SIPROTEC

Combined Multi-end Line Differential Protection with Distance Protection 7SD538

Communication Module

Redundant IEC 60870-5-103

Bus Mapping

Edition: February 2010

C53000-L2540-A309-1

Preface

Aim of this Manual

The manual is divided into the following topics:

- Notes to SIPROTEC® Objects
- Redundant IEC 60870-5-103 Device Profile
- Bus Mapping

General information about design, configuration, and operation of SIPROTEC® devices are laid down in the SIPROTEC® 4 system manual, order no. E50417-H1176-C151.

Target Audience

Protection engineers, commissioning engineers, persons who are involved in setting, testing and service of protection, automation, and control devices, as well as operation personnel in electrical plants and power plants.

Additional Literature

This manual describes the redundant IEC 60870-5-103 Device Profile of the SIPROTEC® devices.

The following additional manuals inform you about the redundant IEC 60870-5-103 and the function, operation, assembly, and commissioning of the SIPROTEC® devices:

Manual	Contents	Order number
Combined multi-end line differential protection with distance protection SIPROTEC 7SD538	Function, operation, assembly, and commissioning of the SIPROTEC® device 7SD538	C53000-G115D-C343-1
IEC 60870-5-103 Communication Database	Redundant IEC 60870-5-103 communication database of the SIPROTEC® devices	C53000-L2540-A301-1

IEC 60870-5-103 Specification

The IEC 60870-5-103 specification and the structure of the IEC 60870-5-103 messages are defined in:

> International Standard IEC 60870-5-103
> Transmission protocols-
> Companion standard for the informative interface of protection equipment
> Edition 1997-12
> Reference number CEI/IEC 60870-5-103: 1997

Applicability of this Manual

This manual is valid for

- SIPROTEC® 4 device 7SD538 version V4.70 or higher
- Redundant IEC 60870-5-103 communication module version 01.02.04 or higher

Note:

The redundant IEC 60870-5-103 module is not for all SIPROTEC® devices available. Check the manual of the device or contact your Siemens representative.

For device parameterization **DIGSI® 4 version 4.8 or higher** and IEC 60870-5-103 standard mapping 3-1 have to be used.

Additional Support

Should further information be desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, the matter should be referred to the local Siemens representative.

Instructions and Warnings

The warnings and notes contained in this manual serve for your own safety and for an appropriate lifetime of the device. Please observe them!

The following terms are used:

Warning

indicates that death, severe personal injury, or substantial material damage can result if proper precautions are not taken.

Note

indicates information about the device or respective part of the instruction manual which is essential to highlight.

Warning!

Hazardous voltages are present in this electric equipment during operation. Non-observance of the safety rules can result in severe personal injury or material damage.

Only electrically qualified personnel shall work on and around this equipment after becoming thoroughly familiar with all warnings and safety notices of this manual as well as with the applicable safety regulations.

The successful and safe operation of this device is dependent on proper handling, installation, operation, and maintenance by electrically qualified personnel under observance of all warnings and hints contained in this manual.

In particular the general election and safety regulations (e.g. IEC, DIN, VDE, EN or other national and international standards) regarding the correct use of hoisting gear must be observed. Non-observance can result in death, personal injury, or substantial material damage.

QUALIFIED PERSONNEL

For the purpose of this instruction manual and product labels, a qualified person is one who is familiar with the installation, construction, and operation of the equipment and the hazards involved. In addition, he has the following qualifications:

- Is trained and authorized to energize, de-energize, clear, ground, and tag circuits and equipment in accordance with established safety practices.
- Is trained in the proper care and use of protective equipment in accordance with established safety practices.
- Is trained in rendering first aid.

Typographic and Symbol Conventions

The following text formats are used when literal information from the device or to the device appear in the text flow:

`Parameter names`, i.e. designators of configuration or function parameters which may appear word-for-word in the display of the device or on the screen of a personal computer (with operation software DIGSI® 4), are marked in bold letters of a monospace type style.

`Parameter options`, i.e. possible settings of text parameters, which may appear word-for-word in the display of the device or on the screen of a personal computer (with operation software DIGSI® 4), are written in italic style, additionally.

“`Annunciations`”, i.e. designators for information, which may be output by the relay or required from other devices or from the switch gear, are marked in a monospace type style in quotation marks.

Deviations may be permitted in drawings when the type of designator can be obviously derived from the illustration.

Table of Contents

Notes to SIPROTEC® Objects

1

This chapter contains notes for the use and evaluation of certain SIPROTEC® objects which are available via IEC 60870-5-103 communication.

Note

The description of the standard mapping contains the pre-allocation of the mapping file at delivery or first assignment of a mapping in DIGSI® 4 to the SIPROTEC® device.

Changes of the allocation and the scaling of the measured values are possible in adaptation to the concrete installation environment (ref. to page 3).

1.1 Indications

1.1.1 Alarm Summary Event

Note

Depending on the device composition and the existing protection packages not all of the indicated binary inputs or protection indications (and corresponding IEC 60870-5-103 Information numbers) may be available in the SIPROTEC® device.

The "Alarm summary event" (Adr. 160) is indicated, if at least one of the following internal alarms assumes the ON status:

- “Failure Battery empty”,
- “Error Board 0“, “Error Board 1“, “Error Board 2“, "Error Board 3“, "Error Board 4“, "Error Board 5“, “Error Board 6“, "Error Board 7“
- “Calibration data fault”,
- "Failure: Current Balance", "Failure: Voltage summation Phase-Ground", "Failure: Voltage Balance",
- “Failure: Voltage absent”.

Reference Refer to chapter 3.2.10.

1.1.2 Stop Data Transmission

The functionality "Stop data transmission" is not supported via IEC 60870-5-103 communication. If "Stop data transmission" is active nevertheless data via IEC 60870-5-103 will be transmitted furthermore.

Reference Refer to chapter 3.2.10.

1.2 Commands

Note

The allocation of the standard relays to the switching devices and to the binary outputs is defined during parameterization of the SIPROTEC® devices.

Depending on the device composition there may be less than the indicated standard relays (and corresponding IEC 60870-5-103 Information numbers) available in the SIPROTEC® device.

1.2.1 Single Commands

The command output mode (*pulse output*, *continuous output*) is changeable for the single commands using parameterization software DIGSI® 4.

The switching direction OFF for single commands with *pulse output* is not permitted and is rejected in the SIPROTEC® device.

Reference Refer to chapter 3.1.2.

1.2.2 Changing the Settings Group

Switching on one settings group automatically switches off the current active settings group. Transmission of the value OFF is insignificant for the change of the settings group and is refused by the device.

A change of the settings group is only possible via IEC 60870-5-103 if the parameter **`Change to Another settings group`** (parameter address = 302) has the value "Protocol".

Reference Refer to chapter 3.1.2 to the command for changing the settings group. The indication for a change of a settings group is shown in chapter 3.1.2.

1.3 Measured Values

Note

Depending on the device composition not all of the indicated analog inputs (and corresponding IEC 60870-5-103 mapping entry) may be available in the SIPROTEC® device.

For the transmission of measured values, the compatible range and the private range can be used. Are there several measurement telegrams parameterised then these are transferred cyclically after each other.

Note

If all parameterised measurement telegrams aren't transferred, the parameter **`Scanning period (in ms) for measurements`** must be put on a greater value.

The range of the values which can be transmitted is mostly +/-240 % or +/-2.4 of the rated value. The value in data unit 9 has 13 bit (1 sign, 12 bit data). That means that +/- 4096 indicates +/- 240% of the measured value.

Changes of the scaling of the measured values are possible in adaptation to the concrete installation environment (ref. to manual “IEC 60870-5-103 Communication database”).

IEC 60870-5-103 Interoperability 2

Redundant IEC 60870-5-103

DEVICE PROFILE DOCUMENT

Vendor Name: **SIEMENS AG**

Device Name: **7SD538**

2.1 Physical Layer

2.1.1 Electrical Interface

☒ EIA RS-485
☐ Number of loads _____ for one protection equipment

2.1.2 Optical Interface

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

2.1.3 Transmission Speed

☒ 2 400 bit/s
☒ 4 800 bit/s
☒ 9 600 bit/s
☒ 19 200 bit/s
☒ 38 400 bit/s
☒ 57 600 bit/s

2.2 Link Layer

There are no choices for the link layer.

2.3 Application Layer

2.3.1 Transmission Mode for Application Data

Mode 1 (least significant octet first), as defined in 4.10 of IEC 60870-5-4, is used exclusively in this companion standard.

2.3.2 Common Address of ASDU

☒ One Common Address of ASDU (identical with station address)
☐ More than one Common Address of ASDU

2.3.3 Selection of Standard Information Numbers in Monitor Direction

2.3.3.1 System Functions in Monitor Direction

	INF	Semantics
☐	<0>	End of general interrogation
☐	<0>	Time synchronization
☐	<2>	Reset FCB
☐	<3>	Reset CU
☒	<4>	Reset Device
☒	<5>	Initial Start

2.3.3.2 Status Indications in Monitor Direction

	INF	Semantics
☒	<16>	Auto-recloser active
☐	<17>	Teleprotection active
☒	<18>	Protection active
☒	<19>	LED reset
☒	<20>	Stop data transmission
☒	<21>	Test mode
☒	<22>	Setting calculation is running
☒	<23>	Setting Group A active
☒	<24>	Setting Group B active
☒	<25>	Setting Group C active
☒	<26>	Setting Group D active
☒	<27>	>Annunciation 1
☒	<28>	>Annunciation 2
☒	<29>	>Annunciation 3
☒	<30>	>Annunciation 4

2.3.3.3 Supervision Indications in Monitor Direction

	INF	Semantics
☒	<32>	Fail I supervision
☒	<33>	Fail V supervision
☒	<35>	Fail phase sequence supervision
☐	<36>	Fail trip circuit
☒	<37>	Emergency mode
☒	<38>	Fail Feeder VT
☐	<39>	Teleprotection disturbed
☒	<46>	Alarm summary event
☒	<47>	Error summary alarm

2.3.3.4 Fault Indications in Monitor Direction

	INF	Semantics
☒	<64>	Relay pick-up phase A
☒	<65>	Relay pick-up phase B
☒	<66>	Relay pick-up phase C
☒	<67>	Relay pick-up G
☒	<68>	Relay trip
☒	<69>	Relay trip command phase A
☒	<70>	Relay trip command phase B
☒	<71>	Relay trip command phase C
☐	<72>	Trip I>> (back-up operation)
☐	<73>	Fault location X in ohms
☐	<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>	Relay pick-up
☐	<85>	Busbar trip
☐	<86>	Trip measuring system A
☐	<87>	Trip measuring system B
☐	<88>	Trip measuring system C
☐	<89>	Trip measuring system G
☐	<90>	Trip I>
☐	<91>	Trip I>>
☐	<92>	Trip IN>
☐	<93>	Trip IN>>

2.3.3.5 Auto-Reclosure Indications in Monitor Direction

	INF	Semantics
☒	<128>	Close command by AR
☐	<129>	Close command 2nd cycle
☐	<130>	AR not ready

2.3.3.6 Measurands in Monitor Direction

	INF	Semantics
☐	<144>	Measurand I
☐	<145>	Measurands I, V
☐	<146>	Measurands I, V, P, Q
☐	<147>	Measurands I_N, V_{EN}
☐	<148>	Measurands $I_{A,B,C}$, $V_{A,B,C}$, P, Q, f

2.3.3.7 Generic Functions in Monitor Direction

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

2.3.4 Selection of Standard Information Numbers in Control Direction

2.3.4.1 System Functions in Control Direction

	INF	Semantics
☐	<0>	Initiation of general interrogation
☐	<0>	Time synchronization

2.3.4.2 General Commands in Control Direction

	INF	Semantics
☒	<16>	Auto-recloser active
☐	<17>	Teleprotection on/off
☒	<18>	Protection active
☒	<19>	LED reset
☒	<20>	Stop data transmission
☒	<21>	Test mode
☒	<23>	Setting Group A active
☒	<24>	Setting Group B active
☒	<25>	Setting Group C active
☒	<26>	Setting Group D active

2.3.4.3 Generic Functions in Control Direction

	INF	Semantics
☐	<240>	Read headings of all defined groups
☐	<241>	Read values or attributes of all entries of one group
☐	<243>	Read directory of a single entry
☐	<244>	Read value or attribute 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

2.3.5 Basic Application Functions

- ☒ Test mode
- ☒ Blocking of monitor direction
- ☒ Disturbance data
- ☒ Generic services

2.3.6 Miscellaneous

Measurand	Max. MVAL = rated value times 1,2	or	2,4
Current A	☐		☒
Current B	☐		☒
Current C	☐		☒
Voltage A-G	☐		☒
Voltage B-G	☐		☒
Voltage C-G	☐		☒
Active power P	☐		☒
Reactive power Q	☐		☒
Frequency f	☐		☒
Voltage A - B	☐		☒

Point List

3

3.1 General Command (Control Direction)

3.1.1 Double Point Command

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	240	160	52Breaker	Breaker switch	-
1	240	161	Disc.Swit.	Disconnect switch	-
1	240	164	GndSwit.	Ground switch	-
1	240	162	Q2 Op/Cl	Q2 Open / Close	-
1	240	163	Q9 Op/Cl	Q9 Open / Close	-
1	240	175	Fan ON/OFF	Fan ON/OFF	-

3.1.2 Single Point Command

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	192	16	79 ON	79: Auto-reclosurer is switched ON	-
1	192	18	ProtActive	At Least 1 Protection Funct. is Active	-
1	192	19	Reset LED	Reset LED	-
1	192	20	DataStop	Data stop transmission	-
1	192	21	Test mode	Test mode	-
1	192	23	P-GrpA act	Setting Group A is active	-
1	192	24	P-GrpB act	Setting Group B is active	-
1	192	25	P-GrpC act	Setting Group C is active	-
1	192	26	P-GrpD act	Setting Group D is active	-

3.2 Indications in Monitor Direction

3.2.1 Distance Protection

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	28	51	21 Dist. OFF	21 Distance is switched OFF	3651
1	28	52	21 Dist. BLOCK	21 Distance is BLOCKED	3652
1	28	53	21 Dist. ACTIVE	21 Distance is ACTIVE	3653
2	28	71	21 PICKUP	21 PICKED UP	3671
2	28	72	21 Pickup ∅A	21 PICKUP Phase A	3672
2	28	73	21 Pickup ∅B	21 PICKUP Phase B	3673
2	28	74	21 Pickup ∅C	21 PICKUP Phase C	3674
2	28	75	21 Pickup G	21 PICKUP GROUND	3675
2	28	82	21 Pickup AG	21 Pickup AG	3682
2	28	84	21 Pickup BG	21 Pickup BG	3684
2	28	85	21 Pickup AB	21 Pickup AB	3685
2	28	86	21 Pickup ABG	21 Pickup ABG	3686
2	28	88	21 Pickup CG	21 Pickup CG	3688
2	28	89	21 Pickup CA	21 Pickup CA	3689
2	28	90	21 Pickup CAG	21 Pickup CAG	3690
2	28	91	21 Pickup BC	21 Pickup BC	3691
2	28	92	21 Pickup BCG	21 Pickup BCG	3692
2	28	93	21 Pickup ABC	21 Pickup ABC	3693
2	28	94	21 Pickup ABCG	21 Pickup ABCG	3694
2	28	201	21 TRIP	21 Distance General TRIP command	3801
2	28	202	21 TRIP 1p. ∅A	21 TRIP command - Only Phase A	3802
2	28	203	21 TRIP 1p. ∅B	21 TRIP command - Only Phase B	3803
2	28	204	21 TRIP 1p. ∅C	21 TRIP command - Only Phase C	3804
2	28	205	21 TRIP ∅ABC	21 TRIP command Phases ABC	3805
2	28	211	21 TRIP 1p. Z1	21 TRIP single-phase Z1	3811
2	28	216	21 TRIP 1p. Z2	21 TRIP single-phase Z2	3816
2	28	217	21 TRIP 3p. Z2	21 TRIP 3phase in Z2	3817
2	28	218	21 TRIP 3p. Z3	21 TRIP 3phase in Z3	3818
2	28	224	21 TRIP3p. Z1sf	21 TRIP 3phase in Z1 with single-ph Flt.	3823
2	28	225	21 TRIP3p. Z1mf	21 TRIP 3phase in Z1 with multi-ph Flt.	3824

3.2.2 Power Swing Detection

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	29	164	68 Power Swing	68 Power Swing detected	4164

3.2.3 Automatic Reclosure Status

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	40	3	> BLOCK 79	>BLOCK 79	2703
2	40	15	>79 TRIP 1p	>79: External 1pole trip for AR start	2715
2	40	16	>79 TRIP 3p	>79: External 3pole trip for AR start	2716
1	40	87	CB not ready	79: Circuit breaker 1 not ready	2787
2	40	88	79 T-CBreadyExp	79: CB ready monitoring window expired	2788
2	40	101	79 in progress	79 - in progress	2801
2	40	118	79 Evolving Flt	79: Evolving fault recognition	2818
2	40	148	79 Tdead 1pTrip	79 dead time after 1pole trip running	2839
2	40	149	79 Tdead 3pTrip	79 dead time after 3pole trip running	2840
1	40	161	79 T-Recl. run.	79: Reclaim time is running	2861
1	40	162	79 Successful	79 - cycle successful	2862
2	40	171	79 TRIP 3pole	79: TRIP command 3pole	2871
2	192	128	79 Close	79 - Close command	2851
2	192	16	79 ON	79: Auto recloser is switched ON	2782
1	41	34	25 Sync. faulty	25: Synchro-check function faulty	2934
1	41	35	25 Sy.Tsup.Exp	25: Synchro-check supervision time exp.	2935
1	41	41	25 Sy. running	25: Synchronization is running	2941
1	41	43	25 Synchronism	25: Synchronism detected	2943
1	41	44	25 Vsy1> Vsy2<	25: SYNC Condition Vsy1>Vsy2< true	2944
1	41	45	25 Vsy1< Vsy2>	25: SYNC Condition Vsy1<Vsy2> true	2945
1	41	46	25 Vsy1< Vsy2<	25: SYNC Condition Vsy1<Vsy2< true	2946
1	41	47	25 Sync. Vdiff>	25: Sync. Volt. diff. greater than limit	2947
1	41	48	25 Sync. fdiff>	25: Sync. Freq. diff. greater than limit	2948
1	41	49	25 Sync.(phi)-diff>	25: Sync. Angle diff. greater than limit	2949

3.2.4 Backup Time Overcurrent Protection

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	64	5	>BLOCK 50-B2	>BLOCK 50-B2 Backup OverCurrent	7105
1	64	8	>BLOCK O/C Ie>	>BLOCK Backup OverCurrent Ie>	7108
1	64	51	5X-B OFF	50(N)/51(N) Backup O/C is switched OFF	7151
1	64	52	5X-B BLOCK	50(N)/51(N) Backup O/C is BLOCKED	7152
1	64	53	5X-B ACTIVE	50(N)/51(N) Backup O/C is ACTIVE	7153
2	64	61	5X-B PICKUP	50(N)/51(N) Backup O/C PICKED UP	7161
2	64	115	5X-B TRIP ABC	50(N)/51(N)-B TRIP Phases ABC	7215

3.2.5 Differential Protection

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	92	89	2nd Harmonic A	Diff: Tolerance invalid in phase A	3102
1	92	90	2nd Harmonic B	Diff: Tolerance invalid in phase B	3103
1	92	91	2nd Harmonic C	Diff: Tolerance invalid in phase C	3104
1	92	92	87 active	87 Active	3120
2	92	93	87 Fault in A	87 Fault detection in phase A	3133
2	92	94	87 Fault in B	87 Fault detection in phase B	3134
2	92	95	87 Fault in C	87 Fault detection in phase C	3135
2	92	96	87 Ground Fault	87 Ground fault detection	3136
2	92	97	87-2 Fault det.	87-2 Fault detection	3137
2	92	98	87-1 Fault det.	87-1 Fault detection	3139
2	92	99	87 General TRIP	87 General TRIP	3141
2	92	100	87 TRIP 1pole A	87 TRIP - Only A	3142
2	92	101	87 TRIP 1pole B	87 TRIP - Only B	3143
2	92	102	87 TRIP 1pole C	87 TRIP - Only C	3144
2	92	103	87 TRIP ABC	87 TRIP ABC	3145
1	92	104	87 is blocked	87 is blocked	3148
1	92	105	87 is OFF	87 is switched off	3149
1	92	106	Test 87	87 Set test state of 87	3190
1	92	107	Commiss.87	87 Set Commissioning state of 87	3191
1	92	108	Test 87 remote	87 Remote relay in test state	3192
1	92	109	Comm. 87 active	87 Commissioning state is active	3193

3.2.6 Protection Data Interface

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	93	135	PI1 Data fault	Prot Interface 1: Recept. of faulty data	3229
1	93	136	PI1 Datafailure	Prot Interface 1: Total receipt. failure	3230
1	93	137	PI2 Data fault	Prot Interface 2: Recept. of faulty data	3231
1	93	138	PI2 Datafailure	Prot Interface 2: Total receipt. failure	3232
1	93	139	PI1 TD alarm	Prot Int 1: Transmission delay too high	3239
1	93	140	PI2 TD alarm	Prot Int 2: Transmission delay too high	3240

3.2.7 Diff.-Topology

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	93	141	Ringtopology	System operates in closed ring topology	3457
1	93	142	Chaintopology	System operates in open chain topology	3458
1	93	143	Rel1Logout	Relay 1 in Logout state	3475
1	93	144	Rel2Logout	Relay 2 in Logout state	3476
1	93	149	Logout	Local activation of Logout state	3484
1	93	191	Rel1 Login	Relay 1 in Login state	3491
1	93	192	Rel2 Login	Relay 2 in Login state	3492

3.2.8 Remote Signal

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	93	154	RemoteTrip1 Rx	Remote Trip 1 received	3545
1	93	155	RemoteTrip2 Rx	Remote Trip 2 received	3546
1	93	156	RemoteTrip3 Rx	Remote Trip 3 received	3547
1	93	157	RemoteTrip4 Rx	Remote Trip 4 received	3548
1	93	158	Rem.Sig 1 Rx	Remote signal 1 received	3573
1	93	159	Rem.Sig 2 Rx	Remote signal 2 received	3574
1	93	160	Rem.Sig 3 Rx	Remote signal 3 received	3575
1	93	161	Rem.Sig 4 Rx	Remote signal 4 received	3576
1	93	162	Rem.Sig 5 Rx	Remote signal 5 received	3577
1	93	163	Rem.Sig 6 Rx	Remote signal 6 received	3578

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	93	164	Rem.Sig 7 Rx	Remote signal 7 received	3579
1	93	165	Rem.Sig 8 Rx	Remote signal 8 received	3580
1	93	166	Rem.Sig 9 Rx	Remote signal 9 received	3581
1	93	167	Rem.Sig 10 Rx	Remote signal 10 received	3582
1	93	168	Rem.Sig 11 Rx	Remote signal 11 received	3583
1	93	169	Rem.Sig 12 Rx	Remote signal 12 received	3584
1	93	170	Rem.Sig 13 Rx	Remote signal 13 received	3585
1	93	171	Rem.Sig 14 Rx	Remote signal 14 received	3586
1	93	172	Rem.Sig 15 Rx	Remote signal 15 received	3587
1	93	173	Rem.Sig 16 Rx	Remote signal 16 received	3588
1	93	174	Rem.Sig 17 Rx	Remote signal 17 received	3589
1	93	175	Rem.Sig 18 Rx	Remote signal 18 received	3590
1	93	176	Rem.Sig 19 Rx	Remote signal 19 received	3591
1	93	177	Rem.Sig 20 Rx	Remote signal 20 received	3592
1	93	178	Rem.Sig 21 Rx	Remote signal 21 received	3593
1	93	179	Rem.Sig 22 Rx	Remote signal 22 received	3594
1	93	180	Rem.Sig 23 Rx	Remote signal 23 received	3595
1	93	181	Rem.Sig 24 Rx	Remote signal 24 received	3596

3.2.9 Intertrip

ASDU	Function type	Informa-tion number	Name	Description	Adr.
2	93	150	ITrp.TRIP 1p A	Int.Trip: TRIP - Only A	3518
2	93	151	ITrp.TRIP 1p B	Int.Trip: TRIP - Only B	3519
2	93	152	ITrp.TRIP 1p C	Int.Trip: TRIP - Only C	3520
2	93	153	ITrp.TRIP ABC	Int.Trip: TRIP ABC	3521

3.2.10 Internal Mode Status

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	101	1	>Door open	>Cabinet door open	-
1	101	2	>CB wait	>CB waiting for Spring charged	-
1	135	53	>Test mode	>Test mode	15

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	135	54	>DataStop	>Stop data transmission	16
1	135	81	Device OK	Device is Operational and Protecting	51
1	135	97	Resume	Resume	67
1	135	130	Event Lost	Event lost	110
1	135	136	Flag Lost	Flag Lost	113
1	135	137	Broken Iwire L1	Alarm: Broken current-wire detected L1	290
1	135	138	Broken Iwire L2	Alarm: Broken current-wire detected L2	291
1	135	139	Broken Iwire L3	Alarm: Broken current-wire detected L3	292
1	135	145	Chatter ON	Chatter ON	125
1	135	164	Error 5V	Error 5V	144
1	135	169	Error1A/5Awrong	Error:1A/5Ajumper different from setting	192
1	135	171	Error Board 1	Error Board 1	183
1	135	172	Error Board 2	Error Board 2	184
1	135	173	Error Board 3	Error Board 3	185
1	135	174	Error Board 4	Error Board 4	186
1	135	175	Error Board 5	Error Board 5	187
1	135	176	Error Board 6	Error Board 6	188
1	135	177	Error Board 7	Error Board 7	189
1	135	178	Error A/D-conv.	Error: A/D converter	181
1	135	180	Error neutralCT	Error: Neutral CT different from MLFB	194
1	135	181	Alarm adjustm.	Alarm: Analog input adjustment invalid	193
1	135	183	Fail I balance	Failure: Current Balance	163
1	135	184	Fail (Summe) V Ph-G	Failure: Voltage summation Phase-Ground	165
1	135	186	Fail V balance	Failure: Voltage Balance	167
1	135	187	Fail V absent	Failure: Voltage absent	168
1	135	188	VT FuseFail>10s	VT Fuse Failure (alarm >10s)	169
1	135	193	Fail Battery	Failure: Battery empty	177
1	135	196	Fuse Fail M.OFF	Fuse Fail Monitor is switched OFF	196
1	135	197	MeasSup OFF	Measurement Supervision is switched OFF	197
1	135	210	Error Board 0	Error Board 0	190
1	135	250	Failure Sumi	Alarm: Current summation supervision	289
1	150	1	>52-a ∅A	>52-a Phase A (Position Contact=Breaker)	351
1	150	2	>52-a ∅B	>52-a Phase B (Position Contact=Breaker)	352
1	150	3	>52-a ∅C	>52-a Phase C (Position Contact=Breaker)	353
1	150	6	>Manual Close	>Manual close signal	356

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	150	7	>Blk Man. Close	>Block manual close cmd. from external	357
1	150	12	>FAIL:Vsy2 VT	>Failure: Vsy2 VT (MCB tripped)	362
1	150	35	>Lockout SET	>Lockout SET	385
1	150	36	>Lockout RESET	>Lockout RESET	386
1	150	66	>52a Bkr1 ∅A	>52-a Bkr.1 Ph A (for AR,CB-Test)	366
1	150	67	>52a Bkr1 ∅B	>52-a Bkr.1 Ph B (for AR,CB-Test)	367
1	150	68	>52a Bkr1 ∅C	>52-a Bkr.1 Ph C (for AR,CB-Test)	368
1	150	71	>Bkr1 Ready	>Breaker 1 READY (for AR,CB-Test)	371
1	150	78	>52a 3p Closed	>52a Bkr. aux. contact (3pole closed)	379
1	150	79	>52b 3p Open	>52b Bkr. aux. contact (3pole open)	380
1	150	80	>52a Bkr1 3p Cl	>52a Bkr1 aux. 3pClosed (for AR,CB-Test)	410
1	150	81	>52b Bkr1 3p Op	>52b Bkr1 aux. 3p Open (for AR,CB-Test)	411
2	150	180	Definitive TRIP	Relay Definitive TRIP	536
2	150	210	Trip Coupled 3p	Single-phase trip was coupled 3phase	560
1	150	211	Man.Clos.Detect	Manual close signal detected	561
1	192	4	Reset Device	Reset Device	55
1	192	5	Initial Start	Initial Start of Device	56
1	192	18	ProtActive	At Least 1 Protection Funct. is Active	52
1	192	19	Reset LED	Reset LED	-
1	192	20	DataStop	Data stop transmission	-
1	192	21	Test mode	Test mode	-
1	192	22	Settings Calc.	Setting calculation is running	70
1	192	23	P-GrpA act	Setting Group A is active	-
1	192	24	P-GrpB act	Setting Group B is active	-
1	192	25	P-GrpC act	Setting Group C is active	-
1	192	26	P-GrpD act	Setting Group D is active	-
1	192	32	Fail I Superv.	Failure: General Current Supervision	161
1	192	33	Fail V Superv.	Failure: General Voltage Supervision	164
1	192	35	Fail Ph. Seq.	Failure: Phase Sequence	171
1	192	37	Emer. mode	Emergency mode	2054
1	192	38	>FAIL:Feeder VT	>Failure: Feeder VT (MCB tripped)	361
1	192	46	Alarm Sum Event	Alarm Summary Event	160
1	192	47	Error Sum Alarm	Error with a summary alarm	140
2	192	64	Relay PICKUP ∅A	Relay PICKUP Phase A	503
2	192	65	Relay PICKUP ∅B	Relay PICKUP Phase B	504

ASDU	Function type	Informa-tion number	Name	Description	Adr.
2	192	66	Relay PICKUP ∅C	Relay PICKUP Phase C	505
2	192	67	Relay PICKUP G	Relay PICKUP GROUND	506
2	192	68	Relay TRIP	Relay GENERAL TRIP command	511
2	192	69	Relay TRIP ∅A	Relay TRIP command Phase A	507
2	192	70	Relay TRIP ∅B	Relay TRIP command Phase B	508
2	192	71	Relay TRIP ∅C	Relay TRIP command Phase C	509
2	192	84	Relay PICKUP	Relay PICKUP	501

3.2.11 Circuit Breaker Trip Test

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	153	25	CB1-TESTtrip ∅A	CB1-TEST TRIP command - Only Phase A	7325
1	153	26	CB1-TESTtrip ∅B	CB1-TEST TRIP command - Only Phase B	7326
1	153	27	CB1-TESTtrip ∅C	CB1-TEST TRIP command - Only Phase C	7327
1	153	28	CB1-TESTtripABC	CB1-TEST TRIP command ABC	7328
1	153	29	CB1-TEST close	CB1-TEST CLOSE command	7329
1	153	45	CB-TEST running	CB-TEST is in progress	7345

3.2.12 Ground Fault Protection

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	166	5	>BLOCK 50N-1	>BLOCK 50N-1 Ground O/C	1305
1	166	7	>BLOCK 50N-2	>BLOCK 50N-2 Ground O/C	1307
1	166	8	>BLOCK 50N-3	>BLOCK 50N-3 Ground O/C	1308
1	166	9	>BLOCK 51N	>BLOCK 51N Ground O/C	1309
1	166	33	50N/51N ACTIVE	50N / 51N Ground O/C is ACTIVE	1333
2	166	45	50N/51N Pickup	50N / 51N PICKED UP	1345
2	166	58	67N PU forward	67N picked up FORWARD	1358
2	166	59	67N PU reverse	67N picked up REVERSE	1359
2	166	61	50N/51N TRIP	50N / 51N General TRIP command	1361
2	166	62	50N/51N Trip A	50N / 51N: Trip 1pole Ph.A	1362
2	166	63	50N/51N Trip B	50N / 51N: Trip 1pole Ph.B	1363
2	166	64	50N/51N Trip C	50N / 51N: Trip 1pole Ph.C	1364

ASDU	Function type	Informa-tion number	Name	Description	Adr.
2	166	65	50N/51N Trip 3p	50N / 51N: Trip 3pole	1365
2	166	66	50N-1 TRIP	50N-1 TRIP	1366
2	166	67	50N-2 TRIP	50N-2 TRIP	1367
2	166	68	50N-3 TRIP	50N-3 TRIP	1368
2	166	69	51N TRIP	51N TRIP	1369

3.2.13 Control Switches Return Position Indication (Double Point Commands)

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	240	160	52Breaker	52 Breaker	-
1	240	161	Disc.Swit.	Disconnect Switch	-
1	240	164	GndSwit.	Ground Switch	-
1	240	162	Q2 Op/Cl	Q2 Open/Close	-
1	240	163	Q9 Op/Cl	Q9 Open/Close	-
1	240	175	Fan ON/OFF	Fan ON/OFF	-

3.2.14 Output Channels Return Position Indication (Single Point Commands)

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	240	181	>Err Mot V	>Error Motor Voltage	-
1	240	182	>ErrCntrlV	>Error Control Voltage	-
1	240	183	>SF6-Loss	>SF6-Loss	-
1	240	184	>Err Meter	>Error Meter	-
1	240	185	>Tx Temp.	>Transformer Temperature	-
1	240	186	>Tx Danger	>Transformer Danger	-

3.2.15 Free Channels

ASDU	Function type	Informa-tion number	Name	Description	Adr.
1	192	27	>Annunc. 1	>User defined annunciation 1	11
1	192	28	>Annunc. 2	>User defined annunciation 2	12
1	192	29	>Annunc. 3	>User defined annunciation 3	13
1	192	30	>Annunc. 4	>User defined annunciation 4	14

3.3 Measurements

3.3.1 ASDU9 (Measurements I)

Function type	Informa-tion number	Position	Name	Description	Adr.
134	129	1	Ia =	Ia	601
134	129	2	Ib =	Ib	602
134	129	3	Ic =	Ic	603
134	129	4	Va =	Va	621
134	129	5	Vb =	Vb	622
134	129	6	Vc =	Vc	623
134	129	7	P =	P (active power)	641
134	129	8	Q =	Q (reactive power)	642
134	129	9	Freq=	Frequency	644
134	129	10	Va-b=	Va-b	624
134	129	11	Vb-c=	Vb-c	625
134	129	12	Vc-a=	Vc-a	626
134	129	13	PF =	Power Factor	643
134	129	14	3I0 =	3I0 (zero sequence)	610
130	1	1	Vsy2=	Measured value Vsy2	638
130	1	2	Vdiff=	Measured value V-diff (Vsy1- Vsy2)	636
130	1	3	Vsy1=	Measured value Vsy1	637
130	1	4	F-sy2 =	Frequency fsy2	646
130	1	5	F-diff=	Frequency difference	647
130	1	6	phi-diff=	Angle difference	648
130	1	7	F-sy1 =	Frequency fsy1	649
134	122	1	IDiff A=	IDiff A (% Operational nominal current)	7742
134	122	2	IDiff B=	IDiff B (% Operational nominal current)	7743
134	122	3	IDiff C=	IDiff C (% Operational nominal current)	7744
134	122	4	IRest A=	IRest A (% Operational nominal current)	7745
134	122	5	IRest B=	IRest B (% Operational nominal current)	7746
134	122	6	IRest C=	IRest C (% Operational nominal current)	7747
134	122	7	PI1 TD	Prot. Interface 1: Transmission delay	7751
134	122	8	PI1A/h	Prot. Interface 1: Availability per hour	7754
134	122	9	PI2 TD	Prot. Interface 2: Transmission delay	7752
134	122	10	PI2A/h	Prot. Interface 2: Availability per hour	7756

3.3.2 Time Tagged Measurements

ASDU	Function type	Informa-tion number	Name	Description	Adr.
4	150	177	Ia =	Primary fault current Ia	533
4	150	178	Ib =	Primary fault current Ib	534
4	150	179	Ic =	Primary fault current Ic	535
4	151	14	Rpri =	Flt Locator: primary RESISTANCE	1114
4	151	15	Xpri =	Flt Locator: primary REACTANCE	1115
4	151	17	Rsec =	Flt Locator: secondary RESISTANCE	1117
4	151	18	Xsec=	Flt Locator: secondary REACTANCE	1118
4	151	19	dist=	Flt Locator: Distance to fault	1119
4	151	20	d[%] =	Flt Locator: Distance [%] to fault	1120
4	151	31	RFpri=	Flt Locator: primary FAULT RESISTANCE	1131

3.4 Settings

Note

The settings which can be read and written are given in the following table. The setting options are indicated in column "Generic identification data". The GID range of a numeric parameter isn't directly equal to the setting range of this parameter in 7SD538 manual.

The formula for the GID is "setting value in the manual * factor" (the factor isn't fixed for each parameter and changes the GID into an integer value). E.g. the setting range of parameter A is 1.00 to 5.00, so the factor is 100 and the GID range is 100 to 500. Setting range of parameter B is 1.0 to 5.0, so the factor is 10 and the GID range is 10 to 50.

For writing parameters KOD is fixed to 1: "Actual value" and GDD Datatype is fixed to 4: "Integer", Datasize is fixed to 4 and Number is fixed to 1.

GIN = Generic Identification Number

For the position and format of the GIN within the telegram please refer to the official IEC 60870-5-103 standard.

GIN		Adr.	Name	Generic Identification Data	
Group	Entry				
10	0	1103	FullScaleVolt.		0.4 kV to 1200.0 kV
10	1	1104	FullScaleCurr.		10 A to 10000 A
10	2	1105	Line Angle		10° to 89°
10	3	1111	x'	1 A	0.0050 Ω/km to 9.5000 Ω/km
				5 A	0.0010 Ω/km to 1.9000 Ω/km
10	4	1112	c'	1 A	0.000 µF/km to 100.000 µF/km
				5 A	0.000 µF/km to 500.000 µF/km
10	5	1113	Line Length		0.1 km to 1000.0 km
10	6	1114	Tot.Line Length		0.1 km to 1000.0 km
10	7	1120	K0		0.000 to 4.000
10	8	1121	Angle K0		-180.00° to 180.00°
10	9	1125	C0/C1		0.01 to 10.00
10	10	0012	STATE OF DIFF.	23 OFF 22 ON	
10	11	1210	87-1 PICKUP	1 A	0.10 A to 20.00 A
				5 A	0.50 A to 100.00 A

GIN		Adr.	Name	Generic Identification Data	
Group	Entry				
10	12	1213	87-1 SWITCH ON	1 A	0.10 A to 20.00 A
				5 A	0.50 A to 100.00 A
10	13	1221	Ic-comp.	23 OFF 22 ON	
10	14	1224	IcSTAB/IcN		2.0 to 4.0
10	15	1233	87-2 PICKUP	1 A	0.8 A to 100.0 A, ∞
				5 A	4.0 A to 500.0 A, ∞
10	16	1235	87-2 SWITCH ON	1 A	0.8 A to 100.0 A, ∞
				5 A	4.0 A to 500.0 A, ∞
10	17	0015	FCT 21	22 ON 23 OFF	
10	18	1541	R load	1 A	0.100 Ω to 600.000 Ω, ∞
				5 A	0.020 Ω to 120.000 Ω, ∞
10	19	1542	φ load		20° to 60°
10	20	1601	Op. mode Z1	22 ON 23 OFF	
10	21	1602	X(Z1) ϕ-ϕ	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω
10	22	1603	XG(Z1) ϕ-G	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω
10	23	1604	R ϕ-ϕ	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω
10	24	1605	RG ϕ-G	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω
10	25	1611	Op. mode Z2	22 ON 23 OFF	
10	26	1612	X(Z2) ϕ-ϕ	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω
10	27	1613	XG(Z2) ϕ-G	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω
10	28	1615	T2- ϕ-G		0.00 sec to 30.00 sec, ∞
10	29	1616	T2- ϕ-ϕ		0.00 sec to 30.00 sec, ∞
10	30	1618	Z2 inst. TRIP	24 NO 25 YES	
10	31	1621	Op. mode Z3	22 ON 23 OFF	
10	32	1622	X(Z3) ϕ-ϕ	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω

GIN		Adr.	Name	Generic Identification Data	
Group	Entry				
10	33	1623	XG(Z3) ϕ-G	1 A	0.050 Ω to 600.000 Ω
				5 A	0.010 Ω to 120.000 Ω
10	34	1625	T3- ϕ-G		0.00 sec to 30.00 sec, ∞
10	35	1626	T3- ϕ-ϕ		0.00 sec to 30.00 sec, ∞
10	36	1628	Z3 inst. TRIP	24 NO 25 YES	
10	37	1401	High Speed Distance Protection	22 ON 23 OFF	
10	38	2001	FCT 68	22 ON 23 OFF	
10	39	2620	Iph>	1 A	0.10 A to 25.00 A, ∞
				5 A	0.50 A to 125.00 A, ∞
10	40	2621	T Iph>		0.00 sec to 30.00 sec, ∞
10	41	2622	3I0>	1 A	0.05 A to 25.00 A, ∞
				5 A	0.25 A to 125.00 A, ∞
10	42	2623	T 3I0>		0.00 sec to 30.00 sec, ∞
10	43	2931	BROKEN WIRE	23 OFF 22 ON 25258 Alarm only	
10	44	0031	FCT 50N/51N Gnd	22 ON 23 OFF	
10	45	3110	50N-1 Op. Mode	12514 Forward 12516 Non-Directional 12656 Inactive	
10	46	3111	50N-1 PICKUP	1 A	0.05 A to 25.00 A
				5 A	0.25 A to 125.00 A
10	47	3112	50N-1 TimeDELAY		0.00 sec to 30.00 sec
10	48	3114	50N-1 SOTF-Trip	24 NO 25 YES	
10	49	3116	BLK /1p 50N-1	25 YES 25502 No (non-dir.)	
10	50	3117	Trip 1p 50N-1	25 YES 24 NO	
10	51	3120	50N-2 Op. Mode	12514 Forward 12516 Non-Directional 12656 Inactive	
10	52	3121	50N-2 PICKUP	1 A	0.05 A to 25.00 A
				5 A	0.25 to 125.00 A
10	53	3122	50N-2 TimeDELAY		0.00 sec to 30.00 sec
10	54	3124	50N-2 SOTF-Trip	24 NO 25 YES	
10	55	3126	BLK /1p 50N-2	25 YES 25502 No (non-dir.)	

GIN		Adr.	Name	Generic Identification Data	
Group	Entry				
10	56	3127	Trip 1p 50N-2	25 YES 24 NO	
10	57	3130	50N-3 Op. Mode	12514 Forward 12516 Non-Directional 12656 Inactive	
10	58	3131	50N-3 PICKUP	1 A	0.05 A to 25.00 A
				5 A	0.25 A to 125 A
10	59	3132	50N-3 TimeDELAY		0.00 sec to 30.00 sec
10	60	3136	BLK /1p 50N-3	25 YES 25502 No (non-dir.)	
10	61	3140	51N Op. Mode	12514 Forward 12516 Non-Directional 12656 Inactive	
10	62	3141	51N PICKUP		0.05 A to 25.00 A
10	63	3143	51N Time Dial		0.005 sec to 10.000 sec
10	64	3147	Add.T-DELAY		0.00 sec to 30.00 sec
10	65	3149	51N SOTF-Trip	24 NO 25 YES	
10	66	3157	BLK /1p 51N	25 YES 25502 No (non-dir.)	
10	67	3173	SOTF Time DELAY		0.00 sec to 0.30 sec
10	68	3401	FCT 79	22 ON 23 OFF	
10	69	3413	AR MODE	1-/3-pole AR 1 pole AR 3 pole AR AR disabled AR closed	
10	70	3414	BI CONTROLS AR	23 OFF 22 ON	
10	71	3415	POLE DISCREP.1P	23 OFF 22 ON	
19	72	3416	POLE DISCREP.3P	23 OFF 22 ON	
10	73	3419	3PH TRIP MODE	22 ON 23 OFF	
10	74	3417	II SEG BLOCK AR	22 ON 23 OFF	
10	75	3418	MFAULT BLOCK AR	22 ON 23 OFF	
10	76	3456	1.AR:Dead 1Trip		0.01 sec to 1800.00 sec
10	77	3457	1.AR:Dead 3Trip		0.01 sec to 1800.00 sec
10	78	3513	Max. Angle Diff		2° to 80°

GIN		Adr.	Name	Generic Identification Data	
Group	Entry				
10	79	3520	Voltage Check	23 OFF 22 ON	
10	80	3521	Sync Check	23 OFF 22 ON	
10	81	3802	START fault locator	12552 TRIP 12553 Pickup	

Index

V

W

Glossary

AR	**A**utomatic **R**ecloser
CFC	**C**ontinuous **F**unction **C**hart
DC	**D**ouble **C**ommand
DIGSI® 4	Parameterization system for SIPROTEC® devices
DP	**D**ouble-**P**oint Indication
IEC	**I**nternational **E**lectrotechnical **C**ommission
GID	**G**eneric **I**dentification **D**ata
GIN	**G**eneric **I**dentification **N**umber
Input data/ input direction	Data from the IEC 60870-5-103 **slave to the** IEC 60870-5-103 **master**.
Mapping	Allocation of the SIPROTEC® data objects to the IEC 60870-5-103 protocol.
Output data/ output direction	Data from the IEC 60870-5-103 **master to the** IEC 60870-5-103 **slave**.
RTU	**R**emote **T**erminal **U**nit
SC	**S**ingle **C**ommand
SP	**S**ingle-**P**oint Indication