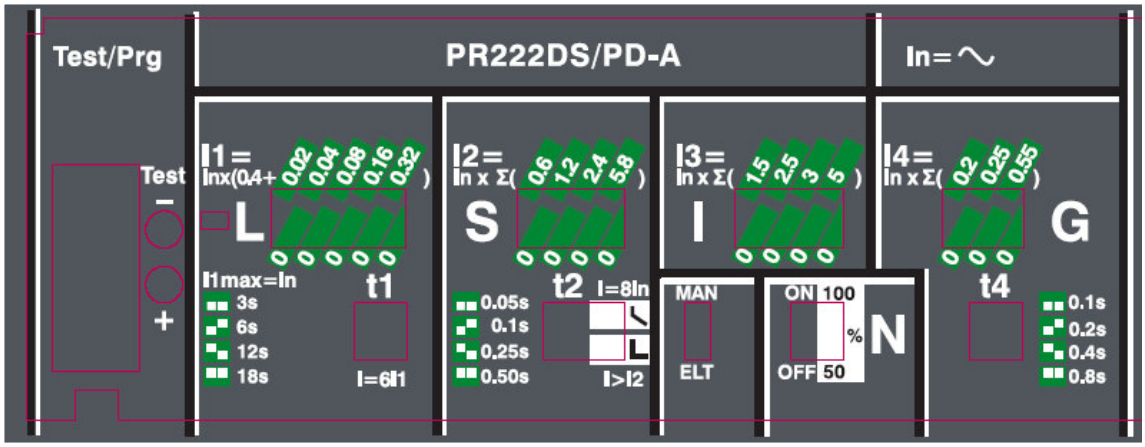
Instruction manual

PR222DS/PD-A
Modbus™ System Interface



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Author Autore.	LB-DTA	L2572	Title Titolo	**PR222DS/PD-A** **Modbus™ System Interface**	**ENG**
ABB			Doc. No N. Doc.	**1SDH000599R0001**	Tot. Pag. 1/42

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1. General

This document describes the Modbus interface regarding:

- Network Management of the device (installation, configuration, …)
- Application Objects and Slave Variables

1.1 Applicability

This document applies to the device PR222DS/PD-A.
This version of the document has been updated with SW version 3.0.

1.2 Applicable Documents

[1] Schneider Automation Inc. '*Modicon MODBUS Protocol Reference Guide*', June 1996, rev. J, PI-MBUS-300

In the PR22DS/PD- A version all writing functions are managed as the device is in LOCAL mode, therefore it produces the refuse of these commands with the exception code 06 (SLAVE DEVICE BUSY)

1.3 Acronyms and Definitions

1.3.1 Acronyms

AI	**Analog Input**
AO	**Analog Output**
AUX-E	**I^2C bus module for acquisition of CB status**
AppObj	**Application Object**
CB	**Circuit Breaker (MCCB TMAX family)**
CP	**Configuration Parameter**
CT	**Current Transformer**
DI	**Digital Input**
DO	**Digital Output**
ER	**Exception Response**
ETT	**Electronic Trip Test**
In	**Nominal current**
LSb	**Least Significant bit**
LSB	**Least Significant Byte**
MOE-E	**I^2C bus module for CB commands sending and for acquisition of MC temperature**
MSb	**Most Significant bit**
MSB	**Most Significant Byte**
MTT	**Mechanical Trip Test**
PU	**Protection Unit (PR222DS/PD-A)**
OR	**(Main) Opening Release**
SOR	**Shunt Opening Release**
TC	**Trip Coil**
UVR	**Under Voltage Release**
Vaux	**Auxiliary Supply**

1.3.2 Definitions

ALARM: there are two types of alarm:

Alarm Type	Definition
Alarm	It's similar to a status. It will be frozen after a protection trip in the "Trip Reports" structure. A Trip Reset is NOT necessary to reset it. Ex. L Pre-Alarm, S Alarm, ...
Trip	Only a command can reset it, i.e. a new alarm won't be signalled until the reset. Ex. L Tripped, S Tripped, ...

Trips are reset after a Trip Reset command or CB Reset command.

BUFFER: meaningful part of a Modbus Map section.

It's defined by the Modbus Map of the device.

CB RESET: event (Any Trip) /alarm reset of any information related to the (last) trip.

It changes also the 'real' CB status (i.e. the CB goes to OPEN).

DEVICE: Protection Unit (i.e. the PR222DS/PD-A)

EVENT: information that signals a normal (foreseen) device behaviour.

Typically, the producer of an event is the device, while the consumer (who resets it) is the system.

Reset of an event is automatically done after a read operation from the system.

ITEM: analog (register) Modbus data type

OPERATION: every CB status transition towards OPEN state. It doesn't matter which is the starting state (TRIPPED or CLOSED).

OTHER TRIPS: sum of CB status transitions towards the TRIPPED state, either from the OPEN or CLOSED starting state, but not caused by the protection.

So they are all the transitions caused by an electronic / mechanical trip test, under voltage release and secondary shunt opening release.

PARAMETER: information that allows configuration of device functionality (e.g. a protection algorithm).

PERSISTENCE: 'volatile/non-volatile' attribute concerning information, i.e. the information is/is not still available after a power fail/HW reset/...

PERSISTENCE	Description
Temporary (default)	Information is NOT still available after a power fail/HW reset/...
Permanent	Information is still available after a power fail/HW reset/...

For example, parameters and trip data have this attribute set to PERMANENT, while states/events/alarms settings are TEMPORARY.

PROTECTION TRIPS: sum of real protection trips (Σ LSIG trips).

'Real' means 'not caused by the Test Unit PR010/T.

PROTECTION UNIT:PR222DS/PD-A electronic board that implements protection algorithms

PROTECTION X TRIPS: sum of trip of protection X (e.g. L, S, I, G).

REGISTER: the least analogue information container (one word = 2 bytes)

REMOTE SYSTEM: a device (SCADA) who behaves as Modbus Master on the external bus. It polls the information provided by the device and sends to it commands and parameters.

STATUS: information that represents the dynamics of a functionality (e.g. the CB or a protection algorithm). It can be managed (i.e. set/reset) only by the device itself.

TRIP COMMAND FAIL: after a protection trip, with relevant opening command to the release, CB stays in CLOSED state. In this case, the device tries to open the CB by starting a back-up procedure. Meanwhile, the device tries also to open the CB using the YO (through the I/O).

TRIP RESET: command equal to CB Reset, but it doesn't change the 'real' CB status (i.e. the CB remains TRIPPED).

(PROCESS) VARIABLE: information strictly connected to device functionality. Examples are:

- commands
- states/events
- alarms
- measurements
- historical/statistical data
- ...

2. Introduction

It has been decided to describe the device according to the Modbus protocol [1].
When the Test Unit is connected, the device stops communicating with the Remote System after it has read the "Events" structure or a time-out has expired.

2.1 Modbus Protocol and Map Organisation

2.1.1 Communication parameters

1. Transmission mode: RTU (2 four bits hexadecimal chars for each byte).
2.
3. Serial parameters:

Start Bit	Data Bits	Parity Bit	Stop Bit
1	8 (LSb first)	1 (even | odd | none)	1

Table 1. Serial parameters

Please note that transmission mode and serial parameters MUST be the same for all devices on a Modbus network.
Only the parity parameter is modifiable.

Baud Rate: [9600 | 19200]

DEFAULT VALUES: Parity = Even, Baud Rate = 19200

2.1.2 Device RTU Framing

START	SLAVE ADDRESS	FUNCTION	DATA	CRC CHECK	END
T1 – T2 – T3 – T4	8 bits	8 bits	n * 8 bits	16 bits	T1 – T2 – T3 – T4

Table 2. Modbus message

Up to 32 bytes can be sent.

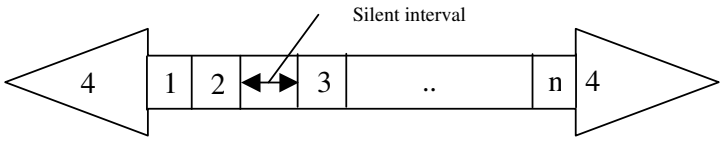
The allowed inter-character silent interval is been relaxed from 'at least 2 characters' to 'at least 4 characters' (the same silent interval to recognise the end of a message). This means:

2.1.2.1 Silent interval < 4 char between two characters inside the message

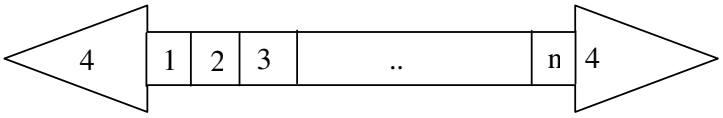
In this case the receiver filters the silent interval and the following characters will be appended to those already received.
The difference from the protocol specification is:

1. Silent interval < 2 char between two characters inside the message

Transmitter



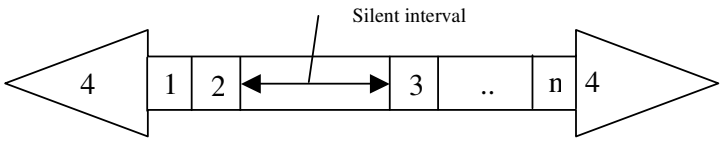
Receiver



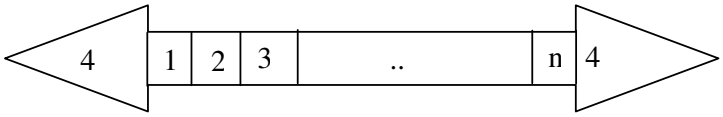
The behaviour is exactly as specified by the protocol.

2. Silent interval ≥ 2 char and < 4 char between two characters inside the message
The received characters are NOT flushed and the following ones will be appended.

Transmitter



Receiver



Note that after flushing, the standard protocol specification allows:

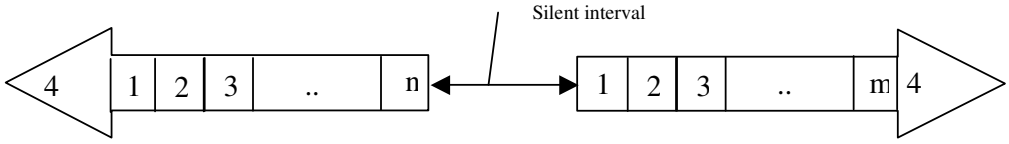
- reception of the remaining characters of a partially received message
- reception of a completely new message

The device behaviour **doesn't cover the second case** because it always appends new incoming characters to the previous ones, leading to a CRC error.
So the behaviour is exactly the same if and only if the incoming characters are NOT a new message. In this case the received packet will lead to a CRC error and the CRC error counter will be incremented.

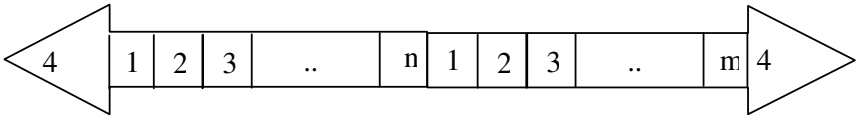
2.1.2.2 Silent interval ≥ 4 char between two characters inside the message
If the message transmission is NOT ended, all the previously received characters are managed as a message because this is exactly the protocol specification regarding the end of a message.

2.1.2.3 New frame before 4 character silent interval at the end of a frame
In this case the receiver filters the silent interval and the following characters (of the new frame) will be appended to those already received (see case 2 of par. 2.1.2.1).
This will lead to a CRC error.

Transmitter



Receiver



So the CRC error counter will count both the 'real' CRC errors and the inter-character errors.

2.1.3 Response Timeout

The reported timeouts have been measured between the end of the query and the beginning of the transmission of the relevant response, with baudrate 19200 bit/s. The measurement has been executed in the following conditions:

- device in 'normal' status, i.e. only measurements are periodically updated and NO alarm conditions are satisfied

Query	Min (ms)	Max (ms)	Average (ms)
Read 1 RAM register	2,300	3,230	2,754
Read 11 RAM registers	2,810	4,180	3,500
Read 5 RAM registers (currents different from zero) (*)	42,800	43,200	43,142
Read 5 RAM registers (currents equal to zero) (*)	17,200	18,300	17,750
Read 1 EEPROM register	10,360	11,640	10,833
Read 9 EEPROM registers	44,230	45,520	44,923

Table 3. Response Timeout

Please note that the multiple items read has been performed on maximum number of items allowed by the device map:

- for data contained into EEPROM, 9 items
- for data contained into RAM, 11 items

(*) Calculation influences current reading

2.1.4 Reception Checks

After reception, the device performs the following checks:

CRC
Max Message Length allowed (32 bytes)
Slave Address

If any of this information is not correct, the received message is discarded and no response message is sent back to the Master.

2.1.5 Function Codes

The following standard functions have to be supported:

Code	HEX Code	Name	Applies to
03	0x03	Read Holding Register	AO
04	0x04	Read Input Register	AI
06*	0x06	Preset Single Register	AO
08	0x08	Diagnostic Sub-function: 0 (0x00)	
16*	0x10	Preset Multiple Registers	AO
17	0x11	Report Slave ID	

Table 4. PR222DS/PD-A function codes

All other NOT supported functions lead to an exception response 'ILLEGAL_FUNCTION'.
(*) All writing functions are supported only on Test Bus. The use of these functions on System Bus leads to an exception response "SLAVE DEVICE BUSY ".

These functions can be grouped into two different categories:

1. Data Management functions.

Functions applied to device data into the Modbus Map (codes 03, 04, 06, 16).

2. Network / Device Management functions.

Functions applied to device that can:

- request / setting general information
- change the device behaviour / status
- …

Function codes 08 and 17 belong to this category.

2.1.5.1 08 (0x08) Diagnostic

The function uses a two-byte sub-function code field in the query to define the type of test to be performed.
Most of the diagnostic queries use a two-byte data field to send diagnostic data or control information to the slave.

Sub-function Hi	Sub-function Lo	Data Hi	Data Lo

Table 5. 'Diagnostic' query data field structure

where the only supported sub-function code is:

Sub-function code	HEX code	Name	Description
00	0x00	Return Query Data	The data passed in the information field will be returned to the Master via the addressed Modbus Slave. The entire message returned should be identical to the message transmitted by the Master, field-per-field.

NOTE: the protocol specification on data field ('Any', pages 74 – 75, 77) is NOT clear. The device allows both a generic field length (i.e. more than two bytes) and a generic value range.

2.1.5.2 17 (0x11) Report Slave ID

A normal response has some fields defined and others device dependent:

Byte Count	Slave ID	Run Indicator Status	Additional Data ...

Table 6. 'Report Slave ID' response data field structure

where:

- 'Byte Count' depends on 'Additional Data'. Its minimum value is 2. In this application its value is 22.
- 'Slave ID' is the identifier of the device of a specific manufacturer (i.e. devices from different manufacturers could have the same 'Slave ID'):

Slave ID	Device
67 = 0x43	**PR222DS/PD-A**

Table 7. Slave ID

- 'Run Indicator Status' reports the current Slave Run status, fixed to ON (0xFF).
- Additional Data' contains device dependent information. In this application it is so organized:

- SW version (2 bytes): see "Table 39"
- Event section address (2 bytes): see "Table 20"
- Device serial number (16 bytes): see "Table 32"

2.1.6 Data Addressing (Map organisation)

Two different data addressing types are implemented:

1. Standard Modbus addressing
2. ABB SACE addressing (old ABB SACE Modbus Communication Units)

Standard			ABB	
Starting Address	**Item Address**	**Data Type**	**Starting Address**	**Item Address**
0 … 9999	1 … 10000	DO	1 … 10000	1 … 10000
0 … 9999	10001 … 20000	DI	10001 … 20000	10001 … 20000
0 … 9999	30001 … 40000	AI	30001 … 40000	30001 … 40000
0 … 9999	40001 … 50000	AO	40001 … 50000	40001 … 50000

The organisation of every section of the map (i.e. AI, AO) can be partitioned into different areas, called 'buffers', containing a contiguous number of item. For example the white cells in the following figure

Item Address	Item Value
30001	
…	
30027	
30028	
30029	
30030	
30031	
…	
…	
39999	

defines a AI buffer starting at 30027 and with length 5 (grey cells are map items not defined for the device).

Please note that:

Item Address	Item Value
30001	
…	
30027	
30028	
30029	
30030	
30031	
…	
…	
39999	

defines two different AI buffers. The first one starts at 30027 with length 2, while the second one starts at 30030 with length 3.

It's possible to query a buffer as a whole or a portion of it, but **it's NOT possible to query two buffers within the same message: an exception response will rise up.**

Please note that PR222DS/PD-A doesn't implement Digital Items.

2.1.6.1 Standard Modbus Addressing

In Modbus messages Start Address is always referred to zero.

Every single item in these sections is identified by a LOGICAL ABSOLUTE ADDRESS in the following ranges:

Data	Logical Absolute Address Range	Offset / Reference (decimal)	Offset / Reference (hex)
AI	(MIN_AI_ADDR) 30001 – 40000 (MAX_AI_ADDR)	30000 (AI_OFFSET)	0x7530
AO	40001 – 50000 (MAX_AO_ADDR)	40000 (AO_OFFSET)	0x9C40

Table 8. Modbus logical memory map

Please note that when the Master specifies the 'Starting Address' into the Modbus message, it uses a LOGICAL RELATIVE ADDRESS, calculated from the LOGICAL ABSOLUTE ADDRESS:

Starting Address = LOGICAL RELATIVE ADDRESS
= LOGICAL ABSOLUTE ADDRESS – XX_OFFSET –1
= Item Address – XX_OFFSET –1

Equation 1.

So the Logical Relative Address Range is 00000 – 09999 (= 0x270F, MAX_RELATIVE_ADDR) for all data types.

Moreover, items like 10005, 40001, ... are addressed like 0004, 0000, ... because the function code uniquely identifies the portion of Modbus map they belong to.

Example
Register with LOGICAL ABSOLUTE ADDRESS = 32475 will be addressed by the Master with the LOGICAL RELATIVE ADDRESS = 32475 – 30000 – 1 = 2474.

So the device performs the following check on the Starting Address field:

- Starting Address range between 0 and 9999
- Starting Address belongs to a valid part of the section pointed by the Function Code

2.1.6.2 ABB SACE Addressing

The item address is:

Starting Address = LOGICAL ABSOLUTE ADDRESS = Item Address

The device performs the following check on the Starting Address field:

- Starting Address congruency with the section pointed by the Function Code (see Table 8).
- Starting Address belongs to a valid part of the pointed section

2.1.7 Data Field

The data field is formed by a 'header' part and a data value part: following points consider only the header part of this field.

In some function, there could be a 0 length data field (i.e. the message contains only the function code like in the 'Report Slave ID' function).

There is no restriction to max data length except the maximum message length (32 bytes).

2.1.7.1 Query

Number of items [2 bytes] (except writing function 6)	Byte Count (only for writing function 16) [1 byte]
How many items to read/write	How many data bytes follow

Table 9. Query data field structure

Function Code	Data Type	Max number of items	Max byte count	Min message length	Max message length
3	AO	13	N/A	8	8
4	AI	13	N/A	8	8
6	AO	N/A (1 fixed)	N/A	8	8
16	AO	11	22	11	31

The device performs the following checks on the above-mentioned fields:

- Max number of items, conforming to the Function Code
- Byte Count congruency with the Number of Items
- Data value field length congruency with the Byte Count

Moreover, also the following checks are performed:

- (Starting Address + Number Of Items) belongs to the section pointed by the Function Code
- (Starting Address + Number Of Items) belongs to a valid part of the pointed section

2.1.7.2 Response

1. Read function codes

Byte Count (only for writing function 16) [1 byte]
How many data bytes follow

Table 10. Read function response data field structure

Function Code	Data Type	Max number of items	Max byte count	Min message length
3	AO	13	26	7
4	AI	13	26	7

2. Single item Write function codes (6)
   It's simply an echo of the query message.

Function Code	Data Type	Max number of items	Max byte count	Min message length
6	AO	8	N/A	8

3. Multiple items Write function codes (16)

Starting Address [2 bytes]	Number of items [2 bytes]
Starting item	How many items to read/write

Table 11. Multiple items Write function response data field structure

So the message length is fixed and equal to 8.

Function Code	Data Type	Max number of items	Max byte count	Min message length
16	AO	8	N/A	8

2.1.8 Exception Responses

In this case, the MSb of the function code in the response message is set to one and an error code is added.

Error Code	Error Name	Meaning
01	ILLEGAL FUNCTION	The function code received in the query is not an allowable action for the slave. If a 'Poll Program Complete' command is issued, this code indicates that no program function preceded it.
02	ILLEGAL DATA ADDRESS	The data address received in the query is not an allowable address for the slave.
03	ILLEGAL DATA VALUE	A value contained in the query data field in not an allowable value for the slave.
04	SLAVE DEVICE FAILURE	An unrecoverable error occurred while the slave was attempting to perform the requested action.
06	SLAVE DEVICE BUSY	The slave is processing a long-duration program command. The master should retransmit the message later when the slave is free.

Table 12. Exception response error codes

The slave device sends no response if there is a communication error (i.e. a parity or a CRC error).

Error Code	Error Name	When
01	ILLEGAL FUNCTION	1. Device does NOT support the received Function Code.
02	ILLEGAL DATA ADDRESS	1. Starting Address is > 9999 (Standard Addressing Type). 2. Starting Address is outside a map section (ABB SACE Addressing Type). 3. Starting Address not defined. 4. Starting Address not supported by function.
03	ILLEGAL DATA VALUE	1. The message is too long. 2. Diagnostic function: sub-function is not supported (≠ 0) 3. The Number of Items is NOT in range (= 0 or > Max number of items, see 2.1.7). 4. Byte Count is different from the number of bytes calculated using the number of items and the relevant data type. 5. The whole query requested buffer (Starting Address + Number of Items) doesn't belong to a device map buffer.
04	SLAVE DEVICE FAILURE	1. Data with congruency byte not valid.
06	SLAVE DEVICE BUSY	1. EEPROM busy

Table 13. PR222DS/PD-A exception responses use

2.1.9 Broadcast messaging

According to Modbus protocol (see [1]), the device handles 'broadcast messages'.
The device handles to slave address '0x00' (for functions supporting broadcast, see table below), but it hasn't to reply.

Function	Broadcast supported
0x03	No
0x04	No
0x06	Yes
0x08	No
0x10	Yes
0x11	No

2.2 Installation and Configuration

At the first start-up, the device is configured for communication to the Remote System, i.e. Operating Mode = REMOTE: if the communication parameters are not defined (i.e. the reading of the relevant register returns an ER = 03), the device uses the following default communication parameters:

Communication Parameters	Allowed Values	Start Up Values
Slave Address	{1 … 247}	247
Baud Rate	9600 ǀ 19200 bit/s	19200 bit/s
Parity	Even ǀ Odd ǀ None	Even
Addressing Type	Standard ǀ ABB SACE	Standard

These parameters can't be changed locally.

3. Start-up behaviour

At start-up, data are available in a time that depends on the master polling frequency (scan rate).
The following table contains some measurements of the time passing between the reset of the device and the first valid response sent towards the Remote System. They have been obtained with different values of scan rate and for different query lengths.

The slave timeout set is 100 ms, while the baud rate is 19200 bit/s.

Query	Scan Rate (ms)	Min (ms)	Max (ms)	Average (ms)
Read 1 RAM register	1000	231	902	558
Read 1 RAM register	500	128	520	350
Read 1 RAM register	100	114	220	153,6
Read 1 RAM register	5	40	99	60
Read 11 RAM registers	1000	81	892	372
Read 11 RAM registers	500	44	468	256,5
Read 11 RAM registers	100	32	217	136,5
Read 11 RAM registers	5	28	126	71,2
Read 1 EEPROM register	1000	69	935	500
Read 1 EEPROM register	500	39	486	219,5
Read 1 EEPROM register	100	37	215	90
Read 1 EEPROM register	5	49	134	99
Read 9 EEPROM registers	1000	36	970	550
Read 9 EEPROM registers	500	50	506	283,4
Read 9 EEPROM registers	100	31	200	131
Read 9 EEPROM registers	5	89	274	143,4

Table 14. Start-up time

4. Configuration parameters programming model

The Protection Unit connected to the Communication Unit can use two different parameter sets:

1. Manual parameter set
2. Electronic parameter set

The frontal PU dipswitch 'MAN / ELT' selects the used set and is reported to the Remote System via the 'Electronic/Manual Parameters Settings' event.

4.1 Manual parameters

Manual parameter values can be changed **locally only** using frontal PU dipswitches, so these values are READ ONLY from the Remote System.
This set is used by the PU when either the 'MAN / ELT' dipswitch is set to 'MAN' or the Electronic parameters are corrupted.

The manual parameters are updated towards the Remote System every 500 ms, regardless of the setting of 'MAN / ELT' dipswitch.

Every time the manual parameter set is read, if it's changed, the 'Manual parameter changed' event rises up.
Moreover, if some parameters are not consistent with each other (e.g. Protection L and Protection S thresholds), also the 'Manual parameter inconsistency' event rises up and the register 'Manual Parameter Inconsistency Code' contains the code associated to the description of the error (see Table 23). Besides, the LED starts blinking (see par. 6.1)

Please note that when a protection algorithm (i.e. S, I or G) is disabled (i.e. its trip level is OFF = 0), the device propagates the value set through the dipswitches for the other protection relevant parameters (i.e. time delay, curve type). In this way, the remote system can read the real status of the dipswitches.

NOTE
The manual 'Neutral Selection' dipswitch and 'Neutral Enabling' dipswitch are always periodically read because these parameters are necessary to calculate the right neutral current value.

4.2 Electronic parameters

Electronic parameters values con be changed only using PR010/T Test Unit.

5. Local Commands management

The device manages three local commands:

1. CB Open
2. CB Close
3. CB Reset

5.1 CB Open

A local user performs this command when she/he switches manually the circuit breaker from CLOSED to OPEN.

The device manages this command in the following way:

- CB status change
- Number of CB operation update
- Number of CB manual operation update

5.2 CB Close

A local user performs this command when he switches manually the circuit breaker from OPEN to CLOSED.

The device manages this command in the following way:

- CB status change

5.3 CB Reset

A local user performs this command when he switches manually the circuit breaker either from TRIPPED to OPEN (after a protection trip or another kind of trip) or from OPEN to CLOSED (after a Trip Command Fail).

The device manages this command in the following way:

- CB status change
- If the CB was in TRIPPED state, reset the relevant event and perform a Trip Reset
- If the CB was in OPEN state for TCF, reset the relevant event and perform a Trip Reset
- Reset of relevant event (any trip or another kind of trip)

6. Human Machine Interface / Local User Interface

HMI is made of:

- dipswitches
- LED

6.1 LED

There is only one LED and it is used for the following signalling:

- Protection L Pre Alarm
- Protection L Alarm
- Manual Parameters Inconsistency

As they can be simultaneous, the following priority levels have been defined:

1. Protection L Pre Alarm / Protection L Alarm
2. Manual Parameters Inconsistency

Signalling	**LED behaviour**
Protection L Pre Alarm	Fixed ON
Protection L Alarm	Frequency: 1 Hz Duty cycle: 50 %
Manual Parameters Inconsistency	Frequency: 0.33 Hz Duty cycle: 33.3 % ON

Table 15. LED behaviour

7. Modbus Logical Map

In this section are contained all the Modbus variables, both in Input and in Output, handled by device and accessible from the Remote System. They are divided according to their Modbus data type: Analog Input, Analog Output.
'Persistence = PERMANENT' means that value is saved into non-volatile memory.

These are the buffers defined for this device:

Buffer Name	Buffer Type	Registers Number	Description
Communication Statistics	AI	5	Communication Statistics
Process Statistics	AI	9	Process Statistics
Reports	AI	4	Events, States, Alarms and Trips reports
Information	AI	1	General info (Wink status, MOE-E presence)
Electronic Programming Fail Code	AI	1	Code of the wrong configuration electronic parameters
Manual Parameters Inconsistency Code	AI	1	Code of the wrong configuration manual parameters
Run-time Currents	AI	5	Run time currents
Trip Currents	AI	5	Trip currents
Trip Reports	AI	4	States, Events, Alarms and Trips reports after trip
Manual Parameters	AI	8	Settings of dipswitches
Present Electronic Parameters	AI	11	Parameters in use
Product Execution	AI	1	Product Execution (LSI/LSIG)
Device Serial Number	AI	5	Device Serial Number
Communication Parameters	AI	1	Slave Address, Baud Rate, Parity, Addressing Type
System Disconnection Timeout	AI	1	System Disconnection Timeout
Protection Unit Nominal Current	AI	1	Protection Unit Nominal Current
CB Type	AI	6	CB Type (T4, T5, T6)
SW version	AI	1	SW version
Device Version	AI	1	Device Version (P or PD)
Max value limitation	AI	1	Max parameter value according to CB type (L time delay, I threshold)
Protection I Selection	AI	1	Protection I configuration (Instantaneous/Selective)

Table 16. Buffers

7.1 Bit field organization

There are some registers that are organized as bit fields. The bit field structure is:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0	bit 7	bit 6	bit 5	bit 4	bit 3	bit 2	bit 1	bit 0
MSB								LSB							

Table 17. Bit field organization

Each bit can be identified in two ways:

a) MSB bit 6
b) bit 14

In the following sections, the bit are identified in the b) way.

7.2 Product execution

In the following tables, it is specified to which product execution any parameter is related to. If not specified, the parameter is valid for all the versions (LSIG, LSI, SI).

7.3 Analog Input

7.3.1 Buffer "Communication Statistics"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Communication Statistics	**30001**	**0001**	**0000**	**0000**	**5**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address – 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Range	Unit of Meas.	Persistence	Comments
Communication Statistics	**30001**	**0001**	**0000**	**0000**	**5**							
	30001	0001	0000	0000	1			Number of received messages	0 - 65535			Bus Message Count (see 1)
	30002	0002	0001	0001	1			Number of received messages with char/frame error	0 - 65535			Bus Communication Error Count (see 2)
	30003	0003	0002	0002	1			Number of responses	0 - 65535			Slave Message Count
	30004	0004	0003	0003	1			Number of Slave Busy responses	0 - 65535			Slave Busy Count
	30005	0005	0004	0004	1			Number of exception responses	0 - 65535			Bus Exception Error Count (see 3)

1. This number counts only the messages received from the device that has right Slave Address.
2. This number counts both the low level transmission errors (i.e. overrun, parity), also called 'char errors', and the CRC errors, also called 'frame errors'. They are counted only if the slave address is the right one.
3. 'Number of exception responses' contains number of 'Slave Busy responses'.

Table 18. AI – Buffer 'Communication Statistics'

7.3.2 Buffer "Process Statistics"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Statistics	**30007**	**0007**	**0006**	**0006**	**9**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address – 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Range	Unit of Meas.	Persistence	Comments
Process Statistics	**30007**	**0007**	**0006**	**0006**	**9**							
	30007	0007	0006	0006	1			CB number of operations	0 - 65535		Permanent	See 4
	30008	0008	0007	0007	1			CB number of manual opens	0 - 65535		Permanent	See 5
	30009	0009	0008	0008	1			CB number of protection trips	0 - 65535		Permanent	See 6
	30010	0010	0009	0009	1			CB number of protection trips fail	0 - 65535		Permanent	See 7
	30011	0011	0010	000A	1			CB number of other trips (trip test)	0 - 65535		Permanent	See 8
	30012	0012	0009	000B	1			Protection L number of trips	0 - 65535		Permanent	See 9
	30013	0013	0012	000C	1			Protection S number of trips	0 - 65535		Permanent	See 10
	30014	0014	0013	000D	1			Protection I number of trips	0 - 65535		Permanent	See 11
	30015	0015	0014	000E	1			Protection G number of trips	0 - 65535		Permanent	See 12

Table 19. AI – Buffer 'Process Statistics'

4. CB number of operations: transitions towards 'Open', regardless from the cause
5. CB number of manual opens: transitions from 'Closed' to 'Open' due to opening command (local or remote)
6. CB number of protection trips: transitions from 'Closed' to 'Tripped' due to device intervention after a trip
7. CB number of protection trips fail: transitions from 'Closed' to 'Tripped' due to backup procedure (through TC)
   transitions from 'Closed' to 'Open' due to backup procedure (through YO)
8. CB number of other trips (trip test): transitions from 'Closed' to 'Tripped' due to trip test through TT1
   transitions from 'Closed' to 'Tripped' due to trip test through Test Unit
   transitions from 'Open' to 'Tripped' due to local test through CB test button
9. Protection L number of trips: interventions of the protection L, regardless from the result (valid for LSIG, LSI)
10. Protection S number of trips: interventions of the protection S, regardless from the result
11. Protection I number of trips: interventions of the protection I, regardless from the result
12. Protection G number of trips: interventions of the protection G, regardless from the result (valid for LSIG)

NB: if these data are not valid, an ER = 04 is returned

7.3.3 Buffer "Reports"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Reports	**30033**	**0033**	**0032**	**0020**	**4**

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address – 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Bit field Structure	Range	Comments
Reports	**30033**	**0033**	**0032**	**0020**	**4**						
	30033	0033	0032	0020	1			Events	bit 0 Manual parameters changed	1 = Manual parameters changed	See 13
									bit 1	NOT USED	
									bit 2	NOT USED	
									bit 3 Electronic trip test	1 = Electronic trip test	
									bit 4 Power up after self supply	1 = Power up after self supply	
									bit 5 Test Unit connected	1 = Test Unit connected	
	30034	0034	0033	0021	1			Status	bit 0 Any alarm	1 = Any alarm	See 14
									bit 1 Any trip	1 = Any trip	See 15
									bit 2 CB tripped	1 = CB tripped	See 16
									bit 3 CB open/closed	[CB Open (0) | CB Closed (1)]	
									bit 4 Trip command fail	1 = Trip command fail	See 17
									bit 5 Other trips	1 = Other trips	See 18
									bit 6	NOT USED	
									bit 7	NOT USED	
									bit 8	NOT USED	
									bit 9 Electronic/Manual parameters selected	[Electronic parameters (0) Manual parameters (1)]	
									bit 10 Manual parameters inconsistency	1 = Manual parameters inconsistency	
									bit 11 EEPROM parameters error	1 = EEPROM parameters error	
									bit 12 AUX-E unknown	1 = AUX-E unknown	
									bit 13 Nominal current unknown	1 = Nominal current unknown	
									bit 14 Serial parameters unknown	1 = Serial parameters unknown	
									bit 15 Trip data available	1 = Trip data available	See 19
	30035	0035	0034	0022	1			Alarms	bit 0 L Pre-alarm	1 = L Pre-alarm	**Valid for LSIG, LSI**
									bit 1 L alarm (timing/tripping)	1 = L alarm (timing/tripping)	**Valid for LSIG, LSI**
									bit 2 S alarm (timing/tripping)	1 = S alarm (timing/tripping)	
									bit 3 G alarm (timing/tripping)	1 = G alarm (timing/tripping)	**Valid for LSIG**
									bit 4 Motor Command overheated	1 = MC over 100 °C	See 21
									bit 5 General purpose I/O	NOT USED	See 21
									bit 6 General purpose I/O	NOT USED	See 21
									bit 7 General purpose I/O	NOT USED	See 21
									bit 8 General purpose I/O	NOT USED	See 21

						bit 9 General purpose I/O	NOT USED (= 0)	See 21
30036	0036	0035	0023	1	Trips	bit 0 L tripped	1 = L tripped	See 20 **Valid for LSIG, LSI**
						bit 1 S tripped	1 = S tripped	See 20
						bit 2 I tripped	1 = I tripped	See 20
						bit 3 G tripped	1 = G tripped	See 20 **Valid for LSIG**

Table 20. AI - Buffer 'Reports'

All these items are organized as bit field (See § 7.1).

13. It signals any changes on dipswitches concerning protection parameters (thresholds and time delays). It doesn't signal changes of the following dipswitches:
    - Neutral selection
    - Neutral enabling
    - Operating mode
    - Parameters selected
14. 'Any alarm' is set if any of alarm item is set. It is reset when all the alarm items are equal to 0.
15. 'Any trip' is set if any of trip item is set. It is reset after either a remote 'Trip Reset' or a local / remote 'CB Reset'.
16. If the CB is in TRIPPED mechanical state, also 'CB open' is set.
17. 'Trip command fail' is set when the device haven't succeeded in opening the CB at first attempt. After that two different back-up procedures are started:
    - the device sends periodically (100 ms) a command to SA. If successful, the CB goes into 'Tripped' state.
    - if auxiliary supply and the CB I/O are present, the device sends once a command to the YO after 100 ms. If successful, the CB goes into 'Open' state.
18. 'Other trip' is set if and only if the CB tripped state is due to a electronic / mechanical trip test, a UVR trip or a SOR trip.
19. 'Trip data available' is always ON, but when the PU is storing trip currents after a trip or data are not valid
20. If 'X tripped' is set, the relevant 'X Alarm (timing / tripping)' is reset.
21. These alarms concern the motor command: only the first one is used, the other ones are available for future features.

7.3.4 Information

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Information	**30038**	**0038**	**0037**	**0025**	**1**

and these are the relevant items:

Section	Absolute	Relative	Relative Address - 1	Relative Address – 1	Number	HIGH	LOW	Description	Bit field	Range	Comments

	Address	Address		(HEX)	of items	byte	byte	Structure	
Information	**30038**	**0038**	**0037**	**0025**	**1**				
	30038	0038	0037	0025	1		Information	bit 0	Not Used
								bit 1 MOE-E unknown 1 = MOE-E unknown	

Table 21. AI – Buffer 'Information'

7.3.5 Buffer "Programming Fail Code"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Programming Fail Code	**30052**	**0052**	**0051**	**0033**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address – 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Range	Unit of Meas.	Persistence	Comments
Programming Fail Code	**30052**	**0052**	**0051**	**0033**	**1**							
	30052	0052	0051	0033	1			Manual Parameters Inconsistency Code	see Table 23			

Table 22. AI – Buffer 'Programming Fail Code'

(°) These error codes are not generated if any of the relevant protections are disabled or not present (SI execution).
(*) It signals when it tries to enable G protection in a LSI device.

System Error Code	Description
0	NO ERROR
31	S Threshold ≤ L Threshold
32	I Threshold ≤ S Threshold

Table 23. 'Manual Programming Inconsistency Code' range

7.3.6 Buffer "Run-time currents"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Run-time RMS Measurements	**30101**	**0101**	**0100**	**0064**	**5**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Range	Unit of Meas.	Persistence	Comments
Run-time currents	**30101**	**0101**	**0100**	**0064**	**5**							
	30101	0101	0100	0064	1			RMS current phase L1	0 - 65535	A or In		
	30102	0102	0101	0065	1			RMS current phase L2	0 – 65535	A or In		
	30103	0103	0102	0066	1			RMS current phase L3	0 – 65535	A or In		
	30104	0104	0103	0067	1			RMS current neutral	0 – 65535	A or In		
	30105	0105	0104	0068	1			RMS current ground	0 – 65535	A or In		See 22

Table 24. AI – Buffer 'Run-time currents'

Their values are expressed as percentage of IN if the Nominal current is not set (i.e. the event 'Nominal current unknown' = 1), otherwise (i.e. the event 'Nominal current unknown' = 0) in Ampere.

Example: value read 150

- Nominal current unknown → 1.5 IN
- Nominal current known → 150 A

If the value is less than 0.1 IN, the value provided to the Remote System is 0.

22. This value is filtered for visualization. Its rise / fall time can vary from 2.5 to 5 seconds **(NB: available only from SW version 3.00).**

7.3.7 Buffer "Trip currents"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Trip currents	**30201**	**0201**	**0200**	**00C8**	**5**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Range	Unit of Meas.	Persistence	Comments
Trip currents	**30201**	**0201**	**0200**	**00C8**	**5**							
	30201	0201	0200	00C8	1			Trip current phase L1	0 - 65535	A or In	Permanent	
	30202	0202	0201	00C9	1			Trip current phase L2	0 – 65535	A or In	Permanent	
	30203	0203	0202	00CA	1			Trip current phase L3	0 – 65535	A or In	Permanent	
	30204	0204	0203	00CB	1			Trip current neutral	0 – 65535	A or In	Permanent	
	30205	0205	0204	00CC	1			Trip current ground	0 – 65535	A or In	Permanent	

Table 25. AI – Buffer 'Trip currents'

NB: if these data are not valid, an ER = 04 is returned.

7.3.8 Buffer "Trip Reports"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Trip Reports	**30273**	**0273**	**0272**	**0110**	**4**

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address – 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Comments	Bit field Structure	Range	Comments
Trip Reports	**30273**	**0273**	**0272**	**0110**	**4**							
	30273	0273	0272	0110	1			Trip events	Bit field	bit 0 Manual parameters changed	1 = Manual parameters changed	Permanent
										bit 1		Not Used
										bit 2		Not Used
										bit 3 Electronic trip test	1 = Electronic trip test	
										bit 4 Power up after self supply	1 = Power up after self supply	
										bit 5 Test Unit connected	1 = Test Unit connected	
	30274	0274	0273	0111	1			Trip status	Bit field	bit 0 Any alarm	1 = Any alarm	Permanent
										bit 1 Any trip	1 = Any trip	
										bit 2 CB tripped	1 = CB tripped	
										bit 3 CB open/closed	[CB Open (0) | CB Closed (1)]	
										bit 4 Trip command fail	1 = Trip command fail	
										bit 5 Other trips	1 = Other trips	
										bit 6	NOT USED	
										bit 7	NOT USED	
										bit 8	NOT USED	
										bit 9 Electronic/Manual parameters selected	[Electronic parameters (0) Manual parameters (1)]	
										bit 10 Manual parameters inconsistency	1 = Manual parameters inconsistency	
										bit 11 EEPROM parameters error	1 = EEPROM parameters error	
										bit 12 AUX-E unknown	1 = AUX-E unknown	
										bit 13 Nominal current unknown	1 = Nominal current unknown	
										bit 14 Serial parameters unknown	1 = Serial parameters unknown	
										bit 15 Trip data available	1 = Trip data available	
	30275	0275	0274	0112	1			Trip alarms	Bit field	bit 0 L Pre-alarm	1 = L Pre-alarm	Permanent
												Valid for LSIG, LSI
										bit 1 L alarm (timing/tripping)	1 = L alarm (timing/tripping)	**Valid for LSIG, LSI**
										bit 2 S alarm (timing/tripping)	1 = S alarm (timing/tripping)	
										bit 3 G alarm (timing/tripping)	1 = G alarm (timing/tripping)	**Valid for**

									LSIG
								bit 4 Motor Command overheated	1 = MC over 100 °C
								bit 5 General purpose I/O	NOT USED
								bit 6 General purpose I/O	NOT USED
								bit 7 General purpose I/O	NOT USED
								bit 8 General purpose I/O	NOT USED
								bit 9 General purpose I/O	NOT USED
30276	0276	0275	0113	1		Trip trips	Bit field	bit 0 L tripped	1 = L tripped
									Valid for LSIG, LSI
								bit 1 S tripped	1 = S tripped
								bit 2 I tripped	1 = I tripped
								bit 3 G tripped	1 = G tripped
									Valid for LSIG

Table 26. AI - Buffer 'Trip Reports'

NB: if these data are not valid, an ER = 04 is returned. If ‘Trip data available’ status bit is not set, these data are not available.

7.3.9 Buffer "Manual Parameters"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Manual parameters	**30324**	**0324**	**0323**	**0143**	**8**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Bit field Structure	Range	Comments
Manual parameters	**30324**	**0324**	**0323**	**0143**	**8**							
	30324	0324	0323	0143	1	N/A		Protection L manual trip level	scaled *100	N/A	{ 0.4 … 1 } In, step 0.02	**Valid for LSIG, LSI**
	30325	0325	0324	0144	1	N/A		Protection L manual trip delay	scaled *10	N/A	See Table 28	**Valid for LSIG, LSI**
	30326	0326	0325	0145	1	N/A		Protection S manual trip level	scaled *10	N/A	[0 (Disabled) ǀ 0.6 ǀ 1.2 ǀ 1.8 ǀ 3 ǀ 3.6 ǀ 4.2 ǀ 5.8 ǀ 6.4 ǀ 7 ǀ 7.6 ǀ 8.2 ǀ 8.8 ǀ 9.4 ǀ 10] In	
	30327	0327	0326	0146	1	N/A		Protection S manual trip delay	scaled *100	N/A	[50 ǀ 100 ǀ 250 ǀ 500] ms	
	30328	0328	0327	0147	1	N/A		Protection I manual trip level	scaled *10	N/A	See Table 28	
	30329	0329	0326	0148	1	N/A		Protection G manual trip level	scaled *100	N/A	[0 (Disabled) ǀ 0.2 ǀ 0.25 ǀ 0.45 ǀ 0.55 ǀ 0.75 ǀ 0.8 ǀ 1] In	**Valid for LSIG**
	30330	0330	0329	0149	1	N/A		Protection G manual trip delay	scaled *100	N/A	[100 ǀ 200 ǀ 400 ǀ 800] ms	**Valid for LSIG**
	30331	0331	0330	014A	1				Bit field	bit 0 Neutral selection	[50% (0) ǀ 100 % (1)]	
										bit 1 Neutral enabling	[Off (Disabled) (0) ǀ On (Enabled) (1)]	
										bit 2 Protection S manual disable	[Enabled (0) ǀ Disabled (1)]	
										bit 3 Protection S manual curve type	[Definite Time (0) ǀ Inverse Time (1)]	
										bit 4 Protection I manual disable	[Enabled (0) ǀ Disabled (1)]	
										bit 5 Protection G manual disable	[Enabled (0) ǀ Disabled (1)]	**Valid for LSIG**

Table 27. AI -Buffer 'Manual Parameters'

CB Type	Protection L manual time delay	Protection I manual threshold
T4-320 I T5-630 I T5-600 UL	3 I 6 I 9 I 12 s	[0 (Disabled) I 1.5 I 2.5 I 3 I 4 I 4.5 I 5 I 5.5 I 6.5 I 7 I 7.5 I 8 I 9 I 9.5 I 10 I 10] In
T4 - T5	3 I 6 I 9 I 18 s	[0 (Disabled) I 1.5 I 2.5 I 3 I 4 I 4.5 I 5 I 5.5 I 6.5 I 7 I 7.5 I 8 I 9 I 9.5 I 10.5 I 12] In
T6	3 I 6 I 12 I 18 s	[0 (Disabled) I 1.5 I 2.5 I 3 I 4 I 4.5 I 5 I 5.5 I 6.5 I 7 I 7.5 I 8 I 9 I 9.5 I 10.5 I 12] In

Table 28. Manual parameters limitation according to CB type

7.3.10 Buffer "Present Electronic Parameters"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Present Electronic Parameters	**30338**	**0338**	**0337**	**0151**	**11**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Bit field Structure	Range	Default	Comments
Present Electronic Parameters	**30338**	**0338**	**0337**	**0151**	**11**								
	30338	0338	0337	0151	3			Date of test	DD MM YYYY	N/A	1 – 31 1 – 12 0 – 65535		
	30341	0341	0340	0154	1	N/A		Protection L electronic trip level	scaled *100	N/A	{ 0.4 … 1 } In, step 0.01 In	1 In	**Valid for LSIG, LSI**
	30342	0342	0341	0155	1	N/A		Protection L electronic trip delay	scaled *10	N/A	See Table 28	18 s	**Valid for LSIG, LSI**
	30343	0343	0342	0156	1	N/A		Protection S electronic trip level	scaled *10	N/A	{ 0.6 … 10 } In, step 0.1 In	10 In	
	30344	0344	0343	0157	1	N/A		Protection S electronic trip delay	scaled *100	N/A	{ 0.05 … 0.5 } s, step 0.01 s	0.5 s	
	30345	0345	0342	0158	1	N/A		Protection I electronic trip level	scaled *10	N/A	See Table 28	4 In	
	30346	0346	0345	0159	1	N/A		Protection G electronic trip level	scaled *100	N/A	{ 0.2 … 1 } In, step 0.01 In	1 In	**Valid for LSIG**
	30347	0347	0346	015A	1	N/A		Protection G electronic trip delay	scaled *100	N/A	{ 0.1 … 0.8 } s, step 0.01 s	0.8 s	**Valid for LSIG**
	30348	0348	0347	015B	1	N/A			Bit field	bit 0 Protection L electronic pre-alarm disable	[Enabled (0) | Disabled (1)]	0	**Valid for LSIG, LSI**
										bit 1 Protection S electronic disable	[Enabled (0) | Disabled (1)]	1	
										bit 2 Protection S electronic curve type	[Definite Time (0) | Inverse Time (1)]	1	
										bit 3 Protection I electronic disable	[Enabled (0) | Disabled (1)]	0	
										bit 4 Protection G electronic disable	[Enabled (0) | Disabled (1)]	1	**Valid for LSIG**

Table 29. AI – Buffer 'Present Electronic Parameters'

CB Type	Protection L electronic time delay	Protection I electronic threshold
T4-320 I T5-630 I T5-600 UL	3 … 12 s step 0.5 s	1.5 … 10 IN step 0.1 IN
T4 - T5	3 … 18 s step 0.5 s	1.5 … 12 IN step 0.1 IN
T6	3 … 18 s step 0.5 s	1.5 … 12 IN step 0.1 IN

Table 30. Electronic parameters limitation according to CB type

NB: if these data are not valid, an ER = 04 is returned and the relevant bit is set into 'Status' structure.

7.3.11 Buffer "Product Execution"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Product Execution	**30350**	**0350**	**0349**	**015D**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Range	Default
Product Execution	**30350**	**0350**	**0349**	**015D**	**1**						
	30350	0350	0349	015D	1			Product Execution		[LSI (0) ¦ LSIG (1) ¦ SI (2)]	

Table 31. AI - Buffer 'Product Execution'

NB: if these data are not valid, an ER = 04 is returned

NB: Product execution SI is available only from SW version 3.00

7.3.12 Buffer "Device Serial Number"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Device Serial Number	**30352**	**0352**	**0351**	**015F**	**8**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Range	Default
Device Serial Number	**30352**	**0352**	**0351**	**015F**	**8**						
	30352	0352	0351	015F	8			Device Serial Number	1 byte for character (ASCII)		

NB: characters are right aligned. If there are not used characters, they're zero-filled.

Table 32. AI - Buffer 'Device Serial Number'

7.3.13 Buffer "Communication Parameters"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Communication Parameters	**30361**	**0361**	**0360**	**0168**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Bit field Structure	Range	Default
Communication Parameters	**30361**	**0361**	**0360**	**0168**	**1**							
	30361	0361	0360	0168	1				Bit field	bit 11 Addressing Type	[ABB (0) | Standard (1)]	Standard
										bit 9 – bit 10 Parity	00 = Even	Even
											01 = Odd	
											10 = None	
										bit 8 Baud Rate	[9600 (0) | 19200 (1)]	19200
										bit 0 – bit 7 Slave Address	{1 … 247}	247

Table 33. AI - Buffer 'Communication Parameters'

NB: if these data are not valid, an ER = 04 is returned and the default set is used.

7.3.14 Buffer "System Disconnection Timeout"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
System Disconnection Timeout	**30363**	**0363**	**0362**	**016A**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Range	Default
System Disconnection Timeout	**30363**	**0363**	**0362**	**016A**	**1**						
	30363	0363	0362	016A	1					{0 … 6000} tenths of ms, step 1 tenth of ms	0 seconds for PR222DS/P 1 seconds for PR222DS/PD

Table 34. AI - Buffer 'System Disconnection Timeout'

The value is expressed in tenth of milliseconds. For example, if the value read is 10, it means 100 ms.
NB: if these data are not valid, an ER = 04 is returned

7.3.15 Buffer "Protection Unit Nominal Current"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Protection Unit Nominal Current	**30365**	**0365**	**0364**	**016C**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Range	Default
Protection Unit Nominal Current	**30365**	**0365**	**0364**	**016C**	**1**						
	30365	0365	0364	016C	1					See Table 36	

Table 35. AI -Buffer 'Protection Unit Nominal Current'

The nominal current can assume the following values (no control is made on data validity):

100 A
150 A
200 A
250 A
300 A
400 A
600 A
800 A

Table 36. Nominal Current allowed values

NB: if these data are not valid, an ER = 04 is returned

7.3.16 Buffer "CB type"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
CB type	**30367**	**0367**	**0366**	**016E**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Range	Default
CB type	**30367**	**0367**	**0366**	**016E**	**1**						
	30367	0367	0366	016E	1			CB Type		See Table 38	

Table 37. AI – Buffer 'CB Type'

The CB type can assume the following values, expressed by an index (no control is made on data validity):

Index	CB Type
0	T4
1	T5
2	T6

Table 38. CB type allowed values

7.3.17 Buffer "SW version"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
SW version	**30371**	**0371**	**0370**	**0172**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address - 1	Relative Address - 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Bit field Structure	Range	Default
SW version	**30371**	**0371**	**0370**	**0172**	**1**							
	30371	0371	0370	0172	1			SW version	MM.mm			

Table 39. AI - Buffer 'SW version'

7.3.18 Buffer "Device version"

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items
Device version	**30373**	**0373**	**0372**	**0174**	**1**

and these are the relevant items:

Section	Absolute Address	Relative Address	Relative Address – 1	Relative Address – 1 (HEX)	Number of items	HIGH byte	LOW byte	Description	Format	Bit field Structure	Range	Default
Device version	**30373**	**0373**	**0372**	**0174**	**1**							
	30373	0373	0372	0174	1			Device version			[PR222DS-P (0) ǀ PR222DS/PD (1)]	

Table 40. AI – Buffer 'Device version'

8. Revision History

8.1 Revision a – 13/02/2006

First release.