Data transfer between easy und IEC stations easyNet

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Original Operating Instructions
The German-language edition of this document is the original operating manual.

Translation of the original operating manual
All editions of this document other than those in German language are translations of the original German manual.

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Content

About this manual

List of revisions

The following are the main changes and amendments which have been made since the last edition of this manual:

Edition date	Page	Description	Change
10/10	all	Change to Eaton notation	✓

The manual provides the essential information required for the access of an IEC station, such as an XC200, to other stations in the easyNet network. The access of the IEC stations is executed by the program containing the functions for sending and receiving data.

The functions contain structure variables, and both are described briefly in chapter 2 and chapter 3.

The relationship between the functions and structures, as well as their integration in the program, are shown in the chapter 4.

The possible data transfer options are described in chapter 2.

This manual is divided into the following chapters:

- The easyNet network
  Provides an introduction to the easyNet network,
  → chapter 1, page 5.
- Functions
  Describes the functions and their properties,
  → chapter 2, page 7.
- Structures
  Describes the structures, → chapter 3, page 9.
- Application
  Shows the possibilities for data transfer between the IEC stations and easy stations, e.g. easy800, in the form of examples. The functions and structures are used in these examples, → chapter 4, page 15.
  Additional information on accessing easy stations on the network is provided in the manuals of the relevant easy stations.
- Network configuration
  Describes how to configure easy stations via the first station (Net ID 1) on the easyNet, → chapter 5, page 27.
- Combination of easyNet with CAN/CANopen
  Provides information on combinations of easyNet – CANopen, CAN Direct, CAN network variables,
  → chapter 6, page 31.
- Routing
  Shows the possibility of indirect communication between the PC and stations via the easyNet, → chapter 7, page 33.
- Bus topology
  Shows different topologies, → chapter 8, page 35.

Abbreviations and symbols

Symbols used in this manual have the following meanings:

▶ Indicates actions to be taken.

→ Draws your attention to interesting tips and supplementary information.

For greater clarity, the name of the current chapter is shown in the header of the left-hand page and the name of the current section in the header of the right-hand page. This does not apply to pages at the start of a chapter and empty pages at the end of a chapter.

1 The easyNet network

Network overview

easyNet is based on the CAN network which enables the exchange of process and system data. It is designed for 8 stations, i.e. controllers. There are two types of stations that are programmed differently:

- easy station (programming in the form of a circuit diagram)
  - easy800
  - MFD-CP8-…
  - EASY223-SWIRE (SmartWire gateway without a program, with a configuration)

- IEC station (programming according to the IEC 1131 standard)
  - XC200
  - EC4-200
  - MFD4

Configuring stations and the network

In easyNet each station has to be configured. In order to identify each station in the network, each one of them is assigned an address (Net-ID), as well as parameters that define the behaviour of the station in the network (e.g. baud rate, SEND IO, Remote Run). You configure easy stations in the configurator of the programming software or via the keypad/display on the device.

The IEC stations can be configured individually. The easySoft-CoDeSys configurator is used to set the communication parameters and load them with the user program in the stations.

easy stations are configured in the network using easySoft. If a project contains both easy and IEC stations, both types of station must be configured in the network.

In easySoft select a symbol for the station in Project View and drag the symbol onto the Workbench. A general symbol is available under Net stations for the IEC stations. Position the devices and enter the communication parameters.

→ The device at position 1 in Project View is permanently assigned Net-ID = 1 and must also be the first physical device on the network line.

Once you have configured all stations you can load the configuration onto the easy stations. The configuration and the program for the IEC stations must be loaded separately with the easySoft-CoDeSys programming software!

Overview of data transfer

Each station is assigned an ID number 1..8 and can exchange data with all other stations. Bit, byte, word and double word data formats are possible. A station with Net-ID = 1 must always be present. This station handles the management of the communication on the network. It is the only station that can set the outputs of the remote I/O stations.

Remote I/O stations are devices, such as an easy800, without a program.
The data transfer options are described in → chapter "Functions", page 7.

→ Further information on data transfer between the easy stations is provided in the following operating manuals:

- easy800 control relay (MN04902001Z-EN; previously AWB2528-1423G),
- EASY223-SWIRE (MN05006003Z-EN; previously AWB2528+1251-1589GB),
- MFD-Titan multi-function display (MN05002001Z-EN; previously AWB2528-1480GB)

easySoft provides the easy stations with special operands for sending and receiving data via the network.

IEC stations use the functions of easySoft-CoDeSys for sending and receiving the data. These functions are contained in the library SysLibEasyNet.lib. Add this library to the Library Manager in order to integrate it into the project. Calling the functions in the program enables the data to be exchanged between the user program and the protocol task that is invisible to it and which operates independently to it. The protocol task is a program that handles the actual data transfer between the IEC station and the individual stations. It also handles the administrative tasks such as station monitoring and the support of the routing function.

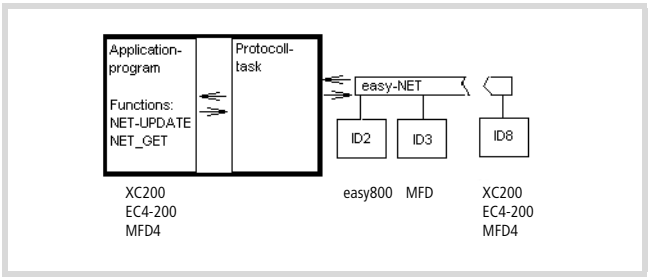


Figure 1: Data transfer between IEC and easy/IEC stations

2 Functions

Data transfer functions

The SysLibEasyNet.lib library provides the functions NET_UPDATE and NET_GET for sending and receiving the data, as well as NET_CONFIG for configuring the network. The NET_UPDATE and NET_GET functions provide the following transfer options:

- NET_UPDATE
  - Send output states (bit) of station with Net-ID = 1 to a station without a program (Remote I/O) (Operand Q/S).
    → section "IEC station (Net-ID1) -> Remote I/O station, e.g. easy800 (I/O information)", page 16,.
    → section "IEC station (Net-IDn) -> EASY223-SWIRE gateway (I/O information)", page 19
  - Scan input/output states (bit) of each station (also Remote I/O) (Operand Q/S and I/R).
    → section "IEC station <- IEC/easy station (I/O information)", page 15,
    → section "IEC station (Net-IDx) <- EASY223-SWIRE gateway (I/O information)", page 17.
  - Exchange bit information between two stations with programs. The sending station transfers the bit using the operand SN. The receiving station receives the bit with the operand RN.
    → section "IEC station <-> IEC/easy station (bit information)", page 20,
  - Put values (DWORD format) onto the network so that they can be fetched by other stations using the NET-GET function.
    → section "IEC station <-> several IEC/easy stations (double-word data exchange)", page 22.

- NET_GET
  - Get values (DWORD format) from the network that another station has placed there with the NET_UPDATE function
    → section "IEC station <-> several IEC/easy stations (double-word data exchange)", page 22.

Description of functions

This section describes the parameters of the functions. Detailed information and the handling of functions is described in
→ chapter "Applications", page 15.

NET_UPDATE function for data exchange

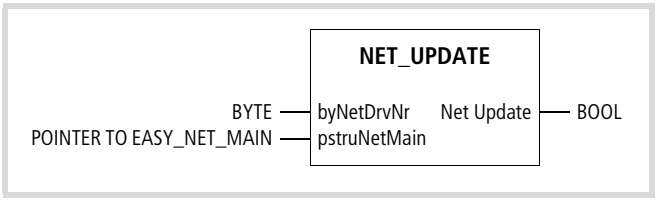


Figure 2: NET_UPDATE function

Function parameters

byNetDrvNr	easyNet driver number (default setting = 0)
pstruNetMain	Pointer to a data structure of type EASY_NET_MAIN
Net_Update	(return value) TRUE: Function completed successfully. FALSE: Function aborted with error.

The return value must be included in the user program (error output).

Calling the function (example)

```
PROGRAM PLC_PRG
VAR
myEASY_NET_MAIN:EASY_NET_MAIN;
(*Declaration local/global possible*)
xResult: BOOL;
END_VAR
xResult:=Net_Update(0 ,ADR(myEASY_NET_MAIN));
```

→ The NET_UPDATE function must be called once in every program cycle. The call can only be executed from a task!

Description
The NET_UPDATE function enables you to send and receive data. The function contains the parameter "pstruNetMain" at which you can set a pointer that points to a variable of type EASY_NET_MAIN, e.g. "myEASY_NET_MAIN".

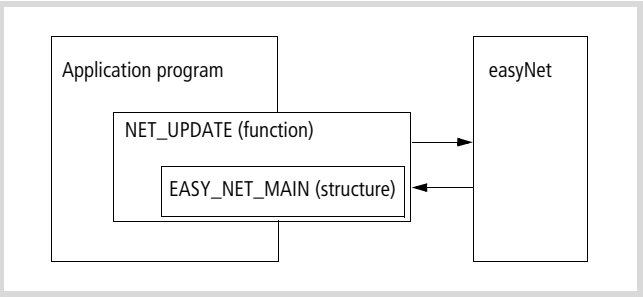


Figure 3: Access of the user program to easyNet

The EASY_NET_MAIN structure and the subsequent structures are described in → chapter "Structures", page 9.

NET_GET function for fetching data stored on the network

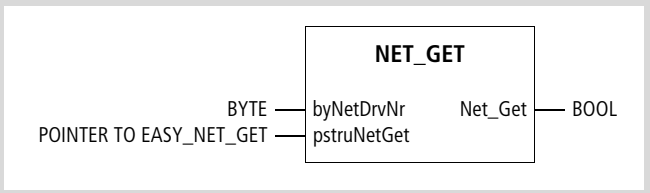


Figure 4: NET_GET function

Function parameters

byNetDrvNr:	
	easyNet driver number. Default setting = 0.
pstruNetGet:	
	Pointer to a data structure of type EASY_NET_GET: This structure is used for data exchange between the easyNet and the user program of the station.
Net_Get (return value):	
	TRUE: Function completed successfully.
	FALSE: Function aborted with error.

Calling the function (example)

```
PROGRAM PLC_PRG
VAR
myEASY_NET_GET : EASY_NET_GET;
xResult:BOOL;
END_VAR

xResult:=NET_GET(0,ADR(myEASY_NET_GET));
```

Description
Calling the NET_GET function enables you to read (get) data from the network that was placed there by other stations on it using the EASY_NET_PUT structure. Calling the function only allows you to "get" one data unit. If several stations have put a data unit on the network, a station can fetch all data units in succession. The following scanning options are possible:

- Incorporating the function once in the program and for each data unit.
  The NET-ID of the station and the module number of the data unit must be specified before every function call.
- Incorporating the function in the program for each data unit.
  Each function is assigned a Net-ID and a module number.
  All functions are called in one program cycle.

Any number of NET_GET function calls can be executed in one program cycle.

The function contains the "pstruNetGet" parameter at which you can set a pointer to the structure EASY_NET_GET and a variable of type EASY_NET_GET, e.g. "myEASY_NET_GET".

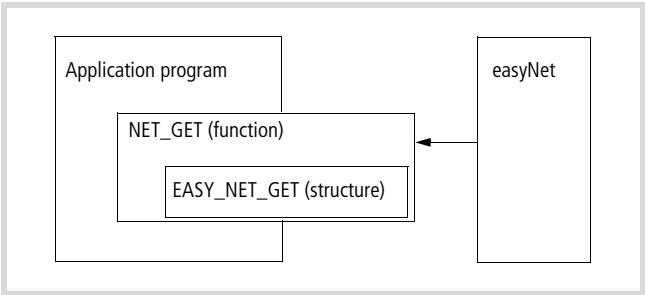


Figure 5: Get stored data from the network

→ section "EASY_NET_GET structure", page 14.

3 Structures

EASY_NET_MAIN structure

Structure layout

```
TYPE EASY_NET_MAIN:
STRUCT
INFO: EASY_NET_INFO;
SND: EASY_NET_SND;
RCV: ARRAY [1..8] OF EASY_NET_RCV;
END_STRUCT
END_TYPE
```

Structure components

The components of the major structure contain the following information:

INFO (status information of the stations):
The information is entered in the structure EASY_NET_INFO.
The data is updated when the NET_UPDATE function is called.
SND (send data):
The information must be entered in the structure EASY_NET_SND:
It is transferred with the next call of the NET_UPDATE function.
RCV (receive data):
Array of 8 elements RCV[1, … ,8]. Each element is assigned to a station. The assignment is based on the element number and the Net-ID of the station (1,…,8), which are identical. An element is of structure type EASY_NET_RCV.
The data is updated when the NET_UPDATE function is called.

EASY_NET_INFO structure

The states and the status of a station can be interrogated from the components of a structure. The "aNET_STATE" component contains an array with an element for each station. An element contains the state and status of a station.

Structure layout

```
TYPE EASY_NET_INFO:
STRUCT
byNrOfActiveDevices: BYTE;
byNrOfConfDevices: BYTE;
uiBaudrate: UINT;
byMY_NET_ID: BYTE;
aNET_STATE: ARRAY [1..8] OF EASY_NET_DEVICE;
byError: BYTE;
END_STRUCT
END_TYPE
```

Structure components

byNrOfActiveDevices (number of active stations)
byNrOfConfDevices IEC station with Net-ID1 (except XC200):
Number of stations in the configuration list. IEC stations with Net-ID2, … ,8:
Max. number of stations detected as active at the same time.
uiBaudrate (baud rate in easyNet)
byMY_NET_ID (variable shows the Net-ID of the station)
aNET_STATE (state of the stations):
Array of 8 "aNET_STATE[1,…,8]" elements. Each element is assigned to a station. The assignment is based on the element number and the Net-ID of the station (1, … ,8), which are identical. An element is of structure type EASY_NET_DEVICE. This structure stores the current state of the station.
byError (shows the last detected error in easyNet, → table 1).

Table 1: Possible error codes

0x00	No Error.
0xC0	Undefined NET-Device missing.
0xC1	NET-Device 1 missing.
0xC2	NET-Device 2 missing.
0xC3	NET-Device 3 missing.
0xC4	NET-Device 4 missing.
0xC5	NET-Device 5 missing.
0xC6	NET-Device 6 missing.
0xC7	NET-Device 7 missing.
0xC8	NET-Device 8 missing.
0xD0	Daisy-Chain Error.
0xD2	Daisy-Chain Error, too few devices on the NET-Bus available.
0xD3	Daisy-Chain Error, device with unexpected NET-ID found - BUS STOPPED.
0xD4	Daisy-Chain Error, device with unexpected NET-ID found, Net-ID changed - BUS STARTED.
0xE0	CAN-Error.
0xE1	CAN-Error, failed to open CAN-Port. Device stopped.
0xE2	CAN-Error, failed to set Baud-Rate. Device stopped.
0xE3	CAN-Error, not all COB-IDs cold be registered for reading
0xF0	Undefined Error…

The variable "byError" can be reset by setting the send variable "xAcknowledgeActiveError".

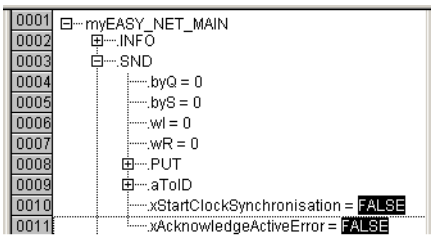


Figure 6: Status display of the structure myEASY_NET_MAIN

„xAcknowledgeActiveError":

A change from FALSE to TRUE sets the "byError" variable to zero. The system sets the variable back to FALSE after the reset.

EASY_NET_DEVICE structure

Structure layout

```
TYPE EASY_NET_DEVICE:
STRUCT
xDeviceAvailable: BOOL;
xProgram: BOOL;
xRUN: BOOL;
byDelay: BYTE;
END_STRUCT
END_TYPE
```

Structure components

xDeviceAvailable:
TRUE = Communication with station possible.
FALSE = Communication with station not possible.
xProgram: BOOL;
TRUE = The station contains a program
FALSE = The station does not contain a program
xRUN: BOOL;
TRUE = The station is in "RUN" mode.
FALSE = The station is in "STOP" mode
byDelay: BYTE;
easy station: Bus delay setting.
IEC station: Always "0".

EASY_NET_SND structure

The EASY_NET_SND structure enables the data to be sent from the user program to the protocol task. The values of the local inputs and outputs, including the outputs and inputs of an expansion module, are entered in the components byQ, byS, wI and wR.

→ The EC4-200 controller does not evaluate these components.

Structure layout

```
TYPE EASY_NET_SEND:
STRUCT
byQ:BYTE;
byS:BYTE;
wI:WORD;
wR:WORD;
PUT:EASY_NET_PUT;
aToID:ARRAY[1..8] OF EASY_NET_SNDx;
xStartClockSynchronisation:BOOL;
xAcknowledgeActiveError:BOOL;
END_STRUCT
END_TYPE
```

Structure components

byQ:

Local bit outputs Q1 to Q8
(IEC notation = byQ.0 to byQ.7).
The output states are interpreted by all other stations as current output values.

byS:

Local bit outputs S1 to S8
(IEC notation = byS.0 to byS.7).
The value is set from the user program.

wI:

Local bit inputs I1 to I16
(IEC notation = wI.0 to wI.15).
The input states are interpreted by all other stations as current input values.

wR:

Local bit inputs R1 to R16
(IEC notation = wR.0 to wR.15).
The value is set from the user program.

PUT:

The PUT component of structure type EASY_NET_PUT enables the sending of 32 data blocks of 4 bytes each in succession. These data blocks can be read by another station using a GET function block or function, → section "IEC station <-> several IEC/easy stations (double-word data exchange)", page 22.

aToID:

Array of 8 elements "aToID[1,…,8]". Each element is assigned to a station (1,…,8). The receiving station is determined by the element selected.
Enter the data in the element you wish to send. An element is of structure type EASY_NET_SNDx.

xStartClockSynchronisation:

A change from FALSE to TRUE starts the synchronisation of the station clocks to the value of the locally set clock. The synchronisation is executed on the next full minute. After this is successfully completed, the variable "xStartClockSynchronisation" is set to FALSE.

xAcknowledgeActiveError:

A change from FALSE to TRUE sets the "byError" variable to zero. After the reset, the variable "xAcknowledgeActiveError" is set to FALSE, → section "EASY_NET_INFO structure", page 9.

EASY_NET_SNDx structure

Structure layout

```
TYPE EASY_NET_SNDx :
STRUCT
byQ:BYTE;
byS:BYTE;
dwSN:DWORD;
END_STRUCT
END_TYPE
```

Structure components

byQ/byS:	
	The sending station must have Net-ID = 1. The receiving station must be of type Remote I/O!
byQ:	
	Output bits Q1 to Q8 of the selected station (IEC notation = byQ.0 to byQ.7).
byS:	
	Output bits S1 to S8 of the expansion device of the selected station (IEC notation = byS.0 to byS.7).
dwSN:	
	32 bits that are sent to the selected station, (IEC notation = dwSN.0 to dwSN.31), → section "IEC station <-> IEC/easy station (bit information)", page 20.

EASY_NET_PUT structure

The structure allows a data unit/value (DWORD format) to be put on the network that is fetched from the network by another station using the NET_GET function. Only one value can be sent.

→ If you use this structure to send values, only one task should be used.

Structure layout

```
TYPE EASY_NET_PUT :
STRUCT
xStartTransfer: BOOL;
byModuleNumber: BYTE;dwData: DWORD;
xTransferPending: BOOL;
xTransferFailed: BOOL;
END_STRUCT
END_TYPE
```

Structure components

xStartTransfer:	
	A change from FALSE to TRUE starts the sending of the data entered in the "dwData" component.
byModuleNumber:	
	Module number of the data to be sent (1 to 32).
dwData:	
	Data unit/value (DWORD format).
xTransferPending:	
	TRUE = The sending of the data is executed. Another send job cannot be executed.
	FALSE = The send function block is free. A new send job can be executed.
xTransferFailed:	
	TRUE = Data transfer faulty.
	FALSE = Data transfer ok.

→ If no station accepts the data (NET_GET), no error is indicated at "xTransferFailed".

→ section "IEC station <-> several IEC/easy stations (double-word data exchange)", page 22.

Table 2: Comparison of the parameters of the structure EASY_NET_PUT (easySoft-CoDeSys) and the inputs/outputs of the PUT function block (easySoft)

Parameter	easySoft	easySoft-CoDeSys
Data	I1	dwData
PUT number	PTxx	byModuleNumber
Strobe	T_	xStartTransfer
Active	AC	xTransferPending
Started	Q1	–
Error	E1	xTransferFailed

Put data unit/value on the network

The data unit or value is put on the network after entering the "byModuleNumber" and "dwData" parameters and a rising edge at "xStartTransfer". The output ".xTransferPending" is set temporarily to TRUE as a feedback signal. A new value can then be sent.

EASY_NET_RCV structure

The EASY_NET_RCV structure is used by the user program to fetch the data from the protocol task. The "RCV" structure component is an array of 8 elements RCV[1,…,8]. The elements are of structure type "EASY_NET_RCV". Each element is assigned to a station (1,…,8) into which the station writes the data. The received data is scanned by reading out an element such as "myEASY_NET_MAIN.RCV[2].byQ".

The data is refreshed with every call of the Net_Update function.

Structure layout

```
TYPE EASY_NET_RCV:
STRUCT
byQ:BYTE;
byS:BYTE;
wI:WORD;
wR:WORD;
dwRN:DWORD;
END_STRUCT
END_TYPE
```

Structure components

byQ:	
	Output bits Q1 to Q8 of the sending station (IEC notation = byQ.0 to byQ.7).
byS:	
	Output bits S1 to S8 of the sending station (expansion device) or an XC200 controller (IEC notation = byS.0 to byS.7).
wI:	
	Input bits I1 to I16 of the sending station (IEC notation = wI.0 to wI.15).
wR:	
	Input bits R1 to R16 of the sending station (expansion device) (IEC notation = wR.0 to wR.15).
dwRN:	
	32-bit data of the sending station (IEC notation = dwRN.0 to dwRN.31).

→ section "IEC station <-> IEC/easy station (bit information)", page 20.

EASY_NET_GET structure

Structure layout

```
TYPE EASY_NET_GET :
STRUCT
byNET_ID: BYTE;
byModuleNumber: BYTE;
xNewDataReceived: BOOL;
byReceiveCount: BYTE;
dwGet_Data: DWORD;
byError: BYTE;
END_STRUCT
END_TYPE
```

Structure components

For this you must have parameterised a variable, such as "myEasy_Net_Get" of structure type EASY_NET_GET. The components of the structure contain the following information.

byNET_ID:
This is where the Net-ID is entered of the station that has put the data onto the network.
byModuleNumber:
This is where the module number is entered of the data unit to be fetched.
xNewDataReceived:
TRUE: New data received.
FALSE: No new data present at the specified address. The last data entered is transferred.
byReceiveCount:
This variable contains the number of telegrams that were received (cyclical counter that moves back from 16#FF to 16#00).
dwGET_Data:
This contains the received data in a double word.
byError:
0: Data successfully read.
1: Error when reading data.

Table 3: Comparison of the parameters of the NET_GET function (easySoft-CoDeSys) and the inputs/outputs of the GET function block (easySoft)

Parameter	easySoft	easySoft-CoDeSys
Function block number	GTxx	–
Receive data	Qv	dwGet_Data
Module number	PTxx	byModuleNumber
Net-ID of the sending station	NET_ID	byNET_ID
New value present	Q1	xNewDataReceived
Receive counter	–	byReceiveCount
Error	–	byError

4 Applications

Data can be sent and received in several ways. The data transfer depends on the type of station (IEC or easy station) and is described below. A structure overview here shows the components of structures that must be parameterised according to the type of data transferred. The entire structure tree is shown as it is displayed in online mode in the Status display.

IEC station <- IEC/easy station (I/O information)

An IEC station scans the inputs/outputs (bit data) of IEC or easy stations, e.g. EC4-200/easy800. The data transfer is cyclical.

The EC4-200 and easy800 stations (also as remote I/O) with their EASY202-RE or EASY6…-RE/-TE expansion devices provide the bit data of their local inputs/outputs. They can be scanned by any station with a user program, including XC200, with the "Net_Update" function using the "myEASY_NET_MAIN.RCV" structure.

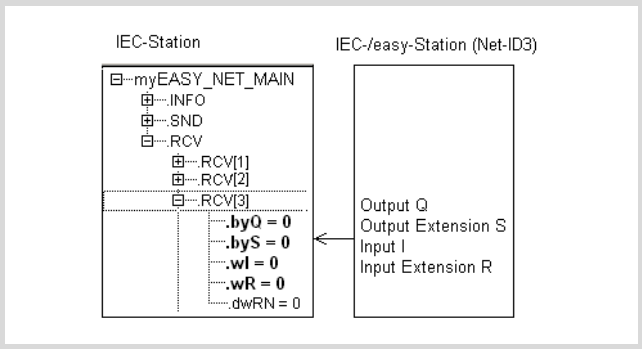
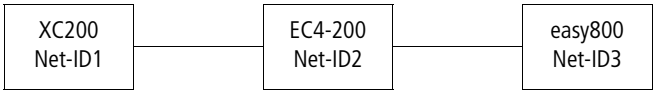


Figure 7: Online display: IEC station (Net-ID1) scans the inputs/ outputs of the device (Net-ID3)

Example



XC200 scans:

1. the local input 1 of the EC4-200 (Net-ID2),
2. the local input 3 of the easy800 (Net-ID3).

This requires the following programming:

```
VAR
myEASY_NET_MAIN: EASY_NET_MAIN;
x1NetID2 :BOOL;
x3NetID3 :BOOL;
END_VAR


Net_Update(byNetDrvNr:=0,
pstruNetMain:=ADR(myEASY_NET_MAIN));
(* read input *)
X1NetID2:=myEASY_NET_MAIN.RCV[2].wI.0;
(*input1 of EC4-200*)
X3NetID3:=myEASY_NET_MAIN.RCV[3].wI.2;
(*input3 of easy800*)
```

If in the easy 800 (Net-ID3) the inputs 3, 5, 8, 9 = TRUE and outputs 1, 3 = TRUE, the status display of the XC200 (Net-ID1) will show the following structure:

"myEASY_NET_MAIN" structure	
INFO	
SND	
RCV	
RCV[3]	I/O of the easy800 (Net-ID3)
.byQ=16#05	The outputs 1 and 3 are TRUE.
.byS=16#00	The outputs of the expansion (not present).
.wI=16#2194	The inputs 3, 5, 8 and 9 are TRUE.
.wR=16#0000	The inputs of the expansion (not present).

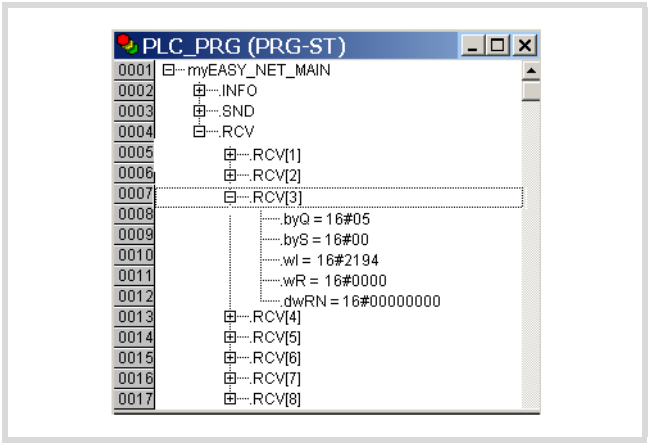


Figure 8: Online status display: IEC station (Net-ID1) scans the inputs/outputs of the device (Net-ID3)

IEC station (Net-ID1) -> Remote I/O station, e.g. easy800 (I/O information)

An IEC station sets the outputs of a remote I/O station. The data transfer is cyclical.

→ Only the station with Net-ID1 can set the outputs of a remote I/O station, e.g. easy800.

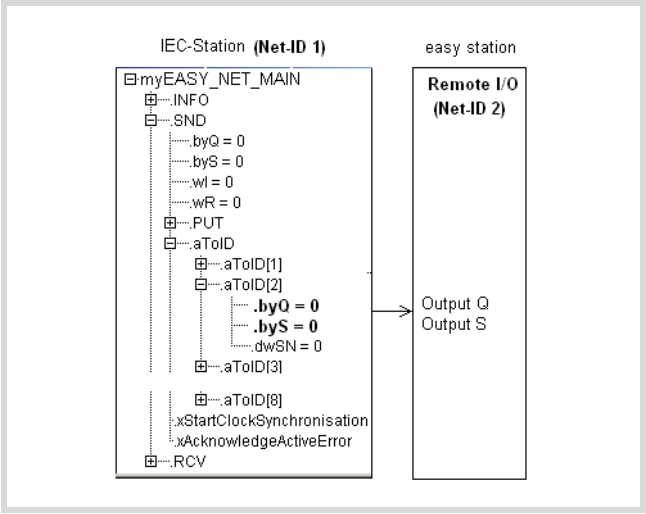
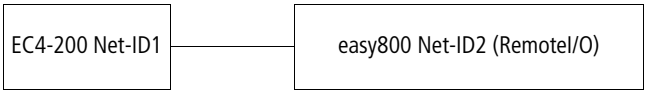


Figure 9: Online display: Set outputs of the remote I/O device

Example
The IEC station (Net-ID1) sets the output 3 of the easy800 (Net-ID2).



This requires the following programming:

```
VAR
myEASY_NET_MAIN: EASY_NET_MAIN;
END_VAR

Net_Update(byNetDrvNr:=0,
pstruNetMain:= ADR(myEASY_NET_MAIN));
(* write Output *)
myEASY_NET_MAIN.SND.aToID[2].byQ.2:=TRUE;
```

The following structure for the device (Net-ID 2) is shown in the status display of the device with station Net-D1:

"myEASY_NET_MAIN" structure

INFO	
SND	
–	
aToID[1]	
aToID[2]	Outputs of easy800.
.byQ=16#04	Output 3 (TRUE) is sent to Net-ID2.
.byS=16#00	The outputs of the expansion (not present)
.dwSN= 16#00000000	No function.

IEC station (Net-IDx) <-> EASY223-SWIRE gateway (I/O information)

The data transfer between an IEC station and the EASY223-SWIRE gateway via the easyNet uses the same functions as between an IEC station and easy800.

16 modules can be connected to the gateway. A module can send up to 4 input signals (SI) and one diagnostics signal (SD) to the gateway. The signals can be scanned by several stations.
A selected station can conversely send two signals (SQ) to a module via the gateway.

The signals between IEC stations/EASY223-SWIRE and two SmartWire modules are shown in figure 10. The meaning of the signals is provided in the module descriptions.

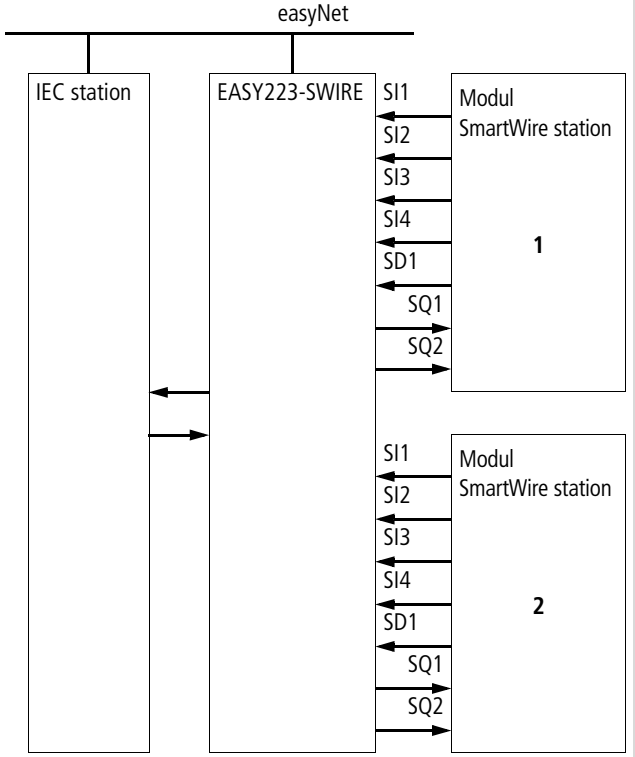


Abbildung 10: Data transfer
IEC <-> EASY223-SWIRE <-> Modules

SI = Input signal
SQ = Output signal
SD = Diagnose signal

Example

easy-Net connection between IEC station and EASY223-SWIRE.

IEC station Net-ID1	easyNet	EASY223-SWIRE (Gateway) Net-ID2	1	2	3	…	16
			SmartWire modules				

IEC station (Net-IDx) <- EASY223-SWIRE gateway (I/O information)

An IEC station scans the input/diagnostics data of the modules. The data transfer is cyclical.
The inputs/diagnostics inputs of the modules can be scanned by each station, "→ section "IEC station <- IEC/easy station (I/O information)".

The "myEASY_NET_MAIN.RCV[2]" structure in figure 11 shows the allocation between the operands of the IEC station and the outputs of a SmartWire module. In this example the gateway has Net-ID 2.

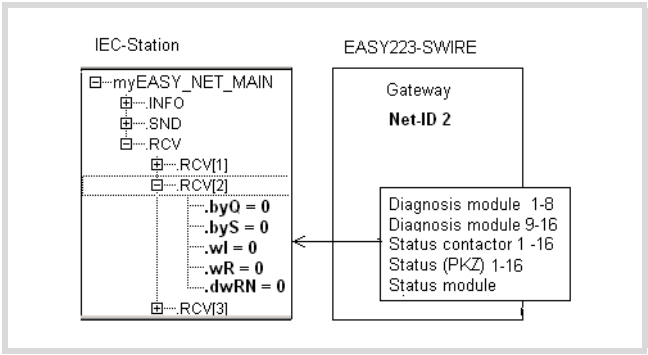


Figure 11: Scanning of module signals from EASY223-SWIRE (Net-ID2)

Signal scan of the EASY223-SWIRE

Module no. 1

Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand RCV[x]
SI 1	Coil status	.wI.0
SI 2	PKZ	.wR.0
SI 3	No function	.dwRN.0
SI 4	No function	.dwRN.16
SD 1	Diagnostics	.byQ.0

Module no. 2

Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand RCV[x]
SI 1	Coil status	.wI.1
SI 2	PKZ	.wR.1
SI 3	No function	.dwRN.1
SI 4	No function	.dwRN.17
SD 1	Diagnostics	.byQ.1

etc. up to

Module no. 8

Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand RCV[x]
SI 1	Coil status	.wI.7
SI 2	PKZ	.wR.7
SI 3	No function	.dwRN.7
SI 4	No function	.dwRN.23
SD 1	Diagnostics	.byQ.7

Module no. 9

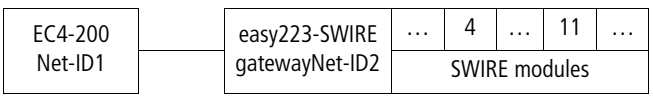
Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand RCV[x]
SI 1	Coil status	.wI.8
SI 2	PKZ	.wR.8
SI 3	No function	.dwRN8
SI 4	No function	.dwRN.24
SD 1	Diagnostics	.byS.0

etc. up to

Module no. 16

Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand RCV[x]
SI 1	Coil status	.wI.15
SI 2	PKZ	.wR.15
SI 3	No function	.dwRN.15
SI 4	No function	.dwRN.31
SD 1	Diagnostics	.byS.7

Example
The EC4-200 (Net-ID1) reads the input I1 of module 4 and I1 of module 11.



This requires the following programming:

```
VAR
myEASY_NET_MAIN: EASY_NET_MAIN;
X3NetID2
X1ONetID2
END_VAR

Net_Update(
byNetDrvNr=0,
pstruNetMain = ADR(myEASY_NET_MAIN));
(* read input *)
X3NetID2:= myEASY_NET_MAIN.RCV[2].wI.3;
X1ONetID2:=myEASY_NET_MAIN.RCV[2].wI.10;
```

IEC station (Net-IDn) -> EASY223-SWIRE gateway (I/O information)

An IEC station sends output signals to the modules (→ example, page 19). The data transfer is cyclical.

If a SmartWire gateway is integrated in an easyNet network, you define a station (n) in easySoft which sets the outputs of the modules that are connected to the gateway.

→ Only a selected station can set the outputs on one or several SmartWire gateways.

The structure in the status display of an IEC station shows the assignment between the operand of an IEC station and the output of a SmartWire module.

"myEASY_NET_MAIN" structure

INFO	
SND	
–	
aToID[1]	
aToID[2]	Outputs of the modules of the EASY223-SWIRE
.byQ=16#00	
.byS=16#00	
.dwSN= 16#00000000	dwSN.0 to dwSN.15 = Output module 1 to 16 (e.g. control of the contactor coils)

Send signals to EASY223-SWIRE
Module no. 1

Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand aToID[x]
SQ1	Coil	.dwSN.0
SQ2	No function	.dwSN.16

Module no. 2

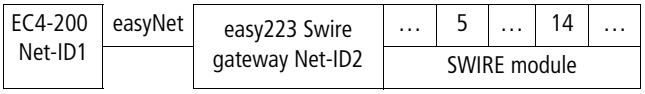
Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand aToID[x]
SQ1	Coil	.dwSN.1
SQ2	No function	.dwSN.17

etc. up to

Module no. 15

Signal	EASY223-SWIRE Signal meaning Example SWIRE-DIL	IEC station Operand aToID[x]
SQ1	Coil	.dwSN.15
SQ2	No function	.dwSN.31

Example
The EC4-200 (Net-ID1) sets the output "SQ1" of module 5 and 14.



This requires the following programming:

```
VAR
myEASY_NET_MAIN: EASY_NET_MAIN;
END_VAR

Net_Update(
byNetDrvNr:=0 ,
pstruNetMain:= ADR(myEASY_NET_MAIN));
(* write Output *)
myEASY_NET_MAIN.SND.aToID[2].dwSN.4:=TRUE;
myEASY_NET_MAIN.SND.aToID[2].dwSN.13:=TRUE;
```

IEC station <-> IEC/easy station (bit information)

Each station can send a single bit or a data block with up to 32 bits (SN operand) to another station. These bits are scanned (RN operand) in the receiving station. The bits, or network markers, are combined in a 32-bit data block.

Each station has one send and one receive data block (→ figure 12) for communication with the seven other network stations. The send and receive data blocks are arranged in a one-dimensional array, consisting of 8 elements. There is a direct allocation between the send data block of a station and the receive data block of another station. The position of the data block in the send array, specified for example on an IEC station in the aToID structure element, corresponds to the Net-ID of the receiving station.

The position of the data block in the receive array, which for example is specified on an IEC station in the RCV structure component, corresponds to the Net-ID of the sending station. The data exchange on the bus is cyclical.

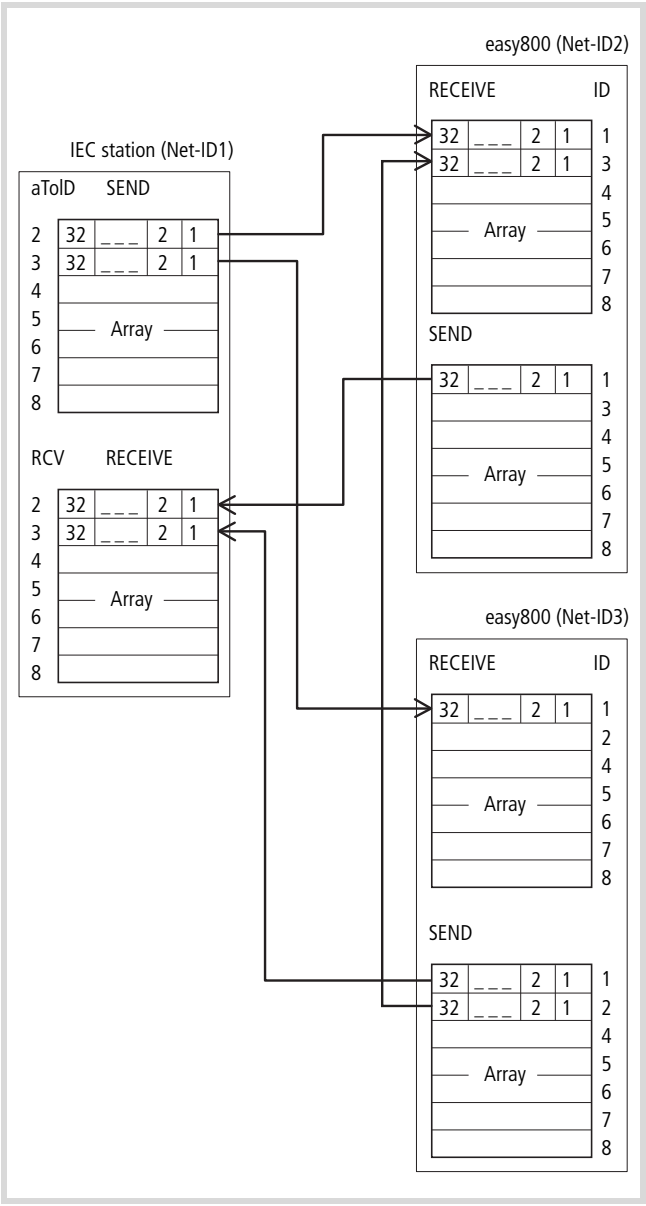


Figure 12: Overview of data blocks

Example 1
Transfer IEC station (Net-ID1) -> easy station (Net-ID2).

An IEC station (Net-ID1) is required to send network marker 1 (dwSN.0) or a 32-bit value to the easy station Net-ID2.

Access to the network master is implemented using the data structure "myEASY_NET_MAIN" with the ".SND.aToID[x].dwSN" component (double word)
(IEC notation = dwSN.0 to dwSN.31).

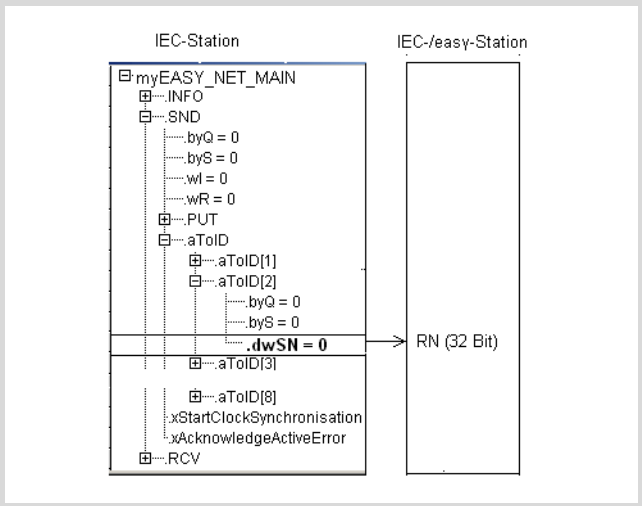


Figure 13: Structure overview, send 32 bits

The following program is required for the IEC station Net-ID1:

```
VAR
myEASY_NET_MAIN: EASY_NET_MAIN;
END_VAR

Net_Update(
byNetDrvNr:=0 ,
pstruNetMain :=ADR(myEASY_NET_MAIN));
(* set dwSN.0 = TRUE*)
myEASY_NET_MAIN.SND.aTo[2].dwSN.0:=TRUE;
or
(* set value = 5 *)
myEASY_NET_MAIN.SND.aToID[2].dwSN:=5;
```

In the easy station (Net-ID2), the individual network marker 1 can be processed by scanning network marker 1RN1. Or the value can be scanned by scanning network markers 1RN1 or 1RN32.

Example 2
Transfer IEC station (Net-ID1) <- easy station (Net-ID3).

An IEC station (Net-ID3) is required to transfer the value = 7 (3hex) to the IEC station (Net-ID1). In the easy station, the network markers 1SN1,1SN2,1SN3 must be set to TRUE. In the IEC station (Net-ID1) the structure component "RCV[x].dwRN" (double word) must be programmed (IEC notation = dwRN.0 to dwRN.31).

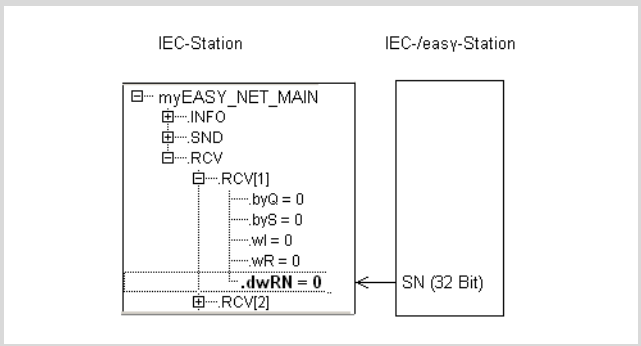


Figure 14: Structure overview, receive 32 bits

The following program is required for scanning the value in the IEC station Net-ID1:

```
VAR
myEASY_NET_MAIN: EASY_NET_MAIN;
Inpval: DWORD;
END_VAR

Net_Update(byNetDrvNr:=0,
pstruNetMain := ADR(myEASY_NET_MAIN));
(* Demand value *)
Inpval := myEASY_NET_MAIN.RCV[3].dwRN;
```

IEC station <-> several IEC/easy stations (double-word data exchange)

This uses the PUT-GET principle, i.e.

- PUT = Put data unit on the network
- GET = Get data unit from the network.

According to this principle, an IEC station puts onto the network a data unit (double word) that is identified by a module number (MN number). For this it uses the PUT (PUT function) which is part of the NET_UPDATE function.

For this, easy stations use the PUT function block.

The fetching of the data depends on the station type:

- IEC stations fetch the data unit using the NET_GET function,
- Easy stations use the GET function block.

In order to select the data unit, the NET_GET function or the function block must contain the Net-ID of the sending station and the module number of the data unit.

The access to the data in the network using the PUT and NET_GET functions is shown in figure 15.

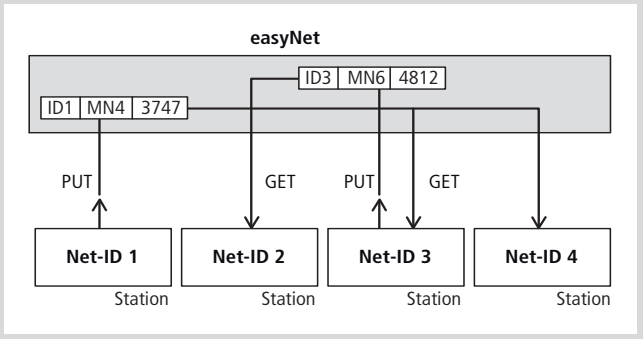


Figure 15: Example with PUT- and NET_GET functions

Two of the stations each use the PUT function to put onto the network a data unit, identified with the Net-ID number of the sender and the module number (MN). Net-ID1 has the value 3747, module number 4, and Net-ID3 the value 4812, module number 6.

The stations (Net-ID3) and (Net-ID4) fetch the data unit 3747 with the NET_GET function, and station (Net-ID2) fetches the data unit 4812.

The following tables show the functions and function blocks for sending and fetching the data.

IEC station (sender)	Network	IEC station (receiver)
Function: NET_UPDATE (PUT)	Data	Function: NET_GET

IEC station (sender)	Network	easy station (receiver)
Function: NET_UPDATE (PUT)	Data	Function block: GET

easy station (sender)	Network	easy station (receiver)
Function block: PUT	Data	Function: NET_GET

PUT function (PUT structure element)

Each IEC station can use the PUT function to send onto the network sequential data, identified by the MN/PT numbers 1, 2, … ,32. The data is sent onto the network cyclically via a data sluice with one data unit sent in each cycle.

Call the NET_UPDATE function to activate the PUT function.

Example
The following program is required for executing the PUT function:

```
PROGRAM PLC_PRG
VAR
myEASY_NET_MAIN: EASY_NET_MAIN;
END_VAR

Net_Update(
byNetDrvNr:= 0 ,pstruNetMain:= ADR(myEASY_NET_MAIN));
```

Structure overview of EASY_NET_MAIN with PUT
PUT, of type Easy_Net_PUT, has the following structure:

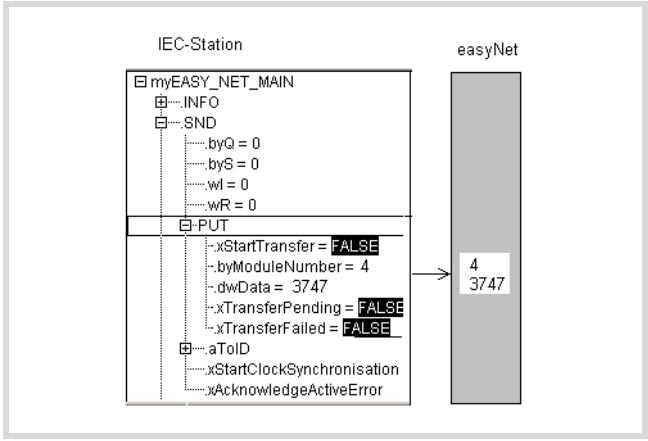


Figure 16: EASY_NET_PUT structure

Executing the PUT function

The following program sequence enables an IEC station to execute a PUT function.

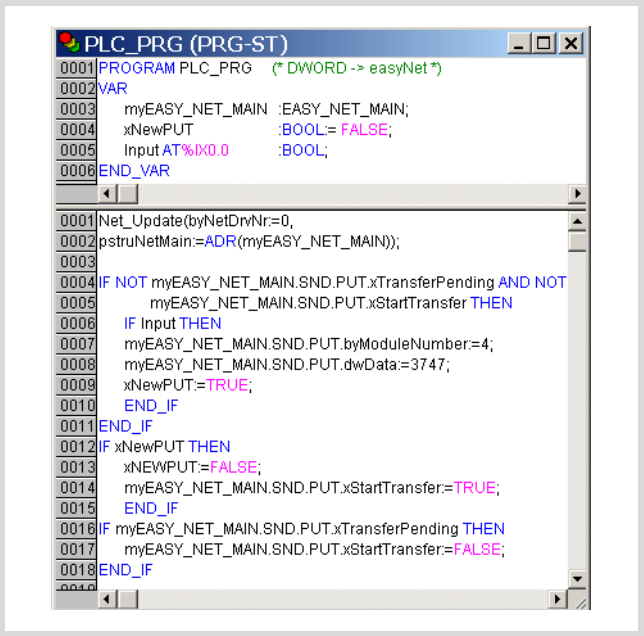


Figure 17: Program example of the PUT function

After entering the parameters "byModuleNumber" = 4 and "dwData" = 3747 and a rising edge at "xStartTransfer" the data unit is put onto the network. The ".xTransferPending" output is set momentarily to TRUE as a feedback signal, after which a new PUT function can be sent.

→ An error is not indicated for ".xTransferFailed" if no station receives the data with the NET_GET function.

Example

In order to put data sequentially onto the network, the following program is required:

```
PROGRAM PLC_PRG (*Program for XC200*)
(*The XC200 sends 3 data telegrams to the network*)
VAR
     sEasyNetMain           :EASY_NET_MAIN;
     bNetUpdate             :BOOL;
     byState                :BYTE;
     xNewPUTMsgToTransmit   :BOOL := FALSE;
END_VAR
VAR_INPUT
     dwnumb: DWORD;
END_VAR

(*Program*)
dwnumbl:=dwnumb+1;

bNetUpdate:=Net_Update(0, ADR(sEasyNetMain));
IF NOT sEasyNetMain.SND.PUT.xTransferPending AND NOT
                          sEasyNetMain.SND.PUT.xStartTransfer THEN
     (*A new data telegram can be transferred.*)
     IF sEasyNetMain.SND.PUT.xTransferFailed THEN
                          ; (* Error on transferring the last data telegram. *)
     END_IF
     (* In the Case instruction, the values (addressing and data) of the next data telegram to be sent are entered.*)
     CASE (byState) OF
     0:                   (* Application Data Telegram 1*)
                            sEasyNetMain.SND.PUT.byModuleNumber := 1;
                            sEasyNetMain.SND.PUT.dwData := dwnumb;
                            xNewPUTMsgToTransmitt := TRUE; (* ready for send*)
                            byState:=1;
     1:                   (* Application Data Telegram 2 *)
                            sEasyNetMain.SND.PUT.byModuleNumber := 2;
                            sEasyNetMain.SND.PUT.dwData := 22;              xNewPUTMsgToTransmitt := TRUE; (* ready for send*)
                            byState:=2;
     2:                   (* Application Data Telegram 3*)
                            sEasyNetMain.SND.PUT.byModuleNumber := 3;
                            sEasyNetMain.SND.PUT.dwData := 33;              xNewPUTMsgToTransmitt := TRUE; (* ready for send*)
                            byState:=0;
     END_CASE
END_IF
IF xNewPUTMsgToTransmit THEN
     (* Start of the send operation by setting the Start flag.*)
     xNewPUTMsgToTransmit := FALSE;
     sEasyNetMain.SND.PUT.xStartTransfer := TRUE;
END_IF
IF sEasyNetMain.SND.PUT.xTransferPending THEN
     (* The data transfer is active, Start flag can be reset.*)
     sEasyNetMain.SND.PUT.xStartTransfer := FALSE;
END_IF
```

The NET_GET function

Calling the NET_GET function enables you to read (get) data from the network that was placed there by other stations on it using the PUT function. Calling the function only allows you to "get" one data unit.

Call the NET_GET function to activate the function of the same name.

Example
The following program is required for executing the NET_GET function:

```
PROGRAM PLC_PRG
VAR

myEasyNetGet : EASY_NET_GET;
END_VAR
NET_GET(0,ADR(myEasyNetGet));
```

The structure of EASY_NET_GET is shown in the following online display:

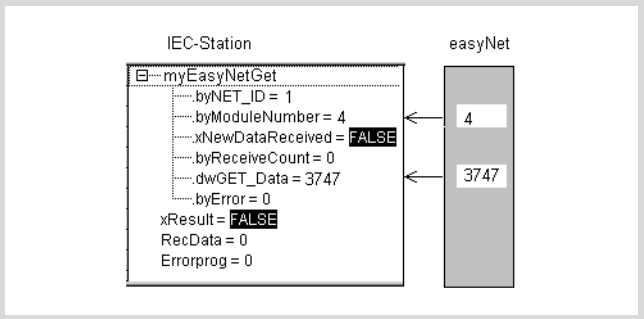


Figure 18:EASY_NET_GET structure

Executing the NET_GET function

The following program sequence enables an IEC station to execute a NET_GET function.

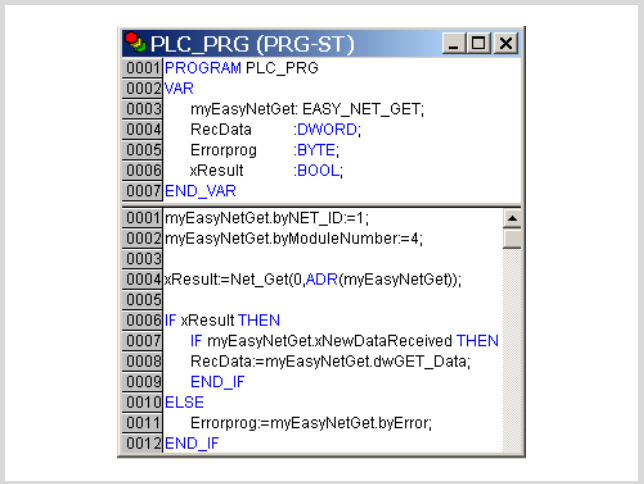


Figure 19: Program example of the NET-GET function

After the parameters for the "byNET_ID" = 1 and "byModuleNumber" = 4 components are set, a cyclical call of the NET_GET function is initiated. The "xNewDataReceived" variable must be scanned continuously. If the variable is TRUE, a new data unit is received. It is presented at the "dwData" component.

Example
Fetching several modules from the network.

With the following program for an EC4-200, Net-ID2, the modules 1, 2 and 3 are fetched from the network that are put there by the station with Net-ID1.

```
PROGRAM PLC_PRG
VAR
myEasyNetGet: EASY_NET_GET;
bNetUpdate: BOOL;
byState: BYTE;
xSuccess: BOOL;
RecData: DWORD;
xReceive: BOOL;
Errorflag: BYTE;
RecData1: DWORD;
RecData2: DWORD;
RecData3: DWORD;
END_VAR

IF xReceive = FALSE THEN
CASE (byState) OF
0:
    myEasyNetGet.byModuleNumber := 1;
    myEasyNetGet.byNet_ID := 1;
    xReceive := TRUE;
    byState:=1;
1:
    myEasyNetGet.byModuleNumber := 2;
    myEasyNetGet.byNet_ID := 1;
    xReceive := TRUE;
    byState:=2;
2:
    myEasyNetGet.byModuleNumber := 3;
    myEasyNetGet.byNet_ID := 1;
    xReceive := TRUE;
    byState:=0;
END_CASE
END_IF
(* GET data…*)
xSuccess:=Net_Get(0, ADR(myEasyNetGet));
IF xSuccess AND xReceive THEN
  IF myEasyNetGet.xNewDataReceived THEN
    IF myEasyNetGet.xNewDataReceived THEN
    IF byState = 1 THEN
    RecData1:=myEasyNetGet.dwGet_Data;
    END_IF
    IF byState = 2 THEN
    RecData2:=myEasyNetGet.dwGet_Data;
    END_IF
    IF byState = 0 THEN
    RecData3:=myEasyNetGet.dwGet_Data;
    END_IF
  xReceive:=FALSE;
  END_IF
  ELSE
  Errorflag:=myEASYNetGet.byError;
END_IF
```

Synchronisation of the real-time clock

The real-time clocks of all easyNet stations can be set to the current time of the local real-time clock. This synchronisation can be carried out very simply.

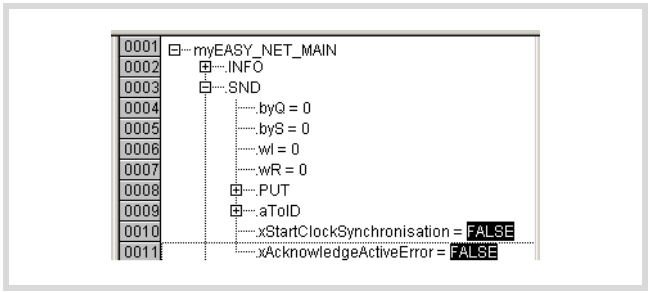


Figure 20: Data structure for the synchronisation of the real-time clock

The SND area of the "myEASY_NET_MAIN" data structure contains the variable "xStartClockSynchronisation". A change from FALSE to TRUE starts the synchronisation of the clocks to the value of the locally set clock. The synchronisation is executed on the next full minute. After this is successfully completed, the variable "xStartClockSynchronisation" is set automatically to FALSE.

5 Configuring the (easyNet) network

The easy station (Net-ID = 1) enables you to configure all other stations on the network, such as easy800, MFD-CP8-… and EC4P. The stations addressed with Net-ID 2,…,8 are assigned the communication parameters such as Net-ID, baud rate, bus delay and Send IO. The station with Net-ID1 can be an EC4-200 or an easy station such as easy800 or MFD-CP8-…

Requirements for the configuration:

- The network cannot contain an XC200.
  If the network contains an XC200 each station must be configured separately!
- The network line must not have any spur lines.
- The stations must be suitable for network configuration.
- If an IEC station is to be configured via the network, it must contain a project in which the easyNet function is activated.
- The executing station must have Net-ID = 1 and be located at the start of the line (position 1).

Carrying out the configuration

The configuration is carried out in two steps:

1. Create the configuration (enter the communication parameters),
2. Transfer parameters to the individual stations.

Configuring with easySoft-CoDeSys (Net-ID1 = IEC station)

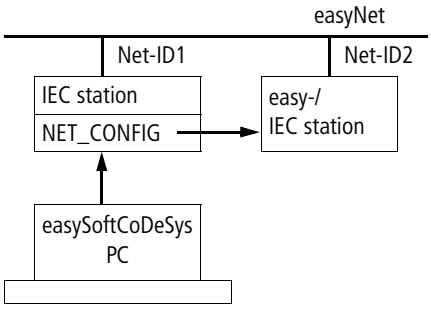


Figure 21: Network configuraton via PC (easySoft-CoDeSys)

1. Enter communication parameters
Enter in the easySoft-CoDeSys programming software the parameters for all stations.

- ▶ In the programming software call up the PLC configurator.
- ▶ Select the "CAN/easyNET" tab.
- ▶ Add a tick to the "Activate" field in the "easyNET settings" area.
- ▶ Add a 1 in the "easyNET-ID" field.
- ▶ Activate/deactivate the functions Remote Run (Net-ID = 2 … 8) and Send I/O.

Assign the other stations with a Net-ID:

- ▶ Click the "Configure easy-NET" button and select the Net-IDs for the stations, as shown in figure 22.

The activated/deactivated functions "Remote Run" and "Send I/O" apply to all selected stations.

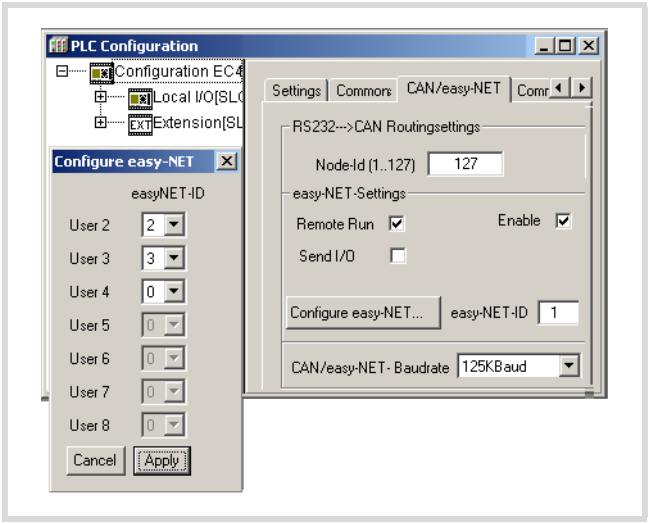


Figure 22: Entering parameters and specifying station Net-IDs

- ▶ Enter the baud rate in the CAN/easy-NET Baud rate field.

Create the user program and include the NET_CONFIG function,
→ section "Configuring with the Net_Config function", page 29.

2. Transferring the parameters to the individual stations with the NET_CONFIG software function
Transfer the project to the station with Net-ID =1. After the station is started, the NET_CONFIG function handles the transfer of the parameters to the individual stations.

Configuring with easySoft (Net-ID1 = easy or IEC station)

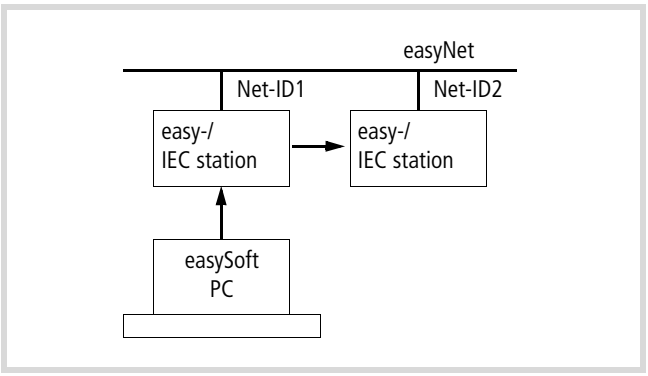


Figure 23: Network configuraton via PC (easySoft)

Create the entire network with the communication parameters for the individual stations in the easySoft programming software. Connect the PC to the station with Net-ID1. Start the transfer of the parameters from the PC to the individual stations via the menu command Communication-> Configuration -> NET.

Requirement:

- First of all load the station with the Net-ID1 with its program and configuration containing the Net-ID = 1 setting.
- If an IEC station is to be assigned Net-ID1, the easyNet setting must also be activated, → section "Configuring with easySoft-CoDeSys (Net-ID1 = IEC station)", page 27.
- Using easySoft, it is then possible to access station Net-ID1 and configure the other stations via this device.

1. Enter communication parameters

If you have placed the stations in easySoft in the Project tab, each station will have been assigned a Net-ID on the basis of its position on the line or as you have specified.

You can only enter parameters such as Remote-RUN and Sende I/O after a station has been selected.

2. Transferring the parameters and assigning Net-IDs

▶ Connect the PC with the station Net-ID1.
▶ Select online mode.
▶ Click the NET button via Communication -> Configuration.
▶ Answer the question in the Configuration NET window with 'yes' in order to load the parameters including the Net-ID to all stations.

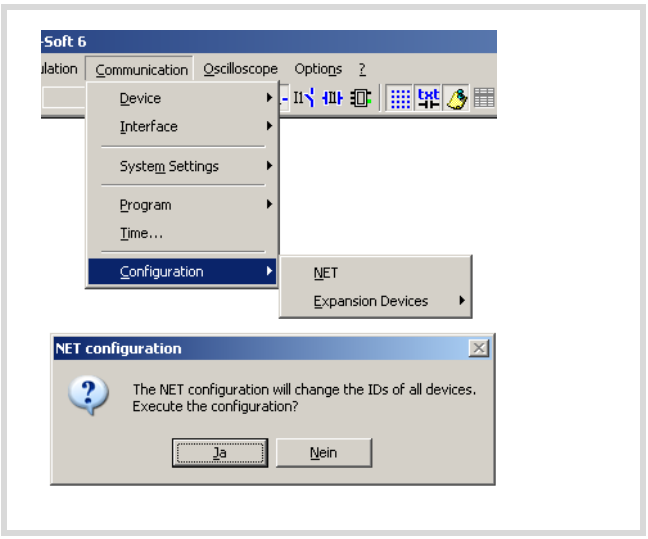


Figure 24: Carrying out the configuration, menu overview

Configuring via the device display

If you are using an easy800, MFD-CP8-… or EC4-200 with a display you can also enter the parameters via the display.

Requirement:

- You have transferred NET-ID = 1 and the baud rate to the device.
- You complete the configuration when you answer 'ok' to the question "configure?" in CONFIGURATOR -> NET -> CONFIGURE.

Configuring with the Net_Config function

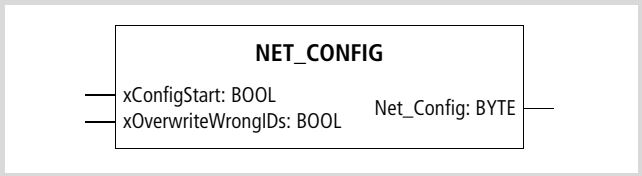


Figure 25: NET_CONFIG function

The function is contained in the library SysLibEasyNet.lib.

Description
This function enables the stations to be configured.

→ Observe the configuration requirements → section "Configuring with easySoft-CoDeSys (Net-ID1 = IEC station)", page 27!

A rising edge at the "xConfigStart" input starts the function. You can monitor the process by checking the feedback values.

Call the Net_Config function in a separate program section which is run only on request (configuration request).

Inputs of the function

- xConfigStart:
  A rising edge (FALSE->TRUE) starts the function.
- xOverwriteWrongIDs:
  If stations are connected in a network that already have an address, the user can use TRUE/FALSE at this input to set whether the existing addresses are to be retained or changed.
  – TRUE:
    Stations already with an address are assigned the addresses of the configuration.
  – FALSE:
    The existing addresses and the order of the stations are compared with the configured addresses and order. If they are not the same, the configuration is not carried out and an error message (0xFE) is output at the output variable.
- Output variables of the Net_Config function:
  – 0x00(0): No action
  – 0x01(1): Configuration completed properly
  – 0x02(2): Configuration is being carried out
  – 0xFF(-1): Station that is to carry out the configuration does not have Net-ID = 1, the address sequence is incorrect
  – 0xFE(-2): Net-ID conflict
  – 0xFD(-3): Timeout error, no answer from the addressed station
  – 0xFC(-4): Number of existing stations is more than that of the configured stations
  – 0xFB(-5): easyNet not active

Example
Programming the Net-Config function.

```
Program NETConfig
VAR
xStartAutoconfig          AT%IX0.0    :BOOL;
xOverwriteWrongIDs        AT%IX0.1    :BOOL;
xConfigStart                          :BOOL:=FALSE;
xConfigurationDone                    :BOOL:=FALSE;
siStateOf Autoconfig                  :SINT;
siErrorCode                           :SINT;
fbTriggerConfig                       :R_TRIG;
END_VAR

fbTriggerConfig(CLK:=xStartAutoconfig );
IF fbTriggerConfig.Q AND siStateOfAutoconfig = 0 THEN
  xConfigStart:= TRUE;
  xConfigurationDone:= FALSE;
  siErrorCode:= 0;
END_IF
siStateOfAutoconfig := Net_Config
(xConfigStart, xOverwriteWrongIDs);
CASE siStateOfAutoconfig OF
0:(* Waiting for start of configuration *)
; (* Do nothing *)
1:(* Configuration successfully terminated *)
  xConfigurationDone := TRUE;
  xConfigStart := FALSE;
2:(* Configuration pending*)
; (* Do nothing *)
ELSE
  (* Configuration done with error *)
  siErrorCode := siStateOfAutoconfig;(* Error handling *);
  xConfigStart := FALSE;
END_CASE
```

6 Combination of easyNet with CAN/CANopen

Combination possibilities

The combination of easyNet with CAN (different types) via a bus is always possible. Some rules must be observed depending on the CAN communication.

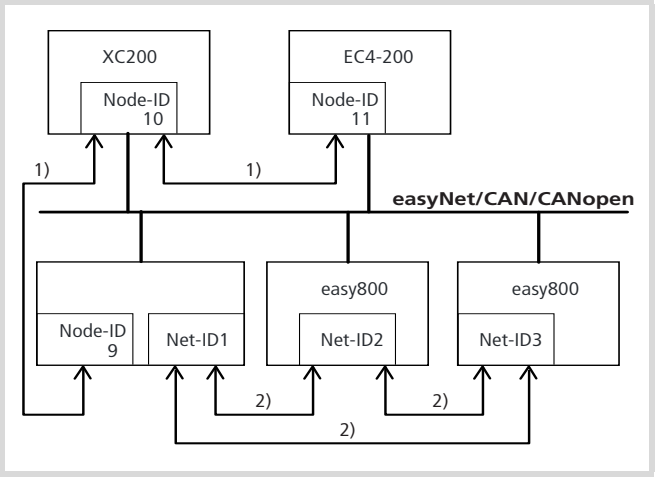


Figure 26: Data transfer possibilities in easyNet, CAN, CANopen network

1) CANopen, CAN Direct, CAN network variables.

2) easyNet.

- easyNet and CANopen
  Simultaneous use of easyNet and CANopen causes only the following Node-IDs to be available for the CANopen stations:
  – Node-IDs: 9…12; 16; 25…32.
  – A use of other Node-IDs may cause collisions with easy stations.
- easyNet and CAN Direct[1)]
  If easyNet is used with CAN Direct, the following COB-ID ranges are available (COB = Communication Object) COB-IDs 0x1:
  – 0x7f for high-priority CAN telegrams 0x781;
  – 0x7FF low-priority CAN telegrams.
- easyNet and CAN network variables[1)]
  In order to use easyNet and CAN network variables simultaneously, the following COB-ID ranges are available (COB =Communication-Object) COB-IDs 0x1:
  – 0x7f for high-priority CAN telegrams 0x781;
  – 0x7FF low-priority CAN telegrams.

1) When using CAN Direct and CAN network variables at the same time, the COB-IDs must not overlap.

Notes on operation

Controlling bus load

In an easyNet network the stations control the bus load. This ensures the transfer of all messages.

The bus load is higher in a CAN/CANopen network and in a combination of easyNet and CAN/CANopen than in an easyNet network. In this case, the parameter "SendIO/xSendIO" must be deactivated on every easy station so that the bus load can be reduced.

In order to further reduce the bus load, you can increase the bus delay time between the transfer cycles of user data for an easy station. Raise the Bus Delay parameter on the Communication Parameters tab in the easySoft Project View. The value 1 means that the bus delay time is doubled, value 15 means that the bus delay is increased by the factor of 16, see easySoft Online Hep -> Configuration of the Network.

To ensure proper data exchange, the bus load must not exceed 75 %.

→ With routing, i.e. access from the PC to a target station (not to the station that is connected to the PC), remember that an additional bus load of 15 % is possible.

Try to achieve as even a bus utilisation as possible.

Program the stations so that they cannot send the data at the same time!

Displaying the loading of the CAN bus

The user can check the bus load in easySoft-CoDeSys using the "canload" browser command.

The PLC browser command "canload" belongs to the "XC200_Util.lib" library. It indicates the loading of the CAN bus.

Display examples → fig. 27 and fig. 28, page 32.

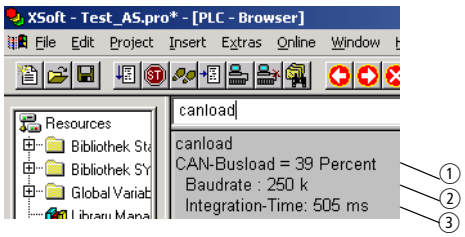


Figure 27: Loading of the CAN bus (Example 1)

① Loading of the CAN bus in the last integration interval.

② Current baud rate of the CAN bus

③ Time of the integration interval.
The integration time is set by default to 500 ms and can't be changed via the browser.

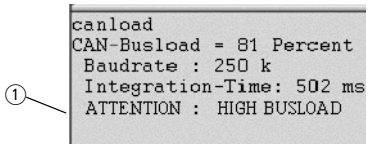


Figure 28: Loading of the CAN bus with warning message (Example 2)

① Warning message, → table 4

Table 4: Possible alarm messages

Alarm message	Meaning
ATTENTION: HIGH BUSLOAD	Loading of the CAN bus ≧ 75 %
CAN bus not activated	The CAN bus is not active
CAN-Busload = Invalid Calculation	Monitoring of the bus load has failed

Monitoring the easyNet telegram

With an XC200 or EC4-200 controller, the following example program enables the reception of easyNet telegrams to be monitored. A loss of a telegram by the controller or the overflow of a receive buffer can be detected by the user program. In this case one of the two parameters "CAN_GET_HW_OVERFLOW_COUNT" or "CAN_GET_QUEUE_OVERFLOW_COUNT" is greater than 0. The bus load must be reduced in order to prevent telegram loss.

In order to create the program, the library "SysLibCan.lib" must be incorporated. The "dwHandle" parameter must be entered according to the station type:

- A XC200 requires a "5",
- a EC4-200 requires a "6".

Program for monitoring telegrams:

```
PROGRAM PLC_PRG
VAR
MyNetMainStruct : EASY_NET_MAIN;
iHwOverflowCount: INT := 0;
iQueueOverflowCount: INT :=0;
END_VAR
VAR CONSTANT
dwHandle_XC200:DWORD:=05;
dwHandle_EC4-200:DWORD:=06;
END_VAR

iHwOverflowCount:= SysCanControl(
dwHandle:=dwHandle_XC200,
wFunction:=CAN_GET_HW_OVERFLOW_COUNT,dwParam := 0);
iQueueOverflowCount:= SysCanControl(
dwHandle := dwHandle_XC200,
wFunction := CAN_GET_QUEUE_OVERFLOW_COUNT,dwParam := 0);
IF iHwOverflowCount > 0 OR iQueueOverflowCount > 0 THEN
; (*Telegram lost.*)
END_IF
(* General bus access *)
Net_Update(ByNetDrvNr:=0 ,
pstruNetMain:= ADR(MyNetMainStruct));
```

→ The parameter "CAN_GET_HW_OVERFLOW_COUNT" for the XC200 is available from hardware version 5 (V05).

7 Programming via easyNet (Routing)

"Routing" is the ability to establish an online connection from a programming device (PC) to any desired (routing capable) station in an easyNet network, without having to directly connect the programming device with the target station. It can be connected to another station in the network.

The routing connection enables you to carry out all the operations that are also possible with a direct online connection between the programming device and the station:

- Program download
- Online modifications
- Program test (Debugging)

Routing offers the benefit of being able to access all routing capable stations on the easyNet from any station which is connected with the programming device. This makes it possible to operate remotely configured stations easily.

However, the data transfer rate with routing connections is considerably slower than with direct connections (serial or TCP/IP). This will result in slower refresh times for visualisation elements (variables) or slower download speeds.

The following requirements must be fulfilled in order to use routing:

- Both the routing station and the target station must support routing.
- Both stations must be connected via the bus.
- The stations must have the same active bus baud rate.

The routing options available are listed in the following fig. 29. If you connect the PC to a station, you can establish a connection to another station via the easyNet.

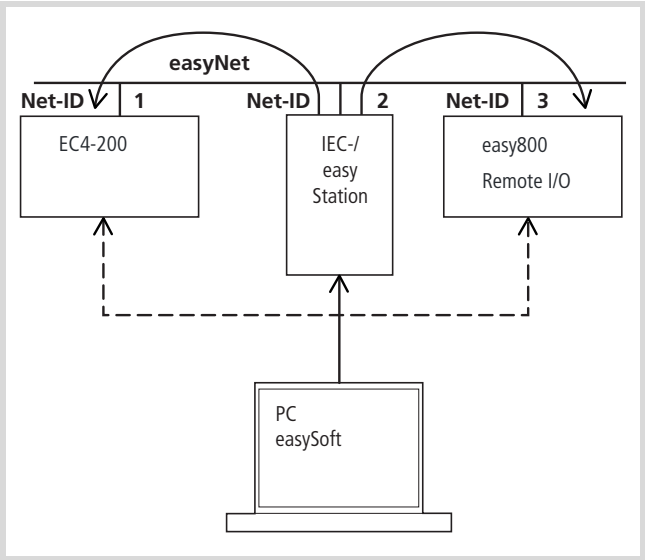


Figure 29: Routing options

Establish the connection via one of the programming interfaces of the station, e.g. RS232, USB or Ethernet.

▶ In easySoft first click the Communication button and then Connection.
▶ Select the interface:
  – Ethernet:
    Under the Ethernet profiles heading click the Edit button and enter the IP address, such as 192.168.119.200. Port = 10001
  – COMx:
    Select an interface and the baud rate (standard baud rate of the IEC stations: 38400 bits/s of easy stations 19200 bits/s).
  – COM3 (USB) only EC4-200

▶ Click on the Online button.
  The PC is connected with the station. To establish the connection to the target station, it must have a configuration with a Net-ID.
▶ Under Device select a target station with which you wish to communicate.

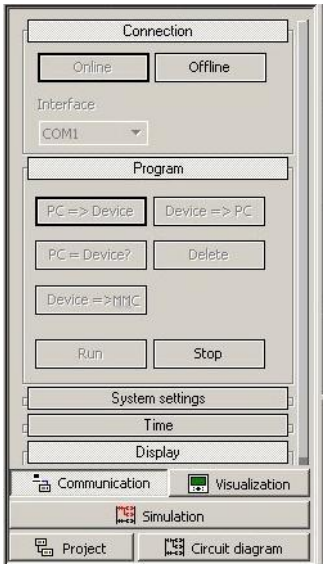


Figure 30: Program download in online mode

In online mode you can then carry out the functions in the operating fields:

Field	Function
Time	Set the local time and synchronise the device times in the network.
Program	Change between RUN and STOP.
Display	View the status of the easy-NET variables and the device information.

If you have selected an easy station as target station you can carry out a program download (click the PC -> Device button) or change parameters.

You can change the following parameters:

Baud rate	In the Project menu in the network overview
Bus delay	
REMOTE RUN	Depending on the PLC selected in the Communication parameter tab → NET Configurator
Send IO	
NET-ID	

Transfer the new settings to the stations in the following way:

- ▶ First click Communication → Program button and then the PC => Device button.
- ▶ The settings can be read from the PLC by clicking the Device => PC button.

The routing options are also available if you configure an easy station with Net-ID1 and an IEC station with Net-ID2, as in figure 31, page 34. If you then select the IEC station as target station, you can carry out the following operations with the IEC station after the easySoft communication menu is called:

- Start/stop,
- Set time
- Allow display of device information.

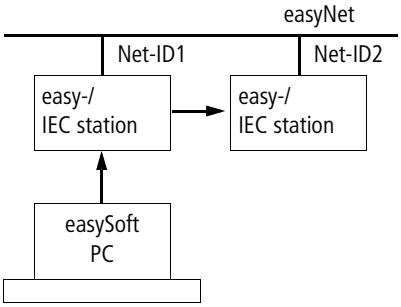


Figure 31: Routing via easy station Net-ID1 to the IEC station Net-ID2

8 Bus topology

Overview

A linear topology with optional stub lines can be implemented for the bus topology. The ends of the bus must be terminated by bus terminating resistors (120 Ω).

To transfer the data on easyNet you can set one of the baud rates of 50 Kbit/s or 125 Kbit/s on the XC200. The baud rate must be adapted at the other stations so that all stations communicate with the same baud rate.

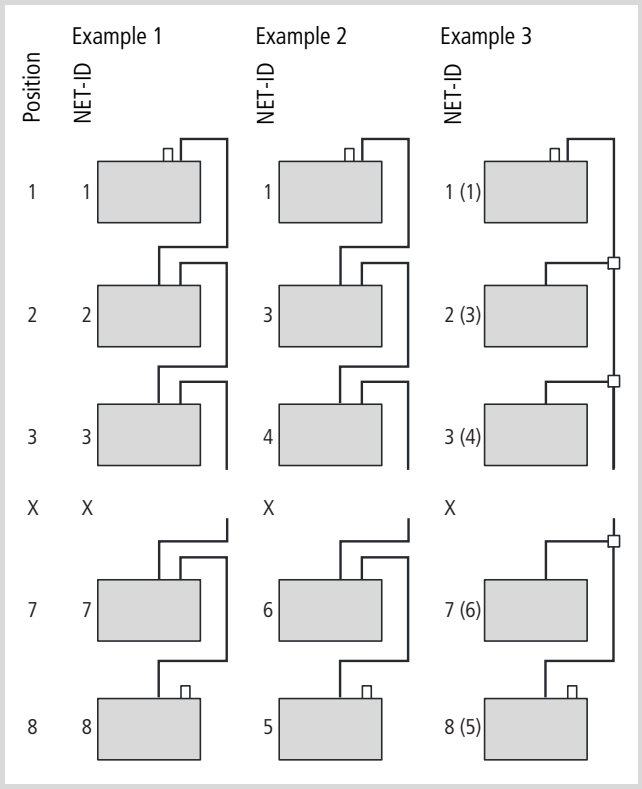


Figure 32: PLC connection options

easy/IEC station

Example 1
Geographical position same as Net-ID
Stations: EC4-200, easy800,MFD-CP8, MFD-AC-CP8
Network configuration possible

Example 2
Geographical position not same as Net-ID
Stations: EC4-200, easy800,MFD-CP8, MFD-AC-CP8
Network configuration possible

Example 3
Geographical position same or not same as Net-ID
Stations: EC4-200, easy800,MFD-CP8, MFD-AC-CP8, XC200
Network configuration possible, configure devices individually

The station at the physical location 1 is always assigned Net-ID = 1. The 7 other stations are connected to this station via the easyNet.

The IEC stations that have two easyNet connections with the signal cables (SEL_IN/SEL_OUT) can be incorporated as in the easyNet, → fig. 32.

→ The XC200 has two CAN/easy-NET interfaces in one plug connector. Unlike other devices, however, it does not have a signal cable (SEL_IN/OUT)!
The cables of both interfaces are internally connected with each other. They can be incorporated into the network as shown in fig. 32, example 3.

If you connect the stations as shown in figure 32, example 3, you must connect the connection cable between the stations and the T connectors as follows:

The easyNet stations have one input and one output channel for connecting to the easyNet. The bus cable is connected to the station with Net-ID 1 on the output channel and via the T connectors to which the input channels of the other stations are connected.

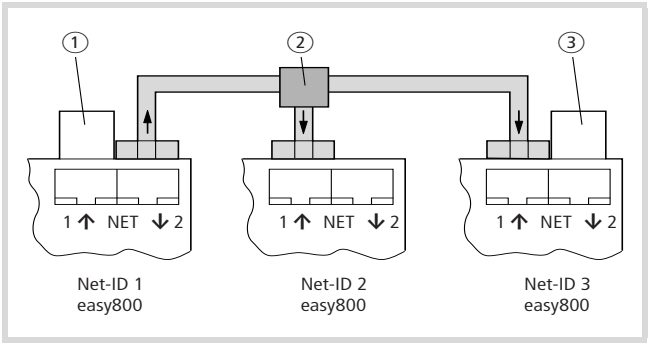


Figure 33: easyNet network with T connector

① Bus termination resistor
② T connector
③ Bus termination resistor

Table 5: Signal connection between the stations

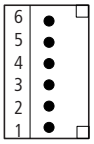
IEC station	↔	easy station
ECAN_H		ECAN_H
ECAN_L		ECAN_L
GND		GND
SEL_IN (Net-IDn)		SEL_OUT (Net-IDn-1)
SEL_OUT (Net-IDn)		SEL_IN (Net-IDn+1)

n = 1..8

CANopen/easyNet interface

XC200

Table 6: Assignment of the CANopen/easyNet interface of the XC200

	Terminal	Signal	
		CANopen	easyNet
	6	GND	GND
	5	CAN_L	ECAN_L
	4	CAN_H	ECAN_H
	3	GND	GND
	2	CAN_L	ECAN_L
	1	CAN_H	ECAN_H

Terminals 1 and 4, 2 and 5, 3 and 6 are internally connected.

EC4-200, easy800, MFD-(AC-)CP8

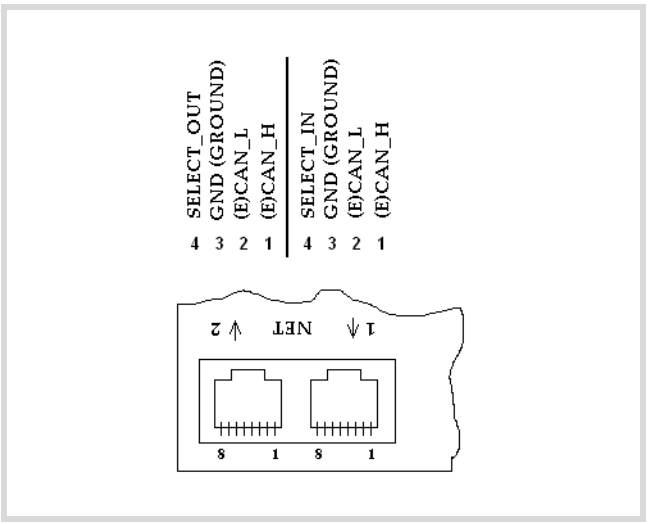


Figure 34: CAN/easyNet interfaces

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