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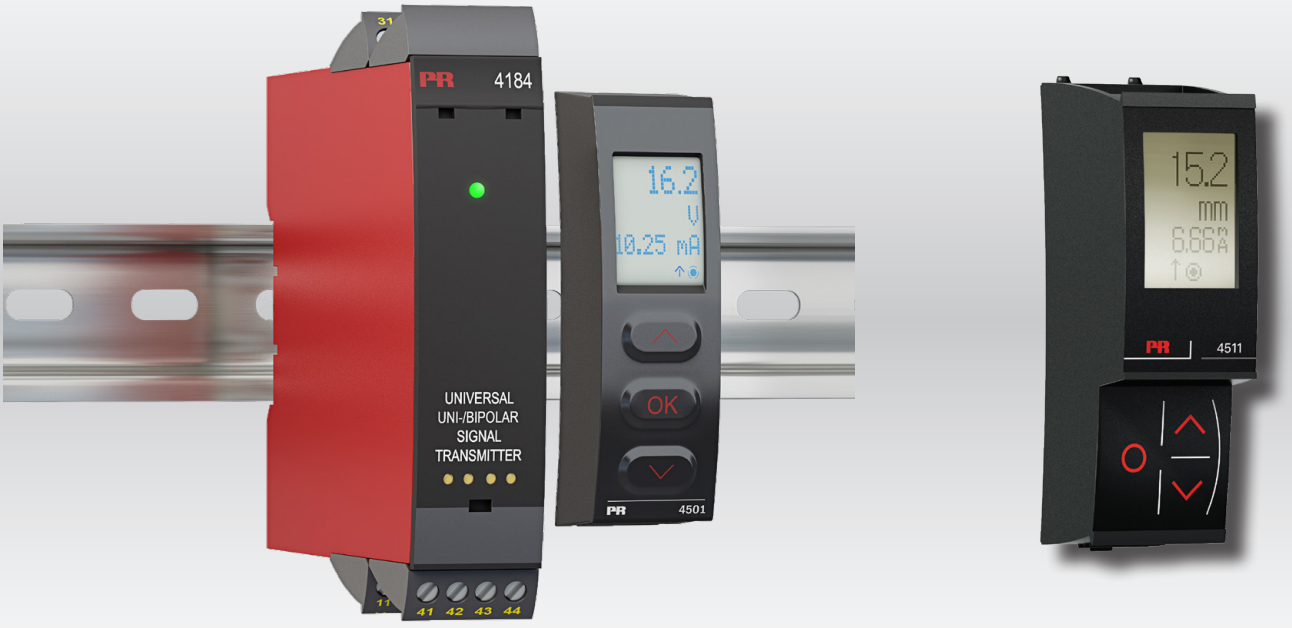
Configuration Manual
4184 / 4511
Modbus RTU configuration of
4184 Universal uni-/bipolar signal transmitter



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

No. 4184MCM100-UK
For 4511 devices from ser. no. 141590001

PR electronics

6 Product Pillars
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Individually outstanding, unrivalled in combination

With our innovative, patented technologies, we make signal conditioning smarter and simpler. Our portfolio is composed of six product areas, where we offer a wide range of analog and digital devices covering over a thousand applications in industrial and factory automation. All our products comply with or surpass the highest industry standards, ensuring reliability in even the harshest of environments and have a 5-year warranty for greater peace of mind.

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We provide inexpensive, easy-to-use, future-ready communication interfaces that can access your PR installed base of products. The detachable 4501 Local Operator Interface (LOI) allows for local monitoring of process values, device configuration, error detection and signal simulation. The next generation, our 4511 Remote Operator Interface (ROI) does all that and more, adding remote digital communications via Modbus/RTU, while the analog output signals are still available for redundancy.
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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.

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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.

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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.

Contents

Introduction

This configuration manual

contains the necessary information for configuring a PR 4184 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 **NO**
Supported baudrates:	2400, 4800, 9600, **19.2k**, 38.4k, 57.6k, 115.2k bps
Parity Mode:	**Even**, Odd or None parity
Stop Bits:	**1** or 2 stop bits
Response delay:	0...1000 ms **(0 ms = default)**
Modbus slave addressing range:	1 - 247 **(247 = default address)**
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.

4184 Configuration Parameter List

Category	Parameter Name	Modbus Address	Register Size	Read/ Write	Type	Description	Values
GENERAL	DEVICE NUMBER	0	1	RO	UNSIGNED INTEGER	Defines the actual device type	4184 = 16772 (0x4184)
GENERAL	DEVICE VERSION	1	1	RO	UNSIGNED INTEGER	Product version	0
GENERAL	VARIANT	2	1	RO	UNSIGNED INTEGER	Device variant	0
GENERAL	SERIAL NUMBER	3	2	RO	UNSIGNED INTEGER	Device serial number	Range: 0..999999999
GENERAL	PASSWORD	5	1	R/W	UNSIGNED INTEGER	Password for entering configuration menu	Range: 0..9999
INPUT	INPUT FUNCTION	6	1	R/W	UNSIGNED INTEGER	Analog function for input	Linear = 0 Square root function = 1
INPUT	INPUT TYPE	7	1	R/W	UNSIGNED INTEGER	Selected input type	Current = 0 Voltage = 1 Potentiometer = 2
INPUT	INPUT VOLTAGE RANGE	8	1	R/W	UNSIGNED INTEGER	Fixed input range for voltage measurements	Custom input range = 0 0...0.1 V = 1 0...1 V = 2 0.2...1 V = 3 0...2.5 V = 4 0...5 V = 5 1...5 V = 6 0...10 V = 7 2...10 V = 8 0...100 V = 9 0...300 V = 10 -0.1...0.1 V = 11 -1...1 V = 12 -2.5...2.5 V = 13 -5...5 V = 14 -10...10 V = 15 -100...100 V = 16 -300...300 V = 17
INPUT	INPUT CURRENT RANGE	9	1	R/W	UNSIGNED INTEGER	Fixed input range for current measurements	Custom input range = 0 0...1 mA = 1 0...5 mA = 2 1...5 mA = 3 0...20 mA = 4 4...20 mA = 5 -1...1 mA = 6 -5...5 mA = 7 -10...10 mA = 8 -20...20 mA = 9 -50...50 mA =10 -100...100 mA =11
INPUT	INPUT CUST. VOLTAGE RANGE LOW	10	2	R/W	INTEGER	Low range for CUSTOM VOLTAGE INPUT RANGE in µV	Range: -300000000...299000000
INPUT	INPUT CUST. VOLTAGE RANGE HIGH	12	2	R/W	INTEGER	High range for CUSTOM VOLTAGE INPUT RANGE in µV	Range: -299000000...300000000
INPUT	INPUT CUST. CURRENT RANGE LOW	14	2	R/W	INTEGER	Low range for CUSTOM CURRENT INPUT RANGE in µA	Range: -100000...99900
INPUT	INPUT CUST. CURRENT RANGE HIGH	16	2	R/W	INTEGER	High range for CUSTOM CURRENT INPUT RANGE in µA	Range: -99900...100000
INPUT	INPUT CUST. POTM RANGE LOW	18	2	R/W	INTEGER	Low range for CUSTOM POTENTIOMETER INPUT RANGE in ‰	Range: 0...999
INPUT	INPUT CUST. POTM RANGE HIGH	20	2	R/W	INTEGER	High range for CUSTOM POTENTIOMETER INPUT RANGE in ‰	Range: 1...1000
INPUT	ENABLE INPUT LIMIT LOW	22	1	R/W	UNSIGNED INTEGER	Enable low limit detection on input	NO = 0 YES = 1
INPUT	ENABLE INPUT LIMIT HIGH	23	1	R/W	UNSIGNED INTEGER	Enable high limit detection on input	NO = 0 YES = 1
INPUT	INPUT LIMIT LOW	24	2	R/W	INTEGER	Low limit for input	Range for voltage input: -300000000...<input range low> Range for current input: -100000...<input range low> (upper limit for this value is equal to input range low)

Category	Parameter Name	Modbus Address	Register Size	Read/ Write	Type	Description	Values
INPUT	INPUT LIMIT HIGH	26	2	R/W	UNSIGNED INTEGER	High limit for input	Range for voltage input: <input range high>...300000000 Range for current input: <input range high>...100000 (lower limit for this value is equal to input range high)
INPUT	SQUARE ROOT POINT LOW	28	1	R/W	UNSIGNED INTEGER	Low point for SQUARE ROOT input function (in 1/1000)	Range: 0...1000 (Representing 0.000...1.000)
INPUT	SQUARE ROOT POINT HIGH	29	1	R/W	UNSIGNED INTEGER	High point for SQUARE ROOT input function (in 1/1000)	Range: 0...1000 (Representing 0.000...1.000)
INPUT	SQUARE ROOT LOW CUTOFF POINT	30	1	R/W	UNSIGNED INTEGER	High point for SQUARE ROOT input function (in 1/1000)	Range: 0...500 (Representing 0.0...50.0%)
INPUT	SQUARE ROOT CUTOFF TYPE	31	1	R/W	UNSIGNED INTEGER	Selected square root cut-off mode	Disable cut-off = 0 Linear cut-off = 1 Zero cut-off = 2
DISPLAY	DISPLAY UNIT	32	1	R/W	UNSIGNED INTEGER	Units shown as display units for input	Acc. to table 1
DISPLAY	DECIMAL POINT	33	1	R/W	UNSIGNED INTEGER	Decimal point place for display reading	XXXX = 0 X.XXX = 1 XX.XX = 2 XXX.X = 3
DISPLAY	DISPLAY LOW	34	1	R/W	INTEGER	Low display range for display reading of input	Range: -1999...9999
DISPLAY	DISPLAY HIGH	35	1	R/W	INTEGER	High display range for display reading of input	Range: -1999...9999
OUTPUT	OUTPUT FUNCTION	36	1	R/W	UNSIGNED INTEGER	Analog function for output	Direct output = 0 Inverted output = 1 V-function output = 2
OUTPUT	OUTPUT TYPE	37	1	R/W	UNSIGNED INTEGER	Analog output type	CURR = 0 VOLT = 1
OUTPUT	OUTPUT CURRENT MODE	38	1	R/W	UNSIGNED INTEGER	Mode for analog output current	Active = 0 Passive* = 1 ** Passive output not valid for bipolar output*
OUTPUT	OUTPUT VOLTAGE MODE	39	1	R/W	UNSIGNED INTEGER	Mode for analog output voltage	Buffered = 0 Shunted = 1
OUTPUT	VOLTAGE OUTPUT RANGE (BUFFERED)	40	1	R/W	UNSIGNED INTEGER	Fixed output range for voltage output	Custom output range = 0 0...1 V = 1 0.2...1 V = 2 0...2.5 V = 3 0...5 V = 4 1...5 V = 5 0...10 V = 6 2...10 V = 7 0...20 V = 8 4...20 V = 9 -1...1 V = 10 -2.5...2.5 V = 11 -5...5 V = 12 -10...10 V = 13 -20...20 V = 14
OUTPUT	VOLTAGE OUTPUT RANGE (SHUNTED)	41	1	R/W	UNSIGNED INTEGER	Fixed output range for voltage output	Custom output range = 0 0...1 V = 1 0.2...1 V = 2 0...5 V = 3 1...5 V = 4 0...10 V = 5 2...10 V = 6 -1...1 V = 7 -5...5 V = 8 -10...10 V = 9
OUTPUT	CURRENT OUTPUT RANGE	42	1	R/W	UNSIGNED INTEGER	Fixed output range for current output	Custom output range = 0 0...5 mA = 1 1...5 mA = 2 0...10 mA = 3 2...10 mA = 4 0...20 mA = 5 4...20 mA = 6 4...20 mA (SIL) = 7 -5...5 mA* = 8 -10...10 mA* = 9 -20...20 mA* = 10 **bipolar output not valid for passive output (OUTPUT CURRENT MODE = PASSIVE)*

Category	Parameter Name	Modbus Address	Register Size	Read/ Write	Type	Description	Values
OUTPUT	OUTPUT CUST. VOLTAGE RANGE LOW	43	2	R/W	INTEGER	Low range for CUSTOM VOLTAGE OUTPUT RANGE in µV	**Range for buffered voltage output:** -20000000...19990000 **Range for shunted voltage output:** -10000000...9990000
OUTPUT	OUTPUT CUST. VOLTAGE RANGE HIGH	45	2	R/W	INTEGER	High range for CUSTOM VOLTAGE OUTPUT RANGE in µV	**Range for buffered voltage output:** -19990000...20000000 **Range for shunted voltage output:** -9990000...10000000
OUTPUT	OUTPUT CUST. CURRENT RANGE LOW	47	1	R/W	INTEGER	Low range for CUSTOM OUTPUT RANGE in µA	**Range for active current output:** -20000...19990 **Range for passive current output:** 0...19990
OUTPUT	OUTPUT CUST. CURRENT RANGE HIGH	48	1	R/W	INTEGER	High range for CUSTOM OUTPUT RANGE in µA	**Range for active current output:** -19990...20000 **Range for passive current output:** 1...20000
OUTPUT	OUTPUT AT LOW INPUT ERROR	49	1	R/W	UNSIGNED INTEGER	Analog output level at input below configured input limit low	DOWN = 0 ZERO = 1 UP = 2 NONE = 3
OUTPUT	OUTPUT AT HIGH INPUT ERROR	50	1	R/W	UNSIGNED INTEGER	Analog output level at input beyond configured input limit high	DOWN = 0 ZERO = 1 UP = 2 NONE = 3
OUTPUT	OUTPUT RESPONSE	51	1	R/W	UNSIGNED INTEGER	Analog output damping (in 1/10 s)	Range: 0..600 (0...60.0 s)
INPUT	CALIB RANGE LOW	52	2	R/W	FLOAT	Actual process value for low calibration point in input values	**Range for voltage input:** -300000000...300000000 **Range for current input:** -50000...50000
INPUT	CALIB RANGE HIGH	54	2	R/W	FLOAT	Actual process value for high calibration point in input values	As CALIB RANGE LOW
INPUT	CALIB POINT LOW	56	2	R/W	FLOAT	Measured process value for low calibration point in input values (can be read from PRIMARY RAW VALUE)	As CALIB RANGE LOW
INPUT	CALIB POINT HIGH	58	2	R/W	FLOAT	Measured process value for high calibration point in input values (can be read from PRIMARY RAW VALUE)	As CALIB RANGE LOW
INPUT	USE CALIB	60	1	R/W	UNSIGNED INTEGER	Use the applied calibration values	NO = 0 YES = 1
DISPLAY	DISPLAY CONTRAST	61	1	R/W	UNSIGNED INTEGER	Contrast on the LCD display	Range: 0...9
DISPLAY	DISPLAY BACKLIGHT	62	1	R/W	UNSIGNED INTEGER	Backlight intensity on LCD	Range: 0...9
DISPLAY	TAG TEXT	63	3	R/W	ASCII CHAR	Tag of the device (6 characters)	Range: ASCII values from 32 to 90 (' ' to 'Z').
DISPLAY	LINE 3 FUNCTION	66	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 = 0 TAG = 1
GENERAL	ENABLE PASSWORD	67	1	R/W	UNSIGNED INTEGER	Password protect entry to configuration menu via display	NO = 0 YES = 1
GENERAL	HELPTEXT LANGUAGE	68	1	R/W	UNSIGNED INTEGER	Language for the help texts shown in display	UK = 0 DK = 1 DE = 2 FR = 3 SE = 4 IT = 5 ES = 6
GENERAL	CHECKSUM	100	1	RO	UNSIGNED INTEGER	CRC16 checksum of the configuration	Range 0..65535
GENERAL	Configuration counter	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

0	°C	10	mils	20	in/s	30	t	40	kJ	50	kA	60	m^3/h
1	°F	11	yd	21	ips	31	kg	41	Wh	51	mA	61	l/s
2	K	12	m^3	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^2	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^3/min	69	[blank]

4184 Input Types and Ranges

Input type	Min. value	Max. value
mA V	-100 mA -300 VDC	+100 mA +300 VDC

4184 Process Parameter List

Parameter Name	Register Address	Register Size	Read/ Write	Type	Description	Values
INPUT VALUE	1000	2	RO	FLOAT	The measured, scaled and process calibrated input value (in µA or µV).	**Range for voltage input:** 345000000...345000000 **Range for current input:** -110000...110000
MEASURE STATUS	1002	1	RO	UNSIGNED INTEGER	The actual measurement status	INPUT UNDERRANGE: bit 0 = 1 INPUT OVERRANGE: bit 1 = 1 OUTPUT UNDERRANGE: bit 2 = 1 OUTPUT OVERRANGE: bit 3 = 1 LOW INPUT LIMIT ERROR DETECTED: bit 4 = 1 HIGH INPUT LIMIT ERROR DETECTED: bit 5 = 1 NOT USED: bit 6...7
RELATIVE INPUT	1003	2	RO	FLOAT	The relative input calculated from INPUT VALUE. 0.0...1.0 corresponds to the selected range (e.g. 0...20 mA).	Range: 0.0...1.0 (e.g. 0.7898 = 78.98% = 16.6368 mA)
OUTPUT VALUE	1005	2	RO	FLOAT	The calculated output value (in µA or µV).	**Range for voltage input:** -23000000...23000000 **Range for current input:** -23000...23000
PRIMARY RAW VALUE	1007	2	RO	FLOAT	The measured input value (in µA or µV), NOT PROCESS CALIBRATED/SIMULATED.	**Range for voltage input:** -345000000...345000000 **Range for current input:** -110000...110000
ERROR STATUS	1009	1	RO	UNSIGNED INTEGER	The actual error status (Device errors).	ADC ERROR bit 0 = 1 RAM ERROR bit 1 = 1 CONFIG ERROR bit 2 = 1 INT. FLASH ERROR bit 3 = 1 EXT. FLASH ERROR bit 4 = 1 OUTPUT ERROR bit 5 = 1 SUPPLY ERROR bit 6 = 1 ADC COMM. ERROR bit 7 = 1

4184 Simulation Parameter List

Parameter Name	Register Address	Register Size	Read/ Write	Type	Description	Values
SIMULATION CONTROL	2000	1	R/W	UNSIGNED INTEGER	Control register for simulation	Clear errors and reload config. bit 0 = 1 Simulate input bit 1 = 1 Simulate output bit 2 = 1 **Reserved MUST BE SET TO "0"** bit 3...7
INPUT VALUE	2001	2	R/W	FLOAT	Simulated input value (in µA or µV)	**Range for voltage input:** -345000000...345000000 **Range for current input:** -110000...110000
OUTPUT VALUE	2003	2	R/W	FLOAT	Simulated output value (in µA or µV)	**Range for voltage output:** -23000000...23000000 **Range for current output:** -23000...23000
SIMULATION TIMEOUT	2005	1	R/W	UNSIGNED INTEGER	If this value is greater than zero the counter decrements once every 5 ms. Upon reaching 0 SIMULATION CONTROL is cleared.	0...4000

4511 Modbus Configuration Parameter List

Parameter Name	Register Address	Register Size	Read/ Write	Type	Description	Values
ENABLE MODBUS	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 YES = 1
BAUDRATE	3001	1	R/W	INTEGER	The baud value used for Modbus communication	2400 BAUD = 0 4800 BAUD = 1 9600 BAUD = 2 19200 BAUD = 3 38400 BAUD = 4 57600 BAUD = 5 115200 BAUD = 6
ENABLE AUTOBAUD	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 YES = 1
PARITY	3003	1	R/W	INTEGER	Configures parity check on Modbus frames	NONE = 0 EVEN PARITY = 1 ODD PARITY = 2
STOP BITS	3004	1	R/W	INTEGER	Configures the number of stop bits in Modbus frames	ONE STOP BIT = 1 TWO STOP BITS = 2
ADDRESS	3005	1	R/W	INTEGER	Configures the Modbus address of the 4511 (Address 0 is broadcast address)	Range: 1...247
RESPONSE DELAY	3006	1	R/W	INTEGER	Configures minimum delay for Modbus response in ms	Range: 0...1000

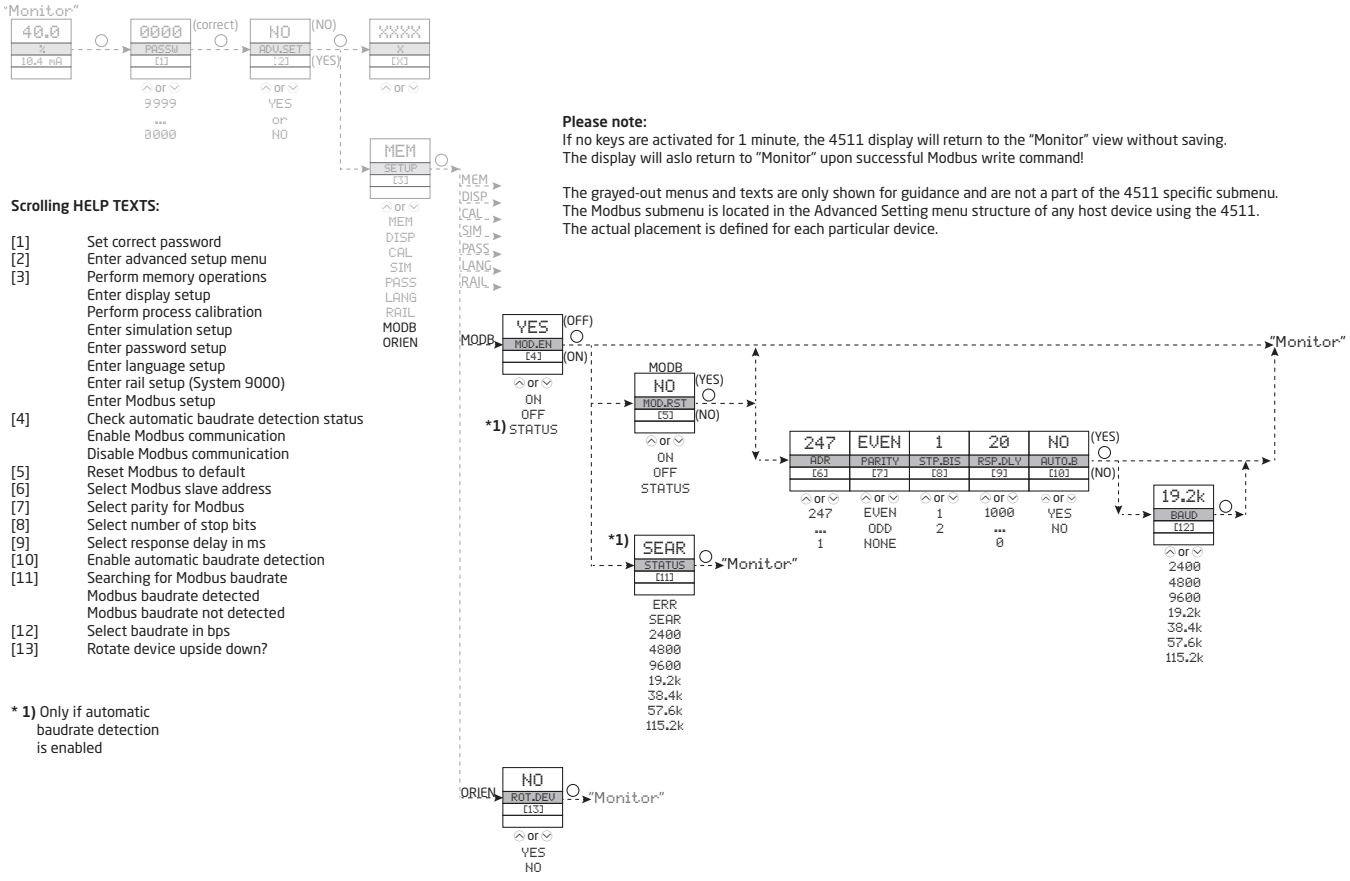
4511 Additional Parameter List

Parameter Name	Register Address	Register Size	Read/ Write	Type	Description	Values
ROTATE DEVICE	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 YES = 1

4511 Modbus Status Parameter List

Parameter Name	Register Address	Register Size	Read/ Write	Type	Description	Values
AUTOBAUD STATUS	4000	1	RO	INTEGER	Actual state of automatic baudrate detection	2400 BAUD = 0 4800 BAUD = 1 9600 BAUD = 2 19200 BAUD = 3 38400 BAUD = 4 57600 BAUD = 5 115200 BAUD = 6 SEARCHING = 7 ERROR = 8
IDENTIFY DEVICE	4001	1	R/W	INTEGER	Enables the device to flash the LCD background with approx. 4 Hz. **Value will automatically return to NO if not written within 10 seconds!**	NO = 0 YES = 1
MAXIMUM READ REGISTERS	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



Please note:
If no keys are activated for 1 minute, the 4511 display will return to the "Monitor" view without saving.
The display will aslo 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.

Scrolling HELP TEXTS:

[1] Set correct password
[2] Enter advanced setup menu
[3] Perform memory operations
Enter display setup
Perform process calibration
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

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