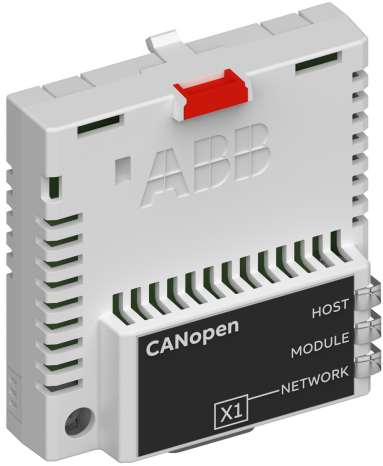
OPTION FOR ABB DRIVES, CONVERTERS AND INVERTERS

FCAN-01 CANopen adapter module

User’s manual



List of related manuals

See section *Related manuals* on page *17*.

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.

The code below opens an online listing of the manuals applicable to the product:

FCAN-01 manual

Fieldbus connectivity webpage

User’s manual

FCAN-01 CANopen adapter module

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3AFE68615500 Rev F
EN
EFFECTIVE: 2018-03-16

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1

Safety instructions

What this chapter contains

The chapter presents the warning symbols used in this manual and the safety instructions which you must obey when you install or connect an optional module to a drive, converter or inverter. If you ignore the safety instructions, injury, death or damage can occur. Read this chapter before you start the installation.

Use of warnings

Warnings caution you about conditions which can cause injury or death and, or damage to the equipment. They also tell you how to prevent the danger. The manual uses these warning symbols:

Electricity warning tells you about hazards from electricity which can cause injury or death, or damage to the equipment.

General warning tells you about conditions, other than those caused by electricity, which can cause injury or death, or damage to the equipment.

Safety in installation

These instructions are 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 do the work.

WARNING! Obey these instructions. If you ignore them, injury or death, or damage to the equipment can occur.

- If you are not a qualified electrician, do not do installation or maintenance work.
- Disconnect the drive, converter or inverter from all possible power sources. After you have disconnected the drive, converter or inverter, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you continue.
- Disconnect all dangerous voltages connected to other control signal connectors in reach. For example, it is possible that 230 V AC is connected from outside to a relay output of the drive, converter or inverter.
- Always use a multimeter to make sure that there are no parts under voltage in reach. The impedance of the multimeter must be at least 1 Mohm.

2

About the manual

What this chapter contains

This chapter introduces this manual.

Purpose of the manual

The manual provides information on installing, commissioning and using the FCAN-01 CANopen adapter module.

Applicability

This manual applies to the FCAN-01 CANopen adapter module (+K457), SW version 1.046 or later.

Compatibility

The FCAN-01 CANopen adapter module is compatible with the following drives:

- ACS355
- ACSM1
- ACS380
- ACH580
- ACQ580
- ACS580
- ACS850
- ACS880.

Note: The adapter module is compatible with more drives that may not be listed here. For details of compatibility, check the drive's firmware manual.

Target audience

This manual is intended for people who plan the installation, install, start up, use and service the adapter module. Before you do work on the module, read this manual and the applicable drive manual that contains the hardware and safety instructions for the product in question.

You are expected to know the fundamentals of electricity, wiring, electrical components and electrical schematic symbols.

The manual is written for readers worldwide. Both SI and imperial units are shown.

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.

Related manuals

The related manuals are listed below.

Drive user's manuals	Code (EN/Multilingual)
ACS355 drives (0.37…22 kW, 0.5…30 hp) user's manual	*3AUA0000066143*
Drive hardware manuals and guides	
ACSM1 manuals	*00578051*
ACS380-04 manuals	*9AAK10103A6193*
ACH580-01 manuals	*9AKK10103A0587*
ACH580-04 manuals	*9AKK106930A9059*
ACH580-07 manuals	*9AKK106930A5241*
ACQ580-01 manuals	*9AKK106713A2709*
ACQ580-04 manuals	*9AKK106930A9053*
ACQ580-07 manuals	*9AKK106930A3150*
ACS580-01 manuals	*9AKK105713A8085*
ACS580-04 manuals	*9AKK106930A9060*
ACS580-07 (75 to 250 kW) manuals	*9AKK106930A5239*
ACS580-07 (250 to 500 kW)	*9AKK106713A0278*
ACS850-04 manuals	*00592009*
ACS880-01 manuals	*9AKK105408A7004*
ACS880-04 manuals	*9AKK105713A4819*
ACS880-07 manuals (45 to 710 kW)	*9AKK105408A8149*
ACS880-07 (560 to 2800 kW)	*9AKK105713A6663*
ACS880-17 (132 to 355 kW)	*9AKK106930A3466*
ACS880-17 (160 to 3200 kW)	*9AKK106354A1499*
ACS880-37 (132 to 355 kW)	*9AKK106930A3467*
ACS880-37 (160 to 3200 kW)	*9AKK106354A1500*
Option manuals and guides	
FENA-01/-11/-21 Ethernet adapter module user's manual	*3AUA0000093568*
FSO safety functions module user's manual	*3AUA0000097054*

Contents

The manual consists of the following chapters:

- *Safety instructions* contains the safety instructions which you must follow when installing a fieldbus adapter module.
- *About the manual* introduces this manual.
- *Overview of the CANopen protocol and the FCAN-01 adapter module* contains a short description of the CANopen protocol and the adapter module.
- *Mechanical installation* contains a delivery checklist and instructions to install the adapter module.
- *Electrical installation* contains wiring and bus termination instructions.
- *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 system.
- *Communication profiles* describes the communication profiles used in communication between the CANopen network, the adapter module and the drive.
- *Communication protocol* describes the communication on a CANopen network.
- *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 CANopen link.
- *Appendix A – Dictionary structure and entries* contains information about PDO transmission and mapping.
- *Appendix B – CANopen error codes* contains reference tables for decoding CANopen error messages.

Cybersecurity disclaimer

This product is designed to be connected to and to communicate information and data via a network interface. It is Customer's sole responsibility to provide and continuously ensure a secure connection between the product and Customer network or any other network (as the case may be). Customer shall establish and maintain any appropriate measures (such as but not limited to the installation of firewalls, application of authentication measures, encryption of data, installation of anti-virus programs, etc.) to protect the product, the network, its system and the interface against any kind of security breaches, unauthorized access, interference, intrusion, leakage and/or theft of data or information. ABB and its affiliates are not liable for damages and/or losses related to such security breaches, any unauthorized access, interference, intrusion, leakage and/or theft of data or information.

Note: The web pages are meant only for configuring the device during commissioning. For security reasons, it is recommended to disable the web pages after commissioning.

Terms and abbreviations used in this manual

Terms

Term	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)
FCAN-01 CANopen adapter module	One of the optional fieldbus adapter modules available for ABB drives. FCAN-01 is a device through which an ABB drive is connected to a CANopen network.
Object dictionary	Local storage of all Communication Objects (COB) recognized by a device
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

CANopen abbreviations

Abbreviation	Explanation
CAN	Controller Area Network
CiA	CAN in Automation, International User's and Manufacturer's Group
CMS	CAN Message Specification; one of the service elements of the CAN Application Layer in the CAN Reference Model
COB	Grouping of pre-defined data objects accessible via the network.
DBT	Distributor; one of the service elements of the CAN Application Layer in the CAN Reference Model. It is the responsibility of the Distributor to distribute COB IDs to the COBs that are used by a CMS.
EDS	Electronic Data Sheet; a node-specific ASCII-format file required when configuring the CAN network. The EDS file contains general information on the node and its dictionary objects (parameters). EDS files for ABB Drives are available at the Document library (www.abb.com/drives).
LMT	Layer Management; one of the service elements of the CAN Application Layer in the CAN Reference Model. It serves to configure parameters for each layer in the CAN Reference Model.
LSB	Least significant bit/byte
MSB	Most significant bit/byte
NMT	Network Management; one of the service elements of the CAN Application Layer in the CAN Reference Model. It performs initialization, configuration and error handling on a CAN network.
OSI	Open Systems Interconnection
PDO	Process Data Object; a type of COB. Used for transmitting time critical data, such as control commands, references and actual values.

Abbreviation	Explanation
RO	Denotes read-only access.
RW	Denotes read/write access.
SDO	Service Data Object; a type of COB. Used for transmitting non-time-critical data, such as parameters.

3

Overview of the CANopen protocol and the FCAN-01 adapter module

What this chapter contains

This chapter contains a short description of the CANopen protocol and the FCAN-01 CANopen adapter module.

CANopen protocol

CANopen is a higher layer protocol based on the CAN (Control Area Network) serial bus system and the CAL (CAN Application Layer). CANopen assumes that the hardware of the connected device has a CAN transceiver and a CAN controller as specified in ISO 11898.

The CANopen Communication Profile, CiA 301, includes both cyclic and event driven communication, which makes it possible to reduce the bus load to minimum while still maintaining extremely short reaction times. High communication performance can be achieved at relatively low baud rates, thus reducing EMC problems and cable costs.

CANopen device profiles define both direct access to drive parameter and time critical process data communication. The adapter module fulfills CiA (CAN in Automation) specification CiA 402 (CANopen device profile for drives and motion control).

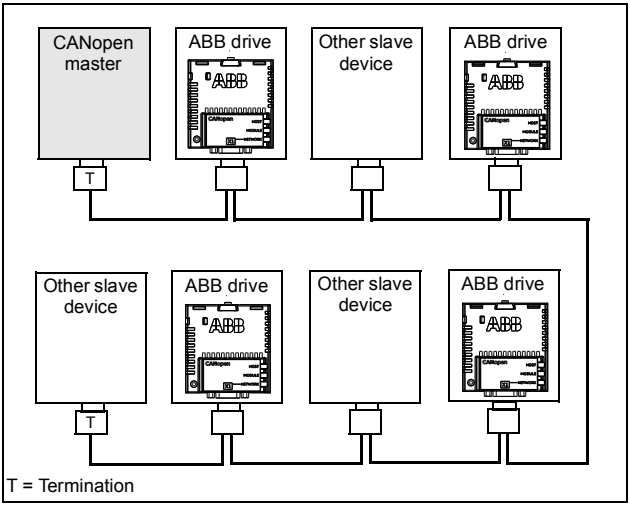
The physical medium of CANopen is a differentially driven two wire bus line with common return according to ISO 11898. The maximum length of the bus is limited by the communication speed.

The maximum theoretical number of nodes is 127. However, in practice, the maximum number depends on the capabilities of the used CAN transceivers.

Further information is available from the CAN in Automation International Users and Manufacturers Group (www.can-cia.org).

Topology of the CANopen link

The figure below shows an example topology of the CANopen link.



FCAN-01 CANopen adapter module

The FCAN-01 CANopen adapter module is an optional device for ABB drives. It enables the connection of the drive to a CANopen network. The drive is considered as a slave (server) on the CANopen network.

Through the adapter module you can:

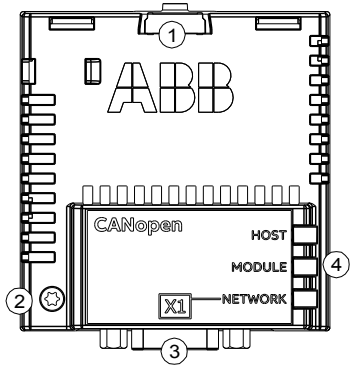
- give control commands to the drive (for example, Start, Stop, Run enable)
- feed a motor speed, torque or position reference to the drive
- give a process actual value or a process reference to the PID controller of the drive
- read status information and actual values from the drive
- change drive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

The CANopen commands and services supported by the adapter module are discussed in chapter *Communication protocol* on page *109*. Refer to the drive manuals 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

The following figure describes the layout of the adapter module.



No.	Description	See chapter
1	Lock	*Mechanical installation*
2	Mounting screw	*Mechanical installation*
3	Bus connector X1	*Electrical installation*
4	Diagnostic LEDs	*Diagnostics*

4

Mechanical installation

What this chapter contains

This chapter contains a delivery checklist and instructions to install the adapter module.

Necessary tools and instructions

You will need a Torx TX10 screwdriver to secure the FCAN-01 adapter module to the drive. See also, the applicable drive hardware manual.

Unpacking and examining the delivery

1. Open the option package.
2. Make sure that the package contains:
   - Ethernet POWERLINK adapter module, type FCAN-01
   - this manual.
3. Make sure that there are no signs of damage.

Installing the adapter module

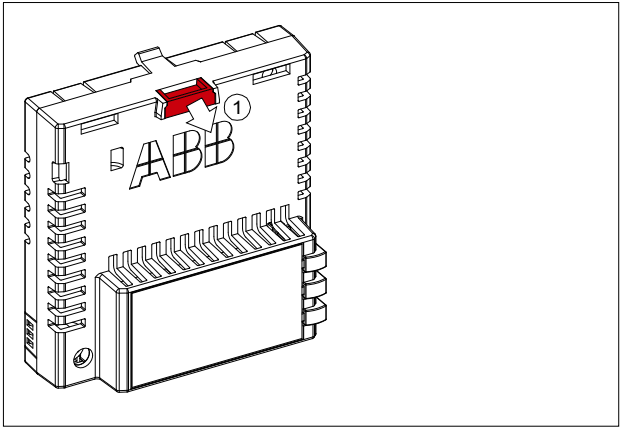
WARNING! Obey the safety instructions. See chapter *Safety instructions* on page *11*. If you ignore the safety instructions, injury or death can occur.

The adapter module has a specific position in the drive. Plastic pins, a lock and one screw hold the adapter module in place. The screw also makes an electrical connection between the module and drive frame for cable shield termination.

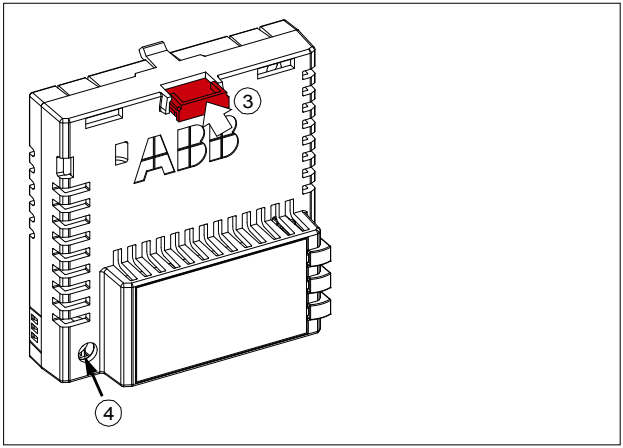
When the adapter module is installed, it makes the signal and power connection to the drive through a 20-pin connector.

When you install or remove the adapter module from the control unit:

1. Pull out the lock.



2. Put the adapter module carefully into its position on the drive.
3. Push in the lock.



4. Tighten the screw to torque 0.8 N·m using a Torx TX10 screwdriver.

   Note: A too high torque may break the screws. It is necessary to tighten the screw properly to fulfill the EMC requirements and to ensure the proper operation of the module.

See the applicable drive manual for further instructions on how to install the adapter module to the drive.

5

Electrical installation

What this chapter contains

This chapter contains:

- general cabling instructions
- bus termination instructions
- instructions on connecting the adapter module to the CANopen network.

WARNING! Obey the safety instructions. See chapter *Safety instructions* on page *11*. If you ignore the safety instructions, injury or death can occur. If you are not a qualified electrician, do not do electrical work.

Necessary tools and instructions

See the applicable drive hardware manual.

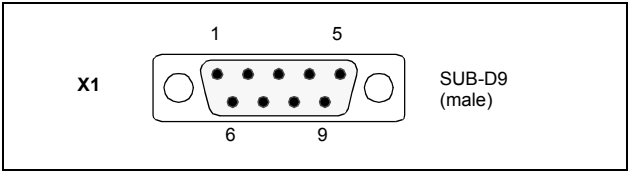
General cabling instructions

- 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 CANopen network

Connect the bus cable to connector X1 on the adapter module.

The connector pin allocation described below follows the CANopen specification CiA 301.

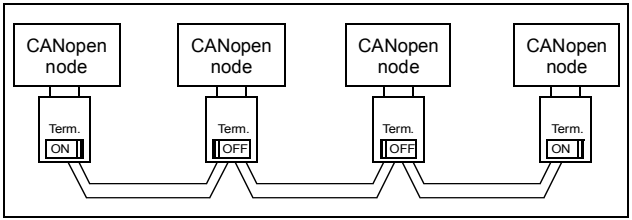


X1		Description
1	-	Not in use
2	CAN_L	CAN_L bus line (dominant low)
3	CAN_GND	CAN ground
4	-	Not in use
5	CAN_SHLD	Optional CAN shield
6	GND	Optional ground
7	CAN_H	CAN_H bus line (dominant high)
8	-	Not in use
9	CAN_V+	Optional CAN external power supply. Not supported by FCAN-01.

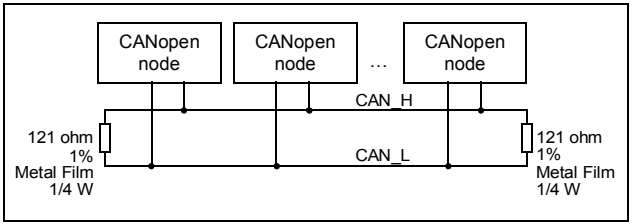
Bus termination

Bus termination is required to prevent signal reflections from the bus cable ends. The adapter module is not equipped with internal bus termination. Therefore the first and last nodes of the bus must be included with bus termination. Termination is done by connecting one resistor between the CAN_H and CAN_L signals. The nominal value for the terminating resistor is 120 ohms. The resistors can be connected between the CAN_H and CAN_L wires or a D-SUB connector with a built-on termination can be used.

In the following diagram, the built-on terminations of the D-SUB connectors at the first and last nodes are switched on.



In the following diagram, the bus line is terminated with 121 ohm, 1 % (E96) resistors connected between the CAN_L and CAN_H wires at each end.



Note: Further information on CANopen wiring is available from www.can-cia.org.

AC and DC parameters for the CANopen network

Bus cable and termination resistors

The cables, connectors, and termination resistors used in CANopen networks must meet the requirements specified in ISO 11898.

The table below lists the standard values for DC parameters for CANopen networks with less than 64 nodes:

Bus length [m]	Bus cable[1)]		Termination resistance [ohm]	Baud rate [kbit/s]
	Length-related resistance [mohm/m]	Cross-section [mm^2]		
0…40	70	0.25…0.34	124	1000 at 40 m
40…300	< 60	0.34…0.6	150…300	> 500 at 100 m
300…600	< 40	0.5…0.6	150…300	> 100 at 500 m
600…1000	< 26	0.75…0.8	150…300	> 50 at 1 km

1) Recommended cable for AC parameters: 120 ohm impedance and 5 ns/m line delay

With drop cables the recommended cable cross-section is 0.25…0.34 mm^2.

In addition to the cable resistance, the real resistance of the connectors should be taken into account in voltage drop calculation. The transmission resistance of one connector should be 2.5...10 mohm.

The following table lists the maximum bus cable length for different node numbers (n), when

- minimum dominant value $V_{diff.out.min}$ = 1.5 V
- minimum differential input resistance $R_{diff.min}$ = 20 kohm
- requested differential input voltage $V_{th.max}$ = 1.0 V
- minimum termination resistance $R_{T.min}$ = 118 ohm.

Wire cross-section [mm^2]	Maximum length [m][1)]			Maximum length [m][2)]		
	n = 32	n = 64	n = 100	n = 32	n = 64	n = 100
0.25	200	170	150	230	200	170
0.5	360	310	270	420	360	320
0.75	550	470	410	640	550	480

[1)] Safety margin of 0.2
[2)] Safety margin of 0.1

6

Start-up

What this chapter contains

This chapter contains:

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

WARNING! Obey 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.

CANopen connection configuration

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

The detailed procedure of activating the module for CANopen communication with the drive depends on the drive type. Normally, a parameter must be adjusted to activate the communication. See the drive-specific start-up sections on pages *58*, *64*, *69* and *75*.

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: 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.

An example on how to configure PDOs via the CAN bus is given in section *PDO configuration via the CAN bus*.

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.

Data transfer rates supported

The FCAN-01 CANopen adapter module supports the following CANopen communication speeds: 50 kbit/s, 100 kbit/s, 125 kbit/s, 250 kbit/s, 500 kbit/s, 1 Mbit/s.

Note: The CANopen standard CiA 301 does not list 100 kbit/s as a recommended bit rate, and therefore it should not be used in new installations.

FCAN-01 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 and ACS850
- 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 setting
01	FBA TYPE	**Read-only.** Shows the fieldbus adapter type as detected by the drive. 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.	**1** = CAN-open
02	Node ID	Selects the node address of the module. Each device on the CANopen network must have a unique node identifier. Used to define a node identifier for the drive it is connected to.	3
	1…127	Node address	

No.	Name/Value	Description	Default setting
03	Bit rate	Sets the bit rate for the CANopen interface. This is user selectable, but must be the same on every node on the CANopen network. **Note:** 100 kbit/s is not recommended for a new installation.	**3** = 125 kbit/s
	0 = 1 Mbit/s	1 Mbit/s	
	1 = 500 kbit/s	500 kbit/s	
	2 = 250 kbit/s	250 kbit/s	
	3 = 125 kbit/s	125 kbit/s	
	4 = 100 kbit/s	100 kbit/s	
	5 = 50 kbit/s	50 kbit/s	
04	Conf location	Selects the source of the PDO configuration. **Note:** The first mapping entries of the Tx/Rx PDO1 and Tx/Rx PDO6 are fixed in the ACS355 drive. **Note:** Make sure that the PLC does not overwrite the selected configuration during the initialization phase when the configuration is taken from the FCAN-01 configuration parameter groups.	0
	0 = Network	PDO configuration via CAN bus: CANopen objects 1400h, 1600h, 1405h, 1605h, 1414h, 1614h, 1800h, 1A00h, 1805h, 1A05h, 1814h and 1A14h only.	
	1 = Parameters	PDO configuration with drive parameters: adapter module configuration parameter group A (group 1), group B (group 2) and group C (group 3) (initial values).	
05	Profile	Selects the used communication profile used by the adapter module: For more information on the communication profiles, see chapter *Communication profiles* on page 87.	**1** = ABB Drives
	0 = CiA 402	CANopen device profile CiA 402 selected	
	1 = ABB Drives	ABB Drives profile selected	
	2 = Transp. 16	Transparent 16 profile selected	
	3 = Transp. 32	Transparent 32 profile selected	

No.	Name/Value	Description	Default setting
06	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 (for example, 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 and ACS880, setting this parameter to 65535 provides the approximation of 1 ≈ 1 rpm.	99
	0…65535	Reference multiplier/actual value divisor	

No.	Name/Value	Description	Default setting
07	RPDO1-COB-ID	Defines the COB-ID for Rx PDO1. **Note:** It is recommended to use the default COB-ID.	1
	0 = Disable	Rx PDO1 is not valid (disabled). COB-ID is 80000200h + Node-ID.	
	1 = Default	Rx PDO1 is valid and configured to use the default COB-ID (200h + Node-ID).	
	385…1407 (dec) = 181h … 57Fh	Rx PDO1 is valid and configured to use a custom COB-ID defined with this parameter. COB-ID must be within the allowed PDO COB-ID range (181h - 57Fh).	
08	RPDO1-TR type	Defines the Rx PDO1 transmission type. See chapter *Appendix A – Dictionary structure and entries* on page *161*.	255
	0…255 (dec)	Rx PDO1 transmission type. See section *Description of transmission type* on page *162*.	

No.	Name/Value	Description	Default setting
09	RPDO1-EV time	Defines the event time (time-out time) for the Rx PDO1 in the asynchronous transmission mode. If the Rx PDO1 communication between the adapter module and the bus master fails, the adapter module sets the communication between the module and the drive to the off-line mode. Event timer (time-out timer) elapses as a multiple of 1 ms of the entry of this parameter. **Note:** The time-out supervision is activated upon a successful reception of an Rx PDO1.	**0** = Disable
	0 = Disable	Time-out supervision is disabled.	
	1…65535 (ms)	Event time in ms	
10	TPDO1-COB-ID	Defines the COB-ID for Tx PDO1. **Note:** It is recommended to use the default COB-ID.	**1** = Default
	0 = Disable	Tx PDO1 is not valid (disabled). COB-ID is 80000180h + Node-ID.	
	1 = Default	Tx PDO1 is valid and configured to use the default COB-ID (180h + Node-ID).	
	385…1407 (dec) = 181h … 57Fh	Tx PDO1 is valid and configured to use a custom COB-ID defined with this parameter. COB-ID must be within the allowed PDO COB-ID range (181h - 57Fh).	

No.	Name/Value	Description	Default setting
11	TPDO1-TR type	Defines the PDO1 transmission type. See chapter *Appendix A – Dictionary structure and entries* on page *161*.	255
	0…255 (dec)	PDO1 transmission type. See section *Description of transmission type* on page *162*.	
12	TPDO1-EV time	Defines the event time for the Tx PDO1 asynchronous transmission mode. Event timer elapses as a multiple of 1 ms of the entry of this parameter.	**0** = Disable
	0 = Disable	Event timer is disabled.	
	1…65535 (ms)	Event time in ms.	
13	RPDO6-COB-ID	Defines the COB-ID for Rx PDO6. **Note:** It is recommended to use the default COB-ID.	**0** = Disable
	0 = Disable	Rx PDO6 is not valid (disabled). COB-ID is 80000300h + Node-ID.	
	1 = Default	Rx PDO6 is valid and configured to use the default COB-ID (300h + Node-ID).	
	385…1407 (dec) = 181h … 57Fh	Rx PDO1 is valid and configured to use a custom COB-ID defined with this parameter. COB-ID must be within the allowed PDO COB-ID range (181h - 57Fh).	
14	RPDO6-TR type	Defines the Rx PDO6 transmission type. See chapter *Appendix A – Dictionary structure and entries* on page *161*.	255
	0…255 (dec)	Rx PDO6 transmission type. See section *Description of transmission type* on page *162*.	
15	RPDO6-EV time	Defines the event time (time-out time) for the Rx PDO6 in the asynchronous transmission mode. If the Rx PDO6 communication between the adapter module and the bus master fails, the adapter module sets the communication between the module and the drive to the off-line mode. Event timer (time-out timer) elapses as a multiple of 1 ms of the entry of this parameter. **Note:** The time-out supervision is activated upon a successful reception of an Rx PDO6.	**0** = Disable
	0 = Disable	Time-out supervision is disabled.	
	1…65535 (ms)	Event time in ms.	

No.	Name/Value	Description	Default setting
16	TPDO6-COB-ID	Defines the COB-ID for Tx PDO6. **Note:** It is recommended to use the default COB-ID.	**0** = Disable
	0 = Disable	Tx PDO6 is not valid (disabled). COB-ID is 80000280h + Node-ID.	
	1 = Default	Tx PDO6 is valid and configured to use the default COB-ID (280h + Node-ID).	
	385…1407 (dec) = 181h … 57Fh	Tx PDO6 is valid and configured to use a custom COB-ID defined with this parameter. COB-ID must be within the allowed PDO COB-ID range (181h - 57Fh).	
17	TPDO6-TR type	Defines the Tx PDO6 transmission type. See chapter *Appendix A – Dictionary structure and entries* on page *161*.	255
	0…255 (dec)	Tx PDO6 transmission type. See section *Description of transmission type* on page *162*.	
18	TPDO6-EV time	Defines the event time for the Tx PDO6 asynchronous transmission mode. Event timer elapses as a multiple of 1 ms of the entry of this parameter.	**0** = Disable
	0 = Disable	Event timer is disabled.	
	1…65535 (ms)	Event time in ms.	
19	RPDO21-COB-ID	Defines the COB-ID for Rx PDO21. **Note:** It is recommended to use the default COB-ID.	**0** = Disable
	0 = Disable	Rx PDO21 is not valid (disabled). COB-ID is 80000400h + Node-ID.	
	1 = Default	Rx PDO21 is valid and configured to use the default COB-ID (400h + Node-ID).	
	385…1407 (dec) = 181h … 57Fh	Rx PDO21 is valid and configured to use a custom COB-ID defined with this parameter. COB-ID must be within the allowed PDO COB-ID range (181h - 57Fh).	
20	RPDO21-TR type	Defines the Rx PDO21 transmission type. See chapter *Appendix A – Dictionary structure and entries* on page *161*.	255
	0…255 (dec)	Rx PDO21 transmission type. See section *Description of transmission type* on page *162*.	

No.	Name/Value	Description	Default setting
21	RPDO21-EV time	Defines the event time (time-out time) for the Rx PDO21 in the asynchronous transmission mode. If the Rx PDO21 communication between the adapter module and the bus master fails, the adapter module sets the communication between the module and the drive to the off-line mode. Event timer (time-out timer) elapses as a multiple of 1 ms of the entry of this parameter. **Note:** The time-out supervision is activated upon a successful reception of an Rx PDO21.	**0** = Disable
	0 = Disable	Time-out supervision is disabled.	
	1…65535 (ms)	Event time in ms.	

No.	Name/Value	Description	Default setting
22	TPDO21-COB-ID	Defines the COB-ID for Tx PDO21. **Note:** It is recommended to use the default COB-ID.	**0** = Disable
	0 = Disable	Tx PDO21 is not valid (disabled). COB-ID is 80000380h + Node-ID.	
	1 = Default	Tx PDO21 is valid and configured to use the default COB-ID (380h + Node-ID).	
	385…1407 (dec) = 181h … 57Fh	Tx PDO21 is valid and configured to use a custom COB-ID defined with this parameter. COB-ID must be within the allowed PDO COB-ID range (181h - 57Fh).	
23	TPDO21-TR type	Defines the Tx PDO21 transmission type. See chapter *Appendix A – Dictionary structure and entries* on page *161*.	255
	0…255 (dec)	Tx PDO21 transmission type. See section *Description of transmission type* on page *162*.	

No.	Name/Value	Description	Default setting
24	TPDO21-EV time	Defines the event time for the Tx PDO21 asynchronous transmission mode. Event timer elapses as a multiple of 1 ms of the entry of this parameter.	**0** = Disable
	0 = Disable	Event timer is disabled.	
	1...65535 (ms)	Event time in ms.	
25	Conformance Mode	Defines conformance mode.	**0** = Standard
	0 = Standard	CiA 402 standard conformance mode.	
	1 = ABB	Compatibility mode with previous implementation that have existed in previous FCAN-01 versions. Means that in vl mode, the CiA 402 SW “target reached” bit indicates that the target velocity has been reached. CiA 402 standard requires that the bit be always 0 in vl mode.	
26	Reserved	Not used by the adapter module.	N/A
27	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	**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 **x** = correction number OR in format **axyz**, where **a** = major revision number **xy** = minor revision numbers **z** = correction number or letter.	N/A
		Parameter table revision	

No.	Name/Value	Description	Default setting
29	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	
30	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	

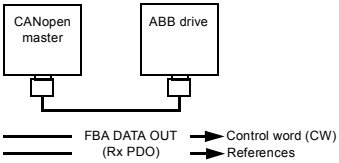
No.	Name/Value	Description	Default setting
31	D2FBA comm sta	**Read-only.** Displays the status of the fieldbus adapter module communication. **Note:** The value names may vary by drive.	**0** = Idle OR **4** = Off-line
	0 = Idle	Adapter is not configured.	
	1 = Exec.init	Adapter is initializing.	
	2 = Time out	Time-out has occurred in the communication between the adapter and the drive.	
	3 = Conf.err	Adapter configuration error: 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.	
32	FBA comm SW rev	**Read-only.** Displays the common program revision of the adapter module in format **axyz**, where: **a** = major revision number **xy** = minor revision numbers **z** = correction number or letter. Example: 190A = revision 1.90A	N/A
		Common program version of the adapter module	
33	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 numbers **z** = correction number or letter. Example: 190A = revision 1.90A	N/A
		Application program revision of the adapter module	

FCAN-01 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
- 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.

<table>
<tr><th>No.[1)]</th><th>Name[2)]/Value</th><th>Description</th><th>Default</th></tr>
<tr><td>01</td><td>For ACS355:
Rx PDO1 word 2
For other drives:
Rx PDO1 word 1

ACS355:
FBA DATA OUT 1
ACSM1:
FBA DATA OUT1
ACS850/ACS880:
FBA data out1</td><td>Selects data word 1 received by the drive over the CANopen network. From the drive's perspective this corresponds to Rx PDO communication in CANopen.
 

Content is defined by a decimal number in the range of 0 to 9999 as follows:
<table>
<tr><td>0</td><td>Not used</td></tr>
<tr><td>1…99</td><td>Virtual address area of drive control</td></tr>
<tr><td>101… 9999</td><td>Parameter area of the drive</td></tr>
</table>
See also Additional information on the virtual address area allocation on page 57.

Note: The FCAN-01 configuration parameters are 16-bit parameters. If the mapped parameter is a 32-bit parameter, it automatically reserves two consecutive parameters. For example, mapping of a 32-bit parameter to parameter no. 1 also reserves parameter no. 2.
Note: In ACS355 drives, Rx PDO1 word 1 and Rx PDO6 word 1 are fixed and always mapped to object 6040h Control word. The first configuration parameters have effect on the 2nd words of these PDOs in ACS355 drives.</td><td>0 = Not used</td></tr>
</table>

No.[1]	Name[2]/Value	Description	Default
	0 = None	Not used	
	1 = CW 16bit	Control word (16 bits)	
	2 = Ref1 16bit	Reference REF1 (16 bits)	
	3 = Ref2 16bit	Reference REF2 (16 bits)	
	11 = CW 32bit	Control word (32 bits)	
	12 = Ref1 32bit	Reference REF1 (32 bits)	
	13 = Ref2 32bit	Reference REF2 (32 bits)	
	101…9999	Parameter number with format **xxyy**, where: • **xx** is the parameter group number (1 to 99) • **yy** is the parameter number index within that group (01 to 99). **Note:** In ACS880, choose **Other** to display a list of mappable drive parameters.	
02	**For ACS355:** Rx PDO1 word 3 **For other drives:** Rx PDO1 word 2	See parameter *01* above.	0
03	**For ACS355:** Rx PDO1 word 4 **For other drives:** Rx PDO1 word 3	See parameter *01* above.	0
04	**For ACS355:** Rx PDO6 word 2 **For other drives:** Rx PDO1 word 4	See parameter *01* above.	0
05	**For ACS355:** Rx PDO6 word 3 **For other drives:** Rx PDO6 word 1	See parameter *01* above.	0
06	**For ACS355:** Rx PDO6 word 4 **For other drives:** Rx PDO6 word 2	See parameter *01* above.	0
07	**For ACS355:** Rx PDO21 word 1 **For other drives:** Rx PDO6 word 3	See parameter *01* above.	0
08	**For ACS355:** Rx PDO21 word 2 **For other drives:** Rx PDO6 word 4	See parameter *01* above.	0

No.[1]	Name[2]/Value	Description	Default
09	**For ACS355:** Rx PDO21 word 3 **For other drives:** Rx PDO21 word 1	See parameter *01* above.	0
10	**For ACS355:** Rx PDO21 word 4 **For other drives:** Rx PDO21 word 2	See parameter *01* above.	0
11	**For ACS355:** N/A **For other drives:** Rx PDO21 word 3	See parameter *01* above. **Note:** ACS355 has only ten FBA DATA OUT parameters, indexes 1 to 10.	0
12	**For ACS355:** N/A **For other drives:** Rx PDO21 word 4	See parameter *01* above. **Note:** ACS355 has only ten FBA DATA OUT parameters, indexes 1 to 10.	0

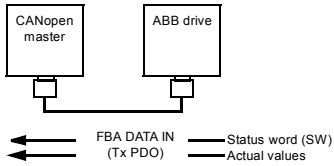
[1] The number of parameters in this group may vary by drive type and drive firmware.
[2] For more information, see chapter *Communication protocol*.

FCAN-01 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
- 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.

<table>
<tr><th>No.[1)]</th><th>Name[2)]/Value</th><th>Description</th><th>Default</th></tr>
<tr><td>01</td><td>For ACS355:
Tx PDO1 word 2
For other drives:
Tx PDO1 word 1

ACS355:
FBA DATA IN 1
ACSM1:
FBA DATA IN1
ACS850/ACS880:
FBA data in1</td><td>Data word 1 sent by the drive over the CANopen network. From the drive's perspective this corresponds to Tx PDO communication in CANopen.
 

Content is defined by a decimal number in the range of 0 to 9999 as follows:
<table>
<tr><td>0</td><td>Not used</td></tr>
<tr><td>1…99</td><td>Virtual address area of drive control</td></tr>
<tr><td>101… 9999</td><td>Parameter area of the drive</td></tr>
</table>
See also Additional information on the virtual address area allocation on page 57.

Note: The FCAN-01 configuration parameters are 16-bit parameters. If the mapped parameter is a 32-bit parameter, it automatically reserves two consecutive parameters. For example, mapping of a 32-bit parameter to parameter no. 1 also reserves parameter no. 2.
Note: In ACS355 drives, Tx PDO1 word 1 and Tx PDO6 word 1 are fixed and always mapped to object 6041h Status word. The first configuration parameters have effect on the 2nd words of these PDOs in ACS355 drives.</td><td>0 = Not used</td></tr>
</table>

No.[1]	Name[2]/Value	Description	Default
	0 = None	Not used	
	4 = SW 16bit	Status word (16 bits)	
	5 = Act1 16bit	Actual value ACT1 (16 bits)	
	6 = Act2 16bit	Actual value ACT2 (16 bits)	
	14 = SW 32bit	Status word (32 bits)	
	15 = Act1 32bit	Actual value ACT1 (32 bits)	
	16 = Act2 32bit	Actual value ACT2 (32 bits)	
	101…9999	Parameter number with format **xxyy**, where: • **xx** is the parameter group number (1 to 99) • **yy** is the parameter number index within that group (01 to 99). **Note:** In ACS880, choose **Other** to display a list of mappable drive parameters.	
02	**For ACS355:** Tx PDO1 word 3 **For other drives:** Tx PDO1 word 2	See parameter *01* above.	0
03	**For ACS355:** Tx PDO1 word 4 **For other drives:** Tx PDO1 word 3	See parameter *01* above.	0
04	**For ACS355:** Tx PDO6 word 2 **For other drives:** Tx PDO1 word 4	See parameter *01* above.	0
05	**For ACS355:** Tx PDO6 word 3 **For other drives:** Tx PDO6 word 1	See parameter *01* above.	0
06	**For ACS355:** Tx PDO6 word 4 **For other drives:** Tx PDO6 word 2	See parameter *01* above.	0
07	**For ACS355:** Tx PDO21 word 1 **For other drives:** Tx PDO6 word 3	See parameter *01* above.	0
08	**For ACS355:** Tx PDO21 word 2 **For other drives:** Tx PDO6 word 4	See parameter *01* above.	0

No.[1]	Name[2]/Value	Description	Default
09	**For ACS355:** Tx PDO21 word 3 **For other drives:** Tx PDO21 word 1	See parameter *01* above.	0
10	**For ACS355:** Tx PDO21 word 4 **For other drives:** Tx PDO21 word 2	See parameter *01* above.	0
11	**For ACS355:** N/A **For other drives:** Tx PDO21 word 3	See parameter *01* above. **Note:** ACS355 has only ten FBA DATA IN parameters, indexes 1 to 10.	0
12	**For ACS355:** N/A **For other drives:** Tx PDO21 word 4	See parameter *01* above. **Note:** ACS355 has only ten FBA DATA IN parameters, indexes 1 to 10.	0

[1] The number of parameters in this group may vary by drive type and drive firmware.
[2] For more information, see chapter *Communication protocol*.

Additional information on the virtual address area allocation

The drive virtual address area is allocated as follows:

Virtual address	Description	Data length	Profile								
			CiA 402[1]						ABB Drives	Transparent 16	Transparent 32
			hm	pp	ip	pv	pt	vl			
1	Control word	16-bit	6040h	6040h		6040h	6040h	6040h	6040h	6040h	-
2	Reference 1	16-bit	-	-		-	-	6042h	6042h	6042h	-
3	Reference 2	16-bit	-	-		-	6071h	-	2000h03	2000h03	-
4	Status word	16-bit	6041h	6041h		6041h	6041h	6041h	6041h	6041h	-
5	Actual value 1	16-bit	-	-		-	6077h	6044h	6044h	6044h	-
6	Actual value 2	16-bit	-	-		-	-	-	2000h06	2000h06	-
7…10	Reserved	N/A	-	-		-	-	-	-	-	-
11	Control word	32-bit	-	-		-	-	-	-	-	2001h
12	Reference 1	32-bit	-	607Ah		60FFh	-	-	-	-	2002h
13	Reference 2	32-bit	-	-		-	-	-	-	-	2003h
14	Status word	32-bit	-	-		-	-	-	-	-	2004h
15	Actual value 1	32-bit	-	6064h		606Ch	-	-	-	-	2005h
16	Actual value 2	32-bit	-	-		-	-	-	-	-	2006h

hm = homing mode
pp = profile position mode
ip = interpolated position mode
pv = profile velocity mode
pt = profile torque mode
vl = velocity mode

[1] ACS355 supports only vl.
[1] ACS850 and ACS880 support vl and pt.
[1] ACSM1 supports hm, pp, pv, pt and vl.

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, FCAN-01). 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 of 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 FCAN configuration parameters in drive parameter group *51*.

   At the minimum, set the required node address in parameter ***5102 NODE ID***, the required bit rate in ***5103 BIT RATE***, select the source of the PDO configuration in ***5104 CONF LOC*** and the communication profile in ***5105 PROFILE***.
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. If group *51* is selected as the source for the PDO configuration, select the application specific configuration for the PDOs with parameters *5107*…*5124*.

7. If group *51* is selected as the source for the PDO configuration, define the process data transferred to and from the drive in FCAN-01 parameter groups *54* and *55*.

   Note: If the PDO configuration is written from the PLC, parameters *5107…5124* are not used and the parameter groups *54* and *55* display the process data selected in the PLC.

8. To validate the settings made in parameter groups *51*, *54* and *55*, set parameter ***5127 FBA PAR REFRESH*** to 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 – ACS355

CiA 402 vl velocity mode with default PDO mapping

The following example shows how to configure a basic speed control application that uses the CiA 402 profile. The start/stop commands are according to the CiA 402 profile velocity control mode.

Rx PDO1 and Tx PDO1 are enabled by default. In ACS355 drives, the first mapping entries of Rx PDO1 and Tx PDO1 are fixed and always mapped to objects 6040h and 6041h.

PDO	Word 1	Length
Rx PDO1	6040h Control word	16 bits
Tx PDO1	6041h Status word	16 bits

Note: The Tx PDO1 default transmission type is 255 (asynchronous) and event time is 0. The event time should be changed with CANopen object 1800h05 if the default transmission type is used.

The ACS355 parameters and recommended parameter settings for the CANopen fieldbus communication are listed in the following table.

Drive parameter	Setting for ACS355 drives	Description
9802 COMM PROT SEL	**4** = EXT FBA	Activates the communication (fieldbus) module.
5101 FBA TYPE	**32** (= CANopen)[1]	Communication module type
5102 FBA PAR 2 (NODE ID)	3[2]	Adapter module node ID
5103 FBA PAR 3 (BIT RATE)	**3** (= 125 kbit/s)[2]	Bit rate used on the CANopen network
5104 FBA PAR 4 (CONF LOC)	**0** (= Network)	CANopen objects (14xxh, 16xxh, 18xxh and 1Axxh) as the source for the PDO settings
5105 FBA PAR 5 (PROFILE)	**0** (= CiA 402)	CiA 402 mode communication profile
3018 COMM FAULT FUNC	**1** = FAULT	Sets the fieldbus communication loss functionality.
3019 COMM FAULT TIME	3.0 s	Fieldbus communication loss supervision time-out
5127 FBA PAR REFRESH	**1** = REFRESH	Fieldbus configuration parameter settings activation
1001 EXT1 COMMANDS	**10** = COMM	Communication module as the source for the start, stop and direction commands
1103 REF1 SELECT	**1** = AI1[2]	Analogue input as the source for reference 1
1601 RUN ENABLE	**7** = COMM	Communication module as the source for the Run enable signal
1604 FAULT RESET SEL	**8** = COMM	Communication module as the source for the fault reset signal

[1] Automatically detected
[2] Example

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

Control word:

- Reset the fieldbus communication fault (if active).
- 7Fh → Operation enabled = Drive starts modulating
- 77h → Disable operation = Ramp stop (possible to restart during ramping)
- 7Eh → Switch on disabled = Coast stop
- 7Bh → Quick stop = Emergency stop (not possible to restart during ramping)

Speed and torque control using ABB Drives communication profile with parameter-configured PDO mapping

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 section *ABB Drives communication profile* on page *100*.)

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.

PDO	Word 1	Word 2	Word 3	Word 4	Length
Rx PDO1	6040h Control word[1)]	6042h Target velocity[1)]	2000h03 Reference 2[1)]	4001h23 Par. 0135 COMM VALUE 1[2)]	64 bits
Tx PDO1	6041h Status word[1)]	6044h vl control effort[1)]	2000h06 Actual value 2[1)]	4001h06 Par. 0106 POWER[2)]	64 bits

PDO	Word 1	Word 2	Word 3	Word 4	Length

1) According to the ABB Drives profile mode
2) Example
Note: In ACS355 drives, the first mapping entries of PDOs 1 and 6 are fixed. See *Process Data Objects (PDO)* on page *113*.

Note: The settings of the PDOs can be changed with CANopen objects 14xxh, 16xxh, 18xxh and 1Axxh. The communication parameter settings of CANopen objects 14xxh and 18xxh are valid only to the next boot-up unless they are stored to the non-volatile memory.

The ACS355 parameters and recommended parameter settings for the CANopen fieldbus communication are listed in the following table.

Drive parameter	Setting for ACS355 drives	Description
9802 COMM PROT SEL	**4** = EXT FBA	Activates the communication (fieldbus) module.
5101 FBA TYPE	**32** (= CANopen)[1]	Communication module type
5102 FBA PAR 2 (NODE ID)	3[2]	Adapter module node ID
5103 FBA PAR 3 (BIT RATE)	**2** (= 250 kbit/s)[2]	Bit rate used on the CANopen network
5104 FBA PAR 4 (CONF LOC)	**1** (= Parameters)	PDO configuration is done with FCAN-01 configuration parameters, that is, ACS355 parameter groups 51, 55 and 54.
5105 FBA PAR 5 (PROFILE)	**1** (= ABB Drives)	ABB Drives profile mode (that is, communication profile used by the module)
3018 COMM FAULT FUNC	**1** = FAULT	Sets the fieldbus communication loss functionality.
3019 COMM FAULT TIME	3.0 s	Fieldbus communication loss supervision time-out
5107 FBA PAR 7 (RPDO1-COB-ID)	**1** (= Default)	Rx PDO1 is enabled and configured to use the default COB-ID.

Drive parameter	Setting for ACS355 drives	Description
5108 FBA PAR 8 (RPDO1-TR TYPE)	255[2)]	Asynchronous transmission mode is used by Rx PDO1.
5110 FBA PAR 10 (TPDO1-COB-ID)	**1** (= Default)	Tx PDO1 is enabled and configured to use the default COB-ID.
5111 FBA PAR 11 (TPDO1-TR TYPE)	255	Asynchronous transmission mode is used by Tx PDO1. Transmission is triggered by the event time.
5112 FBA PAR 12 (TPDO1-EV TIME)	100[2)]	Event time, that is, event time elapses every 100 ms.

5401 FBA DATA IN 1	**5** (= Act1 16bit)	Actual value 1 as mapping entry 2 in Tx PDO1
5402 FBA DATA IN 2	**6** (= Act2 16bit)	Actual value 2 as mapping entry 3 in Tx PDO1
5403 FBA DATA IN 3	106	Signal 106 POWER as mapping entry 4 in Tx PDO1
5501 FBA DATA OUT 1	**2** (= Ref1 16bit)	Reference 1 as mapping entry 2 in Rx PDO1
5502 FBA DATA OUT 2	**3** (= Ref2 16bit)	Reference 2 as mapping entry 3 in Rx PDO1
5503 FBA DATA OUT 3	135	Signal 135 COMM VALUE 1 as mapping entry 4 in Rx PDO1

5127 FBA PAR REFRESH	**1** = REFRESH	Activates the fieldbus configuration parameter settings.

9904 MOTOR CTRL MODE	**2** = VECTOR: TORQ	Selects the motor control mode.
1001 EXT1 COMMANDS	**10** = COMM	Communication module as the source for the start, stop and direction commands in EXT1 mode
1002 EXT2 COMMANDS	**10** = COMM	Communication module as the source for the start, stop and direction commands in EXT2 mode

Drive parameter	Setting for ACS355 drives	Description
1102 EXT1/EXT2 SEL	**8** = COMM	Communication module as the source for the control location selection
1103 REF1 SELECT	**8** = COMM	Communication module as the source for reference 1
1106 REF2 SELECT	**8** = COMM	Communication module as the source for reference 2
1601 RUN ENABLE	**7** = COMM	Communication module as the source for the Run enable signal
1604 FAULT RESET SEL	**8** = COMM	Communication module as the source for the fault reset signal

[1] Automatically detected
[2] Example

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

Control word:

- Reset the fieldbus communication fault (if active).
- 47Eh (1150 decimal) → READY TO SWITCH ON
- 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 by setting parameter ***50.01 FBA ENABLE*** to 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 adapter module and communication between the adapter module and 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 FCAN-01 configuration parameters in parameter group 51.

   At minimum, set the required node address in parameter ***51.02 NODE ID*** and the required bit rate in ***51.03 BIT RAT***E, select the source of the PDO configuration in ***51.04 CONF LOC*** and the communication profile in ***51.05 PROFILE***.
7. If group *51* is selected as the source for the PDO configuration, select the application specific configuration for the PDOs with parameters *51.07*…*51.24*.
8. If group *51* is selected as the source for the PDO configuration, define the process data transferred to and from the drive in the FCAN-01 configuration parameter groups *52* and *53*.

   Note: If the PDO configuration is written from the PLC, parameters *51.07*…*51.24* are not used and the parameter groups *52* and *53* display the process data selected in the PLC.
9. To validate the settings made in parameter groups *51*, *52* and *53*, set parameter ***51.27 FBA PAR REFRESH*** to REFRESH.
10. Set the relevant drive control parameters to control the drive according to the application.

    See the parameter setting examples below.

Parameter setting examples – ACSM1

Using position control with the CiA 402 Profile Position mode

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 CiA 402 Profile Position mode.

The parameter setting example results in the following PDO configuration.

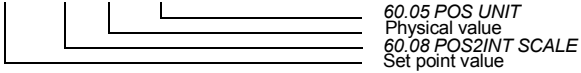
Note: Rx PDO1 and Tx PDO1 are enabled by default.

PDO	Word 1	Word 2, 3	Length
Rx PDO1	6040h Control word	607Ah Target position	48 bits
Tx PDO1	6041h Status word	6064h Position actual value	48 bits

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	Example setting
60.05 POS UNIT (Position unit)	m
60.08 POS2INT SCALE	100

1000 / 100 = 10.00 m



The ACSM1 parameters and recommended parameter settings for the CANopen fieldbus communication are listed in the following table.

Drive parameter	Setting for ACSM1 drives	Description
50.01 FBA ENABLE	Enable	Activates the communication (fieldbus) module.
50.02 COMM LOSS FUNC	Fault	Enables communication between the drive and the fieldbus adapter module.
50.03 COMM LOSS T OUT	1.0 s	Defines the fieldbus communication break supervision time-out.
50.04 FBA REF1 MODESEL	Position	Defines the fieldbus reference scaling.
51.01 FBA TYPE	**32** (= CANopen)[1)]	Communication module type
51.02 FBA PAR2 (NODE ID)	3[2)]	Adapter module node ID
51.03 FBA PAR3 (BIT RATE)	**3** (= 125 kbit/s)[2)]	Bit rate used on the CANopen network
51.04 FBA PAR4 (CONF LOC)	**1** (= Parameters)	PDO configuration is done with FCAN-01 configuration parameter group A (group 1), B (group 2) and C (group 3) (that is, ACSM1 parameter groups 51, 52 and 53).
51.05 FBA PAR5 (PROFILE)	**0** (= CiA 402)	CiA 402 communication profile (that is, communication profile used by the module)
51.08 FBA PAR8 (RPDO1-TR TYPE)	255[2)]	Asynchronous transmission mode is used by Rx PDO1.
52.01 FBA DATA IN1	**4** (= SW 16bit)	Status word (16-bit) as mapping entry 1 in Tx PDO1
52.02 FBA DATA IN2	**15** (= Act1 32bit)	Position actual value (32-bit) as mapping entries 2 and 3 in Tx PDO1

Drive parameter	Setting for ACSM1 drives	Description
52.03 FBA DATA IN3	**0** (reserved)	Parameters in groups 52 and 53 are 16-bit parameters. Mapping of 32-bit parameters automatically reserves also the following cell (that is, the mapping of 15 to parameter 52.02 reserves also the parameter 52.03).
53.01 FBA DATA OUT1	**1** (= CW 16bit)	Control word (16-bit) as mapping entry 1 in Rx PDO1
53.02 FBA DATA OUT2	**12** (= Ref1 32bit)	Position Reference (32-bit) as mapping entries 2 and 3 in Rx PDO1
53.03 FBA DATA OUT3	**0** (reserved)	Parameters in groups 52 and 53 are16-bit parameters. Mapping of 32-bit parameters automatically reserves also the following cell (that is, the mapping of 12 to parameter 53.02 reserves also the parameter 53.03).

51.27 FBA PAR REFRESH	REFRESH	Activates the fieldbus configuration parameter settings.

10.01 EXT1 START FUNC	FBA	Communication module as the source for the start, stop and direction commands
34.03 EXT1 CTRL MODE 1	Position	Selects the position control mode for external control location EXT1.
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] Automatically detected
[2] Example

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

Control word:

- Reset the fieldbus communication fault (if active).
- 0Eh (14 decimal) → SWITCH ON DISABLED
- 0Fh (15 decimal) → OPERATION ENABLED
- 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 by setting parameter ***50.01 FBA* enable** to 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 adapter module and communication between the adapter module and 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 FCAN-01 configuration parameters in drive parameter group *51*.

   At minimum, set the required node address in parameter ***51.02 NODE ID***, the required bit rate in ***51.03 BIT RATE***, select the source of the PDO configuration in ***51.04 CONF LOC*** and the communication profile in ***51.05 PROFILE***.

7. If group *51* is selected as the source for the PDO configuration, select the application specific configuration for the PDOs with parameters *51.07…51.24*.
8. Define the process data transferred to and from the drive in the FCAN-01 configuration parameter groups *52* and *53*.

   Note: If the PDO configuration is witten from the PLC, parameters *51.07…51.24* are not used and the parameter groups *52* and *53* display the process data selected in the PLC.
9. To validate the settings made in parameter groups *51*, *52* and *53*, set parameter ***51.27 FBA par refresh*** to Refresh.
10. Set the relevant drive control parameters to control the drive according to the application.

    See the parameter setting examples below.

Parameter setting examples – ACS850

CiA 402 Velocity mode with default PDO mapping

This example shows how to configure a basic speed control application that uses the CiA 402 profile. The start/stop commands are according to the CiA 402 profile velocity control mode.

Rx PDO1 and Tx PDO1 are enabled by default.

PDO	Word 1	Length
Rx PDO1	6040h Control word	16 bits
Tx PDO1	6041h Status word	16 bits

Note: The Tx PDO1 default transmission type is 255 (asynchronous) and event time is 0. The event time should be changed with CANopen object 1800h05 if the default transmission type is used.

The ACS850 parameters and recommended parameter settings for the CANopen fieldbus communication are listed in the following table.

Drive parameter	Setting for ACS850 drives	Description
50.01 FBA enable	Enable	Activates the communication (fieldbus) module.
50.02 Comm loss func	Fault	Enables fieldbus communication fault monitoring.
50.03 Comm loss t out	3.0 s	Defines the fieldbus communication break supervision time-out.
50.04 FBA ref1 modesel	Speed	Defines the fieldbus reference scaling.
51.01 FBA type	CANopen[1)]	Communication module type
51.02 FBA par2 (NODE ID)	3[2)]	Adapter module node ID
51.03 FBA par3 (BIT RATE)	**3** (= 125 kbit/s)[2)]	Bit rate used on the CANopen network
51.04 FBA par4 (CONF LOC)	**0** (= Network)	CANopen objects (14xxh, 16xxh, 18xxh and 1Axxh) as the source for the PDO settings
51.05 FBA par5 (PROFILE)	**0** (= CiA 402)	CiA 402 Velocity mode communication profile (that is, communication profile used by the module)
52.01 FBA data in1	**4** (= SW 16bit)	Status word (16-bit) as mapping entry 1 in Tx PDO1
53.01 FBA data out1	**1** (= CW 16bit)	Control word (16-bit) as mapping entry 1 in Rx PDO1
51.27 FBA par refresh	Refresh	Activates the fieldbus configuration parameter settings activation.
10.01 Ext1 start func	FB	Communication module as the source for the start, stop and direction commands

Drive parameter	Setting for ACS850 drives	Description
12.03 Ext1 ctrl mode	Speed	Selects the speed control mode for external control location EXT1.
21.01 Speed ref1 sel	AI1 scaled[2] (Parameter 02.05)	Analog input as the source for reference 1

[1] Automatically detected
[2] Example

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

Control word:

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

ABB Drives communication profile with parameter-configured PDO mapping

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 section *ABB Drives communication profile* on page *100*.)

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.

PDO	Word 1	Word 2	Length
Rx PDO1	6040h Control word	6042h Target velocity	32 bits
Tx PDO1	6041h Status word	6044h vl control effort	32 bits

Note: The settings of the PDOs can be changed with CANopen objects 14xxh, 16xxh, 18xxh and 1Axxh. The communication parameter settings of CANopen objects 14xxh and 18xxh are valid only to the next boot-up unless stored to the non-volatile memory.

The ACS850 parameters and recommended parameter settings for the CANopen fieldbus communication are listed in the following table:

Drive parameter	Setting for ACS850 drives	Description
50.01 FBA enable	Enable	Activates the communication (fieldbus) module.
50.02 Comm loss func	Fault	Enables fieldbus communication fault monitoring.
50.03 Comm loss t out	3.0 s	Defines the fieldbus communication break supervision time.
50.04 FBA ref1 modesel	Speed	Defines the fieldbus reference scaling.
51.01 FBA type	CANopen[1)]	Communication module type
51.02 FBA par2 (NODE ID)	3[2)]	Adapter module node ID
51.03 FBA par3 (BIT RATE)	**3** (= 125 kbit/s)[2)]	Bit rate used on the CANopen network
51.04 FBA par4 (CONF LOC)	**1** (= Parameters)	PDO1 configuration is done with FCAN-01 configuration parameters group A (group1), group B (group 2) and group C (group 3), that is, ACS850 parameter groups 51, 52 and 53.
51.05 FBA par5 (PROFILE)	**1** (= ABB Drives)	ABB Drives profile mode (that is, communication profile used by the module)
51.07 FBA par7 (RPDO1-COB-ID)	**1** (= Default)	Rx PDO1 is enabled.
51.08 FBA par8 (RPDO1-TR TYPE)	255[2)]	Asynchronous transmission mode is used by Rx PDO1.
51.10 FBA par10 (TPDO1-COB-ID)	**1** (= Default)	Tx PDO1 is enabled.

Drive parameter	Setting for ACS850 drives	Description
51.11 FBA par11 (TPDO1-TR TYPE)	255[2)]	Asynchronous transmission mode is used by Tx PDO1.
52.01 FBA data in1	**4** (= SW 16bit)	16-bit Status word as mapping entry 1 in Tx PDO1
52.02 FBA data in2	**5** (= Act1 16bit)	16-bit actual value as mapping entry 2 in Tx PDO1
53.01 FBA data out1	**1** (= CW 16bit)	16-bit Control word 1 as mapping entry 1 in Rx PDO1
53.02 FBA data out2	**2** (= Ref1 16bit)	16-bit reference as mapping entry 2 in Rx PDO1
51.27 FBA par refresh	Refresh	Activates the fieldbus configuration parameter settings.
10.01 Ext1 start func	FBA	Communication module as the source for the start, stop and direction commands
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)	Fieldbus reference 1 as the source for speed reference 1

[1)] Automatically detected
[2)] Example

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

Control word:

- Reset the fieldbus communication fault (if active).
- 47Eh (1150 decimal) → READY TO SWITCH ON
- 47Fh (1151 decimal) → OPERATING

Starting up ACS880 drives

1. Power up the drive.
2. Enable the communication between the adapter module and the drive by setting parameter ***50.01 FBA A enable*** to 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 adapter module and communication between the adapter module and 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 FCAN-01 configuration parameters in drive parameter group *51*.

   At minimum, set the required node address in parameter ***51.02 Node ID***, the required bit rate in ***51.03 Bit rate***, select source of the PDO configuration in ***51.04 Conf location*** and the communication profile in ***51.05 Profile***.
7. If the group 51 is selected as the source for the PDO configuration, select the application specific configuration for the PDOs with parameters *51.07*…*51.24*.
8. Define the process data transferred to and from the drive in the FCAN-01 configuration parameter groups *52* and *53*.

   Note: If the PDO configuration is written from the PLC, the parameters *51.07*…*51.24* are not used and the parameter groups *52* and *53* display the process data selected in the PLC.

9. Save the valid parameter values to permanent memory by setting parameter ***96.07 Param save*** to Save.
10. To validate the settings made in the parameter groups *51*, *52* and *53*, set parameter ***51.27 FBA par refresh*** to Configure.
11. 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

CiA 402 Velocity mode with default PDO mapping

This example shows how to configure a basic speed control application that uses CiA 402 profile. The start/stop commands are according to the CiA 402 profile velocity control mode.

Rx PDO1 and Tx PDO1 are enabled by default.

PDO	Word 1	Length
Rx PDO1	6040h Control word	16 bits
Tx PDO1	6041h Status word	16 bits

Note: The Tx PDO1 default transmission type is 255 (asynchronous) and event time is 0. The event time should be changed with CANopen object 1800h05 if the default transmission type is used.

The ACS880 parameters and recommended parameter settings for the CANopen fieldbus communication are listed in the following table.

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	Enables fieldbus communication fault monitoring.
50.03 FBA A comm loss t out	3.0 s	Defines the fieldbus communication break supervision time.
50.04 FBA A ref1 type	**4** = Speed	Defines the fieldbus A reference 1 scaling.
51.01 FBA type	CANopen[1)]	Communication module type
51.02 Node ID	3[2)]	Adapter module node ID
51.03 Bit rate	**3** = 125 kbit/s[2)]	Bit rate used on the CANopen network
51.04 Conf location	**0** = Network	CANopen objects (14xxh, 16xxh, 18xxh and 1Axxh) as the source for the PDO settings
51.05 Profile	**0** = CiA 402	CiA 402 Velocity mode communication profile (that is, communication profile used by the module)
52.01 FBA data in1	**4** = SW 16bit[2)]	16-bit Status word as mapping entry 1 in Tx PDO1
53.01 FBA data out1	**1** = CW 16bit[2)]	16-bit Control word 1 as mapping entry 1 in Rx PDO1
51.27 FBA par refresh	**1** = Configure	Activates the fieldbus configuration parameter settings.
19.12 Ext1 control mode 1	**2** = Speed	Selects speed control as control mode 1 for external control location 1.

Drive parameter	Setting for ACS880 drives	Description
20.01 Ext1 commands	**21** = Fieldbus A	Selects the fieldbus A interface as the source of the start and stop commands for external control location 1.
22.11 Speed ref1 selection	AI1 scaled[2)]	Analog input as the source for reference 1

[1)] Automatically detected
[2)] Example

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

Control word:

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

Configuring the master station

After the adapter module has been initialized by the drive, the master station must be prepared for communication with the adapter module. Examples of an ABB AC500 PLC are given below. If you are using another master system, refer to its documentation for more information.

The examples can be applied to all drive types compatible with the adapter module.

EDS files

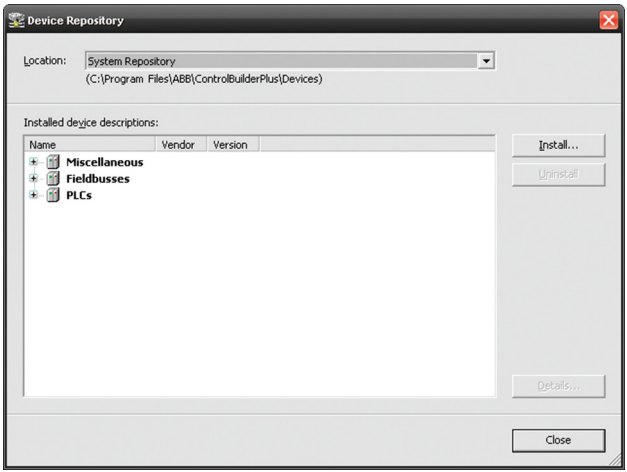
The Electronic Data Sheet (EDS) files specify the device properties for the CANopen master (client). The EDS files for the FCAN-01 CANopen adapter module contain information on the supported communication objects. The EDS files for ABB Drives are available at the Document library (www.abb.com/drives).

Configuring an ABB AC500 PLC

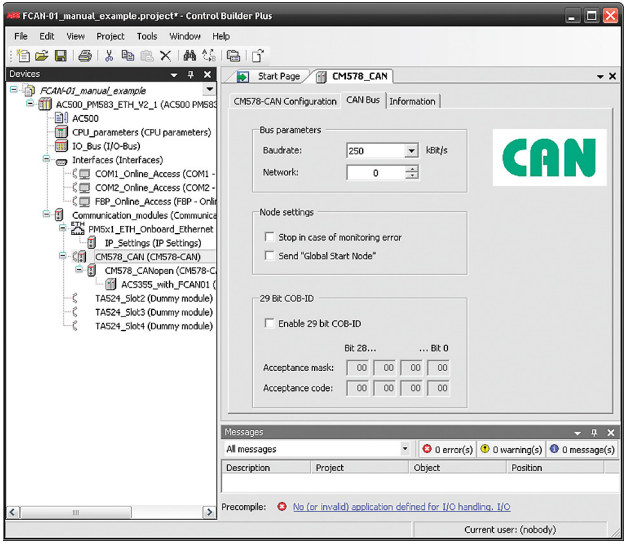
This example shows how to configure the communication between an AC500 PLC and the adapter module using the Control Builder Plus PS501 software version 2.1.0 and later.

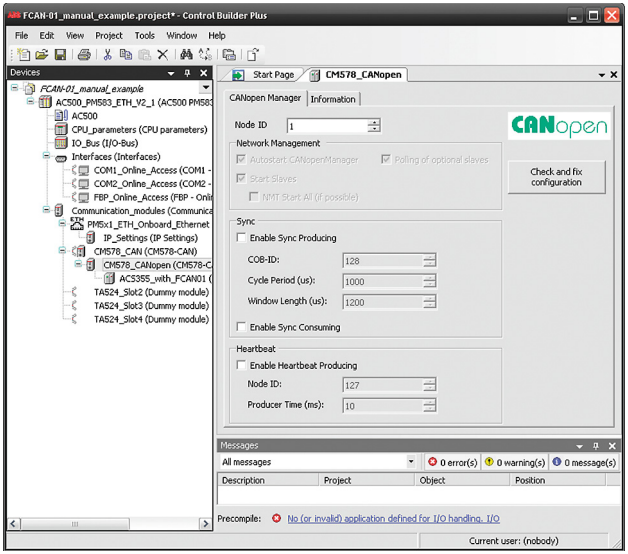
Before you start, make sure that you have downloaded the FCAN-01 EDS description file from the Document library.

1. Start the ABB Control Builder software.
2. On the **Tools** menu, select **Device Repository**.
3. In the opening window, click **Install** and browse for the EDS file downloaded from the Document library.



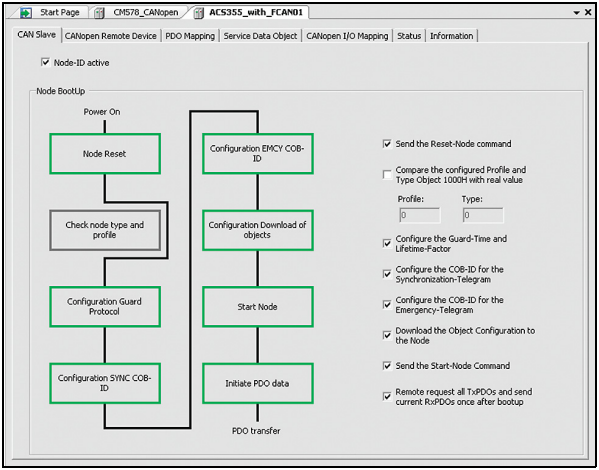
4. Open or create the PLC project that is used to control the drive.
5. Add the CM578-CN CANopen master device to the PLC project if necessary.
6. Add the adapter module/drive to the CANopen network.
7. Configure the master properties such as baud rate, node ID and heartbeat.



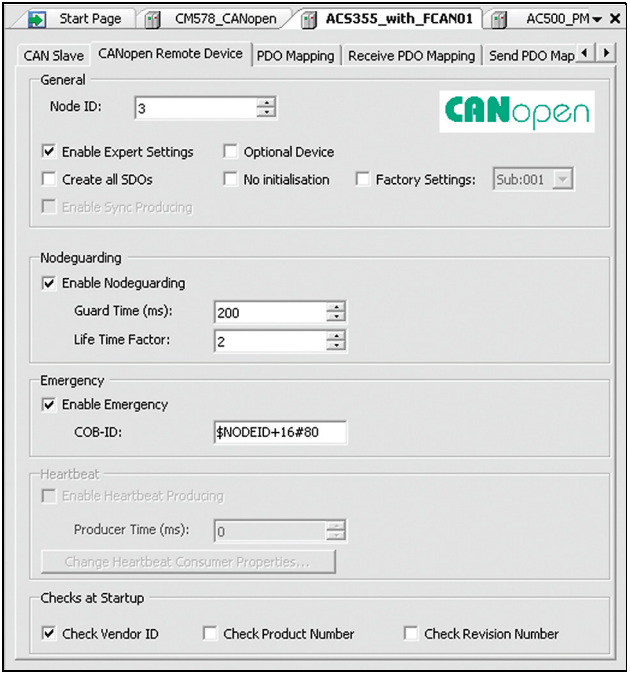

FCAN-01_manual_example.project* - Control Builder Plus
File Edit View Project Tools Window Help
Devices
FCAN-01_manual_example
AC500_PM583_ETH_V2_1 (AC500 PM583
AC500
CPU_parameters (CPU parameters)
IO_Bus (I/O-Bus)
Interfaces (Interfaces)
COM1_Online_Access (COM1 -
COM2_Online_Access (COM2 -
FBP_Online_Access (FBP - Onli
Communication_modules (Communica
PM5xx1_ETH_Onboard_Ethernet
IP_Settings (IP Settings)
CM578_CAN (CM578-CAN)
CM578_CANopen (CM578-C
AC3355_with_FCAN01 (
TA524_Slot2 (Dummy module)
TA524_Slot3 (Dummy module)
TA524_Slot4 (Dummy module)
Start Page
CM578_CANopen
CANopen Manager
Information
Node ID
1
CANopen
Network Management
Autostart CANopenManager
Polling of optional slaves
Start Slaves
NMT Start All (if possible)
Check and fix configuration
Sync
Enable Sync Producing
COB-ID:
128
Cycle Period (us):
1000
Window Length (us):
1200
Enable Sync Consuming
Heartbeat
Enable Heartbeat Producing
Node ID:
127
Producer Time (ms):
10
Messages
All messages
0 error(s)
0 warning(s)
0 message(s)
Description
Project
Object
Position
Precompile:
No (or invalid) application defined for I/O handling, I/O
Current user: (nobody)

8. Configure the FCAN-01 properties:

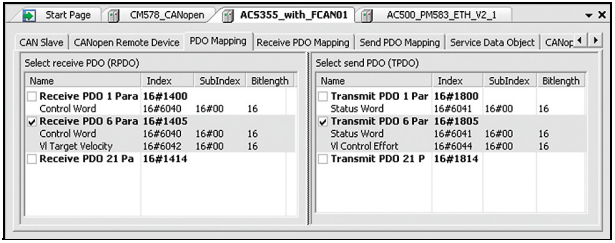
- Select the node boot up sequence.



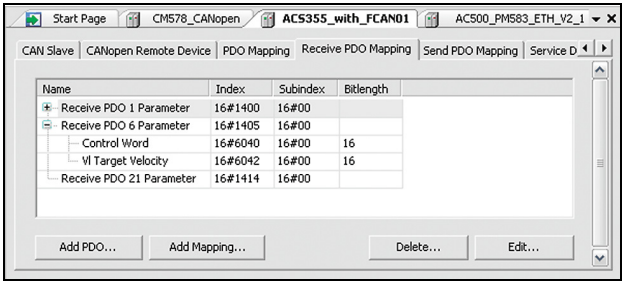
- On the **CANopen Remote Device** tab,
  - select the node ID for the device
  - select **Enable Expert Settings** to configure the process data mapping, node guarding and emergency settings for the drive.



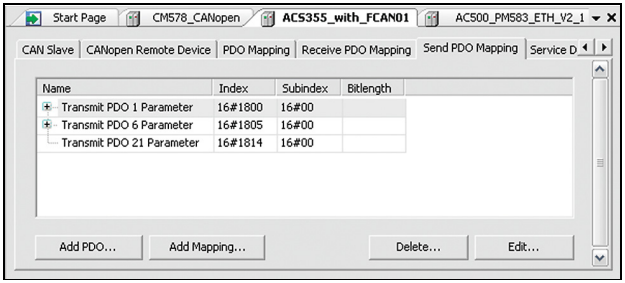
- On the **PDO Mapping** tab, select the PDOs transferred between the PLC and the drive.



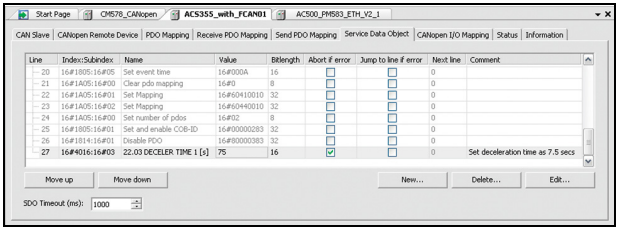
- On the **Receive PDO Mapping** tab, select the variables transferred from PLC to drive.



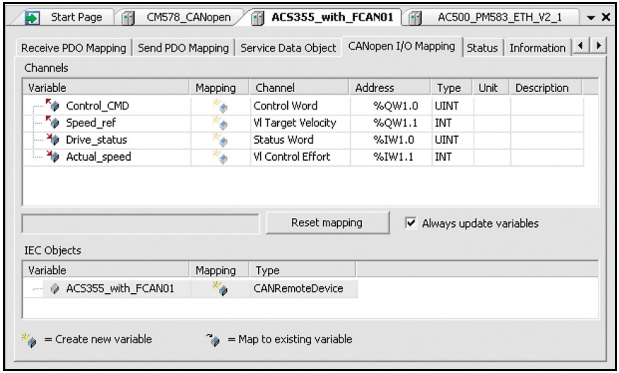
- On the **Send PDO Mapping** tab, select the variables transferred from drive to PLC.



- On the **Service Data Object** tab, define the parameter values that are sent to the drive when the communication is initialized.

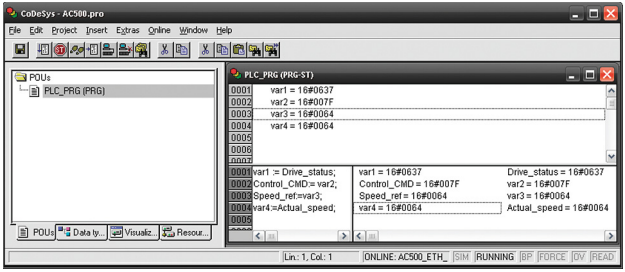


- On the **CANopen I/O Mapping** tab, configure the I/O mapping. Type names for the variables that refer to the signals of the drive in the PLC program.



- Open the PLC program, compile the project and download it to the PLC.

  Make sure that the variable names defined for the signals of the drive are used in the PLC program, otherwise the communication will not work.



7

Communication profiles

What this chapter contains

This chapter describes the communication profiles used in communication between the CANopen network, the adapter module and the drive.

Communication profiles

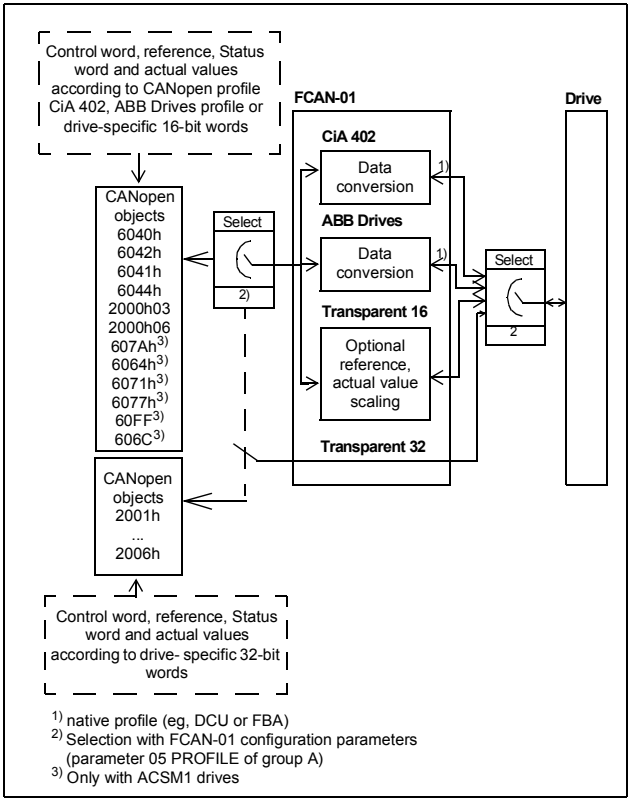
Communication profiles are ways of conveying control commands (Control word, Status word, references and actual values) between the master station and the drive.

With the FCAN-01 CANopen adapter module, the CANopen network may employ the CiA 402 profile (Device profile for drives and motion control) or the ABB Drives profile. Both are converted to the native profile (for example, DCU or FBA, detailed in the drive manuals) 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.

Note: The CiA 402 operation mode support is drive-specific. See *CANopen device profile CiA 402* on page *89* for more details.

The profile is selected from the drive with parameter 05 PROFILE of the fieldbus configuration group A. For example, if parameter 05 PROFILE is set to 0, the Control word of the drive is set according to the CiA 402 specification.

The figure below illustrates the profile selection:

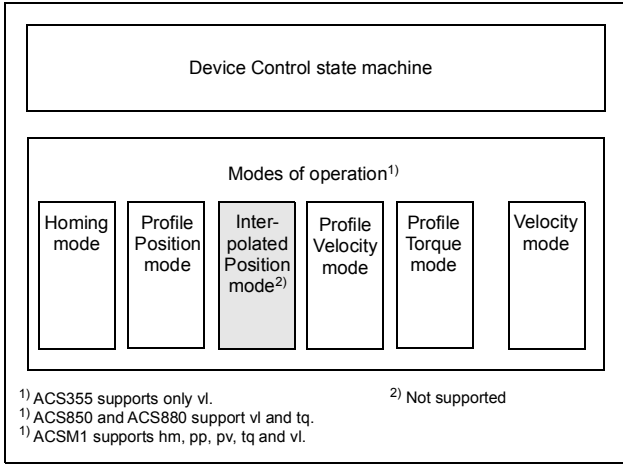


The following sections describe the Control word, the Status word, references and actual values for the CANopen device profile CiA 402 and ABB Drives communication profiles. See the drive manuals for details on the native profiles.

CANopen device profile CiA 402

Device Control state machine

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 below.



The Control word is the principal means for controlling the drive from a fieldbus system. It is sent by the fieldbus master station 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 section *Control word and Status word of the CiA 402 profile* on page *93*.

Modes of operation

The operation mode defines the behavior of the drive. CiA 402 defines following operation modes:

- *Homing mode*
- *Profile position mode*
- *Interpolated position mode*
- *Profile velocity mode*
- *Profile torque mode*
- *Velocity mode*

The FCAN-01 CANopen adapter module supports minimal implementation of the operation modes. Operation mode support is drive-specific (see the figure at the beginning of this chapter). The interpolated position mode is not supported.

In this chapter scalings of the reference and actual values are described for each operation mode. Operation-mode-specific objects are defined in section *CANopen Object Dictionary* on page *131*.

In ACSM1 drives, the mode of operation is automatically selected according to the control mode configured with parameter ***34.03 EXT1 CTRL MODE***, ***34.04 EXT1 CTRL MODE2*** or ***34.05 EXT2 CTRL MODE1*** (depending on the current control location). The correct reference scaling must be selected with parameter ***50.04 FBA REF1 MODESEL***.

If the value of parameter ***50.04 FBA REF1 MODESEL*** and ***50.05 FBA REF2 MODESEL*** of ACSM1 is (5) AUTO, it is possible to set the mode of operation with object 6060h. For more information, see section *Standardized device profile area (6000...9FFF)* on page *146*.

Homing mode

Homing mode describes various methods of finding a home position, or zero point. Either limit switches at the ends of travel or a home switch in mid travel are used. Most of the methods also use the index (zero) pulse from an encoder. For more information on the homing mode and descriptions of the various homing methods, see the drive manual.

Profile position mode

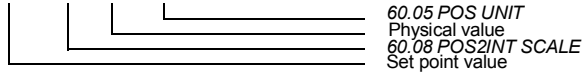
This mode enables the positioning of the drive to be controlled.

Position demand value

Position demand value defines the position set point. The position set point is scaled as follows:

Drive parameter (ACSM1)	Example setting
60.05 POS UNIT (Position unit)	m
60.08 POS2INT SCALE	100

1000 / 100 = 10.00 m



Position actual value

Position actual value defines the actual position of the application. Position actual value is scaled as position demand value (see above).

Interpolated position mode

Not supported with the FCAN-01 CANopen adapter module.

Profile velocity mode

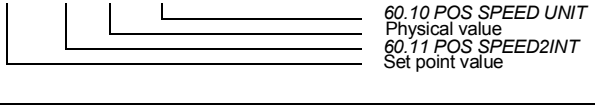
The profile velocity mode is used to control the velocity of the drive with no special regard of the position.

Target velocity

Target velocity is the required velocity of the application. The target velocity is scaled as follows:

Drive parameter (ACSM1)	Example setting
60.05 POS UNIT (Position unit)	m
60.10 POS SPEED UNIT	unit/s
60.11 POS SPEED2INT	100

1000 / 100 = 10.00 m/s



Velocity actual value

Velocity actual value defines the actual velocity of the application. Velocity actual value is scaled as target velocity (see above).

Profile torque mode

Profile torque mode enables the drive torque to be controlled directly.

Target torque

Target torque is the required torque of the application. The value is given per thousand of the rated torque, 10 = 1%.

Torque actual value

Torque actual value corresponds to the instantaneous torque in the drive motor. The value is given per thousand of the rated torque, that is 10 = 1%.

Velocity mode

Basic mode to control the velocity of the drive with limits and ramp functions.

Target velocity of CiA 402 Velocity mode

Target velocity is the required velocity of the application. The unit of the target velocity is interpreted as rpm. 1 = 1 rpm.

Control effort of CiA 402 Velocity mode

Control effort is the actual velocity of the application. The unit of the control effort is interpreted as rpm. 1 = 1 rpm.

Control word and Status word of the CiA 402 profile

Control word of CiA 402	
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...10	Reserved
11...15	Drive-specific bit

Operation-mode-specific bits						
Bit	**Velocity mode**	**Profile position mode**[1)]	**Profile velocity mode**[1)]	**Profile torque mode**[2)]	**Homing mode**[1)]	**Interpolated position mode**[3)]
4	rfg enable	New setpoint	Reserved	Reserved	Homing operation start	Enable ipmode
5	rfg unlock	Change set immediately	Reserved	Reserved	Reserved	Reserved
6	rfg use ref	abs / rel	Reserved	Reserved	Reserved	Reserved

[1)] Supported with ACSM1 only
[2)] Supported with ACSM1, ACS850 and ACS880 only
[3)] Not supported

Status word of CiA 402	
Bit	**Description**
0	Ready to switch on
1	Switched on
2	Operation enabled
3	Fault
4	Voltage enabled
5	Quick stop
6	Switch on disabled
7	Warning
8	Drive-specific bit
9	Remote
10	Target reached
11	Internal limit active
12…13	Operation-mode-specific
14…15	Drive-specific bit

Operation-mode-specific bits						
Bit	**Velocity mode**	**Profile position mode**[1)]	**Profile velocity mode**[1)]	**Profile torque mode**[2)]	**Homing mode**[1)]	**Interpolated position mode**[3)]
12	Reserved	Set point acknowledge	Speed	Reserved	Homing attained	IP mode active
13	Reserved	Following error	Max slippage error	Reserved	Homing error	Reserved

[1)] Supported with ACSM1 only
[2)] Supported with ACSM1 and ACS850 only
[3)] Not supported

Device control commands are triggered by the Control word bits as follows:

Device control commands						
Command	**Control word bit**					
	Fault reset, bit 7	**Enable operation, bit 3**	**Quick stop, bit 2**	**Enable voltage, bit 1**	**Switch on, bit 0**	**State transi-tions***
Shut down	0	x	1	1	0	2, 6, 8
Switch on	0	0	1	1	1	3[1)]
Switch on	0	1	1	1	1	3[1)]
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

Bits marked with x are irrelevant.

[1)] When Control word bit 3 (Enable operation) is 1, the drive does not perform any tasks in the SWITCHED ON state. When bit 3 is 0, state SWITCHED ON tasks are performed. See the Device Control state machine figure on page *89*.

The following stop modes are associated with the control commands and other events:

Command/Event	**Drive stop mode**
Quick stop	Emergency stop
Shut down	Coast stop
Disable voltage	Coast stop
Halt	Ramp stop (configurable with CANopen object 605Dh)
Fault	Fault reaction specified by the drive. Typically a coast stop.

The halt mode is controlled with bit 8 of the CiA 402 control word. When the halt bit is set during the OPERATION ENABLED state, the drive stops and the state machine remains in the OPERATION ENABLED state. When the bit is reset, the drive starts running again. In all modes supporting the halt function, CiA 402 Status Word bit 10 (target reached) is set when the drive is stopped.

Note: The drive may not necessarily stop completely as it is still the in running (OPERATION ENABLED) state.

The following table summarizes the drive features used to perform the ramp stop during the halt function, as well as the different halt option codes supported by each CiA 402 operating mode. The halt option code is selected by CANopen object 605Dh.

Mode	Description	Halt option codes
Profile Position	Dynamic limiter ramp	1
Interpolated Position	Dynamic limiter ramp	1
Profile Velocity	Dynamic limiter ramp	1
Profile Torque	Sets the torque reference to 0. Ramp depends on drive parameters.	1
Homing	Dynamic limiter ramp	1
Velocity	Halt mode 1: Ramp input is set to 0. Halt mode 2,3,4: Ramp output is set to 0.	1, 2, 3, 4
Other modes	Halt bit has no effect.	N/A

State machine

The following figure describes the CANopen state machine.

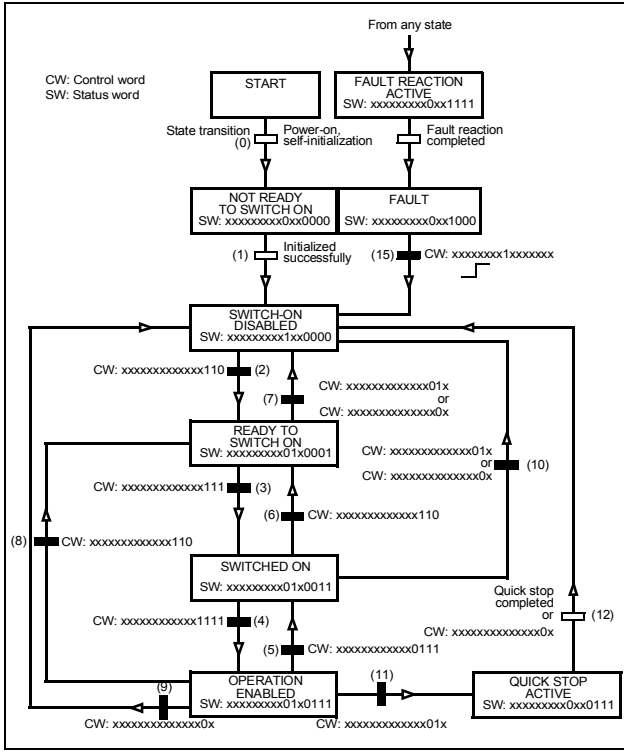


ABB Drives communication profile

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 station 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 in the ABB Drives profile state transition diagram on page *105*.

Control word contents

The following table presents the Control word of the ABB Drives communication profile. The upper case boldface text refers to the states shown in the ABB Drives profile state machine figure on page *105*.

Control word of ABB Drives profile			
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**.

Control word of ABB Drives profile			
Bit	**Name**	**Value**	**STATE/Description**
2	OFF3_ CONTROL	1	Continue operation (OFF3 inactive).
		0	Emergency stop; stop within time defined with the drive parameter. Proceed to **OFF3 ACTIVE**; proceed to **SWITCH-ON INHIBITED**. **Warning:** Ensure motor and driven machine can be stopped using this stop mode.
3	INHIBIT_ OPERATION	1	Proceed to **OPERATION ENABLED**. **Note:** Run enable signal must be active; see the drive manuals. 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 **RFG: OUTPUT ENABLED**.
		0	Force the Ramp Function Generator output to zero. The drive ramps to stop (current and DC voltage limits in force).
5	RAMP_HOLD	1	Enable the ramp function; proceed to **RFG: ACCELERATOR ENABLED**.
		0	Halt ramping (the Ramp Function Generator output held).
6	RAMP_IN_ ZERO	1	Normal operation; proceed to **OPERATION**. **Note:** Effective only if the fieldbus interface is set as the source for this signal with drive parameters.
		0	Force the Ramp Function Generator input to zero.

Control word of ABB Drives profile			
Bit	**Name**	**Value**	**STATE/Description**
7	RESET	0 →1	Fault reset if an active fault exists. Proceed to **SWITCH-ON INHIBITED**. **Note:** Effective only if the fieldbus interface is set as the source for this signal with drive parameters.
		0	Continue normal operation.
8…9	Drive-specific (for information, see the drive documentation.)		
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 the control location is parameterized to be selected from the fieldbus.
		0	Select external control location EXT1. Effective if the control location is parameterized to be selected from the fieldbus.
12…15	Reserved		

Status word contents

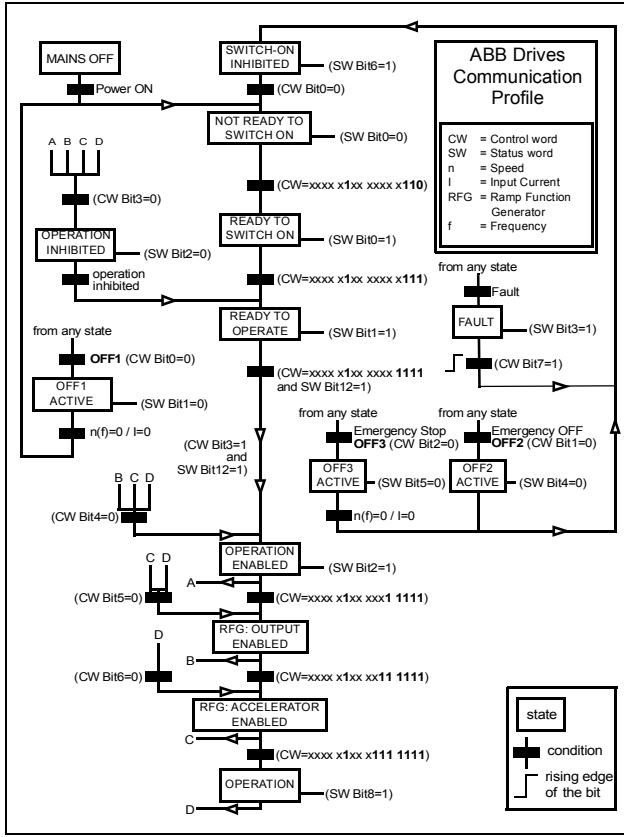
The following table presents the Status word of the ABB Drives communication profile. The upper case boldface text refers to the states shown in the ABB Drives profile state machine figure on page *105*.

Status word of ABB Drives profile			
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	–
7	ALARM	1	Warning/Alarm
		0	No warning/alarm
8	AT_ SETPOINT	1	**OPERATION**. Actual value equals reference = is within tolerance limits, that is, in speed control, speed error is 10% max. of the nominal motor speed.
		0	Actual value differs from reference, that is, it is outside tolerance limits.
9	REMOTE	1	Drive control location: REMOTE (EXT1 or EXT2)
		0	Drive control location: LOCAL

Status word of ABB Drives profile			
Bit	**Name**	**Value**	**STATE/Description**
10	ABOVE_ LIMIT	1	Actual frequency or speed equals or exceeds the supervision limit (set with the 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_E NABLE	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	Reserved		
15	FBA_ERROR	1	Communication error detected by the fieldbus adapter module.
		0	Fieldbus adapter communication OK

State machine

The following figure describes the state machine of the ABB Drives communication profile.



References

References are 16-bit signed two's complement integers. A negative reference indicates a reverse direction of rotation.

ABB drives can receive control information from multiple sources including analogue and digital inputs, the drive control panel and a communication module (for example, FCAN-01). To have the drive controlled through the fieldbus, the module must be defined as the source for control information, for example, reference.

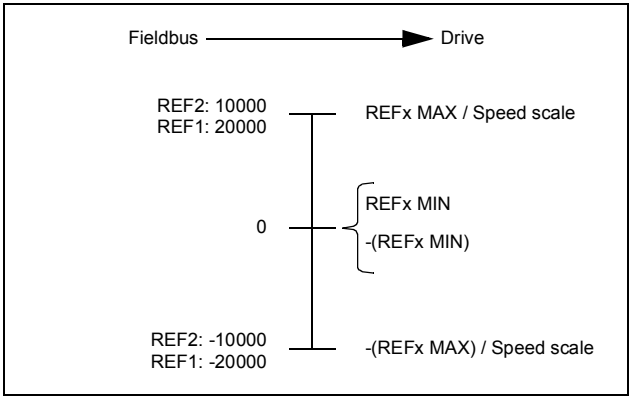
Scaling

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 and ACS880 the speed reference (REFx) in decimal (0…20000) corresponds to 0…100% of the speed scaling value (as defined with drive parameter, eg, ACS850 parameter ***19.01 Speed scaling***, ACS880 parameter ***46.01 Speed scaling***).

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



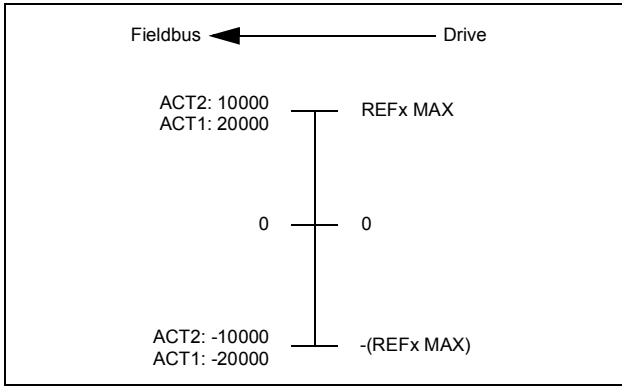
Actual values

Actual values are 16-bit signed two's complement integers containing information on the operation of the drive. A negative reference indicates a reverse direction of rotation. The functions to be monitored are selected with a drive parameter.

Scaling

The 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

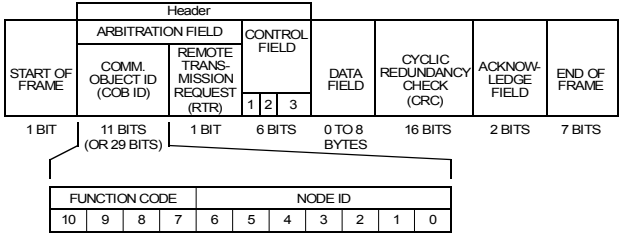
Communication protocol

What this chapter contains

This chapter describes the communication on a CANopen network.

CAN data frame

CAN employs data frames for transferring data between the host (controller) and the nodes on the bus. The following figure presents the structure of the data frame.



Communication object	Function code (binary)	COB ID (hex)	COB ID (dec)
NMT	0000	00	0
SYNC	0001	80	128
TIME STAMP	0010	100	256
EMERGENCY	0001	81…FF	129…255
PDO1 (Tx)	0011	181...1FF	385...511
PDO1 (Rx)	0100	201...27F	513...639
PDO6 (Tx)	0101	281...2FF	641...767
PDO6 (Rx)	0110	301...37F	769...895
PDO21 (Tx)	0111	381...3FF	897...1023
PDO21 (Rx)	1000	401...47F	1025...1151
SDO (Tx)	1011	581…5FF	1409…1535
SDO (Rx)	1100	601…67F	1537…1663
NODEGUARD	1110	701…77F	1793…1919

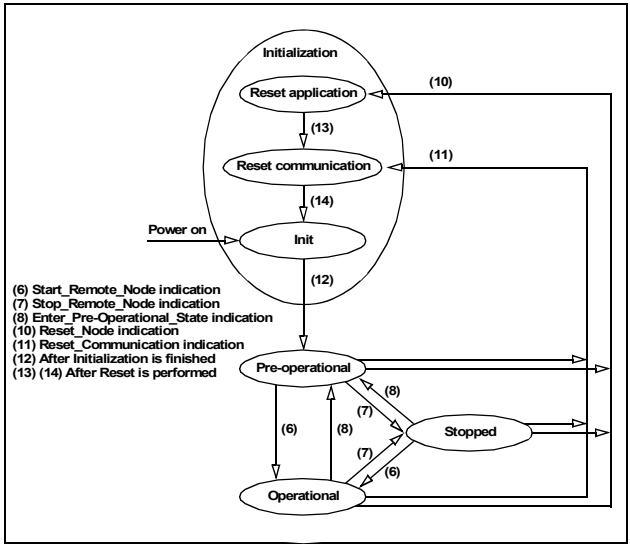
Control field contents:
1 = IDE bit = 29-bit Extended identifier / 11-bit standard identifier (1 bit)
2 = r0 = reserved (1 bit)
3 = DLC = Data Length Code (4 bits)

Inside the CANopen data frame, different types of Communication Objects are used to convey the data. Process Data Objects (PDO) are used for transmitting time critical process data (references, control commands, status information); Service Data Objects (SDO) are used for less time critical data, for example, parameters.

In addition, there are Special Function Objects and Network Management Objects.

FCAN-01 boot-up sequence and Network Management (NMT)

The adapter module supports the boot-up sequence of a “Minimum Capability Device”, as defined by the CANopen Communication Profile. The boot-up state diagram of the adapter module is shown below.



The NMT (Network Management) message is mapped to a single CAN frame with data length of 2 bytes. Its identifier is 0. The first byte contains the command specifier and the second byte contains the Node ID of the device, which must perform the command. The NMT message transmitted by the NMT master forces the nodes to transit to another NMT state. The CANopen state machine specifies the following states: Initialization, Pre-Operational, Operational and Stopped. After power-on, each CANopen device

is at first in the Initialization state and then the state transits automatically to the Pre-Operational state.

The NMT commands used for controlling the node are:

Command (dec)	Name
1	Start_Remote_Node
2	Stop_Remote_Node
128	Enter_Pre-Operational_State
129	Reset_Node
130	Reset_Communication

Header (bin)	Payload data byte	
	1	2
0000 0000000 0 0 0 0010	NMT Command	Node ID

Note: If Node ID is 0, all NMT slaves are addressed.

The node state indications are as follows:

Indication (dec)	State
0	Boot-up
4	Stopped
5	Operational
127	Pre-operational

Process Data Objects (PDO)

Process Data Object (PDO) is used for time critical process data exchange. PDO transmissions can be controlled by an internal timer, by remote requests or by the received Sync message. For each PDO the transmission mode of the PDO as well as the default mappings of the application objects are described in the Object Dictionary. The adapter module supports also configuration of the PDOs with drive parameters.

The adapter module supports a maximum of three PDOs in both directions. By default only Tx PDO1 and Rx PDO1 are enabled (valid) and Tx/Rx PDO6 and Tx/Rx PDO21 are disabled (not valid).

PDO mapping defines which application objects (parameters) are transmitted within a PDO. PDO mappings of the adapter module can be changed in the Pre-operational state (variable objects). Transmission of the enabled (valid) PDOs is possible only in the Operational state.

Each PDO can contain up to 8 bytes of process data. In ACS355, the first mapping entries of Tx/Rx PDO1 and Tx/Rx PDO6 are fixed and cannot be changed. The length of the PDOs and mapping entries of the PDOs are configurable.

The mapping entries of the PDOs can be configured through CANopen objects or from the drive with fieldbus configuration parameters. The configuration location is selected from the drive with parameter 04 CONF LOC of the fieldbus configuration group A (group 1) (parameter 51.04 in ACS355, ACSM1, ACS850 and ACS880).

When mapping through CANopen objects, the PDO length must be set to zero before the mapping entries can be changed.

Rx PDO1

		Mapped obj 1		Mapped obj 2		Mapped obj 3		Mapped obj 4	
Byte		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CANopen object for mapping		1600h01		1600h02		1600h03		1600h04	
Mapping parameter[2]	**ACS355**	Fixed[1]		FBA DATA OUT 1		FBA DATA OUT 2		FBA DATA OUT 3	
	ACSM1 ACS850 ACS880	FBA DATA OUT 1		FBA DATA OUT 2		FBA DATA OUT 3		FBA DATA OUT 4	

[1] In ACS355 drives, the first mapping entry is fixed and always mapped to object 6040h Control word. The other mapping entries are configurable. In ACSM1, ACS850 and ACS880 drives, all mapping entries are configurable.
[2] Configuration group B (group 2) (when parameter 04 CONF LOC = 1)

The mapping entries of the Rx PDO1 can be configured through CANopen object 1600h or from the drive with fieldbus configuration parameter group B (group 2).

The default COB ID for Rx PDO1 is 200h + Node ID, the default transmission type is 255 and the event time is 0. These values can be changed with CANopen object 1400h or from the drive with parameters 7, 8 and 9 of the fieldbus configuration group A (group 1).

Tx PDO1

		Mapped obj 1		Mapped obj 2		Mapped obj 3		Mapped obj 4	
Byte		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CANopen object for mapping		1A00h01		1A00h02		1A00h03		1A00h04	
Mapping parameter[2]	**ACS355**	Fixed[1]		FBA DATA IN 1		FBA DATA IN 2		FBA DATA IN 3	
	ACSM1 ACS850 ACS880	FBA DATA IN 1		FBA DATA IN 2		FBA DATA IN 3		FBA DATA IN 4	

[1] In ACS355 drives, the first mapping entry is fixed and always mapped to object 6041h Status word. The other mapping entries are configurable. In ACSM1, ACS850 and ACS880 drives, all mapping entries are configurable.
[2] Configuration group C (group 3) (when parameter 04 CONF LOC = 1)

Note: The mapping entries of the Tx PDO1 can be configured through CANopen object 1A00h or from the drive with fieldbus configuration parameter group C (group 3).

The default COB ID for Tx PDO1 is 180h + Node ID, the default transmission type is 255 and the event time is 0. These values can be changed with CANopen object 1600h or from the drive with parameters 10, 11 and 12 of the fieldbus configuration group A (group 1).

Rx PDO6

		Mapped obj 1		Mapped obj 2		Mapped obj 3		Mapped obj 4	
Byte		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CANopen object for mapping		1605h01		1605h02		1605h03		1605h04	
Mapping parameter[2]	**ACS355**	Fixed[1]		FBA DATA OUT 4		FBA DATA OUT 5		FBA DATA OUT 6	
	ACSM1 ACS850 ACS880	FBA DATA OUT 5		FBA DATA OUT 6		FBA DATA OUT 7		FBA DATA OUT 8	

[1] In ACS355 drives, the first mapping entry is fixed and always mapped to object 6040h Control word. The other mapping entries are configurable. In ACSM1, ACS850 and ACS880 drives, all mapping entries are configurable.
[2] Configuration group B (group 2) (when parameter 04 CONF LOC = 1)

Note: The mapping entries of the Rx PDO6 can be configured through CANopen object 1605h or from the drive with fieldbus configuration parameter group B (group 2).

The default COB ID for Rx PDO6 is 80000300h + Node ID (Rx PDO6 disabled), the default transmission type is 255 and the event time is 0. These values can be changed with CANopen object 1405h or from the drive with parameters 13, 14 and 15 of the fieldbus configuration group A (group 1).

Tx PDO6

		Mapped obj 1		Mapped obj 2		Mapped obj 3		Mapped obj 4	
Byte		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CANopen object for mapping		1A05h01		1A05h02		1A05h03		1A05h04	
Mapping parameter[2]	**ACS355**	Fixed[1]		FBA DATA IN 4		FBA DATA IN 5		FBA DATA IN 6	
	ACSM1 ACS850 ACS880	FBA DATA IN 5		FBA DATA IN 6		FBA DATA IN 7		FBA DATA IN 8	

[1] In ACS355 drives, the first mapping entry is fixed and it is always mapped to object 6041h Status word. The other mapping entries are configurable. In ACSM1, ACS850 and ACS880 drives, all mapping entries are configurable.

[2] Configuration group C (group 3) (when parameter 04 CONF LOC = 1)

Note: The mapping entries of the Tx PDO6 can be configured through CANopen object 1A05h or from the drive with fieldbus configuration parameter group C (group 3).

The default COB ID for Tx PDO6 is 80000280h + Node ID (Tx PDO6 disabled), the default transmission type is 255 and the event time is 0. These values can be changed with CANopen object 1605h or from the drive with parameters 16, 17 and 18 of the fieldbus configuration group A (group 1).

Rx PDO21

		Mapped obj		Mapped obj 2		Mapped obj 3		Mapped obj 4	
Byte		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CANopen object for mapping		1614h01		1614h02		1614h03		1614h04	
Mapping parameter[1)]	**ACS355**	FBA DATA OUT 7		FBA DATA OUT 8		FBA DATA OUT 9		FBA DATA OUT 10	
	ACSM1 ACS850 ACS880	FBA DATA OUT 9		FBA DATA OUT 10		FBA DATA OUT 11		FBA DATA OUT 12	

1) Configuration group B (group 2) (when parameter 04 CONF LOC = 1)

Note: The mapping entries of the Rx PDO21 can be configured through CANopen object 1614h or from the drive with fieldbus configuration parameter group B (group 2).

The default COB ID for Rx PDO21 is 80000400h + Node ID (Rx PDO21 disabled), the default transmission type is 255 and the event time is 0. These values can be changed with CANopen object 1414h or from the drive with parameters 19, 20 and 21 of the fieldbus configuration group A (group 1).

Tx PDO21

		Mapped obj 1		Mapped obj 2		Mapped obj 3		Mapped obj 4	
Byte		**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
CANopen object for mapping		1A14h01		1A14h02		1A14h03		1A14h04	
Mapping parameter[1)]	**ACS355**	FBA DATA IN 7		FBA DATA IN 8		FBA DATA IN 9		FBA DATA IN 10	
	ACSM1 ACS850 ACS880	FBA DATA IN 9		FBA DATA IN 10		FBA DATA IN 11		FBA DATA IN 12	

[1)] Configuration group C (group 3) (when parameter 04 CONF LOC = 1)

Note: The mapping entries of the Tx PDO21 can be configured through CANopen object 1A14h or from the drive with fieldbus configuration parameter group C (group 3).

The default COB ID for Tx PDO21 is 80000380h + Node ID (Tx PDO21 disabled), the default transmission type is 255 and the event time is 0. These values can be changed with CANopen object 1614h or from the drive with parameters 22, 23 and 24 of the fieldbus configuration group A (group 1).

Mapping format

Note: Subindex 0 contains the number of valid entries within the mapping record. This number is also the number of the application variables (parameters), which shall be transmitted/received with the corresponding PDO. The subindexes from 1 to the number of objects contain information about the mapped application variables.

The mapping values in the CANopen object are hexadecimal coded. The following table presents an example of the PDO mapping entry structure:

Type	MSB					LSB
UINT32	31	16	15	8	7	0
Description	Index eg, 6048h (16 bits)		Subindex eg, 02h (8 bits)		Object length in bits eg, 10h (= 16 bits) (8 bits)	

If the PDO mappings are configured with fieldbus configuration parameter group B (group 2) and group C (group 3), only objects belonging to the virtual address area of the drive control and to the drive parameter area can be mapped, that is, objects 6040h, 6042h, 6041h, 6044h, 6064h, 60FFh, 606Ch, 607Ah, 6077h, 6071h, 2001h, 2002h, 2003h, 2004h, 2005h, 2006h, 2000h03, 2000h06 and objects 4000h…4063h. The mapping values are in decimal format and only virtual addresses of the drive control (1...6 and 11...16) or drive parameter numbers (101...9999) can be set. The adapter module converts the values to CANopen objects. The length of the object is detected automatically.

Note: The PDO mappings should be started from subindex 1. If a PDO mapping entry is zero, the mapping for that subindex and from that subindex onwards is neglected. That is, if there are zeros in the PDO mapping, only objects from subindex 1 to the first zero are taken into account.

PDO configuration via the CAN bus

This section gives an example of how to configure PDOs via the CAN bus from the CANopen master. In this example, the following PDO configuration is made:

- Rx PDO1 (from master to drive): 6040h Control word and 6042h vl target velocity
- Tx PDO1 (from drive to master): 6041h Status word, 6044h vl control effort and drive parameter 01.20
- Tx PDO1 sent to the master at 100 ms intervals

Set the drive parameters as listed in the table below.

Drive parameter[1)]	**Setting**	**Description**
51.02 NODE ID	3	In this example, module node ID = 3
51.03 BIT RATE	0…5	Bit rate used on the CANopen network. See *Drive configuration*.
51.04 CONF LOC	0	PDO configuration via CAN bus
51.05 PROFILE	0	CiA 402

[1)] The actual parameter group number depends on the drive type. For example, the fieldbus configuration parameter group A (group 1) equals to parameter group 51 in drives ACS355, ACSM1, ACS850 and ACS880 if the adapter is installed as fieldbus adapter A.

Write the CANopen objects via the CAN bus as shown in the following table. The adapter module must be in the Pre-operational state.

Object index	Sub-index	Name	Write value (hex)	Description
1400	01	Rx PDO1 Parameter, COB-ID	80000203	Disable Rx PDO1[1)].
1400	02	Rx PDO1 Parameter, Transmission type	FF	Transmission type 255
1600	00	Rx PDO1 Mapping, Number of entries	0	Required before mapping[2)]
1600	01	Rx PDO1 Mapping, Mapped object 1	60400010	6040h Control word (subindex 0, length 16 bits)
1600	02	Rx PDO1 Mapping, Mapped object 2	60420010	6042h vl target velocity (subindex 0, length 16 bits)
1600	00	Rx PDO1 Mapping, Number of entries	2	2 objects mapped[2)]
1400	01	Rx PDO1 Parameter, COB-ID	203	Enable Rx PDO1, use COB-ID 203h.
1800	01	Tx PDO1 Parameter, COB-ID	80000183	Disable Tx PDO1[1)].
1800	02	Tx PDO1 Parameter, Transmission type	FF	Transmission type 255
1800	05	Tx PDO1 Parameter, Event timer	64	100 ms
1A00	00	Tx PDO1 Mapping, Number of entries	0	Required before mapping[2)]
1A00	01	Tx PDO1 Mapping, Mapped object 1	60410010	6041h Status word (subindex 0, length 16 bits)

Object index	Sub-index	Name	Write value (hex)	Description
1A00	02	Tx PDO1 Mapping, Mapped object 2	60440010	6044h vl control effort (subindex 0, length 16 bits)
1A00	03	Tx PDO1 Mapping, Mapped object 3	40011410	Parameter 01.20 (length 16 bits)
1A00	00	Tx PDO1 Mapping, Number of entries	3	3 objects mapped[2)]
1800	01	Tx PDO1 Parameter, COB-ID	183	Enable Tx PDO1, use COB-ID 183h.

[1)] Before modifying PDO parameters or mapping, the PDO must be disabled by setting bit 31 of its COB-ID to 1. Remember to enable the PDO again after the mapping has been set.

[2)] Before changing the contents of a PDO mapping object, the "number of entries" field must be set to zero. After the mapping is done, the number of the entries must be set according to the actual number of the mapped entries.

Service Data Objects (SDO)

Service Data Objects are mainly used for transferring non-time critical data, for example, parameter values. SDOs provide access to the entries in the device Object Dictionary.

If 4 bytes (or less) of data is to be transmitted, an Expedited transfer SDO message can be used. Larger quantities of data can be segmented, that is, split between several CAN messages.

The following services can be applied to SDO depending on the service requirements:

- **SDO Upload**, which can be divided into
  - Initiate SDO Upload
  - Upload SDO Segment.
- **SDO Download**, which can be divided into
  - Initiate SDO Download
  - Download SDO Segment.
- **Abort SDO Transfer**

With expedited transfer all data is transferred during the initialization phase (Initiate SDO Upload/Download). With segmented transfer only part of the data is transferred during the initialization phase and the rest of the data is transferred during the Upload/Download SDO Segment phase.

The COB IDs for the SDO communication are:

- Client to Server (Master to Slave): 600h + Node ID
- Server to Client (Slave to Master): 580h + Node ID.

SDO Download

Through this service the client of an SDO downloads data to the server (owner of the Object Dictionary).

The data, the multiplexor (index and subindex) of the data set that is downloaded and the data size are indicated to the server. The service is confirmed. The remote result parameter will indicate the success or failure of the request. In case of a failure, an Abort SDO Transfer request has to be executed.

SDO Upload

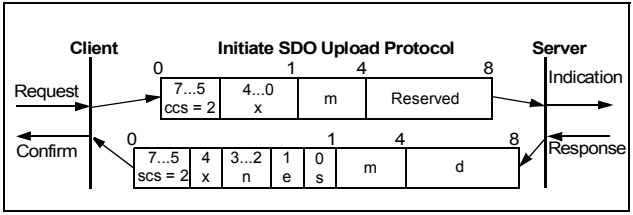
Through this service the client of an SDO requests the server to prepare to upload data to the client.

The multiplexor (index and subindex) of the data set to be uploaded is indicated to the server. The service is confirmed. The remote result parameter will indicate the success of the request. In case of a failure, an Abort SDO Transfer request has to be executed. In case of success, the size of the data to be uploaded is confirmed. In case of successful expedited upload, this service concludes the upload of the data set (identified by the multiplexor) and confirms the corresponding data.

Read Service (SDO Upload)

Initiate SDO Upload Protocol

This protocol is used to implement the Initiate SDO Upload service.

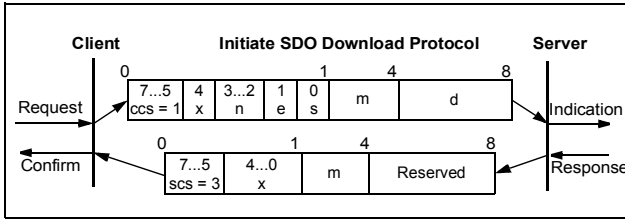


ccs	Client command specifier; ccs = 2: Initiates the upload request.
scs	Server command specifier; scs = 2: Initiates the upload response.
n	Number of data bytes (in d) which do not contain data. Bytes [8-n, 7] do not contain segment data. Valid only if e = 1 and s = 1 (otherwise n = 0).
e	Transfer type; e = 0: Normal transfer. e = 1: Expedited transfer.
s	Size indicator; s = 0: No data set size indication. s = 1: Data set size indication.
m	Multiplexor; represents the index/subindex of the data to be transferred by the SDO.
d	Data; e = 0, s = 0: Reserved for further use. e = 0, s = 1: Contains the number of bytes to be uploaded. Byte 4 contains the LSB and byte 7 contains the MSB. e = 1, s = 1: Contains the data of length 4-n to be uploaded. Encoding depends on the type of the data referenced by index and subindex. e = 1, s = 0: Contains unspecified number of bytes to be uploaded.
x	Not used. Value is always 0.
Reserved	Reserved for further use. Value is always 0.

Write Service (SDO Download)

Initiate SDO Download Protocol

This protocol is used to implement the Initiate SDO Download service.

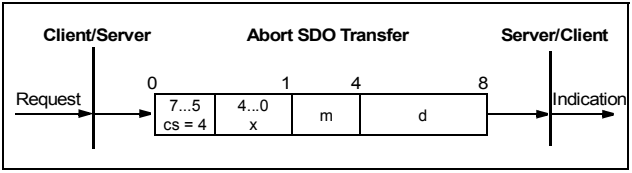


ccs	Client command specifier; ccs = 1: Initiates the download request.
scs	Server command specifier; scs = 3: Initiates the download response.
n	Number of data bytes (in d) which do not contain data. Bytes [8-n, 7] do not contain segment data. Valid only if e = 1 and s = 1 (otherwise n = 0).
e	Transfer type; e = 0: Normal transfer. e = 1: Expedited transfer.
s	Size indicator; s = 0: No data set size indication. s = 1: Data set size indication.
m	Multiplexor; represents the index/subindex of the data to be transferred by the SDO.
d	Data; e = 0, s = 0: Reserved for further use. e = 0, s = 1: Contains the number of bytes to be downloaded. Byte 4 contains the LSB and byte 7 contains the MSB. e = 1, s = 1: Contains the data of length 4-n to be downloaded. Encoding depends on the type of the data referenced by index and subindex. e = 1, s = 0: Contains unspecified number of bytes to be downloaded.
x	Not used. Value is always 0.
Reserved	Reserved for further use. Value is always 0.

Abort SDO Transfer

Abort SDO Transfer Protocol

This protocol is used to implement the Abort SDO Transfer Service.



cs	Command specifier; cs = 4: Aborts the transfer request.
x	Not used. Value is always 0.
m	Multiplexor; represents the index and subindex of the SDO.
d	Contains a 4-byte abort code which includes the reason for the abort.

Abort code description

Error class	Error code	Additional code	Description
05	03	0000h	Toggle bit not alternated
	04	0000h	SDO protocol time-out
		0001h	Client/Server command specifier not valid or unknown
		0002h	Invalid block size (block mode only)
		0003h	Invalid sequence number (block mode only)
		0004h	CRC error (block mode only)
		0005h	Out of memory
06	01	0000h	Unsupported access to an object
		0001h	Attempt to read a write-only object.
		0002h	Attempt to write a read-only object.
	02	0000h	Object does not exist in the Object Dictionary.
	04	0041h	Object cannot be mapped to the PDO.
		0042h	Number and length of the objects to be mapped would exceed the PDO length.
		0043h	General parameter incompatibility
		0047h	General internal incompatibility in the device
	06	0000h	Access failed because of hardware error
	07	0010h	Data type does not match. The length of the service parameter does not match.
		0012h	Data type does not match. The length of the service parameter is too long.
		0013h	Data type does not match. The length of the service parameter is too short.

Error class	Error code	Additional code	Description
	09	0011h	Subindex does not exist.
		0030h	Parameter value range is exceeded (for write access parameters).
		0031h	Value of the written parameter is too high.
		0032h	Value of the written parameter is too low.
		0036h	Maximum value is less than the minimum value.
08	00	0000h	General error
		0020h	Data cannot be transferred or stored to the application.
		0021h	Data cannot be transferred or stored to the application because of local control.
		0022h	Data cannot be transferred or stored to the application because of the active device state.
		0023h	Object Dictionary dynamic generation fails or no Object Dictionary is present (for example the object dictionary is generated from a file and the generation fails because of a file error).

The abort codes not listed here are reserved.

CANopen Object Dictionary

Each object within the dictionary is addressed using a 16-bit index.

Object Dictionary Structure

The overall layout of the standardized Object Dictionary:

Index (hex)	Object
0000	Not used
0001...001F	Static Data Types
0020...003F	Complex Data Types
0040...005F	Manufacturer-Specific Complex Data Types
0060...007F	Device-Profile-Specific Static Data Types
0080...009F	Device-Profile-Specific Complex Data Types
00A0...0FFF	Reserved for further use
1000...1FFF	Communication Profile Area
2000...5FFF	Manufacturer-Specific Profile Area See *Manufacturer-specific profile area (2000...5FFF)* on page *143*.
6000...9FFF	Standardized Device Profile Area
A000...BFFF	Standardized Interface Profile area
C000...FFFF	Reserved for further use

The serial communication properties of the drive, as well as drive parameters, are detailed further in the appropriate drive firmware manual.

Communication profile area (1000...1FFF)

<table>
<tr><th>Index (hex)</th><th>Sub-index</th><th>Name</th><th>Type</th><th>Attri-bute</th><th>Information</th></tr>
<tr><td>1000</td><td>0</td><td>Device Type</td><td>U32</td><td>RO</td><td>Describes the type of the device.</td></tr>
<tr><td>1001</td><td>0</td><td>Error Register</td><td>U8</td><td>RO</td><td>Bit value 1 = error occurred
<table>
<tr><th>Bit</th><th>Description</th></tr>
<tr><td>0</td><td>Generic error</td></tr>
<tr><td>1</td><td>Current</td></tr>
<tr><td>2</td><td>Voltage</td></tr>
<tr><td>3</td><td>Temperature</td></tr>
<tr><td>4</td><td>Communication error</td></tr>
<tr><td>5</td><td>Device-profile-specific</td></tr>
<tr><td>6</td><td>Reserved</td></tr>
<tr><td>7</td><td>Manufacturer-specific</td></tr>
</table></td></tr>
</table>

<table>
<tr><th>Index (hex)</th><th>Sub-index</th><th>Name</th><th>Type</th><th>Attri-bute</th><th>Information</th></tr>
<tr><td rowspan="4">1003</td><td>0</td><td>Pre-defined Error Field</td><td>U8</td><td>RW</td><td>Number of errors occurred. Errors are listed in subindexes 1 to 5. The list is deleted by writing a zero.</td></tr>
<tr><td>1</td><td>Pre-defined Error Field</td><td>U32</td><td>RO</td><td rowspan="3">List of errors. The most recent error is at subindex 1. When a new error occurs, the previous errors move down the list. Error numbers comprise a 16-bit error code (see the appropriate drive firmware manual and Appendix B – CANopen error codes) and a 16-bit additional information field (0 with FCAN-01). The error code is contained in the lower 2 bytes (LSB), the additional information in the upper 2 bytes (MSB).

Slave to master
<table><tr><th rowspan="2">Header</th><th colspan="2">Byte</th></tr><tr><td>1…2</td><td>3</td></tr><tr><td>0001xxxxxx01000</td><td>Error code</td><td>Error register</td></tr><tr><td></td><td>4...7</td><td>8</td></tr><tr><td></td><td>Addi-tional error info</td><td>Unused</td></tr></table></td></tr>
<tr><td>…</td><td>…</td><td>…</td><td>…</td></tr>
<tr><td>5</td><td>Pre-defined Error Field</td><td>U32</td><td>RO</td></tr>
<tr><td>1005</td><td>0</td><td>COB ID Sync Message</td><td>U32</td><td>RW</td><td>Identifier of the SYNC message. The SYNC message controls the actions of PDOs that have the Synchronous transmission type.</td></tr>
</table>

Index (hex)	Sub-index	Name	Type	Attri-bute	Information
1008	0	Manufac-turer Device Name	Visible string	RO	Device name. The constant string is FCAN-01 with <drive type>.
1009	0	Manufac-turer Hard-ware Version	Visible string	RO	Adapter module hardware version, eg, V.1.00
100A	0	Manufac-turer Software Version	Visible string	RO	Adapter module firmware version, eg, V.1.02B
100C	0	Guard Time	U16	RW	Guard Time (ms) × Life Time Factor = Life time for the Node Guarding Protocol
100D	0	Life Time Factor	U8	RW	

Index (hex)	Sub-index	Name	Type	Attri-bute	Information
1010	0	Store Parame-ters	U32	RO	Largest supported subindex. Subindex 1...n bit 0 value 1 indicates that the device can save the parameters in question. Parameters can be saved by writing 65766173h ("evas") to the appropriate subindex.
	1		U32	RW	Saves all parameters.
	2		U32	RW	Saves communication parameters (1000h...1FFFh).
	3		U32	RW	Saves application parameters (6000h...9FFFh). **Note:** Some of the application parameters are associated with drive parameters. After application parameters have been saved, FCAN-01 overwrites these drive parameters when it is powerd up or fieldbus parameter are refreshed. This can be reversed by setting the application parameters to default values with object 0x1011.
	4		U32	RW	Requests the drive to perform the parameter save function. Refer to the drive manual for more information.

Index (hex)	Sub-index	Name	Type	Attribute	Information
1011	0	Restore Default Parameters	U32	RO	Largest supported subindex. Default values can be restored by writing 64616F6Ch ("daol") to the appropriate subindex.
	1		U32	RW	Restores default values to all parameters.[1)]
	2		U32	RW	Restores default values to communication parameters (1000h...1FFFh).
	3		U32	RW	Restores default values to application parameters (6000h...9FFFh).
	4		U32	RW	Requests the drive to perform the parameter save function. Refer to the drive manual for more information.[1)]
1014	0	COB-ID Emergency Message	U32	RW	Defines the COB ID of the Emergency Object (EMCY). Default: 80h + Node ID
1016	0	Consumer heartbeat time	U8	RO	Number of entries
	1		U32	RW	• Bits 0...15 - (UNSIGNED 16) Heartbeat receive timeout (ms) • Bits 16...23 - (UNSIGNED 8) Node-ID • Bits 24...31 - Reserved (must be 00h)
1017	0	Producer Heartbeat Time	U16	RW	Defines the cycle time of the heartbeat (ms). 0 = Not used

Index (hex)	Sub-index	Name	Type	Attri-bute	Information
1018	0	Identity Object	U8	RO	Number of entries
	1	Vendor ID	U32	RO	Vendor ID; Value: B7h = ABB
	2	Product code	U32	RO	Drive dependent, eg, 21C00h = ACS850
	3	Module revision	U32	RO	Adapter module firmware version, eg, 102Bh
	4	Serial number	U32	RO	Serial number of the adapter module
1400	0	Receive PDO1 Parame-ter	U8	RO	Number of entries
	1	COB ID	U32	RW	Default: 200h + Node ID
	2	Trans-mission Type	U8	RW	Default: 255 = FFh (asynchronous transmission)[2)]
	3	Inhibit time	U16	RW	Not used for Rx PDO
	5	Event timer	U16	RW	0...65535 ms 0 = not used Default: 0
1600	0	Receive PDO1 Mapping	U8	RW	Number of mapped objects, 0...4[3)]
	1	Mapped Obj 1	U32	RW	Default: 60400010h = 6040h Control word[3)]. See *Mapping format*.
	2	Mapped Obj 2	U32	RW	
	3	Mapped Obj 3	U32	RW	
	4	Mapped Obj 4	U32	RW	

Index (hex)	Sub-index	Name	Type	Attri-bute	Information
1405	0	Receive PDO6 Parame-ter	U8	RO	Number of entries
	1	COB ID	U32	RW	Default: 80000300h + Node ID (= PDO not valid)[2)]
	2	Trans-mission Type	U8	RW	Default: 255 asynchronous[2)]
	3	Inhibit time	U16	RW	Not used for Rx PDO
	5	Event timer	U16	RW	0...65535 ms 0 = not used Default: 0
1605	0	Receive PDO6 Mapping	U8	RW	Number of mapped objects, 0...4[3)]
	1	Mapped Obj 1	U32	RW	Default: 60400010h = 6040h Control word[3)]. See *Mapping format*.
	2	Mapped Obj 2	U32	RW	
	3	Mapped Obj 3	U32	RW	
	4	Mapped Obj 4	U32	RW	

Index (hex)	Sub-index	Name	Type	Attri-bute	Information
1414	0	Receive PDO21 Parame-ter	U8	RO	Number of entries
	1	COB ID	U32	RW	Default: 80000400h + Node ID (= PDO not valid)[2)]
	2	Trans-mission Type	U8	RW	Default: 255[2)]
	3	Inhibit time	U16	RW	Not used for Rx PDO
	5	Event timer	U16	RW	0...65535 ms 0 = not used Default: 0
1614	0	Receive PDO21 Mapping	U8	RW	Number of mapped objects, 0...4
	1	Mapped Obj 1	U32	RW	See *Mapping format*.
	2	Mapped Obj 2	U32	RW	
	3	Mapped Obj 3	U32	RW	
	4	Mapped Obj 4	U32	RW	

Index (hex)	Sub-index	Name	Type	Attribute	Information
1800	0	Transmit PDO1 Parameter	U8	RO	Number of entries
	1	COB ID	U32	RW	Default: 180h + Node ID
	2	Transmission Type	U8	RW	Default: 255 (asynchronous transmission)[2)]
	3	Inhibit Time	U16	RW	Minimum interval for PDO transmission (= value x 100 microseconds)
	5	Event Timer	U16	RW	0...65535 ms 0 = Not used Default: 0
1A00	0	Transmit PDO1 Mapping	U8	RW	Number of mapped objects, 0...4[3)]
	1	Mapped Obj 1	U32	RW	Default: 60410010h = 6041h Status word[3)]. See *Mapping format*.
	2	Mapped Obj 2	U32	RW	
	3	Mapped Obj 3	U32	RW	
	4	Mapped Obj 4	U32	RW	

Index (hex)	Sub-index	Name	Type	Attribute	Information
1805	0	Transmit PDO6 Parameter	U8	RO	Number of entries
	1	COB ID	U32	RW	Default: 80000280h + Node ID (= PDO not valid)[2)]
	2	Transmission Type	U8	RW	Default: 255 (asynchronous transmission)[2)]
	3	Inhibit Time	U16	RW	Minimum interval for PDO transmission (= value x 100 microseconds)
	5	Event Timer	U16	RW	0...65535 ms 0 = Not used Default: 0
1A05	0	Transmit PDO6 Mapping	U8	RW	Number of mapped objects, 0...4[3)]
	1	Mapped Obj 1	U32	RW	Default: 60410010h = 6041h Status word[3)]. See *Mapping format*.
	2	Mapped Obj 2	U32	RW	
	3	Mapped Obj 3	U32	RW	
	4	Mapped Obj 4	U32	RW	

Index (hex)	Sub-index	Name	Type	Attribute	Information
1814	0	Transmit PDO21 Parameter	U8	RO	Number of entries
	1	COB ID	U32	RW	Default: 80000380h + Node ID (= not valid)[1]
	2	Transmission Type	U8	RW	[2]
	3	Inhibit Time	U16	RW	Minimum interval for PDO transmission (= value x 100 microseconds)
	5	Event Timer	U16	RW	0...65535 ms 0 = Not used Default: 0
1A14	0	Transmit PDO21 Mapping	U8	RW	Number of mapped objects, 0...4
	1	Mapped Obj 1	U32	RW	See *Mapping format*.
	2	Mapped Obj 2	U32	RW	
	3	Mapped Obj 3	U32	RW	
	4	Mapped Obj 4	U32	RW	

[1] **WARNING:** Drive default values are set immediately after the restore command, without discrete reset command or power cycle. The adapter module may lose the connection to the drive.
[2] See *Appendix A – Dictionary structure and entries*.
[3] With ACS355 drives subindex 1 is fixed.
Uxx = unsigned xx

Manufacturer-specific profile area (2000...5FFF)

Manufacturer-specific profile objects

Index (hex)	Sub-index	Name	Type	Attri-bute	Information
2000	0	Virtual Address of the drive control	U8	RO	Number of entries
	3	REF2	INT16	RW	Reference value 2
	6	ACT2	INT16	RO	Actual value 2
2001	0	Transparent 32 Control word	U32	RW	32-bit Transparent Control word
2002	0	Transparent 32 Refer-ence 1	INT32	RW	32-bit Transparent reference value 1
2003	0	Transparent 32 Refer-ence 2	INT32	RW	32-bit Transparent reference value 2
2004	0	Transparent 32 Status word	U32	RO	32-bit Transparent Status word
2005	0	Transparent 32 Actual 1	INT32	RO	32-bit Transparent actual value 1
2006	0	Transparent 32 Actual 2	INT32	RO	32-bit Transparent actual value 2

Index (hex)	Sub-index	Name	Type	Attri-bute	Information
2100	0	Number of entries	U8	RO	
	1	Alarm code 1 (latest)	U16	RO	
	2	Alarm code 2	U16	RO	
	3	Alarm code 3	U16	RO	
	4	Alarm code 4	U16	RO	
	5	Alarm code 5 (oldest)	U16	RO	

Uxx = unsigned xx
INTxx = signed xx

Drive actual signals and parameters

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. CANopen object index equals the drive parameter group in hexadecimal format + 4000h and subindex is the parameter index. For example, the index for drive parameter 30.19 equals 1Eh + 4000h = 401Eh and subindex = 19 (dec) = 13h. See the following table.

Index (hex)	Sub-index	Name	Type	Attribute	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)	2)	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.

Standardized device profile area (6000...9FFF)

Index (hex)	Sub	Access	Type	Name	Information	Support
603F		RO	U16	Error code	See *Appendix B – CANopen error codes*.	all
6040		RW	U16	Control word	See *Communication protocol*.	all
6041		RO	U16	Status word		all
6042		RW	INT16	Target velocity		vl
6043		RO	INT16	Vl velocity demand	Instantaneous velocity provided by the ramp function. Scaled to the unit of the vl target velocity.	vl
6044		RO	INT16	Vl control effort	Actual velocity	vl
6046				Vl velocity min max amount	Vl velocity min max amount	vl
	0	RO	U8	Number of entries		vl
	1	RW	U32	Vl velocity min amount	Mapped internally to vl velocity min pos and vl velocity max neg values	vl
	2	RW	U32	Vl velocity max amount	Mapped internally to vl velocity max pos and vl velocity max neg values	vl
6048				Vl velocity accelera-tion	Slope of the acceleration ramp = delta speed / delta time. If delta time = 0, the function follows the set point (=target velocity) value.	vl
	0	RO	U8	Number of entries		vl
	1	RW	U32	Delta speed	[rpm]	vl
	2	RW	U16	Delta time	0...65535 [sec]	vl

<table>
<tr><th>Index (hex)</th><th>Sub</th><th>Access</th><th>Type</th><th>Name</th><th>Information</th><th>Sup-port</th></tr>
<tr><td rowspan="4">6049</td><td></td><td></td><td></td><td>Vl velocity decelera-tion</td><td>Slope of the deceleration ramp = delta speed / delta time. If delta time = 0, the function follows the set point (=target velocity) value.</td><td>vl</td></tr>
<tr><td>0</td><td>RO</td><td>U8</td><td>Number of entries</td><td></td><td>vl</td></tr>
<tr><td>1</td><td>RW</td><td>U32</td><td>Delta speed</td><td>[rpm]</td><td>vl</td></tr>
<tr><td>2</td><td>RW</td><td>U16</td><td>Delta time</td><td>0...65535 [sec]</td><td>vl</td></tr>
<tr><td>605D</td><td></td><td>RW</td><td>INT16</td><td>Halt option code</td><td>Sets the action to be performed when the halt function is executed.
Default: +1.
<table><tr><th>Value</th><th>Operation</th></tr><tr><td>0</td><td>Reserved</td></tr><tr><td>+1</td><td>Slows down on a slow down ramp and stays in OPERATION ENABLED</td></tr><tr><td>+2</td><td>Slows down on a quick stop ramp and stays in OPERATION ENABLED (vl mode only)</td></tr><tr><td>+3</td><td>Slows down on a current limit and stays in OPERATION ENABLED (vl mode only)</td></tr><tr><td>+4</td><td>Slows down on a voltage limit and stays in OPERATION ENABLED (vl mode only)</td></tr></table></td><td>all</td></tr>
</table>

<table>
<tr><th>Index (hex)</th><th>Sub</th><th>Access</th><th>Type</th><th>Name</th><th>Information</th><th>Sup-port</th></tr>
<tr><td>6060</td><td></td><td>RW</td><td>INT8</td><td>Modes of operation</td><td>Operation mode request
<table><tr><th>Bit</th><th>Mode</th></tr><tr><td>-128…-1</td><td>Manufacturer-specific</td></tr><tr><td>0</td><td>Reserved</td></tr><tr><td>1</td><td>Profile position mode</td></tr><tr><td>2</td><td>Velocity mode</td></tr><tr><td>3</td><td>Profile velocity mode</td></tr><tr><td>4</td><td>Profile torque mode</td></tr><tr><td>5</td><td>Reserved</td></tr><tr><td>6</td><td>Homing mode</td></tr></table>Note: If the value of parameter 50.04 FBA REF1 MODESEL and 50.05 FBA REF2 MODESEL of ACSM1 is (5) AUTO, it is possible to set the mode of operation with object 6060h. Otherwise the mode of operation cannot be changed with this object. See section Modes of operation on page 90.</td><td>all</td></tr>
<tr><td>6061</td><td></td><td>RO</td><td>INT8</td><td>Modes of operation display</td><td>Current operation mode
See index 6060h.</td><td>all</td></tr>
<tr><td>6064</td><td></td><td>RO</td><td>INT32</td><td>Position actual value</td><td>See chapter Communication profiles on page 87.</td><td>pp</td></tr>
<tr><td>6069</td><td></td><td>RO</td><td>INT32</td><td>Velocity sensor actual value</td><td>Value read from a velocity encoder</td><td>pv</td></tr>
<tr><td>606B</td><td></td><td>RO</td><td>INT32</td><td>Velocity demand value</td><td>Demand value from the velocity controller</td><td>pv</td></tr>
<tr><td>606C</td><td></td><td>RO</td><td>INT32</td><td>Velocity actual value</td><td>See chapter Communication profiles on page 87.</td><td>pv</td></tr>
<tr><td>6071</td><td></td><td>RW</td><td>INT16</td><td>Target torque</td><td></td><td>tq</td></tr>
<tr><td>6072</td><td></td><td>RW</td><td>UINT16</td><td>Max torque</td><td>Unit 0.1%</td><td>all</td></tr>
</table>

Index (hex)	Sub	Access	Type	Name	Information	Support
6073		RW	UINT16	Max current	Unit 0.1% $\text{Value} = \frac{\text{Current}}{\text{Nominal current}} \cdot 1000$ Supported with ACS850 and ACQ810.	all
6077		RW	INT16	Torque actual value	See chapter *Communication profiles* on page *87*.	tq
607A		RW	INT32	Target position		pp
6081		RW	INT32	Profile velocity	Velocity attained at the end of the acceleration ramp during a profiled move	pp, tq
6083		RW	U32	Profile acceleration	Acceleration during a profiled move	pp, tq
6084		RW	U32	Profile deceleration	Deceleration during a profiled move	pp, tq
6098		RW	INT8	Homing method	0 = No homing method selected 1...35 = Methods 1...35 See the firmware manual of the drive for description of the available homing methods.	hm
6099				Homing speeds		hm
	0	RO	U8	Number of entries		hm
	1	RO	U32	Speed during search for switch		hm
	2	RO	U32	Speed during search for zero		hm
60FF		RW	INT32	Target velocity	See chapter *Communication profiles* on page *87*.	pv

<table>
<tr><th>Index (hex)</th><th>Sub</th><th>Access</th><th>Type</th><th>Name</th><th>Information</th><th>Sup-port</th></tr>
<tr><td>6402</td><td></td><td>RW</td><td>U16</td><td>Motor type</td><td><table><tr><th>Value (hex)</th><th>Type</th></tr><tr><td>0000</td><td>Non-standard motor</td></tr><tr><td>0001</td><td>Phase-modulated DC motor</td></tr><tr><td>0002</td><td>Frequency-controlled DC motor</td></tr><tr><td>0003</td><td>PM synchronous motor</td></tr><tr><td>0004</td><td>FC synchronous motor</td></tr><tr><td>0005</td><td>Switched reluctance motor</td></tr><tr><td>0006</td><td>Wound rotor induction motor</td></tr><tr><td>0007</td><td>Squirrel cage induction motor</td></tr><tr><td>0008</td><td>Stepper motor</td></tr><tr><td>0009</td><td>Micro-step stepper motor</td></tr><tr><td>000A</td><td>Sinusoidal PM BL motor</td></tr><tr><td>000B</td><td>Trapezoidal PM BL motor</td></tr><tr><td>000C</td><td>Reserved</td></tr><tr><td></td><td></td></tr><tr><td>7FFF</td><td>Reserved</td></tr><tr><td>8000</td><td>Manufacturer-specific</td></tr><tr><td></td><td></td></tr><tr><td>FFFF</td><td>Manufacturer-specific</td></tr></table></td><td>all</td></tr>
<tr><td>6502</td><td></td><td>RO</td><td>U32</td><td>Sup-ported drive modes</td><td><table><tr><th>Bit</th><th>Mode</th></tr><tr><td>0</td><td>Profile position mode</td></tr><tr><td>1</td><td>Velocity mode</td></tr><tr><td>2</td><td>Profile velocity mode</td></tr><tr><td>3</td><td>Profile torque mode</td></tr><tr><td>4</td><td>Reserved</td></tr><tr><td>5</td><td>Homing mode</td></tr><tr><td>6</td><td>Interpolated position mode</td></tr><tr><td>7…15</td><td>Reserved</td></tr><tr><td>16…31</td><td>Manufacturer-specific</td></tr></table></td><td>all</td></tr>
</table>

Index (hex)	Sub	Access	Type	Name	Information	Sup-port
6504		RO	Visible string	Drive manufac-turer	ABB Drives	
6505		RO	Visible string	http drive catalog address	www.abb.com/drives	

9

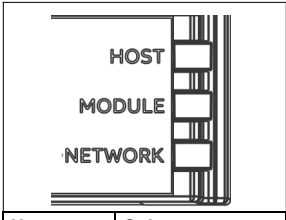
Diagnostics

What this chapter contains

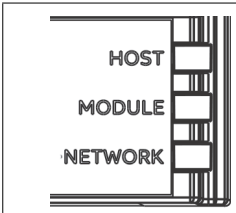
This chapter explains how to trace faults with the status LEDs on the adapter module.

LED indications

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



Name	Color	Function
HOST	Blinking green	Establishing communication to the host.
	Green	Connection to the host OK
	Blinking red	Communication to the host lost
	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.
MODULE (CANopen ERROR)	Off	Module status OK
	Red single flash	CANopen controller error counters have reached the warning limit (that is, too many error frames).
	Red double flash	Guard event or a receive heartbeat time-out has occurred.
	Red triple flash	Expected PDO has not been received before the event-timer elapsed
	Red	CANopen controller is in bus off state.
	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.



Name	Color	Function
NETWORK (CANopen RUN)	Green single flash	Module is in the stopped state.
	Blinking green	Module is in the pre-operational state.
	Green	Module is in the operational state.

10

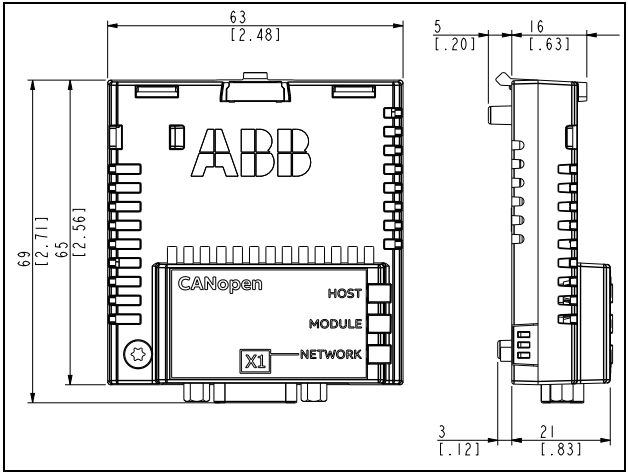
Technical data

What this chapter contains

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

FCAN-01

The following figure describes the enclosure of the adapter module from the front and side.



Mounting	Into the option slot on the drive
Degree of protection	IP20
Ambient conditions	Applicable ambient conditions specified for the drive in its manuals are in effect.
Indicators	Three bicolor LEDs: HOST, MODULE, NETWORK
Connectors	20-pin connector to drive (X2) 9-pin male D-SUB connector to bus (X1)
Power supply	+3.3 V ±5% max. 300 mA (supplied by the drive)
General	Complies with EMC standard EN 61800-3:2004. Bus interface functionally isolated from the drive Printed circuit board conformal coated

CANopen link

Compatible devices	All CANopen-compliant devices
Medium	Shielded twisted pair with nominal impedance of 120 ohms (CANopen-approved cable recommended) • Termination: 120 ohms, or active termination circuitry at each end of the trunk cable (termination not built in the adapter module)
Transfer rate	1 Mbit/s max. (1 Mbit/s; 500 kbit/s; 250 kbit/s; 125 kbit/s; 100 kbit/s; 50 kbit/s)
Serial communication type	Asynchronous, half-duplex, CAN
Protocol	CANopen
Maximum bus length	• 1 Mbit/s: 25 m • 500 kbit/s: 100 m • 250 kbit/s: 250 m • 125 kbit/s: 500 m • 50 kbit/s: 1000 m

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Appendix A – Dictionary structure and entries

What this chapter contains

This chapter contains information about PDO transmission and mapping.

Description of transmission type

Trans-mission type	PDO transmission				
	Cyclic	Acyclic	Synchro-nous	Asyn-chronous	RTR only
0		X	X		
1...240	X		X		
241...251	Reserved				
252			X		X
253				X	X
254[1)]				X	
255[2)]				X	

1) The transmission of the PDO is initiated by a manufacturer-specific event on the device.
2) The transmission of the PDO is initiated by a device profile specified event on the device.

Description of PDO COB-ID entry

Bit	Value	Description
31	0	PDO valid
	1	PDO not valid
30	0	RTR allowed on this PDO
	1	No RTR allowed on this PDO
29	0	11-bit ID is used (CAN 2.0A).[1)]
	1	29-bit ID is used (CAN 2.0B).[2)]
28...11	0	If 11-bit ID is used, bits 28...11 = 0.
	x	29-bit COB-ID not supported.
10…0	x	COB-ID

1) Recommended
2) Not supported

PDO mapping entry structure – example

Type	**MSB**			**LSB**
UINT32	31 16	15 8	7 0	
Description	Index eg, 6048h (16 bits)	Subindex eg, 01 (8 bits)	Object length in bits eg, 20h (= 32 bits) (8 bits)	

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Appendix B – CANopen error codes

What this chapter contains

This chapter contains the CANopen error codes.

Error codes

Error codes can be read from objects 1003h and 603Fh. Error codes between xx80h...xxFFh and between FF00h...FFFFh are manufacturer-specific. Description for these error codes can be found from the appropriate drive firmware manual.

Error code (hex)	Meaning
0000	No error
1000	Generic error
2000	Current
2100	Current on device input side
2110	Short circuit / Earth leakage
2120	Earth leakage
2121	Earth leakage phase L1
2122	Earth leakage phase L2

Error code (hex)	Meaning
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 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

Error code (hex)	Meaning
3230	Load error
3300	Output voltage
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

Error code (hex)	Meaning
5110	Supply low voltage
5111	U1 = supply +/-15 V
5112	U2 = supply +24 V
5113	U3 = supply +5 V
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	Control
5444	Measurement circuit
5445	Computing circuit
5450	Operating unit
5451	Power section

Error code (hex)	Meaning
5452	Output stages
5453	Chopper
5454	Input stages
5455	Contactors
5456	Contactor 1 = manufacturer-specific
5457	Contactor 2 = manufacturer-specific
5458	Control
5459	Measurement circuit
5500	Computing circuit
5510	Operating unit
5520	Power section
5530	Output stages
6000	Chopper
6010	Input stages
6100	Contactors
6200	User software
6300	Data record
6301	Data record No. 1
...	...
630E	Data record No. 14
630F	Data record No. 15
6310	Loss of parameters
6320	Parameter error
7000	Additional modules
7100	Power
7110	Brake chopper
7111	Failure brake chopper

Error code (hex)	Meaning
7112	Overcurrent brake chopper
7113	Protective circuit brake chopper
7120	Motor
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
8110	CAN overrun (objects lost)
8120	CAN in Error Passive Mode
8130	Life guard error or heartbeat error

Error code (hex)	Meaning
8140	Recovered from bus-off
8150	Transmit COB-ID
8200	Protocol error
8210	PDO not processed due to length error
8220	PDO length exceeded
8300	Torque control
8311	Excess torque
8312	Difficult start up
8313	Standstill torque
8321	Insufficient torque
8331	Torque fault
8400	Velocity speed controller
8500	Position controller
8600	Positioning controller
8611	Following error
8612	Reference limit
8700	Sync controller
8800	Winding controller
8900	Process data monitoring
8A00	Control
9000	External error
F000	Additional functions
F001	Deceleration
F002	Sub-synchronous run
F003	Stroke operation
F004	Control
FF00	Manufacturer-specific

Error code (hex)	Meaning
...	...
FFFF	Manufacturer-specific

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 abb.com/searchchannels.

Product training

For information on ABB product training, navigate to new.abb.com/service/training.

Providing feedback on ABB manuals

Your comments on our manuals are welcome. Navigate to new.abb.com/drives/manuals-feedback-form.

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3AFE68615500 Rev F (EN) 2018-03-16