PROCESS AUTOMATION

Freelance 2019

Engineering Manual
IEC 60870-5 Telecontrol Library

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About this book

Use of warning, caution, information, and tip icons

This publication includes **Warning**, **Caution**, and **Information** where appropriate to point out safety related or other important information. It also includes **Tip** to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

Electrical warning icon indicates the presence of a hazard which could result in *electrical shock.*

Warning icon indicates the presence of a hazard which could result in *personal injury.*

Caution icon indicates important information or warning related to the concept discussed in the text. It might indicate the presence of a hazard which could result in *corruption of software or damage to equipment/property.*

Information icon alerts the reader to pertinent facts and conditions.

Tip icon indicates advice on, for example, how to design your project or how to use a certain function

Although **Warning** hazards are related to personal injury, and **Caution** hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all **Warning** and **Caution** notices.

Terminology

The Glossary contains terms and abbreviations that are unique to ABB or have a usage or definition that is different from standard industry usage. Please make yourself familiar to that.

You will find the glossary at the end of the ***Engineering Manual System Configuration.***

Document conventions

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a window, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the ENTER key.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the **space bar**, **comma key**, and so on.
- Press CTRL+C indicates that you must hold down the CTRL key while pressing the C key (to copy a selected object in this case).
- Press **ESC, E, C** indicates that you press and release each key in sequence (to copy a selected object in this case).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
  - The following convention is used for menu operations: MenuName > MenuItem > CascadedMenuItem. For example: select **File** > **New** > **Type**.
  - The **Start** menu name always refers to the **Start** menu on the Windows Task Bar.

- System prompts/messages are shown in the Courier font, and user responses/input are in the boldfaced Courier font. For example, if you enter a value out of range, the following message is displayed:

  ```
  Entered value is not valid. The value must be 0 to 30.
  ```

  You may be told to enter the string TIC132 in a field. The string is shown as follows in the procedure:

  TIC132

  Variables are shown using lowercase letters.

  sequence name

1 General

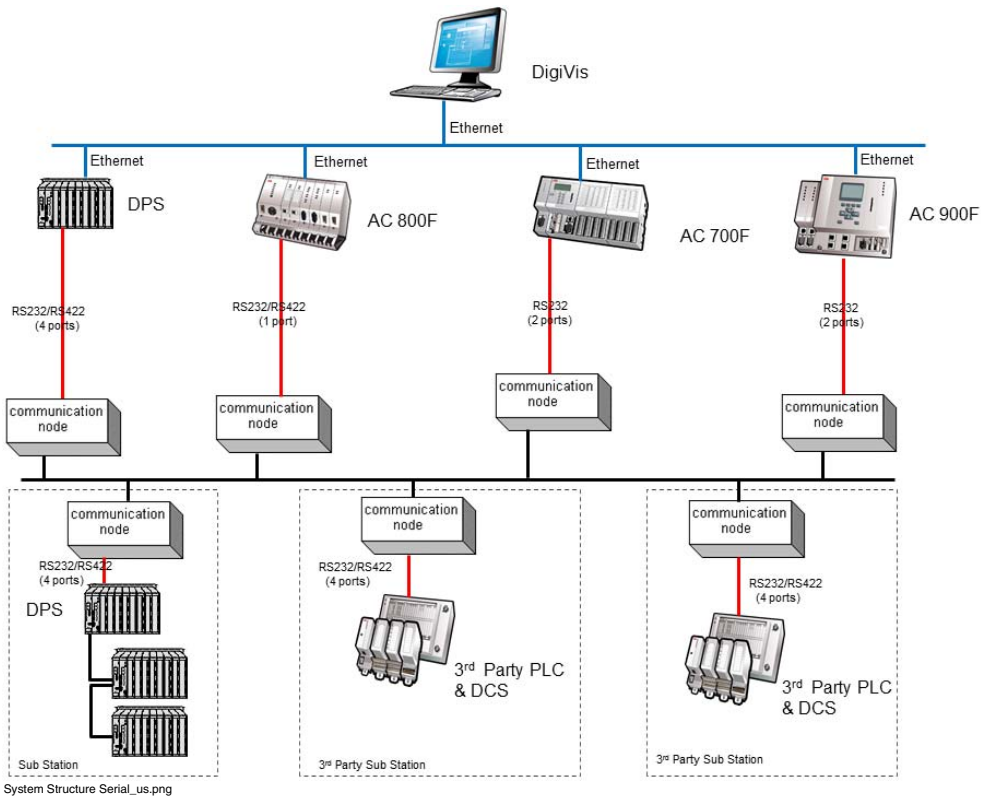
1.1 Function block overview

Designation	Function	Data type to IEC 60870-5
FWK_DEV	Balanced device module	
FWK_DEV_M	Unbalanced device module, master	
FWK_DEV_SL	Telecontrol device module, slave	
FWK_DEV_TCP	TCP/IP device module	
FWK_S_MELD	Send status value	1, 2, 30
FWK_S_DMEL	Send double status value	3, 4, 31
FWK_S_MWERT	Send real value	9, 10, 13, 14, 34, 36
FWK_S_ZWERT	Send discrete value	15, 16, 37
FWK_S_ZWR	Send discrete value with relocate and reset functions	15, 16, 37
FWK_S_SWERT	Send real setpoint value	48, 50, 61, 63
FWK_S_BEFEHL	Send command value	45, 58
FWK_S_DBEF	Send double command value	46, 59
FWK_R_SWERT	Receive real setpoint value	48, 50
FWK_R_BEFEHL	Receive command value	45
FWK_R_DBEF	Receive double command value	46
FWK_R_MELD	Receive 1 status value	1, 2, 30

Designation	Function	Data type to IEC 60870-5
FWK_R_MELDM	Receive 16 status values	1
FWK_R_DMEL	Receive double status value	3, 4, 31
FWK_R_MWERT	Receive real value	9, 10, 13, 14, 34, 36
FWK_R_ZWERT	Receive discrete value	15, 16, 37
FWK_VIEW	Balanced statistical module	
FWK_DEV_M_V	Unbalanced statistical module, master	
FWK_DEV_SL_V	Unbalanced statistical module, slave	

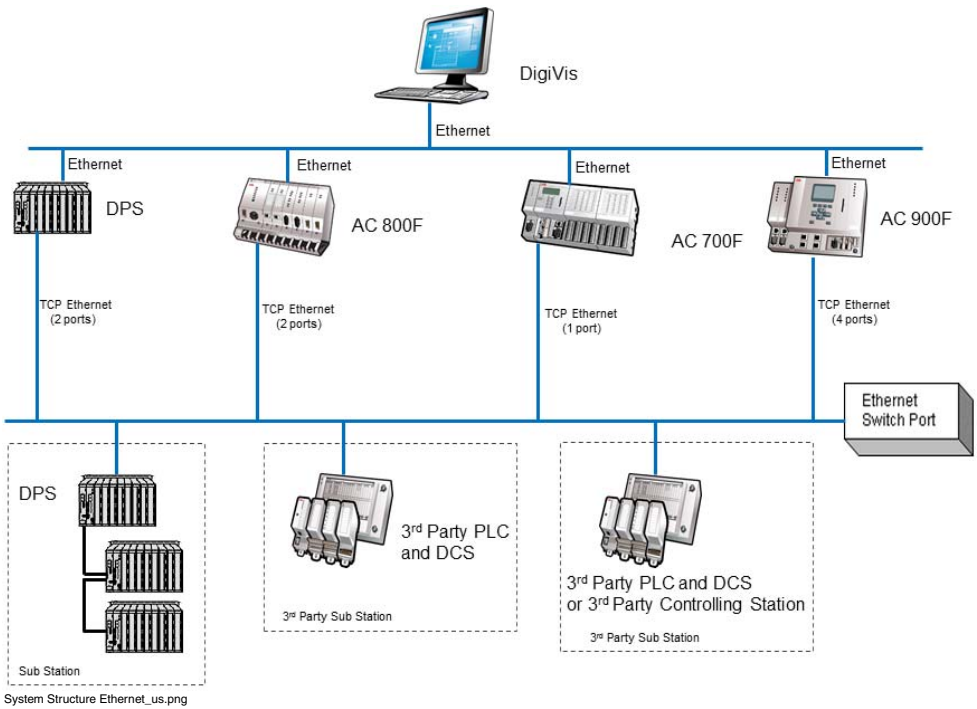
1.2 System structure

1.2.1Serial interface



System Structure Serial_us.png

1.2.2 Ethernet interface



System Structure Ethernet_us.png

1.3 General description

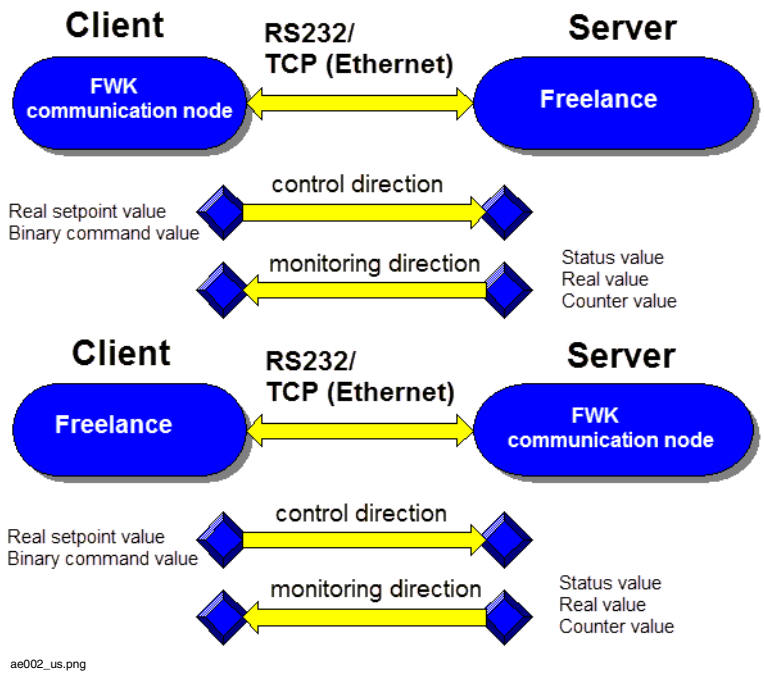
The function blocks of the telecontrol library allow link-ups to be made between Freelance and external systems. The link-up takes place through a serial interface (IEC 60870-5-101) or a Ethernet interface (IEC 60870-5-104) of the Freelance controllers. The telecontrol protocol according to IEC 60870-5 (101/104) is used.

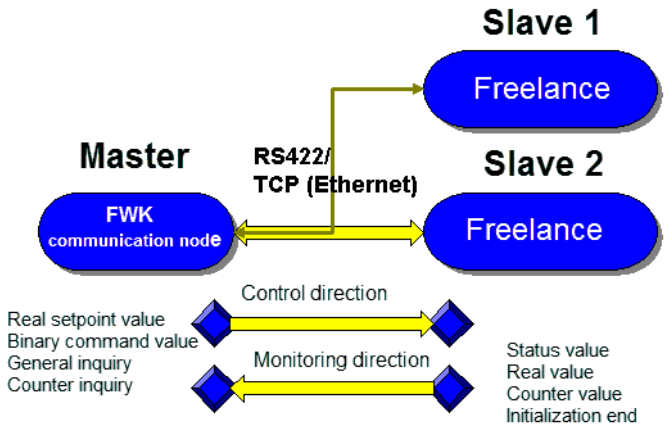
The CPU module and telecontrol head can work simultaneously as both server and client. In control direction, setpoints and commands are set in the server, in monitoring direction the server sends status values, real values and discrete values to the client. The client requests the server through general interrogation to send all status values, real values and discrete values. Otherwise, these values are sent by the server on a change driven basis, cyclically or when triggered by an application. Status values, real values and discrete values may contain timestamps. These are

filled in with the time of the process station when sent. Time synchronization of the telecontrol link by Freelance system and vice versa can be realized as a function of the used protocol. DCF 77 and GPS clocks are available for Freelance. Greenwich Mean Time (GMT) is used as the time for time synchronization.

For CP56Time2a time stamp the bits DayOfWeek are always in use.

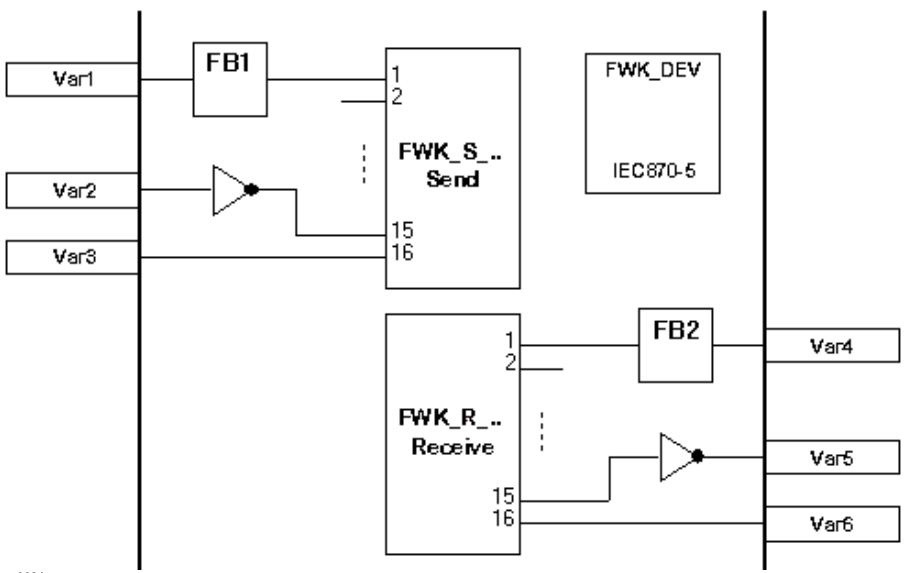
Time synchronization telegrams are always sent with system time (GMT). Setting the “daylight saving time” flag has no effect on time synchronization telegrams.





ae057_us.png

A device module accepts the configuration of the physical interface and the general protocol parts. Send and receive blocks are available for data exchange. These blocks exist for the IEC 60870-5-101 (serial)/IEC 60870-5-104 (Ethernet) data types setpoint value, command value, double command value, status value, double status value, real value and discrete value. The inputs/outputs of the send and receive blocks are combined with the signals to be communicated. The blocks are mapped to the Freelance data types BOOL, REAL and DINT.



ae003.bmp

In the parameter definition dialog of the send and receive blocks, a telecontrol address can be assigned to each pin. The send and receive blocks have a common address of 2 bytes for all their data pins. Every device module generates a telecontrol list of all connected send and receive block pins, which also contains the information object address. This list is displayed in the device module. It can also be exported in CSV format or imported, in which connection the actual data source is always the send and receive blocks. Importing the list serves only as a configuration aid or to change an existing address assignment. No Freelance Engineering program or variable configuration is changed!

1.3.1 Configuration, maximum values and resource consumption

For the telecontrol link-up of a process station, precisely one device module must be configured. This block has a send buffer of 100 entries. Each transmission job of a send block and each acknowledgment job of a setpoint and command receive block dynamically occupies one entry of this buffer. When more than 100 of these blocks are configured, an overrun may occur with simultaneous job generation. This overrun is displayed at the blocks; in send blocks the job is repeated, in receive blocks the reception data are accepted, but no acknowledgment is generated. Any number of client receive blocks (status, real value and count value) can be configured without having to take the buffer capacity into consideration.

At least one send and one receive function block must be configured for each device module. Otherwise the project will not get plausible. If a function block is only inserted to ensure plausibility, a telecontrol address must be entered (eg: 000) and the processing should be deactivated.

1.3.2 Data flow control

Each send or receive block can only process one data message. Ideally, new data are available at each user task run through or new data can be sent. This is indicated by the TRUE state of the **DSR** outputs (one cycle long).

If the **OVR** output (send block only) indicates the TRUE (1 cycle long), the block computes more quickly than the data can be sent. If the receive block is not computed quickly enough and has thus not collected all the data, this is indicated through error code 7 (receive buffer overrun).

For the send blocks, the transmission process can be triggered optionally with the **REQ** input by program control. Alternatively, this block sends either cyclically or

when the input value is changed. Ideally, the topical data can be sent through the telecontrol link in connection with every user task run-through.

1.3.3 Data integrity of the IEC 60870-5-101/104 protocol

With the IEC 60870-5 protocol, a distinction is made between data transmission in the monitoring direction (status values, real values, discrete values) and in the control direction (commands and setpoints).

All data transmissions are acknowledged from the link communication level by the receiver. This acknowledgement is not sent to the sender of the data in every telecontrol link.

For data transmission in the control direction, additional acknowledgement on the application communication level with ACTCON and ACTTERM is possible. These acknowledgements are not sent by every telecontrol link either. For safe data transmission, it is necessary, in such cases, to configure data read back. The receiver then sends the data received back to the sender through the corresponding send blocks.

Information in the monitoring direction is acknowledged by the receiver on the lowest communication level (link level) when received. This acknowledgement is generated by the telecontrol heads. In the event of overload, a data message may be lost. For data in the control direction, ACTTERM acknowledgement can be used. This additional acknowledgement is sent back to the sender when the data have been executed in the process. If data are to be sent in the monitoring direction with guaranteed transmission, it is necessary to read back the sent value through another variable and, after observing a monitoring time, resend in the event of an error.

1.3.4 Redundancy behavior

The two redundant interfaces of a redundant process station can be wired in parallel. The secondary CPU module initializes its interface passively. In the event of redundancy toggle, the interface reacts by interrupting the link. Current data transmissions are cancelled.

The data received through the telecontrol link are sent to the secondary CPU module with the computation of the user task. Therefore, in the event of a redundancy toggle, it can also happen that a message is lost. If this definitely must not happen

for security or safety reasons, the value must be read back from the target system and checked.

In redundant process stations an interruption of the communication on the telecontrol link does not result in a redundancy toggle. A system alarm is tripped only if the Ethernet interface is affected by the communication interruption.

There are two other measures which also solve this problem:

Configuration of general inquiry in connection with link abort. In the event of a redundancy toggle, the process station reacts by aborting the link. If general inquiry is configured, the current value of the send blocks is sent. This applies to real values, status values and discrete values.

For setpoints and commands, it is possible to activate transmission with ACTTERM in the device module. In this setting, an ACTTERM acknowledgment is generated by the corresponding receive blocks. The send blocks indicate on their DSR pins that they have received this acknowledgment and are also not ready for the next transmission job until then.

1.3.5 Error codes of the STA outputs

Error code	Reason for error
0	No error; block operates correctly
1	The serial interface cannot be initialized
2	Send buffer overrun, too many block jobs at the same time
4	No expected response from the partner (synchronization error)
5	Time monitoring error on link or application level
6	Other errors
7	Receive buffer overrun
8	Buffer for send jobs is no longer being processed
9	Interface is occupied by another device module

Error code	Reason for error
10	No link to telecontrol head
11	No link to device module
12	Redundancy toggle leads to link abort
13	Time monitoring error on account of no ‘ACTTERM acknowledgement’
14	Data with incorrect data type received
15	Access error at DEV block
16	Protocol error
17	Float error

2 Device modules

The telecontrol protocol has device modules for balanced data transmission (FWK_DEV), unbalanced data transmission as a master (FWK_DEV_M), unbalanced data transmission as a slave (FWK_DEV_SL) and Ethernet data transmission (FWK_DEV_TCP). Device modules define the physical interface and the IEC 60870-5 protocol parameters. They are configured in the hardware structure. Refer to manual ***System Configuration, Hardware structure***.

A maximum of 1024 send and receive blocks can be configured for each device module. The telecontrol addresses under control of the device modules can be exported as a telecontrol list, or can be re-imported, as required.

2.1 Balanced device module, FWK_DEV

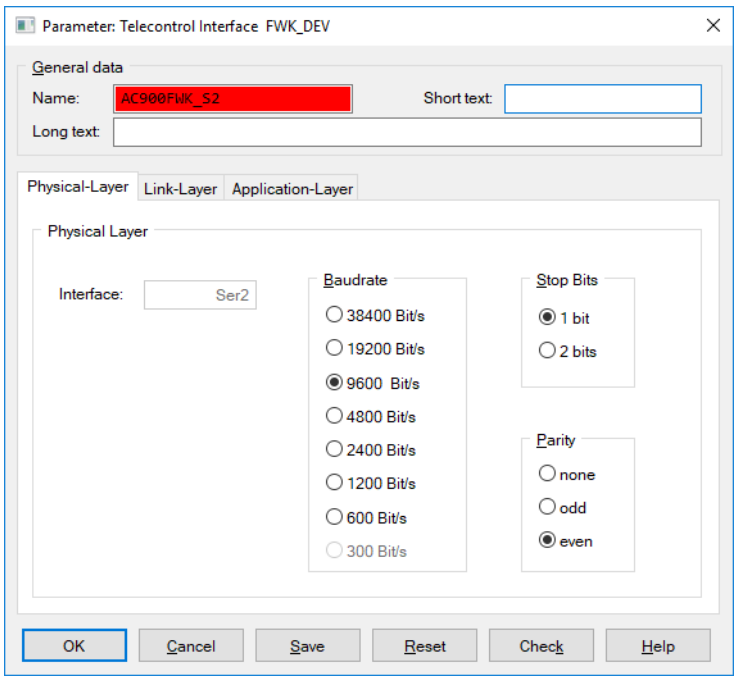
Function

The physical interface and the IEC 60870-5-101 protocol parameters are set with this block, which is designed for balanced data transmission through the serial interface. Data messages are sent independently of the user task.

The FWK_DEV device module is configured in the hardware structure.

FWK_DEV device module supports only RS-232. RS-485 or RS-422 is not supported.

Parameters: Balanced device module, FWK_DEV



ae079_us.png

Parameters of the serial interface

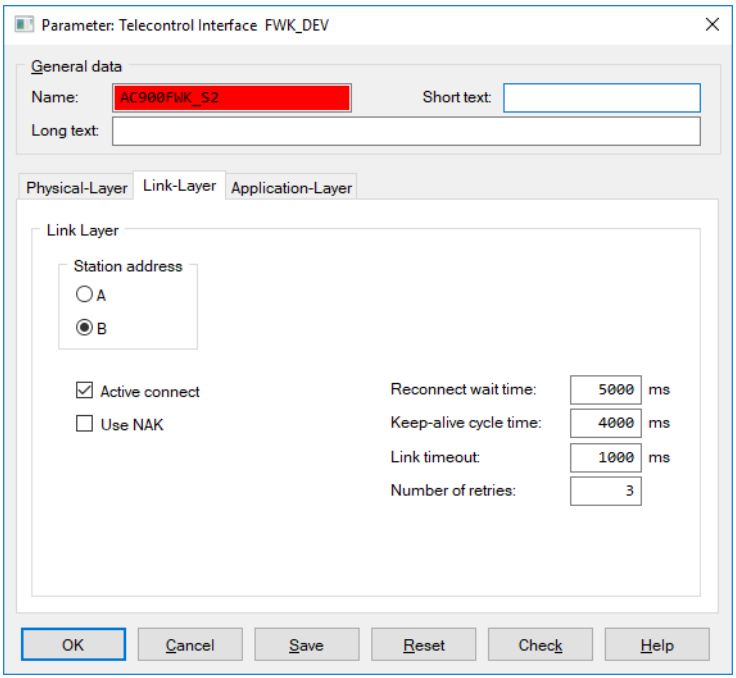
Interface Display of the serial interface for which the telecontrol protocol is defined.

Baud ◉ Selection of transmission rate (38400, 19200, 9600, 4800, 2400, 1200, 600, 300 Bit/s).

For AC 900F controller 300 Bit/s transmission rate is not supported.

Stop bits ◉ Selection of number of stop bits (1 or 2 bits).

Parity ◉ Selection of the parity bit (none, odd, or even).



ae080_us.png

Link layer

The link layer (link level) is the communication layer which accesses the serial interface directly. Messages are confirmed with acknowledge on the link layer level.

Station address

Station A or B: the two stations in a telecontrol link must have different values here. If A is configured here, the other station must be configured as B and, conversely, if B is configured here, the other station must be configured as A.

Use NAK ☑ Incorrect messages are acknowledged negatively (NAK - negative acknowledge).

Link timeout This time indicates how long an acknowledgement will be awaited on the link layer level (link level). The setting of this parameter depends on the telecontrol head used. The minimum time of 200 ms must be configured for this parameter.

Active connect

☑ The station begins actively to establish a link. At least one of the two stations must actively establish a link. Freelance can also manage with both sides actively establishing a link.

Reconnect wait time

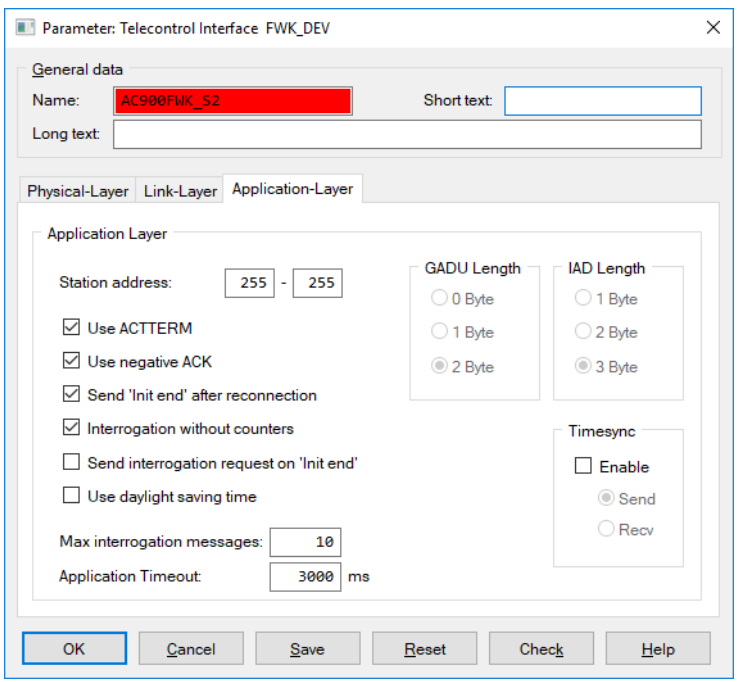
The delay after a link abort before the link is re-established. This value must be greater than the link timeout multiplied by the number of retries.

Keep-alive cycle time

Time without message traffic after which the link is tested.

Number of retries

The number of retries of a message which is not acknowledged or incorrectly acknowledged. After the last failed retry, an error is indicated at the data block. With 0, no retry takes place.



ae081_us.png

Application layer

The application layer is the communication layer with which the send and receive blocks work.

Station address The station address defines which station will be subject to a count query. The values define the 2 bytes for the common address (GADU1 and GADU2). The following values are defined as follows:

0	The station address is not used.
1 to 254	The count is queried on the station defined by the station address.
255	The count is queried on all accessible stations.

Use ACTTERM

☑ This parameter is used only for setpoints and commands. When this parameter is checked, an acknowledgement with set 'ACTTERM' is generated as the reason for transmission at the time at which the receive block is computed and outputs its telecontrol data at its output pins. On the transmission side, the data block awaits the reception of this ACTTERM acknowledgement and reacts with its **DSR** pin to the reception of this acknowledgement. For commands with execution time, the acknowledgement is generated when the command is terminated, for commands with continuous execution time and for setpoints, the acknowledgement is generated when the data are output to the output pins.

Use negative ACK

☑ Incorrect messages are acknowledged negatively.

Send 'Init end'after reconnection

☑ After each establishment of a link, an init end message is generated.

☐ An init end message is generated only in connection with the first initialization of the system.

Interrogation without counters

☑ With an inquiry (global) no counters are sent.

☐ With an inquiry (global) the counters are also sent. This characteristic is an extension of IEC 60870-5-101.

Send interrogation request on 'Init end'

☑ After each establishment of a link or only in connection with the first establishment of a link and after reconfiguration, an init end message is generated. After the init end message, there is a general inquiry, if configured.

Use daylight saving time

☑ The timestamp in telecontrol messages will be sent using Daylight Saving Time (DST).

Max interrogation messages

The number of messages to be indicated by an application. This status is indicated by a value of 10 at pin STA.

Application timeout

This time indicates how long an acknowledgement will be awaited on the application level. An acknowledgement is generated only for commands and setpoints on the application level. The minimum time of 500 ms must be configured for this parameter.

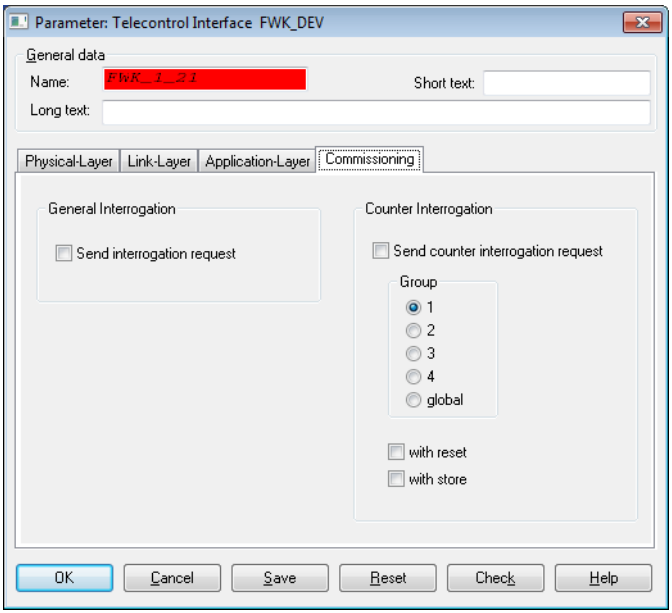
GADU length Not supported at present.

IAD length Not supported at present.

Timesync

Enable ☑ After each new establishment of a link and once per hour, a 'time synchronization' message is generated. Greenwich Mean Time (GMT) is used as the time for synchronization.
"*Send*" option: Time synchronization is sent by Freelance to an external system. Time synchronization from an external system to Freelance is not provided. Incoming time synchronization messages are confirmed by the process station, but are not executed.
"*Recv*" option: Time synchronization from an external system is received by Freelance. Incoming time synchronization messages are confirmed and executed by the process station.

Time synchronization telegrams are always sent with system time (GMT). Setting the "daylight saving time" flag has no effect on time synchronization telegrams.



ae082_us.png

General Interrogation

Send interrogation request

☑ In commissioning mode a general interrogation command (IEC 60870-5 data type 100) can be initiated.

Counter interrogation

Send counter interrogation request

☑ In commissioning mode a counter interrogation command (IEC 60870-5 data type 101) can be initiated.

Group

1 to 4 ◉ The counter interrogation is executed for a specific group of counters (1 to 4).

global ◉ The counter interrogation is executed for all groups of counters.

with reset ☑ The reset quality bit is sent along with the counter interrogation.

with store ☑ The store quality bit is sent along with the counter interrogation.

Function block data: Balanced device module, FWK_DEV

Name	Data type	Conf.	Access	Comments
Diagnostic data				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
CTX	DWORD	no	RO	Number of messages sent
CRX	DWORD	no	RO	Number of messages received
TOT	DWORD	no	RO	Number of messages without acknowledgment (timeout)
RYS	DWORD	no	RO	Number of messages with retries
CRC	DWORD	no	RO	Number of messages with checksum errors
SCE	DWORD	no	RO	Number of messages with scan errors
ADR	DWORD	no	RO	Number of messages with address errors
FRM	DWORD	no	RO	Number of messages with framing errors
DTE	DWORD	no	RO	Number of messages for which the received data type is different from the configured data type
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				

Name	Data type	Conf.	Access	Comments
BAUD	INT	yes	RO	Transmission rate: 0 = 19200 baud, 1 = 9600 baud, 2 = 4800 baud, 3 = 2400 baud, 4 = 1200 baud, 5 = 600 baud, 6 = 300 baud
STOPBITS	INT	yes	RO	Stop bits: 0 = 1 bit, 1 = 2 bits
PARITAET	INT	yes	RO	Parity: 0 = none, 1 = odd, 2 = even
Parameter definition dialog 2				
StationAB	INT	yes	RO	Station: 0 = A, 1 = B
NAKusage	BOOL	yes	RO	TRUE: use NAK
ActiveCon	BOOL	yes	RO	TRUE: active connection
MAXRE-TRYS	WORD	yes	RO	Number of retries
LnkTime-out	WORD	yes	RO	Link timeout
Keep-AlivCT	WORD	yes	RO	Keep-Alive cycle time
Recon-WaitT	WORD	yes	RO	Reconnect sleep time
Parameter definition dialog 3				
ActTerm	BOOL	yes	RO	TRUE: ACTTERM
Inquiry	BOOL	yes	RO	TRUE: general interrogation
TimeSync	BOOL	yes	RO	TRUE: timesync
AddInitEnd	BOOL	yes	RO	TRUE: init end after reconnection
GalessCnt	BOOL	yes	RO	TRUE: general interrogation without discrete values
GADU1	BYTE	yes	RO	Common address – byte 1

Name	Data type	Conf.	Access	Comments
GADU2	BYTE	yes	RO	Common address – byte 2
AppTime-out	WORD	yes	RO	Application timeout
Parameter definition dialog 4				
GArequest	BOOL	yes	RW	TRUE: initiate general interrogation (IBT)
ZWrequest	BOOL	yes	RW	TRUE: initiate counter interrogation command (IBT)
ZwreqReset	BOOL	yes	RW	TRUE: counter interrogation with reset
ZWreq-Store	BOOL	yes	RW	TRUE: counter interrogation with store
ZWclass	INT	yes	RW	Group for counter interrogation: 0 = Group 1, 1 = Group 2, 2 = Group 3, 3 = Group 4, 4 = global

2.2 Unbalanced device module, master, FWK_DEV_M

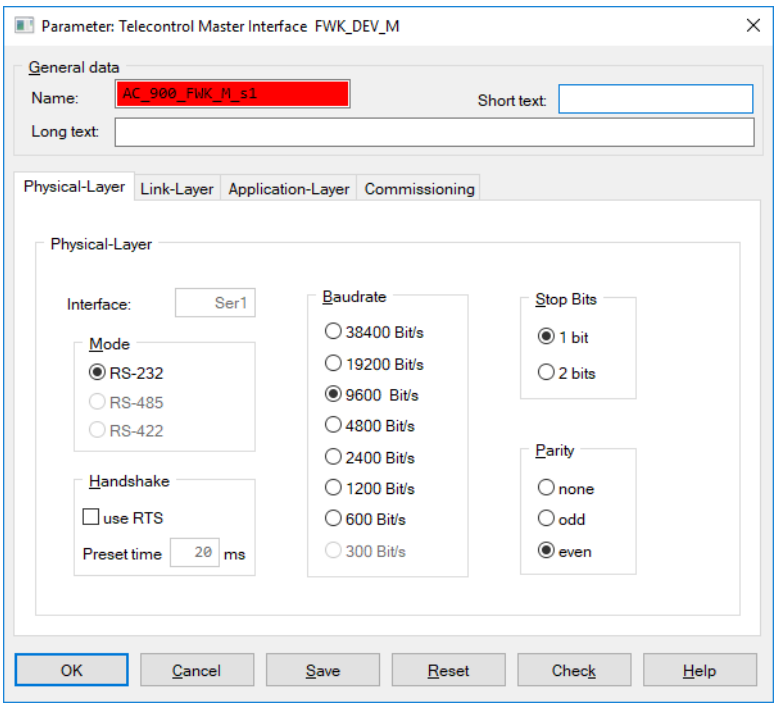
This module is intended for test purposes and is available in demo mode only!

Function

This block is used to configure the physical interface and adjust the IEC 60870-5-101 protocol parameters. It is designed for unbalanced data transmission through the serial interface. Data messages are sent independently from the user task.

The FWK_DEV_M device module is configured in the hardware structure.

Parameters: Unbalanced device module, master, FWK_DEV_M



FWK_DEV_M_1_us.png

Parameters of the serial interface

Interface Display of the serial interface for which the telecontrol protocol is defined.

Mode ◉ Definition of the type of serial interface (RS-232 and RS-422)

RS-422 is supported by AC 800F only.

Each interface type (RS-232 and RS--422) also requires appropriate cabling.

Handshake

use RTS The RTS pin of the serial interface is set active permanently. Certain serial line multiplexers need this signal to detect which slave is sending. The permanent active RTS prevents these multiplexers

from functioning properly with controller.
☐ The check box is used for activating the behavior of the RTS signal as set at the “Preset time”.

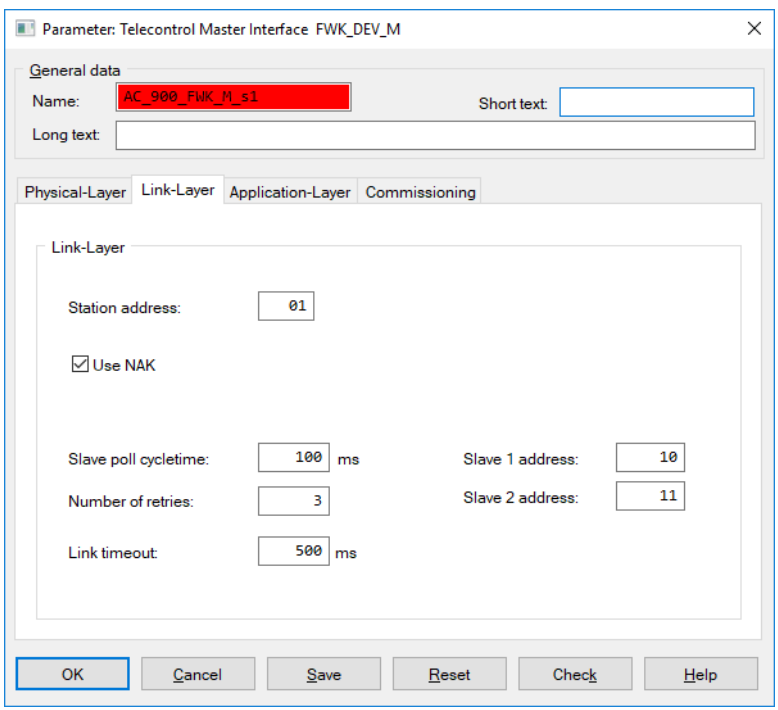
Preset time Use this field to indicate the time interval (in milliseconds) in which the RTS signal is set active before the controller starts transmitting and reset after the last character is sent.

Baudrate ◉ Selection of transmission rate (38400, 19200, 9600, 4800, 2400, 1200, 600, 300 Bit/s)

For AC 900F controller 300 Bit/s transmission rate is not supported.

Stop bits ◉ Selection of number of stop bits (1 or 2 bits)

Parity ◉ Selection of the parity bit (none, odd, or even)



FWK_DEV_M_2_us.png

Link layer

The link layer (link level) is the communication layer which accesses the serial interface directly. Messages are confirmed with acknowledge on the link layer level.

Station address
Communication address of the master

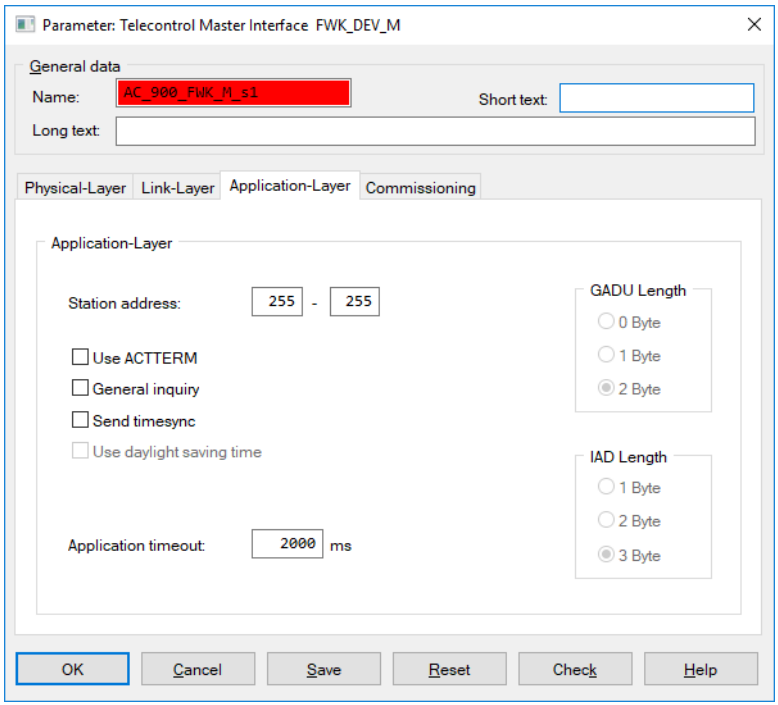
Use NAK ☑ Incorrect messages are acknowledged negatively (NAK - negative acknowledge)

Slave poll cycletime
This time indicates how long a slave can poll

Number of retries
The number of retries of a message which is not acknowledged or incorrectly acknowledged. After the last failed retry, an error is indicated at the data block. With 0, no retry takes place.

Link timeout This time indicates how long an acknowledgement will be awaited on the link layer level (link level). The setting of this parameter depends on the telecontrol head used. The minimum time of 200 ms must be configured for this parameter.

Slave 1, 2 address
Communication address of the slaves (1 and 2)



FWK_DEV_M_3_us.png

Application layer

The application layer is the communication layer with which the send and receive blocks work.

Station address

The station address defines which station will be subject to a count query. The values define the 2 bytes for the common address (GADU1 and GADU2). The following values are defined as follows:

0	The station address is not used.
1 to 254	The count is queried on the station defined by the station address.
255	The count is queried on all accessible stations.

Use ACTTERM

☑ This parameter is used only for setpoints and commands.

When this parameter is checked, an acknowledgement with set 'ACTTERM' is generated as the reason for transmission at the time at which the receive block is computed and outputs its telecontrol data at its output pins. On the transmission side, the data block awaits the reception of this ACTTERM acknowledgement and reacts with its **DSR** pin to the reception of this acknowledgement. For commands with execution time, the acknowledgement is generated when the command is terminated, for commands with continuous execution time and for setpoints, the acknowledgement is generated when the data are output to the output pins.

General inquiry

☑ This parameter is used only for real values, discrete values, and status values. The device module generates a general inquiry message after each new establishment of a link. The other side, then generates a message with the reason for transmission 'general inquiry' for every data point and subsequently an init end message. This procedure ensures that, in the event of a new establishment of a link, all data are available on the reception side in topical form.

Send timesync

☑ After each new establishment of a link and once per hour, a 'time synchronization' message is generated. Greenwich Mean Time (GMT) is used as the time for the synchronization. This time synchronization is sent from Freelance to an external system. Time synchronization from an external system to Freelance is not provided. Incoming time synchronization messages are confirmed by the process station but not executed.

Time synchronization telegrams are always sent with system time (GMT). Setting the "daylight saving time" flag has no effect on time synchronization telegrams.

Use daylight saving time

☑ Not currently supported.

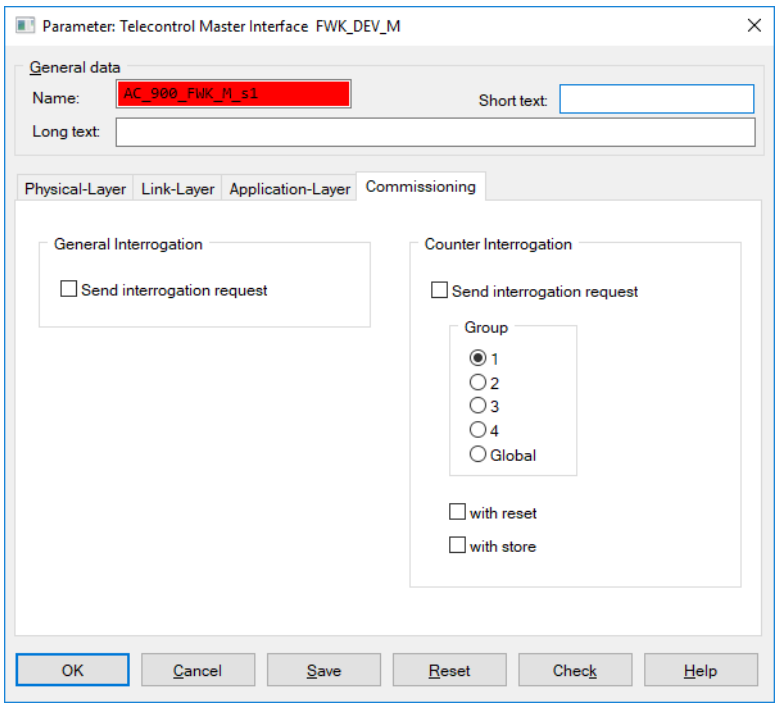
Application timeout

This time indicates how long an acknowledgement will be awaited on the application layer. An acknowledgement is generated only for

commands and setpoints on the application layer. The minimum time of 500 ms must be configured for this parameter.

GADU length Not supported at present.

IAD length Not supported at present.



FWK_DEV_M_4_us.png

General interrogation

Send interrogation request

☑ In commissioning mode a general interrogation command (IEC 60870-5 data type 100) can be initiated.

Counter interrogation

Send interrogation request

☑ In commissioning mode a counter interrogation command (IEC 60870-5 data type 101) can be initiated.

Group

1 to 4 ◉ The counter interrogation is executed for a specific group of counters (1 to 4).

Global ◉ The counter interrogation is executed for all groups of counters.

with reset ☑ The reset quality bit is sent along with the counter interrogation.

with store ☑ The store quality bit is sent along with the counter interrogation.

Function block data: Unbalanced device module, master, FWK_DEV_M

Name	Data type	Conf.	Access	Comments
Diagnostic data				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
CTX	DWORD	no	RO	Number of messages sent
CRX	DWORD	no	RO	Number of messages received
TOT	DWORD	no	RO	Number of messages without acknowledgement (timeout)
RYS	DWORD	no	RO	Number of messages with retries
CRC	DWORD	no	RO	Number of messages with checksum errors
SCE	DWORD	no	RO	Number of messages with scan errors
ADR	DWORD	no	RO	Number of messages with address errors
FRM	DWORD	no	RO	Number of messages with framing errors

Name	Data type	Conf.	Access	Comments
DTE	DWORD	no	RO	Number of messages for which the received data type is different from the configured data type
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
BAUD	INT	yes	RO	Transmission rate: 0 =19200 baud, 1 = 9600 baud, 2 = 4800 baud, 3 = 2400 baud, 4 = 1200 baud, 5 = 600 baud, 6 = 300 baud
STOP-BITS	INT	yes	RO	Stop bits: 0 = 1 bit, 1 = 2 bits
PARITAET	INT	yes	RO	Parity: 0 = none, 1 = odd, 2 = even
RSMode	INT	yes	RO	Physical: 0 = RS232, 1 = RS485, 2 = RS422
Parameter definition dialog 2				
MastAdr	INT	yes	RO	Station: 0 = A, 1 = B
NAKusage	BOOL	yes	RO	TRUE: use NAK
MAXRE-TRYS	WORD	yes	RO	Number of retries
LnkTime-out	WORD	yes	RO	Link timeout
Parameter definition dialog 3				
ActTerm	BOOL	yes	RO	TRUE: ACTTERM
Inquiry	BOOL	yes	RO	TRUE: general interrogation
TimeSync	BOOL	yes	RO	TRUE: timesync

Name	Data type	Conf.	Access	Comments
GADU1	BYTE	yes	RO	Common address – byte 1
GADU2	BYTE	yes	RO	Common address – byte 2
AppTime-out	WORD	yes	RO	Application timeout
Parameter definition dialog 4				
GArequest	BOOL	yes	RW	TRUE: initiate general interrogation (IBT)
ZWre-quest	BOOL	yes	RW	TRUE: initiate counter interrogation com-mand (IBT)
ZwreqRe-set	BOOL	yes	RW	TRUE: counter interrogation with reset
ZWreq-Store	BOOL	yes	RW	TRUE: counter interrogation with store
ZWclass	INT	yes	RW	Group for counter interrogation: 0 = Group 1, 1 = Group 2, 2 = Group 3, 3 = Group 4, 4 = Global

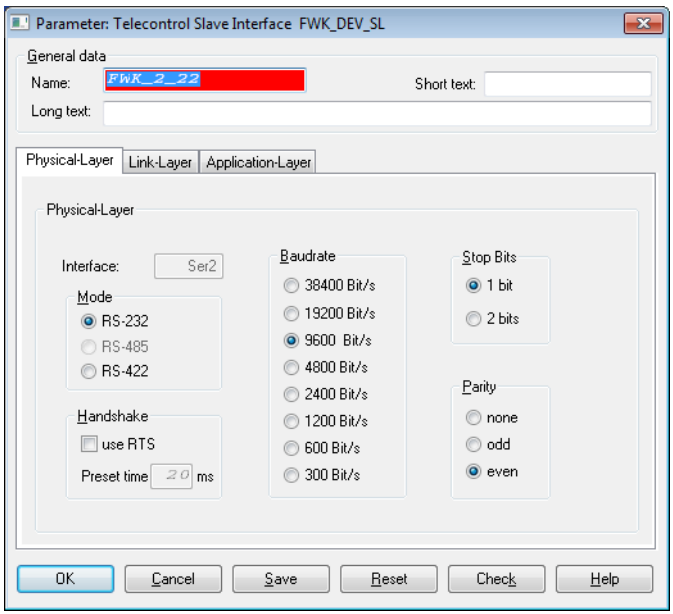
2.3 Unbalanced device module, slave, FWK_DEV_SL

Function

This block is used to configure the physical interface and adjust the IEC 60870-5-101 protocol parameters. It is designed for unbalanced data transmission through the serial interface. Data messages are sent independently from the user task.

The FWK_DEV_SL device module is configured in the hardware structure.

Parameters: Unbalanced device module, slave, FWK_DEV_SL



ae083_us.png

Parameters of the serial interface

Interface Display of the serial interface for which the telecontrol protocol is defined.

Mode ◉ Definition of the type of serial interface (RS-232 and RS-422)

RS-422 is supported with AC 800F only.

Each interface type (RS-232 and RS-422) also requires appropriate cabling.

Handshake

use RTS The RTS pin of the serial interface is set active permanently. Certain serial line multiplexers need this signal to detect which slave is sending. The permanent active RTS prevents these multiplexers from functioning properly with controller.

☐ The check box is used for activating the behavior of the RTS signal as set at the “Preset time”.

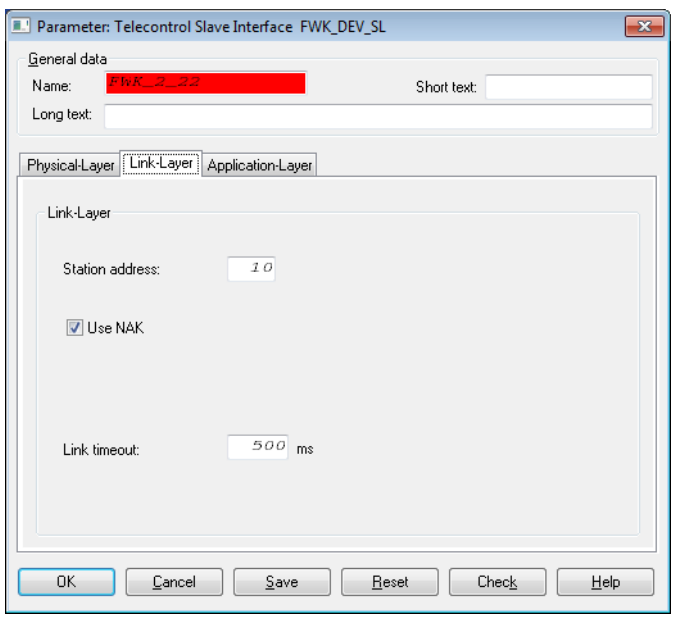
Preset time Use this field to indicate the time interval (in milliseconds) in which the RTS signal is set active before the controller starts transmitting and reset after the last character is sent.

Baudrate ◉ Selection of transmission rate (38400, 19200, 9600, 4800, 2400, 1200, 600, 300 Bit/s).

For AC 900F controller 300 Bit/s transmission rate is not supported.

Stop bits ◉ Selection of number of stop bits (1 or 2 bits).

Parity ◉ Selection of the parity bit (none, odd, or even).



ae084_us.png

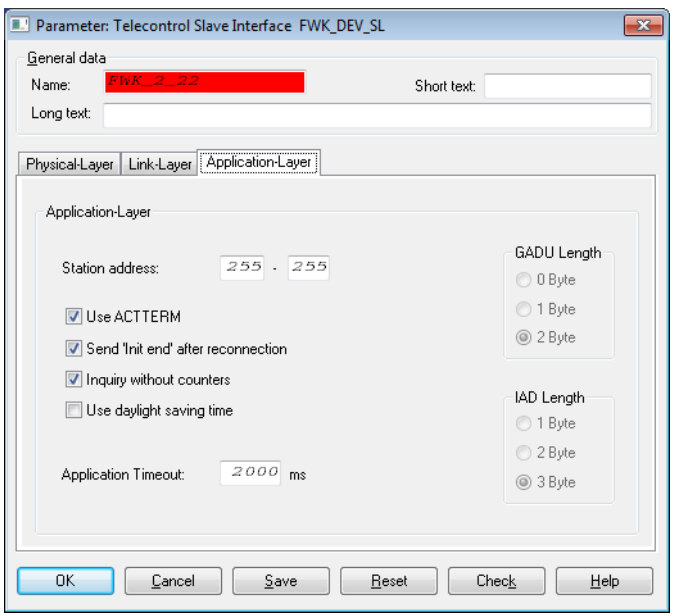
Link layer

The link layer (link level) is the communication layer which accesses the serial interface directly. Messages are confirmed with acknowledge on the link layer level.

Station address
Communication address of the slave

Use NAK ☑ Incorrect messages are acknowledged negatively (NAK - negative acknowledge)

Link timeout This time indicates how long an acknowledgement will be awaited on the link layer level (link level). The setting of this parameter depends on the telecontrol head used. It is only used with establishment of a link. The minimum time of 200 ms must be configured for this parameter.



ae085_us.png

Application layer

The application layer is the communication layer with which the send and receive blocks work.

Station address The station address defines which station will be subject to a count query. The values define the 2 bytes for the common address

(GADU1 and GADU2). The following values are defined as follows:

0	The station address is not used.
1 to 254	The count is queried on the station defined by the station address.
255	The count is queried on all accessible stations.

Use ACTTERM

☑ This parameter is used only for setpoints and commands. When this parameter is checked, an acknowledgement with set 'ACTTERM' is generated as the reason for transmission at the time at which the receive block is computed and outputs its telecontrol data at its output pins. On the transmission side, the data block awaits the reception of this ACTTERM acknowledgement and reacts with its **DSR** pin to the reception of this acknowledgement. For commands with execution time, the acknowledgement is generated when the command is terminated, for commands with continuous execution time and for setpoints, the acknowledgement is generated when the data are output to the output pins.

Send 'Init end' after reconnection

☑ After each establishment of a link, an init end message is generated.

☐ An init end message is generated only in connection with the first initialization of the system.

Inquiry without counters

☑ With an inquiry (global) no counters are sent.

☐ With an inquiry (global) the counters are also sent. This characteristic is an extension of IEC 60870-5-101.

Use daylight saving time

☑ The timestamp in telecontrol messages will be sent using Daylight Saving Time (DST).

Application timeout

This time indicates how long an acknowledgement will be awaited on the application layer. An acknowledgement is generated only for

commands and setpoints on the application layer. The minimum time of 500 ms must be configured for this parameter.

GADU length Not supported at present.

IAD length Not supported at present.

Function block data: Unbalanced device module, slave, FWK_DEV_SL

Name	Data type	Conf.	Access	Comments
Diagnostic data				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
CTX	DWORD	no	RO	Number of messages sent
CRX	DWORD	no	RO	Number of messages received
TOT	DWORD	no	RO	Number of messages without acknowledgment (timeout)
RYS	DWORD	no	RO	Number of messages with retries
CRC	DWORD	no	RO	Number of messages with checksum errors
SCE	DWORD	no	RO	Number of messages with scan errors
ADR	DWORD	no	RO	Number of messages with address errors
FRM	DWORD	no	RO	Number of messages with framing errors
DTE	DWORD	no	RO	Number of messages for which the received data type is different from the configured data type
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				

Name	Data type	Conf.	Access	Comments
BAUD	INT	yes	RO	Transmission rate: 0 = 19200 baud, 1 = 9600 baud, 2 = 4800 baud, 3 = 2400 baud, 4 = 1200 baud, 5 = 600 baud, 6 = 300 baud
STOP-BITS	INT	yes	RO	Stop bits: 0 = 1 bit, 1 = 2 bits
PARITAET	INT	yes	RO	Parity: 0 = none, 1 = odd, 2 > even
RSMode	INT	yes	RO	Physical: 0 = RS232, 1 = RS485, 2 = RS422
Parameter definition dialog 2				
SlavAdr	WORD	yes	RO	Station address
NAKusage	BOOL	yes	RO	TRUE: use NAK
AppTime-out	WORD	yes	RO	Application timeout
LnkTime-out	WORD	yes	RO	Link timeout
Parameter definition dialog 3				
ActTerm	BOOL	yes	RO	TRUE: ACTTERM
AddIni-tEnd	BOOL	yes	RO	TRUE: Init end after reconnection
GalessCnt	BOOL	yes	RO	TRUE: general inquiry without discrete values
GADU1	BYTE	yes	RO	Common address – byte 1
GADU2	BYTE	yes	RO	Common address – byte 2

2.4 TCP/IP device module, FWK_DEV_TCP

Function

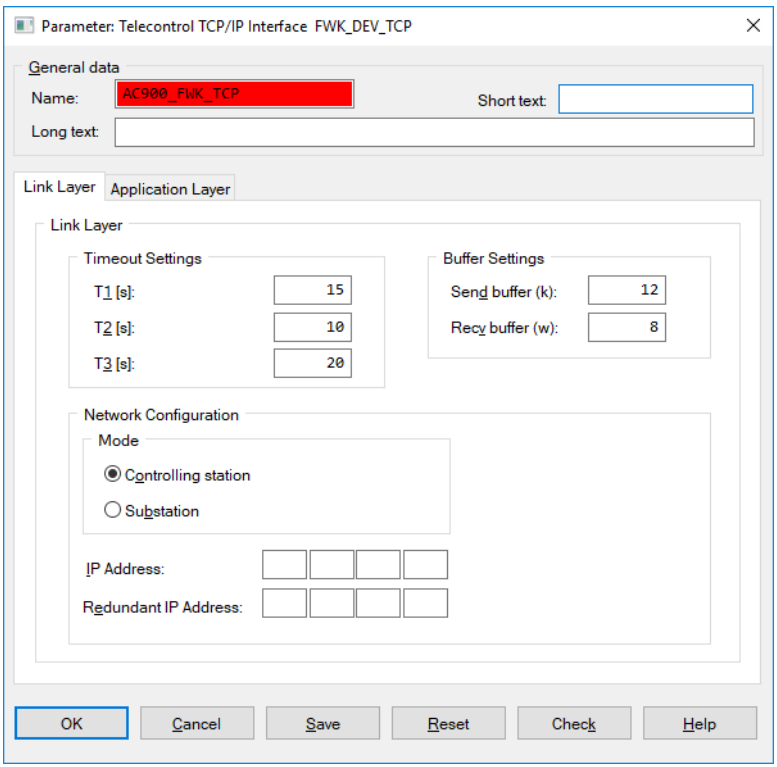
The physical interface and the IEC 60870-5-104 protocol parameters are set with this function block, which is designed for data transmission through the Ethernet interface. Data messages are sent independently of the user task.

The FWK_DEV_TCP interface module is configured in the hardware structure.

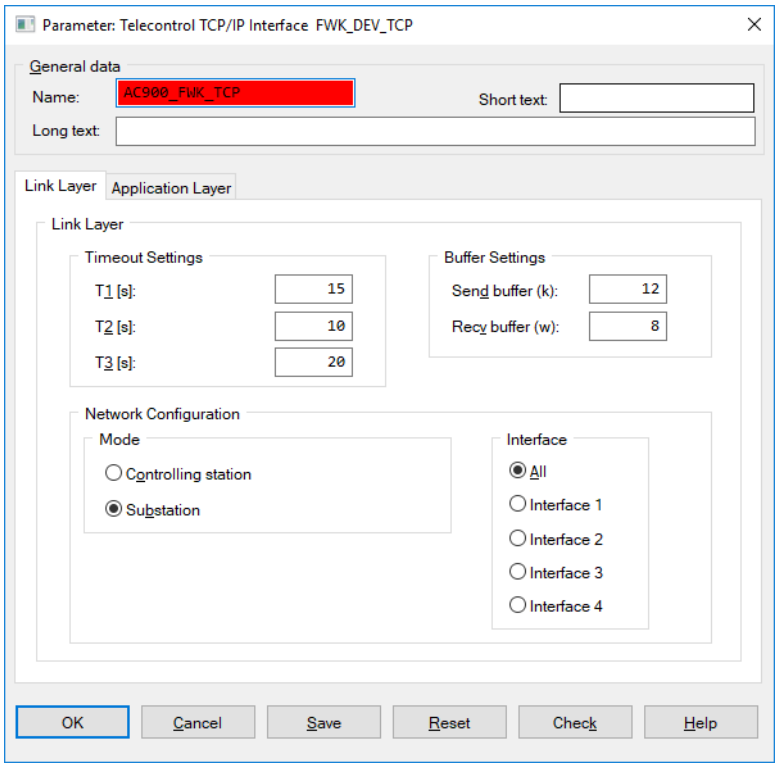
Several FWK_DEV_TCP device modules can be configured per process station. Only one of these device modules can be used as substation, the others can be as controlling station.

A maximum of 20 Ethernet device modules (Modbus, Send and Receive and Telecontrol) can be configured per AC 900F. For AC 800F and AC 700F a maximum of 10 Ethernet device modules (Modbus, Send and Receive and Telecontrol) can be configured only.

Parameters: TCP/IP device module, FWK_DEV_TCP



FWK_DEV_104 master_us.png



FWK_DEV_104_1_us.png

Link layer The link layer (link level) is the communication layer which accesses the Ethernet interface directly. Messages are confirmed with acknowledge on the link layer level.

Timeout settings

T1, T2, T3 (s) The time setting parameters are used to monitor the connection and to repeat the messages.

Buffer settings

Send buffer (k) and Recv buffer (w)

The buffer setting parameters are used to define the maximum number of outstanding messages and the behavior of acknowledgment.

Network Configuration

This setting is used to switch between the control station network and a substation network. In case of a control station network, the function block establishes the connection. In case of a substation network, the function block remains passive and is waiting for connection establishment.

Mode This option determines if the function block is connected to a control station or a substation network.

Controlling station

◉ The function block connects to the substation network.

Substation ◉ The function block remains passive and expects the controlling station to establish the connection.

IP-address In case of a control station network, at least one IP-address of a substation network has to be configured. In case of a substation network, the address is fixed.

Redundant IP-address

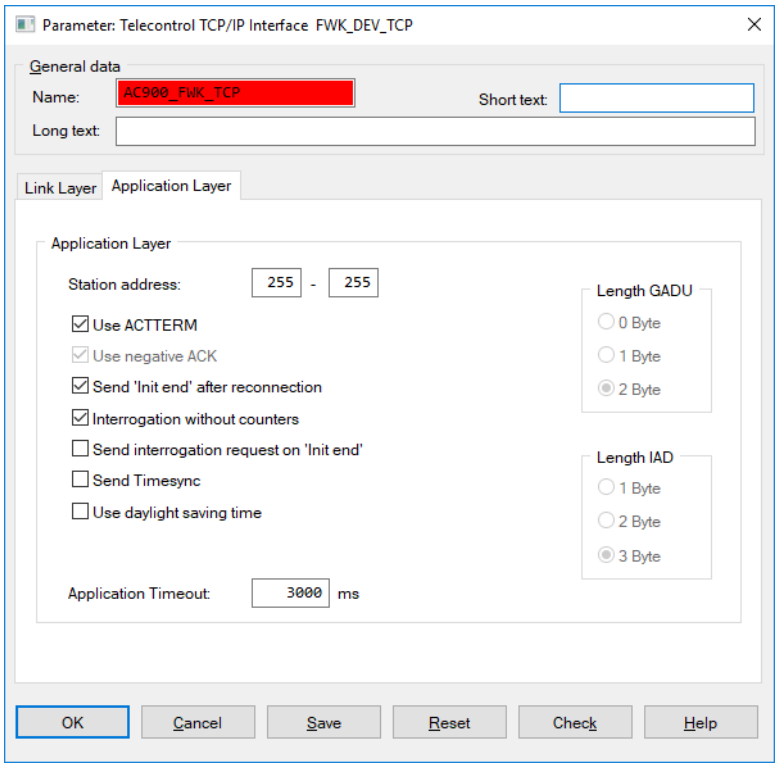
If the “Controlling station” option has been selected and a redundant connection is configured, A second IP address must be entered.

Interface 1 to 4 or All

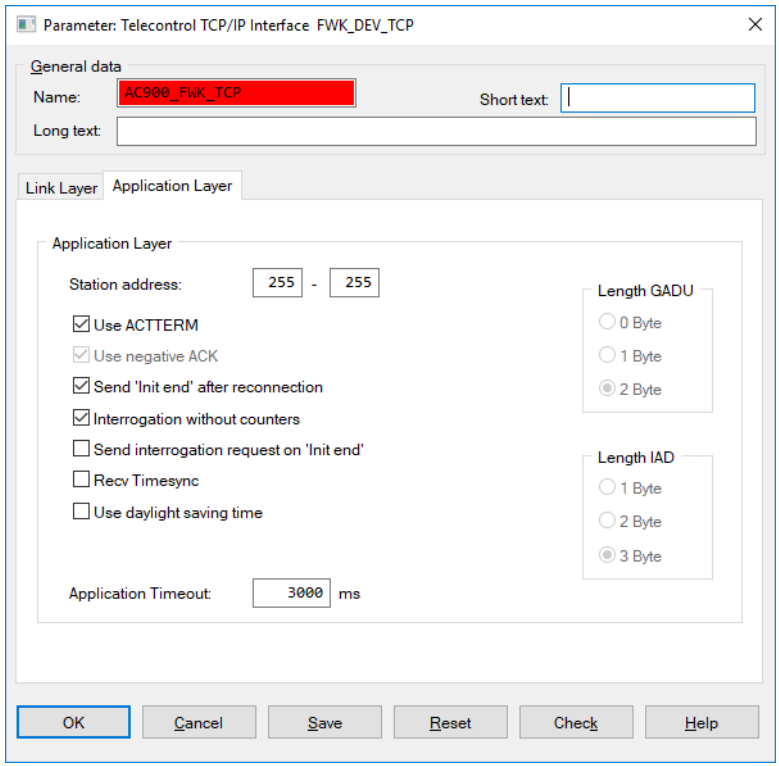
◉ Depending on the type of the process station and the configured position of the function block, the used network interface can be selected. This option must be used only for substations. It determines on which connector the function block is waiting for the connection. In case of controlling station, the interface will be set automatically depending on the IP address.

The device module FWK_DEV_TCP provides a point-to-point communication. As soon as the communication is established, packets are sent to the connected peer only.

Choosing one of the options **Interface 1 to Interface 4**, the device module reads and communicates to the selected port only. Choosing option **All**, the device module is reading all Ethernet ports of the controller and establishes the connection to the port only where incoming communication arrives.



FWK_DEV_104_Master2_us.png



FWK_DEV_104_2_us.png

Application layer

The application layer is the communication layer with which the send and receive blocks work.

Station address

The station address defines which station will be subject to a count query. The values define the 2 bytes for the common address (GADU1 and GADU2). The following values are defined as follows:

0	The station address is not used.
1 to 254	The count is queried on the station defined by the station address.
255	The count is queried on all accessible stations.

Use ACTTERM

☑ This parameter is used only for setpoints and commands. When this parameter is checked, an acknowledgement with set 'ACTTERM' is generated as the reason for transmission at the time at which the receive block is computed and outputs its telecontrol data at its output pins. On the transmission side, the data block awaits the reception of this ACTTERM acknowledgement and reacts with its **DSR** pin to the reception of this acknowledgement. For commands with execution time, the acknowledgement is generated when the command is terminated, for commands with continuous execution time and for setpoints, the acknowledgement is generated when the data are output to the output pins.

Use negative ACK

☑ Incorrect messages are acknowledged negatively.

Send 'Init end' after reconnection

☑ After each establishment of a link, an init end message is generated.

☐ An init end message is generated only in connection with the first initialization of the system.

Interrogation without counters

☑ With an interrogation (global) no counters are sent.

☐ With an interrogation (global) the counters are also sent. This characteristic is an extension of IEC 60870-5-104.

Send interrogation request on 'Init end'

☑ After each establishment of a link or only in connection with the first establishment of a link and after reconfiguration, an init end message is generated. After the init end message, there is a general inquiry, if configured.

Send Timesync ☑ If "Controlling station" has been selected as the station type, a 'time synchronization' message is generated after each new establishment of a link and once per hour. This time synchronization is sent from the controlling station to the substations. Incoming time synchronization messages are

confirmed by the process station but not executed. Greenwich Mean Time (GMT) is used as the time for the synchronization.

Time synchronization telegrams are always sent with system time (GMT). Setting the “daylight saving time” flag has no effect on time synchronization telegrams.

Recv Timesync

☑ If “Substation” has been selected as the station type, a ‘time synchronization’ message is expected. Incoming time synchronization telegrams are confirmed by the process station and cause a time correction in the process station. Greenwich Mean Time (GMT) is used as the time for the synchronization.

Use daylight saving time

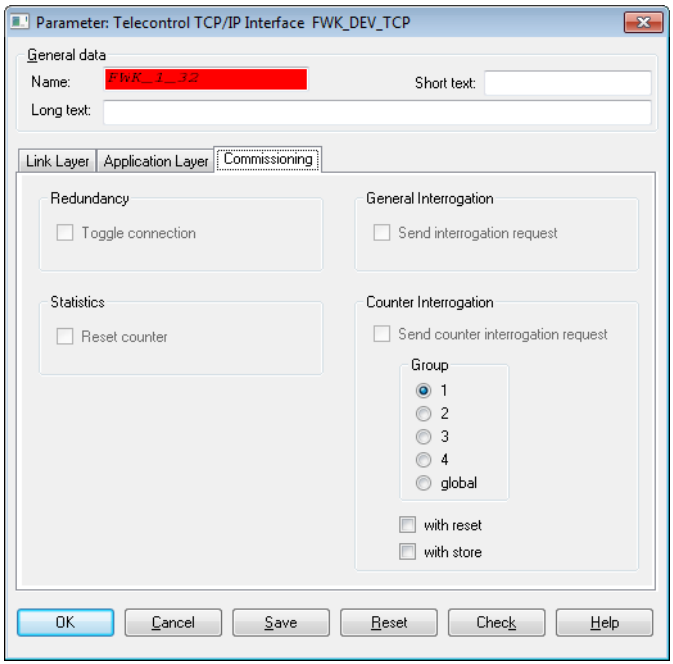
☑ The timestamp in telecontrol messages will be sent using Daylight Saving Time (DST).

Application timeout

This time indicates how long an acknowledgement will be awaited on the application level. An acknowledgement is generated only for commands and setpoints on the application level.

Length GADU Not supported at present.

Length IAD Not supported at present.



FWK_DEV_104_3_us.png

The following options are available only in commissioning mode.

Redundancy If two connections are connected at the same time, only one of them will be active. In case of a controlling station, the first established connection will be activated. Established, but not active connections are cyclically monitored with TESTFR messages. At commissioning time, the active connection can be switched in the parameter definition dialog.

Toggle connection

☑ Select to interrupt the connection link. Current data transmissions are canceled. For more information on toggle redundancy connection, refer to Redundancy behavior on Page 20.

Statistics

Reset counter ☑ Select to send the reset error counters (RX/TX counters) of the statistic function to the controller in commissioning mode. After

reset is performed in the controller, the check mark will be removed.

General interrogation

Send interrogation request

In commissioning mode a general interrogation command (IEC 60870-5-104 data type 100) can be initiated.

This option can be used only if the device module is switched to **"Control station"** mode on Link layer tab.

Counter interrogation

Send counter interrogation request

In commissioning mode a counter interrogation command (IEC 60870-5-104 data type 101) can be initiated.

This option can be used only if the device module is switched to **"Control station"** mode on Link layer tab.

Group

1 to 4 ◉ The counter interrogation is executed for a specific group counters (1 to 4).

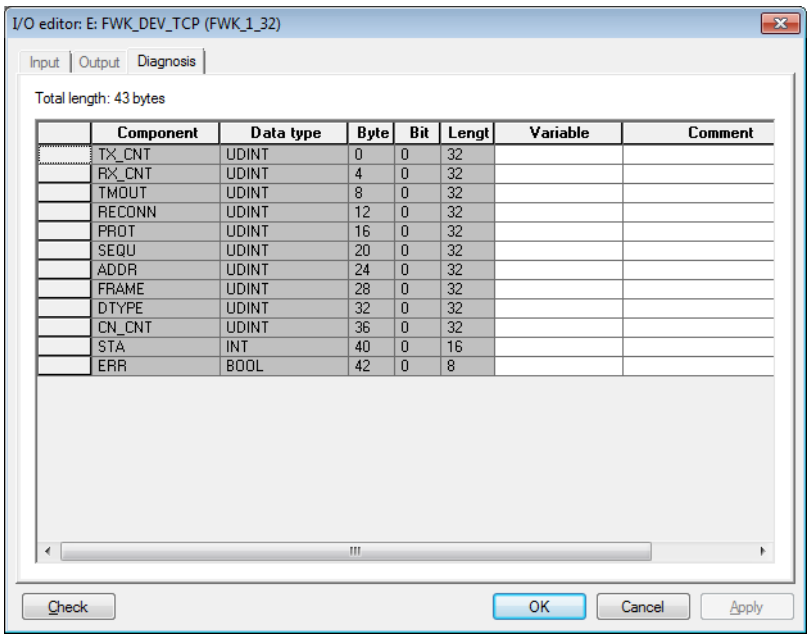
global ◉ The counter interrogation is executed for all groups of counters.

with reset ☑ The reset quality bit is sent along with the counter interrogation.

with store ☑ The store quality bit is sent along with the counter interrogation.

Diagnosis of the TCP/IP device module, FWK_DEV_TCP

For the Telecontrol TCP/IP device module (FWK_DEV_TCP) no view function block exists. Instead I/O variables are available for diagnosis. All information can be accessed in the I/O editor.



FWK_DEV_104_IO Editor_us.png

TX_CNT Number of ASDUs sent

RX_CNT Number of ASDUs received

TMOUT Number of link aborts because of timeout errors. If this error occurs several times the values of timeout parameter must be checked and increased if required.

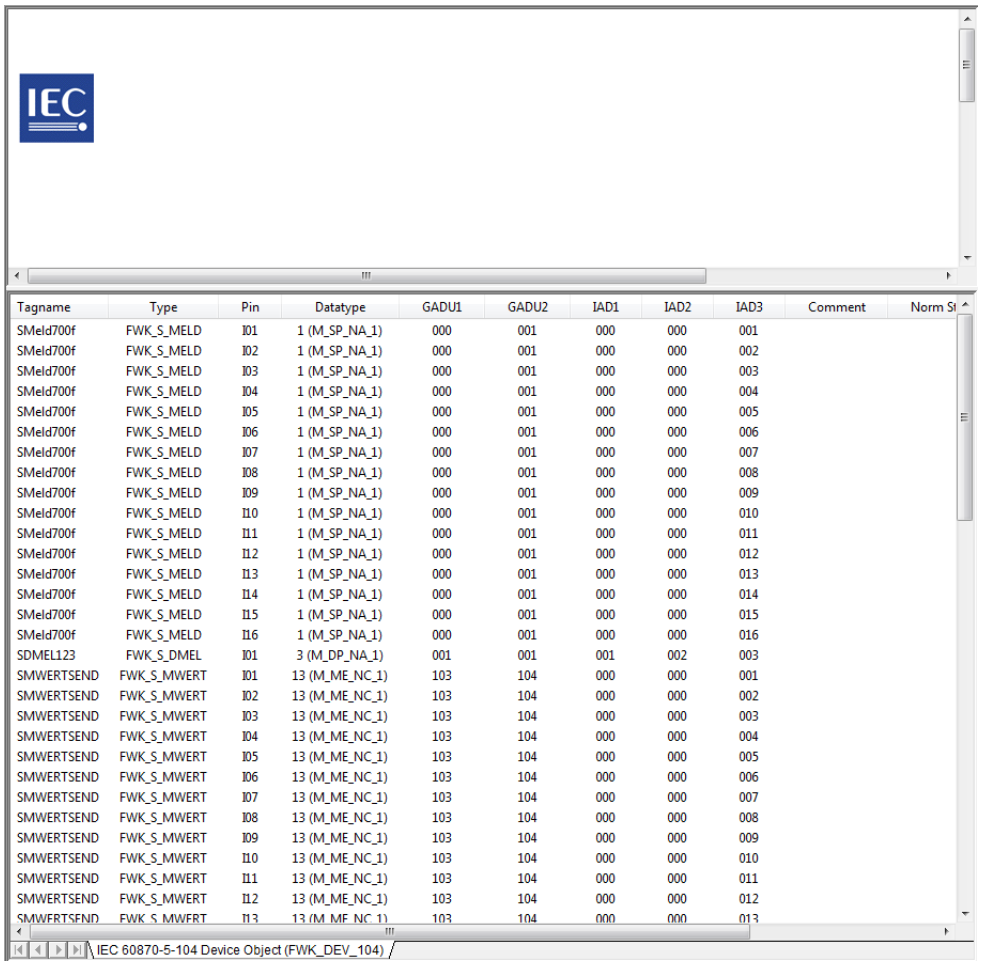
RECONN Number of connection connected. If this value increases steadily, it must be checked if the connection was aborted on purpose or if an error is the reason. This can be determined by checking the error counters.

PROT Number of protocol errors. Received data does not fit into the protocol or a protocol violation is detected. This results in an abort of the actual connection.

SEQU	Number of sequence errors. The order of the received messages was not correct. This results in an abort of the actual connection.
ADDR	Number of address errors. Some received messages contained an invalid address. This error has no influence on existing connections but it points to a wrong configuration.
FRAME	Number of format errors.
DTYPE	Number of data type errors. The messages for which the received data type is different from the configured data type.
CN_CNT	Number of current established Ethernet connections. Values must be from 0 to 2.
STA	Common status of function block.
ERR	Error code.

2.5 Telecontrol list

Every device module indicates in the lower part of the graphics display a list of the configured telecontrol signals.



Tagname	Type	Pin	Datatype	GADU1	GADU2	IAD1	IAD2	IAD3	Comment	Norm St
SMeld700f	FWK_S_MELD	I01	1 (M_SP_NA_1)	000	001	000	000	001		
SMeld700f	FWK_S_MELD	I02	1 (M_SP_NA_1)	000	001	000	000	002		
SMeld700f	FWK_S_MELD	I03	1 (M_SP_NA_1)	000	001	000	000	003		
SMeld700f	FWK_S_MELD	I04	1 (M_SP_NA_1)	000	001	000	000	004		
SMeld700f	FWK_S_MELD	I05	1 (M_SP_NA_1)	000	001	000	000	005		
SMeld700f	FWK_S_MELD	I06	1 (M_SP_NA_1)	000	001	000	000	006		
SMeld700f	FWK_S_MELD	I07	1 (M_SP_NA_1)	000	001	000	000	007		
SMeld700f	FWK_S_MELD	I08	1 (M_SP_NA_1)	000	001	000	000	008		
SMeld700f	FWK_S_MELD	I09	1 (M_SP_NA_1)	000	001	000	000	009		
SMeld700f	FWK_S_MELD	I10	1 (M_SP_NA_1)	000	001	000	000	010		
SMeld700f	FWK_S_MELD	I11	1 (M_SP_NA_1)	000	001	000	000	011		
SMeld700f	FWK_S_MELD	I12	1 (M_SP_NA_1)	000	001	000	000	012		
SMeld700f	FWK_S_MELD	I13	1 (M_SP_NA_1)	000	001	000	000	013		
SMeld700f	FWK_S_MELD	I14	1 (M_SP_NA_1)	000	001	000	000	014		
SMeld700f	FWK_S_MELD	I15	1 (M_SP_NA_1)	000	001	000	000	015		
SMeld700f	FWK_S_MELD	I16	1 (M_SP_NA_1)	000	001	000	000	016		
SDMEL123	FWK_S_DMEL	I01	3 (M_DP_NA_1)	001	001	001	002	003		
SMWERTSEND	FWK_S_MWERT	I01	13 (M_ME_NC_1)	103	104	000	000	001		
SMWERTSEND	FWK_S_MWERT	I02	13 (M_ME_NC_1)	103	104	000	000	002		
SMWERTSEND	FWK_S_MWERT	I03	13 (M_ME_NC_1)	103	104	000	000	003		
SMWERTSEND	FWK_S_MWERT	I04	13 (M_ME_NC_1)	103	104	000	000	004		
SMWERTSEND	FWK_S_MWERT	I05	13 (M_ME_NC_1)	103	104	000	000	005		
SMWERTSEND	FWK_S_MWERT	I06	13 (M_ME_NC_1)	103	104	000	000	006		
SMWERTSEND	FWK_S_MWERT	I07	13 (M_ME_NC_1)	103	104	000	000	007		
SMWERTSEND	FWK_S_MWERT	I08	13 (M_ME_NC_1)	103	104	000	000	008		
SMWERTSEND	FWK_S_MWERT	I09	13 (M_ME_NC_1)	103	104	000	000	009		
SMWERTSEND	FWK_S_MWERT	I10	13 (M_ME_NC_1)	103	104	000	000	010		
SMWERTSEND	FWK_S_MWERT	I11	13 (M_ME_NC_1)	103	104	000	000	011		
SMWERTSEND	FWK_S_MWERT	I12	13 (M_ME_NC_1)	103	104	000	000	012		
SMWERTSEND	FWK_S_MWERT	I13	13 (M_ME_NC_1)	103	104	000	000	013		

IEC 60870-5-104 Device Object (FWK_DEV_104)

ae039_us.png

Description of the columns

Tag name	Name of the telecontrol block.
Type	Type of telecontrol block
Pin	Pin identifier of the block.
	I stands for an input, O represents an output, and a number is the serial number of the input/output.

Datatype	Data type in accordance with IEC 60870-5-101/IEC 60870-5-104.
GADU1	Byte 1 of the common address of the block.
GADU2	Byte 2 of the common address of the block
IAD1	Byte 1 of the information object address of the pin
IAD2	Byte 2 of the information object address of the pin
IAD3	Byte 3 of the information object address of the pin
Comment	Comment related the telecontrol signal. Note that the comment is only visible in the telecontrol list.
Norm start	Low limit (0%) of the normalized range for real values and setpoints.
Norm end	High limit (100%) of the normalized range for real values and setpoints.
Threshold	Threshold limit beyond which a change of the input value referred to the last sent value is sent.

The telecontrol list can be sorted by columns.

Exporting the telecontrol list

Context menu in the graphics display of a telecontrol device module
> **Address list export**

The list will be exported with the contents described above. Exporting the list is possible even when the project has not yet passed the plausibility check. The list will be exported in CSV format (that is, one line per list entry).

Do not use the exported telecontrol list for exchanging data between different Freelance versions.

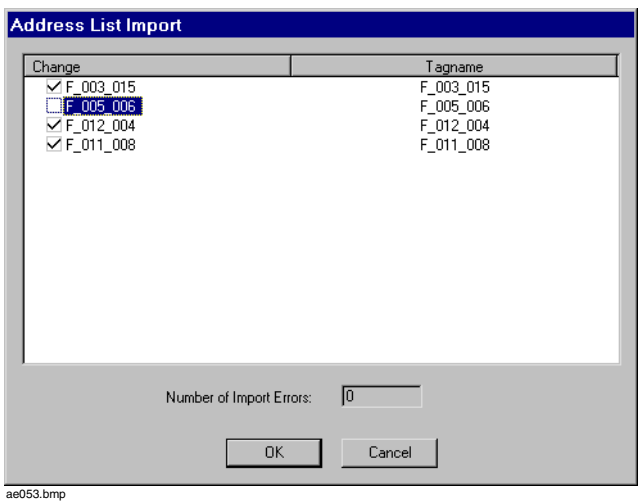
Importing the telecontrol list

An exported list can be re-imported again.

Context menu in the graphics display of a telecontrol device module
> **Address list import**

Only the telecontrol address, the telecontrol parameters and the comment can be edited in the imported list. Only entries with identical features (pin, data type) can be taken over.

All changed blocks are indicated in a list.



ae053.bmp

☑ Modified telecontrol data are taken over in the block.

☐ Modified telecontrol data are not taken over in the block.

User documentation of telecontrol data

The telecontrol data are documented with the documentation of the telecontrol blocks. Explicit documentation of the telecontrol data list is not possible.

When exporting the telecontrol list, an ASCII data file containing all telecontrol addresses is created. This list can be edited with other programs.

3 Send blocks

On the basis of the communication protocol, it is sensible to restrict the data types at one send block to one type. Therefore, there are five types of send blocks: send of status values, commands, real values, setpoints and discrete values. These types are mapped to the Freelance data types BOOL, REAL and DINT.

At least one send and one receive function block must be configured for each device module. Otherwise the project will not get plausible. If a function block is only inserted to ensure plausibility, a telecontrol address must be entered (eg: 000) and the processing should be deactivated.

3.1 Operating modes of the send blocks

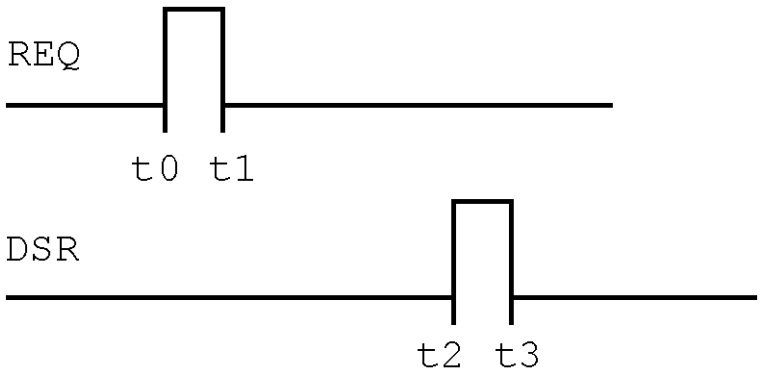
The send blocks know three operating modes to send their data

- Caused by request pin
- Send in connection with a change of data or
- Cyclic send of data

Send through request pin

The **REQ** signal is evaluated on the rising edge, the **DSR** signal remains applied for one computation cycle. If a rising edge is generated again at the **REQ** signal although no acknowledgement has yet been received from the receiver, the **OVR** pin is set to indicate that an overrun has taken place. The evaluation of the receive acknowledgement is carried out before the evaluation of whether transmission is to take place. This means, assuming that there is an appropriately fast telecontrol link, that in connection with change driven and cyclic transmission, a transmission job can be sent in connection with every computation of the block. In connection with send through the request pin it is possible to send only in connection with every second computation (send takes place only with a rising edge).

Time diagram of a send process caused through the request pin:



ae099.bmp

t0 Request to send data to the receiver
t1 REQ cancelled
t2 Acknowledgement received from the receiver
t3 DSR signal cancelled after one computation cycle; block ready for next send

Change driven send of data

Data are always sent when the value of the input variables changes. When changes take place, there is an internal simulation that the **REQ** pin changed from 0 to 1 (t0). The variable is then sent as in the time diagram shown. At time t3 the **REQ** pin is set internally to 0. The block is ready for send again.

To prevent unnecessarily frequent send in the event of mild fluctuations in the input value, a threshold value can be configured for real values and setpoints. The input value is not sent until it differs positively or negatively from the value last sent by more than the threshold value.

If the input value changes again although no acknowledgement has yet been received from the receiver, the **OVR** pin is set in exactly the same way as in connection with send through the Request pin. If an error occurs during send, the job is automatically retried until the value has been sent without error.

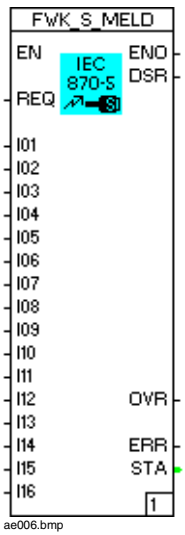
Cyclic send

The data are automatically sent after the expiry of a configurable cycle time. This cycle time is indicated in multiples of the task cycle time in which the block is computed. In this operating mode, an overrun error can occur if the transmission is faster than the response time of the receiver. For setpoints, it is necessary to ensure that an acknowledgement is generated by the receiver which is not sent until the

setpoint is accepted. The send block is not ready for transmission again until after this acknowledgement has been received.

All data which are sent by a send function block in the telegram must be received by receive function blocks. Otherwise the corresponding device module block will not be able to deliver all data and counts up its error counter **ADR**. In this case the corresponding receive function blocks will not be updated.

3.2 Send status value, FWK_S_MELD



ae006.bmp

Function

Transmission of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104

1	Single status value	M_SP_NA_1
2	Single status value with timestamp CP24Time	M_SP_TA_1
30	Single status value with timestamp CP56Time2a	M_SP_TB_1

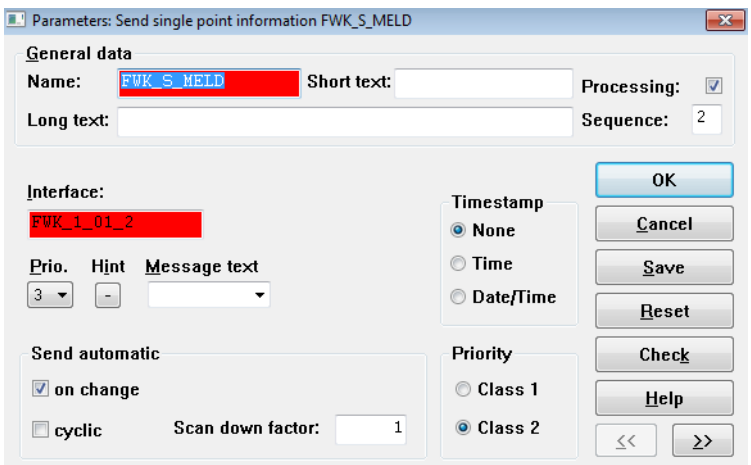
Data of Freelance data type BOOL are applied at inputs I01 to I16. For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle.

The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast.

The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Send status value, FWK_S_MELD



ae007_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or "-" for no message.

Hint Enter the hint text.

Message text Output text of the message; enter directly or select from the drop-down list.

Timestamp Data messages can be sent with a time stamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only) or without the timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Priority

Class 1 ◉ Data with high priority.

Class 2 ◉ Data with normal priority.

Send automatic

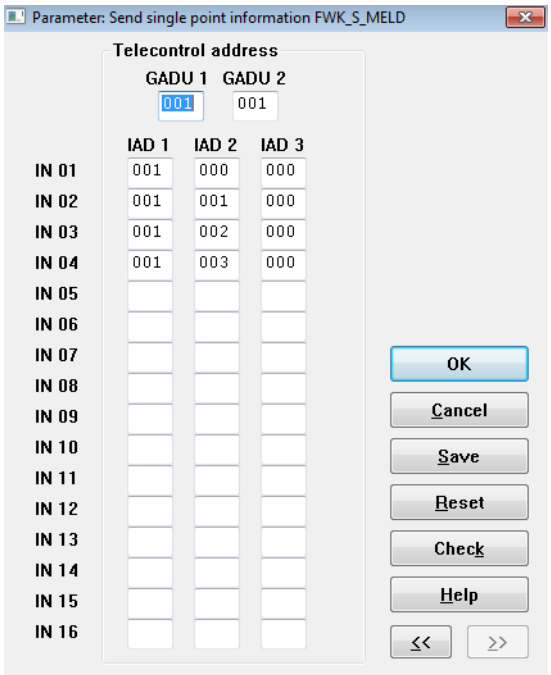
Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

On change ☑ Input value is sent when it changes.

Cyclic ☑ Input value is sent every n (scan down factor) computation cycles.

Scan down factor

The parameter defines, in connection with cyclic transmission, the interval at which the input value is sent. For example, if cycle scaling 5 is selected and the task cycle time is 200 ms, the input value is sent every 1000 ms.



ae008_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IN 01** to **IN16 Information object address of the telecontrol address of input pins 1 to 16

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

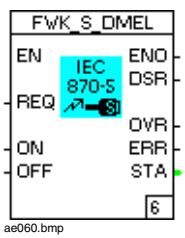
IAD 3 Byte 3 of the information object address

Function block data: Send status value, FWK_S_MELD

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: the function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
I01 to I016	BOOL	no	RW	The data to be sent
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: the function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OVR	BOOL	no	RO	TRUE: overrun (overload)
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	Yes	none	Interface name
TIMESEND	BOOL	yes	RW	TRUE: send with timestamp
DATACLASS	INT	yes	RO	Priority: 0 = Class 1, 1 = Class 2
AENDSND	BOOL	yes	RW	TRUE: send on change
ZYKSND	BOOL	yes	RW	TRUE: send cyclic
UFAK	WORD	yes	RW	Scan down factor

Name	Data type	Conf.	Access	Comments
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1 to 16	BYTE	yes	RO	Information object address byte 1 Input 1 to 16
FWADRB1 to 16	BYTE	yes	RO	Information object address byte 2 Input 1 to 16
FWADRC1 to 16	BYTE	yes	RO	Information object address byte 3 Input 1 to 16

3.3 Send double status value, FWK_S_DMEL



Function

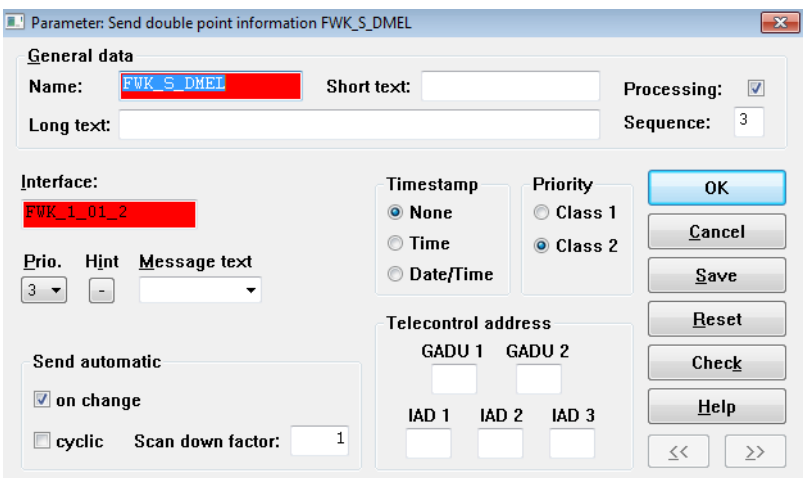
Transmission of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104

3	Double status value	M_DP_NA_1
4	Double status value with timestamp CP24Time	M_DP_TA_1
31	Double status value with timestamp CP56Time2a	M_DP_TB_1

Data of Freelance data type BOOL are applied at inputs **ON** (defined status ON) and **OFF** (defined status OFF). For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Send double status value, FWK_S_DMEL



ae061_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or "-" for no status value.

Hint Enter the hint text.

Message text Output text of the status value; enter directly or select from the drop-down list.

Timestamp Data messages can be sent with a timestamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only) or without timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Priority

Class 1 ◉ Data with high priority.

Class 2 ◉ Data with low priority.

Send automatic

Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

On change ☑ The input value is sent when it changes.

Cyclic ☑ The input value is sent every n (scan down factor) computation cycles.

Scan down factor

This parameter defines, in connection with cyclic transmission, the interval at which the input value is sent. For example, if scan down factor 5 is selected and the task cycle time is 200 ms, the input value is sent every 1000 ms.

Telecontrol address

A data point has a 5-byte long telecontrol address which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

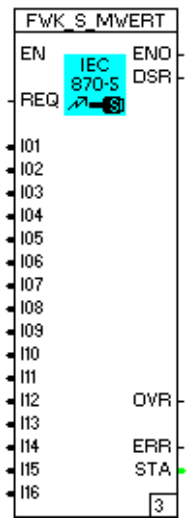
IAD 3 Byte 3 of the information object address

Function block data: Send double status value, FWK_S_DMEL

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
ON	BOOL	no	RW	TRUE: specific status ON (double status value)
OFF	BOOL	no	RW	TRUE: specific status OFF (double status value)
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: the function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OVR	BOOL	no	RO	TRUE: overrun in communication
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name

Name	Data type	Conf.	Access	Comments
TIMESEND	BOOL	yes	RO	TRUE: send with timestamp
DATA-CLASS	INT	yes	RO	Priority: 0 = Class 1, 1 = Class 2
AENDSND	BOOL	yes	RO	TRUE: send on change
ZYKSND	BOOL	yes	RO	TRUE: send cyclic
UFAK	WORD	yes	RO	Scan down factor
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3

3.4 Send real value, FWK_S_MWERT



ae009.bmp

Function

Transmission of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104

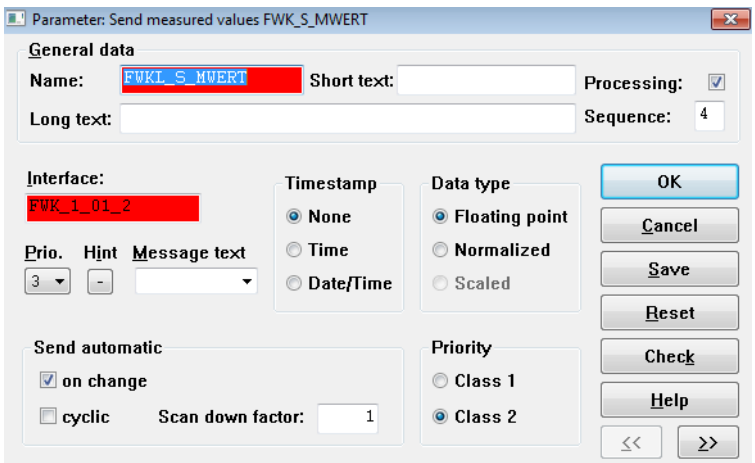
9	Real value, normalized value	M_ME_NA_1
10	Real value, normalized value with timestamp CP24Time	M_ME_TA_1
34	Real value, normalized value with timestamp CP56Time2a	M_ME_TD_1
13	Real value, floating-point number 1	M_ME_NC_1
14	Real value, floating-point number with timestamp CP24Time	M_ME_TC_1
36	Real value, floating-point number with timestamp CP56-Time2a	M_ME_TF_1

Data of Freelance data type REAL are applied at inputs **I01** to **I16**. For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast. The output **ERR** indicates through a TRUE that an error code

is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Send real value, FWK_S_MWERT



ae010_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or "-" for no message.

Hint Enter the hint text.

Message text Output text of the message; enter directly or select from the drop-down list.

Data type

Floating point ◉ Send data message as real value, floating-point number.

Normalized ◉ Send data message as real value, normalized value.

If the input signal exceeds the upper or lower normalization range, the output signal will be limited to +1.0 (maximum after normalization) or -1.0 (minimum after normalization).

Timestamp Data messages can be sent with a timestamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only) or without timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Send automatic

Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

On change ☑ The input value is sent when it changes.

Cyclic ☑ The input value is sent every n (scan down factor) computation cycles.

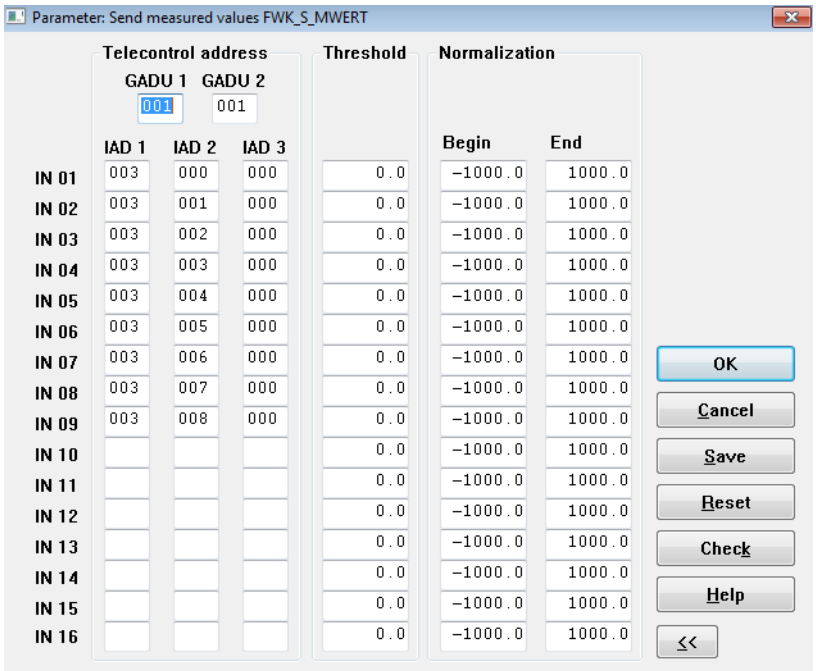
Scan down factor

The parameter defines, in connection with cyclic transmission, the interval at which the input value is sent. For example, if cycle scaling 5 is selected and the task cycle time is 200 ms, the input value is sent every 1000 ms.

Priority

Class 1 ◉ Data with high priority.

Class 2 ◉ Data with low priority.



ae011_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IN 01** to **IN16 Information object address of the telecontrol address of input pins 1 to 16

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

Threshold Tolerance threshold from which a change in the input value in relation to the last sent value is sent. This parameter is significant only if send automatically on change is selected.

Normalization

Begin Lower limit (0%) of the normalized range.

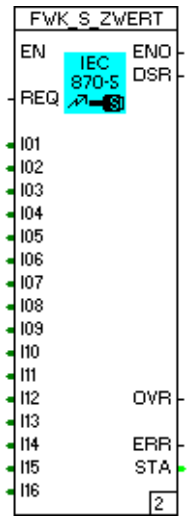
End Upper limit (100%) of the normalized range.

Function block data: Send real value, FWK_S_MWERT

Name	Data type	Conf.	Ac-cess	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
I01 to I016	REAL	no	RW	Data to be sent
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: the function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OVR	BOOL	no	RO	TRUE: overrun (overload)
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	yes	none	Interface name
AENDSND	BOOL	yes	RW	TRUE: send on change

Name	Data type	Conf.	Ac-cess	Comments
ZYKSND	BOOL	yes	RW	TRUE: send cyclic
UFAK	WORD	yes	RW	Scan down factor
TYPKENNUNG	INT	yes	RO	Type identification: 0 = Floating-point number, 1 = Normalized, (2 = Scaled)
TIMESEND	BOOL	yes	RW	TRUE: send with timestamp
DATACLASS	INT	yes	RO	Priority: 0 = Class 1, 1 = Class 2
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1 to 16	BYTE	yes	RO	Information object address byte 1 Input 1 to 16
FWADRB1 to 16	BYTE	yes	RO	Information object address byte 2 Input 1 to 16
FWADRC1 to 16	BYTE	yes	RO	Information object address byte 3 Input 1 to 16
SWELL1 to 16	REAL	yes	RW	Threshold value
FWNORMA1 to 16	REAL	yes	RO	Normalizing value, start, input 1 to 16
FWNORME1 to 16	REAL	yes	RO	Normalizing value, end, input 1 to 16

3.5 Send discrete value, FWK_S_ZWERT



ae012.bmp

Function

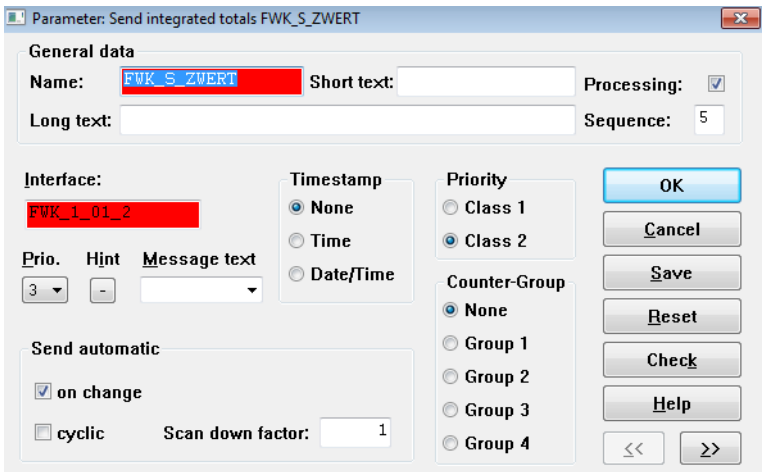
Transmission of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

15	Discrete values	M_IT_NA_1
16	Discrete values with timestamp CP24Time	M_IT_TA_1
37	Discrete values with timestamp CP56Time2a	M_IT_TB_1

Data of Freelance data type DINT are applied at inputs **I01** to **I16**. For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Send discrete value, FWK_S_ZWERT



ae013_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or "-" for no message.

Hint Enter the hint text.

Message text Output text of the message; enter directly or select from the drop-down list.

Timestamp Data messages can be sent with a timestamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only) or without timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Priority

Class 1 Data with high priority.

Class 2 Data with low priority.

Send automatic

Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

On change ☑ The input value is sent when it changes.

Cyclic ☑ The input value is sent every n (scan down factor) computation cycles.

Scan down factor

The parameter defines, in connection with cyclic transmission, the interval at which the input value is sent. For example, if cycle scaling 5 is selected and the task cycle time is 200 ms, the input value is sent every 1000 ms.

Counter-group

Establishment of the transmission cause

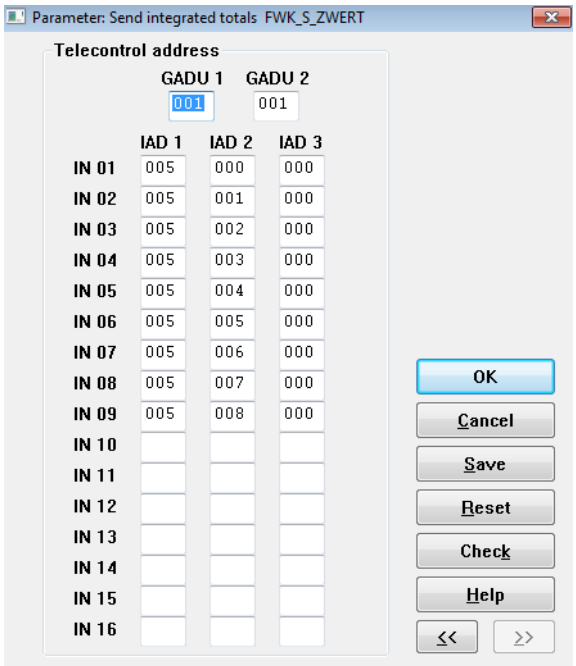
None ◉ No group allocation for counter query

Group 1 ◉ Counter group 1 for counter query

Group 2 ◉ Counter group 2 for counter query

Group 3 ◉ Counter group 3 for counter query

Group 4 ◉ Counter group 4 for counter query



Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IN 01 to ***IN16*** Information object address of the telecontrol address of input pins 1 to 16

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

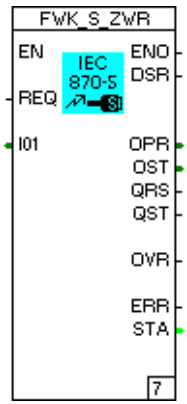
IAD 3 Byte 3 of the information object address

Function block data: Send discrete value, FWK_S_ZWERT

Name	Data type	Conf.	Access	Comments
Inputs				
En	BOOL	yes	RW	Enable TRUE: function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
I01 to I016	DINT	no	RW	Data to be sent
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: the function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OVR	BOOL	no	RO	TRUE: overrun (overload)
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	yes	none	Interface name
TIMESEND	BOOL	yes	RW	TRUE: send with timestamp
DATACLASS	INT	yes	RO	Priority: 0 = Class 1, 1 = Class 2
AENDSND	BOOL	yes	RW	TRUE: send on change
ZYKSND	BOOL	yes	RW	TRUE: send cyclic
UFAK	WORD	yes	RW	Scan down factor

Name	Data type	Conf.	Access	Comments
CNTGROUP	INT	yes	RO	Group for counter query: 0 = None, 1 = Group 1, 2 = Group 2, 3 = Group 3, 4 = Group 4
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1 to 16	BYTE	yes	RO	Information object address byte 1 Input 1 to 16
FWADRB1 to 16	BYTE	yes	RO	Information object address byte 2 Input 1 to 16
FWADRC1 to 16	BYTE	yes	RO	Information object address byte 3 Input 1 to 16

3.6 Send discrete value with relocate and reset functions, FWK_S_ZWR



ae062.bmp

Function

Transmission of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

15	Discrete values	M_IT_NA_1
16	Discrete values with timestamp CP24Time	M_IT_TA_1
37	Discrete values with timestamp CP56Time2a	M_IT_TB_1

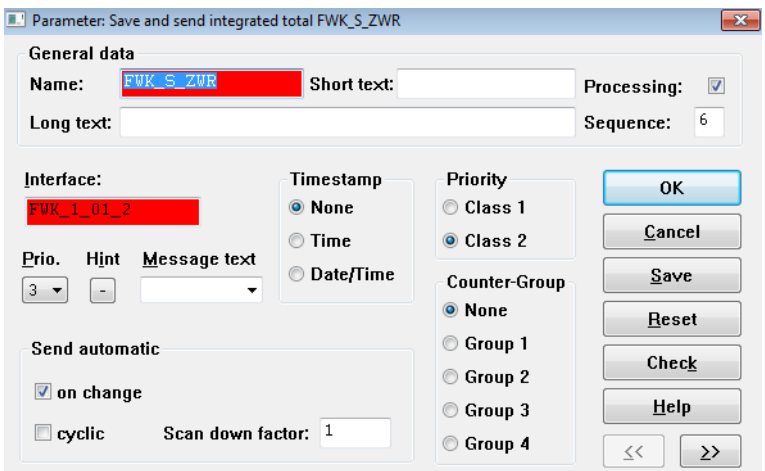
This block has outputs for exchanging data with a counter block. When a counter is queried through telecontrol command, it can be reset (output **QRS**), or the current counter state can be transferred to a register (output **QST**). Output **OPR** receives the current discrete value (input **I01**) on reset, and output **OST** receives the current discrete value (input **I01**) on relocation.

Data of Freelance data type DINT are applied at input **I01**. For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast. The output **ERR** indicates through a TRUE that an error code

is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Send discrete value with relocate and reset functions, FWK_S_ZWR



ae063_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or "-" for no message.

Hint Enter the hint text.

Message text Output text of the message; enter directly or select from the drop-down list.

Timestamp Data messages can be sent with a timestamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only) or without timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Priority

Class 1 Data with high priority.

Class 2 Data with low priority.

Send automatic

Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

On change ☑ The input value is sent when it changes.

Cyclic ☑ The input value is sent every n (scan down factor) computation cycles.

Scan down factor

The parameter defines, in connection with cyclic transmission, the interval at which the input value is sent. For example, if cycle scaling 5 is selected and the task cycle time is 200 ms, the input value is sent every 1000 ms.

Counter-group Establishment of the transmission cause

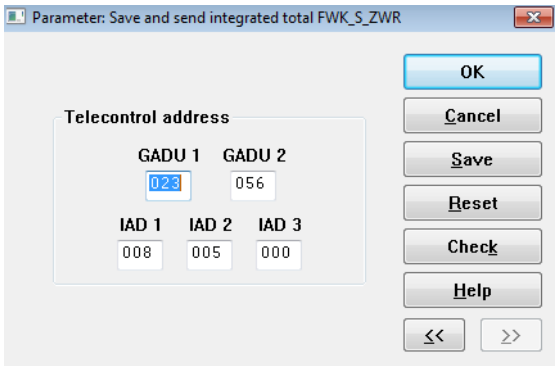
None ◉ No group allocation for counter query

Group 1 ◉ Counter group 1 for counter query

Group 2 ◉ Counter group 2 for counter query

Group 3 ◉ Counter group 3 for counter query

Group 4 ◉ Counter group 4 for counter query



ae064_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

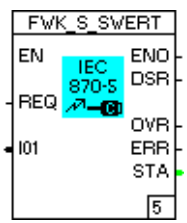
Function block data: Send discrete value with relocate and reset functions, FWK_S_ZWR

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
I01	DINT	no	RW	Data to be sent

Name	Data type	Conf.	Access	Comments
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OPR	DWORD	no	RO	Transmission of discrete value on re-set
OST	DWORD	no	RO	Relocated discrete value
QRS	BOOL	no	RO	TRUE: reset discrete value
QST	BOOL	no	RO	TRUE: relocate discrete value
OVR	BOOL	no	RO	TRUE: overrun in communication
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	yes	none	Interface name
TIMESEND	BOOL	yes	RO	TRUE: send with timestamp (not FWK_S_SWERT)
DATACLASS	INT	yes	RO	Priority: 0 = Class 1, 1 = Class 2
AENDSND	BOOL	yes	RO	TRUE: send on change
ZYKSND	BOOL	yes	RO	TRUE: send cyclic
UFAK	WORD	yes	RO	Scan down factor
CNTGROUP	INT	yes	RO	Group for counter query: 0 = None, 1 = Group 1, 2 = Group 2, 3 = Group 3, 4 = Group 4

Name	Data type	Conf.	Access	Comments
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3

3.7 Send real setpoint value, FWK_S_SWERT



ae015.bmp

Function

Transmission of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

48	Setpoint correction command, normalized value	C_SE_NA_1
61	Setpoint correction command, normalized value with time-stamp CP56Time2a	C_SE_TA_1
50	Setpoint correction command, floating-point number	C_SE_NC_1
63	Setpoint correction command, floating-point number with timestamp CP56Time2a	C_SE_TC_1

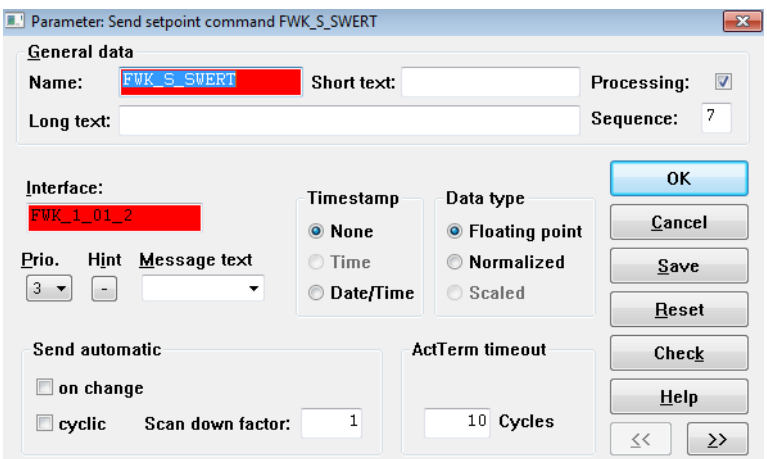
Data of Freelance data type REAL are applied at input **I01**. For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one

computation cycle. The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

When the timeout has expired, the **ERR/STA** pins are set to error state. If the acknowledge arrives after the timeout has expired, the **ERR/STA** pins are reset to no error state. The **ERR/STA** pins must be latched by user logic in order to get notified of the delay.

Parameters: Send real setpoint value, FWK_S_SWERT



ae016_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or “-” for no message.

Hint Enter the hint text.

Message text Output text of the message; enter directly or select from the drop-down list.

Send automatic

Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

On change ☑ The input value is sent when it changes.

Cyclic ☑ The input value is sent every n (scan down factor) computation cycles.

Scan down factor

The parameter defines, in connection with cyclic transmission, the interval at which the input value is sent. For example, if cycle scaling 5 is selected and the task cycle time is 200 ms, the input value is sent every 1000 ms.

Timestamp Data messages can be sent with a timestamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only,) or without timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

This option is disabled for this function block only.

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Data type

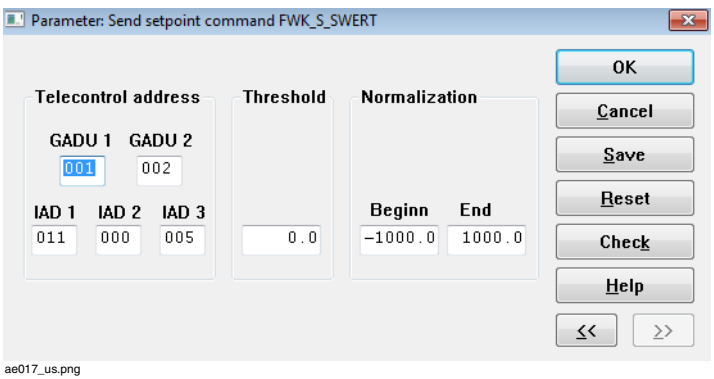
Floating point ◉ Send data message as setpoint correction command, floating-point number.

Normalized ◉ Send data message as setpoint correction command, normalized value.

If the input signal exceeds the upper or lower normalization range, the output signal will be limited to +1.0 (maximum after normalization) or -1.0 (minimum after normalization).

ActTerm timeout (cycles)

Number of computation cycles during which acknowledgment from the receiver of setting the setpoint is awaited. If this time is exceeded, an error is output at the STA output.



ae017_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

Threshold value

Tolerance threshold from which a change in the input value in relation to the last sent value is sent. This parameter is significant only if send automatic on change is selected.

Normalization

Begin Lower limit (0%) of the normalized range.

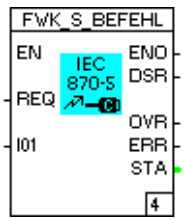
End Upper limit (100%) of the normalized range.

Function block data: Send real setpoint value, FWK_S_SWERT

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
I01	REAL	no	RW	Data to be sent
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OVR	BOOL	no	RO	TRUE: overrun (overload)
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	yes	none	Interface name
AENDSND	BOOL	yes	RO	TRUE: send on change
ZYKSND	BOOL	yes	RO	TRUE: send cyclic
UFAK	WORD	yes	RO	Scan down factor

Name	Data type	Conf.	Access	Comments
TYPKEN-NUNG	INT	Yes	RO	Type identification 0 = floating-point value 1 = normalized value (2 = scaled)
ActtTout	INT	yes		Timeout ActTerm
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3
SWELL	REAL	yes	RO	Threshold value Input 1
FWNORMA	REAL	yes	RO	Normalizing value, start
FWNORME	REAL	yes	RO	Normalizing value, end

3.8 Send command value, FWK_S_BEFEHL



ae018.bmp

Function

Transmission of data messages of the data type according to IEC 60870-5-101/IEC 60870-5-104.

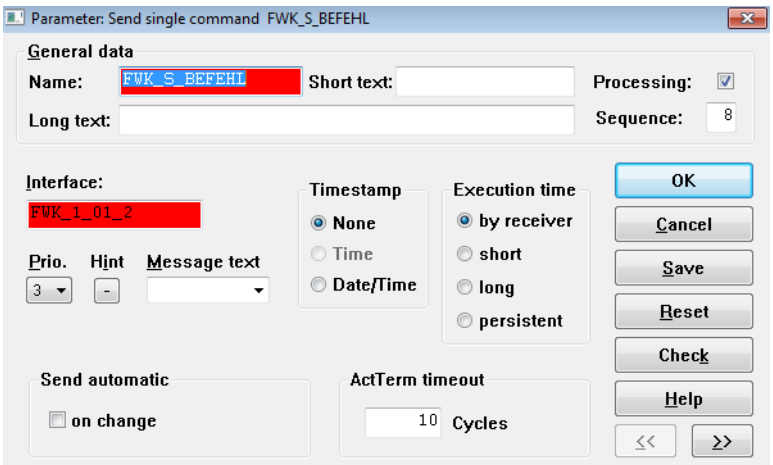
45	Single command	C_SC_NA_1
58	Single command with timestamp CP56Time2a	C_SC_TA_1

Data of Freelance data type BOOL are applied at input **I01**. For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

When the timeout has expired, the **ERR/STA** pins are set to error state. If the acknowledge arrives after the timeout has expired, the **ERR/STA** pins are reset to no error state. The **ERR/STA** pins must be latched by user logic in order to get notified of the delay.

Parameters: Send command value, FWK_S_BEFEHL



ae019_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or "-" for no message.

Hint Enter the hint text.

Message text Output text of the message; enter directly or select from the drop-down list.

Send automatic

Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

on change ☑ The input value is sent when it changes.

If on change option is turned on, only the persistent option has to be selected in the Execution time. If other options of the Execution time (by receiver, short and long) are selected, a configuration error will be displayed during the plausibility check.

Timestamp Data messages can be sent with a timestamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only) or without timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

This option is disabled for this function block only.

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Execution time

The execution time of the command can be defined in four different ways. The actual duration of the execution time depends on the implementation in the receiver.

By receiver ◉ The execution time is defined in the receiver.

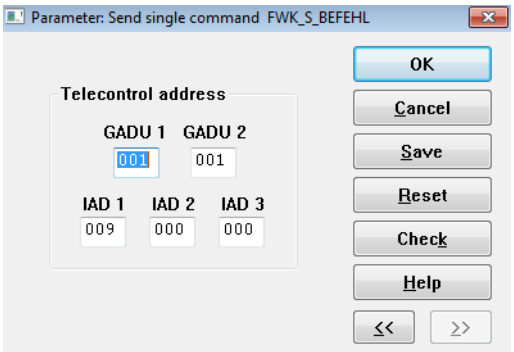
Short ◉ Short execution time (with a Freelance process station as the receiver: 1 computation cycle).

Long ◉ Long execution time (with a Freelance process station as the receiver: same execution time as that defined through receiver).

Persistent ◉ The input value sent is set continuously.

ActTerm timeout (cycles)

Number of computation cycles during which acknowledgment from the receiver of setting the command is awaited. If this time is exceeded, an error is output at the STA output.



ae020_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

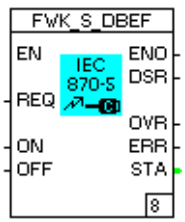
IAD 3 Byte 3 of the information object address

Function block data: Send command value, FWK_S_BEFEHL

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
I01	BOOL	no	RW	The data to be sent

Name	Data type	Conf.	Access	Comments
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OVR	BOOL	no	RO	TRUE: overrun (overload)
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	yes	no Acc.	Interface name
AENDSND	BOOL	yes	RO	TRUE: send on change
ActtTout	INT	yes	RO	Timeout ActTerm
AKTZEIT	INT	yes	RO	Execution time: 0 = By receiver, 1 = Short, 2 = Long, 3 = Persistent
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3

3.9 Send double command value, FWK_S_DBEF



ae069.bmp

Function

Transmission of data messages of the data type according to IEC 60870-5-101/IEC 60870-5-104.

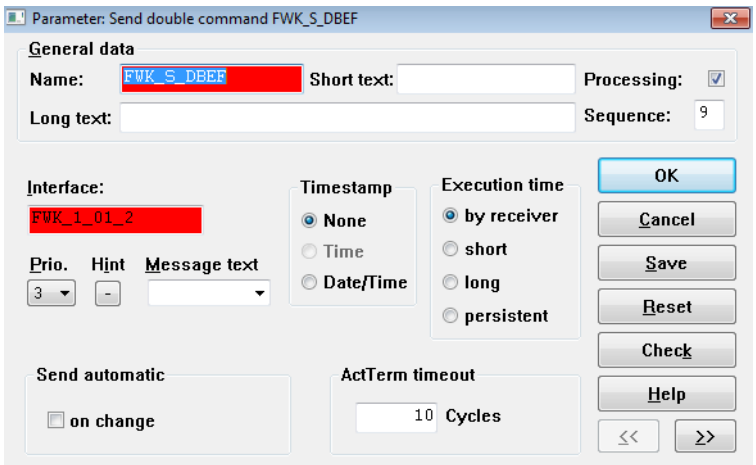
46	Double command	C_DC_NA_1
59	Double command with timestamp CP56Time2a	C_DC_TA_1

Data of Freelance data type BOOL are applied at inputs **ON** (double command status ON) and **OFF** (double command status OFF). For more information on sending data, refer to Operating modes of the send blocks on Page 63. Inputs may be released in any order. The two inputs must not assume the same status at the same time. Instead, they must have different statuses (e.g. ON = TRUE, OFF = FALSE). The transmission is started by a change from FALSE to TRUE at one of the two inputs, provided that the input data are valid.

The output **DSR** indicates the state of the transmission. The end of transmission is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **OVR** indicates, by changing from FALSE to TRUE, that the transmission requests are coming too fast, that is, the task cycle time is configured as too fast. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

When the timeout has expired, the **ERR/STA** pins are set to error state. If the acknowledge arrives after the timeout has expired, the **ERR/STA** pins are reset to no error state. The **ERR/STA** pins must be latched by user logic in order to get notified of the delay.

Parameters: send double command value, FWK_S_DBEF



ae070_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Prio. Enter priority 1 to 5 or "-" for no status value.

Hint Enter the hint text.

Message text Output text of the status value; enter directly or select from the drop-down list.

Send automatic

Automatic transmission of the input data. At the same time, all the variants, including transmission through the request pin, can be selected.

On change ☑ The input value is sent when it changes.

If on change option is turned on, only the persistent option has to be selected in the Execution time. If other options of the Execution time (by receiver, short and long) are selected, a configuration error will be displayed during the plausibility check.

Timestamp Data messages can be sent with a timestamp in short time format CP24Time (IEC 60870-5-101 only), extended time format CP56Time2a (IEC 60870-5-104 only), or without timestamp.

If the short time format CP24Time is used with IEC 60870-5-104 or the extended time format CP56Time2a is used with IEC 60870-5-101, a configuration error will be displayed during plausibility check.

None ◉ Data messages are sent without a timestamp.

Time ◉ Data messages are sent with a timestamp relevant to the time (CP24Time).

This option is disabled for this function block only.

Date/Time ◉ Data messages are sent with a timestamp relevant to the date and time (CP56Time2a).

Execution time The execution time of the command can be defined in four different ways. The actual duration of the execution time depends on the implementation in the receiver.

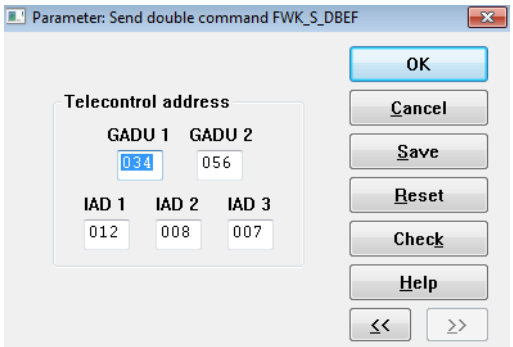
By receiver ◉ The execution time is defined in the receiver.

Short ◉ Short execution time (with a Freelance process station as the receiver: 1 computation cycle).

Long ◉ Long execution time (with a Freelance process station as the receiver: same execution time as that defined through receiver).

Persistent ◉ The input value is set continuously.

ActTerm timeout (cycles)
Number of computation cycles during which acknowledgment from the receiver of setting the command is awaited. If this time is exceeded, an error is output at the STA output.



ae071_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2- byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

Function block data: Send double command value, FWK_S_DBEF

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
REQ	BOOL	no	RW	TRUE: start of a transmission process with a rising edge
ON	BOOL	no	RW	TRUE: specific status ON (double status value)

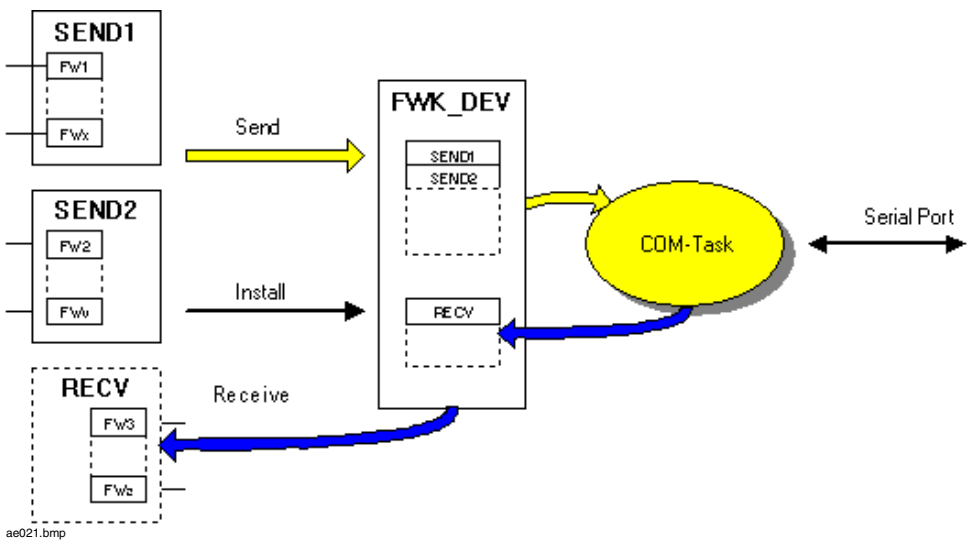
Name	Data type	Conf.	Access	Comments
OFF	BOOL	no	RW	TRUE: specific status OFF (double status value)
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
OVR	BOOL	no	RO	TRUE: overrun in communication
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	yes	none	Interface name
AENDSND	BOOL	yes	RO	TRUE: send on change
ActtTout	INT	yes	RO	Timeout Actterm
AKTZEIT	INT	yes	RO	Execution time: 0 = By receiver, 1 = Short, 2 = Long, 3 = Persistent
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3

4 Receive blocks

In receive direction, the jobs enter the device module through the interface. The device module selects the correct receive block using the telecontrol address. To this end, during installation the receive blocks pass their parameterized telecontrol addresses to the device module.

The device module stores the data received and the receive blocks make the data available at their output pins in connection with the next computation of the user task.

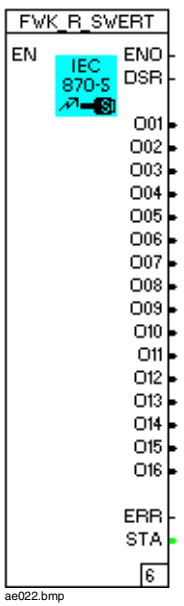
At least one send and one receive function block must be configured for each device module. Otherwise the project will not get plausible. If a function block is only inserted to ensure plausibility, a telecontrol address must be entered (eg: 000) and the processing should be deactivated.



All data which are sent by a send function block in the telegram must be received by receive function blocks. Otherwise the corresponding device module block will not be able to deliver all data and counts up its error counter **ADR**. In this case the corresponding receive function blocks will not be updated.

All Telecontrol receive function blocks which receive a CP56Time2a timestamp with Daylight Saving Time (DST), will show local time (minus 1 hour) at the output pin **DT**.

4.1 Receive real setpoint value, FWK_R_SWERT



ae022.bmp

Function

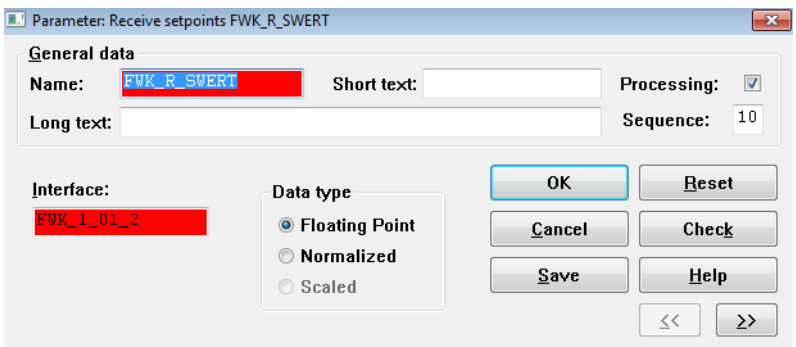
Reception of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

48	Setpoint correction command, normalized value	C_SE_NA_1
50	Setpoint correction command, floating-point number	C_SE_NC_1

The data received of Freelance data type REAL are applied at output pins **O01** to **O16**.

The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive real setpoint value, FWK_R_SWERT



ae023_us.png

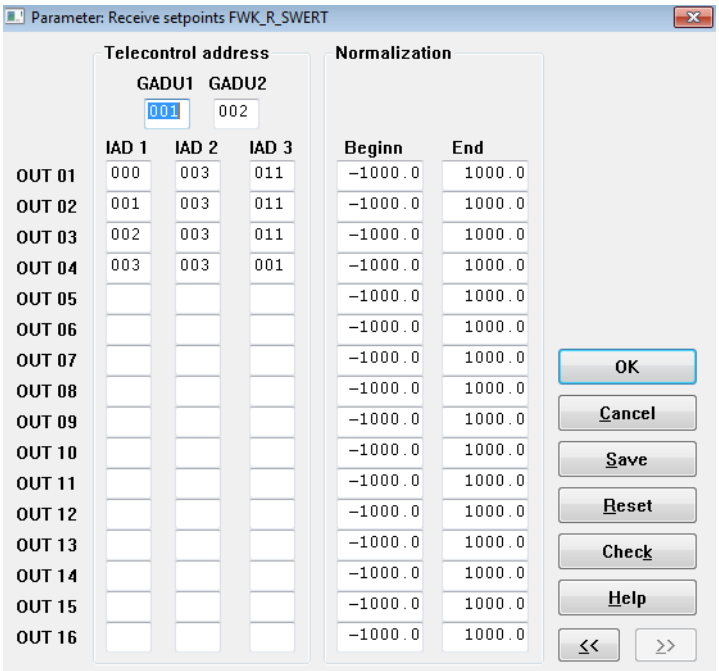
Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Data type

Floating point ◉ Receive data message as setpoint correction command, floating-point number.

Normalized ◉ Receive data message as setpoint correction command, normalized value.

If the input signal exceeds the upper or lower normalization range, the output signal will be limited to +1.0 (maximum after normalization) or -1.0 (minimum after normalization).



ae024_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

OUT 01** to **OUT16

Information object address of the telecontrol address of output pins 1 to 16

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

Normalization

Begin Lower limit (0%) of the normalized range.

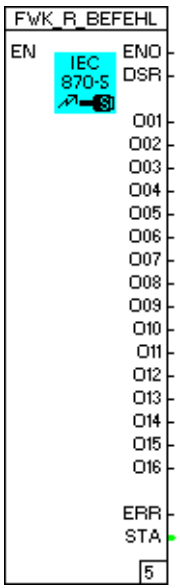
End Upper limit (100%) of the normalized range.

Function block data: Receive real setpoint value, FWK_R_SWERT

Name	Data type	Conf.	Ac-cess	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
O01 to O16	REAL	no	RO	The data received
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TYPKENNUNG	INT	yes	RO	Type identification 0 = floating point value 1 = normalized (2 = scaled)
TAGNAME	TEXT	yes	none	Interface name
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1

Name	Data type	Conf.	Access	Comments
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1 to 16	BYTE	yes	RO	Information object address byte 1 Output 1 to 16
FWADRB1 to 16	BYTE	yes	RO	Information object address byte 2 Output 1 to 16
FWADRC1 to 16	BYTE	yes	RO	Information object address byte 3 Output 1 to 16
FWNORMA1 to 16	REAL	yes	RO	Normalizing value, start, output 1 to 16
FWNORME1 to 16	REAL	yes	RO	Normalizing value, end, output 1 to 16

4.2 Receive command value, FWK_R_BEFEHL



ae025.bmp

Function

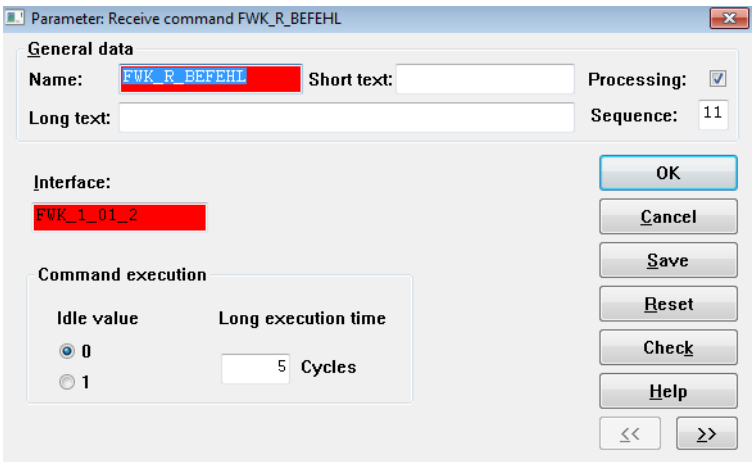
Reception of data messages of the data type according to IEC 60870-5-101/IEC 60870-5-104.

45 Single command C_SC_NA_1

The data received of Freelance data type BOOL are applied at output pins **O01** to **O16**.

The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive command value, FWK_R_BEFEHL



ae026_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Command execution

IEC 60870-5 contains four different command execution times: ‘short’, ‘long’, ‘persistent’ and ‘defined in the receiver’. The execution time for ‘short’ is one task cycle time of the block, for ‘long’ and ‘defined in the receiver’ it must be set under *Long execution time*, for ‘persistent’ the execution time is unlimited. After the end of the execution time, the block assumes the idle value.

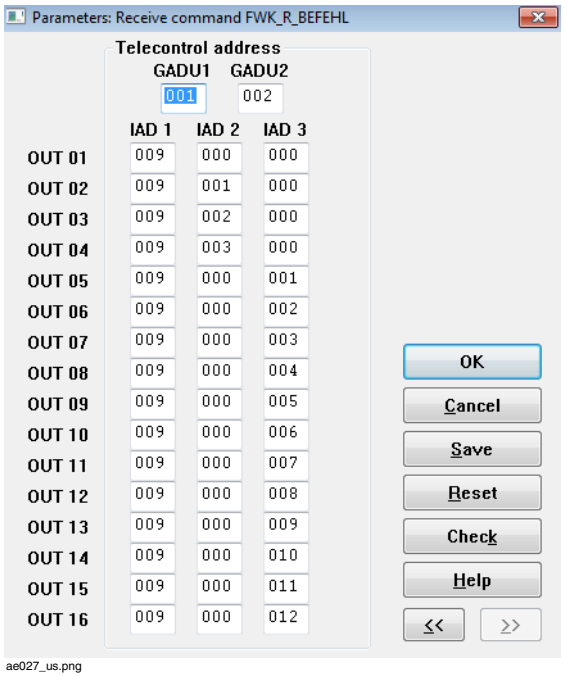
Long execution time

Number of execution cycles of the ‘long’ command and the command ‘defined in the receiver’.

Idle value The value which the data output assumes after initialization and after the termination of a command.

0 ◉ The idle value is FALSE.

1 ◉ The idle value is TRUE.



Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

OUT 01** to **OUT16

Information object address of the telecontrol address of output pins 1 to 16

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

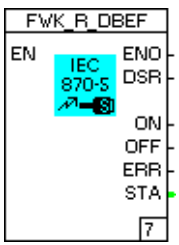
IAD 3 Byte 3 of the information object address

Function block data: Receive command value, FWK_R_BEFEHL

Name	Data type	Conf.	Ac-cess	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
O01 to O16	BOOL	no	RO	The data received
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog 1				
TAGNAME	TEXT	yes	none	Interface name
Dtime	WORD	yes	RO	Command execution time (only FWK_R_BEFEHL)
DefVal	INT	yes	RO	Idle value (only FWK_R_BEFEHL) 0 = FALSE 1 = TRUE
Parameter definition dialog 2				
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1 to 16	BYTE	yes	RO	Information object address byte 1 Output 1 to 16

Name	Data type	Conf.	Ac-cess	Comments
FWADRB1 to 16	BYTE	yes	RO	Information object address byte 2 Output 1 to 16
FWADRC1 to 16	BYTE	yes	RO	Information object address byte 3 Output 1 to 16

4.3 Receive double command value, FWK_R_DBEF



ae065.bmp

Function

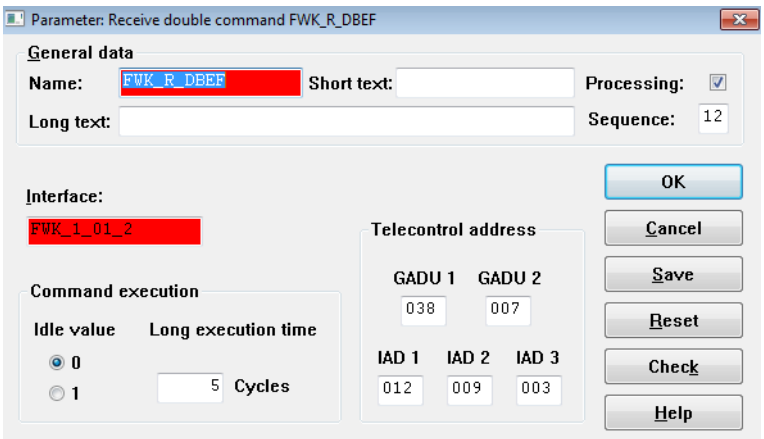
Reception of data messages of the data type according to IEC 60870-5-101/IEC 60870-5-104.

46 Double command C_DC_NA_1

The data received are available at the output pins **ON** (double command status ON) and **OFF** (double command status OFF).

The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive double command value, FWK_R_DBEF



ae066_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Command execution

IEC 60870-5 contains four different command execution times: ‘short’, ‘long’, ‘persistent’ and ‘defined in the receiver’. The execution time for ‘short’ is one task cycle time of the block, for ‘long’ and ‘defined in the receiver’ it must be set under *Long execution time*, for ‘persistent’ the execution time is unlimited. After the end of the execution time, the block assumes the idle value.

Long execution time

Number of execution cycles of the ‘long’ command and the command ‘defined in the receiver’.

Idle value The value which the data output assumes after initialization and after the termination of a command.

0 ◉ The idle value is FALSE.

1 ◉ The idle value is TRUE.

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of

a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

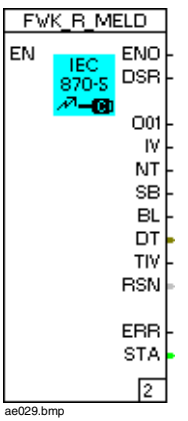
IAD 3 Byte 3 of the information object address

Function block data: Receive double command value, FWK_R_DBEF

Name	Data type	Conf.	Access	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
ON	BOOL	no	RO	TRUE: status ON
OFF	BOOL	no	RO	TRUE: status OFF
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name
FWGADU1	BYTE	yes	RO	Common address GADU 1

Name	Data type	Conf.	Access	Comments
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3
Dtime	WORD	yes	RO	Command execution time
DefVal	INT	yes	RO	Idle value: 0 = FALSE, 1 = TRUE

4.4 Receive status value, FWK_R_MELD



ae029.bmp

Function

Reception of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

1	Single status value	M_SP_NA_1
2	Single status value with timestamp CP24Time	M_SP_TA_1
30	Single status value with timestamp CP56Time2a	M_SP_TB_1

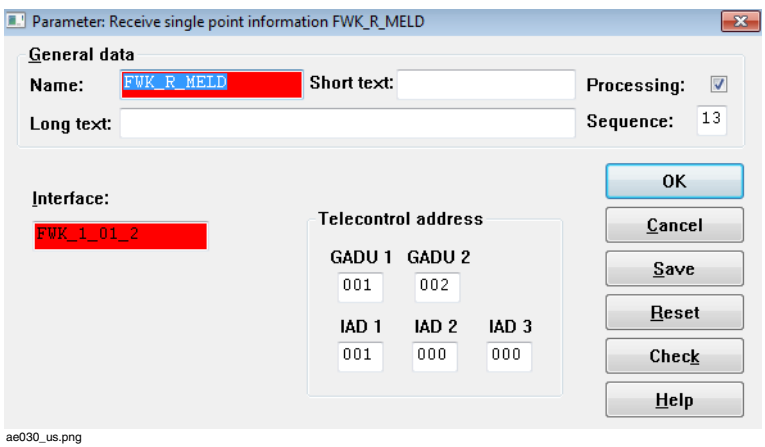
The received timestamp is available at output DT. In the case of an invalid timestamp the output TIV is set to TRUE.

The outputs **IV**, **NT**, **SB** and **BL** contain the bits for quality identification of the data types 1 and 2. The cause of transmission is applied at the output **RSN**.

The data received of Freelance data type BOOL are applied at output pin **O01**.

The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive status value, FWK_R_MELD



ae030_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

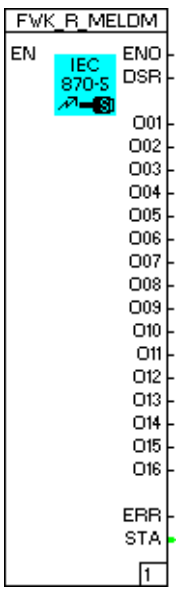
Function block data: Receive status value, FWK_R_MELD

The outputs **IV**, **NT**, **SB** and **BL** are derived from the "quality byte" of the data message.

Name	Data type	Conf.	Access	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
O01	BOOL	no	RO	The data received
IV	BOOL	no	RO	TRUE: data invalid
NT	BOOL	no	RO	TRUE: data not topical
SB	BOOL	no	RO	TRUE: data substituted
BL	BOOL	no	RO	TRUE: data blocked
DT	DT	no	RO	Timestamp on the data received
TIV	BOOL	no	RO	TRUE: timestamp invalid
RSN	BYTE	no	RO	Reason for transmission
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block

Name	Data type	Conf.	Access	Comments
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3

4.5 Receive 16 status values, FWK_R_MELDM



ae028.bmp

Function

Reception of data messages of the data type according to IEC 60870-5-101/IEC 60870-5-104.

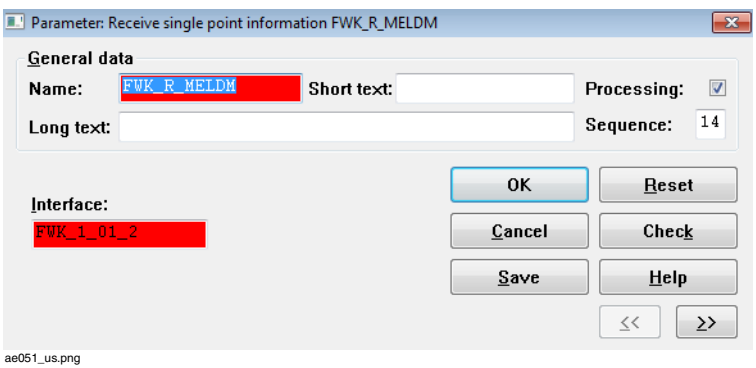
1 Single status value M_SP_NA_1

The block is designed for the reception of up to 16 messages without a timestamp.

The data received of Freelance data type BOOL are applied at output pins **O01** to **O16**.

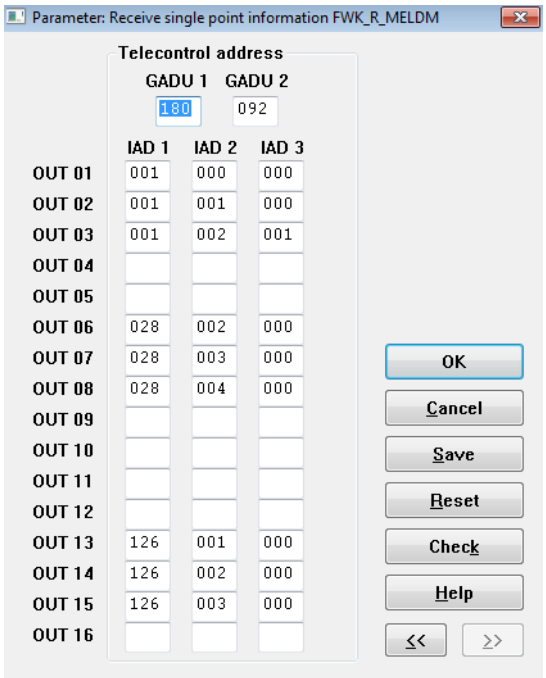
The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive 16 status values, FWK_R_MELDM



ae051_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.



ae052_us.png

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

OUT 01** to **OUT 16

Information object address of the telecontrol address of output pins 1 to 16

IAD 1 Byte 1 of the information object address

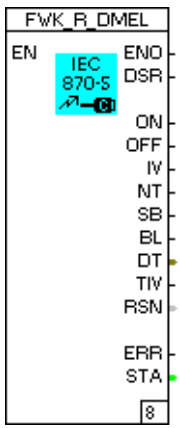
IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

Function block data: Receive 16 status values, FWK_R_MELDM

Name	Data type	Conf.	Access	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
O01 to O16	BOOL	no	RO	The data received
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1 to 16	BYTE	yes	RO	Information object address byte 1 Output 1 to 16
FWADRB1 to 16	BYTE	yes	RO	Information object address byte 2 Output 1 to 16
FWADRC1 to 16	BYTE	yes	RO	Information object address byte 3 Output 1 to 16

4.6 Receive double status value, FWK_R_DMEL



ae072.bmp

Function

Reception of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

3	Double status value	M_DP_NA_1
4	Double status value with timestamp CP24Time	M_DP_TA_1
31	Double status value with timestamp CP56Time2a	M_DP_TB_1

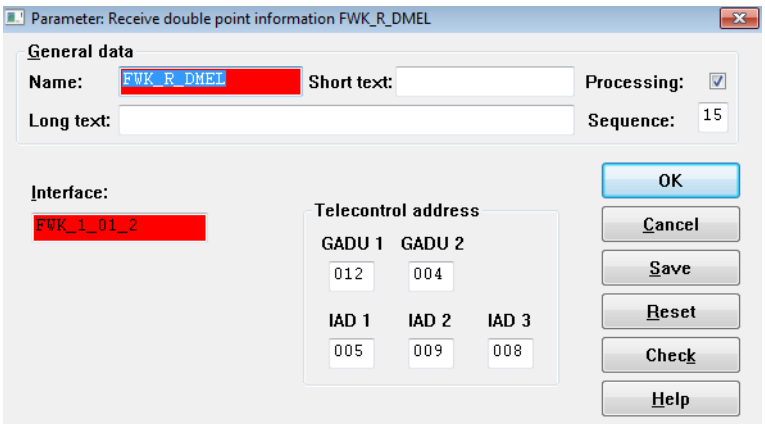
The received timestamp is available at output **DT**. In the case of an invalid timestamp the output **TIV** is set to TRUE.

The outputs **IV**, **NT**, **SB** and **BL** contain the bits for quality identification of the data types 3 and 4. The cause of transmission is applied at the output **RSN**.

The data received of Freelance data type BOOL are applied at the output pins **ON** and **OFF**.

The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive double status value, FWK_R_DMEL



ae073_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2- byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

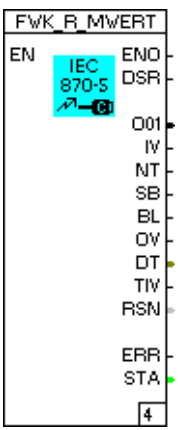
Function block data: Receive double status value, FWK_R_DMEL

The outputs **IV**, **NT**, **SB** and **BL** are derived from the quality byte of the data message.

Name	Data type	Conf.	Access	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
ON	BOOL	no	RO	TRUE: status ON
OFF	BOOL	no	RO	TRUE: status OFF
IV	BOOL	no	RO	TRUE: data invalid
NT	BOOL	no	RO	TRUE: data not actual
SB	BOOL	no	RO	TRUE: data substituted
BL	BOOL	no	RO	TRUE: data blocked
DT	DT	no	RO	Timestamp on the data received
TIV	BOOL	no	RO	TRUE: timestamp invalid
RSN	BYTE	no	RO	Reason for transmission
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name

Name	Data type	Conf.	Access	Comments
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3

4.7 Receive real value, FWK_R_MWERT



ae031.bmp

Function

Reception of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

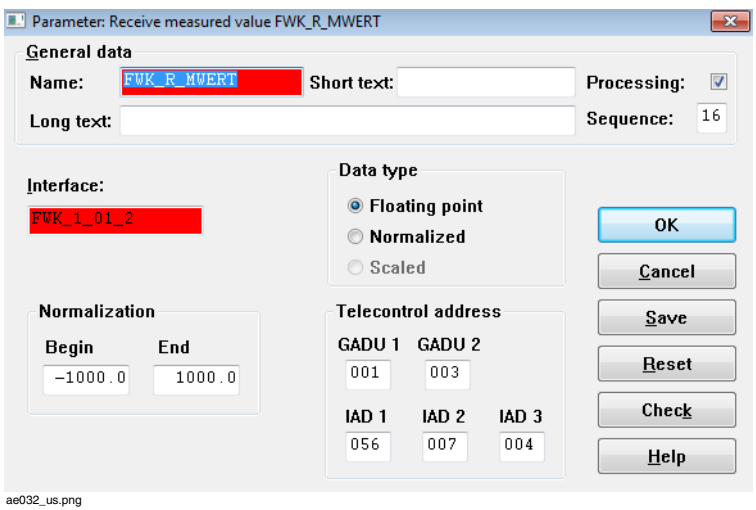
9	Real value, normalized value	M_ME_NA_1
10	Real value, normalized value with timestamp CP24Time	M_ME_TA_1
34	Real value, normalized value with timestamp CP56Time2a	M_ME_TD_1
13	Real value, floating-point number	M_ME_NC_1
14	Real value, floating-point number with timestamp CP24Time	M_ME_TC_1
36	Real value, floating-point number with timestamp CP56-Time2a	M_ME_TF_1

The data received of Freelance data type REAL are applied at output pin **O01**.

The received timestamp is available at output **DT**. In the case of an invalid timestamp the output **TIV** is set to TRUE. The outputs **IV**, **NT**, **SB**, **BL** and **OV** contain the bits for quality identification of the data types 9, 10, 13 and 14. The reason for the transmission is applied at the output **RSN**.

The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive real value, FWK_R_MWERT



ae032_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Data type

Floating point ◉ Receive data message as real value, floating-point number.

Normalized ◉ Receive data message as real value, normalized value.

If the input signal exceeds the upper or lower normalization range, the output signal will be limited to +1.0 (maximum after normalization) or -1.0 (minimum after normalization).

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

Normalization

Begin Lower limit (0%) of the normalized range.

End Upper limit (100%) of the normalized range.

Function block data: Receive real value, FWK_R_MWERT

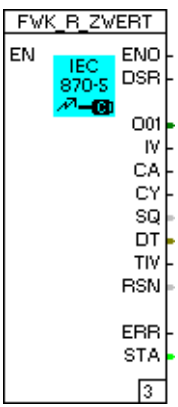
The outputs **IV**, **NT**, **SB**, **BL** and **OV** are derived from the "quality byte" of the data message.

Name	Data type	Conf.	Access	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed

Name	Data type	Conf.	Ac-cess	Comments
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
O01	REAL	no	RO	The data received
IV	BOOL	no	RO	TRUE: data invalid
NT	BOOL	no	RO	TRUE: data not topical
SB	BOOL	no	RO	TRUE: data substituted
BL	BOOL	no	RO	TRUE: data blocked
OV	BOOL	no	RO	TRUE: overrun (overload)
DT	DT	no	RO	Timestamp on the data received
TIV	BOOL	no	RO	TRUE: timestamp invalid
RSN	BYTE	no	RO	Reason for transmission
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3
FWNORMA	REAL	yes	RO	Normalizing value, start

Name	Data type	Conf.	Ac-cess	Comments
FWNORME	REAL	yes	RO	Normalizing value, end
TYPKENNUNG	INT	yes	RO	Type identification: 0 = Floating-point number, 1 = Normalized, (2 = Scaled)

4.8 Receive discrete value, FWK_R_ZWERT



ae033.bmp

Function

Reception of data messages of data types according to IEC 60870-5-101/IEC 60870-5-104.

15	Discrete values	M_IT_NA_1
16	Discrete values with timestamp CP24Time	M_IT_TA_1
37	Discrete values with timestamp CP56Time2a	M_IT_TB_1

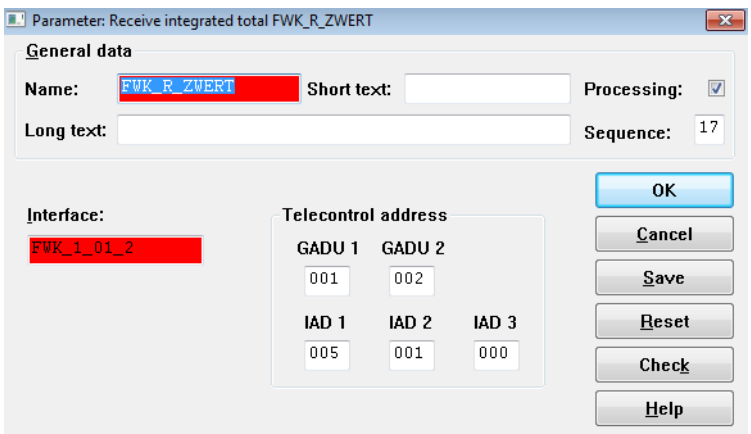
The data received of Freelance data type DINT are applied at output pin **O01**.

The received timestamp is available at output **DT**. In the case of an invalid timestamp the output **TIV** is set to TRUE.

The outputs **IV**, **CA**, **CY** contain the bits for quality identification, and the output **SQ** contains the sequence number for the data types 15 and 16. The reason for the transmission is applied at the output **RSN**.

The output **DSR** indicates the state of the transmission. When new data are received, this is indicated by a change from FALSE to TRUE. This signal is applied for one computation cycle. The output **ERR** indicates through a TRUE that an error code is being indicated at output **STA**. For error codes, refer to Error codes of the STA outputs on Page 21. The error code is not buffered; depending on the cause, it is applied for only one computation cycle.

Parameters: Receive discrete value, FWK_R_ZWERT



ae034_us.png

Interface Tag name of the associated device module in the hardware structure. Enter directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Telecontrol address

A data point has a 5-byte long telecontrol address, which consists of a 2-byte long common address and a 3-byte long information object address.

GADU 1 Byte 1 of the common address of the block

GADU 2 Byte 2 of the common address of the block

IAD 1 Byte 1 of the information object address

IAD 2 Byte 2 of the information object address

IAD 3 Byte 3 of the information object address

Function block data: Receive discrete value, FWK_R_ZWERT

The outputs **IV**, **CA**, **CY** and **SQ** are derived from the "quality byte" of the data message.

Name	Data type	Conf.	Access	Comments
Input				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
DSR	BOOL	no	RO	TRUE: data sent/received (applied for one computation cycle)
O01	DINT	no	RO	The data received
IV	BOOL	no	RO	TRUE: data invalid
CA	BOOL	no	RO	TRUE: counter has been preset since the last reading
CY	BOOL	no	RO	TRUE: transmission divided into associated measurement periods
SQ	BYTE	no	RO	Sequence identifier
DT	DT	no	RO	Timestamp on the data received
TIV	BOOL	no	RO	TRUE: timestamp invalid
RSN	BYTE	no	RO	Reason for transmission
ERR	BOOL	no	RO	Error state TRUE: error in the function block

Name	Data type	Conf.	Ac-cess	Comments
STA	INT	no	RO	Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name
FWGADU1	BYTE	yes	RO	Common address GADU 1
FWGADU2	BYTE	yes	RO	Common address GADU 2
FWADRA1	BYTE	yes	RO	Information object address byte 1
FWADRB1	BYTE	yes	RO	Information object address byte 2
FWADRC1	BYTE	yes	RO	Information object address byte 3

5 Statistical modules

The telecontrol protocol has statistical modules for balanced data transmission (FWK_VIEW), unbalanced data transmission as a master (FWK_DEV_M_V) and unbalanced data transmission as a slave (FWK_DEV_SL_V) through the serial interface. The statistical module is not available for data transmission through the Ethernet interface (FWK_DEV_TCP).

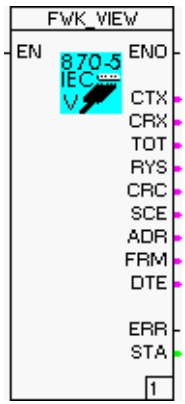
The statistic data will be shown in the parameter dialog of the FWK_DEV_TCP Ethernet interface function block. For more information on statistic data, refer to Diagnosis of the TCP/IP device module, FWK_DEV_TCP on Page 58.

Statistical modules supply statistical data at outputs.

Description of the statistical outputs

CTX	Total number of messages sent (Counter TX).
CRX	Total number of messages received (Counter RX).
TOT	Number of messages sent to which, within the configured monitoring time, the device module has received no response (Timeout).
RYS	Number of messages sent which were retried (Retries).
CRC	Number of messages received which generated a checksum error (CRC error).
SCE	Number of messages received which generated an error in connection with interpretation (Scan errors).
ADR	Number of messages received which contained telecontrol addresses which were not configured in Freelance (Address errors).
FRM	Number of messages received whose message format was incorrect (Framing errors)
DTE	Number of messages received for which the received data type was different from the configured data type (Data type errors).

5.1 Balanced statistical module, FWK_VIEW



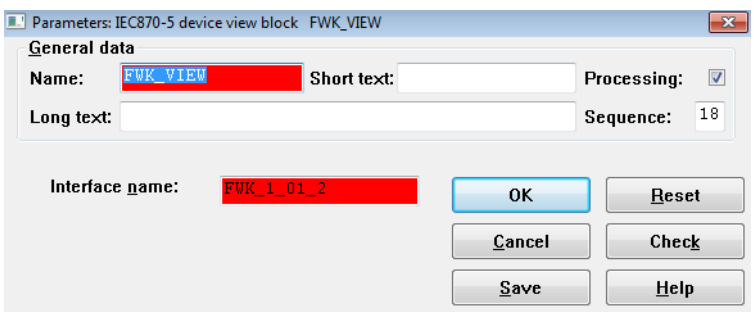
ae087.bmp

Function

With this module, the statistical data of the device module FWK_DEV can be further processed in a user program.

For each cyclical processing of the module, only the statistical outputs are updated; the actual telecontrol communication through the hardware interface runs in the background independently of the user task.

Parameters: Balanced statistical module, FWK_VIEW



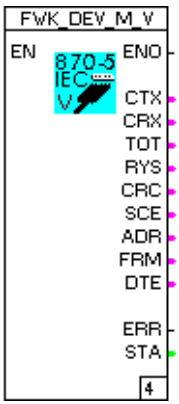
ae088_us.png

Interface name Tag name of the connected device module FWK_DEV in the hardware structure. The entry is mandatory. Tag name can be entered directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Function block data: Balanced statistical module, FWK_VIEW

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
CTX	DWORD	no	RO	Number of messages sent
CRX	DWORD	no	RO	Number of messages received
TOT	DWORD	no	RO	Number of messages without acknowledgement (timeout)
RYS	DWORD	no	RO	Number of messages with retries
CRC	DWORD	no	RO	Number of messages with checksum errors
SCE	DWORD	no	RO	Number of messages with scan errors
ADR	DWORD	no	RO	Number of messages with address errors
FRM	DWORD	no	RO	Number of messages with framing errors
DTE	DWORD	no	RO	Number of messages for which the received data type is different from the configured data type
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT	no	RO	Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name

5.2 Unbalanced statistical module, master, FWK_DEV_M_V



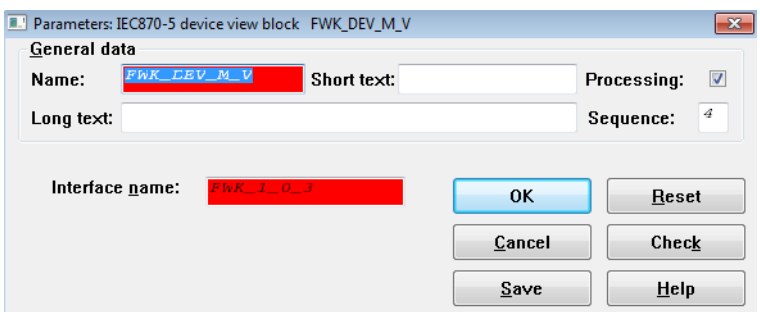
FWK_DEV_M_V.png

Function

With this module, the statistical data of the device module FWK_DEV_M can be further processed in a user program.

For each cyclical processing of the module, only the statistical outputs are updated; the actual telecontrol communication through the hardware interface runs in the background independently of the user task.

Parameters: Unbalanced statistical module, master, FWK_DEV_M_V



FWK_DEV_M_V Parameters_us.png

Interface name Tag name of the connected device module FWK_DEV_M in the hardware structure. The entry is mandatory. Tag name can be

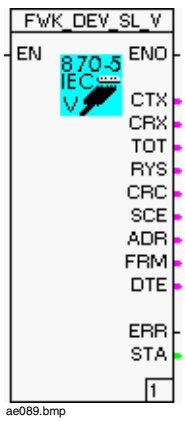
entered directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Function block data: Unbalanced statistical module, master FWK_DEV_M_V

Name	Data type	Conf.	Access	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
CTX	DWORD	no	RO	Number of messages sent
CRX	DWORD	no	RO	Number of messages received
TOT	DWORD	no	RO	Number of messages without acknowledgement (timeout)
RYS	DWORD	no	RO	Number of messages with retries
CRC	DWORD	no	RO	Number of messages with checksum errors
SCE	DWORD	no	RO	Number of messages with scan errors
ADR	DWORD	no	RO	Number of messages with address errors
FRM	DWORD	no	RO	Number of messages with framing errors
DTE	DWORD	no	RvO	Number of messages for which the received data type is different from the configured data type
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT			Status error code of function block

Name	Data type	Conf.	Access	Comments
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name

5.3 Unbalanced statistical module, slave, FWK_DEV_SL_V



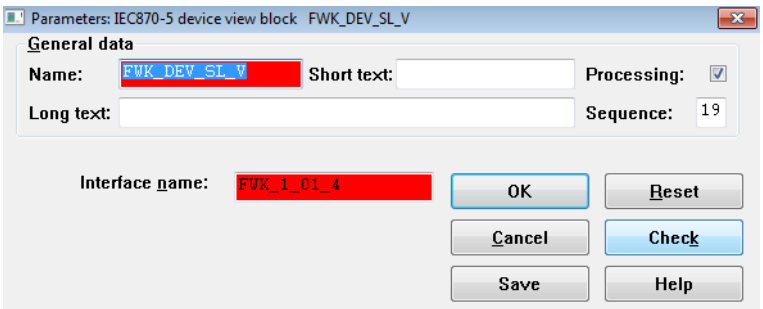
ae089.bmp

Function

With this module, the statistical data of the device module FWK_DEV_SL can be further processed in a user program.

For each cyclical processing of the module, only the statistical outputs are updated; the actual telecontrol communication through the hardware interface runs in the background independently of the user task.

Parameters: Unbalanced statistical module, slave, FWK_DEV_SL_V



ae090_us.png

Interface name Tag name of the connected device module FWK_DEV_SL in the hardware structure. The entry is mandatory. Tag name can be entered directly or press **F2**. A Select tag dialog opens. From the Select tag dialog, select the required tag.

Function block data: Unbalanced statistical module, slave, FWK_DEV_SL_V

Name	Data type	Conf.	Ac-cess	Comments
Inputs				
EN	BOOL	yes	RW	Enable TRUE: function block is processed
Outputs				
ENO	BOOL	no	RO	Processing state TRUE: function block is processed
CTX	DWORD	no	RO	Number of messages sent
CRX	DWORD	no	RO	Number of messages received
TOT	DWORD	no	RO	Number of messages without acknowledge-ment (timeout)
RYS	DWORD	no	RO	Number of messages with retries
CRC	DWORD	no	RO	Number of messages with checksum errors

Name	Data type	Conf.	Access	Comments
SCE	DWORD	no	RO	Number of messages with scan errors
ADR	DWORD	no	RO	Number of messages with address errors
FRM	DWORD	no	RO	Number of messages with framing errors
DTE	DWORD	no	RvO	Number of messages for which the received data type is different from the configured data type
ERR	BOOL	no	RO	Error state TRUE: error in the function block
STA	INT			Status error code of function block
Parameter definition dialog				
TAGNAME	TEXT	yes	none	Interface name

6 IEC 60870-5-101 compatibility list

6.1 Implementation scope in Freelance

The application-related standard IEC 60870-5-101 stipulates parameter sets and alternatives; subsets of these must be selected to set up a single telecontrol system. Certain parameters, such as the number of octets in the ASDU common address, are mutually exclusive. This means that only one value of the specified parameter is permitted per system. Other parameters, such as the listed sets containing various items of process information in command and monitoring direction, allow either the entire range to be specified or subsets that are suitable for the application concerned. The overview below lists the parameters available in the Freelance system to enable a relevant selection to be made for a specific application. Where a system is made up from a number of components from different manufacturers, then it is important that all parties should be in agreement with the selected parameters.

The selected parameters are displayed with a cross in the white square.

The parameters shaded gray are not available in the Freelance system.

6.2 Network layer

Network configuration

☐	End-to-end configuration
☐	Multiple-end configuration
☐	Linear configuration
☐	Star configuration

Physical layer

Transmission rate

Unbalanced interface
V.24/V.28 (asynchronous)

- ☐ 100 bit/s
- ☐ 200 bit/s
- ☐ 300 bit/s
- ☐ 600 bit/s
- ☐ 1200 bit/s
- ☐ 2400 bit/s
- ☐ 4800 bit/s
- ☐ 9600 bit/s
- ☐ 19200 bit/s

Transmission rate

Balanced interface
X.24/X.27 (synchronous)

- ☐ 2400 bit/s
- ☐ 4800 bit/s
- ☐ 9600 bit/s
- ☐ 19200 bit/s
- ☐ 38400 bit/s
- ☐ 56000 bit/s
- ☐ 64000 bit/s

Parity: even, odd, none

Stop bits: 1, 2 bits

Link layer

Message format FT 1.2, single sign 1 and a constant timeout are used exclusively in this norm.

Transmission procedure

- ☐ Balanced transmission
- ☐ Unbalanced transmission

Address field of the link layer

- ☐ None (only unbalanced transmission)
- ☐ One byte
- ☐ Two bytes
- ☐ Structured
- ☐ Unstructured

Message length:

Maximum length 256 bytes

6.3 Application layer

MODE 1 (lowest-value byte first, as specified in IEC 60870-5-4, section 4.10) is used exclusively.

Common address of ASDU (System-specific parameter)

- ☐ One byte
- ☐ Two bytes

Address of the information object (System-specific parameter)

- ☐ One byte
- ☐ Two bytes
- ☐ Three bytes
- ☐ Structured
- ☐ Unstructured

Cause of transmission (System-specific parameter)

- ☐ One byte
- ☐ Two bytes (with address of origin)

Process information in monitoring direction (Station-specific parameter)

☐	<1>:= Single status value	M_SP_NA_1
☐	<2>:= Single status value with timestamp	M_SP_TA_1
☐	<3>:= Double status value	M_DP_NA_1
☐	<4>:= Double status value with timestamp	M_DP_TA_1
☐	<5>:= Step-by-step adjusting message	M_ST_NA_1
☐	<6>:= Step-by-step adjusting message with timestamp	M_ST_TA_1
☐	<7>:= Bit pattern of 32 bits	M_BO_NA_1
☐	<8>:= Bit pattern of 32 bits with timestamp	M_BO_TA_1
☐	<9>:= Real value, normalized value	M_ME_NA_1
☐	<10>:= Real value, normalized value with timestamp	M_ME_TA_1
☐	<11>:= Real value, scaled value	M_ME_NB_1
☐	<12>:= Real value, scaled value with timestamp	M_ME_TB_1
☐	<13>:= Real value, floating point value	M_ME_NC_1

☐	<14>:= Real value, floating point value with timestamp	M_ME_TC_1
☐	<15>:= Discrete value	M_IT_NA_1
☐	<16>:= Discrete value with timestamp	M_IT_TA_1
☐	<17>:= Protective event with timestamp	M_EP_TA_1
☐	<18>:= Blocked actuation of protection with timestamp	M_EP_TB_1
☐	<19>:= Blocked triggering of protection with timestamp	M_EP_TC_1
☐	<20>:= Blocked single status values with state change display	M_PS_NA_1
☐	<21>:= Real value, normalized value with no quality identification	M_ME_ND_1
☐	<30>:= Single status value with timestamp CP56Time2a	M_SP_TB_1
☐	<31>:= Double status value with timestamp CP56-Time2a	M_DP_TB_1
☐	<32>:= Step-by-step adjusting message with timestamp CP56Time2a	M_ST_TB_1
☐	<33>:= Bit pattern of 32 bits with timestamp CP56-Time2a	M_BO_TB_1
☐	<34>:= Real value, normalized value with timestamp CP56Time2a	M_ME_TD_1
☐	<35>:= Real value, scaled value with timestamp CP56-Time2a	M_ME_TE_1
☐	<36>:= Real value, short floating point value with time-stamp CP56Time2a	M_ME_TF_1
☐	<37>:= Discrete value with timestamp CP56Time2a	M_IT_TB_1
☐	<38>:= Protective event with timestamp CP56Time2a	M_EP_TD_1
☐	<39>:= Blocked actuation of protection with timestamp CP56Time2a	M_EP_TE_1
☐	<40>:= Blocked triggering of protection with timestamp CP56Time2a	M_EP_TF_1

Process information in controlling direction (Station-specific parameter)

☐	<45>:= Single command	C_SC_NA_1
☐	<46>:= Double command	C_DC_NA_1
☐	<47>:= Step-by-step adjusting command	C_RC_NA_1
☐	<48>:= Setpoint adjusting command, normalized value	C_SE_NA_1
☐	<49>:= Setpoint adjusting command, scaled value	C_SE_NB_1

☐	<50>:= Setpoint adjusting command, short floating-point value	C_SE_NC_1
☐	<51>:= Bit pattern of 32 bits	C_BO_NA_1

System information in monitoring direction (Station-specific parameter)

☐	<70>:= End of initialization	M_EI_NA_1

System information in controlling direction (Station-specific parameter)

☐	<100>:= General interrogation command	C_IC_NA_1
☐	<101>:= Counter interrogation command	C_CI_NA_1
☐	<102>:= Retrieval	C_RD_NA_1
☐	<103>:= Time synchronization command	C_CS_NA_1
☐	<104>:= Test command	C_TS_NB_1
☐	<105>:= Process reset command	C_RP_NC_1
☐	<106>:= Command for capturing the message run-time	C_CD_NA_1

Parameters in controlling direction (Station-specific parameter)

☐	<110>:= Parameter for real values, normalized value	P_ME_NA_1
☐	<111>:= Parameter for real values, scaled value	P_ME_NB_1
☐	<112>:= Parameter for real values, short floating point value	P_ME_NC_1
☐	<113>:= Parameter activation	P_AC_NA_1

Transfer of files (Station-specific parameter)

☐	<120>:= File ready	F_FR_NA_1
☐	<121>:= Section ready	F_SR_NA_1
☐	<122>:= Retrieve file directory	F_SC_NA_1
☐	<123>:= Last section/segment	F_LS_NA_1
☐	<124>:= File/section confirmation	F_AF_NA_1
☐	<125>:= Segment	F_SG_NA_1
☐	<126>:= File directory	F_DR_NA_1

6.4 Basic application functions

Station initialization (Station-specific parameter)

- ☐ Remote initialization

General interrogation (System- or station-specific parameter)

The addresses for each group must be defined.

- ☐ Global
- ☐ Group 1
- ☐ Group 2
- ☐ Group 3
- ☐ Group 4
- ☐ Group 5
- ☐ Group 6
- ☐ Group 7
- ☐ Group 8
- ☐ Group 9
- ☐ Group 10
- ☐ Group 11
- ☐ Group 12
- ☐ Group 13
- ☐ Group 14
- ☐ Group 15
- ☐ Group 16

Time synchronization (Station-specific parameter)

- ☐ Time synchronization

Command transmission (Object-specific parameter)

- ☐ Direct command transmission
- ☐ Commands: “Selection and execution”
- ☐ Direct setpoint command transmission
- ☐ Setpoints: “Selection and execution”

- ☐ C_SE_ACTTERM used
- ☐ No additional definition
- ☐ Short command execution time (duration defined through parameter in sub-station)
- ☐ Long command execution time (duration defined through parameter in sub-station)
- ☐ Persistent command

Transmission of discrete values (Station- or object-specific parameter)

The addresses for each group must be defined.

- ☐ Query counter
- ☐ General counter query
- ☐ Relocate counter without reset
- ☐ Relocate counter with reset
- ☐ Reset counter
- ☐ Query group 1 counter
- ☐ Query group 2 counter
- ☐ Query group 3 counter
- ☐ Query group 4 counter

Loading of parameters (Object-specific parameter)

- ☐ Threshold value
- ☐ Smoothing factor
- ☐ Lower limit value for transmission of real values
- ☐ Upper limit value for transmission of real values

Parameter activation (Object-specific parameter)

- ☐ Activation/Deactivation of cyclical or periodical transmission of the addressed object

File transfer (Station-specific parameter)

- ☐ Transfer of file in monitoring direction
- ☐ Transfer of file in controlling direction

7 IEC 60870-5-104 compatibility list

7.1 Implementation scope in Freelance

The application-related standard IEC 60870-5-104 stipulates parameter sets and alternatives; subsets of these must be selected to set up a single telecontrol system. Certain parameters, such as the selection of structured or unstructured fields of the ASDU information object address, are mutually exclusive. This means that only one value of the specified parameter is permitted per system. Other parameters, such as the listed sets containing various items of process information in command and monitoring direction, allow either the entire range to be specified or subsets that are suitable for the application concerned.

The overview below lists the parameters available in the Freelance system to enable a relevant selection to be made for a specific application. Where a system is made up from a number of components from different manufacturers, then it is important that all parties should be in agreement with the selected parameters.

The selected parameters are displayed with a cross in the white square.

The parameters shaded gray are not available in the Freelance system.

7.2 Application layer

MODE 1 (lowest-value byte first, as specified in IEC 60870-5-4, section 4.10) is used exclusively.

Common address of ASDU (System-specific parameter)

- ☐ One byte
- ☐ Two bytes

Address of the information object (System-specific parameter)

- ☐ One byte
- ☐ Two bytes

- ☐ Three bytes
- ☐ Structured
- ☐ Unstructured

Cause of transmission (System-specific parameter)

- ☐ One byte
- ☐ Two bytes (with address of origin)

7.3 Selecting standard ASDUs

Process information in monitoring direction (Station-specific parameter)

☐	<1>:= Single status value	M_SP_NA_1
☐	<2>:= Single status value with timestamp	M_SP_TA_1
☐	<3>:= Double status value	M_DP_NA_1
☐	<4>:= Double status value with timestamp	M_DP_TA_1
☐	<5>:= Step-by-step adjusting message	M_ST_NA_1
☐	<6>:= Step-by-step adjusting message with timestamp	M_ST_TA_1
☐	<7>:= Bit pattern of 32 bits	M_BO_NA_1
☐	<8>:= Bit pattern of 32 bits with timestamp	M_BO_TA_1
☐	<9>:= Real value, normalized value	M_ME_NA_1
☐	<10>:= Real value, normalized value with timestamp	M_ME_TA_1
☐	<11>:= Real value, scaled value	M_ME_NB_1
☐	<12>:= Real value, scaled value with timestamp	M_ME_TB_1
☐	<13>:= Real value, floating point value	M_ME_NC_1
☐	<14>:= Real value, floating point value with timestamp	M_ME_TC_1
☐	<15>:= Discrete value	M_IT_NA_1
☐	<16>:= Discrete value with timestamp	M_IT_TA_1
☐	<17>:= Protective event with timestamp	M_EP_TA_1
☐	<18>:= Blocked actuation of protection with timestamp	M_EP_TB_1
☐	<19>:= Blocked triggering of protection with timestamp	M_EP_TC_1
☐	<20>:= Blocked single status values with state change display	M_PS_NA_1
☐	<21>:= Real value, normalized value with no quality identification	M_ME_ND_1

☐	<30>:= Single status value with timestamp CP56Time2a	M_SP_TB_1
☐	<31>:= Double status value with timestamp CP56-Time2a	M_DP_TB_1
☐	<32>:= Step-by-step adjusting message with timestamp CP56Time2a	M_ST_TB_1
☐	<33>:= Bit pattern of 32 bits with timestamp CP56-Time2a	M_BO_TB_1
☐	<34>:= Real value, normalized value with timestamp CP56Time2a	M_ME_TD_1
☐	<35>:= Real value, scaled value with timestamp CP56-Time2a	M_ME_TE_1
☐	<36>:= Real value, short floating point value with time-stamp CP56Time2a	M_ME_TF_1
☐	<37>:= Discrete value with timestamp CP56Time2a	M_IT_TB_1
☐	<38>:= Protective event with timestamp CP56Time2a	M_EP_TD_1
☐	<39>:= Blocked actuation of protection with timestamp CP56Time2a	M_EP_TE_1
☐	<40>:= Blocked triggering of protection with timestamp CP56Time2a	M_EP_TF_1

Process information in controlling direction (Station-specific parameter)

☐	<45>:= Single command	C_SC_NA_1
☐	<46>:= Double command	C_DC_NA_1
☐	<47>:= Step-by-step adjusting command	C_RC_NA_1
☐	<48>:= Setpoint adjusting command, normalized value	C_SE_NA_1
☐	<49>:= Setpoint adjusting command, scaled value	C_SE_NB_1
☐	<50>:= Setpoint adjusting command, short floating-point value	C_SE_NC_1
☐	<51>:= Bit pattern of 32 bits	C_BO_NA_1
☐	<58>:= Single command with timestamp CP56Time2a	C_SC_TA_1
☐	<59>:= Double command with timestamp CP56Time2a	C_DC_TA_1
☐	<60>:= Step-by-step adjusting command with time-stamp CP56Time2a	C_RC_TA_1
☐	<61>:= Setpoint adjusting command, normalized value with timestamp CP56Time2a	C_SE_TA_1

☐	<62>:= Setpoint adjusting command, scaled value with timestamp CP56Time2a	C_SE_TB_1
☐	<63>:= Setpoint adjusting command, short floating point value with timestamp CP56Time2a	C_SE_TC_1
☐	<64>:= Bit pattern of 32 bits with timestamp CP56-Time2a	C_BO_TA_1

System information in monitoring direction (Station-specific parameter)

☐	<70>:= End of initialization	M_EI_NA_1

System information in controlling direction (Station-specific parameter)

☐	<100>:= General interrogation command	C_IC_NA_1
☐	<101>:= Counter interrogation command	C_CI_NA_1
☐	<102>:= Retrieval	C_RD_NA_1
☐	<103>:= Time synchronization command	C_CS_NA_1
☐	<104>:= Test command	C_TS_NB_1
☐	<105>:= Process reset command	C_RP_NC_1
☐	<106>:= Command for capturing the message run-time	C_CD_NA_1
☐	<107>:= Test command with timestamp CP56Time2a	C_TS_TA_1

Parameters in controlling direction (Station-specific parameter)

☐	<110>:= Parameter for real values, normalized value	P_ME_NA_1
☐	<111>:= Parameter for real values, scaled value	P_ME_NB_1
☐	<112>:= Parameter for real values, short floating point value	P_ME_NC_1
☐	<113>:= Parameter activation	P_AC_NA_1

Transfer of files (Station-specific parameter)

☐	<120>:= File ready	F_FR_NA_1
☐	<121>:= Section ready	F_SR_NA_1
☐	<122>:= Retrieve file directory	F_SC_NA_1
☐	<123>:= Last section/segment	F_LS_NA_1
☐	<124>:= File/section confirmation	F_AF_NA_1
☐	<125>:= Segment	F_SG_NA_1

☐	<126>:= File directory	F_DR_NA_1
☐	<127>:= Query log - request archive file	F_SC_NB_1

7.4 Basic application functions

Station initialization (Station-specific parameter)

☐	Remote initialization

General interrogation (System- or station-specific parameter)

The addresses for each group must be defined.

☐	Global
☐	Group 1
☐	Group 2
☐	Group 3
☐	Group 4
☐	Group 5
☐	Group 6
☐	Group 7
☐	Group 8
☐	Group 9
☐	Group 10
☐	Group 11
☐	Group 12
☐	Group 13
☐	Group 14
☐	Group 15
☐	Group 16

Time synchronization (Station-specific parameter)

☐	Time synchronization

Command transmission (Object-specific parameter)

- ☐ Direct command transmission
- ☐ Commands: “Selection and execution”
- ☐ Direct setpoint command transmission
- ☐ Setpoints: “Selection and execution”
- ☐ C_SE_ACTTERM used
- ☐ No additional definition
- ☐ Short command execution time (duration defined through parameter in sub-station)
- ☐ Long command execution time (duration defined through parameter in sub-station)
- ☐ Persistent command

Transmission of discrete values (Station- or object-specific parameter)

The addresses for each group must be defined.

- ☐ Query counter
- ☐ General counter query
- ☐ Relocate counter without reset
- ☐ Relocate counter with reset
- ☐ Reset counter
- ☐ Query group 1 counter
- ☐ Query group 2 counter
- ☐ Query group 3 counter
- ☐ Query group 4 counter

Loading of parameters (Object-specific parameter)

- ☐ Threshold value
- ☐ Smoothing factor
- ☐ Lower limit value for transmission of real values
- ☐ Upper limit value for transmission of real values

Parameter activation (Object-specific parameter)

- ☐ Activation/Deactivation of cyclical or periodical transmission of the addressed object

File transfer (Station-specific parameter)

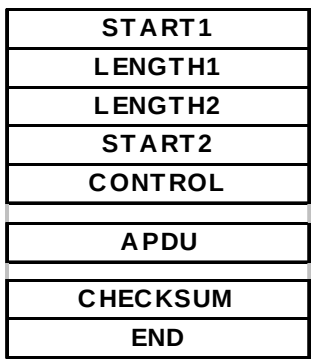
☐ Transfer of file in monitoring direction
☐ Transfer of file in controlling direction

8 Protocol description (Excerpt)

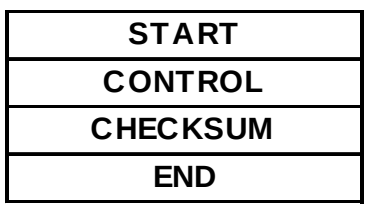
8.1 Link layer

The following FT 1.2 message formats are used for the link layer:

- Message of variable length with user data



- Message of fixed length without user data only for system communication on the link layer

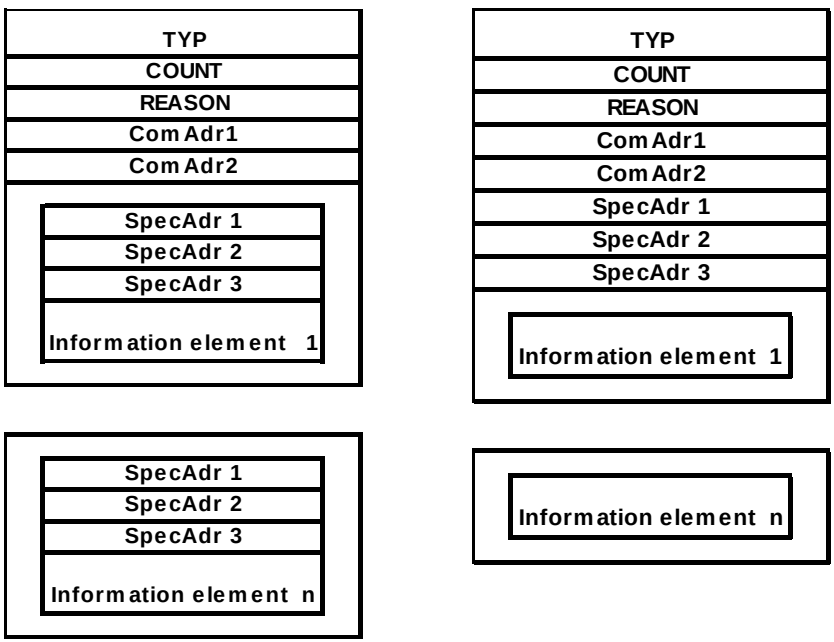


- Single control characters for positive (negative) acknowledgement

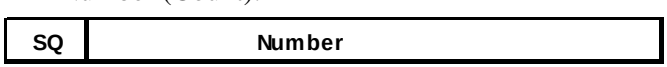
8.2 Application layer

The application layer defines different information objects and services for their transmission. A data point or information object is identified through a system-wide unambiguous address containing a maximum 5 bytes. Several information objects

of the same type can be sent in one unit (APDU). The address used is either the 2 byte common address of all information objects of an APDU and the 3 byte information object address in each individual information object or the 5 byte address for the first information object followed by information elements (InfoObj without special address), the address of which is produced implicitly by further counting the 5 byte address of the first. In addition to the type identifier and the common address, the header of an APDU contains the number of information objects/elements and the reason for transmission for this unit.



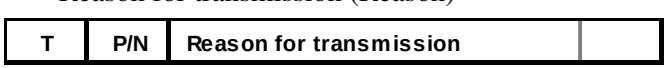
- Number (Count):



SQ = 0: Number of information objects (each with address)

SQ = 1: Number of information elements (previously not supported!)

- Reason for transmission (Reason)



T = Test

P/N = 0 positive/1 negative confirmation

Reasons for transmission:

1	Periodic/cyclic	per/cyc
2	Background interrogation	back
3	Spontaneous	spont
4	Initialized	init
5	Requested	req
6	Activation	act
7	Confirmation of activation	actcon
8	Deactivation	deact
9	Confirmation of deactivation	deactcon
10	Termination of activation	actterm
11	Return information, caused by a remote command	retrem
12	Return information, caused by a local command	retloc
20	Interrogated by general inquiry	inrogen

8.3 Types of information elements

The information objects marked with CONFIRMED are sent with confirmed application layer services. For acknowledgement, the received APDU is played back to the sending primary station with the relevant reason for transmission.

Information elements in monitoring direction

Single-status without Timestamp M_SP_NA_1 **<1>**

IV	NT	SB	BL	0	0	0	SPI

According to IEC 60870-5-101/104 chapter 7.2.6.1 SIQ:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
SPI		1 = on

Single-status with timestamp M_SP_TA_1 **<2>**

IV	NT	SB	BL	0	0	0	SPI
			MIN				
			MSEC				
			MSEC				

According to IEC 60870-5-101/104 chapter 7.2.6.1 SIQ:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
SPI		1 = on

Double-status without timestamp M_DP_NA_1 **<3>**

IV	NT	SB	BL	0	0	DPI

According to IEC 60870-5-101 7.2.6.1 DIQ:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
DPI		0 = undefined status, interim position
		1 = status off
		2 = status on
		3 = undefined status, interim position

Double-status with timestamp M_DP_NA_1 **<4>**

IV	NT	SB	BL	0	0	DPI	
			MIN				
			MSEC				
			MSEC				

According to IEC 60870-5-101/104 7.2.6.1 DIQ:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
DPI		0 = undefined status, interim position 1 = status off 2 = status on 3 = undefined status, interim position

Real value normalized value M_ME_NA_1 **<9>**

			Value				
S			Value				
IV	NT	SB	BL	0	0	0	OV

According to IEC 60870-5-101/104 7.2.6.3 QDS:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
OV	Overload	1 = overload (not supported)
Value		Normalized value between -1 and +1

Real value normalized value with timestamp M_ME_TA_1 <10>

			Value				
S			Value				
IV	NT	SB	BL	0	0	0	OV
			MIN				
			MSEC				
			MSEC				

According to IEC 60870-5-101/104 7.2.6.3 QDS:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
OV	Overload	1 = overload (not supported)
Value		Normalized value between -1 and +1

Real value without timestamp M_ME_NC_1 <13>

			Mantissa				
			Mantissa				
E			Mantissa				
S			Exponent				
IV	NT	SB	BL	0	0	0	OV

According to IEC 60870-5-101/104 7.2.6.3 QDS:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
OV	Overload	1 = overrun (not supported)

Real value with timestamp M_ME_TC_1 **<14>**

			Mantissa				
			Mantissa				
E			Mantissa				
S			Exponent				
IV	NT	SB	BL	0	0	0	OV
			MIN				
			MSEC				
			MSEC				

According to IEC 60870-5-101/104 7.2.6.3 QDS:

IV	Invalid	1 = invalid
NT	Not topical	1 = not topical (not supported)
SB	Substituted	1 = substituted (not supported)
BL	Blocked	1 = blocked (not supported)
OV	Overload	1 = overrun (not supported)

Discrete value without timestamp M_IT_NA_1 **<15>**

			Value				
			Value				
			Value				
S			Value				
IV	CA	CY	Sequence number				

According to IEC 60870-5-101/104 7.2.6.9 BCR:

IV	Invalid	1 = invalid
CA		1 = counter has been preset since last reading (not supported)
CY		1 = transmission divided into associated measurement periods (not supported)
SQ		Sequence identifier

Discrete value with timestamp M_IT_TA_1 **<16>**

			Value			
			Value			
			Value			
S			Value			
IV	CA	CY	Sequence number			
			MIN			
			MSEC			
			MSEC			

According to IEC 60870-5-101/104 7.2.6.9 BCR:

IV Invalid 1 = invalid
CA 1 = counter has been preset since last reading (not supported)
CY 1 = transmission divided into associated measurement periods (not supported)
SQ Sequence identifier

Information elements in control direction

Single command C_SC_NA_1 **<45> CONFIRMED**

S/E			QU			0	SCS

According to IEC 60870-5-101/104 7.2.6.15 SCO:

S/E 0 = Execution (Execute)
1= Selection (Select) (not supported)
QU 0 = No definition
1 = Short command execution time
2 = Long command execution time
3 = Persistent command
SCS Single command state

Double command C_DC_NA_1 **<46> CONFIRMED**

S/E			QU		DCS

According to IEC 60870-5-101/104 7.2.6.15 DCS:

S/E 0 = execute
1 = select
QU 0 = no definition
1 = short command execution time
2 = long command execution time
3 = persistent command
DCS double command
0 = not permissible
1 = off
2 = on
3 = not permissible

Setpoint normalized C_SE_NA_1 **<48> CONFIRMED**

			Value				
S			Value				
S/E				QL			

According to IEC 60870-5-101/104 7.2.6.39 QOS:

S/E 0 = execute
1 = select (not supported)
QL 0 = not used
Value Normalized value between -1 and +1

Real setpoint C_SE_NC_1 **<50> CONFIRMED**

			Mantissa				
			Mantissa				
E			Mantissa				
S			Exponent				
S/E				QL			

According to IEC 60870-5-101/104 7.2.6.39 QOS:

S/E 0 = Execution (Execute)
1= Selection (Select) (not supported)
QL 0 = Not used

System information in monitoring direction

End of initialization M_EI_NA_1 **<70>**

COI

System information in controlling direction

General inquiry C_IC_NA_1 **<100> CONFIRMED**

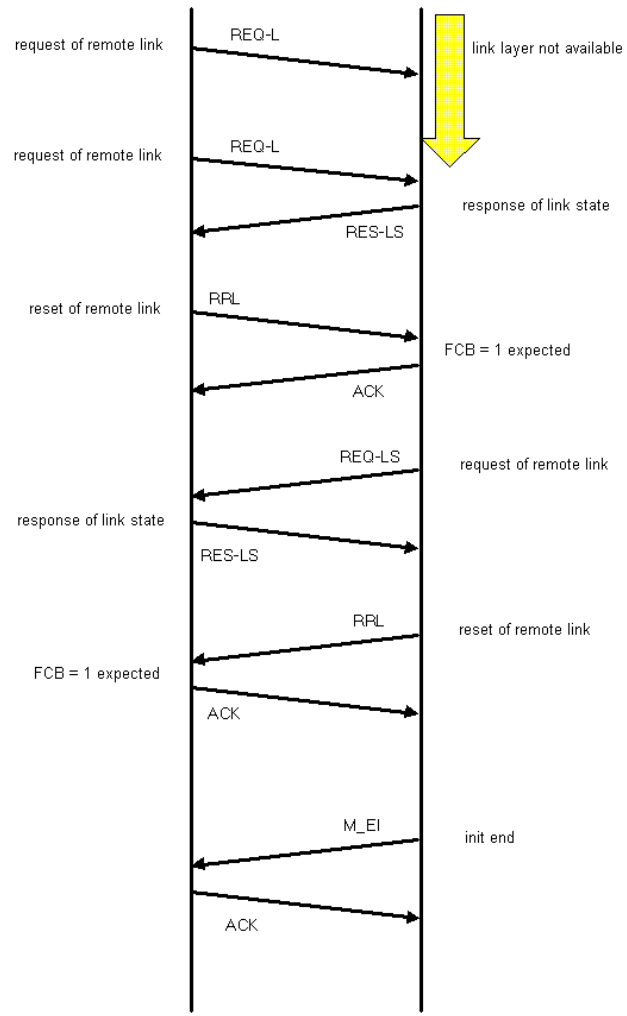
	QOI = Inquiry identifier			

QOI = Inquiry identifier

Counter query C_IC_NA_1 **<101> CONFIRMED**

RQT = 1	Query group 1 counter
RQT = 2	Query group 2 counter
RQT = 3	Query group 3 counter
RQT = 4	Query group 4 counter
RQT = 5	General counter query
FRZ = 0	No relocate or reset
FRZ = 1	Relocate counter
FRZ = 2	Relocate counter with reset
FRZ = 3	Reset counter

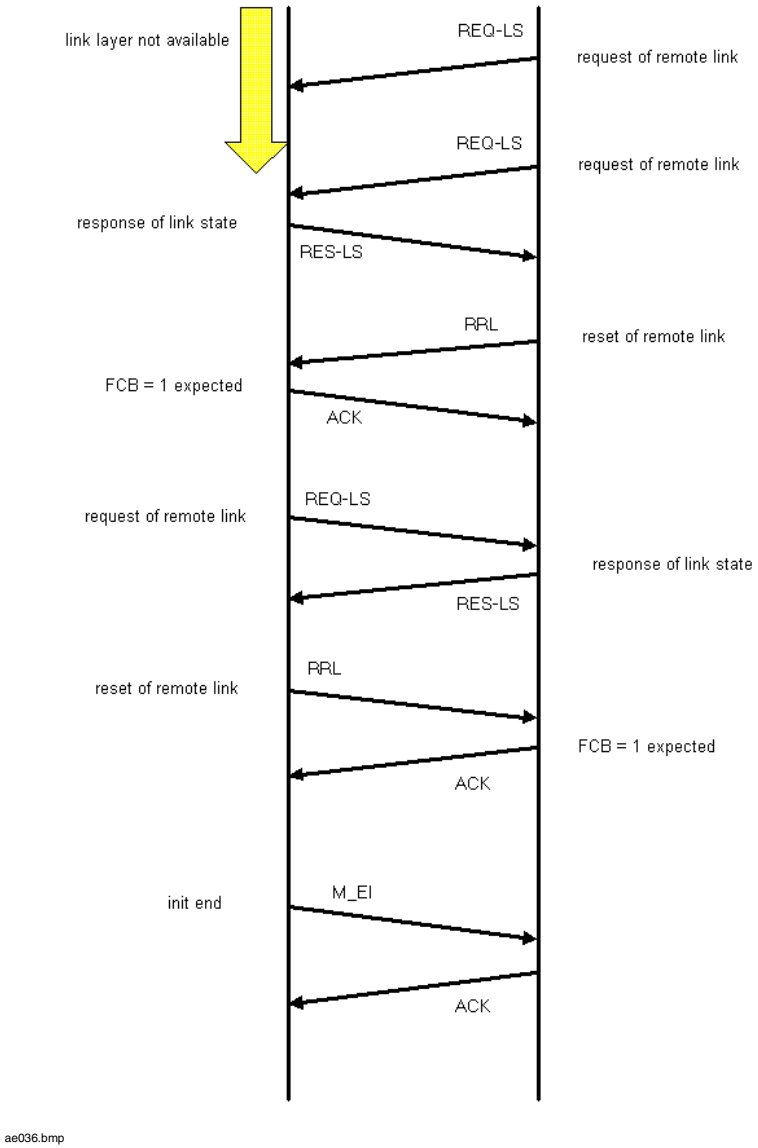
8.4 Establishment of a link



ae035.bmp

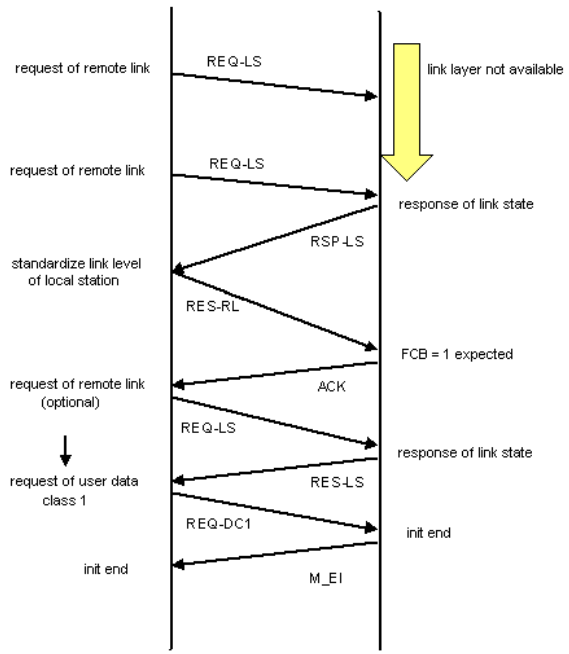
See figure for Initializing a secondary station with balanced transmission

After the initialization of the data link on the data link layer level, successful initialization is signalled with M_EI. M_AA is not used!



ae036.bmp

Fig.: Initializing a primary station with balanced transmission



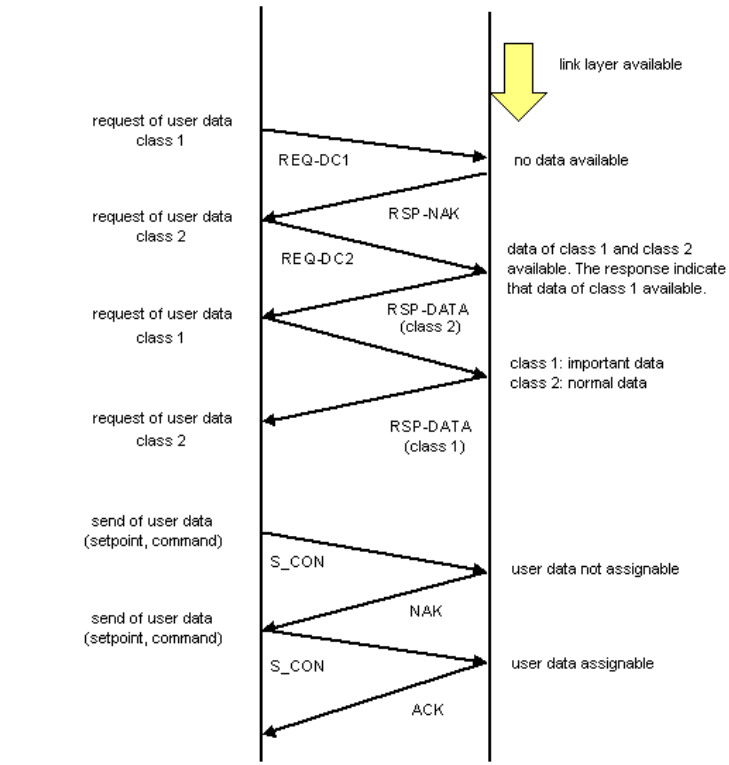
ae067.bmp

Fig.: Initializing a substation (slave) with unbalanced transmission

REQ-LS:	Request link state	Function code master	9
RES-RL	Reset remote link	Function code master	0
REQ-DC1	Request data class1	Function code master	10
REQ-DC2	Request data class2	Function code master	11
RSP-LS	Response link state	Function code slave	11
ACK	Acknowledge	Function code slave	0
NACK	Non acknowledge	Function code slave	1
RSP-NACK	Data not available	Function code slave	9
RSP-Data	User data	Function code slave	8

After initialization of the link on the data link layer, the successful initialization is reported with M_EI.

8.5 Data exchange

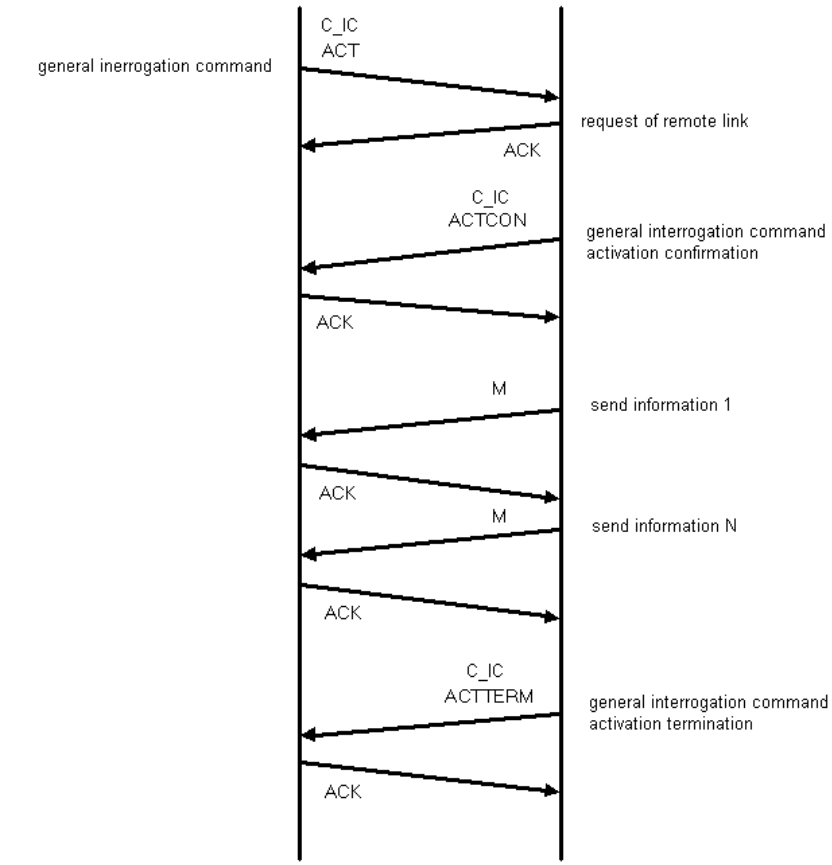


ae068.bmp

Fig.: Data exchange with a substation (slave), with unbalanced transmission

REQ-LS:	Request link state	Function code master	9
RES-RL	Reset remote link	Function code master	0
REQ-DC1	Request data class1	Function code master	10
REQ-DC2	Request data class2	Function code master	11
S_CON	Send user data	Function code master	3
RSP-LS	Response link state	Function code slave	11
ACK	Acknowledge	Function code slave	0
NACK	Non acknowledge	Function code slave	1
RSP-NACK	Data not available	Function code slave	9
RSP-Data	Response user data	Function code slave	8

8.6 General inquiry



ae037.bmp

Fig.: General inquiry

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