Substation Automation Products

Distributed busbar protection REB500 Communication Protocol Manual, IEC 60870-5-103

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Conformity

This product complies with the directive of the Council of the European Communities on the approximation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive 2004/108/EC) and concerning electrical equipment for use within specified voltage limits (Low-voltage directive 2006/95/EC). This conformity is the result of tests conducted by ABB in accordance with the product standards EN 50263 and EN 60255-26 for the EMC directive, and with the product standards EN 60255-1 and EN 60255-27 for the low voltage directive. The product is designed in accordance with the international standards of the IEC 60255 series.

Safety information

Dangerous voltages can occur on the connectors, even though the auxiliary voltage has been disconnected.

Non-observance can result in death, personal injury or substantial property damage.

Only a competent electrician is allowed to carry out the electrical installation.

National and local electrical safety regulations must always be followed.

The frame of the IED has to be carefully earthed.

Whenever changes are made in the IED, measures should be taken to avoid inadvertent tripping.

The IED contains components which are sensitive to electrostatic discharge. Unnecessary touching of electronic components must therefore be avoided.

Table of contents

Section 1 Introduction

1.1 This manual

The communication protocol manual describes a communication protocol supported by the IED. The manual concentrates on vendor-specific implementations.

1.2 Intended audience

This manual addresses the communication system engineer or system integrator responsible for pre-engineering and engineering for communication setup in a substation from an IED perspective.

The system engineer or system integrator must have a basic knowledge of communication in protection and control systems and thorough knowledge of the specific communication protocol.

1.3 Product documentation

Manual	Document number
Product Guide	1MRK 505 319-BEN
Application Manual	1MRK 505 333-UEN
Technical Manual	1MRK 505 335-UEN
Operation Manual	1MRK 500 121-UEN
Commissioning Manual	1MRK 505 336-UEN
Cyber Security Guideline	1MRK 511 345-UEN
Communication Protocol Manual, IEC 61850	1MRK 511 342-UEN
Communication Protocol Manual, IEC 60870-5-103	1MRK 511 343-UEN

1.4 Symbols and conventions

1.4.1 Symbols

The electrical warning icon indicates the presence of a hazard which could result in electrical shock.

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

The caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in corruption of software or damage to equipment or property.

The information icon alerts the reader of important facts and conditions.

The tip icon indicates advice on, for example, how to design your project or how to use a certain function.

Although warning hazards are related to personal injury, it is necessary to understand that under certain operational conditions, operation of damaged equipment may result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warning and caution notices.

1.4.2 Document conventions

A particular convention may not be used in this manual.

- Abbreviations and acronyms in this manual are spelled out in the glossary. The glossary also contains definitions of important terms.
- Parameter names are shown in *italics*.

Section 2 Interbay bus functions

2.1 Introduction

An interface is available for connecting the numerical busbar protection to a station automation system or station monitoring system (SCS/SMS).

For an overview of REB500's communication interfaces confer to the operation manual.

In contrast to feeder control and protection Bay Units, REB500 is equipped with only a single interbay bus interface via which all the REB500 Bay Units in the entire station communicate. This has to be taken into account by the various bus protocols.

This document applies for IEC 60870-5-103. However Section 2 of this document also contains information of a second IBB using if IEC 61850-8-1 configured.

2.2 Basic configuration

The fourth octet in the DATA UNIT IDENTIFICATION FIELD of an ASDU determines the COMMON ADDRESS OF ASDU. It normally has to be the same as the station address on the link layer. Exceptions are permitted where additional COMMON ASDU ADDRESSES are needed because of multiple instances of functions.

In the case of REB500, this exception allowed in the IEC recommendation is used in order to be able to address the Central Unit and the Bay Units via a single physical connection.

Common Address of ASDU – CAA

Basic setting:

0	Central Unit
1-60	Bay Units
255	Global address

The dialog for configuring the communication is accessed by selecting “Communication” in the HMI500 “SCS Configuration” menu.

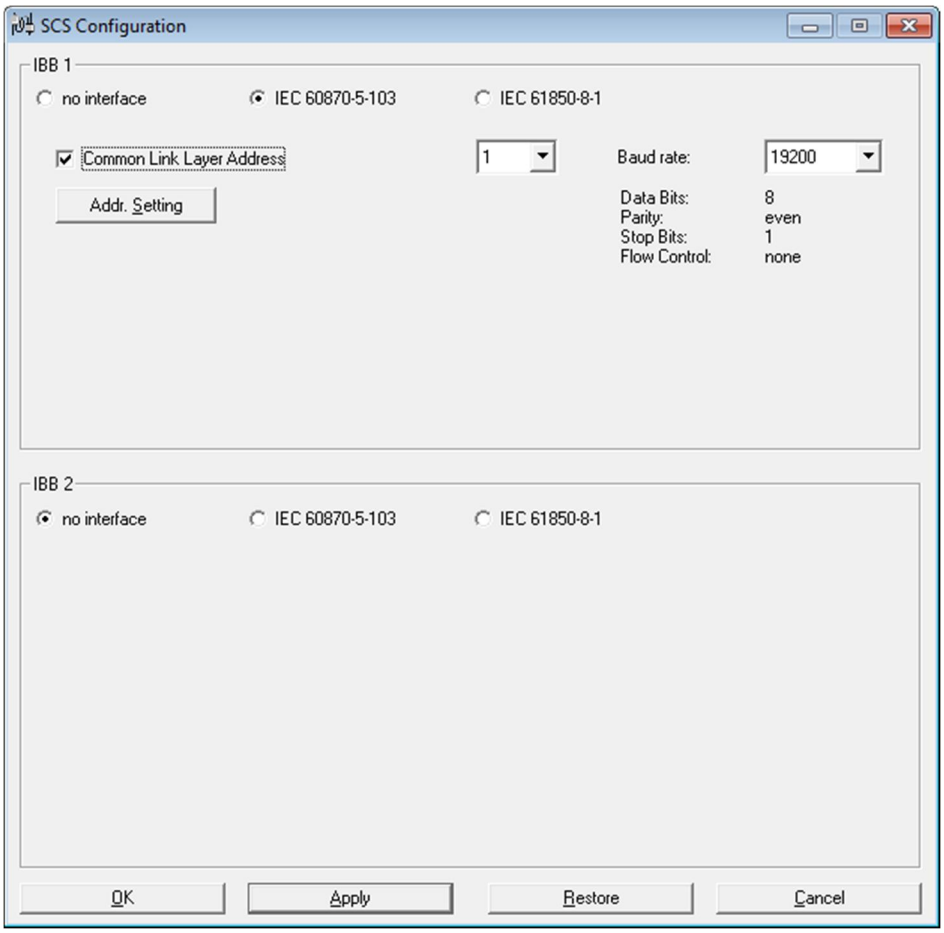


Figure 1 Dialog for configuring the communication

If “Common Link Layer Address” of the ‘SCS Configuration’ is selected:

The link address can be setup in this dialog. The Common Address of ASDU (CAA) for all units is setup in the “CAA Setting” dialog by pressing the “Addr. Setting” button.

Table 1 Configuration of IEC 870-5-103

Setting	Description	Default setting
Common Link layer address	Link layer address used for all Units in common	1
Baud Rate	Baud rate	9600
Addr. Setting	Individual Common Address of ASDU for each Bay Unit	0 Central Unit 1-60 Bay Units

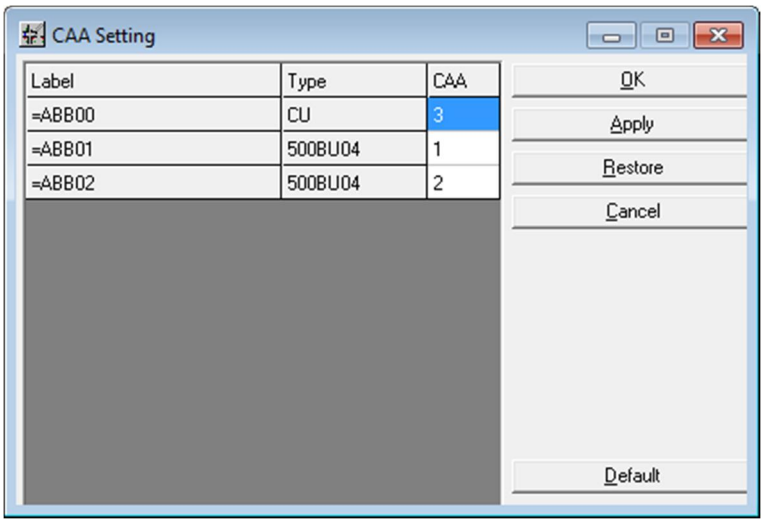


Figure 2 Dialog for configuring the CAA

Table 2 Configuration of IEC 870-5-103

Setting	Description	Default setting
CAA	Individual Common Address of ASDU for each Bay Unit	0 Central Unit 1-60 Bay Units

If "Common Link Layer Address" of the 'SCS Configuration' is not selected:

The link address and the Common Address of ASDU (CAA) for all units is setup in the "CAA Setting" dialog by pressing the "Addr. Setting" button.

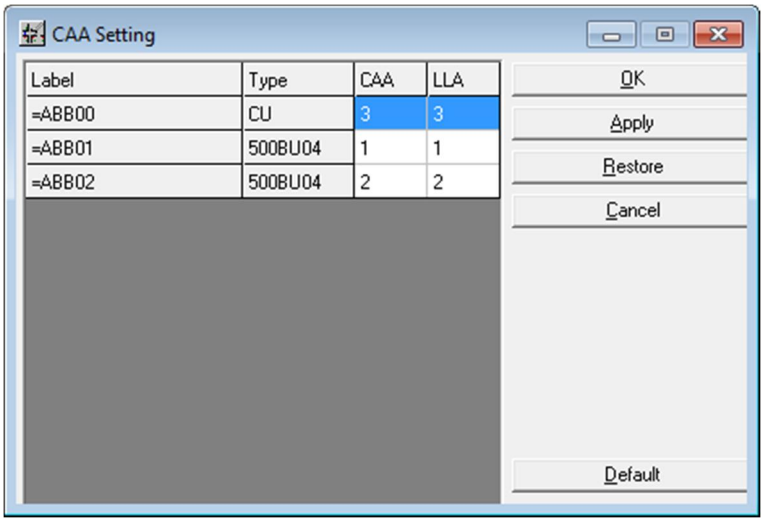


Figure 3 Dialog for configuring the CAA and LLA

Table 3 Configuration of IEC 870-5-103

Setting	Description	Default setting
CAA	Individual Common Address of ASDU for each Bay Unit	0 Central Unit 1-60 Bay Units
LLA	Individual Link Address for each Bay Unit	0 Central Unit 1-60 Bay Units

2.3 Configuring IEC 60870-5-103 IBB

For changes in status generated by REB500 to be transferred as events to an SCS/SMS, the corresponding signals must be configured by selecting them in HMI500 “Configuration / Binary module” and making the settings in the “Event configuration” section of the “Details” dialog. To which IBB an event is sent is determined by selecting the appropriate checkbox IBB 1 or IBB 2 when configuring the signal.
As the 61850 model is implemented as defined by the standard, no custom assignments can be made for the IBB associated with 61850.

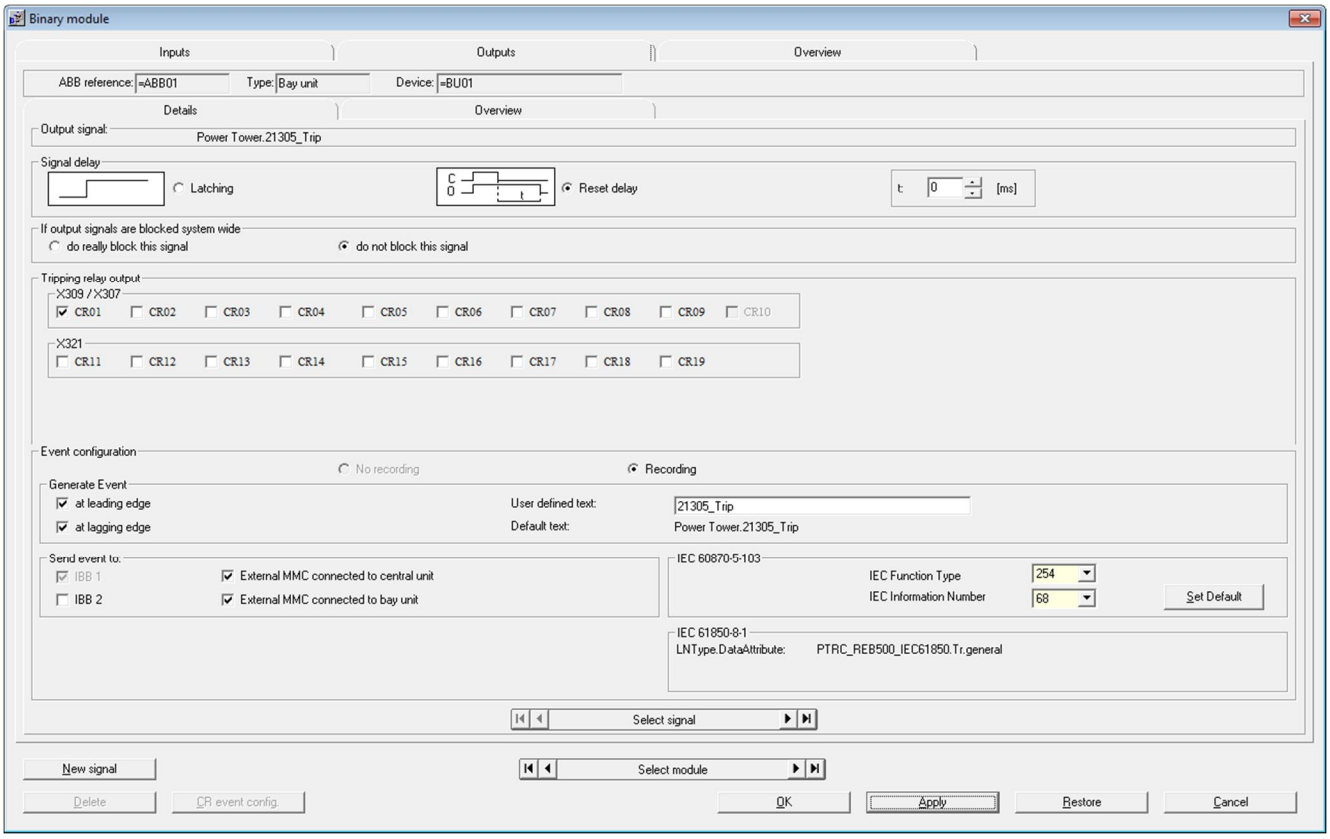


Figure 4 Configuring signals as events

Diagnostic and system events are always available for transfer whichever protocol is in use and cannot be configured.

The IEC 60870-5-103 section only appears when the protocol is configured.

2.4 Transfer of differential current values

2.4.1 The delta/dead band algorithm

To keep the load on the IBB as low as possible, the bus zone differential currents are checked cyclically, but only actually transferred via the bus if the value has changed.

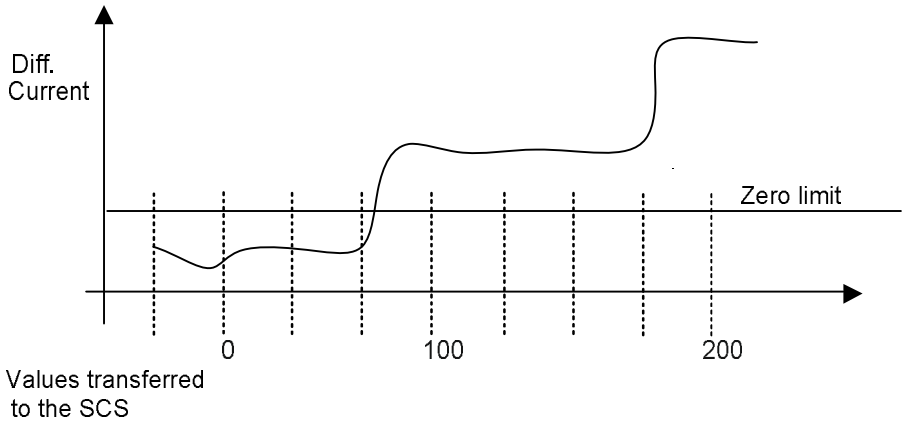


Figure 5 Transmitted values and the zero limit

To stabilize the display during normal operation, differential currents below the zero limit (dead band) count as zero and are transferred as such.

Providing the condition for transmitting a current value is fulfilled, all the differential currents belonging to the respective zone are sent to the SCS/SMS.

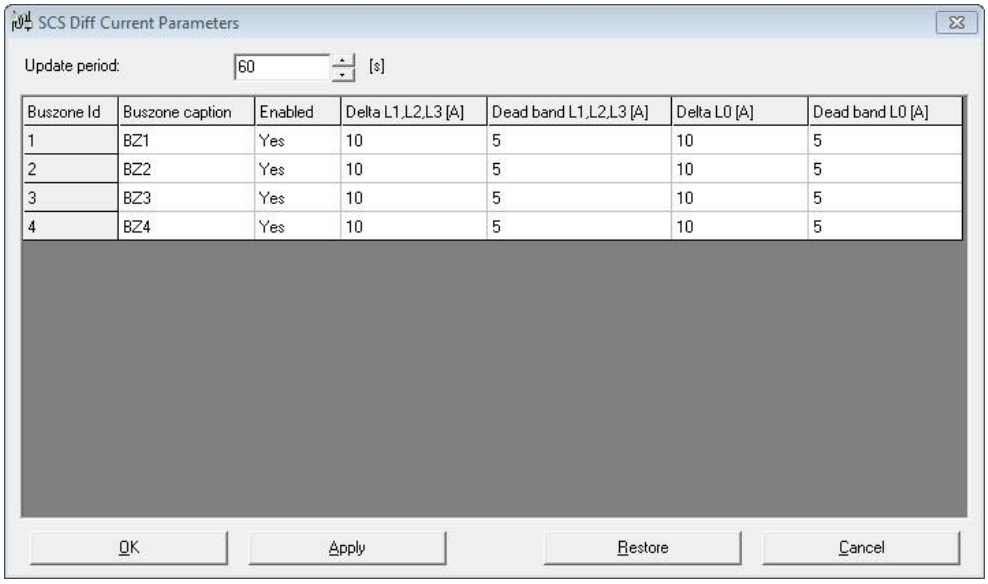
```
sum = sum + |current – last|
if sum > delta then
   sum = 0
   if current < deadband then
       current = 0
   endif
   send current
endif
last = current
```

The system continuously performs the above algorithm: It adds up the absolute difference between the last two measurements (`current` and `last`) since the last status update was sent (`sum`).

As soon as `sum` is greater than the threshold `delta` a new event will be sent with the `current` value. If this value is below the `deadband` threshold, the value 0 will be sent instead.

2.4.2 Configuring the SCS differential current parameter

The precise conditions for sending differential currents to the SCS can be set by selecting HMI500 “Settings / Communication / SCS Diff. current parameters”.



Buszone Id	Buszone caption	Enabled	Delta L1,L2,L3 [A]	Dead band L1,L2,L3 [A]	Delta L0 [A]	Dead band L0 [A]
1	BZ1	Yes	10	5	10	5
2	BZ2	Yes	10	5	10	5
3	BZ3	Yes	10	5	10	5
4	BZ4	Yes	10	5	10	5

Figure 6 Settings / Communication / SCS Diff. Current Parameters

Settings in this dialog are made for each busbar section (bus zone) and can be changed after activating the respective field. The differential current parameters are as follows:

Table 4 SCS Differential Current Parameters

Item	Description	Min.	Max.	Default	Step	Unit
Update period	Determines how often the differential current measurement has to be updated.	0	1000	60	100	s
Enabled	Enables polling of the bus zone differential currents.	yes	no	Yes		
Delta L1_L2_L3	Applies to all bus zones. Delta per bus zone for phases L1, L2 and L3.	0	65535	10	1	A
Dead band L1_L2_L3	Dead band per bus zone for phases L1, L2 and L3.	0	65535	5	1	A
Delta L0	Delta per bus zone for the neutral current L0.	0	65535	10	1	A
Dead band L0	Dead Band per bus zone for the neutral current L0	0	65535	5	1	A

‘Delta’ and ‘Dead band’ settings that are too low result in a high data load on the bus. For this reason, care should be taken to set reasonable values.

Section 3 IEC 60870-5-103

3.1 Introduction

Busbar protection is not one of the types of protection defined in IEC 60870-5-103. Nevertheless, the commands and signals of the REB500 system are modeled as far as possible on functions defined in the IEC recommendation. The functional scope of the station protocol is therefore reduced. The backup protection functions breaker failure, time-overcurrent and end fault that are optionally available with REB500 are also supported.

According to the IEC recommendation, usage of the private range is only permitted with regard to the compatibility of existing devices. For this reason, additional REB500 functions that are not defined in the recommendation were implemented according to the future-oriented generic part of IEC 60870-5-103.

REB500 also optionally provides a private range.

Refer to IEC 60870-5-103 for an explanation of the various abbreviations.

3.2 General functions

The tables below define the functional scope of REB500 according IEC 60870-5-103. The details are to be found in the recommendation itself.

System functions in monitoring direction

Table 5 System functions in monitoring direction

INF	Description	GI.	TYPE.	COT
<0>	End of general interrogation (polling)	–	8	10
<0>	Time synchronization	–	6	8
<2>	Reset frame control bit (FCB)	–	5	3
<3>	Reset CU	–	5	4
<4>	Start/restart	–	5	5
<5>	Power on	–	5	6

The information number 0 refers to the global function type and is the same for all system functions. The information numbers 2 to 5 are used with FUN in relation to the main function of a protection system.

Table 6 Status signals in monitoring direction

INF	Description	GI.	TYPE	COT	REB500 signal configuration
<18>	Protection active	x	1	1,9	41810_In service (CU output) 21805_In service (BU output)
<19>	LED reset	–	1	11	31810_External reset (CU input) 11610_external reset (BU input)
<20>	Blocks the supervisory equipment	x	1	9,11	31215_Block.IEC master_direction (CU input)

Table 7 Supervisory signals in monitoring direction

INF	Description	GI.	TYPE	COT	REB500 signal configuration
<47>	General alarm	x	1	1,9	41805_Alarm (CU output)

Table 8 Disturbance signals in monitoring direction

INF	Description	GI.	TYPE	COT	FUN	REB500 signal configuration
<68>	General trip	–	2	1	254	42305_BBP trip (CU output) 21110_TRIP (BU output) 21305_TRIP (BU output)
<69>	Trip L_1	–	2	1	254	42315_BBP trip L1 (CU output) 23315_BFP TRIP L1 (BU output)
<70>	Trip L_2	–	2	1	254	42320_BBP trip L2 (CU output) 23320_BFP TRIP L2 (BU output)
<71>	Trip L_3	–	2	1	254	42325_BBP trip L3 (CU output) 23325_BFP TRIP L3 (BU output)
<72>	Trip L_0	–	2	1	254	23340_BFP TRIP L0 (BU output)
<85>	Breaker failure	–	2	1	254	43305_BFP trip t1 (CU output) 43310_BFP trip t2 (CU output) 23305_BFP trip t1 (BU output) 23310_BFP trip t2 (BU output)
<90>	Trip I>	–	2	1	254	45305_OCDT trip (CU output) 25105_OCDT TRIP (BU output) 25305_OCDT trip (BU output)
<92>	Trip I_N>	–	2	1	254	42310_BBP trip L0 (CU output)

Table 9 Types of function

FUN	Description
<254>	Generic

Table 10 Generic functions in monitoring direction

INF	Description	GI	TYPE	COT
<240>	Read headings of all defined groups	–	10	42,43
<241>	Read values or attributes of all entries of one group	–	10	42,43
<242>	Not used	–	–	–
<243>	Read the directory of a single entry	–	11	42,43
<244>	Read the value or attribute of a single entry	(x)	10	1,2,9,11,12,42,43

Table 11 Generic functions in control direction

INF	Description	TYPE	COT
<240>	Read headings of all defined groups	21	42
<241>	Read values or attributes of all entries of one group	21	42
<242>	Not used	–	–
<243>	Read the directory of a single entry	21	42
<244>	Read the value or attribute of a single entry	21	42

Table 12 Commands in control direction

INF	Description	TYPE	COT	FUN	CAA
<19>	LED reset	20	20	254	Central Unit

3.3 Disturbance recorder

Disturbance data are uploaded and displayed in accordance with the IEC recommendation with the following exceptions:

- REB500 supports a maximum of 15 records per Bay Unit, but only the first (oldest) eight in the queue can be displayed in accordance with the recommendation.
- Of the records that are displayed, only the oldest can be deleted or uploaded. This is determined by the REB500 principle.
- The time stamp invalid bit (IV) in a disturbance record is always set, because the CIM module is unaware of the synchronization status at the instant of the record.

Creating an export file

HMI500 provides facility for exporting the IEC 60870-5-103 communication data contained in the system database in the form of a text file (export file). To do this, select “Tools / Export SCS data” and IEC 60870-5-103 IBB and then click on the “Export” button.

The application creates a text file (export file) iec103exp.lst, which contains all the information required.

The file has the following structure:

1. Disturbance recorder signal configuration
2. IEC 60870-5-103 events

The columns are separated by a semicolon “;”. The following is an example of an export file generated by HMI500:

IEC 60870-5-103 Disturbance Recorder signals

CAA;ABB ref.;Feeder;Station number;Signal ID;Signal text
0;CU;-;Null;Null;Null
2;BU2;BU2;2;1;Trip
2;BU2;BU2;2;2;In service

IEC 60870-5-103 events and private Information Object Identifier settings
---
CAA;ABB ref.;Feeder;Signal text;IEC FUN;IEC INF
0;CU;BU2;41810_In service;254;18
2;BU1;BU1;23310_BFP trip t2;254;85
2;BU1;BU1;221105_I0INV Trip Si;160;67
2;BU1;BU1;211880_DIST Com Send.2;128;76

Table 13 Description of the columns above

Colum	Description
CAA	Common Address ASDU: Sub-address for identifying a Bay Unit at the application level
ABB ref.:	ABB's designation for the Bay Unit
Feeder:	User's designation for the respective bay
Station Number:	Disturbance recorder number
Signal ID:	Consecutive signal number
Signal Text:	User's signal description
IEC FUN:	Assigned IEC function type
IEC INF:	Assigned IEC information number

The above Signal Id and Signal Text assignment for a specific Bay Unit can also be made via HMI500 providing a COMTRADE file for the Bay Unit disturbance recorder is uploaded. The file <filename>.cfg generated by the PC contains the same in-formation as the list generated by the export tool.

The assignment can change when the disturbance recorder con-figuration changes, for example, by deleting or adding signals. The above list then has to be recreated and possibly corrected by the control system.

The configured length of disturbance records shall not exceed one second (1s) to avoid conflicts with the maximum number of 65535 Events foreseen in IEC81750-5-103.

3.4 ACC actual channel

The REB500 Bay Unit 500BU04 supports five voltage channels. Since, however, the compatible range of the standard only lists four voltage channels, the fifth channel is transferred to the private domain.

Assignment of REB500 channels to IEC 60870-5-103 channel numbers:

Table 14 IEC 60870-5-103 analog channel assignment

REB500 channel designation	REB500 application	IEC 60870-5-103 channel designation ACC (actual channel)
I1	I_{L1}	1 = I_{L1}
I2	I_{L2}	2 = I_{L2}
I3	I_{L3}	3 = I_{L3}
I4	I_{L0}	4 = V_{L1}
U1	U_{L1}	5 = V_{L1E}
U2	U_{L2}	6 = V_{L3}
U3	U_{L3}	7 = V_{0E}
U4	U_{L0}	8 = U_{L1}
U5	U 5	64 = private

3.5 Generic REB500 functions

3.5.1 Diagnostic information

Status and diagnostic information is generated by the various REB500 application software modules and transferred spontaneously as events every time the status changes. A separate group exists for diagnostic information with an entry for every subsystem of the REB500 system software REBSYS.

Diagnostic event group:

Table 15 Diagnostic event

ENTRY No.	Group 64 (0x40)
0 (Heading)	Diagnostic information
1	BBP (Busbar protection)
2	ITT (Intertripping)
3	BCF (Binary input and output configuration facility)
4	DIA (Diagnostic)
5	TGR (Test generator)
6	EMI (External man/machine interface)
7	LMI (Local man/machine interface)
8	DAC (Data access)
9	TIM (Time management)
10	DBS (Database system)
11	SIG (Signal processor)
12	EVR (Event recording)
13	RFS (Remote file system)
14	SPR (Signal pre-processing and recording)
15	MBA (Multi-function bus administrator)
16	OCP (Overcurrent protection)
17	BFP (Breaker failure protection)
18	DRR (Disturbance recorder)
19	MPL (Multi functional process bus library)
20	EFP (End-fault protection)
21	PDF (Pole discrepancy function)
22	BOC (Binary input/output control)
23	BPP (Binary pre-processing)
24	DIE (Diagnostic extensions)
25	DRD (Disturbance recorder dispatcher)
26	EVA (Event and alarm handling)
27	GPI (General purpose interface)
28	LAC (LON application converter)
29	IAC (IAC application converter)
30	CMD (Command processor)
31	LPL (LON protocol layer)
32	TRC (Traceability)
33	BP (Bay protection)

Table 16 Used attributes of ASDU 10 for diagnostic events

COT	CAA	FUN
1 Spontaneous	0 / 1..60 REB500 CU / REB500 BU	254 Generic

With the exception of the header (entry 0), the current values of the entries are not available on request. The response to the corresponding generic read command is therefore COT 43 ‘invalid data response to generic read command’.

The current value of the group header (entry 0) corresponds to the number of subsystems in the REB500 system software.

Table 17 Directory entry for GIN 0x4000 (header)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> OS8ASCII	21	1	“Diagnostic information”
<1> Current value	<3> UI	1	1	Number of SW subsystems

All the other entries in this group consist of the following attributes that are needed to describe a diagnostic event generated by one of the software subsystems.

The status of a diagnostic event is indicated by an ASCII string, which can have one of the following values:

- “Initializing”
- “Major error”
- “Minor error”
- “Not ready”
- “Ready”
- “Last wish”
- “Shutdown”
- “No status”

The error code is assigned by the application when the status changes and precisely describes the cause of the error.

Table 18 Directory entry for GIN 0x40 (xx)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> OS8ASCII	3	1	“BBP” (example)
<1> Current value	<23> DATASTRUCTURE	29	1	(Includes the following three definitions)
	<1> OS8ASCII	12	1	Status
	<3> UI	1	1	Error code
	<14> BINARY TIME	7	1	Time stamp (CP56Time2a)

The following table gives an example of the ASDU 10 “Generic Data” that is transferred spontaneously for a diagnostic event.

Table 19 TYPE IDENTIFICATION: Generic data

0	0	0	0	1	0	1	0	**T**ype **I**dentification	10	**DATA UNIT**
1	0	0	0	0	0	0	1	**V**ariable **S**tructure **Q**ualifier	SQ=1, SQ_No.= 1	**IDENTIFIER**
Spontaneous <1>								**C**ause **O**f **T**ransmission	COT	
REB500 CU/BU No.								**C**ommon **A**ddress of **A**SDU	<0 .. 60>	
GEN <254>								**Fun**ction type	FUN	**INFORMATION**
Read value of single entry <244>								**Inf**ormation number	INF	OBJECT
<0>								Return information identifier	RII	
{1, 0, 0}								Number of generic data sets	NGD {NO, COUNT, CONT}	
40 H								Generic identification number	GIN	
01 H									Example	
Current value <1>								Kind of description	KOD	
DATA STRUCTURE <23>								DATA TYPE		
29								DATA SIZE	GDD	
1,0								NUMBER, CONT		
<1> OS8ASCII								DATA TYPE		
12								DATA SIZE	GDD 1	
1,0								NUMBER, CONT		
"Major Error "									GID 1 (example)	
<3> UI								DATA TYPE		
1								DATA SIZE	GDD 2	
1,0								NUMBER, CONT		
Error code (UI1)									GID 2	
<14> BINARY TIME								DATA TYPE		
7								DATA SIZE	GDD 3	
1,0								NUMBER, CONT		
Time stamp (CP56Time2a)									GID 3	

3.5.2 Status information

All the status information relating to binary input and output signals, internal signals (single-point indications - SPI) and switchgear positions (double-point indications - DPI) that are configured in REB500 for transfer via IEC60870-5-103, but are not covered by the compatible part of the IEC recommendation, are transferred as generic data. An entry is made in the table for every event configured using HMI500 or REBCON for transfer via IEC 60870-5-103. Since there can be more events per type (SPI or DPI) than the maximum number of entries a group can have (255), the system reserves additional groups as necessary. By this means, up to 1020 events per event type can be defined in the generic part.

Table 20 Group for displaying status information

Entry No.	Group No. 66 (0x42) to Group No. 69 (0x45)	Group No. 70 (0x46) to Group No. 73 (0x49)
0 (Heading)	Single-point indications	Double-point indications
1	Indication #1	Indication #1
2	Indication #2	Indication #2
…	…	…
255	Indication #255	Indication #255

Table 21 Used attributes of ASDU 10 for status information

COT	CAA	FUN
1 Spontaneous	0 / 1..60 REB500 CU / REB500 BU	254 Generic

With the exception of the header (entry 0), the current values of the entries are not available on request. The response to the corresponding generic read command is therefore COT 43 “invalid data response to generic read command”.

3.5.3 Entries for single-point indications

Table 22 Directory entry for GIN 0x4200 (header)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> OS8ASCII	24	1	"Single-point indications”
<1> Current value	<3> UI	1	1	Number of SPI defined in this group

Table 23 Directory entry for GIN 0x42 (xx)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> os8ascii	20	1	Event text defined by user
<1> Current value	<23> data structure	14	1	(Includes the following two definitions)
	<9> Double Point Information	1	1	OFF (1) / ON (2)
	<14> binary time	7	1	Time stamp (CP56Time2a)

The following table gives an example of the ASDU 10 *‘Generic Data’* that is transferred spontaneously for a single-point indication.

Table 24 TYPE IDENTIFICATION: Generic data

0	0	0	0	1	0	1	0	**T**ype **I**dentification	10	**DATA UNIT**
1	0	0	0	0	0	0	1	**V**ariable **S**tructure **Q**ualifier	SQ=1, SQ_No.= 1	**IDENTIFIER**
Spontaneous <1>								**C**ause **O**f **T**ransmission	COT	
REB500 CU/BU No.								**C**ommon **A**ddress of **A**SDU	<0 .. 60>	
GEN <254>								**Fun**ction type	FUN	**INFORMATION**
Read value of single entry <244>								**Inf**ormation number	INF	OBJECT
<0>								Return information identifier	RII	
{1, 0, 0}								Number of generic data sets	NGD {NO, COUNT, CONT}	
43 H 01 H								Generic identification number	Group <41H .. 45H> Entry <1 .. 255>	
Current value <1>								Kind of description	KOD	
DATA STRUCTURE <23> 14 1,0								DATA TYPE DATA SIZE NUMBER, CONT	GDD	
<9> DOUBLE-POINT INFORMATION 1 1,0								DATA TYPE DATA SIZE NUMBER, CONT	GDD 1	
0	0	0	0	0	0	<0 .. 3>			GID 1	
<14> BINARY TIME 7 1,0								DATA TYPE DATA SIZE NUMBER, CONT	GDD 2	
Time stamp (CP56Time2a)									GID 2	

3.5.4 Entries for double-point indications

Table 25 Directory entry for GIN 0x4600 (header)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> OS8ASCII	24	1	"Double-point Indications"
<1>Current value	<3> UI	1	1	Number of DPI defined in this group.

Table 26 Directory entry for GIN 0x4600 (header)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> os8ascii	20	1	Event text defined by user
<1> Current value	<23> data structure	14	1	(Includes the following two definitions)
	<9> Double Point INFORMATION WITH TRANSIENT AND ERROR	1	1	TRANSIENT (0) / OFF (1) / ON (2) / ERROR (3)
	<14> binary time	7	1	Time stamp (CP56Time2a)

The following table gives an example of the ASDU 10 *'Generic Data'* that is transferred spontaneously for a double-point indication.

Table 27 TYPE IDENTIFICATION: Generic data

0	0	0	0	1	0	1	0	**T**ype **I**dentification	10	**DATA UNIT IDENTIFIER**
1	0	0	0	0	0	0	1	**V**ariable **S**tructure **Q**ualifier	SQ=1, SQ_No.= 1	
Spontaneous <1>								**C**ause **O**f **T**ransmission	COT	
GEN <254>								**Fun**ction type	FUN	**INFORMATION OBJECT**
Read value of single entry <244>								**Inf**ormation number	INF	
<0>								Return information identifier	RII	
{1, 0, 0}								Number of generic data sets	NGD {NO, COUNT, CONT}	
46 H								Generic identification number	Group <46H .. 49H>	
01 H									Entry <1 .. 255>	
Current value <1>								Kind of description	KOD	
DATA STRUCTURE <23>								DATA TYPE		
14								DATA SIZE	GDD	
1,0								NUMBER, CONT		
<11> DOUBLE POINT INFORMATION WITH TRANSIENT AND ERROR								DATA TYPE		
1								DATA SIZE	GDD 1	
1,0								NUMBER, CONT		
0	0	0	0	0	0	<0 .. 3>			GID 1	
<14> BINARY TIME								DATA TYPE		
7								DATA SIZE	GDD 2	
1,0								NUMBER, CONT		
Time stamp (CP56Time2a)									GID 2	

3.5.5 Display of busbar differential currents

The differential currents are displayed for each corresponding busbar zone (1..32) (see transfer of differential currents).

Table 28 Used attributes of ASDU 10 for differential current

COT	CAA	FUN
1 Spontaneous	0 REB500 CU	254 Generic

The group number 75 (0x4B) is used to display busbar differential currents and is therefore only assigned to the Central Unit (CAA = 0).

Table 29 Directory entry for GIN 0x4B00 (header)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> OS8ASCII	21	1	"Differential currents"
<1> Current value	<3> UI	1	1	Number of valid entries

The number of valid entries corresponds to the number of bus-bar zones and thus limited to the range [1…32].

Each of the entries 1…32 in the group relates to a given busbar zone.

Table 30 Directory entry for GIN 0x4B (xx)

COD	Data type	Length	Number	Value / Significance
<10> Description	<1> os8ascii	3	1	"BBI" example
<1> Current value	<23> data structure	2	1	(Includes the following two definitions)
	<12> Measured variable with quality descriptor	2	3,4	Field with 3 / 4 measurements CP16 {OV,ER,RES,MVAL}
	<14> binary time	7	1	Time stamp (CP56Time2a)
<9> Unit	<1> os8ascii	1	1	"A"
<6> Factor	<6> I	4	1	32 Bit integer

The description has a maximum length of 16 characters.

The current value is a field with three (L1, L2, L3) or four (L1, L2, L3, L0) measurements and the associated time stamp. The effective number of measurements is determined by how the REB500 is configured.

Table 31 COD Current Value

Attribute	Description
OV Overflow	This Bit is set to <1> whenever an overflow occurs or the measurement is not assigned. It is normally therefore set to <0>.
ER Error flag	BBP (Busbar protection) This Bit indicates whether a measurement is valid or not (measurement valid <0>, measurement invalid <1>).
RES Reserved	Spare for future use.
MVAL	Contains the actual measurement in fixed decimal point format.

The Factor is a 32 Bit integer for scaling to the original value.

The following table gives an example of the ASDU 10 ‘Generic Data’ that is transferred spontaneously for displaying the differential currents of a given bus zone.

Table 32 TYPE IDENTIFICATION: Generic data

0	0	0	0	1	0	1	0	**T**ype **I**dentification	10	**DATA UNIT IDENTIFIER**
1	0	0	0	0	0	0	1	**V**ariable **S**tructure **Q**ualifier	SQ=1, SQ_No.= 1	
Spontaneous <1>								**C**ause **O**f **T**ransmission	COT	
REB500 CU								**C**ommon **A**ddress of **A**SDU	<0>	
GEN <254>								**Fun**ction Type	FUN	**INFORMATION OBJECT**
Read value of single entry <244>								**Inf**ormation number	INF	
<0>								Return information identifier	RII	
{1, 0, 0}								Number of generic data sets	NGD {NO, COUNT, CONT}	
4B H								Generic identification number	Group	
01 H									Entry <1 .. 32>	
Current value <1>								Kind of description	KOD	
DATA STRUCTURE <23>								DATA TYPE		
21								DATA SIZE	GDD	
1,0								NUMBER, CONT		
<12> MEASUREMENT WITH QUALITY DESCRIPTOR								DATA TYPE		
2								DATA SIZE	GDD 1	
3,0								NUMBER, CONT	3 or 4 (including measurement L0)	
OV	ER	RES	MVAL (4..8)						GID 1a	
MVAL (9..16)										
OV	ER	RES	MVAL (4..8)						GID 1b	
MVAL (9..16)										
OV	ER	RES	MVAL (4..8)						GID 1c	
MVAL (9..16)										
<14> BINARY TIME								DATATYPE		
7								DATASIZE	GDD 2	
1,0								NUMBER, CONT		
Time stamp (CP56Time2a)									GID 2	

3.6 Special information and instructions for configuring the control system

Private range

Provision is made in the event configuration (see Section 2.3) for the user to enter his own private IEC 60870-5-103 definition for each REB500 signal.

The input fields for REB500 signals covered by the public part of the standard (see Section 3.2) have a bright yellow back-ground their default setting ‘0’ for both IEC function type and in-formation number. All other signals receive the presetting 0 for the IEC function type and the information number. A signal de-fined for protocol 60870-5-103 that is not in the public range and has ‘0’ set for function type and information number is transmit-ted via the generic part of the protocol.

A private IEC 60870-5-103 definition can be entered for every REB500 signal in this dialog. The “Set default” button is enabled for a signal in the public range of the protocol so that the ABB default setting can be restored at any time.

The limitations specified in the standard must be observed when assigning information numbers. The latter must be within the following ranges:

16-52; 73; 128-130; 64-72; 74-93

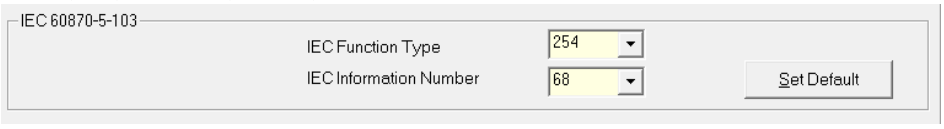


Figure 7 Private IEC 60870-5-103 definition

Disturbance recorder, binary signal transfer

Binary signals transmitted in disturbance records only have numbers and no designation. The assignment of numbers to signal names is given in the COMTRADE file <filename>.CFG, which can be uploaded, for example, from a Bay Unit using HMI500.

Signal configuration instructions

Should the same logical signal be configured on two different BIO modules in a Bay Unit, only one of them should be relayed to the IEC 60870-5-103 bus. A configuration that is duplicated produces two indistinguishable events, which can cause some confusion. The response is reflected by HMI500, which also generates two events.

Cause of transmission

With the exception of 42 (generic writing command), all the possible causes of transmission are supported in the command direction.

In the supervisory direction, they are all supported with the exception of 7 (test mode), 12 (local HMI) and 44 (return confirmation of a generic write command).

Type identification

The type identification defines the type of ASDU that has been transferred.

Table 33 Information in the supervisory direction

TYPE	Description
<1>	time-tagged message
<2>	time-tagged message with relative time
<5>	Identification
<6>	Time synchronization
<8>	General interrogation termination
<10>	Generic data
<11>	Generic identification
<23>	List of recorded disturbances
<26>	Ready for transmission of disturbance data
<27>	Ready for transmission of a channel
<28>	Ready for transmission of tags
<29>	Transmission of tags
<30>	Transmission of disturbance values
<31>	End of Transmission

Table 34 Information in the command direction

TYPE	Description
<6>	Time synchronization
<7>	General interrogation (polling)
<10>	Generic data
<20>	General command
<21>	Generic command
<24>	Order for disturbance data transmission
<25>	Acknowledgement for disturbance data transmission

Timeouts

- Protocol time-out <50 ms as defined in the IEC recommendation applies for the protocol.

- When a command to upload the disturbance recorder data is issued, the data has to be transferred from the Bay Unit to the Central Unit first before they are transferred via the IEC bus. The timeout from the instant the upload command is is-sued to the receipt of the data varies in relation to the length of the disturbance record. The following applies:

  STP timeout <2.5 minutes per 1 second of disturbance record data (4I+4U, 2400 Hz).

- Once the transfer of disturbance recorder data has started, the timeout changes to:
  Transfer timeout <1 Minute

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