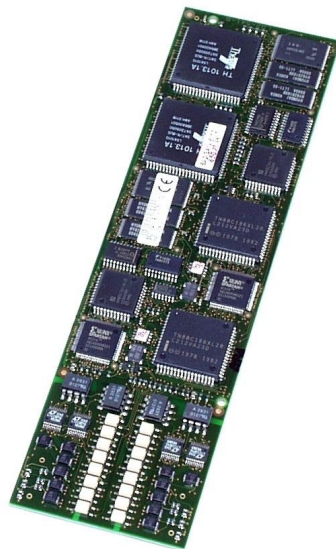


SIEMENS

ACP 1703

SM-2541/PROTOCOL

2 Protocol Elements (2x V.28 / V.11)



2 protocol elements based on a Serial Interface Module (SIM) with two serial interfaces:

Protocol element (serial)

- Standard protocols according to IEC 60870-5-101/103 for
 - point-to-point traffic
 - multi-point traffic
 - dial-up traffic
- protocols subject to license
- with byte-asynchronous or byte-synchronous pulse code modulation
- all interface signals (RS232, RS485) and all interfaces are galvanically insulated from each other
- protocol selectable per interface

The SIM can be plugged on master control and communication elements of ACP 1703 platforms

Applications

The protocol elements described herein are used in several automation units based on ACP 1703 platforms.

Protocol elements process specific communication protocols when 1703 automation units communicate with each other or with devices of third-party manufacturers, in the field of telecontrol, automation, and protection.

Due to its features, protocol element technology has a successful tradition for many years at SIEMENS. A fundamental characteristic is the separation of protocol-bound communication from application tasks of an automation unit.

- Each interface has its own protocol processor
 - communication has no impact on the application, and vice versa
 - each processor runs one communication protocol
 - various different protocols run on one and the same hardware
 - all protocols can be loaded with TOOLBOX II
- You can change the communication protocol, for instance from serial to LAN, without retroactive effect to the application tasks of an automation unit
- Each automation unit can be equipped with various protocols This allows easy implementation of data nodes and frontends.

Engineering is done using TOOLBOX II.

The protocol elements described in this document are based on the following hardware:

Module	Designation	Note
SM-2541	Universal Serial Interface Processor (2 IF)	<ul style="list-style-type: none"> one protocol element per interface SM-2541/PROTOCOL contains one license for a standard protocol per interface

The protocol elements can be used on ACP 1703 platforms.

Standard Protocols	Standard	Protocol Element(s)	Note
for point-to-point traffic	IEC 60870-5-101	SM-2541/BPP00	
for dial-up traffic	IEC 60870-5-101	SM-2541/DIAM00 SM-2541/DIAS00	central station remote station
for multi-point traffic	IEC 60870-5-101	SM-2541/UMPM02 SM-2541/UMPS00	central station remote station
Field bus master/slave	IEC 60870-5-101	SM-2541/UMPM01 SM-2541/UMPS01	central station remote station
for interfacing of protective devices	IEC 60870-5-103	SM-2541/103M00	central station

Protocols subject to License	License	Standard	Protocol Element(s)	Note
Serial interfacing of counters (IEC 61107)	LIC-IEC_61107	IEC 61107	SM-2541/COUM00	central station
Modbus protocol (master or slave)	LIC-MODBUS		SM-2541/MODM00 SM-2541/MODS00	central station remote station
DNP 3.0 protocol master	LIC-DNP_3.0_M		SM-2541/DNPM00	central station
Digitale Schnittstelle für Gasmeßgeräte (DSfG)	LIC-DSFG		SM-2541/DSFGS1	
SPA bus interfacing of protective devices	LIC-SPA_BUS		SM-2541/SPAM00	central station
Interfacing audio-frequency ripple control systems	LIC-TRA		SM-2541/TRA00	
SINAUT 8 protocol	LIC-SINAUT_8		SM-2541/SA8S00	

1) further subject-to-license protocols on request

Standard Protocol for Point-to-Point Traffic

SM-2541/BPP00

General Functions

Communication with a remote station:

- Balanced Point-to-Point (point-to-point traffic) according to IEC 60870-5-101
The functions supported by the protocol element are defined in the following document:
"Description IEC 60870-5-101 and -104 Interoperability" (item number DA0-046-1)

Supported operating mode(s)

- Unbalanced interchange circuit V.24/V.28 (IEC 60870-5-101)
 - Operating mode 1 (V.28) asynchronous
 - Transmission rates in transmit and receive direction: 100 .. 38400 Bit/s;
transmit and receive directions can be set to different transmission rates
 - Signals and levels according to V.24, V.28, RS-232
 - RJ45 connector
- Balanced interchange circuit X.24/X.27 (IEC 60870-5-101)
 - Operating mode 2 (V.11) isochronous
 - Transmission rates in transmit and receive direction: 2400 .. 64000 Bit/s;
transmit and receive directions can be set to different transmission rates
 - Signals and levels according to RS-422
 - RJ45 connector
- Balanced interface RS-422
 - Operating mode 2 (V.11) asynchronous
 - Transmission rates in transmit and receive direction: 100 .. 38400 Bit/s;
transmit and receive directions can be set to different transmission rates
 - Signals and levels according to V.11, RS-422
 - RJ45 connector
- Time synchronization
Cyclic, at least 1 times per minute.

Proprietary Functions

- Supports the Ax 1703 redundancy functionality
Interface can be switched to tri-state.

Configuration

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

Own station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/BPP00	
BC 1703 ACP	CP-5000/CPC55	SM-2541/BPP00	
TM 1703 ACP	CP-6003/CPC65	SM-2541/BPP00	

Remote station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/BPP00	
BC 1703 ACP	CP-5000/CPC55	SM-2541/BPP00	
TM 1703 ACP	CP-6003/CPC65	SM-2541/BPP00	
AK 1703	CP-2000/CPC00 CP-2002/PCCE00 CP-2002/CE00 CP-2012/CE20	SM-2541/BPP00	
AMC 1703	CP-4000/CPC4x CP-4003/CCP4x	SM-2541/BPP00	
AM 1703	CP-1001/CPC10	SM-1543/BPP00	
BC 1703	CP-5001/CPC51	SM-1543/BPP00	
SICAM 230	---	---	
SAT 250	---	---	
Third-party system	---	---	IEC 60870-5-101 balanced point-to-point, according to "Description IEC 60870-5-101 and -104 Interoperability"

Standard Protocol for Dial-Up Traffic

SM-2541/DIAM00 • SM-2541/DIAS00

General Functions

Communication between one central station and up to 100 protective devices:

- Unbalanced Multi-Point (Dial-Up Traffic)
DIAM00 is master (primary station), DIAS00 ist slave (secondary station).

Connecting and disconnecting via the data transmission facilities is controlled by AT-Hayes or CCITT V.25bis commands (modem control). When connected a communication protocol according to IEC 60870-5-101 "Unbalanced Multi-Point (dial-up traffic)" is used.

The protocol element uses special administration messages in the private range of IEC 60870-5-101 for controlling the connection and disconnection process, the use of a stand-by transmission line, and access (password protection).

Supported operating mode(s)

- Unbalanced interchange circuit V.24/V.28 (IEC 60870-5-101)
 - Operating mode 1 (V.28) asynchronous
 - Transmission rates in transmit and receive direction: 50 .. 38400 Bit/s;
modem control and data transmission can be set to different transmission rates
 - Signals and levels according to V.24, V.28, RS-232
 - RJ45 connector

Proprietary Functions

• Toll-Saving Transmission Strategies

By setting parameters (maximum connection time, prioritization, selection of process data for spontaneous transmission when data have changed, etc.) to appropriate values the transmission of data transmission can be reduced to a minimum necessary for operation.

Whenever a station (central station, remote station) has data ready for spontaneous transmission, it makes a connection to the partner station.

Apart from spontaneous transmission, there is the so-called "monitoring cycle": DIAM00 and DIASxx can cyclically connect to partner stations and this way monitor their availability.

Whenever a connection is established, all data ready for transmission is transmitted

• Connecting and Disconnecting (spontaneously and cyclically)

- Secure against unauthorized access
To improve security, a login sequence with password verification is performed after a connection has been established.
- Alternate phone number(s)
If a remote station cannot be reached using its primary phone number an alternate phone number can be used if available.

- Time synchronization
Immediately after a connection is established the time synchronization process is performed; later on cyclically every minute as long as being connected. The accuracy of the time maintained in the remote station depends essentially on the monitoring cycle.
- Availability and data throughput
(only if SM-2541/DIAM00 is installed on CP-2012/CE25)
In mult-master operating mode, provided there are several modems available in the central station and just as many SM-2541/DIAM00 protocol elements, more than one connection can be established simultaneously with different remote stations. Remote stations are not assigned to a specific master. By means of that higher availability and higher data throughput is achieved.

- **Transmission Facilities (Modems)**

- For dial-up communication selected modems available on the market are used.
Parameter profiles are already predefined for a series of transmission facilities, through which the effort during engineering can be reduced considerably. Amongst other things, there is support for:
 - Kabelmetall LGM 64k (ISDN) (*)
 - WESTERMO TD-32 (analog) (*)
 - EUROCOM-24 Modem (analog) (*)
 - Siemens M-20, TC35 (GSM)
 - SIMOCO SRM1000 (TETRA)

Apart from this, a transmission facility, that can be freely defined by the user, can be selected, for which all parameters that are available can be individually set. Modems can be controlled using industrial standard AT-Hayes commands or commands according to CCITT V.25bis.
- Having a telephone set connected in parallel
You can make normal phone calls over a phone line used for data transmission, if one of the modems marked with (*) is installed on the line. If the modem is not using the line phone calls can be made. If a data connection is established it cannot be influenced by the telephone set. If a call comes in the modem takes the call either immediately or after a settable delay.

- **Configuration**

- Multi-hierarchical configurations
Multi-hierarchical configurations are supported. This means that additional stations can be connected to a dial-up remote station, also using different communication protocols.

Configuration

Central Station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/DIAM00	
BC 1703 ACP	CP-5000/CPC55	SM-2541/DIAM00	
TM 1703 ACP	CP-6003/CPC65	SM-2541/DIAM00	

Remote Station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/DIAS00	
BC 1703 ACP	CP-5000/CPC55	SM-2541/DIAS00	
TM 1703 ACP	CP-6003/CPC65	SM-2541/DIAS00	
AK 1703	CP-2000/CPC00 CP-2002/PCCE00 CP-2002/CE00 CP-2012/CE20	SM-2541/DIAS00	
AMC 1703	CP-4000/CPC4x CP-4003/CCP4x	SM-2541/DIAS00	
	CP-4000/CPC42	SM-4599/DIAS40	
AM 1703	CP-1001/CPC10	SM-1543/DIAS00	
BC 1703	CP-5001/CPC51	SM-1543/DIAS00	
TM 1703 mic	CP-6020/CPC60	---	

Standard Protocol for Multi-Point Traffic

SM-2541/UMPM02 • SM-2541/UMPS00

General Functions

Communication between one central station and up to 100 protective devices:

- Unbalanced Multi-Point (Multi-Point Traffic)
UMPM02 is master (primary station), UPMSxx ist slave (secondary station).
The functions supported by the protocol element are defined in the following document:
"Description IEC 60870-5-101 and -104 Interoperability" (item number DA0-046-1)

Supported operating mode(s)

- Unbalanced interchange circuit V.24/V.28 (IEC 60870-5-101)
 - Operating mode 1 (V.28) asynchronous
 - Transmission rates in transmit and receive direction: 50 .. 57600 bps
 - Signals and levels according to V.24, V.28, RS-232
 - RJ45 connector
- Balanced interchange circuit X.24/X.27 (IEC 60870-5-101)
 - Operating mode 2 (V.11) isochronous
 - Transmission rates in transmit and receive direction: 2400 .. 64000 bps
 - Signals and levels according to RS-422
 - RJ45 connector
- Balanced interface RS-485
 - Operating mode 2 (RS-485) asynchronous
 - Transmission rates in transmit and receive direction: 50 .. 57600 bps
 - Signals and levels according to V.11, RS-485
 - RJ45 connector
- Time synchronization
Cyclic, can be set in a minute grid; at least 1x per minute.

Proprietary Functions

- **Optimized parameters for selected transmission facilities**

Parameter profiles are already predefined for a series of transmission facilities, through which the effort during engineering can be reduced considerably. Amongst other things, there is support for:

- Modems in 4-wire- and 2-wire-technique (including: WT 101, CE-0700, CE-0701)
- DMS 120-
- Optical media
- Digital and analog radio
- Direct connection RS-485
- DLC Modems (CE-0740, CE-0741)

Apart from this, a transmission facility, that can be freely defined by the user, can be selected, for which all parameters that are available can be individually set.

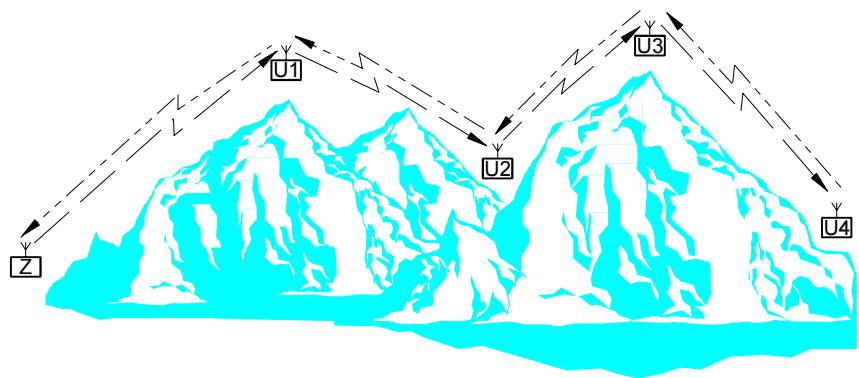
- **Relay operation (multi-point traffic with routing)**

In utilities, many small and medium size stations fail to become automated because of communication problems. Where dedicated lines or, because of poor infrastructure, dial-up traffic cannot be used, one often has to fall back on radio communication. With radio communication, it can happen, that due to the geographical location or the limited transmission power and an insufficient number of transmission frequencies, not all stations can be reached with just one transmitter installed in the central station.

Relay operation solves this problem despite the fact that only most simple radio communication units, even of low transmission power, with only one single frequency are used in the entire automation area.

In relay operation, messages broadcast from the central station can also reach the remote station indirectly (and vice versa), namely by way of intermediate stations along the transmission path, that can always communicate directly with their respective adjacent station. Such stations lying along the path between source and destination of a message transmission "only" provide a routing function for the transmission in question (namely reception and forwarding of messages). In this sense, such stations are routing stations.

All stations participating in the multi-point traffic are equipped with protocol elements for radio repeater communication and through this possess the capability of routing – in general besides their process-related tasks and independent from these. The routing path is defined by the parameter setting in the central station. The routing can take place via up to 7 routing stations. For each station a primary path and a secondary path can be defined.



- Legende:
- Funkantenne
 - Funkübertragung
 - Z** Zentrale
 - U_x** Unterstation
 - U1-U3** Routingstationen (bei Übertragung zwischen Z und U4)

The example illustrated above shows that individual stations cannot reach others directly via radio. Stations which are capable of communicating with one another directly via radio communication are located within one "radio region": the example shown includes the following radio regions: (Z, U1), (U1, U2, U3), and (U3, U4).

For the transmission of a message from the central station Z to the remote stations U1, U2, U3, and U4, the following routes are possible (reverse direction along the same route):

Source	Destination	Route ¹⁾	Note
Z	U1	Z ⇔ U1	
Z	U2	Z ⇔ U1 ⇔ U2	
Z	U3	Z ⇔ U1 ⇔ U3	shorter route ⇔ advantageous
		Z ⇔ U1 ⇔ U2 ⇔ U3	longer route ⇔ disadvantageous
Z	U4	Z ⇔ U1 ⇔ U3 ⇔ U4	

¹⁾ **Z, U** source, destination
U routing station

The shortest route along which an outstation can be reached is determined by parameter setting. This route is also contained in the message transmitted. All stations within reach of the respective transmitter will receive the message. However, it will be retransmitted only by the routing station that is next in the routing order and thus be passed on in the radio repeater mode - until it arrives at its destination.

With wired communication, the relay operation can be used for regenerating the signal: if for example a very remote station can only be reached with great difficulty, error-free communication is often only possible with a very high number of retries. By routing the messages over a routing station, the attainability can be improved considerably.

Configuration

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

Central Station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/UMPM02	
BC 1703 ACP	CP-5000/CPC55	SM-2541/UMPM02	
TM 1703 ACP	CP-6003/CPC65	SM-2541/UMPM02	

Remote Station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/UMPS00	
BC 1703 ACP	CP-5000/CPC55	SM-2541/UMPS00	
TM 1703 ACP	CP-6003/CPC65	SM-2541/UMPS00	
AK 1703	CP-2000/CPC00 CP-2002/PCCE00 CP-2002/CE00 CP-2012/CE20	SM-2541/UMPS00	
AMC 1703	CP-4000/CPC4x CP-4003/CCP4x	SM-2541/UMPS00	
	CP-4000/CPC42	SM-4599/UMPS40	
AM 1703	CP-1001/CPC10	SM-1543/UMPS00	
BC 1703	CP-5001/CPC51	SM-1543/UMPS00	
TM 1703 mic	CP-6020/CPC60	---	
Third-party system	---	---	IEC 60870-5-101 unbalanced slave (secondary), according to "Description IEC 60870-5-101 and -104 Interoperability"

Standard Field Bus Protocol

SM-2541/UMPM01 • SM-2541/UMPS01

General Functions

Communication between one central station and up to 100 protective devices:

- Unbalanced Multi-Point (Multi-Point Traffic)
UMPM01 is master (primary station), UPMS01 ist slave (secondary station).

Supported operating mode(s)

- Unbalanced interchange circuit V.24/V.28 (IEC 60870-5-101)
 - Operating mode 1 (V.28) asynchronous
 - Transmission rates in transmit and receive direction: 38400 bps
 - Signals and levels according to V.24, V.28, RS-232
 - RJ45 connector
- Balanced interface RS-485
 - Operating mode 2 (RS-485) asynchronous
 - Transmission rates in transmit and receive direction: 38400 bps
 - Signals and levels according to V.11, RS-485
 - RJ45 connector
- Time synchronization
Cyclic, every 5 seconds.

Configuration

Central Station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/UMPM01	
BC 1703 ACP	CP-5000/CPC55	SM-2541/UMPM01	
TM 1703 ACP	CP-6003/CPC65	SM-2541/UMPM01	

Remote Station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/UMPS01	
BC 1703 ACP	CP-5000/CPC55	SM-2541/UMPS01	
TM 1703 ACP	CP-6003/CPC65	SM-2541/UMPS01	
AK 1703	CP-2000/CPC00 CP-2002/PCCE00 CP-2002/CE00 CP-2012/CE20	SM-2541/UMPS01	
AMC 1703	CP-4000/CPC4x CP-4003/CCP4x	SM-2541/UMPS01	
AM 1703	CP-1001/CPC10	SM-1543/UMPS01	
BC 1703	CP-5001/CPC51	SM-1543/UMPS01	

Standard Protocol for Interfacing of Protective Devices

SM-2541/103M00

General Functions

Communication between one central station and up to 100 protective devices:

- Unbalanced Multi-Point (Multi-Point Traffic)
103M00 is master (primary station), protective device ist slave (secondary station).

Supported operating mode(s)

- Unbalanced interchange circuit V.24/V.28 (IEC 60870-5-101)
 - Operating mode 1 (V.28) asynchronous
 - Transmission rates in transmit and receive direction: 9600 .. 38400 bps
 - Signals and levels according to V.24, V.28, RS-232
 - RJ45 connector
- Balanced interface RS-485
 - Operating mode 2 (RS-485) asynchronous
 - Transmission rates in transmit and receive direction: 9600 .. 38400 bps
 - Signals and levels according to V.11, RS-485
 - RJ45 connector
- Time synchronization
Cyclic, can be set in a seconds grid

Proprietary Functions

- **Resetting the short-circuit location values**

After spontaneous transmission of the values of the short-circuit location values, the protocol element can reset the short-circuit location values after a settable time by itself or initiated by a command message.

- **Measured value change monitoring**

Certain protective devices transmit measured values cyclically. In order to transmit measured values through the SICAM 1703 system only when they have changed or during general interrogation, measured value change monitoring is implemented on the protocol element.

- **Intermediate position and faulty position monitoring**

Double-point information transmitted from protective devices can be monitored by the protocol element to detect intermediate and faulty positions. Intermediate and faulty positions are reported when the monitoring time has elapsed.

- **"Embedded REYDISP"**

If Reyrolle protection equipment is installed and a MS Windows based process control system of the SAT 250 / SICAM 230 family is available, REYDISP, the engineering tool for this protection equipment, can be run directly from this process control system.

Configuration

Central Station

System	System Element	Protocol Element	Note
AK 1703 ACP	CP-2010/CPC25 CP-2012/PCCE25	SM-2541/103M00	
BC 1703 ACP	CP-5000/CPC55	SM-2541/103M00	
TM 1703 ACP	CP-6003/CPC65	SM-2541/103M00	

Substation (Protective Device)

System	System Element	Protocol Element	Note
Third-party system	---	---	IEC 60870-5-103 unbalanced slave (secondary), according to "Description IEC 60870-5-103 Interoperability"

SM-2541 - Universeller Serieller Interface Prozessor (2 SS)

Unterstützte Konfigurationen sind in der folgenden Tabelle angeführt. Zusätzlich zu ein (SI0/SI1 oder SI2/SI3) oder zwei (SI0/SI1 und SI2/SI3) SM-2541 benötigt man alle für die gewählte Konfiguration angeführten Teile (Trägerbaugruppe, Anschlussplatine, Patch-Plug, etc.):

Konfiguration			Schnittstellen			
Trägerbaugruppe	Anschlussplatine ¹⁾	Patch-Plug ¹⁾	SI0	SI1	SI2	SI3
CP-2010	CM-2837	✓ ²⁾	✓	✓		
CP-2012	CM-2838	✓ ²⁾	✓	✓	✓	✓
CP-5000	je S1x ein integriertes Patch-Modul ³⁾		✓	✓		
CP-6003		✓ ²⁾	✓	✓	✓	✓

¹⁾ eine Anschlussplatine je Trägerbaugruppe; ein Patch-Plug je Schnittstelle

²⁾ je nach Konfiguration und Betriebsart unterschiedlich

³⁾ jede bestellbare Variante des BC 1703 ACP (Bay Controller) hat je Schnittstelle ein festgelegtes Patch-Modul

Technical Specifications

Processor and Memory	
Processor	80C186XL, 16 MHz
Program memory	FLASH-PROM 512 kByte
Main memory	RAM 256 kByte
Serial controller	85C30
	<ul style="list-style-type: none"> • Operating mode V.28 • Operating mode V.11
Communication Circuits	
2 serial interfaces, can be switched independently between operating modes	<ul style="list-style-type: none"> • Operating mode 1 (a) V.28 asynchronous line length according to V.28 • Operating mode 2 (a) V.11 isochronous line length up to 500 m • Operating mode 2 (c) V.11 asynchronous, RS-485 asynchronous line length up to 500 m <p>Transmission rates</p> <ul style="list-style-type: none"> • see description of the respective protocol, "Supported operating mode(s)"
Power Supply	
Operating voltage	4.75 .. 5.25 VDC, typ. 800 mA The voltage is supplied by the carrier module.
Auxiliary voltage (serial interfaces)	2x5 VDC \pm 10%, max. 2x200 mA The voltage (data circuit voltage) is supplied by the carrier module (galvanically insulated).
Mechanics	
Dimensions	227.3 x 63.5 mm
Weight	Approx. 114 g

Literature

Folder TM 1703 ACP	MC6-003-2
System Data Sheet TM 1703 ACP	MC6-007-2
BC 1703 ACP Functional Description	MC5-006-2
BC 1703 ACP User's Guide	DC5-001-2
Description IEC 60870-5-101 and -104 Interoperability	DA0-046-2
Description IEC 60870-5-103 Interoperability	DA0-063-2