SPA-ZC 302
Profibus-DPV1 SPA Gateway

Standard Configuration Templates

User's Manual

1. About this manual

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1.3. General

This manual describes the standard configurations that are designed to be used with SPA-ZC 302 gateways. The information is needed when a Profibus master is configured in accordance with the system that the gateway is used in. You can build a multislave configuration by using the configuration templates described in this manual. For more information, refer to the SPA-ZC 302 Installation and Commissioning manual.

1.4. Use of symbols

This publication includes warning, caution, and information icons that point out safety related conditions or other important information. It also includes tip icons to point out useful information to the reader. The corresponding icons should be interpreted as follows:

The warning icon indicates the presence of a hazard which could result in personal injury.

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Although warning hazards are related to personal injury, and caution hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

1.5. Terminology

The following is a list of terms associated with this product that you should be familiar with. The list contains terms that are unique to ABB or have a usage or definition that is different from standard industry usage.

Term	Description
PCT	Profibus DP/SPA Gateway configuration tool
RE500	Product family which contains the products REF 54_, REM 54_, REX 521, RET 54_, REJ 500, and REU 500.
SPA	Data communication protocol developed by ABB
SPACOM	ABB product family

1.6. Abbreviations

DC	Direct current
DP	Data processing
GSD	Geräte Stamm Datei, basic Profibus device
HV	High voltage
LV	Low voltage
RTD	Resistance temperature detector

1.7. Related documents

Name of the manual	MRS number
SPA-ZC 302 Installation and Commissioning Manual	1MRS755014
SPA-ZC 302 configuration CD	1MRS752534-MCD

1.8. Document revisions

Version	Revision number	Date	History
A	1.03.03	14.11.2003	Document created
B		27.01.2004	Document updated
C	2.0	16.05.2005	Tables on new templates added

1.9. Safety information

	Dangerous voltages can occur on the connectors, even though the auxiliary voltage has been disconnected.
	National and local electrical safety regulations must always be followed.
	The device contains components which are sensitive to electrostatic discharge. Unnecessary touching of electronic components must therefore be avoided.
	The frame of the device has to be carefully earthed.
	Only a competent electrician is allowed to carry out the electrical installation.
	Non-observance can result in death, personal injury or substantial property damage.
	Breaking the sealing tape on the upper handle of the device will result in loss of warranty and proper operation will no longer be guaranteed.
	Do not touch the inside of the case. The adapter case internals may contain high voltage potential and touching these may cause personal injury.

2. Introduction

This manual describes the standard configurations that are designed for use with SPA-ZC 302 gateways. The information is needed when a Profibus master is configured in accordance with the system that the gateway is used in.
The SPA-ZC 302 gateway is called gateway hereinafter in this document.

Table 2.-1 Standard configuration templates

Relay type[a]	Standard configuration template																						
	SPAJ_SPAU	**SPAM150**	**SPAU140**	**SACO16A3**	**SACO16D1_3**	**SACO64D4**	**SPAU341**	**SPAD346**	**SPAD346C3**	**REM 610**	**REF 610**	**REX 521**	**REX521_M01_M02**	**REX521_H05_H07**	**REX521_H05_08_09**	**RE500**	**RE500_Motor**	**REM 54_**	**RE500_Feeder**	**RET54_Basic**	**RET54_Multi**	**RET54_Control**	**RET 521**
SPAJ 140 C	X																						
SPAJ 141 C	X																						
SPAJ 144 C	X																						
SPAJ 160 C	X																						
SPAM 150 C		X																					
SPAU 130 C	X																						
SPAU 140 C			X																				
SACO 16A3				X																			
SACO 16D1					X																		
SACO 16D3					X																		
SACO 64D4						X																	
SPAU 341							X																
SPAD 346								X															
SPAD 346 C3									X														
REM 610										X													
REF 610											X												
REF 541																X			X				
REF 541R																X	X		X				
REF 543																X			X				
REF 543R																X	X		X				
REF 545																X			X				
REM 543																X		X	X				
REM 543R																X	X	X	X				
REM 545																X		X	X				
REM 545R																X	X	X	X				
REX 521 B01												X											
REX 521 B02												X											
REX 521 H02												X											
REX 521 H03												X											
REX 521 H04												X											
REX 521 H05												X		X	X								
REX 521 H06												X											
REX 521 H07												X		X									

Table 2.-1 Standard configuration templates (Continued)

Relay type[a]	Standard configuration template																						
	SPAJ_SPAU	SPAM150	SPAU140	SACO16A3	SACO16D1_3	SACO64D4	SPAU341	SPAD346	SPAD346C3	REM 610	REF 610	REX 521	REX521_M01_M02	REX521_H05_H07	REX521_H05_08_09	RE500	RE500_Motor	REM 54_	RE500_Feeder	RET54_Basic	RET54_Multi	RET54_Control	RET 521
REX 521 H08												X			X								
REX 521 H09												X			X								
REX 521 M01												X	X										
REX 521 M02												X	X										
RET 54 Basic																X				X			
RET 54 Multi																X					X		
RET 54 Control																						X	
RET 521																							X

a. Protection relay types marked with an R contain a RTD card that enable use of analog inputs.

2.1. General

Signals that can be transferred cyclically from the protection relay to the control system, and vice versa, are pre-defined in the standard configuration templates. The standard configuration templates contain most of the data needed for the configuration to work properly when it is downloaded to the gateway. Only data that is protection relay dependent need to be defined by the user, such as the SPA slave address and the scaling factors. The configurations are downloaded to the gateway by using Profibus Configuration Tool (PCT) software. For more information about the downloading and Profibus Configuration Tool, refer to Installation and Commissioning manual.

Each configuration contains a list of protection relays that may be used with that specific configuration, not excluding the possibility to use other relays as well.

The configurations contain different information depending on the protection relay they are connected to. In the initialization phase, the gateway checks which of the parameters defined in the configuration are actually available in the relay. This check is done because some of the standard configuration templates support several relays (refer to Table 2.-1). If there are parameters that are not available in the relay, they will be excluded from the cyclic polling schema, and the position in the Profibus data stream will have the value 0xFF, 0xFFFF or 0xFFFFFFFF according to the size of the data, except for values that are updated by events, they will have the value 0x0F. In addition, the Configuration Warning bit will be set to high in the Module Status Word (Bit 5 = 1). For details on the gateway initialization and the Module Status Word description, refer to the Installation and Commissioning manual.

The signal mapping between the SPA protocol and Profibus DP is done in the following order:

1. Analog input values
2. Binary input data
3. Analog output data
4. Binary output data

The data mapping is suitable for several applications. In some applications, you may need less signals. You can delete the unnecessary signals before downloading to the gateway. The tool automatically updates the offset table. The new offset can be read from the PCT template info window, or you can export the configuration template file to Excel by selecting **File** > **Export CSV**. The calculated offset data can be read from the exported configuration template.

3. Data mapping table explanations

3.1. Cyclic signal table

The cyclic signal table defines which signals are mapped between the two protocols. Thus, it describes the message structure of the Profibus DP message on the bus, and they are polled in the same order as they are listed in the signal table. The signals are transferred with the most significant byte (MSB) first: the first byte is the high byte of the module status word, the second byte is the low byte of the module status word, the next byte is the highest byte of the following signal, and so forth.

Table 3.1.-1 Cyclic table principle

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	

Offset: The offset in bytes from the beginning of the message frame to the start of the signal.

Data size: The width of the signal in the data frame transferred to the master. The data is of unsigned type, unless otherwise stated in the tables.

Direction: The direction of the signal data seen from the Profibus DP master's perspective.

Signal: A descriptive name of the signal.

SPA parameter:

Channel: The channel used in the SPA protocol part of the gateway. The formats are FCh and LCh.

Code: The SPA protocol parameter name used on the SPA protocol part of the gateway. The formats are Cat, FDno, and LDno.

First Ch/ Last Ch and First Dno/ Last: Allows gateway to read multible binary data by using one SPA command:

- This enables faster updating of data, which is always polled and not updated by events.
- Consumes less bytes on the profibus side.

In the profibus side, this data is packed in 2 bytes. First data is in bit number 0 and second in bit number 1 and so forth.

If the datatype is P (= Packed) FirstCh/Last Ch and First Dno/LastDno format is used.

In case the data type is packed, the datatype numbering of Ch and Dno has to be consecutive.

Event:

Channel: The channel from which the event comes.

Code — When an event code, such as E1, is defined for a data, the initial value for this data is read from the SPA parameter. Subsequently, updating this data is done by using the defined events, for example, based on "E1". For more information, see Chapter 4. Configuration Templates.

Description: A short description of the functionality of the mapped signal.

3.2. Acyclic signal table

The acyclic signal table defines which signals are mapped between the two protocols. These messages are not tied to any poll cycle, and can thus be used independently whenever the user wants to.

The acyclic property of the gateway can only be used when it is connected to a master system that is compliant with Profibus DP version 1.

The acyclic messages are called indirect SPA messages in this gateway implementation and the handling is described in more detail in the Installation and Commissioning manual.

Table 3.2.-1 Acyclic table principle

Index	Data size	Direction	SPA parameter		Description
			Channel	Code	

Index — Enumeration of acyclic signals.

Data size — The width of the signal in the data frame transferred to the master.

Direction — The direction of the signal data seen from the Profibus DP master's perspective.

Channel — The channel used in the SPA protocol part of the gateway. The defined channel number is used in REF, REM, and REX relays only. SPACOM relays use channel zero for these signals.

Code — The SPA protocol parameter name, or event, used on the SPA protocol part of the gateway.

Description — A short description of the functionality of the mapped signal.

The offset numbers given in this template manual are based on the full template. When you delete a signal by using the tool, the offset number changes.

4. Configuration Templates

4.1. SPAJ_SPAU configuration

The general features of this configuration are:

- SPACOM series protection relay support
- 22 bytes of input data consisting of 3-phase
  - Current or voltage measurement
  - START and TRIP detection of two stages of non-directional overcurrent or over- and undervoltage.
- Three pre-defined acyclic signals for change of setting bank and reset of output relays

4.1.1. Supported signals in SPAJ_SPAU

The following tables shows the signals and their descriptions in SPAJ_SPAU.

Table 4.1.1-1 Cyclic signals and their descriptions supported when using SPAJ 140 C, SPAJ141 C, or SPAJ 144 C

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	SPA Device status =IRF	0	V169			
6	DWORD	R	Phase 1 current	0	I1			
10	DWORD	R	Phase 2 current	0	I2			
14	DWORD	R	Phase 3 current	0	I3			
18	BYTE	R	Input 4	0	O1	0	"E1, E2"	I> Start
19	BYTE	R	Input 5	0	O2	0	"E3, E4"	I> Trip
20	BYTE	R	Input 6	0	O3	0	"E5, E6"	I>> Start
21	BYTE	R	Input 7	0	O4	0	"E7, E8"	I>> Trip

Table 4.1.1-2 Cyclic signals and their descriptions supported when using SPAJ 160 C

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	SPA Device status =IRF	0	V169			
6	DWORD	R	Phase 1 current	0	I1			
10	DWORD	R	Phase 2 current	0	I2			
14	DWORD	R	Phase 3 current	0	I3			
18	BYTE	R	Input 4	0	O1	0	"E1, E2"	Ib> Start
19	BYTE	R	Input 5	0	O2	0	"E3, E4"	Ib> Trip
20	BYTE	R	Input 6	0	O3	0	"E5, E6"	Ia> Start

Table 4.1.1-2 Cyclic signals and their descriptions supported when using SPAJ 160 C (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
21	BYTE	R	Input 7	0	O4	0	"E7, E8"	Ia> Trip

Table 4.1.1-3 Cyclic signals and their descriptions supported when using SPAU 130 C

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	SPA Device status =IRF	0	V169			
6	DWORD	R	Phase 1 current	0	I1			
10	DWORD	R	Phase 2 current	0	I2			
14	DWORD	R	Phase 3 current	0	I3			
18	BYTE	R	Input 4	0	O1	0	"E1, E2"	U > Start
19	BYTE	R	Input 5	0	O2	0	"E3, E4"	U > Trip
20	BYTE	R	Input 6	0	O3	0	"E5, E6"	U < Start
21	BYTE	R	Input 7	0	O4	0	"E7, E8"	U < Trip

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

The following signals are available only when using communication masters compliant with Profibus DP version 1.

Table 4.1.1-4 Acyclic signals supported

Index	Data size	Direction	SPA parameter		Description
			Channel	Code	
1	BYTE	W	0	V101	Reset of output relays at latched outputs 1 = output relays and all at latched output information from the display are reset
2	BYTE	W	0	V102	Reset of output relays and recorded data 1 = output relays and recorded data registers are reset
3	BYTE	"R, W"	0	V150	Remote control of settings 0 = main settings activated 1 = second settings activated

4.2. SPAM150 configuration

The general features of this configuration are:

- 37 bytes of input data consisting of
  - Current measurement
  - Cooling time indication
  - START and TRIP detection of thermal protection, two stages of overcurrent, neutral, under, and D current
- Three pre-defined acyclic signals for reset of output relays

4.2.1. Supported signals in SPAM150

The following table shows the signals and their descriptions supported in SPAM150.

Table 4.2.1-1 Cyclic signals supported when using SPAM 150 C

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	SPA Device status =IRF	0	V169			
6	DWORD	R	Phase 1 current	0	I1			
10	DWORD	R	Phase 2 current	0	I2			
14	DWORD	R	Phase 3 current	0	I3			
18	DWORD	R	Neutral current	0	I4			
22	WORD	R	Estimated time to enable of motor restart	0	V3			
24	BYTE	R	Iq start signal	0	O1	0	"E3, E4"	
25	BYTE	R	Iq Prior alarm	0	O2	0	"E5, E6"	
26	BYTE	R	Iq trip signal	0	O3	0	"E7, E8"	
27	BYTE	R	Is> start signal	0	O4	0	"E9, E10"	
28	BYTE	R	Is> trip signal	0	O5	0	"E11, E12"	
29	BYTE	R	I>> start signal	0	O6	0	"E13, E14"	
30	BYTE	R	I>> trip signal	0	O7	0	"E15, E16"	
31	BYTE	R	Io> start signal	0	O8	0	"E17, E18"	
32	BYTE	R	Io> trip signal	0	O9	0	"E19, E20"	
33	BYTE	R	D I start signal	0	O10	0	"E21, E22"	
34	BYTE	R	D I trip signal	0	O11	0	"E23, E24"	
35	BYTE	R	I< start signal	0	O12	0	"E25, E26"	
36	BYTE	R	I< trip signal	0	O13	0	"E27, E28"	

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

The following signals are available only when using communication masters compliant with Profibus DP version 1.

Table 4.2.1-2 Acyclic signals supported in SPAM150

Index	Data size	Direction	SPA parameter		Description
			Channel	Code	
1	BYTE	W	0	V101	Reset of output relays at latched outputs 1 = output relays and all at latched output information from the display are reset
2	BYTE	W	0	V102	Reset of output relays and recorded data 1 = output relays and recorded data registers are reset

4.3. SPAU140 configuration

The general features of this configuration are:

- 54 bytes of input data consisting of:
  - Voltage and voltage difference measurement
  - Frequency and frequency difference measurement
  - START and CLOSE detection of synchro check and voltage check protection
- Three pre-defined acyclic signals for change of setting bank and reset of output relays

4.3.1. Supported signals in SPAU140

The following table shows the signals and their descriptions supported in SPAU140.

Table 4.3.1-1 Cyclic signals supported when using SPAU 140 C

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	SPA Device status =IRF	0	V169			
6	DWORD	R	Measured phase 1 voltage	0	I1			
10	DWORD	R	Measured phase 2 voltage	0	I2			
14	DWORD	R	Measured phase 3 voltage	0	I3			
18	signed DWORD	R	Measured voltage difference U1-U3	0	I4			
22	signed DWORD	R	Measured voltage difference U2-U3	0	I5			
26	DWORD	R	Measured frequency of U3	0	I6			
30	DWORD	R	Measured frequency difference U1-U3	0	I7			
34	DWORD	R	Measured frequency difference U2-U3	0	I8			
38	signed DWORD	R	Measured phase angle difference U1-U3	0	I9			
42	signed DWORD	R	Measured phase angle difference U2-U3	0	I10			

Table 4.3.1-1 Cyclic signals supported when using SPAU 140 C (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
46	BYTE	R	Syncho check U1-U3 start signal	0	O1	0	"E1, E2"	
47	BYTE	R	Syncho check U1-U3 closing permission/command	0	O2	0	E3	
48	BYTE	R	Voltage check U1-U3 start signal	0	O3	0	"E4, E5"	
49	BYTE	R	Voltage check U1-U3 closing permission/command	0	O4	0	E6	
50	BYTE	R	Syncho check U2-U3 start signal	0	O5	0	"E7, E8"	
51	BYTE	R	Syncho check U2-U3 closing permission/command	0	O6	0	E9	
52	BYTE	R	Voltage check U2-U3 start signal	0	O7	0	"E10, E11"	
53	BYTE	R	Voltage check U2-U3 closing permission/command	0	O8	0	E12	

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

The following signals are available only when using communication masters compliant with Profibus DP version 1:

Table 4.3.1-2 Acyclic signals supported in SPAU140

Offset	Data size	Direction	SPA parameter		Description
			Channel	Code	
1	BYTE	W	0	V102	Reset of recorded data 1 = recorded data registers are reset
2	BYTE	"R, W"	0	V150	Remote control of settings 0 = main settings activated 1 = second settings activated

4.4. SACO 16A3 configuration

The general features of this configuration are:

- 74 bytes of input data consisting of:
  - Measurement values of all input channels
  - Status of all output relays
  - Pre-defined acyclic signals for audible alarm silence, and for alarm acknowledgement and resetting

4.4.1. Supported signals in SACO 16A3

The following table shows the signals and their descriptions supported in SACO 16A3.

Table 4.4.1-1 Cyclic signals supported in SACO 16A3

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	Input channel 1	1	I1			
8	DWORD	R	Input channel 2	2	I1			
12	DWORD	R	Input channel 3	3	I1			
16	DWORD	R	Input channel 4	4	I1			
20	DWORD	R	Input channel 5	5	I1			
24	DWORD	R	Input channel 6	6	I1			
28	DWORD	R	Input channel 7	7	I1			
32	DWORD	R	Input channel 8	8	I1			
36	DWORD	R	Input channel 9	9	I1			
40	DWORD	R	Input channel 10	10	I1			
44	DWORD	R	Input channel 11	11	I1			
48	DWORD	R	Input channel 12	12	I1			
52	DWORD	R	Input channel 13	13	I1			
56	DWORD	R	Input channel 14	14	I1			
60	DWORD	R	Input channel 15	15	I1			
64	DWORD	R	Input channel 16	16	I1			
68	BYTE	R	Output 1 state	0	O1			
69	BYTE	R	Output 2 state	0	O2			
70	BYTE	R	Output 3 state	0	O3			
71	BYTE	R	Output 4 state	0	O4			
72	BYTE	R	Output 5 state	0	O5			
73	BYTE	R	Output 6 state	0	O6			

This configuration template is not backwards compatible with the gateway versions before 2.0. Therefore, it should be downloaded to the gateway version 2.0 or later. The configuration template contains packed binary data that is supported in version 2.0 or later of the gateway.

4.5. SACO16D1_3 configuration

The general features of this configuration are:

- SPACOM series alarm annunciator support
- 8 bytes of input data consisting of:
  - Input channel states
  - Output relay states

4.5.1. Supported signals in SACO16D1_3

The following table shows the signals and their descriptions supported in SACO 16D1_3.

Table 4.5.1-1 Cyclic signals supported in SACO 16D1 and SACO 16D3

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	All 16 channels module 1	1/16	I1			
6	BYTE	R	Output 1 status	0	O1			
7	BYTE	R	Output 2 status	0	O2			

Table 4.5.1-2 Acyclic signals supported in SACO16D1 and SACO 16D3

Index	Data size	Direction	SPA parameter		Description	
			Channel	Code		
1	BYTE	W	0	V2	Silence Module 1	Module 1
2	BYTE	W	0	V3	Ack Module 1	Module 1
3	BYTE	W	0	V100	RESET Module 1	Module 1

This configuration template is not backwards compatible with the gateway versions before 2.0. Therefore, it should be downloaded to the gateway version 2.0 or later. The configuration template contains packed binary data that is supported in version 2.0 or later of the gateway.

4.6. SACO64D4 configuration

The general features of this configuration are:

- 12 bytes of input data consisting of:
  - Status of all input channels for each SACO module
  - Pre-defined acyclic signals for audible alarm silence, and for alarm acknowledgement and resetting

4.6.1. Supported signals in SACO 64D4

The following table shows the signals and their descriptions supported in SACO 64D4.

Table 4.6.1-1 Cyclic signals supported in SACO 64D4

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	All 16 channels module 1	1/16	I1			Module 1
6	WORD	R	All 16 channels module 2	1/16	I1			Module 2
8	WORD	R	All 16 channels module 3	1/16	I1			Module 3
10	WORD	R	All 16 channels module 4	1/16	I1			Module 4

Table 4.6.1-2 Acyclic signals supported in SACO 64D4

Index	Data size	Direction	SPA parameter		Description	
			Channel	Code		
1	BYTE	W	0	V2	Silence Module 1	Module 1
2	BYTE	W	0	V3	Ack Module 1	Module 1
3	BYTE	W	0	V100	RESET Module 1	Module 1
4	BYTE	W	0	V2	Silence Module 2	Module 2
5	BYTE	W	0	V3	Ack Module 2	Module 2
6	BYTE	W	0	V100	RESET Module 2	Module 2
7	BYTE	W	0	V2	Silence Module 3	Module 3
8	BYTE	W	0	V3	Ack Module 3	Module 3
9	BYTE	W	0	V100	RESET Module 3	Module 3
10	BYTE	W	0	V2	Silence Module 4	Module 4
11	BYTE	W	0	V3	Ack Module 4	Module 4
12	BYTE	W	0	V100	RESET Module 4	Module 4

This configuration template is not backwards compatible with the gateway versions before 2.0. Therefore, it should be downloaded to the gateway version 2.0 or later. The configuration template contains packed binary data that is supported in version 2.0 or later of the gateway.

4.7. SPAU341 configuration

The general features of this configuration are:

- 36 bytes of input data consisting of:
  - Current measurements
  - Phase-to-phase voltage
  - Measured phase shift
  - Raise and lower activation
  - Overcurrent and undervoltage blocking, and overvoltage detection
  - Auto/Man position

4.7.1. Supported signals in SPAU341

The following table shows the signals and their descriptions supported in SPAU341.

Table 4.7.1-1 Cyclic signals and their descriptions supported in SPAU 341

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	Spa device 1 status = IRF	0	V169			SPCU 1D50
6	WORD	R	Spa device 2 status = IRF	0	V169			SPCN 1D56
8	DWORD	R	Phase to phase voltage Um	0	I1			SPCU 1D50
12	DWORD	R	Measured current phase L1	0	I2			SPCU 1D50
16	DWORD	R	Measured current phase L2	0	I3			SPCU 1D50
20	DWORD	R	Measured current phase L3	0	I4			SPCU 1D50
24	DWORD	R	Measured phase shift	0	I5			SPCU 1D50
28	WORD	R	Present tap changer position	0	V3			SPCN 1D56
30	BYTE	R	Raise activated	0	O1	0	"E5, E6"	SPCU 1D50
31	BYTE	R	Lower activated	0	O2	0	"E7, E8"	SPCU 1D50
32	BYTE	R	Overcurrent blocking signal	0	O3	0	"E25, E26"	SPCU 1D50
33	BYTE	R	Undervoltage blocking signal	0	O4	0	"E27, E28"	SPCU 1D50
34	BYTE	R	Overvoltage detection	0	O5	0	"E23, E24"	SPCU 1D50
35	BYTE	R	Auto/Man	0	O6	0		SPCU 1D50

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.8. SPAD346 configuration

The general features of this configuration are:

- 58 bytes of input data consisting of:
  - Current measurements
  - TRIP detection of two stages of differential current protection
  - START and TRIP detection of earth-fault protection
  - START and TRIP detection of three stages of overcurrent protection
- Three pre-defined acyclic signals for change of setting bank and reset of output relays

This configuration is designed to be used in differential protection.

4.8.1. Supported signals in SPAD346

The following table shows the signals and their descriptions supported in SPAD346.

Table 4.8.1-1 Cyclic signals supported when using SPAD 346 C

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	SPCD 3D53 status =IRF	0	V169			SPCD 3D53
6	WORD	R	SPCD 2D55 status =IRF	0	V169			SPCD 2D55
8	WORD	R	SPCJ 4D28 status =IRF	0	V169			SPCJ 4D28
10	DWORD	R	Phase 1 HV current	0	I1			SPCD 3D53
14	DWORD	R	Phase 2 HV current	0	I2			SPCD 3D53
18	DWORD	R	Phase 3 HV current	0	I3			SPCD 3D53
22	DWORD	R	Phase 1 differential current	0	I4			SPCD 3D53
26	DWORD	R	Phase 2 differential current	0	I5			SPCD 3D53
30	DWORD	R	Phase 3 differential current	0	I6			SPCD 3D53
34	DWORD	R	Phase 1 LV current	0	I7			SPCD 3D53
38	DWORD	R	Phase 2 LV current	0	I8			SPCD 3D53
42	DWORD	R	Phase 3 LV current	0	I9			SPCD 3D53
46	BYTE	R	3DI> operation	0	O1	0	"E1, E2"	SPCD 3D53
47	BYTE	R	3DI>> operation	0	O2	0	"E3, E4"	SPCD 3D53
48	BYTE	R	DIo1 start signal	0	O1	0	"E1, E2"	SPCD 2D55
49	BYTE	R	DIo1 trip signal	0	O2	0	"E3, E4"	SPCD 2D55
50	BYTE	R	DIo2 start signal	0	O4	0	"E7, E8"	SPCD 2D55
51	BYTE	R	DIo2 trip signal	0	O5	0	"E9, E10"	SPCD 2D55
52	BYTE	R	I> start signal	0	O1	0	"E1, E2"	SPCJ 4D28
53	BYTE	R	I> trip signal	0	O2	0	"E3, E4"	SPCJ 4D28
54	BYTE	R	I>> start signal	0	O3	0	"E5, E6"	SPCJ 4D28
55	BYTE	R	I>> trip signal	0	O4	0	"E7, E8"	SPCJ 4D28
56	BYTE	R	I>>> start signal	0	O5	0	"E9, E10"	SPCJ 4D28
57	BYTE	R	I>>> trip signal	0	O6	0	"E11, E12"	SPCJ 4D28

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

The following signals are available only when using communication masters compliant with Profibus DP version 1.

Table 4.8.1-2 Acyclic signals supported in SPAD 346

Index	Data size	Direction	SPA parameter		Description	
			Channel	Code		
1	BYTE	W	0	V101	Reset of output relays at latched outputs 1 = output relays and all at latched output information from the display are reset	SPCD 3D53
2	BYTE	W	0	V102	Reset of output relays and recorded data 1 = output relays and recorded data registers are reset	SPCD 3D53
3	BYTE	"R, W"	0	V150	Remote control of settings 0 = main settings activated 1 = second settings activated	SPCD 3D53
4	BYTE	W	0	V101	Reset of output relays at latched outputs 1 = output relays and all at latched output information from the display are reset	SPCD 2D55
5	BYTE	W	0	V102	Reset of output relays and recorded data 1 = output relays and recorded data registers are reset	SPCD 2D55
6	BYTE	"R, W"	0	V150	Remote control of settings 0 = main settings activated 1 = second settings activated	SPCD 2D55
7	BYTE	W	0	V101	Reset of output relays at latched outputs 1 = output relays and all at latched output information from the display are reset	SPCJ 4D28
8	BYTE	W	0	V102	Reset of output relays and recorded data 1 = output relays and recorded data registers are reset	SPCJ 4D28
9	BYTE	"R, W"	0	V150	Remote control of settings 0 = main settings activated 1 = second settings activated	SPCJ 4D28

4.9. SPAD346C3 configuration

The general features of this configuration are:

- 44 bytes of input data consisting of:
  - Current measurements
  - TRIP detection of two stages of differential current protection
  - START and TRIP detection of earth-fault protection
  - Three pre-defined acyclic signals for changing setting bank, and for resetting output relays

This configuration can be used in differential protection.

4.9.1. Supported signals in SPAD346C3

The following table shows the signals and their descriptions supported in SPAD346C3.

Table 4.9.1-1 Cyclic signals supported in SPAD 346 C3

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	SPCD 3D53 status =IRF	0	V169			SPCD 3D53
6	DWORD	R	Phase 1 HV current	0	I1			SPCD 3D53
10	DWORD	R	Phase 2 HV current	0	I2			SPCD 3D53
14	DWORD	R	Phase 3 HV current	0	I3			SPCD 3D53
18	DWORD	R	Phase 1 differential current	0	I4			SPCD 3D53
22	DWORD	R	Phase 2 differential current	0	I5			SPCD 3D53
26	DWORD	R	Phase 3 differential current	0	I6			SPCD 3D53
30	DWORD	R	Phase 1 LV current	0	I7			SPCD 3D53
34	DWORD	R	Phase 2 LV current	0	I8			SPCD 3D53
38	DWORD	R	Phase 3 LV current	0	I9			SPCD 3D53
42	BYTE	R	3DI> operation	0	O1	0	"E1, E2"	SPCD 3D53
43	BYTE	R	3DI>> operation	0	O2	0	"E3, E4"	SPCD 3D53

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

Table 4.9.1-2 Acyclic signals supported in SPAD346C3

Index	Data size	Direction	SPA parameter		Description	
			Channel	Code		
1	BYTE	W	0	V101	Reset of output relays at latched outputs 1 = output relays and all at latched output information from the display are reset	SPCD 3D53
2	BYTE	W	0	V102	Reset of output relays and recorded data 1 = output relays and recorded data registers are reset	SPCD 3D53
3	BYTE	"R, W"	0	V150	Remote control of settings 0 = main settings activated 1 = second settings activated	SPCD 3D53

4.10. REM 610 configuration

The general features of this configuration are:

- 95 bytes of input data consisting of:
  - Current measurement
  - Negative-phase-sequence current

- Thermal level
- Time to next possible motor start-up
- Temperatures from RTD 1-6
- Resistance values of thermistors 1 & 2
- Start (and/or alarm) and trip from:

  thermal overload protection

  motor start-up supervision

  over-/undercurrent protection

  earth-fault protection

  unbalance protection

  phase reversal protection

  temperature protection

  external trip state

  motor start up signal state

  restart inhibit signal state
- Binary input states

This configuration is designed to be used in motor protection.

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.10.1. Supported signals in REM 610

The following table shows the signals and their descriptions supported in REM 610.

Table 4.10.1-1 Cyclic signals supported in REM 610

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	Spa device status = IRF	0	V169			
6	WORD	R	Warning code	0	V168			
10	DWORD	R	Current measured on phase I L1	0	I1			
14	DWORD	R	Current measured on phase I L2	0	I2			
18	DWORD	R	Current measured on phase I L3	0	I3			
22	DWORD	R	Measured earth-fault current	0	I4			
26	DWORD	R	Calculated NPS current	0	I5			
30	DWORD	R	Thermal level	0	V60			

Table 4.10.1-1 Cyclic signals supported in REM 610 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
34	DWORD	R	Time to next possible motor start up	0	V62			
38	BYTE	R	Temperature from RTD1	0	I11			
42	BYTE	R	Temperature from RTD2	0	I12			
46	BYTE	R	Temperature from RTD3	0	I13			
50	BYTE	R	Temperature from RTD4	0	I14			
54	BYTE	R	Temperature from RTD5	0	I15			
58	BYTE	R	Temperature from RTD6	0	I16			
62	BYTE	R	Thermistor1 resistance value	0	I17			
66	BYTE	R	Thermistor2 resistance value	0	I18			
70	BYTE	R	DI1 status	0	I6			
71	BYTE	R	DI2 status	0	I7			
72	BYTE	R	DI3 status	0	I8			
73	BYTE	R	DI4 status	0	I9			
74	BYTE	R	DI5 status	0	I10			
75	BYTE	R	Theta> start signal	0	O1	1	"E3, E4"	
76	BYTE	R	Theta> alarm signal	0	O2	1	"E5, E6"	
77	BYTE	R	Theta> trip signal	0	O3	1	"E7, E8"	
78	BYTE	R	Is2 x ts or Is> start signal	0	O4	1	"E15, E16"	
79	BYTE	R	Is2 x ts or Is> trip signal	0	O5	1	"E17, E18"	
80	BYTE	R	I>> start signal	0	O6	1	"E19, E20"	
81	BYTE	R	I>> trip signal	0	O7	1	"E21, E22"	
82	BYTE	R	I< start signal	0	O8	1	"E23, E24"	
83	BYTE	R	I< trip signal	0	O9	1	"E25, E26"	
84	BYTE	R	I0> start signal	0	O10	1	"E27, E28"	
85	BYTE	R	I0> trip signal	0	O11	1	"E29, E30"	
86	BYTE	R	I2> start signal	0	O12	1	"E31, E32"	
87	BYTE	R	I2> trip signal	0	O13	1	"E33, E34"	
88	BYTE	R	REV trip signal	0	O14	1	"E35, E36"	
89	BYTE	R	Motor start up	0	O16	1	"E1, E2"	
90	BYTE	R	Restart inhibit	0	O17	1	"E13, E14"	
91	BYTE	R	ThA> alarm signal	0	O18	2	"E21, E22"	
92	BYTE	R	ThA> trip signal	0	O19	2	"E23, E24"	
93	BYTE	R	ThB> alarm signal	0	O20	2	"E25, E26"	
94	BYTE	R	ThB> trip signal	0	O21	2	"E27, E28"	

This configuration template is not backwards compatible with the gateway versions before 2.0. Therefore, it should be downloaded to the gateway version 2.0 or later. The configuration template contains binary input data that uses the event channel feature supported in version 2.0 or later of the gateway.

4.11. REF 610 configuration

The general features of this configuration are:

- 59 bytes of input data consisting of:
  - Current measurement
  - Calculated phase discontinuity value
  - Thermal level
  - Circuit breaker indication
  - Arc detection
  - Start (and/or alarm) and trip from:
    thermal overload protection for cables
    overcurrent protection
    non-directional earth-fault protection
    phase discontinuity protection
    external trip state
  - Binary input states

This configuration can be used in feeder protection.

4.11.1. Supported signals in REF 610

The following table shows the signals and their descriptions supported in REF 610.

Table 4.11.1-1 Cyclic signals supported in REF 610

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	WORD	R	Spa device status = IRF	0	V169			
6	WORD	R	Warning code	0	V168			
10	DWORD	R	Current measured on phase IL1	0	I1			
14	DWORD	R	Current measured on phase IL2	0	I2			
18	DWORD	R	Current measured on phase IL3	0	I3			
22	DWORD	R	Measured earth-fault current	0	I4			
26	DWORD	R	Calculated phase discontinuity value	0	I5			
30	DWORD	R	Thermal level	0	V60			
34	BYTE	R	CB Indication	0	I7			
35	BYTE	R	Light detected (arc)	0	I6			
36	BYTE	R	DI1 status	0	I8			
37	BYTE	R	DI2 status	0	I9			
38	BYTE	R	DI3 status	0	I10			
39	BYTE	R	DI4 status	0	I11			
40	BYTE	R	DI5 status	0	I12			

Table 4.11.1-1 Cyclic signals supported in REF 610 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description
				Channel	Code	Channel	Code	
41	BYTE	R	I> start signal	0	O1	1	"E1, E2"	
42	BYTE	R	I> trip signal	0	O2	1	"E3, E4"	
43	BYTE	R	I>> start signal	0	O3	1	"E5, E6"	
44	BYTE	R	I>> trip signal	0	O4	1	"E7, E8"	
45	BYTE	R	I>>> start signal	0	O5	1	"E9, E10"	
46	BYTE	R	I>>> trip signal	0	O6	1	"E11, E12"	
47	BYTE	R	I0> start signal	0	O7	1	"E13, E14"	
48	BYTE	R	I0> trip signal	0	O8	1	"E15, E16"	
49	BYTE	R	I0>> start signal	0	O9	1	"E17, E18"	
50	BYTE	R	I0>> trip signal	0	O10	1	"E19, E20"	
51	BYTE	R	dI> start signal	0	O11	1	"E21, E22"	
52	BYTE	R	dI> trip signal	0	O12	1	"E23, E24"	
53	BYTE	R	Theta> start signal	0	O13	1	"E25, E26"	
54	BYTE	R	Theta> Alarm signal	0	O14	1	"E27, E28"	
55	BYTE	R	Theta> trip signal	0	O15	1	"E29, E30"	
56	BYTE	R	External trip	0	O16	1	"E39, E40"	
57	BYTE	R	Trip lockout	0	O17	1	"E37, E38"	
58	BYTE	R	CBFP trip	0	O18	1	"E41, E42"	

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

Table 4.11.1-2 Acyclic signals supported in REF 610

Index	Data size	Direction	SPA parameter		Description
			Channel	Code	
1	BYTE	W	0	V102	Clearing indications and memorized values and unlatching contacts

This configuration template is not backwards compatible with the gateway versions before 2.0. Therefore, it should be downloaded to the gateway version 2.0 or later. The configuration template contains binary input data that uses the event channel feature supported in version 2.0 or later of the gateway.

4.12. REX 521 configuration

The general features of this configuration are:

- 24 bytes of input data consisting of:
  - Current measurement
  - Start and trip indication from non-directional overcurrent protection
- Two pre-defined acyclic signals for change of setting bank

4.12.1. Supported signals in REX 521

The following table shows the signals and their descriptions supported in REX 521.

Table 4.12.1-1 Cyclic signals supported when using REX 521, B01, B02, M01, M02, H02, H03, H04, H05, H06, H07, H08, H09

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	24	V15			
8	DWORD	R	Phase 1 current	200	I1			MECU3A
12	DWORD	R	Phase 2 current	200	I2			MECU3A
16	DWORD	R	Phase 3 current	200	I3			MECU3A
20	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3Low
21	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3Low
22	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3High
23	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3High

The event mask must be set to match the values that are updated by using events codes, see relay manual for details.

The following signals are available only when using communication masters compliant with Profibus DP version 1.

Table 4.12.1-2 Cyclic signals supported when using REX 521, B01, B02, M01, M02, H01, H02, H03, H04, H05, H06, H07, H08, H09

Index	Data size	Direction	SPA parameter		Description/function block
			Channel	Code	
1	BYTE	R/W	31	V3	Remote control of settings for NOC3Low 0 = Group 1 1 = Group 2 2 = Group input
2	BYTE	R/W	32	V3	Remote control of settings for NOC3High 0 = Group 1 1 = Group 2 2 = Group input
3	BYTE	W	0	V160	1 - 999 =Open password
4	BYTE	W	0	V161	0=Close password 1-999 =Change password

4.13. REX 521_M01_M02 configuration

The general features of this configuration are:

- 91 bytes of input data consisting of:
  - Current measurement
  - Voltage measurement
  - Active and reactive power
  - Power factor
  - Energy measurement
  - System frequency
  - Circuit breaker inidication and two other indications
  - Start (and/or alarm) and trip from:
    overcurrent protection
    non-directional earth-fault protection
    phase discontinuity protection
    thermal protection for cables
  - Binary input states
- 2 bytes of output data consisting of:
  - Circuit breaker direct open and close

This configuration can be used with REX 521 variants M01 and M02.

4.13.1. Supported signals in REX 521_M01_M02

The following table shows the signals and their descriptions supported in REX 521_M01_M02.

Table 4.13.1-1 Cyclic signals supported in REX 521 M01 and M02

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	"Spa device status = IRF,"	24	V15			
8	signed DWORD	R	"Current IL1 in amperes,"	200	I1			MECU3A
12	DWORD	R	"Current IL2 in amperes,"	200	I2			MECU3A
16	DWORD	R	"Current IL3 in amperes,"	200	I3			MECU3A
20	DWORD	R	Current Io in amperes	201	I1			MECU1A
24	DWORD	R	Voltage UL1_U12 in kilovolts	204	I1			MEVO3A
28	DWORD	R	Voltage UL2_U23 in kilovolts	204	I2			MEVO3A
32	DWORD	R	Voltage UL3_U31 in kilovolts	204	I3			MEVO3A
36	DWORD	R	Residual voltage Uo in volts	205	I1			MEVO1A
40	signed DWORD	R	3-phase active power	207	I1			MEPE7

Table 4.13.1-1 Cyclic signals supported in REX 521 M01 and M02 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
44	signed DWORD	R	3-phase reactive power	207	I2			MEPE7
48	signed DWORD	R	Power factor	207	I3			MEPE7
52	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
56	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
60	DWORD	R	System frequency in Hertz	208	I1			MEFR1
64	BYTE	R	"CB Indication,"	120	V1			COCB1
65	BYTE	R	"Indication 1,"	127	V1			COIND1
66	BYTE	R	"Indication 2,"	128	V1			COIND2
67	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3LOW
68	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3LOW
69	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3HIGH
70	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3HIGH
71	BYTE	R	3I>>> start signal	33	O2	33	"E0, E1"	NOC3INST
72	BYTE	R	3I>>> trip signal	33	O3	33	"E2, E3"	NOC3INST
73	BYTE	R	Io> -> start signal	40	O1	40	"E0, E1"	DEF2LOW
74	BYTE	R	Io> -> trip signal	40	O2	40	"E2, E3"	DEF2LOW
75	BYTE	R	Io>> -> start signal	41	O1	41	"E0, E1"	DEF2HIGH
76	BYTE	R	Io>> -> trip signal	41	O2	41	"E2, E3"	DEF2HIGH
77	BYTE	R	Io>>> -> start signal	42	O1	42	"E0, E1"	DEF2INST
78	BYTE	R	Io>>> -> trip signal	42	O2	42	"E2, E3"	DEF2INST
79	BYTE	R	"3I2f> start signal,"	34	O1	34	"E0, E1"	INRUSH3
80	BYTE	R	"3Ith> start signal,"	47	O1	47	"E0, E1"	TOL3CAB
81	BYTE	R	"3Ith> trip signal,"	47	O2	47	"E2, E3"	TOL3CAB
82	BYTE	R	"DI> start signal,"	51	O1	51	"E0, E1"	CUB3LOW
83	BYTE	R	"DI> trip signal,"	51	O2	51	"E2, E3"	CUB3LOW
84	BYTE	R	3I> CBFP signal	31	O3	31	"E4, E5"	NOC3LOW
85	BYTE	R	3I>> CBFP signal	32	O4	32	"E4, E5"	NOC3HIGH
86	BYTE	R	3I>>> CBFP signal	33	O4	33	"E4, E5"	NOC3INST
87	BYTE	R	Io> -> CBFP signal	40	O3	40	"E4, E5"	DEF2LOW
88	BYTE	R	Io>> -> CBFP signal	41	O3	41	"E4, E5"	DEF2HIGH
89	BYTE	R	Io>>> -> CBFP signal	42	O3	42	"E4, E5"	DEF2INST
90	BYTE	R	"DI> CBFP signal,"	51	O3	51	"E4, E5"	CUB3LOW
0	BYTE	W	CB Direct open	120	V4			COCB1
1	BYTE	W	CB Direct close	120	V5			COCB1

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.14. REX 521_H05_H07 configuration

The general features of this configuration are:

- 118 bytes of input data consisting of:
  - Current measurement
  - Power measurement
  - Power factor
  - Voltage measurement
  - System frequency measurement
  - Time to next possible motor start-up
  - Thermal level
  - Start and trip indication from:
    - non-directional over-current protection
    - undervoltage protection
    - overvoltage protection
    - thermal overload protection
    - motor start-up supervision
    - over-/undercurrent protection
    - unbalance protection
    - phase reversal protection
  - Binary input states
- 2 bytes of output data consisting of:
  - Circuit breaker direct open and close

This configuration is designed to be used in motor protection.

4.14.1. Supported signals in REX 521_H05_H07

The following table shows the signals and their descriptions supported in REX521_H05_H07.

Table 4.14.1-1 Cyclic signals supported when using REX 521 H05 or REX 521 H07

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status=IRF	24	V15			SPA device status
8	DWORD	R	Phase 1 current	200	I1			MECU3A
12	DWORD	R	Phase 2 current	200	I2			MECU3A
16	DWORD	R	Phase 3 current	200	I3			MECU3A
20	DWORD	R	Current Io in amperes	201	I1			MECU1A
24	signed DWORD	R	3-phase active power	207	I1			MEPE7

Table 4.14.1-1 Cyclic signals supported when using REX 521 H05 or REX 521 H07 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
28	signed DWORD	R	3-phase reactive power	207	I2			MEPE7
32	signed DWORD	R	Power factor	207	I3			MEPE7
36	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
40	DWORD	R	Reversed active energy in kWh (Accumulated)	207	V208			MEPE7
44	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
48	DWORD	R	Reversed reactive energy in kvarh (Accumulated)	207	V210			MEPE7
52	DWORD	R	Residual voltage Uo in volts	205	I1			MEVO1A
56	DWORD	R	Voltage UL1_U12 in kilovolts	204	I1			MEVO3A
60	DWORD	R	Voltage UL2_U23 in kilovolts	204	I2			MEVO3A
64	DWORD	R	Voltage UL3_U31 in kilovolts	204	I3			MEVO3A
68	DWORD	R	System frequency in Hertz	208	I1			MEFR1
72	DWORD	R	Cooling time in seconds before restart is possible	48	O6			TOL3DEV
76	WORD	R	Thermal level	48	O3			TOL3DEV
78	BYTE	R	Circuit breaker 2 position	120	V1			COCB1
79	BYTE	R	Truck position	127	V1			COIND1
80	BYTE	R	Truck position	128	V1			COIND2
81	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3LOW
82	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3LOW
83	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3HIGH
84	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3HIGH
85	BYTE	R	Io> start signal	38	O1	38	"E0, E1"	NEF1Low
86	BYTE	R	Io> trip signal	38	O2	38	"E2, E3"	NEF1Low
87	BYTE	R	Io>> start signal	39	O1	39	"E0, E1"	NEF1High
88	BYTE	R	Io>> trip signal	39	O2	39	"E2, E3"	NEF1High
89	BYTE	R	3U> start signal	62	O1	62	"E0, E1"	OV3LOW
90	BYTE	R	3U> trip signal	62	O2	62	"E2, E3"	OV3LOW
91	BYTE	R	3U>> start signal	63	O1	63	"E0, E1"	OV3HIGH
92	BYTE	R	3U>> trip signal	63	O2	63	"E2, E3"	OV3HIGH
93	BYTE	R	3U< start signal	64	O1	64	"E0, E1"	UV3LOW
94	BYTE	R	3U< trip signal	64	O2	64	"E2, E3"	UV3LOW
95	BYTE	R	3U<< start signal	65	O1	65	"E0, E1"	UV3HIGH
96	BYTE	R	3U<< trip signal	65	O2	65	"E2, E3"	UV3HIGH
97	BYTE	R	I2> start signal	77	O1	77	"E0, E1"	NPS3LOW
98	BYTE	R	I2> trip signal	77	O2	77	"E2, E3"	NPS3LOW
99	BYTE	R	I2>> start signal	78	O1	78	"E0, E1"	NPS3High
100	BYTE	R	I2>> trip signal	78	O2	78	"E2, E3"	NPS3High
101	BYTE	R	Motstart start signal	54	O1	54	"E0, E1"	MOTStart
102	BYTE	R	Motstart trip signal	54	O2	54	"E2, E3"	MOTStart
103	BYTE	R	TOL3dev start signal	48	O1	48	"E0, E1"	TOL3Dev

Table 4.14.1-1 Cyclic signals supported when using REX 521 H05 or REX 521 H07 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
104	BYTE	R	TOL3dev trip signal	48	O2	48	"E2, E3"	TOL3Dev
105	BYTE	R	3I() start signal	55	O1	55	"E0, E1"	PREV3
106	BYTE	R	3I() trip signal	55	O2	55	"E2, E3"	PREV3
107	BYTE	R	3I< stage 1 start signal	88	O1	88	"E0, E1"	NUC3St1
108	BYTE	R	3I< stage 1 trip signal	88	O2	88	"E2, E3"	NUC3St2
109	BYTE	R	State of binary input 1	11	I1			DIPO
110	BYTE	R	State of binary input 2	11	I2			DIPO
111	BYTE	R	State of binary input 3	11	I3			DIPO
112	BYTE	R	State of binary input 4	11	I4			DIPO
113	BYTE	R	State of binary input 5	11	I5			DIPO
114	BYTE	R	State of binary input 6	11	I6			DIPO
115	BYTE	R	State of binary input 7	11	I7			DIPO
116	BYTE	R	State of binary input 8	11	I8			DIPO
117	BYTE	R	State of binary input 9	11	I9			DIPO
118	BYTE	W	CB Direct open	120	V4			COCB1
119	BYTE	W	CB Direct close	120	V5			COCB1

The event mask in the SPA slave must be set to match for the values that are updated using events codes, see SPA slave manual for details.

4.15. REX 521_H05_H08_H09 configuration

The general features of this configuration are:

- 100 bytes of input data consisting of:
  - Current input
  - Voltage measurement
  - Active and reactive power
  - Power factor
  - Energy measurement
  - System frequency
  - Circuit breaker indication and two other indications
  - Start (and/or) alarm) and trip from:
    - overcurrent protection
    - non-directional earth-fault protection
    - phase discontinuity protection
    - thermal protection for cables
  - Binary input states
- 2 bytes of output data consisting of:

- Circuit breaker direct open and close

This configuration can be used with REX 521 variants H05, H08 and H09.

4.15.1. Supported signals in REX 521_H05_H08_H09

The following table shows the signals and their descriptions supported in REX 521_H05_H08_H09.

Table 4.15.1-1 Cyclic signals supported in REX521 H05, H08 and H09

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
		Offset		Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	"Spa device status = IRF,"	24	V15			
8	signed DWORD	R	"Current IL1 in amperes,"	200	I1			MECU3A
12	DWORD	R	"Current IL2 in amperes,"	200	I2			MECU3A
16	DWORD	R	"Current IL3 in amperes,"	200	I3			MECU3A
20	DWORD	R	Current Io in amperes	201	I1			MECU1A
24	DWORD	R	Voltage UL1_U12 in kilovolts	204	I1			MEVO3A
28	DWORD	R	Voltage UL2_U23 in kilovolts	204	I2			MEVO3A
32	DWORD	R	Voltage UL3_U31 in kilovolts	204	I3			MEVO3A
36	DWORD	R	Residual voltage Uo in volts	205	I1			MEVO1A
40	signed DWORD	R	3-phase active power	207	I1			MEPE7
44	signed DWORD	R	3-phase reactive power	207	I2			MEPE7
48	signed DWORD	R	Power factor	207	I3			MEPE7
52	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
56	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
60	DWORD	R	System frequency in Hertz	208	I1			MEFR1
64	BYTE	R	"CB Indication,"	120	V1			COCB1
65	BYTE	R	"Indication 1,"	127	V1			COIND1
66	BYTE	R	"Indication 2,"	128	V1			COIND2
67	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3LOW
68	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3LOW
69	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3HIGH
70	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3HIGH
71	BYTE	R	3I>>> start signal	33	O2	33	"E0, E1"	NOC3INST
72	BYTE	R	3I>>> trip signal	33	O3	33	"E2, E3"	NOC3INST
73	BYTE	R	"3I2f> start signal,"	34	O1	34	"E0, E1"	INRUSH3
74	BYTE	R	Io> start signal	38	O1	38	"E0, E1"	NEF1LOW
75	BYTE	R	Io> trip signal	38	O2	38	"E2, E3"	NEF1LOW
76	BYTE	R	Io>> start signal	39	O1	39	"E0, E1"	NEF1HIGH
77	BYTE	R	Io>> trip signal	39	O2	39	"E2, E3"	NEF1HIGH
78	BYTE	R	Io>>> start signal	90	O1	90	"E0, E1"	NEF1INST

Table 4.15.1-1 Cyclic signals supported in REX521 H05, H08 and H09 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
		Offset		Channel	Code	Channel	Code	
79	BYTE	R	Io>>> trip signal	90	O2	90	"E2, E3"	NEF1INST
80	BYTE	R	Uo> start signal	44	O1	44	"E0, E1"	ROV1LOW
81	BYTE	R	Uo> trip signal	44	O2	44	"E2, E3"	ROV1LOW
82	BYTE	R	Uo>> start signal	45	O1	45	"E0, E1"	ROV1HIGH
83	BYTE	R	Uo>> trip signal	45	O2	45	"E2, E3"	ROV1HIGH
84	BYTE	R	Uo>>> start signal	46	O1	46	"E0, E1"	ROV1INST
85	BYTE	R	Uo>>> trip signal	46	O2	46	"E2, E3"	ROV1INST
86	BYTE	R	3U> start signal	62	O1	62	"E0, E1"	OV3LOW
87	BYTE	R	3U> trip signal	62	O2	62	"E2, E3"	OV3LOW
88	BYTE	R	3U>> start signal	63	O1	63	"E0, E1"	OV3HIGH
89	BYTE	R	3U>> trip signal	63	O2	63	"E2, E3"	OV3HIGH
90	BYTE	R	3U< start signal	64	O1	64	"E0, E1"	UV3Low
91	BYTE	R	3U< trip signal	64	O2	64	"E2, E3"	UV3Low
92	BYTE	R	3U<< start signal	65	O1	65	"E0, E1"	UV3High
93	BYTE	R	3U<< trip signal	65	O2	65	"E2, E3"	UV3High
94	BYTE	R	3I> CBFP signal	31	O3	31	"E4, E5"	NOC3LOW
95	BYTE	R	3I>> CBFP signal	32	O4	32	"E4, E5"	NOC3HIGH
96	BYTE	R	3I>>> CBFP signal	33	O4	33	"E4, E5"	NOC3INST
97	BYTE	R	Io> CBFP signal	38	O3	38	"E4, E5"	NEF1LOW
98	BYTE	R	Io>> CBFP signal	39	O3	39	"E4, E5"	NEF1HIGH
99	BYTE	R	Io>>> CBFP signal	90	O3	90	"E4, E5"	NEF1INST
0	BYTE	W	CB Direct open	120	V4			COCB1
1	BYTE	W	CB Direct close	120	V5			COCB1

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.16. RE500 configuration

The general features of this configuration are:

- 24 bytes of input data consisting of:
  - Current measurement
  - Start and trip indication from non-directional over-current protection
- Two pre-defined acyclic signals for change of setting bank

4.16.1. Supported signals in RE500

The following table shows the signals and their descriptions supported in RE500.

Table 4.16.1-1 Cyclic signals supported when using REF 541, REF 543, REF 545, REM 54x, REF 541R, REF 543R, and REM 54xR

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	1	V15			
8	DWORD	R	Phase 1 current	200	I1			MECU3A
12	DWORD	R	Phase 2 current	200	I2			MECU3A
16	DWORD	R	Phase 3 current	200	I3			MECU3A
20	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3Low
21	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3Low
22	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3High
23	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3High

The event mask must be set to match for the values that are updated using events codes, see relay manual for details.

The following signals are available only when using communication masters compliant with Profibus DP version 1.

Table 4.16.1-2 Acyclic signals supported in RE500

Index	Data size	Direction	SPA parameter		Description/function block
			Channel	Code	
1	BYTE	R/W	31	V3	Remote control of settings for NOC3Low 0 = Group 1 1 = Group 2 2 = Group input
2	BYTE	R/W	32	V3	Remote control of settings for NOC3High 0 = Group 1 1 = Group 2 2 = Group input
3	BYTE	W	0	V160	1 - 999 =Open password
4	BYTE	W	0	V161	0=Close password 1-999 =Change password

4.17. RE500_Motor configuration

The general features of this configuration are:

- 122 bytes of input data consisting of:
  - Current measurement values
  - Power measurement values
  - Power factor
  - Exported energy measurement values
  - Motor cooling time before next start

- Circuit breaker position
- Truck position
- Analog input measurement values
- Start and trip indication from:
  - non-directional over-current protection
  - negative Phase Sequence protection
  - undervoltage protection
  - non-directional earth fault protection
  - motor start-up protection
  - thermal overload protection
- Binary input states

- 2 bytes of output data consisting of:
  - Circuit breaker 1 direct open and close

This configuration is designed for use in motor protection.

4.17.1. Supported signals in RE500_Motor

The following table shows the signals and their description supported in RE500_Motor.

Table 4.17.1-1 Cyclic signals supported when using REF 541, REF 543, REF 545, REM 54x, REF 541R,REF543R, or REM 54xR

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	1	V15			SPA Device status
8	DWORD	R	Phase 1 current	200	I1			MECU3A
12	DWORD	R	Phase 2 current	200	I2			MECU3A
16	DWORD	R	Phase 3 current	200	I3			MECU3A
20	signed DWORD	R	3-phase active power	207	I1			MEPE7
24	signed DWORD	R	3-phase reactive power	207	I2			MEPE7
28	signed DWORD	R	Power factor	207	I3			MEPE7
32	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
36	DWORD	R	Reversed active energy in kWh (Accumulated)	207	V208			MEPE7
40	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
44	DWORD	R	Reversed reactive energy in kvarh (Accumulated)	207	V210			MEPE7
48	DWORD	R	Cooling time in seconds before restart is possible	48	O6			TOL3DEV

Table 4.17.1-1 Cyclic signals supported when using REF 541, REF 543, REF 545, REM 54x, REF 541R,REF543R, or REM 54xR (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
52	DWORD	R	Time to restart enable (minutes)	54	V7			MOTSTART
56	signed DWORD	R	Analog input value 1 (RTD)	213	I1			MEAI1
60	signed DWORD	R	Analog input value 2 (RTD)	214	I1			MEAI2
64	signed DWORD	R	Analog input value 3 (RTD)	215	I1			MEAI3
68	signed DWORD	R	Analog input value 4 (RTD)	216	I1			MEAI4
72	signed DWORD	R	Analog input value 5 (RTD)	217	I1			MEAI5
76	signed DWORD	R	Analog input value 6 (RTD)	218	I1			MEAI6
80	signed DWORD	R	Analog input value 7 (RTD)	219	I1			MEAI7
84	signed DWORD	R	Analog input value 8 (RTD)	220	I1			MEAI8
88	BYTE	R	Circuit breaker 1 position	120	V1			COCB1
89	BYTE	R	Circuit breaker 2 position	121	V1			COCB2
90	BYTE	R	Truck position	127	V1			COIND1
91	BYTE	R	Truck position	128	V1			COIND2
92	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3Low
93	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3Low
94	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3High
95	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3High
96	BYTE	R	I2> start signal	77	O1	77	"E0, E1"	NPS3Low
97	BYTE	R	I2> trip signal	77	O2	77	"E2, E3"	NPS3Low
98	BYTE	R	3U< start signal	64	O1	64	"E0, E1"	UV3Low
99	BYTE	R	3U< trip signal	64	O2	64	"E2, E3"	UV3Low
100	BYTE	R	3U<< start signal	65	O1	65	"E0, E1"	UV3High
101	BYTE	R	3U<< trip signal	65	O2	65	"E2, E3"	UV3High
102	BYTE	R	Io> start signal	38	O1	38	"E0, E1"	NEF1Low
103	BYTE	R	Io> trip signal	38	O2	38	"E2, E3"	NEF1Low
104	BYTE	R	Io>> start signal	39	O1	39	"E0, E1"	NEF1High
105	BYTE	R	Io>> trip signal	39	O2	39	"E2, E3"	NEF1High
106	BYTE	R	Motstart start signal	54	O1	54	"E0, E1"	MOTStart
107	BYTE	R	Motstart trip signal	54	O2	54	"E2, E3"	MOTStart
108	BYTE	R	TOL3dev start signal	48	O1	48	"E0, E1"	TOL3Dev
109	BYTE	R	TOL3dev trip signal	48	O2	48	"E2, E3"	TOL3Dev
110	BYTE	R	State of binary input 1	15	I1			BIO1
111	BYTE	R	State of binary input 2	15	I2			BIO1
112	BYTE	R	State of binary input 3	15	I3			BIO1
113	BYTE	R	State of binary input 4	15	I4			BIO1
114	BYTE	R	State of binary input 5	15	I5			BIO1

Table 4.17.1-1 Cyclic signals supported when using REF 541, REF 543, REF 545, REM 54x, REF 541R,REF543R, or REM 54xR (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
115	BYTE	R	State of binary input 6	15	I6			BIO1
116	BYTE	R	State of binary input 7	15	I7			BIO1
117	BYTE	R	State of binary input 8	15	I8			BIO1
118	BYTE	R	State of binary input 9	15	I9			BIO1
119	BYTE	R	State of binary input 10	15	I10			BIO1
120	BYTE	R	State of binary input 11	15	I11			BIO1
121	BYTE	R	State of binary input 12	15	I12			BIO1
122	BYTE	W	CB Direct open	120	V4			COCB1
123	BYTE	W	CB Direct close	120	V5			COCB1

The event mask in the SPA slave must be set to match for the values that are updated using events codes, see SPA slave manual for details.

4.18. REM 54_ configuration

The general features of this configuration are:

- 109 bytes of input data consisting of:
  - Current measurement
  - Power measurement
  - Power factor
  - Voltage measurement
  - System frequency measurement
  - Start and trip indication from
  - Non-directional over-current protection:
    - negative Phase Sequence protection
    - undervoltage protection
    - overvoltage protection
    - thermal overload protection
    - under- or reverse power protection
    - under- and overfrequency protection
    - underexcitation protection
    - differential protection
  - Binary input states

This configuration is designed for use in generator protection.

4.18.1. Supported signals in REM 54_

The following table shows the signals and their descriptions supported in REM 54_.

Table 4.18.1-1 Cyclic signals supported when using REM 54x or REM 54xR

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	1	V15			SPA Device status
8	DWORD	R	Phase 1 current	200	I1			MECU3A
12	DWORD	R	Phase 2 current	200	I2			MECU3A
16	DWORD	R	Phase 3 current	200	I3			MECU3A
20	signed DWORD	R	3-phase active power	207	I1			MEPE7
24	signed DWORD	R	3-phase reactive power	207	I2			MEPE7
28	signed DWORD	R	Power factor	207	I3			MEPE7
32	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
36	DWORD	R	Reversed active energy in kWh (Accumulated)	207	V208			MEPE7
40	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
44	DWORD	R	Reversed reactive energy in kvarh (Accumulated)	207	V210			MEPE7
48	DWORD	R	Voltage UL1_U12	204	I1			MEVO3A
52	DWORD	R	System frequency in Hertz	208	I1			MEFR1
56	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3LOW
57	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3LOW
58	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3HIGH
59	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3HIGH
60	BYTE	R	I2> start signal	77	O1	77	"E0, E1"	NPS3LOW
61	BYTE	R	I2> trip signal	77	O2	77	"E2, E3"	NPS3LOW
62	BYTE	R	3U> start signal	62	O1	62	"E0, E1"	OV3LOW
63	BYTE	R	3U> trip signal	62	O2	62	"E2, E3"	OV3LOW
64	BYTE	R	3U>> start signal	63	O1	63	"E0, E1"	OV3HIGH
65	BYTE	R	3U>> trip signal	63	O2	63	"E2, E3"	OV3HIGH
66	BYTE	R	TOL3dev start signal	48	O1	48	"E0, E1"	TOL3DEV
67	BYTE	R	TOL3dev trip signal	48	O2	48	"E2, E3"	TOL3DEV
68	BYTE	R	3U< start signal	64	O1	64	"E0, E1"	UV3LOW
69	BYTE	R	3U< trip signal	64	O2	64	"E2, E3"	UV3LOW
70	BYTE	R	3U<< start signal	65	O1	65	"E0, E1"	UV3HIGH
71	BYTE	R	3U<< trip signal	65	O2	65	"E2, E3"	UV3HIGH
72	BYTE	R	3d I> trip signal	99	O1	99	"E0, E1"	Diff6G

Table 4.18.1-1 Cyclic signals supported when using REM 54x or REM 54xR (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
73	BYTE	R	"f>,f< St1 START1 signal"	72	O1	72	"E0, E1"	Freq1St1
74	BYTE	R	"f>,f< St1 TRIP1 signal"	72	O2	72	"E2, E3"	Freq1St1
75	BYTE	R	"f>,f< St2 START1 signal"	73	O1	73	"E0, E1"	Freq1St2
76	BYTE	R	"f>,f< St2 TRIP1 signal"	73	O2	73	"E2, E3"	Freq1St2
77	BYTE	R	P< stage 1 start signal	95	O1	95	"E0, E1"	UPOW6St1
78	BYTE	R	P< stage 1 trip signal	95	O2	95	"E2, E3"	UPOW6St1
79	BYTE	R	P< stage 2 start signal	96	O1	96	"E0, E1"	UPOW6St2
80	BYTE	R	P< stage 2 trip signal	96	O2	96	"E2, E3"	UPOW6St2
81	BYTE	R	Io> start signal	38	O1	38	"E0, E1"	NEF1LOW
82	BYTE	R	Io> trip signal	38	O2	38	"E2, E3"	NEF1LOW
83	BYTE	R	Io>> start signal	39	O1	39	"E0, E1"	NEF1HIGH
84	BYTE	R	Io>> trip signal	39	O2	39	"E2, E3"	NEF1HIGH
85	BYTE	R	Uo> start signal	44	O1	44	"E0, E1"	ROV1LOW
86	BYTE	R	Uo> trip signal	44	O2	44	"E2, E3"	ROV1LOW
87	BYTE	R	Uo>> start signal	45	O1	45	"E0, E1"	ROV1HIGH
88	BYTE	R	Uo>> trip signal	45	O2	45	"E2, E3"	ROV1HIGH
89	BYTE	R	X< start signal	66	O1	66	"E0, E1"	UE6LOW
90	BYTE	R	X< trip signal	66	O2	66	"E2, E3"	UE6LOW
91	BYTE	R	X<< start signal	67	O1	67	"E0, E1"	UE6HIGH
92	BYTE	R	X<< trip signal	67	O2	67	"E2, E3"	UE6HIGH
93	BYTE	R	VOC6low start signal	91	O1	91	"E0, E1"	VOC6LOW
94	BYTE	R	VOC6low trip signal	91	O2	91	"E2, E3"	VOC6LOW
95	BYTE	R	VOC6high start signal	107	O1	107	"E0, E1"	VOC6HIGH
96	BYTE	R	VOC6high trip signal	107	O2	107	"E2, E3"	VOC6HIGH
97	BYTE	R	State of binary input 1	15	I1			BIO1
98	BYTE	R	State of binary input 2	15	I2			BIO1
99	BYTE	R	State of binary input 3	15	I3			BIO1
100	BYTE	R	State of binary input 4	15	I4			BIO1
101	BYTE	R	State of binary input 5	15	I5			BIO1
102	BYTE	R	State of binary input 6	15	I6			BIO1
103	BYTE	R	State of binary input 7	15	I7			BIO1
104	BYTE	R	State of binary input 8	15	I8			BIO1

Table 4.18.1-1 Cyclic signals supported when using REM 54x or REM 54xR (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
105	BYTE	R	State of binary input 9	15	I9			BIO1
106	BYTE	R	State of binary input 10	15	I10			BIO1
107	BYTE	R	State of binary input 11	15	I11			BIO1
108	BYTE	R	State of binary input 12	15	I12			BIO1

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.19. RE500_Feeder configuration

The general features of this configuration are:

- 100 bytes of input data consisting of:
  - Current measurement
  - Power measurement
  - Power factor
  - Voltage measurement
  - System frequency measurement
  - Start and trip indication from:
    non-directional over-current protection
    undervoltage protection
    overvoltage protection
  - Binary input states
- 2 bytes of output data consisting of:
  - Circuit breaker direct open and close

This configuration is designed to be used in feeder protection.

4.19.1. Supported signals in RE500_Feeder

The following table shows the signals and their descriptions supported in RE500_Feeder.

Table 4.19.1-1 Cyclic signals supported when using REF 541, REF 543, REF 545, REM 54x, REF 541R, or REF 543R

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	1	V15			
8	DWORD	R	Phase 1 current	200	I1			MECU3A
12	DWORD	R	Phase 2 current	200	I2			MECU3A
16	DWORD	R	Phase 3 current	200	I3			MECU3A
20	DWORD	R	Current Io in amperes	201	I1			MECU1A
24	signed DWORD	R	3-phase active power	207	I1			MEPE7
28	signed DWORD	R	3-phase reactive power	207	I2			MEPE7
32	signed DWORD	R	Power factor	207	I3			MEPE7
36	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
40	DWORD	R	Reversed active energy in kWh (Accumulated)	207	V208			MEPE7
44	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
48	DWORD	R	Reversed reactive energy in kvarh (Accumulated)	207	V210			MEPE7
52	DWORD	R	Residual voltage Uo in volts	205	I1			MEVO1A
56	DWORD	R	Voltage UL1_U12 in kilovolts	204	I1			MEVO3A
60	DWORD	R	Voltage UL2_U23 in kilovolts	204	I2			MEVO3A
64	DWORD	R	Voltage UL3_U31 in kilovolts	204	I3			MEVO3A
68	DWORD	R	System frequency in Hertz	208	I1			MEFR1
72	BYTE	R	Circuit breaker 1 position	120	V1			COCB1
73	BYTE	R	Circuit breaker 2 position	121	V1			COCB2
74	BYTE	R	Truck position	127	V1			COIND1
75	BYTE	R	Truck position	128	V1			COIND2
76	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3LOW
77	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3LOW
78	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3HIGH
79	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3HIGH
80	BYTE	R	3U> start signal	62	O1	62	"E0, E1"	OV3LOW
81	BYTE	R	3U> trip signal	62	O2	62	"E2, E3"	OV3LOW
82	BYTE	R	3U>> start signal	63	O1	63	"E0, E1"	OV3HIGH
83	BYTE	R	3U>> trip signal	63	O2	63	"E2, E3"	OV3HIGH
84	BYTE	R	3U< start signal	64	O1	64	"E0, E1"	UV3LOW
85	BYTE	R	3U< trip signal	64	O2	64	"E2, E3"	UV3LOW

Table 4.19.1-1 Cyclic signals supported when using REF 541, REF 543, REF 545, REM 54x, REF 541R, or REF 543R (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
86	BYTE	R	3U<< start signal	65	O1	65	"E0, E1"	UV3HIGH
87	BYTE	R	3U<< trip signal	65	O2	65	"E2, E3"	UV3HIGH
88	BYTE	R	State of binary input 1	15	I1			BIO1
89	BYTE	R	State of binary input 2	15	I2			BIO1
90	BYTE	R	State of binary input 3	15	I3			BIO1
91	BYTE	R	State of binary input 4	15	I4			BIO1
92	BYTE	R	State of binary input 5	15	I5			BIO1
93	BYTE	R	State of binary input 6	15	I6			BIO1
94	BYTE	R	State of binary input 7	15	I7			BIO1
95	BYTE	R	State of binary input 8	15	I8			BIO1
96	BYTE	R	State of binary input 9	15	I9			BIO1
97	BYTE	R	State of binary input 10	15	I10			BIO1
98	BYTE	R	State of binary input 11	15	I11			BIO1
99	BYTE	R	State of binary input 12	15	I12			BIO1
100	BYTE	W	CB Direct open	120	V4			COCB1
101	BYTE	W	CB Direct close	120	V5			COCB1

The event mask in the SPA slave must be set to match for the values that are updated using events codes, see SPA slave manual for details.

4.20. RET_basic configuration

The general features of this configuration are:

- 194 bytes of input data consisting of:
  - Current measurement, HV and LV sides
  - Voltage measurement, HV and LV sides
  - Active and reactive power
  - Energy measurement
  - System frequency
  - RTD inputs 1...8
  - MMI alarm
  - Circuit breaker indication, DC indications and other indications
  - Start (and/or alarm) and trip from:

    differential transformer protection

    overcurrent protection

    overvoltage protection

    undervoltage protection

earth-fault protection

- Binary input states

- 8 bytes of output data consisting of:
  - Circuit breaker direct open and close

4.20.1. Supported signals in RET_basic

The following table shows the signals and their descriptions supported in RET_basic.

Table 4.20.1-1 Cyclic signals supported in RET 54 Basic

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	1	V15			
8	signed DWORD	R	Tap changer position	106	I28			DIFF6T
12	DWORD	R	Current IL1 in amperes HV side	200	I1			MECU3A
16	DWORD	R	Current IL2 in amperes HV side	200	I2			MECU3A
20	DWORD	R	Current IL3 in amperes HV side	200	I3			MECU3A
24	DWORD	R	Current IL1 in amperes LV side	202	I1			MECU3B
28	DWORD	R	Current IL2 in amperes LV side	202	I2			MECU3B
32	DWORD	R	Current IL3 in amperes LV side	202	I3			MECU3B
36	DWORD	R	Current Io in amperes HV side	201	I1			MECU1A
40	DWORD	R	Current Io in amperes LV side	203	I1			MECU1B
44	DWORD	R	Voltage UL1_U12 in kilovolts HV side	204	I1			MEVO3A
48	DWORD	R	Voltage UL2_U23 in kilovolts HV side	204	I2			MEVO3A
52	DWORD	R	Voltage UL3_U31 in kilovolts HV side	204	I3			MEVO3A
56	DWORD	R	Voltage UL1_U12 in kilovolts LV side	206	I1			MEVO3B
60	DWORD	R	Voltage UL2_U23 in kilovolts LV side	206	I2			MEVO3B
64	DWORD	R	Voltage UL3_U31 in kilovolts LV side	206	I3			MEVO3B
68	DWORD	R	Residual voltage Uo in volts HV side	205	I1			MEVO1A
72	DWORD	R	Residual voltage Uo in volts LV side	226	I1			MEVO1B
76	DWORD	R	3-phase active power	207	I1			MEPE7
80	DWORD	R	3-phase reactive power	207	I2			MEPE7
84	DWORD	R	Displacement power factor cos(j)	207	I3			MEPE7
88	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
92	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7

Table 4.20.1-1 Cyclic signals supported in RET 54 Basic (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
96	DWORD	R	System frequency in Hertz	208	I1			MEFR1
100	DWORD	R	RTD input 1	213	I1			MEAI1
104	DWORD	R	RTD input 2	214	I1			MEAI2
108	DWORD	R	RTD input 3	215	I1			MEAI3
112	DWORD	R	RTD input 4	216	I1			MEAI4
116	DWORD	R	RTD input 5	217	I1			MEAI5
120	DWORD	R	RTD input 6	218	I1			MEAI6
124	DWORD	R	RTD input 7	219	I1			MEAI7
128	DWORD	R	RTD input 8	220	I1			MEAI8
132	BYTE	R	CB Indication	120	V1			COCB1
133	BYTE	R	DC 1 Indication	122	V1			CODC1
134	BYTE	R	DC 2 Indication	123	V1			CODC2
135	BYTE	R	DC 3 Indication	124	V1			CODC3
136	BYTE	R	Object 1 Indication	127	V1			COIND1
137	BYTE	R	Object 2 Indication	128	V1			COIND2
138	BYTE	R	Object 3 Indication	129	V1			COIND3
139	BYTE	R	Local Remote Indication	142	V2			COLOCAT
140	BYTE	R	MMI alarm 1	162	I1	162	"E0, E1"	MMIALA1
141	BYTE	R	MMI alarm 2	163	I1	163	"E0, E1"	MMIALA2
142	BYTE	R	MMI alarm 3	164	I1	164	"E0, E1"	MMIALA3
143	BYTE	R	MMI alarm 4	165	I1	165	"E0, E1"	MMIALA4
144	BYTE	R	MMI alarm 5	166	I1	166	"E0, E1"	MMIALA5
145	BYTE	R	MMI alarm 6	167	I1	167	"E0, E1"	MMIALA6
146	BYTE	R	MMI alarm 7	168	I1	168	"E0, E1"	MMIALA7
147	BYTE	R	MMI alarm 8	169	I1	169	"E0, E1"	MMIALA8
148	BYTE	R	HV trip signal circuit supervision alarm	191	O1	191	"E0, E1"	CMTC1
149	BYTE	R	LV trip signal circuit supervision alarm	192	O1	192	"E0, E1"	CMTC2
150	BYTE	R	CB wear alarm	187	O1	187	"E0, E1"	CMBWEAR1
151	BYTE	R	Gas pressure alarm	186	O1	186	"E0, E1"	CMGAS1
152	BYTE	R	Spring charge alarm max	190	O2	190	"E2, E3"	CMSPCR1
153	BYTE	R	Spring charge alarm min	190	O3	190	"E4, E5"	CMSPCR1
154	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3LOW
155	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3LOW
156	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3HIGH
157	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3HIGH
158	BYTE	R	3I>>> start signal	33	O2	33	"E0, E1"	NOC3INST
159	BYTE	R	3I>>> trip signal	33	O3	33	"E2, E3"	NOC3INST
160	BYTE	R	3I> start signal	53	O1	53	"E0, E1"	NOC3LOWB
161	BYTE	R	3I> trip signal	53	O2	53	"E2, E3"	NOC3LOWB
162	BYTE	R	Io> start signal	38	O1	38	"E0, E1"	NEF1LOW
163	BYTE	R	Io> trip signal	38	O2	38	"E2, E3"	NEF1LOW
164	BYTE	R	Io>> start signal	39	O1	39	"E0, E1"	NEF1HIGH
165	BYTE	R	Io>> trip signal	39	O2	39	"E2, E3"	NEF1HIGH

Table 4.20.1-1 Cyclic signals supported in RET 54 Basic (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
166	BYTE	R	Io>>> start signal	90	O1	90	"E0, E1"	NEF1INST
167	BYTE	R	Io>>> trip signal	90	O2	90	"E2, E3"	NEF1INST
168	BYTE	R	dI0> REF4A high voltage start signal	101	O1	101	"E0, E1"	REF4A
169	BYTE	R	dI0> REF4A high voltage trip signal	101	O2	101	"E2, E3"	REF4A
170	BYTE	R	dI0> REF4B low voltage start signal	119	O1	119	"E0, E1"	REF4B
171	BYTE	R	dI0> REF4B low voltage trip signal	119	O2	119	"E2, E3"	REF4B
172	BYTE	R	dI0> REF1A trip signal	102	O1	102	"E2, E3"	REF1A
173	BYTE	R	3U> 3-phase thermal overload start signal	48	O1	48	"E0, E1"	TOL3DEV
174	BYTE	R	3U> 3-phase thermal overload trip signal	48	O2	48	"E2, E3"	TOL3DEV
175	BYTE	R	I2> start signal	77	O1	77	"E0, E1"	NPS3LOW
176	BYTE	R	I2> trip signal	77	O2	77	"E2, E3"	NPS3LOW
177	BYTE	R	I2>> start signal	78	O1	78	"E0, E1"	NPS3HIGH
178	BYTE	R	I2>> trip signal	78	O2	78	"E2, E3"	NPS3HIGH
179	BYTE	R	3d I> start signal	106	O2	106	"E0, E1"	DIFF6T
180	BYTE	R	3d I>> trip signal	106	O3	106	"E2, E3"	DIFF6T
181	BYTE	R	3I> CBFP signal	31	O3	31	"E4, E5"	NOC3LOW
182	BYTE	R	3I>> CBFP signal	32	O4	32	"E4, E5"	NOC3HIGH
183	BYTE	R	3I>>> CBFP signal	33	O4	33	"E4, E5"	NOC3INST
184	BYTE	R	3I> CBFP signal	53	O3	53	"E4, E5"	NOC3LOWB
185	BYTE	R	Io> CBFP signal	38	O3	38	"E4, E5"	NEF1LOW
186	BYTE	R	Io>> CBFP signal	39	O3	39	"E4, E5"	NEF1HIGH
187	BYTE	R	Io>>> CBFP signal	90	O3	90	"E4, E5"	NEF1INST
188	BYTE	R	dI0> high voltage REF4A CBFP signal	101	O3	101	"E4, E5"	REF4A
189	BYTE	R	dI0> low voltage REF4B CBFP signal	119	O3	119	"4,5"	REF4B
190	BYTE	R	dI0> REF1A CBFP signal	102	O2	102	"E2, E3"	REF1A
191	BYTE	R	I2> CBFP signal	77	O4	77	"E4, E5"	NPS3LOW
192	BYTE	R	I2>> CBFP signal	78	O4	78	"E4, E5"	NPS3HIGH
193	BYTE	R	3d I> or 3d I>> CBFP signal	106	O4	106	"E4, E5"	DIFF6T
1	BYTE	W	CB Direct open	120	V4			COCB1
2	BYTE	W	CB Direct close	120	V5			COCB1
3	BYTE	W	DC 1 Direct open	122	V4			CODC1
4	BYTE	W	DC 1 Direct close	122	V5			CODC1
5	BYTE	W	DC 2 Direct open	123	V4			CODC2
6	BYTE	W	DC 2 Direct close	123	V5			CODC2
7	BYTE	W	DC 3 Direct open	124	V4			CODC3
8	BYTE	W	DC 3 Direct close	124	V5			CODC3

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.21. RET_multi configuration

The general features of this configuration are:

- 238 bytes of input data consisting of:
  - Current measurement, HV and LV sides
  - Voltage measurement, HV and LV sides
  - Active and reactive power
  - Energy measurement
  - System frequency
  - RTD inputs 1...8
  - MMI alarm
  - Circuit breaker indication, DC indications and other indications
  - Start (and/or alarm) and trip from:
    differential transformer protection
    overcurrent protection
    overvoltage protection
    undervoltage protection
    earth-fault protection
    underimpedance protection
    overexcitation protection
  - Binary input states
- 8 bytes of output data consisting of:
  - Circuit breaker direct open and close

4.21.1. Supported signals in RET_multi

The following table shows the signals and their descriptions supported in RET_multi.

Table 4.21.1-1 Cyclic signals supported in RET 54 Multi

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	1	V15			
8	signed DWORD	R	Tap changer position	106	I28			DIFF6T

Table 4.21.1-1 Cyclic signals supported in RET 54 Multi (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
12	DWORD	R	Current IL1 in amperes HV side	200	I1			MECU3A
16	DWORD	R	Current IL2 in amperes HV side	200	I2			MECU3A
20	DWORD	R	Current IL3 in amperes HV side	200	I3			MECU3A
24	DWORD	R	Current IL1 in amperes LV side	202	I1			MECU3B
28	DWORD	R	Current IL2 in amperes LV side	202	I2			MECU3B
32	DWORD	R	Current IL3 in amperes LV side	202	I3			MECU3B
36	DWORD	R	Current Io in amperes HV side	201	I1			MECU1A
40	DWORD	R	Current Io in amperes LV side	203	I1			MECU1B
44	DWORD	R	Voltage UL1_U12 in kilovolts HV side	204	I1			MEVO3A
48	DWORD	R	Voltage UL2_U23 in kilovolts HV side	204	I2			MEVO3A
52	DWORD	R	Voltage UL3_U31 in kilovolts HV side	204	I3			MEVO3A
56	DWORD	R	Voltage UL1_U12 in kilovolts LV side	206	I1			MEVO3B
60	DWORD	R	Voltage UL2_U23 in kilovolts LV side	206	I2			MEVO3B
64	DWORD	R	Voltage UL3_U31 in kilovolts LV side	206	I3			MEVO3B
68	DWORD	R	Residual voltage Uo in volts HV side	205	I1			MEVO1A
72	DWORD	R	Residual voltage Uo in volts LV side	226	I1			MEVO1B
76	DWORD	R	3-phase active power	207	I1			MEPE7
80	DWORD	R	3-phase reactive power	207	I2			MEPE7
84	DWORD	R	Displacement power factor cos(j)	207	I3			MEPE7
88	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
92	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
96	DWORD	R	System frequency in Hertz	208	I1			MEFR1
100	DWORD	R	RTD input 1	213	I1			MEAI1
104	DWORD	R	RTD input 2	214	I1			MEAI2
108	DWORD	R	RTD input 3	215	I1			MEAI3
112	DWORD	R	RTD input 4	216	I1			MEAI4
116	DWORD	R	RTD input 5	217	I1			MEAI5
120	DWORD	R	RTD input 6	218	I1			MEAI6
124	DWORD	R	RTD input 7	219	I1			MEAI7

Table 4.21.1-1 Cyclic signals supported in RET 54 Multi (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
128	DWORD	R	RTD input 8	220	I1			MEAI8
132	BYTE	R	CB Indication	120	V1			COCB1
133	BYTE	R	DC 1 Indication	122	V1			CODC1
134	BYTE	R	DC 2 Indication	123	V1			CODC2
135	BYTE	R	DC 3 Indication	124	V1			CODC3
136	BYTE	R	Object 1 Indication	127	V1			COIND1
137	BYTE	R	Object 2 Indication	128	V1			COIND2
138	BYTE	R	Object 3 Indication	129	V1			COIND3
139	BYTE	R	Local Remote Indication	142	V2			COLOCAT
140	BYTE	R	MMI alarm 1	162	I1	162	"E0, E1"	MMIALA1
141	BYTE	R	MMI alarm 2	163	I1	163	"E0, E1"	MMIALA2
142	BYTE	R	MMI alarm 3	164	I1	164	"E0, E1"	MMIALA3
143	BYTE	R	MMI alarm 4	165	I1	165	"E0, E1"	MMIALA4
144	BYTE	R	MMI alarm 5	166	I1	166	"E0, E1"	MMIALA5
145	BYTE	R	MMI alarm 6	167	I1	167	"E0, E1"	MMIALA6
146	BYTE	R	MMI alarm 7	168	I1	168	"E0,E1"	MMIALA7
147	BYTE	R	MMI alarm 8	169	I1	169	"E0, E1"	MMIALA8
148	BYTE	R	HV trip signal circuit supervision alarm	191	O1	191	"E0, E1"	CMTC1
149	BYTE	R	LV trip signal circuit supervision alarm	192	O1	192	"E0, E1"	CMTC2
150	BYTE	R	CB wear alarm	187	O1	187	"E0, E1"	CMBWEAR1
151	BYTE	R	Gas pressure alarm	186	O1	186	"E0, E1"	CMGAS1
152	BYTE	R	Spring charge alarm max	190	O2	190	"E2, E3"	CMSPCR1
153	BYTE	R	Spring charge alarm min	190	O3	190	"E4, E5"	CMSPCR1
154	BYTE	R	3I> start signal	31	O1	31	"E0, E1"	NOC3LOW
155	BYTE	R	3I> trip signal	31	O2	31	"E2, E3"	NOC3LOW
156	BYTE	R	3I>> start signal	32	O2	32	"E0, E1"	NOC3HIGH
157	BYTE	R	3I>> trip signal	32	O3	32	"E2, E3"	NOC3HIGH
158	BYTE	R	3I>>> start signal	33	O2	33	"E0, E1"	NOC3INST
159	BYTE	R	3I>>> trip signal	33	O3	33	"E2, E3"	NOC3INST
160	BYTE	R	3I> start signal	53	O1	53	"E0, E1"	NOC3LOWB
161	BYTE	R	3I> trip signal	53	O2	53	"E2, E3"	NOC3LOWB
162	BYTE	R	3I> -> start signal	35	O2	35	"E0, E1"	DOC6LOW
163	BYTE	R	3I> -> trip signal	35	O3	35	"E2, E3"	DOC6LOW
164	BYTE	R	3I>> -> start signal	36	O3	36	"E0, E1"	DOC6HIGH
165	BYTE	R	3I>> -> trip signal	36	O4	36	"E2, E3"	DOC6HIGH
166	BYTE	R	3I>>> -> start signal	37	O3	37	"E0, E1"	DOC6INST
167	BYTE	R	3I>>> -> trip signal	37	O4	37	"E2, E3"	DOC6INST
168	BYTE	R	Z< start signal	110	O1	110	"E0, E1"	UI6LOW
169	BYTE	R	Z< trip signal	110	O2	110	"E2, E3"	UI6LOW
170	BYTE	R	Z<< start signal	111	O1	111	"E0, E1"	UI6HIGH
171	BYTE	R	Z<< trip signal	111	O2	111	"E2, E3"	UI6HIGH
172	BYTE	R	Io> start signal	38	O1	38	"E0, E1"	NEF1LOW
173	BYTE	R	Io> trip signal	38	O2	38	"E2, E3"	NEF1LOW

Table 4.21.1-1 Cyclic signals supported in RET 54 Multi (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
174	BYTE	R	Io>> start signal	39	O1	39	"E0, E1"	NEF1HIGH
175	BYTE	R	Io>> trip signal	39	O2	39	"E2, E3"	NEF1HIGH
176	BYTE	R	Io>>> start signal	90	O1	90	"E0, E1"	NEF1INST
177	BYTE	R	Io>>> trip signal	90	O2	90	"E2, E3"	NEF1INST
178	BYTE	R	Io> -> start signal	40	O1	40	"E0, E1"	DEF2LOW
179	BYTE	R	Io> -> trip signal	40	O2	40	"E2, E3"	DEF2LOW
180	BYTE	R	Io>> -> start signal	41	O1	41	"E0, E1"	DEF2HIGH
181	BYTE	R	Io>> -> trip signal	41	O2	41	"E2, E3"	DEF2HIGH
182	BYTE	R	Io>>> -> start signal	42	O1	42	"E0, E1"	DEF2INST
183	BYTE	R	Io>>> -> trip signal	42	O2	42	"E2, E3"	DEF2INST
184	BYTE	R	Uo> start signal	44	O1	44	"E0, E1"	ROV1LOW
185	BYTE	R	Uo> trip signal	44	O2	44	"E2, E3"	ROV1LOW
186	BYTE	R	Uo>> start signal	45	O1	45	"E0, E1"	ROV1HIGH
187	BYTE	R	Uo>> trip signal	45	O2	45	"E2, E3"	ROV1HIGH
188	BYTE	R	Uo>>> start signal	46	O1	46	"E0, E1"	ROV1INST
189	BYTE	R	Uo>>> trip signal	46	O2	46	"E2, E3"	ROV1INST
190	BYTE	R	dI0> REF4A high voltage start signal	101	O1	101	"E0, E1"	REF4A
191	BYTE	R	dI0> REF4A high voltage trip signal	101	O2	101	"E2, E3"	REF4A
192	BYTE	R	dI0> REF4B low voltage start signal	119	O1	119	"E0, E1"	REF4B
193	BYTE	R	dI0> REF4B low voltage trip signal	119	O2	119	"E2, E3"	REF4B
194	BYTE	R	dI0> REF1A trip signal	102	O1	102	"E2, E3"	REF1A
195	BYTE	R	3U> 3-phase thermal overload start signal	48	O1	48	"E0, E1"	TOL3DEV
196	BYTE	R	3U> 3-phase thermal overload trip signal	48	O2	48	"E2, E3"	TOL3DEV
197	BYTE	R	I2> start signal	77	O1	77	"E0, E1"	NPS3LOW
198	BYTE	R	I2> trip signal	77	O2	77	"E2, E3"	NPS3LOW
199	BYTE	R	I2>> start signal	78	O1	78	"E0, E1"	NPS3HIGH
200	BYTE	R	I2>> trip signal	78	O2	78	"E2, E3"	NPS3HIGH
201	BYTE	R	3U> start signal	62	O1	62	"E0, E1"	OV3LOW
202	BYTE	R	3U> trip signal	62	O2	62	"E2, E3"	OV3LOW
203	BYTE	R	3U>> start signal	63	O1	63	"E0, E1"	OV3HIGH
204	BYTE	R	3U>> trip signal	63	O2	63	"E2, E3"	OV3HIGH
205	BYTE	R	3U< start signal	64	O1	64	"E0, E1"	UV3LOW
206	BYTE	R	3U< trip signal	64	O2	64	"E2, E3"	UV3LOW
207	BYTE	R	3U<< start signal	65	O1	65	"E0, E1"	UV3HIGH
208	BYTE	R	3U<< trip signal	65	O2	65	"E2, E3"	UV3HIGH
209	BYTE	R	3d I> start signal	106	O2	106	"E0, E1"	DIFF6T
210	BYTE	R	3d I>> trip signal	106	O3	106	"E2, E3"	DIFF6T
211	BYTE	R	U/f> start signal	68	O1	68	"E0, E1"	OE1LOW
212	BYTE	R	U/f> trip signal	68	O2	68	"E2, E3"	OE1LOW
213	BYTE	R	U/f>> start signal	69	O1	69	"E0, E1"	OE1HIGH

Table 4.21.1-1 Cyclic signals supported in RET 54 Multi (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
214	BYTE	R	U/f>> trip signal	69	O2	69	"E2, E3"	OE1HIGH
215	BYTE	R	3I> CBFP signal	31	O3	31	"E4, E5"	NOC3LOW
216	BYTE	R	3I>> CBFP signal	32	O4	32	"E4, E5"	NOC3HIGH
217	BYTE	R	3I>>> CBFP signal	33	O4	33	"E4, E5"	NOC3INST
218	BYTE	R	3I> CBFP signal	53	O3	53	"E4, E5"	NOC3LOWB
219	BYTE	R	Z< CBFP signal	110	O3	110	"E4, E5"	UI6LOW
220	BYTE	R	Z<< CBFP signal	111	O3	111	"E4, E5"	UI6HIGH
221	BYTE	R	3I> -> CBFP signal	35	O3	35	"E4, E5"	DOC6LOW
222	BYTE	R	3I>> -> CBFP signal	36	O5	36	"E4, E5"	DOC6HIGH
223	BYTE	R	3I>>> -> CBFP signal	37	O5	37	"E4, E5"	DOC6INST
224	BYTE	R	Io> CBFP signal	38	O3	38	"E4, E5"	NEF1LOW
225	BYTE	R	Io>> CBFP signal	39	O3	39	"E4, E5"	NEF1HIGH
226	BYTE	R	Io>>> CBFP signal	90	O3	90	"E4, E5"	NEF1INST
227	BYTE	R	Io> -> CBFP signal	40	O3	40	"E4, E5"	DEF2LOW
228	BYTE	R	Io>> -> CBFP signal	41	O3	41	"E4, E5"	DEF2HIGH
229	BYTE	R	Io>>> -> CBFP signal	42	O3	42	"E4, E5"	DEF2INST
230	BYTE	R	dI0> high voltage REF4A CBFP signal	101	O3	101	"E4, E5"	REF4A
231	BYTE	R	dI0> low voltage REF4B CBFP signal	119	O3	119	"E4, E5"	REF4B
232	BYTE	R	dI0> REF1A CBFP signal	102	O2	102	"E2, E3"	REF1A
233	BYTE	R	I2> CBFP signal	77	O4	77	"E4, E5"	NPS3LOW
234	BYTE	R	I2>> CBFP signal	78	O4	78	"E4, E5"	NPS3HIGH
235	BYTE	R	3d I> or 3d I>> CBFP signal	106	O4	106	"E4, E5"	DIFF6T
236	BYTE	R	U/f> CBFP signal	68	O3	68	"E4, E5"	OE1LOW
237	BYTE	R	U/f>> CBFP signal	69	O3	69	"E4, E5"	OE1HIGH
1	BYTE	W	CB Direct open	120	V4			COCB1
2	BYTE	W	CB Direct close	120	V5			COCB1
3	BYTE	W	DC 1 Direct open	122	V4			CODC1
4	BYTE	W	DC 1 Direct close	122	V5			CODC1
5	BYTE	W	DC 2 Direct open	123	V4			CODC2
6	BYTE	W	DC 2 Direct close	123	V5			CODC2
7	BYTE	W	DC 3 Direct open	124	V4			CODC3
8	BYTE	W	DC 3 Direct close	124	V5			CODC3

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.22. RET_control configuration

The general features of this configuration are:

- 182 bytes of input data consisting of:
  - Current measurement, HV and LV sides
  - Voltage measurement, HV and LV sides
  - Active and reactive power
  - Energy measurement
  - System frequency
  - RTD inputs 1...8
  - MMI alarm
  - Circuit breaker indication, DC indications and other indications
  - Binary input states
- 8 bytes of output data consisting of:
  - Circuit breaker direct open and close

4.22.1. Supported signals in RET_control

The following table shows the signals and their descriptions supported in RET_control.

Table 4.22.1-1 Cyclic signals supported in RET 54 Control

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
0	WORD	R	Gateway status					
2	WORD	R	Slave status					
4	DWORD	R	SPA Device status =IRF	1	V15			
8	DWORD	R	Current IL1 in amperes HV side	200	I1			MECU3A
12	DWORD	R	Current IL2 in amperes HV side	200	I2			MECU3A
16	DWORD	R	Current IL3 in amperes HV side	200	I3			MECU3A
20	DWORD	R	Current IL1 in amperes LV side	202	I1			MECU3B
24	DWORD	R	Current IL2 in amperes LV side	202	I2			MECU3B
28	DWORD	R	Current IL3 in amperes LV side	202	I3			MECU3B
32	DWORD	R	Current Io in amperes HV side	201	I1			MECU1A
36	DWORD	R	Current Io in amperes LV side	203	I1			MECU1B
40	DWORD	R	Voltage UL1_U12 in kilovolts HV side	204	I1			MEVO3A
44	DWORD	R	Voltage UL2_U23 in kilovolts HV side	204	I2			MEVO3A
48	DWORD	R	Voltage UL3_U31 in kilovolts HV side	204	I3			MEVO3A

Table 4.22.1-1 Cyclic signals supported in RET 54 Control (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
52	DWORD	R	Voltage UL1_U12 in kilovolts LV side	206	I1			MEVO3B
56	DWORD	R	Voltage UL2_U23 in kilovolts LV side	206	I2			MEVO3B
60	DWORD	R	Voltage UL3_U31 in kilovolts LV side	206	I3			MEVO3B
64	DWORD	R	Residual voltage Uo in volts HV side	205	I1			MEVO1A
68	DWORD	R	Residual voltage Uo in volts LV side	226	I1			MEVO1B
72	DWORD	R	3-phase active power	207	I1			MEPE7
76	DWORD	R	3-phase reactive power	207	I2			MEPE7
80	DWORD	R	Displacement power factor cos(j)	207	I3			MEPE7
84	DWORD	R	Active energy in kWh (Accumulated)	207	V207			MEPE7
88	DWORD	R	Reactive energy in kvarh (Accumulated)	207	V209			MEPE7
92	DWORD	R	System frequency in Hertz	208	I1			MEFR1
96	DWORD	R	RTD input 1	213	I1			MEAI1
100	DWORD	R	RTD input 2	214	I1			MEAI2
104	DWORD	R	RTD input 3	215	I1			MEAI3
108	DWORD	R	RTD input 4	216	I1			MEAI4
112	DWORD	R	RTD input 5	217	I1			MEAI5
116	DWORD	R	RTD input 6	218	I1			MEAI6
120	DWORD	R	RTD input 7	219	I1			MEAI7
124	DWORD	R	RTD input 8	220	I1			MEAI8
128	DWORD	R	Operation counter	144	V19			COLTC
132	DWORD	R	Phase-to-phase voltage U12 (low voltage side) average filtered	144	I1			COLTC Scaling notice: This analog value has three decimals.
136	DWORD	R	Primary current (HV side) maximum of 3-phases peak measurement	144	I2			COLTC
140	DWORD	R	Secondary current (LV side) maximum of 3-phases average filtered	144	I3			COLTC
144	DWORD	R	Measured angle value between U1 and IL1 (LV side)	144	I4			COLTC
148	signed DWORD	R	Tap changer pos for transformer 1 (own transformer)	144	I5			COLTC
152	signed DWORD	R	Tap changer position for transformer 2	144	I6			COLTC
156	DWORD	R	Current from transformer 2	144	I12			COLTC
160	BYTE	R	CB Indication	120	V1			COCB1

Table 4.22.1-1 Cyclic signals supported in RET 54 Control (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Event		Description/ function block
				Channel	Code	Channel	Code	
161	BYTE	R	DC 1 Indication	122	V1			CODC1
162	BYTE	R	DC 2 Indication	123	V1			CODC2
163	BYTE	R	DC 3 Indication	124	V1			CODC3
164	BYTE	R	Object 1 Indication	127	V1			COIND1
165	BYTE	R	Object 2 Indication	128	V1			COIND2
166	BYTE	R	Object 3 Indication	129	V1			COIND3
167	BYTE	R	Local Remote Indication	142	V2			COLOCAT
168	BYTE	R	MMI alarm 1	162	I1	162	"E0, E1"	MMIALA1
169	BYTE	R	MMI alarm 2	163	I1	163	"E0, E1"	MMIALA2
170	BYTE	R	MMI alarm 3	164	I1	164	"E0, E1"	MMIALA3
171	BYTE	R	MMI alarm 4	165	I1	165	"E0, E1"	MMIALA4
172	BYTE	R	MMI alarm 5	166	I1	166	"E0, E1"	MMIALA5
173	BYTE	R	MMI alarm 6	167	I1	167	"E0, E1"	MMIALA6
174	BYTE	R	MMI alarm 7	168	I1	168	"E0, E1"	MMIALA7
175	BYTE	R	MMI alarm 8	169	I1	169	"E0, E1"	MMIALA8
176	BYTE	R	HV trip signal circuit supervision alarm	191	O1	191	"E0, E1"	CMTC1
177	BYTE	R	LV trip signal circuit supervision alarm	192	O1	192	"E0, E1"	CMTC2
178	BYTE	R	CB wear alarm	187	O1	187	"E0, E1"	CMBWEAR1
179	BYTE	R	Gas pressure alarm	186	O1	186	"E0, E1"	CMGAS1
180	BYTE	R	Spring charge alarm max	190	O2	190	"E2, E3"	CMSPCR1
181	BYTE	R	Spring charge alarm min	190	O3	190	"E4, E5"	CMSPCR1
1	BYTE	W	CB Direct open	120	V4			COCB1
2	BYTE	W	CB Direct close	120	V5			COCB1
3	BYTE	W	DC 1 Direct open	122	V4			CODC1
4	BYTE	W	DC 1 Direct close	122	V5			CODC1
5	BYTE	W	DC 2 Direct open	123	V4			CODC2
6	BYTE	W	DC 2 Direct close	123	V5			CODC2
7	BYTE	W	DC 3 Direct open	124	V4			CODC3
8	BYTE	W	DC 3 Direct close	124	V5			CODC3

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

4.23. RET 521 configuration

The general features of this configuration are:

- 190 bytes of input data consisting of:
  - Current and voltage measurement
  - Tap changer position
  - Binary input states
  - mA input values
  - System frequency measurement
- 16 bytes of output data for commands
- TRIP detection of differential, overcurrent, thermal, overvoltage, undervoltage and earth-fault protection

4.23.1. Supported signals in RET 521

The following table shows the signals and their descriptions supported in RET 521.

Table 4.23.1-1 Cyclic signals supported when using RET 521

Offset	Data size	Direction	Signal	SPA parameter		Description
				Channel	Code	
0	WORD	R	Status			
2	signed DWORD	R	Internal Fail Status	5	0481	Internal fail status
6	signed DWORD	R	Input1	7	I340	Current magnitude, input 1 (AIM1)
10	signed DWORD	R	Input2	7	I348	Current magnitude, input 2 (AIM1)
14	signed DWORD	R	Input3	7	I356	Current magnitude, input 3 (AIM1)
18	signed DWORD	R	Input4	7	I364	Current magnitude, input 4 (AIM1)
22	signed DWORD	R	Input5	7	I372	Current magnitude, input 5 (AIM1)
26	signed DWORD	R	Input6	7	I380	Current magnitude, input 6 (AIM1)
30	signed DWORD	R	Input7	7	I388	Current magnitude, input 7 (AIM1)
34	signed DWORD	R	Input8	7	I396	Current magnitude, input 8 (AIM1)
38	signed DWORD	R	Input9[a]	7	I398	Voltage magnitude, input 8 (AIM1)
42	signed DWORD	R	Input10	7	I404	Current magnitude, input 9 (AIM1)
46	signed DWORD	R	Input11[a]	7	I406	Voltage magnitude, input 9 (AIM1)
50	signed DWORD	R	Input12	7	I414	Current magnitude, input 10 (AIM1)

Table 4.23.1-1 Cyclic signals supported when using RET 521 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Description
				Channel	Code	
54	signed DWORD	R	Input13	7	I420	Current magnitude, input 1 (AIM2)
58	signed DWORD	R	Input14	7	I428	Current magnitude, input 2 (AIM2)
62	signed DWORD	R	Input15	7	I436	Current magnitude, input 3 (AIM2)
66	signed DWORD	R	Input16	7	I444	Current magnitude, input 4 (AIM2)
70	signed DWORD	R	Input17	7	I452	Current magnitude, input 5 (AIM2)
74	signed DWORD	R	Input18	7	I460	Current magnitude, input 6 (AIM2)
78	signed DWORD	R	Input19	7	I468	Current magnitude, input 7 (AIM2)
82	signed DWORD	R	Input20	7	I476	Current magnitude, input 8 (AIM2)
86	signed DWORD	R	Input21[a]	7	I478	Voltage magnitude, input 8 (AIM2)
90	signed DWORD	R	Input22	7	I484	Current magnitude, input 9 (AIM2)
94	signed DWORD	R	Input23[a]	7	I486	Voltage magnitude, input 9 (AIM2)
98	signed DWORD	R	Input24	7	I494	Current magnitude, input 10 (AIM2)
102	signed DWORD	R	Input25	7	I225	Bias current in A (DIFP)
106	signed DWORD	R	Input26	7	I226	Differential current, phase L1in A (DIFP)
110	signed DWORD	R	Input27	7	I227	Differential current, phase L2 in A (DIFP)
114	signed DWORD	R	Input28	7	I228	Differential current, phase L3 in A (DIFP)
118	DWORD	R	Input29	7	I240	Actual busbar voltage in kV (VCTR)
122	signed DWORD	R	Input30	4	I980	mA input 1 (MIM1)
126	signed DWORD	R	Input31	4	I981	mA input 2 (MIM1)
130	signed DWORD	R	Input32	4	I982	mA input 3 (MIM1)
134	signed DWORD	R	Input33	4	I983	mA input 4 (MIM1)
138	signed DWORD	R	Input34	4	I984	mA input 5 (MIM1)
142	signed DWORD	R	Input35	4	I985	mA input 6 (MIM1)
146	DWORD	R	Input36	7	I229	Actual tap changer position (DIFP)
150	DWORD	R	Input37	19	O538	Frequency (FRME)
154	BYTE	R	Input38	6	I101	Binary input 1 (BIM1)
155	BYTE	R	Input39	6	I102	Binary input 2 (BIM1)

Table 4.23.1-1 Cyclic signals supported when using RET 521 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Description
				Channel	Code	
156	BYTE	R	Input40	6	I103	Binary input 3 (BIM1)
157	BYTE	R	Input41	6	I104	Binary input 4 (BIM1)
158	BYTE	R	Input42	6	I105	Binary input 5 (BIM1)
159	BYTE	R	Input43	6	I106	Binary input 6 (BIM1)
160	BYTE	R	Input44	6	I107	Binary input 7 (BIM1)
161	BYTE	R	Input45	6	I108	Binary input 8 (BIM1)
162	BYTE	R	Input46	6	I109	Binary input 9 (BIM1)
163	BYTE	R	Input47	6	I110	Binary input 10 (BIM1)
164	BYTE	R	Input48	6	I111	Binary input 11 (BIM1)
165	BYTE	R	Input49	6	I112	Binary input 12 (BIM1)
166	BYTE	R	Input50	6	I113	Binary input 13 (BIM1)
167	BYTE	R	Input51	6	I114	Binary input 14 (BIM1)
168	BYTE	R	Input52	6	I115	Binary input 15 (BIM1)
169	BYTE	R	Input53	6	I116	Binary input 16 (BIM1)
170	BYTE	R	Input54	19	O56	Earth fault common trip (TEF1)
171	BYTE	R	Input55	19	O66	Earth fault common trip (TEF2)
172	BYTE	R	Input56	19	O76	Earth fault common trip (TEF3)
173	BYTE	R	Input57	14	O11	Over current common trip (TOC1)
174	BYTE	R	Input58	14	O26	Over current common trip (TOC2)
175	BYTE	R	Input59	14	O41	Over current common trip (TOC3)
176	BYTE	R	Input60	19	O2	Over excitation common trip (OVEX)
177	BYTE	R	Input61	19	O231	Over voltage common trip (TOV1)
178	BYTE	R	Input62	19	O253	Over voltage common trip (TOV2)
179	BYTE	R	Input63	19	O275	Over voltage common trip (TOV3)
180	BYTE	R	Input64	19	O297	Over voltage common trip (TOV4)
181	BYTE	R	Input65	19	O319	Over voltage common trip (TOV5)
182	BYTE	R	Input66	19	O341	Over voltage common trip (TOV6)
183	BYTE	R	Input67	19	O531	Thermal overload common trip (THOL)
184	BYTE	R	Input68	19	O166	Under voltage common trip (TUV1)
185	BYTE	R	Input69	19	O187	Under voltage common trip (TUV2)
186	BYTE	R	Input70	19	O208	Under voltage common trip (TUV3)
187	BYTE	R	Input71	19	O86	Differential protection common trip (DIFP)
188	BYTE	W	Output1	12	I1	Command output 1 (CD01)
189	BYTE	W	Output2	12	I2	Command output 2 (CD01)
190	BYTE	W	Output3	12	I3	Command output 3 (CD01)
191	BYTE	W	Output4	12	I4	Command output 4 (CD01)
192	BYTE	W	Output5	12	I5	Command output 5 (CD01)
193	BYTE	W	Output6	12	I6	Command output 6 (CD01)
194	BYTE	W	Output7	12	I7	Command output 7 (CD01)
195	BYTE	W	Output8	12	I8	Command output 8 (CD01)
196	BYTE	W	Output9	12	I9	Command output 9 (CD01)
197	BYTE	W	Output10	12	I10	Command output 10 (CD01)
198	BYTE	W	Output11	12	I11	Command output 11 (CD01)
199	BYTE	W	Output12	12	I12	Command output 12 (CD01)
200	BYTE	W	Output13	12	I13	Command output 13 (CD01)

Table 4.23.1-1 Cyclic signals supported when using RET 521 (Continued)

Offset	Data size	Direction	Signal	SPA parameter		Description
				Channel	Code	
201	BYTE	W	Output14	12	I14	Command output 14 (CD01)
202	BYTE	W	Output15	12	I15	Command output 15 (CD01)
203	BYTE	W	Output16	12	I16	Command output 16 (CD01)

a. These inputs can act as either current or voltage inputs depending on the configuration.

The event mask in the SPA slave must be set to match the values that are updated by using events codes, see SPA slave manual for details.

Table 4.23.1-2 Function blocks necessary for RET 521

Function block
AIM1
AIM2
BIM
BOM
MIM
TOC1
TOC2
TOC3
TOV1
TOV2
TOV3
TOV4
TOV5
TOV6
TUV1
TUV2
TUV3
TEF1
TEF2
TEF3
DIFP
OVEX
FRME
CD01
VCTR

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