SIEMENS

SICAM RTUs • Ax 1703

SM-x551/103xA0

System Element Manual

DC0-040-2.01

Note

Please observe Notes and Warnings for your own safety in the Preface.

Identification	SIC1703-HBSMX551103XA0_ENG-V2.01
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Preface

This document is applicable to the following product(s):

- SICAM AK
- SICAM TM
- SICAM BC
- AK 1703
- AMC 1703

Purpose of this manual

This manual describes the functioning of the system elements

- SM-2551/103MA0
- SM-2551/103SA0
- SM-0551/103MA0
- SM-0551/103SA0

and essentially contains

- Functional descriptions
- Technical specifications
- Descriptions of interfaces to the process and other system elements
- Possible Configurations

Target Group

The document you are reading right now is addressed to users, who are in charge of the following engineering tasks:

- Conceptual activities, as for example design and configuration
- Creation of the assembly technical documentation using the designated engineering tools
- System parameterization and system diagnostic, using the designated engineering tools
- Technical system maintenance

Placement in the Information Landscape

SICAM RTUs • Ax 1703 Common Functions Protocol Elements	DC0-023-2
SICAM RTUs Common Functions System and Basic System Elements	DC0-015-2
SICAM RTUs Platforms Configuration Automation Units and Automation Networks	DC0-021-2
Ax 1703 Interoperability IEC 60870-5-101/104	DA0-046-2
SICAM RTUs Interoperability IEC 60870-5-101/104	DC0-013-2

Notes on Safety

This manual does not constitute a complete catalog of all safety measures required for operating the equipment (module, device) in question because special operating conditions might require additional measures. However, it does contain notes that must be adhered to for your own personal safety and to avoid damage to property. These notes are highlighted with a warning triangle and different keywords indicating different degrees of danger.

Danger

means that death, serious bodily injury or considerable property damage **will** occur, if the appropriate precautionary measures are not carried out.

Warning

means that death, serious bodily injury or considerable property damage **can** occur, if the appropriate precautionary measures are not carried out.

Caution

means that minor bodily injury or property damage could occur, if the appropriate precautionary measures are not carried out.

Note

is important information about the product, the handling of the product or the respective part of the documentation, to which special attention is to be given.

Qualified Personnel

Commissioning and operation of the equipment (module, device) described in this manual must be performed by qualified personnel only. As used in the safety notes contained in this manual, qualified personnel are those persons who are authorized to commission, release, ground, and tag devices, systems, and electrical circuits in accordance with safety standards.

Use as Prescribed

The equipment (device, module) must not be used for any other purposes than those described in the Catalog and the Technical Description. If it is used together with third-party devices and components, these must be recommended or approved by Siemens.

Correct and safe operation of the product requires adequate transportation, storage, installation, and mounting as well as appropriate use and maintenance.

During operation of electrical equipment, it is unavoidable that certain parts of this equipment will carry dangerous voltages. Severe injury or damage to property can occur if the appropriate measures are not taken:

- Before making any connections at all, ground the equipment at the PE terminal.
- Hazardous voltages can be present on all switching components connected to the power supply.
- Even after the supply voltage has been disconnected, hazardous voltages can still be present in the equipment (capacitor storage).
- Equipment with current transformer circuits must not be operated while open.
- The limit values indicated in the manual or the operating instructions must not be exceeded; that also applies to testing and commissioning.

Table of Contents

1 Introduction

Content

1.1 Application

The protocol elements SM-x551/103xA0 are used in automation units of the systems SICAM AK, SICAM TM, SICAM BC, AK 1703 and AMC 1703. It is deployed in the field of telecontrol and automation.

A protocol element is used for the exchange of data - and thereby for the transmission of messages - over a communication interface to other automation units or devices of third-party manufacturers, e.g. control systems.

The hardware of a protocol element is a communication interface which - dependent on system and interface - can be available in different ways:

integrated on a basic system element
on a serial interface module (SIM), which is installed - directly or cascaded (SIM on SIM) - on the basic system element

System element type	Protocol Element
consists of	Module SM-2551 or SM-0551 with firmware 103MA0 oder 103SA0
can be used in	SICAM AK, SICAM TM, SICAM BC, AK 1703 and AMC 1703
Engineering	SICAM TOOLBOX II with OPM II

1.2 Overview

Protocol elements based on a Serial Interface Module (SIM) with serial interfaces

- SM-2551: two interfaces
- SM-0551: one interface

Protocol element (serial)

- Standard protocols according to IEC 60870-5-101/103 for
  - multi-point traffic
- with byte-asynchronous puls code modulation
- all interface signals (RS-232) and all interfaces are galvanically insulated from each other

SM-2551 can be attached to master control and communication elements of SICAM RTUs and Ax 1703 platforms.

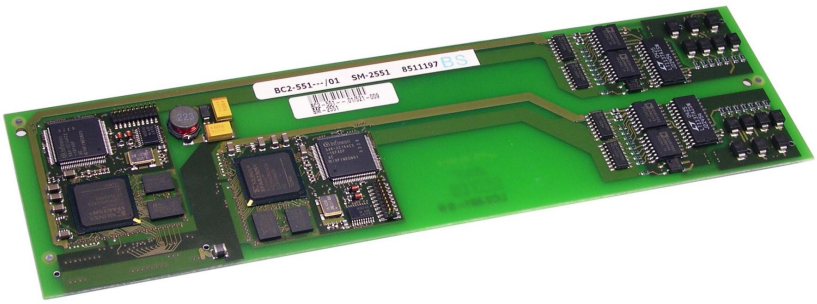
SM-0551 can be attached to selected SIM's SM-25xx.

1.3 Mechanics

1.3.1 SM-2551

SIM SM-2551 can be attached to master control and communication elements of SICAM RTUs and Ax 1703 platforms.

View



1.3.2 SM-0551

SM-0551 can be attached to SIM SM-2558 and SM-2546.

SIM SM-2558 can be attached to master control and communication elements of SICAM RTUs and Ax 1703 platforms.

SIM SM-2546 can only be attached to the SICAM BC master control element.

View

For further information see also chapter 2.3.2; Hardware

2 Protocol Element SM-x551/103xA0

Content

2.1 Features and Functions

General Functions

Communication between one central station and up to 100 protective devices (see note below)

- Unbalanced multi-point (multi-point traffic) according to IEC 60870-5-103

  103Mxx is controlling station (primary station), 103Sxx / protective device is controlled station (secondary station).

  - Supported functionality according to
    - *SICAM RTUs Interoperability IEC 60870-5-103*
    - *Ax 1703 Interoperability IEC 60870-5-103*
  - Data acquisition by polling (station interrogation)
  - Acquisition of events (transmission of data ready to be sent)
  - General interrogation, outstation interrogation
  - Clock synchronization
    - Cyclic, can be set in a seconds grid
  - Command transmission
    - Set control location, control location check
  - File transfer
    - Disturbance records to SAT DISTO
    - Disturbance records to control centre systems according to IEC 60870-5-101/104
  - Generic functions
  - Acquisition of transmission delay (for the correction of time synchronisation)
- Resetting the short-circuit location values
- Measured value change monitoring
- Monitoring intermediate and faulty positions of double-point information
- Transmission of parameters and diagnostic information for Reyrolle protection equipment (Embedded REYDISP)
- Optimized parameters for selected transmission facilities
- Functions for supporting redundant communication routes
- Special functions

Note

The figure 100 is the theoretical limit based on the organization of multi-point traffic. Considering configuration and performance, a maximum number of protective devices is recommeded and can be found in *SICAM RTUs Platforms Configuration Automation Units and Automation Networks*

Note

The above mentioned functions are described in detail in the document *SICAM RTUs • Ax 1703 Common Functions Protocol Elements, section "Point-to-Point Traffic (BPP)"*.

2.2 Modes of Operation

Operating mode	Patch Plug	Extras [1]	Note
Optical interface (multimode fibre optic) Ring	CM-2860 [a] CM-5860 [b]	CM-0821	• 50…115200 bps • RJ45 connector to CM-0821 RXD, TXD, +5 V, GND, Status • 820 nm signals • 50/125 µ and 62.5/125 µ fibres • ST compatible connector on CM-0821
Optical interface (multimode fibre optic)	CM-2860 [a]	CM-0827	• RJ45 connector to CM-0827 RXD, TXD, +5 V, GND, Status
Balanced interface RS-485 V.11 asynchronous	CM-2860 [a]	CM-0829 CM-0819	• 50…115200 bps • Signals and levels according to V.11, RS-485 • RJ45 connector to CM-0819 or CM-0829 RXD, TXD, CTS, RTS, DCD, DTR, DSR/+5 V, GND • 5-pin terminals on CM-0819 and CM-0829
Unbalanced interchange circuit V.24/V.28 V.28 asynchronous	CM-2860 [a] CM-5860 [b]	---	• 50…115200 bps • Signals and levels according to V.24, V.28, RS-232 • RJ45 connector RXD, TXD, CTS, RTS, DCD, DTR, DSR/+5 V, GND • RJ45 connector pin assignment corresponds with SM-2541 operating mode 1a, V.28 asynchronous

[1] Extras is optional equipment

[a] Patch Plug for SICAM AK, SICAM TM; AK 1703, AMC 1703, AM 1703, BC 1703

[b] Patch Module for SICAM BC

2.3 Configuration

2.3.1 Communication

For the stations to communicate with each other, suitable transmission facilities and/or network components may be needed in addition.

Controlling station

System	System Element	Protocol Element	Note
SICAM AK	CP-2014/CPCX25 CP-2017/PCCX25	SM-2551/103MA0 SM-0551/103MA0	
SICAM BC	CP-5014/CPCX55	SM-2551/103MA0 SM-0551/103MA0	
SICAM TM	CP-6014/CPC10	SM-2551/103MA0 SM-0551/103MA0	
SICAM CMIC	CP-6010/CPC30	103MT0	
SICAM EMIC	CP-6010/CPC30	103MT0	
Ax 1703	-	-	IEC 60870-5-103 unbalanced slave (secondary), acc. to *SICAM RTUs Interoperability IEC 60870-5-103* or *Ax 1703 Interoperability IEC 60870-5-103*

Protective Device

System	System Element	Protocol Element	Note
SICAM BC	CP-5014/CPCX55	SM-2551/103SA0 SM-0551/103SA0 SM-2541/103S00	electrical
		Optical serial interface (LOC)	optical
Ax 1703	-	-	IEC 60870-5-103 unbalanced slave (secondary), acc. to *SICAM RTUs Interoperability IEC 60870-5-103* or *Ax 1703 Interoperability IEC 60870-5-103*

2.3.2 Hardware

2.3.2.1 SM-2551

The following table lists supported configurations. In addition to one (SI0/SI1 or SI2/SI3) or two (SI0/SI1 and SI2/SI3) SM-2551, all parts (carrier module, connection board, patch plug, etc.) listed for the choosen configuration are needed:

Configuration			Interfaces			
Carrier Module	**Connection Board** [1]	**Patch Plug** [1]	**SI0**	**SI1**	**SI2**	**SI3**
CP-2014	CM-2839	[2]	✓	✓		
CP-2017	CM-2838	[2]	✓	✓	✓	✓
CP-5014	one integrated patch module per SIx [3]		✓	✓		
CP-6014	-	[2]	✓	✓	✓	✓

1) One connection board for each carrier module, one patch plug for each interface

2) see "Modes of Operation"

3) Each variant of the SICAM BC which can be ordered comes with a determined patch module for each interface

2.3.2.2 SM-0551

The following table lists supported configurations. In addition SM-0551, all parts (SIM, carrier module, connection board, patch plug, etc.) listed for the choosen configuration are needed:

Configuration				Interfaces			
Carrier Module	**SIM**	**Connection Board** [1]	**Patch Plug** [2]	**SI0**	**SI1**	**SI2**	**SI3**
CP-2014	[4]	CM-2839	[2]	✓	[6]		
CP-2017	[4]	CM-2838	[2]	✓	[6]	✓	[6]
CP-5014	[5]	one integrated patch module per Six [3]		✓	[6]		
CP-6014	[4]	---	[2]	✓	[6]	✓	[6]

1) One connection board for each carrier module, one patch plug for each interface

2) see “Modes of Operation”

3) Each variant of the SICAM BC which can be ordered comes with a determined patch module for each interface

4) SM-2558 required, on which SM-0551 can be installed

5) SM-2546 or SM-2558 required, on which SM-0551 can be installed

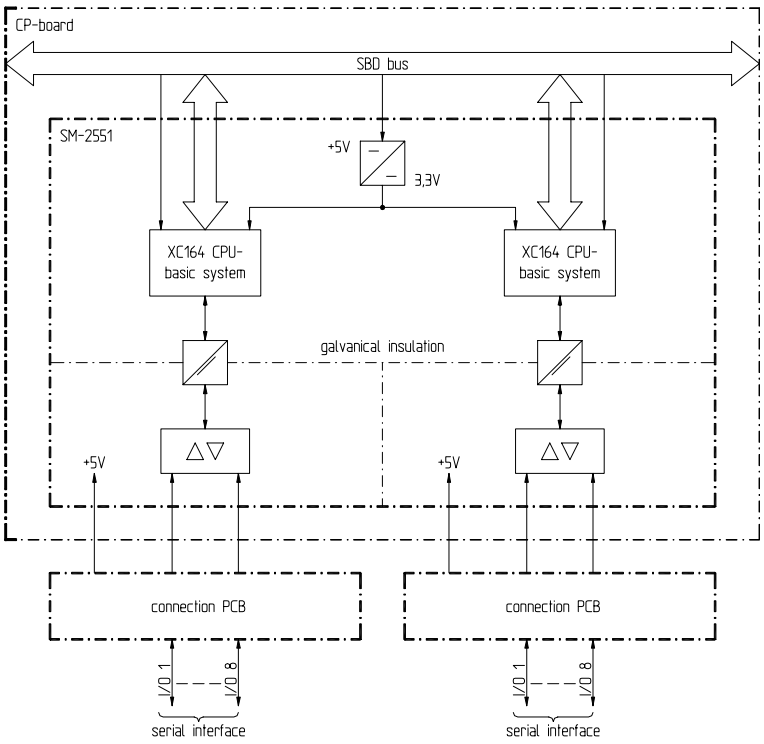
6) Interface is not operated by SM-0551 but directly by SM-2546 / SM-2558

2.4 Engineering

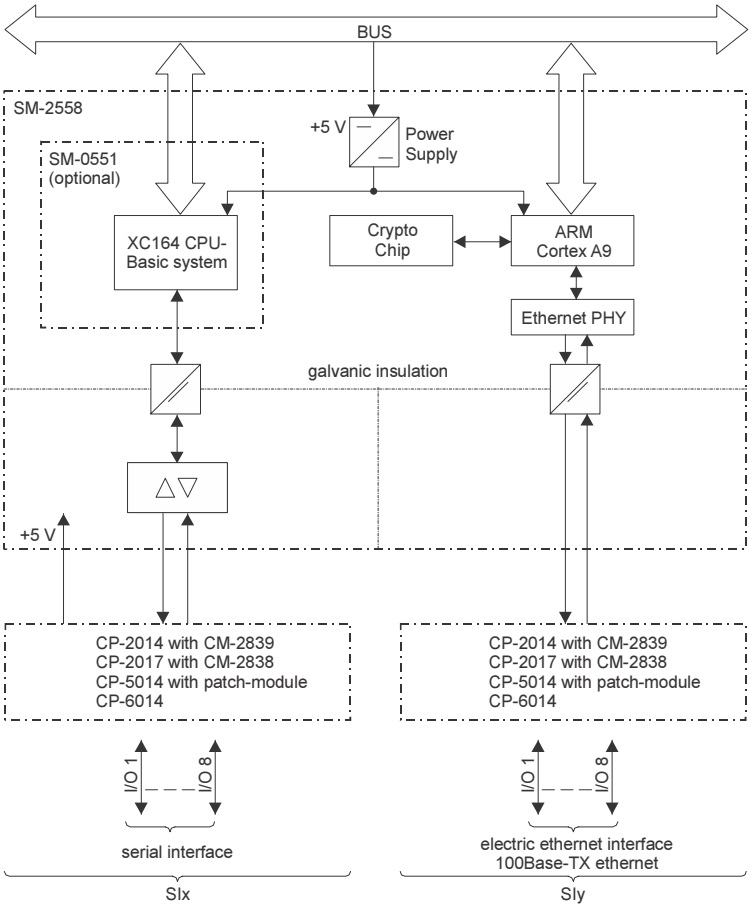
For diagnosis, testing, parameter setting or documentation, the system element is supported by the engineering tools of SICAM TOOLBOX II. OPM II is required.

2.5 Block Diagrams

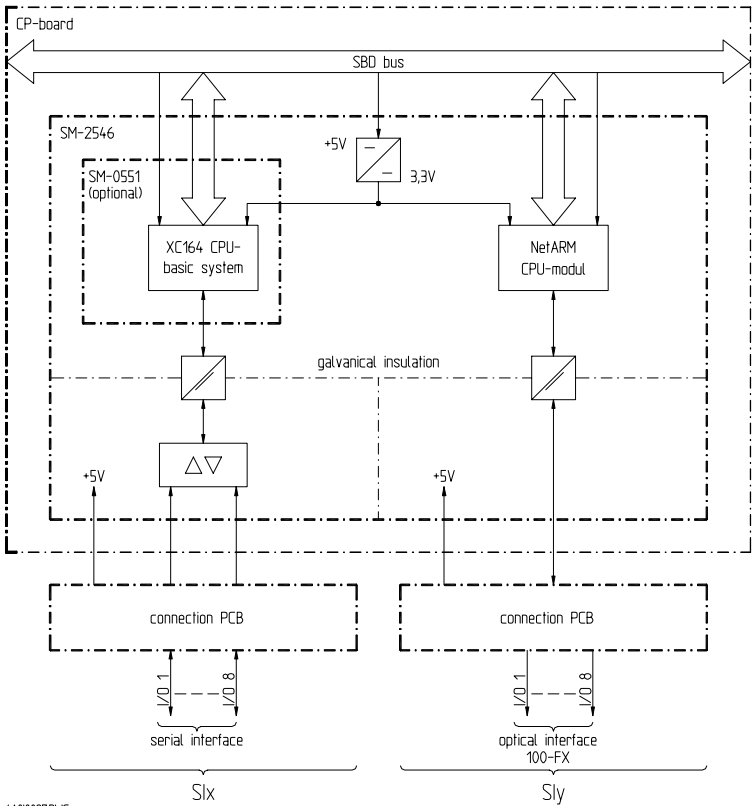
2.5.1 SM-2551



2.5.2 SM-0551



… on SM-2558



… on SM-2546

2.6 Technical Specifications

2.6.1 SM-2551

Communication Circuits	
2 serial interfaces	• Interface characteristics, interface signals, modes of operation, transmission rates – see description of the respective protocol, "Modes of operation" • Instead of the interface signal DSR the gate circuit voltage (+5 VDC) can be provided (settable) • Ability to be connected in parallel – outgoing interface signals in tristate technology – up to 2 interfaces can be connected in parallel – circuits for incoming interface signals always active • The signals are galvanically insulated from logic circuits • Line lengths V.28 – 50 bps up to 25 m – 115200 bps up to 5 m
Power supply	
Operating voltage	4.75…5.25 VDC, typ. 300 mA, max. 540 mA @5 V The voltage is supplied by the carrier module.
Gate circuit voltage +5VDC instead of DSR	• Voltage 4.7…5.6 VDC • Max. output current 150 mA at U > 4.75 V • Max. output power 750 mW • Max. idle voltage ≤ 5.6 VDC • Not short-circuit proof • Not overload proof • Galvanically insulated from logic voltage • The voltage (data circuit voltage) is supplied by the carrier module (galvanically insulated)
Mechanics	
Dimensions	227.3 x 63.5 mm
Weight	Approx. 200 g

2.6.2 SM-0551

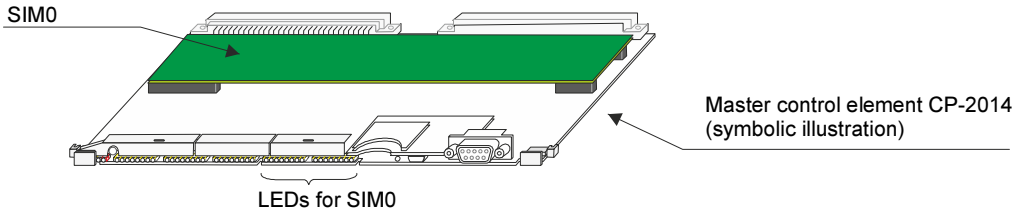
Communication Circuits	
1 serial interface	• Interface characteristics, interface signals, modes of operation, transmission rates – see description of the respective protocol, "Modes of operation" • Instead of the interface signal DSR the gate circuit voltage (+5 VDC) can be provided (settable) • Ability to be connected in parallel – outgoing interface signals in tristate technology – up to 2 interfaces can be connected in parallel – circuits for incoming interface signals always active • The signals are galvanically insulated from logic circuits • Line lengths V.28 – 50 bps up to 25 m – 115200 bps up to 5 m
Power supply	
Operating voltage	4.75…5.25 VDC, typ. 25 mA, max. 50 mA @5 V 3.14…3.47 VDC, typ. 150 mA, max. 330 mA @3.3 V The voltage is supplied by the carrier module.
Gate circuit voltage +5 VDC instead of DSR	• Voltage 4.7…5.6 VDC • Max. output current 150 mA at U > 4.75 V • Max. output power 750 mW • Max. idle voltage ≤ 5.6 VDC • Not short-circuit proof • Not overload proof • Galvanically insulated from logic voltage • The voltage (data circuit voltage) is supplied by the carrier module (galvanically insulated)
Mechanics	
Dimensions	56 x 43 x 5.5 mm
Weight	Approx. 15 g

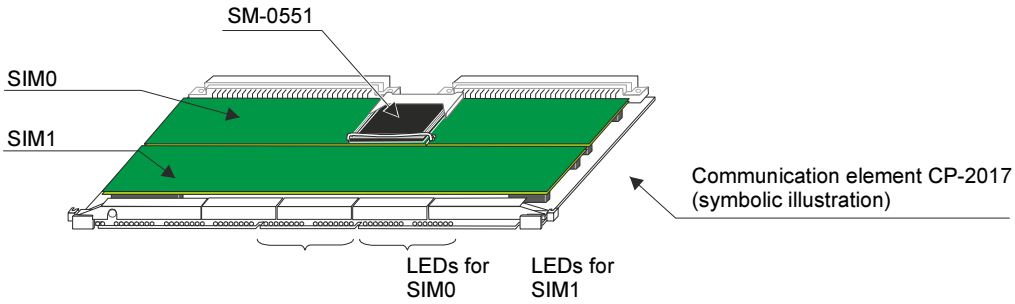
2.7 Status and Function Display

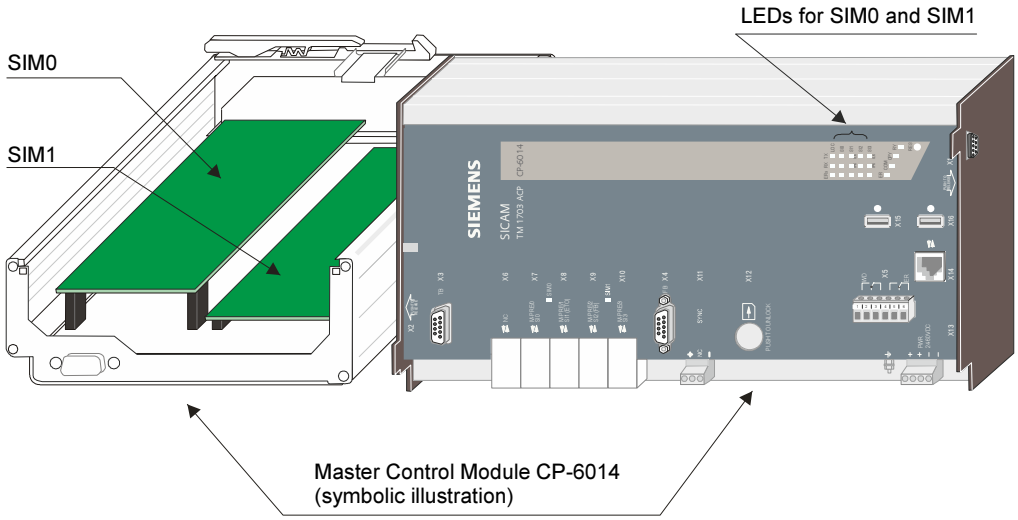
The protocol elements SM-2551/BPPA0 and SM-0551/BPPA0 itself have neither a front panel nor LED displays.

They use the LED displays on the master control- or communication elements, or, in case of SICAM BC, additional the displays on the operating panel. The meaning of these LED displays is described in the manual of the concerning system element.

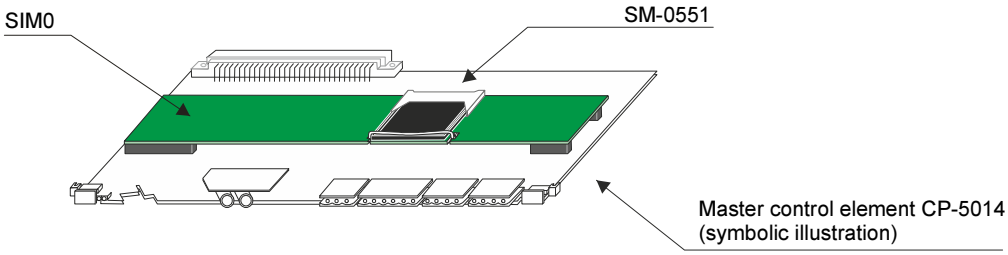
Protocol elements – Mounting place and LED display SICAM AK/SICAM TM







Protocol elements – Mounting place SICAM BC



Note

SICAM BC has no LEDs for status and function display of protocol elements.

2.8 Pin Assignment

Standard Operation Mode	Pin Assignment (RJ45)
Unbalanced interchange circuit V.24/V.28 – V.28 asynchronous	

pin	alias	signal
1	I/O 1	CTS
2	I/O 2	RTS
3	I/O 3	DSR/+5V
4	I/O 4	TxD
5	I/O 5	RxD
6	I/O 6	GND
7	I/O 7	DCD
8	I/O 8	DTR

Optional Operation Mode	Pin Assignment (RJ45)
Optical interface (multimode fibre optic) – Ring with CM-0821	

pin	alias	pin	alias
1	I/O 1	1	I/O 1
2	I/O 2	2	I/O 2
3	I/O 3	3	I/O 3
4	I/O 4	4	I/O 4
5	I/O 5	5	I/O 5
6	I/O 6	6	I/O 6
7	I/O 7	7	I/O 7
8	I/O 8	8	I/O 8

Optical interface (multimode fibre optic)
– With CM-0827

pin	alias	pin	alias
1	I/O 1	1	I/O 1
2	I/O 2	2	I/O 2
3	I/O 3	3	I/O 3
4	I/O 4	4	I/O 4
5	I/O 5	5	I/O 5
6	I/O 6	6	I/O 6
7	I/O 7	7	I/O 7
8	I/O 8	8	I/O 8

Balanced interface RS-485
– V.11 asynchronous

pin	alias	signal
1	I/O 1	
2	I/O 2	RTS
3	I/O 3	+5V
4	I/O 4	TxD
5	I/O 5	RxD
6	I/O 6	GND
7	I/O 7	
8	I/O 8	

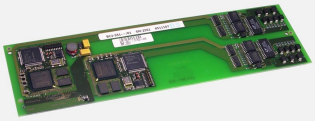
The abbreviations have the following meaning:

CTS . . . . serial interface (V.28) - clear to send
RTS . . . . serial interface (V.28) - request to send
DSR . . . . serial interface (V.28) - data set ready
DCD . . . . serial interface (V.28) - data carrier detect
DTR . . . . serial interface (V.28) - data terminal ready
TxD . . . . serial interface (V.28) - transmit data
RxD . . . . serial interface (V.28) - receive data
GND . . . . serial interface (V.28) - signal ground
+5V . . . . serial interface - +5V-supply
TxC . . . . serial interface (V.28) - generated clock pulse
RxC . . . . serial interface (V.28) - received clock pulse
RNGERR . .signaling ring failure (in conjunction with CM-0821)
MODE . . . operating mode V.28 on CM-0827

3 Order Information

Content

3.1 System Element SM-2551

	Designation	Item Number/MLFB
	SM-2551 Serial Interface Processor 2 serial interfaces	BC2-551 6MF10130CF510AA0

3.2 System Element SM-0551

	Designation	Item Number/MLFB
	SM-0551 Serial Interface Processor 1 serial interface	BC0-551 6MF10130AF510AA0

3.2.1 Required for Installation

Prerequisite for the installation of SM-0551 is one of the following SIM:

	Designation	Item Number/MLFB
	SM-2558 Ethernet-Interface 1x100Base-TX +1 ser. interface (optional)	BC2-558 6MF10130CF580AA0
	SM-2546 Ethernet 100FX + 1 serial interface (optional)	BC2-546 6MF10130CF460AA0

3.3 Accessories

	Designation	Item Number/MLFB
	CM-2860 Patch Plug standard V28, ET, TR	CA2-860 6MF12110CJ600AA0