

PERFORMANCE
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Configuration manual

4222 / 4511

Modbus RTU configuration of 4222 Universal I/f converter



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

No. 4222MCM101-UK
For 4511 devices from ser. no. 141590001

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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 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 4222 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

*Holding Registers and Input Registers contain identical data in PR 4511.

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.

4222 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	4222 = 16930 (0x4222)
GENERAL	DEVICE VERSION	1	1	RO	UNSIGNED INTEGER	Product version	0
GENERAL	PASSWORD	2	1	R/W	UNSIGNED INTEGER	Password for entering configuration menu	Range: 0...9999
INPUT	INPUT TYPE	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	1	R/W	UNSIGNED INTEGER	Fixed input range for voltage measurements	0...1 V = 0 0.2...1 V = 1 0...2.5 V = 2 0.5...2.5 V = 3 0...5 V = 4 1...5 V = 5 0...10 V = 6 2...10 V = 7
INPUT	INPUT CURRENT RANGE	5	1	R/W	UNSIGNED INTEGER	Fixed input range for current measurements	0...20 mA = 0 4...20 mA = 1
INPUT	CONNECTION TYPE	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	1	R/W	UNSIGNED INTEGER	Input range low for Linear resistance measurements	Range: 0...9998
INPUT	LIN RES HIGH	8	1	R/W	UNSIGNED INTEGER	Input range high for Linear resistance measurements.	Range: 1...9999
INPUT	TEMP UNIT	9	1	R/W	UNSIGNED INTEGER	Temperature units	°C = 0 °F = 1
INPUT	TEMP SENSOR TYPE	10	1	R/W	UNSIGNED INTEGER	Temperature sensor type	TC = 0 Ni = 1 Pt = 2
INPUT	Pt TYPE	11	1	R/W	UNSIGNED INTEGER	Pt value (Pt10, Pt20, Pt50...)	Pt10 = 0 Pt20 = 1 Pt50 = 2 Pt100 = 3 Pt200 = 4 Pt250 = 5 Pt300 = 6 Pt400 = 7 Pt500 = 8 Pt1000 = 9
INPUT	NI TYPE	12	1	R/W	UNSIGNED INTEGER	Ni value (Ni50, Ni100...)	Ni50 = 0 Ni100 = 1 Ni120 = 2 Ni1000 = 3
INPUT	TC TYPE	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	1	R/W	UNSIGNED INTEGER	Units shown as display units for non-temperature input types	Acc. to table 1
DISPLAY	DECIMAL POINT	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	1	R/W	INTEGER	Low display range for display reading of non-temperature input types	Range: -1999...9999
DISPLAY	DISPLAY HIGH	17	1	R/W	INTEGER	High display range for display reading of non-temperature input types	Range: -1999...9999

Category	Parameter Name	Modbus Address	Register Size	Read/Write	Type	Description	Values
OUTPUT	OUTPUT TYPE	18	1	R/W	UNSIGNED INTEGER	Output type: Programmable pulse is available for: Frequency < 500 Hz Pulses < 30,000 p/m < 1,800,000 p/hour < 43,200,000 p/day	DC 50% = 0 Prog Pulse = 1
OUTPUT	OUTPUT UNIT	19	1	R/W	UNSIGNED INTEGER	Output unit	Hz = 0 p/min = 1 p/hour = 2 p/day = 3
OUTPUT	FREQUENCY LOW / PULSE LOW	20	2	R/W	UNSIGNED INTEGER	Frequency output low value in mHz or 1/1000nds of pulses per min./hour/day	Range with frequency selected: 0...2500000 Range with p/min. selected: 0...30000000 Range with p/hour selected: 0...30000000 Range with p/day selected: 0...30000000
OUTPUT	FREQUENCY HIGH / PULSE HIGH	22	2	R/W	UNSIGNED INTEGER	Frequency output high value in mHz or 1/1000nds of pulses per min./hour/day	Range with frequency selected: 0...25000000 Range with p/min. selected: 0...30000000 Range with p/hour selected: 0...30000000 Range with p/day selected: 0...30000000
OUTPUT	CUTOFF FREQUENCY / PULSE	24	2	R/W	UNSIGNED INTEGER	Cutoff frequency in mHz or 1/1000nds of pulses per min./hour/day	Range with frequency selected: 0...25000000 Range with p/min. selected: 0...30000000 Range with p/hour selected: 0...30000000 Range with p/day selected: 0...30000000
OUTPUT	PULSE TIME	26	1	R/W	UNSIGNED INTEGER	Pulse length in ms, must be set less than 0.9 x (1 / Fmax)	Range: 1...1000
OUTPUT	INDICATE ERROR	27	1	R/W	UNSIGNED INTEGER	Use a specific frequency to indicate errors	NO = 0 YES = 1
OUTPUT	ERROR FREQUENCY	28	2	R/W	UNSIGNED INTEGER	Frequency to indicate an error in mHz or 1/1000nds of pulses per min./hour/day	Range with frequency selected: 0...26250000 Range with pulse selected: 0...31500000
OUTPUT	RESPONSE TIME	30	1	R/W	UNSIGNED INTEGER	Response time in 1/10 s	Range for non-temperature inputs: 4...600 (0.4...60 s) Range for temperature inputs: 10...600 (1...60 s)
OUTPUT	OUTPUT LOW	31	2	R/W	INTEGER	Specific output value low. Dependant of selected input. For temperature types value is 1/10°	Range equals the measurement range for the selected sensor type and must be lower than OUTPUT HIGH
OUTPUT	OUTPUT HIGH	33	2	R/W	INTEGER	Specific output value high. Dependant of selected input. For temperature types value is 1/10°	Range equals the measurement range for the selected sensor type and must be higher than OUTPUT LOW
DISPLAY	DISPLAY CONTRAST	35	1	R/W	UNSIGNED INTEGER	Contrast on the LCD display	Range: 0...9
DISPLAY	DISPLAY BACKLIGHT	36	1	R/W	UNSIGNED INTEGER	Backlight intensity on LCD	Range: 0...9
DISPLAY	TAG TEXT	37	3	R/W	ASCII CHAR	Tag of the device (6 characters)	Range: ASCII values from 32 to 90 (' ' to 'Z').
DISPLAY	LINE 3 FUNCTION	40	1	R/W	UNSIGNED INTEGER	Information shown in line 3 of display in monitor mode (normal mode). Choose between the output frequency value or the configured tag.	Output value = 0 TAG = 1
INPUT	USE CALIB	41	1	R/W	UNSIGNED INTEGER	Use the applied calibration values	NO = 0 YES = 1
GENERAL	ENABLE PASSWORD	42	1	R/W	UNSIGNED INTEGER	Password protect entry to configuration menu via display	NO = 0 YES = 1
INPUT	CALIB RANGE LOW	43	2	R/W	FLOAT	Actual process value for low calibration point in either display values or 1/10°C	For non-temperature input types: range is DISPLAY LOW...DISPLAY HIGH. For temperature input types: the range equals the measurement range for the selected sensor type.
INPUT	CALIB RANGE HIGH	45	2	R/W	FLOAT	Actual process value for high calibration point in either display values or 1/10°C	As CALIB RANGE LOW
INPUT	CALIB POINT LOW	47	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	649	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

Category	Parameter Name	Modbus Address	Register Size	Read/Write	Type	Description	Values
GENERAL	HELPTXT LANGUAGE	53	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	kHz	40	MPa	50	GW	60	mV	70	gal/h
1	°F	11	yd	21	ips	31	Hz	41	kPa	51	MW	61	Ω	71	t/h
2	K	12	m ³	22	ft/s	32	p/min	42	hPa	52	kW	62	S	72	mol
3	%	13	l	23	in/min	33	p/h	43	bar	53	hp	63	μS	73	pH
4	m	14	s	24	ft/min	34	p/day	44	mbar	54	A	64	m ³ /min	74	[blank]
5	cm	15	min	25	in/h	35	t	45	kJ	55	kA	65	m ³ /h		
6	mm	16	m/s	26	ft/h	36	kg	46	Wh	56	mA	66	l/s		
7	μm	17	mm/s	27	m/s ²	37	g	47	MWh	57	μA	67	l/min		
8	ft	18	m/min	28	mm/s ²	38	N	48	kWh	58	V	68	l/h		
9	in	19	m/h	29	rmp	39	Pa	49	W	59	kV	69	gal/min		

4222 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	-200°C	+250°C	DIN 43760
Lin. R	0 Ω	10000 Ω	-
Potentiometer	10 Ω	100 kΩ	-
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

4222 Process parameter list

Parameter Name	Register Address	Register Size	Read/Write	Type	Description	Values
DISPLAY VALUE	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 (INTEGER version of PRIMARY VALUE)	Range for non-temperature input types: DISPLAY LOW...DISPLAY HIGH Range for temperature input types: equals the measurement range for the selected sensor type
PERCENT PV	1002	1	RO	INTEGER	The relative input value as 1/100 of % calculated from PRIMARY VALUE. For temperature input types 0..100% corresponds to the selected temperature range (OUTPUT LOW...OUTPUT HIGH) For non-temperature input types 0..100% corresponds to the selected fixed range (e.g. 4...20 mA)	Range: 0...9999 (e.g. 7898 = 78.98%)
MEASURE STATUS	1003	1	RO	INTEGER	The actual measurement status	OUTPUT UNDERRANGE bit 0 = 1 OUTPUT OVERRANGE bit 1 = 1 OUTPUT LOW LIMITED bit 2 = 1 OUTPUT HIGH LIMITED bit 3 = 1 INPUT UNDERRANGE bit 4 = 1 INPUT OVERRANGE bit 5 = 1 SENSOR SHORTED bit 6 = 1 SENSOR BROKEN bit 7 = 1
ERROR STATUS	1004	1	RO	INTEGER	The actual error status (Device errors)	AD COMM. ERROR bit 0 = 1 CJC ERROR bit 1 = 1 RAM ERROR bit 2 = 1 EEP ERROR bit 3 = 1 FLASH ERROR bit 4 = 1 NOT CALIBRATED bit 5 = 1 BAD OUTPUT bit 6 = 1 NO OUTPUT bit 7 = 1 OUTPUT SUPPLY ERROR bit 8 = 1 INPUT SUPPLY ERROR bit 9 = 1
PRIMARY RAW VALUE	1005	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.	Range for non-temperature input types: DISPLAY LOW...DISPLAY HIGH Range for temperature input types: equals the measurement range for the selected sensor type
PRIMARY VALUE	1007	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	Range for non-temperature input types: DISPLAY LOW...DISPLAY HIGH Range for temperature input types: equals the measurement range for the selected sensor type
RELATIVE PV	1009	2	RO	FLOAT	The relative input value calculated from PRIMARY VALUE. For temperature input types relative to selected temperature range (OUTPUT LOW...OUTPUT HIGH) For non-temperature input types relative to selected fixed range (e.g. 4...20 mA)	Range: 0.0...1.0
OUTPUT FREQUENCY	1011	2	R/W	FLOAT	Calculated output value in mHz or 1/1000nds of pulses per min./hour/day	Range with frequency selected: 0...25000000 (0...25000 Hz) Range with pulse selected: 0...30000000
MEASURE CONTROL	1013	1	R/W	INTEGER	Measurement control. By disabling update of certain READ/WRITE parameters PRIMARY VALUE or OUTPUT VALUE, these can be simulated by writing values. All bits are cleared when TIMEOUT COUNTER reaches 0	RESTART SCAN bit 0 = 1 RESTART WITH NEW CONFIGURATION bit 1 = 1 DISABLE PRIMARY VALUE UPDATE bit 2 = 1 DISABLE OUTPUT VALUE UPDATE bit 3 = 1 NOT USED bit 4 = 1 DISABLE CONFIGURATION CHECK bit 5 = 1 GET NEW CONFIGURATION bit 6 = 1
TIMEOUT COUNTER	1014	1	R/W	INTEGER	Time out counter, decrements every 0.075 second. When reaching 0 (if not refreshed) all bits in MEASURE CONTROL will be cleared.	Range: 0...255
INTERNAL TEMPERATURE	1015	1	RO	INTEGER	Internal measured or connector temperature in 1/10 of °C/°F	Range: -200...800 (-20.0...80.0 °C) or -40...1760 (-4.0...176.0 °F)

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
STOPBITS	3004	1	R/W	INTEGER	Configures the number of stopbits in Modbus frames	ONE STOPBIT = 0 TWO STOPBITS = 1
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

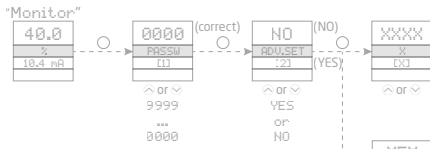
4511 Additional parameter list

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 appr. 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

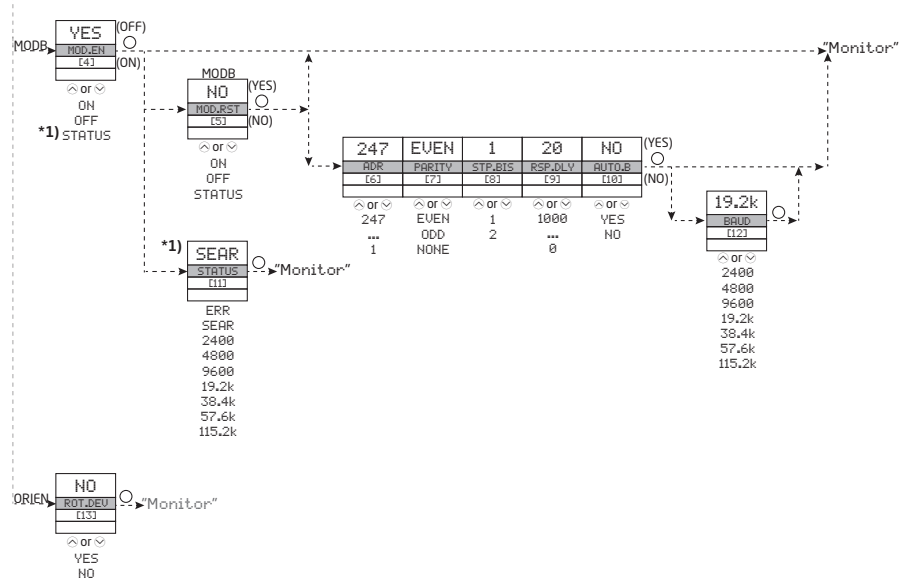


Scrolling HELP TEXTS:

- [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
- MEM
- 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.

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