Danfoss

ISD Encoder Box

Operating Instructions
## VLT® ISD Encoder Box

VLT®
THE REAL DRIVE

Contents

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1 General Information

1.1 Important Safety Warnings

⚠WARNING
HIGH VOLTAGE
The ISD 410 servo system contains components which operate at a high voltage when connected to the electrical supply network. A hazardous voltage is present on the servomotors, the power supply module and the connection box whenever they are connected to the mains network. There are no indicators on the servomotor that indicate the presence of mains voltage. This indication is provided on the connection box. Installation, commissioning and maintenance may only be performed by qualified staff. Incorrect installation, commissioning or maintenance can lead to death or serious injury.

⚠WARNING
UNINTENDED START
The ISD 410 servo system contains servomotors which are connected to the electrical supply network and can start running at any time. This may be caused by an external switch, a CAN bus command, a reference signal, or clearing a fault condition. Servomotors and all connected devices must be in good operating condition. A deficient operating condition may lead to death, serious injury, damage to equipment or other material damage when the unit is connected to the electrical supply network. Take suitable measures to prevent unintended starts.

⚠WARNING
DISCHARGE TIME
The servomotors, the connection box and the power supply module contain DC link capacitors, that remain charged for some time after the mains supply is switched off at the power supply module.
To avoid electrical shock, fully disconnect the power supply module from the mains before carrying out any maintenance on the ISD servo system or its components. Wait for at least the time listed below before carrying out maintenance work:

Number	Minimum waiting time (discharge time)
1-60 servomotors	10 minutes
Note: High voltage may still be present even if the LED on the ISD connection box is not lit!	

Table 1.1 Discharge Time

1.2 Copyright

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ISD is a registered trademark.

1.3 Disclaimer

No liability is assumed for any damage or breakdown resulting from:

- Failure to observe the information in the instruction manuals
- Unauthorised modifications to the ISD servo system or its components
- Operator error
- Improper work on or with the ISD servo system or its components.

1.4 Approvals

1.4.1 ISD 410 Servomotor, ISD Encoder Box and ISD Connection Box
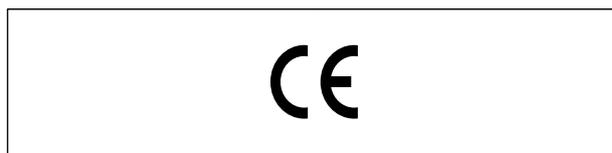
Table 1.2 Approvals for the ISD 410 Servomotor, ISD Encoder Box and ISD Connection Box

1.4.2 ISD Power Supply Module
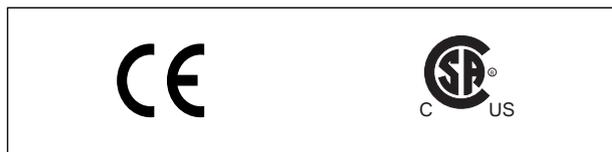
Table 1.3 Approvals for the ISD Power Supply Module

1.5 Service and Support

Contact your local service representative for service and support:
http://www.danfoss.com/Contact/Worldwide/

2 Introduction

2.1 System Overview
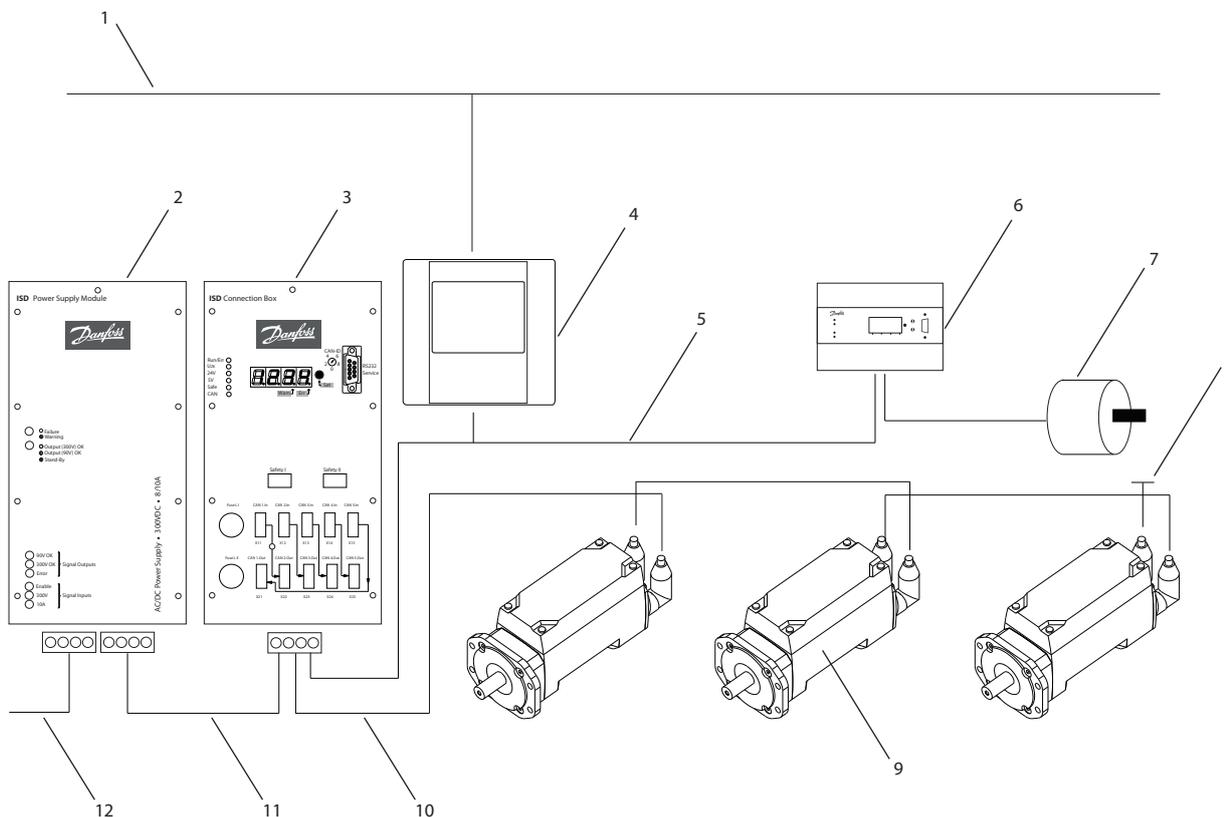
Illustration 2.1 ISD Servo System with 3 Servomotors

Number	Description	Number	Description
1	Ethernet	7	Master encoder
2	Power supply module	8	Terminating resistor
3	Connection box	9	ISD servomotor
4	Master	10	Hybrid cable (DC & CAN)
5	CAN line	11	DC line
6	Encoder box	12	AC line

Table 2.1 Legend to *Illustration 2.1*

The servomotors are self-contained distributed drives, which means that the drive electronics is housed together with the motor in the same casing. The motion control software also runs independently in the servomotor; which reduces the load on the higher-level control system.

A master system controls the servomotors. In this system servomotors operated in a DC group are controlled by a master system.

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Several motors can be operated in a group using a hybrid cable. This cable carries the DC supply voltage and the CAN bus signals. The ISD 410 servo system is designed to accommodate up to 60 ISD 410 servomotors and consists of:

- 1 Power supply module
- 1 Connection box
- 1 Encoder Box
- Servomotors
- 1 Master
- Hybrid cables

NOTE
The ISD 410 servomotors cannot be used in other servo systems from other manufacturers!
Motors from other manufacturers cannot be used in the Danfoss ISD 410 servo system!

2.2 Terminology

ISD	Integrated Servo Drives
ISD servo system	Complete system including all components.
ISD master	Control system hardware
ISD master system	Control system hardware and software
ISD servo drive	ISD servomotor with hybrid cable

Table 2.2 Terminology

2.3 Purpose of the Operating Instructions

The purpose of these operating instructions is to describe the Danfoss ISD encoder box exclusively in the context of a Danfoss ISD 410 servo system.

These operating instructions contain information about:

- Installation
- Commissioning
- Operation
- Troubleshooting
- Maintenance and repair

These operating instructions are intended for use by qualified personnel. Read these operating instructions in full in order to use the servo system safely and professionally, and pay particular attention to the safety instructions and general warnings. These operating instructions are an integral part of the ISD encoder box. Keep these operating instructions available with the servo system at all times.

Compliance with the information in the operating instructions is a prerequisite for:

- Trouble-free operation
- Recognition of product liability claims

Therefore, read these operating instructions before working with the encoder box!

The operating instructions also contain important service information. The operating instructions should therefore be kept close to the encoder box.

2.4 Additional Resources

Available documents for the ISD 410 servo system:

Document	Contents
VLT® ISD 410 Servomotor Operating Instructions	Information about the commissioning and operation of the servomotors
VLT® ISD Encoder Box Operating Instructions	Information about the commissioning and operation of the encoder box
VLT® ISD Connection Box Operating Instructions	Information about the commissioning and operation of the connection box
VLT® ISD Power Supply Module Operating Instructions	Information about the commissioning and operation of the power supply module
VLT® ISD 410 Design Guide	Information about the construction and commissioning of the ISD 410 servo system

Table 2.3 Available Documents for the ISD 410 Servo System

Technical literature for Danfoss drives is also available online at http://www.danfoss.com/BusinessAreas/DrivesSo-lutions/Documentations/Technical+Documentation.htm.

Firmware updates may be available. When firmware updates are available, they can be downloaded from the www.danfoss.com website. For further information see the *VLT® ISD 410 Design Guide.*

3 Safety Instructions

3.1 Symbols used in this Manual

The following symbols are used in this document.

⚠WARNING

Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠CAUTION

Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices.

CAUTION

Indicates a situation that may result in equipment or property-damage-only accidents.

NOTE

Indicates highlighted information that should be regarded with attention to avoid mistakes or operate equipment at less than optimal performance.

3.2 General

The following safety instructions and precautions relate to the ISD 410 servo system. The number of servomotors in the servo system is not significant.
Read the safety instructions carefully before starting to work in any way with the servo system.
Pay particular attention to the safety instructions in the relevant sections of this instruction manual.
Also observe the safety instructions and precautions in the instruction manuals for the other system components.

⚠WARNING

HIGH VOLTAGE
The ISD 410 servo system contains components which operate at a high voltage when connected to the electrical supply network.
A hazardous voltage is present on the servomotors, the power supply module and the connection box whenever they are connected to the mains network.
There are no indicators on the servomotor that indicate the presence of mains voltage. This indication is provided at the connection box. Installation, commissioning and maintenance may only be performed by qualified staff. Incorrect installation, commissioning or maintenance can lead to death or serious injury.

⚠WARNING

HAZARDOUS SITUATION
If the servomotor or the bus lines is/are incorrectly connected, there is a risk of death, serious injury or damage to the unit.
Always comply with the instructions within these operating instructions, as well as national and local safety regulations. Also read the operating instructions for the other components of the servo system.

3.3 Safety Instructions and Precautions for the ISD 410 Servo System

Read the safety instructions carefully before starting to work in any way with the servo system. Compliance with the safety instructions and precautions is necessary at all times.

- Orderly and proper transport, storage, fitting and installation, as well as careful operation and maintenance, are essential for the trouble-free and safe operation of this servo system and its components.

- Only suitably trained and qualified staff may work on the servo system and its components or in its vicinity. See chapter *3.4 Qualified Personnel*.

- Use only accessories and spare parts approved by the manufacturer.

- Comply with the specified ambient conditions.

- The information in these operating instructions about the use of available components is provided solely by way of examples of applications and suggestions.

- The plant engineer or system engineer is personally responsible for checking the suitability of the supplied components and the information provided in this document for the specific application concerned:

    - for compliance with the safety regulations and standards relevant to the specific application concerned.

    - for implementing the necessary measures, changes and extensions.

- Commissioning the servo system and its components is not allowed until it has been ascertained that the machine, system or plant in which they are installed conforms to the statutory provisions, safety regulations and standards that apply in the country of use to that application.

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- Operation is allowed only in compliance with the national EMC regulations for the application concerned.

- See the *VLT® ISD 410 Design Guide* for information regarding EMC-compliant installation of the servo system.

- Compliance with the limit values specified by national regulations is the responsibility of the producer of the plant, system or machine.

- Compliance with the specifications, connection conditions and installation conditions in this instruction manual is mandatory.

- The safety regulations and safety provisions of the country in which the equipment is used must be observed.

- Care must be taken to ensure that orderly protective earthing of the equipment, which protects the user against the supply voltage and protects the power supply module against overload, is performed in accordance with local and national regulations.

- Overload protection for the servomotor can be programmed using the master system. For more information, see *Programming* in the *VLT® ISD 410 Design Guide*.

- Do not remove or replace the SD card on the encoder box during operation, otherwise the contents of the SD card could be destroyed. Switch the encoder box off and wait 10 seconds before removing the SD card.

⚠WARNING

EARTHING HAZARD

For reasons of operator safety, the components of the servo system must be earthed correctly in accordance with national or local electrical regulations and the information in these operating instructions. The earth leakage current is greater than 3.5 mA. Improper earthing of the servomotor may result in death or serious injury.

Operational Safety

- Safety-related applications are allowed only if they are explicitly and unambiguously mentioned in the *VLT® ISD 410 Design Guide*. Otherwise they are not allowed.

- All applications that can cause hazards to people or damage to property are safety-related applications.

- The stop functions implemented in the software of the master system do not interrupt the mains voltage supply to the power supply module and are therefore not allowed to be used as safety switches for the servo system.

- The motor can be brought to a stop by a software command or a zero speed setpoint, but DC voltage remains present on the servomotor and/or mains voltage in the power supply module. If personal safety considerations (e.g. risk of personal injury caused by contact with moving machine parts after an unintended start) make it necessary to ensure that an unintended start cannot occur, these stop functions are not sufficient. In this case the servo system must be detached from the mains network or a suitable stop function must be implemented.

- When the servomotor is stopped, it may start up again on its own if the circuitry of the servomotor is defective or after the elimination of a temporary overload, a problem with the supply voltage or a problem with the servomotor. If personal safety considerations (e.g. risk of personal injury caused by contact with moving machine parts after an unintentional start) make it necessary to ensure that an unintended start cannot occur, the normal stop functions of the servomotor are not sufficient. In this case the servo system must be disconnected from the mains network or a suitable stop function must be implemented.

- The servomotor may start running unintentionally during parameter configuration or programming. If this can pose a risk to personal safety (e.g. risk of personal injury due to contact with moving machine parts), unintended motor starting must be prevented, for example by using the Safe Stop function or by safe disconnection of the servomotors.

- Do not disconnect the cables from the servomotor while the servo system is connected to mains voltage. Ensure that the mains supply is disconnected and the required waiting time has elapsed before disconnecting or connecting the hybrid cable or disconnecting cables from the connection box and/or the power supply module.

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- In addition to the L1, L2 and L3 supply voltage inputs on the power supply module, the servo system has other supply voltage inputs, including external DC 24 V. Before commencing repair work, check that all supply voltage inputs have been switched off and that the necessary discharge time for the intermediate circuit capacitors has elapsed.

- The supply of power to the servo system must be switched off for repair work. Before disconnecting or connecting the hybrid cable or disconnecting cables from the connection box and/or the power supply module, ensure that the mains supply is disconnected and the necessary discharge time has elapsed.

⚠WARNING

DISCHARGE TIME

The servomotors, the connection box and the power supply module contain DC link capacitors, that remain charged for some time after the mains supply is switched off at the power supply module.
To avoid electrical shock, fully disconnect the power supply module from the mains before carrying out any maintenance on the ISD servo system or its components. Wait for at least the time listed below before carrying out maintenance work:

Number	Minimum waiting time (discharge time)
1-60 servomotors	10 minutes
Note: High voltage may still be present even if the LED on the ISD connection box is not lit!	

Table 3.1 Discharge Time

CAUTION

Never connect or disconnect the hybrid cable to or from the servomotor when voltage is present. Doing so will damage the electronic circuitry. Observe the discharge time for the DC link capacitors.

3.4 Qualified Personnel

Installation, commissioning and maintenance of the ISD 410 servo system may only be carried out by qualified personnel.
For the purposes of this document and the safety instructions in this document, qualified staff are trained staff who are authorised to fit, install, commission, earth and label equipment, systems and circuits in accordance with the standards for safety technology and who are familiar with the safety concepts of automation engineering.

Additionally, the personnel must be familiar with all the instructions and safety measures described in these operating instructions.
They must have suitable safety equipment and be trained in first aid.

3.5 Due Diligence

The operator and/or fabricator must ensure that:

- the servo system and its components are used only as intended

- the components are operated only in a perfect operational condition

- the operating instructions are always available near the servo system in complete and readable form

- the servo system and its components are fitted, installed, commissioned and maintained only by adequately qualified and authorised personnel

- these personnel are regularly instructed on all relevant matters of occupational safety and environmental protection, as well as the contents of the operating instructions and in particular the instructions it contains

- the product markings and identification markings applied to the components, as well as safety and warning instructions, are not removed and are always kept in a legible condition

- the national and international regulations regarding the control of machinery and equipment, that are applicable at the place of use of the servo system, are complied with

- the users always have all current information relevant to their interests about the servo system and its use and operation

3.6 Intended Use

The components of the ISD servo system are intended to be installed in machines used in commercial and industrial environments.

To ensure that the product is used as intended, the following conditions must be fulfilled before use:

- Everyone who uses Danfoss products in any manner must read and understand the corresponding safety regulations and the description of the intended use

- Hardware must be left in its original state, which means that no structural changes may be made to the hardware

- Software products may not be reverse-engineered and their source code may not be altered

- Damaged or faulty products may not be installed or put into service

- It must be ensured that the products are installed in conformance with the regulations mentioned in the documentation

- Any specified maintenance and service intervals must be observed

- All protective measures must be complied with

- Only the components described in these operating instructions may be fitted or installed. Third-party devices and equipment may be used only in consultation with Danfoss

- The documentation must be read completely and correctly followed

The servo system **may not** be used in the following application areas:

- Areas with potentially explosive atmospheres

- Mobile or portable systems

- Floating or airborne systems

- Inhabited facilities

- Sites where radioactive materials are present

- Areas with extreme temperature variations or in which the maximum rated temperatures may be exceeded

- Under water

3.7 Foreseeable Misuse

Any use not expressly approved by Danfoss constitutes misuse. This also applies to failure to comply with the specified operating conditions and applications.

Danfoss assumes no liability of any sort for damage attributable to improper use.

4 Description

The encoder box is intended to be used in an environment where several servo drives require an exact position in order to follow a specific curve profile, or to determine the speed at which the machine is running. The position can be read either from an externally connected encoder or from a software encoder simulation running on the encoder box.

- The encoder box reads the position values from an absolute or incremental encoder, applies a precise timestamp and sends them periodically to the CAN.

- DS301 and DS406 of the CAN-CiA-Standard are implemented in the encoder box.

- The object dictionary is detailed in the *VLT® ISD 410 Design Guide*.

- The encoder box fulfils the requirements of class 2 encoders according to the DS406 CAN standard.

- When simulating the encoder the speed and ramp can be set.

- If an error or unexpected event occurs the encoder box transmits an emergency message (error code).

- Every error is logged in the encoder box memory and remains in the error history. However a maximum of 6 errors and 6 warnings are saved and older events are overwritten (first-in-first-out principle).

4.1 Supported Encoders

Encoder	Description
SSI	All single-turn SSI encoders are compatible up to 28 bit.
SSI-CRC	All single-turn SSI-CRC encoders are compatible up to 28 bit. The CRC Polynomial is fixed and the CRC-Check can be enabled or disabled.
QEP	All QEP encoders are compatible up to 24 bit.
BiSS	All single-turn BiSS encoders are compatible up to 32 bit. The CRC polynomial can be parameterised.

Table 4.1 Supported Encoders

4.2 ISD Encoder Box Display

The display shows the operating status of the encoder box.
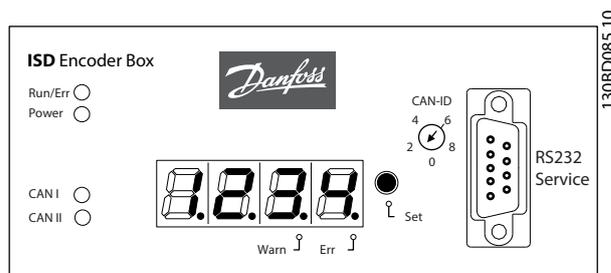
Illustration 4.1 Encoder Box Display

See chapter *7.1 Operating Display* for detailed information on the display.

4.3 Connection Cable/Cabling

The encoder box is connected to the ISD servo system via the CAN bus.
The encoder is connected via an RS 422 interface.
The maximum cable length between the encoder box and the encoder is limited to 50 m, other than BiSS encoders with CRC at 8 MHz, which are limited to 10 m.

4.3.1 ISD Servo System with 1 Connection Box

The ISD servo system is set up with 1 connection box when the servomotors are used in ISD curve mode.
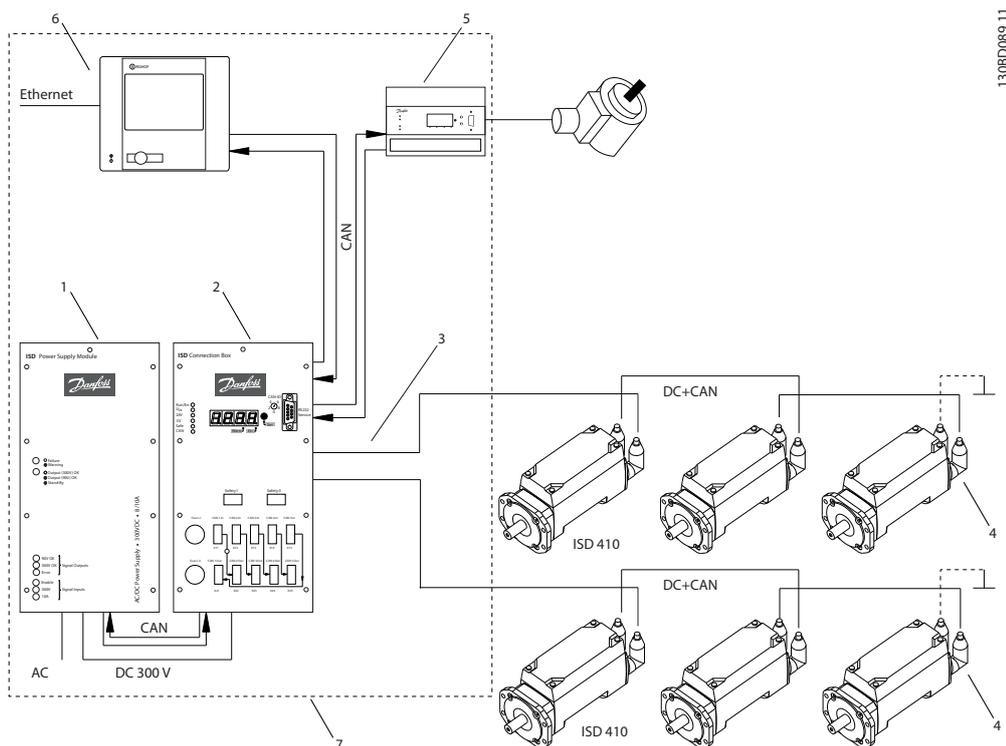
Illustration 4.2 ISD Servo System with 1 ISD Connection Box

No.	Name	Line Type	Cross-section	Flexible Cable
1	ISD Power Supply Module	–	–	–
2	ISD Connection Box	–	–	–
3	Feed cable	Hybrid cable (DC & CAN)	1 mm² / 2.5 mm²	X (only with 2.5 mm²)
4	Terminating resistor	Connector with terminating resistor	–	–
5	ISD Encoder Box	–	–	–
6	Master	–	–	–
–	Ethernet	Ethernet cable	4 x 2 x 0,27 mm², shielded twisted pairs (CAT 5)	X
–	CAN line	CAN cable (screened)	4 x 0.25 mm²	–
–	Encoder line	Encoder cable	4 x 0.25 mm²	–
–	Loop cable	Hybrid cable (DC & CAN)	1 mm² / 2.5 mm²	X (only with 2.5 mm²)
–	DC cable	Single wire	1.5 mm²	–
–	AC feed	Single wire	1.5 mm²	–

Table 4.2 Legend to *Illustration 4.2*

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4.3.2 ISD Servo System with 2 Connection Boxes

The ISD servo system is set up with 2 connection boxes if the maximum number of servomotors for one connection box is reached or the application requires more power.

The encoder box has 2 different CAN lines (CAN I and CAN II). Both of them use the same CAN-ID.

If there is a machine with ISD 410 servomotors that are split up in 2 separate CAN lines and all of them have to listen to the same encoder value, the encoder box CAN I should be put on the first line and the encoder box CAN II on the second line. Hereby, the drives can operate synchronously with the same guide value. CAN line II can be enabled or disabled via the SD card parameter *(General.SecondCANLineEnable)*.
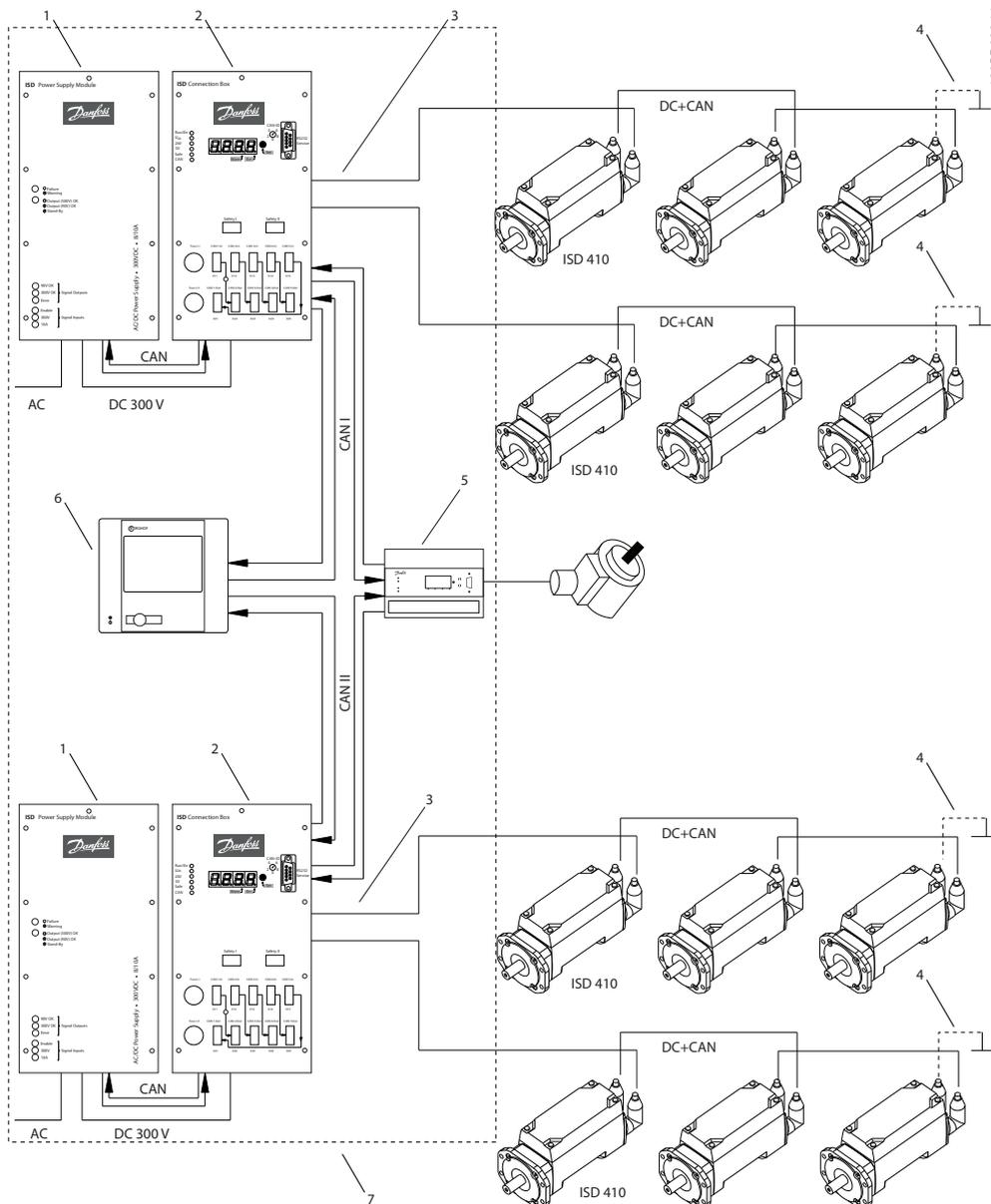

Illustration 4.3 ISD Servo System with 2 ISD Connection Boxes

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No.	Name	Line Type	Cross-section	Flexible Cable
1	ISD Power Supply Module	–	–	–
2	ISD Connection Box	–	–	–
3	Feed cable	Hybrid cable (DC & CAN)	1/2.5 mm²	X (only with 2.5 mm²)
4	Terminating resistor	Connector with terminating resistor	–	–
5	ISD Encoder Box	–	–	–
6	Master	–	–	–
7	Control Cabinet	–	–	–
–	Ethernet	Ethernet cable	4 x 2 x 0.27 mm², shielded twisted pairs (CAT 5)	X
–	CAN line	CAN cable (screened)	4 x 0.25 mm²	–
–	Encoder line	Encoder cable	4 x 0.25 mm²	–
–	Loop cable	Hybrid cable (DC & CAN)	1/2.5 mm²	X (only with 2.5 mm²)
–	DC cable	Single wire	1.5 mm²	–
–	AC feed	Single wire	1.5 mm²	–

Table 4.3 Legend to *Illustration 4.3*

4.3.3 Connections
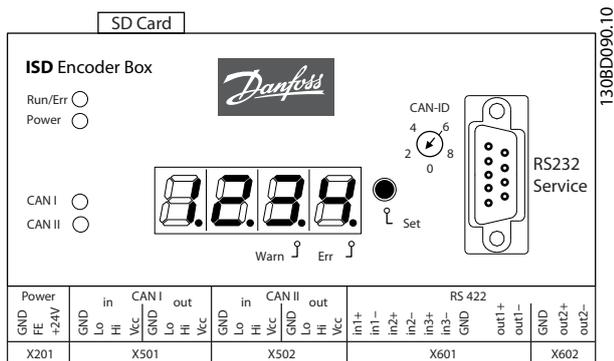
Illustration 4.4 Connections on the ISD Encoder Box

Inscription	Function	Designation
Power	24 V Power supply	X201
CAN I (in / out)	Connection CAN line I	X501
CAN II (in / out)	Connection CAN line II	X502
RS 422-I	Connection encoder I	X601
RS 422-II	Connection encoder II (currently not in use)	X602
SD	SD card slot	–

Table 4.4 Connections on the ISD Encoder Box

4.3.3.1 24 V Power Supply (X201)
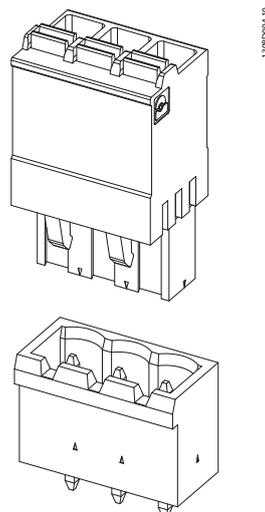
Illustration 4.5 24 V Housing and Plug

Pin	Signal	Description	Cross-Section
1	GND_24 V	Power Supply Input (DC Ground)	1 mm²
2	FE	Functional- Earth connection	1 mm²
3	+24 V	Power Supply Input (DC 24 V)	1 mm²

Table 4.5 Connector Pin Assignment

4.3.3.2 CAN Connector (X501 & X502)
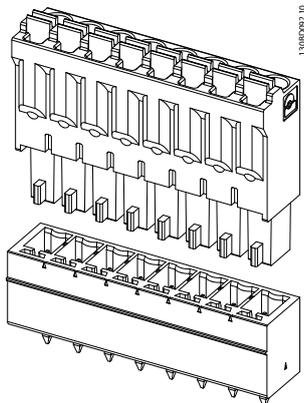
Illustration 4.6 CAN Housing and Plug

| Pin	Signal	Description	Cross-Section
1	CAN I in GND	CAN Power Supply Input (Ground)	0.5 mm²
2	CAN I in Lo	CAN Low Signal Input	0.5 mm²
3	CAN I in Hi	CAN High Signal Input	0.5 mm²
4	CAN I in V_{CC}	CAN Power Supply Input (+5 V)	0.5 mm²
5	CAN I out GND	CAN Power Supply Output (Ground)	0.5 mm²
6	CAN I out Lo	CAN Low Signal Output	0.5 mm²
7	CAN I out Hi	CAN High Signal Output	0.5 mm²
8	CAN I out V_{CC}	CAN Power Supply Output (+5 V)	0.5 mm²

Table 4.6 Connector Pin Assignment

The input and output pin assignment of the CAN plug connectors is the same for CAN lines I and II.

4.3.3.3 RS 422 I; AB, BiSS and SSI Encoder Connector (X601)
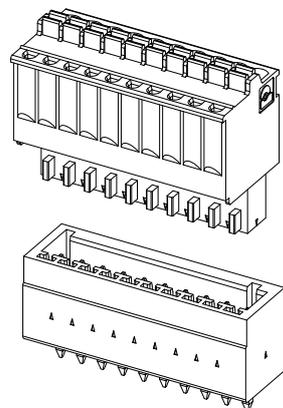
Illustration 4.7 RS 422 I Housing and Plug

Pin	Signal	Function		
		BiSS	SSI	QEP
1	in1+	–	–	A
2	in1–	–	–	/A
3	in2+	–	–	B
4	in2–	–	–	/B
5	in3+	D+	D+	0
6	in3–	D–	D–	/0
7	GND	GND	GND	GND
8	n.c.	–	–	–
9	out1+	CLK+	CLK+	–
10	out1–	CLK–	CLK–	–

Table 4.7 Connector Pin Assignment

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4.3.3.4 RS 422 II; Additional Encoder Connector (X602)

130BD091.10

Illustration 4.8 RS 422 II Housing and Plug

Pin	Signal	Function
1	GND_24 V	–
2	out2+	–
3	out2–	–

Table 4.8 Connector Pin Assignment
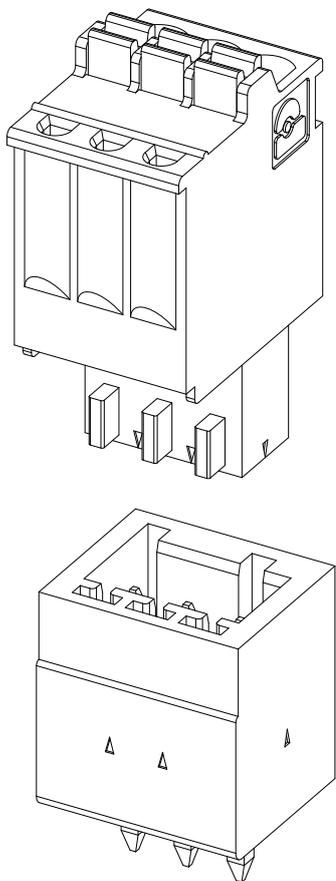
4.3.3.5 SD Card Slot

Slot for standard SD card with maximum 2 GB memory. The memory card must be formatted using file-system FAT16.
SDHC-SD is not supported.

CAUTION
Do not remove or replace the SD card during operation, otherwise the contents of the SD card could be destroyed. Switch the encoder box off and wait 10 seconds before removing the SD card

5 Installation/Fitting

5.1 Transport and Delivery

5.1.1 Scope of Delivery

The scope of delivery of the ISD Encoder Box comprises:

- The encoder box
- 1 SD card, pre-formatted with software installed
- 1 set of plug connectors (see chapter *4.3.3 Connections*)
- These operating instructions

5.1.2 Transport

The maximum weight of a packaged encoder box is approximately 2.5 kg.

- Avoid vibration during transportation.
- Avoid heavy impacts and blows.

5.1.3 Inspection on Receipt

After receiving the delivery, immediately check whether the scope of delivery matches the shipping documents. Danfoss will not honour claims for faults registered at a later time.

Register a complaint immediately:

- with the carrier in case of visible transport damage;
- with the responsible Danfoss representative in case of visible defects or incomplete delivery.

5.2 Safety Measures during Installation

Always observe the safety instructions in chapter *3 Safety Instructions* during installation.

Pay particular attention to ensuring that the following points are observed carefully:

- Installation may only be performed by qualified staff.
- Installation must be performed with due care and attention.

- All safety regulations and protective measures are complied with, and the environmental conditions are observed.
- The documentation is read and understood.

5.3 Installation Environment

Environmental Conditions

The installation must provide the following environmental conditions to allow the encoder box to be operated safely and efficiently.

- The allowable operating ambient temperature range is not exceeded.
- The relative humidity is ≤ 85%, non-condensing.
- The vibration level is ≤ 1 g / 20 m/s^2 without resonance excitation.
- Unrestricted ventilation is available.
- The maximum operating temperature is 40 °C. A control cabinet climate control should be used if necessary.

Contact Danfoss if it is not possible to comply with these environmental conditions.

5.4 Preparation for Installation

Mount the DIN rail on the back wall of the control cabinet.

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5.5 Mechanical Installation

5.5.1 Earthing (Grounding) the Encoder Box

A dedicated PE line is required for the encoder box. Use the faston connector on the rear of the encoder box to earth (ground) the unit.

5.5.2 Mounting

CAUTION
Do not squash the PE line.

1. Hook the encoder box onto the DIN-rail.

2. Press the lower part of the encoder box onto the DIN-rail until it clicks into place.

5.5.3 Demounting

1. Push the encoder box upwards to release it from the DIN-rail.

2. Pull the encoder box towards you.

5.6 Electrical Installation

For the electrical connection, the relevant local and national regulations must be observed in addition to the information in these operating instructions.

5.6.1 Electrical Environmental Conditions

Compliance with the following electrical environmental conditions is necessary to enable safe and effective operation of the encoder box:

- Mounting in a control cabinet
- Suitable DC 24 V power supply unit (see chapter *5.6.2 24 V Power Supply Requirements*)
- PE line
- Observe national statutory provisions

5.6.2 24 V Power Supply Requirements

The encoder box must be supplied with DC 24 V power supply with the following properties:

- Input range: DC 18–30 V
- Overload protection (for 30 V) 33.3 V
- Reverse voltage protection
- A PTC ("Polyswitch") resistor can be used for over-voltage protection and reverse voltage protection; tripping current: 2.2 A
- Power input: 110 mA current demand

NOTE
Use a 24 V power supply which is CE marked according to the standards EN 61000-6-2 and EN 61000-6-4 or similar for industrial use. The power supply can only be used for the ISD system.

5.6.3 Connecting the CAN Cable

The CAN cable connects the encoder box to the ISD servo system.

1. Assemble the CAN cable according to the connector pin assignment in chapter *4.3.3 Connections*.

2. Lay the CAN cable according to the local conditions.

3. Connect the CAN cable to the encoder box and the connection box.
   Use CAN line I if only 1 CAN line is being used.
   Pay attention to the correct CAN cable number when 2 CAN cables (for 2 connection boxes) are being used.
   Observe the connection diagrams in chapter *4.3 Connection Cable/Cabling*.

5.6.4 Connecting the Encoder Cable

The encoder cable connects the encoder to the encoder box.

1. Assemble the encoder cable according to the connector pin assignment in chapter *4.3.3 Connections*.

2. Lay the encoder cable according to the local conditions.

3. Connect the encoder cable to the encoder box.

5.6.5 Inserting the SD Card

NOTE
The SD card delivered with the encoder box is pre-formatted and contains the necessary parameter file. If the SD card has to be replaced, the new SD card must be formatted and the parameter file copied to it before use. See chapter*4.3.3.5 SD Card Slot* for further information about formatting the SD card.

1.   Insert the SD card into the slot above the display.

5.6.6 Connecting the 24 V Power Supply

1.   Assemble the power supply cable according to the connector pin assignment in chapter *4.3.3 Connections*.

2.   Connect the power supply as described in the manual for the power supply.

5

6 Commissioning

6.1 Standard Configuration

In the standard configuration the encoder box can read the positions from the following encoder types:

- SSI
- SSI-CRC
- BiSS
- QEP
- Encoder Box internal encoder simulation

In the default setting the position value is transmitted every 5 ms.
The encoder box is controlled via CAN commands. When the encoder box is ready for operation the various encoder sources can be selected and the input can be started and stopped at any time.
The encoder type currently being used can be read from the object dictionary.

6.2 Parameter Setting

6.2.1 Encoder Box Parameter List

The encoder box parameters are saved on the SD card under the filename "MPARAM.dat".

The encoder box parameter list is loaded when the encoder box is switched on. At the same time the software checks that all fields exist. Missing or incorrectly written parameters are set to 0, except the CAN-ID, which is set to 127.

The encoder box can still be started and operated normally even when a value is missing. It is recommended that the encoder box parameter list contains all fields, even if these are not used or the value is set to 0.

If the encoder box parameter list is missing, the encoder box cannot be started and error code "Err2" is shown on the 7-segment display.

The complete encoder box parameter list can be found in chapter *12.2 Encoder Box Parameters*.

6.2.2 Changing the Parameters

In order to modify the encoder-specific parameters, the parameters in the encoder box parameter list must be changed.

Proceed as follows:

CAUTION

Do not remove or replace the SD card during operation, otherwise the contents of the SD card could be destroyed. Switch the encoder box off and wait 10 seconds before removing the SD card.

1. Switch the encoder box off and wait 10 seconds.
2. Remove the SD card.
3. Change the parameters on the SD card on a PC using the text editor.
4. Replace the SD card in the encoder box.
5. Switch the encoder box on.

6.2.3 CAN Settings

The encoder box has 2 different CAN lines (CAN I and CAN II). Both of them use the same CAN-ID. See chapter *4.3.2 ISD Servo System with 2 Connection Boxes* for further information.

CAN line II can be enabled or disabled via the SD card parameter (*General.SecondCANLineEnable*).

Available CAN bit rates are 50, 125, 250, 500 and 1000 kBaud. The encoder box is preset to 500 kBaud. This parameter can be configured via the SD card parameter (*General.BitRate*) or by writing the bit rate to the corresponding object in the object dictionary.

To activate this parameter, carry out a restart or an NMT reset.

6.2.4 CAN-ID Setting

The *General.BaseCanId* and *General.DefaultCanId* are preset to 100. All the settings can also be read from the object dictionary.

There are several ways to set/change the CAN-ID. The easiest way is setting via the BCD switch.

BCD switch is set to 0

- The CAN-ID specified as *General.DefaultCanId* on the SD card will be used.

- The ISD ID distribution protocol can be used to give another ID to the box. Note that the ID will be stored on the SD card as the new *General.DefaultCanId*

BCD switch is set to between 1 and 9

- The CAN-ID is calculated by *General.BaseCanId* + the value of the BCD switch.

The message for the ID setting over CAN bus is shown in the table below. Note that the first 4 bytes have to be 0, otherwise the encoder box ignores the ID setting message. This is also the case if the BCD switch is not set to 0. After this message is sent, the new CAN-ID will start flashing on the encoder box display. Press the <SET> button on the encoder box to accept the new ID. The encoder box will only leave this ID setting mode following the acceptance of the new ID or after an NMT reset.

Note that the other ISD servo system components will also be in ID setting mode after this message is sent, so an "NMT reset communication" message has to be sent to release all devices from this mode.

Note that whilst in ID setting mode, it is not possible to communicate with the device.

COB-ID	Byte 0	Byte 1	Byte 2	Byte 3	Byte 4	Byte 5
0x7F2	0		0		new CAN-ID	

Table 6.1 ISD ID Setting Message

6.3 Switching the Encoder Box on

Ensure that the SD card is inserted and that the encoder box parameter file (MPARAM.dat) exists before switching on the encoder box. If not, the encoder box cannot be started and error code "Err2" is shown on the 7-segment display.

This error can only be reset by inserting an SD card (with a valid parameter file) and carrying out a re-start (removing and replacing the mains supply plug).

Furthermore, the CAN bus and the encoder must be connected to the encoder box correctly.

For the servo system to function correctly, all components must be wired correctly. Read the operating instructions of the other ISD components carefully.

Switching on (booting up)

The encoder box parameter file (MPARAM.dat) contains the parameter list and is automatically read after the encoder box is switched on.

The pre-configuration of the defined objects for the chosen encoder takes place. During this initialisation phase, the LED "Run / Err." flashes green.

CAUTION

Do not remove or replace the SD card during operation, otherwise the contents of the SD card could be destroyed. Switch the encoder box off and wait 10 seconds before removing the SD card.

7 Operation

7.1 Operating Display

The display shows the operating status of the encoder box.
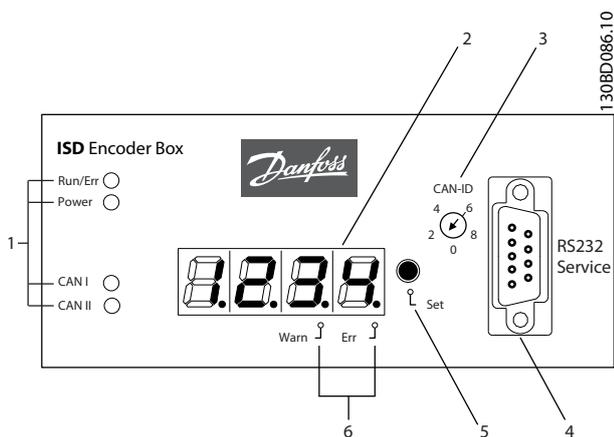
Illustration 7.1 Encoder Box Display

1	Operating LEDs	4	Service interface
2	7-segment display	5	<SET> push button
3	BCD switch	6	Segment dots

Table 7.1 Legend to *Illustration 7.1*

7.1.1 Operating LEDs

The operating LEDs show the operating status.

LED	Description
Run/Err. (green/red)	• Constant light (green): Normal operation • Flashing LED (green): Encoder box is being initialised. • Constant light (red): Active encoder box error
"Power" (green)	• Constant light (green): 24 V power supply is connected
CAN I (green/red)	• Flashing LED (green): CAN communication on line I • Constant light (red): CAN error on line I
CAN II (green/red)	• Flashing LED (green): CAN communication on line II • Constant light (red): CAN error on line II

Table 7.2 Description of the Operating LEDs

7.1.2 Display Mode

The CAN-ID, warnings and error codes can be displayed on the 7-segment display.

A dot at the bottom right of the display segment shows the respective type of indicator. The sequence of the display occurs as demonstrated in the graphic below. Continually pressing the <SET> push button enables scrolling through the display.
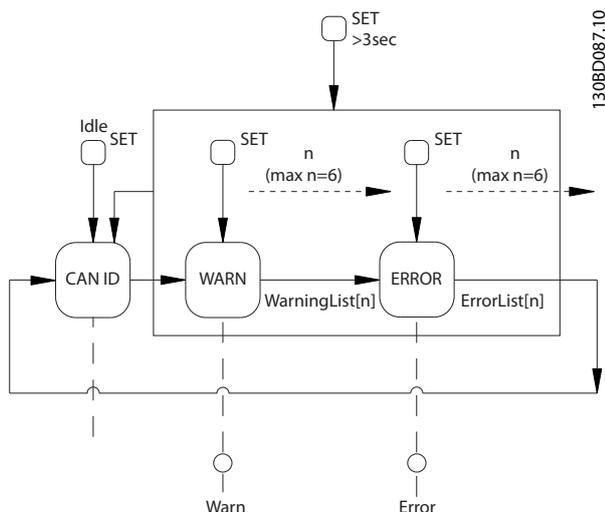

Illustration 7.2 Display Sequence with <SET> Push Button

Display / Segment Dot	Description
CAN-ID (no segment dot)	Encoder box CAN-ID • Display: decimal. • Factory setting: 100. See chapter *6.2.3 CAN Settings* for information on how to change the CAN-ID.
WARN (segment dot "Warn")	Warning about a potential error, e.g. incorrect CAN-ID. • Display: 4-digit hexadecimal code See chapter *12.3 Emergency Codes* for a description of the emergency codes.
ERROR (segment dot "Err")	An error occurred, e.g. encoder CRC error. • Display: 4-digit hexadecimal code See chapter *12.3 Emergency Codes* for a description of the emergency codes.

Table 7.3 Description of the Segment Dots

7.1.3 7-Segment Display

During operation the 7-segment display shows the current encoder box CAN-ID. The LED "Run/Err" is constantly lit green.

The last 6 warnings and error messages can be called up on the 7-segment display. Press the <SET> push button repeatedly to scroll through the individual lists. These are displayed as a continual loop (see *Illustration 7.2*):

- CAN-ID
- Warnings
- Errors
- CAN-ID
- Warnings
- Errors
- …

Press the <SET> push button for 3 seconds to jump to the start (CAN-ID).

When a new event occurs, it is displayed as follows:

- The error code is shown on the 7-segment display immediately. The type of event is shown via the "Warn" or "Err" segment dot.
- The LED "Run/Err" is constantly lit red.
- The error message (CAN emergency message) appears on the CAN bus.
- The cause of the error and the date and time stamp are saved in the log file.
- An entry is made in the error memory. This can be read via SDO (Service Data Object).

Depending on the error, the encoder box switches to a different NMT-state. For example, the encoder box switches to "pre-operational" if an encoder error occurs.

The full list of error codes and NMT reactions are detailed in chapter *12.3 Emergency Codes*.

NOTE
It is not possible to reset errors or warnings on the encoder box itself. An active error can only be deleted by carrying out an NMT-Reset or by restarting the encoder box. See chapter *12.3 Emergency Codes* for further information.

7.1.4 <SET> Push Button

The <SET> push button can be used to scroll through the
list of messages and during the ID setting procedure.
The CAN-ID is shown when the push button is pressed for
3 seconds.

7.1.5 <CAN-ID> BCD Switch

The <CAN-ID> BCD switch is used to assign the ID
manually. See chapter *6.2.4 CAN-ID Setting*.

7.1.6 Service Interface

CAUTION
The service interface is only for use by Danfoss Service.

7.2 Display via Toolbox and CoDeSys

In addition to the display on the ISD encoder box, it is
possible to query the status of the encoder box via ISD
Toolbox.
In order to do this, it is necessary to connect to the CAN
bus network via a PC/laptop. A CAN dongle is required,
which realises the physical connection between the CAN
bus network and the encoder box.
The ISD Toolbox enables the individual ISD components to
be displayed directly and thereby information about the
ISD components to be attained.
The parameters of the ISD components can also be read
via CoDeSys on the master controller.
The ISD Toolbox software, firmware updates, EDS files and
CoDeSys libraries can be downloaded from the Danfoss
website (www.danfoss.com).

7

8 Faults

Encoder box faults are displayed on the 7-segment display on the encoder box (see chapter *7.1 Operating Display*).

The behaviour of the encoder box is detailed in the following chapters. Information on troubleshooting can be found in chapter *8.5 Troubleshooting*.

NOTE
If a fault cannot be eliminated by one of the measures listed, notify Danfoss Service (see chapter *1.5 Service and Support*).

Have the following information available to enable Danfoss to help you quickly and effectively:

- Type number
- Error message number
- Firmware version

8.1 Emergency

If an error occurs the encoder box sends an emergency message. Possible emergencies are listed in chapter *12.3 Emergency Codes*.

8.2 Error History

The encoder box keeps an error history with the emergency codes from chapter *12.3 Emergency Codes* along with a date and timestamp.

The encoder box keeps a maximum of 12 emergencies divided into 6 errors and 6 warnings. After the history is filled, the oldest will be replaced. All 12 emergencies can be read by using SDO.

8.3 Debugging

For debugging purposes the encoder box logs the following information on the SD card with time and date information from the real-time clock:

1. Power on
    - Software version information
    - System information CPU frequency
    - CAN settings: baud rate and CAN-ID
2. Events
    - New control code received
    - Unknown control parameter received
3. Encoder interface behaviour: which encoder is activated
4. Emergencies including power fail emergency
5. Load/save commands
    - The process of write-parameter is logged: open file, write file.

8.4 Under-Voltage / Power-Failure Behaviour

The encoder box is able to detect and handle 3 different voltage level scenarios:

- Under-voltage during power-up
- Sudden drop in the supply voltage
- Power-failure

The encoder box reaction to the different scenarios ensures predetermined behaviour while ensuring the integrity of the file and log content.

NOTE
The encoder box is designed to have enough power to ensure that the parameter and log file are not damaged during a power failure or voltage drop.

8

8.4.1 Under-Voltage during Power-Up

In this case the voltage level is high enough for the encoder box to boot and load the firmware correctly, but the voltage level is not high enough to ensure that a power failure can be handled correctly.

The under-voltage during power-up is detected with a timeout of 5 seconds and the encoder box displays "Err1". To reset this error, apply the correct supply voltage of 24 V and carry out a power cycle.
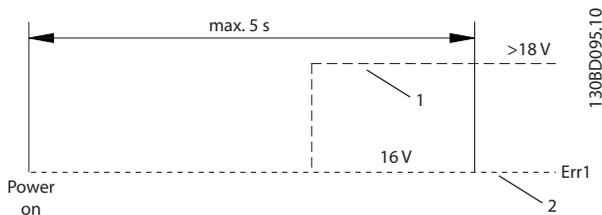

Illustration 8.1 Under-Voltage during Power-Up

1	Power up and normal operation
2	Under-voltage during power-up, "Err1" shown on display

Table 8.1 Legend to *Illustration 8.1*

8.4.2 Sudden Voltage Drop

If the supply voltage suddenly drops, the encoder box will log the event, close the log file on the SD card, and send a voltage emergency message. If the drop is not enough to shut down the encoder box, it remains in a state where the voltage level is verified continuously in order to detect a possible voltage rise. If a voltage rise is detected, an internal reset is issued.
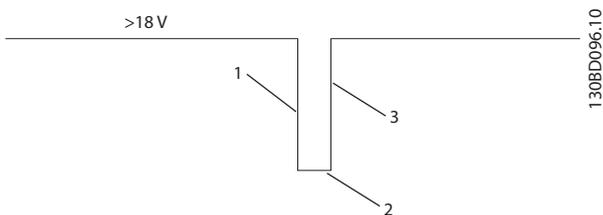

Illustration 8.2 Voltage Drop

1	Log event, send emergency message, close log
2	Wait for voltage rise
3	Internal reset

Table 8.2 Legend to *Illustration 8.2*

8.4.3 Power Failure

In this case the voltage drop to <18 V means a power failure, in which case the encoder box will log the event, close the log file on the SD card, and send a voltage emergency message.
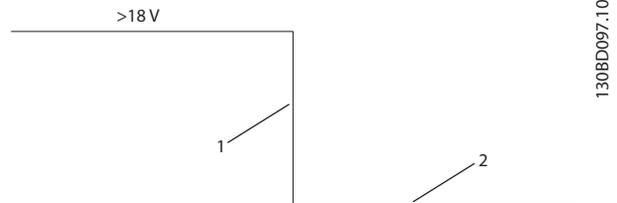

Illustration 8.3 Power Failure

1	Log event, send emergency message, close log
2	Power failure

Table 8.3 Legend to *Illustration 8.3*

8.5 Troubleshooting

When problems occur in the servo system, they must first be located and properly identified.
The following table lists potential faults on the encoder box, their possible causes, and actions for correcting the faults.
If it is not possible to correct the fault, contact Danfoss Service.

Fault	Possible Cause	Possible Solution
LED "Power" is off although 24 V power supply is connected.	• Cable connected incorrectly. • 24 V power supply voltage not present.	• Check cabling • Check 24 V power supply
LED "Run / Err" flashes green for >1 min.	Error during initialisation.	Carry out a power cycle.
LED "Run / Err" is lit red constantly.	Active encoder box error.	See error codes below.
LED "CAN I" or "CAN II" is off.	No CAN messages on the bus.	• Check cabling • Check terminating resistors
LED "CAN I" or "CAN II" is red (constantly).	Current CAN bus problems on line I or II.	• Check cabling • Check terminating resistors • Check parameter *General.BitRate*
Fault code 5100 (hex)	Power supply failure.	• Check cabling • Check 24 V power supply
Fault code 8100 / 8101 (hex)	CAN controller error counter reached limit CAN line I / II.	• Check CAN cabling and voltage • Check terminating resistors • Check for EMC interference • Check parameter *General.BitRate*
Fault code 8120 / 8121 (hex)	CAN passive error CAN line I / II.	
Fault code 8140 / 8141 (hex)	Bus off CAN line I / II.	
Fault code FF02 (hex)	Write to log failed.	• Ensure the SD card is inserted correctly • Check if the file-system on the SD card is corrupt
Fault code FF05 (hex)	BiSS encoder is not connected while start-BiSS command is executed.	Check cabling to BiSS encoder
Fault code FF06 (hex)	Encoder is counting in reverse.	• Check cabling to encoder • Check direction parameter for the specific encoder type used • Check parameter *General.WrongDirectionCheck*
Fault code FF09 (hex)	QEP failed to detect zero pulse.	• Check cabling to encoder • Check parameter *QEP.PulsesPerRevolution*
Fault code FF0A (hex)	Encoder CRC failure.	• Check cabling to encoder • Check for EMC interference • Check CRCPoly parameter for the specific encoder type used
Fault code FF0B (hex)	Encoder *MaxAngleDifference* threshold exceeded.	Check parameter *General.MaxAngleDifference* in relation to maximum encoder speed
Fault code FF0F (hex)	Incorrect CAN-ID.	• Check parameters *General.DefaultCanId* and *General.BaseCanId* • Check the BCD switch setting
Fault code Err1	Under-voltage during power-up.	Check 24 V power supply
Fault code Err2	SD card not available.	• Ensure the SD card is inserted correctly • Ensure the SD card contains the parameter file

Table 8.4 Troubleshooting Overview

8

9 Maintenance and Repair

9.1 Maintenance tasks

The encoder boxes are largely maintenance free.

The maintenance tasks listed in the following table may be performed by the customer. No other tasks are required.

Component	Maintenance Task	Maintenance Interval	Instruction
Encoder box	Clean	Regularly or as necessary	Clean the surface with a dry cloth
24 V supply cable	Check for damage and wear	Every 6 months	Replace cable if damaged or worn
CAN cable			
Encoder cable			

Table 9.1 Overview of Maintenance Tasks

9.2 Inspection during Operation

Carry out regular inspections during operation. Check the encoder box at regular intervals for anything unusual.

Pay particular attention to:

- Loose fastenings
- Condition of electrical wiring and cables

In the event of irregularities or problems, see chapter *8.5 Troubleshooting*.

9.3 Repair

NOTE
No repairs to the encoder box are allowed.
Always return defective encoder boxes to Danfoss.

10 Decommissioning and Disposal

10.1 Decommissioning

The procedure for decommissioning the encoder box is the reverse of the installation procedure described in chapter *5 Installation/Fitting*.

Proceed as follows:

- Disconnect the power supply and wait for the discharge time to elapse.

10.2 Dismounting

The procedure for dismounting the servomotor is the reverse of the fitting procedure described in chapter *5 Installation/Fitting* .

Proceed as follows:

1. Disconnect the power supply and wait for the discharge time to elapse.
2. Disconnect the electrical cables.
3. Dismount the encoder box.

10.3 Recycling and Disposal

10.3.1 Recycling

Take metals and plastics to recycling stations.

The entire encoder box is classified as electronic waste, and the packaging is classified as packaging waste.

10.3.2 Disposal

Devices containing electronic components cannot be disposed of as normal domestic waste.

Dispose of the encoder box as hazardous waste, electrical waste, recyclable waste, etc. in accordance with applicable local regulations.

10

11 Specifications

11.1 Nameplate

Check the nameplate and compare it with the order data. Use the part number for reference.

The part number uniquely identifies the encoder box.
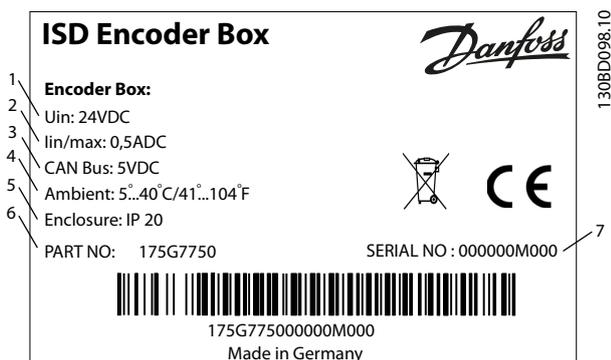
Illustration 11.1 Nameplate

The following data is shown on the nameplate of the ISD encoder box:

1	Supply voltage	5	Protection rating
2	Current details	6	Part number
3	Bus details	7	Serial number
4	Ambient temperature range		

Table 11.1 Legend to *Illustration 11.1*

Ensure that the nameplate is clearly legible.

11.2 Storage

Store the encoder box in a dry, dust-free location with low vibration (V_{eff} ≤0.2 mm/s).

The storage location must be free from corrosive gases.

Avoid sudden temperature changes.

11.3 Characteristic Data

Definition	Value and Unit
Environmental Conditions	
Operating temperature	5–40 °C
Storage temperature	0–55 °C
Humidity	5–85%, non-condensing (according to IEC 60721-3-3)
Protection rating	2
Vibration rating	3M4
Protection type	IP20
Housing	
Dimensions (W x H x D)	142 x 105.2 x 70.78 mm
Weight	0.46 kg
Mounting	In a control cabinet

Table 11.2 Characteristic Data

11.4 Dimensions

11.4.1 Front View

All dimensions are in mm.
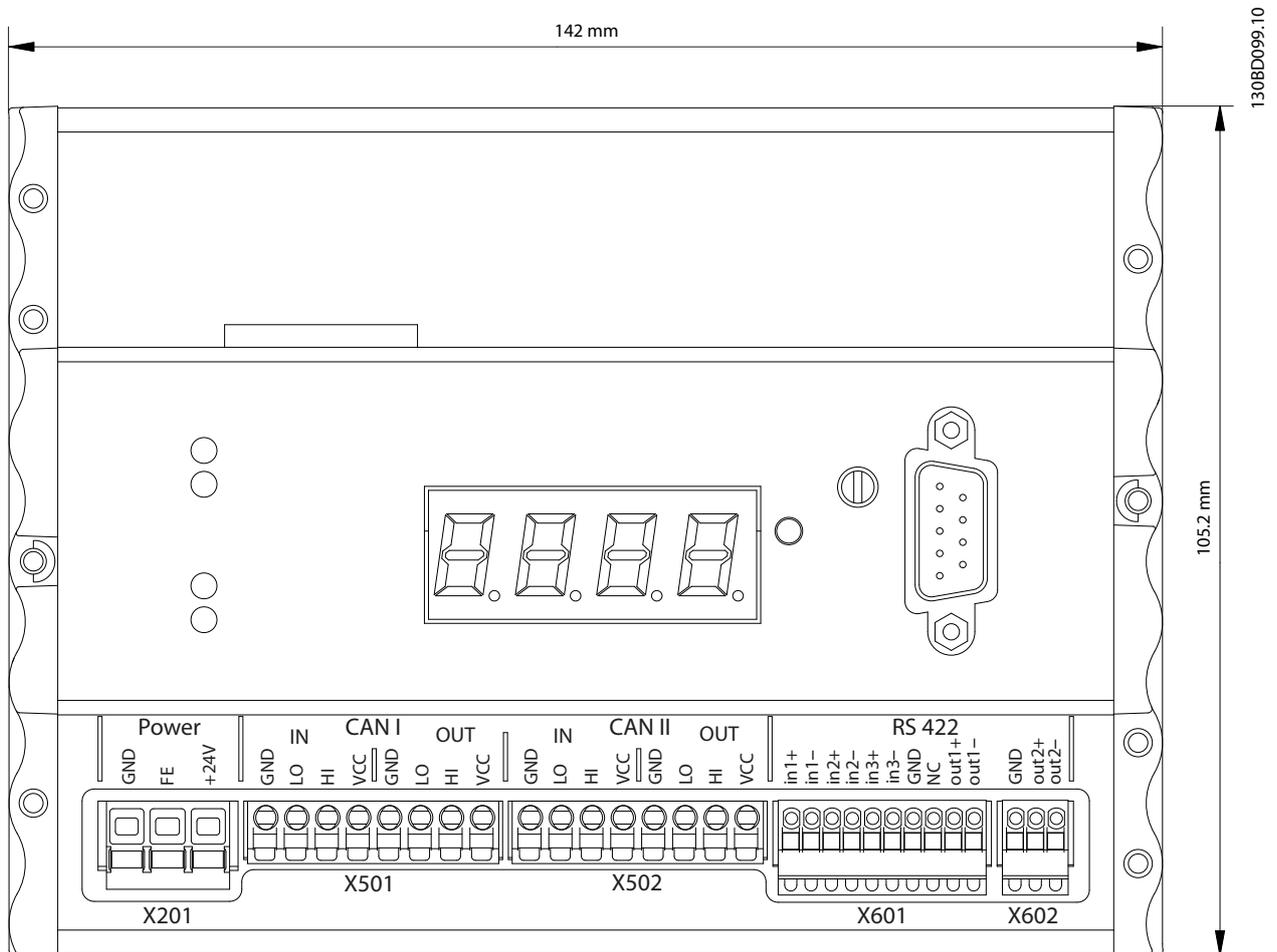
Illustration 11.2 Front View

11.4.2 Side View

All dimensions are in mm.
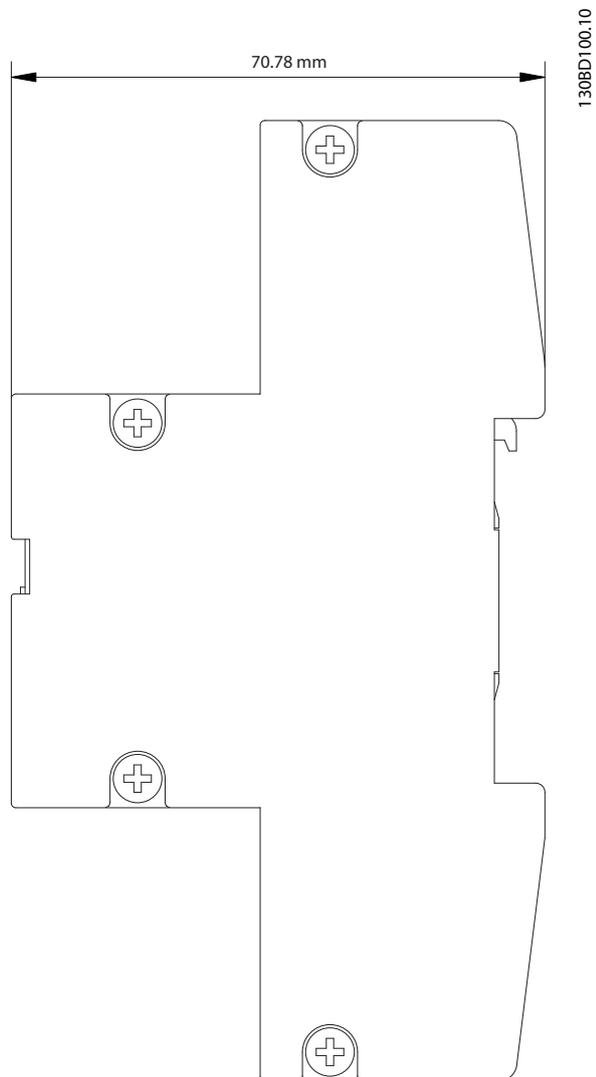
Illustration 11.3 Side View

12 Appendix

12.1 Glossary

A flange
The A side is the shaft side of the motor.

Ambient temperature
The temperature in the immediate vicinity of the servo system or component.

Axial force
The force in newton-metres acting on the rotor axis in the axial direction.

BCD
Binary-coded decimal

Bearings
The ball bearings of the servo drive.

B flange
The rear side of the servomotor with the plug-and-socket connectors.

BiSS
Bi-directional Synchronous Serial

Brake
Power-off brake of the ISD servomotor, on the A side of the motor.

CAN
Controller Area Network

CANopen DS301
A standard that specifies the application layer and communication profile.

CANopen DS402
An object-based CAN standard that specifies the device profile for drives and motion control.

CANopen DS406

An object-based CAN standard that specifies the device profile for encoders.

CE
European test and certification mark.

Clamping set
A mechanical device, which, for example, can be used to secure gears to a motor shaft.

CoDeSys
Controller Development System; a development environment for programming controller applications, based on IEC 61131-3 and developed by 3S-Smart Software Solutions GmbH.

Connection box
The connection box provides the link between the power supply module and the servo drives.

Connector (M23)
Servomotor connector.

Cooling
ISD servo drives are cooled by convection, which means without fans.

CRC
Cyclic Redundancy Check

CSA
Canadian test and certification mark.

DC link
Each servomotor has its own DC link, consisting of capacitors.

DC link voltage
A DC voltage shared by several ISD servomotors connected in parallel.

DC voltage
A direct constant voltage.

DSP
Digital signal processor; processor IC on an ISD control board.

Encoder box
The encoder box allows external encoder signals to be sent to the servo drives over the CAN bus with high precision.

Feed cable
Hybrid connection cable between connection box and servomotor, with a connector.

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Feedback system
Feedback systems for servomotors in general.

Fieldbus
Communication bus between controller and servo axis; in general between controller and field nodes.

Firmware
Software in the unit; runs on the control board.

Flash
Memory IC on the ISD control board; a form of EPROM.

Function block
Device functionalities are accessible via CoDeSys.

Gear ratio
The speed ratio of the input pinion and the output shaft of the gear unit.

Gear unit
External gear unit used to change the output shaft speed and the torque on the motor shaft.

Hole circle
The hole patterns of the ISD and IEC flanges.

IEC flange
Industry-standard flange

Installation elevation
Installation elevation above normal sea level, typically associated with a derating factor.

ISD
Integrated servo drive, integrated servomotor solution.

ISD flange
The standard flange for ISD servo drives; larger than the IEC flange.

ISD servomotor
Designates the ISD servomotor with hybrid cable.

Loop cable
Hybrid connection cable between two servomotors, with two connectors.

M12 connector
Input connector for connecting the sensor on the B side of the servomotor.

Motor shaft
Rotating shaft on the A side of the servomotor, typically without a key groove.

Multi-turn encoder
Describes a digital absolute encoder, in which the absolute position remains known after several revolutions.

NMT
Network Management

PELV
Low-voltage directive regarding voltage levels and distances between lines.

PDO
Process Data Object (see CANopen DS301).

Planetary gear
A specific type of gearing, typically used with servomotors.

Power-off principle
The brake is normally engaged. It is released by applying a voltage (safety function).

Power supply module
The power supply module provides a regulated DC 300 V from AC 400 V.

QEP
Quadrature Encoder Pulse

Radial force
The force in newton-metres acting at 90° to the longitudinal direction of the rotor axis.

Resolver
A feedback device for servomotors, typically with two analog tracks (sine and cosine).

Safety (STO)
A servomotor safety circuit that switches off the voltages of the driver components for the IGBTs.

Scope
Used for diagnosis. Enables internal signals to be depicted.

SD Card
Secure Digital Card for encoder box.

SDO
Service Data Object (see CANopen DS301).

12

Segment

A segment refers to a movement within a curve.

SIL 2

Safety Integrated Level II.

Single-turn encoder

Describes a digital absolute encoder, in which the absolute position for one revolution remains known.

SSI

Synchronous Serial Interface

Toolbox

A software tool used for parameter setting and diagnostics of ISD servomotors, the ISD connection box and the ISD encoder box.

12

12.2 Encoder Box Parameters

The following table shows the complete list of encoder box parameters found in the MPARAM.dat file. These parameters can be adjusted.

There is always one parameter per line, consisting of the parameter group name followed by a dot and then the parameter name. No spaces are allowed in the parameter lines. The parameter value must be decimal or hexadecimal (prefix 0x). Note that the parameters are case-sensitive and that the order of the parameters cannot be changed.

Example of a parameter line: *General.EncoderType=SIM*

Further information on the objects mentioned can be found in the *VLT® ISD 410 Design Guide.*.

Parameter	Description	Default Value
General.		
General.BitRate	CAN baud rate for both CAN lines. Possible values: 1000, 500, 250, 125, 50 kBaud	500
General.DefaultCanId	This value is used as the CAN-ID when the BCD switch is set to 0.	100
General.BaseCanId	When the BCD switch is not set to 0, then the CAN-ID = BaseCanId + BCD-value.	100
General.SecondCANLineEnable	0 = CAN line II is disabled (default) 1 = CAN line II is enabled	0
General.EncoderType	Defines the default encoder; if left empty, simulation is default. Possible values: SIM, SSI, QEP, SSI_CRC, BiSS	SIM
General.HeartbeatTime	Defines the interval for the transmission of the heartbeat in ms. 0 = disabled Value range: 0-65535 ms.	0
General.MaxAngleDifference	Maximum angle difference threshold allowed between 2 subsequent encoder samples with scaling of 65536 for 360° or 1° --> 1° x 65536/360° = 182. This parameter affects emergency code 0xFF0B. A value larger than 32768 disables monitoring.	184
General.WrongDirectionThreshold	Wrong direction threshold with scaling of 65536 for 360° or 1° --> 1° x 65536/360° = 182. This parameter influences emergency code 0xFF06. A value larger than 32768 disables monitoring.	10
General.WrongDirectionCheck	Enables wrong direction check. 1 = enabled (default) This parameter influences emergency code 0xFF06.	1
RxPD01.		
RxPD01.CobId	COB-ID for RxPDO1	0x200+ $NODEID
TxPD01.		
TxPD01.CobId	DS406 position	0xC0000180+ $NODEID
TxPD01.EventTimer	Transmission interval in ms. Value range: 0-65535 ms. 0 = disabled	0
TxPD02.		
TxPD02.CobId	COB-ID for position valid message	0x40000280+ $NODEID
TxPD02.EventTimer	Transmission interval in ms. Value range: 0-65535 ms. 0 = disabled	0
TxPD03.		
TxPD03.CobId	Position message ID	0x40000040
TxPD03.EventTimer	Transmission interval in ms. Value range: 0-65535 ms. Default = 5 ms	5
Simulation.		

Parameter	Description	Default Value
Simulation.UnitsPerRevolution	Used to scale the output (see object 0x6001). Value range: 1000-65536. Higher values provide better position resolution.	65536
Simulation.Offset	Used to scale the output. The scaling is 65536 for 360° (see object 0x6509).	0
SSI.		
SSI.Direction	Sets the measurement direction. 1 = encoder position is reversed 0 = original encoder position	0
SSI.UnitsPerRevolution	Used to scale the output (see object 0x6001). Value range: 1000-65536. Higher values provide better position resolution.	65536
SSI.Offset	Used to scale the output. The scaling is 65536 for 360° (see object 0x6509).	0
SSI.GrayCode	0 = binary code is used 1 = Gray code is used	0
SSI.Databits	Number of data bits being read from the SSI encoder.	13
SSI.Positionbits	Number of position bits within the data bits.	13
SSICRC.		
SSICRC.Direction	Sets the measurement direction. 1 = encoder position is reversed 0 = original encoder position	0
SSICRC.UnitsPerRevolution	Used to scale the output (see object 0x6001). Value range: 1000-65536. Higher values provide better position resolution.	65536
SSICRC.Offset	Used to scale the output. The scaling is 65536 for 360° (see object 0x6509).	0
SSICRC.CRCPoly	CRC generator polynomial used to verify the data.	50585 (0xC599)
QEP.		
QEP.Direction	Sets the measurement direction. 1 = encoder position is reversed 0 = original encoder position	0
QEP.PulsesPerRevolution	QEP encoder parameter of pulses/revolution. For QEP encoders, the DS 406 object 0x6001. Measuring units per revolution is always set to 4 times of pulses/revolution of the encoder.	2000 for ABO-2000 encoder
QEP.Offset	Used to scale the output. The scaling is 65536 for 360° (see object 0x6509).	0 inc
BiSS.		
BiSS.Direction	Sets the measurement direction. 1 = encoder position is reversed 0 = original encoder position	0
BiSS.UnitsPerRevolution	Used to scale the output (see object 0x6001). Value range: 1000-65536. Higher values provide better position resolution.	65536
BiSS.Offset	Used to scale the output. The scaling is 65536 for 360° (see object 0x6509).	0
BiSS.DataLengthMT	Number of bits of multi-turn part of the encoder. For single-turn BiSS encoders this parameter must be set to 0.	0
BiSS.DataLengthST	Number of bits of single-turn part of the encoder.	22 for AC58/0022 encoder
BiSS.DataLengthMF	Number of bits for manufacturer-specific data field of a BiSS encoder, e.g. Hengstler BiSS encoder AC58/0022 has 2 alignment bits plus 1 error bit and 1 warning bit.	4 for AC58/0022 encoder
BiSS.Frequency	Clock frequency for the BiSS encoder in MHz. It supports 4 possible frequencies: 8, 4, 2 or 1 MHz	8

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Parameter	Description	Default Value
BiSS.CRCPoly	CRC generator polynomial used to verify the data. For Hengstler BiSS encoder: CRCPoly = 0x43 = 67.	67

Table 12.1 Encoder Box Parameters

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12.3 Emergency Codes

Code	Severity	Description	NMT Reaction
0x5100	Error	Power supply failure.	Reset
0x8100	Warning	CAN controller error counter reached limit CAN line I.	No change
0x8101	Warning	CAN controller error counter reached limit CAN line II.	No change
0x8120	Warning	CAN passive error CAN line I.	No change
0x8121	Warning	CAN passive error CAN line II.	No change
0x8140	Warning	Bus off CAN line I.	No change
0x8141	Warning	Bus off CAN line II.	No change
0xFF02	Warning	Write to log failed.	No change
0xFF05	Error	BiSS encoder is not connected while start-BiSS command is executed.	No change
0xFF06	Error	Encoder is counting in reverse.	Enter NMT pre-operational state
0xFF09	Error	QEP failed to detect zero pulse.	Enter NMT pre-operational state
0xFF0A	Error	Encoder CRC failure.	Enter NMT pre-operational state
0xFF0B	Error	Encoder *MaxAngleDifference* threshold exceeded.	Enter NMT pre-operational state
0xFF0F	Warning	Incorrect CAN-ID.	No change

Table 12.2 Emergency Codes

12.4 Error Codes

Error Code	Description
Err1	Under-voltage during power-up.
Err2	SD card not available.

Table 12.3 Error Codes

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