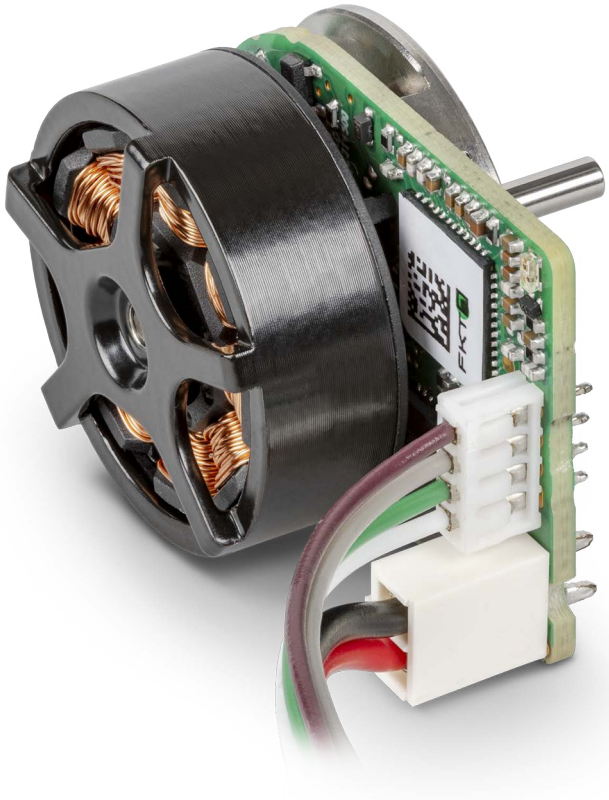
maxon

ECX FLAT 22

OPERATING MANUAL



ECX FLAT 22, brushless, with integrated electronics
Operating Manual
mmag | Edition 2025-05 | DocID rel12838

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READ THIS FIRST

***These instructions are intended for qualified technical personnel. Prior commencing with any activities**…*

- *you must carefully read and understand this manual and*
- *you must follow the instructions given therein.*

***The ECX FLAT 22 iE** is considered as partly completed machinery according to EU Directive 2006/42/EC, Article 2, Clause (g) and **is intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment**.*

***Therefore, you must not put the device into service**,…*

- *unless you have made completely sure that the other machinery fully complies with the EU directive's requirements!*
- *unless the other machinery fulfills all relevant health and safety aspects!*
- *unless all respective interfaces have been established and fulfill the herein stated requirements!*

1 ABOUT

1.1 About this Document

1.1.1 Intended Purpose

The purpose of the present document is to familiarize you with the ECX FLAT 22 iE. It will highlight the tasks for safe and adequate installation and/or commissioning. Follow the described instructions …

- to avoid dangerous situations,
- to keep installation and/or commissioning time at a minimum,
- to increase reliability and service life of the described equipment.

The present document is part of a documentation set and contains performance data and specifications, information on fulfilled standards, details on connections and pin assignment, and wiring examples.

1.1.2 Target Audience

The present document is intended for trained and skilled personnel. It conveys information on how to understand and fulfill the respective work and duties.

1.1.3 How to use

Throughout the document, the following notations and terms will be used.

Notation	Meaning
(n)	refers to an item (such as part numbers, list items, etc.)
➔	denotes “see”, “see also”, “take note of” or “go to”

Table 1-1 Notation used

Term	Meaning
Direction **CW / CCW**	Indicates the direction of rotation of the motor shaft: • CW: Rotor turning to the right (clockwise) when looking towards the mounting flange • CCW: Rotor turning to the left (counterclockwise) when looking towards the mounting flange
Ingress protection **IP00**	The IP code (Ingress Protection Code) classifies and rates the degree of protection provided by casings and enclosures against intrusion, dust, accidental contact, and water. • IP00: No protection against access to dangerous parts. No protection against water.
ECX FLAT 22 iE	Shorthand for the complete designation of the motor: ECX FLAT 22 brushless with integrated electronics.

Table 1-2 Terms used

1.1.4 Symbols & signs

This document uses the following symbols and signs:

Type	Symbol	Meaning
Safety alert DANGER		Indicates an **imminent hazardous situation**. If not avoided, it **will result in death or serious injury.**
WARNING		Indicates a **potential hazardous situation**. If not avoided, it **can result in death or serious injury.**
CAUTION		Indicates a **probable hazardous situation** or calls the attention to unsafe practices. If not avoided, it **may result in injury.**
Prohibited action	 (typical)	Indicates a dangerous action. Hence, **you must not!**
Mandatory action	 (typical)	Indicates a mandatory action. Hence, **you must!**
Requirement, Note, Remark		Indicates an activity you must perform prior to continuing, or gives information on a particular point that must be observed.
Best practice		Indicates an advice or recommendation on the easiest and best way to further proceed.
Material Damage		Indicates information particular to possible damage of the equipment.

Table 1-3 Symbols and signs

1.1.5 Trademarks and Brand Names

For easier legibility, registered brand names are listed below and will not be further tagged with their respective trademark. It must be understood that the brands (the list below is not necessarily concluding) are protected by copyright and/or other intellectual property rights even if their legal trademarks are omitted in the later course of this document.

Brand Name	Trademark Owner
Micro-Fit™ Mini-Fit Jr.™	© Molex, USA-Lisle, IL

Table 1-4 Brand names and trademark owners

1.1.6 Copyright

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1.2 About the Device

The ECX FLAT 22 with integrated electronics is a brushless, speed-controlled 4-quadrant drive. It combines the advantages of a flat motor with the performance of an integrated, digital 4-quadrant servo controller. The electronics are based on the proven maxon «ESCONc» platform.

The ECX FLAT 22 iE is available as short (S) or long (L) version. The motor can be commanded via 4 I/Os. The I/Os and other parameters have to be specified through the CTO configurator before ordering.

Variant	Output [W]
ECX FLAT 22 S brushless, with integrated electronics.	16.7
ECX FLAT 22 L brushless, with integrated electronics.	29

Table 1-5 Available versions

Among others, the ECX FLAT 22 iE has the following features.

- Commutation with Hall sensors
- digital speed control
- 4 factory-configured inputs and outputs
- comprehensive protection system (protection against reverse polarity, overvoltage, undervoltage, blockage, transients, over temperature monitoring of the electronics)

The ECX FLAT 22 iE can be used in various application areas (examples are not exhaustive):

- Fans and ventilators
- Pumps
- Laboratory application
- Measuring systems
- Printers
- Analytical equipment
- or similar products

Intended use
The ECX FLAT 22 iE may only be used as a component in electrical equipment or machinery and may only be put into operation as an integral part of such equipment or machinery. Any other use is not permitted.
The ECX FLAT 22 iE may only be operated within the performance limits described in this document.

1.3 About the Safety Precautions

- Make sure that you have read and understood the note “READ THIS FIRST” on page 1-2!
- Do not engage with any work unless you possess the stated skills (➔Chapter “1.1.2 Target Audience” on page 1-3)!
- Refer to ➔Chapter “1.1.4 Symbols & signs” on page 1-4 to understand the subsequently used indicators!
- You must observe any regulation applicable in the country and/or at the site of implementation with regard to health and safety/accident prevention and/or environmental protection!

DANGER

High voltage and/or electrical shock
Touching live wires causes death or serious injuries!
- *Consider any power cable as connected to live power, unless having proven the opposite!*
- *Make sure that neither end of cable is connected to live power!*
- *Make sure that power source cannot be engaged while work is in process!*
- *Obey lock-out/tag-out procedures!*
- *Make sure to securely lock any power engaging equipment against unintentional engagement and tag it with your name!*

Requirements
- *Make sure that all associated devices and components are installed according to local regulations.*
- *Be aware that, by principle, an electronic apparatus cannot be considered fail-safe. Therefore, you must make sure that any machine/apparatus has been fitted with independent monitoring and safety equipment. If the machine/apparatus should break down, if it is operated incorrectly, if the control unit breaks down or if the cables break or get disconnected, etc., the complete drive system must return – and be kept – in a safe operating mode.*
- *Be aware that you are not entitled to perform any repair on components supplied by maxon.*

Electrostatic sensitive device (ESD)
- *Observe precautions for handling Electrostatic sensitive devices.*
- *Handle the device with care.*

2 SPECIFICATIONS

2.1 Technical data drive

2.1.1 ECX FLAT 22 S & L

Drive Data	Unit	ECX FLAT 22 S	ECX FLAT 22 L
Nominal power supply voltage	V	24	24
Nominal speed	rpm	12’000	11’000
Nominal torque at 25°C	mNm	13.3	25
Nominal supply current at 25°C	A	1.25	2.2
Maximum speed at nominal voltage	rpm	14’000	14’000
Maximum permissible drive speed	rpm	14’000	14’000
Maximum torque (short-time)	mNm	30.8	57.6
Maximum supply current (short time)	A	2.134	3.88
Rotor inertia of the drive	gcm^2	4.84	6.82
Nominal supply voltage $+V_{CC}$	V	8...28	8...28
Mechanical time constant	ms	6.82	4.67
Speed constant	rpm/V	682	661
Speed set value input	V	0...10	0...10
Scale speed set value input	rpm/V	1’200	1’100
Min. permissible drive speed	rpm	300	300
Max. acceleration	rpm/s	20’000	20’000

Thermal data	Unit	ECX FLAT 22 S	ECX FLAT 22 L
Thermal resistance housing-ambient	K/W	8.48	5.9
Thermal resistance winding-housing	K/W	14	5.84
Thermal time constant winding	s	11.9	6.09
Thermal time constant drive	s	20.3	14.1
Ambient temperature	°C	-25...+85	-25...+85

Mechanical data	Unit	ECX FLAT 22 S	ECX FLAT 22 L
Axial play at axial load	< 4 N > 4 N	0 mm 0.14 mm	0 mm 0.14 mm
Direction of force		Pull	Pull
Radial play		preloaded	preloaded
Max. axial load (dynamic)	N	1.8	1.8

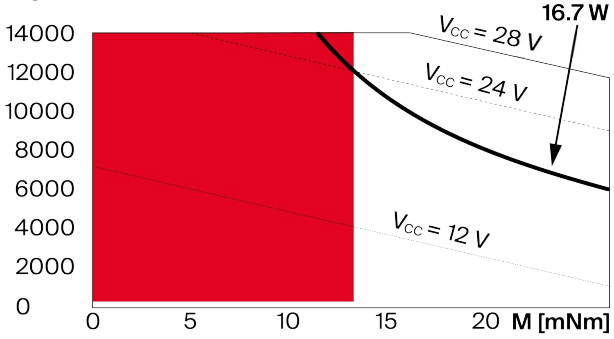
Mechanical data	Unit	ECX FLAT 22 S	ECX FLAT 22 L
Max. force for press fits (static) (shaft supported)	N N	26 200	26 200
Max. radial load [mm from flange]	N	3.5 [5]	3.5 [5]

Other specifications	Unit	ECX FLAT 22 S	ECX FLAT 22 L
Weight of the drive	g	27	33.5

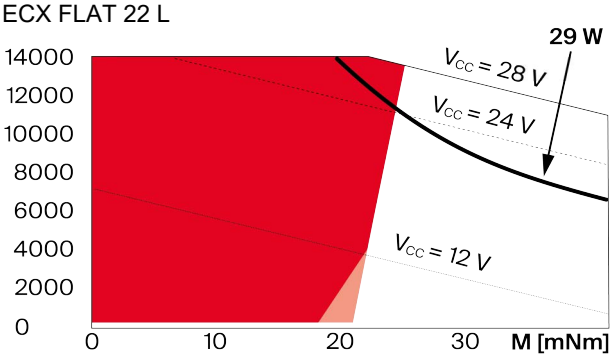
Table 2-6 Technical data

2.2 Operating Range

ECX FLAT 22 S



ECX FLAT 22 L



- Continuous operation
- Continuous operation with reduced thermal resistance R_{th2} 50%
- Short term operation

Table 2-7 Operating range

2.3 Technical data electronics

Parameter		Unit	ECX FLAT	
			22 S	22 L
Electrical rating	Nominal supply voltage V_{CC}	VDC	24	
	Absolute supply voltage $+V_{min}$ / $+V_{max}$	VDC	8 / 28	
	Pulse width modulation frequency	kHz	50	
	Commutation	kHz	Bloc commutation	
	Sampling rate PI speed controller	kHz	1 (1 ms)	
	Max. motor voltage	VDC	1.00 x $+V_{CC}$	

Continued on next page.

Parameter		Unit	ECX FLAT	
			22 S	22 L
Environment	Protection class	—	IP00	
	Operation temperature	°C	−25…+25	
	Extended temperature range [a]	°C	+25…+85	
	Storage temperature	°C	−40…+85	
	Humidity (non-condensing)	%	5…90	
	Operation altitude [b]	m MSL	0...3'000	
Inputs & Outputs	Input/output 1 (I/O 1)		Analog input: 0…+10 V	
	Input/output 2 (I/O 2)		Digital input: +2.0…+24 VDC	
	Input/output 3 (I/O 3) Input/output 4 (I/O 4)		Digital input: +2.0…+24 VDC	
			Digital output: 0…+3 V	
Connections	X1 Supply voltage	—	Molex Mini-Fit Jr., 2-pole, female	
	X2 Inputs/outputs	—	Molex Micro-Fit, 4-pole, female	

[a] Operation within the extended temperature range is permitted, whereby a respective derating will apply
[b] Operating altitude in meters above mean sea level, MSL

Table 2-8 Technical data

2.4 Limitations

Protective function	Switch-off threshold	Recovery threshold
Undervoltage	7.2 V	7.4 V
Overvoltage	29.6 V	29.5 V
Overcurrent	±9.0 A	—
Thermal overload	110 °C	95 °C

Table 2-9 Limitations

2.5 Dimensional Drawings

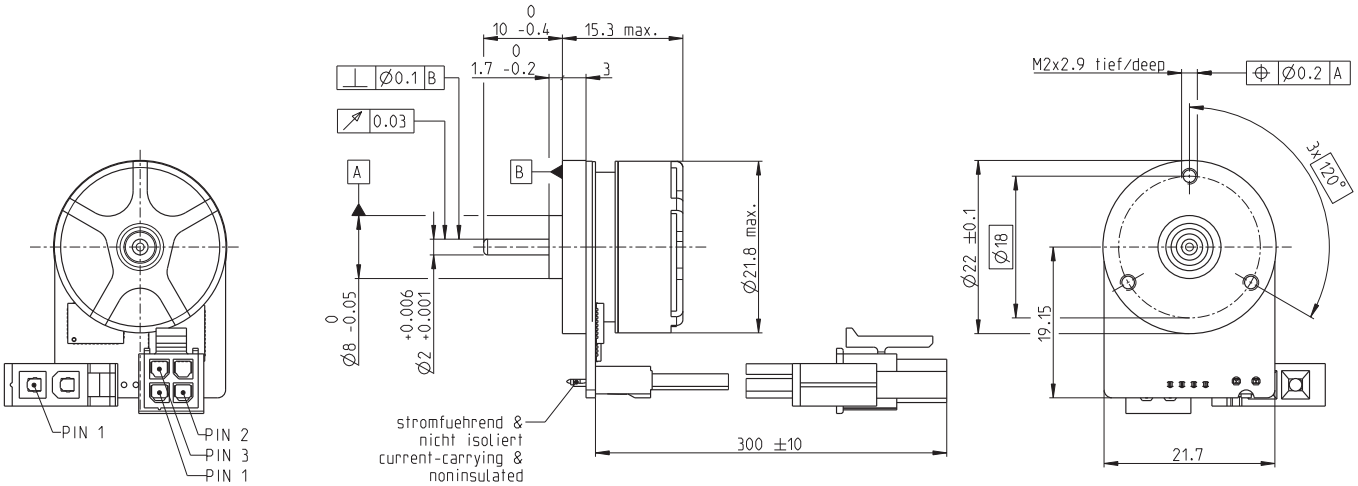


Figure 2-1 ECX FLAT 22 S │Dimensional drawing [mm] (not to scale)

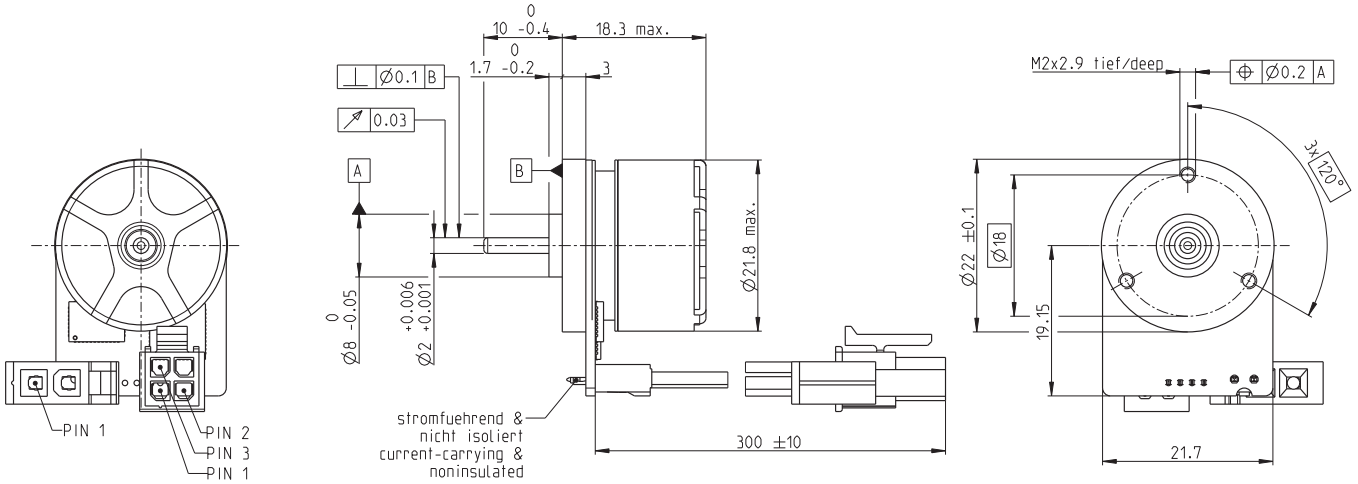


Figure 2-2 ECX FLAT 22 L │Dimensional drawing [mm] (not to scale)

2.6 Standards

The described device has been successfully tested for compliance with the below listed standards. In practical terms, only the complete system (the fully operational equipment comprising all individual components, such as drive, power supply unit, EMC filter, cabling etc.) can undergo an EMC test to ensure interference-free operation.

Important notice on the EMC-compliant installation
The device's compliance with the mentioned standards does not imply its compliance within the final, ready to operate setup. In order to achieve compliance of your operational system, you must perform EMC testing of the involved equipment as a whole.

Electromagnetic compatibility		
Generic	IEC/EN 61000-6-2	Immunity for industrial environments
	IEC/EN 61000-6-3	Emission standard for residential, commercial and light-industrial environments
Applied	IEC/EN 55032 (CISPR 32)	Radio disturbance characteristics / radio interference
	IEC 61000-4-3	Radiated, radio-frequency, electromagnetic field immunity test > 10 V/m
	IEC 61000-4-6	Immunity to conducted disturbances, induced by radio-frequency fields 10 Vrms
	IEC 61000-4-8	Power frequency magnetic field 30 A/m

Others		
Environment	IEC/EN 60068-2-6	Environmental testing – Test Fc: Vibration (sinusoidal, 10…500 Hz, 20 m/s^2)
	MIL-STD-810F	Random transport (10…500 Hz up to 2.53 g_{rms})
Safety	UL File Number	E207844; unassembled printed circuit board

Table 2-10 Standards

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3 ADJUSTMENT

3.1 General Rules

WARNING

Risk of injury
Operating the device without the full compliance of the surrounding system with the EU Directive 2006/42/EC may cause serious injuries
- *Do not operate the device, unless you have made completely sure that the other machinery fully complies with the EU directive's requirements!*
- *Do not operate the device, unless the other machinery fulfills all relevant health and safety aspects!*
- *Do not operate the device, unless all respective interfaces have been established and fulfill the requirements stated in this document!*

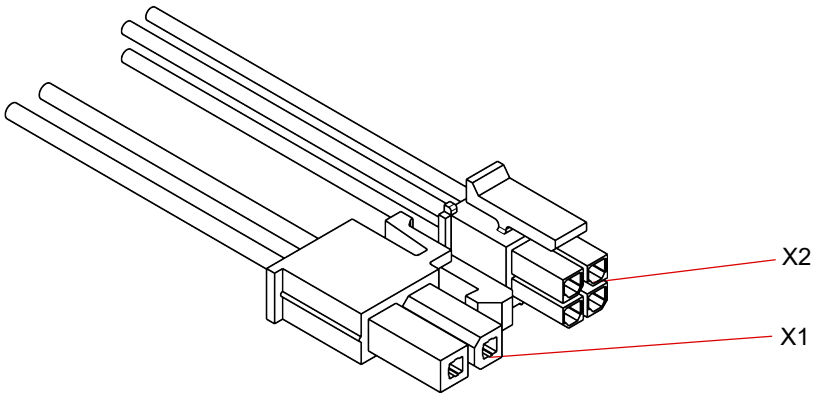
WARNING

Risk of injury
Unintentional operation or automatic start-up can lead to serious injury
- *Make sure that the surrounding system is protected from automatic start-up!*
- *Make sure to apply all necessary safeguards against unintentional operation!*

Maximal permitted supply voltage
- *Make sure that supply power is between 8…28 VDC.*
- *Supply voltages above 30 VDC will destroy the unit.*

Electrostatic sensitive device (ESD)
- *Observe precautions for handling Electrostatic sensitive devices.*
- *Handle the device with care.*

3.2 Connections



X1 Power Supply ➔Page 3-14 **X2** Inputs and Outputs ➔Page 3-15

Figure 3-3 Connectors

3.2.1 Power Supply

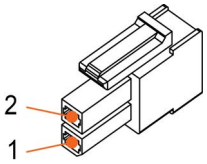


Figure 3-4 Connector X1

Plug	Pin	Color	Signal	Description
X1	1	red	$+V_{CC}$	Nominal supply voltage (+24 VDC)
	2	black	GND	Ground

Table 3-11 Connector X1 | Pin assignment

Plug	Type	Matching counterpart
X1	Molex Mini-Fit Jr., 2-pole (39-01-2020)	Molex Mini-Fit Jr. Headers or Plug Housings, Dual Row, 2 Circuits (z.B.: 39-30-1020 or 39-28-1023)

Table 3-12 Connector X1 | Specifications

Power supply requirements	
Output voltage	$+V_{CC}$ 24 VDC
Absolute output voltage	min. 8 VDC; max. 28 VDC
Output current	Depending on load • Refer to the technical data of the drive for the respectively valid current limits for the continuous maximum current and the short-term maximum acceleration current.

Table 3-13 Power supply requirements

3.2.2 Inputs and Outputs

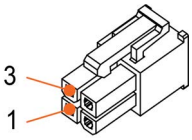


Figure 3-5 Connector X2

Plug	Pin	Color	Signal	Description
X2	1	white	I/O 1	Input/output 1
	2	green	I/O 2	Input/output 2
	3	gray	I/O 3	Input/output 3
	4	brown	I/O 4	Input/output 4

Table 3-14 Connector X2 | Pin assignment

Plug	Type	Matching counterpart
X2	Molex Micro-Fit 3.0, 4-pole (43025-0400)	Molex Micro-Fit 3.0 Headers or Plug Housings, Dual Row, 4 Circuits (z.B.: 43045-0400 or 43045-0427)

Table 3-15 Connector X2 | Specifications

3.2.2.1 I/O 1

Pin assignment	
I/O 1 GND	Pin X2 | 1 Pin X1 | 2

Analog input	
Input voltage	0…10 V (referenced to GND)
Max. input voltage	± 30 VDC
Internal pull-down resistor	47 kΩ // (47 kΩ + 20 kΩ) = 27.6 kΩ
Resolution	2.699 mV
First order lowpass time constant	660 µs

Table 3-16 I/O 1 | Specifications

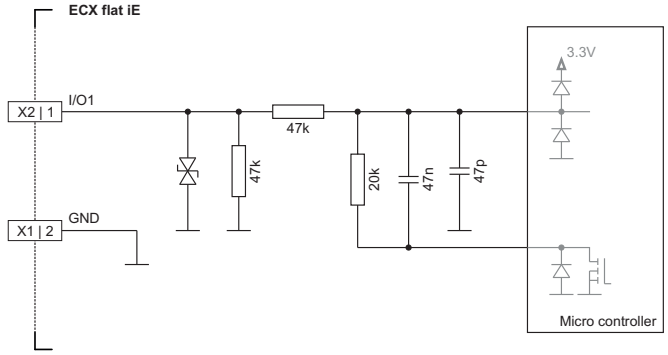


Figure 3-6 I/O 1 | Internal circuitry

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3.2.2.2 I/O 2

Pin assignment	
I/O 2 GND	Pin X2 | 2 Pin X1 | 2

Digital input	
Input voltage	0…24 V (referenced to GND)
Max. input voltage	± 30 VDC
Logic 0	< 0.8 V
Logic 1	> 2.0 V
Internal pull-down resistor	47 kΩ
First order lowpass time constant	462 µs

Table 3-17 I/O 2 | Specifications

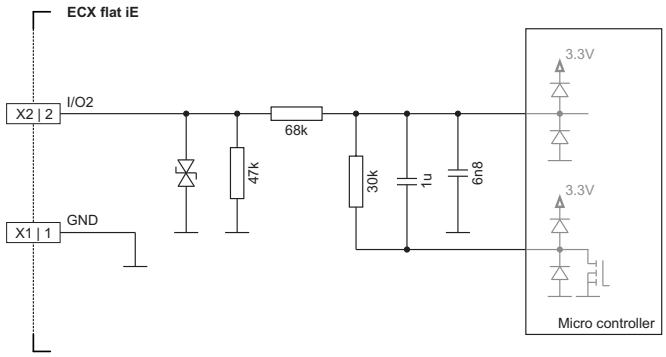


Figure 3-7 I/O 2 | Internal circuitry

3.2.2.3 I/O 3, I/O 4

Pin assignment	
I/O 3 I/O 4 GND	Pin X2 | 3 Pin X2 | 4 Pin X1 | 2

Digital input	
Input voltage	0…24 V (referenced to GND)
Max. input voltage	− 24…+30 VDC
Logic 0	< 0.8 V
Logic 1	> 2.0 V
Internal pull-down resistor	47 kΩ
First order lowpass time constant	470 µs

Digital output	
Output voltage	0…3 V @ no load
Max. external voltage	± 30 VDC
Logic 0	< 0.4 V @ <−90 µA
Logic 1	> 2.4 V @ <+190 µA
Internal pull-down resistor	47 kΩ
First order lowpass time constant	0.43 µs @ U_{out} 0.25…2.75 V, no load 470 µs @ U_{out} 0…3 V, no load

Table 3-18 I/O 3, I/O 4 | Specifications

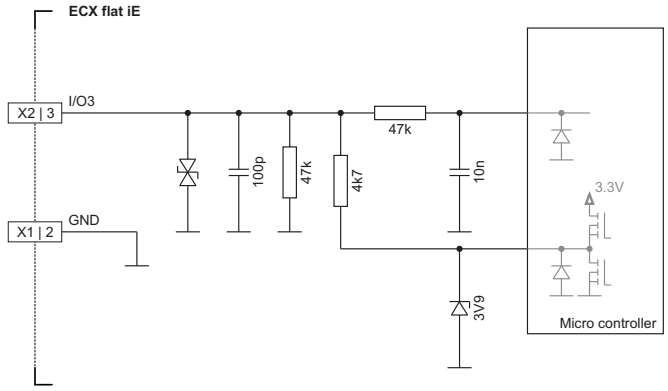


Figure 3-8 I/O 3, I/O 4 | Internal circuitry

3.3 Status Indicator

The LED shows the operational and error status.

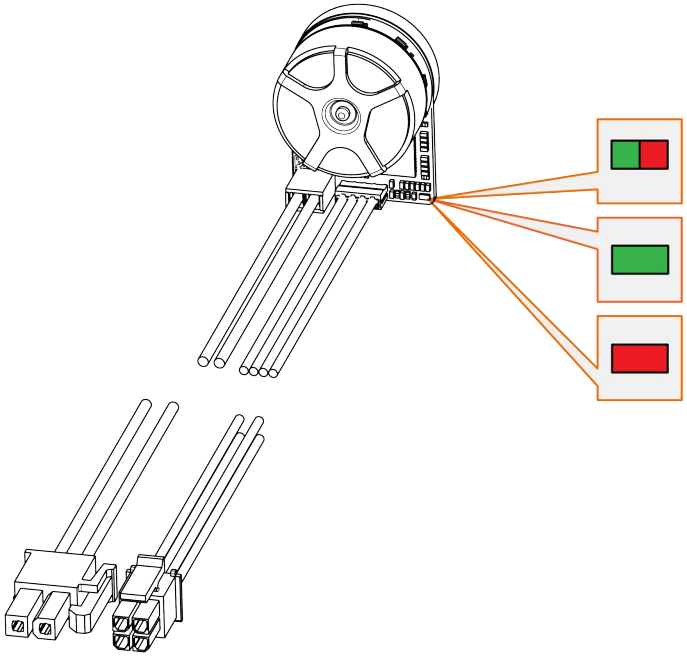


Figure 3-9 Status indicator

LED		Status / Error	
Green	Red		
off	off	INIT	
slow	off	DISABLE	
on	off	ENABLE	
2x	off	STOPPING; STOP STANDSTILL	
off	1x	ERROR	• +Vcc Overvoltage Error • +Vcc Undervoltage Error • +5 VDC Undervoltage Error
off	2x	ERROR	• Thermal Overload Error • Overcurrent Error • Power Stage Protection Error
off	4x	ERROR	• PWM Set Value Input out of Range Error
off	5x	ERROR	• Hall Sensor Pattern Error • Hall Sensor Sequence Error • Hall Sensor Frequency too high Error

Continued on next page.

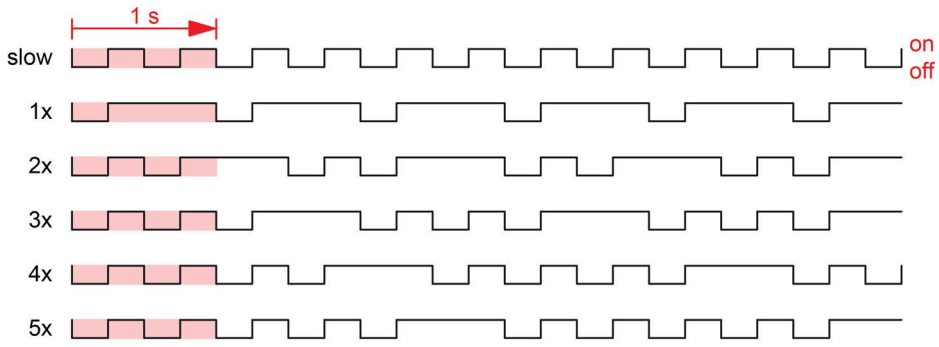
LED		Status / Error	
Green	Red		
off	on	ERROR	• Internal Software Error
			

Table 3-19 Device status LEDs | Interpretation of Condition

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4 INSTALLATION

Important notice
***The ECX FLAT 22 iE** is considered as partly completed machinery according to EU Directive 2006/42/EC, Article 2, Clause (g) and **is intended to be incorporated into or assembled with other machinery or other partly completed machinery or equipment**. The following prerequisites must be fulfilled before you are permitted to commence with the installation.*

4.1 General Rules

WARNING

Risk of injury
Operating the device without the full compliance of the surrounding system with the EU Directive 2006/42/EC may cause serious injuries
- *Do not operate the device, unless you have made completely sure that the other machinery fully complies with the EU directive's requirements!*
- *Do not operate the device, unless the other machinery fulfills all relevant health and safety aspects!*
- *Do not operate the device, unless all respective interfaces have been established and fulfill the requirements stated in this document!*

WARNING

Risk of injury
Unintentional operation or automatic start-up can lead to serious injury
- *Make sure that the surrounding system is protected from automatic start-up!*
- *Make sure to apply all necessary safeguards against unintentional operation!*

Maximal permitted supply voltage
- *Make sure that supply power is between 8…28 DC.*
- *Supply voltages above 30 VDC will destroy the unit.*
- *Note that the necessary output current is depending on the load torque. Check ➔ Chapter " Nominal supply current at 25°C" on page 2-7.*

Possible irreversible damage of motor
- *Until completion of the installation, individual components can be permanently damaged by improper handling. Therefore, handle the components with particular care.*
- *Point the cable outlet preferably downwards.*
- *Handle connection cables with special care! – Do not kink. Do not bend. Do not route around sharp edges. Do not strain.*

Electrostatic sensitive device (ESD)
- *Wear working cloth and use equipment in compliance with ESD protective measures.*
- *Handle device with extra care.*

4.2 EMC-compliant Installation

EMC conformity of the operational system
Observe the note on Page 2-11.

CABLE LENGTH ≤ 300 MM

- Usually, no shielding is required.
- Star wiring recommended if several ECX FLAT 22 iE are supplied by a common power supply.

CABLE LENGTH > 300 MM

- The voltage drop in the connection cable must be minimized by choosing a sufficiently large wire cross section.
- In electromagnetically harsh environments, use of shielded cables connected to ground at both ends can improve immunity against interferences.
- Release cable shielding on one side if 50/60 Hz interference problems occur.
- The incidence surface for interferences can be reduced by shortening the unshielded original connection cable.
- Immunity against interferences and speed stability in case of fluctuating loads can be accomplished by routing the set speed value signal separately in a both side shielded cable that is put to ground. In addition to the set speed value signal, a second ground (GND) line must also be carried in this separate cable, but only connected on the motor side. The external set value speed signal must be potential-free.

4.3 Mounting

For sufficient heat dissipation during operation, we recommend mounting on a metallic component.

The motor has a centering collar and frontal fixation threads in the flange.

When mounting output elements (e.g. pinion, shaft coupling), observe the maximum permissible axial and radial loads (➔ Chapter “2.1 Technical data drive” on page 2-7).

4.4 Wiring

4.4.1 Configuration of Inputs and Outputs

The functionality of the motor was defined during the ordering process and implemented accordingly upon production. It cannot be changed.

Find below an overview of the standard configuration of the motor. The actually selected configuration and the resulting pin assignment can be taken from the data sheet, which was generated upon placing the order

Funktion	I/O 1	I/O 2	I/O 3	I/O 4
Set value speed	X			
Enable		X		
Direction			X	
Speed monitor				X

Table 4-20 Standard configuration

4.4.2 Minimal wiring for standard configuration

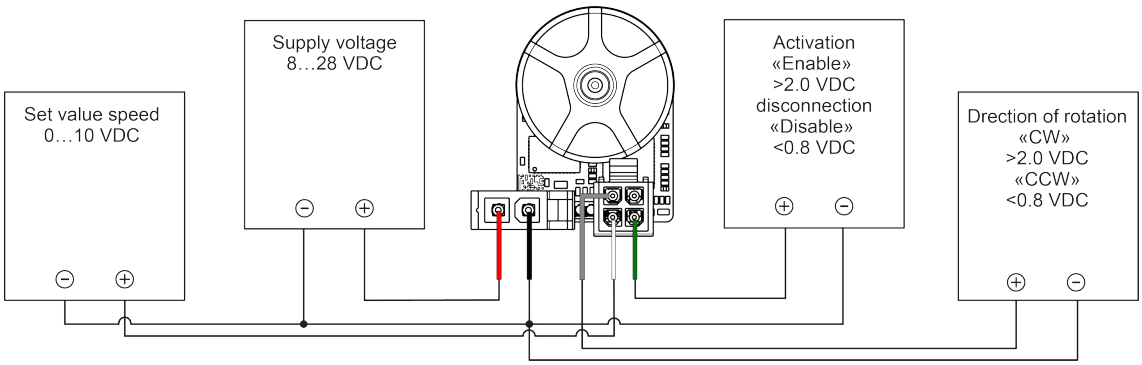


Figure 4-10 Speed set value «Enable» | «Direction» external power source

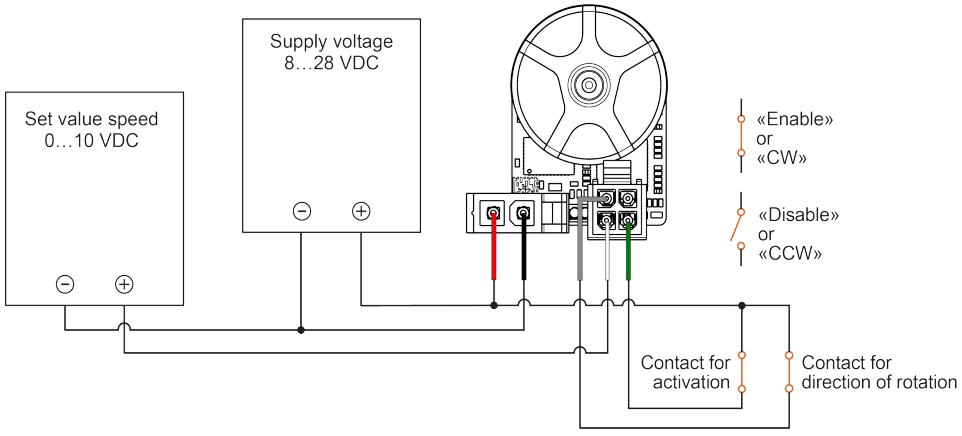


Figure 4-11 Speed set value external power source «Enable» | «Direction» potentialfree contact

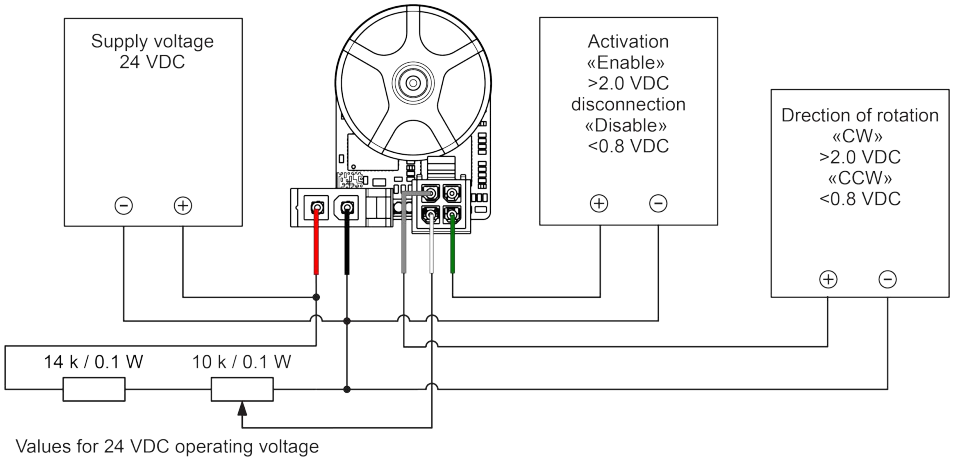


Figure 4-12 Speed set value external potentiometer «Enable» | «Direction» external power source

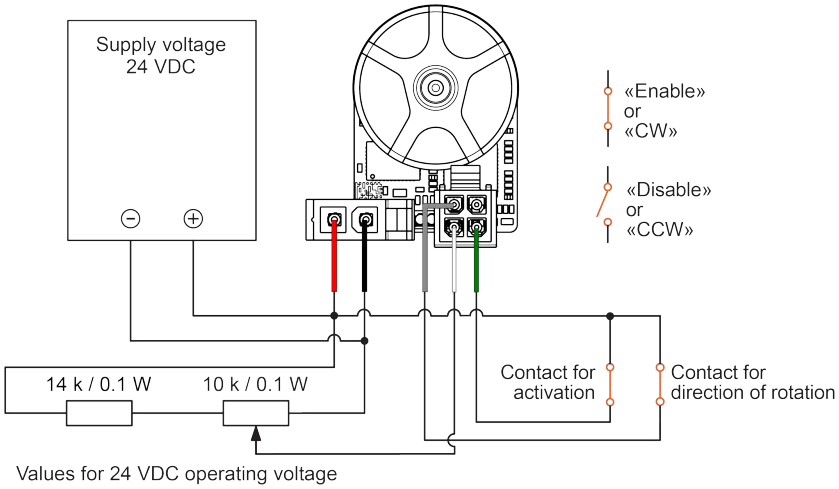


Figure 4-13 Speed set value external potentiometer «Enable» | «Direction» potential-free contact

5 HANDLING

5.1 Velocity controller with current limit

The speed controller compares the actual speed with the applied set value. In the event of a deviation, the speed is dynamically readjusted via a PI controller. The output variable of the speed controller is limited by the limit value of the current controller. In addition, an IxR compensation with constant resistance value supports the feedforward control to improve the control quality at low speeds.

5.2 Set value setting

5.2.1 Speed set value via analogue input voltage

The motor speed is set with an analog voltage at an as analog input configured I/O (➔"Configuration of Inputs and Outputs" on page 4-23).

The set speed is regulated by the controller. Changes to the speed set value are restricted by the set acceleration ramp.

In order to activate the motor, the voltage at the input «Set value speed» must be at least 0.2 V. With the «Enable» version, additionally the corresponding input must be activated.

The following set value ranges are distinguished:

Set value	Function	Remarks
<0.15 V	Voltage threshold «Disable»	Power stage disabled
>0.2 V	Voltage threshold «Enable»	Power stage enableled [1]
0.2...5.0 V 0.2...10.0 V	Linear speed setting between minimum speed[2] and set value $V_{Set} = \frac{V_{reference}}{n_{reference}} \times n_{Set}$	At low speed between minimum speed and 400 min^{-1} the control accuracy is the control accuracy is limited. The speed may deviate from the set value depending on the load and operating voltage.

V_{set}
Set value voltage [V]

n_{set}
Desired speed [rpm]

V_{enable}
Voltage switching threshold «Enable» [V]

$V_{reference}$
Voltage reference for characteristic curve slope [V]

$n_{reference}$
Speed reference for characteristic curve slope [min-1]

n_{min}
Minimum speed [rpm]

[1] With the «Enable» variant, the corresponding input must also be activated.

[2] The minimum speed is used as the lower speed limit and cannot be reached depending on the set value curve. Check ➔ Chapter "Figure 5-15 Speed set value input │switch-on and switch-off hysteresis (detail)" on page 5-27

Calculation of achievable minimum speed: $n_{min} = \frac{n_{reference} \times V_{enable}}{V_{reference}}$

Table 5-21 Set value ranges

The speed may deviate from the set value depending on the load and operating voltage. Operation up to the nominal operating point at nominal voltage or higher is recommended.

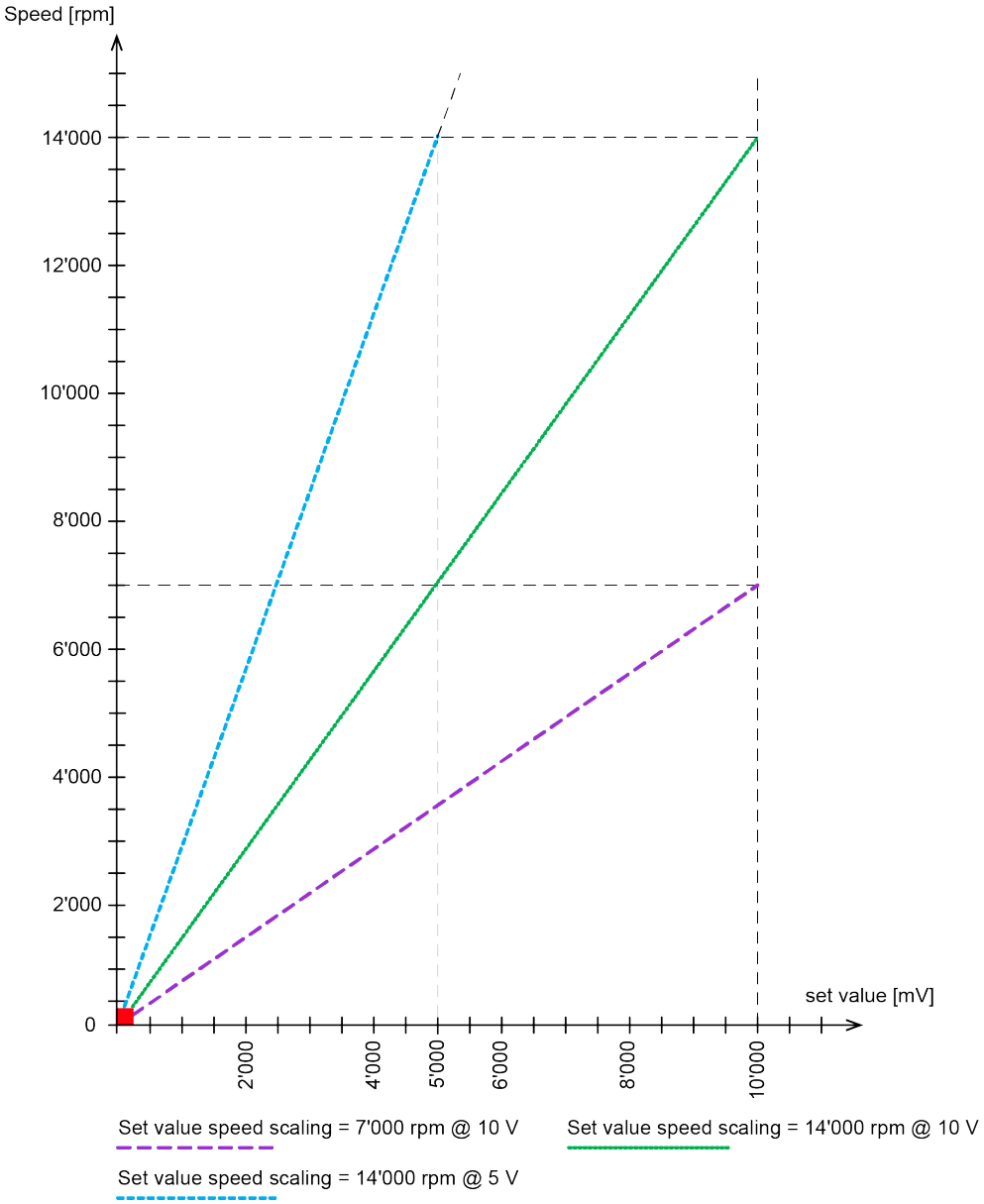


Figure 5-14 Speed set value input | characteristic curve examples

Continued on next page.

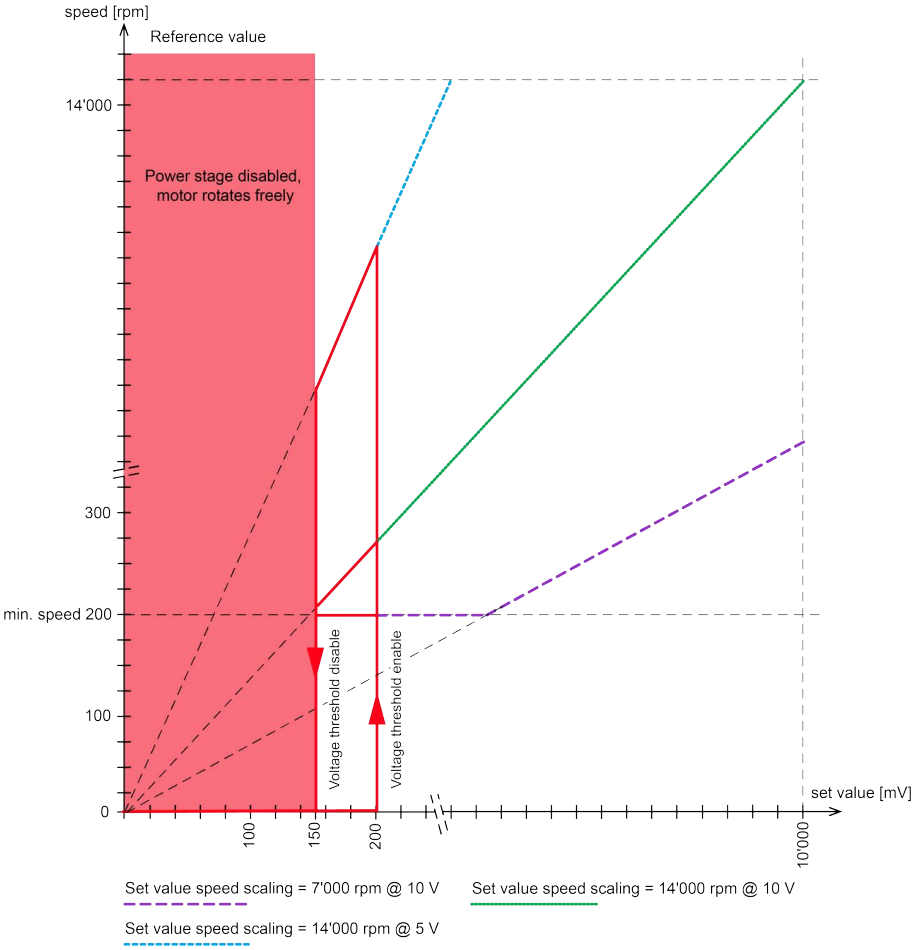


Figure 5-15 Speed set value input | switch-on and switch-off hysteresis (detail)

5.2.2 Speed set value by means of fixed value

The speed set value is preset with a fixed value and cannot be changed.

For this functionality, a digital input as «Enable» is mandatory.

The speed can be adjusted depending on the load and operating voltage from the set value depending on the load and operating voltage. Operation up to the rated operating point at rated voltage or higher is recommended.

5.3 Enable

5.3.1 Enable via digital input

The output stage is activated with the digital input «Enable». In the «Disable» state, the motor rotates freely and is not actively driven.

If the analog set value function is preselected, the analog signal must also be higher than the «Enable» switching threshold for enable.

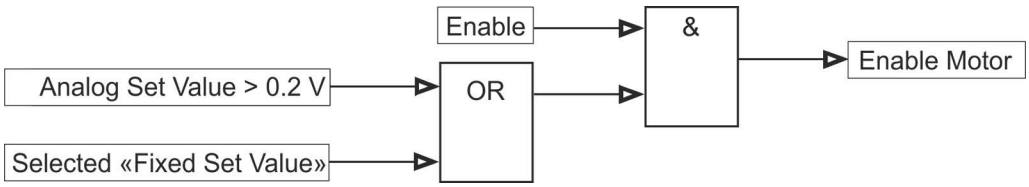


Figure 5-16 Enable connection

Entry logic	Polarity	Function	Remarks
0	«High» activ	«Disable»	Power stage disabled
1	«High» activ	«Enable»	Power stage enabled if set value higher than 0.2 V

Table 5-22 Enable function

5.3.2 Enable via set value

Enabling or disabling the output stage via the motor set value.

To enable the motor, the voltage applied to the "speed set value" Input must be at least 0.2 V.

Nominal value input	Function	Remarks
< 0.15 V	«Disable»	Power stage disabled
> 0.2 V	«Enable»	Power stage enabled

Table 5-23 Enable via set value

5.4 Direction (CW / CCW)

By changing the input signal from logic 0 to logic 1 (or vice versa), the direction of rotation is switched during operation. The motor runs down freely to the minimum speed and then accelerates in the opposite direction of rotation.

Entry logic	Polarity	Function	Remarks
0	«High» activ	Direction of rotation «CCW»	Motor rotates in direction «CCW»
1	«High» activ	Direction of rotation «CW»	Motor rotates in direction «CW»

Table 5-24 Direction

5.5 Speed Monitor

The actual speed of the motor shaft can be monitored at the output «Speed monitor». It is available as digital signal (High/Low) and delivers 6 pulses per mechanical turn.

The output «Speed monitor» is also available in «Disable» state.

Duty cycle	50%
Frequency at speed monitor output	$f_{monitor} = \frac{n_{actual}}{10}$ $n_{actual} = 10 \cdot n$

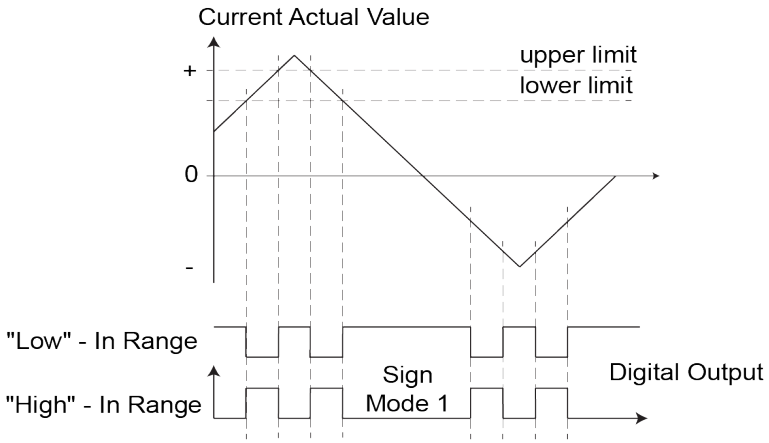
$f_{monitor}$ Frequency at speed monitor output [Hz] n_{actual} Speed [rpm]

Table 5-25 Output «Speed monitor» | Specifications

5.6 Comparator

5.6.1 Speed comparator

The speed comparator monitors the actual speed and sets the digital output as long as the speed is between the upper and lower limit in the comparison window. The range comparator is sign-independent and is active in CW as well as in CCW operation.



The input and output values are sign independent (absolute values)

Figure 5-17 Range comparator

5.6.2 Current comparator

The current comparator monitors the actual current and sets the digital output as long as the current is in the comparison window between upper and lower limit. The range comparator is sign-independent and is active in CW as well as in CCW operation. See ➔ Figure 5-17 Range comparator5-29

5.7 Fault / Ready

The error signal can be used to report the error status, or readiness for operation, to a higher-level control system.

Output logic	Function	Function	Remarks
0	«Ready»	«Ready»	Ready
1	«Fault»	«Fault»	Error pending

Table 5-26 Fault function

5.8 Protective Functions

The ECX FLAT 22 iE is equipped with the following protective devices:

INVERSE POLARITY PROTECTION

The supply voltage V_{CC} is protected against polarity reversal. Thereby, the negative input voltage must not exceed the maximum permitted supply voltage V_{CC}.

UNDERVOLTAGE SWITCH-OFF

The power stage is switched off when the supply voltage V_{CC} drops below 7.2 V.
To restore operational readiness, the operating voltage must exceed the restart threshold of 7.4 V and the error must be reset by an enable/disable operation.

OVERVOLTAGE SWITCH-OFF

The power stage is switched off when the supply voltage V_{CC} exceeds 29.6 V.
In order to restore operational readiness, the operating voltage must fall below the reclosing threshold of 29.5 V and the error must be reset by an enable/disable process.

BLOCKAGE PROTECTION

If the rotor locks for at least two seconds, the power stage is deactivated for six seconds. After that the power stage is activated again.

THERMAL PROTECTION OF THE ELECTRONICS

The power stage is switched off if the PCB temperature exceeds 110 °C. To restore operational readiness, the PCB temperature must drop below 95 °C and the error must be reset by an enable/disable operation.

Possible permanent damage to the motor
*The motor winding is **not** protected against thermal overload. To avoid defects, the motor may only be operated within the permissible operating ranges (➔Chapter "2.2 Operating Range" on page 2-8).*

I2T MODEL

The I2T model protects the motor from thermal overload. When the thermal limit is reached, the torque is limited to the nominal torque. When the motor has cooled down sufficiently, the maximum torque is permitted again.

6 OPERATION

6.1 Troubleshooting

The following requirements must be met for trouble-free operation:

Prerequisite for operation	
Motor shaft	The motor shaft is not blocked and can run freely
Power supply	The supply voltage V_{CC} is connected (red “+”, black “–”)
	The supply voltage V_{CC} is switched on and in the specified range
Set value speed	The set value voltage is connected to the configured I/O
	The set value voltage is switched on and between 0.2…10 VDC
«Enable» (Activation)	The activation voltage is connected to the configured I/O
	With activation via a potential-free contact: • The configured I/O is directly connected to the power supply (red “+”) via a switch • The switch is closed
Sense of rotation	The motor’s direction of rotation depends on the voltage applied to the «Direction» input (➔Page 5-28). • CCW (counterclockwise direction, left): <0.8 V (High active) • CW (clockwise direction, right): > 2.0 V (High active)

Table 6-27 Troubleshooting

6.2 Maintenance

The ECX FLAT 22 iE does not contain any user-serviceable parts.

The ECX FLAT 22 iE is designed for demanding long term use and is maintenance-free. Nevertheless, please contact our Service Center if any malfunction should occur.
➔https://support.maxongroup.com/

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