![PR electronics logo]

4511 MODBUS RTU

Configuration Manual

HART® transparent repeater

No. 9106MCM101(1445)
For 4511 devices from
ser. no: 141590001

9106

CONTENTS

INTRODUCTION

This configuration manual
> contains the necessary information for configuring a PR 9106 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 and factory default 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 adress)**
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.

9106 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 number	9106 = 37126 (0x9106)
GENERAL	DEVICE VERSION	1	1	1	RO	UNSIGNED INTEGER	Product version	0
GENERAL	PASSWORD	2	2	1	R/W	UNSIGNED INTEGER	Password for entering configuration menu	Range: 0...9999
INPUT	CHANNEL 1 LOW LIMIT	3	3	1	R/W	UNSIGNED INTEGER	Low limit for loop error detection on channel 1 in 1/10 mA	Range: 0...299
INPUT	CHANNEL 1 HIGH LIMIT	4	4	1	R/W	UNSIGNED INTEGER	High limit for loop error detection on channel 1 in 1/10 mA	Range: 0...299
INPUT	CHANNEL 2 LOW LIMIT	5	5	1	R/W	UNSIGNED INTEGER	Low limit for loop error detection on channel 2 in 1/10 mA	Range: 0...299
INPUT	CHANNEL 2 HIGH LIMIT	6	6	1	R/W	UNSIGNED INTEGER	High limit for loop error detection on channel 2 in 1/10 mA	Range: 0...299
OUTPUT	RAIL ERROR	7	7	1	R/W	UNSIGNED INTEGER	Set device to indicate on rail when error occurring.	NO = 0 YES = 1
DISPLAY	DISPLAY CONTRAST	8	8	1	R/W	UNSIGNED INTEGER	Contrast in the LCD display	Range: 0...9
DISPLAY	DISPLAY BACKLIGHT	9	9	1	R/W	UNSIGNED INTEGER	Backlight intensity in LCD	Range: 0...9
DISPLAY	TAG TEXT CHANNEL 1	10	10	3	R/W	CHAR ASCII	Tag of the device channel 1 (5 characters)	Range:Ascii values from 32 to 90 (' ' to 'Z')
DISPLAY	TAG TEXT CHANNEL 2	11	13	3	R/W	CHAR ASCII	Tag of the device channel 2 (5 characters)	Range:Ascii values from 32 to 90 (' ' to 'Z')
DISPLAY	LINE FUNCTION	12	16	1	R/W	UNSIGNED INTEGER	Information shown on input line of display in monitor mode (normal mode).	LOOP = 0 TAG = 1 ALTERNATING = 2
GENERAL	ENABLE PASSWORD	13	17	1	R/W	UNSIGNED INTEGER	Password protect entry to configuration menu	NO = 0 YES = 1
GENERAL	HELP TEXT LANGUAGE	14	18	1	R/W	UNSIGNED INTEGER	Language for the help texts shown on display	UK = 0 DK = 1 DE = 2 FR = 3 SE = 4 IT = 5 ES = 6
GENERAL	DEVICE TYPE	15	19	1	RO	UNSIGNED INTEGER	Defines the actual device type (1 or 2 channel) (e.g. 9106BA=0xBA)	BA = 42 (0x2A) BB = 43 (0x2B)
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

9106 Process Parameter List

Parameter Name	No.	Register Address	Register Size	Read/Write	Type	Description	Values	
DISPLAY VALUE 1	1000	1000	1	RO	INTEGER	Shows the value of channel 1 in 1/10 mA	-	
DISPLAY VALUE 2	1001	1002	1	RO	INTEGER	Shows the value of channel 2 in 1/10 mA	-	
LOOP STATUS	1002	1003	1	RO	UNSIGNED INTEGER	Shows the status of internal errors	LOOP 1 BROKEN: LOOP 1 UNDER RANGE: LOOP 1 OVER RANGE: UNUSED: LOOP 2 BROKEN: LOOP 2 UNDER RANGE: LOOP 2 OVER RANGE: UNUSED:	bit 0 = 1 bit 1 = 1 bit 2 = 1 bit 3 = 1 bit 4 = 1 bit 5 = 1 bit 6 = 1 bit 7 = 1
ERROR STATUS	1003	1003	1	RO	UNSIGNED INTEGER	The calculated output value (in µA or µV)	RAM ERROR: EEPROM ERROR: CHANNEL 1 ERROR: CHANNEL 2 ERROR: SUPPLY ERROR: FLASH ERROR: INIT ERROR: UNUSED	bit 0 = 1 bit 1 = 1 bit 2 = 1 bit 3 = 1 bit 4 = 1 bit 5 = 1 bit 6 = 1 bit 7
EEPROM Status	1004	1004	1	RO	UNSIGNED INTEGER	Shows the status of the internal EEPROM	EEPROM 1 OK: EEPROM 2 OK: SET WHILE WRITING EEPROM 1: SET WHILE WRITING EEPROM 2: UNUSED	bit 0 = 1 bit 1 = 1 bit 2 = 1 bit 3 = 1 bit 4...7
OUT STATE	1005	1005	1	R/W	UNSIGNED INTEGER	Controls error out and rail signal	UNUSED: ERROR OUT (1 = De-energized, 0 = Energized) RAIL SIGNAL (1 = Closed, 0 = Open) UNUSED:	bit 0...2 bit 3 bit 4 bit 5...7
VALUE 1	1006	1006	2	RO	FLOAT	The measured value for channel 1 in µA		
VALUE 2	1007	1008	2	RO	FLOAT	The measured value for channel 2 in µA		
MEASURE CONTROL	1008	1012	1	R/W	UNSIGNED INTEGER	Controls the various updates of process values and configuration enabling simulation.	NEW CONFIG DISABLE ERROR OUT DISABLE RAIL SIGNAL UNUSED NOTE: NEW CONFIG reads a new configuration from EEPROM and clears all errors.	bit 0 = 1 bit 1 = 1 bit 2 = 1 bit 3...7
TIMEOUT COUNTER	1009	1013	1	RO	UNSIGNED INTEGER	Time-out counter will reset all bits in MEASURE CONTROL when reaching 0. Decrements once every 0.075 s and is by default reset to 133 every 10 seconds effectively disabling simulation. The counter is reset to 10 s by the 9106 when there is successful communication with 4511. Effectively disabling simulation when 4511 is removed.	Range: 0...255	

4511 Modbus Configuration Parameter List

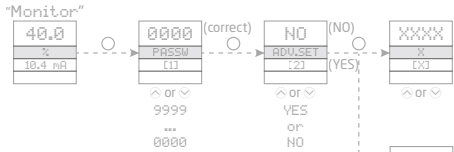| Parameter Name:	Nr.	Register Address:	Register Size:	Read/Write:	Type:	Description:	Values	
ENABLE MODBUS	1	3000	1	R/W	INTEGER	Enable Modbus communication. If disabled, 4511 ignores all frames send from the Modbus master and the only way to re-enable Modbus communication is by using the 4511 menu.	NO YES	= 0 = 1
BAUDRATE	2	3001	1	R/W	INTEGER	The baud value used for Modbus communication	2400 BAUD 4800 BAUD 9600 BAUD 19200 BAUD 38400 BAUD 57600 BAUD 115200 BAUD	= 0 = 1 = 2 = 3 = 4 = 5 = 6
ENABLE AUTOBAUD	3	3002	1	R/W	INTEGER	Enable automatic baudrate detection. If enabled, 4511 determines the baud automatically by listening to frames send on the Modbus line.	NO YES	= 0 = 1
PARITY	4	3003	1	R/W	INTEGER	Configures parity check on Modbus frames	NONE EVEN PARITY ODD PARITY	= 0 = 1 = 2
STOPBITS	5	3004	1	R/W	INTEGER	Configures the number of stopbits in Modbus frames	ONE STOPBIT TWO STOPBITS	= 1 = 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 Additional Parameter List

Parameter Name:	Nr.	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 YES	= 0 = 1

4511 Modbus Status Parameter List

Parameter Name:	Nr.	Register Address:	Register Size:	Read/Write:	Type:	Description:	Values	
AUTOBAUD STATUS	1	4000	1	RO	INTEGER	Actual state of automatic baudrate detection	2400 BAUD 4800 BAUD 9600 BAUD 19200 BAUD 38400 BAUD 57600 BAUD 115200 BAUD SEARCHING ERROR	= 0 = 1 = 2 = 3 = 4 = 5 = 6 = 7 = 8
IDENTIFY DEVICE	2	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 YES	= 0 = 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

"Monitor"

40.0
%
10.4 mA

0000
PASSW
[1]

(correct)

NO
ADV.SET
[2]

(NO)

XXXX
X
[X]

∧ or ∨

∧ or ∨
9999
...
0000

∧ or ∨
YES
or
NO

(YES)

MEM
SETUP
[3]

∧ or ∨
MEM
DISP
CAL
SIM
PASS
LANG
RAIL
MODB
ORIEN

MEM ▶
DISP ▶
CAL ▶
SIM ▶
PASS ▶
LANG ▶
RAIL ▶

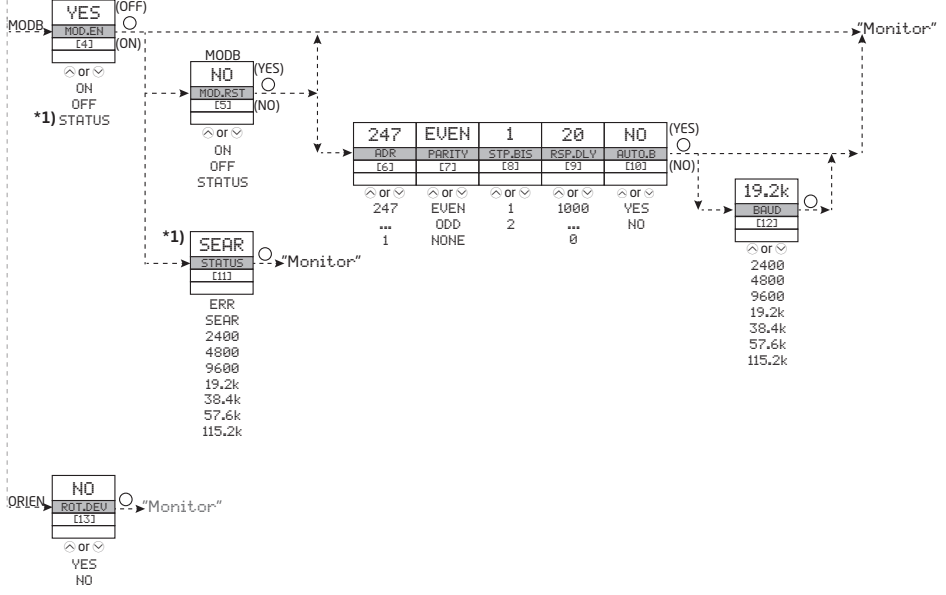## Scrolling HELP TEXTS:

[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

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.

MODB ▶

YES
MOD.EN
[4]

(OFF)

(ON)

∧ or ∨
ON
OFF
*1) STATUS

| MODB |
NO
MOD.RST
[5]

(YES)

(NO)

∧ or ∨
ON
OFF
STATUS

"Monitor"

247
ADR
[6]

EVEN
PARITY
[7]

1
STP.BIS
[8]

20
RSP.DLY
[9]

NO
AUTO.B
[10]

(YES)

(NO)

∧ or ∨
247
...
1

∧ or ∨
EVEN
ODD
NONE

∧ or ∨
1
2

∧ or ∨
1000
...
0

∧ or ∨
YES
NO

19.2k
BAUD
[12]

∧ or ∨
2400
4800
9600
19.2k
38.4k
57.6k
115.2k

*1)

SEAR
STATUS
[11]

"Monitor"

ERR
SEAR
2400
4800
9600
19.2k
38.4k
57.6k
115.2k

ORIEN ▶

NO
ROT.DEV
[13]

"Monitor"

∧ or ∨
YES
NO