

## SIPLUS RIC IEConS7




### AddOn Nodal Blocks Version V1.6



## 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.

	<b>DANGER</b>
indicates that death or serious injury <b>will</b> result if proper precautions are not taken.	
	<b>WARNING</b>
indicates that death or serious injury <b>may</b> result if proper precautions are not taken.	
	<b>CAUTION</b>
indicates that minor personal injury <b>may</b> result if proper precautions are not taken.	
<b>NOTICE</b>	
means that material damage <b>can</b> 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 and marking 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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	<b>CAUTION</b>
<p><b>Changes to cabinet wiring!</b></p> <p>Changes to cabinet wiring may only be performed in <b>zero-voltage</b> state! An additional or modified wiring realized outside of the manufacturing enterprise requires an <b>additional</b> functional and insulation test.</p>	

## 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".



<b>NOTICE</b>
<p><b>Electrostatic Sensitive Devices ESD!</b></p> <p>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.</p>

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.

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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 IEC on S7*. 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 telecontrol protocols conforming to IEC 60870-5-101 and IEC 60870-5-104
- 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.

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## 1. General

This manual describes the functionality of the AddOn function blocks FB161 and FB166. They allow the low effort realization of an IEC nod with the software SIPLUS RIC Application IEC on S7 V1.6.

The present description has to be perceived as a supplement of the SIPLUS RIC IEC on S7 manual V1.6.

You'll receive the blocks in the form of a SIMATIC block library.

## 2. Overview Nodal function

The nodal function is a configuration with a SIPLUS RIC IEC on S7 station connected between two IEC telecontrol equipments for enabling the transmission of information via the telecontrol protocols IEC101 resp. IEC104.

Depending on the case of operation classical control center/substation interlinkings as well as interconnections between several substations can be carried out.

In practice the classical control center/substation link with exchange of information between one or several subordinated RTUs and one control center will be the most used application. Therefore the instructions and figures in the subsequent description apply to this configuration.

In this case SIPLUS RIC IEC on S7 has IEC-Slave function compared to the control center and IEC-Master function compared to the subordinated RTU.

The nodal blocks support the easy and extensively non parameterized projection of the information to be transferred.

The following blocks are available:

FB161 for the control direction

subordinated RTU → SIPLUS RIC IEC on S7 → Control center

FB166 for the monitoring direction

control center → SIPLUS RIC IEC on S7 → subordinated RTU

In control direction the blocks are designed for realization of a "transparent" node:

- for direct passing of information (exception: time stamp, ASDU address conversion).
- automatically update of the image (created during operation)
- In order to transmit measured values not with each change of a bit a global programmable threshold for slowdown of the measured values was added.

as well as user configurable by assigning of a parameter data block. This implicates the essential features:

- defining the information which has to be transferred (defined quantity structure)
- individual conversion of the information object addresses
- parameterizable threshold for measured values per information
- possibility for image access (diagnosis/further processing)

Interrogation and disturbances are processed out of the image.

### 3. Application blocks for nodal functionality

Basically two packages are available for the SIPLUS RIC IEC on S7: Slave and Master function.

Slave (SL) blocks perform the classical substation functions like capture of indication/measured values or command output.

Master (MA) blocks perform control center tasks like taking over of states in images, initiation of commands etc.

The FB161 and FB166 blocks described here are application blocks performing Master as well as Slave functions.

For more detailed information about Slave and Master blocks we refer you to the SIPLUS RIC IEC on S7 manual V1.6.

#### NOTICE

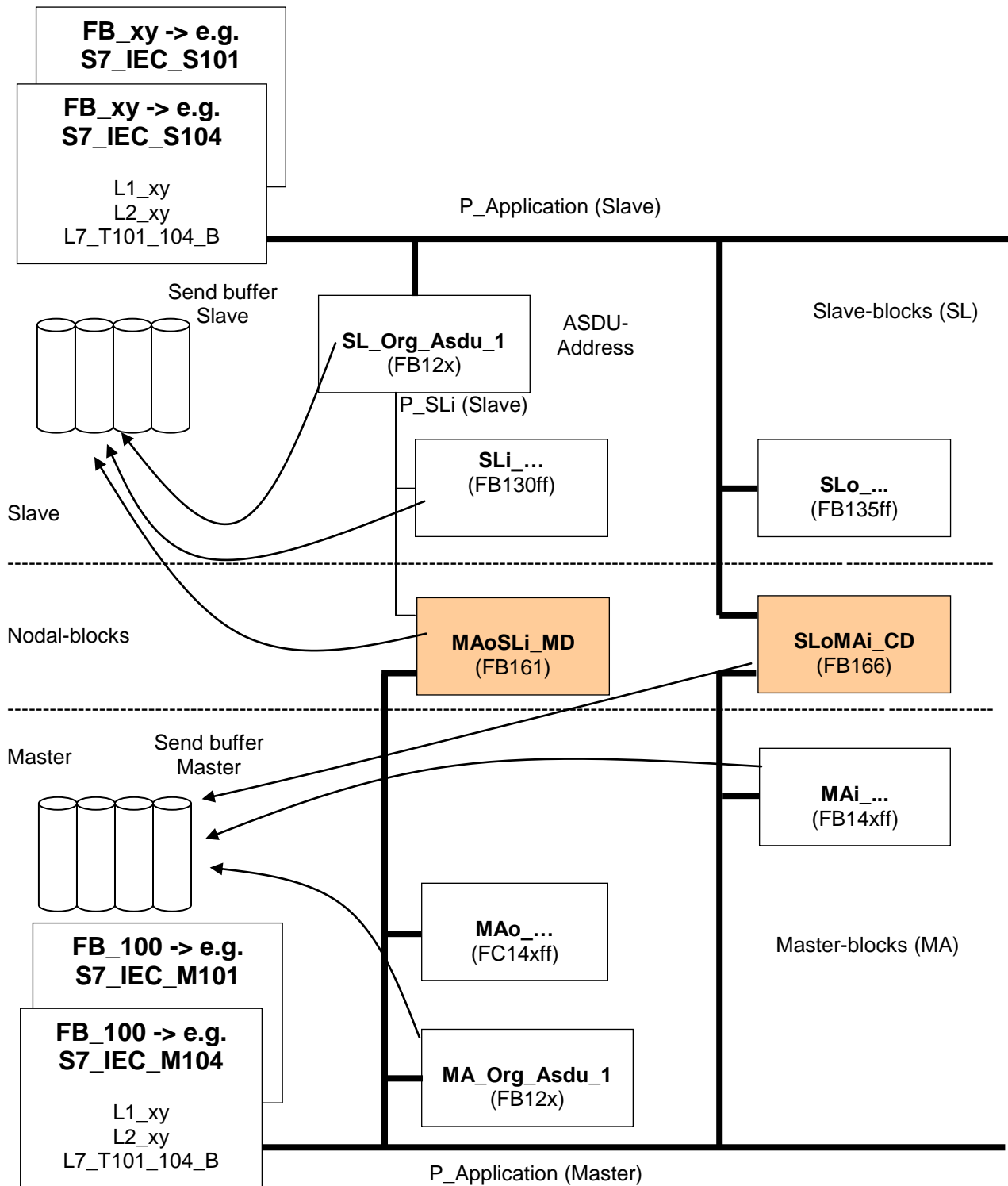
All application blocks are designed **exclusively for the OB1** priority level. The FB100 communication blocks ('S7\_IEC\_Config') also have to be operated in priority level OB1!



#### 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.

### 3.1. Nodal blocks MAoSLi/SLoMAi



All blocks are multiple usable.



Pre-condition for using the nodal blocks is the existence of minimum two IEC-channels in the system. They mostly consist of an IEC-Slave (as interface to the control center) and an IEC-Master (interface to the subordinated RTU).

#### Figure Nodal blocks:

The figure shows the „classical“ information flow from an subordinated station via the node to the control center (monitoring direction, `_MD`) resp. from the control center via the node to the subordinated station (command direction `_CD`).

Each of the node application blocks (`,MaoSLi_MD` and `,SLoMAi_CD`) have one interface each to the source **and** to the target application available, which have to be interconnected according to the following description

#### **MAoSLi\_MD, for the monitoring direction**

The flow direction of the information is:

Master (source) -> node -> Slave (target)

The application block, `MAoSLi_MD` is connected via the pointer `,P_Application (Master)` with the `,S7_IEC_Config` of the Master protocol version (information source) like the MAo-blocks i.e. the functional block will be linked directly to the IEC-Master-activation.

The link to the Slave-application (information target) is carried out like the activation of the SLi-blocks with the pointer `,P_SLi (Slave)` via an organization block `,SL_Org_AsdU_1`. The parameterized ASDU-address from the `,SL_Org_AsdU_1` will be also used for the information of the nodal block.

#### **SLoMAi\_CD, for the command direction**

The flow direction of the information is:

Slave (source) -> node -> Master (target)

The application block `,SLoMAi_CD` is connected via the pointer `,P_Application (Slave)` with the `,S7_IEC_Config` of the Slave protocol version (information source) like the SLo-blocks.

The link to the Master-application (information target) is carried out with the pointer `,P_Application (Master)` to the `,S7_IEC_Config` of the Master protocol version like the MAi-blocks.

#### **NOTICE**

All application blocks are designed **exclusively for the OB1** priority level. The FB100 communication blocks (`,S7_IEC_Config`) also have to be operated in priority level OB1!

### 3.1.1. Nodal block for the monitoring direction MAoSLi

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

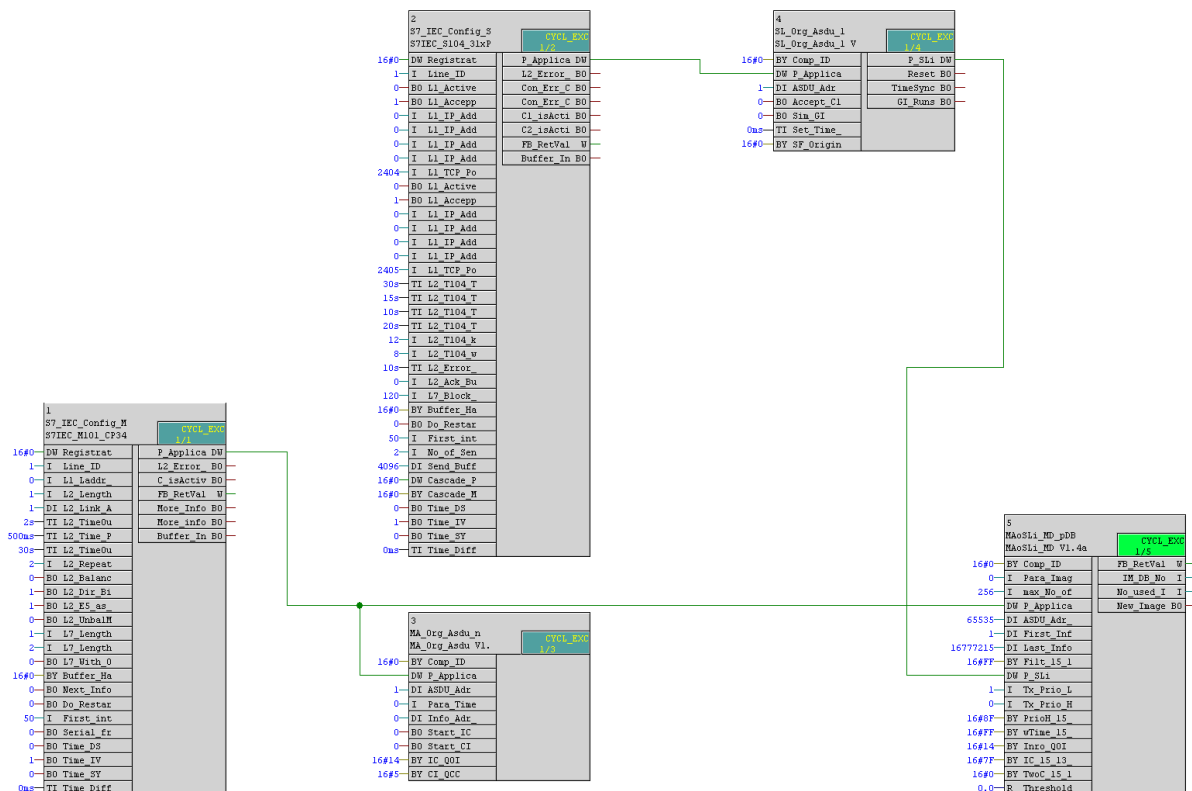
- MAoSLi\_MD\_pDB**      **MAo** is the abbreviation for **Master** block **output**. It is an output block. The output of the block is the information contained in the message (in this case to an image DB)
- MAoSLi\_MD\_pDB**      **SLi** is the abbreviation for **Slave**-block **input**. It is a process acquisition block. The block captures the information in the image-DB and hands it over to the IEC-Slave.
- MAoSLi\_MD\_pDB**      **MD** is the abbreviation for **Monitoring Direction**. This is the signaling resp. monitoring direction (subordinated Station → SIPLUS RIC IEC on S7 → control station)
- MAoSLi\_MD\_pDB**      **pDB** is the abbreviation for parameterizable by DB (option)

The available MAoSLi-functional blocks are shown in the following overview.

Block	Block.-No.	Function
<b>MAoSLi_MD_pDB</b>	FB161	Transfer of information in monitoring direction (indications, measured values etc.) from a subordinated station to the remote station.

Depending on the used SIMATIC CPU the block is applicable for the transfer of up to 1400 information. The number can be increased by multiple use of the block

Illustration of the necessary interconnection – here exemplifying in a CFC-plan:



### 3.1.1.1. Nodal block MAoSli\_MD\_pDB (FB161)

The block has to be embedded between ‚SL\_ORG\_ASDU‘ of the target application (Slave) and ‚S7\_IEC\_Config‘ of the source application (Master).

The block transfers the information received by telecontrol messages from the Master connection to the Slave connection. In the simplest case it is carried out “transparent” i.e. the information are transferred 1 to 1 without any pre-processing.

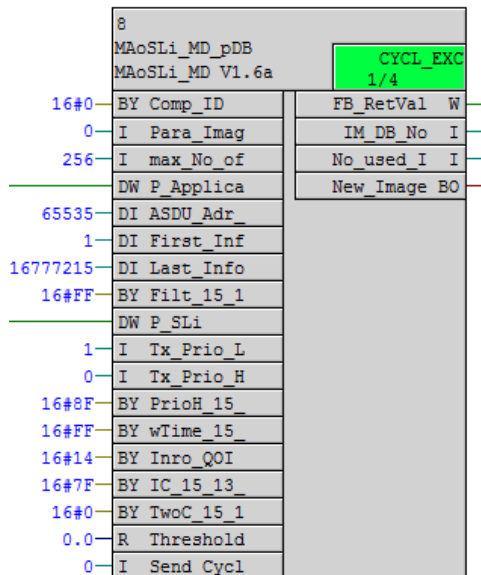


Illustration as CFC-block with default values

```
CALL "MAoSli_MD_pDB" , DB261
  Comp_ID           :=
  Para_Image_DB     :=162
  max_No_of_Images :=
  P_Application_Src :=#P_Appl_MA
  ASDU_Adr_Src     :=L#111
  First_Info_Adr_Src :=L#1
  Last_Info_Adr_Src :=L#20000
  Filt_15_13_11_9_7_5_3_1 :=
  P_SLi            :=#P_Sli_S1
  Tx_Prio_L        :=
  Tx_Prio_H        :=
  PrioH_15_13_11_9_7_5_3_1:=
  wTime_15_13_11_9_7_5_3_1:=
  Inro_QOI         :=
  IC_15_13_11_9_7_5_3_1 :=
  TwoC_15_13_11_9_7_5_3_1 :=
  Threshold_Val_ME :=1.000000e+001
  Send_Cyclic_Interval_sec:=
  FB_RetVal        :=MW200
  IM_DB_No         :=MW202
  No_used_IMs      :=MW204
  New_Image        :=M206.0
```

Illustration in AWL with fractional parameter supply

#### Important features are:

- With minor effort of parameterization much information (‚max\_No\_of\_Images‘) can be processed:
  - Single indication with TI1, 2, 30
  - double indication with TI3, 4, 31
  - transformer tap with TI5, 6, 32
  - Bit pattern with TI7, 8, 33
  - measured value normalized value with TI9, 10, 34
  - measured value with scaled value with TI11, 12, 35
  - measured value with short floating point number with TI13, 14, 36
  - integrated totals with TI15, 16, 37
- Readings for the default adjustments can be taken from the corresponding variable comment. On the other hand only a minimum of mandatory inputs are required. The interconnection of ‚P\_Application\_Src‘, ‚ASDU\_Adr\_Src‘ and ‚P\_SLi‘ is a minimum requirement.
- automatic update of the image-DB with filter possibility for
  - defined address bands with ‚First\_Info\_Adr\_Src‘, ‚Last\_Info\_Adr\_Src‘
  - certain information types with ‚Filt\_15\_13\_11\_9\_7\_5\_3\_1‘
- Adjustable processing per information type
  - Priority
  - time stamp
  - GI (in parallel to the general interrogation (GI) a group interrogation is supported)
  - Transfer also without changes
- Automatic designation of all information with status not topical (NT) in case of disturbed connection to the subordinated station.
- Optional assignable parameter block for
  - Individual quantity structure
  - Address conversion (of the information object address)
  - parameterizable threshold for measured values per information
  - possibility of image access (diagnosis/further processing)

### 3.1.1.2. Block parameter with its default assignment and short comment

FB161		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 will be created at runtime
max_No_of_Images	IN	INT	256	Default: 256; dimension of dynamic generated data block for the images
P_Application_Src	IN	DWORD	DW#16#0	Pointer which has to be connected to 'S7_IEC_Config' - Module (Source of info)
ASDU_Adr_Src	IN	DINT	L#65535	Default: 65535=FFFFh -> All;
First_Info_Adr_Src	IN	DINT	L#1	Default: 1
Last_Info_Adr_Src	IN	DINT	L#16777215	Default: max=16777215=FFFFFFh;
Filt_15_13_11_9_7_5_3_1	IN	BYTE	B#16#FF	TI-Filter for IT/MEC/MEB/MEA/BO/ST/DP/SP: Def: all TIs are forwarded (B#16#FF)
P_SLi	IN	DWORD	DW#16#0	must be connected with P_to_SLi from SL_Org_ASDU - Module
Tx_Prio_L	IN	INT	1	Priority of transmission with Prio L: 0 (highest) - 15 (lowest) Default = 1
Tx_Prio_H	IN	INT	0	Priority of transmission with Prio H: 0 (highest) - 15 (lowest) Default = 0
Pri- oH_15_13_11_9_7_5_3_1	IN	BYTE	B#16#8F	Priority for transmission: 0: Low, 1: High Default = B#16#8F (MEs=Prio Low)
wTime_15_13_11_9_7_5_3_1	IN	BYTE	B#16#FF	Transmission with(1) or without(0) Timestamp if COT < 20(requested); Def. = B#16#FF
Inro_QOI	IN	BYTE	B#16#14	0: No Reaction; 20 (=14hex, default) General interrogation; 21 - 36 -> Group 1 - 16
IC_15_13_11_9_7_5_3_1	IN	BYTE	B#16#7F	active. TIs will be transmitted within an interrogation; Default: B#16#7F
TwoC_15_13_11_9_7_5_3_1	IN	BYTE	B#16#0	active. TIs will be forwarded without change of val/state, if rcv. COT < 20. Def: 0;
Threshold_Val_ME	IN	Real	0.0	0.0 without (def.), > 0: Threshold value (digits) for forwarding of measured val.
Send_Cyclic_Interval_sec	IN	INT	0	0: without (def); each 1-x [sec] will be send one info as background scan
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
New_Image	OUT	BOOL	FALSE	Signals that the number of Images has been increased within this cycle

### 3.1.1.3. Parameter and functions details:

Comp_ID	Block identification for (actual only internal) diagnostic functions. Assign different numbers within one block type as byte variable e.g. B#16#1
Para_Image_DB	DB-No. of the dedicated parameter -/image data block. 0: the parameter-/image data block is created automatically during process. Size correspondent 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 image data block. The use of the memory per information object is 44 Byte. At CPUs supporting a DB size of 16kByte → max. 371 at CPUs supporting a DB size of 64kByte → max. 1489 with one FB call. With corresponding capable CPUs the amount of information can be increased by multiple call of the FB.
P_Application_Src	P_Application is a pointer on a common data range from ‚S7_IEC_Config’ block. Therefore it must be interconnected via a DWord variable with its output ‚P_Application’. Via this pointer resp. the data range behind, application data like ASDU address, receive buffer etc. are handed over to the config block.
ASDU_Adr_Src	Value of the address from the application service data unit, which is the source of the information. Permissible range for the length of the ASDU address 1 byte is 1 up to 254 Permissible range for the length of the ASDU address 2 byte is 1 up to 65534 The broadcast addresses 255 (FFh if length 1) resp. 65535 (FFFFh if length 2) are always accepted.
First_Info_Adr_Src	Value of the address of the first information object processed from the block Permissible range for the length of the IOA address 1 byte is 1 up to 255 Permissible range for the length of the IOA address 2 byte is 1 up to 65535 Permissible range for the length of the IOA address 3 byte is 1 up to 16777215 If the information object address exists in structured form (3 octets), it has to be converted into a decimal number: IOA dec = octet1 + 256*octet2 + 256*256*octet3 Together with ‚Last_Info_Adr_Src’ it is possible to filter on defined address ranges.
Last_Info_Adr_Src	Value of the address from the last information object processed from the block Permissible range for the length of the IOA address 1 is 1 up to 255 Permissible range for the length of the IOA address 2 is 1 up to 65535 Permissible range for the length of the IOA address 3 is 1 up to 16777215 If the information object address exists in structured form (3 octets), it has to be converted into a decimal number: IOA dec = octet1 + 256*octet2 + 256*256*octet3 Together with ‚First_Info_Adr_Src’ it is possible to filter on defined address ranges.
Tx_Prio_L/Tx_Prio_H Filt_15_13_11_9_7_5_3_1	Priority of transmission with Prio L/H: 0 (highest) - 15 (lowest) Default = 0 Filter for the processible information types. Set bits unlock the processing for the allocated information types. The numbers in the parameter name respond to the basis TI (without time).

Allocation of the parameter bits to the TIs:

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
TI	15	13	11	9	7	5	3	1
Type	IT	MEc	MEb	MEa	BO	ST	DP	SP
Def.	1	1	1	1	1	1	1	1

With the default adjustment (B#16#FF) all TIs are forwarded.

P_SLi	P_SLi is a pointer to a common data range from ‚SL_ORG_ASDU’, block. Thus it has to be interconnected with its output ‚P_SLi’ via a DWord variable. Via this pointer resp. the data range behind values like ASDU address, actual time stamp, send buffer etc. are taken over from ORG block as well as general interrogations are processed.
-------	--

PrioH\_15\_13\_11\_9\_7\_5\_3\_1

Serves for prioritization of the information transmission.  
Set bits cause the transmission of the allocated information types with high priority.  
The numbers in the parameter name respond to the basis TI (without time).

Allocation of the parameter bits to the TIs:

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
TI	15	13	11	9	7	5	3	1
Type	IT	MEc	MEb	MEa	BO	ST	DP	SP
Def.	1	0	0	0	1	1	1	1

With the default adjustment (B#16#8F) measured values are transmitted with low priority all other TIs with high priority.

wTime\_15\_13\_11\_9\_7\_5\_3\_1

Serves for fixing TIs which are transmitted with time.  
Set bits cause the transmission of the allocated information type with time stamp.  
The numbers in the parameter name respond to the basis TI (without time).

Allocation of the parameter bits to the TIs

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
TI	15	13	11	9	7	5	3	1
Type	IT	MEc	MEb	MEa	BO	ST	DP	SP
Def.	1	1	1	1	1	1	1	1
res. TI	37	36	35	34	33	32	31	30

For the transfer with time the following rules apply:

Receive Message	Transfer with
without time stamp	Full time stamp and time of the CPU
with fractional time stamp	completed full time stamp with time from received message
with full time stamp	Taking over the full time stamp from received message

With the default adjustment (B#16#FF) all information are transmitted with time stamp, if the COT (cause of transmission) is < 20 (requested).

Inro\_QOI

Interrogation process:  
Adjustable interrogation according IEC norm, to be responsive to:  
- 0; no reaction  
- 20 (B#16#14 hex) -> general interrogation  
- 21 (B#16#15 hex) up to 36: group interrogation + (always) general interrogation  
The actual processing (check whether any information of the requested group are existing – corresponding reaction = pos/neg confirmation...) is administered from ORG block.  
The requested data are always from the image.

IC\_15\_13\_11\_9\_7\_5\_3\_1

Serves for fixing which TIs are transmitted after an interrogation command.  
Set bits cause the transmission of the allocated information type due to a group interrogation command.  
The numbers in the parameter name respond to the basis TI (without time).

Allocation of the parameter bits to the TIs.

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
TI	15	13	11	9	7	5	3	1
Type	IT	MEc	MEb	MEa	BO	ST	DP	SP
Def.	0	1	1	1	1	1	1	1

With the default adjustment (B#16#7F) all information except for the integrated totals (IT) are transmitted after an interrogation command.

TwoC\_15\_13\_11\_9\_7\_5\_3\_1

Serves for fixing which TIs are transmitted also without change of the value or status. Set bits cause the transfer of the allocated information types also without change of the value or status if the information was received with  $COT < 20$ . The numbers in the parameter name respond to the basis TI (without time).

Allocation of the parameter bits to the TIs

Bit	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
TI	15	13	11	9	7	5	3	1
Type	IT	MEc	MEb	MEa	BO	ST	DP	SP
Def.	0	0	0	0	0	0	0	0

With the default adjustment (B#16#0) only information with change of value or status are transferred.

Threshold\_Val\_ME

The nodal block offers the possibility for stabilization of measured values using threshold procedure.  
 0: without any change of the measurements leads to forwarding.  
 >0 (e.g. 20): This value is used for direct or mathematical reachable threshold  
 In each cycle is a check and immediately reaction on direct threshold exceeding  
 The threshold processing is integrating – in a 1 sec interval the measured value difference to the last transmission is added up and transmitted spontaneously with the mathematical achievement of the threshold.  
 For each measured value individual thresholds can be provided in a parameter data block if assigned.

Send\_Cyclic\_Interval\_sec

Time interval for cyclic (background) transmission  
 Value 0: without cyclic transmission  
 Value 1- x sec. time interval in seconds for transmitting always one information with cause of transmission 2 = background scan.  
 The timer is not free-wheeling. It is synchronized with the absolute time of the day.

FB\_RetVal

The function block is signaling as follows:  
 Positive values → ok  
 W#16#0000                      ok, no fault  
 W#16#1000                      ok, with reduced cycle (next\_Info)  
  
 Negative values (16#8xxx) → fault  
 W#16#8102:                      P\_from\_SL\_Org = 0  
 W#16#8103:                      Shared.Version (Job-ID) = wrong or pointer wrong positioned  
 W#16#8112:                      P\_from\_Application = 0  
 W#16#8113:                      Application Version (Job-ID) = wrong or pointer wrong positioned  
 W#16#8301                      IM-DB could not be installed  
 W#16#8302                      Reason could be insufficient working memory  
    Image-DB full  
    Info could not be entered anymore

IM\_DB\_No

Number of the image-DB created from this block.

No\_used\_IMs

Number of the actually entered information in the image-DB.  
 The update of the image-DB is carried out automatically by incoming spontaneous, requested or cyclic information.

New\_Image

Indicates that the number of information in the image-DB has been increased within this OB1-cycle.

### 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.

### 3.1.1.4. General notes about function and handling of the block:

#### Multiple applications

The nodal blocks can be requested several times within the application. Depending on the parameterizing at the inputs functions can be carried out like:

- distribution of the information to several targets
- enlargement of the quantity structure by clever filtering (using efficient CPUs correspondingly)

#### Update of an automatically created image-DB:

The block creates an image-DB (default DB80) in the CPU-start-up procedure (cold start) if no external data block is assigned (Para\_Image\_DB = 0). The size of this image-DB depends on the parameterized maximum number of information elements (max\_No\_of\_Images).

The update of the image-DB is carried out automatically by incoming spontaneous, requested or cyclic information. At the nodal block thus no explicit parameterizing of the information to be processed is necessary.

New additional information in the subordinated station are added automatically into the image until achievement of the parameterized maximum number of information elements and processed if they perform the parameterized filter adjustments.

In case already existing information are changing (IOA, TI) in the subordinated station, a new start (cold start) is required. Hereby the image-DB is created new and updated.

#### External parameter and image data block.

A data block may be assigned to the FB (DB-Number -> Para\_Image\_DB) whose structure is described subsequently:

A sample data block (DB161) is added to the library which should serve in principle as a basis! If only the number of array fields is set to the number of expected information in this data block (or in a copy) and the DB is assigned without further adaption this functionally corresponds to the automatic creation. The only difference is the (own) fixed DB number and the structured design. This allows already a monitoring/diagnosis and may be already helpful.

In a second step individual adaptations may be carried out in the data block:

- Fixing of the number of required information by the size of array (declaration view, the further adjustments have to be carried out in the data view!)
- For each information to be forwarded minimum the information object address (IOA, Parameter: P\_Src\_Info\_Address) has to be indicated.  
The first parameter field with information object address = 0 is established during start up. From this all further images are released for the automatic update.
- The ASDU address (P\_Src\_ASDU\_Address) has not to be indicated if it has been limited accordingly with the block parameters or the information addresses are clearly. With use of the image however the value is written with the received ASDU address and fixed.  
With „P\_Dst\_Info\_Address“ it is possible to convert the information object address. Without specification (according to default = 0) the received IOA will be forwarded.  
With P\_Threshold\_Value it is possible to parameterize an individual threshold for measured values. Without specification (default = 0.0) an optional global threshold specified at the block input ,Threshold\_Val\_ME' is effective.

All further values in the data block are written from the FB during operating time and may be read only from the user. Exception: If the value ,Im\_TI\_Basic' is already pre-allocated with the expected type identification the FB can respond to a GI (with status .not topical) immediately after start up, even if the information was never updated. The pre-allocated type identification will be overwritten and not checked when receiving a message with suitable IOA.

Please observe when reading the information contained in the image:

The values contained in ,IM\_Value' have to be read as Dword/Dint or Real

Measured values in ,IM\_Value' are always available as Real value in Simatic format, independently from received value.




IM\_State at single and double indications contains as well the status of the indication (complete byte according to IEC standard)

The parameter/image DB has the following basically structure

Group/ Parameter	Addr. rel	Addr. Abs	Type	Start value	Comment
<b>DB_Manag</b>	0	0	STRUCT		
<i>DB_Manag.</i> <b>Pos_of_DB</b>	+0.0	0.0	BYTE	B#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>No_of_all_DBs</b>	+1.0	1.0	BYTE	B#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>DB_No_Act</b>	+2.0	2.0	WORD	W#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>DB_No_Prev</b>	+4.0	4.0	WORD	W#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>DB_No_Next</b>	+6.0	6.0	WORD	W#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>Reserved</b>	+8.0	8.0	WORD	W#16#0	reserved for future - do not change!
	+10.0	10.0	END_STRUCT		END_STRUCT (10 BYTE)
<b>Info_Manag</b>			STRUCT		
<i>Info_Manag.</i> <b>P_Byte_First_Info</b>	+0.0	10.0	INT	32	(Byte-) Position of first Para-Block - do not change!
<i>Info_Manag.</i> <b>No_of_INFos</b>	+2.0	12.0	INT	0	0: unspecified (DB is filled up to the end); otherwise size n of ARRAY [1..n]
<i>Info_Manag.</i> <b>Len_Info</b>	+4.0	14.0	BYTE	B#16#2C	Difference in [byte] between two Para-Blocks - do not change!
<i>Info_Manag.</i> <b>Len_Sort_Key</b>	+5.0	15.0	BYTE	B#16#0	0: without sorting; > 0: Data sets are sorted ascending with x Bytes
<i>DB_Manag.</i> <b>Re_internal_usage</b>	+6.0	16.0	DWORD	DW#16#0	
	+10.0	20.0	END_STRUCT		END_STRUCT (10 BYTE)
<b>Global</b>			STRUCT		
<i>Global.</i> <b>Para_DB_Type</b>	0.0	20.0	WORD	W#16#A1	Internal identification for this Data Block - do not change!
<i>Global.</i> <b>Internal</b>	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)

Group/ Parameter	Addr. rel	Addr. Abs	Type	Start value	Comment
Para_MD			ARRAY [1..n] STRUCT		n = number of parameter inputs
<i>Para_MD[x].</i> <b>P_Src_ASDU_Address</b>	+0.0	32.0	INT	0	Parameter: Source common address of ASDU (0 -> all ASDU will be accepted)
<i>Para_MD[x].</i> <b>P_Src_Info_Address</b>	+2.0	34.0	DINT	L#0	Parameter: Source information object address (Src_IOA)
<i>Para_MD[x].</i> <b>P_Dst_Info_Address</b>	+6.0	38.0	DINT	L#0	Parameter: Destination information object address (0 -> Src_IOA will be used)
<i>Para_MD[x].</i> <b>Res_10</b>	+10.0	42.0	BYTE	B#16#0	
<i>Para_MD[x].</i> <b>Res_11</b>	+11.0	43.0	BYTE	B#16#0	
<i>Para_MD[x].</i> <b>Int_ToDo</b>	+12.0	44.0	BYTE	B#16#0	Internal
<i>Para_MD[x].</i> <b>Im_State_of_TimeStamp</b> <b>pg</b>	+13.0	45.0	BYTE	B#16#0	Image: State of TimeStamp
<i>Para_MD[x].</i> <b>Im_S7_TimeStamp</b>	+14.0	46.0	DATE_AND_TIME		Image: Timestamp (S7 Date and Time)
<i>Para_MD[x].</i> <b>Im_TI_Basic</b>	+22.0	54.0	BYTE	B#16#0	Image: Basic type identification (1,3,5,7,9,15) of received info
<i>Para_MD[x].</i> <b>Im_TI</b>	+23.0	55.0	BYTE	B#16#0	Image: Real type identification of received info
<i>Para_MD[x].</i> <b>Im_Value</b>	+24.0	56.0	DWORD	DW#16#0	Image: Value of the received info (ME always as Real)
<i>Para_MD[x].</i> <b>IM_State</b>	+28.0	60.0	BYTE	B#16#0	Image: State of the received info
<i>Para_MD[x].</i> <b>Diag_Count</b>	+29.0	61.0	BYTE	B#16#0	Info: Counter which will be increased with each received info
<i>Para_MD[x].</i> <b>IM_COT</b>	+30.0	62.0	BYTE	B#16#0	Image: Cause of transmission of received info (may be changed internal)
<i>Para_MD[x].</i> <b>IM_Originator</b>	+31.0	63.0	BYTE	B#16#0	Image: Original of received info
<i>Para_MD[x].</i> <b>P_Threshold_Value</b>	+32.0	64.0	REAL	0.0	Threshold value (0: without), integrating threshold calculation
<i>Para_MD[x].</i> <b>Value_Last</b>	+36.0	68.0	REAL	0.0	Internal
<i>Para_MD[x].</i> <b>Threshold_Memory</b>	+40.0	72.0	REAL	0.0	Internal
	44.0	76.0	END_STRUCT		END_STRUCT (48 BYTE)

	These values are pre-adjusted in the sample DB (DB161) and have not to be changed.
	<b>!!! These values are parameter and can be adjusted !!!</b>
	<b>Note:</b> 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)

<b>Pos_of_DB</b>	Number (1 – n) of the current data block for the parameter block 0: not used
<b>No_of_all_DBs</b>	Total number (n) of data blocks for the parameter block 0: not used
<b>DB_No_Act</b>	DB number of the current data block 0: not used
<b>DB_No_Prev</b>	DB number of the previous data block, if one exists. Otherwise: 0
<b>DB_No_Next</b>	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.

<b>P_Byte_First_Info</b>	Byte position of the first data record in this DB, may not be changed
<b>No_of_Infos</b>	Number of data records contained in this DB 0: unspecified -> the data block end marks the last data record
<b>Len_Info</b>	Length of the data records: May not be changed
<b>Len_Sort_Key</b>	0: no sorting (default setting) Sorting actual not supported from FB161

## ***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

<b>Para_DB_Type</b>	Internal used. Don't change the identification for this parameter DB!
<b>Internal</b>	Internal used. Lastly processed information – don't change!

<b>Para_MD</b>	
<b>Para pro Info</b>	
<b>P_Src_ASDU_Address</b>	Create any amount of parameter blocks by setting the array value n in the declaration view accordingly. In the detail view the parameters can be individual adjusted.
<b>P_Src_Info_Address</b>	ASDU address from the expected information. A ,0' entered here (default) will switch off the check for the ASDU address. This should be carried out only in conjunction with a filter at the block input or in conjunction with clear information object addresses.
<b>P_Dst_Info_Address</b>	For each information to be transferred this information object address (IOA) minimum has to be declared. The first parameter field with information object address = 0 will be established during start up. From this all further images are released for the automatically update.
<b>Res_10</b>	Reserve
<b>Res_11</b>	Reserve
<b>Int_ToDo</b>	Internally use
<b>Im_State_of_TimeStampg</b>	Image: State of the time stamp of the information
<b>Im_S7_TimeStamp</b>	Image: Time stamp of the information in S7 format date and time In this case it is the time from the received message, a combination of CPU time and time from the message, or the absolute CPU time.
<b>Im_TI_Basic</b>	Basic type identification of the last received message. Basic type identification and from this FB supported are: 1,3,5,7,9,1,13,15. They represent the information types single, double indication, transformer step position, bit pattern, measurements normalized value, scaled value, short floating point number and integrated totals
<b>Im_TI</b>	Type identification of the last received message
<b>Im_Value</b>	Actual value of the received information Measurements are always entered as real value in the Simatic format independent of the received format.
<b>IM_State</b>	Actual status of the information. Structure according to IEC standard. At single and double information the state is contained as well.
<b>Diag_Count</b>	Counter which is increased with each reception and with it updating of the image
<b>IM_COT</b>	Cause of transmission (COT) according to IEC standard of the last received message. The value can be changed from the FB during operation.
<b>IM_Originator</b>	Originator of the last received message (if existing otherwise 0)
<b>P_Threshold_Value</b>	With P_Threshold_Value it is possible to parameterize an individual threshold for measured values. Without specification (default = 0.0) an optional global threshold specified at the block input 'Threshold_Val_ME' is effective.
<b>Value_Last</b>	Internally use
<b>Threshold_Memory</b>	Internally use

## '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 from 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 (FB170-Parameter Time\_DS).

SY: Synchronized  
Taking over from time status carried in the CPU (FB170-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 (FB170-Parameter Time_IV).
without time stamp	Taking over from time status carried in the CPU (FB170-Parameter Time_IV)

LO: Local time is set, if the FB170-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.

### **Info to data performance**

The IEC communication blocks issue max. 1 user information per (OB1) cycle at a time. The information in this cycle 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.

### 3.1.2. Nodal block for the command direction SLoMAI

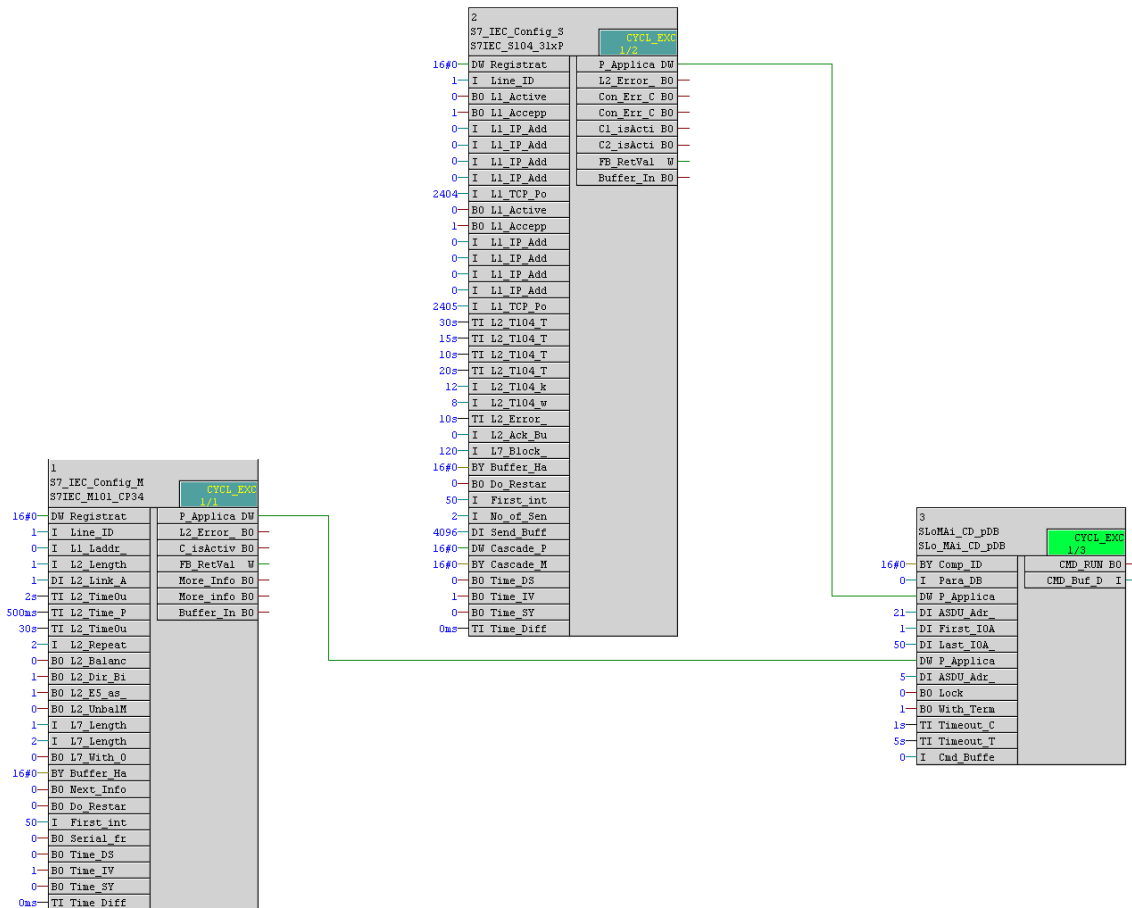
The symbol name encodes the most important object features as follows:

- SLoMAi\_CD\_pDB**      **SLo** is the abbreviation for **S**lave-blocks **o**utput. This are output blocks. The information contained in the command direction message is evaluated and provided at the MAi-part of the block.
- SLoMAi\_CD\_pDB**      **MAi** is the abbreviation for **M**aster-blocks **i**nterface. This are input blocks. The block evaluates the information from the SLo-part and generates the appropriate command messages.
- SLoMAi\_CD\_pDB**      **CD** is the abbreviation for **C**ommand **D**irection, this is the Command resp. control direction  
(Control center → SIPLUS RIC IEC on S7 → subordinated station)
- SLoMAi\_CD\_pDB**      **pDB** is the abbreviation for parameterizable by DB (option)

The available SLoMAi functional blocks can be seen in the following overview

Block	Block-No.	Function
<b>SLoMAi_CD</b>	FB166	Transfer of the commands and setpoint values from a control center to the subordinated station.

Illustration of the necessary interconnection – here exemplifying in a CFC-plan:



### 3.1.2.1. Nodal block SLoMAi\_CD\_pDB (FB166)

The block receives single, double or tap changing commands as well as analog and digital setpoint values from the control center and transfers these to the subordinated remote control unit.

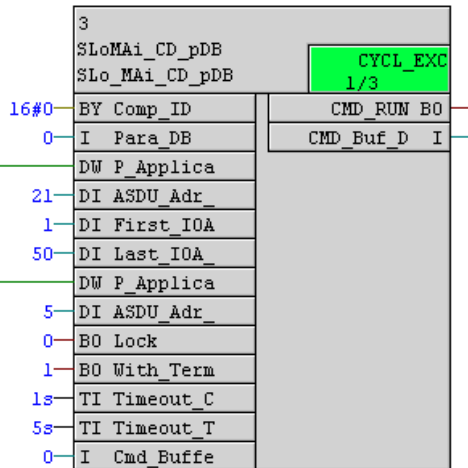


Illustration as CFC-block with default values

```
CALL "SLoMAi_CD_pDB" , DB201
  Comp_ID           :=B#16#41
  P_Application_Src :=#P_Appl_S1
  ASDU_Adr_Src      :=L#21
  First_IOA_or_Para_DB_No:=L#1
  Last_IOA_or_No_of_Infos:=L#8
  P_Application_Dst :=#P_Appl_Ma
  ASDU_Adr_Dst      :=L#5
  Lock              :=
  With_Termination :=
  Timeout_Conf      :=
  Timeout_Term      :=T#5S
  Cmd_Buffer_Dim     :=
  CMD_RUN           :=M400.0
  CMD_Buf_DB        :=
```

Illustration in AWL with fractional parameter supply

#### Important features are:

- With minor effort of parameterization you can process all information in command direction:
  - Single commands with TI45, 58
  - Double commands with TI46, 59
  - Tap changing commands with TI47, 60
  - Setpoint command with normalized value with TI48, 61
  - Setpoint command with scaled value with TI49, 62
  - Setpoint command with shortened floating point number with TI50, 63
  - Digital setpoint commands with 32 Bit pattern with TI51, 64
- Readings for the default adjustments can be taken from the corresponding variable comment. On the other hand only a minimum of mandatory inputs are required. The interconnection of ‚P\_Application\_Src‘, ‚ASDU\_Adr\_Src‘, ‚P\_Application\_Dst‘ and ‚ASDU\_Adr\_Dst‘ is a minimum requirement.
- Possibility for filtering by
  - defined address bands with ‚First\_Info\_Adr\_Src‘, ‚Last\_Info\_Adr\_Src‘
- Parameterization of the information object addresses (IOA) to be transferred not necessary if the addresses can be used 1:1.
- The allocation of an optional parameter data block enables the conversion of the information object addresses.
- A global blocking input allows the easy locking of all commands
- Output for external evaluation of an active input command existing
- Function (output) independent from received TI
- Command storage and serial output of the buffered commands possible (number according to ‚Cmd\_Buffer\_Dim‘)

### 3.1.2.2. Block parameter with its default assignment and short comment

FB166		Type	Default	Block comment/brief description
Comp_ID	IN	BYTE	B#16#0	Identifier for Diagnostic-Functions
P_Application_Src	IN	DWORD	DW#16#0	Pointer which must be connected to 'S7_IEC_Config' - Module
ASDU_Adr_Src	IN	DINT	L#0	ASDU-Address which will expected by this module; Default: 0
First_IOA_or_Para_DB_No	IN	DINT	L#0	First forwarded IOA (Default: 0) or Para-DB with Offset 100000000
Last_IOA_or_No_of_Infos	IN	DINT	L#0	Last forwarded IOA (Default: 0) or number of infos if Para-DB is used
P_Application_Dst	IN	DWORD	DW#16#0	Pointer which has to be connected to 'S7_IEC_Config' - Module
ASDU_Adr_Dst	IN	DINT	L#0	ASDU-Address which is expected by this module; Default: 0
Lock	IN	BOOL	FALSE	If set, new commands will not be executed, they will be locked and neg. conf
With_Termination	IN	BOOL	TRUE	0: without; 1 (default): with termination of activation
Timeout_Conf	IN	TIME	T#1s	Within this time a confirmation is expected; Default: 1 sec
Timeout_Term	IN	TIME	T#5s	Within this time a termination is expected; Default: 5 sec
Cmd_Buffer_Dim	IN	INT	0	0: without (default); > 0 max. number of buffered commands
CMD_RUN	OUT	BOOL	FALSE	Signals a running (pulse-) command
CMD_Buf_DB	OUT	INT	0	Shows the data block number of command buffer (which is created at runtime)

### 3.1.2.3. Parameter and functions details:

Comp_ID	Block identification for (actual only internal) diagnostic functions. Assign different numbers within one block type as byte variable e.g. B#16#1
P_Application_Src	P_Application_Src is a pointer on a common data range of 'S7_IEC_Config' block. Therefore it must be interconnected via a DWord variable with its output 'P_Application'. Via this pointer resp. the data range behind, application data like ASDU address, actual time stamp receive buffer etc. are handed over to the config block as well as GI-requests processed. 'P_Application_Src' has to be connected with the 'S7_IEC_Config' block' which receives the messages from the superior station (control center). Usually this is the S7_IEC_Config in the Slave configuration.
ASDU_Adr_Src	Value of the address from the application service data unit which is the source of the command messages. Permissible range for the length of the ASDU address 1 byte is 1 up to 254 Permissible range for the length of the ASDU address 2 byte is 1 up to 65534 The broadcast addresses 255 (FFh if length 1) resp. 65535 (FFFFh if length 2) are always accepted.
First_IOA_or_Para_DB_No	Value of the address of the first information object processed from the block Permissible range for the length of the IOA address 1 byte is 1 up to 255 Permissible range for the length of the IOA address 2 byte is 1 up to 65535 Permissible range for the length of the IOA address 3 byte is 1 up to 16777215 If the information object address exists in structured form (3 octets), it has to be converted into a decimal number: $IOA_{dec} = octet1 + 256 * octet2 + 256 * 256 * octet3$ Alternatively here a parameter-DB can be indicated where the information to be processed is deposited, like at the standard SLo-blocks. If the parameterization has to be carried out via a parameter-DB, an offset of 100000000 (eight zeros) has to be entered. I.e. If the parameters have to be taken from the DB1301 the value L#100001301 has to be entered.



Last_IOA_or_No_of_Infos	<p>Without application of a parameter-DB:            Value of the address of the last information object processed from the block            Permissible range for the length of the IOA address 1 byte is 1 up to 255            Permissible range for the length of the IOA address 2 byte is 1 up to 65535            Permissible range for the length of the IOA address 3 byte is 1 up to 16777215            If the information object address exists in structured form (3 octets), it has to be converted into a decimal number:  <math>IOA\ dec = octet1 + 256 * octet2 + 256 * 256 * octet3</math></p> <p>With application of a parameter-DB:            Number of the information to be processed.            The associated parameters are deposited in a parameter-DB (see First_IOA_or_Para_DB_No).</p>
P_Application_Dst	<p>P_Application_Dst is a pointer on a common data range from 'S7_IEC_Config' block. Therefore it must be interconnected via a DWord variable with its output 'P_Application'. Via this pointer resp. the data range behind, application data like ASDU address, receive buffer etc. are handed over to the config block. 'P_Application_Dst' has to be connected with the 'S7_IEC_Config' block' which transmits the messages to the subordinated station (RTU). Usually this is the S7_IEC_Config in the Master configuration.</p>
ASDU_Adr_Dst	<p>Value of the address from the application service data unit, which is the destination of the command messages.            Permissible range for the length of the ASDU address 1 byte is 1 up to 254            Permissible range for the length of the ASDU address 2 byte is 1 up to 65534            The broadcast addresses 255 (FFh if length 1) resp. 65535 (FFFFh if length 2) are always accepted.</p>
Lock	<p>Blocking input for all commands processed from this block.            FALSE: New commands are executed.            TRUE: New commands are not executed and negatively acknowledged.</p>
With_Termination	<p>Selection whether a command has to be completed with or without transmission of 'Termination of activation'.            FALSE: without 'Termination of activation'            TRUE: with 'Termination of activation' (default adjustment)</p>
Timeout_Conf	<p>Supervisory time in seconds.            Within this time a confirmation of the activation (COT=7) is expected. Otherwise the command is negatively acknowledged.</p>
Timeout_Term	<p>Supervisory time in seconds.            Within this time the end of the activation (COT=10) is expected. Otherwise the command is negatively acknowledged. This time has to be selected slightly longer than the output time of the command in the subordinated station.</p>
Cmd_Buffer_Dim	<p>The parameter defines the maximum number of buffered commands            0 without command buffer (like V1.1)            &gt;0 maximum number of buffered commands            In this case a command buffer DB will be created during the runtime            An entry into the command buffer DB happens only if during arrival from an impulse command another impulse command already runs.</p>
CMD_RUN	<p>Command output (impulse command) running.            The output is set for the duration of the command output if an impulse command is emitted via this block.</p>
CMD_BUF_DB	<p>Defines the number of the command buffer DB            The size of the command buffer DB will be fixed with 'Cmd_Buffer_Dim'.</p>

### 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.

**Structure and values of the (optional) parameter data block for IOA conversion:**

The use of this parameter DB should be carried out, when only specific information object addresses shall be processed or must be converted.

The parameter DB has the following structure:

Group/ Parameter	Addr. rel	Addr. Abs	Type	Start value	Comment
<b>DB_Manag</b>	0	0	STRUCT		
<i>DB_Manag.</i> <b>Pos_of_DB</b>	+0.0	0.0	BYTE	B#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>No_of_all_DBs</b>	+1.0	1.0	BYTE	B#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>DB_No_Act</b>	+2.0	2.0	WORD	W#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>DB_No_Prev</b>	+4.0	4.0	WORD	W#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>DB_No_Next</b>	+6.0	6.0	WORD	W#16#0	reserved for future - do not change!
<i>DB_Manag.</i> <b>Reserved</b>	+8.0	8.0	WORD	W#16#0	reserved for future - do not change!
	+10.0	10.0	END_STRUCT		END_STRUCT (10 BYTE)
<b>Info_Manag</b>			STRUCT		
<i>Info_Manag.</i> <b>P_Byte_First_Info</b>	+0.0	10.0	INT	24	(Byte-) Position of first Para-Block - do not change!
<i>Info_Manag.</i> <b>No_of_INFOS</b>	+2.0	12.0	INT	0	0:unspecified (DB is filled up to the end); otherwise size n of ARRAY [1..n]
<i>Info_Manag.</i> <b>Len_Info</b>	+4.0	14.0	BYTE	B#16#8	Difference in [byte] between two Para-Blocks - do not change!
<i>Info_Manag.</i> <b>Len_Sort_Key</b>	+5.0	15.0	BYTE	B#16#0	0: without sorting; > 0: Data sets are sorted ascending with x Bytes
<i>DB_Manag.</i> <b>Re_internal_usage</b>	+6.0	16.0	DWORD	DW#16#0	
	+10.0	20.0	END_STRUCT		END_STRUCT (10 BYTE)
<b>Global</b>			STRUCT		
<i>Global.</i> <b>Para_DB_Type</b>	0.0	20.0	WORD	W#16#A601	Internal identification for this Data Block - do not change!
<i>Global.</i> <b>Int_W22</b>	2.0	22.0	WORD	W#16#0	Reserved for internal use
	+4.0	24.0	END_STRUCT		END_STRUCT (4 BYTE)
<b>IEC_Addr</b>			ARRAY [1..n] STRUCT		n = number of parameter inputs
<i>IEC_Addr.</i> <b>P_Src_Info_Address</b>	+0.0	24.0	DINT	L#0	IOA Information object address from T101/T104 (Source)
<i>IEC_Addr.</i> <b>P_Dst_Info_Address</b>	+4.0	28.0	DINT	B#16#0	IOA to T101/T104 (Destination): 0: IOA from Src will be used.
	+8.0	32.0	END_STRUCT		END_STRUCT (8 BYTE)

	These values are pre-adjusted in the sample DB (DB166) and have not to be changed.
	<b>!!! These values are parameter and can be adjusted !!!</b>
	<b>Note:</b> 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)

<b>Pos_of_DB</b>	Number (1 – n) of the current data block for the parameter block 0: not used
<b>No_of_all_DBs</b>	Total number (n) of data blocks for the parameter block 0: not used
<b>DB_No_Act</b>	DB number of the current data block 0: not used
<b>DB_No_Prev</b>	DB number of the previous data block, if one exists. Otherwise: 0
<b>DB_No_Next</b>	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.

<b>P_Byte_First_Info</b>	Byte position of the first data record in this DB, may not be changed
<b>No_of_Infos</b>	Number of data records contained in this DB 0: unspecified -> the data block end marks the last data record
<b>Len_Sort_Key</b>	0: no sorting (default setting) 4: the first 4 bytes of the information specific parameter (see parameter group IEC_Addr) form the sorting criteria Other sorting lengths are not permitted If very much parameter blocks are needed it is recommended to deposit the parameter blocks ascending sorted according to 'T101_104_IOA'. A so applied data block will be scanned more effective in conjunction with 'Len_Sort_Key' = 4 (binary scan)

## ***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

<b>Para_DB_Type</b>	Internal used. Don't change the identification for this parameter DB!
<b>Internal</b>	Internal used. Lastly processed information – don't change!

## ***IEC\_Addr Para per Info group***

Create any amount of parameter blocks by setting the array value n in the declaration view accordingly. In the detail view the parameters can be individual adjusted.

In this case for each desired command a parameter block has to be created. There the allocation of control bit to command and the complete description of the command with all its attributes are carried out statically.

<b>P_Src_Info_Address</b>	IEC101/104 information object address (IOA) which is expected in the command message to be received from source.
<b>P_Dst_Info_Address</b>	IEC101/104 information object address (IOA) for the transfer of the command message to the destination. If '0' is specified here, the transfer is carried out with the received address.

### 3.1.2.4. Additional references for the processing of commands/setpoint commands

- The commands are subject of a 1 out of n control.  
Only one command is processed at a time  
In case of several command messages have to be processed at the same time the block has to be called several times and has to be filtered onto the corresponding IOA at the inputs ‚First\_IOA\_or\_Para\_DB\_No‘ resp. ‚Last\_IOA\_or\_No\_of\_Infos‘, or a parameter DB has to be allocated.
- The IEC-Originator is mirrored and included in the answer messages if necessary.
- Test-Bits and set P/N-Bit in the cause of transmission (COT) lead to ‚non treatment‘ – the message is not processed.
- Commands are confirmed negative from block SL\_ORG\_ASDU if no output block SLo... is available for processing the command messages within the next OB1 cycle after receipt of a command message with (with COT 6 or COT 8).  
The confirmation is as follows:
  - COT 44: unknown TI, if no output block is programmed for the received TI.
  - COT 45: unknown COT, if the received COT isn't supported by the output block.
  - COT 47: unknown IOA, if no output block is programmed for the received IOA.
- Select/Execute will be entered into the status bit SE, and transferred but not evaluated for the command output.  
The command is emitted independently from S/E
- Command messages with time stamp (TI58... 64) are accepted, transferred with time and executed. However in the actual version the time stamp is not evaluated.

Commands can be cached in a command buffer DB in case a command is already active. With it fast ‚none supervised‘ command sequences are supported.

The processing is as follows:

- The buffered commands are executed serial, i.e. the next command is executed after the preceding command has been executed.  
The commands are processed in the sequence of its arrival.
- Abortion commands have no effect to commands in the buffer.
- **Without cache:** (‚Cmd\_Buffer\_Dim‘ = 0, or Buffer-DB could not be created) Further switching commands arriving during an active command are refused (negative confirmed).
- **With cache:** Commands are immediately forwarded, if no command is active.
- **With cache:** Switching commands are buffered if
  - a command is active/executed
  - already minimum one command is in the buffer
- **With cache:** Commands are refused, if the buffer is full.

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#### Command processing in case of connection failure



After the connection failure to the (IEC-) partner disappears the send buffer of the IEC Master is cleared.

This avoids the delayed output of commands which were activated during an identified connection failure.

The corresponding commands have to be initiated new if necessary.

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