Options for ABB drives, converters and inverters

User's manual
FEPL-02 Ethernet POWERLINK adapter module

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List of related manuals

See section *Related manuals* on page *14*.

User’s manual

FEPL-02 Ethernet POWERLINK adapter module

3AUA0000123527 Rev A
EN
EFFECTIVE: 2012-10-04

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1

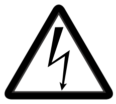
Safety

What this chapter contains

The chapter presents the warning symbols used in this manual and the safety instructions which you must follow when installing or connecting an optional module to a drive, converter or inverter. If ignored, physical injury or death may follow, or damage may occur to the equipment. Read this chapter before you start the installation.

Use of warnings

Warnings caution you about conditions which can result in serious injury or death and/or damage to the equipment and advise on how to avoid the danger. The following warning symbols are used in this manual:



WARNING! Danger; electricity warns of high voltage which can cause physical injury and/or damage to the equipment. Electricity warning warns of hazards from electricity which can cause physical injury and/or damage to the equipment.

WARNING! General danger warns about conditions, other than those caused by electricity, which can result in physical injury and/or damage to the equipment.

Safety in installation

These warnings are intended for all who install or connect an optional module to a drive, converter or inverter and need to open its front cover or door to perform the work.

WARNING! Ignoring the following instructions can cause physical injury or death, or damage to the equipment.

- Only qualified electricians are allowed to install and maintain the drive, converter or inverter!
- Disconnect the drive, converter or inverter to which the module will be installed or connected from all possible power sources. After disconnecting, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you proceed.
- Switch off all dangerous voltages connected to other control signal connectors in reach. For example, 230 V AC may be connected from outside to a relay output of the drive, inverter or converter.
- Always ensure by measuring with a multimeter (impedance at least 1 Mohm) that there are no parts under voltage in reach.

2

About the manual

What this chapter contains

This chapter introduces this manual.

Applicability

This manual applies to the FEPL-02 Ethernet POWERLINK adapter module (+K470), SW version 0.16 or later.

Compatibility

The FEPL-02 Ethernet POWERLINK adapter module is compatible with the following drives:

- ACS355
- ACSM1
- ACS850
- ACQ810
- ACS880.

The FEPL-02 Ethernet POWERLINK adapter module is compatible with all master stations that support the Ethernet POWERLINK protocol.

Target audience

The reader is expected to have a basic knowledge of the fieldbus interface, electrical fundamentals, electrical wiring practices and how to operate the drive.

Purpose of the manual

The manual provides information on installing, commissioning and using an FEPL-02 Ethernet POWERLINK adapter module.

Related manuals

	Code (English)
Drive user's manuals	
ACS355 drives (0.37…22 kW, 0.5…30 hp) user's manual	3AUA0000066143
Drive hardware manuals and guides	
ACSM1-204 regen supply modules (5.3 to 61 kW) hardware manual	3AUA0000053713
ACSM1-04 drive modules (0.75 to 45 kW) hardware manual	3AFE68797543
ACSM1-04 drive modules (55 to 110 kW) hardware manual	3AFE68912130
ACSM1-04Lx liquid-cooled drive modules (55 to 160 kW) hardware manual	3AUA0000022083
ACS850-04 (0.37…45 kW) hardware manual	3AUA0000045496
ACS850-04 (55…160 kW, 75…200 hp) hardware manual	3AUA0000045487
ACS850-04 (200…500 kW, 250…600 hp) hardware manual	3AUA0000026234
ACQ810-04 drive modules (0.37…45 kW, 0.5…60 hp) hardware manual	3AUA0000055160
ACQ810-04 drive modules (55 to 160 kW, 75 to 200 hp) hardware manual	3AUA0000055161

	Code (English)
ACQ810-04 drive modules (200…400 kW, 250…600 hp) hardware manual	*3AUA0000055155*
ACS880-01 (0.55 to 250 kW, 0.75 to 350 hp) hardware manual	*3AUA0000078093*

Drive firmware manuals and guides	
ACSM1 motion control program firmware manual	*3AFE68848270*
ACSM1 speed and torque control program firmware manual	*3AFE68848261*
ACSM1 regen supply control program firmware manual	*3AUA0000052174*
ACS850 standard control program firmware manual	*3AUA0000045497*
ACQ810 standard pump control program firmware manual	*3AUA0000055144*
ACS880 primary control program firmware manual	*3AUA0000085967*

Option manuals and guides	
FEPL-02 Ethernet POWERLINK adapter module user's manual	*3AUA0000123527*

You can find manuals and other product documents in PDF format on the Internet. See section *Document library on the Internet* on the inside of the back cover. For manuals not available in the Document library, contact your local ABB representative.

Before you start

It is assumed that the drive is installed and ready to operate before you start the installation of the adapter module.

In addition to conventional installation tools, have the drive manuals available during the installation as they contain important information not included in this manual. The drive manuals are referred to at various points of this manual.

Contents

The manual consists of the following chapters:

- *Safety* presents the safety instructions which you must follow when installing a fieldbus adapter module.
- *About the manual* introduces this manual.
- *Overview of the Ethernet POWERLINK network and the FEPL-02 module* contains a short description of the Ethernet POWERLINK network and the adapter module.
- *Mechanical installation* contains a delivery checklist and instructions on mounting the adapter module.
- *Electrical installation* contains instructions on cabling and connecting the module to the Ethernet POWERLINK network.
- *Start-up* presents the steps to take during the start-up of the drive with the adapter module and gives examples of configuring the master.
- *Communication profiles* describes the communication profiles used in the communication between the master, the adapter module and the drive.
- *Communication protocol* describes the Ethernet POWERLINK protocol for the adapter module.
- *Diagnostics* explains how to trace faults with the status LEDs on the adapter module.
- *Technical data* contains the technical data of the adapter module and the Ethernet POWERLINK link.
- *Appendix A – CANopen Object Dictionary* contains a list of the CANopen objects supported by the adapter module.
- *Appendix B – CANopen error codes* contains a list of the CANopen error codes.
- *Appendix C – IdentResponse Frame* contains the contents of the IdentResponse Frame.

Terms and abbreviations used in this manual

General terms and abbreviations

Term/abbreviation	Explanation
Command word	See *Control word*.
Communication module	Communication module is a name for a device (eg, a fieldbus adapter) through which the drive is connected to an external communication network (eg, a fieldbus). The communication with the module is activated with a drive parameter.
Control word	16-bit or 32-bit word from master to slave with bit-coded control signals (sometimes called the Command word).
FEPL-02 Ethernet POWERLINK adapter module	One of the optional fieldbus adapter modules available for ABB drives. FEPL-02 is a device through which an ABB drive is connected to an Ethernet POWERLINK network.
Parameter	Operating instruction for the drive. Parameters can be read and programmed with the drive control panel, drive PC tools or through the adapter module.
Profile	Adaptation of the protocol for certain application field, for example, drives. In this manual, drive-internal profiles (eg, DCU or FBA) are called native profiles.
Status word	16-bit or 32-bit word from slave to master with bit-coded status messages

Ethernet POWERLINK terms and abbreviations

Term/abbreviation	Explanation
CN	Controlled Node; A node in a POWERLINK network without the ability to manage the SCNM mechanism.
Device description file	All device-specific information is stored in the Device Description File (XDD) of each device.

Term/abbreviation	Explanation
MN	Managing Node; A node capable of managing the SCNM mechanism in a POWERLINK network.
Object Dictionary	A local storage of all communication objects recognized by the device.
OSI	Open Systems Interconnection
PDO	Process Data Object; Used for transmitting time critical data, such as control commands, references and actual values.
PReq	PollRequest; A frame used in the isochronous phase of the cyclic communication. With PollRequest, the MN requests the CN to send its data.
PRes	PollResponse; A frame used in the isochronous phase of the cyclic communication. The CN responses with a PollResponse frame when it receives a PollRequest from the MN.
R	Read-only access
RW	Read-write access
SCNM	Slot Communication Network Management; In a POWERLINK network, the MN allocates data transfer time for data from each node in a cyclic manner within a guaranteed cycle time. Within each cycle there are slots for Isochronous Data, and for Asynchronous Data for ad-hoc communication. The SCNM mechanism ensures that there are no collisions during physical network access in any of the networked nodes. Thus, it provides deterministic communication via Legacy Ethernet.
SDO	Service Data Object; Used for transmitting non time critical data, such as parameters.

3

Overview of the Ethernet POWERLINK network and the FEPL-02 module

What this chapter contains

This chapter contains a short description of the Ethernet POWERLINK network and the FEPL-02 Ethernet POWERLINK adapter module.

Ethernet POWERLINK network

Ethernet POWERLINK is a communication profile for Real Time Ethernet. It extends standard Ethernet IEEE802.3 with a mechanism to transfer data deterministically. The mechanism is called Slot Communication Network Management (SCNM). SCNM is managed by a networked device designated as the Managing Node (MN). All other nodes are Controlled Nodes (CN).

Unlike standard Ethernet, SCNM ensures that only one node is accessing the network at a time. The schedule is divided into an isochronous phase and an asynchronous phase. During the isochronous phase, time-critical data is transfered, while the asynchronous phase provides bandwidth for the transmission of data that is not time-critical. The MN grants access to the physical medium via dedicated poll request messages. As a result, only one CN has access to the network at a time, and thus no collisions occur.

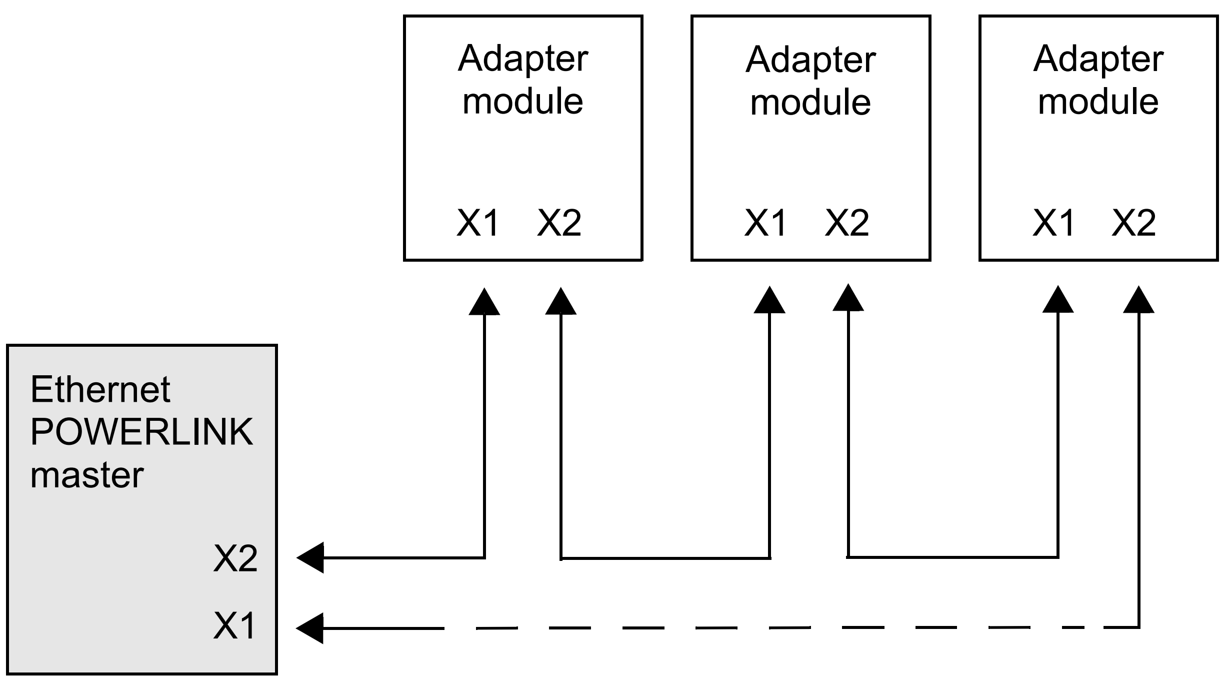
The Ethernet POWERLINK network applies the same protocol technology as CANopen. It defines Service Data Objects (SDO), Process Data Objects (PDO) and the Object Dictionary structure to manage the parameters.

The Ethernet POWERLINK network may have a star, tree, daisy chain or ring structure. The network can also be a combination of these topologies. The use of repeating hubs instead of switches is recommended to minimize delay and jitter. Use class 2 hubs. FEPL-02 has an internal hub, and thus, no external hub is required.

Further information is available from the Ethernet POWERLINK Standardization Group (www.ethernet-powerlink.org).

Example topology of the Ethernet POWERLINK link

An example of an allowable topology is shown below.



FEPL-02 Ethernet POWERLINK adapter module

The FEPL-02 Ethernet POWERLINK adapter module is an optional device for ABB drives which enables the connection of the drive to an Ethernet POWERLINK network. The module is classified as a full Ethernet POWERLINK slave.

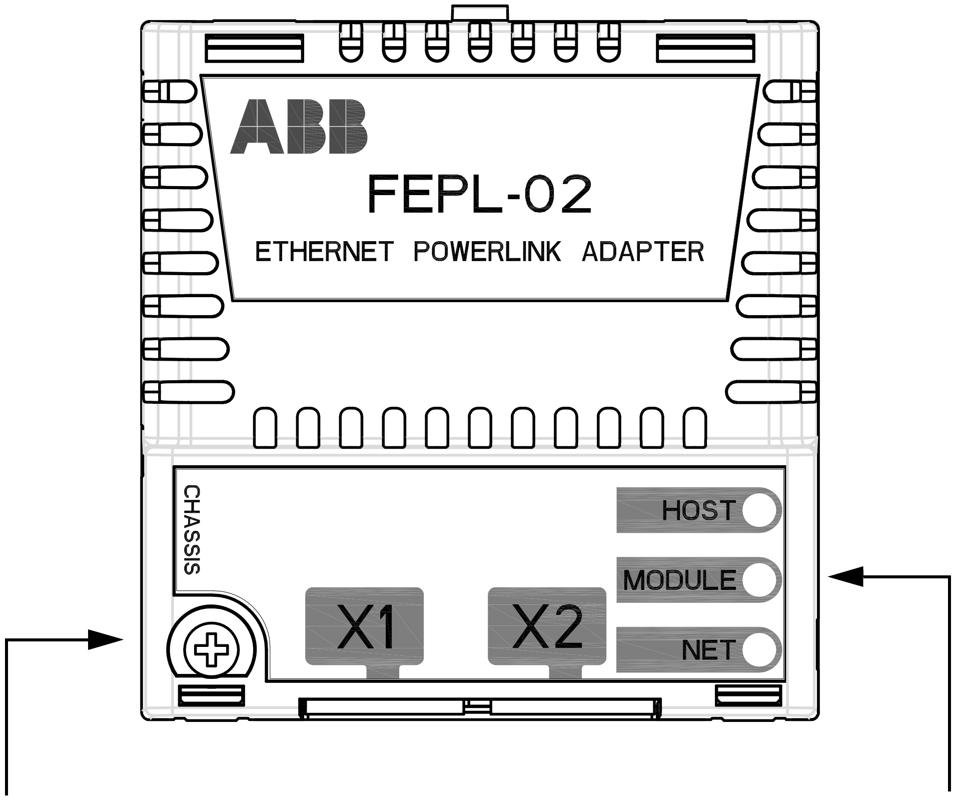
Through the adapter module you can:

- give control commands to the drive (for example, Start, Stop, Run enable)
- feed a motor speed or torque reference to the drive
- give a process actual value or a process reference to the PID controller of the drive
- read status information and actual values from the drive
- change drive parameter values
- reset a drive fault.

The Ethernet POWERLINK commands and services supported by the adapter module are described in chapter *Communication protocol*. Refer to the user documentation of the drive as to which commands are supported by the drive.

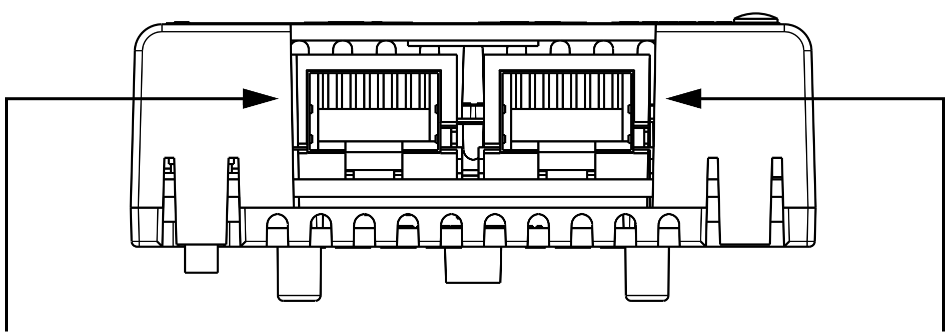
The adapter module is mounted into an option slot on the motor control board of the drive. See the drive manuals for module placement options.

Layout of the adapter module



Mounting screw

Diagnostic LEDs
(See chapter *Diagnostics*)



Ethernet POWERLINK
connector X1

Ethernet POWERLINK
connector X2
(See chapter *Electrical installation*)

4

Mechanical installation

What this chapter contains

This chapter contains a delivery checklist and instructions on mounting the adapter module.

WARNING! Obey the safety instructions. See chapter *Safety*. If you ignore the safety instructions, injury or death can occur.

Delivery check

The option package for the adapter module contains:

- Ethernet POWERLINK adapter module, type FEPL-02
- this manual.

Mounting the adapter module

The adapter module is to be inserted into its specific position in the drive. The module is held in place with plastic pins and one screw. The screw also provides the electrical connection between the module and drive frame for cable shield termination.

When the module is installed, the signal and power connection to the drive is made through a 20-pin connector. (All drives do not use all the available signals so the connector on the drive may have fewer pins.)

Mounting procedure:

1. Insert the module carefully into its position on the drive.

2. Fasten the screw.

Note: It is essential to install the screw properly to fulfill the EMC requirements and to ensure the proper operation of the module.

For more information on mounting, see the drive manuals.

5

Electrical installation

What this chapter contains

This chapter contains:

- general cabling instructions
- instructions on connecting the module to the Ethernet POWERLINK network.

WARNING! Obey the safety instructions. See chapter *Safety*. If you ignore the safety instructions, injury or death can occur. If you are not a qualified electrician, do not do electrical work.

General cabling instructions

- Arrange the bus cables as far away from the motor cables as possible.
- Avoid parallel runs.
- Use bushings at cable entries.

Connecting the module to the Ethernet POWERLINK network

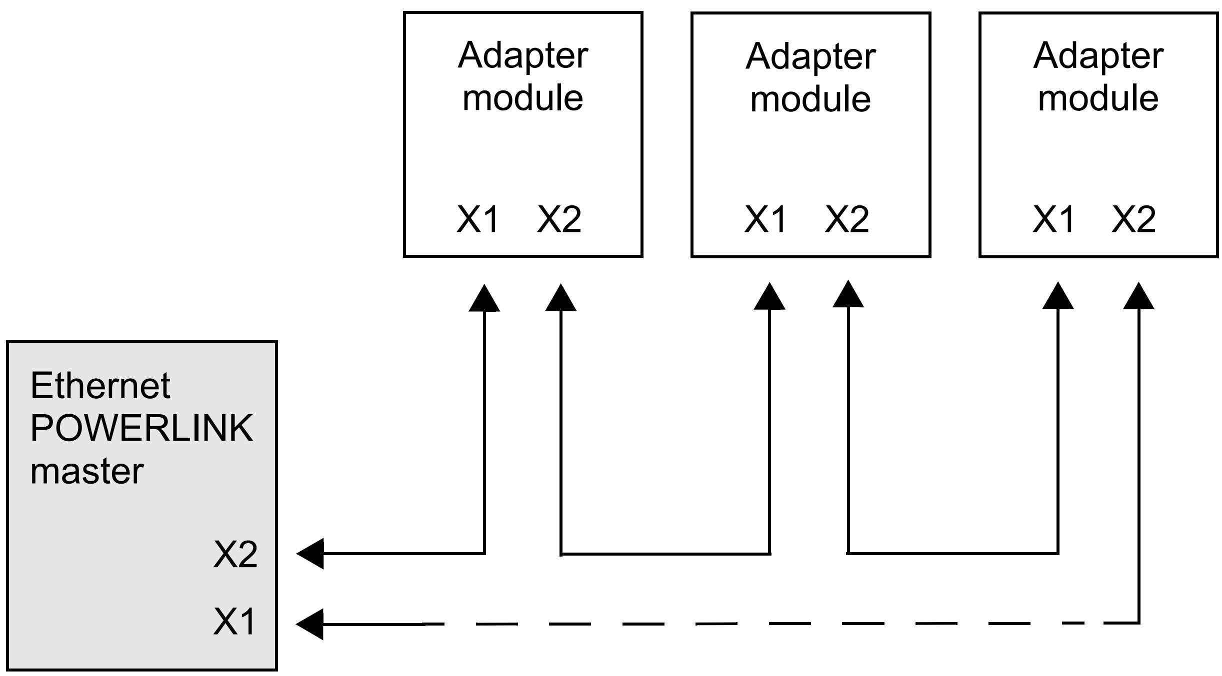
1. Connect the network cables to the two RJ-45 connectors (X1 and X2) on the adapter module.

   Connect the cable from the master to the left port (X1).

2. In the line topology, if there are more slave devices in the same line, connect the next slave device to the right port (X2).

3. If there is a redundant ring, connect the right port (X2) of the last slave device to the second port of the master.

The figure below illustrates the cable connections.



6

Start-up

What this chapter contains:

This chapter contains:

- information on configuring the drive for operation with the adapter module
- drive-specific instructions and examples on starting up the drive with the adapter module
- example of configuring the master station for communication with the adapter module.

WARNING! Follow the safety instructions given in this manual and the drive documentation.

Drive configuration

The following information applies to all drive types compatible with the adapter module, unless otherwise stated.

Ethernet POWERLINK connection configuration

After the adapter module has been installed according to the instructions in chapters *Mechanical installation* and *Electrical installation*, you must prepare the drive for communication with the module.

The detailed procedure of activating the module for POWERLINK communication with the drive depends on the drive type. Normally, you must adjust a parameter to activate the communication. See the drive-specific start-up procedures starting on page *35*.

Once communication between the drive and the adapter module has been established, several configuration parameters are copied to the drive. These parameters are shown in the tables below and must be checked first and adjusted where necessary.

Note that not all drives display descriptive names for the configuration parameters. To help you identify the parameters in different drives, the names displayed by each drive are given in grey boxes in the tables.

Note: The new settings take effect only when the adapter module is powered up the next time or when the fieldbus adapter refresh parameter is activated.

FEPL-02 configuration parameters – group A (group 1)

Note: The actual parameter group number depends on the drive type. Group A (group 1) corresponds to:

- parameter group 51 in ACS355, ACSM1, ACS850 and ACQ810
- parameter group 51 in ACS880 if the adapter is installed as fieldbus adapter A or group 54 if the adapter is installed as fieldbus adapter B.

No.	Name/Value	Description	Default
01	FBA TYPE	**Read-only.** Shows the fieldbus adapter type as detected by the drive. The value cannot be adjusted by the user. If the value is **0** = None, the communication between the drive and the module has not been established.	**136** = ETH Pwrlink
02	PROFILE **ACS355:** FB PAR 2 **ACSM1:** FBA PAR2 **ACS850/ACQ810**: FBA par2 **ACS880:** Profile	Selects the communication profile for the network connection.	**0** = CiA 402
	0 = CiA 402	CANopen device profile CiA 402	
	1 = ABB Drives profile	ABB Drives profile	
	2 = Transparent16	Transparent 16 profile	
	3 = Transparent32	Transparent 32 profile	
03	NODE ID **ACS355:** FB PAR 3 **ACSM1:** FBA PAR3 **ACS850/ACQ810:** FBA par3 **ACS880:** Node ID	Defines the node number of the device. Two units with the same address are not allowed on-line.	1
	0…139	Node number	

No.	Name/Value	Description	Default
04	T16 SCALE **ACS355:** FB PAR 4 **ACSM1:** FBA PAR4 **ACS850/ACQ810:** FBA par4 **ACS880:** T16 scale	Defines the reference multiplier/actual value divisor for the adapter module. The parameter is effective only when the Transparent 16 profile is selected AND the drive is using the native communication profile (eg, DCU or FBA) and a 16-bit transparent Reference 1/Actual value 1. With an ACS355 drive, the speed reference from the PLC is multiplied by the value of this parameter plus one. For example, if the parameter has a value of 99 and a reference of 1000 given by the master, the reference will be multiplied by 99 + 1 = 100 and forwarded to the drive as 100000. According to the DCU profile, this value is interpreted as a reference of 100 rpm in the drive. With ACSM1, ACS850, ACQ810 and ACS880, setting this parameter to 65535 provides the approximation of 1 = 1 rpm.	99
	0…65535	Reference multiplier/actual value divisor	
05 … 25	Reserved	These parameters are not used by the adapter module.	N/A
26	RESTORE DEF CONF **ACS355:** FB PAR 26 **ACSM1:** FBA PAR26 **ACS850/ACQ810:** FBA par26 **ACS880:** Restore def conf	Reverts the module to the factory settings by restoring the default values of the CANopen objects and the configuration parameters. The object values that have been stored to the non-volatile memory are also erased. When this parameter is set to **1** = Yes, the default values are restored at the next power-up or when configuration parameters are validated with parameter *27 FBA PAR REFRESH*.	**0** = No
	0 = No	Do not restore default settings.	
	1 = Yes	Restore default settings.	

No.	Name/Value	Description	Default
27	FBA PAR REFRESH **ACS355/ACSM1:** FBA PAR REFRESH **ACS850/ACQ810/ ACS880:** FBA par refresh	Validates any changed adapter module configuration parameter settings. After refreshing, the value reverts automatically to **0** = Done. **Note:** This parameter cannot be changed while the drive is running.	**0** = Done
	0 = Done	Refreshing done	
	1 = Refresh / Configure	Refreshing	
28	PAR TABLE VER **ACS355:** FILE CPI FW REV **ACSM1:** PAR TABLE VER **ACS850/ACQ810/ ACS880:** Par table ver	**Read-only.** Displays the parameter table revision of the fieldbus adapter module mapping file stored in the memory of the drive. In format **xyz**, where **x** = major revision number **y** = minor revision number **z** = correction number OR in format **axyz**, where **a** = major revision number **xy** = minor revision number **z** = correction number or letter.	N/A
		Parameter table revision	
29	DRIVE TYPE CODE **ACS355:** FILE CONFIG ID **ACSM1:** DRIVE TYPE CODE **ACS850/ACQ810/ ACS880:** Drive type code	**Read-only.** Displays the drive type code of the fieldbus adapter module mapping file stored in the memory of the drive.	N/A
		Drive type code of the fieldbus adapter module mapping file	

No.	Name/Value	Description	Default
30	MAPPING FILE VER **ACS355:** FILE CONFIG REV **ACSM1:** MAPPING FILE VER **ACS850/ACQ810/ ACS880:** Mapping file ver	**Read-only.** Displays the fieldbus adapter module mapping file revision stored in the memory of the drive in decimal format.	N/A
		Mapping file revision	
31	D2FBA COMM STA **ACS355:** FBA STATUS **ACSM1:** D2FBA COMM STA **ACS850/ACQ810/ ACS880:** D2FBA comm sta	**Read-only.** Displays the status of the fieldbus adapter module communication. **Note:** The value names may vary by drive.	**0** = Idle OR **4** = Off-line
	0 = Idle	Adapter is not configured.	
	1 = Exec.init	Adapter is initializing.	
	2 = Time out	A timeout has occurred in the communication between the adapter and the drive.	
	3 = Conf.err	Adapter configuration error: The major or minor revision code of the common program revision in the fieldbus adapter module is not the revision required by the module or mapping file upload has failed more than three times.	
	4 = Off-line	Adapter is off-line.	
	5 = On-line	Adapter is on-line.	
	6 = Reset	Adapter is performing a hardware reset.	

No.	Name/Value	Description	Default
32	FBA COMM SW VER **ACS355:** FBA CPI FW REV **ACSM1:** FBA COMM SW VER **ACS850/ACQ810:** FBA comm sw ver **ACS880**: FBA comm SW ver	**Read-only.** Displays the common program revision of the adapter module in format **axyz**, where: **a** = major revision number **xy** = minor revision number **z** = correction number or letter.	N/A
		Common program revision of the adapter module	
33	FBA APPL SW VER **ACS355:** FBA APPL FW REV **ACSM1:** FBA APPL SW VER **ACS850/ACQ810:** FBA appl sw ver **ACS880:** FBA appl SW ver	**Read-only.** Displays the application program revision of the adapter module in format **axyz**, where: **a** = major revision number **xy** = minor revision number **z** = correction number or letter.	N/A
		Application program revision of the adapter module	

FEPL-02 configuration parameters – group B (group 2)

Note: The actual parameter group number depends on the drive type. Group B (group 2) corresponds to:

- parameter group 55 in ACS355
- parameter group 53 in ACSM1 and ACS850
- parameter group 53 in ACS880 if the adapter is installed as fieldbus adapter A or group 56 if the adapter is installed as fieldbus adapter B.

All parameters in this group are handled by the adapter module automatically. Do not modify the settings of these parameters.

FEPL-02 configuration parameters – group C (group 3)

Note: The actual parameter group number depends on the drive type. Group C (group 3) corresponds to:

- parameter group 54 in ACS355
- parameter group 52 in ACSM1 and ACS850
- parameter group 52 in ACS880 if the adapter is installed as fieldbus adapter A or group 55 if the adapter is installed as fieldbus adapter B.

All parameters in this group are handled by the adapter module automatically. Do not modify the settings of these parameters.

Control locations

ABB drives can receive control information from multiple sources including digital inputs, analog inputs, the drive control panel and a communication module (for example, the adapter module). ABB drives allow the user to separately determine the source for each type of control information (Start, Stop, Direction, Reference, Fault reset, etc.).

To give the fieldbus master station the most complete control over the drive, the communication module must be selected as the source for this information. The drive-specific parameter setting examples below contain the drive control parameters needed in the examples. For a complete parameter list, see the drive documentation.

Starting up ACS355 drives

1. Power up the drive.
2. Enable the communication between the adapter module and the drive with parameter 9802 COMM PROT SEL.
3. Set the FEPL configuration parameters in group 51.
   - Select the communication profile with parameter 5102.
   - Configure the network settings with parameters 5103 and 5104.
4. With parameter 3018 COMM FAULT FUNC, select how the drive reacts to a fieldbus communication break.
5. With parameter 3019 COMM FAULT TIME, define the time between communication break detection and the selected action.
6. Validate the settings made in parameter group 51 with parameter 5127 FBA PAR REFRESH.
7. Set the relevant drive control parameters to control the drive according to the application. Examples of appropriate values are shown in the tables below.

Parameter setting examples – ACS355

Speed control using the CiA 402 velocity mode (vl)

This example shows how to configure a speed control application that uses the velocity mode (vl) of the CiA 402 profile.

When configuring the master, you need to map the following objects to the transmit and receive PDOs. For an example, see section *Mapping objects required for controlling the drive* on page *60*.

CANopen object	Output data
0x6040	Control word
0x6042	Target velocity

CANopen object	Input data
0x6041	Status word
0x6044	Vl control effort

The table below gives the recommended drive parameter settings.

Drive parameter	Setting for ACS355 drives	Description
9802 COMM PROT SEL	**4** = EXT FBA	Enables communication between the drive and the fieldbus adapter module.
5101 FBA TYPE	**136** = ETH Pwrlink[1)]	Displays the type of the fieldbus adapter module.
5102 FB PAR 2 (PROFILE)	**0** (= CiA 402)	Selects the CANopen device profile CiA 402.
5103 FB PAR 3 (NODE ID)	3[2)]	Defines the address of the device.
3018 COMM FAULT FUNC	**1** = FAULT[2)]	Enables fieldbus communication fault monitoring.
3019 COMM FAULT TIME	3.0 s[2)]	Defines the fieldbus communication break supervision time.
5127 FBA PAR REFRESH	**1** = REFRESH	Validates the FEPL configuration parameter settings.

Drive parameter	**Setting for ACS355 drives**	**Description**
1001 EXT1 COMMANDS	**10** = COMM	Selects the fieldbus interface as the source of the start and stop commands for external control location 1.
1102 EXT1/EXT2 SEL	**0** = EXT1	Enables external control location 1/2 selection through the fieldbus.
1103 REF1 SELECT	**8** = COMM	Selects the fieldbus reference 1 as the source of the speed reference.
1601 RUN ENABLE	**7** = COMM	Selects the fieldbus interface as the source for the inverted Run enable signal (Run disable).
1604 FAULT RESET SEL	**8** = COMM	Selects the fieldbus interface as the source for the fault reset signal.

1) Read-only or automatically detected/set
2) Example

The start sequence for the parameter example above is given below.

Control word:

- Reset the fieldbus communication fault (if active).
- Enter 7Eh (126 decimal) –> SWITCH-ON DISABLED.
- Enter 7Fh (127 decimal) –> OPERATION ENABLED.

Speed and torque control using ABB Drives communication profile

This example shows how to configure a speed and torque control application that uses the ABB Drives profile. In addition, some application-specific data is added to the communication.

The start/stop commands and references are according to the ABB Drives profile. For more information, see the state machine on page 81.

When reference 1 (REF1) is used, reference value ±20000 (decimal) corresponds to the reference set with parameter 1105 REF1 MAX in the forward and reverse directions.

When reference 2 (REF2) is used, a reference value of ±10000 (decimal) corresponds to the reference set with parameter 1108 REF2 MAX in the forward and reverse directions.

The minimum and maximum 16-bit integer values that can be given through the fieldbus are -32768 and 32767 respectively.

When configuring the master, you need to map the following objects to the transmit and receive PDOs. For an example, see section *Mapping objects required for controlling the drive* on page 60.

CANopen object	Output data
0x2101	Control word
0x2102	Speed reference
0x2103	Torque reference

CANopen object	Input data
0x2104	Status word
0x2105	Speed actual value
0x2106	Torque actual value

The table below gives the recommended drive parameter settings.

Drive parameter	Setting for ACS355 drives	Description
9802 COMM PROT SEL	**4** = EXT FBA	Enables communication between the drive and the fieldbus adapter module.
5101 FBA TYPE	**136** = ETH Pwrlink[1)]	Displays the type of the fieldbus adapter module.
5102 FB PAR 2 (PROFILE)	**1** (= ABB Drives profile)	Selects the ABB Drives profile.

Drive parameter	Setting for ACS355 drives	Description
5103 FB PAR 3 (NODE ID)	3[2)]	Defines the address of the device.
3018 COMM FAULT FUNC	**1** = FAULT[2)]	Enables fieldbus communication fault monitoring.
3019 COMM FAULT TIME	3.0 s[2)]	Defines the fieldbus communication break supervision time.
5127 FBA PAR REFRESH	**1** = REFRESH	Validates the FEPL configuration parameter settings.
9904 MOTOR CTRL MODE	**2** = VECTOR: TORQ	Selects the vector control mode as the motor control mode.
1001 EXT1 COMMANDS	**10** = COMM	Selects the fieldbus interface as the source of the start and stop commands for external control location 1.
1002 EXT2 COMMANDS	**10** = COMM	Selects the fieldbus interface as the source of the start and stop commands for external control location 2.
1102 EXT1/EXT2 SEL	**8** = COMM	Enables external control location 1/2 selection through the fieldbus.
1103 REF1 SELECT	**8** = COMM	Selects the fieldbus reference 1 as the source of the speed reference.
1106 REF2 SELECT	**8** = COMM	Selects the fieldbus reference 2 as the source of the torque reference.
1601 RUN ENABLE	**7** = COMM	Selects the fieldbus interface as the source for the inverted Run enable signal (Run disable).
1604 FAULT RESET SEL	**8** = COMM	Selects the fieldbus interface as the source for the fault reset signal.

1) Read-only or automatically detected/set
2) Example

The start sequence for the parameter example above is given below.

Control word:

- Reset the fieldbus communication fault (if active).
- Enter 47Eh (1150 decimal) –> READY TO SWITCH ON
- Enter 47Fh (1151 decimal) –> OPERATING (Speed mode)

  or

  C7Fh (3199 decimal) –> OPERATING (Torque mode).

Starting up ACSM1 drives

1. Power up the drive.
2. Enable the communication between the adapter module and the drive with parameter 50.01 FBA ENABLE.
3. With parameter 50.02 COMM LOSS FUNC, select how the drive reacts to a fieldbus communication break.

   Note: This function monitors both communication between the fieldbus master and the adapter module and communication between the adapter module and the drive.
4. With parameter 50.03 COMM LOSS T OUT, define the time between communication break detection and the selected action.
5. Select application-specific values for parameters 50.04…50.11. Examples of appropriate values are shown in the tables below.
6. Set the FEPL configuration parameters in group 51.
   - Select the communication profile with parameter 51.02.
   - Configure the network settings with parameters 51.03 and 51.04.
7. Validate the settings made in parameter group 51 with parameter 51.27 FBA PAR REFRESH.
8. Set the relevant drive control parameters to control the drive according to the application. Examples of appropriate values are shown in the tables below.

Parameter setting examples – ACSM1

Position control with the CiA 402 profile position mode (pp)

This example shows how to configure a basic positioning application for an ACSM1 motion control drive. The start/stop commands and reference are according to the profile position mode (pp) of the CiA 402 profile.

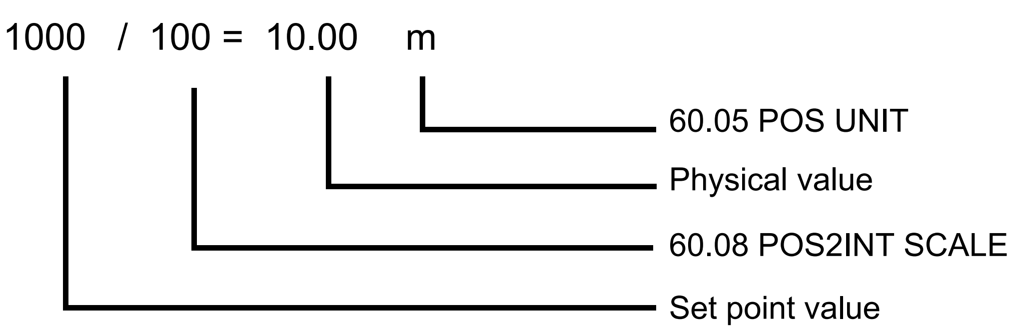
When configuring the master, you need to map the following objects to the transmit and receive PDOs. For an example, see section *Mapping objects required for controlling the drive* on page *60*.

CANopen object	Output data
0x6040	Control word
0x607A	Target position

CANopen object	Input data
0x6041	Status word
0x6064	Position actual value

The target position and actual value are defined as 32-bit integer values; both are scaled as defined by drive parameter settings. The target position (reference) and the position actual value are scaled as follows:

Drive parameter	Setting
60.05 POS UNIT (Position unit)	m
60.08 POS2INT SCALE	100



The table below gives the recommended drive parameter settings.

Drive parameter	**Setting for ACSM1 drives**	**Description**
50.01 FBA ENABLE	ENABLE	Enables communication between the drive and the fieldbus adapter module.
50.02 COMM LOSS FUNC	Fault[2)]	Enables fieldbus communication fault monitoring.
50.03 COMM LOSS T OUT	1.0 s[2)]	Defines the fieldbus communication break supervision time.
50.04 FBA REF1 MODESEL	Position	Selects the fieldbus reference 1 scaling.
51.01 FBA TYPE	**136** = ETH Pwrlink[1)]	Displays the type of the fieldbus adapter module.
51.02 FBA PAR2 (PROFILE)	**0** (= CiA 402)	Selects the CANopen device profile CiA 402.
51.03 FBA PAR3 (NODE ID)	3[2)]	Defines the address of the device.
51.27 FBA PAR REFRESH	REFRESH	Validates the FEPL configuration parameter settings.
10.01 EXT1 START FUNC	FBA	Selects the fieldbus interface as the source of the start and stop commands for external control location 1.
34.03 EXT1 CTRL MODE1	Position	Selects the position control mode for external control location EXT1.
62.24 POS START MODE	PULSE	Positioning starts at the rising edge of the pulse.
65.01 POS REFSOURCE	Ref table	Reference and other positioning parameters are read from reference set 1/2.
65.04 POS REF 1 SEL	FBA REF1	Fieldbus reference 1 is the source for the position reference when reference set 1 is used.

1) Read-only or automatically detected/set
2) Example

The start sequence for the parameter example above is given below.

Control word:

- Reset the fieldbus communication fault (if active).
- Enter 0Eh (14 decimal) –> SWITCH ON DISABLED.
- Enter 0Fh (15 decimal) –> OPERATION ENABLED.
- Enter 1Fh (31 decimal) –> MOVE TO NEW SETPOINT.

Starting up ACS850 drives

1. Power up the drive.
2. Enable the communication between the adapter module and the drive with parameter 50.01 FBA enable.
3. With parameter 50.02 Comm loss func, select how the drive reacts to a fieldbus communication break.

   Note: This function monitors both communication between the fieldbus master and the adapter module and communication between the adapter module and the drive.
4. With parameter 50.03 Comm loss t out, define the time between communication break detection and the selected action.
5. Select application-specific values for parameters 50.04…50.11. Examples of appropriate values are shown in the tables below.
6. Set the FEPL configuration parameters in group 51.
   - Select the communication profile with parameter 51.02.
   - Configure the network settings with parameters 51.03 and 51.04.
7. Validate the settings made in parameter group 51 with parameter 51.27 FBA par refresh.
8. Set the relevant drive control parameters to control the drive according to the application. Examples of appropriate values are shown in the tables below.

Parameter setting examples – ACS850

Speed control using the CiA 402 velocity mode (vl)

This example shows how to configure a speed control application that uses the velocity mode (vl) of the CiA 402 profile.

When configuring the master, you need to map the following objects to the transmit and receive PDOs. For an example, see section *Mapping objects required for controlling the drive* on page *60*.

CANopen object	Output data
0x6040	Control word
0x6042	Target velocity

CANopen object	Input data
0x6041	Status word
0x6044	Vl control effort

The table below gives the recommended drive parameter settings.

Drive parameter	Setting for ACS850 drives	Description
50.01 FBA enable	Enable	Enables communication between the drive and the fieldbus adapter module.
50.02 Comm loss func	Fault[2)]	Enables fieldbus communication fault monitoring.
50.03 Comm loss t out	3.0 s[2)]	Defines the fieldbus communication break supervision time.
50.04 FBA ref1 modesel	Speed	Selects the fieldbus reference 1 scaling.
51.01 FBA type	**136** = ETH Pwrlink[1)]	Displays the type of the fieldbus adapter module.
51.02 FBA par2 (PROFILE)	**0** (= CiA 402)	Selects the CANopen device profile CiA 402.
51.03 FBA par3 (NODE ID)	3[2)]	Defines the address of the device.
51.27 FBA par refresh	Refresh	Validates the FEPL configuration parameter settings.

Drive parameter	Setting for ACS850 drives	Description
10.01 Ext1 start func	FB	Selects the fieldbus interface as the source of the start and stop commands for external control location 1.
12.03 Ext1 ctrl mode	Speed	Selects the speed control mode for external control location EXT1.
21.01 Speed ref1 sel	FBA ref1 (Parameter 02.26)	Selects fieldbus reference 1 as the source for speed reference 1.

1) Read-only or automatically detected/set
2) Example

The start sequence for the parameter example above is given below.

Control word:

- Reset the fieldbus communication fault (if active).
- Enter 7Eh (126 decimal) –> SWITCH-ON DISABLED.
- Enter 7Fh (127 decimal) –> OPERATION ENABLED.

Speed control using the ABB Drives communication profile

This example shows how to configure a speed control application that uses the ABB drives profile.

The start/stop commands and references are according to the ABB Drives profile. For more information, see the state machine on page *81*.

Reference 1 (REF1) value ±20000 (decimal) corresponds to the reference set with parameter 19.01 (Speed scaling) in the forward and reverse directions.

The minimum and maximum 16-bit integer values that can be given through the fieldbus are -32768 and 32767 respectively.

When configuring the master, you need to map the following objects to the transmit and receive PDOs. For an example, see section *Mapping objects required for controlling the drive* on page *60*.

CANopen object	Output data
0x2101	Control word
0x2102	Speed reference

CANopen object	Input data
0x2104	Status word
0x2105	Speed actual value

The table below gives the recommended drive parameter settings.

Drive parameter	Setting for ACS850 drives	Description
50.01 FBA enable	Enable	Enables communication between the drive and the fieldbus adapter module.
50.02 Comm loss func	Fault[2)]	Enables fieldbus communication fault monitoring.
50.03 Comm loss t out	3.0 s[2)]	Defines the fieldbus communication break supervision time.
50.04 FBA ref1 modesel	Speed	Selects the fieldbus reference 1 scaling.
51.01 FBA type	**136** = ETH Pwrlink[1)]	Displays the type of the fieldbus adapter module.

Drive parameter	Setting for ACS850 drives	Description
51.02 FBA par2 (PROFILE)	**0** (= CiA 402)	Selects the CANopen device profile CiA 402.
51.03 FBA par3 (NODE ID)	3[2)]	Defines the address of the device.
51.27 FBA par refresh	Refresh	Validates the FEPL configuration parameter settings.
10.01 Ext1 start func	FB	Selects the fieldbus interface as the source of the start and stop commands for external control location 1.
12.03 Ext1 ctrl mode	Speed	Selects the speed control mode for external control location EXT1.
21.01 Speed ref1 sel	FBA ref1 (Parameter 02.26)	Selects fieldbus reference 1 as the source for speed reference 1.

1) Read-only or automatically detected/set
2) Example

The start sequence for the parameter example above is given below.

Control word:

- Reset the fieldbus communication fault (if active).
- Enter 47Eh (1150 decimal) –> READY TO SWITCH ON.
- Enter 47Fh (1151 decimal) –> OPERATING (Speed mode).

Starting up ACS880 drives

1. Power up the drive.
2. Enable the communication between the adapter module and the drive with parameter 50.01 FBA A enable.
3. With parameter 50.02 FBA A comm loss func, select how the drive reacts to a fieldbus communication break.

   Note: This function monitors both communication between the fieldbus master and the adapter module and communication between the adapter module and the drive.
4. With parameter 50.03 FBA A comm loss t out, define the time between communication break detection and the selected action.
5. Select application-specific values for parameters 50.04…50.11. Examples of appropriate values are shown in the tables below.
6. Set the FEPL configuration parameters in group 51.
   - Select the communication profile with parameter 51.02.
   - Configure the network settings with parameters 51.03 and 51.04.
7. Save the valid parameter values to permanent memory with parameter 96.07 Parameter save.
8. Validate the settings made in parameter group 51 with parameter 51.27 FBA par refresh.
9. Set the relevant drive control parameters to control the drive according to the application. Examples of appropriate values are shown in the tables below.

Parameter setting examples – ACS880

Speed control using the ABB Drives communication profile

This example shows how to configure a speed control application that uses the ABB Drives communication profile.

The start/stop commands and reference are according to the ABB Drives profile. For more information, see the state machine on page *81*.

When Reference 1 (REF1) is used, a reference value of ±20000 (4E20h) corresponds to the reference set with parameter 46.01 Speed scaling in the forward and reverse directions.

The minimum and maximum 16-bit integer values that can be given through the fieldbus are -32768 and 32767 respectively.

When configuring the master, you need to map the following objects to the transmit and receive PDOs. For an example, see section *Mapping objects required for controlling the drive* on page *60*.

CANopen object	Output data
0x2101	Control word
0x2102	Speed reference

CANopen object	Input data
0x2104	Status word
0x2105	Speed actual value

The table below gives the recommended drive parameter settings.

Drive parameter	Setting for ACS880 drives	Description
50.01 FBA A enable	**1** = Enable	Enables communication between the drive and the fieldbus adapter module.
50.02 FBA A comm loss func	**1** = Fault[2)]	Enables fieldbus A communication fault monitoring.
50.03 FBA A comm loss t out	3.0 s[2)]	Defines the fieldbus A communication break supervision time.
50.04 FBA A ref1 type	**4** = Speed	Selects the fieldbus A reference 1 type and scaling.

Drive parameter	Setting for ACS880 drives	Description
51.01 FBA type	**136** = ETH Pwrlink[1]	Displays the type of the fieldbus adapter module.
51.02 Profile	**1** = ABB Drives profile	Selects the ABB Drives profile.
51.03 Node ID	3[2]	Defines the address of the device.
51.27 FBA par refresh	**1** = Configure	Validates the FEPL configuration parameter settings.
20.01 Ext1 commands	**12** = Fieldbus A	Selects the fieldbus A interface as the source of the start and stop commands for external control location 1.
20.02 Ext1 start trigger	**1** = Level[2]	Defines the start signal for external control location 1 as level-triggered.
22.11 Speed ref1 selection	**4** = FB A ref1	Selects the fieldbus A reference 1 as the source for speed reference 1.

1) Read-only or automatically detected/set
2) Example

The start sequence for the parameter example above is given below.

Control word:

- Reset the fieldbus communication fault (if active).
- Enter 47Eh (1150 decimal) –> READY TO SWITCH ON.
- Enter 47Fh (1151 decimal) –> OPERATING (Speed mode).

Configuring the master station

After the adapter module has been initialized by the drive, you must prepare the master station for communication with the module.

The PLC used in the example below is a B&R X20 CP1485. The information should, however, be easily adaptable for use with other PLCs as well. The example can be applied to all drive types compatible with the module.

Downloading an XML Device Description File (XDD)

XML Device Description Files (XDD) are XML files that specify the properties of the follower device for the Ethernet POWERLINK master. The description files contain information on the supported communication objects.

Download the XDD file from the Document library (www.abb.com/drives).

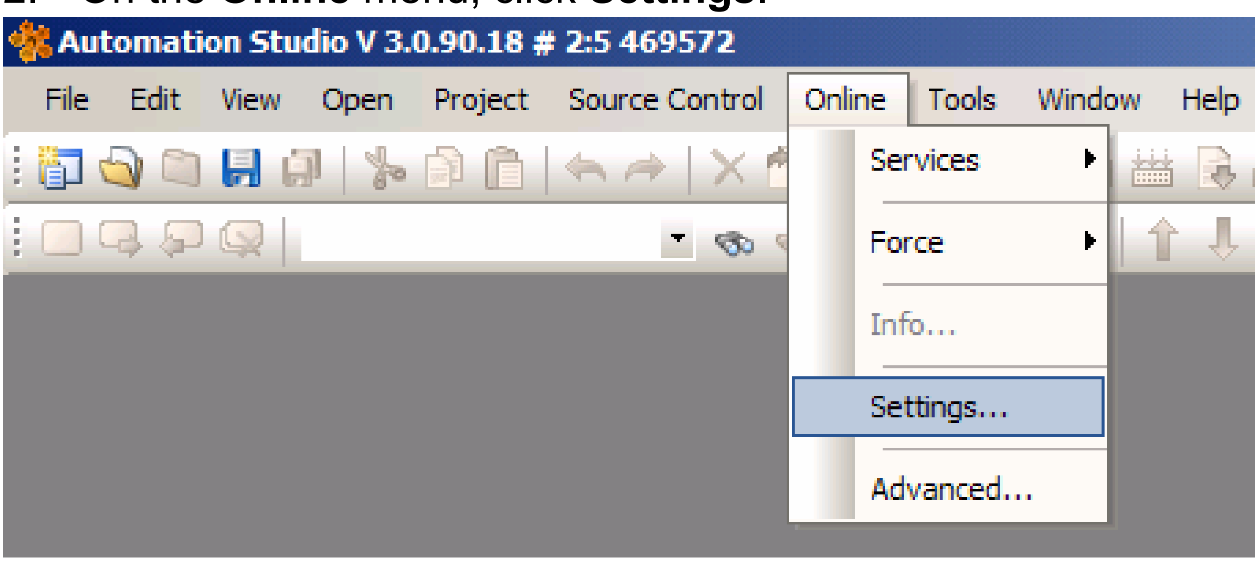
Configuring a B&R PLC

This example shows how to configure the PLC with B&R Automation Studio PC software, version 3.0.90.18, so that it can be used to control the drive using the FEPL-02 module.

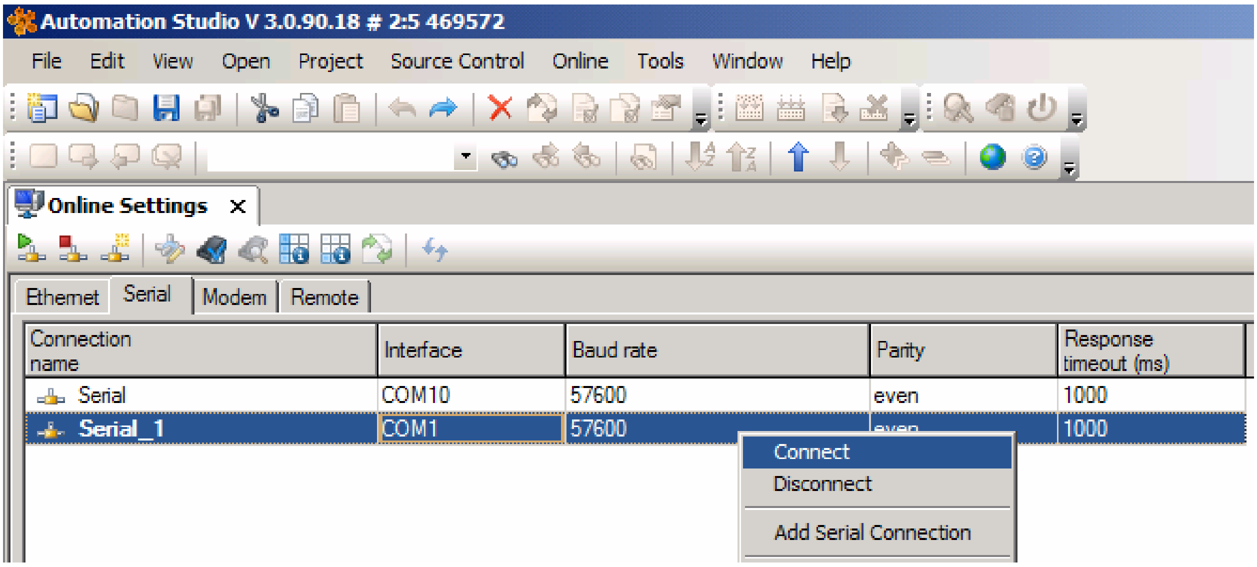
Before you start, make sure that you have downloaded the XDD file from the Document library.

1. Start the Automation Studio software.

2. On the **Online** menu, click **Settings**.

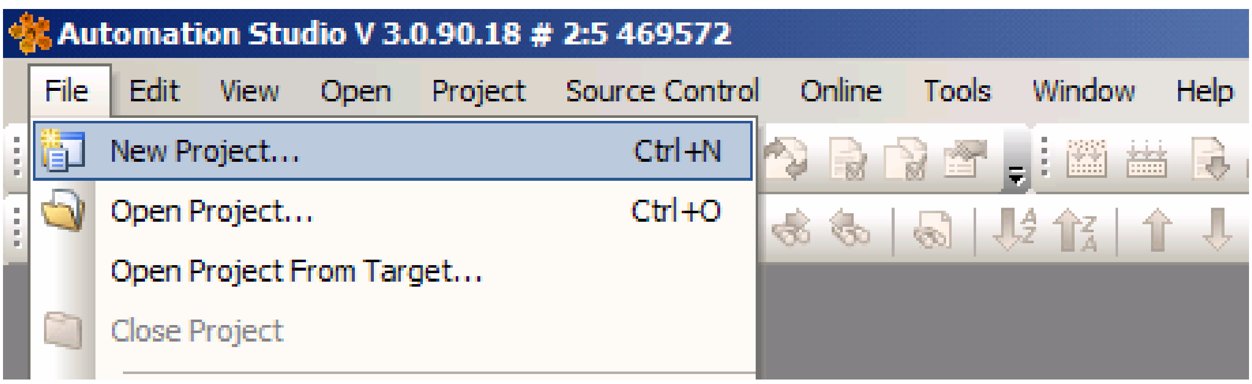


3. Create or modify the connection settings to reflect the serial connection to the PLC. Then, on the **Serial** tab, right-click the connection and click **Connect**.



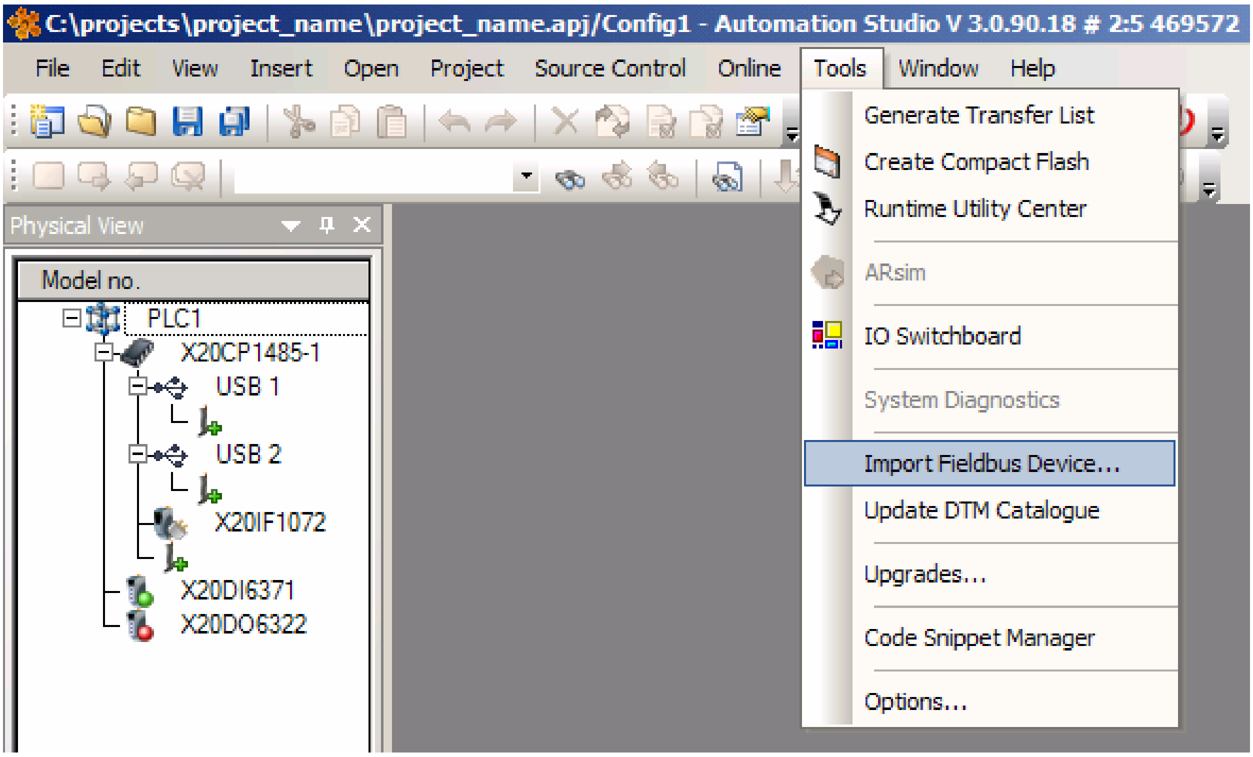
4. On the **File** menu, click **New Project...** to create a new project for your PLC, or click **Open Project...** to open an existing project.

   For more information on creating a project, see the B&R documentation.

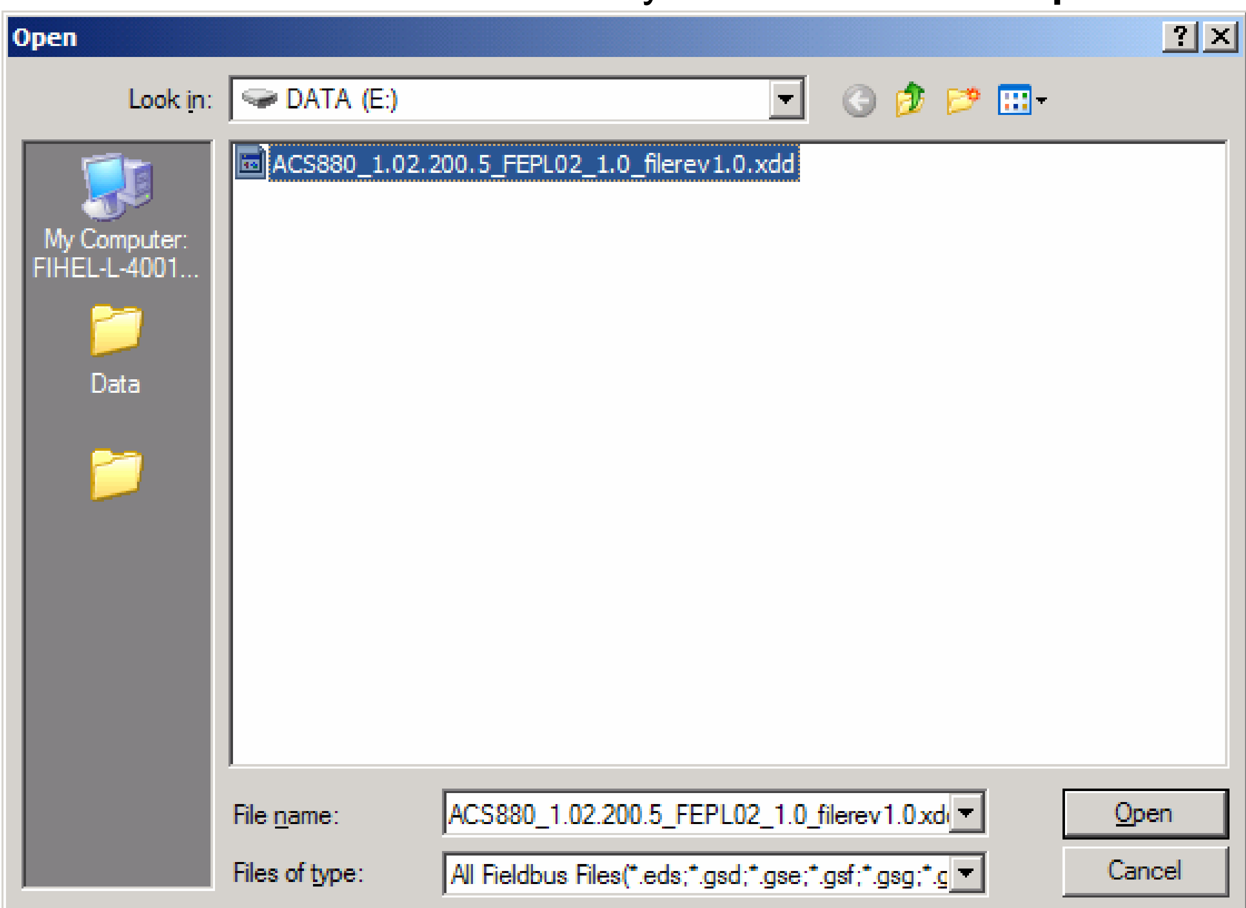


Adding the .xdd file

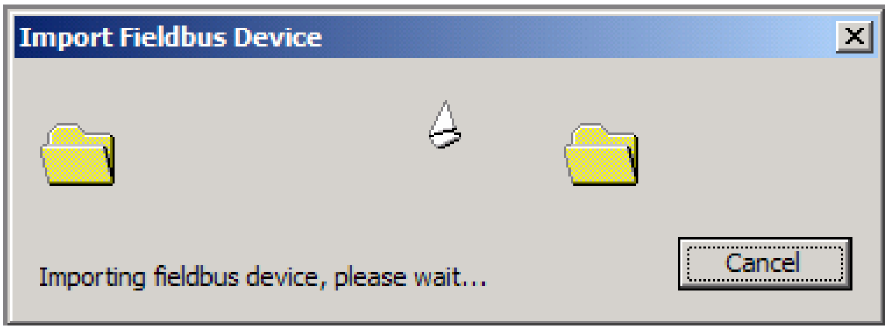
1. On the **Tools** menu, click **Import Fieldbus Device...**.



2. Select the correct .xdd file for your drive and click **Open**.



3. Wait until the .xdd file has been imported.

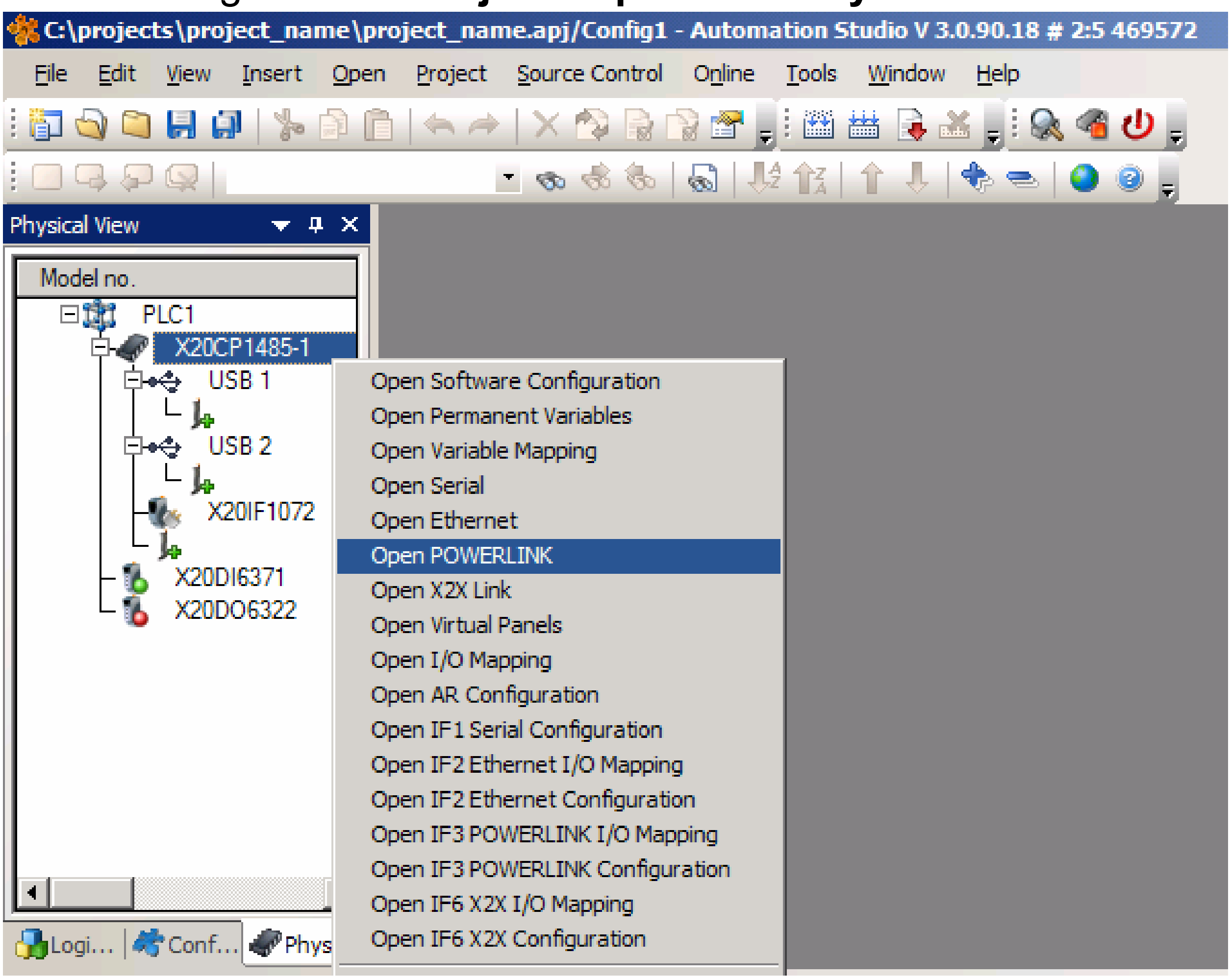


Associating the adapter module with the PLC

When the .xdd file has been imported, add the adapter module to the list of the POWERLINK devices associated with the PLC.

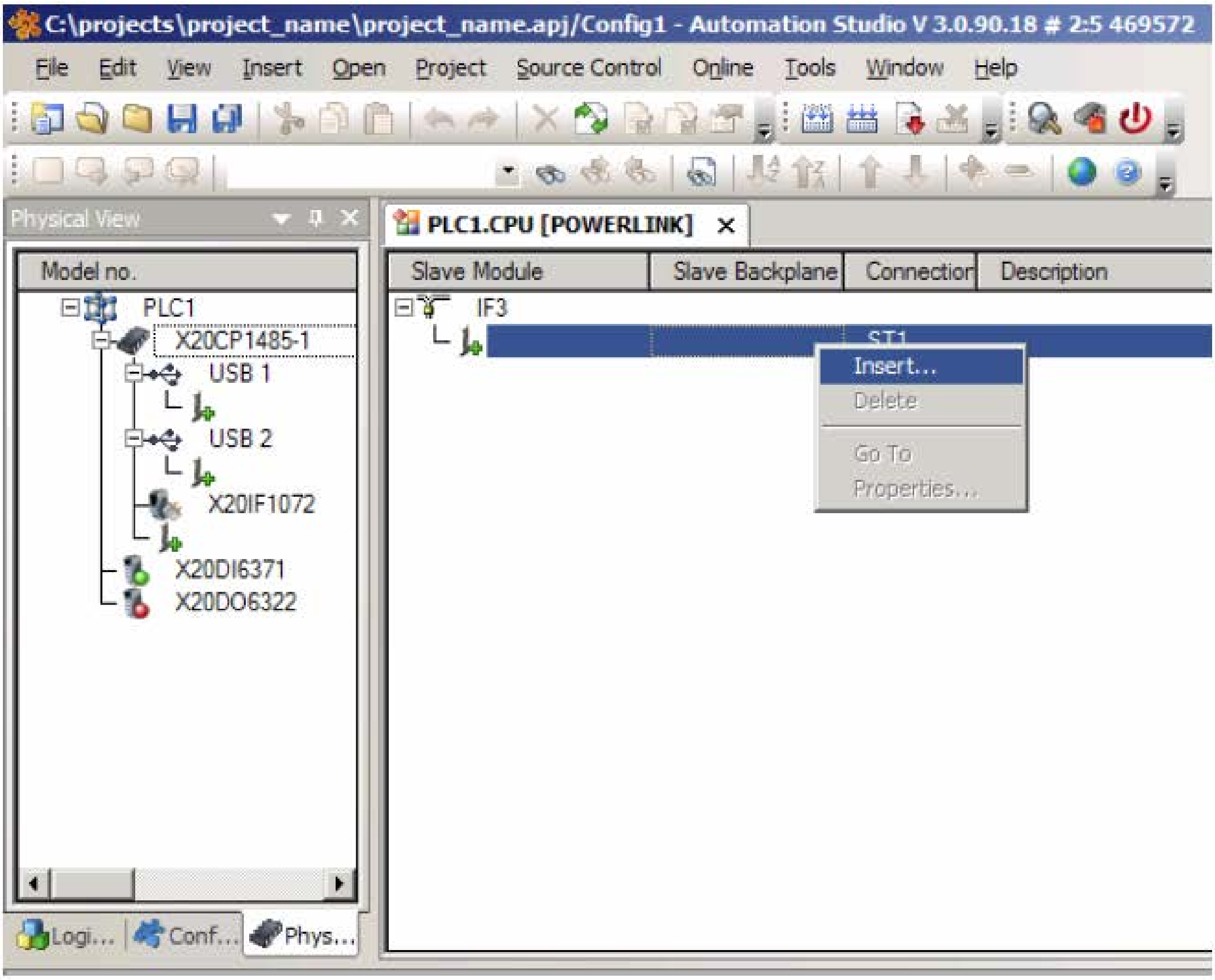
1. In the Physical View window, right-click the node that represents the CPU, and then click **Open POWERLINK**.

   If the Physical View window is not visible, you can open it by selecting **View** -> **Project Explorer** -> **Physical view**.

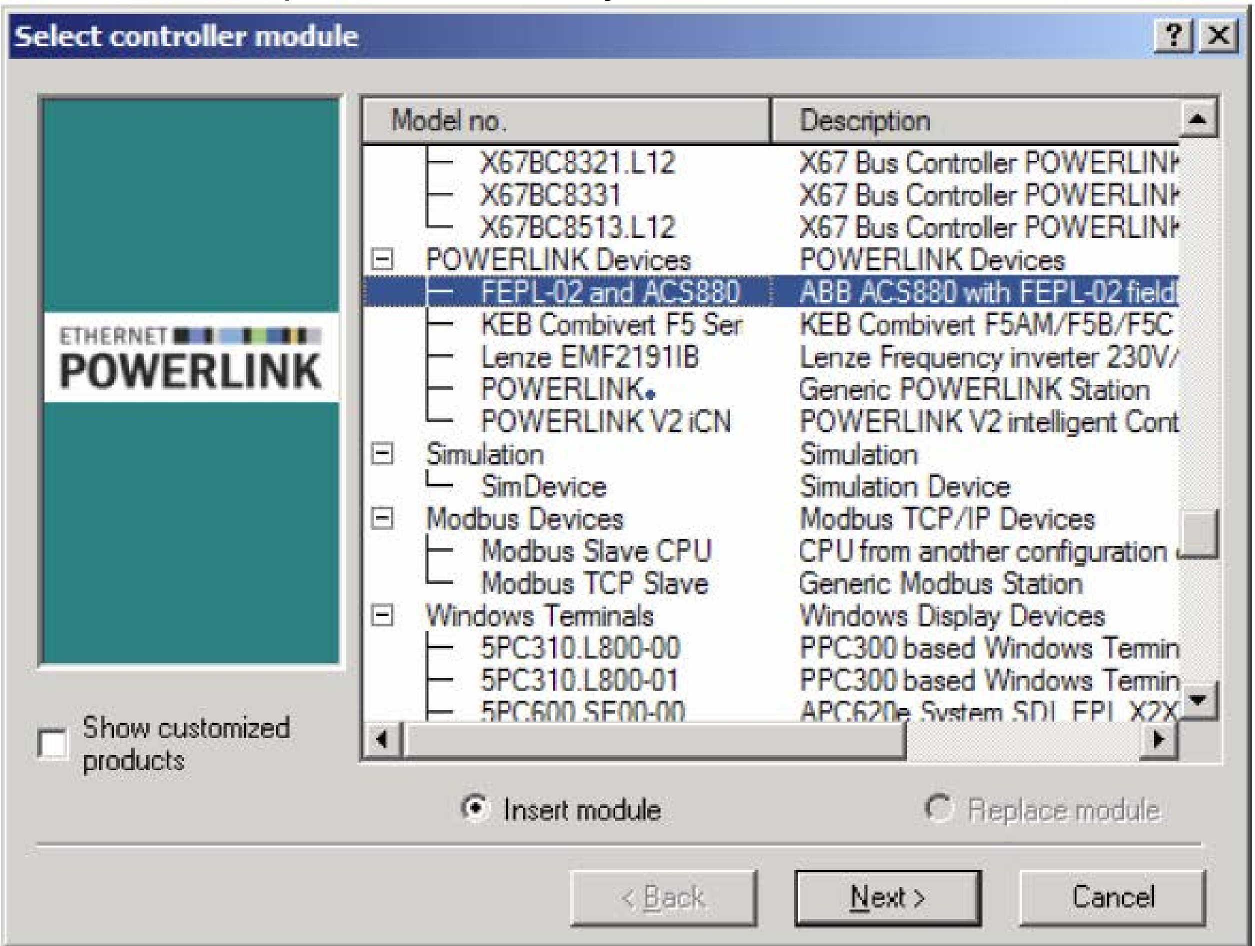


   The POWERLINK window opens, displaying a list of the devices connected to the Powerlink interface (IF3) of the PLC.

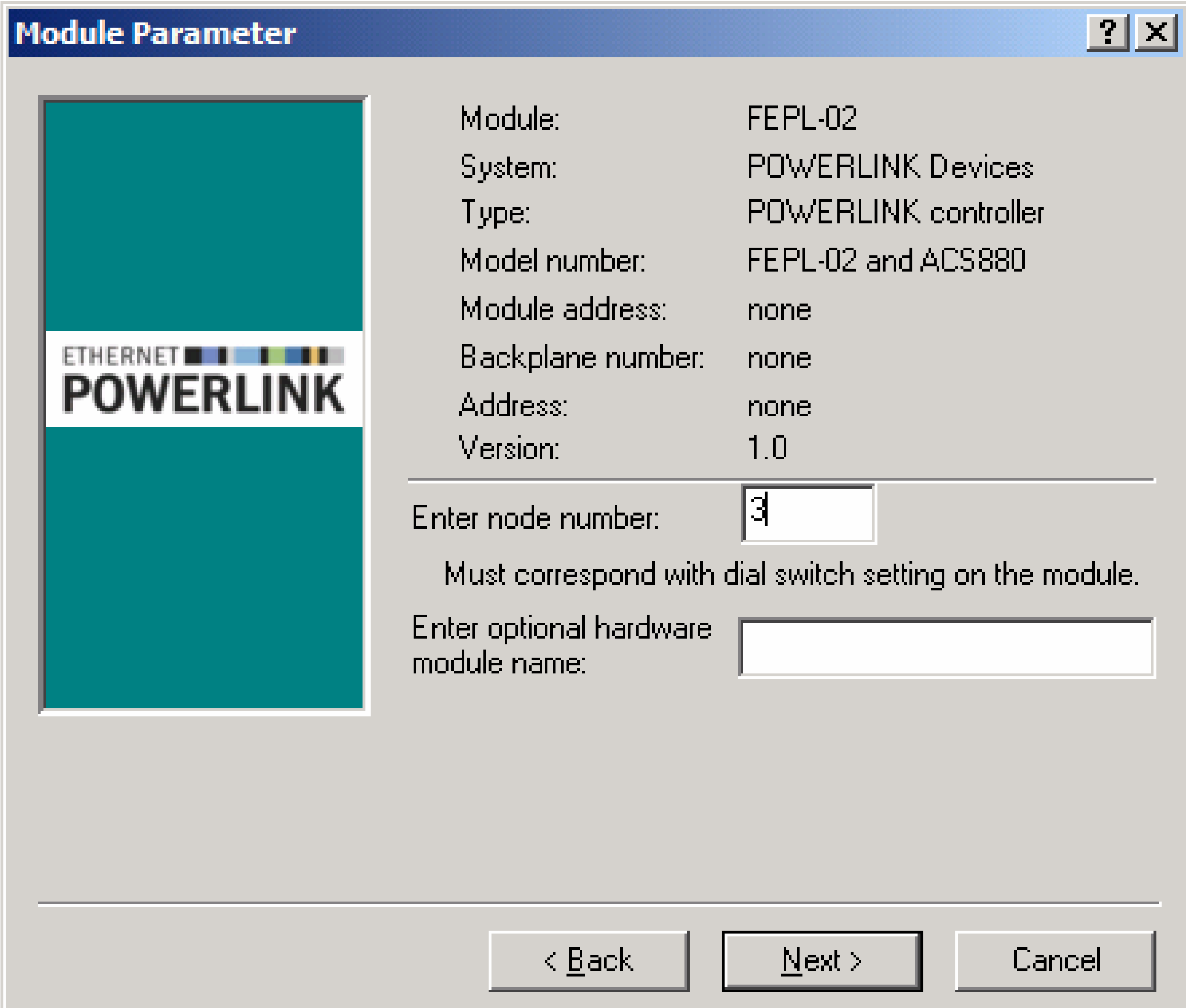
2. To add the adapter module, right-click the IF3 list entry, and then click **Insert…**.



3. In the **Select controller module** dialog box, select the entry for the adapter module and your drive, and then click **Next >**.



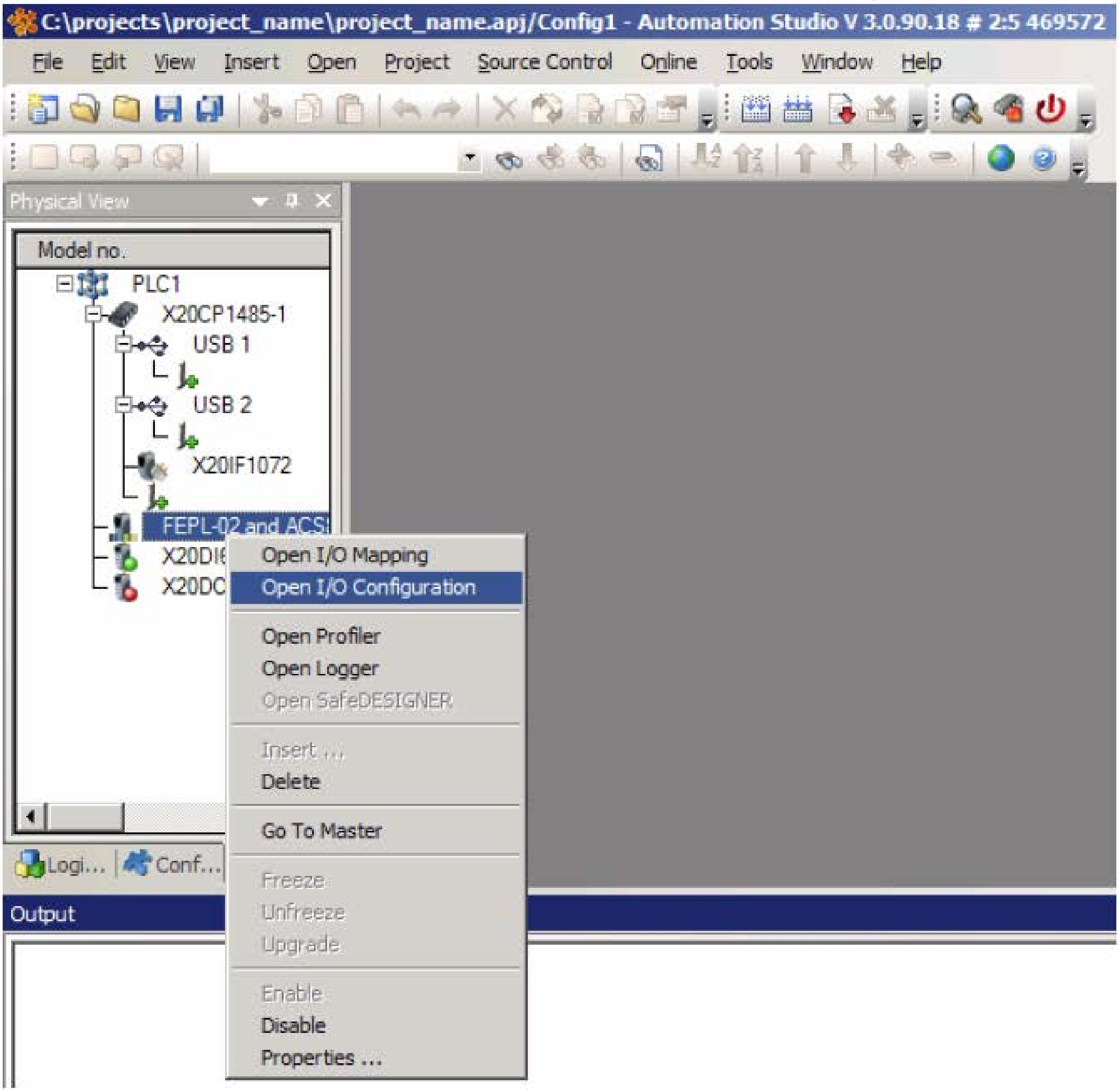
4. In the **Module Parameter** dialog box, type the node number of the adapter module, and then click **Next >**.



The adapter module is now displayed in the POWERLINK window, as well as in the Physical View. You can close the POWERLINK window.

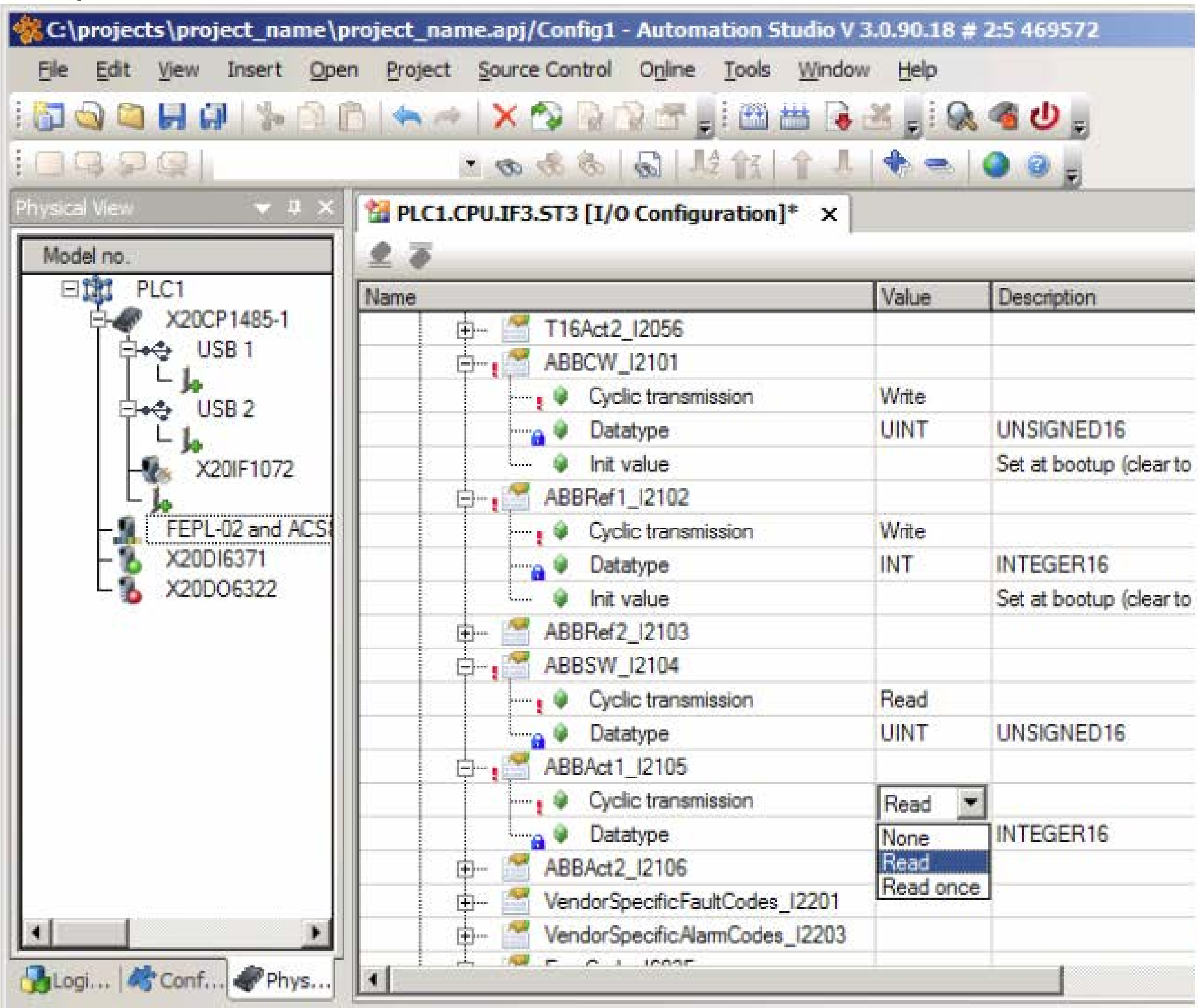
Mapping objects required for controlling the drive

1. In the Physical View window, right-click the entry for the adapter module, and then click **Open I/O Configuration**.



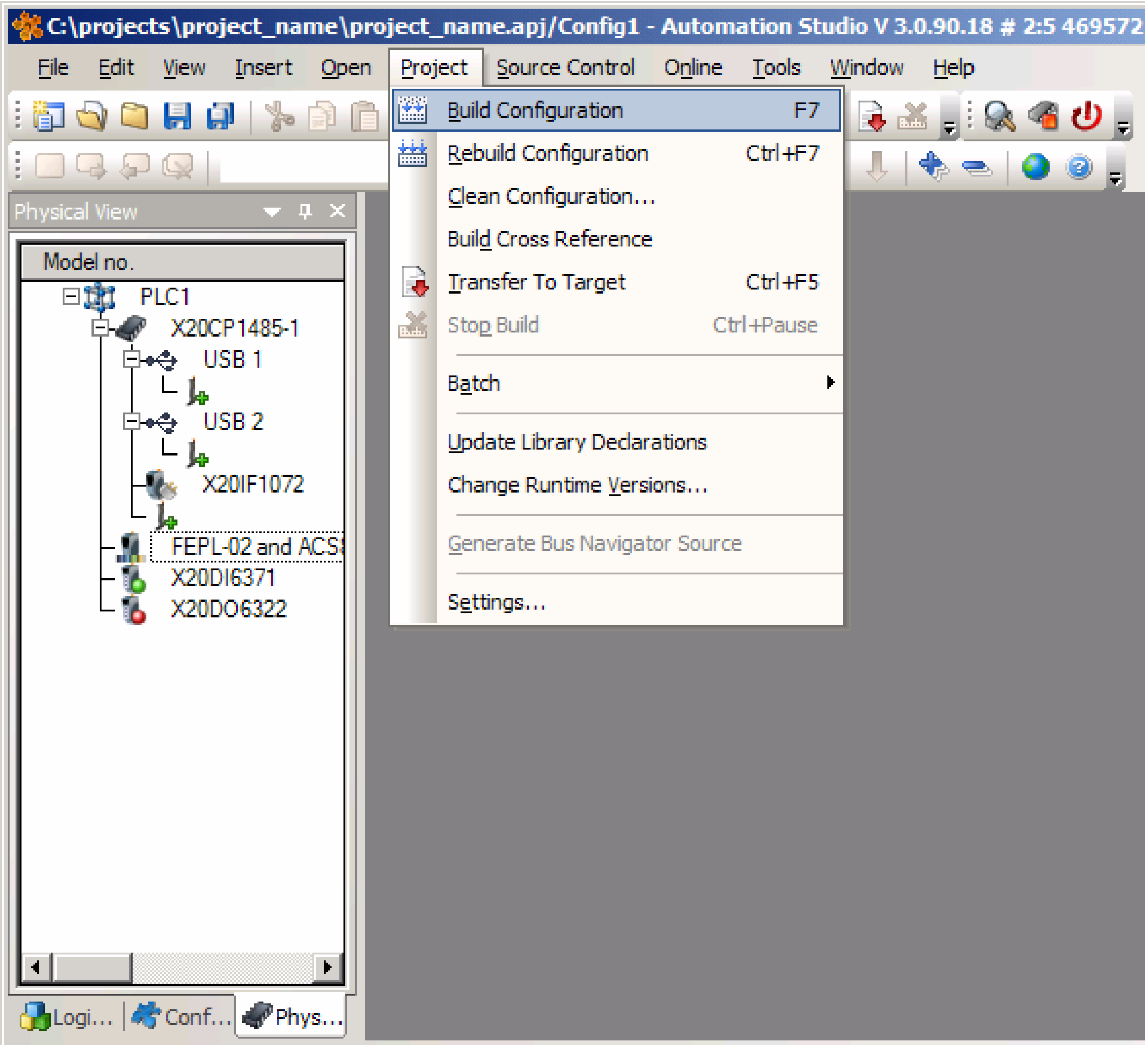
2. In the I/O Configuration window, choose the objects that you want to map into the PDOs by selecting cyclic transmission types for these objects.

   The selections displayed in the example below allow you to control the drive and monitor its status using the ABB Drives profile.

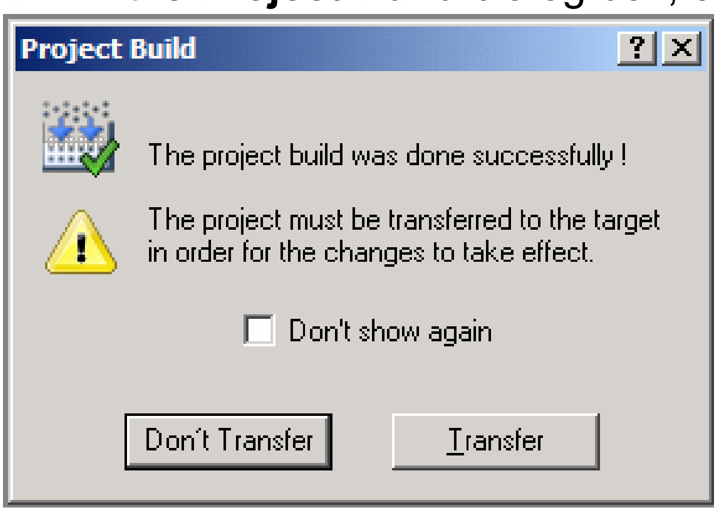


Building a project and transfering it to the PLC

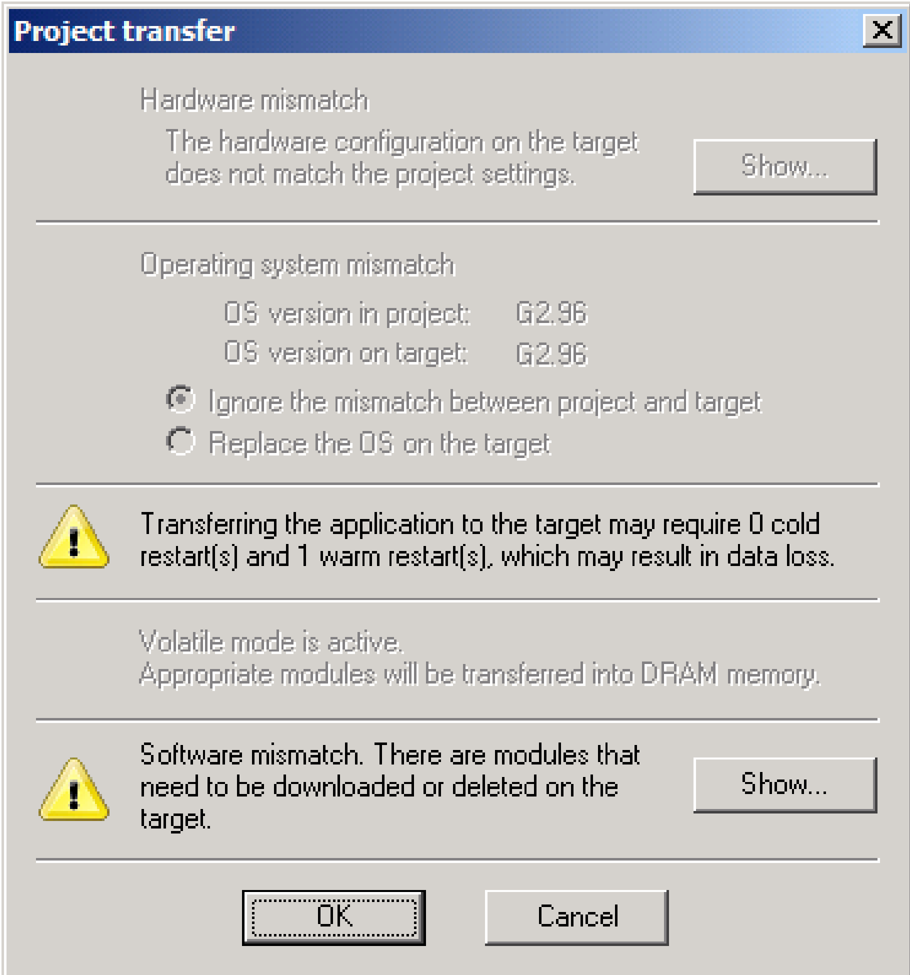
1. On the **Project** menu, click **Build Configuration**.



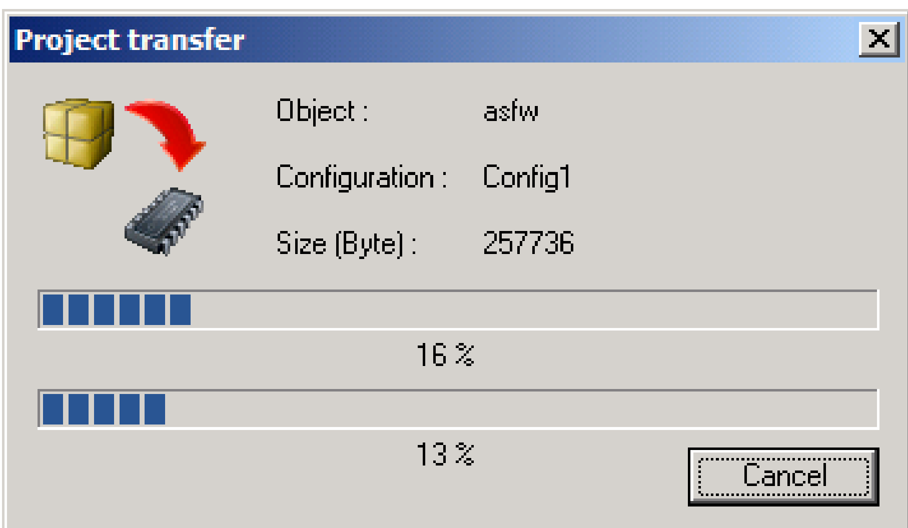
2. In the **Project Build** dialog box, click **Transfer**.



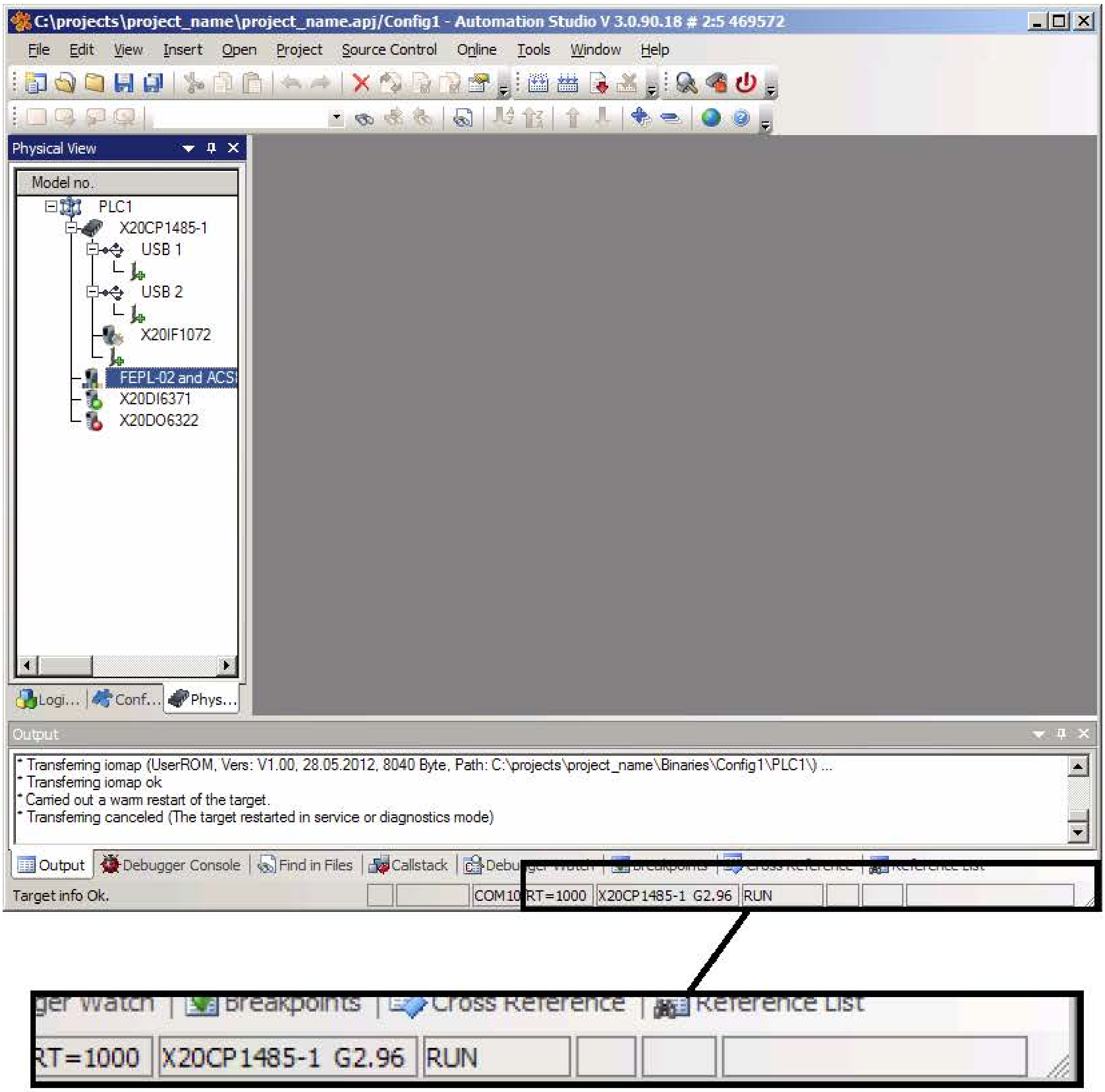
3. In the **Project transfer** dialog box, click **OK**.



4. Wait for the transfer to finish.



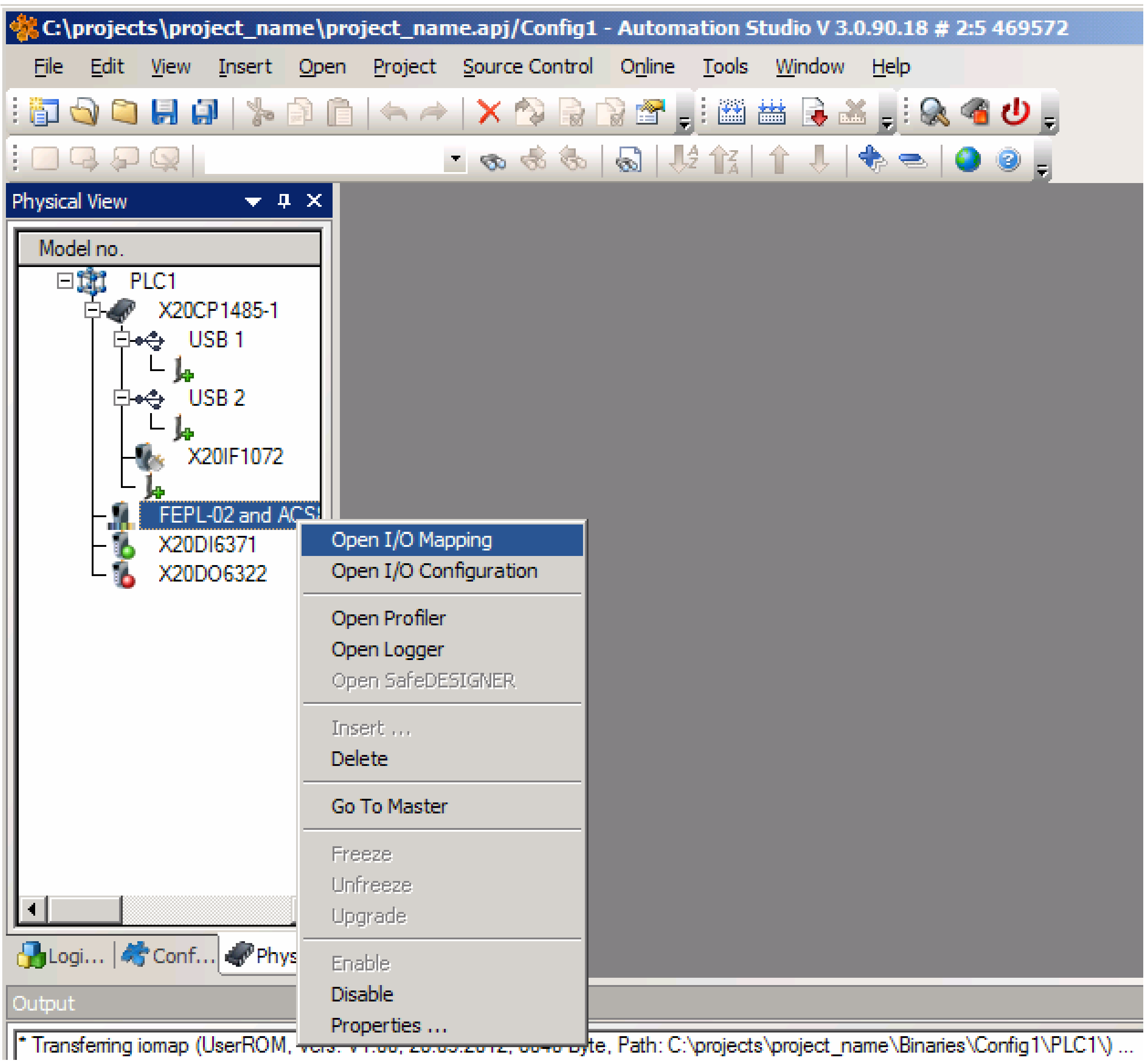
When the transfer is finished, the PLC starts up in the RUN mode.



Forcing values

When Automation Studio is set to the Monitor mode, you can use the window to force values to the control word and speed reference variables. This way, the fieldbus control of the drive can be tested without writing a complete PLC program.

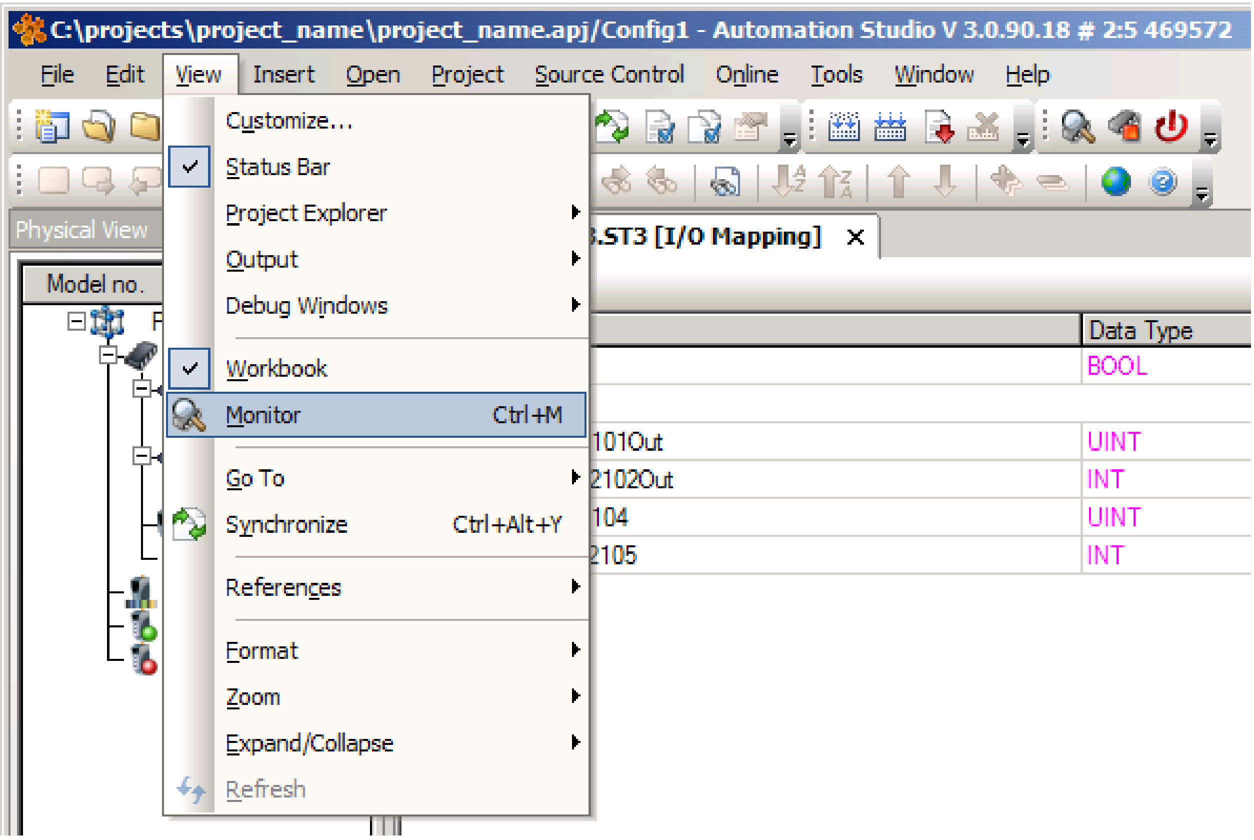
1. To access the PDO data manually, right-click the adapter module entry in the Physical View window, and then click **Open I/O Mapping**.



A list of the mapped objects is displayed.

2. To access the online data, change to the Monitor mode:

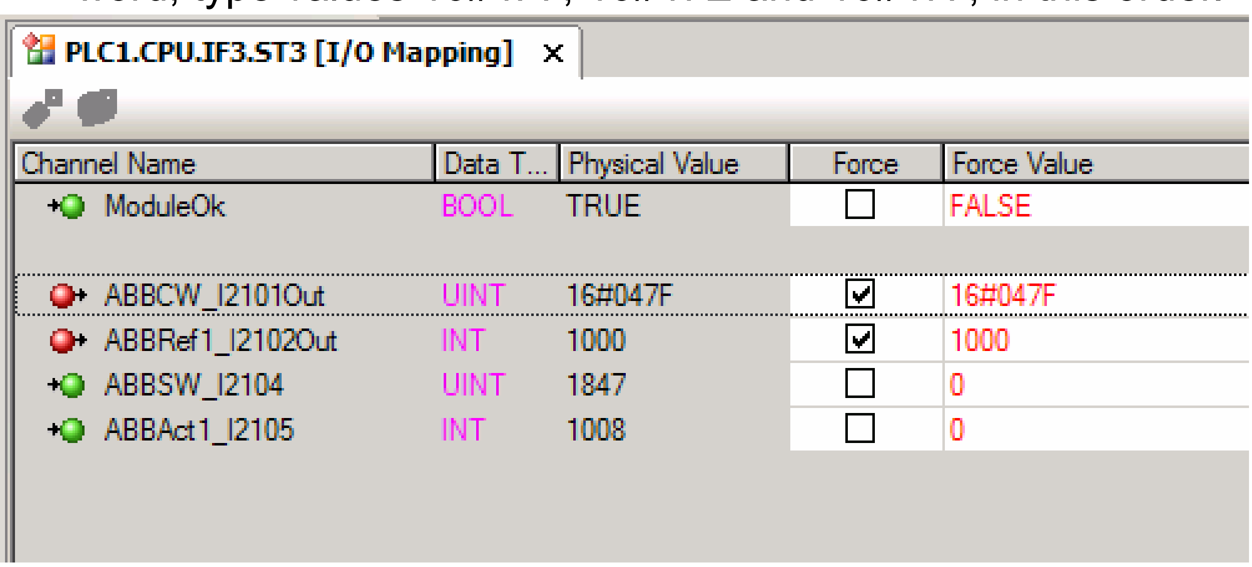
   On the **View** menu, click **Monitor**.



   Automation Studio is now in the Monitor mode.

3. To force values, select the respective check box in the **Force** column, type the value into the **Force Value** column, and then press **Enter** to validate the value.

   For example, to start the drive using the ABB Drives control word, type values 16#4FF, 16#47E and 16#47F, in this order.



7

Communication profiles

What this chapter contains

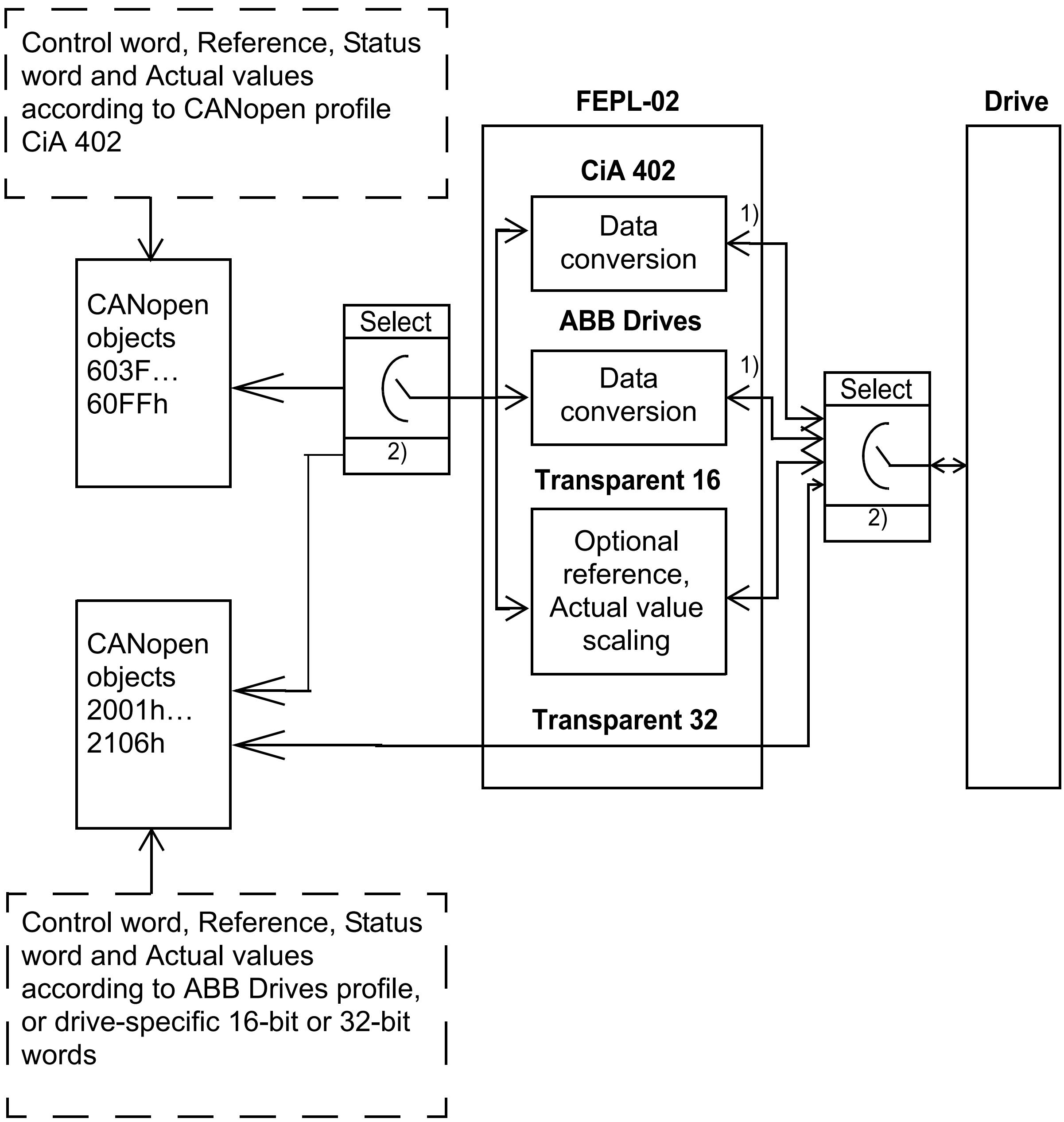
This chapter describes the communication profiles used in the communication between the Ethernet POWERLINK master, the adapter module and the drive.

Communication profiles

Communication profiles are ways of conveying control commands (Control word, Status word, references and actual values) between the master station and the drive.

You can configure the adapter module to provide either the CANopen CiA 402 (Device Profile Drives and Motion Control) profile or the ABB Drives profile. Both are converted to the native profile (eg, DCU or FBA) by the adapter module. In addition, two Transparent profiles – for 16-bit and 32-bit words respectively – are available. With the Transparent modes, no data conversion takes place in the module.

The figure below illustrates the profile selection:



1) Native profile (eg, DCU or FBA)
2) Selection with par. *02 PROFILE* of group 1 (group A)

The following sections describe the Control word, the Status word, references and actual values for the CANopen device profile CiA 402 and the ABB Drives communication profile. See the drive manuals for details on the native communication profiles.

CANopen device profile CiA 402

The CiA 402 profile is a standardized device profile used for digital controlled motion products (for example, drives) and is part of the CANopen specification. Additional information can be obtained at www.can-cia.org.

Supported modes of operation

The CiA 402 profile offers several modes of operation. These modes define the operation of the drive. The CiA 402 operation modes are supported by the drives as follows:

Operation mode	ACSM1 motion	ACSM1 speed	ACS850	ACS355	ACS880
Velocity mode	vl	vl	vl	vl	vl
Profile torque mode	tq	tq	tq	tq	tq
Profile velocity mode	pv				
Profile position mode	pp				
Homing mode	hm				

Note: Drive synchronization is supported only with ACSM1 drives.

In this section, the scalings of the reference and actual values are described for each operation mode. Operation mode -specific objects are defined in *Appendix A – CANopen Object Dictionary*. The current operation mode is displayed in object 0x6061, and it can be changed using object 0x6060.

Velocity mode

The velocity mode is the basic mode to control the velocity of the drive with limits and ramp functions.

The velocity command value is object 0x6042 vl target velocity (rpm).

Note: In the velocity operation mode, the operation is governed by a different set of objects than in other operation modes, namely: 0x6046 vl velocity min max amount, 0x6048 vl velocity acceleration, 0x6049 vl velocity deceleration, 0x604A vl velocity quick stop and 0x604C vl dimension factor.

Profile torque mode

In the profile torque operation mode, the target torque value is processed via a trajectory generator on the adapter module, which generates a linear ramp on the torque command value to the drive.

The torque command value is object 0x6071 Target torque (0.1%). The torque ramp slope is set with object 0x6087 Torque slope (0.1% / s).

Profile velocity mode

In the profile velocity operation mode, the module uses the profile velocity control mode of the drive instead of the Speed control mode.

The velocity command value is object 0x60FF Target velocity (inc/s).

Profile position mode

The profile position mode enables the positioning of the drive to be controlled. The setting of position set-points is controlled by the new set-point and the change sets immediately bits in the Control word as well as the set-point acknowledge bit in the Status word.

The position command value is object 0x607A Target position (inc).

Homing mode

The homing mode describes various methods of finding a home position, or a zero point. The switches pointing the home position can be located at the ends or in the middle of the path that the moving object is travelling. Most of the methods also use the index (zero) pulse from an incremental encoder.

For more information on the homing mode and descriptions of the various homing methods, see the drive manual.

Process data scaling

Torque data

Torque data is expressed in 0.1% of nominal torque, eg, value 10 = 1% torque.

Velocity data

Velocity data is expressed in position increments per second (inc/s).

The scaling for the velocity mode is different from other velocity data. Velocity data for the velocity operation mode is expressed in axis revolutions per minute (rpm). Additionally, a rational factor by which the velocity data will be scaled can be set by object 0x604C vl dimension factor.

Position data

Position data is expressed in position increments (inc).

Process feedback values

Feedback values for control purposes are available in the following objects:

- 0x6077 Torque actual value
- 0x6044 vl velocity actual value
- 0x606C Velocity actual value
- 0x6064 Position actual value.

For the objects to be operational, the drive must be configured to transmit the corresponding feedback data to the adapter module.

Control word and Status word

The Control word is the principal means for controlling the drive from a fieldbus system. It is sent by the fieldbus master to the drive through the adapter module. The drive switches between its states according to the bit-coded instructions in the Control word, and returns status information to the master in the Status word.

The start and stop of the drive and several mode-specific commands are executed by the device control state machine. This is described in figure *State machine* on page *76*.

Control word contents

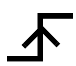
The functionality of the CiA 402 Control word is described in the following tables. The Control word described in the table below can be found in object 0x6040 (hex) and the Status word in object 0x6041 (hex) (see *Appendix A – CANopen Object Dictionary*).

Bit	Description
0	Switch on
1	Enable voltage
2	Quick stop
3	Enable operation
4…6	Operation mode specific
7	Fault reset
8	Halt
9	Operation mode specific
10	Reserved
11…15	Drive specific

The operation mode specific bits of the Control word of the CiA 402 profile are listed in the table below:

Bit	Velocity mode	Profile position mode	Profile velocity mode	Profile torque mode	Homing mode
4	Ramp function generator enable	New set point	Reserved	Reserved	Homing operation start
5	Ramp function generator unlock	Change set immediately	Reserved	Reserved	Reserved
6	Ramp function generator use ref.	Absolute / relative	Reserved	Reserved	Reserved

The CiA 402 state machine is controlled by commands issued via Control word bits 7, 3…0. The commands are listed in the table below:

Control word bit						
Command	**Fault reset bit 7**	**Enable operation bit 3**	**Quick Stop bit 2**	**Enable voltage bit 1**	**Switch on bit 0**	**State transitions[1)]**
Shut down	0	X	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3
Switch on	0	1	1	1	1	3 (+4)[2)]
Disable voltage	0	X	X	0	X	7, 9, 10, 12
Quick stop	0	X	0	1	X	7, 10, 11
Disable operation	0	0	1	1	1	5
Enable operation	0	1	1	1	1	4
Fault reset		X	X	X	X	15

X: Bits marked with X are irrelevant.

[1)] See the state machine of the CiA 402 profile on page 76.

[2)] When Control word bit 3 (Enable operation) is 1, the drive does not stay in the SWITCHED ON state, but immediately moves to state OPERATION ENABLED.

Status word contents

The following table describes the functionality of the Status word of the CiA 402 profile.

Bit	Name	Value	Description
0	Ready to switch on	0	Not ready to switch on
		1	Ready to switch on
1	Switched on	0	Not switched on
		1	Switched on

Bit	Name	Value	Description
2	Operation enabled	0	Operation not enabled
		1	Operation enabled
3	Fault	0	No fault
		1	Fault
4	Voltage enabled	0	No high voltage applied to the drive
		1	High voltage applied to the drive
5	Quick stop	0	Quick stop is active
		1	Normal operation
6	Switch on disabled	0	Switch on enabled
		1	Switch on disabled
7	Warning	0	No warning/alarms
		1	Warning/Alarm is active
8	Drive-specific	0	
		1	
9	Remote	0	Controlword is not processed
		1	Controlword is processed
10	Target reached	0	Set-point not reached
		1	Set-point reached
11	Internal limit active	0	Internal limit not active
		1	Internal limit active
12…13	Operation mode specific		
14…15	Drive-specific	0	
		1	

The following table describes the operation mode specific bits of the Status word of the CiA 402 profile:

Bit	Velocity mode	Profile position mode	Profile velocity mode	Profile torque mode	Homing mode
12	Reserved	Set-point acknowledge-ment	Speed	Reserved	Homing attained
13	Reserved	Following error	Max slippage error	Reserved	Homing error

State machine

The state machine for the CiA 402 communication profile is shown below.

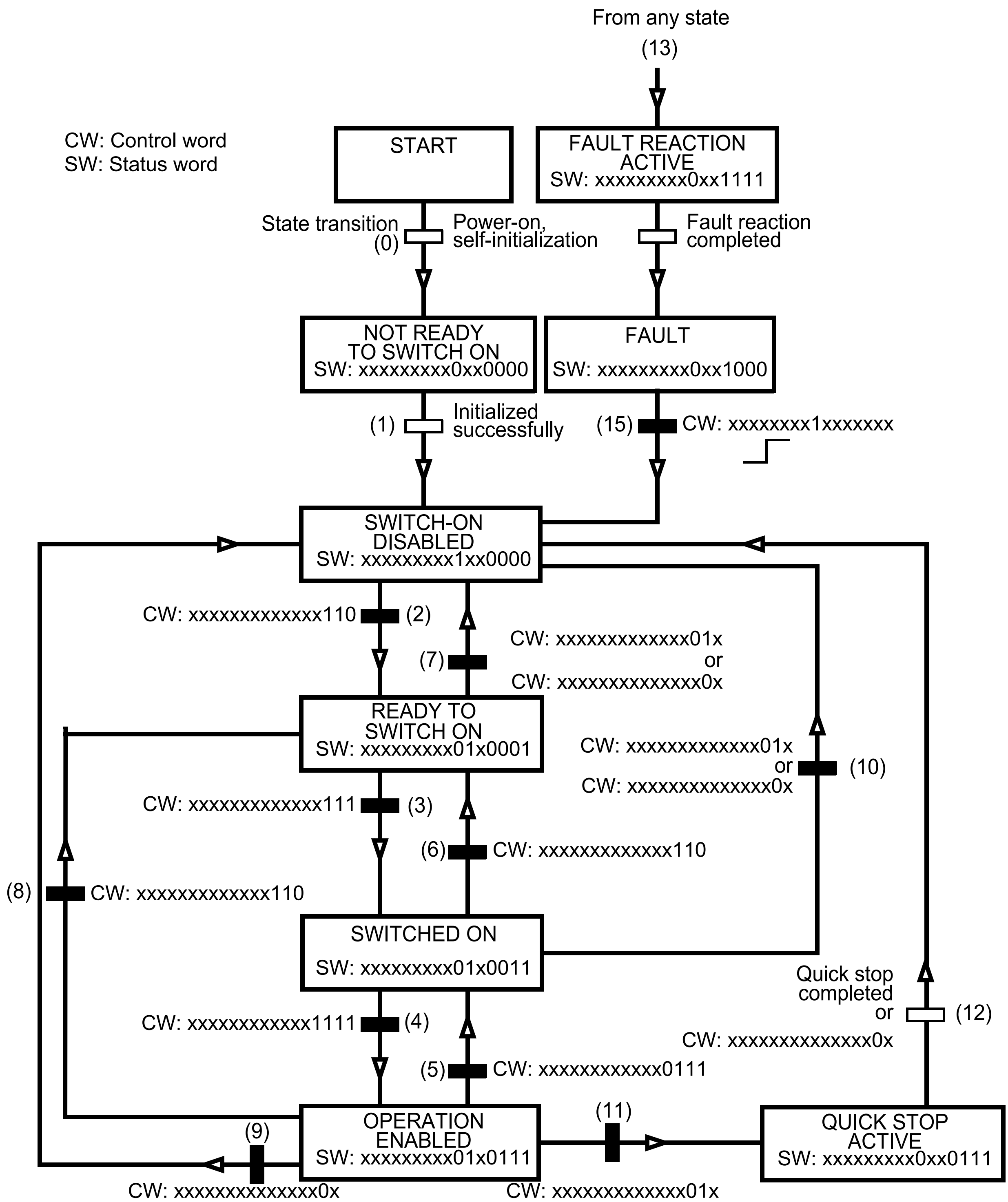


ABB Drives communication profile

Control word and Status word

The Control word is the principal means for controlling the drive from a fieldbus system. The fieldbus master station sends the Control word to the drive through the adapter module. The drive switches between its states according to the bit-coded instructions in the Control word and returns status information to the master in the Status word.

The contents of the Control word and the Status word are detailed below. The drive states are presented on page 81.

Control word contents

The table below shows the contents of the Control word for the ABB Drives communication profile. The upper case boldface text refers to the states shown in the state machine on page 81.

Bit	Name	Value	STATE/Description
0	OFF1_ CONTROL	1	Proceed to **READY TO OPERATE**.
		0	Stop along currently active deceleration ramp. Proceed to **OFF1 ACTIVE**; proceed to **READY TO SWITCH ON** unless other interlocks (OFF2, OFF3) are active.
1	OFF2_ CONTROL	1	Continue operation (OFF2 inactive).
		0	Emergency OFF, coast to stop. Proceed to **OFF2 ACTIVE**, proceed to **SWITCH-ON INHIBITED**.
2	OFF3_ CONTROL	1	Continue operation (OFF3 inactive).
		0	Emergency stop, stop within time defined by drive parameter. Proceed to **OFF3 ACTIVE**; proceed to **SWITCH-ON INHIBITED**. **Warning:** Ensure that motor and driven machine can be stopped using this stop mode.

Bit	Name	Value	STATE/Description
3	INHIBIT_ OPERATION	1	Proceed to **OPERATION ENABLED**. **Note:** Run enable signal must be active; see drive documentation. If the drive is set to receive the Run enable signal from the fieldbus, this bit activates the signal.
		0	Inhibit operation. Proceed to **OPERATION INHIBITED**.
4	RAMP_OUT_ ZERO	1	Normal operation. Proceed to **RAMP FUNCTION GENERATOR: OUTPUT ENABLED**.
		0	Force Ramp Function Generator output to zero. Drive ramps to stop (current and DC voltage limits in force).
5	RAMP_HOLD	1	Enable ramp function. Proceed to **RAMP FUNCTION GENERATOR: ACCELERATOR ENABLED**.
		0	Halt ramping (Ramp Function Generator output held).
6	RAMP_IN_ ZERO	1	Normal operation. Proceed to **OPERATION**. **Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Force Ramp Function Generator input to zero.
7	RESET	0 –> 1	Fault reset if an active fault exists. Proceed to **SWITCH-ON INHIBITED**. **Note:** This bit is effective only if the fieldbus interface is set as the source for this signal by drive parameters.
		0	Continue normal operation.
8…9	Reserved.		

Bit	Name	Value	STATE/Description
10	REMOTE_ CMD	1	Fieldbus control enabled.
		0	Control word and reference not getting through to the drive, except for CW bits OFF1, OFF2 and OFF3.
11	EXT_CTRL_ LOC	1	Select External Control Location EXT2. Effective if control location parameterized to be selected from fieldbus.
		0	Select External Control Location EXT1. Effective if control location parameterized to be selected from fieldbus.
12… 15	Drive-specific (For information, see the drive documentation.)		

Status word contents

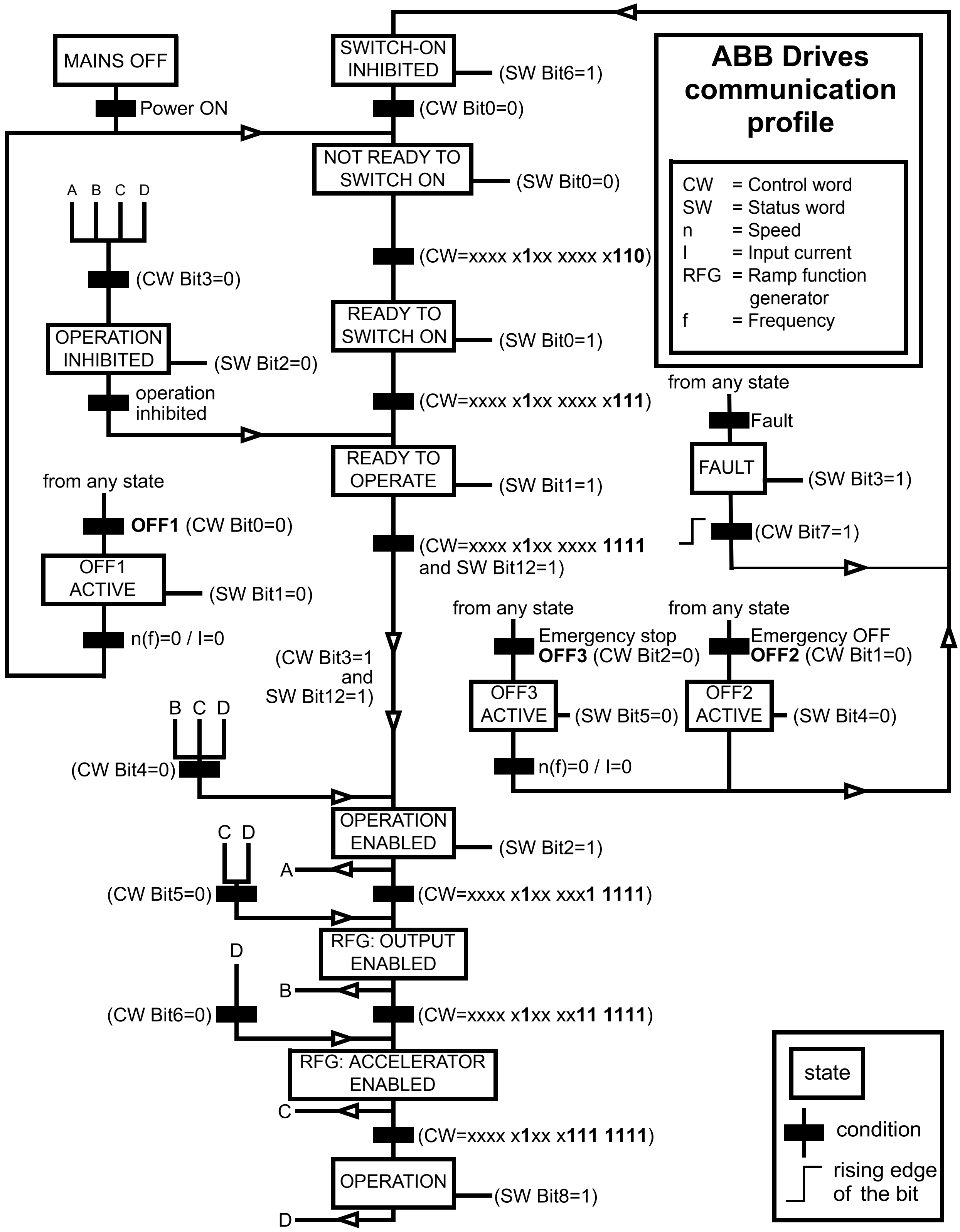
The table below shows the contents of the Status word for the ABB Drives communication profile. The upper case boldface text refers to the states shown in the state machine on page *81*.

Bit	Name	Value	STATE/Description
0	RDY_ON	1	**READY TO SWITCH ON**
		0	**NOT READY TO SWITCH ON**
1	RDY_RUN	1	**READY TO OPERATE**
		0	**OFF1 ACTIVE**
2	RDY_REF	1	**OPERATION ENABLED**
		0	**OPERATION INHIBITED**
3	TRIPPED	1	**FAULT**
		0	No fault
4	OFF_2_STA	1	OFF2 inactive
		0	**OFF2 ACTIVE**
5	OFF_3_STA	1	OFF3 inactive
		0	**OFF3 ACTIVE**
6	SWC_ON_ INHIB	1	**SWITCH-ON INHIBITED**
		0	–

Bit	Name	Value	STATE/Description
7	ALARM	1	Warning/Alarm
		0	No warning/alarm
8	AT_ SETPOINT	1	**OPERATION.** Actual value equals reference (= is within tolerance limits, ie, in speed control, speed error is 10% max. of nominal motor speed).
		0	Actual value differs from reference (= is outside tolerance limits).
9	REMOTE	1	Drive control location: REMOTE (EXT1 or EXT2)
		0	Drive control location: LOCAL
10	ABOVE_ LIMIT	1	Actual frequency or speed equals or exceeds supervision limit (set by drive parameter). Valid in both directions of rotation.
		0	Actual frequency or speed within supervision limit
11	EXT_CTRL_ LOC	1	External Control Location EXT2 selected. **Note concerning ACS880:** This bit is effective only if the fieldbus interface is set as the target for this signal by drive parameters. User bit 0 selection (06.33).
		0	External Control Location EXT1 selected
12	EXT_RUN_ ENABLE	1	External Run Enable signal received. **Note concerning ACS880:** This bit is effective only if the fieldbus interface is set as the target for this signal by drive parameters. User bit 1 selection (06.34).
		0	No External Run Enable signal received
13… 14	Drive-specific (For information, see the drive documentation.)		
15	FBA_ERROR	1	Communication error detected by fieldbus adapter module
		0	Fieldbus adapter communication OK

State machine

The state machine for the ABB Drives communication profile is shown below.



References

References are 16-bit words containing a sign bit and a 15-bit integer. A negative reference (indicating reversed direction of rotation) is formed by calculating the two's complement from the corresponding positive reference.

ABB drives can receive control information from multiple sources including analog and digital inputs, the drive control panel and a communication module (for example, FEPL-02). To have the drive controlled through the fieldbus, the module must be defined as the source for control information, for example, reference.

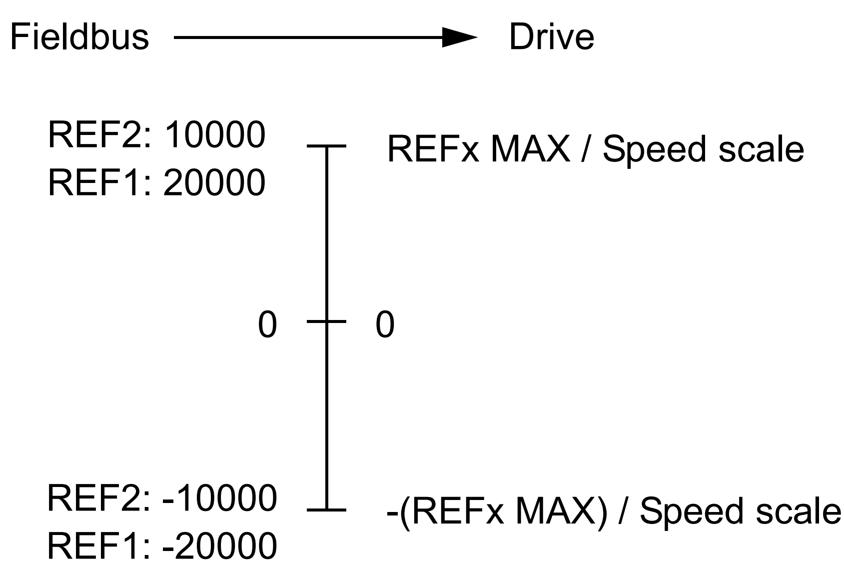
Scaling

References are scaled as shown below.

Note: The values of REF1 MAX and REF2 MAX are set with drive parameters. See the drive manuals for further information.

In ACSM1, ACS850, ACQ810 and ACS880, the speed reference (REFx) in decimal (0…20000) corresponds to 0…100% of the speed scaling value (as defined with a drive parameter, eg, ACS880 parameter 46.01 Speed scaling).

In ACS355, drive parameter REFx MIN may limit the actual minimum reference.



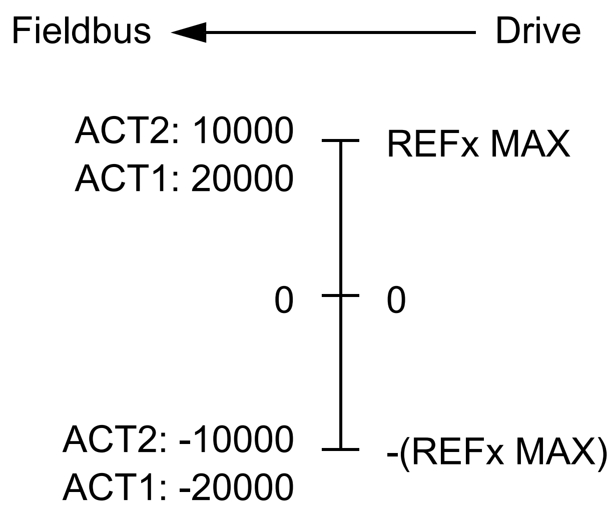
Actual values

Actual values are 16-bit words containing information on the operation of the drive. The functions to be monitored are selected with a drive parameter.

Scaling

Actual values are scaled as shown below.

Note: The values of REF1 MAX and REF2 MAX are set with drive parameters. See the drive manuals for further information.



8

Communication protocol

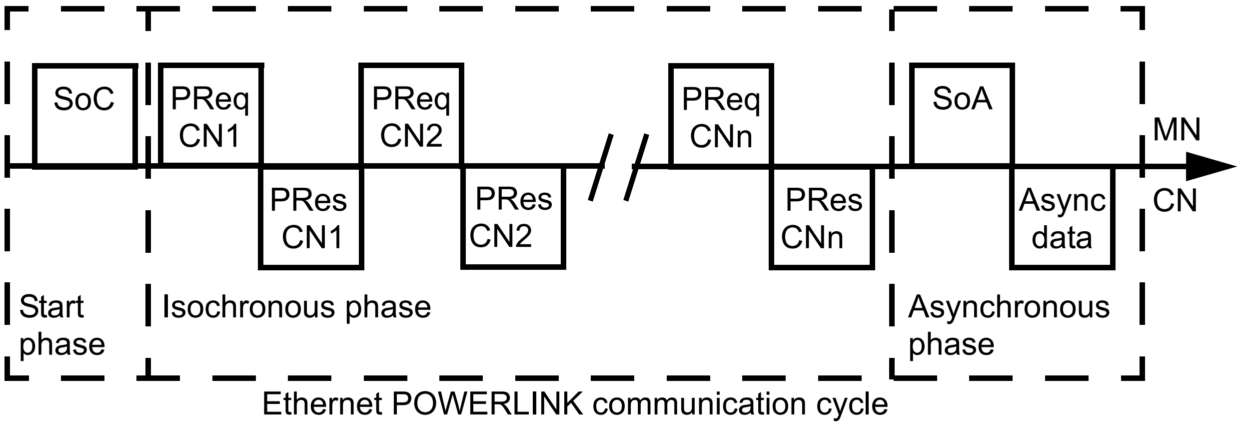
What this chapter contains

This chapter describes the Ethernet POWERLINK communication protocol for the adapter module.

Ethernet POWERLINK communication cycle

In an Ethernet POWERLINK network, one of the nodes, for example, a PLC, motion controller or industrial PC, is designated to function as the Managing Node (MN), the master in the network. All other devices operate as Controlled Nodes (CN), slaves in the network. The MN defines the clock pulse for the synchronization of all devices and manages the data communication cycle. In the course of one clock cycle within which all nodes are addressed, the MN sends Poll Requests (PReq) to all CNs one after another. They reply immediately to the prompts with Poll Responses (PRes).

An Ethernet POWERLINK cycle consists of three phases. During the start phase, the MN sends a Start of Cycle Frame (SoC) signal to all CNs to synchronize the devices. Payload data exchange then proceeds in the second phase, the isochronous phase. The third phase, the asynchronous phase, allows the transfer of large packets that are not time-critical, for example, parametrization data.



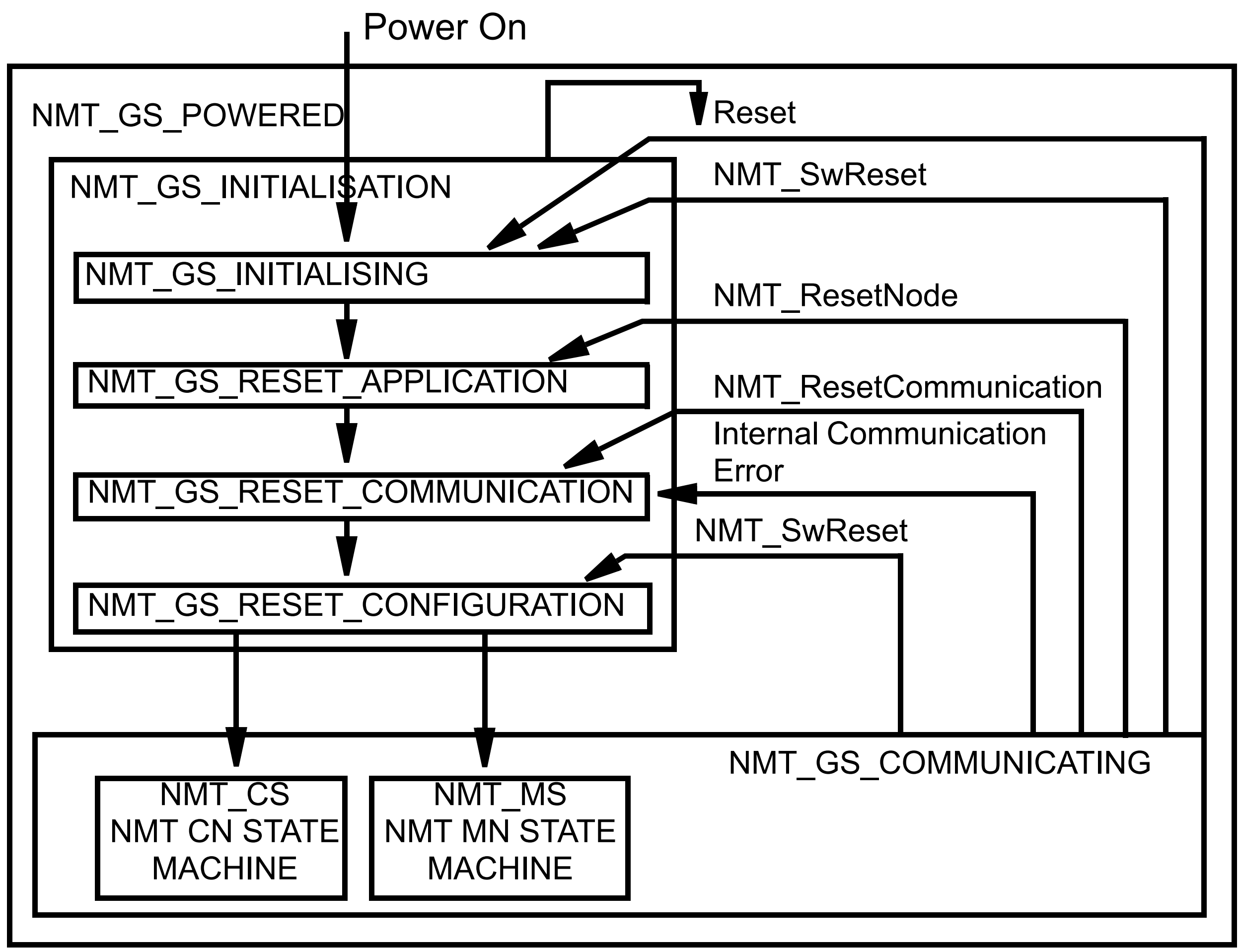
Ethernet POWERLINK state machine

In Ethernet POWERLINK, a Controlled Node starts up by a common initialization process. All the states are valid when the device is powered, and they are substates of the NMT_GS_POWERED superstate.

NMT_GS_INITIALISATION

After system start, the device automatically assumes this state and network functionality begins. NMT_GS_INITIALISATION and all its substates are only internal states of the device.

In the NMT_GS_RESET_CONFIGURATION substate, the node address of the device is identified, and it is determined whether the device is configured as a MN or CN. The FEPL-02 module is a CN, and thus, it enters the NMT CN state machine in the NMT_GS_COMMUNICATING superstate.



NMT_GS_COMMUNICATING

NMT_CS_NOT_ACTIVE

This is a non-permanent state that allows a starting node to recognize the current network state. Timeout for SoC, PReq, PRes and SoA frames trigger the device to enter state NTM_CS_BASIC_ETHERNET.

The NMT_CS_PREOPERATIONAL states

NMT_CS_PREOPERATIONAL_1 is one of the substates in the superstate NMT_CS_EPL_MODE. Transition from NMT_CS_NOT_ACTIVE to NMT_CS_PRE_OPERATIONAL_1 is triggered by a SoA or SoC frame being received. In this state, the CN may send a frame only if the MN has authorized it to do so by a SoA command. There is no PDO communication in this state.

Receiving a SoC frame triggers the transition from NMT_CS_PREOPERATIONAL_1 to NMT_CS_PREOPERATIONAL_2. In this state, PReq and PRes data may be invalid because PDO mappings may differ.

In NMT_CS_EPL_MODE, error recognition (for example, loss of SoC or PReq) always triggers the transition to NMT_CS_PREOPERATIONAL_1.

NMT_CS_READY_TO_OPERATE

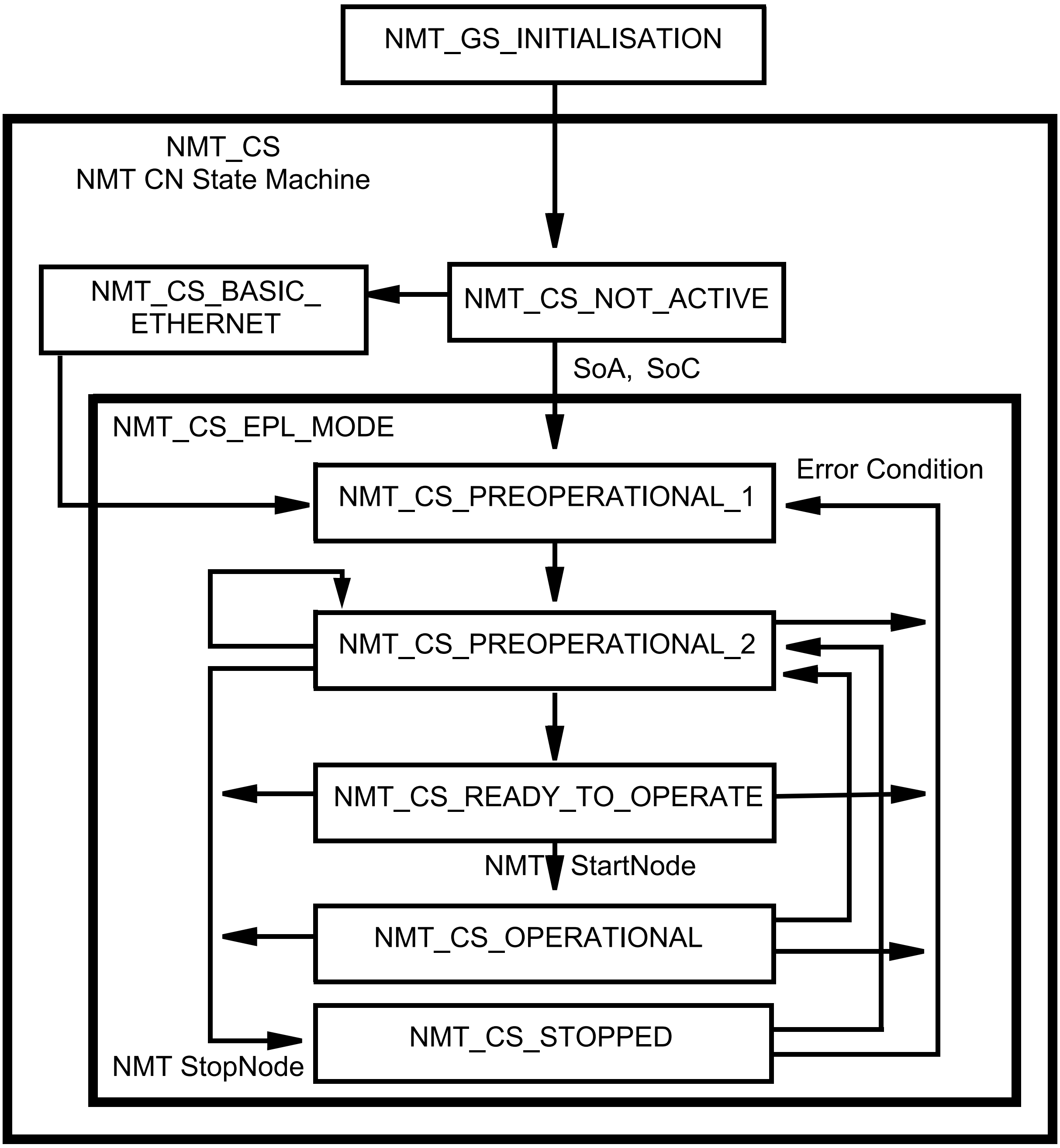
In this state, the CN signals that it is ready to operate to the MN. It responds to the PReq query of the MN by sending a PRes frame.

NMT_CS_OPERATIONAL

NMT StartNode command triggers the transition from NMT_CS_READY_TO_OPERATE to NMT_CS_OPERATIONAL. This is the normal operating state of the CN.

NMT_CS_STOPPED

This state is used for the controlled shutdown of a selected CN while the system is still running. In this state, the CN does not participate in cyclic frame exchange, but it still observes SoA frames.



DS 301 and DS 402 specification

The application layer communication protocol in the FEPL-02 module is based on the CANopen DS 301 communication profile and DS 402 device profile for drives and motion control. The protocol specifies the Object Dictionary in the adapter module, as well as communication objects for exchanging process data and acyclic messages.

The adapter module implements the following message types:

- Process Data Object (PDO)

  The PDO is used for cyclic I/O communication, in other words, process data.

- Service Data Object (SDO)

  The SDO is used for acyclic data transmission.

- NMT response services

  NMT response services are used for identity and status signaling both during the start-up and in runtime.

The Object Dictionary is described in *Appendix A – CANopen Object Dictionary*.

Process Data Objects

Process Data Objects (PDO) are used for exchanging time-critical process data between the master and the slave. Tx PDOs are used to transfer data from the slave to the master and Rx PDOs to transfer data from the master to the slave.

PDO mapping defines which application objects are transmitted inside a PDO. These typically include control and status words, references and actual values, but most dictionary objects and drive parameters can be mapped for cyclical communication.

The FEPL-02 adapter module has one receive PDO (Rx PDO) and one transmit PDO (Tx PDO). In each PDO, 0…16 application objects can be mapped. PDOs are mapped to objects during configuration (the NMT_CS_PRE-OPERATIONAL_1 and NMT_CS_PREOPERATIONAL_2 states).

The Tx PDO is mapped by writing to the 0x1A00 object. By default, there is no parameter mapped to the Tx PDO. Choose which parameters are exchanged by the Tx PDO.

The Rx PDO is mapped by writing to the 0x1600 object. By default, there is no parameter mapped to the Rx PDO. Choose which parameters are exchanged by the Rx PDO.

Note: The maximum number of I/O parameters that can be simultaneously mapped for cyclic communication depends on the drive type and application. For example, ACS880 supports 12 inputs and 12 outputs.

Service Data Objects

Service Data Object (SDO) uses asynchronous data transmission and is used to access object without mapping them to a PDO connection. With SDO communication, all CANopen objects in the adapter module can be accessed.

Ethernet POWERLINK provides different kinds of SDO transfer methods. The adapter module supports SDO transfer via Ethernet POWERLINK ASnd frames in asynchronous phase. For further information, see Ethernet POWERLINK Communication Profile Specification Version 1.1.0.

SDO Protocol

The Download Protocol (for write commands) and Upload Protocol (for read commands) are described in the Ethernet POWERLINK Communication Profile Specification Version 1.1.0.

The adapter module supports the following commands:

- Write by Index
- Read by Index

When the Write by Index command is used, the client of an SDO (the MN) downloads data to the adapter module.

When the Read by Index command is used, the client of an SDO (the MN) requests the adapter module to upload data to the client.

To address the objects, Indexes and Sub-Indexes are used. An Index (0…65535) specifies and entry of the device object and a Sub-Index (0…254) specifies a component of the device object dictionary entry.

Network Management Services

Ethernet POWERLINK Network Management (NMT) is node-oriented and follows a master/slave relationship. The adapter module is administered as an NMT slave by the master.

Ethernet POWERLINK defines five categories of NMT services:

- NMT State Command Services
- NMT Managing Command Services (not supported)
- NMT Response Services
- NMT Info Services (not supported)
- NMT Guard Services (not supported).

NMT State Command Services

The MN controls the state of the CN via NMT State Command Services. For more information, see section *Ethernet POWERLINK state machine* on page *86*.

NMT Response Services

NMT Response Services are used by the MN to query NMT information from the CN, such as current state, error and setup data. Ethernet POWERLINK specifies the following NMT Response Services:

- NMT State Response
- IdentResponse
- StatusResponse.

Via the NMT State Response service, the CNs signal their states to the MN. The IdentResponse service is used by the MN to identify configured but unrecognized CNs at system start-up or after loss of communication. For more information, see *Appendix C – IdentResponse Frame*.

The StatusResponse service is used by the MN to query the current status of CNs that are not communicating isochronously. It is used for error signaling in runtime. If an error occurs, the EN (Error New) flag in the PRes frame is toggled. This notifies the MN that an error has occurred, and the MN polls the CN for a StatusResponse that includes error information. A list of active and historical error events can be read using SDO from object 0x1003.

Error entry specification

Byte	0	1	2	3	4	5	6	7	8	9
	Entry type[1)]		Error code[2)]		Time Stamp (Not used[3)])					
Byte	10	11	12	13	14	15	16	17	18	19
	Time Stamp		Additional information (Not used[3)])							

1) See Ethernet POWERLINK Communication Profile Specification, version 1.1.0.

2) See the error code table in *Appendix B – CANopen error codes*.

3) All bytes are set to zero.

9

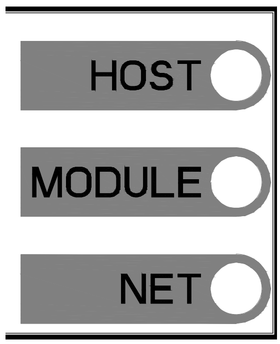
Diagnostics

What this chapter contains

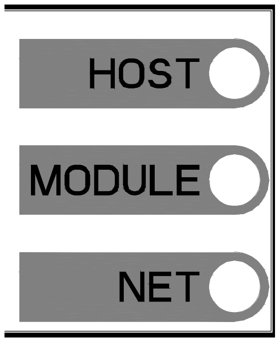
This chapter explains how to trace faults with the status LEDs on the adapter module.

LED indications

The adapter module is equipped with three bicolor diagnostic LEDs. The LEDs are described below.



Name	Color	Function/state
HOST	Blinking green	Establishing communication to host
	Green	Connection to host OK
	Blinking red	Communication to host lost temporarily
	Flashing orange, alternating with the MODULE flashing orange	Internal file system error. The error may be cleared by cycling drive power. If the error persists, contact your local ABB representative.



Name	Color	Function/state
MODULE	Green off	NMT_GS_OFF, NMT_GS_INITIALISATION, NMT_CS_NOT_ACTIVE
	Flickering green	NMT_CS_BASIC_ETHERNET
	Green, single flash	NMT_CS_PRE_OPERATIONAL_1
	Green, double flash	NMT_CS_PRE_OPERATIONAL_2
	Green, triple flash	NMT_CS_READY_TO_OPERATE
	Green	NMT_CS_OPERATIONAL
	Blinking green	NMT_CS_STOPPED
	Red	Error
	Flashing orange, alternating with the HOST flashing orange	Internal file system error. The error may be cleared by cycling drive power. If the error persists, contact your local ABB representative.
NET	Blinking green	TX/RX activity
	Green	Link(s) are active.
	Red	Link(s) are inactive.

10

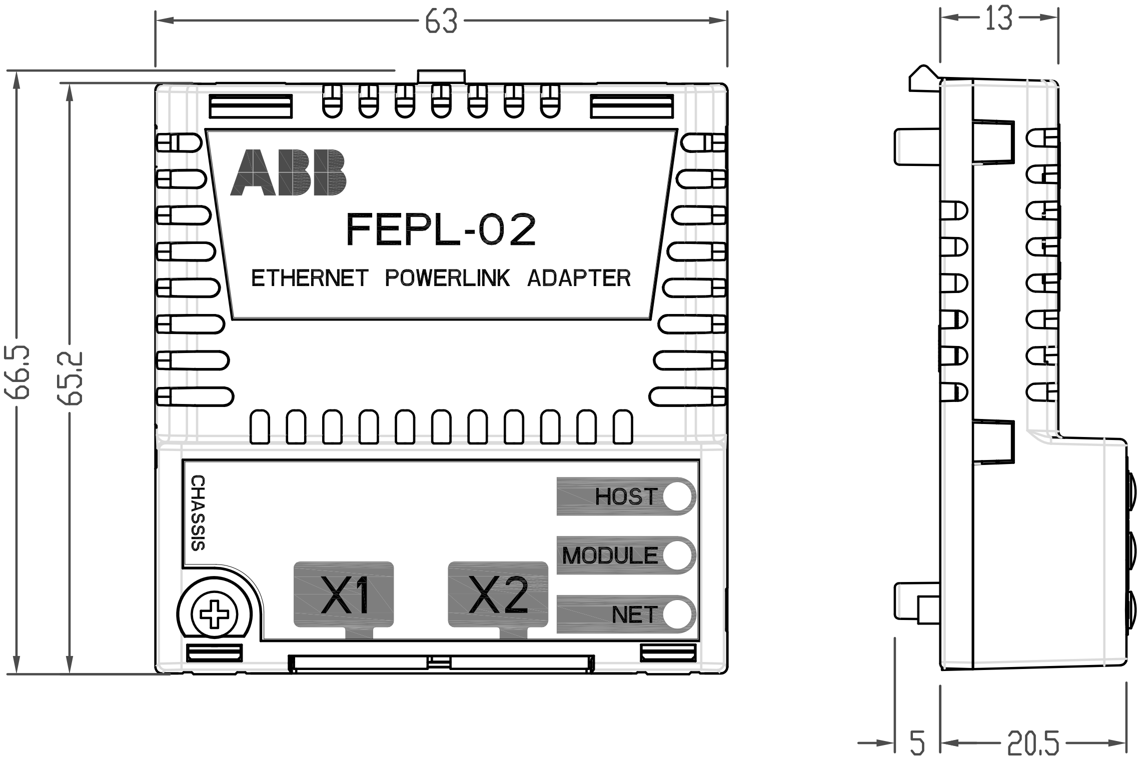
Technical data

What this chapter contains

This chapter contains the technical specifications of the adapter module and the Ethernet POWERLINK link.

FEPL-02

The figure below shows the enclosure of the adapter module from the front and side.



Mounting	Into the option slot of the drive
Degree of protection	IP20
Ambient conditions	The applicable ambient conditions specified for the drive in its manuals are in effect.
Indicators	Three LEDs (HOST, MODULE, NET)
Connectors	20-pin connector to the drive (X3) Two RJ-45 connectors (X1 and X2)
Power supply	+3.3 V +5% max. 450 mA (supplied by the drive)
General	Estimated min. lifetime 100 000 h All materials UL/CSA-approved Complies with EMC standard EN 61800-3:2004 Printed circuit board conformal coated

Ethernet POWERLINK link

Compatible devices	All Ethernet POWERLINK compliant devices
Medium	100Base-TX • Wiring: CAT 5 UTP, CAT 5 FTP* or CAT 5 STP* (*Recommended) • Connector: RJ-45 • Termination: Internal • Maximum segment length: 100 m
Topology	Star, tree, or daisy chain
Transfer rate	100 Mbit/s
Serial communication type	Half-duplex
Protocol	Ethernet POWERLINK

11

Appendix A – CANopen Object Dictionary

What this chapter contains

The CANopen Object Dictionary contains all the configuration data of the adapter module.

Object Dictionary structure

The objects in the Object Dictionary can be accessed with SDO services, and many of the dictionary objects can be mapped for cyclic communication in PDOs. Each object is addressed using a 16-bit index.

The following table presents the overall layout of the standard Object Dictionary.

Index (hex)	Object Dictionary area
0000 - 0FFF	Data type area
1000 - 1FFF	Communication profile area
2000 - 5FFF	Manufacturer-specific profile area
6000 - 9FFF	Device profile area
A000 - FFFF	Reserved area

Explanations for the abbreviations in the columns of the tables are given below:

Index	Object index (hex)
SI	Subindex (hex)
Type	Data type • U64 = 64-bit unsigned integer • U32 = 32-bit unsigned integer (0 … 2^{32} - 1) • I32 = 32-bit signed integer (-2^{31} … 2^{31} - 1) • U16 = 16-bit unsigned integer (0…65535) • I16 = 16-bit signed integer (-32768…32767) • U8 = 8-bit unsigned integer (0…255) • I8 = 8-bit signed integer (-128…127) • OSTR = Octet string • VSTR = Visible string • BOOL = Boolean
Acc. / Access	SDO read/write access • R = object can only be read by the SDO service • RW = object can be both read and written by the SDO service
Def.	Default value

Communication profile objects

The objects in the communication profile section describe the basic Ethernet POWERLINK properties of the adapter module. The objects are described in the following table.

Index	SI	Name	Type	Acc.	Def.	Information
1000	0	Device type	U32	R	0x10192	Describes the type of the device. Composed of two 16-bit fields, the least significant field describing the device profile, and the most significant field giving additional information. The device profile for FEPL-02 is 0×10192 (hex), which corresponds to communication profile CiA 402, and additional information value is 0×01 (hex), which represents a frequency converter.
1001	0	Error register	U8	R	0	Error register for the adapter module. Bit encoded according to DS 301/401. When a bit is set, the error is active. Bits: • 7: Manufacturer-specific • 6: Reserved (always 0) • 5: Device profile specific • 4: Communication • 3: Temperature • 2: Voltage • 1: Current • 0: Generic error (any drive fault).
1003	0	Error history	U8	RW	0	Number of entries. 0 = clear history Range: 0…254
	1	Error entry 1		R	-	
	…	…	…	…	…	
	254	Error entry 254		R	-	
1006	0	Communication cycle time interval	U32	R	0	Length of the cycle time interval in microseconds, ie, the time between SoC-SoC

Index	SI	Name	Type	Acc.	Def.	Information
1008	0	Device name	VSTR	R		Device name. The constant string is FEPL-02 and <drive name>.
1009	0	Hardware version	VSTR	R	-	Board revision, eg, A
100A	0	Software version	VSTR	R	-	Firmware name and version
1010	0	Store parameters	U8	R	-	Number of entries. Write value 0x65766173 into a relevant subindex to save object values to non-volatile memory. Range: 1…127
	1	Save all parameters	U32	RW	-	Save the communication and device profile areas.
	2	Save comm parameters	U32	RW	-	Save objects 1000…1FFF (communication profile area).
	3	Save appl parameters	U32	RW	-	Save objects 6000…9FFF (device profile area).
	4	Save drive parameters	U32	RW	-	Save drive parameters.
1011	0	Restore default parameters	U8	R	-	Number of entries. Write value 0x64616F6C into a relevant subindex to restore the default values to objects. Range: 1…127
	1	Restore all defaults	U32	RW	-	Restore the default values to the communication and device profile areas.
	2	Restore comm defaults	U32	RW	-	Restore objects 1000…1FFF (communication profile area).
	3	Restore appl defaults	U32	RW	-	Restore objects 6000…9FFF (device profile area) which are saved to the FBA.
	4	Restore drive defaults	U32	RW	-	Restore drive default parameters.

Index	SI	Name	Type	Acc.	Def.	Information
1018	0	Identity	U8	R	4	Number of entries Range: 1…4
	1	Vendor ID	U32	R	-	Value 0xB7 = ABB Drives
	2	Product code	U32	R	-	Product code read from the drive. Eg, value 0x1F7 = ACS355, 0x20A = ACSM1 speed, 0x20B = ACSM1 motion, 0x21C = ACS850, 0x259 = ACS880.
	3	Revision	U32	R	-	FBA firmware version number (hex), eg, value 0x015 = FFEPL015
	4	Serial number	U32	R	-	Serial number of the adapter module
1020	0	Verify configuration	U8	R	4	Number of entries Range: 2…4
	1	Configuration date	U32	RW	0	Used by the MN to verify if the module is properly configured
	2	Configuration time	U32	RW	0	Used by the MN to verify if the module is properly configured
	3	Configuration ID	U32	RW	0	Used by the MN to verify if the module is properly configured
	4	Verify configuration valid	BOOL	RW	TRUE	Used by the MN to verify if the module is properly configured

Index	SI	Name	Type	Acc.	Def.	Information
1030	0	Interface Group	U8	R	9	Number of entries
	1	Interface Index	U32	R	-	Interface index of the physical interface. Always 1.
	2	Interface Description	VSTR	R	-	Textual string containing information about the interface
	3	Interface Type	U8	R	6	1 = Other 6 = Ethernet CSMA/CD 7 = iso88023 CSMA/CD Always 6 (Ethernet CSMA/CD)
	4	Interface MTU	U16	R	-	Size of the largest datagram which can be sent/received on the interface, specified in octets
	5	Interface Phys Address	OSTR	R	-	MAC address assigned during manufacturing
	6	Interface Name	VSTR	R	-	Always eth0
	7	Interface Operation Status	U8	R	-	The current operational state of the interface 0 = Down 1 = Up
	8	Interface Admin State	U8	RW	1	The current administration state of the interface 0 = Down 1 = Up
	9	Valid Boolean	BOOL	RW	FALSE	Specifies whether or not the data of this object is valid. TRUE = The data is valid. FALSE = The data is invalid.
1300	0	SDO sequence timeout	U32	RW	-	Timeout value in milliseconds for the connection abort recognition of the SDO sequence layer

Index	SI	Name	Type	Acc.	Def.	Information
1400	0	Receive PDO Communica-tion	U8	R	2	Number of entries
	1	Node ID	U8	RW	0	Node ID of the node transmitting the corresponding PRes. Range: 0…254
	2	Mapping version	U8	RW	-	
1600	0	Receive PDO Mapping	U8	RW	0	Number of mapped application objects. Range: 0…16
	1	Mapped object #1	U64	RW	0	
	…	…	…	…	…	
	16	Mapped object #16	U64	RW	0	
1800	0	Transmit PDO Com-munication	U8	R	2	Number of entries
	1	Node ID	U8	RW	0	Node ID of the PDO target: • CN: not used (0) • MN: NodeID of the PReq target (CN) Valid Node IDs are released by NMT_NodeAssignment_AU32 [Node ID] Bits 0 and 8. Node ID entry 0 indicates the multicast PRes transmitted by the MN. Range: 0…254
	2	Mapping version	U8	RW	0	
1A00	0	Transmit PDO Mapping	U8	RW	0	Number of mapped application objects. Range: 0…16
	1	Mapped object #1	U64	RW	0	
	…	…	…	…	…	
	16	Mapped object #16	U64	RW	0	

Index	SI	Name	Type	Acc.	Def.	Information
1C0B	0	Loss of SoC	U8	R	3	Number of entries. Range: 0…3
	1	Cumulative count	U32	RW	0	Increased by 1 every time a loss of SoC is detected.
	2	Threshold count	U32	R	0	Increased by 8 every time a loss of SoC is detected, decreased by 1 on every healthy SoC.
	3	Threshold	U32	RW	15	When Threshold count reaches this value, an error will occur. Setting it to 0 will disable the error reaction.
1C0D	0	Loss of PReq	U8	R	3	Number of entries. Range: 0…3
	1	Cumulative count	U32	RW	0	Increased by 1 every time a loss of PReq is detected.
	2	Threshold count	U32	R	0	Increased by 8 every time a loss of PReq is detected, decreased by 1 on every healthy PReq.
	3	Threshold	U32	RW	15	When Threshold count reaches this value, an error will occur. Setting it to 0 will disable the error reaction.
1C0F	0	CRC errors	U8	R	3	Number of entries. Range: 1…3
	1	Cumulative count	U32	RW	0	Increased by 1 every time a CRC error is detected.
	2	Threshold count	U32	R	0	Increased by 8 every time a CRC error is detected, decreased by .1 on every healthy cycle
	3	Threshold	U32	RW	15	When Treshold count reaches this value, an error will occur. Setting it to 0 will disable the error reaction.
1C14	0	Loss of frame tolerance	U32	RW	100000	Tolerance interval in nanoseconds to be applied by CN's Loss of SoC error recognition
1F82	0	Feature flags	U32	R	-	Always 0x45

Index	SI	Name	Type	Acc.	Def.	Information
1F83	0	EPL version	U8	R	-	Always 0x20
1F8C	0	Current NMT state	U8	R	-	
1F93	0	EPL Node ID	U8	R	2	Number of entries. Range: 2…3
	1	Node ID	U8	R	1	Currently active node ID. Range: 1…240, 253, 254
	2	Node ID by HW	BOOL	R	-	Always 1
1F98	0	Cycle timing	U8	R	9	Number of entries
	1	Isochr Tx Max Payload	U16	R	-	Device-specific upper limit for the payload data size in octets of isochronous messages to be transmitted by the device. Range: 36…1490
	2	Isochr Rx Max Payload	U16	R	-	Device-specific upper limit for the payload data size in octets of isochronous messages to be received by the device. Range: 36…1490
	3	Pres Max Latency	U32	R	-	Maximum time in nanoseconds required by the CN to respond to PReq
	4	PReq Act Payload Limit	U16	RW	36	Configured PReq payload data slot size in octets expected by the CN. The payload data slot size plus headers gives the size of the PReq frame. The data slot may be filled by PDO data up to this limit. Range: 36…subindex 2

Index	SI	Name	Type	Acc.	Def.	Information
	5	Pres Act Payload Limit	U16	RW	36	Configured PRes payload data slot size in octets sent by the CN. The payload data slot size plus headers gives the size of the PRes frame. The data slot may be filled by PDO data up to this limit. Range: 36…subindex 1
	6	ASnd Max Latency	U32	R	-	Maximum time in nanoseconds required by the CN to respond to SoA
	7	Multiple cycle count	U8	RW	0	Length of the multiplexed cycle in multiples of the POWERLINK cycle
	8	Async MTU	U16	RW	300	Maximum asynchoronous frame size in octets. Set to 1500 on reset. Range: 300…1500
	9	Prescaler	U8	RW	2	Toggle rate of the SoC PS flag. The value is the number of cycles that have to be completed for the MN to toggle the flag. Range: 0…1000
1F99	0	Basic Ethernet Timeout	U32	RW	5000000	Time in microseconds to be applied before changing from NMT_CS_NOT_ACTIVE to NMT_CS_BASIC_ETHERNET
1F9E	0	Reset command	U8	RW	NMTInvalidService	0xff: NMTInvalidService 0x28: NMTResetNode 0x2a: NMTResetConfiguration 0x29: NMTResetCommunication 0x2b: NMTSwReset

Manufacturer-specific profile objects

The manufacturer-specific profile objects contain the control and status words, references and actual values for the ABB Drives profile and the Transparent profiles, as well as diagnostic data. The objects are described in the following table.

Index	SI	Name	Type	Access	Information
2001	0	T32 CW	U32	RW	32-bit transparent profile control word
2002	0	T32 Ref1	I32	RW	32-bit transparent profile reference 1
2003	0	T32 Ref2	I32	RW	32-bit transparent profile reference 2
2004	0	T32 SW	U32	R	32-bit transparent profile status word
2005	0	T32 Act1	I32	R	32-bit transparent profile actual 1
2006	0	T32 Act2	I32	R	32-bit transparent profile actual 2
2051	0	T16 CW	U16	RW	16-bit transparent profile control word
2052	0	T16 Ref1	I16	RW	16-bit transparent profile reference 1
2053	0	T16 Ref2	I16	RW	16-bit transparent profile reference 2
2054	0	T16 SW	U16	R	16-bit transparent profile status word
2055	0	T16 Act1	I16	R	16-bit transparent profile actual 1
2056	0	T16 Act2	I16	R	16-bit transparent profile actual 2
2101	0	ABB CW	U16	RW	ABB Drive profile control word
2102	0	ABB Ref1	I16	RW	ABB Drives profile reference 1
2103	0	ABB Ref2	I16	RW	ABB Drives profile reference 2
2104	0	ABB SW	U16	R	ABB Drives profile status word
2105	0	ABB Act1	I16	R	ABB Drives profile actual 1
2106	0	ABB Act2	I16	R	ABB Drives profile actual 2

Index	SI	Name	Type	Access	Information
2201	0	Vendor-specific fault code	U16	R	
2203	0	Vendor-specific fault code	U16	R	

Actual signals and parameters of the drive

The actual signals and parameters available depend on the drive type. See the appropriate drive firmware manual for signal and parameter listings.

The Read service is used for reading actual signals and parameters from the drive. The Write service is used for writing parameter values to the drive. Both the Read and Write services use the same parameter mapping system. The Object Dictionary Index equals the drive parameter group in hexadecimal format + 4000 (hex) and the subindex is the parameter index. For example, the index for drive parameter 30.19 equals
1E (hex) + 4000 (hex) = 401E (hex) and the subindex = 19 (dec) = 13 (hex). The principle is demonstrated in the following table.

Note: Drive parameter values written through the network are not automatically saved to the permanent memory of the drive. The values should be saved on the drive to retain the changes after a power cycle.

Index (hex)	Sub-index	Name	Type	Access	Information
4001	1	Drive signal 1.01	1)	2)	3)
	2	Drive signal 1.02	1)	2)	3)
…	…	…	…	…	…
4002	1	Drive signal 2.01	1)	2)	3)
…	…	…	…	…	…
4003	1	Drive signal 3.01	1)		3)
…	…	…	…	…	…
400A	1	Drive par. 10.01	1)	2)	3)
	2	Drive par. 10.02	1)	2)	3)
…	…	…	…	…	…
400B	1	Drive par. 11.01	1)	2)	3)
…	…	…	…	…	…
4063	1	Drive par. 99.01	1)	2)	3)
…	…	…	…	…	…

Subindex 0 = number of mapped objects.
1) U16, INT16, U32 or INT32.
2) Depends on the parameter type of the drive.
3) See the appropriate drive firmware manual.

CiA 402 profile objects

The CiA 402 profile objects describe objects for monitoring and controlling frequency controllers. The objects are described in the following table.

Index	SI	Name	Type	Acc.	Def.	Information
603F	0	Error code	U16	R	0	CiA 402 error code of the last error which occurred in the drive. Values according to IEC 61800-7-201. Manufacturer-specific error codes 0xFF00...0xFFFF: In general, all drive fault codes from 0xFF00 and above pass straight through into this object. Two error codes are generated by the adapter module: • 0xFFE1: Failed to read fault code from the drive. • 0xFFFF: Unhandled drive fault code - corresponding CiA 402 error code does not exist. See object 2201 and the drive manual.
6040	0	Control word	U16	RW	-	CiA 402 control word
6041	0	Status word	U16	R	-	CiA 402 status word
6042	0	vl target velocity	I16	RW	-	Effective in the velocity operation mode (vl)
6043	0	vl velocity demand	I16	R	-	Operational if the ramp function generator output (CI 61) is available from the drive. Cyclic low priority communication. **Note:** Not available with ACS355.
6044	0	vl velocity actual value	I16	R	-	Operational when velocity feedback is available from the drive

Index	SI	Name	Type	Acc.	Def.	Information
6046	0	vi velocity min max amount	I8	R	2	Minimum and maximum velocity absolute value settings for the velocity operation mode (vl)
	1	min abs velocity	U32	RW	-	Velocity absolute value minimum
	2	max abs velocity	U32	RW	-	Velocity absolute value maximum
6048	0	vl velocity acceleration	I8	R	2	Acceleration ramp settings for the velocit6y operation mode (vl)
	1	Delta speed	U32	RW	-	Ramp delta speed (vl scaling units). **Note:** Read only in ACS355 and ACS880.
	2	Delta time	U16	RW	-	Ramp delta time (s)
6049	0	vl velocity deceleration	I8	R	2	Deceleration ramp settings for the velocity operation mode (vl)
	1	Delta speed	U32	RW	-	Ramp delta speed (vl scaling units). **Note:** Read only in ACS355 and ACS880.
	2	Delta time	U16	RW	-	Ramp delta time (s)
604A	0	vl velocity quick stop	I8	R	2	Quick stop ramp settings for the velocity operation mode (vl)
	1	Delta speed	U32	RW	-	Ramp delta speed (vl scaling units). **Note:** Read only in ACS355 and ACS880.
	2	Delta time	U16	RW	-	Ramp delta time (s)
604C	0	vl dimension factor	I8	R	2	Velocity data scaling factor for the velocity operation mode (vl). Basic unit in the vl operation mode is rpm.
	1	numerator	I32	RW	-	Default: 1
	2	denominator	I32	RW	-	Default: 1
605B	0	Shutdown option code	I16	RW	0	0 = coast stop (default) 1 = ramp stop

Index	SI	Name	Type	Acc.	Def.	Information
605C	0	Disable operation code	I16	RW	1	0 = coast stop 1 = ramp stop (default)
605D	0	Halt option code	I16	RW	1	vl mode. 1 = force ramp generator input to zero (default) 2…4 = force ramp generator output to zero **Note:** Halt does not cause the drive to stop, merely to run at a zero speed.
6060	0	Modes of operation	I8	RW	-	CiA 402 operation mode request. 0 = No mode change (default) 1 = Profile position mode (pp) 2 = Velocity mode (vl) 3 = Profile velocity mode (pv) 4 = Profile torque mode (tq) 6 = Homing mode (hm) **Note:** The supported modes depend on the drive.
6061	0	Modes of operation display	I8	R	-	Current operation mode
6064	0	Position actual value	I32	R	-	Operational when position feedback is available from the drive
6069	0	Velocity sensor actual value	I32	R	-	Describes the value read from a velocity encoder.
606A	0	Sensor selection code	I16	RW	-	
606B	0	Velocity demand value	I32	R	-	Operational if the ramp function generator output is available from the drive. Cyclic low priority communication. **Note:** Not available with ACS355.
606C	0	Velocity actual value	I32	R	-	Operational when velocity feedback is available from the drive
6071	0	Target torque	I16	RW	0	Input value for the torque controller in the profile torque (tq) mode

Index	SI	Name	Type	Acc.	Def.	Information
6076	0	Motor rated torque	U32	RW	0	Nominal torque of the motor in Nm
6077	0	Torque actual value	I16	R	0	Operational when torque feedback is available from the drive
6078	0	Current actual value	I16	R	0	Actual output current
607A	0	Target position	I32	RW	-	The commanded position that the drive should move to. Operational in the profile position (pp) mode.
6081	0	Profile velocity	U32	RW	-	Velocity normally attained at the end of the acceleration ramp during a profiled move. Cyclic low priority communication.
6087	0	Torque slope	U32	RW	-	Effective in the profile torque (tq) operation mode. Unit: 0.1% / s.
6088	0	Torque profile type	I16	RW	0	Only 0 = Linear ramp (trapezoidal profile) is supported.
6098	0	Homing method	I8	RW	0	CiA 402 homing methods. See the drive manual for more information on the supported homing modes. • -128…-1: Manufacturer-specific • 0: No homing operation required • 1…35: Methods 1 to 35 • 36…127: Reserved
6099	0	Homing speeds	U8	R	2	Speeds during the homing procedure
	1	Speed during search for switch	U32	RW	0	ACSM1 homing speed 1
	2	Speed during search for zero	U32	RW	0	ACSM1 homing speed 2
60FD	0	Digital inputs	U32	R	-	Drive-specific

Index	SI	Name	Type	Acc.	Def.	Information
60FE	0	Digital outputs	U8	R	-	Number of entries
	1	Physical outputs	U32	RW	-	Drive-specific
	2	Bitmask	U32	RW	-	Drive-specific
60FF	0	Target velocity	I32	RW	Rx	Effective in the profile velocity (pv) operation mode

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Appendix B – CANopen error codes

What this chapter contains

This chapter contains a list of the CANopen error codes.

Error codes

Error codes can be read from objects 0×2201 and 0×603F (hex). Additionally, the MN can query the status of the CN with the StatusResponse service. See section *Network Management Services* on page 92.

Error codes between xx80…xxFF (hex) and between FF00…FFFF (hex) are manufacturer specific. Descriptions for these error codes can be found in the appropriate drive firmware manual and/or the drive fault code parameter.

Error code (hex)	Meaning
0000	Error reset or no error
1000	Generic error
2000	Current
2100	Current on device input side
2110	Short circuit / earth leakage
2120	Earth leakage

Error code (hex)	Meaning
2121	Earth leakage phase L1
2122	Earth leakage phase L2
2123	Earth leakage phase L3
2130	Short circuit
2131	Short circuit phases L1-L2
2132	Short circuit phases L2-L3
2133	Short circuit phases L3-L1
2200	Internal current
2211	Internal current No. 1
2212	Internal current No. 2
2213	Overcurrent in ramp function
2214	Overcurrent in the sequence
2220	Continuous overcurrent
2221	Continuous overcurrent No. 1
2222	Continuous overcurrent No. 2
2230	Short circuit / earth leakage
2240	Earth leakage
2250	Short circuit
2300	Current on device output side
2310	Continuous overcurrent
2311	Continuous overcurrent No. 1
2312	Continuous overcurrent No. 2
2320	Short circuit / earth leakage
2330	Earth leakage
2331	Earth leakage phase U
2332	Earth leakage phase V
2333	Earth leakage phase W
2340	Short circuit
2341	Short circuit phases U-V

Error code (hex)	Meaning
2342	Short circuit phases V-W
2343	Short circuit phases W-U
3000	Voltage
3100	Mains voltage
3110	Mains overvoltage
3111	Mains overvoltage phase L1
3112	Mains overvoltage phase L2
3113	Mains overvoltage phase L3
3120	Mains undervoltage
3121	Mains undervoltage phase L1
3122	Mains undervoltage phase L2
3123	Mains undervoltage phase L3
3130	Phase failure
3131	Phase failure L1
3132	Phase failure L2
3133	Phase failure L3
3134	Phase sequence
3140	Mains frequency
3141	Mains frequency too great
3142	Mains frequency too small
3200	DC link voltage
3210	DC link overvoltage
3211	Overvoltage No. 1
3212	Overvoltage No. 2
3220	DC link undervoltage
3221	Undervoltage No. 1
3222	Undervoltage No. 2
3230	Load error
3300	Output voltage

Error code (hex)	Meaning
3310	Output overvoltage
3311	Output overvoltage phase U
3312	Output overvoltage phase V
3313	Output overvoltage phase W
3320	Armature circuit
3321	Armature circuit interrupted
3330	Field circuit
3331	Field circuit interrupted
4000	Temperature
4100	Ambient temperature
4110	Excess ambient temperature
4120	Too low ambient temperature
4130	Temperature supply air
4140	Temperature air outlet
4200	Temperature device
4210	Excess temperature device
4220	Too low temperature device
4300	Temperature drive
4310	Excess temperature drive
4320	Too low temperature drive
4400	Temperature supply
4410	Excess temperature supply
4420	Too low temperature supply
5000	Device hardware
5100	Supply
5110	Supply low voltage
5111	U1 = supply +/-15 V
5112	U2 = supply +24 V
5113	U3 = supply +5 V

Error code (hex)	Meaning
5114	U4 = manufacturer specific
5115	U5 = manufacturer specific
5116	U6 = manufacturer specific
5117	U7 = manufacturer specific
5118	U8 = manufacturer specific
5119	U9 = manufacturer specific
5120	Supply intermediate circuit
5200	Control
5210	Measurement circuit
5220	Computing circuit
5300	Operating unit
5400	Power section
5410	Output stages
5420	Chopper
5430	Input stages
5440	Contactors
5441	Contactor 1 = manufacturer specific
5442	Contactor 2 = manufacturer specific
5443	Contactor 3 = manufacturer specific
5444	Contactor 4 = manufacturer specific
5445	Contactor 5 = manufacturer specific
5450	Fuses
5451	S1 = L1
5452	S2 = L2
5453	S3 = L3

Error code (hex)	Meaning
5454	S4 = manufacturer specific
5455	S5 = manufacturer specific
5456	S6 = manufacturer specific
5457	S7 = manufacturer specific
5458	S8 = manufacturer specific
5459	S9 = manufacturer specific
5500	Data storage
5510	Working memory
5520	Program memory
5530	Non-volatile data memory
6000	Device software
6010	Software reset (Watchdog)
6100	Internal software
6200	User software
6300	Data record
6301	Data record No. 1
…	from 2…14 corresponding
630F	Data record No. 15
6310	Loss of parameters
6320	Parameter error
6330	Ethernet POWERLINK module configuration error
7000	Additional modules
7100	Power
7110	Brake chopper
7111	Failure brake chopper
7112	Overcurrent brake chopper
7113	Protective circuit brake chopper
7120	Motor

Error code (hex)	Meaning
7121	Motor blocked
7122	Motor error or communication malfunc.
7123	Motor tilted
7200	Measurement circuit
7300	Sensor
7301	Tacho fault
7302	Tacho wrong polarity
7303	Resolver 1 fault
7304	Resolver 2 fault
7305	Incremental sensor 1 fault
7306	Incremental sensor 2 fault
7307	Incremental sensor 3 fault
7310	Speed
7320	Position
7400	Computation circuit
7500	Communication
7510	Serial interface no. 1
7520	Serial interface no. 2
7600	Data storage
8000	Monitoring
8100	Communication
8300	Torque control
8311	Excess torque
8312	Difficult start up
8313	Standstill torque
8321	Insufficient torque
8331	Torque fault
8400	Rotational speed controller

Error code (hex)	Meaning
8500	Position controller
8600	Positioning controller
8611	Following error
8612	Reference limit
8700	Sync controller
8800	Winding controller
9000	External error
F000	Additional functions
F001	Deceleration
F002	Sub-synchronous run
F003	Stroke operation
F004	Control
FF00	Manufacturer specific
…	…
FFFF	Manufacturer specific

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Appendix C – IdentResponse Frame

What this chapter contains

This chapter contains the contents of the IdentResponse Frame.

NMT Service Slot structure of IdentResponse

Octet offset	Bit offset							
	7	6	5	4	3	2	1	0
0	res	res	res	res	res	res	res	res
1			PR			RS		
2	NMTStatus							
3	Reserved							
4	EPLVersion							
5	Reserved							
6…9	FeatureFlags							
10…11	MTU							
12…13	PollInSize							
14…15	PollOutSize							
16…19	ResponseTime							
20…21	Reserved							
22…25	DeviceType							
26…29	VendorID							
30…33	ProductCode							
34…37	RevisionNumber							
38…41	SerialNumber							
42…49	VendorSpecificExtension1							
50…53	VerifyConfigurationDate							
54…57	VerifyConfigurationTime							
58…61	ApplicationSwDate							
62…65	ApplicationSwTime							
66…69	IPAddress							
70…73	SubnetMask							
74…77	DefaultGateway							
78…109	HostName							
110…157	VendorSpecificExtension2							

NMT Service Slot data fields of IdentResponse

Field	Abbr.	Description
Priority	PR	Flags: Indicates the priority of the requested asynchronous frame (see 4.2.4.1.2.3)
RequestToSend	RS	Flags: Indicates the number of pending requests to send at the CN. The value C_DLL_MAX_RS indicates C_DLL_MAX_RS or more requests, 0 indicates no pending requests. Values: 0…C_DLL_MAX_RS
NMTStatus	stat	Reports the current status of the CN's NMT state machine.
EPLVersion	eplv	Indicates the POWERLINK version to which the CN conforms.
FeatureFlags	feat	Reports the feature flags of the device. (NMT_FeatureFlags_U32)
MTU	mtu	Reports the size of the largest IP frame that can be transmitted over the network, including the size of the transport header. Values: C_DLL_MIN_ASYNC_MTU … C_DLL_MAX_ASYNC_MTU
PollInSize	pis	Reports the actual CN setting for PReq datablock size (NMT_CycleTiming_REC.PReqActPayloadLimit_U16).
PollOutSize	pos	Reports the actual CN setting for PReq datablock size (NMT_CycleTiming_REC.PReqActPayloadLimit_U16).
ResponseTime	rst	Reports the time required by the CN to respond to PReq. (NMT_CycleTiming_REC.PResMaxLatency_U32)

Field	Abbr.	Description
DeviceType	dt	Reports the CN's Device Type. (NMT_DeviceType_U32)
VendorID	vid	Reports the CN's Vendor ID, index. (NMT_IdentityObject_REC.Vendorid_U32)
ProductCode	prdc	Reports the CN's Product Code, index. (NMT_IdentityObject_REC.ProductCode_U32)
RevisionNumber	mo	Reports the CN's Revision Number. (NMT_IdentityObject_REC.RevisionNo_U32)
SerialNumber	sno	Reports the CN's Serial Number. (NMT_IdentityObject_REC.SerialNo_U32)
VendorSpecificExtension1	vex1	May be used for vendor-specific purpose, to be filled with zeros if not in use.
VerifyConfigurationDate	vcd	Reports the CN's Configuration date (CFM_VerifyConfiguration_REC.ConfDate_U32)
VerifyConfigurationTime	vct	Reports the CN's Configuration time. (CFM_VerifyConfiguration_REC.ConfTime_U32)
ApplicationSWDate	ad	Reports the CN's Application SW date. (PDL_LocVerApplSw_REC.ApplSwDate on programmable device or date portion of NMT_ManufactSwVers_VS on non-programmable device)
ApplicationSWTime	at	Reports the CN's Application SW date. (PDL_LocVerApplSw_REC.ApplSwTime on programmable device or time portion of NMT_ManufactSwVers_VS on non-programmable device)

Field	**Abbr.**	**Description**
IPAddress	ipa	Reports the current IP address value of the CN. (NWL_IpAddrTable_Xh_REC.Addr_IPAD)
SubnetMask	snm	Reports the current IP subnet mask value of the CN. (NWL_IpAddrTable_Xh_REC.NetMask_IPAD)
DefaultGateway	gtw	Reports the current IP default gateway value of the CN. (NWL_IpAddrTable_Xh_REC.DefGateway_IPAD)
HostName	hn	Reports the current DNS host name of the CN. (NMT_HostName_VSTR)
VendorSpecificExtension2	vex2	May be used for vendor-specific purpose, to be filled with zeros if not in use.

Further information

Product and service inquiries

Address any inquiries about the product to your local ABB representative, quoting the type designation and serial number of the unit in question. A listing of ABB sales, support and service contacts can be found by navigating to www.abb.com/drives and selecting *Sales, Support and Service network*.

Product training

For information on ABB product training, navigate to www.abb.com/drives and select *Training courses*.

Providing feedback on ABB Drives manuals

Your comments on our manuals are welcome. Go to www.abb.com/drives and select *Document Library – Manuals feedback form (LV AC drives)*.

Document library on the Internet

You can find manuals and other product documents in PDF format on the Internet. Go to www.abb.com/drives and select *Document Library.* You can browse the library or enter selection criteria, for example a document code, in the search field.

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3AUA0000123527 Rev A (EN) 2012-10-04