SIEMENS

SIPLUS RIC IEConS7

Functional description IEC 60870-5-103 Master Version V1.6 Upd4

Safety instructions

Warning notices

These Operating Instructions contain information that you should observe in order to ensure your own personal safety, as well to avoid material damage. The notices referring to your personal safety are highlighted in the manual by a warning triangle. Notices referring only to equipment damage have no safety alert symbol. Warnings are shown in descending order according to the degree of danger as follows.

⚠ **DANGER**
indicates that death or serious injury **will** result if proper precautions are not taken.

⚠ **WARNING**
indicates that death or serious injury **may** result if proper precautions are not taken.

⚠ **CAUTION**
indicates that minor personal injury **may** result if proper precautions are not taken.

NOTICE
means that material damage **can** occur if the appropriate precautions are not taken.

Note:
highlights important information about the product, handling the product, or part of the documentation that is of particular importance.

Qualified personnel

Commissioning and operation of equipment described in this manual (module, device) may only be carried out by qualified personnel. Qualified personnel in the meaning of the technical safety instructions in this manual are persons authorized to commission, isolate, earth and mark devices, systems and power circuits in accordance with the standards of security technology.

Please observe also the required basic knowledge mentioned in the preamble.

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Correct usage of Siemens products

Please observe the following:

⚠   **WARNING**
Siemens products may only be used for the applications indicated in the catalog and in the relevant technical description. If third-party products and components are used, these must be recommended or approved by Siemens. To ensure trouble-free and safe operation of the products, they must be appropriately transported, stored, assembled, installed, commissioned, operated and maintained. The permitted environmental and ambient conditions must be adhered to. Notices in the relevant documentation must be observed.

⚠   **CAUTION**
Changes to cabinet wiring!
Changes to cabinet wiring may only be performed in **zero-voltage** state! An additional or modified wiring realized outside of the manufacturing enterprise requires an **additional** functional and insulation test.

Electrostatic Sensitive Devices ESD

Almost all SIMATIC modules are equipped with highly integrated components or elements in MOS technology. For technological reasons, these electronic components are very sensitive to overvoltage and, consequently, to electrostatic discharge:

The short designation for such electrostatic sensitive components/modules is: "ESD", which is the commonly used international abbreviation of "Electrostatic Sensitive Device".

NOTICE
Electrostatic Sensitive Devices ESD!
The presence of this symbol on cabinet, rack or packaging labels indicates the use of electrostatically sensitive devices and thus the touch sensitivity of these components.

These modules can be destroyed by voltage and energy far below the limits of human perception. Voltages of this kind occur as soon as a device or an assembly is touched by a person who is not electrostatically discharged.

Security information

Siemens provides products and solutions with industrial security functions that support the secure operation of plants, systems, machines and networks.

In order to protect plants, systems, machines and networks against cyber threats, it is necessary to implement – and continuously maintain – a holistic, state-of-the-art industrial security concept. Siemens' products and solutions only form one element of such a concept.

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Additionally, Siemens' guidance on appropriate security measures should be taken into account. For more information about industrial security, please visit http://www.siemens.com/industrialsecurity.

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To stay informed about product updates, subscribe to the Siemens Industrial Security RSS Feed under http://www.siemens.com/industrialsecurity.

Exclusion of liability

We have checked the content of this printed document in accordance with the hardware and software described. Nevertheless, the risk of deviations cannot be excluded completely, which is why we do not accept liability for complete conformity. The details provided in this printed document are checked on a regular basis, however, and any corrections necessary are included in subsequent editions. We would be happy to receive your suggestions for improvement.

Technical data are subject to change.

Preamble

Purpose of the functional description

This functional description describes all the steps required to use the software application *SIPLUS RIC IEConS7*. It assists in the rapid and effective familiarization of personnel in the functionality of the application.

Contents of the functional description

This functional description contains the following topics

- Principles of communication with the protection device protocol according IEC 60870-5-103
- Configuration of communication
- Description of the communication blocks and application blocks
- Parameterization of the blocks
- Appendices

Basic knowledge required

Comprehension of this manual requires basic knowledge in the field of telecontrol and the IEC 60870-5 protocols as well as general knowledge of automation technology with SIMATIC S7. Users should also have sufficient knowledge of computers, or of tools similar to PCs (e.g. programming devices), and of the Windows operating system.

As the S7 is configured using the STEP 7 basic software, you should also have sufficient experience in handling the basic software.

Target group

This manual is aimed at people with the required qualifications to commission, operate and maintain the products described:

- Installation engineers
- Programmers
- Commissioning engineers
- Servicing and maintenance personnel

Validity of the functional description

This functional description contains the description of the software application valid at the time of publication of the manual. We reserve the right to describe changes in the functionality of the software application in a special product information document.

Table of Contents

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List of abbreviations used

Abbreviation	Meaning
ACD	access demand
ACK	positive acknowledge
APCI	application protocol control information
APDU	application protocol data unit
ASDU	application service data unit
BCR	binary counter reading
BL-Bit	blocked bit: 1 = blocked - 0 = not blocked
BO	bit pattern
CA	counter was adjusted
CI	counter interrogation
CON	control direction
COT	cause of transmission
CP	communication processor
CPU	central processing unit
CTS	clear to send
CY	carry
DB	data block
DCD	data carrier detect
DCE	data circuit terminating equipment
DCO	double command
DCS	double command state
DIR-Bit	direction bit: 1 = control direction - 0 = monitoring direction
DP/DPI	double point information
DSR	data set ready
DST	daylight saving time
DTE	data terminal equipment
DTR	data terminal ready
FB	functional block
FCB	frame count bit
FCV	frame count bit valid
FRZ	freeze
GI	general interrogation
IC	interrogation command
IEC	International Electrotechnical Commission
IM	image
IOA	information object address
IP	inter networking protocol
ISO	International Organization for Standardization
IT	integrated totals
IV-Bit	invalid bit: 1 = invalid - 0 = valid
MAi	master input block
MAo	master output block
ME	measured value
NACK	negative acknowledge
NIM	network image
NT-Bit	topicality bit: 1 = not topical - 0 = topical
NVA	normalized value
OB	organization block
OC	open controller
OSI	open systems interconnection
OV-Bit	overflow bit: 1 = overflow - 0 = no overflow

Abbreviation	Meaning
PAA	Process image of the outputs
PAE	Process image of the inputs
PRM	primary message
PtP	point-to-point
QCC	qualifier field counter interrogation command
QDS	quality descriptor
QOI	qualifier of interrogation
QOS	qualifier of set-point command
RCO	regulating step command
RCS	regulating step command state
RIC	remote interface control
RQT	request
RTS	request to send
RTU	remote telecontrol unit
S/E	Select/execute
SB-Bit	substitution bit: 1 = substituted - 0 = not substituted
SC	software controller
SCO	single command
SCS	single command state
SLi	slave input block
SLo	slave output block
SP	single point information
STARTDT	start data transmission
STOPDT	stop data transmission
SVA	scaled value
TCP	transmission control protocol
TI	type identification
TI-Bit	time bit: 1 = taking over of time status byte - 0 = none taking over of time status byte
TIA	Totally Intergrated Automation
TIA-Portal	Totally Intergrated Automation Portal
UTC	universal time coordinated
VTI-Bit	transient state bit: 1 = value with transient state indication - 0 = none transient state indication

1. General

SIPLUS RIC is a range of hardware and software products facilitating the transmission of information in conformity with the IEC 60870-5 standard.

The standardized IEC60870-5 protocols are sub-divided into the following versions:

- serial protocol IEC 60870-5-101 for telecontrol
- serial protocol IEC 60870-5-102 for remote meter reading
- serial protocol IEC 60870-5-103 for protection data acquisition
- network protocol IEC 60870-5-104 for telecontrol

1.1. IEC 60870-5-103 Master

From V1.2 also the protection devices protocol IEC 60870-5-103 Master with several devices on one polling line is supported.

This manual describes the functionality of the SIPLUS RIC IEConS7 and includes the functions of the protocol IEC 60870-5-103.

SIPLUS RIC IEConS7 uses only standard components of SIMATIC ET 200S, S7-300, S7-400 and S7-400H.

SIPLUS RIC IEConS7 comprises a S7 code library (S7 program).

The IEC protocols use 3 layers of the ISO/OSI layer model.

- Layer 1: Physical layer
- Layer 2: Link layer
- Layer 7: User layer

Layer 1 is the hardware channel of the SIMATIC S7 and is therefore dependent on the interface used. This produces different functional blocks for the various configurations of the SIMATIC ET 200S, S7-300; SIMATIC S7-400 and S7-400H.

Layer 2 is the link layer which creates monitors and secures the link to the communication partner regardless of the hardware being used. With the network-based T104 protocol the real layer 2 forms part of the network layer. When T104 layer 2 is referred to below, the 'APCI' transport interface defined in the standard is meant.

Layer 7 is the user layer which controls the defined user data and represents the link element between the protocol and the user program/process.

For detailed information about the IEC 60870-5-103 protocol we refer you to the corresponding norms.

SIPLUS RIC IEConS7 software packages each include an Communication-FB (T103_S7_IEC_Config) in which layers 1 and 2 required for the hardware and protocol type, as well as a base layer 7, are summarized and the necessary parameters are adjustable.

The ' Communication-FB ' of the IEC 60870-5-103 versions implements a 'telecontrol channel' for protection data transmission on which the application blocks included in delivery as well, can be coupled for the process monitoring and process control.

If multiple telecontrol channels are required, the Communication-FB must be called up multiple times (another instance) and the relevant parameters entered. The channels then function completely independently of each other.

Each software package needs to be activated. This is achieved by entering a registration code at the input of an Communication-FB. The registration code is based on the serial number of the MMC (ET 200S and S7-300) resp. MC (S7-400) or serial number of the CPUs (S7-400H) and can be supplied with the order, in case a MC/MMC is included in the order, or the serial number has been specified. Alternatively, you can request a registration code later on via email.

Complete software packages (block library) can be ordered as HW/SW Bundle.

On request an example project appropriate for your configuration can be supplied, which is pre-allocated with basic parameters (only your registration code is required). It can be adapted with low effort.

1.2. IEC 60870-5-101 and IEC 60870-5-104

The functionality of the SIPLUS RIC IEConS7 application for the protocols IEC 60870-5-101 and IEC 60870-5-104 is described in the SIPLUS RIC IEConS7 manual.

1.3. IEC on WinAC

With the version V1.2 WinAC based systems are supported from SIPLUS RIC IEConS7 now. On these computers the software package WinAC from RTX 2010 must be installed. WinAC contains a Windows logic controller (WinLC) RTX V4.6. With it the IEConS7 application can be operated like on a hardware CPU (S7-300/400).

Up to know the mEC31, nanobox PC and microbox PC hardware is tested and released.

The registration code is not based on the serial number of the MMC (ET 200S and S7-300) resp. MC (S7-400) or serial number of the CPUs (S7-400H) as hitherto, but it is descended from the installed licence-key of the RTX.

1.3.1. Transmission of the Telecontrol protocol IEC 60870-5-103

The transmission of the telecontrol protocol IEC 60870-5-103 is carried out via the COM interface on the Nanobox PC, Microbox PC and mEC31 (in this case an additional EM PC is required). The interface is administrated from Windows. For using it by WinAC first of all the installation of a corresponding driver is required (see chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**).

When using mEC31 the communication can be carried out also via a CP340. This function is currently not released!

> **Note:**
>
> Though a transmission of the telecontrol protocol IEC 60870-5-103 via further interfaces (e.g. USB) is possible, but it cannot be ensured for all applications.

1.4. IEC on Software Controller

From version V1.6 Upd4 computer based systems are now supported by SIPLUS RIC IEConS7, on which the software package SIMATIC S7-1500 Software Controller CPU 1507S is installed, as well as on the ET 200SP PC with the related Software Controller CPU 1505SP.

On the Software Controller the application IEConS7 is operated like on a hardware-CPU (S7-1500).

Until now the platforms ET 200SP OC and IPC427d SC are tested and released.

The registration code is based on a serial number, which is provided by the Software Controller. You can find further information in "Functional description Version V1.6 Upd4"

1.4.1. Transmission of the telecontrol protocol IEC 60870-5-103

The transmission of the telecontrol protocol IEC 60870-5-101 is done by the CM PTP communication module, which is centrally or decentrally projected with ET 200SP in IO-systems (always required with IPC).

2. Ordering information SIPLUS RIC IEConS7

2.1. SIPLUS RIC Software library

SIPLUS RIC are software libraries which are provided together with a MicroMemory-Card in case of S7-300 and ET 200S or with a SIMATIC Memory-Card SMC in case of S7-1500 and ET 200SP including the corresponding activation codes, for the IEC 60870-5-101/103/104 protocolls.

For components of the S7-400 and S7-400H as well as WIN AC, SIPLUS RIC is provided without the corresponding activation codes for the IEC 60870-5-101/103/104 protocols.

The activation is carried out by means of Email to "siplus-ric.automation@siemens.com".

You'll find the Ordering numbers on the SIPLUS Internet pages.
Website: http://www.automation.siemens.com/siplus/index_00.htm

2.2. Add On for SIMATIC PCS 7 AS

As Add On for the assignment in SIMATIC PCS 7 equipment products can be ordered direct via MLFB

For components of the S7-400 and S7-400H as well as Software Controller, SIPLUS RIC is delivered without the corresponding activation codes for the IEC 60870-5-101/103/104 protocols.

The activation is carried out by means of Email to: "siplus-ric.automation@siemens.com"

You'll find the ordering numbers on the SIPLUS web pages.
Website: http://www.automation.siemens.com/siplus/index_00.htm

Note:

The blocks of the SIPLUS RIC IEConS7 library can be used in combination with automation systems of the process control system SIMATIC PCS 7 V7. The utilization of the library SIPLUS RIC IEConS7 for the telecontrol configurations shown above is independent from the SIMATIC PCS 7 telecontrol.

For further information please refer to   **Catalog ST PCS 7.1,**
Add Ons for the
Process control system SIMATIC PCS 7

3. Communication – IEC 60870-5-103

3.1. Overview

IEC 60870-5-103 is a protocol for bit-serial protection data transmission.

SIPLUS RIC IEConS7 supports communication via the communication modules CM PTP, CP1540, CP1541 with Freeport-protocol and CP 1SI, CP340, CP341 resp. CP441 in ASCII- mode and the properties of the interfaces (RS232, RS422/485), baud rates, etc

This means the CPs of the ET 200S- and S7-300 product line can be used 'directly'. They are allocated to the respective IEC communication module via the hardware address.

In the S7-400 system, a 'connection configuration' using NETPRO is required in addition to the hardware configuration. The link ID (local ID) of the point-to-point connection (PtP) constructed must be assigned to the respective IEC communication module.

SIPLUS RIC IEC on WinAC supports the communication via mEC31-RTX (WinAC 2010) resp. Microbox-PC (Nanobox-PC) with RTX.

For details of the hardware configuration and connection parameterization, refer to the chapter 'Settings in the Simatic Manager'.

In the S7-1500-System (S7-1500 and ET 200SP) for the bit-serial transmission the CP PTP, CP1540 and CP1541 are used in the Freeport modus.

SIPLUS RIC IEC on WinAC supports the communication via mEC31-RTX (WinAC 2010) resp. Micro box-PC with RTX.

In the ET 200SP PC with the Software Controller the communication modules can be used for the bit-serial transmission CM PTP in the Freeport modus in central or distributed systems.

For the IPC427d the bit-serial transmission the CM PTP in an IO-device is possible with the Software controller.

SIPLUS RIC IEConS7 resp. SIPLUS RIC IEC on Software Controller is available for IEC 60870-5-103 communication with the following properties:

- as **Master**
- in the traffic type **unbalanced mode**
- in leased line operation – VFT control is a CP property
- to one or several connection partner each.

The following combinations are available:

Software-Variant	Released Hardware	
S7LIB: S7IEC_M103_CP340/341 SIPLUS RIC IEConS7 IEC 60870-5-103 Master via CP340 or CP341 for Standard CPUs S7-300 and S7-400H	CP340-1 RS232 CP340-1 RS485/422 CP341-1 RS232 CP341-1 RS485/422	6ES7340-1AH02-0AE0 6ES7340-1CH02-0AE0 6ES7341-1AH02-0AE0 6ES7341-1CH02-0AE0
S7LIB: S7IEC_M103_CP441 SIPLUS RIC IEConS7 IEC 60870-5-103 Master via CP441 for Standard CPUs S7-400	CP441-1 CP441-2 IF963-RS232 IF963-RS485/422	6ES7441-1AA04-0AE0 6ES7441-2AA04-0AE0 6ES7963-1AA00-0AA0 6ES7963-3AA00-0AA0
S7LIB: S7IEC_M103_CP1SI SIPLUS RIC IEConS7 IEC 60870-5-103 Master via CP1SI for ET 200S CPUs	Interface modules 1SI ASCII (8Byte)	6ES7138-4DF01-0AB0
S7IEC_M103_Software Controller SIPLUS RIC WinAC IEC 60870-5-103 Master for mEC, microbox-PC and nanobox-PC IEC-Comm. via CP340, rep. COM-Interfaces	EC31-RTX (WinAC 2010) Microbox-PC with RTX Nanobox-PC with RTX	6ES7677-1DD10-0BB0 6ES7675-1DF30-0DB0 6ES7xxx
S7_IEC_1500_103_M_CM_PtP_V1_5 SIPLUS RIC IEConS7 IEC 60870-5-103 Master via CM1540 or CM1541 for Standard CPUs S7-1500	CM1540 RS232 CM1540 RS485/422 CM1541 RS232 CM1541 RS485/422	6ES7540-1AD00-0AA0 6ES7540-1AB00-0AA0 6ES7541-1AD02-0AB0 6ES7541-1AB00-0AB0
S7LIB:S7_IEC_1500_103_MS_CM_PtP SIPLUS RIC IEConS7 IEC 60870-5-103 Master via CM PTP für Standard CPUs ET 200SP	CM PTP	6ES7137-6AA00-0BA0
S7LIB:S7_IEC_on ET 200SP_OC_101_MS_CM_PtP SIPLUS RIC IEConS7 IEC 60870-5-103 Master via CM PTP for Standard CPUs ET 200SP PC	CM PTP	6ES7137-6AA00-0BA0
S7LIB:S7_IEC_on IPC427_SC_101_MS_CM_PtP SIPLUS RIC IEConS7 IEC 60870-5-103 Master via IO-Device mit CM PTP for sStandard IPC427_SC	IO-Device with CM PTP	6ES7137-6AA00-0BA0

In each case the library contains a central communication block Communication-FB 'S7_IEC_Config', corresponding subordinate auxiliary blocks, as well as the associated 'application blocks' for the process connection. The Communication-FB has to be programmed with your parameters (see next chapter) and takes care of the entire IEC communication with the connection partner.

A pointer in DWord format establishes the connection/interface to the 'application blocks'. You use only the blocks with the required functionality which can be multiple used too.

Limits are only set here by the memory and resource consumption (cycle time). For more details, see chapter 'Application blocks'.

The blocks for CP340 and CP341 are usable in standard S7-300 systems as well as in S7-400H systems. For more details using the blocks in an H-system, refer to chapter 5.

3.2. Settings in the SIMATIC Manager and TIA Portal

The Settings in the SIMATIC Manager and TIA-Portal are described in the manual "Functional description Version V1.6 Upd4"

3.3. Configuration of 'T103_S7_IEC_Config'

The Communication-FB can be called up directly from the OB1 as well as included in CFC.

Note:

The Communication-FB ('T103_S7_IEC_Config') is designed exclusively for the OB1 priority level. The application blocks need also to be operated in priority level OB1.

The block library contains a datablock as a pre-defined instance DB for Communication-FB with a symbolic name 'S7_IEC'. When calling up the Communication-FB manually you can use this DB directly (Call FB170, DB170). If you prefer or require other DB numbers, or you are working with CFC (automatic DB assignment), you can delete DB170.

In addition, you need to refer to the enclosed variable table 'VAT_S7_IEC_T103' if you want to use this, by assigning a symbolic name to the 'new' instance DB and change the DB numbers in the variable table (DB170.x -> Dbnew.x).

In the figure below the exemplary display of some T103_S7_IEC config blocks in the CFC plan is shown, and that followed a detailed list of the input and output variables with their brief comments, and a detailed description.
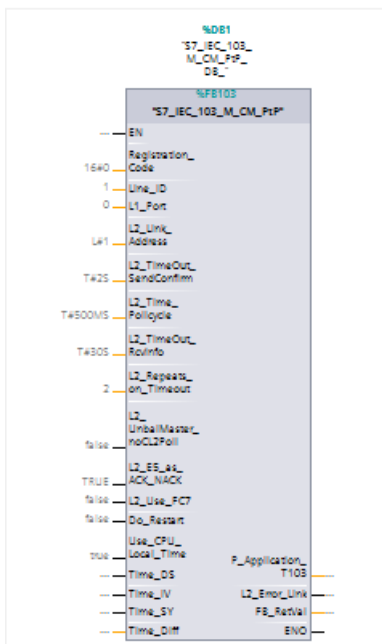
IEC60870-5-103 Master   IEC60870-5-103 Master
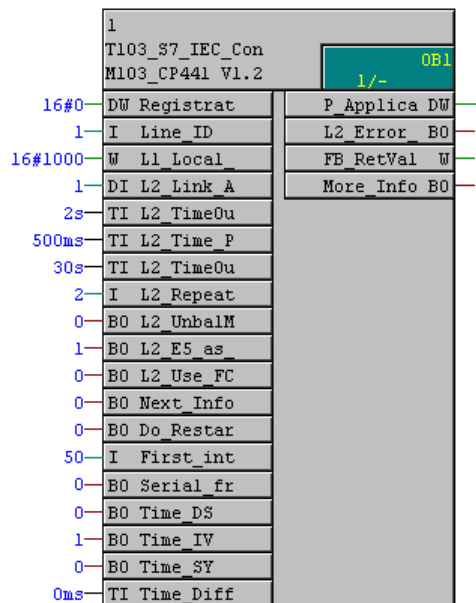
Illustration as FUP-block with default values   Illustration as CFC-block with default values

Note to the CFC plan view

The CFC views included in the manual are only used for illustration purposes. CFC is **not** required for using the blocks. The standard programming options in SIMATIC are sufficient.

NOTICE:

In case you project with CFC (e.g. within PCS7) please observe that data blocks created from SIPLUS RIC during runtime are not overwritten from CFC compiler. See also parameter 'First_internal_DB_No'.

3.3.1. IEC 60870-5-103 Master Parameters

Communication-FB		Type	Default	Block-Comment/brief description.
Registration_Code	IN	DWORD	DW#16#0	!!! IMPORTANT !!! See product information
Line_ID	IN	INT	1	for differentiation of more than one line;1-255; Default: 1;
L1_Local_ID *1)	IN	WORD	W#16#1000	see NetPro Connection Property 'ID' of your PtP-Connection
L1_Laddr_HW *2)	IN	INT	0	see Address of CP-Module in your HW-Configuration
L2_Link_Address	IN	DINT	L#1	Link-Address: 1-254, 1-65534; Default: 1
L2_TimeOut_SendConfirm	IN	TIME	T#2S	Timeout for answers; Default: 2 sec (T#2s)
L2_Time_Pollcycle	IN	TIME	T#500ms	only unbal. mode master: time between two polls, if no ACD is in answer(T#500ms)
L2_TimeOut_RcvInfo	IN	TIME	T#30S	unbal. Slave -> Cycle Error, bal mode -> Link test, 0 -> not active, Default 30s
L2_Repeats_on_Timeout	IN	INT	2	No. of Repeats on Timeout; Default: 2
L2_UnbalMaster_noCL2Poll	IN	BOOL	FALSE	only unbalanced master: Polling only with Class1-Request, no Class2-Requests
L2_E5_as_ACK_NACK	IN	BOOL	TRUE	1 -> E5 will be accepted as ACK (FC0) and NACK (FC9); Default: 1
L2_Use_FC7	IN	BOOL	FALSE	1 -> FC7 (Reset FCB) will be used instead of FC0 (Reset communication unit)
Next_Info	IN	BOOL	FALSE	Only allowed for additional calls in a Cycle ->reduced operation -> next info
Do_Restart	IN	BOOL	FALSE	a rising edge restarts the IEC-Application
First_internal_DB_No	IN	INT	50	First DB-Number for DBs created by the Runtime Software; Default: 50;
Serial_from_CPU	IN	BOOL	FALSE	for Registration use serial number from CPU instead of memory card
P_Application_T103	OUT	DWORD	DW#16#0	Pointer to Application Functions (SL_x, MA_x)
L2_Error_Link	OUT	BOOL	FALSE	Set, if Connection is not established
FB_RetVal	OUT	INT	0	positive Values -> ok; negative Values (16#8xxx) -> Error
More_Info_available *3)	OUT	BOOL	FALSE	Set, if more information is available for processing in the actual OB1-cycle.
Time_DS	IN/OUT	BOOL	FALSE	Time-Qualifier Daylight Saving (Summertime)
Time_IV	IN/OUT	BOOL	TRUE	Time-Qualifier Time is Invalid
Time_SY	IN/OUT	BOOL	FALSE	Time-Qualifier Time is synchronized (actually only internal used)
Time_Diff	IN/OUT	Time	T#0MS	Time difference between CPU-Time and desired IEC-Time-Stamps

*1) Parameter only present in product version for S7-400
*2) Parameter only present in product version for S7-300 and ET 200S
*3) Parameter only present in variants up to V1.4

3.3.2. IEC 60870-5-103 Master-Parameter for WinAC

Communication-FB		Type	Default	Block-Comment/brief description.
Registration_Code	IN	DWORD	DW#16#0	!!! IMPORTANT !!! See product information
Line_ID	IN	INT	1	For differentiation of more than one line;1-255; Default: 1;
L1_COM_or_Laddr	IN	INT	1	COM-Port (ext. ser. drv) or address of CP-Module in your HW-Configuration
L2_Link_Address	IN	DINT	L#1	Link-Address: 1-254, 1-65534; Default: 1
L2_TimeOut_SendConfirm	IN	TIME	T#2S	Timeout for answers; Default: 2 sec (T#2s)
L2_Time_Pollcycle	IN	TIME	T#500ms	only unbal.mode master: time between two polls, if no ACD is in answer(T#500ms)
L2_TimeOut_RcvInfo	IN	TIME	T#30S	unbal. Slave -> Cycle Error, bal mode -> Linktest, 0 -> not active, Default 30s
L2_Repeats_on_Timeout	IN	INT	2	No. of Repeats on Timeout; Default: 2
L2_UnbalMaster_noCL2Poll	IN	BOOL	FALSE	only unbalanced master: Polling only with Class1-Request, no Class2-Requests
L2_E5_as_ACK_NACK	IN	BOOL	TRUE	1 -> E5 will be accepted as ACK (FC0) and NACK (FC9); Default: 1
L2_Use_FC7	IN	BOOL	FALSE	1 -> FC7 (Reset FCB) will be used instead of FC0 (Reset communication unit)
Next_Info	IN	BOOL	FALSE	Only allowed for additional calls in a Cycle ->reduced operation -> next info
Do_Restart	IN	BOOL	FALSE	a rising edge restarts the IEC-Application
First_internal_DB_No	IN	INT	50	First DB-Number for DBs created by the Runtime Software; Default: 50;
Para_DB_No	IN	INT	90	DB-Number which contains the settings for ext. serial driver (Default:90)
P_Application_T103	OUT	DWORD	DW#16#0	Pointer to Application Functions (SL_x, MA_x)
L2_Error_Link	OUT	BOOL	FALSE	Set, if connection is not established
FB_RetVal	OUT	INT	0	positive Values -> ok; negative Values (16#8xxx) -> Error
Z_Info	OUT	WORD	W#16#0	additional information in case of errors
More_Info_available *1)	OUT	BOOL	FALSE	Set, if more infos are available for processing in the actual OB1-cycle.
Time_DS	IN/OUT	BOOL	FALSE	Time-Qualifier Daylight Saving (Summertime)
Time_IV	IN/OUT	BOOL	TRUE	Time-Qualifier Time is Invalid
Time_SY	IN/OUT	BOOL	FALSE	Time-Qualifier Time is synchronized (actually only internal used)
Time_Diff	IN/OUT	Time	T#0MS	Time difference between CPU-Time and desired IEC-Time-Stamps

*1) Parameter only present in variants up to V1.4

3.3.3. Parameter description

Registration_Code	The MMC (S7-300, ET 200S) or MC (S7-400) is used as a dongle. Depending on its serial number, you will receive a registration/activation code from Siemens which you need to specify here. No entries or the incorrect entries will permit the unrestricted operation in demo mode for 15 min. After this period, the telecontrol communication will be stopped. For more details, refer to '**FB_RetVal**' and the software protection chapter. Alternatively also the number of the data block containing a list of registration codes can be entered here. The permissible range for entering a DB 1 up to 2000 (decimal); e.g. DB1000 -> DW#16#3E8 For further details please refer to ,**FB_RetVal**' and chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**.
Line_ID	Is only relevant if you call up the communication block multiple times (as another instance with a separate DB) to realize an additional IEC link. The calls then need to be identified using different Line_IDs.
L1_COM_or_Laddr	Number of the COM Interface (in the hardware configuration) which is used for the transmission of the IEC 60870-5-101 protocol. In case of using a CP340 for transmission the corresponding address has to be entered (still not released)
L1_Local_ID	Is the ID from the connection configuration (NETPRO) e.g. w#16#1000. The value can be taken from NETPRO/properties TCP connection/module parameters.
L1_Laddr_HW	Is the address of the CP allocated/shown in the hardware configuration.
L2_Link_Address	Link_address is the address value of the link layer The length of the Link address is fixed to 1 Byte. Permissible range with length of link address 1 is 1 to 254 If there is more than one device connected to one channel (line operation) you have to use a link address parameter data block. Detailed description see chapter 3.3.4
L2_TimeOut_SendConfirm	Maximum time for responses in balanced mode and unbalanced mode master, incl. the message transfer time itself, in other words, depending on the baud rate. After the time elapses, the last message is repeated. If the repetitions are still unsuccessful (para **L2_Repeats_on_Timeout**), the link is marked as faulted (**L2_Error_Link)** and re-established
L2_Time_Pollcycle	Only with unbalanced mode master: Time [ms] between 2 call messages if there is no high priority data.
L2_TimeOut_RcvInfo	Every correctly received message re-triggers the monitoring timer. When the time set here elapses, the response is as follows, depending on the traffic type: Unbalanced mode slave: -> link error-> (**L2_Error_Link)** balanced mode -> send link test FC2 (whose response must be received, which is monitored)
L2_Repeats_on_Timeout	Refer to **L2_TimeOut_SendConfirm**
L2_UnbalMaster_noCL2Poll	Only relevant with unbalanced mode master: If TRUE, instead of the normal cyclical class 2 interrogations, only class 1 interrogations are implemented. This increases the data through-put with relevant partners.
L2_E5_as_ACK_NACK	If activated single characters are accepted depending on E5 situation as: - positive acknowledgment (ACK FC0) - no user data available (NACK FC9) Independent from this adjustment always short messages are sent. No single characters are used.

L2_Use_FC7	Adjustment of the function code used for scaling:
	FALSE: -> Function-Code 0
	     Reset FCB and Reset of the communication unit
	     (Indications in the send buffer are deleted)
	TRUE: -> Function-Code 7
	     only Reset FCB

Next_Info

Only relevant at Master-Applications.

The parameter **Next_Info** informs the config block that a repeated request occurs within one (OB) cycle. This serves only for handing over the next blocked information. In this case a reduced cycle through the ‚Master chain' occurs.

For further details of increasing the flow rate at Master-Applications please refer to chapter **3.4**.

Do_Restart

Not all parameter are effective in case of online changes (without CPU Stop/Start). The control input enables the save transfer from online changed parameters without CPU Stop/Start.

With rising edge the IEC-application is new initialized with the values programmed at the block inputs and started.

First_internal_DB_No

The IEC application generates during start-up different data blocks (diag DB, message memory. etc.) The parameter defines the first DB number for creating this (default: 50).

Para_DB_No

When using the COM interface on the mEC31 or microbox PC (nanobox PC) for WinAC an external interface driver is required. The communication performance of this external driver is provided in a parameter data block. It's DB No. (default DB90) has to be assigned to the Communication-FB input 'Para-DB_No'.

Serial_from_CPU

Selection whether the serial number of the Memory card or the serial number of the CPU is used for the licensing.
FALSE: Use serial number of the Memory card
TRUE: Use serial number of the CPU

P_Application

Pointer (DWORD) for the interconnection of the application blocks.
The interconnection can be carried out directly in the CFC plan.
With manual programming you assign the output, e.g. to a free memory (MD) or to a temporary variable which you then specify on the relevant input variables of the application blocks.

L2_Error_Link

Signals the communication status to the connection partner, resp. error, as follows:
FALSE: communication established
TRUE: communication error
Errors are formed as follows depending on the traffic type:

With Point to point connections:
True: if the connection partner can't be contacted anymore.

As unbalanced mode slave:
TRUE: No message reception within the programmable time
                period **L2_TimeOut_RcvInfo**

As unbalanced mode master or in balanced mode:
                Please refer to the parameter description
                L2_TimeOut_SendConfirm

With line operation (unbalanced mode Master):
SET   if no device answers
RESET   if at least one device answers.
Device specific Link-Error will be written to the link address parameter data block.

FB_RetVal

The signaling of the functional block is as follows:
W#16#0000   No error
W#16#0001 – 0900   block in demo mode.
                              Remaining runtime in seconds in BCD
                              -> can be read directly in hex display

Error:

W#16#8101   Error when generating data blocks.
                              Cause could be working memory too less

W#16#8201   Problem with registration code and demo time
                              expired
                              -> Enter correct registration code on the parameter input
                              Registration_Code.

Z_Info

In case of error, you'll find here additional information.

More_Info_available **(only up to V1.4)**	Only relevant at Master-Applications The parameter **More_Info_available** signalizes that further information (from a blocked message) is directly available which could be handed over in one of the following cycle (refer also to the parameter **Next_Info)**. For further details of increasing the flow rate at Master-Applications please refer to chapter **3.4**. .
Time_DS	IN/OUT variable: Summer time bit of the current time. Displays the current time status, if the variable is being read exclusively. It can be affected when the assigned variable is forced. The bit is transferred in IEC messages with a time stamp direct into SU
Time_IV	IN/OUT variable: Invalidity bit of the current time. Displays the current time status, if the variable is being read exclusively. It can be affected when the assigned variable is forced. The bit is transferred in IEC messages with a time stamp direct into IV
Time_SY	IN/OUT variable: Synchronization status of the current time. Displays the current time status, if the variable is being read exclusively. It can be affected when the assigned variable is forced. The bit is not used in IEC messages
Time_Diff	Time difference in comparison to CPU base time. The value specified here [ms] is added to the current time in the CPU and the result is used as a time stamp for IEC messages. This means that time corrections such as local time calculations with CPU time on the basis of GMT can be implemented.

NOTICE

Please note the permissible valuation of the block parameters. They are not mandatory checked for plausibility. Incorrect inputs can cause unpredictable responses and incorrect functions.

3.3.4. Link-Address parameter-DB for line operation

Operation with several devices at a polling line (RS232 or RS485) is supported.

The link addresses of the devices at the line have to be different.

If there is more than one device connected to one channel (line operation) the parameterizing of the link addresses is carried out via a link address parameter data block. The number of this data block has to be stated at the input parameter of the ,L2_Link_Address' from the S7_IEC_Config-Block.

If the address setting has to be carried out via a link address parameter DB, an offset of 100000000 (eight zeros) has to be entered there.

If the addresses are taken from the DB111 for example, in the ,L2_Link_Address' the value L#100000111 has to be entered.

In the parameter DB the link addresses have to be entered in the sequence of the devices to be polled. Single devices can be marked as reserve by setting the 'Link_Reserved' entry in the parameter DB to 'TRUE'.

In case of processing information with different ASDU addresses from one device (defined via the link address) the use of an ASDU address parameter DB is provided. For this you find a detailed description in chapter 4.1.2.

System related the maximum number of the link and ASDU addresses is only limited by the DB length. Up to 8 link and ASDU addresses have been tested.

A broad summary of the physically and program technically coherences is shown in the graphic below.

The assignment from the ASDU addresses to the link addresses is necessary:

in control direction for searching the path,

in monitoring direction for trouble shooting of single devices (protection devices)
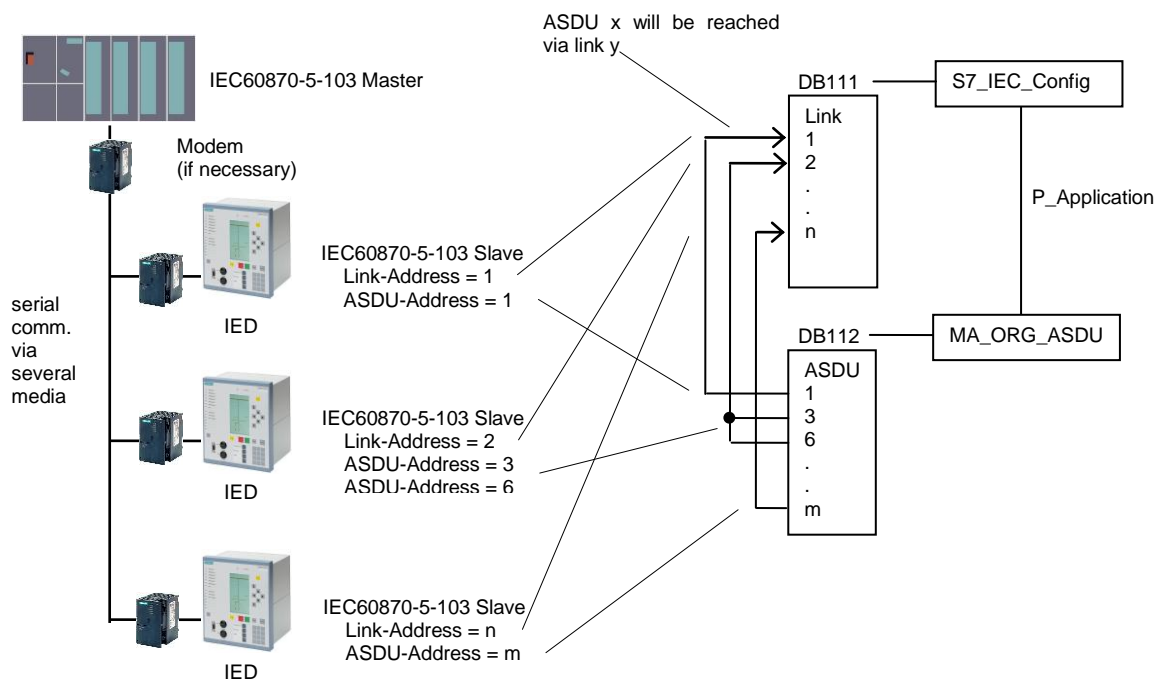
Polling structure for several devices (links) and several ASDU-Addresses per device.

Structure and values of the Parameter-Data block:

The Parameter-DB has the following basic structure:

Group/ Parameter	Addr. rel.	Addr. Abs	Type	Initial value	Comment
DB_Manag	0	0	STRUCT		
DB_Manag. **Pos_of_DB**	+0.0	0.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **No_of_all_DBs**	+1.0	1.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Act**	+2.0	2.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Prev**	+4.0	4.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Next**	+6.0	6.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **Reserved**	+8.0	8.0	WORD	W#16#0	reserved for future - do not change!
	+10.0	10.0	END_STRUCT		END_STRUCT (10 BYTE)
Info_Manag			STRUCT		
Info_Manag. **P_Byte_First_Info**	+0.0	10.0	INT	34	(Byte-) Position of first Para-Block - do not change!
Info_Manag. **No_of_Infos**	+2.0	12.0	INT	0	0:unspecified (DB is filled up to the end); otherwise size n of ARRAY [1..n]
Info_Manag. **Len_Info**	+4.0	14.0	BYTE	B#16#4	Difference in [byte] between two Para-Blocks - do not change!
Info_Manag. **Len_Sort_Key**	+5.0	15.0	BYTE	B#16#0	0: without sorting; > 0: Data sets are sorted ascending with x Bytes
DB_Manag. **Re_internal_usage**	+6.0	16.0	DWORD	DW#16#0	
	+10.0	20.0	END_STRUCT		END_STRUCT (10 BYTE)
Global			STRUCT		
Global. **Link_Para_Type**	0.0	20.0	BYTE	B#16#0	reserved for future - do not change!
Global. **Class_1_Requests**	1.0	21.0	BYTE	B#16#3	Parameter: Max no. of Class 1 requests for a station before going to the next
Global. **Act_Parablock**	2.0	22.0	INT	0	actual processed parablock at runtime -> 'read only'
	4.0	24.0	END_STRUCT		END_STRUCT (4 BYTE)
Link_Para			ARRAY [0..n] STRUCT		n = number-1 of the parameter entries
Link_Para **Link_Error**	+0.0	24.0	BOOL	TRUE	actual state of this link connection at runtime -> 'read only'
Link_Para **Link_Reserved**	+0.1	24.1	BOOL	FALSE	Parameter: Set if you actually don't want to use this link
Link_Para **Res_1**	+1.0	25.0	BYTE	B#16#0	
Link_Para **Link_Address**	+2.0	26.0	DINT	L#0	Parameter: Link address
Link_Para **Res_2**	+6.0	30.0	INT	0	
Link_Para **PRM_State**	+8.0	32.0	BYTE	B#16#0	Internal
Link_Para **L2_Send_FCB**	+9.0	33.0	BOOL	FALSE	Internal
Link_Para **L2_PRM0_ACD**	+9.1	33.1	BOOL	FALSE	Internal
Link_Para **Res_3**	+10.0	34.0	DINT	L#0	
Link_Para **Res_4**	+14.0	38.0	INT	0	
	16.0	40.0	END_STRUCT		END_STRUCT (16 BYTE)

	These values are pre-adjusted in the sample DB and have not to be changed. A sample DB is enclosed in the particular block libraries. DB111 = ‚P_LinkAdr_n'.
	!!! These Parameters have to be adjusted !!!
	Note: Changes have to be performed always in the ‚Data view', and not in the ‚Declaration view' (except dimensioning of the array).

DB_Management

Parameter blocks which include an enumeration are constructed so, that more than one data block can be used if required. The following information is required for management.
Currently the DB management is not used – for this reason all parameters can be left at their default settings (0)

Pos_of_DB

Number (1 – n) of the current data block for the parameter block
0: not used

No_of_all_DBs

Total number (n) of data blocks for the parameter block
0: not used

DB_No_Act

DB number of the current data block
0: not used

DB_No_Prev

DB number of the previous data block, if one exists.
Otherwise: 0

DB_No_Next

DB number of the subsequent data block, if there is another one.
Otherwise: 0

Info_Management

Parameter blocks containing an enumeration have one information block 'Info management'. It contains following information
The values of the information management parameters are already preset and therefore do not need to be modified.

P_Byte_First_Info

Byte position of the first data record in this DB, may not be changed

No_of_Infos

Number of data records contained in this DB
0: unspecified -> the data block end marks the last data record

Len_Info
Len_Sort_Key

Length of the data records:
In this case 4: may not be changed
0: no sorting (default setting)
Other sort lengths are not supported when using as parameter DB for Individual IEC addressing.

Global Parameter

Class_1_Requests

Maximum number of class 1 requests until switching forward to the next device.

Act_Parablock

This value gives information about the actual processed parameter block.
-> access only reading.

Link_Para

The dimensioning of the array happens in the declaration layer of the data block. It has to be carried out according to the number of devices which have to be requested.

n+1 devices are requested.

Link_Reserved

Deactivates the request for this device.
FALSE: The device will be requested
TRUE: The device will be not requested (reserve)

Link_Address

Link_address is the value of the link layer address
The link address length is fixed to 1 Byte
The permissible range for link address length 1 is 1 up to 254

NOTICE

Please note the permissible valuation of the block parameters. They are not mandatory checked for plausibility. Incorrect inputs can cause unpredictable responses and incorrect functions.

3.4. Improvement of the IEC-Master performance

In normal case in each OB1 cycle one information is processed. This may lead to problems in case of receiving blocked information and longer OB1 cycle times.

In order to process more than one information per cycle the 'Master-Chain', this means the Communication-FB and all evaluation blocks, could be called principally several times (but always the complete Master-Chain).

In this case all functions would be passed every time. This is not necessary in order to evaluate only a further information from a blocked message.

In the Communication-FB (T103_S7_IEC_Config) from the Master applications therefore parameters have been established which allow a reduced cycle of the 'Master-Chain'. This can be used as follows:

> 'More_Info_Available' signals that further information (from a blocked message) is actual existing which could be handed over in a subsequent cycle.

> 'Next_Info' informs the Config-block that a repeated call is executed within a (OB-) cycle only for the purpose to hand over the next blocked information.

With programming a suitable loop an increasing of the performance when receiving blocked messages can be achieved.

Example for the programming:

```
// Master
   SET
   R   #Next_Info

   L   10
Loop: T   #L_Count

   CALL "T103_S7_IEC_Config" , DB170
    Next_Info          :=#Next_Info
    More_Info_available  :=#More_Info_Available
   CALL "MA_Org_Asdu" , DB171

   CALL "T103_MAo_IND_SLi_T104"
… (further evaluation blocks)

// set Rep after the first cycle
   SET
   U   #More_Info_available
   S   #Next_Info
   SPBN WWW
   L   #L_Count
   LOOP Loop
WWW: NOP  0
```

The loop shown above is causing the processing and output of up to 10 (#L_Count) information from a received blocked message within one OB1-cycle. The drop is carried out if #More_Info_available=FALSE or the loop counter is #L_Count=0.

Wiring the Communication-FB input Next_Info with the variable #Next_Info is causing thereby the reduced cycle of the 'Master-Chain'. In this case an explicit enhanced information performance has been reached with only slight increased cycle time.

The size of the loop counter should be selected in such a way to reach a possible optimum ratio between performance increase and extension of the maximum cycle time. Normally 10 should be a practicable value.

Note:

From version V1.5 up to 10 information objects are internal provided per cycle and edited from the Mao blocks. This is carried out independently of the use of the blocks, in Master or Slave communication in standard or reversed direction.

The possibility to improve the performance described in this chapter for the Master library is no longer necessary. It is inapplicable including the related parameter.

4. Application blocks

SILPUS RIC IEConS7 supports the Master function for IEC 103, i.e. existing IEC 103 Slaves (protection devices, transducer, etc.) are interrogated.

Furthermore the application blocks provide an interface for an IEC 101 resp. IEC 104 Slave application. The information can be transferred mostly without parameter to a primary IEC 101 resp. IEC 104 Master.

NOTICE

All application blocks are designed exclusively for the **priority class OB1**. The communication blocks ('T103_S7_IEC_Config') also need to be operated in this priority class!

Note to the CFC plan view

The CFC views included in the manual are used exclusively for explanation purposes. CFC is **not** required for using the blocks.

The standard programming options in SIMATIC are sufficient.

4.1. Master Blocks MA

Master blocks (MA)
(IED Connection)

All blocks are also multiple applicably
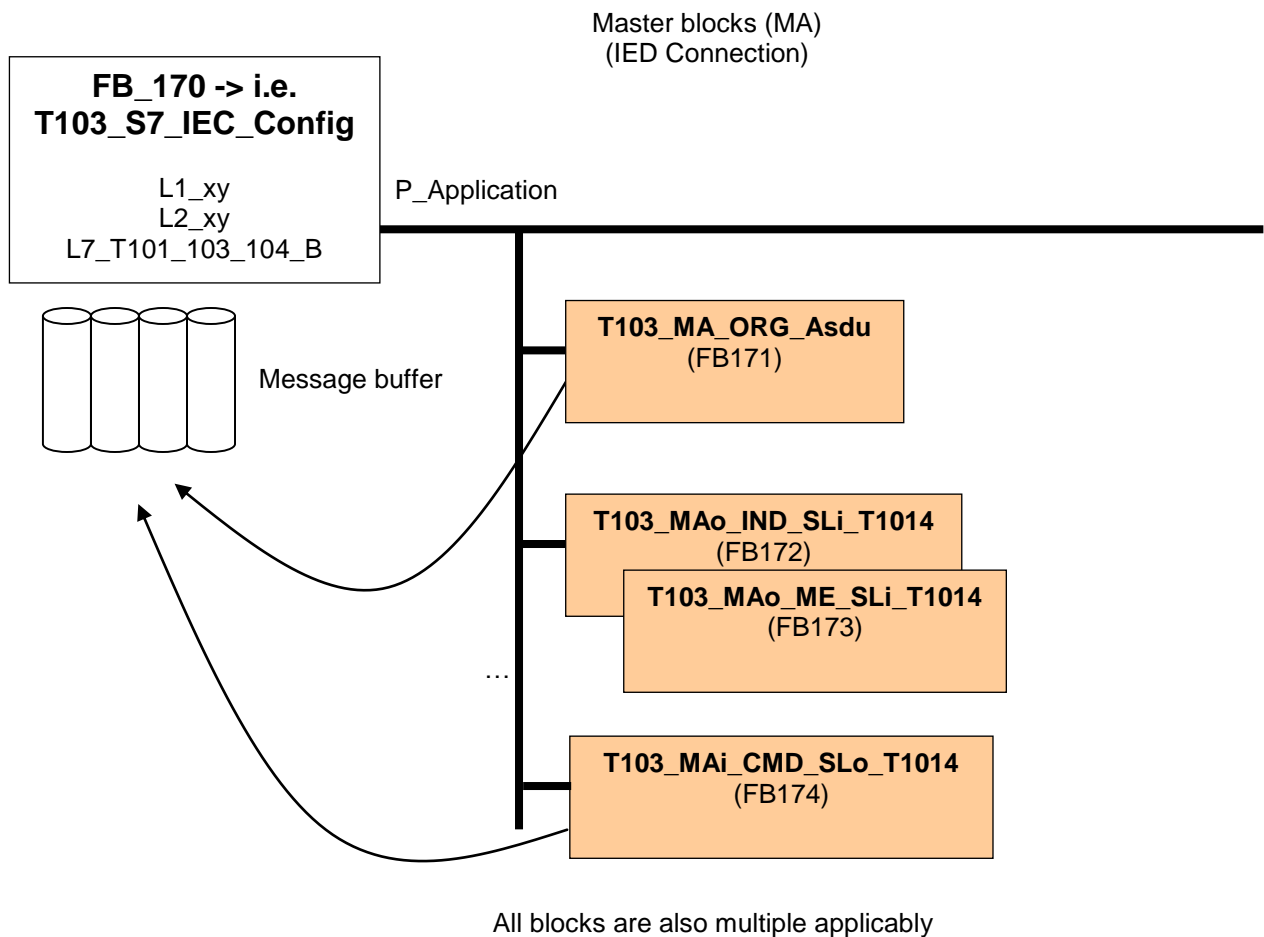
The Master (MA) application blocks are connected via the pointer 'P_Application' to the IEC 103 protocol version supplied, i.e. the functional block 'T103_MA_Org_Asdu_1' and the blocks for the outputs in monitoring direction (MAo) as well as the inputs in control direction (MAi) are coupled directly to the IEC 103 interface connection.

The following blocks are available:

> MA_Org block for organizational tasks per ASDU address, such as send time, GI after link error.
> MAi blocks for the activation and monitoring of commands.
  One block for all commands.
> MAo blocks for the output of messages and measured values.
  One block per information type.

The parameterizing of the information is carried out by means of a data block. This contains 'global parameter' as well as 'allocation tables' and the actual states and values (image). A detailed description can be found in the following chapters.

Note:

The application blocks are designed exclusively for priority level OB1. The IEC communication blocks need to be operated as well in the OB1!

4.1.1. Organization block - T103_MA_ORG_ASDU (FB171)
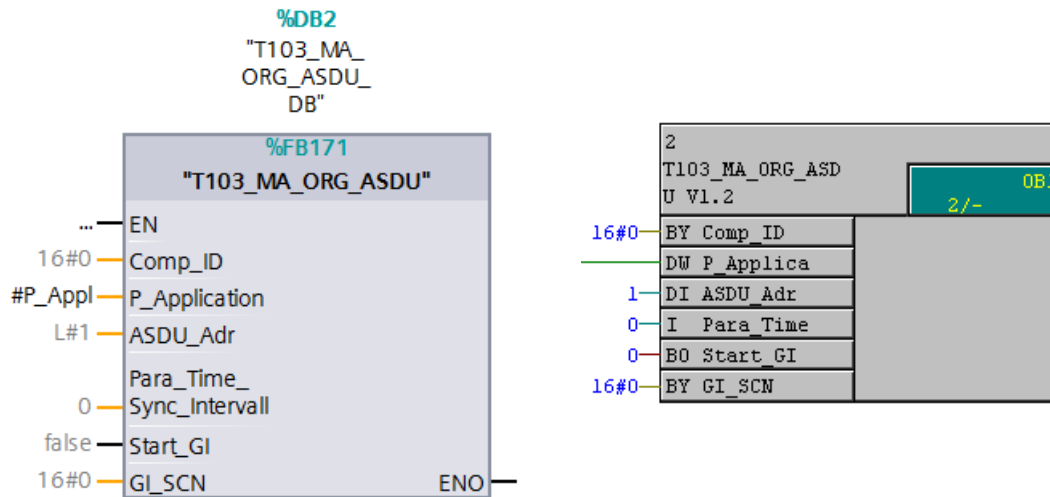
Display as FUP block with default values   Display as CFC block with default values

The block has been constructed as a function block (FB), and therefore requires an instance DB (e.g. Call FB171,DB171) or can be used within a higher level FB as a 'multi-instance'.

The task of T103_MA_ORG_ASDU is the station monitoring for the parameterized ASDU address concerning:

> Detected link error (from link layer L2)

T103_MA_Org_ASDU is Multi-ASDU capable and supports the processing of several ASDU addresses per station/device.

Depending on the events the following actions are executed:

> GI request
  - After outgoing link error

> Clock adjustment request (TI103), if activated
  - after 'link error' going
  - In cyclical intervals according to parameterization

The block can also execute interrogation commands 'manually' by activating the relevant input and setting the associated identifier.

> (General) interrogations

Note:

From V1.2 polling lines with IEC 103 connections and several stations per interface are also supported.

Block parameters with their default assignment and brief comment

FB171		Type	Default	Block comment/brief description
Comp_ID	IN	BYTE	0	Identifier for Diagnostic-Functions
P_Application	IN	DWORD	0	Pointer which must be connected to 'S7_IEC_Config' – Module
ASDU_Adr	IN	DINT	L#1	ASDU-Address which will be controlled by this module Default L#1
Para_Time_Sync_Intervall	IN	INT	0	Send Clock synchronization command cyclic [min] or never (0 = default)
Start_GI	IN	Bool	FALSE	a rising edge will start an interrogation command with parameterized GI_SCN
GI_SCN	IN	BYTE	B#16#0	IEC-Qualifier SCN (scan number) of GIs (Default: B#16#0)

Parameter and functional details:

Comp_ID

Block identifier for (currently only internal) diagnostic functions. Assign different numbers within a block type as byte variable.
e.g. B#16#1

P_Application

P_Application is a pointer to a common data range of block S7_IEC_Config. Therefore it has to be interconnected to its output P_Application via a DWord variable. The Config block receives user data such as 'ASDU address', receiver buffer, etc. via this pointer or the data range behind it.

ASDU_Adr

Address value of the Application-Service-Data-Unit processed and inserted into send messages from this block.
At protection devices the ASDU-Address normally complies with its device resp. link address.
Permissible range is 1 to 254

The broadcast address 255 (FFh) is valid as well and may be given, if the remote station in a point-to-point connection transmits the information with several ASDU addresses.
In devices with several defined ASDU addresses or with several devices at one polling line, the number of an ASDU address parameter DB has to be given here

For more details refer to chapter 4.1.2.

Para_Time_Sync_Intervall

Time interval for sending a time synchronization message (TI103)
Permissible range at 0 to 65535.
Value 0: none
Value 1-x: Interval in min. In this interval time adjusting messages TI103 are sent to the partner.

Start_GI

With a rising edge an interrogation command (TI7)
is started with interrogation identification according to parameter 'GI_SCN'.
If a defined ASDU address is parameterized at the input ‚ASDU_Adr' this ASDU address will be used.
When using an ASDU address parameter DB the broadcast address 255 (FFh) is used.

Note:
To avoid entries into the send buffer when the link layer has not been constructed, the trigger should be linked to LINK_ERR.

GI_SCN

Interrogation identification 'SCN' according to the standard, for transmitting a manual started interrogation command.
Permissible values: 0 to 255
The interrogation is started with a rising edge at 'Start_IC'.

4.1.2. ASDU-Address Parameter-DB

From V1.2 the FB ,MA_Org_ASDU_1' is Multi-ASDU capable and supports the processing of several ASDU addresses per device.

In case of processing information with different ASDU addresses in one device (defined via the link address) the ASDU address parameter DB can be used for this.

For execution of a polling line with several devices at one line the use of the ASDU address parameter DB is mandatory. Furthermore the use of the ASDU address parameter DB can be useful as well if only one device (point-to-point operating) is connected, in order to achieve a structuring of the information to be transmitted.

In addition to the parameterization of the ASDU addresses the assignment to the link address is carried out in this data block too. The number of this data block has to be indicated at the input parameter 'ASDU_Adr' of the 'MA_Org_Asdu' block.

If the address setting has to be carried out via an ASDU address parameter DB, an offset of 100000000 (eight zeros!) has to be entered there.

If the addresses are taken from the DB112 for example, the value of L#100000112 has to be entered in the 'ASDU_Adr'.

In the parameter DB the ASDU addresses and the assignment to the corresponding device (link address) have to be indicated. The path for reaching the respective ASDU is defined via this assignment.

System related the maximum number of the link and ASDU addresses is only limited by the DB length. Up to 8 link and ASDU addresses have been tested.

Design and values of the parameter data block:

The parameter-DB has the following basic design:

Group/ Parameter	Addr. rel.	Addr. Abs	Type	Initial value	Comment
DB_Manag	0	0	STRUCT		
DB_Manag. **Pos_of_DB**	+0.0	0.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **No_of_all_DBs**	+1.0	1.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Act**	+2.0	2.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Prev**	+4.0	4.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Next**	+6.0	6.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **Reserved**	+8.0	8.0	WORD	W#16#0	reserved for future - do not change!
	+10.0	10.0	END_STRUCT		END_STRUCT (10 BYTE)
Info_Manag			STRUCT		
Info_Manag. **P_Byte_First_Info**	+0.0	10.0	INT	34	(Byte-) Position of first Para-Block - do not change!
Info_Manag. **No_of_Infos**	+2.0	12.0	INT	0	0:unspecified (DB is filled up to the end); otherwise size n of ARRAY [1..n]
Info_Manag. **Len_Info**	+4.0	14.0	BYTE	B#16#4	Difference in [byte] between two Para-Blocks - do not change!
Info_Manag. **Len_Sort_Key**	+5.0	15.0	BYTE	B#16#0	0: without sorting; > 0: Data sets are sorted ascending with x Bytes
DB_Manag. **Re_internal_usage**	+6.0	16.0	DWORD	DW#16#0	
	+10.0	20.0	END_STRUCT		END_STRUCT (10 BYTE)
Global			STRUCT		
Global. **Glob_R1**	0.0	20.0	INT	0	
Global. **Glob_R2**	2.0	22.0	WORD	W#16#0	
	4.0	24.0	END_STRUCT		END_STRUCT (4 BYTE)

ASDU_Adr_Para			ARRAY [0..n] STRUCT		n = number-1 of the parameter entries
ASDU_Adr_Para **ASDU_Address**	+0.0	24.0	DINT	L#0	Parameter: ASDU address
ASDU_Adr_Para **Link_Para_DB**	+4.0	28.0	INT	0	Parameter: associated link db no. - 0 -> direct (no link db available)
ASDU_Adr_Para **Link_Para_Pos**	+6.0	30.0	INT	0	Parameter: parablock no. in link db
ASDU_Adr_Para **Error**	+8.0	32.0	BOOL	FALSE	internal
ASDU_Adr_Para **Res_1**	+9.0	33.0	BYTE	B#16#0	internal
ASDU_Adr_Para **Res_2**	+10.0	34.0	DINT	L#0	internal
ASDU_Adr_Para **Res_3**	+14.0	38.0	INT	0	internal
	16.0	40.0	END_STRUCT		END_STRUCT (16 BYTE)

	These values are preset in the sample DB and must not be changed. A sample DB is included in the relevant block libraries. DB112 = 'P_ASDUAdr_n'.
	!!! These parameters you have to set!!!
i	**Note:** Always make changes in the 'Data view', not in the 'Declaration view' (except dimensioning of the array)

DB_Management

Parameter blocks which include an enumeration have been especially constructed so that more than one data block can be used if required. The following information is required for management.
Currently the DB management is not used – for this reason all parameters can be left at their default settings (0)

Pos_of_DB

Number (1 – n) of the current data block for the parameter block
0: not used

No_of_all_DBs

Total number (n) of data blocks for the parameter block
0: not used

DB_No_Act

DB number of the current data block
0: not used

DB_No_Prev

DB number of the previous data block, if one exists.
Otherwise: 0

DB_No_Next

DB number of the subsequent data block, if there is another one.
Otherwise: 0

Info_Management

Parameter blocks containing an enumeration have one information block 'Info management'. It contains the following information
The values of the information management parameters are already preset and therefore do not need to be modified.

P_Byte_First_Info

Byte position of the first data record in this DB, may not be changed

No_of_Infos

Number of data records contained in this DB
0: unspecified -> the data block end marks the last data record

Len_Info

Length of the data records:
In this case 4: may not be changed

Len_Sort_Key

0: no sorting (default setting)
Other sorting lengths are not supported when using as parameter DB for optional IEC-addressing.

Global Parameter

Glob_R1   Reserve, not used

Glob_R2   Reserve, not used

ASDU_Adr_Para   The dimensioning of the array is carried out in the declaration view of the data block. It has to be done according to the number of the requested ASDU address-es.

n + 1 ASDU-Addresses are requested.

ASDU_Address   Address value of the Application-Service –Data-Unit, receiving the commands from the MA_Org_ASDU block.
Permissible range is 1 up to 254
Permissible range for length of the ASDU-address 2 is 1 up to 65534
The broadcast address 255 (FFh) is automatically used from the block if necessary (e.g. for the clock synchronization with TI103)

Link_Para_DB   Refers to the assigned link address parameter DB
1 - n: Number of the assigned link address parameter DB
0:          no link address parameter DB available (default setting)
           This setting has to be selected, when only one device with several ASDU addresses has to be requested.

Link_Para_Pos   Refers to a parameter block in the link address parameter DB and defines the link address (station/device) the ASDU belongs to.
0 – n   Number of the assigned parameter block in the link address parameter DB

Error   Indicates whether the connection to the ASDU address is disturbed:
FALSE: ASDU is not disturbed
TRUE: ASDU is disturbed

NOTICE

Please note the permissible valuation of the block parameters. They are not mandatory checked for plausibility. Incorrect inputs can cause unpredictable responses and incorrect functions.

4.1.3.   Output/Input blocks - T103_MAo_xyz_SLi_T1014

For the various information types in the monitoring direction, output/input blocks (FBs) are available which have to be 'interconnected' via the pointer 'P_Application' with the relevant IEC 103 protocol version supplied. The blocks then react on the receive messages with the corresponding type identifier and take over from these values and qualifier which are written into an image in the data block (output function)

The 'routing' from IEC information objects to the desired image positions, as well as the transfer of basic settings/parameters, is carried out in an allocated parameter/image data block.

If the blocks are additional connected to P_SLi from an IEC 101/104 Slave they transmit the information to this application (input function). The respective block functions as node, transmitting the information from the subordinated IEC103 Slave(s) to the superior IEC 101/104 Master (e.g. telecontrol center).

The symbol name encrypts the most important block properties as follows:

T103_MAo_IND_SLi_T1014	The block processes messages of the IEC 60870-5-103 protocol
T103_**MAo**_IND_SLi_T1014	MAo is the abbreviation for Master block output. The block issues the information contained in the IEC 103 messages (in this case to a parameter/image DB).
T103_MAo_**IND**_SLi_T1014	Indication types supported from this block IND = Indication
T103_MAo_IND_**SLi_T101**4 T103_MAo_IND_SLi_**T10**14	SLi is the abbreviation for Slave Input blocks, blocks for process capturing from the view of the Slaves. The block provides the IEC 103 information to other applications (input function). This can be an IEC 60870-5-**101** Slave or an IEC 60870-5-**104** Slave. In this case the block is operated as a combined input/output block (node block) with protocol converter function.

The available T103_Mao_xyz_Sli_T1014 function blocks can be found in the overview below.

Block	Block No.	Parameter/ image DB no. (Default)	Routing from … …..to image (DB) and T101/4./4,
T103_MAo_IND_SLi_T1014	FB172	DB172	… Indication (TI1, 2) …
T103_MAo_ME_SLi_T1014	FB173	DB173	… Measured values (TI3, 4, 9, 140) …

Presentation of the necessary interconnection – here exemplary in a CFC-plan:
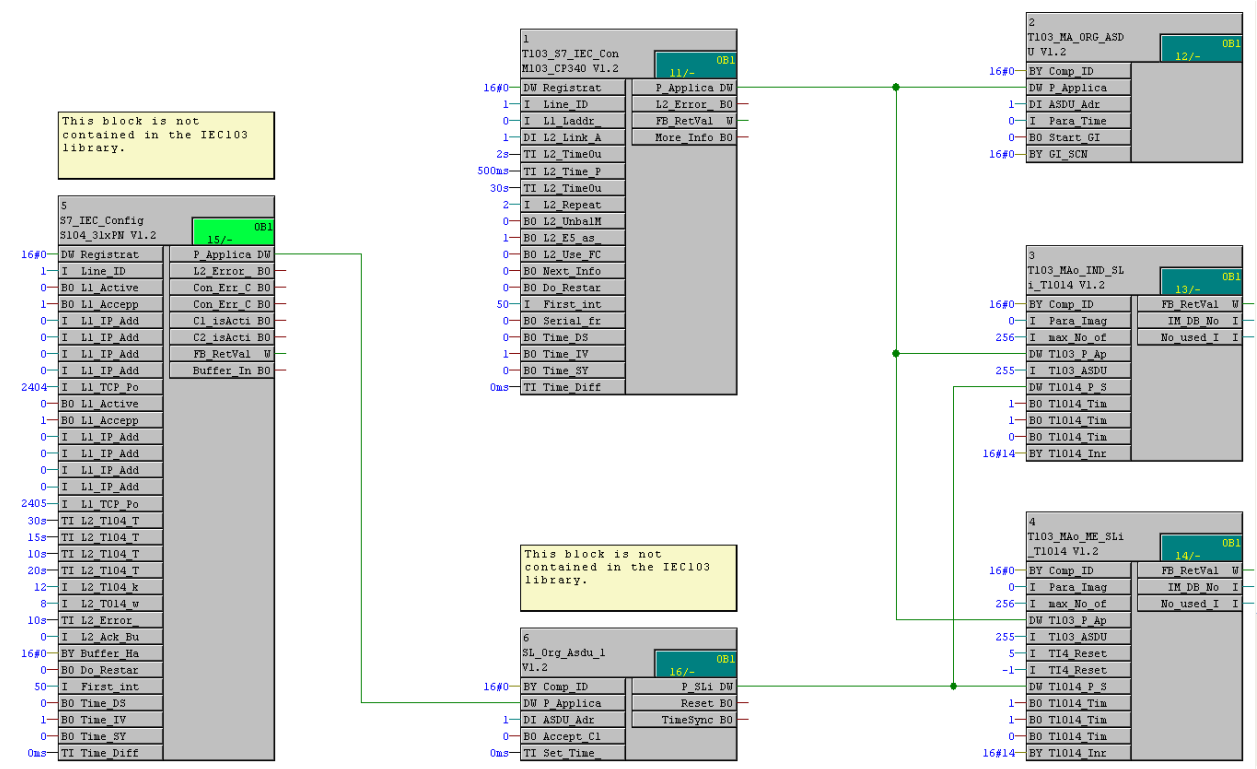
Additionally to the interconnection of the T103 blocks the figure shows the interconnection of T1014_P_SLI, which is necessary for the connection to an IEC 101/104 Slave.

Information for the connection to an IEC 101/104 Slave

You receive the necessary IEC 101/104 Slave blocks with the corresponding IEC 101/104 application. Only blocks from the Version 1.2 can be used.

The parameter/image-DBs have the following basic structure (example of the parameter/image-DBs for measured values):

Group/ Parameter	Addr. rel.	Addr. Abs	Type	Initial value	Comment
DB_Manag	0	0	STRUCT		
DB_Manag. **Pos_of_DB**	+0.0	0.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **No_of_all_DBs**	+1.0	1.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Act**	+2.0	2.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Prev**	+4.0	4.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Next**	+6.0	6.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **Reserved**	+8.0	8.0	WORD	W#16#0	reserved for future - do not change!
	+10.0	10.0	END_STRUCT		END_STRUCT (10 BYTE)
Info_Manag			STRUCT		
Info_Manag. **P_Byte_First_Info**	+0.0	10.0	INT	32	(Byte-) Position of first Para-Block - do not change!
Info_Manag. **No_of_Infos**	+2.0	12.0	INT	0	0:unspecified (DB is filled up to the end); otherwise size n of ARRAY [1..n]
Info_Manag. **Len_Info**	+4.0	14.0	BYTE	B#16#30	Difference in [byte] between two Para-Blocks - do not change!
Info_Manag. **Len_Sort_Key**	+5.0	15.0	BYTE	B#16#0	0: without sorting; > 0: Data sets are sorted ascending with x Bytes
DB_Manag. **Re_internal_usage**	+6.0	16.0	DWORD	DW#16#0	
	+10.0	20.0	END_STRUCT		END_STRUCT (10 BYTE)
Global			STRUCT		
Global. **Para_DB_Type**	0.0	20.0	WORD	W#16#AD	Internal identifier for this Data Block - do not change!
Global. **Internal**	2.0	22.0	Array [1..10] BYTE	B#16#0	Internal use: Last processed info - do not change!
	12.0	32.0	END_STRUCT		END_STRUCT (12 BYTE)

Para_T103_ME			ARRAY [1..n] STRUCT		n = Number of parameter entries
Para_T103_ME[x]. **P_T103_ASDU_Add ress**	+0.0	32.0	Byte	B#16#0	Source(T103): Address of ASDU (Device Address)
Para_T103_ME_[x]. **P_T103_Info_Positi on**	+1.0	33.0	Byte	B#16#0	Source(T103): Position of the measured value inside the telegram; 0=first
Para_T103_ME_[x]. **P_T103_Function_T ype**	+2.0	34.0	Byte	B#16#0	Source(T103): Function Type
Para_T103_ME_[x]. **P_T103_Info_Numb er**	+3.0	35.0	Byte	B#16#0	Source(T103): Information Number
Para_T103_ME_[x]. **P_T1014_IOA**	+4.0	36.0	DINT	L#0	Dest (T101/4): Information object address (IOA)
Para_T103_ME_[x]. **P_T1014_Info_Type**	+8.0	40.0	Byte	B#16#D	Parameter Info_Type -> B#16#9: ME_A; B#16#B: ME_B; B#16#D: ME_C
Para_T103_ME_[x]. **P_T1014_Info_Hand ling**	+9.0	41.0	Byte	B#16#0	Bit 0: Res; Bit 1: Not Requested; Bit 3: PrioH; Bit 4: Reset TI4-Values
Para_T103_ME_[x]. **Int_Res_10**	+10.0	42.0	INT	0	
Para_T103_ME_[x]. **P_Scale_Factor**	+12.0	44.0	REAL	1.000000 e+000	Scale_Factor e.g. 7.326007e-003: 32760 -> ±240 (%)
Para_T103_ME_[x]. **P_Threshold_Value**	+16.0	48.0	REAL	0.000000 e+000	0: without, otherwise the necessary change of the scaled measured value ...
Para_T103_ME_[x]. **Int_ToDo**	+20.0	52.0	Byte	B#16#0	Internal
Para_T103_ME[x]. **Im_State_of_TimeSt amp**	+21.0	53.0	Byte	B#16#0	Image: State of Time Stamp
Para_T103_ME_[x]. **Im_S7_TimeStamp**	+22.0	54.0	DATE_AND_TIME	DT#90-1-1- 0:0:0.000	Image: Timestamp (S7 Date and Time)
Para_T103_ME_[x]. **Im_Value**	+30.0	62.0	REAL	0.000000 e+000	Image: Value of the measurand (S7 Real)
Para_T103_ME_[x]. **IM_State**	+34.0	66.0	Byte	B#16#0	State of the measurand
Para_T103_ME_[x]. **Diag_Count**	+35.0	67.0	Byte	B#16#0	
Para_T103_ME_[x]. **Diag_T103_TI**	+36.0	68.0	Byte	B#16#0	
Para_T103_ME_[x]. **Diag_T103_COT**	+37.0	69.0	Byte	B#16#0	
Para_T103_ME_[x]. **Value_Last**	+38.0	70.0	REAL	0.000000 e+000	Internal
Para_T103_ME_[x]. **Threshold_Memory**	+42.0	74.0	REAL	0.000000 e+000	Internal
Para_T103_ME_[x]. **Res**	+46.0	78.0	INT	0	
	48.0	80.0	END_STRUCT		END_STRUCT (48 BYTE)

	These values are preset in the sample DB and must not be changed. A sample DB is included in the relevant block libraries. DB173 = ‚P_T103_ME' for measured values, DB172 = ‚P_T103_IND' for indications.
	!!! These parameters you have to set !!!
(i)	**Note:** Always make changes in the 'Data view', not in the 'Declaration view' (except dimensioning of the array)

DB_Management

Parameter blocks which include an enumeration have been constructed so that more than one data block can be used if required. The following information is required for management.
Currently the DB management is not used – for this reason all parameters can be left at their default settings (0)

Pos_of_DB

Number (1 – n) of the current data block for the parameter block
0: not used

No_of_all_DBs

Total number (n) of data blocks for the parameter block
0: not used

DB_No_Act

DB number of the current data block
0: not used

DB_No_Prev

DB number of the previous data block, if one exists.
Otherwise: 0

DB_No_Next

DB number of the subsequent data block, if there is another one.
Otherwise: 0

Info_Management

Parameter blocks containing an enumeration have one information block 'Info management'. It contains the following information
The values of the information management parameters are already preset and therefore do not need to be modified.

P_Byte_First_Info

Byte position of the first data record in this DB, may not be changed

No_of_Infos

Number of data records contained in this DB
0: unspecified -> the data block end marks the last data record

Len_Info

Length of the data records:
may not be changed

Len_Sort_Key

0: no sorting (default setting)
4: the first 4 Bytes of the information specific parameter (ref. parameter group Para_T103_ME) form the sorting criteria.
Other lengths are not permissible.

If many parameter blocks are needed, it is recommended to file the blocks with ascending criteria according to 'P_T103_ASDU_Address', P_T103_Info_Position', ,P_T103_Info_Function_Type' and ,P_T103_Info_Number' into the parameter DB.
A so set up data block can be searched more effectively related to ,Len_Sort_Key' = 4 (binary search).

Global Parameter		These parameters are type specific. Its function is described at this place only partially.
		You find supported values in the corresponding chapters for block description
Para_DB_Type		Internal used. Don't change the identification for this parameter DB!
Internal		Internal used. Lastly processed information – don't change!

Information about failure handling

If a failure is detected the NT-Bit in IEC-Images (Parameter 'Global.Image_Type') will always be affected.

The NT-Bit in the image is set for the respectively affected information:

> ➢ when a link failure to the (IEC-) partner is detected
> ➢ when the NT-Bit (not topical) is set in the received message
> ➢ when the IV-Bit (invalid) is set in the received message

Para_T103_ME **Para per Info**	Set up an arbitrary number of parameter blocks by setting the corresponding array value n in the declaration view. In the detail view the parameter can be adjusted individually.
P_T103_ASDU_Address	ASDU-Address of the IEC 103 device, from which the information comes
P_T103_Info_Position	Position number from measured values within the IEC 103 measured value message. 0 = first measured value in the message Information source is the IEC103 device fixed in the ‚P_T103_ASDU_Address'
P_T103_Function_Type	IEC 103 function type Information source is the IEC103 device fixed in the ‚P_T103_ASDU_Address'
P_T103_Info_Number	IEC 103 information number Information source is the IEC103 device fixed in the ‚P_T103_ASDU_Address
P_T1014_IOA	The transfer of the IEC 103 information to IEC 101/104 is carried out with the Information Object Address (IOA) recorded here. Only relevant, when transferring to IEC101/104

P_T1014_Info_Type	The transfer of the IEC 103 information to IEC 101/104 is carried out with the type identifier fixed here.
	Type identifier 9 (B#16#9):
	    transmission occurs as measured value, normalized value (ME_A)
	Type identifier 11 (B#16#B):
	    transmission occurs as measured value, scaled value (ME_B)
	Type identifier 13 (B#16#D):
	    transmission occurs as measured value, shortened floating point
	    number (ME_C)
	    (default)
	(others not allowed)
	
	Only relevant, when transferring to IEC 101/104

P_T1014_Info_Handling   The processing of information with IEC 101/104 is fixed here

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
			R4	PH		NR	

NR	= Not Requested = not requested transmitting resp. fade out when requested!
PH	= Prio H = transmitting the indication with high priority
R4	= Reset TI4 -> new value will be reset according to time

Only relevant, when transferring to IEC 101/104

Int_Res_10	Internal used
P_Scale_Factor	The measured value will be scaled with the factor entered here. Example: The scale factor 7.326007e-003 causes the scaling of a measured value from ±32760 to ±240 (%).
P_Threshold_Value	Threshold value for the spontaneous transfer of the measured value to T101/T104.

0:	without threshold value Each changing of the measured value is transmitted spontaneously.
> 0	Change of the measured value by the value parameterized here will cause the spontaneous transmission of the measured value.

Int_ToDo   Internal used

Im_State_of_TimeStamp   Image:
                                          Status of the information's time stamp

Im_S7_TimeStamp   Image:
                                          Time stamp of the information
                                          This is a combination of CPU-Time and the time from the message in S7 Format
                                          Date and Time.

Im_Value   Image:
                                          Value of the measured value in Format S7-Real

IM_State   Image:
                                          Status of the measured value

Diag_Count   Internal used
Diag_T103_TI   Internal used
Diag_T103_COT   Internal used
Value_Last   Internal used
Threshold_Memory   Internal used
Res   Internal used

‚Im_State_of_TimeStamp' and ‚IM_S7_Timestamp' in Detail

Im_State_of_TimeStamp

Prior the status byte serves for handing over of time status bits, which are not supported form S7 Date and Time Format.

Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Res	Res	Res	LO	IV	SY	DS	TI

TI: The TI - Bit is always set from the MAo-block.
Status bits (DS, SY, and IV) are taken over from SLi-blocks only if the TI - Bit is set.

DS: Daylight Saving Time
Direct taking over from IEC-messages with full time stamp. Otherwise:
Taking over from time status carried in the CPU (Communication-FB -Parameter Time_DS).

SY: Synchronized
Taking over from time status carried in the CPU (Communication-FB -Parameter Time_SY).
The Bit is informatively and is not used in IEC-Messages

IV: Invalid

IV arises as follows:

Receive message	IV
with partially time stamp	It is set, if the IV-Bit in the IEC-Message (TI1, TI2, TI4) or in the time status carried in the CPU is set (Communication-FB -Parameter Time_IV).
without time stamp	Taking over from time status carried in the CPU (Communication-FB -Parameter Time_IV)

LO: Local time is set, if the Communication-FB -Parameter Time_Diff is <> 0.
Taking over from time status of the CPU
The Bit is informatively and is not used in IEC-Messages.

IM_S7 TimeStamp

Date and Time in S7-Format

The time arises as follows

Receive message	S7 Date and Time
with partially time stamp	The partially time from IEC-message (TI1, TI2, TI4) is completed to full time with the time carried in the CPU
without time stamp	Taking over the time carried in the CPU

The images are initialized with the actual time of the CPU.

Information to data performance

The IEC communication blocks issue max. 1 user information per (OB1) cycle at a time. In this cycle the information can be processed/issued also from the process blocks.

This prevents on the one hand multiple issues from the same information and with it loss of indication changes (if the evaluation of images is carried out in the OB1 as well). On the other hand a direct dependency from the maximum data performance to the CPU cycle time arises. This has effect with high CPU load and may lead also to congestion in the remote station.

By programming a dedicated loop using the S7_IEC_Config parameter ‚More_Info_available' and ‚Next_Info' the data performance per OB1 cycle can be increased. This with minor increase of the cycle time. Refer also to chapter 3.4.

4.1.3.1. Indication T103_MAo_IND_SLi_T1014 (FB172)

T103_MAo_IND_SLi_T1014 is a block (FB) monitoring received messages from the IEC 103 link for indication and taking over the user data according to the dedicated parameter/image data block into its image. If an IEC 101/104 Slave application exists, the block will forward the information received per IEC 103 message from Master connection to the Slave connection on demand.
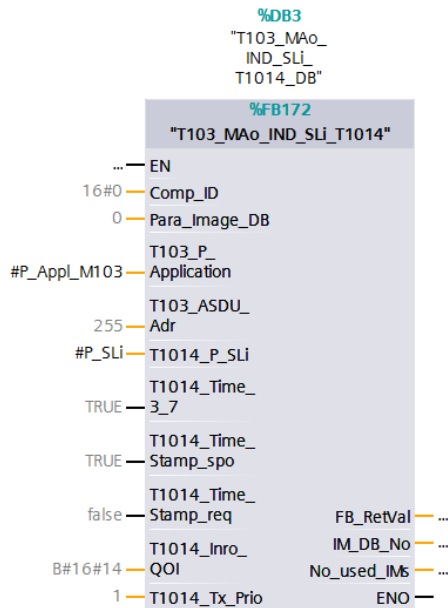
Display as FUP block with default values   Display as CFC block with default values

Important features are:

- The block processes IEC 103 indication messages with TI1 or TI2.

- Default adjustments can be read on the one hand in the respective variable comment on the other hand they require only a minimum of mandatory inputs.
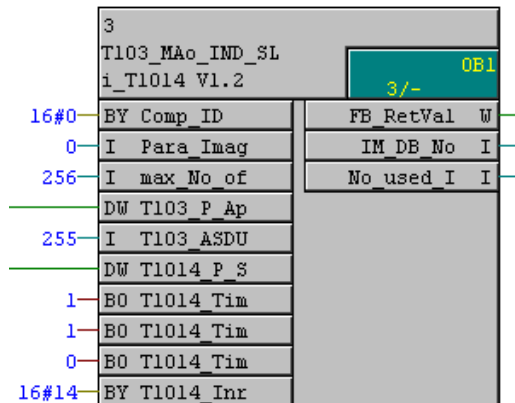 Minimum requirement is the interconnection of 'P_Application_Src', 'ASDU_Adr_Src' and 'P_SLi'.

- The FB is applicable in CFC-plans, as well as in KOP/FUP/AWL with low effort of interconnection. The assignment of parameter/image-DB and pointer to IEC103-connection (T103_P_Application) are sufficient.

- Per information type adjustable information handling
  - Priority, GI, fleeting

- Output is carried out directly into the parameter/image data block

- The block supports automatic update:
  For test purposes, e.g. for inquiry of existing information if the devices are unknown.
  The parameter/image-DB will be constructed in this case automatically

- Integrated error handling with influence on the NT-Bit
  - in case of link interrupt to IEC 103 partner
  - in case of NT-Bit (not topical) set in received messages
  - in case of IV-Bit (invalid) set in received messages

- Easy handling of the parameter data blocks:

  A default DB with the same number like FB will be delivered in the block library as well and can be adjusted immediately (Simatic- Manager).

- Forwarding to T101/4 telecontrol connection is possible
  The interconnection of 'T1014_P_SLi' with its 'P_SLi' is sufficient.

- Type identification and time stamp of the information to be forwarded are parameterizable

Block parameter with its default settings and short comment

FB172		Type	Default	Block Comment/brief description
Comp_ID	IN	BYTE	B#16#0	Identifier for Diagnostic-Functions
Para_Image_DB	IN	INT	0	Number of a para-/image-DB; with 0 a DB is created at runtime
max_No_of_Images	IN	INT	256	Default: 256; dimension of dynamic generated data block for the images
T103_P_Application	IN	DWORD	DW#16#0	Pointer which must be connected to 'S7_IEC_Config' - Module (Source of info)
T103_ASDU_Adr	IN	INT	255	Common Address of ASDU (usually Device Addr) [0..255]; 255 (Default) -> all
T1014_P_SLi	IN	DWORD	DW#16#0	must be connected with P_to_SLi from SL_Org_ASDU - Module
T1014_Time_3_7	IN	BOOL	TRUE	0: -> Time_3 -> TI2 / 1: -> Time_7 -> TI30 / Default = 1
T1014_Time_Stamp_spo	IN	BOOL	TRUE	spontaneous Transmission without (0) or with (1) Timestamp / Default = 1
T1014_Time_Stamp_req	IN	BOOL	FALSE	requested Transmission without (0) or with (1) Timestamp / Default = 0
T1014_Inro_QOI	IN	BYTE	B#16#14	0: No Reaction; 20 (=14hex,default) General interrogation; 21-36 -> Group 1-16
FB_RetVal	OUT	WORD	W#16#0	positive values -> ok; negative values (16#8xxx) -> Error
IM_DB_No	OUT	INT	0	DB number for the internal process image, created by this module
No_used_IMs	OUT	INT	0	Number of information, actually placed in the image data block

Meaning of the block variables:

Comp_ID

Block identifier for (currently only internal) diagnostic functions. Assign different numbers within a block as Byte variable e.g. B#16#1.

Para_Image_DB

DB-No. of the dedicated parameter/image data block
0:    the parameter/image DB will be constructed automatically to run-time. size according to 'max_No_of_Images
> 0:   number of the parameter/image data block to be used

max_No_of_Images

Size of the dynamically generated parameter/image data block.
The demand of memory per information object is 26 Byte.
At CPUs supporting a DB size from 16 kByte max. 628
At CPUs supporting a DB size from 64 kByte max. 2519

With a FB-Call.
According to the capacity of CPUs the amount of information can be increased by multiple calls of the FBs.

T103_P_Application

T103_P_Application is a pointer to a common data range of block T103_S7_IEC_Config. Therefore it has to be interconnected to its output P_Application via a DWord variable.
The Config block receives user data such as 'ASDU address', actual time stamp receiver buffer, etc. via this pointer or the data range behind it.

T103_ASDU_Adr

Address value of the application service data unit receiving the information.
Permissible range with ASDU address length 1 Byte is 1 to 254
The broadcast address 255 (FFh) is always accepted

T1014_...

The ,T1014_...' –parameters are only needed if the information of the IEC 103 Masters has to be forwarded to an IEC 101/104 Slave connection.
For that you **additionally** need an IEC 101 or IEC 104 Slave application from SIPLUS RIC IEConS7.

T1014_P_SLi	Only relevant for additional use of an IEC 101/104 Slave connection. 'T1014_P_SLi' is a pointer to a common data range from the 'SL_ORG_ASDU' block of an IEC 101 or IEC 104 Slave application. If the information has to be forwarded to a IEC 101/104 Slave connection it has to be interconnected with its output 'P_SLi' via a DWord variable. The ORG block transfers values such as 'ASDU address', current time stamp, send buffer, and processes e.g. GIs, via this pointer or the data range behind it.
T1014_Time_3_7	Only relevant for additional use of an IEC 101/104 Slave connection. At input 'T104_Time_3_7' the time stamp format for the IEC 101/104 protocol can be adjusted: FALSE -> 3 - Byte length = short or partially time stamp CP24Time2a TRUE -> 7 - Byte length = long or full time stamp CP56Time2a
T1014_Time_Stamp_...	Only relevant for additional use of an IEC 101/104 Slave connection. The transmission of messages with or without time stamp can be parameterized separately for:
T1014_Time_Stamp_spo T1014_Time_Stamp_req	spontaneous transmission with 'Time_Stamp_spo' requested transmission with 'Time_Stamp_req' FALSE: without time stamp TRUE: with time stamp
T1014_Inro_QOI	Only relevant for additional use of an IEC 101/104 Slave connection. Interrogation mode: Parameterizable interrogation label according IEC 101/104 for reaction: - 0: no reaction - 20 (B#16#14 hex) -> general interrogation GI - 21 (B#16#15 hex) up to 36: group interrogation + (always) GI The actual processing (checking whether information from the requested interrogation group is available anyway – respective reaction = pos/neg confirmation…) is managed from ORG block. The requested data are always coming from the image
FB_RetVal	The function block signals as follows: Positive values → ok

W#16#0000	ok, no fault
W#16#0102:	P_from_SL_Org = 0 - not connected
W#16#1000	ok, with reduced cycle (next_Info)

Negative values (16#8xxx) → fault

W#16#8103:	Shared.Version (Job-ID) = wrong or wrong pointer position
W#16#8112:	P_from_Application = 0
W#16#8113:	Application.Version (Job-ID) = wrong or wrong pointer position
W#16#8301	IM-DB could not be constructed Reason could be to low working memory
W#16#8302	Image-DB full Information could not be entered anymore.

IM_DB_No	Number of the parameter/image DB which is used or constructed from this block. Refer also to parameter 'Para_Image_DB'.
No_used_IMs	Number of the information which is entered actual in the parameter/image DB Updating of the image DB is carried out automatically by incoming spontaneous, interrogated or cyclic information.

NOTICE

Please note the permissible valuation of the block parameters. They are not mandatory checked for plausibility. Incorrect inputs can cause unpredictable responses and incorrect functions.

General information to function and handling of the block:

The block processes the following T103 type identifications:

- TI1, Indications with time mark
- TI2, Indications with relative time

The value (DPI) and the time stamp (dual time 4 Byte, converted into full time) are taken over. Additional information (SIN), relative time (RET) and disturbance number (FAN) are rejected.

- For test purposes the block supports automatic updating (e.g. for the determination of information in case of unknown protection devices).
- The parameter/image DB can be constructed automatically or exists as dedicated DB (sample DB: DB172). Refer to parameter ‚Para_Image_DB'.
- The number of information which can be managed is determined only from the size of the DB.
- Forwarding to a T101/104 telecontrol connection is possible

Behavior with automatically updated parameter/image data block:

- The forwarding to a T101/104 telecontrol connection is carried out with an IOA address configured as follows:

  - Octet 3 = Reserved for position number from measured values, not relevant
  - Octet 2 = Function type
  - Octet 1 = Information number

Forwarding to a T101/104 telecontrol connection is carried out with:

- ASDU Address from ORG-ASDU,
  if the parameterized T103_ASDU_Adr' at the block input is <> 255.

- ASDU - Address is equal ASDU - Address,
  if the parameterized T103_ASDU_Adr' at the block input is = 255
  <u>and</u> was updated automatically.

  Attention: The ASDU - Address from the administrating ORG-ASDU-block will be bypassed! Hence GI requests will operate incomplete in this mode.
  Therefore the parameterizing from ‚T103_ASDU_Adr' = 255 is only sufficient for test purposes.

- Forwarding of all information as double indication (DPI like coming from protection device)
- Forwarding of spontaneously received information, also without changes
  In case of changes compared with old image the transmission is always spontaneously.
- T101/104 interrogations are not forwarded, instead of that they are transmitted from the built up image.

Behavior with dedicated parameter/image data block:

- Only the T103 information (ASDU-Addr, function type information number) which is parameterized in the DB is processed.
- Forwarding to T101/104 is carried out exclusively with the parameterized/assigned IOA
- Forwarding to T101/104 is carried out exclusively with the ASDU-address parameterized at the ORG-ASDU
- The type identification from the information to be forwarded is parameterizable
  3->   as double indication
- 1 (resp. <>3)→   as single indication
- Additional ‚Info-Handling' is parameterizable, in order to influence the behavior at the telecontrol connection.

Block specific values in the parameter data block:

You'll find the complete structure, as well as the general description of the parameter data block in the superior chapter.

At this point we only elaborate on type specific details

Structure of the parameter/image DB:
Header
DB_Manag: 10 Byte
Info_Manag: 10 Byte
Glob_Data: 12 Byte

Per Info
Parameter/Image: 26 Byte

Byte	Field	Description
0	Src_Device address	
1	Src_Info position	Only for measured values, not relevant here
2	Src_Function type	
3	Src_Info number	
4	Dst_Info Addr (HH)	T101/104 – Information address (IOA)
5	(HL)	
6	(LH)	
7	(LL)	
8	Dst_Info type	Information type 1 SP,. 3 DP, …
9	PH NR FL	Information-Handling
10	Res	
11	Res	
12	INI AA cyc req sp	To-Do (internal use)
13	LO IV SY DS TI	Time stamp status
14–21	Time (BCD) S7-Format Date Time	Combination from CPU-time and time from message
22	NT DPI	Value always DPI/status according IEC 103
23	Count	For Info
24	T103_TI	For Info
25	T103_COT	For Info

Information-Handling:
FL = Fleeting

➔ Interrogated transmission and spontaneous transmission by change of status with value 0

➔ Spontaneous transmission also without changes in the image, if not received with COT 'requested' (this is also handled in standard (no WI)

NR = Not Requested transmitted resp. in case of (T101/104 -) inquiries fading out!
PH = Prio H = Transmission of the indication with high priority

(Internal) To-Do-Label
AA = Automatic ASDU -> internal used, if the received ASDU-Address has to be forwarded.
INI = Initiated

(Internal) Fleetings processing

➔ The value of the image is set to OFF before a new entry is carried out. If status or value changes due to the entry a spontaneous transmission is carried out (T101/104).

➔ When station disturbance is recognized the value of the image is set to OFF and simultaneous the status bit NT is set.

➔ With T101/104 GIs the value in the image is also set to OFF (and thus transmitted)

➔ Fleetings and other information set to 'not topical' due to coming link disturbance will be updated by GI in case of going link disturbance resp. they remain on NT until the first change of value if they are not included in the GI.

Image format: -> always DPI

➔ S7-Applications have to consider this.

➔ The conversion to T101/104 is carried out during transmission.

Count:

➔ for diagnosis purposes

➔ is increased with each image entry which leads to transmission as well.

➔ is also increased if unchanged information is received per GI

➔ is not increased, if NT-Bit is set due to coming link disturbance.

Time incl. status:

➔ In case of receive messages (TI1, 2) the partially time (4Byte) from message, completed with CPU time

➔ With own actions (e.g. NT due to disturbance) ->actual CPU time

Completing information for automatic creation and update of the image DB:

The block constructs an image DB (default DB80) during CPU start-up (cold start).

The size of this image DB depends on the parameterized maximum number of information elements.

The update of this image DB is carried out automatically by incoming spontaneous, requested or cyclic information. In this case no explicit parameterizing of the information which has to be processed is necessary at the block.

New added information in the interrogated protection devices is entered automatically into the image and processed if it complies with the conditions until the parameterized maximum number of information elements is reached.

If already existing information (IOA, TI) in the subordinated station change, a new start (cold start) is required. Hereby the image DB will be constructed and updated again.

Multiple uses:

Within the application the block can be called multiple. Depending on the parameterizing at the inputs functions can be implemented with it like e.g.

➔ Distribution of the information to several targets

➔ Increase of the quantity structure with skilled filtering
(using powerful CPUs respectively)

4.1.3.2. Measured values - T103_MAo_ME_SLi_T1014 (FB173)

T103_MAo_ME_SLi_T1014 is a block (FB) monitoring received messages from the IEC 103 link for measured values and taking over the user data into its image according to the dedicated parameter/image data block. If an IEC 101/104 Slave application exists, the block will forward the information received per IEC 103 message from Master connection to the Slave connection on demand.

Illustration as FUP-Block with default values
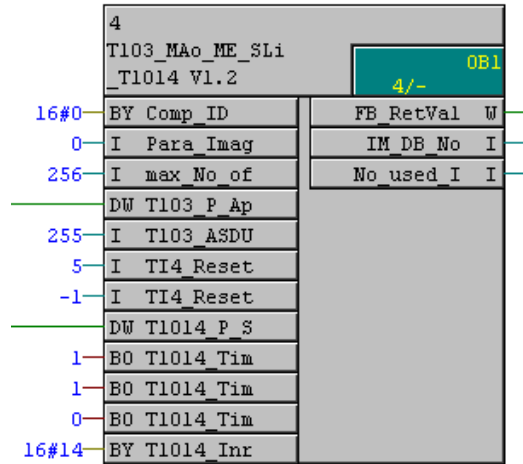
Illustration as CFC-Block with default values

Important features are:

- ➢ The block processes IEC 103 indication messages with TI3, TI4, TI9 or TI140.

- ➢ Default adjustments can be read on the one hand in the respective variables comment on the other hand they require only a minimum of mandatory inputs.
  Minimum requirement is the interconnection of ‚P_Application_Src', ‚ASDU_Adr_Src' and ‚P_SLi'.

- ➢ The FB is applicable in CFC- plans, as well as in KOP/FUP/AWL with low effort of interconnection. The assignment of parameter/image-DB and pointer to IEC 103-connection (T103_P_Application) are sufficient.

- ➢ Per information type adjustable information handling
  - Priority, GI, reset to the defined value

- ➢ Output is carried out direct into the parameter / image data block

- ➢ The block supports automatic update:
  for test purposes, e.g. for inquiry of existing information if the devices are unknown.
  The parameter/image-DB will be constructed in this case automatically

- ➢ Integrated error handling with influence on the NT-Bit
  - in case of link interrupt to IEC 103 partner
  - in case of NT-Bit (not topical) set in received messages
  - in case of IV-Bit (invalid) set in received messages

- ➢ Easy handling of the parameter data blocks:

  A default DB with the same number like FB will be delivered in the block library as well and can be adjusted immediately (Simatic- Manager).

- ➢ Forwarding to T101/4 telecontrol connection is possible
  The interconnection from ‚T1014_P_SLi' with its ‚P_SLi' is sufficient.

- ➢ Type identification and time stamp of the information to be forwarded are parameterizable

Block parameter with its default settings and short comment

FB173		Type	Default	Block comment/brief description
Comp_ID	IN	BYTE	B#16#0	Identifier for Diagnostic-Functions
Para_Image_DB	IN	INT	0	Number of a para-/image-DB; with 0 a DB is created at runtime
max_No_of_Images	IN	INT	256	Default: 256; dimension of dynamic generated data block for the images
T103_P_Application	IN	DWORD	DW#16#0	Pointer which must be connected to 'S7_IEC_Config' - Module (Source of info)
T103_ASDU_Adr	IN	INT	255	Common Address of ASDU (usually Device Addr) [0..255]; 255 (Default) -> all
TI4_Reset_Time	IN	INT	5	TI4-Values will be reset to 'Reset_Val' [0..60 s] after transmission. Def. 5s
TI4_Reset_Val	IN	INT	-1	TI4-Reset-Value; Default: -1;
T1014_P_SLi	IN	DWORD	DW#16#0	must be connected with P_to_SLi from SL_Org_ASDU - Module
T1014_Time_3_7	IN	BOOL	TRUE	0: -> Time_3 -> TI2 / 1: -> Time_7 -> TI30 / Default = 1
T1014_Time_Stamp_spo	IN	BOOL	TRUE	spontaneous transmission without (0) or with (1) time stamp / Default = 1
T1014_Time_Stamp_req	IN	BOOL	FALSE	requested Transmission without (0) or with (1) time stamp / Default = 0
T1014_Inro_QOI	IN	BYTE	B#16#14	0: No Reaction; 20 (=14hex,default) General interrogation; 21-36 -> Group 1-16
FB_RetVal	OUT	WORD	W#16#0	positive Values -> ok; negative values (16#8xxx) -> Error
IM_DB_No	OUT	INT	0	DB number for the internal process image, created by this module
No_used_IMs	OUT	INT	0	Number of information, actually placed in the image data block

Parameter- and Function details:

Comp_ID — Block identifier for (currently only internal) diagnostic functions. Assign different numbers within a block as Byte variable e.g. B#16#1.

Para_Image_DB — DB-No. of the dedicated parameter/image data block
0: the parameter/image DB will be constructed automatically to run-time. size according to 'max_No_of_Images'
> 0: number of the parameter/image data block to be used

max_No_of_Images — Size of the dynamically generated parameter/image data block.
The demand of memory per information object is 48 Byte.
At CPUs supporting a DB size of 16 kByte max. 340
At CPUs supporting a DB size of 64 kByte max. 1364

with a FB-Call.
According to the capacity of CPUs the amount of information can be increased by multiple calls of the FBs.

T103_P_Application — T103_P_Application is a pointer to a common data range of block T103_S7_IEC_Config. Therefore it has to be interconnected to its output P_Application via a DWord variable.
The Config block receives user data such as 'ASDU address', actual time stamp receiver buffer, etc. via this pointer or the data range behind it.

T103_ASDU_Adr — Address value of the application service data unit receiving the information.
Permissible range with ASDU address length 1 Byte is 1 to 254
The broadcast addresses 255 (FFh with length 1) is always accepted

TI4_Reset_Time — After the TI4_Reset_Time has been expired, real time measured values with relative time (TI4, e.g. fault location) are reset to the value adjusted at 'TI4_Reset_Val'
Permissible values: 0 up to 60s
0: The value will not be reset.
1...60: Time in seconds until reset of the value.

TI4_Reset_Val	After the TI4_Reset_Time has been expired, real time measured values with relative time (TI4, e.g. fault location) are reset to the value adjusted at ‚TI4_Reset_Val'
T1014_...	The ‚T1014_...' –parameters are only needed if the information of the IEC 103 Masters has to be forwarded to an IEC 101/104 Slave connection. For that you **additionally** need an IEC 101 or IEC 104 Slave application from SIPLUS RIC IEConS7.
T1014_P_SLi	Only relevant for additional use of an IEC 101/104 Slave connection. ‚T1014_P_SLi' is a pointer to a common data range from the ‚SL_ORG_ASDU' block of an IEC 101 or IEC 104 Slave application. If the information has to be forwarded to an IEC 101/104 Slave connection it has to be interconnected with its output ‚P_SLi' via a DWord variable. The ORG block transfers values such as 'ASDU address', current time stamp, send buffer, and processes e.g. GIs, via this pointer or the data range behind it.
T1014_Time_3_7	Only relevant for additional use of an IEC 101/104 Slave connection. At input ‚T104_Time_3_7' the time stamp format for the IEC 101/104 protocol can be adjusted.: FALSE -> 3-Byte length = short or partially time stamp CP24Time2a TRUE -> 7-Byte length = long or full time stamp CP56Time2a
T1014_Time_Stamp_...	Only relevant for additional use of an IEC 101/104 Slave connection. The transmission of messages with or without time stamp can be parameterized separately for:
T1014_Time_Stamp_spo T1014_Time_Stamp_req	spontaneous transmission with ‚Time_Stamp_spo' requested transmission with ‚Time_Stamp_req' FALSE: without time stamp TRUE: with time stamp
T1014_Inro_QOI	Only relevant for additional use of an IEC 101/104 Slave connection. Interrogation mode: Parameterizable interrogation label according IEC 101/104 for reaction: - 0: no reaction - 20 (B#16#14 hex) -> general interrogation GI - 21 (B#16#15 hex) up to 36: group interrogation + (always) GI The actual processing (checking whether information from the requested interrogation group is available anyway – respective reaction = pos/neg confirmation,…) is managed from ORG block. The requested data are coming always from the image

FB_RetVal — The function block signals as follows:

Positive values → ok

W#16#0000	ok, no fault
W#16#0102:	P_from_SL_Org = 0 - not connected
W#16#1000	ok, with reduced cycle (next_Info)

Negative values (16#8xxx) → fault

W#16#8103:	Shared.Version (Job-ID) = wrong or wrong pointer position
W#16#8112:	P_from_Application = 0
W#16#8113:	Application. Version (Job-ID) = wrong or wrong pointer position
W#16#8301	IM-DB could not be constructed Reason could be to low working memory
W#16#8302	Image-DB full Information could not be entered.

IM_DB_No	Number of the parameter/image DB which is used or constructed from this block. Refer also to parameter ‚Para_Image_DB'.
No_used_IMs	Number of the information which is actually entered in the parameter/image DB Updating of the image DB is carried out automatically by incoming spontaneous, interrogated or cyclic information.

NOTICE

Please note the permissible valuation of the block parameters. They are not mandatory checked for plausibility. Incorrect inputs can cause unpredictable responses and incorrect functions.

General information to function and handling of the block:

The block processes the following T103-type identifications:

- TI3, measured values I
- TI4, real time measured values with relative time
- TI9, measured values II
- TI140, private TI e.g. used for measured values in SIMEAS T

- For **test purposes** the block supports automatic updating (e.g. for the determination of information in case of unknown protection devices)

- The parameter/image DB can be constructed automatically or exists as dedicated DB (sample DB: DB173). Refer to parameter ‚Para_Image_DB'.

- The number of information which can be managed is only determined by the size of the DB.

- Forwarding to a T101/104 telecontrol connection is possible

Behavior with automatically updated parameter/image data block:

- The forwarding to a T101/104 telecontrol connection is carried out with an IOA address configured as follows:

  - Octet 3 = position number of measured values (from 0)
  - Octet 2 = Function type
  - Octet 1 = Information number

- Forwarding to a T101/104 telecontrol connection is carried out with

  - ASDU Address from ORG-ASDU,
    if the parameterized T103_ASDU_Adr' at the block input is <> 255.

  - ASDU - Address is equal ASDU - Address,
    if the parameterized T103_ASDU_Adr' at the block input is = 255
    <u>and</u> was updated automatically.

    Attention: The ASDU - Address from the administrating ORG-ASDU- block will be bypassed! Hence GI requests will operate incompletely in this mode.
    Therefore the parameterizing of ‚T103_ASDU_Adr' = 255 is only sufficient for test purposes.

- Forwarding and image entry of information as real measured values

- T101/104 interrogations are not forwarded, instead of that they are transmitted from the built up image.

Behavior with dedicated parameter/image data block:

- Only the T103 information (ASDU-Addr, function type information number) which is parameterized in the DB is processed.

- Transfer to T101/104 is carried out exclusively with the parameterized/assigned IOA

- Transfer to T101/104 is carried out exclusively with the ASDU- address parameterized at the ORG-ASDU

- The type identification from the information to be forwarded is parameterizable
  9-> as normalized measured value (ME_A)

- 11-> as scaled measured value (ME_B)

- 13-> as floating point measured value (ME_C)

- Additionally ‚Info-Handling' is parameterizable, in order to influence the behavior at the telecontrol connection.

Block specific values in the parameter data block:

You'll find the complete structure, as well as the general description of the parameter data block in the superior chapter.

At this point we elaborate on type specific details only

Structure of the parameter/image DB:

Header
DB_Manag: 10 Byte
Info_Manag: 10 Byte
Glob_Data: 12 Byte

Per Info
Parameter/Image: 48 Byte

Byte	Field	Description
0	Src_Device address	
1	Src_Info position	only for measured values
2	Src_Function type	
3	Src_Info number	
4	Dst_Info Addr (HH)	T101/104 – Information address
5	(HL)	
6	(LH)	
7	(LL)	
8	Dst_Info type	Information type 9 ME_a,. 11 ME_b, 13 ME_c
9	R4 PH NR	Info-Handling
10	Res	
11	Reset –Time [s]	-> will be counted down (internal)
12		scale factor (for measured values)
13	Scale factor	
14	S7 Real	
15		
16		threshold value
17	Threshold value	
18	S7 Real	
19		
20	INI TH AA cyc rqq sp	ToDo (internal use)
21	LO IV SY DS TI	status time stamp
22		
23		
24	Time (BCD)	
25	S7-Format	combination of CPU-time and time from the mes-sage
26	Date Time	
27		
28		
29		
30		scaled measured value as floating point number
31	Value	
32	S7-Real	
33		
34	Status	status according IEC 103
35	Count	for info
36	T103_TI	for info
37	T103_COT	for info
38		intern for threshold value handling
38	Old image	
40	S7 Real	
41		
42		intern for threshold value handling
43	Integration memory	
44	S7 Real	
45		
46	Res	
47	Res	

Info-Handling:

NR = Not Requested transmitted resp. in case of inquiries fade out!

PH = Prio H = Transmitting the indication with high priority

R4 = Reset TI4 -> New value will be reset according to time

(Internal) ToDo-Identifier:

TH = Threshold -> with threshold handling

AA = Automatic ASDU -> will be used internal, if the received ASDU address has to be forwarded.

INI = Initialized

Image/Value:

➔ The processing in the image is carried out with real values. A conversion into other information types (normalized, scaled) is achieved if required.

➔ In the image always the last received and already scaled measured value is always operated.

Status of the measured value:

➔ The T103 measured values contain status information in its least significant bits, which are transformed into the IEC status as follows:

- Bit 0: OV -> OV (Overflow)

- Bit 1: ER -> IV (Invalid)

- Bit 2: Res -> will not be converted

Threshold handling:

➔ A threshold can be parameterized as real number for each information.

➔ Only effective for forwarding to T101/104

➔ 0: No threshold handling for this value. Each change will be transmitted.

➔ Otherwise ‚additive threshold processing'.
Greater changes of value (scaled) than the parameterized threshold lead to direct transmission of the measured value. Fewer changes compared with the last transmitted value (in the image) are added in seconds' clock (integration memory). In case of exceeding the threshold the actual value is send.

Scaling:

➔ One scale factor per measured value can be parameterized.

➔ In case of automatic updating for TI4 values scale factor 1 is entered, because here already scaled values are normally received (e.g. fault location in km).
For all other measured values the default setting is scale factor 7.326007e-003. This complies on the basis 32760 with a standardization to ±240 (%)
±32760 * 7.326007e-003 = ±240 %
100 % operated in the image should be the nominal value of the transducer e.g. 20 kV.

TI4-measured values (real time measured values with relative time)

➔ Can be reset/deleted according to time (parameterizable, handling bit R4) after receipt and with it involved transmission (including transmission to T101/104).
The time and the reset value are parameterizable as variables at the FB.

➔ Provide a 4-byte time stamp which will be completed to full time with receipt. It is than taken over into the image as well as into the message which has to be sent.

➔ The default setting in case of automatic update from TI4 measured values is:
no GI, reset of value according time, no threshold handling.

Count:

➔ for diagnosis purposes

➔ will be increased with each image entry, which also leads to a transmission.

➔ will also be increased when an unchanged information was received by GI.

➔ will be not increased, when the NT-bit was set due to coming link disturbance.

Time including status:

➔ In receipt messages (TI3, 4, 9, 140)
   -> the partially time (4Byte) out of the message, added with the CPU time

➔ With own actions (e.g. NT due to disturbance)
   -> actual CPU time

Completing information for automatic creation and update of the image DB:

The block constructs an image DB (default DB80) during CPU start-up (cold start). The size of this image DB depends on the parameterized maximum number of information elements.

The update of this image DB is carried out automatically by incoming, spontaneous, requested or cyclic information. In this case no explicit parameterizing of the information which has to be processed is necessary at the block.

New added information in the interrogated protection devices are entered automatically into the image and processed if they comply with the conditions until the parameterized maximum number of information elements is reached.

If already existing information (IOA, TI) in the subordinated station change, a new start (cold start) is required. Hereby the image DB will be new constructed and updated.

Multiple use:

The block can be multiple called within the application. Depending on the parameterization at the inputs functions can be implemented with it like e.g.

➔ Distribution of the information to several targets

➔ Increase of the quantity structure with skilled filtering
   (using respectively powerful CPUs)

4.1.4. Input/Output blocks T103_MAi_xyz_SLo_T1014

For the various information types in the control direction, input and output blocks (FBs) are available which have to be 'interconnected' via the pointer 'P_Application' with the relevant IEC 103 protocol version supplied.

The blocks generate the relevant IEC 103 command messages with the addresses specified at its inputs.

With an additional interconnection to P_Application from an IEC 101/104 Slave they receive commands via IEC 101/104 message and pass them on to the IEC 103 application (output function). The respective block functions then as node passing on the commands from superior IEC 101/104 Master (e.g. telecontrol center) to the subordinated IEC 103 Slave. The address conversion from IEC 101/104 to IEC 103 is carried out either automatically according to a fixed pattern or via an optional parameter DB for IOA conversion.

The symbol name encodes the most important block features as follows:

T103_MAi_CMD_SLo_T1014	The block processes messages of the protocol IEC 60870-5-103.
T103_**MAi**_CMD_SLo_T1014	**MAi** is the abbreviation for Master blocks input. This means input blocks. The block evaluates received information (at the block inputs or from an IEC 101/104 application) and generates the dedicated command messages.
T103_MAi_**CMD**_SLo_T1014	Information types supported from the block. **CMD** = Command
T103_MAi_CMD_**SLo_T101**4 T103_MAi_CMD_**SLo_T10**14	**SLo** is the abbreviation for Slave blocks output. This means output blocks from the view of the Slave. The block can receive commands via messages from an IEC 60870-5-**101** Slave or IEC 60870-5-**104** Slave and forwards them to the IEC 103 application (output function). The block will be operated in this case as combined input/output block (node block) with protocol converter function.

The available **T103_MAi_CMD_SLo_T1014** function blocks are shown in the overview below.

Block	Block.-No.	Parameter-/Image DB-No. (Default)	Generating of…
T103_MAi_CMD_SLo_T1014	FB174	DB174	… general commands (TI20)

Illustration of the necessary interconnection – here exemplary in a CFC plan:
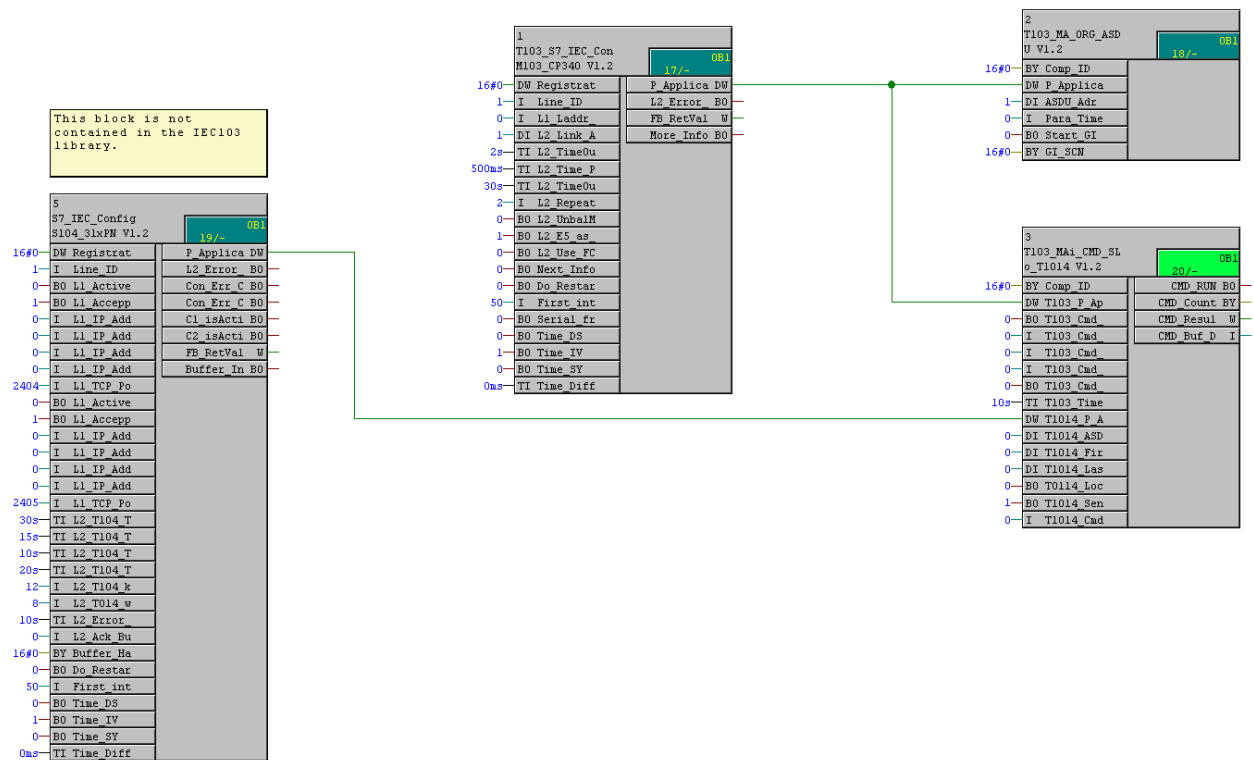
Additionally to the interconnection of the T103 blocks the figure shows the interconnection of T1014_P_SLi, which is necessary for the connection to an IEC 101/104 Slave.

Information for the connection to an IEC 101/104 Slave:

You receive the necessary IEC 101/104 Slave blocks with the corresponding IEC 101/104 application. Only blocks from the Version 1.2 have to be used.

4.1.4.1. Input/Output block T103_MAi_CMD_SLo_T1014 (FB174)

The blocks generate IEC 103 command messages with the addresses specified at its inputs.

With an additional interconnection to P_Application from an IEC 101/104 Slave it receives commands via IEC 101/104 message and passes them on to the addressed IEC 103 (output function). The block functions then as node passing on the commands from superior IEC 101/104 Master (e.g. telecontrol center) to the subordinated IEC103 Slave.
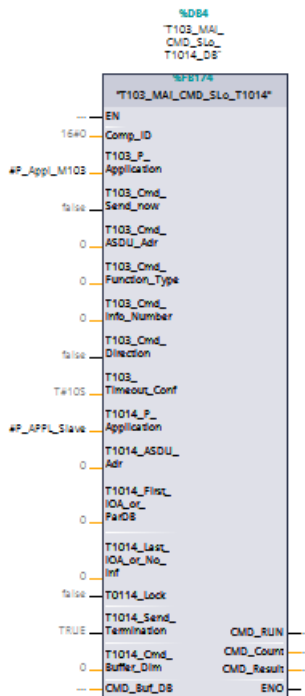
Illustration as FUP-Block with default values   Illustration as CFC-Block with default values
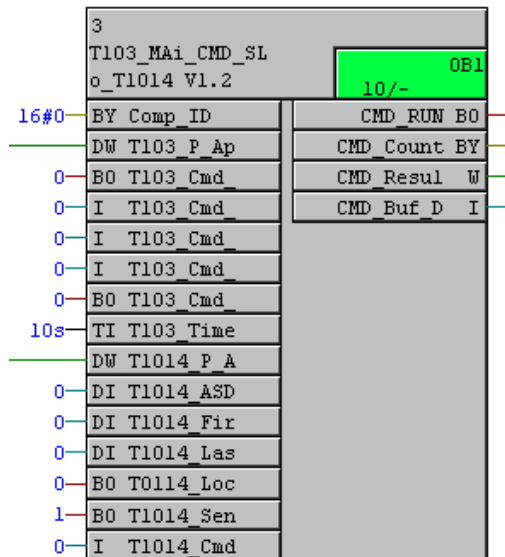
Important features are:

➢ Transmitting commands directly out of the Simatic with 'T103_Cmd_Send_now'

➢ Transmitting commands from an IEC 101 or IEC 104 connection,
  with automatic address conversion according to a fixed pattern.

➢ Transmitting commands from an IEC 101 or IEC 104 connection,
  by means of optional parameter DB for IOA conversion.

➢ Default adjustments can be read on the one hand in the respective variables comment on the other hand they require only a minimum of mandatory inputs.
  Minimum requirement is the interconnection of 'T103_P_Application' and the interconnection of 'T103_Cmd_Send_now', 'T103_Cmd_ASDU_Adr', 'T103_Cmd_Function_Type' and 'T103_Cmd_Info_Number'.

➢ Possibility of filtering by
  - defined address bands with 'First_IOA_or_ParDBSrc', 'Last_IOA_or_No_Inf'

➢ In simplest case no parameterizing of the information object addresses (IOA) to be forwarded is necessary.

➢ A global blocking input allows the easy interlocking of all commands

➢ Output for external evaluation of an active command existing.

➢ Function (output) independent from received IEC 101/104-TI

➢ Command storage and serial output of the buffered IEC 101/104 commands possible
  (number according 'Cmd_Buffer_Dim')

Block parameter with its default settings and short comment

FB174		Type	Default	Block comment/brief description
Comp_ID	IN	BYTE	B#16#0	Identifier for Diagnostic-Functions
T103_P_Application	IN	DWORD	DW#16#0	Pointer which must be connected to 'S7_IEC_Config' - Module
T103_Cmd_Send_now	IN	BOOL	FALSE	A rising edge on this input starts sending a command message
T103_Cmd_ASDU_Adr	IN	INT	L#0	Common Address of ASDU [0..254] (usually Device address) for sent commands
T103_Cmd_Function_Type	IN	INT	L#0	Function type [0..255] for activated commands via 'Send_now'
T103_Cmd_Info_Number	IN	INT	L#0	Information number [0..255] for activated commands via 'Send_now'
T103_Cmd_Direction	IN	BOOL	FALSE	0/False -> Off; 1/True -> On;
T103_Timeout_Conf	IN	TIME	T#10s	Within this time a confirmation is expected; Default: T#10s; T#0ms -> without
T1014_P_Application	IN	DWORD	DW#16#0	Pointer which must be connected to 'S7_IEC_Config' - Function Block
T1014_ASDU_Adr	IN	DINT	L#0	ASDU-Address which will be expected by this module; Default: 0
T1014_First_IOA_or_ParDB	IN	DINT	L#0	First forwarded IOA (Default: 0) or Para-DB with Offset 100000000
T1014_Last_IOA_or_No_Inf	IN	DINT	L#0	Last forwarded IOA (Default: 0) or number of info if Para-DB is used
T1014_Lock	IN	BOOL	FALSE	If set, new cmd will not be executed, they will be locked and neg. con
T1014_Send_Termination	IN	BOOL	TRUE	0: without; 1 (default): with termination of activation
Cmd_Buffer_Dim	IN	INT	0	0: without (default); >0 max. number of buffered commands
CMD_RUN	OUT	BOOL	FALSE	Signals a running command (CMD to T103-devive <-> Confirmation or Timeout)
CMD_Count	OUT	BYTE	B#16#0	will be incremented with each command transmitted to T103
CMD_Result	OUT	WORD	W#16#0	shows the result of the last command to T103 or neg. confirmed cmd from T101/4
CMD_Buf_DB	OUT	INT	0	Shows the data block number of command buffer (which is created at runtime)

Parameter- and Function details:

Comp_ID	Block identifier for (currently only internal) diagnostic functions. Assign different numbers within a block as Byte variable e.g. B#16#1.
T103_P_Application	T103_P_Application is a pointer to a common data range of block T103_S7_IEC_Config. Therefore it has to be interconnected to its output P_Application via a DWord variable. The pointer refers to all internal necessary data like transmit and receive buffer etc.
T103_Cmd_Send_now	A rising edge at this input starts the command specified at the block inputs.
T103_Cmd_ASDU_Adr	Common address of the ASDU transmitting the IEC 103 command messages (normally the device address). Permissible range is 0 to 254 The broadcast address 255 (FFh with length 1) is always accepted
T103_Cmd_Function_Type	Function type for commands activated via ‚T103_Cmd_Send_now'
T103_Cmd_Info_Number	Information number for commands activated via ‚T103_Cmd_Send_now'.
T103_Cmd_Direction	Desired switching direction: FALSE: switching direction OFF TRUE: switching direction ON

T103_Timeout_Conf	Monitoring time in seconds. Within this time a confirmation of the activation (COT=7) is expected. Otherwise the command is acknowledged negatively.
T1014_...	The ‚T1014_...' –parameters are only needed if commands from an IEC 101/104 Slave connection have to be forwarded via the IEC103 Master. For that you **additionally** need an IEC101 or IEC104 Slave application from SIPLUS RIC IEConS7.
T1014_P_Application	Only relevant for additional use of an IEC 101/104 Slave connection: ‚T1014_P_Application' is a pointer to a common data range of the block ‚S7_IEC_Config' from an IEC 101 or IEC 104 Slave application. If commands have to be forwarded from an IEC 101/104 Slave connection it has to be interconnected with its output ‚P_Application' via a DWord variable. The Config block receives user data such as 'ASDU address', actual time stamp receiver buffer, etc. and processes e.g. GIs, via this pointer or the data range behind it.
T1014_ASDU_Adr	Only relevant for additional use of an IEC 101/104 Slave connection: Address value of the Application-Service-Data-Unit forwarding the command messages. Permissible range with ASDU address length 1 Byte is 1 to 254 Permissible range with ASDU address length 2 Byte is 1 to 65534. The broadcast address 255 (FFh with length 1) resp. 65535 (FFFFh with length 2) are always accepted
T1014_First_IOA_or_ParDB	Only relevant for additional use of an IEC101/104 Slave connection: Address value of the first information object processed from the block Permissible range with IOA address length 1 Byte is 1 to 255 Permissible range with IOA address length 2 Byte is 1 to 65535. Permissible range with IOA address length 3 Byte is 1 to 16777215 If the information object address is available in structured form (3 octets) it has to be converted into an decimal number: IOA dec = octet1 + 256*octet2 + 256*256*octet3 Alternatively a parameter DB can be specified containing the information addresses to be processed. If the parameterizing is carried out via a parameter DB, an offset of 100000000 (eight zeros) has to be entered her. If the parameters have to be taken from the sample DB174 for instance, the value L#100000174 has to be entered.
T1014_Last_IOA_or_No_Inf	Only relevant for additional use of an IEC 101/104 Slave connection: Without use of a parameter-DB: Address value of the last information object processed from the block Permissible range with IOA address length 1 Byte is 1 to 255 Permissible range with IOA address length 2 Byte is 1 to 65535. Permissible range with IOA address length 3 Byte is 1 to 16777215 If the information object address is available in structured form (3 octets) it has to be converted into an decimal number: IOA dec = octet1 + 256*octet2 + 256*256*octet3 With use of a parameter-DB: Number of the information to be processed. The appropriate parameters are available in a parameter DB (refer to First_IOA_or_Para_DB_No)
T1014_Lock	Only relevant for additional use of an IEC 101/104 Slave connection: Blocking input for all commands processed from this block. FALSE: New commands are executed TRUE: New commands are not executed and acknowledged negatively.
T1014_Send_Termination	Only relevant for additional use of an IEC 101/104 Slave connection: Selection whether the command is terminated with or without transmitting a ‚Termination of activation' FALSE: without ‚Termination of activation' TRUE: with ‚Termination of activation' (default setting)
T1014_Cmd_Buffer_Dim	Only relevant for additional use of an IEC 101/104 Slave connection: The parameter determines the maximum number of buffered commands. 0 without command buffer (like V1.1) > 0 maximum number of buffered commands For that a command buffer is constructed during run time. An entry into the command buffer DB is only carried out, if an impulse command arrives while an impulse command is already running.

CMD_RUN

Command output running
If there is a command output via this block, the output is set as long as a command is active (transmitting to T103, confirmation from T103 (positive or negative) or timeout)

CMD_Count

Command counter (for diagnosis):
- > access only reading
The counter will be increased by 1 with each command handed over to IEC 103. It complies with the identification "RII" (Return Information Identifier) contained in the IEC 103 command message.
The counter will be not increased, if the command is NOT executed.

CMD_Result

Command status (for diagnosis):
The value informs about the status of the last processed command.
It shows the result of the last IEC 103 command or if necessary the negative confirmation of an IEC 101/104 command.
- > access only reading

Detailed information you find in the following list:

		Conf IEC 101/104	Term IEC 101/104
W#16#0100	Command running (sent to T103)	Pos	
W#16#0101	A command sent to T103 was confirmed positive		Pos
W#16#8001	DCS status not valid (11 or 00)	Neg	
W#16#8002	Not supported Qualifier (>3)	Neg	
W#16#8010	Global output blocking is set	Neg	
W#16#8012	1 out of n (command already running no intermediate buffer projected)	Neg	
W#16#8013	Intermediate buffer full	Neg	
W#16#8020	Target station not accessible (station disturbed)	Neg	
W#16#8101	A command sent to T103 was confirmed negative		Neg
W#16#8102	A command sent to T103 was not confirmed within Timeout		Neg

If the command is not processed from the block, no entry is carried out:
- wrong ASDU
- IOA not in the parameterized range

CMD_BUF_DB

Indicates the number of the command buffer DB
The size of the command buffer DB is fixed with ‚Cmd_Buffer_Dim'.

General information to function and handling of the block:

There are different possibilities for enabling the command output:

- Commands to T103 direct out of the SIMATIC, by setting the block parameter 'ASDU_Adr, Function_Type and Info_Number' and activating the command with Send_Now.
  If commands are only initiated out of the SIMATIC, the block can be operated without interconnection to a T101/T104 channel.

- Transmitting commands out of T101 or T104 connection to T103
  by converting the IOA of the T101/104 commands:
  Octet 1: ->Information number
  Octet 2: -> Function type
  Octet 3: -> (Optional) ASDU/device address. Will be used if <> 0. Otherwise the ASDU address specified at the block input will be used.

Transmitting commands out of a T101 or T104 connection by means of an address conversion DB: The allocation from T101/104 IOA to T103 information number, function type and (optional) ASDU address is parameterizable.

The block can be multiple used e.g. per SZG with an own ASDU/device address.

The block can also provide several protection devices with commands, by handing over always the ASDU resp. device address included.

Structure and values of the (optional) parameter data block:
For IOA conversion (IEC 101/104 to IEC 103):

Application of this parameter DB is only useful, if commands from an IEC 101/104 Slave have to be handed over to an IEC 103 Master.

The parameter DB has the following structure:

Group/ Parameter	Addr. rel.	Addr. Abs	Type	Start value	Comment
DB_Manag	0	0	STRUCT		
DB_Manag. **Pos_of_DB**	+0.0	0.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **No_of_all_DBs**	+1.0	1.0	BYTE	B#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Act**	+2.0	2.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Prev**	+4.0	4.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **DB_No_Next**	+6.0	6.0	WORD	W#16#0	reserved for future - do not change!
DB_Manag. **Reserved**	+8.0	8.0	WORD	W#16#0	reserved for future - do not change!
	+10.0	10.0	END_STRUCT		END_STRUCT (10 BYTE)
Info_Manag			STRUCT		
Info_Manag. **P_Byte_First_Info**	+0.0	10.0	INT	24	(Byte-) Position of first Para-Block - do not change!
Info_Manag. **No_of_Infos**	+2.0	12.0	INT	0	0:unspecified (DB is filled up to the end); otherwise size n of ARRAY [1..n]
Info_Manag. **Len_Info**	+4.0	14.0	BYTE	B#16#8	Difference in [byte] between two Para-Blocks - do not change!
Info_Manag. **Len_Sort_Key**	+5.0	15.0	BYTE	B#16#0	0: without sorting; > 0: Data sets are sorted ascending with x Bytes
DB_Manag. **Re_internal_usage**	+6.0	16.0	DWORD	DW#16#0	
	+10.0	20.0	END_STRUCT		END_STRUCT (10 BYTE)
Global			STRUCT		
Global. **Para_DB_Type**	0.0	20.0	WORD	W#16#AE01	Internal identifier for this Data Block - do not change!
Global. **Int_W22**	2.0	22.0	WORD	W#16#0	Reserved for internal use
	+4.0	24.0	END_STRUCT		END_STRUCT (4 BYTE)
IEC_Addr			ARRAY [1..n] STRUCT		n = number parameter entries
IEC_Addr. **T101_104_IOA**	+0.0	24.0	DINT	L#0	IOA Information object address from T101/T104 (Source)
IEC_Addr. **Res**	+4.0	28.0	BYTE	B#16#0	do not change
IEC_Addr. **T103_Cmd_ ASDU_Address**	+5.0	29.0	BYTE	B#16#0	(optional) Common Address of ASDU [1..254]: 0->ASDU Addr. of FB will be used
IEC_Addr. **T103_Cmd_ Function_Type**	+6.0	30.0	BYTE	B#16#0	Function type [0..255/B#16#0..B#16#FF]
IEC_Addr. **T103_Cmd_ Info_Number**	+7.0	31.0	BYTE	B#16#0	Information number [0..255/B#16#0..B#16#FF]
	+8.0	32.0	END_STRUCT		END_STRUCT (8 BYTE)

	These values are preset in the default DBs and must not be changed. A sample DB is included in the relevant block libraries. DB174 = ‚P_T103_CMD'.
	!!! These parameters you have to set !!!
(info icon)	**Note:** Always make changes in the 'Data view', not in the 'Declaration view' (except dimensioning of the array)

DB_Management

Parameter blocks which include an enumeration are constructed in a way, that more than one data block can be used if required. The following information is required for management.

Currently the DB management is not used – for this reason all parameters can be left at their default settings (0)

Pos_of_DB

Number (1 – n) of the current data block for the parameter block
0: not used

No_of_all_DBs

Total number (n) of data blocks for the parameter block
0: not used

DB_No_Act

DB number of the current data block
0: not used

DB_No_Prev

DB number of the previous data block, if one exists.
Otherwise: 0

DB_No_Next

DB number of the subsequent data block, if there is another one.
Otherwise: 0

Info_Management

Parameter blocks containing an enumeration have one information block 'Info management'. It contains the following information

The values of the information management parameters are already preset and therefore do not need to be modified.

P_Byte_First_Info

Byte position of the first data record in this DB

No_of_Infos

Number of data records contained in this DB
0: unspecified -> the data block end marks the last data record

Len_Sort_Key

0: no sorting (default setting)
4: the first 4 Bytes of the information specific parameter (refer to parameter group IEC_Addr.) form the sorting criteria.
Other sorting length are not permissible

If many parameter blocks are needed, it is recommended to file the blocks with ascending sorting criteria according to ‚T101_104_IOA' , into the parameter DB.
A so set up data block is searched more effective related to ‚Len_Sort_Key' = 4 (binary search).

Global Parameter

These parameters are type specific. This is why its function is only described at this place partially.

You find supported values in the corresponding chapters for block description

Para_DB_Type

Internal used: Identification for this parameter DB – don't change!

Internal

Internal used: don't change

IEC_Addr.
Para per Info (-group)

Set up an arbitrary number of parameter blocks by setting the corresponding array value n in the declaration view. In the data view the parameter can be adjusted individually.

For each desired command a parameter block has to be set up.

The statically assignment from control bit to command and the complete description of the particular command with all its properties is carried out here.

T101_104_IOA

IEC 101/104 information object address (IOA) of the command message received from IEC 101/104 Slave.

T103_Cmd_ASDU_Adress

The specification of a common address of the ASDU for the output of the particular command is optional.

0:          ASDU-Address of the FB will be used

1…254:   ASDU-Address entered here will be used

255:       Broadcast address, not useful/non permissible here.

T103_Cmd_Function_Type

Function type in the output of the particular command

Permissible are the values 0 up to 255.

Input is carried out in the hexadecimal format (B#16#0 up to B#16#FF)

T103_Cmd_Info_Number

Information number in the output of the particular command.

Permissible are the values 0 up to 255.

Input is carried out in the hexadecimal format (B#16#0 up to B#16#FF)

Additional information for processing of IEC 101/104 commands

Only relevant if the commands have to be activated via the IEC 101/104 protocol

→ The switching commands are subject of a 1 out of n control
only one command at a time is processed.
If several command messages have to be processed at the same time, the block has to be called up several times. At the inputs ‚First_IOA_or_Para_DB_No’ resp. ‚Last_IOA_or_No_of_Infos’ the respective IOA has to be filtered.

→ The IEC-Originator is reflected and will be sent in the answer messages if necessary.

→ Test bits and a set P/N Bit in the cause of transmission (COT) lead to 'no handling' – the message is not processed.

→ From V1.1 negative command confirmations are sent 'substitutional' from SL_ORG_ASDU if no command/setpoint value block (SLo_...) has processed (acknowledged) the message within the next OB1 cycle after receiving a command/setpoint value adjusting command (with COT 6 or COT 8).
The acknowledgement is carried out with:
   - COT 44: unknown TI, if no output block is programmed for the received TI
   - COT 45: unknown COT, if the received COT is not supported from the responsible SLo-block (this is the block with the correct IOA).
   - COT 47: unknown IOA, if no output block is programmed for the received IOA.

→ Select/Execute will be entered in the status bit SE; however it is not evaluated for the command output.
The command is issued independently from S/E.

→ Command messages with time stamp (TI58,…64) are accepted, forwarded with time and executed.
However, in the actual version the time stamp is not evaluated.

From V1.2 impulse commands are temporary stored in a command buffer DB in case an impulse command is already active.
With it fast 'not monitored' command sequences are supported.

Received commands addressed to the block (ASDU-Addr, IOA-Addr…) will be operated according the following rules:

→ The output of the buffered commands will be serial, i.e. the output of the next command is executed after completion of the preceding command.
The commands are processed thereby in the sequence of its arrival.

➢ Output of persistent commands as hitherto (finished in one cycle)

➢ Abort commands are carried out if the command to be aborted is just active. Otherwise it is confirmed negative.

➢ Abort commands do not act on commands in the buffer.

→ **Without temporary buffer** (‚Cmd_Buffer_Dim’ = 0, or buffer-DB could not be constructed) the behavior like V1.1 is kept. Further switching commands arriving during a running switching command (impulse command) are rejected (negative confirmation).

→ **With temporary buffer** switching commands are executed directly if no command is running.

→ **With temporary buffer** switching commands are buffered if

   • a (switching) command is active (is running).

   • there is at least one command in the buffer

→ **With temporary buffer** switching commands are rejected, if the buffer is full.

➔ **With temporary buffer** continuous commands are treated like impulse commands, this means they are forwarded and monitored. Hence in this case buffering of the commands.

➔ FB174 in principle does not support stop commands. Hence they are always rejected and negative acknowledged.

Command processing in case of link disturbance

The send buffer of the IEC Master is cleared after a link disturbance to the (IEC-) partner disappears.

This prevents the delayed output of commands initiated during a detected link disturbance. If necessary the corresponding commands have to be initiated new.

5. SIPLUS RIC IEConS7 in SIMATIC H-Systems

The blocks from SIPLUS RIC IEConS7 can be inserted directly in SIMATIC H-Systems.

Subsequently we introduce some typical configuration examples for the protection device protocol IEC 60870-5-103.

5.1. Configurations
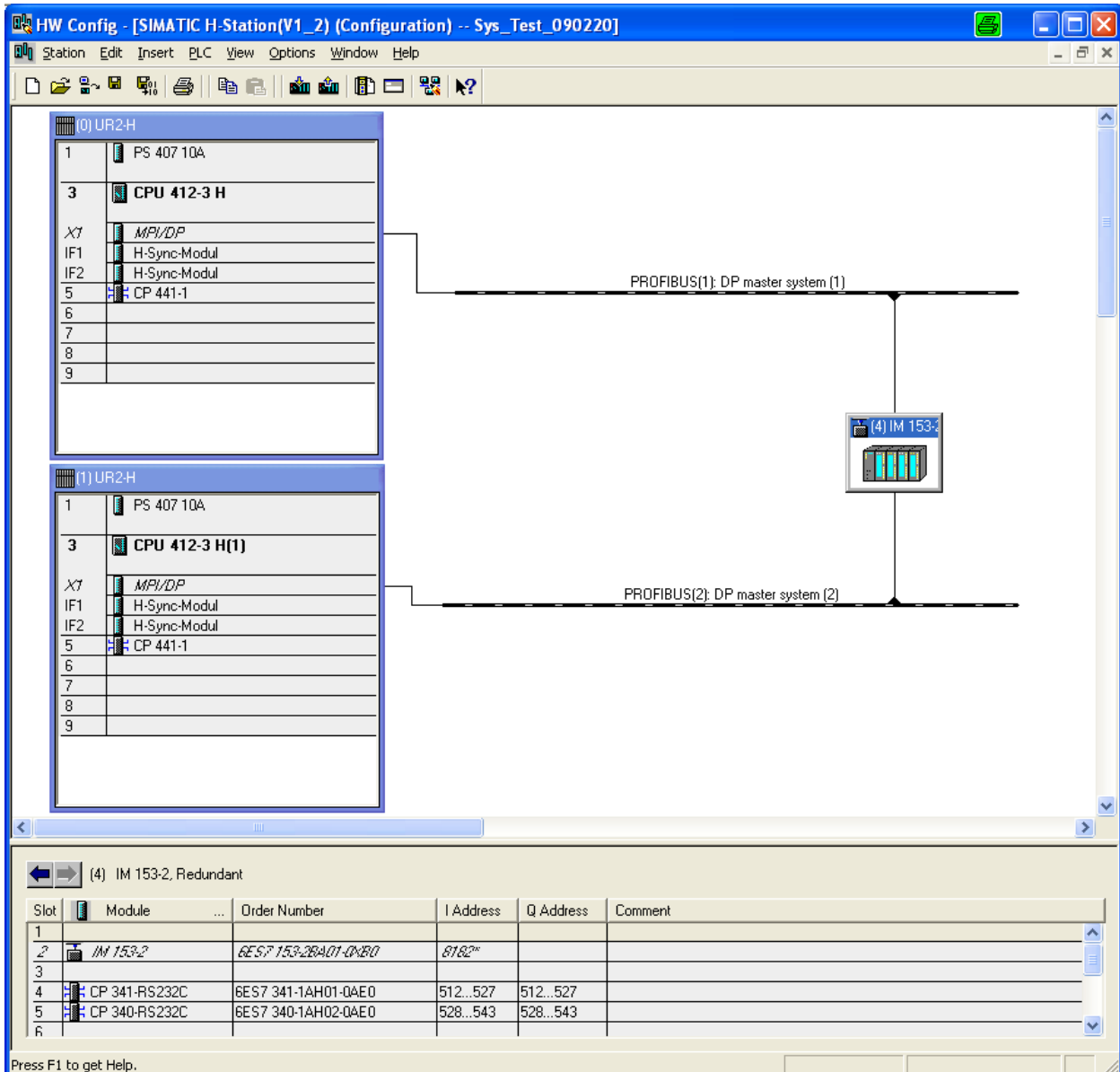
The figure shows a possible hardware configuration. In this configuration the assembly of the following IEC 103 communication links would be possible:

- Protocol IEC 103 Master via CP340 in ET 200 M- Rack
- Protocol IEC 103 Master via CP341 in ET 200 M- Rack
- Protocol IEC 103 Master via **one** of the two CP441-1 in the S7-400H Racks.

  With regard to high availability also in case of rack failure, this configuration is not recommended.

Depending on the protocol variant which has to be carried out, only part of the hardware is required.

5.1.1. IEC 60870-5-103 Master via CP340/341

Configuration:
SIPLUS RIC IEConS7 is working as Master.
The connection of protection device is carried out serial via a CP340 or CP341 in ET 200M-Rack.

Normal operation:
The process leading CPU (Rack) in the H-System communicates via the CP340/341 with the protection device.

Breakdown in the process leading Rack:
The CPU in the reserve rack takes over the data traffic via the CP340/341.
The protection device can't and has not to discover the switch over. No loss of data occurs.
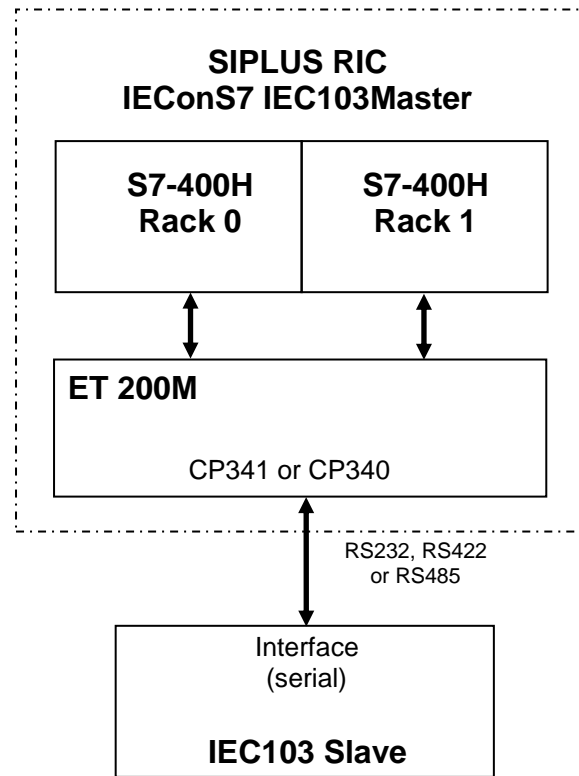
The projection of the CP340/341 is carried out like described in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.**

```
┌─────────────────────────────────────────┐
│           SIPLUS RIC                     │
│      IEConS7 IEC103Master                │
│  ┌─────────────┬─────────────┐           │
│  │  S7-400H    │  S7-400H     │           │
│  │  Rack 0     │  Rack 1      │           │
│  └─────────────┴─────────────┘           │
│         ↕              ↕                  │
│  ┌─────────────────────────────┐         │
│  │  ET 200M                    │         │
│  │                             │         │
│  │      CP341 or CP340         │         │
│  └─────────────────────────────┘         │
└─────────────────────────────────────────┘
                    ↕  RS232, RS422
                       or RS485
        ┌─────────────────────────┐
        │      Interface          │
        │      (serial)           │
        │                         │
        │      IEC103 Slave       │
        └─────────────────────────┘
```

5.1.2. IEC 60870-5-103 Master via CP441

Configuration:
SIPLUS RIC IEConS7 is working as Master.
The connection of protection device is carried out serial via the CP441-1 in Rack 0.

Normal operation:
The process leading CPU (e.g. CPU in Rack 1) in the H-System assembles the connection to the protection device via the CP441-1 in Rack 0.

Break down of the process leading CPU in Rack 1:
The CPU in reserve Rack 0 hitchless takes over the data traffic via the CP441-1.
The protection device can't and has not to discover the switch over. No loss of data occurs.
Break down of the CPU in Rack 0 or from Rack 0:
In this case the communication via CP441-1 in Rack 0 is no longer possible.

With regard to high availability also in case of rack failure, this configuration is not recommended.

```
┌─────────────────────────────────────────┐
│           SIPLUS RIC                     │
│         IEConS7 Master                   │
│  ┌─────────────┬─────────────┐           │
│  │  S7-400H    │  S7-400H     │           │
│  │  Rack 0     │  Rack 1      │           │
│  │  CP441-1    │              │           │
│  └─────────────┴─────────────┘           │
└─────────────────────────────────────────┘
              ↕  RS232, RS422
                 oder RS485
        ┌─────────────────────────┐
        │      Interface          │
        │      (serial)           │
        │                         │
        │      IEC103 Slave       │
        └─────────────────────────┘
```
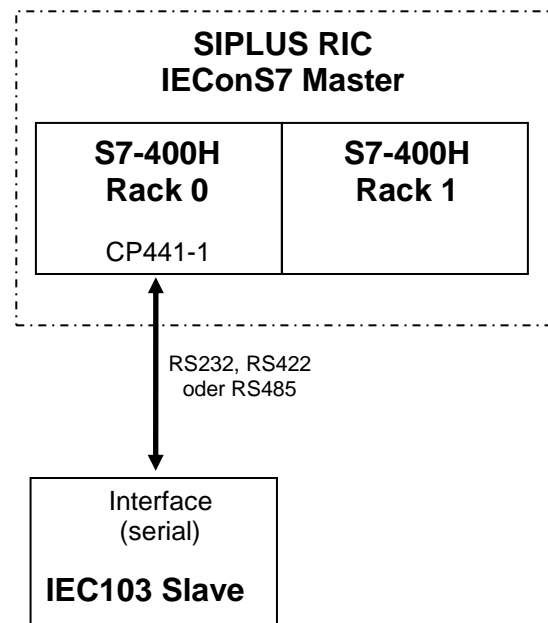
The projection of the CP441-1 is carried out like in chapter **Fehler! Verweisquelle konnte nicht gefunden werden.** described.

6. Contacts/Addresses

In case you have queries concerning the SIPLUS RIC product line or you want advice via phone: we will help.

SIPLUS RIC – Product manager

Dieter Söhlmann
Phone: +49 (0) 911 750-4790
Email: dieter.soehlmann@siemens.com

Based on the existing blocks, enhanced requirements for IEC communication (e.g. other image layouts or information content, transmission causes, etc.…) can be implemented with minimal work and cost-effectively.

Please ask us if your application requires a customized project solution with enhanced functionality. As a service provider in the field of SIMATIC project planning and programming, we look forward to solve your problems together with you.

SIPLUS RIC – Support line
Mail: siplus-ric.automation@siemens.com

You find further information on the SIPLUS Internet pages
Website: http://www.automation.siemens.com/siplus/index_00.htm

Site address	**Postal address**
Siemens AG	Siemens AG
Digital Factory	Digital Factory
Factory Automation	Factory Automation
Systems Engineering	Systems Engineering
DF FA SE - SIPLUS RIC	DF FA SE - SIPLUS RIC
Breslauer Str. 5	P.O. Box 2355
D-90766 Fürth	D-90713 Fürth

SIPLUS RIC IEConS7 is based on standard Siemens products. You will find information and support from our central service & support:

Service & Support

Industry Customer Carecenter
DF CS SD CCC CRU OP
Phone: +49 (0) 911/895 7222
Fax.   +49 (0) 911/895-7223
Inquiries: http://www.siemens.de/automation/support-request
Website: http://www.siemens.de/automation/service&support

7. Appendix

7.1. Resource assignment

Resources required by the application blocks:

Type	Amount or number range	Note
Memory (S7-300 and S7-400)		
Loading memory	64 kB	approx. value, min. requirement
Working memory	64 kB	approx. value, min. requirement
Data	10 kB	approx. value, min. requirement
Memory (S7-1500 and ET 200SP):		
Loading memory	4.5 MB	approx. value, min. requirement if all application blocks have been loaded
Code-Working memory	96 kB	
Data	26 kB	
Remanence memory	7.5 kB	
Blocks:		
FBs	1 – 199 200 -228 (TIA-Portal V13 SP1)	can be re-wired, (with SIMATIC Manager) multi-instance compatible
FCs	1 - 199	can be re-wired
DBs	1 - 199	
Other:		
Markers	none	
Timers	none	
Counters	none	

All functional blocks (FB) are designed in a way so that they can be used in the application as multi-instance functional blocks.

> **NOTICE**
>
> **Released CPU versions!**
>
> **Only the following CPU versions are released:**
>
> ET 200S IM151-7 CPU from V2.6
> ET 200S IM151-8 PN/DP CPU from V2.7
> S7-300 from V2.0 with min 64kB working memory
> S7-400 from V4.0
> S7-1500 and ET 200SP from V1.0
> Station Controller from V1.8

The table below shows in detail which blocks are included in the individual libraries.

Type	No.	Symbolic Name	S7IEC_M103_CP1SI	S7IEC_M103_CP340	S7IEC_M103_CP341	S7IEC_M103_CP441	S7IEC_M103_WinAC													
DB	90	Para_SER_WinAC					x													
DB	90.. 98						x													
DB	100	S7_IEC																		
DB	139	Para_DB_IOA_Demo																		
DB	111	P_LinkAdr_n	x	x	x	x	x													
DB	112	P_ASDUAdr_n	x	x	x	x	x													
DB	140	Para_DB _MAo_SP																		
DB	141	Para_DB _MAo_DP																		
DB	142	Para_DB _MAo_ST																		
DB	143	Para_DB _MAo_BO																		
DB	144	Para_DB _MAo_MEa																		
DB	145	Para_DB _MAo_MEb																		
DB	146	Para_DB _MAo_MEc																		
DB	147	Para_DB _MAo_IT																		
DB	148	Para_DB _MAi_CMD																		
DB	170	S7_IEC_T103	x	x	x	x	x													
DB	172	P_T103_IND	x	x	x	x	x													
DB	173	P_T103_ME	x	x	x	x	x													
DB	174	P_T103_CMD	x	x	x	x	x													

Type	No.	Symbolic Name	S7IEC_M103_CP1SI	S7IEC_M103_CP340	S7IEC_M103_CP341	S7IEC_M103_CP441	S7IEC_M103_WinAC											
FB	2	S_RCV	x															
FB	3	S_SEND	x															
FB	2	P_RCV		x			x											
FB	3	P_SEND		x			x											
FB	7	P_RCV_RK			x													
FB	8	P_SND_RK			x													
FB	63	TSEND																
FB	64	TRCV																
FB	65	TCON																
FB	66	TDISCON																
FB	91	P_RECV_WINAC					x											
FB	92	P_SEND_WINAC					x											
FB	93	V24_STAT_WINAC					x											
FB	94	V24_SET_WINAC					x											
FB	95	COM_INIT_WINAC					x											
FB	96	P_RESET_WINAC					x											
FB	100	S7_IEC_Config																
FB	101	L1_CP341			x													
FB	102	L1_CP441				x												
FB	103	L1_CP340		x														
FB	104	L1_1SI	x															
FB	105	L1_CP343																
FB	106	L1_CP443																
FB	107	L1_CPU31x_PN																
FB	108	L1_CPU41x_PN																
FB	110	L1_T101_103_bal_unbal	x	x	x	x	x											
FB	111	L1_WINAC_SER					x											
FB	120	L7_T101_103_104_B	x	x	x	x	x											
FB	121	SL_Org_Asdu_1																
FB	122	MA_org_Asdu_n																
FB	130	SLi_SP_DP_s128																
FB	131	SLi_ST_s8																
FB	132	SLi_BO_s8																
FB	133	SLi_ME_ABC_s32																
FB	134	SLi_IT_s8																
FB	135	SLo_SC_DC_RC_sx																
FB	136	SLo_SE_ABC_sx																
FB	137	SLo_BO_sx																
FB	148	MAi_SC_DC_RC_pDB																
FB	149	MAi_SE_ABC_1																
FB	150	MAi_BO																
FB	170	T103_S7_IEC_Config	x	x	x	x	x											
FB	171	T103_MA_ORG_ASDU	x	x	x	x	x											
FB	172	T103_MAo_IND_SLi_T1014	x	x	x	x	x											
FB	173	T103_MAo_ME_SLi_T1014	x	x	x	x	x											
FB	174	T103_MAi_CMD_SLo_T1014	x	x	x	x	x											

Type	No.	Symbolic Name	S7IEC_M103_CP1SI	S7IEC_M103_CP340	S7IEC_M103_CP341	S7IEC_M103_CP441	S7IEC_M103_WinAC											
FC	1	AD_DT_TM	x	x	x	x	x											
FC	5	V24_STAT																
FC	6	V24_SET																
FC	10	AG_CNTRL																
FC	50	AG_LSEND																
FC	60	AG_LRECV																
FC	100	Set_Buf_Para	x	x	x													
FC	110	S7_IEC_Buf_Create	x	x	x	x	x											
FC	111	S7_IEC_Buf_Control	x	x	x	x	x											
FC	112	S7_IEC_Job_Info	x	x	x	x	x											
FC	113	S7_IEC_Diag	x	x	x	x	x											
FC	114	S7_IEC_TimeConv	x	x	x	x	x											
FC	115	S7_IEC_MA_Find_IEC_Adr	x	x	x	x	x											
FC	116	S7_IEC_Copy	x	x	x	x	x											
FC	140	MAo_SP_IM_pDB																
FC	141	MAo_DP_IM_pDB																
FC	142	MAo_ST_IM_pDB																
FC	143	MAo_BO_IM_pDB																
FC	144	MAo_ME_NA_IM_pDB																
FC	145	MAo_ME_NB_IM_pDB																
FC	146	MAo_ME_NC_IM_pDB																
FC	147	MAo_IT_IM_pDB																
UDT	65	TCON_PAR																
VAT		VAT_S7_IEC																
VAT		VAT_S7_IEC_T103	x	x	x	x	x											

The (green) marked blocks are standard SIMATIC blocks.

All others are the application-specific blocks.

If there are already blocks in your project with the same name, you can modify the names according to the requirements of your project using the 'block/re-wiring' function.

The Communication-FBs ('S7_IEC_Config' and 'T103_S7_IEC_Config) are designed exclusively for the OB1 sequence level. Within this also the application blocks have to be operated!

7.2. Interoperability list for T103

The interoperability list for the protocol IEC 6087-5-103 is included on the CD as a separate PDF file (IEConS7 Interoperability IEC 103 V1_x.pdf).