ABB Drives

Installation and Start-up Guide

CANopen Adapter Module
NCAN-02

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Installation and Start-up Guide

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Safety Instructions

Overview

This chapter states the safety instructions that must be followed when installing and operating the NCAN-02 CANopen Adapter Module. The material in this chapter must be studied before attempting any work on, or with, the unit.

Warnings and Notes

This manual distinguishes two sorts of safety instructions. Warnings are used to inform of conditions which can, if proper steps are not taken, lead to a serious fault condition, physical injury and death. Notes are used when the reader is required to pay special attention or when there is additional information available on the subject. Notes are less crucial than Warnings, but should not be disregarded.

Warnings

Readers are informed of situations that can result in serious physical injury and/or serious damage to equipment with the following symbols:

Dangerous Voltage Warning: warns of situations in which a high voltage can cause physical injury and/or damage equipment. The text next to this symbol describes ways to avoid the danger.

General Warning: warns of situations which can cause physical injury and/or damage equipment by means other than electrical. The text next to this symbol describes ways to avoid the danger.

Electrostatic Discharge Warning: warns of situations in which an electrostatic discharge can damage equipment. The text next to this symbol describes ways to avoid the danger.

Notes

Readers are notified of the need for special attention or additional information available on the subject with the following symbols:

CAUTION! **Caution** aims to draw special attention to a particular issue.

Note: **Note** gives additional information or points out more information available on the subject.

General Safety Instructions

WARNING! All electrical installation and maintenance work on the drive should be carried out by qualified electricians.

The drive and adjoining equipment must be properly earthed.

Do not attempt any work on a powered drive. After switching off the mains, always allow the intermediate circuit capacitors 5 minutes to discharge before working on the frequency converter, the motor or the motor cable. It is good practice to check (with a voltage indicating instrument) that the drive is in fact discharged before beginning work.

The motor cable terminals of the drive are at a dangerously high voltage when mains power is applied, regardless of motor operation.

There can be dangerous voltages inside the drive from external control circuits even when the drive mains power is shut off. Exercise appropriate care when working with the unit. Neglecting these instructions can cause physical injury and death.

WARNING! There are several automatic reset functions in the drive. If selected, they reset the unit and resume operation after a fault. These functions should not be selected if other equipment is not compatible with this kind of operation, or dangerous situations can be caused by such action.

More Warnings and Notes are printed at appropriate instances along the text.

Table of Contents

Chapter 1 – Introduction to This Guide

Overview

This chapter contains a description of the *Installation and Start-up Guide* for the NCAN-02 CANopen Adapter Module.

Intended Audience

The Guide is intended for the people who are responsible for installing, commissioning and using a NCAN-02 CANopen Adapter Module with an ABB drive. The reader is expected to have a basic knowledge of electrical fundamentals, electrical wiring practices, the drive, and the use of the drive control panel.

What This Guide Contains

The installation and start-up of the NCAN-02 CANopen Adapter Module are introduced in this Guide.

It is assumed that the drive is installed and ready to operate before starting the installation of the adapter module. For more information on the installation and start-up procedures of the drive, please refer to its user documentation.

Safety Instructions are featured in the first few pages of this Guide. Safety Instructions describe the formats for various warnings and notations used within this Guide. This chapter also states the safety instructions which apply to the installation and operation of the NCAN-02 Module.

Chapter 1 – Introduction to This Guide contains a short description of the Guide.

Chapter 2 – Overview contains a short description of the CANopen protocol and the NCAN-02 CANopen Adapter Module, a delivery checklist, and information on the manufacturer's warranty.

Chapter 3 – Mechanical Installation contains placing and mounting instructions for the module.

Chapter 4 – Electrical Installation contains wiring, bus termination and earthing instructions.

Chapter 5 – Programming explains how to program the master station and the drive before the communication through the adapter module can be started.

Chapter 6 – Communication contains a description of how data is transmitted through the NCAN-02 Module.

Chapter 7 – Diagnostics explains the status LED indications of the NCAN-02 Module.

Appendix A contains reference tables for decoding CAN error messages.

Appendix B contains Technical Data.

Appendix C contains a specification of the ambient conditions allowed during transportation, storage and use of the NCAN-02.

Terms and Abbreviations Used in This Guide

CAN	Controller Area Network.
CiA	CAN in Automation International Users and Manufacturers Group.
CMS	CAN Message Specification; one of the service elements of the CAN Application Layer in the CAN Reference Model.
COB	Communication Object; a unit of transportation on a CAN network. Data is sent across a network inside a COB. The COB itself is part of the CAN message frame.
Communication Module	Communication Module (often abbreviated COMM. MODULE or COMM.) is a parameter name/parameter selection name for a device (e.g. a fieldbus adapter) through which the drive is connected to an external serial communication network. The communication with the communication module is activated with a drive parameter (see the drive documentation).
Data Sets and Data Words	Data sets are clusters of data sent through the DDCS link between the NCAN-02 Adapter Module and the drive. Each data set consists of three 16-bit words, i.e. data words. The Control Word (sometimes called the Command Word) and the Status Word, References and Actual Values (see Chapter 6) are types of data words; the contents of some data words are user-definable.
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 through your local ABB representative. A listing of an EDS file can also be found in Chapter 5.
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.

NCAN-02 CANopen Adapter Module	The NCAN-02 Adapter Module is one of the optional fieldbus adapter modules available for ABB drives. The NCAN-02 is a device through which the drive is connected to a CANopen serial communication bus.
NMT	Network Management; one of the service elements of the CAN Application Layer in the CAN Reference Model. It performs initialisation, configuration and error handling on a CAN network.
Object Dictionary	A local storage of all Communication Objects (COB) recognised by a device.
OSI	Open Systems Interconnection.
Parameter	A parameter is an operating instruction for the drive. Parameters can be read and programmed with the drive control panel, or through the NCAN-02 Module.
PDO	Process Data Object; a type of COB. Used for transmitting time-critical data, such as control commands, references and actual values.
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.

Chapter 2 – Overview

Overview

This chapter contains a short description of the CANopen protocol and the NCAN-02 Adapter Module, a delivery checklist, and warranty information.

CANopen

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 DS-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 NCAN-02 fulfils CiA (CAN in Automation) standard DSP-402 (Drives and Motion Control), supporting the 'Manufacturer Specific' operating mode only.

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 as follows:

Baud Rate	Max. Bus Length
1 Mbit/s	25 m
800 kbit/s	50 m
500 kbit/s	100 m
250 kbit/s	250 m

Baud Rate	Max. Bus Length
125 kbit/s	500 m
50 kbit/s	1000 m
20 kbit/s	2500 m
10 kbit/s	5000 m

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

Further information can be obtained from the CAN in Automation International Users and Manufacturers Group (*www.can-cia.de*).

The NCAN-02 CANopen Adapter Module

The NCAN-02 CANopen Adapter Module is an optional device for ABB drives which enables the connection of the drive to a CANopen system. Through the NCAN-02 Module it is possible to:

- Give control commands to the drive (Start, Stop, Run enable, etc.)
- Feed a motor speed or torque reference to the drive
- Give a process actual value or a process reference to the PID controller of the drive
- Read status information and actual values from the drive
- Change drive parameter values
- Reset a drive fault.

The communication objects and functions supported by the NCAN-02 are discussed in Chapter 6.

The adapter module is mounted onto a standard mounting rail inside or outside the drive unit, depending on drive type and configuration. See the drive manuals for module placement options.

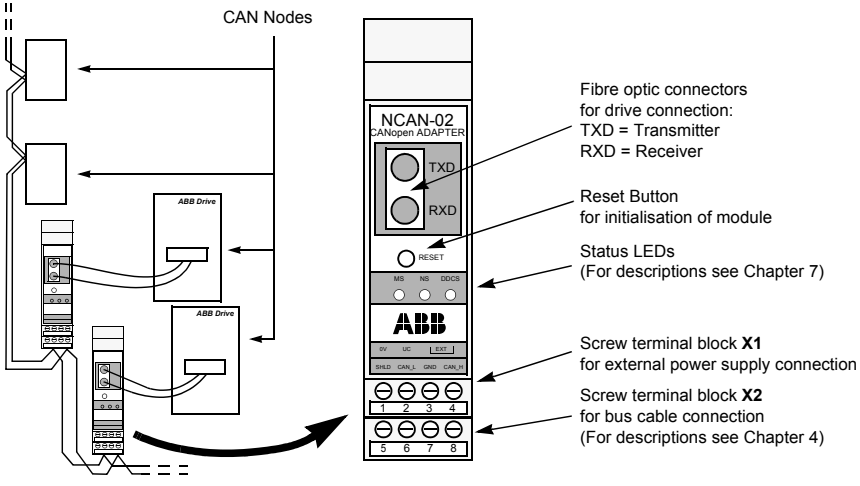


Figure 4-1 The construction of the CANopen network and the face of the NCAN-02 Module.

Compatibility

The NCAN-02 is compatible with the following ABB drives:

- ACS 400
- ACS 600 with Standard, System, Motion Control, Pump and Fan Control, or Crane Application Program
- ACS 800 with Standard, System, Motion Control, Pump and Fan Control, or Crane Application Program
- ACS 1000
- DCS 400
- DCS 500
- DCS 600.

Delivery Check

The option package for the NCAN-02 CANopen Adapter Module contains:

- CANopen Adapter Module, Type NCAN-02
- Shorting plug for power supply selection
- Two pairs (four pieces) of fibre optic cables for connecting the adapter to the drive
- Mounting rail
- This manual.

Warranty and Liability Information

The warranty for your ABB drive and options covers manufacturing defects. The manufacturer carries no responsibility for damage due to transport or unpacking.

In no event and under no circumstances shall the manufacturer be liable for damages and failures due to misuse, abuse, improper installation, or abnormal conditions of temperature, dust, or corrosives, or failures due to operation above rated capacities. Nor shall the manufacturer ever be liable for consequential and incidental damages.

The period of manufacturer's warranty is 12 months, and not more than 18 months, from the date of delivery. Extended warranty may be available with certified start-up. Contact your local distributor for details.

Your local ABB Drives company or distributor may have a different warranty period, which is specified in their sales terms, conditions, and warranty terms.

If you have any questions concerning your ABB drive, contact your local distributor or ABB Drives office.

The technical data and specifications are valid at the time of printing. ABB reserves the right to subsequent alterations.

Chapter 3 – Mechanical Installation

Overview

This chapter contains module mounting instructions. Depending on the drive, the module can be installed either inside or outside the drive housing or cabinet. See the user's manual of the drive for module placement options.

Mounting Outside the Drive

Choose the location for the module. Note the following:

- The cabling instructions must be followed (see Chapter 4). Also, the length of the fibre optic cables included in the option package restrict the distance between the module and the drive.
- Observe the free space requirements for the module (min. 10 mm from adjoining equipment or wall) and the drive (see the drive documentation).
- The ambient conditions should be taken into account (see Appendix D). The degree of protection of the module is IP 20.
- Module earth is connected to the mounting rail by means of an earthing clip (see Figure 3-1). The mounting rail onto which the option module is to be mounted must be earthed to a noiseless earth. If the rail is not mounted on a properly earthed base, a separate earthing conductor must be used. The conductor must be as short as possible and the cross-sectional area must be 6 mm^2 at least.

Note: No solid copper conductor may be used (stranded wire allowed only).

Mounting instructions:

1. Switch off all dangerous voltages in the enclosure that the module is to be mounted in.
2. Fasten the rail and ensure the proper earthing as described above.
3. Push the module onto the rail. The module can be released by pulling the locking spring with a screwdriver (see Figure 3-1).

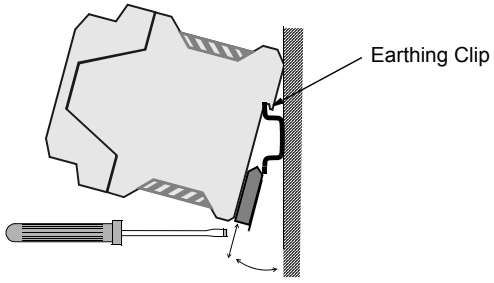


Figure 3-1 Mounting and removing the module.

Mounting Inside the Drive

The work inside the drive should be carried out by a qualified electrician only.

WARNING! Pay attention to the slowly discharging voltage of the capacitor bank and the voltages that are connected from external control circuits to the inputs and outputs of the drive.

WARNING! Do not touch the printed circuit boards. The integrated circuits are extremely sensitive to electrostatic discharge.

Mounting instructions:

1. Stop the drive.
2. Switch off the power supply of the drive and all dangerous voltages connected to the inputs and outputs.
3. Wait for five minutes to ensure that the capacitors in the intermediate circuit have discharged.
4. Remove the front cover of the drive.
5. Ensure that the mains cable, motor cable and capacitor bank (UDC+ and UDC-) are not powered.
6. Locate the position for the module (see the user's manual of the drive). Fasten the mounting rail to its place if not already installed. Observe the free space requirements for the module (min. 10 mm from adjoining equipment/wall).
7. Push the module onto the rail. The module can be released by pulling the locking spring with a screwdriver (see Figure 3-1).

Chapter 4 – Electrical Installation

Overview

This chapter contains:

- general cabling instructions
- module earthing instructions
- instructions of setting the module node number and communication speed (baud rate)
- instructions for connecting the module to the drive and to the CANopen bus.

WARNING! Before installation, switch off the drive power supply. Wait five minutes to ensure that the capacitor bank of the drive is discharged. Switch off all dangerous voltages connected from external control circuits to the inputs and outputs of the drive.

General Cabling Instructions

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

Handle the fibre optic cables with care. When unplugging optic cables, always grab the connector, not the cable itself. Do not touch the ends of the fibres with bare hands as the fibre is extremely sensitive to dirt.

The maximum long term tensile load for the fibre optic cables is 1 N. The minimum short term bend radius is 25 mm.

Earthing the Module

The NCAN-02 module earth is connected to the rail onto which the module is mounted. If the rail is fastened to an earthed metallic assembly plate, the module is automatically earthed, and no external earthing wire is needed. If the rail is fastened to a base that is not earthed, the rail must be connected to the nearest earthing terminal. However, the earthing wire should not be connected to the same terminal as the power cable screens. (See the mounting instructions in Chapter 3.)

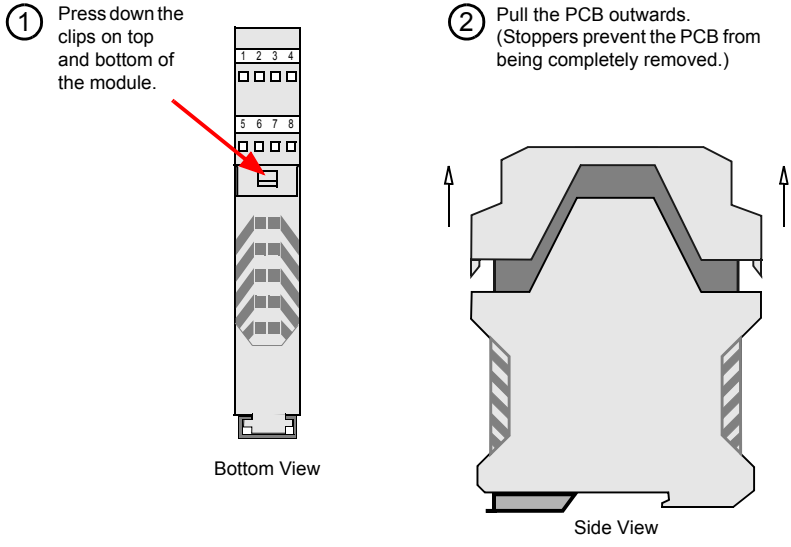
DIP Switch Settings

The DIP switches SW1 and SW2 on the NCAN printed circuit board can be used to select the node number and the baud rate for the module.

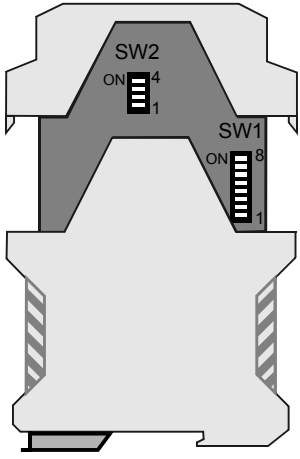
Setting switch SW1:8 to ON enables DIP switch selection. In this case, the corresponding selection parameters (in the fieldbus parameter group; see Chapter 5) only act as read-only indicators.

If SW1:8 is set to OFF (default), the node number and the baud rate are selected through module parameters (see Chapter 5).

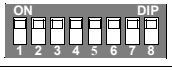
The figures below show how the DIP switches on the circuit board can be accessed.



③ Make the required settings.



Function	SW1
SW1 and SW2 enabled – node no. and baud rate selected with DIP switches.	
*SW1 and SW2 disabled – node no. and baud rate selected with parameters.	

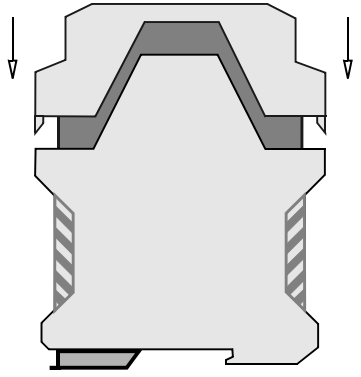
Node No.	Binary	SW1
*1	0000001	
2	0000010	
• • •	• • •	• • •
127	1111111	

Baud Rate	Binary	SW2
1 Mbit/s	000	
500 kbit/s	001	
250 kbit/s	010	
*125 kbit/s	011	

Baud Rate	Binary	SW2
100 kbit/s	100	
50 kbit/s	101	
20 kbit/s	110	
10 kbit/s	111	

*Default setting

④ Finally, close the module by sliding the PCB back until the clips lock into their recesses.



NCAN-02 Connections

Drive Connection The NCAN-02 module is connected to the drive using a fibre optic cable link. Consult the drive documentation as to the corresponding terminals inside the drive.

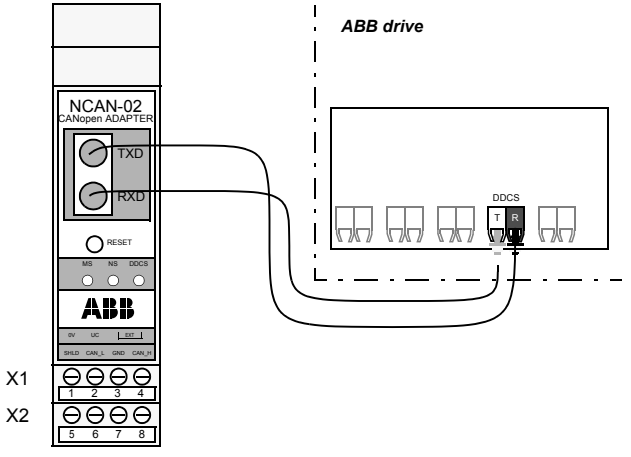


Figure 4-1 Fibre optic link connecting the NCAN-02 to the drive.

CANopen Connection

The bus cable and the external power supply are connected to terminal blocks X1 and X2 on the NCAN-02.

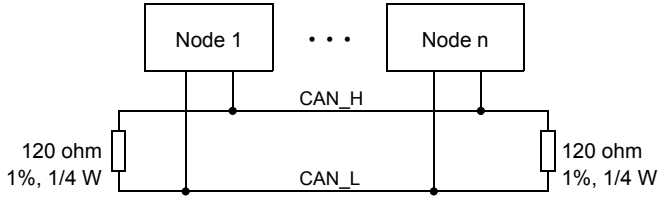
The terminal blocks are described below.

X1		Description	
1	0 V	DC GND	Power supply ground (0 V). If the power to the module is supplied through the CAN network, this terminal should be left unconnected.
2	UC	+24 VDC	+24 V ±10% (80 mA) DC supply to the module. The power can be taken from the drive's internal power supply (see drive manuals), a dedicated external power supply, or through the CAN network. The on-board power supply is disabled if the voltage drops below 11 V.
3	EXT	DC GND	These terminals should be connected together if the power to the module is supplied through the CAN network. This makes the NCAN-02 a non-isolated node.
4		CAN GND	

X2		Description
5	SHLD	Network cable shield.
6	CAN_L	CAN_L bus line.
7	GND	CAN bus ground (digital ground).
8	CAN_H	CAN_H bus line.

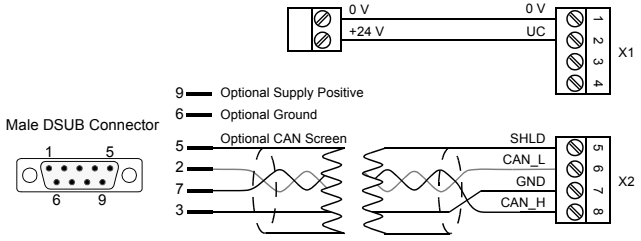
CAN Bus Termination

The CAN bus line must be terminated with 120 ohm resistors connected between the CAN_L and CAN_H wires at each end as shown below.

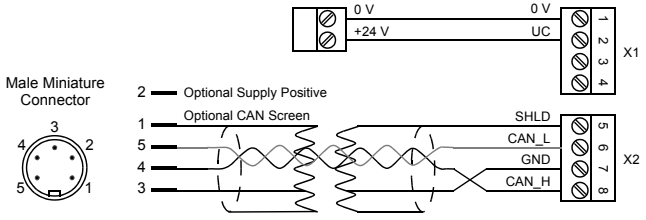


Connection Examples

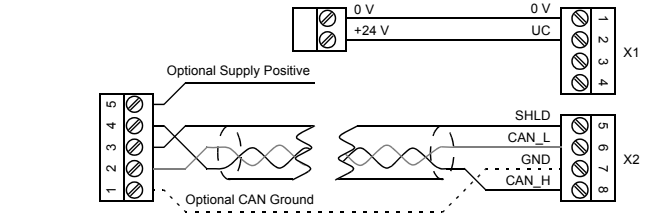
Standard 9-pin DSUB Connector



Standard 5-pin Miniature Connector

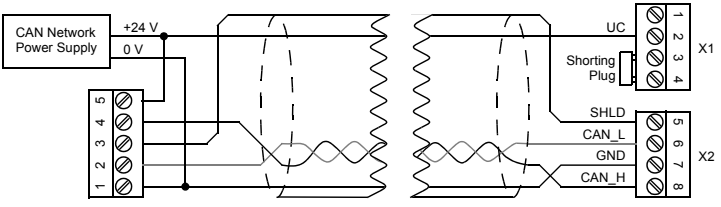


Standard Open-style Connection



Non-isolated Node Powered from the Network

Note: Use this connection only if power supply is connected to CAN ground, and the CAN bus is short.



Chapter 5 – Programming

Overview

This chapter gives information on configuring the drive for operation with the NCAN-02 CANopen Adapter Module.

Configuring the CAN Controller and Network

After the NCAN-02 module has been mechanically and electrically installed according to the instructions in Chapters 3 and 4, the CAN network and the drive must be prepared for communication and operation with the module.

The NCAN-02 cannot communicate with the drive before it is configured for the CAN network. The CAN network is configured using a network installation tool; please refer to the installation tool documentation.

EDS Files

EDS (Electronic Data Sheet) configuration files for ABB drives are available through your local ABB representative.

Configuring the Drive

The detailed procedure of activating the module for communication with the drive is dependent on drive type. (Normally, a parameter must be adjusted to activate the communication. See the drive documentation.)

As communication between the drive and the NCAN-02 is established, several configuration parameters are copied to the drive. These parameters – shown below in Table 5-1 – must be checked first and adjusted if necessary. The alternative selections for these parameters are discussed in more detail below the table. (Note that the new settings take effect only when the module is powered up for the next time, or after the Reset button is pressed.)

Note: The grouping, numbering, and adjustment procedure of parameters vary from drive to drive. See the drive documentation for information.

Table 5-1 The NCAN-02 Configuration Parameters.

Fieldbus Par. No.	Parameter Name	Alternative Settings	Default Setting
1	MODULE TYPE	**(5)** NCAN-02 Vx.x	**(5)** NCAN-02 Vx.x
2	WD MODE	**(0)** FAULT; **(1)** AUTO RESET	**(1)** AUTO RESET
3	NODE ID	1 ... 127	1
4	BAUD RATE	**(0)** 1 Mbit/s; **(1)** 500 kbit/s; **(2)** 250 kbit/s; **(3)** 125 kbit/s; **(4)** 100 kbit/s; **(5)** 50 kbit/s; **(6)** 20 kbit/s; **(7)** 10 kbit/s	**(3)** 125 kbit/s
5	COMM PROFILE	**(0)** CSA 2.8/3.0; **(1)** ABB DRIVES; **(2)** TRANSPARENT	**(1)** ABB DRIVES
6	CUT-OFF TIMEOUT	0 ... 255	10
7	STATUS	**(0)** SELF TEST; **(1)** RX Q OVERRUN; **(2)** CAN OVERRUN; **(3)** BUS OFF; **(4)** ERROR SET; **(5)** ERROR RESET; **(6)** TX Q OVERRUN; **(7)** DISCONNECTED; **(8)** STARTED; **(9)** STOPPED; **(10)** G FAILS; **(11)** PRE-OPERAT. **(12)** RESET COMM.; **(13)** RESET NODE	–
8	DATA SET INDEX	**(0)** FBA D SET 1; **(1)** FBA D SET 10	**(0)** FBA D SET 1
9	NO. OF DATA SETS	1 ... 4	1

MODULE TYPE This parameter shows the module type as detected by the drive. The value cannot be adjusted by the user. (If this parameter is undefined, the communication between the drive and the module has not been established.)

WD MODE This parameter defines the operating mode of the watchdog reset and node reset command.

FAULT
The module remains in the fault state until power-off.

AUTO RESET
The module restarts automatically.

NODE ID Each device on the CAN link must have a unique node number (Node ID). This parameter is used for defining a station number for the drive it is connected to.

1 … 127

Note: If DIP switches are enabled (SW1:8 is ON), this parameter is read-only. See Chapter 4.

BAUD RATE This parameter shows the transfer rate used in the CAN link. This setting must be the same on all devices on the bus.

1 Mbit/s; 500 kbit/s; 250 kbit/s; 125 kbit/s; 100 kbit/s; 50 kbit/s; 20 kbit/s; 10 kbit/s

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Note: If DIP switches are enabled (SW1:8 is ON), this parameter is read-only. See Chapter 4.

COMM PROFILE This parameter selects the communication profile used in the DDCS link between the drive and the NCAN-02. The setting to use is dependent on drive type and application program version as indicated below. (The drive program version can be checked by viewing a parameter; see the drive documentation.)

Drive Type	Drive Prg. Version	Setting to Use
ACS 400	–	**ABB DRIVES**
ACS 600 SingleDrive	CSA 2.8x to CSA 3.0x	**CSA 2.8/3.0**
ACS 600 SingleDrive	ACxA5000 or later	**ABB DRIVES**
ACS 600 SingleDrive with PFC	AHxA2000 or later	**CSA 2.8/3.0**
ACS 600 MultiDrive (ACN 600)	AMxM103a or later	**ABB DRIVES**
ACS 600 MotionControl (ACP 600)	APxA1100 or later	**TRANSPARENT**
ACS 600 Pump & Fan Drive (ACF 600)	AF0A1020 or later	**CSA 2.8/3.0**
ACS 600 CraneDrive (ACC 600)	ACxA2000 or later	**TRANSPARENT**
ACS 1000	–	**ABB DRIVES**
DCS 400	–	**ABB DRIVES**
DCS 500	DC21x226 or later	**ABB DRIVES**
DCS 600	–	**ABB DRIVES**

ABB DRIVES; CSA 2.8/3.0
The Control and Status Words according to the CANopen Drive Profile DS402 are manipulated by the NCAN-02 in order to match them to the communication profile of the drive.

The CANopen state machine is shown in Chapter 6.

TRANSPARENT
The Control Word and the Status Word are exchanged by the NCAN-02 between the PLC and the drive “as is”. Refer to the drive documentation for the meaning of the bits in the Control Word and Status Word. In this mode the support of the Control Word and Status Word according to the CANopen Drive Profile DS402 is disabled.

CUT-OFF TIMEOUT This parameter defines the time after which the NCAN-02 makes a self-reset and thus stops communicating (with the drive and the master) in case the PDO communication between the NCAN-02 and the master fails. Cut-off supervision is activated upon a successful receipt of a PDO, i.e. this parameter has no effect if no messaging has taken place.

The actual timeout in seconds is the value of this parameter (1 ... 255) divided by 10. Setting the parameter to 0 disables cut-off supervision.

0 (disabled)**; 1 … 255**

STATUS This parameter indicates the status of the NCAN-02 module.

Value	Description
(0) SELF TEST	Module initialising and performing self-test.
(1) RX Q OVERRUN	Software overrun. No space in high-priority receive queue to store message. Message discarded.
(2) CAN OVERRUN	Overrun bit in status register of CAN controller set.
(3) BUS OFF	CAN controller state switched to BUS OFF.
(4) ERROR SET	– Error status bit in status register of CAN controller set, or – Self-test error, or – Cut-off timeout expired, or – CAN controller initialisation failed.
(5) ERROR RESET	Error status bit in status register of CAN controller reset.
(6) TX Q OVERRUN	Software overrun. High-priority transmit queue full.
(7) DISCONNECTED	Node state changed to DISCONNECTED.
(8) STARTED	Node started.
(9) STOPPED	Node stopped.
(10) G FAILS	Node not guarded within node life time.
(11) PRE-OPERAT.	Node state changed to PRE-OPERATIONAL.
(12) RESET COMM.	Reset communication indication received.
(13) RESET NODE	Reset node indication received.

DATA SET OFFSET This parameter selects the number of the first data set to be used for fieldbus communication. By default, the value of this parameter is FBA D SET 1, denoting that data sets from no. 1 onwards are used for communication with the drive. However, some drives reserve these data sets for other use, and thus it may be necessary to use other data sets. Setting this parameter to the value of FBA D SET 10 makes data set 10 the first data set to be used for the communication between the NCAN-02 and the drive.

FBA D SET 1; FBA D SET 10

NO. OF DATA SETS This parameter defines the number of data sets and activated PDOs sent in each direction.

1 ... 4

Control Locations

ABB drives can receive control information from multiple sources including digital inputs, analogue inputs, the drive control panel and a communication module (e.g. NCAN-02). ABB drives allow the user to separately determine the source for each type of control information (Start, Stop, Direction, Reference, Fault Reset, etc.). In order to give the fieldbus master station the most complete control over the drive, the communication module must be selected as source for this information. See the user documentation of the drive for information on the selection parameters.

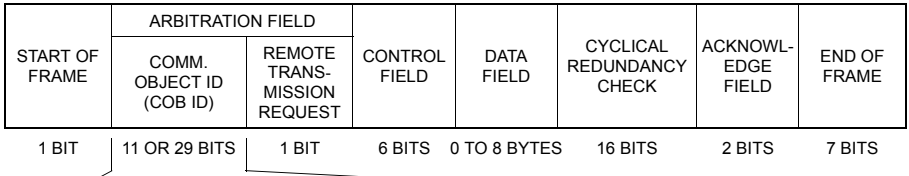
Chapter 6 – Communication

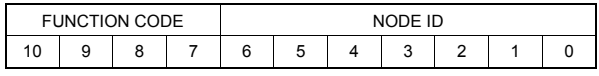
Overview

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.



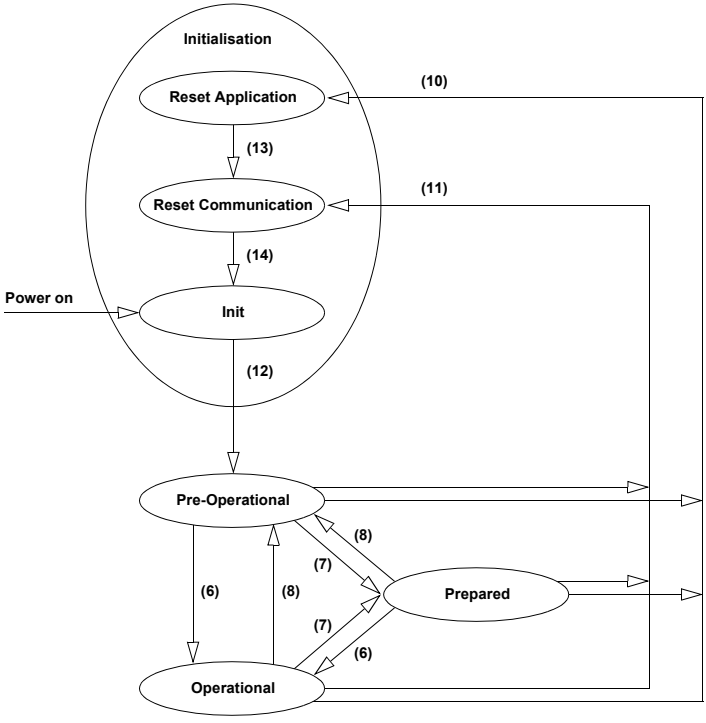


Communication Object	Function Code (Binary)	COB ID (Hex)	COB ID (Dec)
NMT	0000	0×00	0
SYNC	0001	0×80	128
TIME STAMP	0010	0×100	256
EMERGENCY	0001	0×81 … 0×FF	129 … 255
PDO 1 (Tx)	0011	0×181 … 0×1FF	385 … 511
PDO 1 (Rx)	0100	0×201 … 0×27F	513 … 639
PDO 2 (Tx)	0101	0×281 … 0×2FF	641 … 767
PDO 2 (Rx)	0110	0×301 … 0×37F	769 … 895
PDO 3 (Tx)	0111	0×381 … 0×3FF	897 … 1023
PDO 3 (Rx)	1000	0×401 … 0×47F	1025 … 1151
PDO 4 (Tx)	1001	0×481 … 0×4FF	1153 … 1279
PDO 4 (Rx)	1010	0×501 … 0×57F	1281 … 1407
SDO (Tx)	1011	0×581 … 0×5FF	1409 … 1535
SDO (Rx)	1100	0×601 … 0×67F	1537 … 1663
NODEGUARD	1110	0×701 … 0×77F	1793 … 1919

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

NCAN-02 Boot-up Sequence

The NCAN-02 supports the boot-up sequence of a “Minimum Capability Device”, as defined by the CANopen Communication Profile. The boot-up state diagram of the NCAN-02 is shown below.



(6) Start_Remote_Node indication
(7) Stop_Remote_Node indication
(8) Enter_Pre-Operational_State indication
(10) Reset_Node indication
(11) Reset_Communication indication
(12) After Initialisation is finished
(13) (14) After Reset is performed

The NMT commands used for controlling the node are:

Command	Name
001	Start_Remote_Node
002	Stop_Remote_Node
128	Enter_Pre-Operational_State
129	Reset_Node
130	Reset_Communication

Header	Byte	
	1	2
0000000000000010	NMT Command	Node ID

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

The node state indications are as follows:

Indication	State
4	Prepared
5	Operational
127	Pre-Operational

Process Data Objects (PDO)

Process Data Objects contain time-critical process data. Each PDO contains three 16-bit words.

The COB IDs for PDOs are:

- PDO1 Rx (Master to Slave): 200h + Node ID
- PDO2 Rx (Master to Slave): 300h + Node ID
- PDO1 Tx (Slave to Master): 180h + Node ID
- PDO2 Tx (Slave to Master): 280h + Node ID
- PDO3 Rx (Master to Slave): 400h + Node ID
- PDO4 Rx (Master to Slave): 500h + Node ID
- PDO3 Tx (Slave to Master): 380h + Node ID
- PDO4 Tx (Slave to Master): 480h + Node ID

***Note*:** The amount of activated PDOs depends on the value of fieldbus parameter 9 NO. OF DATA SETS.

The PDO transmission types are:

Transmission Type	PDO Transmission				
	Cyclic	Acyclic	Synchro-nous	Asynchro-nous	RTR only
0		+	+		
1 - 240	+		+		
241 - 251	Reserved				
252			+		+
253				+	
254				+	
255				+	

The transmission type of a PDO is defined in the PDO communication parameter index. See the NCAN Object Dictionary (Communication Profile Area, Index 1400h onwards) later in this chapter.

PDO1 Rx The PDO1 Rx object is received by the drive as Data set 1 (or Data set 10 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO1 Rx is as follows:

Master to Slave

Header	Byte					
	1	2	3	4	5	6
0100xxxxxxryyyy	Control Word (2001h/6040h)		Reference 1 (2002h)		Reference 2 (2003h)	

0100 = COB ID Function code
xxxxxxx = Node ID
r = RTR (Remote Transmit Request) bit
yyyy = Data length

The drive switches between the states of the CANopen State Machine (shown further below) according to the bits of the Control Word.

Note: If Fieldbus Parameter 5 (COMM PROFILE) is set to TRANSPARENT, the Control Word of the drive is applied. See the drive documentation. In this case it is assumed that PDO1 Rx bytes 1 and 2 are defined as being Control Word.

Control Word

Bit	Description
0	Switch on
1	Disable voltage
2	Quick stop
3	Enable operation
4	Ramp function generator disable
5	Ramp function generator stop
6	Ramp function generator zero
7	Reset fault
8	Halt
9	(reserved)
10	(reserved)
11	External control location (ABB drives)
12	(reserved)
13	(reserved)
14	(reserved)
15	(reserved)

References 1 and 2 are 16-bit words each containing a sign bit and a 15-bit integer. In order to use these References, the drive must have the NCAN-02 selected as the source. In the drive, references can also be scaled, limited or corrected. See the drive documentation for further information.

PDO1 Tx The PDO1 Tx object is transmitted by the drive as Data set 2 (or Data set 11 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO1 Tx is as follows:

Slave to Master

Header	Byte					
	1	2	3	4	5	6
0011xxxxxxxryyyy	Status Word (2004h/6041h)		Actual Value 1 (2005h)		Actual Value 2 (2006h)	

0011 = COB ID Function code
xxxxxxx = Node ID
r = RTR (Remote Transmit Request) bit
yyyy = Data length

The drive indicates its state in the CANopen State Machine (shown further below) with the bits of the Status Word.

Note: If Fieldbus Parameter 5 (COMM PROFILE) is set to TRANSPARENT, the Status Word of the drive is applied. See the drive documentation.

Status Word

Bit	Description
0	Ready to switch on
1	Switched on
2	Operation enabled
3	Fault
4	Voltage disabled
5	Quick stop
6	Switch-on disabled
7	Warning
8	External control location (ABB drives)
9	Remote
10	Target reached
11	Internal limit active
12	(reserved)
13	(reserved)
14	Run enabled (ABB drives)
15	DDCS communication error (ABB drives)

Actual values 1 and 2 are 16-bit words each containing a sign bit and a 15-bit integer. The values to be transmitted to the CAN bus master are selected by drive parameters. See the drive documentation for further information.

Asynchronous transmission mode PDO1 Tx is automatically transmitted to the CAN bus master in the time interval defined in index 2000 Sub-index 1 (default 40ms). Automatic transmission is stopped when communication with the master is lost.

PDO1 Tx is also transmitted every time PDO1 Rx is received.

Cyclic transmission mode

PDO1 Tx is transmitted to the CAN bus master every time a SYNC message is received.

***Note*:** The automatic transmission of Tx PDO1 is started only after the first receipt of Rx PDO1.

PDO2 Rx

The PDO2 Rx object is received by the drive as Data set 3 (or Data set 12 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO2 Rx are as follows:

Master to Slave

Header	Byte					
	1	2	3	4	5	6
0110xxxxxxxryyyy	Reference 3 (2007h)		Reference 4 (2008h)		Reference 5 (2009h)	

0110 = COB ID Function code
xxxxxxx = Node ID
r = RTR bit
yyyy = Data length

References 3 to 5 are 16-bit words each containing a sign bit and a 15-bit integer. The way in which these values are used by the drive depends on its parameter settings. See the drive documentation for more information.

PDO2 Tx The PDO2 Tx object is transmitted by the drive as Data set 4 (or Data set 13 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO2 Rx is as follows:

Slave to Master

Header	Byte					
	1	2	3	4	5	6
0101xxxxxxxryyyy	Actual Value 3 (200Ah)		Actual Value 4 (200Bh)		Actual Value 5 (200Ch)	

0101 = COB ID Function code
xxxxxxx = Node ID
r = RTR bit
yyyy = Data length

Actual values 3 to 5 are 16-bit words each containing a sign bit and a 15-bit integer. The values to be transmitted to the CAN bus master are selected by drive parameters. See the drive documentation for more information.

Asynchronous transmission mode PDO2 Tx is automatically transmitted to the CAN bus master in the time interval defined in index 2000 Sub-index 2 (default 60 ms). Automatic transmission is stopped when communication with the master is lost.

PDO2 Tx is also transmitted every time PDO2 Rx is received.

Cyclic transmission mode PDO2 Tx is transmitted to the CAN bus master every time a SYNC message is received.

***Note*:** The automatic transmission of Tx PDO2 is started only after the first receipt of Rx PDO2.

PDO3 Rx The PDO3 Rx object is received by the drive as Data set 5 (or Data set 14 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO3 Rx is as follows.)

Master to Slave

Header	Byte					
	1	2	3	4	5	6
1000xxxxxxxryyyy	Reference 6 (200Dh)		Reference 7 (200Eh)		Reference 8 (200Fh)	

0110 = COB ID Function code
xxxxxxx = Node ID
r = RTR bit
yyyy = Data length

References 6 to 8 are 16-bit words each containing a sign bit and a 15-bit integer. The way in which these values are used by the drive depends on its parameter settings. See the drive documentation for more information.

PDO3 Tx The PDO3 Tx object is transmitted by the drive as Data set 6 (or Data set 15 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO3 Rx is as follows:.

Slave to Master

Header	Byte					
	1	2	3	4	5	6
0111xxxxxxxryyyy	Actual Value 6 (2010h)		Actual Value 7 (2011h)		Actual Value 8 (2012h)	

0101 = COB ID Function code
xxxxxxx = Node ID
r = RTR bit
yyyy = Data length

Actual values 6 to 8 are 16-bit words each containing a sign bit and a 15-bit integer. The values to be transmitted to the CAN bus master are selected by drive parameters. See the drive documentation for more information.

Asynchronous transmission mode PDO3 Tx is automatically transmitted to the CAN bus master in the time interval defined in index 2000 Sub-index 3 (default 80 ms). Automatic transmission is stopped when communication with the master is lost.

PDO3 Tx is also transmitted every time PDO3 Rx is received.

Cyclic transmission mode PDO3 Tx is transmitted to the CAN bus master every time a SYNC message is received.

***Note*:** The automatic transmission of Tx PDO3 is started only after the first receipt of Rx PDO3.

PDO4 Rx The PDO4 Rx object is received by the drive as Data set 7 (or Data set 16 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO4 Rx is as follows:

Master to Slave

Header	Byte					
	1	2	3	4	5	6
1010xxxxxxxryyyy	Reference 9 (2013h)		Reference 10 (2014h)		Reference 11 (2015h)	

0110 = COB ID Function code
xxxxxxx = Node ID
r = RTR bit
yyyy = Data length

References 9 to 11 are 16-bit words each containing a sign bit and a 15-bit integer. The way in which these values are used by the drive depends on its parameter settings. See the drive documentation for more information.

PDO4 Tx The PDO4 Tx object is transmitted by the drive as Data set 8 (or Data set 17 if NCAN-02 parameter DATA SET OFFSET is set to FB D SET 10). The contents of PDO4 Rx is as follows:.

Slave to Master

Header	Byte					
	1	2	3	4	5	6
1001xxxxxxryyyy	Actual Value 9 (2016h)		Actual Value 10 (2017h)		Actual Value 11 (2018h)	

0101 = COB ID Function code
xxxxxxx = Node ID
r = RTR bit
yyyy = Data length

Actual values 6 to 8 are 16-bit words each containing a sign bit and a 15-bit integer. The values to be transmitted to the CAN bus master are selected by drive parameters. See the drive documentation for more information.

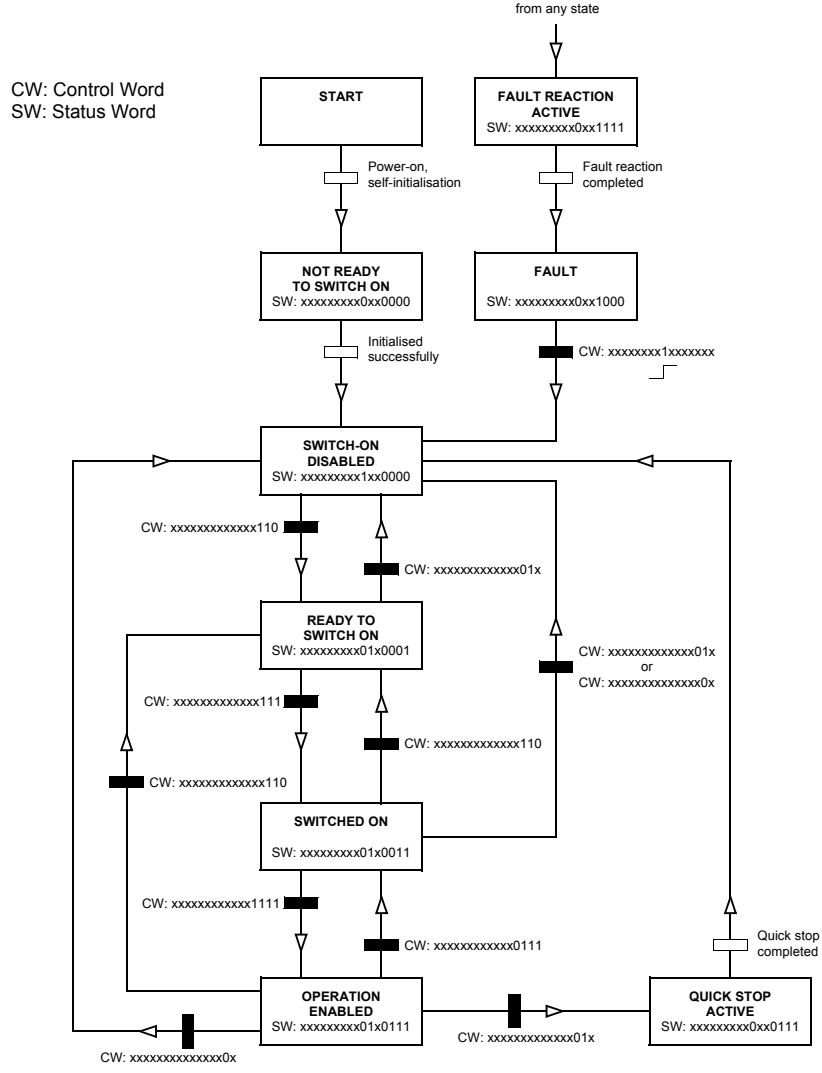
Asynchronous transmission mode PDO4 Tx is automatically transmitted to the CAN bus master in the time interval defined in index 2000 Sub-index 4 (default 100 ms). Automatic transmission is stopped when the communication with the master is lost.

PDO4 Tx is also transmitted every time PDO4 Rx is received.

Cyclic transmission mode PDO4 Tx is transmitted to the CAN bus master every time a SYNC message is received.

***Note*:** The automatic transmission of Tx PDO4 is started only after the first receipt of Rx PDO4.

The CANopen State Machine



Service Data Objects (SDO)

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

If 4 bytes or less data is to be transmitted, an ‘expedited’ SDO message can be used. Larger quantities of data can be segmented, i.e. split between several CAN messages.

The COB IDs for SDO communication are:

- Master to Slave: 600h + Node ID
- Slave to Master: 580h + Node ID.

Read:

Master to Slave

Header	Byte							
	1	2	3	4	5	6	7	8
1100xxxxxxx01000	Command	Object Index		Sub-index	Reserved			

xxxxxxx = Node ID

Write:

Master to Slave (‘Expedited’ message with max. 4 bytes of data)

Header	Byte							
	1	2	3	4	5	6	7	8
1100xxxxxxx01000	Command	Object Index		Sub-index	Data			

Master to Slave (Segmented message with over 4 bytes of data)
1st Frame

Header	Byte							
	1	2	3	4	5	6	7	8
1100xxxxxxx01000	Command	Object Index		Sub-index	Length			

All Subsequent Frames

Header	Byte							
	1	2	3	4	5	6	7	8
1100xxxxxxx01000	Command	Data						

The NCAN Object Dictionary

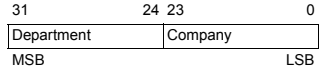
The NCAN Object Dictionary contains all Communication Objects. A listing of the Object Dictionary is given below.

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

Communication Profile Area

<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>Unsigned32</td><td>RO</td><td>Describes the type of the device. Composed of two 16-bit fields (one for device profile, the other for additional information. The object value of the NCAN-02 is 0×0192, which corresponds to drive profile DSP-402 (0×192), and to additional information Frequency Converter (0×01).</td></tr>
<tr><td>1001</td><td>0</td><td>Error Register</td><td>Unsigned8</td><td>RO</td><td>Error register for the NCAN-02. Bit-encoded according to DS301/401. 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>
<tr><td rowspan="3">1003</td><td>0</td><td>Pre-defined Error Field</td><td>Unsigned8</td><td>RO</td><td>Number of errors occurred and listed at Sub-indexes 1 to A. Writing a zero here deletes the list.</td></tr>
<tr><td>1</td><td>Pre-defined Error Field</td><td>Unsigned32</td><td>RO</td><td rowspan="3">List of errors.
The most recent error is at Sub-index 1. When a new error occurs, previous errors move down the list. Error numbers comprise a 16-bit error code (listed in Appendix B) and a 16-bit additional information field (0 with NCAN-02). 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="4">Byte</th></tr>
<tr><th>1 - 2</th><th>3</th><th>4 - 7</th><th>8</th></tr>
<tr><td>0001xxxxxx01000</td><td>Error code</td><td>Error register</td><td>Additional error info</td><td>Unused</td></tr>
</table></td></tr>
<tr><td>• • •</td><td>• • •</td><td>• • •</td><td>• • •</td></tr>
<tr><td>A</td><td>Pre-defined Error Field</td><td>Unsigned32</td><td>RO</td></tr>
<tr><td>1005</td><td>0</td><td>COB ID SYNC Message</td><td>Unsigned32</td><td>RW</td><td>Identifier of the SYNC message.
The SYNC message controls the actions of PDOs that have the transmission type Synchronous.</td></tr>
<tr><td>1006</td><td>0</td><td>Communication Cycle Period</td><td>Unsigned32</td><td>RW</td><td>Time between SYNC messages.</td></tr>
<tr><td>1007</td><td>0</td><td>Synchronous Window Length</td><td>Unsigned32</td><td>RW</td><td>Synchronous window length.
Default value: 0 µs (not used with NCAN-02).</td></tr>
<tr><td>1008</td><td>0</td><td>Manufacturer Device Name</td><td>Visible string</td><td>RO</td><td>Module name.
The constant string is ABB NCAN-02.</td></tr>
<tr><td>1009</td><td>0</td><td>Manufacturer Hardware Version</td><td>Visible string</td><td>RO</td><td>Version of the module hardware.
The constant string is HW V. 02.</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>100A</td><td>0</td><td>Manufacturer Software Version</td><td>Visible string</td><td>RO</td><td>Version of the module software.
The constant string is SW Vx.x where x.x = version number, e.g. 2.0.</td></tr>
<tr><td>100B</td><td>0</td><td>Node ID</td><td>Unsigned32</td><td>RO</td><td>Actual Node ID.
This entry has the access attribute “read only” as it cannot be changed through an SDO service. However, it can be changed through NCAN-02 configuration parameters or DIP switch SW1 (see Chapter 4 or Chapter 5 respectively).</td></tr>
<tr><td>100C</td><td>0</td><td>Guard Time</td><td>Unsigned32</td><td>RW</td><td rowspan="2">Guard time (ms) × Life time factor = Life time for the Node Guarding Protocol.</td></tr>
<tr><td>100D</td><td>0</td><td>Life Time Factor</td><td>Unsigned8</td><td>RW</td></tr>
<tr><td>100E</td><td>0</td><td>COB ID Guarding Protocol</td><td>Unsigned32</td><td>RW</td><td>Describes the COB ID used for node guarding and life guarding.
Default: 700h + Node ID.</td></tr>
<tr><td>100F</td><td>0</td><td>Number of SDOs Supported</td><td>Unsigned32</td><td>RO</td><td>Composed of two fields which describe the number of Client SDOs and Server SDOs.
MSB LSB
<table><tr><td>Client SDOs (16 bits)</td><td>Server SDOs (16 bits)</td></tr></table></td></tr>
<tr><td>1010</td><td>0</td><td>Identity Object</td><td>Unsigned8</td><td>RO</td><td>Largest supported sub-index.</td></tr>
<tr><td></td><td>1</td><td>Save all parameters</td><td>Unsigned32</td><td>RW</td><td>Stores the parameters as defined in Sub-indexes 2 and 4 in the device.
Store command:
MSB LSB
<table><tr><td>65h</td><td>76h</td><td>61h</td><td>73h</td></tr></table></td></tr>
<tr><td></td><td>2</td><td>Save communication parameters</td><td>Unsigned32</td><td>RW</td><td>Stores communication related parameters with index 1400h - 1403h and 1800h - 1803h.
Store command: see Sub-index 1.</td></tr>
<tr><td></td><td>3</td><td>Save application parameters</td><td>Unsigned32</td><td>RW</td><td>Not supported.</td></tr>
<tr><td></td><td>4</td><td>Save manufacturer defined parameter</td><td>Unsigned32</td><td>RW</td><td>Stores manufacturer defined parameter index 2000h.
Store command: see Sub-index 1.</td></tr>
<tr><td>1011</td><td>0</td><td>Identity Object</td><td>Unsigned8</td><td>RO</td><td>Largest supported sub-index.</td></tr>
<tr><td></td><td>1</td><td>Restore all default parameters</td><td>Unsigned32</td><td>RW</td><td>Restores the default value of the parameters as defined in Sub-indexes 2 and 4 in the device.
Restore command:
MSB LSB
<table><tr><td>64h</td><td>61h</td><td>6Fh</td><td>6Ch</td></tr></table></td></tr>
<tr><td></td><td>2</td><td>Restore communication default parameters</td><td>Unsigned32</td><td>RW</td><td>Restores the default value of communication related parameters with index 1400h - 1403h and 1800h - 1803h.
Store command: see Sub-index 1.</td></tr>
<tr><td></td><td>3</td><td>Restore application default parameters</td><td>Unsigned32</td><td>RW</td><td>Not supported.</td></tr>
<tr><td></td><td>4</td><td>Restore manufacturer defined default parameter</td><td>Unsigned32</td><td>RW</td><td>Restores the default of manufacturer defined parameter index 2000h.
Store command: see Sub-index 1.</td></tr>
<tr><td>1014</td><td>0</td><td>COB ID Emergency Message</td><td>Unsigned32</td><td>RW</td><td>Defines the COB ID of the Emergency Object (EMCY).
Default: 80h + Node ID.</td></tr>
</table>

Index (Hex)	Sub-index	Name	Type	Attri-bute	Information
1018	0	Identity Object	Unsigned8	RO	Number of entries.
	1	Vendor ID	Unsigned32	RO	 The ABB Vendor ID is 183 (B7h).
	2	Product Code	Unsigned32	RO	2
	3	Revision Number	Unsigned32	RO	Bits 31-16 correspond to the major revision number and bits 15-0 correspond to the minor revision number.
	4	Serial Number	Unsigned32	RO	Not supported.
1200	0	Server SDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Client -> Server (Rx)	Unsigned32	RW	Default: 600h + Node ID.
	2	COB ID Server -> Client (Tx)	Unsigned32	RW	Default: 580h + Node ID.
1400	0	1st Receive PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 200h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3
1401	0	2nd Receive PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 300h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3
1402	0	3rd Receive PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 400h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3
1403	0	4rd Receive PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 400h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3

Index (Hex)	Sub-index	Name	Type	Attri-bute	Information
1600	0	1st Receive PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	6040h (Control Word [Data set 1 Word 1])
	2	2st Mapping Object	Unsigned32	RO	2002h (Reference 1 [Data set 1 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	2003h (Reference 2 [Data set 1 Word 3])
1601	0	2nd Receive PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	2007h (Reference 3 [Data set 3 Word 1])
	2	2st Mapping Object	Unsigned32	RO	2008h (Reference 4 [Data set 3 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	2009h (Reference 5 [Data set 3 Word 3])
1602	0	3rd Receive PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	200Dh (Reference 6 [Data set 5 Word 1])
	2	2st Mapping Object	Unsigned32	RO	200Eh (Reference 7 [Data set 5 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	200Fh (Reference 8 [Data set 5 Word 3])
1603	0	4th Receive PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	2013h (Reference 9 [Data set 7 Word 1])
	2	2st Mapping Object	Unsigned32	RO	2014h (Reference 10 [Data set 7 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	2015h (Reference 11 [Data set 7 Word 3])
1800	0	1st Transmit PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 180h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (event-controlled asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3
1801	0	2nd Transmit PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 280h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (event-controlled asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3
1802	0	3rd Transmit PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 380h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (event-controlled asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3
1803	0	4th Transmit PDO Parameter	Unsigned8	RO	Number of entries.
	1	COB ID Used by PDO	Unsigned32	RW	Default: 480h + Node ID.
	2	Transmission Type	Unsigned8	RW	254 (event-controlled asynchronous transmission)
	3	Inhibit Time	Unsigned16	RW	Not supported.
	4	CMS Priority Group	Unsigned8	RW	3

Index (Hex)	Sub-index	Name	Type	Attri-bute	Information
1A00	0	1st Transmit PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	6041h (Status Word [Data set 2 Word 1])
	2	2nd Mapping Object	Unsigned32	RO	2005h (Actual value 1 [Data set 2 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	2006h (Actual value 2 [Data set 2 Word 3])
1A01	0	2nd Transmit PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	200Ah (Actual Value 3 [Data set 4 Word 1])
	2	2nd Mapping Object	Unsigned32	RO	200Bh (Actual Value 4 [Data set 4 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	200Ch (Actual Value 5 [Data set 4 Word 3])
1A02	0	3rd Transmit PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	2010h (Actual Value 6 [Data set 6 Word 1])
	2	2nd Mapping Object	Unsigned32	RO	2011h (Actual Value 7 [Data set 6 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	2012h (Actual Value 8 [Data set 6 Word 3])
1A03	0	4th Transmit PDO Mapping	Unsigned32	RO	Number of mapped application objects.
	1	1st Mapping Object	Unsigned32	RO	2016h (Actual Value 9 [Data set 8 Word 1])
	2	2nd Mapping Object	Unsigned32	RO	2017h (Actual Value 10 [Data set 8 Word 2])
	3	3rd Mapping Object	Unsigned32	RO	2018h (Actual Value 11 [Data set 8 Word 3])
2000	0	Event timer	Unsigned8	RO	Number of entries.
	1	Event 1	Unsigned8	RW	Event timer for transmit PDO1 (PDO1 Tx). Default: 4 (i.e. 40 ms). [1)]
	2	Event 2	Unsigned8	RW	Event timer for transmit PDO2 (PDO2 Tx). Default: 6 (i.e. 60 ms). [1)]
	3	Event 3	Unsigned8	RW	Event timer for transmit PDO3 (PDO3 Tx). Default: 8 (i.e. 80 ms). [1)]
	4	Event 4	Unsigned8	RW	Event timer for transmit PDO4 (PDO4 Tx). Default: 10 (i.e. 100 ms). [1)]

[1)] The event interval time equals the setting multiplied by 10 ms. The value 0 allows the fastest possible event interval time (average 2 ms).

Manufacturer-specific Profile Area

Data Sets

Note: The total number of data sets and data words supported depends on drive type and application program. The data set numbers in the **Information** column are increased by 9 if NCAN-02 configuration parameter DATA SET OFFSET is set to FBA D SET 10.

Sub-index is always 0.

Index (Hex)	Sub-index	Name	Type	Attri-bute	Information
2001	0	Control Word	Integer16	RW	Data set 1 Word 1
2002	0	Reference 1	Integer16	RW	Data set 1 Word 2
2003	0	Reference 2	Integer16	RW	Data set 1 Word 3
2004	0	Status Word	Integer16	RO	Data set 2 Word 1
2005	0	Actual Value 1	Integer16	RO	Data set 2 Word 2
2006	0	Actual Value 2	Integer16	RO	Data set 2 Word 3
2007	0	Reference 3	Integer16	RW	Data set 3 Word 1
2008	0	Reference 4	Integer16	RW	Data set 3 Word 2
2009	0	Reference 5	Integer16	RW	Data set 3 Word 3
200A	0	Actual Value 3	Integer16	RO	Data set 4 Word 1
200B	0	Actual Value 4	Integer16	RO	Data set 4 Word 2
200C	0	Actual Value 5	Integer16	RO	Data set 4 Word 3
200D	0	Reference 6	Integer16	RW	Data set 5 Word 1
200E	0	Reference 7	Integer16	RW	Data set 5 Word 2
200F	0	Reference 8	Integer16	RW	Data set 5 Word 3
2010	0	Actual Value 6	Integer16	RO	Data set 6 Word 1
2011	0	Actual Value 7	Integer16	RO	Data set 6 Word 2
2012	0	Actual Value 8	Integer16	RO	Data set 6 Word 3
2013	0	Reference 9	Integer16	RW	Data set 7 Word 1
2014	0	Reference 10	Integer16	RW	Data set 7 Word 2
2015	0	Reference 11	Integer16	RW	Data set 7 Word 3
2016	0	Actual Value 9	Integer16	RO	Data set 8 Word 1
2017	0	Actual Value 10	Integer16	RO	Data set 8 Word 2
2018	0	Actual Value 11	Integer16	RO	Data set 8 Word 3
2019	0	Reference 12	Integer16	RW	Data set 9 Word 1
201A	0	Reference 13	Integer16	RW	Data set 9 Word 2
201B	0	Reference 14	Integer16	RW	Data set 9 Word 3
201C	0	Actual Value 12	Integer16	RO	Data set 10 Word 1
201D	0	Actual Value 13	Integer16	RO	Data set 10 Word 2
201E	0	Actual Value 14	Integer16	RO	Data set 10 Word 3

Drive Actual Signals and Parameters

The actual signals and parameters available depend on drive type. See the drive documentation 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 *Index* equals ((Drive Param./Signal No.) • 100 + 12288), converted to hexadecimal. For example, the Index for drive parameter 30.19 equals 3019 + 12288 = 15307 = 3BCBh.

Sub-index is always 0.

Drive Parameter/ Signal No.	Index (Hex)	Sub-index	Type	Attribute
ACTUAL SIGNALS				
1.01	3065	0	Integer16	RO
1.02	3066	0	Integer16	RO
• • •	• • •	• • •	• • •	• • •
2.01	30C9	0	Integer16	RO
• • •	• • •	• • •	• • •	• • •
3.01	312D	0	Integer16	RO
• • •	• • •	• • •	• • •	• • •
PARAMETERS				
10.01	33E9	0	Integer16	RW
10.02	33EA	0	Integer16	RW
• • •	• • •	• • •	• • •	• • •
11.01	344D	0	Integer16	RW
• • •	• • •	• • •	• • •	• • •
99.01	56AD	0	Integer16	RW
• • •	• • •	• • •	• • •	• • •

The application error codes are a small subset of the error classes of the PROFIBUS specification (EN 50170). The codes are 4-byte values containing the *Error Class, Error Code,* and *Additional Code* (always 0 with NCAN-02) fields.

Slave to Master

Header	Byte							
	1	2	3	4	5	6	7	8
1101xxxxxxx01000	Command	Object Index		Sub-index	Additional Code		Error Code	Error Class

Error Class	Error Code	Example
5 Service Error	**3** Parameter Inconsistent	Toggle bit not alternated.
	4 Illegal Parameter	Timeout value reached.
6 Access Error	**1** Object Access Unsupported	Attempt to write to a read-only parameter, or to read a write-only parameter.
	2 Object Non-existent	Object does not exist in Object Dictionary.
	6 Hardware Fault	Access failed because of a hardware error.
	7 Type Conflict	Data type does not match.
	9 Object Attribute Inconsistent	The sub-index does not exist.
8 Other Error	**0**	User aborted transfer.

Additional Code	Meaning
0	No precise details for the reason for the error.
10h	Service parameter with an invalid value.
11h	Sub-index does not exist.
12h	Service parameter too long.
13h	Service parameter too short.
20h	Service cannot currently be executed
21h	…because of local control.
22h	…because of present device state.
30h	Value range of parameter exceeded.
31h	Value of parameter too high.
32h	Value of parameter too low.
36h	Maximum value smaller than minimum value.
40h	Incompatibility with other values.
41h	Data cannot be mapped to the PDO.
42h	PDO length exceeded.
43h	General parameter incompatibility.
47h	General internal incompatibility in the device.

Standardised Device Profile Area

Index (Hex)	Sub-index	Name	Type	Attri-bute	Information
6040	0	Control Word	Unsigned16	RW	Data set 1 Word 1.
6041	0	Status Word	Unsigned16	RO	Data set 2 Word 1.
6060	0	Modes of Operation	Integer16	RW	Operation mode.
6061	0	Modes of Operation Display	Integer16	RO	Shows the current mode of operation.

Chapter 7 – Diagnostics

Overview

This chapter describes the functions and indications of the Status LEDs on the NCAN-02 CANopen Adapter Module to help solving problems that may arise.

Status LEDs

There are three status LEDs on the NCAN-02 module, labelled *DDCS, NS* (Network Status) and *MS* (Module Status). The LEDs are bicolour (green/red) with white diffused lens.

The LED indications are as follows:

LED	Mode	Description
DDCS	Flashing Green	DDCS initialisation in progress.
	Green	DDCS communication established.
	Flashing Red	DDCS communication errors.
NS	Flashing Green	Pre-operational – waiting for CANopen "Start" command.
	Green	Node started.
	Red	Network error (see Parameter CUT-OFF TIMEOUT in Chapter 5).
MS	Green	Module OK.
	Red	CAN controller error (CAN controller error bit set, TX queue overrun, cable disconnected or faulty).
DDCS, NS and MS	Flashing Red	SRAM test failed.
	Green -> Red -> Green (approx. 1 second each)	Module self-test.
NS and MS	Flashing Red	ROM checksum test failed.

Appendix A – CANopen Error Codes

This Appendix contains cross-reference tables for different ABB drives. The tables contain the CANopen error register bit number, error code and meaning, as well as the corresponding drive error code and/or message.

If the drive indicates a fault as part of a binary word (Fault Word), the name of the word and the corresponding bit number is given in the Additional Information column. Please note that some fault messages shown on the panel are not available in the binary Fault Words, and vice versa.

The cause and corrective action for each error are given in the drive manuals.

ACS 400

CANopen Error			Drive Fault	
Register Bit	**Code**	**Meaning**	**Name**	**Additional Information**
b0	1000	Generic error	HW error: Sporadic fault interrupt	Fault Word 2, b13
b1	2310	Continuous overcurrent	Overcurrent	Fault Word 1, b0
			Output overload	Fault Word 1, b4
b1	2320	Short circuit / Earth leakage	Fault current	Fault Word 1, b3
b1	2330	Earth leakage	Output earth fault	Fault Word 1, b15
b2	3110	Mains overvoltage	DC overvoltage	Fault Word 1, b1
b2	3130	Phase failure	DC bus ripple too large	Fault Word 1, b11
b2	3220	DC link undervoltage	DC undervoltage	Fault Word 1, b5
b3	4210	Excess temperature device	ACS 400 overtemperature	Fault Word 1, b2
b3	4310	Excess temperature drive	Motor overtemperature	Fault Word 1, b8
b5	5210	Measurement circuit	HW error: Bad analogue input; invalid pulse count	Fault Word 2, b11
b5	5300	Operating unit	Panel loss	Fault Word 1, b9
b5	5530	EEPROM	HW error: Bad or new FPROM	Fault Word 2, b8
			HW error: New FPROM detected	Fault Word 2, b9
			HW error: Unsuccessful FPROM download	Fault Word 2, b10
b5	6320	Parameter error	Parameters inconsistent	Fault Word 1, b10
b5	7121	Motor blocked	Motor stall	Fault Word 1, b12
b5	7510	Serial interface 1	DDCS link	Fault Word 2, b2
b5	7520	Serial interface 2	Serial communication loss	Fault Word 1, b13
b5	8110	Process data monitoring	Analogue input 1 fault	Fault Word 1, b6
			Analogue input 2 fault	Fault Word 1, b7
b5	9000	External error	External fault	Fault Word 1, b14
b7	FF55	Drive specific	HW error: Modulator stalled	Fault Word 2, b15
b7	FF57	Drive specific	Type code error	Fault Word 2, b12
b7	FF5D	Drive specific	Application fault	Fault Word 2, b1
b7	FF5E	Drive specific	HW error: SW assert expired	Fault Word 2, b14
b7	FF6A	Drive specific	Underload	Fault Word 2, b0

ACS 600 - Standard Application Prg. v5.x
ACS 800 - Standard Application Prg. ASXR7xxx

CANopen Error			Drive Fault	
Register Bit	**Code**	**Meaning**	**Name**	**Additional Information**
b0	1000	Generic error	Reserved	System Fault Word, b15
b1	2120	Earth leakage	EARTH FAULT	Fault Word 1, b4
b1	2310	Continuous overcurrent	OVERCURRENT	Fault Word 1, b1
b1	2340	Short circuit	SHORT CIRC	Fault Word 1, b0
			SC (INU1)	Fault Word 1, b12
			SC (INU2)	Fault Word 1, b13
			SC (INU3)	Fault Word 1, b14
			SC (INU4)	Fault Word 1, b15
b2	3130	Phase failure	SUPPLY PHASE	Fault Word 2, b0
b2	3210	DC link overvoltage	DC OVERVOLT	Fault Word 1, b2
b2	3220	DC link undervoltage	DC UNDERVOLT	Fault Word 2, b2
b3	4100	Ambient temperature	AMBIENT TEMP	Fault Word 2, b7
b3	4210	Excess temperature device	ACS 600 TEMP	Fault Word 1, b3
b3	4310	Excess temperature drive	THERMISTOR	Fault Word 1, b5
			MOTOR TEMP	Fault Word 1, b6
b5	5210	Measurement circuit	PPCC LINK	Fault Word 2, b11
b5	5300	Operating unit	PANEL LOSS	Fault Word 2, b13
b5	5530	EEPROM	FLT (F1_4)	System Fault Word, b2
			FLT (F1_5)	System Fault Word, b3
b5	6100	Internal software	The error is specified by the System Fault Word	Check the System Fault Word
b5	6200	User software	USER MACRO	System Fault Word, b1
b5	7000	Additional modules	I/O COMM	Fault Word 2, b6
b5	7121	Motor blocked	MOTOR STALL	Fault Word 2, b14
b5	7123	Motor tilted	OVERFREQ	Fault Word 1, b9
b5	7305	Incremental sensor 1 fault	ENCODER FLT	Fault Word 2, b5
b5	7510	Serial interface 1	COMM MODULE	Fault Word 2, b12
b5	7520	Serial interface 2	CH2 COM LOSS	Fault Word 1, b11
b5	8110	Process data monitoring	AI < MIN FUNC	Fault Word 2, b10
b5	9000	External error	EXTERNAL FLT	Fault Word 2, b8
b7	FF51	Device specific (1)	LINE CONV	Fault Word 1, b10
b7	FF52	Device specific (2)	NO MOT DATA	Fault Word 2, b1

CANopen Error			Drive Fault	
Register Bit	**Code**	**Meaning**	**Name**	**Additional Information**
b7	FF53	Device specific (3)	CABLE TEMP	Fault Word 2, b3
b7	FF54	Device specific (4)	RUN DISABLED	Fault Word 2, b4
b7	FF55	Device specific (5)	OVER SWFREQ	Fault Word 2, b9
b7	FF56	Device specific (6)	MOTOR PHASE	Fault Word 2, b15
b7	FF57	Device specific (7)	FLT (F1_7)	System Fault Word, b0
b7	FF58	Device specific (8)	FLT (F2_12)	System Fault Word, b4
b7	FF59	Device specific (9)	FLT (F2_13)	System Fault Word, b5
b7	FF5A	Device specific (10)	FLT (F2_14)	System Fault Word, b6
b7	FF5B	Device specific (11)	FLT (F2_15)	System Fault Word, b7
b7	FF5C	Device specific (12)	FLT (F2_16)	System Fault Word, b8
b7	FF5D	Device specific (13)	FLT (F2_17)	System Fault Word, b9
b7	FF5E	Device specific (14)	FLT (F2_18)	System Fault Word, b10
b7	FF5F	Device specific (15)	FLT (F2_19)	System Fault Word, b11
b7	FF60	Device specific (16)	FLT (F2_3)	System Fault Word, b12
b7	FF61	Device specific (17)	FLT (F2_1)	System Fault Word, b13
b7	FF62	Device specific (18)	FLT (F2_0)	System Fault Word, b14
b7	FF6A	Device specific (25)	UNDERLOAD	Fault Word 1, b8

ACS 600 - Standard Application Prg. v2.8/3.0

CANopen Error			Drive Fault
Register Bit	**Code**	**Meaning**	**Name**
b1	2120	Earth leakage	EARTH FAULT
b1	2310	Continuous overcurrent	OVERCURRENT
b1	2340	Short circuit	SHORT CIRC
b2	3130	Phase failure	SUPPLY PHASE
b2	3210	DC link overvoltage	DC OVERVOLT
b2	3220	DC link undervoltage	DC UNDERVOLT
b3	4100	Ambient temperature	AMBIENT TEMP
b3	4210	Excess temperature device	ACS 600 TEMP
			THERMISTOR
b3	4310	Excess temperature drive	MOTOR TEMP
b5	5300	Operating unit	PANEL LOSS
b5	6200	User software	USER MACRO
b5	7000	Additional modules	I/O COMM
b5	7121	Motor blocked	MOTOR STALL
b2	7123	Motor tilted	OVERFREQ
b5	7305	Incremental sensor 1 fault	ENCODER ERR
b5	7510	Serial interface 1	COMM MODULE
b5	8110	Process data monitoring	AI < MIN FUNC
b5	9000	External error	EXTERNAL FLT
b7	FF51	Device specific (1)	LINE CONV
b7	FF52	Device specific (2)	NO MOT DATA
b7	FF54	Device specific (4)	RUN DISABLED
b7	FF56	Device specific (6)	MOTOR PHASE
b7	FF63	Device specific (19)	ID RUN FAIL
b7	FF64	Device specific (20)	WRITE PROTCT
b7	FF65	Device specific (21)	ID RUN SEL
b7	FF66	Device specific (22)	PARAM LOCK
b7	FF67	Device specific (23)	MOTOR STARTS
b7	FF68	Device specific (24)	ID N CHANGED
b7	FF69	Device specific (25)	MACRO CHANGE
b7	FF6A	Device specific (26)	UNDERLOAD

ACS 600 – Motion Control Application Prg.

CANopen Error			Drive Fault	
Register Bit	**Code**	**Meaning**	**Name**	**Additional Information**
b1	2120	Earth leakage	EARTH FAULT	Fault Word 1, b16
b1	2310	Continuous overcurrent	OVERCURRENT	Fault Word 2, b6
b1	2340	Short circuit	SHORT CIRC	Fault Word 2, b21
b2	3130	Phase failure	SUPPLY PHASE	Fault Word 1, b3
b2	3210	DC link overvoltage	DC OVERVOLT	Fault Word 2, b5
b2	3220	DC link undervoltage	DC UNDERVOLT	Fault Word 2, b4
b3	4210	Excess temperature device	ACS 600 TEMP	Fault Word 2, b11
b3	4310	Excess temperature drive	MOTOR TEMP	Fault Word 2, b9
b5	5210	Measurement circuit	PPCC LINK	Fault Word 2, b10
b5	6200	User software	USER MACRO	Fault Word 1, b6
b5	7000	Additional modules	I/O CONFIG	Fault Word 1, b10
			I/O COMM	Fault Word 1, b19
b5	7121	Motor blocked	MOTOR STALL	Fault Word 2, b20
b5	7123	Motor tilted	OVERFREQ	Fault Word 2, b23
b5	7305	Incremental sensor 1 fault	ENC COMM ERR	Fault Word 1, b13
b5	7320	Position	POSITION ERR	Fault Word 1, b20
b5	7510	Serial interface 1	COMM MODULE	
b7	FF52	Device specific (2)	NO MOT DATA	Fault Word 1, b9
b7	FF56	Device specific (6)	MOTOR PHASE	Fault Word 2, b22
b7	FF6A	Device specific (25)	UNDERLOAD	Fault Word 2, b2
b7	FF6B	Device specific (26)	ENC SSI ERR	Fault Word 1, b11
b7	FF6C	Device specific (27)	SPD ALT ERR	Fault Word 1, b14
b7	FF6D	Device specific (28)	SPD DIFF ERR	Fault Word 1, b15
b7	FF6E	Device specific (29)	POS LIM ERR	Fault Word 1, b21
b7	FF6F	Device specific (30)	OVERSPEED	Fault Word 1, b22

ACS 600 – Crane Application Program

CANopen Error			Drive Fault	
Register Bit	**Code**	**Meaning**	**Name**	**Additional Information**
b1	2120	Earth leakage	EARTH FAULT	Fault Word 2, bit .4
b1	2310	Continuous overcurrent	OVERCURRENT	Fault Word 2, bit .3
b1	2340	Short circuit	SHORT CIRCUIT	Fault Word 2, bit .11
b2	3130	Phase failure	SUPPLY PHASE	Fault Word 2, bit .13
b2	3210	DC link overvoltage	DC OVERVOLT	Fault Word 2, bit .1
b2	3220	DC link undervoltage	DC UNDERVOLT	Fault Word 2, bit .2
b3	4100	Ambient temperature	AMBIENT TEMP	Fault Word 1, bit .13
b3	4210	Excess temperature device	ACS 600 TEMP	Fault Word 2, bit .7
b3	4310	Excess temperature drive	THERMISTOR	Fault Word 1, bit .14
			MOTOR TEMP	Fault Word 2, bit .8
b5	5210	Measurement circuit	PPCC LINK	Fault Word 2, bit .12
b5	5300	Operating unit	PANEL LOSS	Fault Word 1, bit .11
b5	6200	User software	USER MACRO	Fault Word 2, bit .6
b5	7000	Additional modules	I/O COMM	Fault Word 1, bit .12
b5	7123	Motor tilted	OVERFREQ	Fault Word 2, bit .9
b5	7305	Incremental sensor 1 fault	ENCODER ERR	Fault Word 2, bit .14
b5	7310	Speed (sensor)	MOT OVERSP	Fault Word 1, bit .1
b5	7510	Serial interface 1	COMM MODULE	Fault Word 1, bit .16
b5	7520	Serial interface 2	MF COMM ERR	Fault Word 1, bit .10
b5	9000	External error	EXTERNAL FLT	Fault Word 1, bit .9
b7	FF56	Device specific	MOTOR PHASE	Fault Word 2, bit .5
b7	FF73	Device specific	TORQ FLT	Fault Word 1, bit .2
b7	FF74	Device specific	BRAKE FLT	Fault Word 1, bit .3
b7	FF75	Device specific	TORQ PR FLT	Fault Word 1, bit .5
b7	FF76	Device specific	MAS OSC FLT	Fault Word 1, bit .6
b7	FF77	Device specific	CHOPPER FLT	Fault Word 1, bit .7
b7	FF78	Device specific	INV OVERLO	Fault Word 1, bit .8
b7	FF79	Device specific	MF RUN FLT	Fault Word 1, bit .15
b7	FF7A	Device specific	START INHIBIT	Fault Word 2, bit .10

ACS 1000

CANopen Error			Drive Fault
Register Bit	**Code**	**Meaning**	**Name**
b0	1000	Generic error	Reserved
b5	7510	Serial interface 1	COMM MODULE

DCS 400

CANopen Error			Drive Fault		
Register Bit	**Code**	**Meaning**	**Code**	**Message**	**Additional Information**
b1	2221	Continuous overcurrent no. 2	F 14	ARMATURE OVERCURRENT	Fault Word 1, b13
b1	2222	Continuous overcurrent no. 1	F 13	FIELD OVERCURRENT	Fault Word 1, b12
b2	3110	Mains overvoltage	F 10	MAINS OVERVOLTAGE	Fault Word 1, b9
b2	3120	Mains undervoltage	F 1	AUX VOLTAGE FAULT	Fault Word 1, b0
			F 9	MAINS UNDERVOLTAGE	Fault Word 1, b8
b2	3320	Armature circuit	F 15	ARMATURE OVERVOLTAGE	Fault Word 1, b14
b3	4210	Excess temperature device	F 7	CONVERTER OVERTEMP	Fault Word 1, b6
b3	4310	Excess temperature drive	F 8	MOTOR OVERTEMP	Fault Word 1, b7
b5	5220	Computing circuit	F 2	HARDWARE FAULT	Fault Word 1, b1
b5	6100	Internal software	F 3	SOFTWARE FAULT	Fault Word 1, b2
b5	7121	Motor blocked	F 19	MOTOR STALLED	Fault Word 2, b2
b5	7302	Tacho wrong polarity	F 17	TACHO POLARITY FAULT	Fault Word 2, b0
b5	7305	Incremental sensor 1 fault	F 16	SPEED MEAS FAULT	Fault Word 1, b15
b5	7310	Speed	F 18	OVERSPEED	Fault Word 2, b1
b5	7510	Serial interface 1	F 20	COMMUNICATION FAULT	Fault Word 2, b3
b5	9000	External error	F 22	EXTERNAL FAULT	Fault Word 2, b5
b7	FF0D	Device specific	F 11	MAINS SYNC FAULT	Fault Word 1, b10
b7	FF18	Device specific	F 6	TYPECODE READ FAULT	Fault Word 1, b5
b7	FF19	Device specific	F 4	PAR FLASH READ FAULT	Fault Word 1, b3
b7	FF70	Device specific	F 21	LOCAL CONTROL LOST	Fault Word 2, b4
b7	FF71	Device specific	F 5	COMPATIBILITY FAULT	Fault Word 1, b4
b7	FF72	Device specific	F 12	FIELD UNDERCURRENT	Fault Word 1, b11

DCS 500

CANopen Error			Drive Fault		
Register Bit	**Code**	**Meaning**	**Code**	**Control Panel Text**	**Additional Information**
b1	2120	Earth leakage	F 5	EARTH FAULT	Fault Word 1, b4
b1	2220	Continuous overcurrent	F 2	OVERCURRENT	Fault Word 1, b1
b2	3110	Mains overvoltage	F 30	MAINS OVERVOLTAGE	Fault Word 1, b12
b2	3120	Mains undervoltage	F 1	AUXIL. UNDERVOLTAGE	Fault Word 1, b0
			F 29	MAINS UNDERVOLTAGE	Fault Word 1, b11
b2	3320	Armature circuit	F 28	ARMATURE OVERVOLTAGE	Fault Word 1, b2
b3	4200	Device temperature	F 4	CONVERTER OVERTEMP.	Fault Word 1, b3
b3	4300	Temperature drive	F 6	MOTOR 1 OVERTEMP.	Fault Word 1, b5
			F 48	MOTOR 2 OVERTEMP.	Fault Word 1, b8
b3	4310	Excess temperature drive	F 7	MOTOR 1 OVERLOAD	Fault Word 1, b6
			F 27	MOTOR 2 OVERLOAD	Fault Word 1, b9
b5	7121	Motor blocked	F 23	MOTOR STALLED	Fault Word 2, b14
b5	7305	Incremental sensor 1 fault	F 14	SPEED MEAS. FAULT	Fault Word 2, b5
b5	7310	Speed (sensor)	F 37	MOTOR OVERSPEED	Fault Word 2, b15
b5	7500	Communication (additional)	F 44	I/O-BOARD NOT FOUND	Fault Word 1, b7
b5	7510	Serial interface 1	F 60	FIELDBUS TIMEOUT	Fault Word 3, b13
b7	FF0A	Device specific	F 52	NO BRAKE ACK	Fault Word 1, b10
b7	FF0D	Device specific	F 31	NOT IN SYNCHRONISM	Fault Word 1, b13
b7	FF0E	Device specific	F 32	FIELD EX.1 OVERCURR	Fault Word 1, b14
b7	FF0F	Device specific	F 33	FIELD EX.1 COMERROR	Fault Word 1, b15
b7	FF10	Device specific	F 34	ARM. CURRENT RIPPLE	Fault Word 2, b0
b7	FF11	Device specific	F 35	FIELD EX.2 OVERCURR	Fault Word 2, b1
b7	FF12	Device specific	F 36	FIELD EX.2 COMERROR	Fault Word 2, b2
b7	FF13	Device specific	F 38	PHASE SEQUENCE FAULT	Fault Word 2, b3
b7	FF14	Device specific	F 39	NO FIELD ACK.	Fault Word 2, b4
b7	FF16	Device specific	F 40	NO EXT. FAN ACK.	Fault Word 2, b6
b7	FF17	Device specific	F 41	NO MAIN CONT. ACK.	Fault Word 2, b7
b7	FF18	Device specific	F 17	TYPE CODING FAULT	Fault Word 2, b8
b7	FF19	Device specific	F 18	BACKUP READ FAULT	Fault Word 2, b9
b7	FF1A	Device specific	F 50	NO C FAN ACK	Fault Word 2, b10
b7	FF1B	Device specific	F 20	LOCAL & DISCONNECTED	Fault Word 2, b11
b7	FF1C	Device specific	F 42	FIELD EX.1 NOT OK	Fault Word 2, b12
b7	FF1D	Device specific	F 43	FIELD EX.2 NOT OK	Fault Word 2, b13
b7	FF2E	Device specific	F 66	CURRENT DIFFERENCE	Fault Word 3, b14
b7	FF2F	Device specific	F65	REVERSAL FAULT	Fault Word 3, b15

DCS 600

CANopen Error			Drive Fault		
Register Bit	**Code**	**Meaning**	**Code**	**Control Panel Text**	**Additional Information**
b1	2120	Earth leakage	F 5	EARTH FAULT	Fault Word 1, b4
b1	2220	Continuous overcurrent	F 2	OVERCURRENT	Fault Word 1, b1
b2	3110	Mains overvoltage	F 30	MAINS OVERVOLTAGE	Fault Word 1, b12
b2	3120	Mains undervoltage	F 1	AUXIL. UNDERVOLTAGE	Fault Word 1, b0
			F 29	MAINS UNDERVOLTAGE	Fault Word 1, b11
b2	3320	Armature circuit	F 28	ARMATURE OVERVOLTAGE	Fault Word 1, b2
b3	4200	Device temperature	F 4	CONVERTER OVERTEMP.	Fault Word 1, b3
b3	4300	Temperature drive	F 6	MOTOR 1 OVERTEMP.	Fault Word 1, b5
			F 48	MOTOR 2 OVERTEMP.	Fault Word 1, b8
b3	4310	Excess temperature drive	F 7	MOTOR 1 OVERLOAD	Fault Word 1, b6
			F 27	MOTOR 2 OVERLOAD	Fault Word 1, b9
b5	5300	Operating unit		PANEL LOSS	Fault Word 3, b13
b5	5530	EEPROM	F 18	CON FLASH	Fault Word 3, b14
b5	6100	Internal software		SYSTEM FAULT	Fault Word 3, b7
			F 20	CON-SYSTEM FAULT	Fault Word 3, b15
b5	7121	Motor blocked	F 23	MOTOR STALLED	Fault Word 2, b14
b5	7305	Incremental sensor 1 fault	F 14	SPEED MEAS. FAULT	Fault Word 2, b5
b5	7310	Speed (sensor)	F 37	MOTOR OVERSPEED	Fault Word 2, b15
b5	7500	Communication (additional)	F 44	I/O BOARD NOT FOUND	Fault Word 1, b7
b5	7510	Serial interface 1		DDCS CH. 0 COMM. FAULT	Fault Word 2, b11
b5	7520	Serial interface 2		M/F LINK	Fault Word 3, b11
b7	FF0D	Device specific	F 31	NOT IN SYNCHRONISM	Fault Word 1, b13
b7	FF0E	Device specific	F 32	FIELD EX.1 OVERCURR	Fault Word 1, b14
b7	FF0F	Device specific	F 33	FIELD EX.1 COMERROR	Fault Word 1, b15
b7	FF10	Device specific	F 34	ARM. CURRENT RIPPLE	Fault Word 2, b0
b7	FF11	Device specific	F 35	FIELD EX.2 OVERCURR	Fault Word 2, b1
b7	FF12	Device specific	F 36	FIELD EX.2 COMERROR	Fault Word 2, b2
b7	FF13	Device specific	F 38	PHASE SEQUENCE FAULT	Fault Word 2, b3
b7	FF14	Device specific	F 39	NO FIELD ACK.	Fault Word 2, b4
b7	FF16	Device specific	F 40	NO EXT. FAN ACK.	Fault Word 2, b6
b7	FF17	Device specific	F 41	NO MAIN CONT. ACK.	Fault Word 2, b7
b7	FF18	Device specific	F 17	TYPE CODING FAULT	Fault Word 2, b8
b7	FF1A	Device specific	F 50	NO C FAN ACK	Fault Word 2, b10
b7	FF1C	Device specific	F 42	FIELD EX.1 NOT OK	Fault Word 2, b12
b7	FF1D	Device specific	F 43	FIELD EX.2 NOT OK	Fault Word 2, b13
b7	FF7B	Device specific		CON COMMUNIC	Fault Word 3, b10

Appendix B – Technical Data

DDCS Link

Compatible Devices: All ABB Fieldbus Adapter modules, ABB ACS 400, ACS/ACP/ACC/ACF 600, ACS 800, ACS 1000, DCS 400/500/600 drives

Size of the Link: 2 stations

Medium: Fibre optic cable

- Construction: Plastic core, diameter 1 mm, sheathed with plastic jacket
- Attenuation: 0.31 dB/m
- Maximum Length between Stations: 10 m
- Specifications:

Parameter	Minimum	Maximum	Unit
Storage Temperature	-55	+85	°C
Installation Temperature	-20	+70	°C
Short Term Tensile Force		50	N
Short Term Bend Radius	25		mm
Long Term Bend Radius	35		mm
Long Term Tensile Load		1	N
Flexing		1000	cycles

Topology: Point-to-point

Serial Communication Type: Asynchronous, half Duplex

Transfer Rate: 4 Mbit/s

Protocol: Distributed Drives Communication System (DDCS)

Connectors: Blue – receiver; grey – transmitter

CANopen Network

Size of Network: Max. 128 nodes

Medium: Screened, twisted pair RS-485 cable

- Termination: 120 ohm, 1/4 W, (Metal Film)

Topology: Multi-drop

Serial Communication Type: Asynchronous, half Duplex

Transfer Rate: 1 Mbit/s, 500 kbit/s, 250 kbit/s, 125 kbit/s, 100 kbit/s, 50 kbit/s, 20 kbit/s, or 10 kbit/s

Protocol: CANopen

Standards: CAN in Automation DS 301 *(Application Layer and Communication*, DSP 402 *(Device Profile: Drives and Motion Control),* ISO 11898 *(Controller Area Network [CAN] for High-Speed Communication)*

NCAN-02

Enclosure: Plastic, dimensions 100 × 22.5 × 115 mm (H×W×D); degree of protection IP20

Mounting: Onto a standard mounting rail

Settings: Through drive parameters and/or DIP switches

Current Consumption: 30 mA at 24 VDC

Connectors:

- Light transmitter (grey) and receiver (blue) (Hewlett-Packard Versatile Link) for connection to the drive
- Two Combicon MSTBT 2,5/4-ST (4-pole, cross-section 2.5 mm^2 max.) screw terminal blocks for CAN network and power supply connection:

X1		Description	
1	0 V	DC GND	Power supply ground (0 V). If the power to the module is supplied through the CAN network, this terminal should be left unconnected.
2	UC	+24 VDC	+24 V ±10% (80 mA) d.c. supply to the module. The power can be taken from the drive's internal power supply (see drive manuals), a dedicated external power supply, or through the CAN network. The on-board power supply is disabled if the voltage drops below 11 V.
3	EXT	DC GND	These terminals should be connected together if the power to the module is supplied through the CAN network. This makes the NCAN-02 a non-isolated node.
4		CAN GND	

X2		Description
5	SHLD	Network cable shield.
6	CAN_L	CAN_L bus line.
7	GND	CAN bus ground (digital ground).
8	CAN_H	CAN_H bus line.

General:

- All materials are UL/CSA approved
- Complies with EMC Standards EN 50081-2 and EN 50082-2

Appendix C – Ambient Conditions

Ambient Conditions, Operation

Ambient operating conditions refer to the conditions the option module is subjected to when installed for stationary use.

Air Temperature: 0 to +50 °C

Relative Humidity: 5 to 95%, no condensation allowed. Maximum allowed relative humidity is 60% in the presence of corrosive gases.

Contamination Levels:
Chemical gases: IEC 721-3-3, Class 3C2
Solid particles: IEC 721-3-3, Class 3S2

Installation Site Altitude: 0 to 2000 m above sea level. If the installation site is higher than 2000 m above sea level, please contact your local ABB distributor or office for further information.

Vibration: Max 0.3 mm (2 to 9 Hz), max 1 m/s^2 (9 to 200 Hz) sinusoidal (IEC 68-2-6)

Shock: Max 70 m/s^2, 22 ms (IEC 68-2-27)

Ambient Conditions, Storage

Ambient storage conditions refer to the conditions the option module is subjected to during storage in the protective package.

Temperature: -40 to +70 °C.

Relative Humidity: Less than 95%, no condensation allowed

Atmospheric Pressure: 70 to 106 kPa

Vibration: Max 0.3 mm (2 to 9 Hz), max 1 m/s^2 (9 to 200 Hz) sinusoidal (IEC 68-2-6)

Shock: Max 100 m/s^2, 11 ms (IEC 68-2-27)

Ambient Conditions, Transportation

Ambient transportation conditions refer to the conditions the option module is subjected to during transportation in the protective package.

Temperature: -40 to +70 °C

Relative Humidity: Less than 95%, no condensation allowed.

Atmospheric Pressure: 60 to 106 kPa

Vibration: Max 3.5 mm (2 to 9 Hz), max 15 m/s^2 (9 to 200 Hz) sinusoidal (IEC 68-2-6)

Shock: Max 100 m/s^2, 11 ms (IEC 68-2-27)

Bump: Max 300 m/s^2, 6 ms (IEC 68-2-29)

Free Fall: 250 mm

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