )                  |
| Modbus Parameter Storage:      | Saved in non-volatile memory in the 4511 device           |

(Factory Default Values are marked in **bold**)

## Modbus RTU segment line termination

A 120 Ohm resistor should be installed on both ends of a RS485 Modbus RTU segment loop to prevent signal echoes from corrupting data on the line.

## 4116 Configuration parameter list

| Category | Parameter Name      | No. | Modbus Address | Register Size | Read/Write | Type             | Description  | Values                |                          |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
|----------|---------------------|-----|----------------|---------------|------------|------------------|--|-----------------------|--------------------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|---------------|-----------------|-----------------|-----------------|-----------|-----------|-----------|-----------|------------|
|          |                     |     |                |               |            |                  |  | Ver 0                 | Ver 1                    | Ver 2         | Ver 3         |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| GENERAL  | DEVICE NUMBER       | 0   | 0              | 1             | RO         | UNSIGNED INTEGER | Defines the actual device type   | 4116 = 16662 (0x4116) |                          |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| GENERAL  | DEVICE VERSION      | 1   | 1              | 1             | RO         | UNSIGNED INTEGER | Product version  | 0                     | 1                        | 2             | 3             |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| GENERAL  | PASSWORD            | 2   | 2              | 1             | R/W        | UNSIGNED INTEGER | Password for entering configuration menu                                       | Range: 0...9999       |                          |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | INPUT TYPE          | 3   | 3              | 1             | R/W        | UNSIGNED INTEGER | Selected input type (Voltage, Current, Resistance, Potentiometer, Temperature) | TEMP = 0              | POTM = 1                 | LINR = 2      | CURR = 3      | VOLT = 4      |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | INPUT VOLTAGE RANGE | 4   | 4              | 1             | R/W        | UNSIGNED INTEGER | Fixed input range for voltage measurements                                     | 0...1 V = 0           | 0.2...1 V = 1            | 0...5 V = 2   | 1...5 V = 3   | 0...10 V = 4  | 2...10 V = 5  |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | INPUT CURRENT RANGE | 5   | 5              | 1             | R/W        | UNSIGNED INTEGER | Fixed input range for current measurements                                     | 0...20 mA = 0         | 4...20 mA = 1            |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | CONNECTION TYPE     | 6   | 6              | 1             | R/W        | UNSIGNED INTEGER | Sensor connection type for RTD / resistance measurements                       | 2-wire = 0            | 3-wire = 1               | 4-wire = 2    |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | LIN RES LOW         | 7   | 7              | 1             | R/W        | UNSIGNED INTEGER | Input range low for Linear resistance measurements                             | Range: 0...9998       |                          |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | LIN RES HIGH        | 8   | 8              | 1             | R/W        | UNSIGNED INTEGER | Input range high for Linear resistance measurements.                           | Range: 1...9999       |                          |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | TEMP UNIT           | 9   | 9              | 1             | R/W        | UNSIGNED INTEGER | Temperature units  | °C = 0                | °F = 1                   |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | TEMP SENSOR TYPE    | 10  | 10             | 1             | R/W        | UNSIGNED INTEGER | Temperature sensor type  | TC = 0                | Ni = 1                   | Pt = 2        | TC = 0        | Ni = 1        | Pt = 2        | Cu = 3        |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | PT TYPE             | 11  | 11             | 1             | R/W        | UNSIGNED INTEGER | Pt value (Pt10, Pt20, Pt50...)   | Pt10 = 0              | Pt20 = 1                 | Pt50 = 2      | Pt100 = 3     | Pt200 = 4     | Pt400 = 5     | Pt500 = 6     | Pt1000 = 7    | Pt10 = 0      | Pt20 = 1      | Pt50 = 2        | Pt100 = 3       | Pt200 = 4       | Pt250 = 5 | Pt300 = 6 | Pt400 = 7 | Pt500 = 8 | Pt1000 = 9 |
| INPUT    | NI TYPE             | 12  | 12             | 1             | R/W        | UNSIGNED INTEGER | Ni value (Ni50, Ni100...)  | Ni50 = 0              | Ni100 = 1                | Ni120 = 2     | Ni1000 = 3    |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| INPUT    | TC TYPE             | 13  | 13             | 1             | R/W        | UNSIGNED INTEGER | Thermocouple type (TCB, TCK...)  | TC type B = 0         | TC type E = 1            | TC type J = 2 | TC type K = 3 | TC type L = 4 | TC type N = 5 | TC type R = 6 | TC type S = 7 | TC type T = 8 | TC type U = 9 | TC type W3 = 10 | TC type W5 = 11 | TC type Lr = 12 |           |           |           |           |            |
| DISPLAY  | DISPLAY UNIT        | 14  | 14             | 1             | R/W        | UNSIGNED INTEGER | Units shown as display units for non-temperature input types                   | table 1               | table 2 (except [blank]) | table 2       |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| DISPLAY  | DECIMAL POINT       | 15  | 15             | 1             | R/W        | UNSIGNED INTEGER | Decimal point place for display reading of non-temperature input types         | XXXX = 0              | X.XXX = 1                | XX.XX = 2     | XXX.X = 3     |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| DISPLAY  | DISPLAY LOW         | 16  | 16             | 1             | R/W        | INTEGER          | Low display range for display reading of non-temperature input types           | Range: -1999...9999   |                          |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |
| DISPLAY  | DISPLAY HIGH        | 17  | 17             | 1             | R/W        | INTEGER          | High display range for display reading of non-temperature input types          | Range: -1999...9999   |                          |               |               |               |               |               |               |               |               |                 |                 |                 |           |           |           |           |            |

| Category | Parameter Name               | No. | Modbus Address | Register Size | Read/Write | Type             | Description  | Values   |       |       |                   |
|----------|------------------------------|-----|----------------|---------------|------------|------------------|--|--|-------|-------|-------------------|
|          |                              |     |                |               |            |                  |  | Ver 0  | Ver 1 | Ver 2 | Ver 3             |
| RELAY    | RELAY UNIT                   | 18  | 18             | 1             | R/W        | UNSIGNED INTEGER | Units for relay setpoint of non-temperature input types  | Percent = 0<br>Display units = 1   |       |       |                   |
| RELAY    | RELAY 1 FUNCTION             | 19  | 19             | 1             | R/W        | UNSIGNED INTEGER | Relay function (setpoint, window, error etc.)  | OFF = 0<br>POWER = 1<br>ERROR = 2<br>WINDOW = 3<br>SETPOINT = 4  |       |       |                   |
| RELAY    | RELAY 1 CONTACT              | 20  | 20             | 1             | R/W        | UNSIGNED INTEGER | Contact function, (NO/ NC or "open inside window"/"closed inside window")  | NC / Open inside window = 0<br>NO / Closed inside window = 1   |       |       |                   |
| RELAY    | RELAY 1 SETPOINT             | 21  | 21             | 2             | R/W        | INTEGER          | Setpoint in either display values or 1/10% (percent) for non-temperature and in 1/10° for temperature input types              | <b>Range for non-temperature input types:</b><br>DISPLAY LOW...DISPLAY HIGH<br>0...1000 (0.0...100.0%)<br><b>Range for temperature input types:</b><br>equals the measurement range for the selected sensor type |       |       |                   |
| RELAY    | RELAY 1 ACTION DIRECTION     | 22  | 23             | 1             | R/W        | UNSIGNED INTEGER | Activation direction   | DECREASING = 0<br>INCREASING = 1   |       |       |                   |
| RELAY    | RELAY 1 HYSTERESIS           | 23  | 24             | 1             | R/W        | UNSIGNED INTEGER | Hysteresis in either display values or 1/10% (percent) for non-temperature, and in 1/10° for temperature input types           | <b>Range for non-temperature input types:</b>  |       |       |                   |
|          |                              |     |                |               |            |                  |  | 1...Absolute value of (DISPLAY HIGH-DISPLAY LOW)/4 if relay unit is set to Display units.<br>1...250 (0.1...25.0%) if relay unit is set to percent.  |       |       | Note <sup>1</sup> |
|          |                              |     |                |               |            |                  |  | <b>Range for temperature input types:</b>  |       |       |                   |
|          |                              |     |                |               |            |                  |  | 0.1...(temperature sensor range/4)   |       |       | Note <sup>2</sup> |
| RELAY    | RELAY 1 ERROR ACTION         | 24  | 25             | 1             | R/W        | UNSIGNED INTEGER | Action on error  | NONE = 0<br>OPEN = 1<br>CLOSE = 2<br>HOLD = 3  |       |       |                   |
| RELAY    | RELAY 1 ON DELAY             | 25  | 26             | 1             | R/W        | UNSIGNED INTEGER | Relay ON time delay  | Range: 0..3600s  |       |       |                   |
| RELAY    | RELAY 1 OFF DELAY            | 26  | 27             | 1             | R/W        | UNSIGNED INTEGER | Relay OFF time delay   | Range: 0..3600s  |       |       |                   |
| RELAY    | RELAY 1 SETPOINT LOW WINDOW  | 27  | 28             | 2             | R/W        | INTEGER          | Low window setpoint in either display values or 1/10% (percent) for non-temperature, and in 1/10° for temperature input types  | As RELAY SETPOINT  |       |       |                   |
| RELAY    | RELAY 1 SETPOINT HIGH WINDOW | 28  | 30             | 2             | R/W        | INTEGER          | High window setpoint in either display values or 1/10% (percent) for non-temperature, and in 1/10° for temperature input types | As RELAY SETPOINT  |       |       |                   |
| RELAY    | RELAY 2 FUNCTION             | 29  | 32             | 1             | R/W        | UNSIGNED INTEGER | As RELAY 1 FUNCTION  |  |       |       |                   |
| RELAY    | RELAY 2 CONTACT              | 30  | 33             | 1             | R/W        | UNSIGNED INTEGER | As RELAY 1 CONTACT   |  |       |       |                   |
| RELAY    | RELAY 2 SETPOINT             | 31  | 34             | 2             | R/W        | INTEGER          | As RELAY 1 SETPOINT  |  |       |       |                   |
| RELAY    | RELAY 2 ACTION DIRECTION     | 32  | 36             | 1             | R/W        | UNSIGNED INTEGER | As RELAY 1 ACTION DIRECTION  |  |       |       |                   |
| RELAY    | RELAY 2 HYSTERESIS           | 33  | 37             | 1             | R/W        | UNSIGNED INTEGER | As RELAY 1 HYSTERESIS  |  |       |       |                   |
| RELAY    | RELAY 2 ERROR ACTION         | 34  | 38             | 1             | R/W        | UNSIGNED INTEGER | As RELAY 1 ERROR ACTION  |  |       |       |                   |
| RELAY    | RELAY 2 ON DELAY             | 35  | 39             | 1             | R/W        | UNSIGNED INTEGER | As RELAY 1 ON DELAY  |  |       |       |                   |

1 If RELAY UNIT is Display units: 0...Absolute value of (DISPLAY HIGH-DISPLAY LOW)  
If RELAY UNIT is Percent: 0...1000 (0.0...100.0%)

2 0.0...temperature sensor range

| Category | Parameter Name        | No. | Modbus Address | Register Size | Read/Write | Type             | Description   | Values   |               |                     |       |
|----------|-----------------------|-----|----------------|---------------|------------|------------------|---|--|---------------|---------------------|-------|
|          |                       |     |                |               |            |                  |   | Ver 0  | Ver 1         | Ver 2               | Ver 3 |
| RELAY    | RELAY 2 OFF DELAY     | 36  | 40             | 1             | R/W        | UNSIGNED INTEGER | As RELAY 1 OFF DELAY  |  |               |                     |       |
| RELAY    | RELAY 2 SETPOINT LOW  | 37  | 41             | 2             | R/W        | INTEGER          | As RELAY 1 SETPOINT LOW   |  |               |                     |       |
| RELAY    | RELAY 2 SETPOINT HIGH | 38  | 43             | 2             | R/W        | INTEGER          | As RELAY 1 SETPOINT HIGH  |  |               |                     |       |
| OUTPUT   | OUTPUT TYPE           | 39  | 45             | 1             | R/W        | UNSIGNED INTEGER | Output type   | CURR VOLT  | = 0           | = 1                 |       |
| OUTPUT   | VOLTAGE OUTPUT RANGE  | 40  | 46             | 1             | R/W        | UNSIGNED INTEGER | Fixed output range for voltage output   | 0...1 V  | = 0           |                     |       |
|          |                       |     |                |               |            |                  |   | 0.2...1 V  | = 1           |                     |       |
|          |                       |     |                |               |            |                  |   | 0...5 V  | = 2           |                     |       |
|          |                       |     |                |               |            |                  |   | 1...5 V  | = 3           |                     |       |
|          |                       |     |                |               |            |                  |   | 0...10 V   | = 4           |                     |       |
|          |                       |     |                |               |            |                  |   | 0.2...10 V   | = 5           |                     |       |
|          |                       |     |                |               |            |                  |   | 1...0 V  | = 6           |                     |       |
|          |                       |     |                |               |            |                  |   | 1...0.2 V  | = 7           |                     |       |
|          |                       |     |                |               |            |                  |   | 5...0 V  | = 8           |                     |       |
|          |                       |     |                |               |            |                  |   | 5...1 V  | = 9           |                     |       |
|          |                       |     |                |               |            |                  |   | 10...0 V   | = 10          |                     |       |
|          |                       |     |                |               |            |                  |   | 10...2 V   | = 11          |                     |       |
| OUTPUT   | CURRENT OUTPUT RANGE  | 41  | 47             | 1             | R/W        | UNSIGNED INTEGER | Fixed output range for current output   | 0...20 mA = 0  | 0...20 mA = 0 | 0...20 mA = 0       |       |
|          |                       |     |                |               |            |                  |   | 4...20 mA = 1  | 4...20 mA = 1 | 4...20 mA = 1       |       |
|          |                       |     |                |               |            |                  |   | 20...0 mA = 2  | 20...0 mA = 2 | 20...0 mA (SIL) = 2 |       |
|          |                       |     |                |               |            |                  |   | 20...4 mA = 3  | 20...4 mA = 3 | 20...4 mA = 3       |       |
|          |                       |     |                |               |            |                  |   |  |               | 20...4 mA (SIL) = 4 |       |
|          |                       |     |                |               |            |                  |   |  |               | 20...4 mA (SIL) = 5 |       |
| OUTPUT   | OUTPUT ERROR          | 42  | 48             | 1             | R/W        | UNSIGNED INTEGER | Analog output action on error. This sets the output error signaling value (If set to none sensor error detection is disabled)       | NONE   | = 0           |                     |       |
|          |                       |     |                |               |            |                  |   | 0 mA   | = 1           |                     |       |
|          |                       |     |                |               |            |                  |   | 3.5 mA   | = 2           |                     |       |
|          |                       |     |                |               |            |                  |   | 23 mA  | = 3           |                     |       |
| OUTPUT   | OUTPUT LOW            | 43  | 49             | 2             | R/W        | INTEGER          | Temperature for output low value for temperature input types in 1/10°   | Range equals the measurement range for the selected sensor type and must be lower than OUTPUT HIGH   |               |                     |       |
| OUTPUT   | OUTPUT HIGH           | 44  | 51             | 2             | R/W        | INTEGER          | Temperature for output high value for temperature input types in 1/10°  | Range equals the measurement range for the selected sensor type and must be higher than OUTPUT LOW   |               |                     |       |
| DISPLAY  | DISPLAY CONTRAST      | 45  | 53             | 1             | R/W        | UNSIGNED INTEGER | Contrast on the LCD display   | Range: 0...9   |               |                     |       |
| DISPLAY  | DISPLAY BACKLIGHT     | 46  | 54             | 1             | R/W        | UNSIGNED INTEGER | Backlight intensity on LCD  | Range: 0...9   |               |                     |       |
| DISPLAY  | TAG TEXT              | 47  | 55             | 3             | R/W        | ASCII CHAR       | Tag of the device (6 characters)  | Range: ASCII values from 32 to 90 (' ' to 'Z').  |               |                     |       |
| DISPLAY  | LINE 3 FUNCTION       | 48  | 58             | 1             | R/W        | UNSIGNED INTEGER | Information shown in line 3 of display in monitor mode (normal mode). Choose between the analog output value or the configured tag. | Output value TAG   | = 0           | = 1                 |       |
| INPUT    | USE CALIB             | 49  | 59             | 1             | R/W        | UNSIGNED INTEGER | Use the applied calibration values  | NO   | = 0           |                     |       |
|          |                       |     |                |               |            |                  |   | YES  | = 1           |                     |       |
| GENERAL  | ENABLE PASSWORD       | 50  | 60             | 1             | R/W        | UNSIGNED INTEGER | Password protect entry to configuration menu via display  | NO   | = 0           |                     |       |
|          |                       |     |                |               |            |                  |   | YES  | = 1           |                     |       |
| RELAY    | ENABLE FAST SET       | 51  | 61             | 1             | R/W        | UNSIGNED INTEGER | Enable fast set of relay setpoints from monitor menu  | NO   | = 0           |                     |       |
|          |                       |     |                |               |            |                  |   | YES  | = 1           |                     |       |
| INPUT    | CALIB RANGE LOW       | 52  | 62             | 2             | R/W        | FLOAT            | Actual process value for low calibration point in either display values or 1/10°C   | <b>For non-temperature input types:</b> range is DISPLAY LOW...DISPLAY HIGH.<br><b>For temperature input types:</b> the range equals the measurement range for the selected sensor type. |               |                     |       |
| INPUT    | CALIB RANGE HIGH      | 53  | 64             | 2             | R/W        | FLOAT            | Actual process value for high calibration point in either display values or 1/10°C  | As CALIB RANGE LOW   |               |                     |       |

| Category | Parameter Name        | No. | Modbus Address | Register Size | Read/Write | Type             | Description  | Values   |       |                    |   |
|----------|-----------------------|-----|----------------|---------------|------------|------------------|--|--|-------|--------------------|---|
|          |                       |     |                |               |            |                  |  | Ver 0  | Ver 1 | Ver 2              | Ver 3   |
| INPUT    | CALIB POINT LOW       | 54  | 66             | 2             | R/W        | FLOAT            | Measured process value for low calibration point in either display values or 1/10°C. (Must be copied from PROCESS DATA)  | As CALIB RANGE LOW   |       |                    |   |
| INPUT    | CALIB POINT HIGH      | 55  | 68             | 2             | R/W        | FLOAT            | Measured process value for high calibration point in either display values or 1/10°C. (Must be copied from PROCESS DATA) | As CALIB RANGE LOW   |       |                    |   |
| GENERAL  | HELPTXT LANGUAGE      | 57  | 72             | 1             | R/W        | UNSIGNED INTEGER | Language for the help texts shown in display   | UK = 0<br>DK = 1<br>DE = 2<br>FR = 3<br>SE = 4<br>IT = 5<br>ES = 6 |       |                    |   |
| INPUT    | CJC TYPE              | 58  | 73             | 1             | R/W        | UNSIGNED INTEGER | CJC compensation type for TC temperature types (internal/connector)  | None - Fixed internal  |       | INTERNAL CONNECTOR | = 0<br>= 1                                    |
| RELAY    | RELAY 1 LATCH ENABLE  | 59  | 74             | 1             | R/W        | UNSIGNED INTEGER | Activate latch function  | None (Latch function not implemented)                              |       | NO YES             | = 0<br>= 1                                    |
| RELAY    | RELAY 2 LATCH ENABLE  | 60  | 75             | 1             | R/W        | UNSIGNED INTEGER | Activate latch function  | None (Latch function not implemented)                              |       | NO YES             | = 0<br>= 1                                    |
| INPUT    | CU TYPE               | 61  | 76             | 1             | R/W        | UNSIGNED INTEGER | Cu value (Cu10, Cu20, Cu50...)   | None (Cu temperature type not implemented)                         |       |                    | Cu10 = 0<br>Cu20 = 1<br>Cu50 = 2<br>Cu100 = 3 |
| GENERAL  | SERIAL NUMBER         | 62  | 77             | 2             | RO         | UNSIGNED INTEGER | Device serial number   | None (Serial Number not part of CONFIGURATION DATA)                |       |                    | Range: 0...999999999                          |
| GENERAL  | CHECKSUM              | 100 | 100            | 1             | RO         | UNSIGNED INTEGER | CRC16 checksum of the configuration  | Range 0...65535  |       |                    |   |
| GENERAL  | Configuration counter | 101 | 101            | 1             | RO         | UNSIGNED INTEGER | This counter will count the number of times the configuration has been changed. The counter is reset on power-up         | Range 0...65535  |       |                    |   |



**Table 1: Display units, ver. 0**

|   |    |    |                |    |        |    |      |    |    |    |                     |    |       |
|---|----|----|----------------|----|--------|----|------|----|----|----|---------------------|----|-------|
| 0 | °C | 10 | m <sup>3</sup> | 20 | ft/min | 30 | MPa  | 40 | GW | 50 | mV                  | 60 | gal/h |
| 1 | °F | 11 | l              | 21 | in/h   | 31 | kPa  | 41 | MW | 51 | Ω                   | 61 | t/h   |
| 2 | K  | 12 | s              | 22 | ft/h   | 32 | hPa  | 42 | kW | 52 | S                   | 62 | mol   |
| 3 | %  | 13 | min            | 23 | rpm    | 33 | bar  | 43 | hp | 53 | μS                  | 63 | pH    |
| 4 | m  | 14 | m/s            | 24 | Hz     | 34 | mbar | 44 | A  | 54 | m <sup>3</sup> /min |    |       |
| 5 | cm | 15 | m/min          | 25 | t      | 35 | kJ   | 45 | kA | 55 | m <sup>3</sup> /h   |    |       |
| 6 | mm | 16 | m/h            | 26 | kg     | 36 | Wh   | 46 | mA | 56 | l/s                 |    |       |
| 7 | ft | 17 | in/s           | 27 | g      | 37 | MWh  | 47 | μA | 57 | l/min               |    |       |
| 8 | in | 18 | ft/s           | 28 | N      | 38 | kWh  | 48 | V  | 58 | l/h                 |    |       |
| 9 | yd | 19 | in/min         | 29 | Pa     | 39 | W    | 49 | kV | 59 | gal/min             |    |       |

**Table 2: Display units, ver. 1-3**

|   |    |    |                |    |                  |    |      |    |     |    |                     |    |                   |
|---|----|----|----------------|----|------------------|----|------|----|-----|----|---------------------|----|-------------------|
| 0 | °C | 10 | mils           | 20 | in/s             | 30 | t    | 40 | kJ  | 50 | kA                  | 60 | m <sup>3</sup> /h |
| 1 | °F | 11 | yd             | 21 | ips              | 31 | kg   | 41 | Wh  | 51 | mA                  | 61 | l/s               |
| 2 | K  | 12 | m <sup>3</sup> | 22 | ft/s             | 32 | g    | 42 | MWh | 52 | μA                  | 62 | l/min             |
| 3 | %  | 13 | l              | 23 | in/min           | 33 | N    | 43 | kWh | 53 | V                   | 63 | l/h               |
| 4 | m  | 14 | s              | 24 | ft/min           | 34 | Pa   | 44 | W   | 54 | kV                  | 64 | gal/min           |
| 5 | cm | 15 | min            | 25 | in/h             | 35 | MPa  | 45 | GW  | 55 | mV                  | 65 | gal/h             |
| 6 | mm | 16 | m/s            | 26 | ft/h             | 36 | kPa  | 46 | MW  | 56 | Ω                   | 66 | t/h               |
| 7 | μm | 17 | mm/s           | 27 | m/s <sup>2</sup> | 37 | hPa  | 47 | kW  | 57 | S                   | 67 | mol               |
| 8 | ft | 18 | m/min          | 28 | rpm              | 38 | bar  | 48 | hp  | 58 | μS                  | 68 | pH                |
| 9 | in | 19 | m/h            | 29 | Hz               | 39 | mbar | 49 | A   | 59 | m <sup>3</sup> /min | 69 | [blank]*          |

[blank]\* - not available in ver. 1.

## 4116 Input types and ranges

| Input type    | Min. value  | Max. value     | Standard           |
|---------------|-------------|----------------|--------------------|
| mA            | 0 mA        | 20 mA          | -                  |
| V             | 0 V         | 10 V           | -                  |
| Pt10...Pt1000 | -200°C      | +850°C         | IEC 60751          |
| Ni50...Ni1000 | -60°C       | +250°C         | DIN 43760          |
| Cu10...Cu100  | -200°C      | +260°C         | $\alpha = 0,00427$ |
| Lin. R        | 0 $\Omega$  | 10000 $\Omega$ | -                  |
| Potentiometer | 10 $\Omega$ | 100 k $\Omega$ | -                  |
| TC B          | 0°C         | +1820°C        | IEC 60584-1        |
| TC E          | -100°C      | +1000°C        | IEC 60584-1        |
| TC J          | -100°C      | +1200°C        | IEC 60584-1        |
| TC K          | -180°C      | +1372°C        | IEC 60584-1        |
| TC L          | -200°C      | +900°C         | DIN 43710          |
| TC N          | -180°C      | +1300°C        | IEC 60584-1        |
| TC R          | -50°C       | +1760°C        | IEC 60584-1        |
| TC S          | -50°C       | +1760°C        | IEC 60584-1        |
| TC T          | -200°C      | +400°C         | IEC 60584-1        |
| TC U          | -200°C      | +600°C         | DIN 43710          |
| TC W3         | 0°C         | +2300°C        | ASTM E988-90       |
| TC W5         | 0°C         | +2300°C        | ASTM E988-90       |
| TC LR         | -200°C      | +800°C         | GOST 3044-84       |

## 4116 Process parameter list

| Parameter Name       | No. | Register Address | Register Size | Read/Write | Type    | Description  | Values   |
|----------------------|-----|------------------|---------------|------------|---------|--|--|
| DISPLAY VALUE        | 1   | 1000             | 2             | RO         | INTEGER | The measured value in 1/10 of °C/°F for temperature Input types, or the scaled display value for non-temperature input types<br>(INTEGER version of PRIMARY VALUE)   | <b>Range for non-temperature input types:</b><br>DISPLAY LOW...DISPLAY HIGH<br><b>Range for temperature input types:</b><br>equals the measurement range for the selected sensor type  |
| PERCENT PV           | 2   | 1002             | 1             | RO         | INTEGER | The relative input value as 1/100 of % calculated from PRIMARY VALUE.<br>For temperature input types 0..100% corresponds to the selected temperature range (OUTPUT LOW...OUTPUT HIGH)<br>For non-temperature input types 0..100% corresponds the selected fixed range (e.g. 4...20 mA) | Range: 0...9999<br><br>(e.g. 7898 = 78.98%)  |
| MEASURE STATUS       | 3   | 1003             | 1             | RO         | INTEGER | The actual measurement status  | OUTPUT UNDERRANGE bit 0 = 1<br>OUTPUT OVERRANGE bit 1 = 1<br>OUTPUT LOW LIMITED bit 2 = 1<br>OUTPUT HIGH LIMITED bit 3 = 1<br>INPUT UNDERRANGE bit 4 = 1<br>INPUT OVERRANGE bit 5 = 1<br>SENSOR SHORTED bit 6 = 1<br>SENSOR BROKEN bit 7 = 1   |
| ERROR STATUS         | 4   | 1004             | 1             | RO         | INTEGER | The actual error status (Device errors)  | AD COMM. ERROR bit 0 = 1<br>CJC ERROR bit 1 = 1<br>RAM ERROR bit 2 = 1<br>EEP ERROR bit 3 = 1<br>FLASH ERROR bit 4 = 1<br>NOT CALIBRATED bit 5 = 1<br>BAD OUTPUT bit 6 = 1<br>NO OUTPUT bit 7 = 1<br>OUTPUT SUPPLY ERROR bit 8 = 1<br>INPUT SUPPLY ERROR bit 9 = 1<br>EXT. FLASH ERROR bit 10 = 1  |
| RELAY STATUS         | 5   | 1005             | 1             | R/W        | INTEGER | The actual relay status calculated from PRIMARY VALUE  | <b>ALL VERSIONS:</b><br>RELAY 1 INVERTED bit 0 = 1<br>RELAY 2 INVERTED bit 1 = 1<br>RELAY 1 IS ON bit 2 = 1<br>RELAY 2 IS ON bit 3 = 1<br>RELAY 1 WILL GO ON AFTER DELAY bit 4 = 1<br>RELAY 2 WILL GO ON AFTER DELAY bit 5 = 1<br><b>ONLY VERSION 2-3:</b><br>RELAY 1 IS LATCHED bit 6 = 1<br>RELAY 2 IS LATCHED bit 7 = 1<br>RELAY 1 CANNOT RELEASE bit 8 = 1<br>RELAY 2 CANNOT RELEASE bit 9 = 1 |
| PRIMARY RAW VALUE    | 6   | 1006             | 2             | RO         | FLOAT   | The measured value in 1/10 of °C/°F for temperature Input types, or the scaled display value for non-temperature input types, NOT PROCESS CALIBRATED.  | <b>Range for non-temperature input types:</b><br>DISPLAY LOW...DISPLAY HIGH<br>Range for temperature input types equals the measurement range for the selected sensor type   |
| PRIMARY VALUE        | 7   | 1008             | 2             | R/W        | FLOAT   | The measured value in 1/10 of °C/°F for temperature Input types, or the scaled display value for non-temperature input types   | <b>Range for non-temperature input types:</b><br>DISPLAY LOW...DISPLAY HIGH<br>Range for temperature input types equals the measurement range for the selected sensor type   |
| RELATIVE PV          | 8   | 1010             | 2             | RO         | FLOAT   | The relative input value calculated from PRIMARY VALUE.<br>For temperature input types relative to selected temperature range (OUTPUT LOW...OUTPUT HIGH)<br>For non-temperature input types relative to selected fixed range (e.g. 4...20 mA)  | Range: 0.0...1.0   |
| OUTPUT VALUE         | 9   | 1012             | 2             | R/W        | FLOAT   | Calculated output value in µA or µV  | <b>Range:</b><br>CURRENT: 0.0...23000.0 (23 mA)<br>VOLTAGE: 0.0...1150000.0 (11.5 V)   |
| MEASURE CONTROL      | 10  | 1014             | 1             | R/W        | INTEGER | Measurement control. By disabling update of certain READ/WRITE parameters PRIMARY VALUE, OUTPUT VALUE or RELAY STATUS, these can be simulated by writing values.<br>All bits are cleared when TIMEOUT COUNTER reaches 0  | DISABLE PRIMARY VALUE UPDATE (INCL. MEASURE STATUS) bit 2 = 1<br>DISABLE OUTPUT VALUE UPDATE bit 3 = 1<br>DISABLE RELAY STATUS UPDATE bit 4 = 1<br>DISABLE CONFIGURATION CHECK bit 5 = 1<br>REMAINING BITS SHALL BE SET TO 0   |
| TIMEOUT COUNTER      | 11  | 1015             | 1             | R/W        | INTEGER | Time out counter, increments every 0.075 second. When reaching 256 (if not refreshed) all bits in MEASURE CONTROL will be cleared.   | Range: 0...255   |
| INTERNAL TEMPERATURE | 12  | 1016             | 1             | RO         | INTEGER | Internal measured or connector temperature in 1/10 of °C/°F  | <b>Range:</b><br>-200...800 (-20.0...80.0 °C) or<br>-40...1760 (-4.0...176.0 °F)   |

## 4511 Modbus configuration parameter list

| Parameter Name  | No. | Register Address | Register Size | Read/Write | Type    | Description   | Values   |
|-----------------|-----|------------------|---------------|------------|---------|---|--|
| ENABLE MODBUS   | 1   | 3000             | 1             | R/W        | INTEGER | Enable Modbus communication. If disabled, 4511 ignores all frames sent from the Modbus master and the only way to re-enable Modbus communication is by using the 4511 menu. | NO = 0<br>YES = 1  |
| BAUDRATE        | 2   | 3001             | 1             | R/W        | INTEGER | The baud value used for Modbus communication  | 2400 BAUD = 0<br>4800 BAUD = 1<br>9600 BAUD = 2<br>19200 BAUD = 3<br>38400 BAUD = 4<br>57600 BAUD = 5<br>115200 BAUD = 6 |
| ENABLE AUTOBAUD | 3   | 3002             | 1             | R/W        | INTEGER | Enable automatic baudrate detection. If enabled, 4511 determines the baudrate automatically by listening to frames sent on the Modbus line.                                 | NO = 0<br>YES = 1  |
| PARITY          | 4   | 3003             | 1             | R/W        | INTEGER | Configures parity check on Modbus frames  | NONE = 0<br>EVEN PARITY = 1<br>ODD PARITY = 2  |
| STOPBITS        | 5   | 3004             | 1             | R/W        | INTEGER | Configures the number of stopbits in Modbus frames  | ONE STOPBIT = 0<br>TWO STOPBITS = 1  |
| ADDRESS         | 6   | 3005             | 1             | R/W        | INTEGER | Configures the Modbus address of the 4511 (Address 0 is broadcast address)  | Range: 1...247   |
| RESPONSE DELAY  | 7   | 3006             | 1             | R/W        | INTEGER | Configures minimum delay for Modbus response in ms  | Range: 0...1000  |

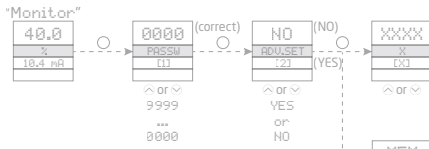
## 4511 Additional parameter list

| Parameter Name | No. | Register Address | Register Size | Read/Write | Type    | Description   | Values            |
|----------------|-----|------------------|---------------|------------|---------|---|-------------------|
| ROTATE DEVICE  | 1   | 3100             | 1             | R/W        | INTEGER | Enables the display and key buttons to be used normally when the host device is mounted upside down | NO = 0<br>YES = 1 |

## 4511 Modbus status parameter list

| Parameter Name         | No. | Register Address | Register Size | Read/Write | Type    | Description  | Values   |
|------------------------|-----|------------------|---------------|------------|---------|--|--|
| AUTOBAUD STATUS        | 1   | 4000             | 1             | RO         | INTEGER | Actual state of automatic baudrate detection   | 2400 BAUD = 0<br>4800 BAUD = 1<br>9600 BAUD = 2<br>19200 BAUD = 3<br>38400 BAUD = 4<br>57600 BAUD = 5<br>115200 BAUD = 6<br>SEARCHING = 7<br>ERROR = 8 |
| IDENTIFY DEVICE        | 2   | 4001             | 1             | R/W        | INTEGER | Enables the device to flash the LCD background with appr. 4 Hz. <b>Value will automatically return to NO if not written within 10 seconds!</b> | NO = 0<br>YES = 1  |
| MAXIMUM READ REGISTERS | 3   | 4002             | 1             | RO         | INTEGER | Maximum allowed number of registers that can be read in one command, with the given/detected baudrate  | Range: 8...32  |

# 4511 Modbus front programming parameter menu



## Scrolling HELP TEXTS:

- [1] Set correct password
- [2] Enter advanced setup menu
- [3] Perform memory operations
  - Enter display setup
  - Enter simulation setup
  - Enter password setup
  - Enter language setup
  - Enter rail setup (System 9000)
  - Enter Modbus setup
- [4] Check automatic baudrate detection status
  - Enable Modbus communication
  - Disable Modbus communication
- [5] Reset Modbus to default
- [6] Select Modbus slave address
- [7] Select parity for Modbus
- [8] Select number of stop bits
- [9] Select response delay in ms
- [10] Enable automatic baudrate detection
- [11] Searching for Modbus baudrate
  - Modbus baudrate detected
  - Modbus baudrate not detected
- [12] Select baudrate in bps
- [13] Rotate device upside down?

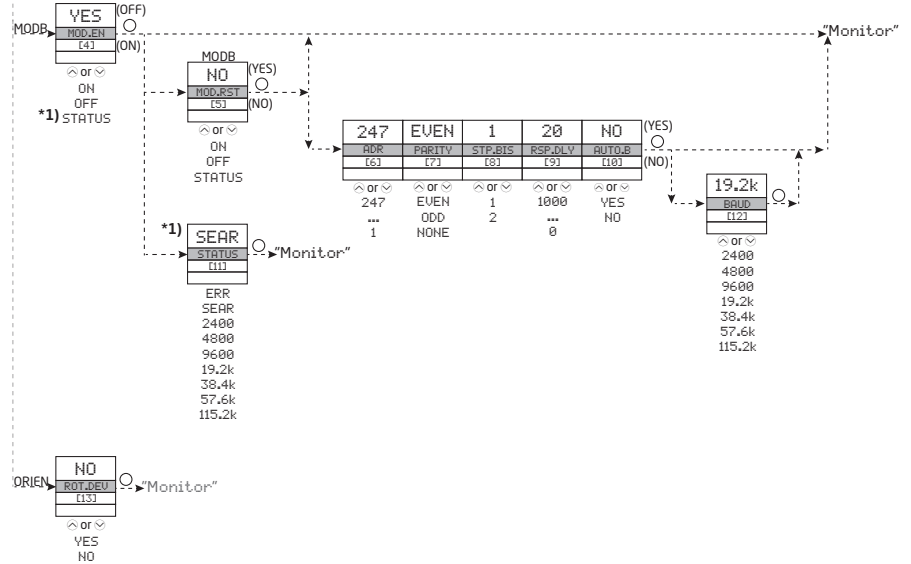
\* 1) Only if automatic baudrate detection is enabled

- MEM
- DISP
- CAL
- DISP
- CAL
- SIM
- PASS
- LANG
- RAIL
- MODB
- ORIEN

## Please note:

If no keys are activated for 1 minute, the 4511 display will return to the "Monitor" view without saving. The display will also return to "Monitor" upon successful Modbus write command!

The grayed-out menus and texts are only shown for guidance and are not a part of the 4511 specific submenu. The Modbus submenu is located in the Advanced Setting menu structure of any host device using the 4511. The actual placement is defined for each particular device.



## Document history

The following list provides notes concerning revisions of this document.

| <b>Rev. ID</b> | <b>Date</b> | <b>Notes</b>                                  |
|----------------|-------------|---|
| 102            | 1938        | Changes to Process parameter list, no 10 & 11 |

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