

for controlling permanent magnet synchronous motors, torque motors and linear motors.

Item no.: 314070

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1 General information

Dear Customer,
Dear operator,

with this Operating instructions we would like to support you Servo output stage isc2010 in your work. It contains information and all useful indications Servo output stage and will be a helpful companion for you.

NOTE



Before Servo output stage commissioning, working with, integrating and/or modifying the electrical installation the frequency converter, please read carefully the following:

> The safety instructions contained in this Operating instructions

If you have further questions, please get in touch with us. Despite all diligence, printing errors and mistakes cannot be excluded. If you notice misprints or errors or you see opportunities to improve our technical documentation, we are grateful for any hint or suggestion!

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1.1 Meaning of the documentation

The Operating instructions contains all descriptions and documentation required for wiring, commissioning and controlling the Servo output stage isc2010.

It is aimed at qualified personnel with basic knowledge of control and automation technology and the EtherCAT fieldbus. Before commissioning the Servo output stage, the safety instructions for electric drives and controllers in this manual must always be read carefully and observed.

The setting of the corresponding program "ie-sc10XXconfig" is described in a separate Operating instructions and offers help for the commissioning of the Servo output stage.

The Operating instructions in German language is the original Operating instructions. All other language versions are translations of the original Operating instructions.

Registered trademarks and patented technologies

EtherCAT® is a registered trademark and patented technology, licensed from Beckhoff Automation GmbH, Germany. Other designations used in this publication may be trademarks whose use by third parties for their own purposes could infringe the rights of the owners.

Customer information

No one is authorized to disclose information that differs from the information in this manual.

Warranty

The isel-automation GmbH & Co. KG guarantees that this product is free from material and manufacturing defects. The isel-automation GmbH & Co. KG assumes no further liability, including any implied warranty of merchantability or fitness for a particular purpose. The user is responsible for the application and the intended use of the product. If damage to the product occurs within the warranty period, your sole claim and isel-automation GmbH & Co. KG's sole obligation is to repair or replace the product.

Limitation of liability

To the extent that an exclusion of liability is permitted by law, the manufacturer isel-automation GmbH & Co. KG is not liable for any loss or damage caused by this product. This applies regardless of whether the damages are direct, indirect, special, incidental or consequential damages, regardless of the legal basis, including warranty, contract, negligence or intent.

1.2 Declaration of conformity

The Manufacturer

isel-automation GmbH & Co. KG
Sachsenweg 8
D-36132 Eiterfeld

Hereby declares that the following product

Product description:	Servo output stage isc2010 for controlling permanent magnet synchronous motors, torque motors and linear motors
Model designation:	isc2010
Item number:	314070

Complies with the provisions of the following European directives:

EMC directive	2014/30/EU
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The following harmonized norms were applied:

EN 61000-6-2:2005	Electromagnetic compatibility (EMV) - Part 6-2: Generic standards - Immunity for industrial areas
EN 61000-4-2:2009	Electromagnetic compatibility (EMV) - Part 4-2: Testing and measurement techniques - Electrostatic discharge immunity test
EN 61000-4-4:2012	Electromagnetic compatibility (EMV) - Part 4-4: Testing and measurement techniques - Electrical fast transient/burst immunity test
EN 61000-4-5:2006	Electromagnetic compatibility (EMV) - Part 4-5: Testing and measurement techniques - High energy pulses (surge) immunity test
EN 61000-4-11:2004	Electromagnetic compatibility (EMV) - Part 4-11: Testing and measurement techniques - Immunity test against voltage drop, short interruptions and voltage fluctuations
EN 61000-6-3:2007 + A1:2011	Electromagnetic compatibility (EMV) - Part 6-3: General technical standards - interference emission for living, business and commercial areas as well as small businesses
EN 61000-6-4:2007 + A1:2011	Electromagnetic compatibility (EMV) - Part 6-4: Generic standards - interference for industrial areas
DIN EN 55016-2-1:2014-12	Requirements of devices and equipments as well as specification of the procedure for the measurement of emitted high-frequency interference (radio interferences) and immunity - 2-1: Procedure for the measurement of emitted high-frequency interference (radio interferences) and immunity - Measurement of conducted interference
Low voltage directive	2014/35/EU

The following harmonized norms were applied:

DIN VDE 0100	Provisions for the erection of heavy current installations up to 1,000 V
EN 60204-1:2006/A1:2009/AC:2010	Safety of machinery - Electrical equipment of machines - Part 1: General requirements.
DIN EN 50178:1998-04; VDE 0160:1998-04	Equipping power installations with electronic equipments
DIN IEC 61800-5-1 (VDE 0160-105):2008-04	Electric power drive systems with adjustable speed. Part 5-1: Safety requirements - Electrical, thermal and energetic requirements (IEC 61800-5-1:2007)
RoHS directive	2011/65/EU + 2015/863/EU

Eichenzell, 26.08.2020



Hugo Isert. Managing Director isel-automation GmbH & Co. KG

1.3 User requirements

The faultless and safe operation of the frequency converter requires its proper and professional transport, storage, assembly, project planning by taking into consideration the risks, protective and emergency measures and installation as well as its careful operation and maintenance. Only trained and qualified personnel must be used to deal with the electrical installations.






TRAINED AND QUALIFIED PERSONNEL.

Within the meaning of this product manual or the warning notices on the product itself the persons being responsible for project planning, installation, assembly, commissioning and operation of the product and are sufficiently familiar with all warnings and precautionary measures according to this Operating instructions and have the appropriate qualifications for their activity:

- Training and instruction and/or authorisation to switch devices/systems on and off according to the standards of safety technology, to earth and label them appropriately according to the work requirements.
- Training or instruction in accordance with the standards of safety technology in the care and use of adequate safety equipment.
- First aid training




1.4 Explanation of symbols and notes

Notes on hazards occurring in connection with works on Servo output stage isc2010 are designated as follows in these operating instructions. They warn against potential damages against persons or material damages or offer working supports.

NOTE	
	If, in case of a hazardous situation, the result of an accident is at most a property damage, the notice shall bear the "NOTE" mark.
⚠ CAUTION	
	If, in case of a hazardous situation, the result of an accident is at most a light injury, the notice shall bear the "CAUTION" mark.
⚠ WARNING	
	If an accident caused by a dangerous situation occurs and may result in a serious or fatal injury , the notice is designated as a "WARNING".
Information	
	Indicates important information, application tips and useful information for proper work.
Environment	
	The information related to the environmental protection are marked this way.
/1/	Refers to a document included in the list of valid documents.

1.5 Symbols used in the operating instructions and on the machine

The use of the symbols is carried out in compliance with the valid regulations of the operator's country.

Warning symbol	Description
	General warning sign
	Warning against hazardous electrical voltage
	Warning against hot surfaces


1.6 List of abbreviations

	Statement	
EN	Europäische Norm [European Standard]	Harmonised European standard
ISO	International Organization for Standardization	International Organisation for Standardisation
EtherCAT	Ethernet for Control Automation Technology	Real-time Ethernet. The protocol disclosed in the IEC standard 61158 is adequate for hard and soft real-time requirements in the field of automation technology.


2 Safety instructions for electrical drives and controls


2.1 General information

In case of damages caused by the non-compliance of the warnings contained in these operating instructions, the company isel-automation GmbH & Co. KG does not assume any liability.

Information	
	Before the commissioning, the safety instructions for electrical drives and controls and the instructions for the safe and EMC-compliant assembly have to be read.


If the documentation is not fully understood in the available language, please get in touch with the company of the supplier and inform it.

Information	
	<p>The following instructions must be read before the first commissioning of the system to avoid personal injury and material damage:</p> <ul style="list-style-type: none"> • These safety instructions must be complied with at any time. • Do not try to install the Servo output stage or to put it into operation before you have carefully read all the safety instructions for electrical drives and controls contained in this document. These safety instructions and all other user instructions must be read before working with Servo output stage . • In case of sale, rent or an other kind of transfer of the Servo output stage these safety instructions must be handed over as well. • The opening of the Servo output stage by the operator is not allowed for safety and warranty reasons. • The prerequisite for the proper functioning of the Servo output stage is a professional project planning.


⚠ WARNING!	
	<p>Improper handling</p> <p>An improper handling of the Servo output stage and the non-observance of the warnings indicated here as well as the improper interventions in the safety device can result in property damage, personal injury, electric shock or, in extreme cases, to death.</p>

2.2 Intended use

The Servo output stage isc2010 is designed for controlling permanent magnet synchronous motors, torque motors and linear motors. The maximum supply voltage for the Servo output stage isc2010 is limited to 100V(DC).

Attention!	
	However, the regenerative behaviour of electrical machines can generate many times the voltage.



2.3 Danger caused by incorrect use

⚠ WARNING!	
	High electrical voltage and elevated working current! Danger to life or serious physical injury caused by electric shock!
⚠ WARNING!	
	High electrical voltage caused by incorrect connection! Danger to life or serious physical injury caused by electric shock!
⚠ WARNING!	
	Risk of injury! Risk of burns! Danger to life or serious physical injury caused by electric shock!
⚠ CAUTION!	
	Hot surfaces on device housings are possible! Risk of injury! Risk of burns!
⚠ WARNING!	
	Dangerous movement! Danger to life, serious physical injury or material damage caused by the unintentional movements of the motors.

2.4 Safety instructions



2.4.1 General safety instructions

- The Servo output stage corresponds to the protection class IP20 and pollution class 1. It has to be ensured that the environment corresponds to this protection and/or pollution class.
- Only use accessories and spare parts the manufacturer has previously approved.
- The Servo output stage must be connected to the network according to the EN standards and the VDE regulations so that it can be disconnected from the network by using adequate disconnection devices (e.g. main switch, contactor and circuit breaker).
- For the switching of control contacts, gold-plated contacts or contacts with high contact pressure should be used.
- The environmental conditions specified in the product documentation must be complied with! Security-critical applications are not allowed.
- The technical data, the connection and installation conditions for the Servo output stage are indicated in the present product manual and must be strictly complied with.

Information	
	<ul style="list-style-type: none"> • The Servo output stage can be protected with an AC/DC sensitive 300mA residual current protective device (RCD). • As a precaution, interference suppression measures must be taken for the switch-gears, such as the connecting contactors and the relays with RC elements and/or diodes. • The safety regulations and provisions applicable in the country where the device is used must be complied with. • The instructions for an EMC-compliant installation are included in the corresponding chapter. The system or machine manufacturer is responsible for the compliance with the limit values required by the national regulations.
⚠ WARNING!	
	<p>Failure to comply with the safety regulations!</p> <p>The failure to comply can result in death, physical injury, or substantial property damage.</p> <p>> The general installation and safety regulations for working on high-voltage systems (e.g. DIN, VDE, EN, IEC or other national and international regulations) must be complied with.</p>

2.4.2 Safety instructions during the assembly and maintenance


For the assembly and maintenance of the Servo output stage isc2010 the relevant DIN, VDE, EN and IEC regulations as well as all national and local safety and accident prevention regulations will be applied in any case. The system builder and/or the operator have to ensure the compliance with these regulations.

⚠ WARNING!	
	<p>Installation and maintenance</p> <p>Accidents, personal injury and property damage</p> <ul style="list-style-type: none"> > Disconnect the electrical equipment from the main switch by securing it against being switched on again, wait until the DC link is discharged at: <ul style="list-style-type: none"> - maintenance and repair works - cleaning works - long downtimes > Before the execution of any maintenance work, it has to be ensured that the power supply is switched off, locked and that the DC link is discharged. > The external or internal braking resistor carries the dangerous intermediate circuit voltage during the operation and up to approximately 5 minutes after the switching off of the frequency converter. The contact can result in death or serious physical injury. > The assembly must be carried out cautiously. It has to be ensured that either during the assembly or during the subsequent operation of the drive, no drilling chips, metal dust or assembly parts fall into the Servo output stage . > The working operations in the machine area must only be carried out if the AC or DC power supply is switched off and locked. Disabled power stages or the disabled controller release are not considered as adequate interlocks. In case of a fault, the drive can release an unintentional procedure. > The commissioning must be carried out with the motors idling to avoid mechanical damage, e.g. caused by incorrect rotation direction. > In general, electronic devices are not fail-safe. In case of a failure of the electrical device, the user is responsible for ensuring that his system is kept in a safe state. > The Servo output stage may reach high temperature level which may result in severe physical burns in case of a contact.
Information	
	<ul style="list-style-type: none"> • You have to ensure that the external voltage supply of the converter (24V) is switched off. • The intermediate cycle of the main voltage must always be switched off before switching off the supply voltage of 24V.

2.4.3 Protection against the contact with electrical parts

This section only applies to devices and drive components reaching voltage values of more than 50 volts. In case of the contact with parts with voltages of more than 50 volts, this can be dangerous for people by causing an electric shock. In case of the operation of electrical devices, certain parts of these devices will be inevitably under dangerous voltage.

The relevant DIN, VDE, EN and IEC regulations as well as all national and local safety and accident prevention regulations will be applied to the operation. The system builder and/or the operator have to ensure the compliance with these regulations.


⚠ WARNING!	
	<p>Contract with electrical parts!</p> <p>Danger to life, risk of injury caused by an electric shock or serious physical injury.</p> <ul style="list-style-type: none"> > Before switching on, attach the covers and guards provided for protection against accidental contact to the equipment. For built-in devices, protection against direct contact with electrical parts must be provided by an external housing, such as a switch cabinet. The regulations BGVA3 must be observed! > The protective conductor of the electrical equipment and of the devices to the supply network have to be firmly connected to the supply network. Because of the integrated main filters, the leakage current is higher than 3,5 mA! > According to the standard EN60617, you have to observe the prescribed minimum copper cross-section for the protective conductor connection in its whole course! > Before the commissioning, also for short-term measurement and test purposes, you have always to connect the protective conductor to all electrical devices according to the connection diagram or to the earth conductor. Otherwise, on the housing high voltages can occur by causing an electric shock. > Do not touch the electrical connection points of the components when they are switched on. > Before the access to the electrical parts reaching voltage values of more than 50 volts, you must disconnect the device from the mains or from the voltage source. Secure against restarting. > During the assembly, the level of the DC link voltage must be taken considered in particular for what concerns the insulation and protective measures. A proper earthing, a correct conductor dimensioning and an appropriate short-circuit protection must be provided. > The Servo output stage can remain under dangerous voltage for up to 5 minutes after its switching off (residual charge in the DC link).

2.4.4 Protection by protective extra-low voltage (PELV) against electric shock

All connections and terminals with voltages between 5 and 50 volts positioned on the Servo output stage are protective extra-low voltages designed to be contact-safe according to the following standards.

- International: IEC 60364-4-41
- European countries: EN 50178/1998, Section 5.2.8.1.

The relevant DIN, VDE, EN and IEC regulations as well as all national and local safety and accident prevention regulations will be applied to the operation. The system builder and/or the operator have to ensure the compliance with these regulations.


⚠ WARNING!	
	<p>False connection!</p> <p>Danger to life, risk of injury caused by an electric shock or serious physical injury.</p> <ul style="list-style-type: none"> > To all connections and terminals between 0 and 5 Volts, only devices, electrical components and lines with a protective extra-low voltage (PELV = Protective Extra Low Voltage) can be connected. > Only voltages and circuits that are safely separated from dangerous voltages can be connected. A safe isolation may be achieved, for example, by isolating transformers, safe optocouplers or by a mains-free battery operation.

2.4.5 Protection against dangerous movement


Dangerous movements can be caused by the improper control of the connected motors. The causes may be of various types:

- Improper or faulty wiring or cabling
- Component operation error
- Errors in the measured value and in the signal transmitters
- Defective or not EMC-compliant components
- Errors in the software of the super-ordinate control system

These errors can occur immediately after the switching on or during operation after an indefinite period. The monitoring operations in the drive components largely exclude a malfunction in the connected drives. For what concerns the personal protection, in particular the risk of physical injury and material damage, this is a situation you should not rely upon alone. Until the effectiveness of the built-in monitoring system becomes effective, a faulty drive movement is to be expected in any case whereby its extent depends on the type of control and the operating state.


⚠ WARNING!	
	<p>Dangerous movement of the connected drive!</p> <p>Danger to life, risk of injury, serious physical injury or material damage!</p> <ul style="list-style-type: none"> > For the reasons mentioned above, the personal protection has to be ensured by the monitoring or by super-ordinate measures on the system side. These are provided by the plant manufacturer according to the specific conditions of the plant in a hazard and error analysis. The safety regulations applicable to the system are also considered. The switching off, bypassing or incorrect activation of the safety devices can result in arbitrary movements of the machine or in other types of malfunctions.

2.4.6 Protection against the contact with hot parts

⚠ WARNING!	
	<p>Hot surfaces on the device housing! Risk of injury! Risk of burns!</p> <ul style="list-style-type: none"> > Do not touch the housing surface next to the hot heat sources! Risk of burns! > Before the access, let devices cool down for 10 minutes after their switching off. > By touching hot parts of the equipment, such as the device housing, where the heat sink and resistors are located, can cause burns!

2.4.7 Protection during the handling and assembly operations

The handling and assembly of certain parts and components in an inadequate way can cause injuries under unfavourable conditions.

⚠ WARNING!	
	<p>Risk of injury caused by improper handling! Bodily harm caused by crushing, shearing, cutting and bumping!</p> <ul style="list-style-type: none"> > Observe the general installation and safety regulations relating to handling and assembly. > Use suitable assembly and transport equipment. > Prevent pinching and crushing by applying adequate precautions. > Use only suitable tools. If required, use special tools. > Use the lifting equipment and tools in a correct manner. > If necessary, use adequate protective equipment (e.g. safety glasses, safety shoes, protective gloves). > Do not stay under the hanging loads. > Escaping liquids on the floor must be immediately removed because of the slipping risk.

2.5 Notes relating to the safe and EMC-compliant Installation

2.5.1 Explanations and terms

The electromagnetic compatibility (EMC) or electromagnetic interference (EMI) comprises the following requirements:

- A sufficient immunity to interference of an electrical system or device against external electrical, magnetic or electromagnetic interference through cables or over the room.
- A sufficiently low emission of electrical, magnetic or electromagnetic interference of an electrical system or device to other devices in the area through cables and over the room.

2.5.2 General information about EMC

The interference emission and immunity to interference of a Servo output stage always depends on the complete design of the drive, consisting of the following components:

- Power Supply
- Servo drive controller / frequency converter
- Engine
- Electromechanics
- Design and type of wiring
- Superimposed controls

Information



In the great majority of cases, no external filter measures are required. Only in a residential environment, this product can result in high-frequency interference which may require to take interference suppression measures.

2.5.3 EMC-compliant cabling

For what concerns the EMC-compliant structure of the drive system the following rules must be complied with:

- To keep the leakage currents and the losses in the motor connection cable as low as possible, the servo drive or the frequency converter should be arranged in the closest position possible to the motor.
- The motor and angle encoder cables must be equipped with a shield.
- The shield of the motor cable is positioned on the housing of the associated servo drive or frequency converter. This way, the leakage currents can flow back into the controller causing it.
- The line-side PE connection and the PE inner conductor of the motor cable is connected to the PE connection point of the servo drive or of the frequency converter.
- The signal lines must be separated as far as possible from the power cables. They have not to be run in parallel. If crossings cannot be avoided, they should be carried out as vertically as possible (i.e. at a 90° angle).
- Signal and control lines which are not equipped with shields have not to be used. If their use cannot be avoided, they should at least be twisted.
- Shielded cables are equipped with short unshielded pieces at both ends as well (if no shielded connector housings are used). In general:
 - Connect the internal shield to the pins positioned on the connectors; maximum length of 40mm.
 - Length of the cores without shield of a maximum of 35mm.
 - Connect the whole screen on the controller side to the PE terminal; maximum length 40mm.
 - Connect the whole shield flat on the motor side to the connector or motor housing, maximum length 40mm.

⚠ WARNING!



Earthing system!

Electric shock, destruction of the device.

- > For safety reasons, all PE protective conductors must absolutely be connected before the commissioning.
- > The provisions of the standard EN 50178 for protective earthing must be observed during the assembly!

3 Description

3.1 General information

The Servo output stage isc2010 is a universal DC powered (36V DC to 100V DC) Servo output stage for controlling permanent magnet synchronous motors, torque motors and linear motors in the power range up to 1.2 kW. The double multi-encoder interface and short controller cycle times together with the EtherCAT real-time bus system enable highly dynamic positioning applications. The continuous recording and evaluation of current, voltage and temperature in real time ensures the safe operation of the Servo output stage. The target values are specified via EtherCAT bus (CiA402). The Servo output stage has an STO function for integration into a safety controller. The configuration of the Servo output stage is user-friendly with the commissioning software via USB, Ethernet or EtherCAT.

3.2 Technical specifications

Supply voltage Power	36V DC to 100V DC
Motor current rated current	to 12A
Motor current peak current	to 25A
Output power Nominal power	1.2kVA
Output power Peak power	2.5kVA
Supply voltage logic 24V	24V ($\pm 10\%$)
Supply voltage Logic Current	0.3A (with one measuring system, without motor brake)
Motor	permanent magnet synchronous motor, torque motor, linear motor
Encoder interface 1	Incremental RS422, Hall (A, B, C), Absolute (BiSS-C)
Encoder interface 2	Incremental RS422, Absolute (BiSS-C or MINAS)
Digital inputs	4 digital inputs 24V / input current approx. 10mA
Digital outputs	1 digital output 24V / output current maximum 20mA
Motor brake output	1 output motor brake 24V / output current maximum 1A
Safe inputs	STO1, STO2 24V / input current approx. 10mA
Setpoint setting	EtherCAT (CiA402)
Protection	Overload, short circuit, temperature
Interfaces	USB 2.0, Ethernet, EtherCAT
Configuration	by software via USB, Ethernet or EtherCAT
Status display	through LED's
Protection class	IP20

Dimensions (W x H x D)	1990m x 46mm x 130mm
Weight	0.65 kg
Ambient temperature	5°C to 40°C
Storage temperature	-25°C to 70°C
Item-No.	314070

3.3 Overview

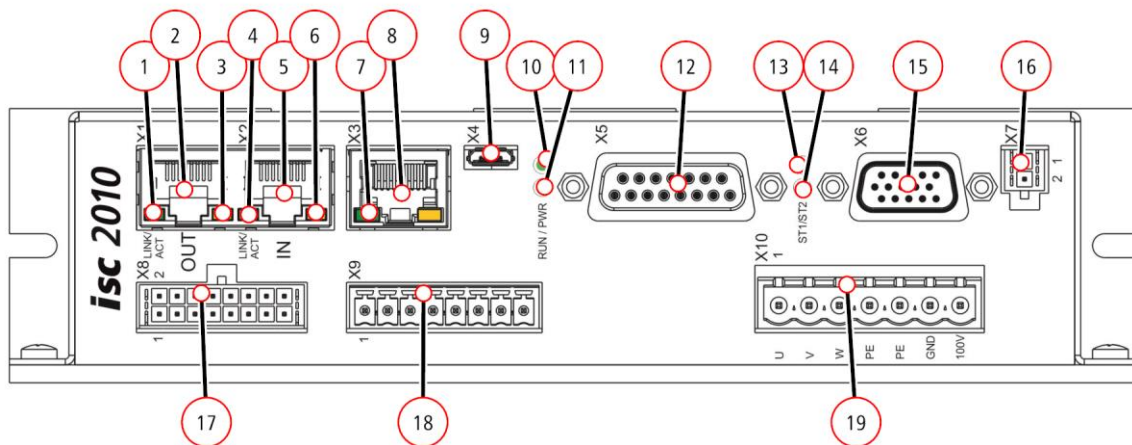


Fig. 1 - Overviewisc2010

Pos.	Meaning
1	Status LED EtherCAT connection Output
2	X1 - EtherCAT connection Output
3	Status LED EtherCAT connection Output
4	Status LED EtherCAT connection Input
5	X2 - EtherCAT connection Input
6	Status LED EtherCAT connection Input
7	Status LED Ethernet
8	X3 - Ethernet connection
9	X4 -USB connection
10	Status LED PWR
11	Status LED EtherCAT-RUN
12	X5 – Anschluss Geberschnittstelle 1
13	Status LED ST2
14	Status LED ST1
15	X6 - Connection encoder interface 2
16	X7 - Connection external battery for absolute measuring system Encoder interface 2
17	X8 - Connection power supply 24V DC and system signals
18	X9 - Connection motor brake and digital inputs
19	X10 - Motor connection and power supply connection 36V DC to 100V DC

3.4 Display elements

See previous illustration!

Pos.	LED	Description
1	Status LED (green) EtherCAT connection Output	EtherCAT LINK/ACT The LED lights up when an EtherCAT connection is established. The LED flashes during data traffic on the interface.
3	Status LED (yellow) EtherCAT connection Output	The LED lights up with an existing 100Mbit Ethernet connection (Layer 0).
4	Status LED (green) EtherCAT connection Input	EtherCAT LINK/ACT The LED lights up when an EtherCAT connection is established. The LED flashes during data traffic on the interface.
6	Status LED (yellow) EtherCAT connection Input	The LED lights up with an existing 100Mbit Ethernet connection (Layer 0).
7	Status LED Ethernet	The LED lights up when an Ethernet connection is established. The LED flashes during data traffic on the interface.
10	Status LED PWR	The PWR LED lights up when the 24V voltage is connected and the internal power supply is working correctly.
11	Status LED RUN	The EtherCAT-RUN LED indicates the state of the EtherCAT State Machine.
13	Status LED ST2	Via LED ST2 error conditions are displayed - see LED error table.
14	Status LED ST1	The ST1 LED lights up when the motor is energized, the phase voltage is output.

3.5 Overview connections

X1 and X2 - EtherCAT connection - RJ45 socket

Plug	Connection
X1	EtherCAT OUT - outgoing EtherCAT line
X2	EtherCAT IN - incoming EtherCAT line

X3 - Ethernet connection - RJ45 socket

Plug	Connection
X3	Ethernet line

X4 - USB connection - USB 2.0 (Micro) socket

Plug	Connection
X4	USB cable

X5 - encoder interface 1 - D-Sub socket 15pole

Pin	Signal	Description
1	Hall A	Hall signal A
2	+5V	Encoder supply voltage +5V (5V/200mA)
3	ENC /Z	/Z-Signal Incremental Encoder
4	ENC /B / CLK-	/B signal incremental encoder or clock (-) signal absolute measuring system
5	ENC /A / DATA-	/A-signal incremental encoder or data (-) signal absolute measuring system
6	Logic 24V	Power supply for digital inputs +24V
7	IN1	digital input IN1 (24V/10mA)
8	Logic GND	Power supply for digital inputs GND
9	Hall B	Hall signal B
10	DGND	Encoder supply voltage DGND
11	ENC Z	Z-Signal Incremental Encoder
12	ENC B / CLK+	B-signal incremental encoder or clock(+) signal absolute measuring system
13	ENC A / DATA+	A-signal incremental encoder or data (+) signal absolute measuring system
14	Hall C	Hall signal C
15	IN2	digital input IN2 (24V/10mA)

X6 - encoder interface 2 - D-Sub HD socket 15pin

Pin	Signal	Description
1	ENC Z	Z-Signal Incremental Encoder
2	ENC /Z	/Z-Signal Incremental Encoder
3		
4		
5	BAT +	Battery (+) connection for absolute measuring system
6	BAT-	battery (-) connection for absolute measuring system
7	+5V	Encoder supply voltage +5V (5V/200mA)
8	DGND	Encoder supply voltage GND
9	ENC A / DATA +	A-signal incremental encoder or data (+) signal absolute measuring system
10	ENC /A / DATA-	/A-signal incremental encoder or data (-) signal absolute measuring system
11	ENC B / CLK+	B-signal incremental encoder or clock(+) signal absolute measuring system
12	ENC /B / CLK-	/B signal incremental encoder or clock (-) signal absolute measuring system
13	PRESET	PRESET signal for absolute measuring system
14	LOW-BAT	Signal condition battery for absolute measuring system
15	n.u.	

X7 - Connection external battery for encoder interface 2 - 2-pin socket

Pin	Signal	Description
1	BAT-	Connection (-) external battery for absolute measuring system
2	BAT+	Connection (+) external battery for absolute measuring system

X8 - Connection power supply 24V DC and system signals - socket 2x8pin

Pin	Signal	Description
1	SF1 IN	Input safety function channel 1
3	SF2 IN	Input safety function channel 2
5	IN4	digital input IN4 (24V/10mA)
7	OUT 1	digital output OUT1 (24V/20mA)
9	STO1 IN	Input safety function STO channel 1
11	STO2 IN	Input safety function STO channel 2
13	Logic 24V	Power supply for digital inputs +24V
15	Logic GND	Power supply for digital inputs GND
2	SF1 OUT	Output safety function channel 1
4	SF2 OUT	Output safety function channel 2
6	IN4	digital input IN4 (24V/10mA)
8	OUT 1	digital output OUT1 (24V/20mA)
10	STO1 IN	Input safety function STO channel 1
12	STO2 IN	Input safety function STO channel 2
14	Logic 24V	Power supply for digital inputs +24V
16	Logic GND	Power supply for digital inputs GND

X9 - Connection motor brake and digital inputs - 8-pin plug

Pin	Signal	Description
1	Brake	Output motor brake 24V / 1A
2	Logic GND	Power supply for digital inputs and outputs GND
3	Logic GND	Power supply for digital inputs and outputs GND
4	IN1	digital input IN1
5	IN2	digital input IN2
6	IN3	digital input IN3
7	IN4	digital input IN4
8	Logic 24V	Power supply for digital inputs and outputs +24V

X10 - Motor connection - 7-pole plug

Pin	Signal	Description
1	U	Connection motor phase U
2	V	Connection motor phase V
3	W	Connection motor phase W
4	PE	Protective earth
5	PE	Protective earth
6	GND	Power supply GND for power
7	100V	Power supply 36V DC to 100V DC for power

3.6 Mechanical dimensions

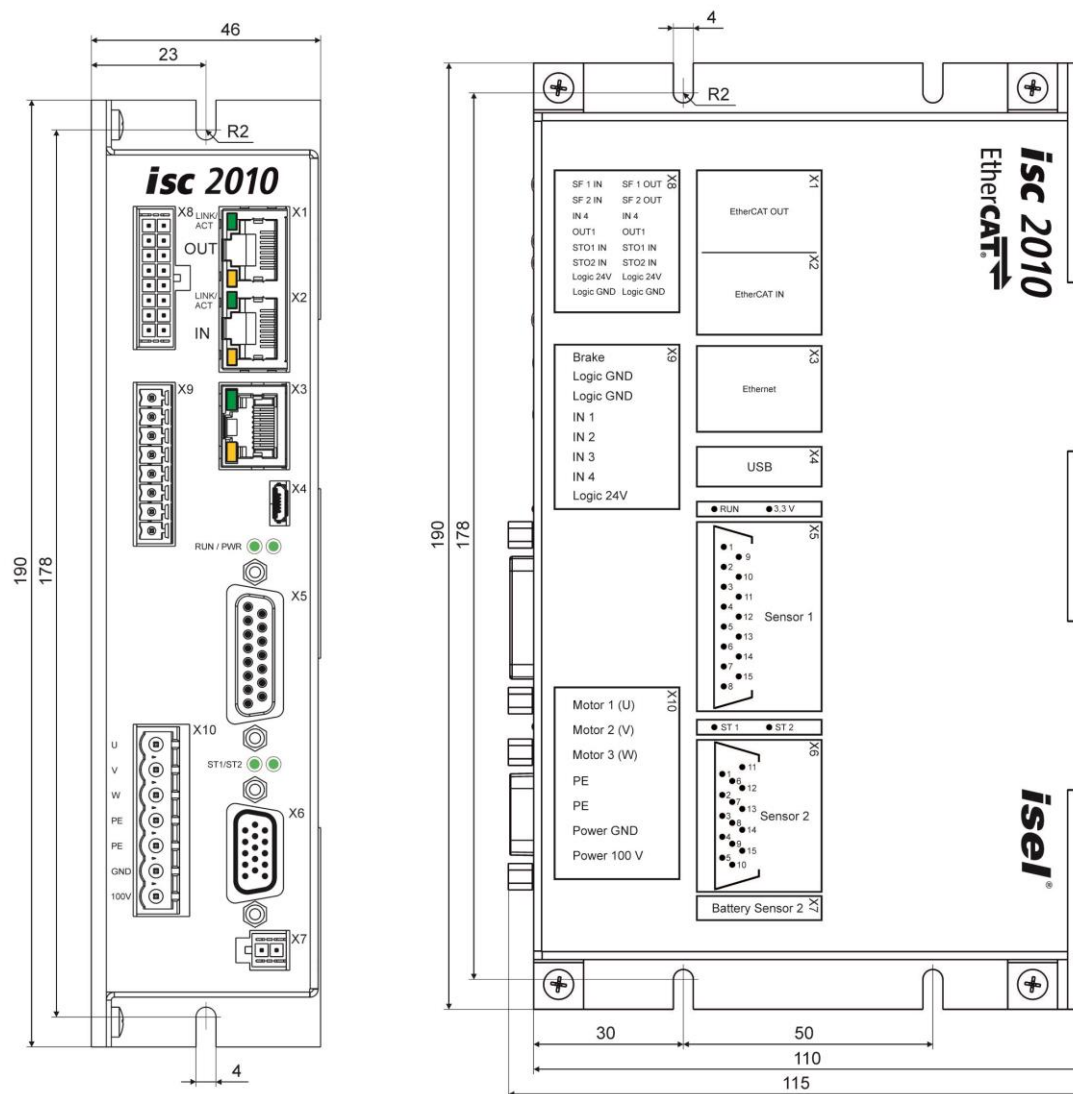


Fig. 2 - Dimensions Servo output stage isc2010

3.7 Scope of delivery

In the scope of delivery of the Servo output stage isc2010 are:

- 1x Servo output stage isc2010
- 1x connector set X8
- 1x connector set X9
- 1x connector set X10
- 1x Operating instructions

4 Functional overview

4.1 Power supply +24V

To supply the module and the inputs and outputs, a +24V power supply (Logic 24V) is fed in at connector X8.

+24V ±10% / minimum current 300mA

The current consumption increases according to the connected peripherals (motor brake, inputs and outputs, second measuring system).

Attention!



Incorrect wiring or operation outside the specified parameters can lead to permanent destruction of the module.

Attention!



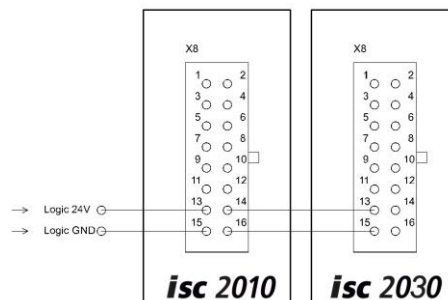
Limit the maximum current of the supply line to 4A.

Attention!






There is no fuse for the +24V power supply on the module; the +24V power supply must be fused externally.

As reference potential for the inputs and outputs, the voltage is also available at connectors X5 and X9.





4.2 Power supply Power - 36V to 100V DC

The Servo output stage isc2010 is operated with a supply voltage (power) of 36V to 100V DC.

Attention!	
	When braking the motor, the DC link voltage increases. This must be limited by switching on an external brake chopper.
Attention!	
	Incorrect wiring of the power supply or operation outside the specified parameters can lead to permanent destruction of the module.
Attention!	
	There is no fuse for the power supply on the board, the power supply must be fused externally.

4.3 Multi-encoder interface

The Servo output stage isc2010 has 2 separate multi-encoder interfaces (encoder system 1 and encoder system 2).

Attention!	
	With the exception of the Hall measuring system (encoder system 1), only 1 incremental measuring system or 1 absolute measuring system is supported per encoder interface.
Attention!	
	Wrong Gerber interface wiring or operation outside the specified parameters may cause permanent damage to the board.

The measuring systems are configured in the setup software. The following measuring systems are supported:

Encoder system 1

Incremental Encoder	different Signal - RS422 /A, A, /B, B, /Z, Z
Hall	digital signals - open collector or TTL Hall A, Hall B, Hall C
Absolute Encoder - multiturn with BiSS-C protocol	different Signal - RS485 DATA+, DATA-, CLK-, CLK+

Encoder system 2

Incremental Encoder	different Signal - RS422 /A, A, /B, B, /Z, Z
Absolute encoder - single or multiturn with BiSS-C or MINAS protocol	different Signal - RS485 DATA+, DATA-, CLK-, CLK+

Incremental encoder - RS422

Incremental encoders with differential signals according to RS422 specification are supported. A termination resistor of 120 Ω is provided on the board.

maximum encoder input frequency	10MHz
minimum pulse length	200ns

Hall

Hall sensors with single-ended signals (open collector or TTL) are supported.

Absolute Encoder

Absolute encoders with differential data transmission according to RS485 specification are supported. A terminating resistor of 120 Ω is provided on the board.

Attention!



Only absolute encoders in multiturn design are supported. Encoder system 2 is specially prepared for absolute encoders that require an external battery, the battery can be connected externally to connector X7.

Attention!



When using a measuring system with external battery, follow the specifications and instructions of the manufacturer of the measuring system.

Supported Protocols	multiturn BiSS-C, MINAS
Maximum data frame	MINAS according to the MINAS specification BiSS-C up to maximum 64Bit

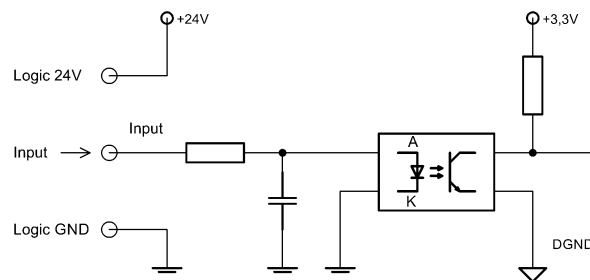
4.4 Digital inputs

The Servo output stage isc2010 has 4 digital inputs 24V/approx. 10mA (IN1, IN2, IN2, IN4) Reference potential for the inputs is Logic 24V and Logic GND. At input +24V = logic 1 and 0V or open = logic 0. The functionality of the inputs is configured in the setting software.

Attention!



Wrong wiring of the inputs or operation outside the specified parameters can lead to permanent destruction of the inputs.



Attention!



Input IN1 and IN2 is available at connectors X5 and X9. Input IN4 is available at connectors X8 and X9.

4.5 Digital output

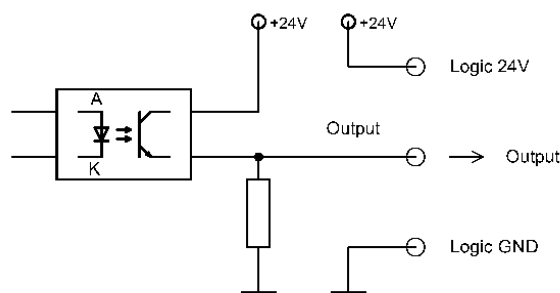
The Servo output stage isc2010 has a digital output 24V/20mA (OUT1)

Attention!




Incorrect wiring of the output or operation outside the specified parameters can lead to permanent destruction of the output.

Reference potential for the output is Logic 24V and Logic GND. Here +24V = logic 1 and 0V = logic 0 at the output. The functionality of the output is configured in the setting software.

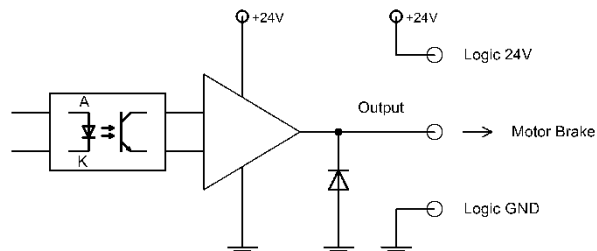


4.6 Motor brake output

The Servo output stage isc2010 has an output for switching a motor brake 24V/1A.


Attention!	
	<p>Incorrect wiring of the output or operation outside the specified parameters can lead to permanent destruction of the output. Observe the instructions of the motor and/or brake manufacturer regarding the switching of the brake (power, freewheeling diode), motors or motor modules from isel-automation GmbH & Co. KG are already correctly configured for this purpose.</p>

Reference potential for the output is Logic 24V and Logic GND. The functionality of the output is configured in the setup software.

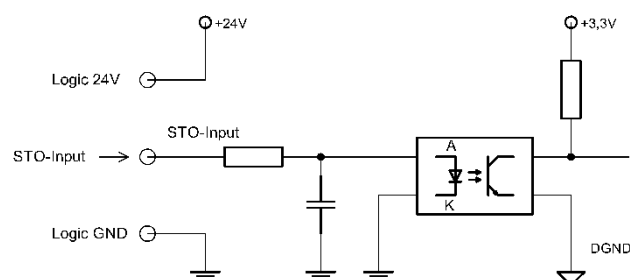


4.7 Safe inputs STO

The Servo output stage isc2010 has 2 safe inputs STO1 and STO2 (24V/ca. 10mA).

Attention!	
	<p>Wrong wiring of the inputs or operation outside the specified parameters can lead to permanent destruction of the inputs.</p>

Reference potential for the inputs is Logic 24V and Logic GND. At the input +24V = logic 1 and 0V or open = logic 0.



5 Configuration

The configuration of the Servo output stage isc2010 is done with the setup software ie-sc10XX-config, available in the download area www.isel-automation.com. The configuration can be done via USB, Ethernet or EtherCAT connection.

The drive module has a persistent memory to store parameters permanently. All motor and control parameters can be loaded and stored in the Servo output stage. Detailed documentation can be found in the commissioning software documentation.

6 Functional safety

The Servo output stage isc2010 has the safety function STO (Safe-Torque-Off) according to IEC61800-5-2. The safety function STO can only be implemented in conjunction with a suitable safety controller. 2 safe inputs are provided for the STO safety function. These must be connected to **the safety control system**. The safe state is active when one of the two inputs is low, 0V or open. Safety controllers with dynamically tested outputs are supported. For this purpose the STO inputs ignore level changes up to a width of 5ms.

6.1 Safety function STO (Safe-Torque-Off)

Definition

The safety function STO (Safe-Torque-Off) in accordance with IEC61800-5-2 enables the motor torque to be switched off safely. No interruption of the supply voltage is necessary. The following stop categories can be realized:



Stop category 0

Shutdown by immediately switching off the power to the drive elements of the machine. This means that an uncontrolled stop is executed.

Stop category 1

In combined use with an approved safety controller, the implementation of the Stop Category 1 function is possible. Shutdown is performed by the Enable function. The safe shutdown is then implemented by the STO function. The braking of the motor is controlled with a defined braking ramp. After the motor has come to a standstill, the STO function is activated. The energy to the drive elements of the machine is immediately switched off. This means that a controlled stop is executed.

Handling

Attention!	
	If the STO function is triggered while the motor is rotating, the motor runs down uncontrolled.
Attention!	
	The STO function may only be reset when the engine is stopped.

The STO function "safe state" is triggered via the redundant inputs STO1 and ST2 at connector X8 by connecting at least one STO input to 0V or open. When the STO function is activated, the power stage is switched off and an error message (if "Enable" is active) is generated. The motor can no longer generate torque. A restart of the motor movement is only possible after resetting the STO function. The STO function may only be reset when the motor is stopped. The two STO inputs must be connected to +24V. The STO function is then enabled again by activating the software enable in EtherCAT mode. The motor can generate a torque again.

7 Installation

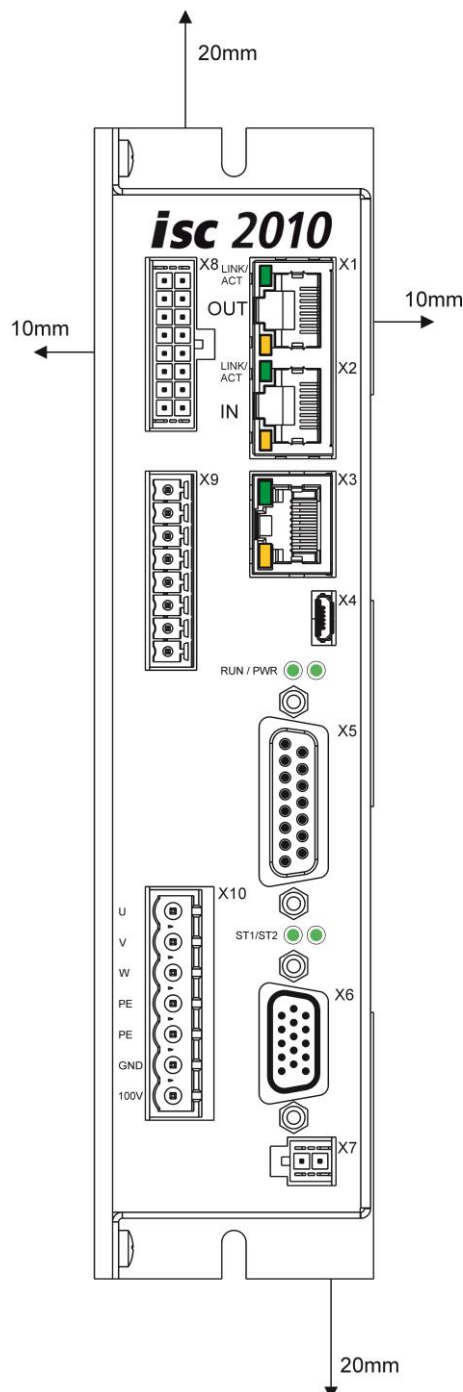
7.1 Mechanical installation

The Servo output stage isc2010 is designed for switch cabinet mounting. The preferred mounting position is vertical with the motor connection pointing downwards. It is fastened to the rear wall with 2 screws (M5). Ensure good electrical contact with earthing of the housing and the mounting plate.





Attention!



A good grounding of the housing and mounting plate must be ensured. Adequate ventilation (sufficient air flow) of the assembly must be provided.



7.2 Electrical installation

Warning!	
	For safety reasons, all PE protective conductors must be connected before commissioning. During installation, the regulations of EN 50178 for protective earthing must be observed!
Warning!	
	The Servo output stage contains capacitors that remain charged after the module is disconnected from the power supply.
Attention!	
	The housing must be connected to PE. All shields must be connected to PE over a large area.
Attention!	
	All work on the electrical installation must be carried out in a de-energized state.

Motor cable

Use only shielded cables for the motor cable.

Measuring system cable

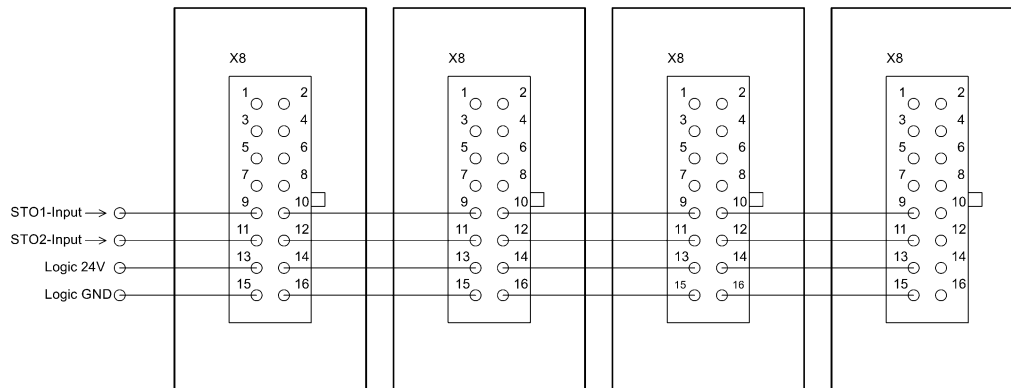
For the measuring system cable use only shielded cables with twisted pair wires for the encoder signals according to RS422 or RS485 specification.

Engine brake

Connect the possibly existing motor brake to connector X9.

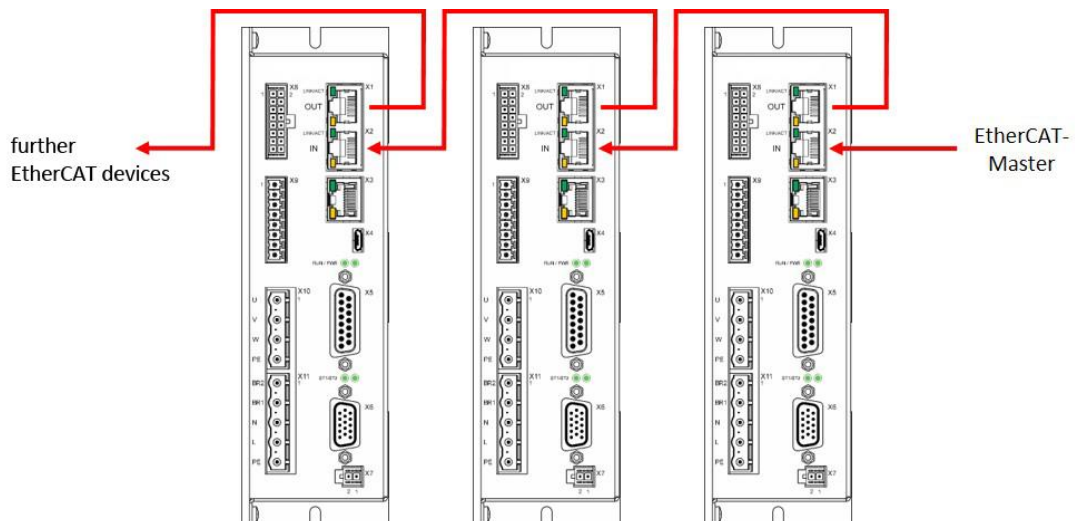
Control lines for 24V signals (X8)

Connector X8 is connected to the +24V power supply, the STO signals, output OUT1, input IN4 and the SF signals. A minimum wiring with +24V power supply and STO signals is shown in the figure below. The signal assignment was prepared for a simple concatenation of several Servo output stage s.



EtherCAT Connection

Use shielded patch cables for the EtherCAT cable, at least according to category CAT 5e. Connect the EtherCAT sockets of the servo controller (X1 and X2) with the patch cable as shown in the figure.



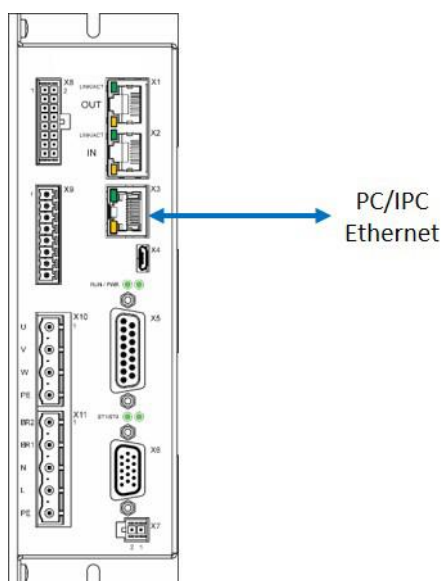
Attention!



Note the assignment for EtherCAT IN at socket X2 and EtherCAT OUT at socket X1. Errors in the bus cabling lead to an error in the EtherCAT communication.

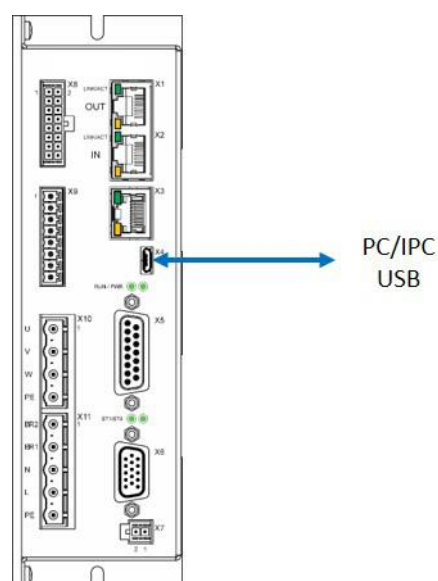
Ethernet connection

Use shielded patch cables for the Ethernet line, at least according to category CAT 5e.



USB connection

Use a shielded USB cable for the USB line.



STO inputs

The Servo output stage has the safety function STO. The STO inputs must be connected to a suitable safety controller.

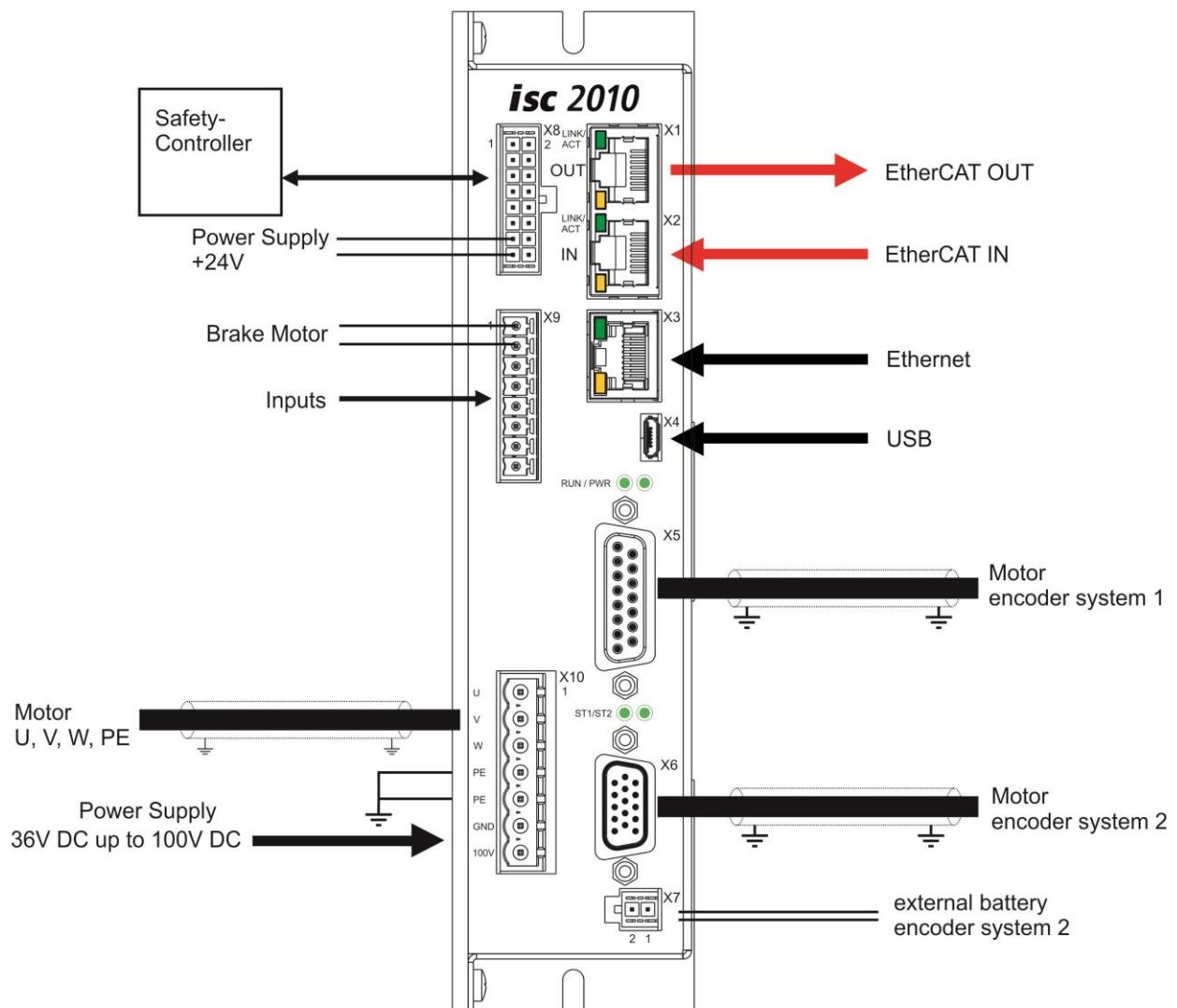


Fig. 3 - system Servo output stage isc2010

8 Disturbances

8.1 LED error table

Flashing Frequency LED Status 2	Error	Remedy
1 Hz	STO error	Check STO cabling, reboot system
2 Hz	Overvoltage	Set braking ramp flatter
4 Hz	Overcurrent	Set acceleration ramp flatter, increase current controller Kp
Permanently switched on	other errors	Read out error in setting program (error code table)
Permanently switched off	no error	

9 Disposal



The symbol on the product or its packaging indicates that it must not be disposed of together with the normal household waste. The users are obliged to return the products/old devices to a collection point for old electrical and electronic devices. The separate collection and proper disposal of your products/old devices supports the conservation of natural resources and guarantees a recycling protecting the human health and the environment. You can get information on where to find take-back points for your old devices from your city administration, local waste disposal companies or on the internet.

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