

SIEMENS

SICAM 1703

IEC 60870-5-103

Interoperability

Preface, Table of Contents

Introduction	1
Interoperability for SICAM 1703 in Multi-point Traffic (103M)	2
Interoperability for SICAM 1703 in Multi-point Traffic (103S)	3

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Preface

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

- SICAM 1703 (ACP 1703)

Purpose of this manual

This manual describes the interoperability of SICAM 1703 using protocol element according to IEC 60870-5-103 and essentially contains

- Interoperability IEC 60870-5-103

Target Group

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

- Sales engineering and technical clarification
- Conceptual activities, as for example design and configuration

Table of Contents

1.	Introduction	7
1.1.	Area of Application	8
1.2.	General Information.....	8
2.	Interoperability for SICAM 1703 in Multi-point Traffic (103M)	9
2.1.	Physical layer	10
2.1.1.	Electrical interface	10
2.1.2.	Optical interface	10
2.1.3.	Transmission speed	10
2.2.	Link layer	11
2.3.	Application layer	11
2.3.1.	Transmission mode for application data	11
2.3.2.	Common address of ASDU	11
2.4.	Selection of standard information numbers in monitor direction	11
2.4.1.	System functions in monitor direction	11
2.4.2.	Status indications in monitor direction.....	12
2.4.3.	Supervision indications in monitor direction	12
2.4.4.	Earth fault indications in monitor direction	12
2.4.5.	Fault indications in monitor direction	13
2.4.6.	Auto-reclosure indications in monitor direction	14
2.4.7.	Measurands in monitor direction	14
2.4.8.	Generic functions in monitor direction	14
2.5.	Selection of standard information numbers in control direction	15
2.5.1.	System functions in control direction.....	15
2.5.2.	General commands in control direction.....	15
2.5.3.	Generic functions in control direction	15
2.5.4.	Basic application functions	16
2.5.5.	Miscellaneous.....	16
3.	Interoperability for SICAM 1703 in Multi-point Traffic (103S).....	17
3.1.	Physical layer	18
3.1.1.	Electrical interface	18
3.1.2.	Optical interface	18
3.1.3.	Transmission speed	18
3.2.	Link layer	19
3.3.	Application layer	19
3.3.1.	Transmission mode for application data	19
3.3.2.	Common address of ASDU	19
3.4.	Selection of standard information numbers in monitor direction	19

3.4.1.	System functions in monitor direction.....	19
3.4.2.	Status indications in monitor direction.....	20
3.4.3.	Supervision indications in monitor direction	20
3.4.4.	Earth fault indications in monitor direction.....	20
3.4.5.	Fault indications in monitor direction	21
3.4.6.	Auto-reclosure indications in monitor direction.....	22
3.4.7.	Measurands in monitor direction	22
3.4.8.	Generic functions in monitor direction	22
3.5.	Selection of standard information numbers in control direction.....	23
3.5.1.	System functions in control direction	23
3.5.2.	General commands in control direction.....	23
3.5.3.	Generic functions in control direction	23
3.5.4.	Basic application functions	24
3.5.5.	Miscellaneous	24

1. Introduction

Contents

1.1.	Area of Application	8
1.2.	General Information.....	8

1.1. Area of Application

In this documentation, all definitions are described that are necessary for communication between protection equipment and substation controller as per IEC 60870-5-103.

1.2. General Information

Syntax:

Function or ASDU is not used

Function or ASDU is used as standardized (default)

Definition:

103M Standard protocol elements for communication according to IEC 60870-5-103 in multi-point traffic for coupling between ACP 1703 respectively ACP 1703 and non-SIEMENS systems, which support these parameters.

System elements for multi-point traffic – master (103M):

SM-2541/103M00
SM-2551/103MA0
SM-0551/103MA0

103S Standard protocol elements for communication according to IEC 60870-5-103 in multi-point traffic for coupling between ACP 1703 respectively ACP 1703 and non-SIEMENS systems, which support these parameters.

System elements for multi-point traffic – slave (103S):

SM-2541/103S00
SM-2551/103SA0
SM-0551/103SA0
local interface CP-5000/103S50

2. Interoperability for SICAM 1703 in Multi-point Traffic (103M)

Contents

2.1.	Physical layer	10
2.2.	Link layer	11
2.3.	Application layer	11
2.4.	Selection of standard information numbers in monitor direction	11
2.5.	Selection of standard information numbers in control direction	15

2.1. Physical layer

2.1.1. Electrical interface

- EIA RS-485
- Number of loads for one protection equipment

NOTE: EIA RS-485 standard defines unit loads so that 32 of them can be operated on one line. For detailed information refer to clause 3 of EIA RS-485 standard.

2.1.2. Optical interface

- Glass fibre (Interface module CM-1822, CM-0827)
- Plastic fibre (Interface module CM-1824)
- F-SMA type connector *)
- BFOC/2,5 type connector *)

*) NOTE: SIEMENS uses ST-connectors "straight tip; = BFOC (2.5)" for optical interfaces. Connection to other connector types is possible by using optical cables with different connectors on both sides.

2.1.3. Transmission speed

- 9 600 bit/s
- 19 200 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 870-5-4, 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 ... available only with Firmware 103M00 (Ax 1703)

2.4. Selection of standard information numbers in monitor direction

2.4.1. System functions in monitor direction

INF	Semantics
<input checked="" type="checkbox"/>	<0> End of general interrogation
<input checked="" type="checkbox"/>	<1> Time synchronization
<input checked="" type="checkbox"/>	<2> Reset FCB
<input checked="" type="checkbox"/>	<3> Reset CU
<input checked="" type="checkbox"/>	<4> Start/restart
<input checked="" type="checkbox"/>	<5> Power on

2.4.2. Status indications in monitor direction

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

2.4.3. Supervision indications in monitor direction

INF	Semantics
<input checked="" type="checkbox"/>	<32> Measurand supervision I
<input checked="" type="checkbox"/>	<33> Measurand supervision V
<input checked="" type="checkbox"/>	<35> Phase sequence supervision
<input checked="" type="checkbox"/>	<36> Trip circuit supervision
<input checked="" type="checkbox"/>	<37> I>> back-up operation
<input checked="" type="checkbox"/>	<38> VT fuse failure
<input checked="" type="checkbox"/>	<39> Teleprotection disturbed
<input checked="" type="checkbox"/>	<46> Group warning
<input checked="" type="checkbox"/>	<47> Group alarm

2.4.4. Earth fault indications in monitor direction

INF	Semantics
<input checked="" type="checkbox"/>	<48> Earth fault L1
<input checked="" type="checkbox"/>	<49> Earth fault L2
<input checked="" type="checkbox"/>	<50> Earth fault L3
<input checked="" type="checkbox"/>	<51> Earth fault forward, i.e. line
<input checked="" type="checkbox"/>	<52> Earth fault reserve, i.e. busbar

2.4.5. Fault indications in monitor direction

INF	Semantics
X	<64> Start/pick-up L1
X	<65> Start/pick-up L2
X	<66> Start/pick-up L3
X	<67> Start/pick-up N
X	<68> General trip
X	<69> Trip L1
X	<70> Trip L2
X	<71> Trip L3
X	<72> Trip I>> (back-up operation)
X	<73> Fault location X in ohms
X	<74> Fault forward/line
X	<75> Fault reverse/busbar
X	<76> Teleprotection signal transmitted
X	<77> Teleprotection signal received
X	<78> Zone 1
X	<79> Zone 2
X	<80> Zone 3
X	<81> Zone 4
X	<82> Zone 5
X	<83> Zone 6
X	<84> General start/pick-up
X	<85> Breaker failure
X	<86> Trip measuring system L1
X	<87> Trip measuring system L2
X	<88> Trip measuring system L3
X	<89> Trip measuring system E
X	<90> Trip I>
X	<91> Trip I>>
X	<92> Trip IN>
X	<93> Trip IN>>

2.4.6. Auto-reclosure indications in monitor direction

	INF	Semantics
<input checked="" type="checkbox"/>	<128>	CB 'on' by AR
<input checked="" type="checkbox"/>	<129>	CB 'on' by long-time AR
<input checked="" type="checkbox"/>	<130>	AR blocked

2.4.7. Measurands in monitor direction

	INF	Semantics
<input checked="" type="checkbox"/>	<144>	Measurand I
<input checked="" type="checkbox"/>	<145>	Measurands I, V
<input checked="" type="checkbox"/>	<146>	Measurands I, V, P, Q
<input checked="" type="checkbox"/>	<147>	Measurands IN, VEN
<input checked="" type="checkbox"/>	<148>	Measurands IL1,2,3, VL1,2,3, P, Q, f

2.4.8. Generic functions in monitor direction

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

2.5. Selection of standard information numbers in control direction

2.5.1. System functions in control direction

INF	Semantics
<input checked="" type="checkbox"/>	<0> Initiation of general interrogation
<input checked="" type="checkbox"/>	<0> Time synchronization

2.5.2. General commands in control direction

INF	Semantics
<input checked="" type="checkbox"/>	<16> Auto-recloser on/off
<input checked="" type="checkbox"/>	<17> Teleprotection on/off
<input checked="" type="checkbox"/>	<18> Protection on/off
<input checked="" type="checkbox"/>	<19> LED reset
<input checked="" type="checkbox"/>	<23> Activate characteristic 1
<input checked="" type="checkbox"/>	<24> Activate characteristic 2
<input checked="" type="checkbox"/>	<25> Activate characteristic 3
<input checked="" type="checkbox"/>	<26> Activate characteristic 4

2.5.3. Generic functions in control direction

INF	Semantics
<input type="checkbox"/>	<240> Read headings of all defined groups
<input type="checkbox"/>	<241> Read values or attributes of all entries of one group
<input type="checkbox"/>	<243> Read directory of a single entry
<input type="checkbox"/>	<244> Read value or attribute of a single entry
<input type="checkbox"/>	<245> General interrogation of generic data
<input type="checkbox"/>	<248> Write entry
<input type="checkbox"/>	<249> Write entry with confirmation
<input type="checkbox"/>	<250> Write entry with execution
<input type="checkbox"/>	<251> Write entry abort

2.5.4. Basic application functions

<input checked="" type="checkbox"/>	Test mode
<input checked="" type="checkbox"/>	Blocking of monitor direction
<input checked="" type="checkbox"/>	Disturbance data
<input type="checkbox"/>	Generic services
<input checked="" type="checkbox"/>	Private data

2.5.5. Miscellaneous

Measurand	Max. MVAL = times rated value	
	1,2	or 2,4
Current L1	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Current L2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Current L3	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L1-E	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L2-E	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L3-E	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Active power P	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Reactive power Q	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Frequency f	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Voltage L1 – L2	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

3. Interoperability for SICAM 1703 in Multi-point Traffic (103S)

Contents

3.1.	Physical layer	18
3.2.	Link layer	19
3.3.	Application layer	19
3.4.	Selection of standard information numbers in monitor direction	19
3.5.	Selection of standard information numbers in control direction	23

3.1. Physical layer

3.1.1. Electrical interface

- EIA RS-485
- Number of loads for one protection equipment

NOTE: EIA RS-485 standard defines unit loads so that 32 of them can be operated on one line. For detailed information refer to clause 3 of EIA RS-485 standard.

3.1.2. Optical interface

- Glass fibre (Interface module CM-1822, CM-0827)
- Plastic fibre (Interface module CM-1824) **)
- F-SMA type connector *)
- BFOC/2,5 type connector *)

*) NOTE: SIEMENS uses ST-connectors "straight tip; = BFOC (2.5)" for optical interfaces. Connection to other connector types is possible by using optical cables with different connectors on both sides.

***) NOTE: With BC 1703 ACP local interface the optical interface is fix integrated and therefore no interface modul is necessary.

3.1.3. Transmission speed

- 9 600 bit/s
- 19 200 bit/s

3.2. Link layer

There are no choices for the link layer.

3.3. Application layer

3.3.1. Transmission mode for application data

Mode 1 (least significant octet first), as defined in 4.10 of IEC 870-5-4, is used exclusively in this companion standard.

3.3.2. Common address of ASDU

- One Common Address of ASDU (identical with station address)
 More than one Common Address of ASDU ... available only with Firmware 103M00 (Ax 1703)

3.4. Selection of standard information numbers in monitor direction

3.4.1. System functions in monitor direction

	INF	Semantics
<input checked="" type="checkbox"/>	<0>	End of general interrogation
<input checked="" type="checkbox"/>	<1>	Time synchronization
<input type="checkbox"/>	<2>	Reset FCB
<input type="checkbox"/>	<3>	Reset CU
<input checked="" type="checkbox"/>	<4>	Start/restart
<input type="checkbox"/>	<5>	Power on

3.4.2. Status indications in monitor direction

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

3.4.3. Supervision indications in monitor direction

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

3.4.4. Earth fault indications in monitor direction

INF	Semantics
X	<48> Earth fault L1
X	<49> Earth fault L2
X	<50> Earth fault L3
X	<51> Earth fault forward, i.e. line
X	<52> Earth fault reserve, i.e. busbar

3.4.5. Fault indications in monitor direction

INF	Semantics
X	<64> Start/pick-up L1
X	<65> Start/pick-up L2
X	<66> Start/pick-up L3
X	<67> Start/pick-up N
X	<68> General trip
X	<69> Trip L1
X	<70> Trip L2
X	<71> Trip L3
X	<72> Trip I>> (back-up operation)
X	<73> Fault location X in ohms
X	<74> Fault forward/line
X	<75> Fault reverse/busbar
X	<76> Teleprotection signal transmitted
X	<77> Teleprotection signal received
X	<78> Zone 1
X	<79> Zone 2
X	<80> Zone 3
X	<81> Zone 4
X	<82> Zone 5
X	<83> Zone 6
X	<84> General start/pick-up
X	<85> Breaker failure
X	<86> Trip measuring system L1
X	<87> Trip measuring system L2
X	<88> Trip measuring system L3
X	<89> Trip measuring system E
X	<90> Trip I>
X	<91> Trip I>>
X	<92> Trip IN>
X	<93> Trip IN>>

3.4.6. Auto-reclosure indications in monitor direction

	INF	Semantics
<input checked="" type="checkbox"/>	<128>	CB 'on' by AR
<input checked="" type="checkbox"/>	<129>	CB 'on' by long-time AR
<input checked="" type="checkbox"/>	<130>	AR blocked

3.4.7. Measurands in monitor direction

	INF	Semantics
<input checked="" type="checkbox"/>	<144>	Measurand I
<input checked="" type="checkbox"/>	<145>	Measurands I, V
<input checked="" type="checkbox"/>	<146>	Measurands I, V, P, Q
<input checked="" type="checkbox"/>	<147>	Measurands IN, VEN
<input checked="" type="checkbox"/>	<148>	Measurands IL1,2,3, VL1,2,3, P, Q, f

3.4.8. Generic functions in monitor direction

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

3.5. Selection of standard information numbers in control direction

3.5.1. System functions in control direction

INF	Semantics
<input checked="" type="checkbox"/>	<0> Initiation of general interrogation
<input checked="" type="checkbox"/>	<0> Time synchronization

3.5.2. General commands in control direction

INF	Semantics
<input checked="" type="checkbox"/>	<16> Auto-recloser on/off
<input checked="" type="checkbox"/>	<17> Teleprotection on/off
<input checked="" type="checkbox"/>	<18> Protection on/off
<input checked="" type="checkbox"/>	<19> LED reset
<input checked="" type="checkbox"/>	<23> Activate characteristic 1
<input checked="" type="checkbox"/>	<24> Activate characteristic 2
<input checked="" type="checkbox"/>	<25> Activate characteristic 3
<input checked="" type="checkbox"/>	<26> Activate characteristic 4

3.5.3. Generic functions in control direction

INF	Semantics
<input type="checkbox"/>	<240> Read headings of all defined groups
<input type="checkbox"/>	<241> Read values or attributes of all entries of one group
<input type="checkbox"/>	<243> Read directory of a single entry
<input type="checkbox"/>	<244> Read value or attribute of a single entry
<input type="checkbox"/>	<245> General interrogation of generic data
<input type="checkbox"/>	<248> Write entry
<input type="checkbox"/>	<249> Write entry with confirmation
<input type="checkbox"/>	<250> Write entry with execution
<input type="checkbox"/>	<251> Write entry abort

3.5.4. Basic application functions

<input checked="" type="checkbox"/>	Test mode
<input type="checkbox"/>	Blocking of monitor direction
<input checked="" type="checkbox"/>	Disturbance data
<input type="checkbox"/>	Generic services
<input checked="" type="checkbox"/>	Private data

3.5.5. Miscellaneous

Measurands are transmitted with ASDU 3 as well as with ASDU 9. As defined in 7.2.6.8, the maximum MVAL can either be 1,2 or 2,4 times the rated value. No different rating shall be used in ASDU 3 and ASDU 9, i.e. for each measurand there is only one choice.

Measurand	Max. MVAL = times rated value		
	1,2	or	2,4
Current L1	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Current L2	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Current L3	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Voltage L1-E	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Voltage L2-E	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Voltage L3-E	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Active power P	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Reactive power Q	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Frequency f	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>
Voltage L1 – L2	<input checked="" type="checkbox"/>		<input checked="" type="checkbox"/>

NOTE: These measurands are not sent by the protection unit.
In case of peripheral boards the demanded reference factors can be adjusted over the scaling.