



4511 MODBUS RTU Configuration Manual

4 1 0 4

Universal uni-/bipolar
signal transmitter

No. 4104MCM100(1402)



4 1 0 4

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INTRODUCTION

This configuration manual

contains the necessary information for configuring a PR 4104 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.

4104 Modbus Configuration Parameter List

Category	Parameter Name	No.	Register Address	Register Size	Read/Write	Type	Description	Values
GENERAL	DEVICE NUMBER	0	0	1	RO	UNSIGNED INTEGER	Defines the actual device type	4104 = 16644 (0x4104)
GENERAL	DEVICE VERSION	1	1	1	RO	UNSIGNED INTEGER	Product version	0
GENERAL	VARIANT	2	2	1	RO	UNSIGNED INTEGER	Device variant	0
GENERAL	SERIAL NUMBER	3	3	2	RO	UNSIGNED INTEGER	Device serial number	Range: 0..99999999
GENERAL	PASSWORD	4	5	1	R/W	UNSIGNED INTEGER	Password for entering configuration menu	Range: 0..9999
INPUT	INPUT TYPE	5	6	1	R/W	UNSIGNED INTEGER	Selected input type.	Current = 0 Voltage = 1
INPUT	INPUT VOLTAGE RANGE	6	7	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 -1...1 V = 6 -5...5 V = 7 -10...10 V = 8
INPUT	INPUT CURRENT RANGE	7	8	1	R/W	UNSIGNED INTEGER	Fixed input range for current measurements	0...20 mA = 0 4...20 mA = 1 -10...10 mA = 2 -20...20 mA = 3
DISPLAY	DISPLAY UNIT	8	9	1	R/W	UNSIGNED INTEGER	Units shown as display units for input	Acc. to table 1
DISPLAY	DECIMAL POINT	9	10	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	10	11	1	R/W	INTEGER	Low display range for display reading of input	Range: -1999...9999
DISPLAY	DISPLAY HIGH	11	12	1	R/W	INTEGER	High display range for display reading of input	Range: -1999...9999
OUTPUT	OUTPUT FUNCTION	12	13	1	R/W	UNSIGNED INTEGER	Analog function for output	Direct output = 0 inverted output = 1 V-function output = 2 Note: V-function is only applicable for output ranges starting at 0 mA / 0 V
OUTPUT	OUTPUT TYPE	13	14	1	R/W	UNSIGNED INTEGER	Analog output type	CURR = 0 VOLT = 1
OUTPUT	OUTPUT MODE	14	15	1	R/W	UNSIGNED INTEGER	Mode for analog output current	Active = 0 Passive = 1
OUTPUT	CURRENT OUTPUT RANGE	15	16	1	R/W	UNSIGNED INTEGER	Fixed output range for current output	0...20 mA = 0 4...20 mA = 1 4...20 mA (SIL) = 2 -10...10mA = 3 -20...20 mA = 4
OUTPUT	OUTPUT ERROR	16	17	1	R/W	UNSIGNED INTEGER	Analog output level at sensor error	NONE = 0 DOWN = 1 ZERO = 2 UP = 3
OUTPUT	VOLTAGE OUTPUT RANGE	17	18	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 2...10 V = 5 -1...1 V = 6 -5...5 V = 7 -10...10 V = 8
OUTPUT	OUTPUT RESPONSE	18	19	1	R/W	UNSIGNED INTEGER	Analog output damping (in 1/10 s)	Range: 0..600 (0..60.0 s)
INPUT	CALIB RANGE LOW	19	20	2	R/W	FLOAT	Actual process value for low calibration point in input values (in μ A or μ V).	Range for voltage input: -12000000..12000000 (-12...+12 V) Range for current input: -23000..23000 (-23...+23 mA)
INPUT	CALIB RANGE HIGH	20	22	2	R/W	FLOAT	Actual process value for high calibration point in input values	As CALIB RANGE LOW
INPUT	CALIB POINT LOW	21	24	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	22	26	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	23	28	1	R/W	UNSIGNED INTEGER	Use the applied calibration values	NO = 0 YES = 1

DISPLAY	DISPLAY CONTRAST	24	29	1	R/W	UNSIGNED INTEGER	Contrast in the LCD display	Range: 0..9
DISPLAY	DISPLAY BACKLIGHT	25	30	1	R/W	UNSIGNED INTEGER	Backlight intensity on LCD	Range: 0..9
DISPLAY	TAG TEXT	26	31	3	R/W	ASCII CHAR	Tag of the device (5 characters)	Range: ASCII values from 32 to 90 (' ' to 'Z').
DISPLAY	LINE 3 FUNCTION	27	34	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
GENERAL	ENABLE PASSWORD	28	35	1	R/W	UNSIGNED INTEGER	Password protect entry to configuration menu via display	NO = 0 YES = 1
GENERAL	HELPTXT LANGUAGE	29	36	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	100	1	RO	UNSIGNED INTEGER	CRC16 checksum of the configuration	Range 0..65536
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..65536

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	m3/min	69	[blank]

4104 Input Types and Ranges

Input type	Min. value	Max. value
mA	-23 mA	23 mA
V	-12 V	12 V

4104 Modbus Process Parameter List

Parameter Name	No.	Register Address	Register Size	Read/Write	Type	Description	Values
INPUT VALUE	1	1000	2	RO	FLOAT	The measured, scaled and process calibrated input value (in μA or μV).	Range for voltage input: -12000000..12000000 (-12...+12 V) Range for current input: -23000..23000 (-23...+23 mA)
MEASURE STATUS	2	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 LOOP ERROR DETECTED: bit 4 = 1 NOT USED: bit 5...7
RELATIVE INPUT	3	1003	2	RO	FLOAT	The relative input calculated from INPUT VALUE. 0.0...1.0 corresponds to the selected range (e.g. 4-20mA).	Range: 0.0...1.0 (e.g. 0.7898 = 78.98% = 16.6368mA)
OUTPUT VALUE	4	1005	2	RO	FLOAT	The calculated output value (in μA or μV).	Range for voltage input: -11500000..11500000 (-11.5...+11.5 V) Range for current input: -23000..23000 (-23...+23 mA)
PRIMARY RAW VALUE	5	1007	2	RO	FLOAT	The measured input value (in μA or μV), NOT PROCESS CALIBRATED/SIMULATED.	Range for voltage input: -12000000..12000000 (-12...+12 V) Range for current input: -23000..23000 (-23...+23 mA)
ERROR STATUS	6	1009	1	RO	UNSIGNED INTEGER	The actual error status (Device errors).	ADC ERROR bit 0 = 1 RAM ERROR bit 1 = 1 EEPROM 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

4104 Modbus Simulation Parameter List

Parameter Name	No.	Register Address	Register Size	Read/Write	Type	Description	Values
SIMULATION CONTROL	1	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	2	2001	2	R/W	FLOAT	Simulated input value (in μA or μV)	Range with current selected: -23000..23000 (-23...+23 mA) Range with voltage selected: -12000000..12000000 (-12...+12 V) NOTE: ranges are restricted to selected input type and range
OUTPUT VALUE	3	2003	2	R/W	FLOAT	Simulated output value (in μA or μV)	Range with current selected: 0..23000 (-23...+23 mA) Range with voltage selected: 0..12000000 (-12...+12 V) NOTE: actual output value is restricted to 24 mA for current connection, 1.2 V for 1 V connection and 12 V for 10 V connection)
SIMULATION TIMEOUT	5	2006	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.	Range: 0...4000

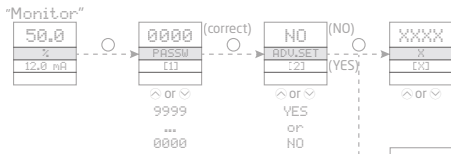
4511 Modbus Configuration Parameter List

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 YES = 1
BAUDRATE	2	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	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 YES = 1
PARITY	4	3003	1	R/W	INTEGER	Configures parity check on Modbus frames	NONE = 0 EVEN PARITY = 1 ODD PARITY = 2
STOP BITS	5	3004	1	R/W	INTEGER	Configures the number of stop bits in Modbus frames	ONE STOP BIT = 1 TWO STOP BITS = 2
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 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 4800 BAUD = 1 9600 BAUD = 2 19200 BAUD = 3 38400 BAUD = 4 57600 BAUD = 5 115200 BAUD = 6 SEARCHING = 7 ERROR = 8
IDENTIFY DEVICE	2	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	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



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.

Scrolling HELP TEXTS:

- [1] Set correct password
- [2] Enter advanced setup menu
- [3] Perform memory operations
- [4] Enter display setup
- [5] Perform process calibration
- [6] Enter simulation setup
- [7] Enter password setup
- [8] Enter language setup
- [9] Enter rail setup (System 9000)
- [10] Enter Modbus setup
- [11] Check automatic baudrate detection status
- [12] Enable Modbus communication
- [13] Disable Modbus communication
- [14] Reset Modbus to default
- [15] Select Modbus slave address
- [16] Select parity for Modbus
- [17] Select number of stop bits
- [18] Select response delay in ms
- [19] Enable automatic baudrate detection
- [20] Searching for Modbus baudrate
- [21] Modbus baudrate detected
- [22] Modbus baudrate not detected
- [23] Select baudrate in bps

