Protect^{IT}

Multifunction Protection and Switchbay Control Unit

Manual Part 4:
Communication to station control system

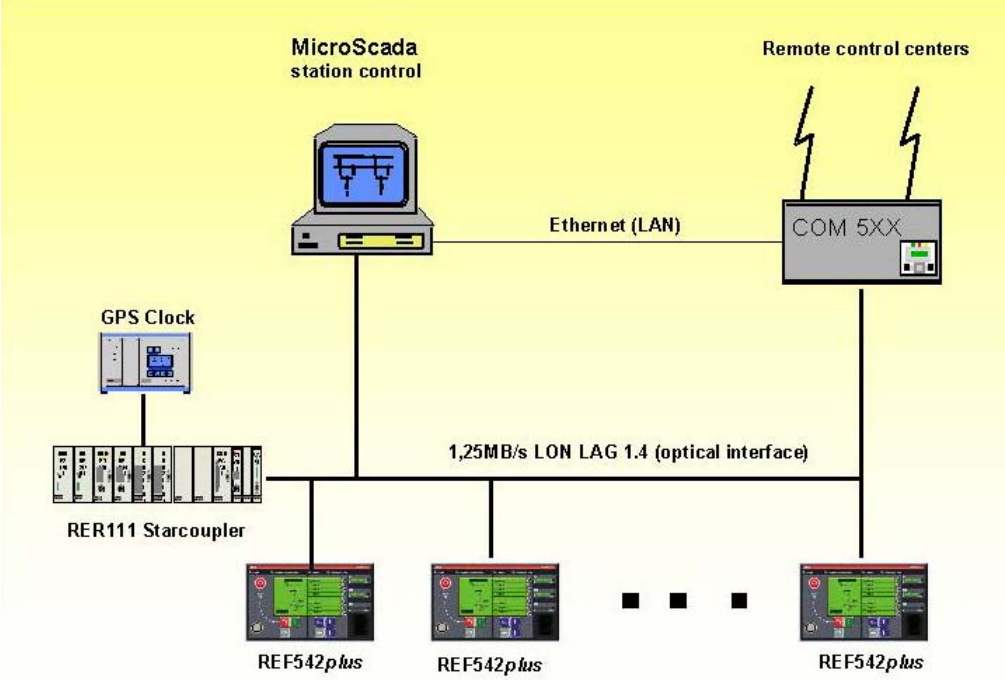

Table of Contents

1 Introduction

This part of the manual describes the communication interface of the REF542*plus* switchbay protection and control unit to the upper level control system. The following section and subsections contain information on the protocols used:

- SPABUS interface
- LON interface (per LAG 1.4)
- IEC 60870-5-103 interface
- MODBUS RTU interface

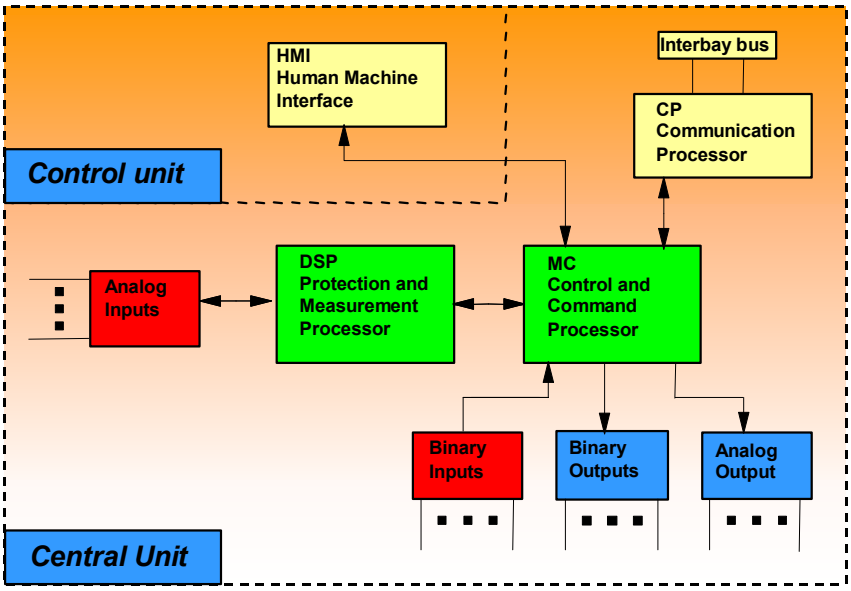

Figure 1: Block diagram of REF 542*plus*

All these protocols are implemented on dedicated communication boards, which can be inserted into the REF542plus core unit. Only one protocol and thus only one communication board can be selected.

REF542plus protection and control functionalities are completely independent by the protocol choice and are not affected by the presence/absence of the communication board.

REF542plus is a certified product for compliance to the Industrial^{IT} architecture concept of ABB.

Industrial^{IT} products can be effectively combined together into value-added systems and solutions in a “Plug & Produce” manner.

Compliance according to “Level 0: Information” ensures that all relevant product documentation – including the operation manual, instructions for installation and maintenance, electrical and mechanical drawings, test reports and specific order information -is online available, in electronic format, for access via software products and systems based on the ABB Aspect Integrator Platform.

In this way, significant benefits are enabled to the final user for much easier and effective installation, configuration, operation and maintenance of the product in the plant.

Detailed information on Industrial IT is available at <http://www.abb.com/industrialit>.

2 Abbreviations and definitions

2.1 Abbreviations

SPABUS	Communication protocol for ABB automation and control system
LON	**L**ocal **O**perating **N**etwork
LAG 1.4	**L**ON **A**pplication **G**uide version 1.4
MODBUS RTU	Communication protocol for industrial application.
IEC	**I**nternational **E**lectro technical **C**ommission
FUPLA	**FU**nctional **P**rogramming **LA**nguage
VATS	**V**ery **A**ccurate **T**ime **S**ynchronization
COMTRADE	**COM**mon Format for **TRA**nsient **D**ata **E**xchange
PC	**P**ersonal **C**omputer
ASCII	**A**merican **S**tandard **C**ode for **I**nformation **I**nterchange
HMI	**H**uman **M**achine **I**nterface
LCU	HMI as **L**ocal **C**ontrol **U**nit

2.2 Definitions

There are notes and warnings on hazards at the beginning of every section and also in the text. They are in a different font to distinguish them from normal text.

The safety warnings must be observed in all circumstances. If they are not observed, no guarantee claims will be accepted.

Note

A note indicates items that are significant in the specific context. A note may contain information on the interplay of various software components and appears as shown below.

Example:

Note — Please read this section completely for information on the various formats for safety notes.

Hazard information level 1

Level 1 hazard information indicates hazards affecting substations and devices. It should always be observed, because otherwise function interruptions or malfunctions may occur. An example is shown below:

Caution

Do not make any changes to the FUPLA unless you are familiar with the REF542*plus* and the configuration software

Hazard information level 2

Level 2 hazard information indicates hazards affecting life and limb. It must be observed to avoid injury to the operator or other personnel.

Example:

Warning!

Never attempt to remove the protection covers on the busbars by force.

3 SPABUS

The SPABUS defines an ABB-owned, terminal-oriented communication protocol that enables efficient access to a register model which completely describes the information content of a field device.

The implementation uses the SPABUS protocol definition V2.3 [SPA2.3]. The time synchronization similar to SPABUS protocol definition V2.5 [SPA2.5] is possible since release 1.2.

3.1 Structure and functions

The SPABUS is used as a plant-wide, non-redundant field-bus system. In most cases, it consists of plastic or optical fiber cables. The use of fiber cable is recommend in order to prevent disturbances caused by electromagnetic effects Due to the more stable transmission performances it is recommend to use the optical fiber than the plastic fiber cables.

Two different bus structures are supported:

- Ring structure
- Star structure

A star-type topology requires a star coupler that is able to interface more than one field devices to a higher-level device. In case one field device fails or a related fiber optic cable is defective, the higher-level device can continue to communicate with the rest of the devices.

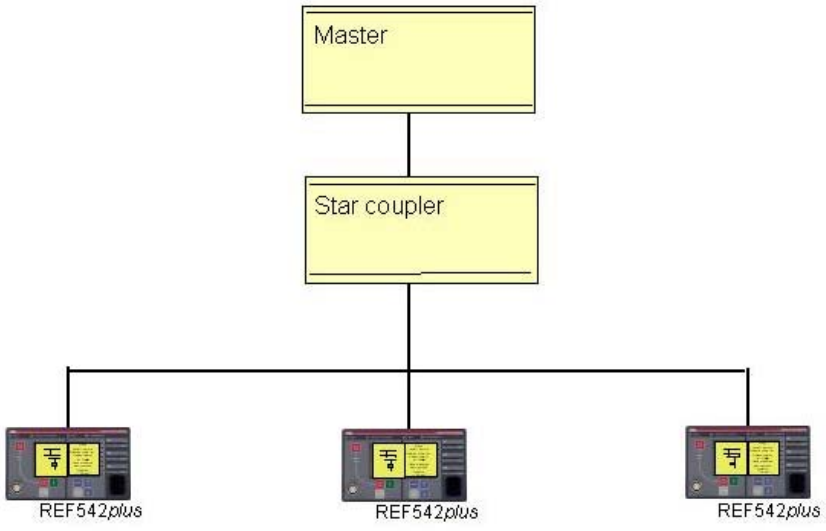

Figure 2: SPABUS in a star-type topology

For a ring bus, less equipment is required. The failure of any component in the ring, however, causes an interruption of communication.

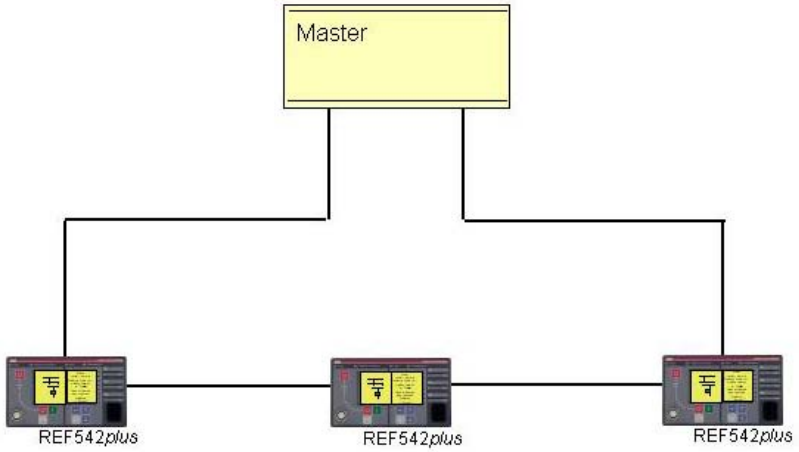

Figure 3: SPABUS in a ring-type topology

The SPABUS protocol operates on the master/slave principle. The higher-level system interrogates the field devices connected. A spontaneous transmission of data does not take place.

3.2 Interface

Three communication boards with different connections are available for operating the REF542*plus* with a SPABUS interface. Optical standard interfaces are offered for plastic or glass fiber optics. In exceptional cases as mentioned above, an electrically isolated RS232 interface can be used.

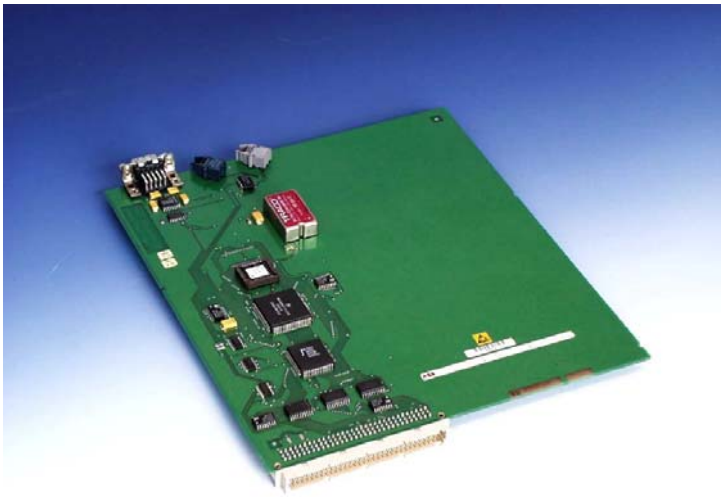

Figure 4: REF542*plus* SPABUS board with optical interfaces

The following tables list some of the technical data of the three physical interfaces.

Table 1: Characteristic features of the optical interface for plastic fiber optics

Description	Specification
Cable connector:	HP HFBR 4503
Cable diameter:	1 mm
Max. cable length:	40 m
Wavelength:	660 nm
Transmitter power (typical):	-13 dBm
Limit received power:	-20 dBm
Idle condition:	Light ON

Table 2: Characteristic features of the optical interface for glass fiber optics

Description	Specification
Cable connector:	F-SMA
Cable diameter:	62.5/125 µm
Max. cable length:	2000 m
Wavelength:	820-900 nm
Transmitter power (typical):	-13 dBm
Limit received power:	-24 dBm
Idle condition:	Light ON

The RS232 interface does not use any handshake signals. Instead, a ±12V voltage supply is available for coupling modules. The power consumption should not exceed 2W. The terminal assignments of the female SUB-D9 plug-type connector are:

Table 3: Characteristic features of the optical interface for glass fiber optics

Terminal	Name
1	—
2	TxD: send data
3	RxD receive data
4	+12V voltage supply
5	Mass (signaling and voltage supply)
6	—
7	—
8	—
9	-12V voltage supply

The parameters specified for the serial interface are listed in the table below:

Table 4: Interface parameters

Description	Specification
Baud rate	9600
Data bits	7
Stop bits	1
Parity	even

3.3 Configuration

In the configuration software, the SPABUS protocol can be selected in the menu `Main Menu/Configure/Hardware,` group box `field bus` and the related combo box. Using the button `Parameters…` the necessary parameter, the device address and the bus structure, can be specified.

Appendix A contains a list of all the SPABUS registers as well as the associated events. The registers are arranged by functions. Most of the registers can only be accessed successfully if the respective function has been released in the configuration software, for instance, by inserting a function block into the flowchart, which is in the following abbreviated as FUPLA. Furthermore, events are indicated only if the associated register is accessible and the respective event message has been released. In case a non-configured register is accessed, a negative check back signal (NACK: negative acknowledgment) is transmitted.

4 LON according to LAG 1.4

Presently, the LON (Local Operating Network) is the standard bus system used in substation control by ABB. It is a standardized and commonly used communication bus with a data transfer rate of up to 1.25 Mbits/sec. In order to meet the high requirements on substation control with regard to safety, throughput and accuracy, ABB uses, to some extent, proprietary mechanisms.

4.1 Structure and functions

A LON network does not need a dedicated master. Messages or specified structures, e.g. network variables, can be sent from any data source to one or several information sinks. A control system, however, will distinguish between field devices and higher-level devices. One speaks of horizontal communication if devices of the same level communicate with each other, otherwise of vertical communication.

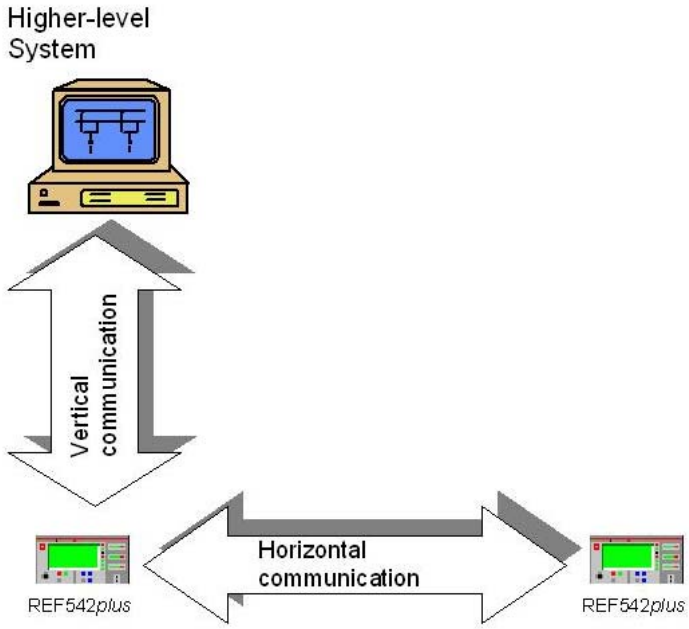

Figure 5: Horizontal and vertical communication

For horizontal communication between field equipment — as it is used, for instance, for interlocking purposes — exclusively standard network variables of the nv_status type are being used. A higher-level system is not necessary in this case.

ABB bases its vertical communication features on the use of explicit messages in accordance with the specifications in [LAG1.4]. Two important issues need to be taken into consideration:

- Firstly, a sliding window protocol is used in order to avoid a potential bus overload and to achieve a good throughput rate without any loss of telegrams. This way, it is possible to transfer approximately 30 messages per second to an individual, higher-level system, while a total of 40 messages per second can be transmitted to four higher-order systems.

- Secondly, the quality attributes known from the international standard IEC 60870-5-101 are used on the LON as well. This makes it possible to make statements regarding the reliability of data.

A typical higher-level system which fully supports [LAG1.4] is ABB's MicroSCADA SYS500.

4.2 Interface

For interfacing the REF542*plus* with the ABB Substation Automation System, a COM_L communication board has to be used.

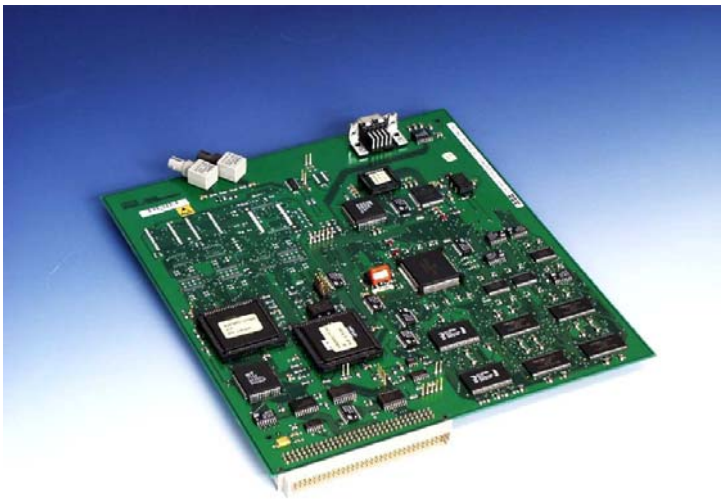

Figure 6: REF542*plus* COM_L board with optical interfaces (ST connectors)

The REF542*plus* is connected to the process control system by means of glass fiber optic cables using an ST plug:

Table 5: Characteristic features of the optical interface for glass fiber optic cables

Description	Specification
Connector:	ST
Cable diameter:	62.5/125 um
Max. cable length:	2000 m
Wavelength:	820-900 nm
Transmitter power (typical):	-13 dBm
Limit received power	-24 dBm

4.3 Configuration

The COM_L communication board is self-configuring. This means, it is only necessary to set the device address in the configuration software. What information can be made available in the network will be determined automatically when starting. For this purpose, the system identifies, internally, which SPABUS registers are accessible. Most of the registers are linked to predefined LON addresses. Appendix B contains a complete list of this address mapping.

By means of a mechanism called Transparent SPABUS Messages and based on message code 65 it is possible to access any information of the register model.

For the purpose of time synchronization, the REF542*plus* supports two different procedures:

- A vendor-independent synchronization of a mean accuracy (approximately 10 msec) using network variables nv_clock_warning and nv_clock, cf. [LAG1.4], and
- an ABB specific synchronization of a high accuracy (approximately 1msec) in accordance with VATS (Very Accurate Time Synchronization) with bit pattern detection, for example, supported by ABB subassembly SLCM (Serial LON Clock Master) of star coupler ABB RER111 [SLCM].

The COM_L board automatically recognizes which procedure is being used and adjusts to it accordingly.

In the flowchart (FUPLA), the REF542*plus* provides 64 16-bit-write and 16-bit-read objects. The associated standard network variables of type nv_status of 64 16-bit-write and 58 16-bit-read objects can be used for horizontal communication. Linking the data sources to the data sinks, referred to as binding, must be done using a suitable add-on program, such as the LON Network Tool [LNT505] by ABB. For this purpose, the field device has to be first assigned a subnet/node address, which, in turn, requires that the 48-bit Neuron ID of the built-in communication processors is used. This ID is transmitted with the service pin message generated by the REF542*plus* as soon as the Local/Remote switch is turned into the "Remote" position and the associated SPABUS event has been released.

For vertical communication, up to 4 higher-order systems are supported in the REF542*plus*. Implementation of quality attributes for signals in accordance with IEC 60870-5-101 is subject to some restrictions in the case of the REF542*plus*. These are listed in the table below.

Table 6: Support of the IEC 870-5-101 quality attributes

Attributes	**Use in the REF542*plus***
Invalid **IV**	Hardware malfunction detected in the process signaling circuit. In the REF542*plus*, this may be an input signal indicating a disturbance within the signaling circuit (e.g. signaling voltage failed). The IV attribute is generated in the flowchart (FUPLA) of the REF542*plus* by the following objects - *Signaling Circuit Supervision for Binary Inputs* and - *Signaling Circuit Supervision for Analog Inputs* and generally applies to all the signals concerned.
Blocked **BL**	Signaling suppression; the acquisition of the signal is inhibited. The signal status is assigned the value collected last until the blocking is canceled. The BL attribute is generated in the flowchart of the REF542*plus* by the following object: - *Signaling Suppression Binary and/or Analog Inputs*

Attributes	Use in the REF542*plus*
Substituted **SB**	**Not** supported by the REF542*plus*
Not Topical **NT**	**Not** supported by the REF542*plus*
Overflow **OV**	Overflow; occurring only with measured values. Is set when leaving the permissible measuring range or when the value can no longer be transferred in the specified data format. Generated on COM-L.
Time Invalid **TV**	COM-L receives no time synchronization. This bit does not affect the signal status. Generated on COM-L.

The MicroSCADA SYS500 system by ABB uses the LIB542*plus* function library which contains all the LON-specific functions of the REF542*plus* within the SYS500 environment. [LIB542]

5 IEC 60870-5-103 protocol

The interface in accordance with the international standard IEC 60870-5-103 [IEC-103] is a vendor-independent communication interface for the REF542*plus*.

5.1 Structure and functions

The protocol to IEC 60870-5-103 operates on the master/slave principle. The higher-level system interrogates the field devices connected. A spontaneous transmission of data does not take place.

5.2 Interface

In order to be able to provide for a IEC 60870-5-103 interface in the REF542*plus*, a COM_I communication board is needed.

Figure 7: REF542*plus* COM_I board with optical interfaces

Connecting the REF542*plus* to the higher-level system is done by means of glass fiber optic cables using ST plugs:

Table 7: Characteristic features of the optical interface

Description	Specification
Cable connector:	ST
Cable diameter:	62.5/125 µm
Max. cable length:	2000 m
Wavelength:	820-900 nm
Transmitter power (typical):	-13 dBm
Limit received power:	-24 dBm
Idle condition:	Light ON

The parameters needed for the serial interface are:

Table 8: Interface parameters

Description	Specification
Baud rate	9600
Data bits	8
Stop bits	1
Parity	even

5.3 Protection functions supported

In addition to general functions, the REF542*plus* supports three main functions on its IEC 60870-5-103 interface:

- Distance protection *t(z)*: *FUN=128*,
- Overcurrent definite time protection *I>>*: *FUN=160*, and
- Transformer differential protection ΔI_T: *FUN=176*.

Generic services and fault log disposal have not been implemented to date. Furthermore, the REF542*plus* does not deliver certain information, namely:

Regarding distance protection

- INF 25 and INF 26 (characteristic 3 or 4) in command and monitoring direction.
  Only two sets of parameters are available with this protection function.
- INF 35 (phase sequence supervision)
  A faulty phase sequence is not indicated with this protection function.
- INF 69, 70, 71 (trip L_1, trip L_2, trip L_3)
  A trip is not indicated separately for each phase with this protection function.
- INF 144, 145, 146, 147
  Measured values are signaled by the ASDU only.

Regarding overcurrent definite time protection

- INF 25 and INF 26 (characteristic 3 or 4) in command and monitoring direction.
  Only two sets of parameters are available with this protection function.
- INF 35 (phase sequence supervision)
  A faulty phase sequence is not indicated with this protection function.
- INF 69, 70, 71 (trip L1, trip L2, trip L3)
  A trip is not indicated separately for each phase with this protection function.
- INF 144, 145, 147
  Measured values are signaled by the ASDU only.

Regarding transformer differential protection

- INF 25 and INF 26 (characteristic 3 or 4) in command and monitoring direction.
  Only two sets of parameters are available with this protection function.
- INF 69, 70, 71 (trip L_1, trip L_2, trip L_3)
  A trip is not indicated separately for each phase with this protection function.
- INF 144, 145, 147
  Measured values are signaled by the ASDU only.

The scope of functions described above is specified in compact form in the interoperability list in Appendix C.

For combined units, such as the REF542*plus*, where protection and binary control functions are integrated within one device, additional information about the 'private' area of the common communication interface has to be transferred that is not included by the IEC 60870-5-103 standard. Therefore, some of the control and measuring functions available in the REF542*plus* are made available, based on the specifications in "Ergänzende Empfehlungen zur Anwendung in Verteilnetzen“ by VDEW [VDEW]. For more details, please refer to Appendix D.

The main function of overcurrent definite time protection has already been tested for the purpose of verifying interoperability and has been certified [FGH_UMZ].

There are two special aspects of the implementation discussed here which need to be taken into consideration:

1. The COM_I communication board does not provide for permanent storage of events. The consequence is that, when the device is being reset, events may be lost which have not yet been transferred to the higher-level system.
2. The commands
   - INF 16 (auto-reclose ON/OFF)
   - INF 17 (teleprotection ON/OFF)
   - INF 18 (protection ON/OFF)

   are executed and the current status is indicated. For disconnecting, for instance, the Auto-reclose ON command is specified. This will prompt a positive acknowledgment by status ON. Then, the status switches over to OFF.

In the configuration software, the IEC 60870-5-103 protocol is selected in the main menu under Settings / Device Configuration in the field bus section. The only parameter that needs to be specified is a device address.

6 MODBUS RTU

All data listed in the SPABUS table for the REF 542*plus* can be processed by the MODBUS RTU card.

The event chronology is codified in the SPABUS table. The buffer is in position to record the last 100 events. As the master unit sends out a request, the REF 542 *plus* transmits the stored events, marked by the absolute time (year-month-day-hour-second-millisecond). REF 542 *plus* shows the number of stored events in a dedicated location so that the master unit can read the event table (polling).

The unit type REF542 *plus* can record and encode as a wave form all the analog channels as well as the status of 32 digital channels and transmit them on request to the master unit. The master unit translates the file in “COMTRADE” format (by means of a *.ddl file). The unit feeds a buffer of 5 sec and a maximum number of 5 records (of 1 sec each). REF 542 *plus* is equipped with a dedicated memory to store the number of recorded events so that the master unit can read the records (polling).

6.1 Structure and operation principle

The communication between REF542 *plus* and the upper system level is based on master-slave procedures; the card does not generate data of any kind and cannot perform polling activities.

All the reading and writing activities carried out by REF 542 *plus* and the communication systems are based on a memory map located in the communication card. A dedicated PC-operated configuration tool defines this map; the card is configured by connecting the communication gate with the serial gate of the PC. The configuration tool is set up so as to program all the units connected to the same communication bus as well as to work on a single map.

The different possible architecture can be seen from the following figures.

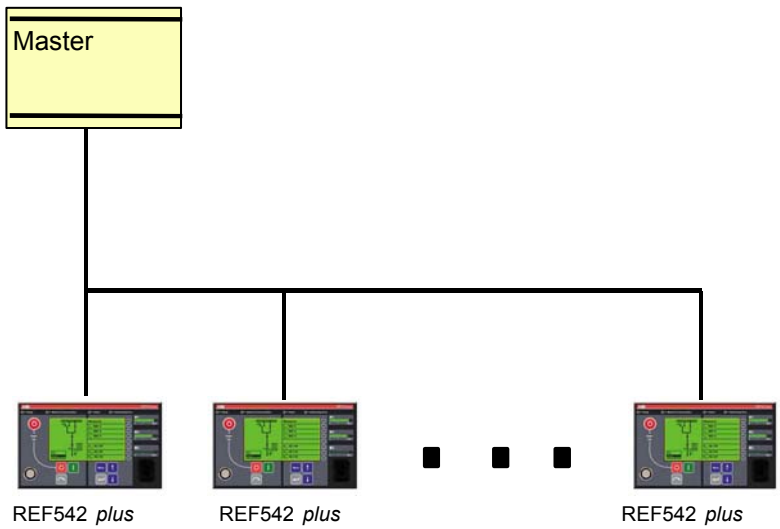

Figure 8: Single communication channel

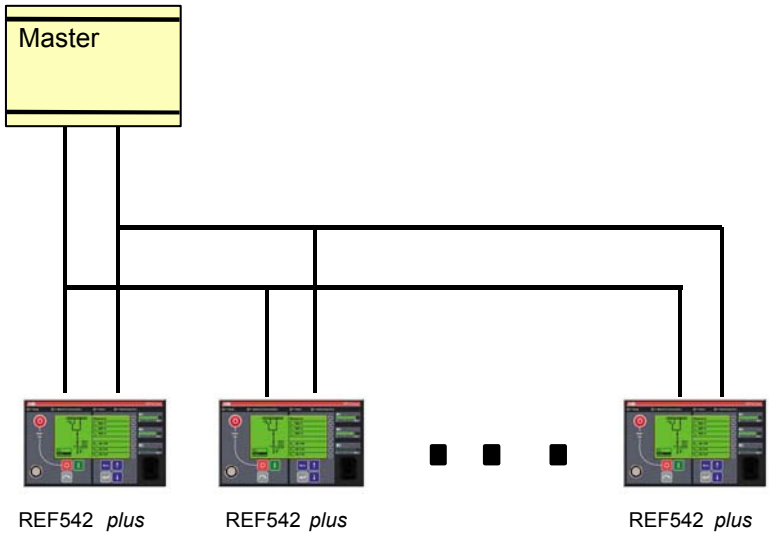

Figure 9: Double communication channel on redundant bus and master units

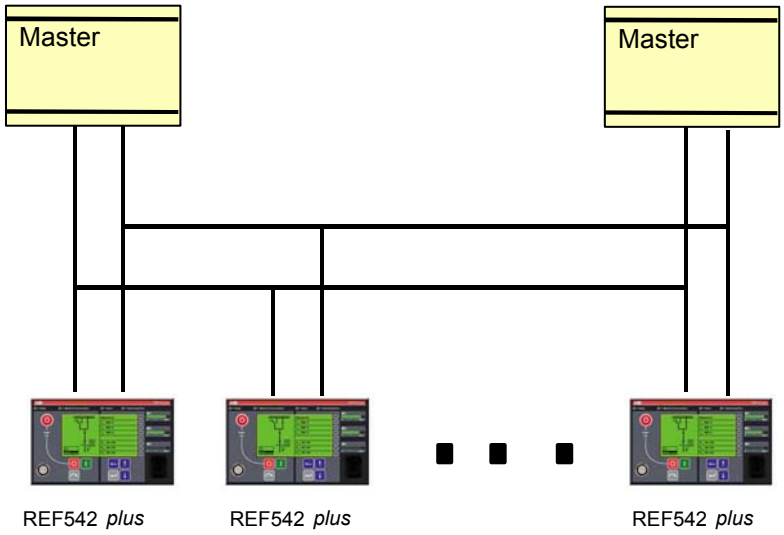

Figure 10: Double communication channel on redundant bus and master units

6.2 Interface

The communication card is available in two hardware versions: the first one with two serial communication gate having the same characteristics according to standard RS485 on twisted shielded pair. The second one also similar to the first one with two gates, but with glass fiber optic. The connector type is ST (up to two pairs of drivers Tx and Rx).

In the RS-485 version, the communication is half duplex for each channel and a general purpose I/O pin is used to enable/disable the transmitter/receiver. In the fibre optic version, the communication is full duplex. A general purpose I/O pin is used to enable/disable the re-circulation from Rx to Tx in case of ring topology of the fibre optic network.

In the next figure the MODBUS RTU board with 2 RS485 can be seen.

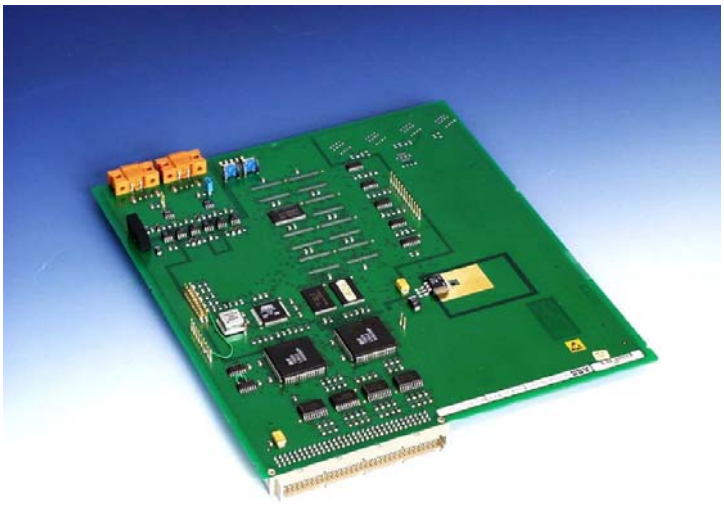

Figure 11: MODBUS RTU communication board with 2 RS485 connectors

The two gates work simultaneously and operate separately. In order to guarantee a high level of safety, the data are processed as per the following table:

R/W	Access	Mode
Data read-out	Always active on both gates.	Simultaneous readout.
Events readout	Always active on both gates.	Simultaneous readout.
Fault recording readout	Always active on both gates.	Simultaneous readout.
Control writing	Active on a single gate after the opening of a control session.	After one of the two gates get the input to open a control session, the same operation cannot be performed on the other gate. A further control session is made possible only after the conclusion of the previous session.
Parameter writing	Active on a single gate after the opening of a parameter session.	After one of the two gates get the input to open a parameter session, the same operation cannot be performed on the other gate. A further parameter session is made possible only after the conclusion of the previous session.

Both the control and the parameter session can work independently; they can be activated simultaneously either on the same gate or separately on the two gates. As to the single gate card, the controls and the parameters can be accessed only after the opening of the relevant sessions. The sessions can be closed in two different ways: on request or automatically, should the opening time exceed the maximum pre-set

time. The session opening does not affect the local or remote functionality of REF542*plus*.

Table 9: Main features of the REF 542 *plus* communication function using MODBUS RTU:

Description	Features
Type of transmission	Serial Asynchronous
Protocol	MODBUS RTU slave
Baud Rate	300, 600, 1.200, 2.400, 4.800, 9.600, 19.200, 38.400, 76.800 bauds
Data bits	11 (including start, stop, parity)
Parity check	None, even, odd
First communication mode	
Data flow	Half duplex
Connections	EIA RS485
Connectors	2 wires terminal block
Maximum distance	1300 m
Second communication mode	
Data flow	Full duplex
Connections	Glass fiber optic
Connector	Standard ST
Maximum distance	2000 m
Number of gates	Up to two for each communication mode
Number of units to be connected on the same bus	Up to 32

6.3 Configuration

The two gates communication cards can be configured independently on both sides:

Table 10: Configuration of the two gate cards

R/W	Access	Mode
Configuration writing	Active on a single gate after the opening of a configuration session.	After one of the two gates get the input to open a configuration session, the same operation cannot be performed on the other gate. A further configuration session is made possible only after the conclusion of the previous session.

6.4 Protocol

The MODBUS specification is implemented according to the following restrictions:

Only the RTU mode is implemented (ASCII mode is not implemented).

MODBUS function are handled according to the following table:

Function	Meaning	Implementation	Notes
1	Read coil status	full compliant	based on dynamic DDefs
2	Read input status	full compliant	based on dynamic DDefs
3	Read holding registers	full compliant	based on dynamic DDefs
4	Read input registers	full compliant	based on dynamic DDefs
5	Force single coil	full compliant	based on dynamic DDefs
6	Preset single register	full compliant	based on dynamic DDefs
7	Read exception status	full compliant	on static custom data
8	Loopback diagnostic test	compliant	on static custom data
9	Program – 1	not implemented	
10	Poll program complete - 1	not implemented	
11	Fetch event counter communications	not implemented	
12	Fetch communications event log	not implemented	
13	Program – 2	not implemented	
14	Poll program complete - 2	not implemented	
15	Force multiple coils	full compliant	based on dynamic DDefs
16	Preset multiple regis-ters	full compliant	based on dynamic DDefs
17	Report slave Id	compliant	on static custom data
18	Program – 3	not implemented	
19	Reset communications link	not implemented	
20	Read general reference	compliant on custom data	on 4 custom files
21	Write general reference	compliant on custom data	on 4 custom files
22..64	Reserved for expanded functions	not implemented	

Note

Each CommBoard serial channel may have a different MODBUS Slave Address. These addresses are supplied to the CommBoard following the steps described in the paragraph “Configuration” in the next chapter.

6.5 Addressing

The MODBUS protocol allows to read/write data by means of their addresses in the MODBUS virtual address space.

Such an address space is partitioned according to the following data types:

Table 11: MODBUS address space

Range	Length	Type	Access functions
1..10000	1 bit data	COILS	1 (read) , 5 (write), 15 (multiple write)
10001..20000	1 bit data	INPUT STATES	2 (read)
20001..30000	unused		
30001..40000	16 bits (word)	INPUT REGISTERS1	4 (read)
40001..50000	16 bits (word)	REGISTRI OUTPUT2	3 (read) , 6 (write), 16 (multiple write)

Note In order to allow a faster transmission of disturbance records, the Comm Board Modbus protocol reserves the Modbus range 39900 .. 39931 to the REF542 variable M31.

1 Device's variables that the Control system can read but not modify.
2 Device's variables that the Control system can read and modify.

7 Appendix A: Address list for the SPABUS communication board

The address list starts with a table of contents providing an overview of the functions listed below. Then, the registers are listed, sorted by functions.

A register address is specified by a channel and a code. The channel generally refers to the higher-level function, however, does not have to be unambiguous. The code describes the register type and contains an index. The register types mostly used are:

- I (input) for information on physical inputs,
- O (output) for information on physical outputs,
- S (setting) for parameters, and
- V (variable) for other variables.

A complete and correct register address, for instance, is 10I4
with channel 10, register type I and index 4. It reflects the status of a binary input. This status is assigned the events 10E0, indicating a changeover to status 1 (ON), and 10E1, occurring in case of change to status 0 (OFF).

Compared to the address list of the REF542, the following changes are to be noted:

System parameters (channel 0)
In order to support the 8th analog input, two new registers have been introduced and others postponed. Now, the following applies:
Sensor configuration:
Sensor 1 R-0-V-30
Sensor 2 R-0-V-31
Sensor 3 R-0-V-32
Sensor 4 R-0-V-33
Sensor 5 R-0-V-34
Sensor 6 R-0-V-35
Sensor 7 R-0-V-36
Sensor 8 R-0-V-37

and

Nominal grid values:
Sensor 1 R-0-V-40
Sensor 2 R-0-V-41
Sensor 3 R-0-V-42
Sensor 4 R-0-V-43
Sensor 5 R-0-V-44
Sensor 6 R-0-V-45
Sensor 7 R-0-V-46
Sensor 8 R-0-V-47

Measured values (channel 1)
In order to support the 8th analog input, registers
R-1-I-22, R-I-I-62, R-1-I-99, R-1-I-100, R-1-I-125, R-1-I-126
have been added.

Display unit (channel 4)
When introducing the new, projecting display unit, registers R-4-I-3 and R-4-I-4 were modified and registers R-4-I-11/42 added.

SPABUS List Release 4C01

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Protection function parameter												
Current protection functions												
Inrush blocking		50										
Overcurrent instantaneous		51										
Overcurrent definite time, high set		52										
Overcurrent definite time, low set		53										
Overcurrent directional, high set		54										
Overcurrent directional, low set		55										
Overcurrent IDMT normally inverse		56										
Overcurrent IDMT very inverse		57										
Overcurrent IDMT extremely inverse		58										
Overcurrent IDMT long-time inverse		59										
Earthfault non-directional, high set		66										
Earthfault non-directional, low set		67										
Earthfault IDMT normal inverse		68										
Earthfault IDMT very inverse		69										
Earthfault IDMT extremely inverse		70										
Earthfault IDMT long time inverse		71										
Earthfault directional, high set		72										
Earthfault directional, low set		73										
Sensitive Earthfault directional		88										
Voltage protection functions												
Overvoltage instantaneous		60										
Overvoltage definite time, high set		61										
Overvoltage definite time, low set		62										

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Undervoltage instantaneous		63										
Undervoltage definite time, high set		64										
Undervoltage definite time, low set		65										
Residual overvoltage definite time high		82										
Residual overvoltage definite time low		83										
Motor protection functions												
Thermal Overload		74										
Motorstart protection		80										
Blocked rotor protection		86										
Number of starts		87										
Distance protection functions												
Distance protection function		81										
Differential protection functions												
Differential protection function		79										
Other protection functions												
Unsymetrical load (Unbalanced load I)		75										
Unbalanced load II		75										
Directional power protection		76										
Low load protection		77										
Thermal supervision		78										
Frequency supervision		84										
Synchro Check		85										
Event list												
Monitoring values		0										
SCU Status		0										

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Monitoring special status IEC 60870-5-103		3										
System Errors												
operating system definition of errors		0										
driver EEPROM definition of errors		0										
HOST INTERFACE: definition errors		0										
COMMUNICATION: PC<->SCU de-fine. Errors		0										
PROTECTION FUNCTION: define. Errors		0										
CONFIGURATION errors		0										
LON: definition of errors		0										
Version and project in-formation												
Module type designation		0	F1	R	y					"ISM SCU"	ST	
Software version of controller		0	F2	R	y						ST	
Software version of DSP		0	F3	R	y						ST	
Software version of field bus interface		0	F4	R	y						ST	
Hardware version		0	F5	R	y						ST	
Software version of config software		0	F6	R	y						ST	
Project name		0	F7	R	y						ST	
Date of configuration of protection functions		0	F8	R	y						ST	
Time of configuration of protection functions		0	F9	R	y						ST	
Date of configuration of FUPLA		0	F10	R	y						ST	
Time of configuration of FUPLA		0	F11	R	y						ST	
Name of project manager		0	F12	R	y						ST	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Measurement values												
Sensors 1,2,3												
Actual Current L1		1	I1	R	n				A		SL	/1000
Actual Current L2		1	I2	R	n				A		SL	/1000
Actual Current L3		1	I3	R	n				A		SL	/1000
Actual Voltage U1_2		1	I8	R	n				V		SL	/1000
Actual Voltage U2_3		1	I9	R	n				V		SL	/1000
Actual Voltage U3_1		1	I10	R	n				V		SL	/1000
Actual Voltage U1_N		1	I11	R	n				V		SL	/1000
Actual Voltage U2_N		1	I12	R	n				V		SL	/1000
Actual Voltage U3_N		1	I13	R	n				V		SL	/1000
Current L1, % of Inom		1	I41	R	n				%		SL	/1000
Current L2, % of Inom		1	I42	R	n				%		SL	/1000
Current L3, % of Inom		1	I43	R	n				%		SL	/1000
Voltage U1_2, % of Unom		1	I48	R	n				%		SL	/1000
Voltage U2_3, % of Unom		1	I49	R	n				%		SL	/1000
Voltage U3_1, % of Unom		1	I50	R	n				%		SL	/1000
Voltage U1_N, % of Unom		1	I51	R	n				%		SL	/1000
Voltage U2_N, % of Unom		1	I52	R	n				%		SL	/1000
Voltage U3_N, % of Unom		1	I53	R	n				%		SL	/1000
Sensors 4,5,6												
Actual Current L1		1	I4	R	n				A		SL	/1000
Actual Current L2		1	I5	R	n				A		SL	/1000
Actual Current L3		1	I6	R	n				A		SL	/1000
Actual Voltage U1_2		1	I15	R	n				V		SL	/1000
Actual Voltage U2_3		1	I16	R	n				V		SL	/1000
Actual Voltage U3_1		1	I17	R	n				V		SL	/1000
Actual Voltage U1_N		1	I18	R	n				V		SL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Actual Voltage U2_N		1	I19	R	n				V		SL	/1000
Actual Voltage U3_N		1	I20	R	n				V		SL	/1000
Current L1, % of Inom		1	I44	R	n				%		SL	/1000
Current L2, % of Inom		1	I45	R	n				%		SL	/1000
Current L3, % of Inom		1	I46	R	n				%		SL	/1000
Voltage U1_2, % of Unom		1	I55	R	n				%		SL	/1000
Voltage U2_3, % of Unom		1	I56	R	n				%		SL	/1000
Voltage U3_1, % of Unom		1	I57	R	n				%		SL	/1000
Voltage U1_N, % of Unom		1	I58	R	n				%		SL	/1000
Voltage U2_N, % of Unom		1	I59	R	n				%		SL	/1000
Voltage U3_N, % of Unom		1	I60	R	n				%		SL	/1000
Sensor 7, 8												
Actual Current Io/ Voltage Uo (analog channel 7)		1	I7	R	n				V/A		SL	/1000
Actual Current Io/ Voltage Uo (analog channel 8)		1	I22	R	n				V/A		SL	/1000
Actual Value Io_Uo, calculated, Set 1		1	I14	R	n				V/A		SL	/1000
Actual Value Io_Uo, calculated, Set 2		1	I21	R	n				V/A		SL	/1000
Value Uo_Io , % of Io / Uo nom (analog channel 7)		1	I47	R	n				%		SL	/1000
Value Uo_Io , % of Io / Uo nom (analog channel 8)		1	I62	R	n				%		SL	/1000
Value Uo_Io, % of nom Set 1		1	I54	R	n				%		SL	/1000
Value Uo_Io, % of nom Set 2		1	I61	R	n				%		SL	/1000
Calculated values												
Frequency		1	I81	R	n				Hz		SL	/1000
Power factor cos(phi)		1	I82	R	n						SL	/1000
Active power		1	I83	R	n				kW		SL	/1000
Reactive power		1	I84	R	n				kvar		SL	/1000
Apparent power		1	I85	R	n				kVA		SL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Io * sin (phi) or Io * cos(phi)		1	I86	R	n				A		SL	/1000
Real Energy		1	I87	R	PD				MWh		SL	/1000
Reactive Energy		1	I88	R	PD				Mvarh		SL	/1000
Maximum measured values												
Demand current L1		1	I89	R	n				A		SL	/1000
Demand current L2		1	I90	R	n				A		SL	/1000
Demand current L3		1	I91	R	n				A		SL	/1000
Maximal demand current L1		1	I92	R	PD				A		SL	/1000
Maximal demand current L2		1	I93	R	PD				A		SL	/1000
Maximal demand current L3		1	I94	R	PD				A		SL	/1000
Synchrocheck dependent values												
Delta Phase		1	I95	R	n				°		SL	/1000
Delta Voltage		1	I96	R	n				V		SL	/1000
Actual Voltage between Sensor 3 and Sensor 7		1	I97	R	n				V		SL	/1000
Actual Voltage between Sensor 6 and Sensor 7		1	I98	R	n				V		SL	/1000
Actual Voltage between Sensor 3 and Sensor 8		1	I99	R	n				V		SL	/1000
Actual Voltage between Sensor 6 and Sensor 8		1	I100	R	n				V		SL	/1000
Delta Voltage in % of Unom		1	I122	R	n				%		SL	/1000
Actual Voltage between Sen. 3 and Sen. 7 in % of Unom		1	I123	R	n				%		SL	/1000
Actual Voltage between Sen. 6 and Sen. 7 in % of Unom		1	I124	R	n				%		SL	/1000
Actual Voltage between Sen. 3 and Sen. 8 in % of Unom		1	I125	R	n				%		SL	/1000
Actual Voltage between Sen. 6 and Sen. 8 in % of Unom		1	I126	R	n				%		SL	/1000
Voltage Monitoring												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
U1max L1-L2		1	I101	R	n				V		SL	/1000
U1max L2-L3		1	I102	R	n				V		SL	/1000
U1max L3-L1		1	I103	R	n				V		SL	/1000
U1min L1-L2		1	I104	R	n				V		SL	/1000
U1min L2-L3		1	I105	R	n				V		SL	/1000
U1min L3-L1		1	I106	R	n				V		SL	/1000
U2max L1-L2		1	I107	R	n				V		SL	/1000
U2max L2-L3		1	I108	R	n				V		SL	/1000
U2max L3-L1		1	I109	R	n				V		SL	/1000
U2min L1-L2		1	I110	R	n				V		SL	/1000
U2min L2-L3		1	I111	R	n				V		SL	/1000
U2min L3-L1		1	I112	R	n				V		SL	/1000
Energy pulse counter												
Actual value		110	V1..10	R/W	PD				MWh		SL	/1000
Energy per pulse		110	S1..10	R/W	y				kWh		SL	/1000
Counter object	#: instance number 1..8											
Number of fractional digits		96	V#1	R/W	y	0	3	1			US	1
Counter value		96	V#2	R/W	y	+/-2e9		acc. V1			SL	1/1000
Reset counter	1: E[7 * (# - 1)]	96	V#3	W	n	1	1	0			US	1
Reset value		96	V#4	R/W	y	+/-2e9		acc. V1			SL	1/1000
Warning threshold		96	V#5	R/W	y	+/-2e9		acc. V1			SL	1/1000
Alarm threshold		96	V#6	R/W	y	+/-2e9		acc. V1			SL	1/1000
Scale factor		96	V#7	R/W	y	1e8		acc. V1			UL	1/1000
Exponent		96	V#8	R/W	y	+/-2e9		1			SL	1/1000
Warning output state	1: E[(7 * (# - 1)) + 1], 0: E[(7 * (# - 1)) + 2]	96	O#1	R	n	0	1	1			US	1
Alarm output state	1: E[(7 * (# - 1)) + 3], 0: E[(7 * (# - 1)) + 4]	96	O#2	R	n	0	1	1			US	1
Overflow output state	1: E[(7 * (# - 1)) + 5](pos.)	96	O#3	R	n	0	1	1			US	1

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
	0: E[(7 * (# - 1)) + 6](neg.)											
Powerfactor controller												
Digital Inputs												
Block input	1=E22;0=E23	97	I1	R	n	0	1	1		0=blocking disabled; 1=blocking enabled	US	
Disconnect	1=E14;0=E15	97	I2	R	n	0	1	1		0=signal off; 1=signal on	US	
Reset	1=E21	97	I3	R	n	0	1	1		1=signal on	US	
Mode: Manual	1=E24;0=E25	97	I4	R	n	0	1	1		0=automatic; 1=manual	US	
Set Night	1=E26;0E27	97	I5	R	n	0	1	1		0=day; 1=night	US	
Overtemp	1=E8;0=E9	97	I6	R	n	0	1	1		0=signal off; 1=signal on	US	
V Min / V Max	1=E12;0=E13	97	I7	R	n	0	1	1		0=signal off; 1=signal on	US	
Va Max	1=E10;0=E11	97	I8	R	n	0	1	1		0=signal off; 1=signal on	US	
Manual Control 0..3		97	I9..12	R	n	0	1	1		0=disconnect bank; 1=connect bank	US	
Checked Back 0..3		97	I13..16	R	n	0	1	1		0=bank not connected;1=bank connected	US	
Digital Outputs												
Q Alarm (more reactive power needed)	1=E18;0=E19	97	O1	R	n	0	1	1		0=signal off; 1=signal on	US	
cos phi Alarm (threshold value reached)	1=E16;0=E17	97	O2	R	n	0	1	1		0=signal off; 1=signal on	US	
Operations Alarm (max allowed operations reached)	1=E20	97	O3	R	n	0	1	1		0=signal off; 1=signal on	US	
General alarm (e.g VaMax, Overtemp ...)		97	O4	R	n	0	1	1		1=signal on	US	
Switch On/Off 0..3 (which banks to connect)	Bank On=E0..E3; Bank Off=E4..E7	97	O5..8	R	n	0	1	1		0=disconnect bank; 1=connect bank	US	
Parameters												
Number of Capacitor Banks		97	S1	R	n	1	4	1		number of available capacitor banks	US	
Reactive Power of smallest Bank, Qc0		97	S2	R	n	1	20000	1	KVAr	capacity of the smallest bank	UL	
Switching sequence (linear, circular)		97	S3	R	n	0	1	1		0=linear; 1=circular	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Configuration of Banks		97	S4	R	n	0	65535	1	Units of Qc0	Units of Qc0 of the Banks: 4 Bit per Bank: Value=0..15 / Bit 0..3=Bank 4, Bit 4..7=Bank 3,Bit 8..11=Bank2, Bit 12..15=Bank1	US	
Max Operations		97	S5	R	n	1	10000	1		maximal operations for each bank	US	
Neutral Zone (Switching hysteresis)		97	S6	R/W	y	105	200	1	%	Neutral Zone for switching of a bank (in % of Qc0)	US	
Pickup Value (Switching hysteresis)		97	S7	R/W	y	0	100	1	%	Pickup Value for switching of a Bank (in % of Qc0)	US	
Parameter Set 1												
Operation Method (direct/integral)		97	S9	R	n	0	1	1		0=direct; 1=integral	US	
Discharge blocking time		97	S10	R/W	y	1	7200	1	s		UL	
Dead time		97	S11	R/W	y	1	120	1	s		UL	
Poweron delay		97	S12	R/W	y	1	7200	1	s		UL	
Integration time		97	S14	R/W	y	1	7200	1	s	duration of integration	UL	
Day / Night												
cos phi setpoint		97	S15/20	R/W	y	0,7	1	0,01		cos phi setpoint	SL	
setpoint cos phi = capacitiv or inductiv		97	S16/21	R/W	y	0	1	1		0=capacitiv; 1=inductiv	US	
cos phi Limit		97	S17/22	R/W	y	0	1	0,01		alarm threshold for cos phi	SL	
Limit cos phi = capacitiv or inductiv		97	S18/23	R/W	y	0	1	1		0=capacitiv; 1=inductiv	US	
Parameter Set 2												
Operation Method (direct/integral)		97	S25	R	n	0	1	1		0=direct; 1=integral	US	
Discharge blocking time		97	S26	R/W	y	0	7200	1	s		UL	
Dead time		97	S27	R/W	y	0	120	1	s		UL	
Poweron delay		97	S28	R/W	y	0	7200	1	s		UL	
Integration time		97	S30	R/W	y	0	7200	1	s		UL	
Day / Night												
cos phi setpoint		97	S31/36	R/W	y	0,7	1	0,01		cos phi setpoint	SL	
setpoint cos phi = capacitiv or inductiv		97	S32/37	R/W	y	0	1	1		0=capacitiv; 1=inductiv	US	
cos phi Limit		97	S33/38	R/W	y	0	1	0,01		alarm threshold for cos phi	SL	
Limit cos phi = capacitiv or inductiv		97	S34/39	R/W	y	0	1	1		0=capacitiv; 1=inductiv	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Monitoring values												
Circuit breaker contact wear CB		90	V100	R/W	PD					0=Reset	UL	/1000
Operating hours		90	V101	R	PD				h		UL	/1000
Added switched current of CB		90	V102	R/W	PD				A		UL	/1000
Coil continuity output 1, I/O card 1		90	V103	R	n	0	1	1		0=continuity; 1=no continuity alarm	US	
Coil continuity output 2, I/O card 1		90	V104	R	n	0	1	1		0=continuity; 1=no continuity alarm	US	
Coil continuity output 1, I/O card 2		90	V105	R	n	0	1	1		0=continuity; 1=no continuity alarm	US	
Coil continuity output 2, I/O card 2		90	V106	R	n	0	1	1		0=continuity; 1=no continuity alarm	US	
LCU												
Status LED 1(ALARM)	0=E7,1=E6	4	I1	R	n	0	3	1		0=black; 1=red	US	
Status LED 2 (interlocking)	All with channel 0: 2=E9,1=E8	4	I2	R	n	0	3	1		0=black; 1=red; 2=green	US	
Status LED: READY		4	I3	R	n	0	3	1		0=black; 2=green	US	
Status LED: network communication		4	I4	R	n	0	3	1		0=black; 1=red; 2=green	US	
Status LED 10 (protection function)	All wich channel 0: E10=ready started (black-grn) E11=start started(grn-amb) E12=trip started(amb-red) E13=trip back(red-amb) E14=start back(amb-grn) E15=ready back(grn-black) grn-red: see trip events start red-grn: see trip events back	4	I10	R	n	0	3	1		0=black; 1=red; 2=green; 3=amber	US	
Status LED: config. 1..32		4	I11/42	R	n	0	3	1		0=black; 1=red; 2=green; 3=amber	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Status of local/remote key switch	0=E29,1=E28	0	V6	R	n	0	1	1		0=local; 1=remote	US	
Status of operational/set key switch	0=E27,1=E26	0	V7	R	n	0	1	1		0=operational; 1=set	US	
Binary inputs												
Card 1												
Binary input status, 1 to 14, I/O card 1		2	I1/14	R	n	0	9	1		0=open status; 1=closed status; 9=not in use	US	
Card 2												
Binary input status, 15 to 28, I/O card 2		3	I1/14	R	n	0	9	1		0=open status; 1=closed status; 9=not in use	US	
Switch objects												
Status input												
Status "1 input"												
Status of an object, "1 input"	0=E1;1=E0	5..49,111...127	I4	R	n	0	1	1		0=false; 1=true	US	
Status "2 input"												
Status of an object, "2 inputs"	0=E0 ; 1=E2 ; 2=E1 ; 3=E4	5..49,111...127	I1	R	n	0	3	1		0=moving; 1=closed; 2=open; 3=error	US	
Closed status of an object "2 inputs"		5..49,111...127	I2	R	n	0	1	1		0=not closed; 1=closed	US	
Open status of an object, "2 inputs"		5..49,111...127	I3	R	n	0	1	1		0=not open; 1=open	US	
Status "3 input"												
Status of an object, "3 inputs"	0=E0;3=E1;2=E2;1=E3;4=E4	5..49,111...127	I5	R	n	0	4	1		0=moving;1=on line;2=isolated;3=on earth;4=error	US	
Line status of an object, "3 inputs"		5..49,111...127	I6	R	n	0	1	1		0=not on line; 1=on line	US	
Isolation/open status of an object, "3 inputs"		5..49,111...127	I7	R	n	0	1	1		0=not isolated; 1=isolated	US	
Earth status of an object, "3 inputs"		5..49,111...127	I8	R	n	0	1	1		0=not on earth; 1=on earth	US	
End not reached	1=E7 ; 0=E8	5..49,111...127	I9	R	n	0	1	1		0=nothing detected; 1=end not reached	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Status output												
Trip/Signal output status, output 1 of switching object		5..49,111...127	I51	R	n	0	9	1		0=open status;1=closed status; 9=not in use	US	
Trip/Signal output status, output 2 of switching object		5..49,111...127	I52	R	n	0	9	1		0=open status;1=closed status; 9=not in use	US	
Direct output write - station												
Write to one output object	0=E5;1=E6	5..49,111...127	O1	W	n	0	1	1		0=open it; 1=close it	US	
Write to two outputs object	0=E9;1=E10	5..49,111...127	O1	W	n	0	1	1		0=open it; 1=close it	US	
Write 4/3 or 6/5 outputs object Isolator		5..49,111...127	O2	W	n	0	1	1		0=goto earth; 1=goto line	US	
Write 4/3 or 6/5 outputs object Earthing switch		5..49,111...127	O3	W	n	0	1	1		0=goto line; 1=goto earth	US	
Direct signal output write 1 to 2		5..49,111...127	O1	W	n	0	1	1		0=not active; 1=active	US	
Direct signal output write 3 to 4		5..49,111...127	O1	W	n	0	1	1		0=not active; 1=active	US	
Direct output write - remote												
Write to one output object	0=E5;1=E6	5..49,111...127	O4	W	n	0	1	1		0=open it; 1=close it	US	
Write to two outputs object	0=E9;1=E10	5..49,111...127	O4	W	n	0	1	1		0=open it; 1=close it	US	
Write 4/3 or 6/5 outputs object Isolator		5..49,111...127	O5	W	n	0	1	1		0=goto earth; 1=goto line	US	
Write 4/3 or 6/5 outputs object Earthing switch		5..49,111...127	O6	W	n	0	1	1		0=goto line; 1=goto earth	US	
Direct signal output write 1 to 2		5..49,111...127	O4	W	n	0	1	1		0=not active; 1=active	US	
Direct signal output write 3 to 4		5..49,111...127	O4	W	n	0	1	1		0=not active; 1=active	US	
Double command state read												
Selection	E21: not selected; E22: selected	5..49,111...127	V1	R	n	0	1	1		0: not selected; 1; selected	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Interlocking bypass	E23: not active; E24: active	5..49,111...127	V7	R	n	0	1	1		7	US	
Double command output write - station												
Select	E21: not selected; E22: selected	5..49,111...127	V1	R/W	n	0	1	1		0: not selected, 1: selected / select	US	
Write to one output object	1=E5	5..49,111...127	V2	W	n	1	1	1		1=switch it ON	US	
Write to one output object	1=E6	5..49,111...127	V3	W	n	1	1	1		1=switch it OFF	US	
Write to two output object	0=E9;1=E10	5..49,111...127	V2	W	n	1	1	1		1=close it	US	
Write to two output object	0=E5;1=E6	5..49,111...127	V3	W	n	1	1	1		1=open it	US	
Two output object: Select open	0=E21;1=E22	5..49,111...127	V5	W	n	1	1	1		1=select open	US	
Two output object: Select close	0=E21;1=E22	5..49,111...127	V6	W	n	1	1	1		1=select close	US	
Cancel select		5..49,111...127	V4	W	n	1	1	1		1=cancel select	US	
Interlocking bypass (ATTENTION! use it with great care!)	E23: not active; E24: active	5..49,111...127	V7	R/W	n	0	1	1		0: not active, 1: active / activate	US	
Synchrocheck bypass (new 22-SO only)	E23: not active; E24: active	5..49,111...127	V8	R/W	n	0	1	1		0: not active, 1: active / activate	US	
Double command output write - remote												
Select	E21: not selected; E22: selected	5..49,111...127	V9	W	n	1	1	1		1: select	US	
Write to one output object	1=E5	5..49,111...127	V10	W	n	1	1	1		1=switch it ON	US	
Write to one output object	1=E6	5..49,111...127	V11	W	n	1	1	1		1=switch it OFF	US	
Write to two output object	0=E9;1=E10	5..49,111...127	V10	W	n	1	1	1		1=close it	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Write to two output object	0=E5;1=E6	5..49,111...127	V11	W	n	1	1	1		1=open it	US	
Two output object: Select open	0=E21;1=E22	5..49,111...127	V13	W	n	1	1	1		1=select open	US	
Two output object: Select close	0=E21;1=E22	5..49,111...127	V14	W	n	1	1	1		1=select close	US	
Cancel select		5..49,111...127	V12	W	n	1	1	1		1=cancel select	US	
Interlocking bypass (ATTENTION! use it with great care!)	E23: not active; E24: active	5..49,111...127	V15	W	n	1	1	1		1: activate	US	
Synchrocheck bypass (new 22-SO only)	E23: not active; E24: active	5..49,111...127	V16	W	n	1	1	1		1: activate	US	
Supervision												
Number of cycles of switching object, SO22, CB		5..49,111...127	V100	R/W	n						US	
Trip relays supervision, output 1 of switching object		5..49,111...127	V102	R	n	0	1	1		1=ok; 0=relay blocked alarm	US	
Trip relays supervision, output 2 of switching object		5..49,111...127	V103	R	n	0	1	1		1=ok; 0=relay blocked alarm	US	
Nr. of cycles isolator (SO43, SO65)		5..49,111...127	V104	R/W	PD						US	
Nr. of cycles earthing switch (SO43, SO65)		5..49,111...127	V105	R/W	PD						US	
Event mask												
Event 1 to 16		5..49,111...127	V21	R	y	0	65535	1			UL	/1000
Event 17 to 32		5..49,111...127	V22	R	y	0	65535	1			UL	/1000
22-switch object II												
Additional events												
Select confirmation positive	E26	5..49,111...127										
Select confirmation negative	E27 incl. error code as analogue parameter	5..49,111...127										

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Execution confirmation positive	E28	5..49,111. ..127										
Execution confirmation negative	E29 incl. error code as analogue parameter	5..49,111. ..127										
Execution termination positive	E30	5..49,111. ..127										
Execution termination negative	E31 incl. error code as analogue parameter	5..49,111. ..127										
Status Indication												
Device Operation Blocked	0=E15; 1=E16	5..49,111. ..127	I14	R	n	0	4	1		0=passive; 1=active		
Disc. Interlocked	0=E17, 1=E18	5..49,111. ..127	I15	R	n	0	4	1		0=passive; 1=active		
Additional: Error codes												
No error (no event)	0	5..49,111. ..127										
Target position already present	1	5..49,111. ..127										
Switch authority (allocation) not granted	2	5..49,111. ..127										
Switch object not selected	3	5..49,111. ..127										
Switch object blocked	4	5..49,111. ..127										
Requested channel interlocked	5	5..49,111. ..127										
Grant signal timeout	6	5..49,111. ..127										
2-2 H-Bridge Switch object II												
Position Indication												
Position Indication	0=E0; 1=E2; 2=E1; 3=E4	5..49,111. ..127	I11	R	n	0	4	1		0=moving; 1= disc.closed; 2=disc. open; 3=error	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Status Indication												
Command Timeout (End position not reached)	0=E9; 1=E10	5..49,111...127	I9	R	n	0	4	1		0=passive; 1=active	US	
Device Operation Blocked	0=E15; 1=E16	5..49,111...127	I14	R	n	0	4	1		0=passive; 1=active		
Disc. Interlocked	0=E17, 1=E18	5..49,111...127	I15	R	n	0	4	1		0=passive; 1=active		
Selected	0=E21, 1=E22	5..49,111...129	V1	R	n	0	1	1		0=passive; 1=active		
Interlocking Bypassed	0=E23, 1=E24	5..49,111...130	V7	R	n	0	1	1		0=passive; 1=active		
Single Commands Station												
Open / Close		5..49,111...127	O2	W	n	0	1	1		0=open line; 1=close line	US	
Single Commands Remote												
Disc. Open / Close		5..49,111...127	O22	W	n	0	1	1		0=open line; 1=close line	US	
Double Commands Station												
Select Open		5..49,111...127	V5	W	n	1	1	1		1=select open	US	
Close		5..49,111...127	V2	W	n	1	1	1		1=close it	US	
Open		5..49,111...127	V3	W	n	1	1	1		1=open it	US	
Cancel Select		5..49,111...127	V4	W	n	1	1	1		1=cancel select	US	
Interlocking bypass		5..49,111...127	V7	W	n	0	1	1		0= bypass passive; 1= bypass active	US	
Double Commands Remote												
Select Open		5..49,111...127	V25	W	n	1	1	1		1=select open	US	
Close		5..49,111...127	V22	W	n	1	1	1		1=close it	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Open		5..49,111...127	V23	W	n	1	1	1		1=open it	US	
Cancel Select		5..49,111...127	V24	W	n	1	1	1		1=cancel select	US	
Interlocking bypass		5..49,111...127	V27	W	n	0	1	1		0= bypass passive; 1= bypass active	US	
Supervision												
Nr. of cycles Line		5..49,111...127	V104	R/W	n	0	65535	1			US	
Nr. of cycles Earth		5..49,111...127	V105	R/W	n	0	65535	1			US	
Additional events												
Select confirmation positive	E26	5..49,111...127										
Select confirmation negative	E27 incl. error code as analogue parameter	5..49,111...127										
Execution confirmation positive	E28	5..49,111...127										
Execution confirmation negative	E29 incl. error code as analogue parameter	5..49,111...127										
Execution termination positive	E30	5..49,111...127										
Execution termination negative	E31 incl. error code as analogue parameter	5..49,111...127										
Event mask												
Event 1 to 16		5..49,111...127	V21	R	y	0	65535	1			UL	
Event 17 to 32		5..49,111...127	V22	R	y	0	65535	1			UL	
4-4 H-Bridge Switch object II												
Position Indication												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Disconnector Position Indication	0=E0; 1=E1; 2=E2; 3=E4	5..49,111...127	I11	R	n	0	4	1		0=moving; 1= disc.closed; 2=disc. open; 3=error	US	
Earth Position Indication	0=E5; 1=E6; 2=E7; 3=E8	5..49,111...127	I12	R	n	0	4	1		0=moving; 1= earth closed; 2= earth open; 3=error	US	
Status Indication												
Command Timeout (End position not reached)	0=E9; 1=E10	5..49,111...127	I9	R	n	0	4	1		0=passive; 1=active	US	
Device Operation Blocked	0=E15; 1=E16	5..49,111...127	I14	R	n	0	4	1		0=passive; 1=active		
Disc. Interlocked	0=E17, 1=E18	5..49,111...127	I15	R	n	0	4	1		0=passive; 1=active		
Earth Interlocked	0=E19, 1=E20	5..49,111...128	I16	R	n	0	4	1		0=passive; 1=active		
Selected	0=E21, 1=E22	5..49,111...129	V1	R	n	0	1	1		0=passive; 1=active		
Interlocking Bypassed	0=E23, 1=E24	5..49,111...130	V7	R	n	0	1	1		0=passive; 1=active		
Single Commands Station												
Disc. Open / Close		5..49,111...127	O2	W	n	0	1	1		0=open line; 1=close line	US	
Earth Open / Close		5..49,111...127	O3	W	n	0	1	1		0=open earth; 1=close earth	US	
Single Commands Remote												
Disc. Open / Close		5..49,111...127	O22	W	n	0	1	1		0=open line; 1=close line	US	
Earth Open / Close		5..49,111...127	O23	W	n	0	1	1		0=open earth; 1=close earth	US	
Double Commands Station												
Disc. Select Open		5..49,111...127	V5	W	n	1	1	1		1=select open	US	
Disc. Select Close		5..49,111...127	V6	W	n	1	1	1		1=select close	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Disc. Close		5..49,111...127	V2	W	n	1	1	1		1=close it	US	
Disc. Open		5..49,111...127	V3	W	n	1	1	1		1=open it	US	
Disc. Cancel Select		5..49,111...127	V4	W	n	1	1	1		1=cancel select	US	
Disc. Interlocking bypass		5..49,111...127	V7	W	n	0	1	1		0= bypass passive; 1= bypass active	US	
Earth Select Open		5..49,111...127	V15	W	n	1	1	1		1=select open	US	
Earth Select Close		5..49,111...127	V16	W	n	1	1	1		1=select close	US	
Earth Close		5..49,111...127	V12	W	n	1	1	1		1=close it	US	
Earth Open		5..49,111...127	V13	W	n	1	1	1		1=open it	US	
Earth Cancel Select		5..49,111...127	V14	W	n	1	1	1		1=cancel select	US	
Earth Interlocking bypass		5..49,111...127	V17	W	n	0	1	1		0= bypass passive; 1= bypass active	US	
Double Commands Remote												
Disc. Select Open		5..49,111...127	V25	W	n	1	1	1		1=select open	US	
Disc. Select Close		5..49,111...127	V26	W	n	1	1	1		1=select close	US	
Disc. Close		5..49,111...127	V22	W	n	1	1	1		1=close it	US	
Disc. Open		5..49,111...127	V23	W	n	1	1	1		1=open it	US	
Disc. Cancel Select		5..49,111...127	V24	W	n	1	1	1		1=cancel select	US	
Disc. Interlocking bypass		5..49,111...127	V27	W	n	0	1	1		0= bypass passive; 1= bypass active	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Earth Select Open		5..49,111...127	V35	W	n	1	1	1		1=select open	US	
Earth Select Close		5..49,111...127	V36	W	n	1	1	1		1=select close	US	
Earth Close		5..49,111...127	V32	W	n	1	1	1		1=close it	US	
Earth Open		5..49,111...127	V33	W	n	1	1	1		1=open it	US	
Earth Cancel Select		5..49,111...127	V34	W	n	1	1	1		1=cancel select	US	
Earth Interlocking bypass		5..49,111...127	V37	W	n	0	1	1		0= bypass passive; 1= bypass active	US	
Additional events												
Select confirmation positive	E26	5..49,111...127										
Select confirmation negative	E27 incl. error code as analogue parameter	5..49,111...127										
Execution confirmation positive	E28	5..49,111...127										
Execution confirmation negative	E29 incl. error code as analogue parameter	5..49,111...127										
Execution termination positive	E30	5..49,111...127										
Execution termination negative	E31 incl. error code as analogue parameter	5..49,111...127										
Supervision												
Nr. of cycles Line		5..49,111...127	V104	R/W	n	0	65535	1			US	
Nr. of cycles Earth		5..49,111...127	V105	R/W	n	0	65535	1			US	
Event mask												
Event 1 to 16		5..49,111...127	V21	R	y	0	65535	1			UL	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Event 17 to 32		5..49,111...127	V22	R	y	0	65535	1			UL	
4-4 H-Bridge Switch object I (old)												
Status input												
Status of an object, "4 inputs"		5..49,111...127	I10	R	n	0	4	1		0=moving;1=line closed;2=line open and earth open;3=earth closed;4=error	US	
Line status of an object, "4 inputs"	0=E0;1=E1;2=E2;3=E4	5..49,111...127	I11	R	n	0	4	1		0=moving; 1= line closed; 2= line open; 3=error	US	
Earth status of an object, "4 inputs"	0=E5;1=E6;2=E7;3=E8	5..49,111...127	I12	R	n	0	4	1		0=moving; 1= earth closed; 2= earth open; 3=error	US	
Status output												
Read Puls Pin Status		5..49,111...127	O4	R	n	0	4	1		0: both passive; 1: right active; 2: left active; 3: error	US	
Puls pin left 1->0	E9	5..49,111...127										
Puls pin left 0->1	E10	5..49,111...127										
Interlocking left	E11	5..49,111...127										
Blocking error left	E12	5..49,111...127										
Puls pin right 1->0	E13	5..49,111...127										
Puls pin right 0->1	E14	5..49,111...127										
Interlocking right	E15	5..49,111...127										
Blocking error right	E16	5..49,111...127										
Timeout reset	E21	5..49,111...127										
Timeout detected	E22	5..49,111...127										

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Direct output write												
Write 4 outputs object Line		5..49,111...127	O2	W	n	0	1	1		0=open line; 1=close line	US	
Write 4 outputs object Earth		5..49,111...127	O3	W	n	0	1	1		0=open earth; 1=close earth	US	
Supervision												
Nr. of cycles Line		5..49,111...127	V104	R/W	n						US	
Nr. of cycles Earth		5..49,111...127	V105	R/W	n						US	
Event mask												
Event 1 to 16		5..49,111...127	V21	R	y	0	65535	1			UL	/1000
Event 17 to 32		5..49,111...127	V22	R	y	0	65535	1			UL	/1000
Horizontal communication												
1bit read-write												
Direct write from SPABUS to FUPLA		101	O0..99	W	n	0	1	1		0=FALSE; 1=TRUE	US	
Status from FUPLA		101	I1..99	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Multiple write to status object		101	V0..83	W	n	0	65535	1			US	
1bit read												
Read input state	rise: E(2*(instance-1)), fall: E(2*(instance-1)+1)	98	I1-32	R	n	0	1	1			US	
16bit read												
Read input state	any change: E(Instance) If LON: incl. input bit pattern	99	I1-64	R	n	0	65535	1			US	
1bit write												
Write output state	no events	98	O1-32	W	n	0	1	1			US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Valid output state		98	V1-32	R	n	0	1	1			US	
16bit write												
Write output state	no events	99	O1-64	W	n	0	65536	1			US	
Valid output state		99	V1-64	R	n	0	1	1			US	
Resets												
Reset alarm		101	O100	W	n	1	1	0		1=reset alarm	US	
Reset maximum bar		101	O102	W	n	1	1	0		1=reset maximum bar	US	
Reset energy		101	O103	W	n	1	1	0		1=reset energy	US	
Reset switch cycles and added switch current CB		101	O104	W	n	1	1	0		1=reset CB values	US	
Analog objects												
Over threshold												
Threshold value		103..109	Sx1	R/W	y				In/Un		SL	/1000
Operational time		103..109	Sx2	R/W	y				s		SL	/1000
Block input		103..109	Ix1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output		103..109	Ox1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output		103..109	Ox2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Under threshold												
Threshold value		103..109	Sx3	R/W	y				In/Un		SL	/1000
Operational time		103..109	Sx4	R/W	y				s		SL	/1000
Block input		103..109	Ix2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output		103..109	Ox3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output		103..109	Ox4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
x : is the number of the analog object minus 1												
System parameters												
Test mode												
Status of test mode	0=E25;1=E24	0	V8	R	n	0	1	1		0=not in test mode; 1=in test mode	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Interlocking												
Interlocking status		0	V9	R	n	0	1	1		0=ok; 1=interlocking error	US	
Sensor configuration												
Sensor 1		0	V30	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Sensor 2		0	V31	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Sensor 3		0	V32	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Sensor 4		0	V33	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Sensor 5		0	V34	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Sensor 6		0	V35	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Sensor 7		0	V36	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Sensor 8		0	V37	R	y	0	4	1		0=not used;1=Volt.Trans;2=Cur.Trans;3=Cur.Rogo ;4=Volt.Sen	US	
Net nominal values												
Sensor 1		0	V40	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	
Sensor 2		0	V41	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	
Sensor 3		0	V42	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	
Sensor 4		0	V43	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	
Sensor 5		0	V44	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	
Sensor 6		0	V45	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Sensor 7		0	V46	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	
Sensor 8		0	V47	R	y	1 / 10	300k	1 / 10	A / V	not configured is replied with 0	SL	
Frequency		0	V25	R	y	50	60	10	Hz		SL	
System event mask												
Event 0 to 15		0	V21	R	y	0	65535	1			UL	/1000
Event 16 to 31		0	V22	R	y	0	65535	1			UL	/1000
Event 32 to 47		0	V23	R	y	0	65535	1			UL	/1000
Event 48 to 63		0	V24	R	y	0	65535	1			UL	/1000
Data communication												
Data communication address		0	V200	R/W	y	0	999	1		99=default	US	
Data transfer rate		0	V201	R	y	9600	9600	0		9600=fixed	UL	/1000
Events												
Reading of event registers		0	L	R	n							
Re-reading of event registers		0	B	R	n							
Event generation on/off	0=E1;1=E0	0	V52	R/W	y	0	1	1		0 = Event generation disable, 1 = Event gener. enable	US	
SCU mode												
Programm/run mode	0=E30;1=E31	0	S198	R/W	y	0	1	1		0=program mode; 1=run mode	US	
Data store into EEPROM	1=E32	0	V151	W	n	1	1	0		1=store and change to run mode	US	
Faultrecorder												
Start / end a session		0	V20	W		0	2	1		0=end session, 1=transfer uncompressed, 2=transfer Compressed		
Read number of stored records		0	V20	R		0	9	1			US	
Select a specific record		0	M28	W		1	9	1			US	
Read directory info of selected record		0	M28	R		0	999	1				
Read number of lines (each 64 Bytes) of selected record		0	M29	R		0	1023	1			US	
Read/Set line pointer of/to specific line to be tranferred next		0	M30	R/W		0	1023	1			US	
Read one line of selected data		0	M31	R		0	1023	1		line pointer will be incremented automatically	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Delete oldest record		0	V16	W		0	1	1		a sequence of 0 -> 1 is required to delete	US	
Read recorder status		0	V16	R		0	2	1		0=recorder memory not full, ready to transfer data (if any present), 1=recorder memory full, ready to tranfer data, 2=recorder busy, rearranging data after delete.	US	
Read/Set compression factor		0	V17	R/W		0	5	1	%	0=no compression, 1=1% compression, ...	US	
New Record available	0=E41											
Number of last stored record		0	V19	R		0	65535	1		0 = no record available 1..65535 = Number of last stored record		
Protection function parameter												
General protection parameter												
Active parameter set	0=E3;1=E2	0	V150	R/W	y	0	1	1		0 = Set 1, 1 = Set 2	US	
AR general on/off	0=E5;1=E4	0	V51	R/W	y	0	1	1		0 = AR off, 1 = AR on	US	
Current protection functions												
Inrush blocking												
Parameter												
Max. current value n		50	S1	R/W	y	2	8	0.001			UL	/1000
Starting time		50	S2	R/W	y	0.22	100	0.001	s	same for solid state and conventional relai	UL	/1000
Activate value m		50	S3	R/W	y	3	4	0.001			UL	/1000
Measurments												
Value at tripping of function		50	V1	R	n						UL	/1000
Max. measured value		50	V2	R	n						UL	/1000
Number of trips		50	V3	R/W	n						UL	/1000
Number of starts phase L1		50	V4	R/W	n						UL	/1000
Number of starts phase L2		50	V5	R/W	n						UL	/1000
Number of starts phase L3		50	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		50	V7	R	n				ms		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Duration of the latest start situation phase L2		50	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		50	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		50	V10	R	y						US	
Eventmask : Event 1 to 16		50	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		50	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	50	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	50	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	50	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	50	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	50	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	50	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent instantaneous												
Parameter												
Parameter set 1												
Overcurrent value Set 1		51	S1	R/W	y	0.1	40	0.001	In		UL	/1000
Overcurrent op. time Set 1		51	S2	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
AR parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	51	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1 Set 1		51	S4	R/W	y	0.1	40	0.001	In		UL	/1000
AR shot starting time 1, Set 1		51	S5	R/W	y	0.02	30	0.001	s		UL	/1000
AR shot dead time 1, Set 1		51	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		51	S7	R/W	y	0.02	30	0.001	s		UL	/1000
AR shot dead time 2, Set 1		51	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		51	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Overcurrent value Set 2		51	S21	R/W	y	0.1	40	0.001	In		UL	/1000
Overcurrent op. time Set 2		51	S22	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
AR parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	51	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		51	S24	R/W	y	0.1	40	0.001	In		UL	/1000
AR shot starting time 1, Set 2		51	S25	R/W	y	0.02	30	0.001	s		UL	/1000
AR shot dead time 1, Set 2		51	S26	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 2		51	S27	R/W	y	0.02	30	0.001	s		UL	/1000
AR shot dead time 2, Set 2		51	S28	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 2		51	S29	R/W	y	0.2	300	0.001	s		UL	/1000
Measurements												
Value at tripping of function		51	V1	R	n						UL	/1000
Max. measured value		51	V2	R	n						UL	/1000
Number of trips		51	V3	R/W	n						UL	/1000
Number of starts phase L1		51	V4	R/W	n						UL	/1000
Number of starts phase L2		51	V5	R/W	n						UL	/1000
Number of starts phase L3		51	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		51	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		51	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		51	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		51	V10	R	y						US	
Eventmask : Event 1 to 16		51	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		51	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	51	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Start output L2	0=E3;1=E2	51	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	51	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	51	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	51	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	51	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR input	0=E21;1=E20	51	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	51	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent definite time, high set												
Parameter												
Parameter set 1												
Overcurrent value Set 1		52	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 1		52	S2	R/W	y	0.2	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	52	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1		52	S4	R/W	y	0.1	40	0.001	In		UL	/1000
AR shot starting time 1, Set 1		52	S5	R/W	y	0.05	300	0.001	s		UL	/1000
AR shot dead time 1, Set 1		52	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		52	S7	R/W	y	0.05	300	0.001	s		UL	/1000
AR shot dead time 2, Set 1		52	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		52	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												
Overcurrent value Set 2		52	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 2		52	S22	R/W	y	0.2	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	52	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		52	S24	R/W	y	0.1	40	0.001	In		UL	/1000
AR shot starting time 1, Set 2		52	S25	R/W	y	0.05	300	0.001	s		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
AR shot dead time 1, Set 2		52	S26	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 2		52	S27	R/W	y	0.05	300	0.001	s		UL	/1000
AR shot dead time 2, Set 2		52	S28	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 2		52	S29	R/W	y	0.2	300	0.001	s		UL	/1000
Measurments												
Value at tripping of function		52	V1	R	n						UL	/1000
Max. measured value		52	V2	R	n						UL	/1000
Number of trips		52	V3	R/W	n						UL	/1000
Number of starts phase L1		52	V4	R/W	n						UL	/1000
Number of starts phase L2		52	V5	R/W	n						UL	/1000
Number of starts phase L3		52	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		52	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		52	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		52	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		52	V10	R	y						US	
Eventmask : Event 1 to 16		52	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		52	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	52	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	52	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	52	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	52	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	52	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block Out	0=E17;1=E16	52	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	52	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Block AR input	0=E21;1=E20	52	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	52	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent definite time, low set												
Parameter												
Parameter set 1												
Overcurrent value Set 1		53	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 1		53	S2	R/W	y	0.2	300	0.001	s	same for solid state and conventional relais	UL	/1000
Parameter set 2												
Overcurrent value Set 2		53	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 2		53	S22	R/W	y	0.2	300	0.001	s	same for solid state and conventional relai	UL	/1000
Measurments												
Value at tripping of function		53	V1	R	n						UL	/1000
Max. measured value		53	V2	R	n						UL	/1000
Number of trips		53	V3	R/W	n						UL	/1000
Number of starts phase L1		53	V4	R/W	n						UL	/1000
Number of starts phase L2		53	V5	R/W	n						UL	/1000
Number of starts phase L3		53	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		53	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		53	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		53	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		53	V10	R	y						US	
Eventmask : Event 1 to 16		53	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		53	V12	R	y	0	65535	1			UL	/1000
Input/Output status												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Start output L1	0=E1;1=E0	53	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	53	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	53	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	53	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	53	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	53	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent directional, high set												
Parameter												
Parameter set 1												
Overcurrent value Set 1		54	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 1		54	S2	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	54	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1		54	S4	R/W	y	0.1	40	0.001	In		UL	/1000
AR shot starting time 1, Set 1		54	S5	R/W	y	0.05	300	0.001	s		UL	/1000
AR shot dead time 1, Set 1		54	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		54	S7	R/W	y	0.05	300	0.001	s		UL	/1000
AR shot dead time 2, Set 1		54	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		54	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												
Overcurrent value Set 2		54	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 2		54	S22	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000
Direction Set 1		54	S10	R/W	y	0	1	1		0=in front; 1=behind	UL	/1000
Direction Set 2		54	S30	R/W	y	0	1	1		0=in front; 1=behind	UL	/1000
AR Parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	54	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		54	S24	R/W	y	0.1	40	0.001	In		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
AR shot starting time 1, Set 2		54	S25	R/W	y	0.05	300	0.001	s		UL	/1000
AR shot dead time 1, Set 2		54	S26	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 2		54	S27	R/W	y	0.05	300	0.001	s		UL	/1000
AR shot dead time 2, Set 2		54	S28	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 2		54	S29	R/W	y	0.2	300	0.001	s		UL	/1000
Measurments												
Value at tripping of function		54	V1	R	n						UL	/1000
Max. measured value		54	V2	R	n						UL	/1000
Number of trips		54	V3	R/W	n						UL	/1000
Number of starts phase L1		54	V4	R/W	n						UL	/1000
Number of starts phase L2		54	V5	R/W	n						UL	/1000
Number of starts phase L3		54	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		54	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		54	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		54	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		54	V10	R	y						US	
Eventmask : Event 1 to 16		54	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		54	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	54	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	54	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	54	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	54	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	54	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block Out	0=E17;1=E16	54	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Block input	0=E19;1=E18	54	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR input	0=E21;1=E20	54	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	54	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent directional, low set												
Parameter												
Parameter set 1												
Overcurrent value Set 1		55	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 1		55	S2	R/W	y	0.22	300	0.001	s	same for solid state and conventional relai	UL	/1000
Direction Set 1		55	S3	R/W	y	0	1	1		0=in front; 1=behind	US	
Parameter set 2												
Overcurrent value Set 2		55	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Overcurrent op. time Set 2		55	S22	R/W	y	0.22	300	0.001	s	same for solid state and conventional relai	UL	/1000
Direction Set 2		55	S23	R/W	y	0	1	1		0=in front; 1=behind	US	
Measurments												
Value at tripping of function		55	V1	R	n						UL	/1000
Max. measured value		55	V2	R	n						UL	/1000
Number of trips		55	V3	R/W	n						UL	/1000
Number of starts phase L1		55	V4	R/W	n						UL	/1000
Number of starts phase L2		55	V5	R/W	n						UL	/1000
Number of starts phase L3		55	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		55	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		55	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		55	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		55	V10	R	y						US	
Eventmask : Event 1 to 16		55	V11	R	y	0	65535	1			UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Eventmask : Event 17 to 32		55	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	55	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	55	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	55	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	55	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block Out	0=E17;1=E16	55	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	55	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	55	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent IDMT normally inverse												
Parameter												
Parameter set 1												
Overcurrent value Set 1		56	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		56	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 1												
Overcurrent value Set 2		56	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 2		56	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		56	V1	R	n						UL	/1000
Max. measured value		56	V2	R	n						UL	/1000
Number of trips		56	V3	R/W	n						UL	/1000
Number of starts phase L1		56	V4	R/W	n						UL	/1000
Number of starts phase L2		56	V5	R/W	n						UL	/1000
Number of starts phase L3		56	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		56	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		56	V8	R	n				ms		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Duration of the latest start situation phase L3		56	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		56	V10	R	y						US	
Eventmask : Event 1 to 16		56	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		56	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	56	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	56	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	56	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	56	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	56	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	56	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent IDMT Very inverse												
Parameter												
Parameter set 1												
Overcurrent value Set 1		57	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		57	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 2												
Overcurrent value Set 2		57	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 2		57	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		57	V1	R	n						UL	/1000
Max. measured value		57	V2	R	n						UL	/1000
Number of trips		57	V3	R/W	n						UL	/1000
Number of starts phase L1		57	V4	R/W	n						UL	/1000
Number of starts phase L2		57	V5	R/W	n						UL	/1000
Number of starts phase L3		57	V6	R/W	n						UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Duration of the latest start situation phase L1		57	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		57	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		57	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		57	V10	R	y						US	
Eventmask : Event 1 to 16		57	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		57	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	57	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	57	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	57	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	57	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	57	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	57	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent IDMT Extremly inverse												
Parameter												
Parameter set 1												
Overcurrent value Set 1		58	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		58	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 2												
Overcurrent value Set 2		58	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 2		58	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		58	V1	R	n						UL	/1000
Max. measured value		58	V2	R	n						UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Number of trips		58	V3	R/W	n						UL	/1000
Number of starts phase L1		58	V4	R/W	n						UL	/1000
Number of starts phase L2		58	V5	R/W	n						UL	/1000
Number of starts phase L3		58	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		58	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		58	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		58	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		58	V10	R	y						US	
Eventmask : Event 1 to 16		58	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		58	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	58	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	58	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	58	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	58	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	58	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	58	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overcurrent IDMT Long-time inverse												
Parameter												
Parameter set 1												
Overcurrent value Set 1		59	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		59	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 2												
Overcurrent value Set 2		59	S21	R/W	y	0.05	40	0.001	In		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Time multiplier Set 2		59	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		59	V1	R	n						UL	/1000
Max. measured value		59	V2	R	n						UL	/1000
Number of trips		59	V3	R/W	n						UL	/1000
Number of starts phase L1		59	V4	R/W	n						UL	/1000
Number of starts phase L2		59	V5	R/W	n						UL	/1000
Number of starts phase L3		59	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		59	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		59	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		59	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		59	V10	R	y						US	
Eventmask : Event 1 to 16		59	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		59	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	59	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	59	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	59	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	59	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	59	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	59	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault non-directional, high set												
Parameter												
Parameter set 1												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Earthfault current value Set 1		66	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 1		66	S2	R/W	y	0.07	100	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	66	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1		66	S4	R/W	y	0.05	40	0.001	In		UL	/1000
AR shot starting time 1, Set 1		66	S5	R/W	y	0.1	100	0.001	s		UL	/1000
AR shot dead time 1, Set 1		66	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		66	S7	R/W	y	0.1	100	0.001	s		UL	/1000
AR shot dead time 2, Set 1		66	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		66	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												
Earthfault current value Set 2		66	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 2		66	S22	R/W	y	0.07	100	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	66	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		66	S24	R/W	y	0.05	40	0.01	In		UL	/1000
AR shot starting time 1, Set 2		66	S25	R/W	y	0.1	100	0.001	s		UL	/1000
AR shot dead time 1, Set 2		66	S26	R/W	y	0.2	300	0.01	s		UL	/1000
AR shot starting time 2, Set 2		66	S27	R/W	y	0.1	100	0.001	s		UL	/1000
AR shot dead time 2, Set 2		66	S28	R/W	y	0.2	300	0.01	s		UL	/1000
AR reclaim time Set 2		66	S29	R/W	y	0.2	300	0.01	s		UL	/1000
Measurments												
Value at tripping of function		66	V1	R	n						UL	/1000
Max. measured value		66	V2	R	n						UL	/1000
Number of trips		66	V3	R/W	n						UL	/1000
Number of starts		66	V4	R/W	n						UL	/1000
Duration of the latest start situation		66	V7	R	n				ms		UL	/1000
Phases and event masks												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Phases used		66	V10	R	y						US	
Eventmask : Event 1 to 16		66	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		66	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	66	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	66	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	66	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	66	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR input	0=E21;1=E20	66	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	66	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault non-directional, low set												
Parameter												
Parameter set 1												
Earthfault current value Set 1		67	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 1		67	S2	R/W	y	0.07	100	0.001	s	same for solid state and conventional relai	UL	/1000
Parameter set 2												
Earthfault current value Set 2		67	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 2		67	S22	R/W	y	0.07	100	0.001	s	same for solid state and conventional relai	UL	/1000
Measurments												
Value at tripping of function		67	V1	R	n						UL	/1000
Max. measured value		67	V2	R	n						UL	/1000
Number of trips		67	V3	R/W	n						UL	/1000
Number of starts		67	V4	R/W	n						UL	/1000
Duration of the latest start situation		67	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		67	V10	R	y						US	
Eventmask : Event 1 to 16		67	V11	R	y	0	65535	1			UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Eventmask : Event 17 to 32		67	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	67	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	67	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	67	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	67	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault IDMT Normal Inverse												
Parameter												
Parameter set 1												
Earthfault current value Set 1		68	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		68	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 2												
Earthfault current value Set 2		68	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 2		68	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		68	V1	R	n						UL	/1000
Max. measured value		68	V2	R	n						UL	/1000
Number of trips		68	V3	R/W	n						UL	/1000
Number of starts		68	V4	R/W	n						UL	/1000
Duration of the latest start situation		68	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		68	V10	R	y						US	
Eventmask : Event 1 to 16		68	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		68	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	68	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	68	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	68	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Block input	0=E19;1=E18	68	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault IDMT Very Inverse												
Parameter												
Parameter set 1												
Earthfault current value Set 1		69	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		69	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 2												
Earthfault current value Set 2		69	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 2		69	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		69	V1	R	n						UL	/1000
Max. measured value		69	V2	R	n						UL	/1000
Number of trips		69	V3	R/W	n						UL	/1000
Number of starts		69	V4	R/W	n						UL	/1000
Duration of the latest start situation		69	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		69	V10	R	y						US	
Eventmask : Event 1 to 16		69	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		69	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	69	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	69	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	69	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	69	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault IDMT Extremly Inverse												
Parameter												
Parameter set 1												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Earthfault current value Set 1		70	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		70	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 2												
Earthfault current value Set 2		70	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 2		70	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		70	V1	R	n						UL	/1000
Max. measured value		70	V2	R	n						UL	/1000
Number of trips		70	V3	R/W	n						UL	/1000
Number of starts		70	V4	R/W	n						UL	/1000
Duration of the latest start situation		70	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		70	V10	R	y						US	
Eventmask : Event 1 to 16		70	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		70	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	70	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	70	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	70	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	70	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault IDMT Long time Inverse												
Parameter												
Parameter set 1												
Earthfault current value Set 1		71	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Time multiplier Set 1		71	S2	R/W	y	0.05	1	0.001	s		UL	/1000
Parameter set 2												
Earthfault current value Set 2		71	S21	R/W	y	0.05	40	0.001	In		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Time multiplier Set 2		71	S22	R/W	y	0.05	1	0.001	s		UL	/1000
Measurments												
Value at tripping of function		71	V1	R	n						UL	/1000
Max. measured value		71	V2	R	n						UL	/1000
Number of trips		71	V3	R/W	n						UL	/1000
Number of starts		71	V4	R/W	n						UL	/1000
Duration of the latest start situation		71	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		71	V10	R	y						US	
Eventmask : Event 1 to 16		71	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		71	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	71	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	71	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	71	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	71	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault directional, high set												
Parameter												
general Parameter												
Net-earthtype		72	S11	R/W	y	0	1	1		0=sin phi (isolated); 1=cos phi (earthed)	US	
Parameter set 1												
Earthfault current value Set 1		72	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 1		72	S2	R/W	y	0.04	100	0.001	s	same for solid state and conventional relai	UL	/1000
Direction Set 1		72	S10	R/W	y	0	1	1		0=in front; 1=behind	US	
AR Parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	72	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1		72	S4	R/W	y	0.05	40	0.001	In		UL	/1000
AR shot starting time 1, Set 1		72	S5	R/W	y	0.1	100	0.001	s		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
AR shot dead time 1, Set 1		72	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		72	S7	R/W	y	0.1	100	0.001	s		UL	/1000
AR shot dead time 2, Set 1		72	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		72	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												
Earthfault current value Set 2		72	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 2		72	S22	R/W	y	0.04	100	0.001	s	same for solid state and conventional relai	UL	/1000
Direction Set 2		72	S30	R/W	y	0	1	1		0=in front; 1=behind	US	
AR Parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	72	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		72	S24	R/W	y	0.05	40	0.001	In		UL	/1000
AR shot starting time 1, Set 2		72	S25	R/W	y	0.1	100	0.001	s		UL	/1000
AR shot dead time 1, Set 2		72	S26	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 2		72	S27	R/W	y	0.1	100	0.001	s		UL	/1000
AR shot dead time 2, Set 2		72	S28	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 2		72	S29	R/W	y	0.2	300	0.001	s		UL	/1000
Measurments												
Value at tripping of function		72	V1	R	n						UL	/1000
Max. measured value		72	V2	R	n						UL	/1000
Number of trips		72	V3	R/W	n						UL	/1000
Number of starts		72	V4	R/W	n						UL	/1000
Duration of the latest start situation		72	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		72	V10	R	y						US	
Eventmask : Event 1 to 16		72	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		72	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	72	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Trip output	0=E7;1=E6	72	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	72	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block Out	0=E17;1=E16	72	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	72	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR input	0=E21;1=E20	72	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	72	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earthfault directional, low set												
Parameter												
Parameter set 1												
Earthfault current value Set 1		73	S1	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 1		73	S2	R/W	y	0.04	100	0.001	s	same for solid state and conventional relai	UL	/1000
Direction Set 1		73	S3	R/W	y	0	1	1		0=sin phi (isolated); 1=cos phi (earthed)	US	
Net-earthtype Set 1		73	S4	R/W	y	0	1	1		0=in front; 1=behind	US	
Parameter set 2												
Earthfault current value Set 2		73	S21	R/W	y	0.05	40	0.001	In		UL	/1000
Earthfault op. time Set 2		73	S22	R/W	y	0.04	100	0.001	s	same for solid state and conventional relai	UL	/1000
Direction Set 2		73	S23	R/W	y	0	1	1		0=sin phi (isolated); 1=cos phi (earthed)	US	
Net-earthtype Set 2		73	S24	R/W	y	0	1	1		0=in front; 1=behind	US	
Measurments												
Value at tripping of function		73	V1	R	n						UL	/1000
Max. measured value		73	V2	R	n						UL	/1000
Number of trips		73	V3	R/W	n						UL	/1000
Number of starts		73	V4	R/W	n						UL	/1000
Duration of the latest start situation		73	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		73	V10	R	y						US	
Eventmask : Event 1 to 16		73	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		73	V12	R	y	0	65535	1			UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Input/Output status												
Start output	0=E1;1=E0	73	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	73	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	73	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block Out	0=E17;1=E16	73	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	73	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Sensitive Earthfault directional												
Parameter												
Parameter set 1												
Earthfault current value Set 1		88	S1	R/W	y	0.05	2	0.001	In0		UL	/1000
Earthfault op. time Set 1		88	S2	R/W	y	0.12	10	0.001	s	same for solid state and conventional relai	UL	/1000
Opening angle alpha		88	S3	R/W	y	0	20	0.001	°		UL	/1000
Residual Voltage		88	S4	R/W	y	0.1	0.7	0.001	Un		UL	/1000
Nettype/Direction/Phasecorrection		88	S5	R/W	y	-180	180	0.01	°		SL	/1000
Parameter set		88										
Earthfault current value Set 2		88	S21	R/W	y	0.05	2	0.001	In0		UL	/1000
Earthfault op. time Set 2		88	S22	R/W	y	0.12	10	0.001	s	same for solid state and conventional relai	UL	/1000
Opening angle alpha		88	S23	R/W	y	0	20	0.001	°		UL	/1000
Residual Voltage		88	S24	R/W	y	0.1	0.7	0.001	Un		UL	/1000
Nettype/Direction/Phasecorrection		88	S25	R/W	y	-180	180	0.01	°		SL	/1000
Parameter set 2		88										
Value at tripping of function		88	V1	R	n				In0		UL	/1000
Max. measured value		88	V2	R	n				In0		UL	/1000
Number of trips		88	V3	R/W	n						UL	/1000
Number of starts		88	V4	R/W	n						UL	/1000
Duration of the latest start situation		88	V7	R	n				ms		UL	/1000
Phases and event masks		88										
Phases used		88	V10	R	y						US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Input/Output status		88										
Start output	0=E1;1=E0	88	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	88	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	88	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block Out	0=E17;1=E16	88	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	88	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Voltage protection functions												
Overvoltage instantaneous												
Parameter												
Parameter set 1												
Overvoltage value Set 1		60	S1	R/W	y	0.8	2	0.001	Un		UL	/1000
Overvoltage op. time Set 1		60	S2	R/W	y	0.02	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	60	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1		60	S4	R/W	y	0.8	2	0.001	Un		UL	/1000
AR shot starting time 1, Set 1		60	S5	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 1, Set 1		60	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		60	S7	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 2, Set 1		60	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		60	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												
Overvoltage value Set 2		60	S21	R/W	y	0.8	2	0.001	Un		UL	/1000
Overvoltage op. time Set 2		60	S22	R/W	y	0.02	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	60	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		60	S24	R/W	y	0.8	2	0.001	Un		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
AR shot starting time 1, Set 2		60	S25	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 1, Set 2		60	S26	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 2		60	S27	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 2, Set 2		60	S28	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 2		60	S29	R/W	y	0.2	300	0.001	s		UL	/1000
Measurments												
Value at tripping of function		60	V1	R	n						UL	/1000
Max. measured value		60	V2	R	n						UL	/1000
Number of trips		60	V3	R/W	n						UL	/1000
Number of starts phase L1		60	V4	R/W	n						UL	/1000
Number of starts phase L2		60	V5	R/W	n						UL	/1000
Number of starts phase L3		60	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		60	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		60	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		60	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		60	V10	R	y						US	
Eventmask : Event 1 to 16		60	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		60	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	60	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	60	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	60	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	60	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	60	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	60	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Block AR input	0=E21;1=E20	60	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	60	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overvoltage definite time, high set												
Parameter												
Parameter set 1												
Overvoltage value Set 1		61	S1	R/W	y	0.8	2	0.001	Un		UL	/1000
Overvoltage op. time Set 1		61	S2	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	61	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1		61	S4	R/W	y	0.8	2	0.001	Un		UL	/1000
AR shot starting time 1, Set 1		61	S5	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 1, Set 1		61	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		61	S7	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 2, Set 1		61	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		61	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												
Overvoltage value Set 2		61	S21	R/W	y	0.8	2	0.001	Un		UL	/1000
Overvoltage op. time Set 2		61	S22	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	61	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		61	S24	R/W	y	0.8	2	0.001	Un		UL	/1000
AR shot starting time 1, Set 2		61	S25	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 1, Set 2		61	S26	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 2		61	S27	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 2, Set 2		61	S28	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 2		61	S29	R/W	y	0.2	300	0.001	s		UL	/1000
Measurments												
Value at tripping of function		61	V1	R	n						UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Max. measured value		61	V2	R	n						UL	/1000
Number of trips		61	V3	R/W	n						UL	/1000
Number of starts phase L1		61	V4	R/W	n						UL	/1000
Number of starts phase L2		61	V5	R/W	n						UL	/1000
Number of starts phase L3		61	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		61	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		61	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		61	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		61	V10	R	y						US	
Eventmask : Event 1 to 16		61	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		61	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	61	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	61	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	61	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	61	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	61	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	61	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR input	0=E21;1=E20	61	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	61	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overvoltage definite time, low set												
Parameter												
Parameter set 1												
Overvoltage value Set 1		62	S1	R/W	y	0.8	2	0.001	Un		UL	/1000
Overvoltage op. time Set 1		62	S2	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Parameter set 2												
Overvoltage value Set 2		62	S21	R/W	y	0.8	2	0.001	Un		UL	/1000
Overvoltage op. time Set 2		62	S22	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000
Measurments												
Value at tripping of function		62	V1	R	n						UL	/1000
Max. measured value		62	V2	R	n						UL	/1000
Number of trips		62	V3	R/W	n						UL	/1000
Number of starts phase L1		62	V4	R/W	n						UL	/1000
Number of starts phase L2		62	V5	R/W	n						UL	/1000
Number of starts phase L3		62	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		62	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		62	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		62	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		62	V10	R	y						US	
Eventmask : Event 1 to 16		62	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		62	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	62	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	62	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	62	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	62	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	62	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	62	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Undervoltage instantaneous												
Parameter												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Parameter set 1												
Undervoltage value Set 1		63	S1	R/W	y	0.2	1.2	0.001	Un		UL	/1000
Undervoltage op. time Set 1		63	S2	R/W	y	0.05	300	0.001	s	same for solid state and conventional relais	UL	/1000
Parameter set 2												
Undervoltage value Set 2		63	S21	R/W	y	0.2	1.2	0.001	Un		UL	/1000
Undervoltage op. time Set 2		63	S22	R/W	y	0.05	300	0.001	s	same for solid state and conventional relais	UL	/1000
Measurments												
Value at tripping of function		63	V1	R	n						UL	/1000
Max. measured value		63	V2	R	n						UL	/1000
Number of trips		63	V3	R/W	n						UL	/1000
Number of starts phase L1		63	V4	R/W	n						UL	/1000
Number of starts phase L2		63	V5	R/W	n						UL	/1000
Number of starts phase L3		63	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		63	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		63	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		63	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		63	V10	R	y						US	
Eventmask : Event 1 to 16		63	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		63	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	63	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	63	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	63	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	63	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	63	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Block input	0=E19;1=E18	63	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Undervoltage definite time, high set												
Parameter												
Parameter set 1												
Undervoltage value Set 1		64	S1	R/W	y	0.2	1.2	0.001	Un		UL	/1000
Undervoltage op. time Set 1		64	S2	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 1												
Number of AR shots Set 1	1=E11;2=E10	64	S3	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 1		64	S4	R/W	y	0.4	1.2	0.001	Un		UL	/1000
AR shot starting time 1, Set 1		64	S5	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 1, Set 1		64	S6	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 1		64	S7	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 2, Set 1		64	S8	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 1		64	S9	R/W	y	0.2	300	0.001	s		UL	/1000
Parameter set 2												
Undervoltage value Set 2		64	S21	R/W	y	0.2	1.2	0.001	Un		UL	/1000
Undervoltage op. time Set 2		64	S22	R/W	y	0.07	300	0.001	s	same for solid state and conventional relai	UL	/1000
AR Parameter set 2												
Number of AR shots Set 2	1=E11;2=E10	64	S23	R/W	y	0	2	1		0=no shot;1=one shot;2=two shots	US	
Max. AR activate current Set 2		64	S24	R/W	y	0.4	1.2	0.001	Un		UL	/1000
AR shot starting time 1, Set 2		64	S25	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 1, Set 2		64	S26	R/W	y	0.2	300	0.001	s		UL	/1000
AR shot starting time 2, Set 2		64	S27	R/W	y	0.03	300	0.001	s		UL	/1000
AR shot dead time 2, Set 2		64	S28	R/W	y	0.2	300	0.001	s		UL	/1000
AR reclaim time Set 2		64	S29	R/W	y	0.2	300	0.001	s		UL	/1000
Measurments												
Value at tripping of function		64	V1	R	n						UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Max. measured value		64	V2	R	n						UL	/1000
Number of trips		64	V3	R/W	n						UL	/1000
Number of starts phase L1		64	V4	R/W	n						UL	/1000
Number of starts phase L2		64	V5	R/W	n						UL	/1000
Number of starts phase L3		64	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		64	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		64	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		64	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		64	V10	R	y						US	
Eventmask : Event 1 to 16		64	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		64	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	64	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	64	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	64	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	64	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	64	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	64	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR input	0=E21;1=E20	64	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	64	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Undervoltage definite time, low set												
Parameter												
Parameter set 1												
Undervoltage value Set 1		65	S1	R/W	y	0.4	1.2	0.001	Un		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Undervoltage op. time Set 1		65	S2	R/W	y	0.07	300	0.001	s	same for solid state and conventional relais	UL	/1000
Parameter set 2												
Undervoltage value Set 2		65	S21	R/W	y	0.4	1.2	0.001	Un		UL	/1000
Undervoltage op. time Set 2		65	S22	R/W	y	0.07	300	0.001	s	same for solid state and conventional relais	UL	/1000
Measurments												
Value at tripping of function		65	V1	R	n						UL	/1000
Max. measured value		65	V2	R	n						UL	/1000
Number of trips		65	V3	R/W	n						UL	/1000
Number of starts phase L1		65	V4	R/W	n						UL	/1000
Number of starts phase L2		65	V5	R/W	n						UL	/1000
Number of starts phase L3		65	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		65	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		65	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		65	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		65	V10	R	y						US	
Eventmask : Event 1 to 16		65	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		65	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	65	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	65	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	65	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	65	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	65	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	65	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Residual overvoltage definite time high												
Parameter												
Parameter set 1												
Voltage Set 1		82	S1	R/W	y	0.05	3	0.001	Un		UL	/1000
Time Set 1		82	S2	R/W	y	0.04	300	0.001	s	same for solid state and conventional relai	UL	/1000
Parameter set 2												
Voltage Set 2		82	S21	R/W	y	0.05	3	0.001	Un		UL	/1000
Time Set 2		82	S22	R/W	y	0.04	300	0.001	s	same for solid state and conventional relai	UL	/1000
Measurments												
Value at tripping of function		82	V1	R	n						UL	/1000
Max. measured value		82	V2	R	n						UL	/1000
Number of trips		82	V3	R/W	n						UL	/1000
Number of starts		82	V4	R/W	n						UL	/1000
Duration of the latest start situation		82	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		82	V10	R	y						US	
Eventmask : Event 1 to 16		82	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		82	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	82	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	82	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	82	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	82	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Residual overvoltage definite time low												
Parameter												
Parameter set 1												
Voltage Set 1		83	S1	R/W	y	0.05	3	0.001	Un		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Time Set 1		83	S2	R/W	y	0.04	300	0.001	s	same for solid state and conventional relai	UL	/1000
Parameter set 2												
Voltage Set 2		83	S21	R/W	y	0.05	3	0.001	Un		UL	/1000
Time Set 2		83	S22	R/W	y	0.04	300	0.001	s	same for solid state and conventional relai	UL	/1000
Measurments												
Value at tripping of function		83	V1	R	n						UL	/1000
Max. measured value		83	V2	R	n						UL	/1000
Number of trips		83	V3	R/W	n						UL	/1000
Number of starts		83	V4	R/W	n						UL	/1000
Duration of the latest start situation		83	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		83	V10	R	y						US	
Eventmask : Event 1 to 16		83	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		83	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	83	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	83	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	83	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	83	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Motor protection function												
Thermal Overload												
Parameter												
Maximum temperature		74	S1	R/W	y	20	400	0.001	C		UL	/1000
Operating time		74	S2	R/W	y	1.02	1000	0.001	s	same for solid state and conventional relais	UL	/1000
Nominal temperature		74	S3	R/W	y	50	400	0.001	C		UL	/1000
Nominal current		74	S4	R/W	y	1	10000	0.001	A		UL	/1000
Initial temperature		74	S5	R/W	y	50	120	0.001	%		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Fundamental time constant for motor OFF		74	S6	R/W	y	10	5000	0.001	s		UL	/1000
Fundamental time constant for normal work		74	S7	R/W	y	10	5000	0.001	s		UL	/1000
Fundamental time constant for fault		74	S8	R/W	y	10	5000	0.001	s		UL	/1000
Warning temperature		74	S9	R/W	y	20	400	0.001	C		UL	/1000
Measurments												
Value at tripping of function		74	V1	R	n						UL	/1000
Max. measured value		74	V2	R	n						UL	/1000
Number of trips		74	V3	R/W	n						UL	/1000
Number of starts		74	V4	R/W	n						UL	/1000
Duration of the latest start situation		74	V7	R	n				ms		UL	/1000
Actual temperature		74	V8	R	n				C		SL	/1000
Time to start		74	V9	R	n				min		UL	/1000
Phases and event masks												
Phases used		74	V10	R	y						US	
Eventmask : Event 1 to 16		74	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		74	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	74	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	74	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	74	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Warning	0=E15;1=E14	74	O6	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	74	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Motorstart protection												
Parameter												
Parameter set 1												
Starting current value Set 1		80	S1	R/W	y	1	20	0.001	In		UL	/1000
Starting current op. time Set 1		80	S2	R/W	y	0.07	300	0.001	s	same for solid state and conventional relais	UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Start Threshold Set 1		80	S3	R/W	y	0.3	1.2	0.001	In		UL	/1000
Parameter set 2												
Starting current value Set 2		80	S21	R/W	y	1	20	0.001	In		UL	/1000
Starting current op. time Set 2		80	S22	R/W	y	0.07	300	0.001	s	same for solid state and conventional relais	UL	/1000
Start Threshold Set 2		80	S23	R/W	y	0.3	1.2	0.001	In		UL	/1000
Measurments												
Value at tripping of function		80	V1	R	n						UL	/1000
Max. measured value		80	V2	R	n						UL	/1000
Number of trips		80	V3	R/W	n						UL	/1000
Number of starts		80	V4	R/W	n						UL	/1000
Duration of the latest start situation		80	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		80	V10	R	y						US	
Eventmask : Event 1 to 16		80	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		80	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	80	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	80	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	80	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block Out	0=E17;1=E16	80	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	80	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked rotor protection												
Parameter												
Parameter set 1												
Overcurrent value Set 1		86	S1	R/W	y	1	20	0.001	In		UL	/1000
Overcurrent op. time Set 1		86	S2	R/W	y	0.07	300	0.001	s	same for solid state and conventional relais	UL	/1000
Parameter set 2												
Overcurrent value Set 2		86	S21	R/W	y	1	20	0.001	In		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Overcurrent op. time Set 2		86	S22	R/W	y	0.07	300	0.001	s	same for solid state and conventional relais	UL	/1000
Measurments												
Value at tripping of function		86	V1	R	n						UL	/1000
Max. measured value		86	V2	R	n						UL	/1000
Number of trips		86	V3	R/W	n						UL	/1000
Number of starts phase L1		86	V4	R/W	n						UL	/1000
Number of starts phase L2		86	V5	R/W	n						UL	/1000
Number of starts phase L3		86	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		86	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		86	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		86	V9	R	n				ms		UL	/1000
Phases and event masks												
Phases used		86	V10	R	y						US	
Eventmask : Event 1 to 16		86	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		86	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output L1	0=E1;1=E0	86	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	86	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	86	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	86	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	86	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	86	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Number of Starts												
Parameter												
Parameter set 1												
Counter warm Set 1		87	S1	R/W	y	1	10	1			UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Counter cold Set 1		87	S2	R/W	y	1	10	1			UL	/1000
Operating time Set 1		87	S3	R/W	y	1.02	7200	1	s	same for solid state and conventional relais	UL	/1000
Temperatur threshold cold->warm Set 1		87	S4	R/W	y	20	400	0.001	C		UL	/1000
Parameter set 2												
Counter warm Set 2		87	S21	R/W	y	1	10	1			UL	/1000
Counter cold Set 2		87	S22	R/W	y	1	10	1			UL	/1000
Operating time Set 2		87	S23	R/W	y	1.02	7200	1	s	same for solid state and conventional relais	UL	/1000
Temperatur threshold cold->warm Set 2		87	S24	R/W	y	20	400	0.001	C		UL	/1000
Measurments												
Value at tripping of function		87	V1	R	n						UL	/1000
Number of warnings		87	V2	R/W	n						UL	/1000
Number of trips		87	V3	R/W	n						UL	/1000
Number of cold starts		87	V4	R	n						UL	/1000
Number of warm starts		87	V5	R	n						UL	/1000
Time to start motor		87	V6	R	n	0		0.001	min			
Phases and event masks												
Phases used		87	V10	R	y						US	
Eventmask : Event 1 to 16		87	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		87	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Trip output	0=E1;1=E0	87	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	87	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Warning output	0=E15;1=E14	87	O6	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input		87	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start motor input		87	I3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Distance protection												
Distance protection												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Parameter												
Net Type		81	S9	R/W	y	0	1	1		0=HighOhmic;1=LowOhmic	US	
E-Start or G-Start		81	S10	R/W	y	0	1	1		0=GStartOrEStart;1=GStart	US	
Transfer Ground Side		81	S11	R/W	y	0	1	1		0=Lineside;1=Busbarside	US	
Switch On Fault		81	S12	R/W	y	0	2	1		0=normal;1=Overreach;2=TripAfterGStart	US	
Mixed Cable/Cverhead		81	S13	R/W	y	0	1	1		0=mixed; 1=homogenous	US	
Cable before Overhead		81	S14	R/W	y	0	1	1		0=OverheadFirst;1=CableFirst	US	
Z boarder Cable/Overhead Zb		81	S15	R/W	y	0.05	120	0.01	Ohm		SL	/1000
Cable impedance Zc		81	S16	R/W	y	0.05	120	0.01	Ohm	0=NoCable	SL	/1000
Overhead impedance Zo		81	S17	R/W	y	0.05	120	0.01	Ohm	0=NoOverhead	SL	/1000
Parameter set 1												
Current threshold I>		81	S1	R/W	y	0.05	4	0.01	In		UL	/1000
Earth current threshold Io>		81	S2	R/W	y	0.05	4	0.01	In		UL	/1000
Current fault threshold If>		81	S3	R/W	y	0.05	4	0.01	In		UL	/1000
Undervoltage threshold Uf<		81	S4	R/W	y	0.05	0.9	0.01	Un		UL	/1000
Phase selection		81	S5	R/W	y	0	3	1		0=NAc312;1=NAc1231;2=IAc132;3=IAc1231	US	
Earthfactor Real		81	S6	R/W	y						SL	/1000
Earthfactor Imag		81	S7	R/W	y						SL	/1000
Signal Comparison Time*		81	S8	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Parameter set 2												
Current threshold I>		81	S21	R/W	y	0.05	4	0.01	In		UL	/1000
Earth current threshold Io>		81	S22	R/W	y	0.05	4	0.01	In		UL	/1000
Current fault threshold If>		81	S23	R/W	y	0.05	4	0.01	In		UL	/1000
Undervoltage threshold Uf<		81	S24	R/W	y	0.05	0.9	0.01	Un		UL	/1000
Phase selection		81	S25	R/W	y	0	3	1		0=NAc312;1=NAc1231;2=IAc132;3=IAc1231	US	
Earthfactor Real		81	S26	R/W	y						SL	/1000
Earthfactor Imag		81	S27	R/W	y						SL	/1000
Signal Comparison Time		81	S28	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Zone 1												
Parameter set 1												
R		81	S41	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S42	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S43	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S44	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S45	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S46	R/W	y	0	1	1		0=InFront;1=Behind	US	
Parameter set 2												
R		81	S51	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S52	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S53	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S54	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S55	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S56	R/W	y	0	1	1		0=InFront;1=Behind	US	
Overreach Zone												
Parameter set 1												
R		81	S61	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S62	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S63	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S64	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S65	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S66	R/W	y	0	1	1		0=InFront;1=Behind	US	
Parameter set 2												
R		81	S71	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S72	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S73	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S74	R/W	y	90	135	1	Grad		SL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Time		81	S75	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S76	R/W	y	0	1	1		0=InFront;1=Behind	US	
Block AR Zone												
Parameter set 1												
R		81	S81	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S82	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S83	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S84	R/W	y	90	135	1	Grad		SL	/1000
Direction		81	S86	R/W	y	0	1	1		0=InFront;1=Behind	US	
Parameter set 2												
R		81	S91	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S92	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S93	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S94	R/W	y	90	135	1	Grad		SL	/1000
Direction		81	S96	R/W	y	0	1	1		0=InFront;1=Behind	US	
Zone 2												
Parameter set 1												
R		81	S101	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S102	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S103	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S104	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S105	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S106	R/W	y	0	1	1		0=InFront;1=Behind	US	
Parameter set 2												
R		81	S111	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S112	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S113	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S114	R/W	y	90	135	1	Grad		SL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Time		81	S115	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S116	R/W	y	0	1	1		0=InFront;1=Behind	US	
Zone 3												
Parameter set 1												
R		81	S121	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S122	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S123	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S124	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S125	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S126	R/W	y	0	1	1		0=InFront;1=Behind	US	
Parameter set 2												
R		81	S131	R/W	y	0.05	120	0.01	Ohm		UL	/1000
X		81	S132	R/W	y	0.05	120	0.01	Ohm		UL	/1000
Delta1		81	S133	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S134	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S135	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S136	R/W	y	0	1	1		0=InFront;1=Behind	US	
Directional Backup												
Parameter set 1												
Delta1		81	S143	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S144	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S145	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S146	R/W	y	0	1	1		0=InFront;1=Behind	US	
Parameter set 2												
Delta1		81	S153	R/W	y	-45	0	1	Grad		SL	/1000
Delta2		81	S154	R/W	y	90	135	1	Grad		SL	/1000
Time		81	S155	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Direction		81	S156	R/W	y	0	1	1		0=InFront;1=Behind	US	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Non Directional Bachup												
Parameter set 1												
Time		81	S165	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Parameter set 2												
Time		81	S175	R/W	y	0.02	30	0.001	s	same for solid state and conventional relais	UL	/1000
Measurments												
E-Start duration		81	V1	R	n				ms		UL	/1000
G-Start duration		81	V2	R	n				ms		UL	/1000
Number of trips		81	V3	R/W	n						UL	/1000
Number of starts L1		81	V4	R/W	n						UL	/1000
Number of starts L2		81	V5	R/W	n						UL	/1000
Number of starts L3		81	V6	R/W	n						UL	/1000
Duration of the latest start situation phase L1		81	V7	R	n				ms		UL	/1000
Duration of the latest start situation phase L2		81	V8	R	n				ms		UL	/1000
Duration of the latest start situation phase L3		81	V9	R	n				ms		UL	/1000
Number of starts earth fault		81	V13	R/W	n						UL	/1000
Number of starts general start		81	V14	R/W	n						UL	/1000
Number of starts of <Z1		81	V15	R/W	n						UL	/1000
Impedance |Z|		81	V16	R	n				Ohm		SL	/1000
Angle phi(Z)		81	V17	R	n				Grad		SL	/1000
Resistance R		81	V18	R	n				Ohm		SL	/1000
Reactance X		81	V19	R	n				Ohm		SL	/1000
Zone		81	V20	R	n						SL	/1000
Distance of the fault		81	V21	R	n				km		SL	/1000
Duration of the latest start of <Z1		81	V22	R	n				ms		UL	/1000
Phases and event masks												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Input/Output status												
Start output L1	0=E1;1=E0	81	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L2	0=E3;1=E2	81	O2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Start output L3	0=E5;1=E4	81	O3	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	81	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	81	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Earth Start	0=E25;1=E24	81	O6	R	n	0	1	1		0=FALSE; 1=TRUE	US	
General Start	0=E23;1=E22	81	O7	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overreach Zone AR		81	O8	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Overreach Zone Switch on Fault		81	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
AR active	0=E9;1=E8	81	O10	R	n	0	1	1		0=FALSE; 1=TRUE	US	
<Z1	0=E17;1=E16	81	O11	R	n	0	1	1		0=FALSE; 1=TRUE	US	
1. AR shot	0=E11;1=E10	81	O12	R	n	0	1	1		0=FALSE; 1=TRUE	US	
2.AR shot	0=E15;1=E14	81	O13	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	81	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR	0=E21;1=E20	81	I4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
CB OK	0=E27;1=E26	81	I5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Signal Comp.	0=E29;1=E28	81	I6	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block AR from DSP	0=E31;1=E30	81	I7	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Differential protection function												
Differential protection												
Parameter												
Parameter set 1												
Primary Winding Nominal Current		79	S1	R/W	y	0	100	0.1	A		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Secondary Winding Nominal Current		79	S2	R/W	y	0	100	0.2	A		UL	/1000
Transformer Group		79	S3	R/W	y	0	11	1			UL	/1000
Primary side earthing		79	S4	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
Secondary side earthing		79	S5	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
Primary current triplet		79	S6	R		0	1	1		0=(1,2,3); 1=(4,5,6)	UL	/1000
Threshold current		79	S7	R/W	y	0.1	0.5	0.01	In		UL	/1000
Unbiased region limit		79	S8	R/W	y	0.5	5	0.01	In		UL	/1000
Slightly biased region threshold		79	S9	R/W	y	0.2	2	0.01	In		UL	/1000
Slightly biased region limit		79	S10	R/W	y	1	10	0.01	In		UL	/1000
Heavily biased behaviour slope		79	S11	R/W	y	0.4	1.0	0.01			UL	/1000
Second harmonic threshold vs. Idiff		79	S12	R/W	y	0.1	0.3	0.01			UL	/1000
Fifth harmonic threshold vs. Idiff		79	S14	R/W	y	0.1	0.3	0.01			UL	/1000
Second harmonic block enable		79	S15	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
Fifth harmonic block enable		79	S17	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
CTs' saturation current limit for 3rd harmonic block		79	S19	R/W	y	5	40	0.01	In		UL	/1000
Operating time		79	S20	R		0.030	0.030		s		UL	/1000
Parameter set 2												
Primary Winding Nominal Current		79	S21	R/W	y	0	100	0.1	A		UL	/1000
Secondary Winding Nominal Current		79	S22	R/W	y	0	100	0.2	A		UL	/1000
Transformer Group		79	S23	R/W	y	0	11	1			UL	/1000
Primary side earthing		79	S24	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
Secondary side earthing		79	S25	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
Primary current triplet		79	S26	R		0	1	1		0=(1,2,3); 1=(4,5,6)	UL	/1000
Threshold current		79	S27	R/W	y	0.1	0.5	0.01	In		UL	/1000
Unbiased region limit		79	S28	R/W	y	0.5	5	0.01	In		UL	/1000
Slightly biased region threshold		79	S29	R/W	y	0.2	2	0.01	In		UL	/1000
Slightly biased region limit		79	S30	R/W	y	1	10	0.01	In		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Heavily biased behaviour slope		79	S31	R/W	y	0.4	1.0	0.01			UL	/1000
Second harmonic threshold vs. Idiff		79	S32	R/W	y	0.1	0.3	0.01			UL	/1000
Fifth harmonic threshold vs. Idiff		79	S34	R/W	y	0.1	0.3	0.01			UL	/1000
Second harmonic block enable		79	S35	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
Fifth harmonic block enable		79	S37	R/W	y	0	1	1		0=FALSE; 1=TRUE	UL	/1000
CTs' saturation current limit for 3rd harmonic block		79	S39	R/W	y	5	40	0.01	In		UL	/1000
Operating time		79	S40	R		0.030	0.030		s		UL	/1000
Measurments												
Number of trips		79	V3	R/W	n						UL	/1000
Number of starts		79	V4	R/W	n						UL	/1000
Duration of the latest start situation phase		79	V7	R	n				ms		UL	/1000
Input/Output status												
Start output	0=E1;1=E0	79	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	79	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	/1000
Blocked Trip	0=E13;1=E12	79	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block 2nd Harmonic	0=E21;1=E20	79	O6	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block 3rd Harmonic	0=E23;1=E22	79	O7	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block 5th Harmonic	0=E25;1=E24	79	O8	R	n	0	1	1		0=FALSE; 1=TRUE	US	
General Block	0=E27;1=E26	79	O9	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	79	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Other protection function												
Unsymetrical load (Unbalanced load I)												
Parameter												
Minimum active current		75	S1	R/W	y	5	100	0.001	%		UL	/1000
Operating time		75	S2	R/W	y	1.02	1000	0.001	s	same for solid state and conventional relais	UL	/1000
Maximum unbalanced		75	S3	R/W	y	5	80	0.001	%		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Measurments												
Value at tripping of function		75	V1	R/W	n					Write: set the value to 0	UL	/1000
Max. measured value		75	V2	R/W	n					Write: set the value to 0	UL	/1000
Number of trips		75	V3	R/W	n						UL	/1000
Number of starts		75	V4	R/W	n						UL	/1000
Duration of the latest start situation		75	V7	R/W	n				ms	Write: set the value to 0	UL	/1000
Phases and event masks												
Phases used		75	V10	R	y						US	
Eventmask : Event 1 to 16		75	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		75	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	75	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	75	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	75	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	75	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Unbalanced load II												
Parameter												
Sensor		75	S1	R	n	0	1	1		0=1,2,3 1=4,5,6	US	
Output channel		75	S2	R	n	0	16	1			US	
Parameter Set 1												
Is Set 1		75	V22	R/W	y	50	300	1	In		UL	/1000
K Set 1		75	V23	R/W	y	2000	30000	100			UL	/1000
Reset time Set 1		75	V24	R/W	y	0	2000	1	s		UL	
Timer decreasing rate Set 1		75	V25	R/W	y	0	100	1	%		UL	
Parameter Set 2												
Is Set 2		75	V32	R/W	y	50	300	1	In		UL	/1000
K Set 2		75	V33	R/W	y	2000	30000	100			UL	/1000
Reset time Set 2		75	V34	R/W	y	0	2000	1	s		UL	

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Timer decreasing rate Set 2		75	V35	R/W	y	0	100	1	%		UL	
Measurments												
Value at tripping of function		75	V1	R/W	n				A	Write: set the value to 0	UL	/1000
Max. measured value		75	V2	R/W	n				A	Write: set the value to 0	UL	/1000
Number of trips		75	V3	R/W	n						UL	/1000
Number of starts		75	V4	R/W	n						UL	/1000
Duration of the latest start situation		75	V7	R/W	n				ms	Write: set the value to 0	UL	/1000
I2		75	V8	R	n				A		UL	/1000
Phases and event masks												
Phases used		75	V10	R	y						US	
Eventmask : Event 1 to 16		75	V11	R	y	0	65535	1			UL	
Eventmask : Event 17 to 32		75	V12	R	y	0	65535	1			UL	
Input/Output status												
Start output	0=E1;1=E0	75	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	75	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	75	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	75	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Reset input	0=E21;1=E20	75	I2	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Directional power protection												
Parameter												
Maximum reverse load		76	S1	R/W	y	1	50	0.001	%		UL	/1000
Operating time		76	S2	R/W	y	1.02	1000	0.001	s	same for solid state and conventional relais	UL	/1000
Nominal real power		76	S3	R/W	y	0.05	1000	0.001	MW		UL	/1000
Direction		76	S4	R/W	y	0	1	1		0=in front; 1=behind	US	
Measurments												
Value at tripping of function		76	V1	R/W	n					Write: allways set to 0	UL	/1000
Max. measured value		76	V2	R/W	n					Write: allways set to 0	UL	/1000
Number of trips		76	V3	R/W	n						UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Number of starts		76	V4	R/W	n						UL	/1000
Duration of the latest start situation		76	V7	R/W	n				ms	Write: allways set to 0	UL	/1000
Phases and event masks												
Phases used		76	V10	R	y						US	
Eventmask : Event 1 to 16		76	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		76	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	76	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	76	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	76	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	76	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Low load protection												
Parameter												
Minimum load		77	S1	R/W	y	5	100	0.001	%		UL	/1000
Operating time		77	S2	R/W	y	1.02	1000	0.001	s	same for solid state and conventional relais	UL	/1000
Nominal real power		77	S3	R/W	y	0.05	1000	0.001	MW		UL	/1000
Minimum operating current		77	S4	R/W	y	2	20	0.001	%		UL	/1000
Measurments												
Value at tripping of function		77	V1	R	n						UL	/1000
Max. measured value		77	V2	R	n						UL	/1000
Number of trips		77	V3	R/W	n						UL	/1000
Number of starts		77	V4	R/W	n						UL	/1000
Duration of the latest start situation		77	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		77	V10	R	y						US	
Eventmask : Event 1 to 16		77	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		77	V12	R	y	0	65535	1			UL	/1000
Input/Output status												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Start output	0=E1;1=E0	77	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	77	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	77	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	77	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Thermal supervision												
Parameter												
Maximum temperature		78	S1	R/W	y	50	400	0.001	C		UL	/1000
Operating time		78	S2	R/W	y	1.02	1000	0.001	s	same for solid state and conventional relais	UL	/1000
Warning temperature		78	S3	R/W	y	50	400	0.001	C		UL	/1000
Measurments												
Value at tripping of function		78	V1	R	n						UL	/1000
Max. measured value		78	V2	R	n						UL	/1000
Number of trips		78	V3	R/W	n						UL	/1000
Number of starts		78	V4	R/W	n						UL	/1000
Duration of the latest start situation		78	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		78	V10	R	y						US	
Eventmask : Event 1 to 16		78	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		78	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	78	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	78	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	78	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Warning	0=E15;1=E14	78	O6	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	78	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Frequency supervision												
Parameter												
Parameter set 1												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Frequency Set 1		84	S1	R/W	y	0.0	0.5	0.001	fn		UL	/1000
Time Set 1		84	S2	R/W	y	1.02	300	0.001	s	same for solid state and conventional relais	UL	/1000
Parameter set 2												
Frequency Set 2		84	S21	R/W	y	0.0	0.5	0.001	fn		UL	/1000
Time Set 2		84	S22	R/W	y	1.02	300	0.001	s	same for solid state and conventional relais	UL	/1000
Measurments												
Value at tripping of function		84	V1	R	n						UL	/1000
Max. measured value		84	V2	R	n						UL	/1000
Number of trips		84	V3	R/W	n						UL	/1000
Number of starts		84	V4	R/W	n						UL	/1000
Duration of the latest start situation		84	V7	R	n				ms		UL	/1000
Phases and event masks												
Phases used		84	V10	R	y						US	
Eventmask : Event 1 to 16		84	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		84	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	84	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Trip output	0=E7;1=E6	84	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked Trip	0=E13;1=E12	84	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	84	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Synchro Check												
Parameter												
Delta Voltage Set 1		85	S1	R/W	y	0.02	0.4	0.001	Un		UL	/1000
Time Set 1		85	S2	R/W	y	0.52	1000	0.001	s	same for solid state and conventional relais	UL	/1000
Delta Phase Set 1		85	S3	R/W	y	0.005	0.05	0.001	°		UL	/1000
Delta Voltage Set 2		85	S21	R/W	y	0.02	0.4	0.001	Un		UL	/1000
Time Set 2		85	S22	R/W	y	0.52	1000	0.001	s	same for solid state and conventional relais	UL	/1000
Delta Phase Set 2		85	S23	R/W	y	0.005	0.05	0.001	°		UL	/1000

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Phases and event masks												
Phases used		85	V10	R	y						US	
Eventmask : Event 1 to 16		85	V11	R	y	0	65535	1			UL	/1000
Eventmask : Event 17 to 32		85	V12	R	y	0	65535	1			UL	/1000
Input/Output status												
Start output	0=E1;1=E0	85	O1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Synchronous	0=E7;1=E6	85	O4	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Blocked synchronous	0=E13;1=E12	85	O5	R	n	0	1	1		0=FALSE; 1=TRUE	US	
Block input	0=E19;1=E18	85	I1	R	n	0	1	1		0=FALSE; 1=TRUE	US	
R : read												
W : write												
PD : saved during power down												
y : saved after download or leaving												
progrqam mode with saving data												
n : not saved												
US : unsigned short X{X{X{X}}}												
UL : unsigned long X{X{X{X}}}.X{X{X}}												
SL : signed long {+}|- X{X{X{X}}}.X{X{X}}												
ST : string of maximal 21 characters												
Event list												
Monitoring values												
Coil continuity output 1, I/O card 1	0=E17;1=E16	0										
Coil continuity output 2, I/O card 1	0=E19;1=E18	0										
Coil continuity output 1, I/O card 2	0=E21;1=E20	0										
Coil continuity output 2, I/O card 2	0=E23;1=E22	0										
SCU status												

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
Down load PC -> SCU	1=E33	0										
Up load PC <- SCU	1=E34	0										
Power down	1=E35	0										
Power up (controller resetted)	1=E36	0										
Watchdog	1=E37	0										
DSP reset	1=E38	0										
Acknowledge Display	1=E39	0										
Energy Owerflow	1=E40	0										
SCU restarting	1=E50	0										
Overflow of event register	1=E51	0										
Temporary disturbance in data communication	1=E52	0								not in the SCU generated (MSU, SRIO ..)		
No response from the SCU	1=E53	0								not in the SCU generated (MSU, SRIO ..)		
The SCU responds again	1=E54	0								not in the SCU generated (MSU, SRIO ..)		
Monitoring special status **IEC 60870-5-103**												
Monitor direction blocked	0=E18;1=E19	3	V13	R	N	0	1	1		1=blocked, 0=not blocked		1
Test Mode enabled	0=E20;1=E21	3	V14	R	N	0	1	1		1=enabled, 0=disabled		1
Systemerrors												
operating system definition of errors												
ENQ_ERROR	1=E0	102										
driver EEPROM definition of errors												
MemFullError	1=E1	102										
ReadyError	1=E2	102										
WritingByteError	1=E3	102										
VppLowError	1=E4	102										
BlockError	1=E5	102										

Data	Events	Channel	Code	R/W	Save	Min	Max	Step	Unit	Single Value	Type	Fator
SuspendedError	1=E6	102										
StatusRegError	1=E7	102										
EraseAdrBlockError	1=E8	102										
NOT_IDENT_EEPROMDATA	1=E9	102										
EEPROM_DATA_DISRUPTED	1=E10	102										
WRONG_BLOCK	1=E11	102										
HOST INTERFACE: definition errors												
WRITE_HOST_ERROR	1=E20	102										
CONFIG_DSP_ERROR	1=E21	102										
CALIBRATION_DSP_FAULT	1=E22	102										
COMMUNICATION: PC<->SCU defin. Err												
TIMEOUT_ERROR	1=E30	102										
PROTECTION FUNCTION: de-fin. Err.												
AUTORECL_ERROR	1=E40	102										
CONFIG_ERROR	1=E41	102										
UNDEFINED_PROT_ERROR	1=E42	102										
CONFIGURATION errors:												
WRONG_CONFIGURATION	1=E43	102										
LON: definition of errors												
CONFIG_LON_ERROR	1=E48	102										

8 Appendix B: Address list for the COM_L communication board

The address list contains the available LON addresses, sorted by functions, and maps these onto the underlying SPABUS registers. Not all of the SPABUS registers are available in the LON.

The following worksheets have been defined:

- "NV Table“
  Describes the network variables defined on the COM_L board that are used for horizontal communication and time synchronization.
- "Object Id Table”
  Lists the addresses for vertical communication.

The list contains all of the information defined. The quantity of information contained in a concrete application depends on the functions used therein.

Please consider that the associated events of the underlying SPABUS register model have to be in a released status.

9 Appendix C: Interoperability list to COM_I Communication Board

1. Physical layer

1.1 Electrical interface

- ☐ EIA RS-485
- ☐ Number of loads

1.2 Optical interface

- ☐ Glass fibre
- ☐ Plastic fibre
- ☐ F-SMA type connector
- ☐ BFOC/2,5 type connector

1.3 Transmission speed

- ☑ 9600 bit/s
- ☐ 19200 bit/s

2. Link layer

There are no choices for the link layer.

3. Application layer

3.1 Transmission mode for application data

Mode 1 (least significant octet first), as defined in 4.10 of IEC 60870-5-4.

3.2 Common address of ASDU

- ☑ One common address of ASDU (identical with station address)
- ☐ More than one common address of ASDU

3.3 Selection of standard information numbers in monitor direction

3.3.1 System functions in monitor direction

	INF	Semantics
☑	<0>	End of general interrogation
☑	<0>	Time Synchronization
☑	<2>	Reset FCB
☑	<3>	Reset CU
☑	<4>	Start / restart
☑	<5>	Power on

3.3.2 Status indication in monitor direction

INF	Semantics

- ☑ <16> Auto-recloser active
- ☑ <17> Teleprotection active
- ☑ <18> Protection active
- ☑ <19> LED reset
- ☑ <20> Monitor direction blocked
- ☑ <21> Test mode
- ☑ <22 > Local parameter setting
- ☐ <23> Characteristic 1
- ☐ <24> Characteristic 2
- ☐ <25> Characteristic 3
- ☐ <26> Characteristic 4
- ☑ <27> Auxiliary input 1
- ☑ <28> Auxiliary input 2
- ☑ <29> Auxiliary input 3
- ☑ <30> Auxiliary input 4

3.3.3 Supervision indications in monitor direction

	INF	Semantics
☑	<32>	Measurand supervision I
☑	<33>	Measurand supervision U
☐	<35>	Phase sequence supervision
☐	<36>	Trip circuit supervision
☐	<37>	I>> back-up operation
☑	<38>	VT fuse failure
☑	<39>	Teleprotection disturbed
☑	<46>	Group warning
☑	<47>	Group alarm

3.3.4 Earth fault indications in monitor direction

	INF	Semantics
☑	<48>	Earth fault L_1
☑	<49>	Earth fault L_2
☑	<50>	Earth fault L_3
☑	<51>	Earth fault forward i.e. line
☑	<52>	Earth fault reverse i.e. busbar

3.3.5 Fault indications in monitor direction

	INF	Semantics
☑	<64>	Start / pick-up L_1
☑	<65>	Start / pick-up L_2
☑	<66>	Start / pick-up L_3

- ☑ <67> Start / pick-up N
- ☑ <68> General trip
- ☐ <69> Trip L_1
- ☐ <70> Trip L_2
- ☐ <71> Trip L_3
- ☐ <72> Trip I>> (back-up operation)
- ☐ <73> Fault location X in Ohm
- ☐ <74> Fault forward / line
- ☐ <75> Fault reverse / busbar
- ☑ <76> Teleprotection signal transmitted
- ☑ <77> Teleprotection signal received
- ☐ <78> Zone 1
- ☐ <79> Zone 2
- ☐ <80> Zone 3
- ☐ <81> Zone 4
- ☐ <82> Zone 5
- ☐ <83> Zone 6
- ☑ <84> General start / pick-up
- ☑ <85> Breaker failure
- ☐ <86> Trip measuring system L_1
- ☐ <87> Trip measuring system L_2
- ☐ <88> Trip measuring system L_3
- ☐ <89> Trip measuring system E
- ☑ <90> Trip I>
- ☑ <91> Trip I>>
- ☑ <92> Trip IN>
- ☑ <93> Trip IN>>

3.3.3 Auto-recloser indications in monitor direction

	INF	Semantics
☐	<128>	CB ‘on’ by AR
☑	<129>	CB ‘on’ by long-time AR
☑	<130>	AR blocked

3.3.4 Measurands in monitor direction

	INF	Semantics
☐	<144>	Measurand I
☐	<145>	Measurands I,V
☐	<146>	Measurand I,V,P,Q
☐	<147>	Measurands I_N,V_{EN}

☑ <148> Measurands $I_{L1,2,3}$,$V_{L1,2,3}$,P,Q,f

3.3.5 Generic functions in monitor direction

	INF	Semantics
☐	<240>	Read headings of all defined groups
☐	<241>	Read values of all entries of one group
☐	<243>	Read directory of a single entry
☐	<244>	Read value of a single entry
☐	<245>	End of general interrogation generic data
☐	<249>	Write entry with confirmation
☐	<250>	Write entry with execution
☐	<251>	Write entry aborted

3.4 Selection of standard information numbers in control direction

3.4.1 System functions in control direction

	INF	Semantics
☑	<16>	Auto-recloser on / off
☑	<17>	Teleprotection on / off
☑	<18>	Protection on / off
☑	<19>	LED reset
☐	<23>	Activate characteristic 1
☐	<24>	Activate characteristic 2
☐	<25>	Activate characteristic 3
☐	<26>	Activate characteristic 4

3.4.2 General commands in control direction

	INF	Semantics
☐	<240>	Read headings of all defined groups
☐	<241>	Read values of all entries of one group
☐	<243>	Read directory of a single entry
☐	<244>	Read value of a single entry
☐	<245>	General interrogation of generic data
☐	<248>	Write entry
☐	<249>	Write entry with confirmation
☐	<250>	Write entry with execution
☐	<251>	Write entry abort

3.5 Basic application functions

☑ Test mode

☑ Blocking of monitor direction

☐ Disturbance data

☐ Generic services

☑ Private data

3.6 Miscellaneous

Measurand	Max. MVAL = rated value times 1.2	2.4
Current L_1	☐	☑
Current L_2	☐	☑
Current L_3	☐	☑
Voltage L_1-E	☐	☑
Voltage L_2-E	☐	☑
Voltage L_3-E	☐	☑
Active power P	☐	☑
Reactive power Q	☐	☑
Frequency f	☐	☑
Voltage L_1- L_2	☐	☐

3.7 Private data

Information numbers in monitor direction: 160-168, 180-190, 200

Information numbers in control direction: 160-168

10 Appendix D: Address list for the COM_I communication board

The description of the IEC60870-5-103 interface, including the address list for mapping the IEC 60870-5-103 information onto the register model of the REF542*plus*, in accordance with SPABUS, is given for version V 0.19. For this purpose, a list indicates all of the IEC 60870-5-103 information, based on attributes FUN (function type) and INF (information number), and is linked with the underlying SPABUS registers and associated events.

Attention: Extract from "REF542 IEC 60870-5-103 Mapping V0.19.XLS“

The following worksheets are defined:

- GLB
  Defines the global functions
- t(z)
  Describes the mappings of the distance protection, including the so called emergency overcurrent definite timeprotection.
- I>>
  Defines the mappings of the overcurrent protection.
- ΔIT
  Reflects the mappings of the transformer differential protection.
- ZX/ZS Control (VDEW)
  Contains the definitions of the private area supplementing the control information.
- Flowchart (FUPLA)
  Defines registers for binary read and write objects in the flowchart (FUPLA) that enable access to a great number of information assigned to the main functions.

Since the REF542*plus* is not a protection device with an invariable functionality, but an integrated field control and protection device whose specific function is defined by an application, on the basis of a flowchart, it is necessary to include certain basic functions for each one of the main functions in an application, in accordance with the address list. To simplify matters, appropriate sample applications are available.

Please consider that the associated events of the underlying SPABUS register models have to be in a released status.

11 Reference

[SPA2.3] SPA-bus Communication Protocol, Version 2.3,
ABB Relays and Network Control, 1991.

[SPA2.5] SPA-bus Communication Protocol, Version 2.5,
ABB Relays and Network Control, 1996.

[LAG1.4] LON Application Guidelines for Substation Automation, LAG 1.4,
ABB, Aug.1998.

[SLCM] SLCM LON Clock Master, Technical reference manual,
ABB Network Partner, Dokument 1MRS 750985-MUM EN, 1998.

[LNT505] LNT 505 LON Network Tool, Operator Manual,
ABB Network Partner, Dokument 1MRS 750831-RUM, 1998.

[LIB542] REF542*plus* LIB542 4.0.3 Main,
User Manual, 1VTA100090, 2001

[IEC103] IEC 60870-5-103
Telecontrol equipment and systems, Part 5-103: Transmission protocols – Companion standard for the informative interface of protection equipment, International Standard IEC 60870-5-103,
First Edition, 1997–12.

[VDEW] Digitale Stationsleittechnik,
Ergänzende Empfehlungen zur Anwendung in Verteilnetzen,
VDEW e.V., 1. Ausgabe 1998.

[FGH_UMZ] Testbericht Überstromzeitschutz:
Forschungsgemeinschaft für Hochspannungs- und Hochstromtechnik e.V., Test Report No. LK 00002, Mannheim, 2000-06.

Product Information	
ABB Transmission and Distribution Limited Indoor Switchgear Bapaume Road Moorebank NSW Australia Phone: +61 2 9821 0007 Fax: +61 2 9602 2454 E-mail: elton.judd@au.abb.com Internet:: http://www.abb.com	ABB Secheron SA Medium Voltage Rue des Sablieres 4-6 CH – 1217 Meyrin Switzerland Phone: +41 22 306 2646 Fax: +41 22 306 2682 E-mail: info.secheron@ch.abb.com Internet: http://www.abb.ch
ABB Xiamen Switchgear Co. Ltd Engineering ABB Industrial Park, Torch Hi-Tech Industrial Development Zone, Xiao Dong Shan Xiamen S.E.Z., Fujian 361006 P.R. China Phone: +86 592 6026-033 Ext. 4061 Fax: +86 592 603-0525 E-mail: david-xiangdong.xu@cn.abb.com Internet: http://www.abb.com	ABB High Voltage Switchgear Co. Ltd. MV Technical No. 7 Shiliuzhuang Nanli, Nanding Road, Yongdingmen Wei, Fengtai District Beijing 100075 P.R. China Phone: +86 10 6764-0055 Fax: +86 10 6766-3121 E-mail: guoqing.pei@cn.abb.com Internet: http://www.abb.com
ABB s.r.o. MV Switchgear Videnska 117 61900 Brno Czech Republic Phone: +420 5 4715 2413 Fax: +420 5 4715 2190 E-mail: info.ejf@cz.abb.com Internet: http://www.abb.com	ABB Arab Technical Marketing Industrial Zone – B1 10th of Ramadan City Egypt Phone: +2 15 36 1288 Fax: +2 15 36 1642 E-mail: Internet: http://www.abb.com/eg
ABB Calor Emag Hochspannung GmbH High Voltage Switchgear Käfertalerstr. 250-256 68167 Mannheim Germany Phone: +49 621 386 2938 Fax: +49 621 386 2909 E-mail: thomas.haas@de.abb.com Internet: http://www.abb.com/de	ABB Calor Emag Mittelspannung GmbH Product Management Oberhausener Straße. 33 40472 Ratingen Germany Phone: +49 2102 12 1901 Fax: +49 2102 12 1808 1901 E-mail: calor.info@de.abb.com Internet: http://www.abb.de/calor
ABB Ltd Nashik India Design & Engineering Plot – 79, street – 17, MIDC SATPUR Nashik – PIN - 422007 India Phone: +91 0253 351095 Fax: +91 0253 350644 E-mail: sanjib.mitra@in.abb.com Internet: http://www.abb.com	PT. ABB Transmission and Distribution Marketing Jl. Gajah Tunggal Im 1, Jatiuwung Tangerang 15135 Indonesia Phone: +62 21 590 9955 x2551 Fax: +62 21 590 0116 E-mail: martha.bachtiar@id.abb.com Internet: http://www.abb.com

Product Information	
ABB T&D S.p.A, Unita' Operativa SACE T.M.S. Product Management Via Friuli 4 I-24044 Dalmine (BG) Italy Phone: +39 035 395 710 Fax: +39 035 395874 E-mail: sacetms.tipm@it.abb.com Internet: http://www.abb.com	ABB Ltd. Power Technology Medium Voltage 513 Sungsung-dong (Chonan Foreign Invested-Enterprises Industrial Park) Chonan, Chungchong-namdo, Post 330-300 Korea Phone: +82 41 529 2458 Fax: +82 41 529 2500 E-mail: swgr.info@kr.abb.com Internet: http://www.abb.com.kr
ABB Transmission & Distribution Sdn. Bhd. Manufacturing Lot 608, Jalan SS 13/1K 47500 Subang Jaya, Petaling Jaya Selanggor Darul Ehsan Malaysia Phone: +603 5628 4888 Fax: E-mail: chun-siaw.ng@my.abb.com Internet: http://www.abb.com	ABB b.v. Power Distribution Marten Meesweg 5 3068 AV Rotterdam Netherland Phone: +31 1 4078149 Fax: +31 10 4078576 E-mail: bert.engbers@nl.abb.com Internet: http://www.abb.com
ABB Elektrik Sanayi. A.S. Design & Engineering Organize Sanayi Bölgesi 2 Cadde: No. 16 Yukar Dudullu 81260 Istanbul Turkey Phone: +90 216 365 2900 Fax: +90 216 365 2943 E-mail: muharrem.pektas@tr.abb.com Internet: http://www.abb.com	
ABB Utilities GmbH Product Management Protection Kallstadter Straße 1 68309 Mannheim Germany Phone: +49 621 381 8965 Fax: +49 621 381 8625 E-mail: christoph.gatzen@de.abb.com Internet: http://www.abb.de	ABB Oy Substation Automation Substation Automation Products Muottitie 2A (P.O. Box 699) 65101 Vaasa Finnland Phone: +358 10 22 4000 Fax: +358 10 22 41094 E-mail: jarkko.makela@fi.abb.com Internet: http://www.abb.com