8DI330.ff045hi00-1

1 Order key

| 8DI | c | d | e | . | ff | ggg | h | i | 0 | 0 | - | 1 |

Size — **Size** (under c)
Length (under d)
Safety technology (under e)
Encoder system (under ff)
Rated speed (under ggg)
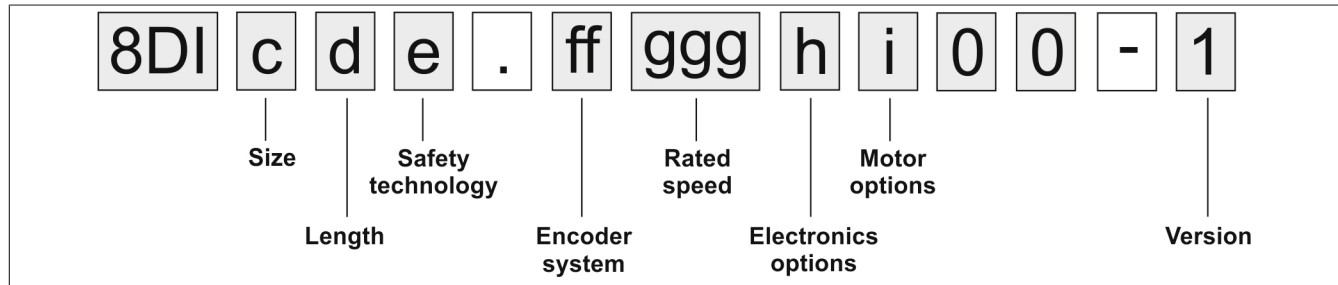**Electronics options** (under h)
Motor options (under i)
Version (under 1)

Encoder system (ff)

EnDat 2.2 encoder

General information

Digital drive systems and position control loops require fast and highly secure transfer of data obtained from position measurement devices. In addition, other data such as drive-specific characteristics, correction tables, etc. should also be available. To ensure a high level of system security, measurement devices must be integrated in routines for detecting errors and be able to perform diagnostics.

The EnDat interface from HEIDENHAIN is a digital, bidirectional interface for measurement devices. It is able to output position values from incremental and absolute measurement devices and can also read and update information on the measurement device or store new data there. Because it relies on serial data transfer, only 4 signal lines are needed. Data is transferred synchronously to the clock signal defined by the subsequent electronics. The type of transfer used (e.g. for position values, parameters, diagnostics, etc.) is selected using mode commands sent to the measurement device by the subsequent electronics.

Name		
Order code (ff)	D8	D9
Encoder type	EnDat single-turn functional safety	EnDat multi-turn functional safety
Operating principle	Inductive	
EnDat protocol	EnDat 2.2	
Position values per revolution	524 288 (19-bit)	
Recognizable revolutions	---	4096 (12-bit)
Precision	±120"	
Vibration during operation 55 to 2,000 Hz	Stator: ≤400 m/s², rotor: ≤600 m/s² (EN 60068-2-6) [1]	
Shock during operation Duration 6 ms	≤2.000 m/s² (EN 60068-2-27)	
Manufacturer's Internet address	Dr. Johannes Heidenhain GmbH www.heidenhain.de	
Manufacturer's product ID	ECI 1119	EQI 1131

[1] Valid according to the standard at room temperature;
  10 to 55 Hz, constant path, 4.9 mm peak to peak
  10 to 55 Hz, constant lift, 4.9 mm peak to peak
  10 to 55 Hz, constant amplitude, 4.9 mm peak to peak

Electronics options (h)

8DI ACOPOSmotor modules are available with optional external connections:

- One additional POWERLINK connection
- Two 24 VDC outputs for supplying external components (e.g. X67 modules)
- Two trigger inputs

The respective execution of the module is listed in the form of a 1-digit code (h) as part of the model number.

POWERLINK	24 VDC outputs (2x)	Trigger inputs (2x)	Code for order key
No	No	No	0
Yes	Yes	Yes	7

Motor options (i)

8DI ACOPOSmotor modules are available with the following features depending on size and length:

- With or without an oil seal
- With or without a holding brake
- With a smooth or keyed shaft

The respective combination of motor options is listed in the form of a 1-digit code (i) as part of the model number.

Holding brake	Keyed shaft	Oil seal	Code for order key
No	No	No	0
		Yes	1
	Yes	No	2
		Yes	3
Yes	No	No	4
		Yes	5
	Yes	No	6
		Yes	7

Oil seal

All 8DI ACOPOSmotor modules are available with an optional Form A oil seal in accordance with DIN 3760.

When equipped with an oil seal, 8DI ACOPOSmotor modules have IP65 protection in accordance with EN 60034-5.

Proper lubrication of the oil seal must be ensured throughout the entire service life of the motor.

Holding brake

All 8DI ACOPOSmotor modules can be delivered with a holding brake. It is installed directly behind the A flange on the module and is used to hold the motor shaft when no power is applied to the servo motor.

The holding brake is a spring-loaded brake. Based on principle, this type of holding brake exhibits a minimal amount of backlash.

This brake is designed as a holding brake and is not permitted to be used for operational braking! Under these conditions, the brake has a service life of approximately 5,000,000 cycles (opening and closing the brake is one cycle). Loaded braking during an emergency stop is permitted but reduces its service life. The required brake holding torque is determined based on the actual load torque. If not enough information is known about the load torque, it is recommended to assume a safety factor of 2.

Name	ACOPOSmotor module size
	3
Holding torque M_{Br} [Nm]	3.2
Connected load P_{on} [W]	12
Supply current I_{on} [A]	0.5
Supply voltage U_{on} [V]	24 VDC +20% / -25%
Activation delay t_{on} [ms]	29
Release delay t_{off} [ms]	19
Moment of inertia J_{Br} [kgcm²]	0.38
Mass m_{Br} [kg]	0.3

Design of the shaft end

8DI ACOPOSmotor module shafts comply with the DIN 748 standard and are available in a smooth or keyed design.

Smooth shaft end

A smooth shaft end is used for a force-fit shaft-hub connection and guarantees a backlash-free connection between the shaft and hub as well as a high degree of operating smoothness. The end of the shaft has a threaded center hole.

Keyed shaft end

A keyed shaft end is used for a form-fit torque transfer with low demands on the shaft-hub connection and for handling torque in a constant direction.

The keyways for 8DI ACOPOSmotor modules conform to keyway form N1 in accordance with DIN 6885-1. Form A keyed shafts that conform to DIN 6885-1 are used. Balancing motors with keyways is done using the shaft and fitment key convention in accordance with DIN ISO 8821.

The end of the shaft has a threaded center hole that can be used to mount drive elements with shaft end plates.

2 Order data

2.1 8DIcde.ffggg7i00-1

Model number	Short description	Figure
	ACOPOSmotor	
8DIcde.ffggg7i00-1	ACOPOSmotor module with electronics options	
	Required accessories	
	Threaded caps	
X67AC0M08	X67 threaded caps M8, 50 pcs.	
X67AC0M12	X67 threaded caps M12, 50 pcs.	
	Accessory sets	
8CXC000.0000-00	Accessory set: 1x slot cover for male hybrid connector	
	Optional accessories	
	Hybrid cables	
8CCH0001.11110-1	Hybrid cable, length 1 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH0002.11110-1	Hybrid cable, length 2 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH0005.11110-1	Hybrid cable, length 5 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH01X1.11110-1	Hybrid cable, length 1.10 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH01X2.11110-1	Hybrid cable, length 1.20 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
	I/O supply cables	
X67CA0P00.0010	Power connection cable, 1 m	
X67CA0P00.0020	Power connection cable, 2 m	
X67CA0P00.0050	Power connection cable, 5 m	
X67CA0P10.0010	Power connection cable, angled, 1 m	
X67CA0P10.0020	Power connection cable, angled, 2 m	
X67CA0P10.0050	Power connection cable, angled, 5 m	
X67CA0P40.0002	Power open cable, 0.2m	
X67CA0P40.0020	Power open cable, 2m	
X67CA0P40.0050	Power open cable, 5m	
	Assembled cables	
X67CA0E61.0020	POWERLINK connection cable, M12 to M12, 2 m	
X67CA0E61.0050	POWERLINK connection cable, M12 to M12, 5 m	
X67CA0E61.0100	POWERLINK connection cable, M12 to M12, 10 m	
	POWERLINK cables	
X67CA0E41.0010	POWERLINK attachment cable, RJ45 to M12, 1 m	
X67CA0E41.0050	POWERLINK attachment cable, RJ45 to M12, 5 m	
	Sensor cable	
X67CA0A41.0020	M12 sensor cable, 2 m	
X67CA0A41.0050	M12 sensor cable, 5 m	
X67CA0A41.0100	M12 sensor cable, 10 m	
X67CA0A51.0020	M12 sensor cable, angled, 2 m	
X67CA0A51.0050	M12 sensor cable, angled, 5 m	
X67CA0A51.0100	M12 sensor cable, angled, 10 m	
	8BVE/8CVI connection cables	
8CCH0002.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 2 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	
8CCH0005.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 5 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	
8CCH0007.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 7 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	
8CCH0010.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 10 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	

Table 1: 8DIcde.ffggg7i00-1 - Order data

2.2 8DIcde.ffggg0i00-1

Model number	Short description	Figure
	ACOPOSmotor	
8DIcde.ffggg0i00-1	ACOPOSmotor module without electronics options	
	Required accessories	
	Accessory sets	
8CXC000.0000-00	Accessory set: 1x slot cover for male hybrid connector	
	Optional accessories	
	Hybrid cables	
8CCH0001.11110-1	Hybrid cable, length 1 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH0002.11110-1	Hybrid cable, length 2 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH0005.11110-1	Hybrid cable, length 5 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH01X1.11110-1	Hybrid cable, length 1.10 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
8CCH01X2.11110-1	Hybrid cable, length 1.20 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 2x female 15-pin TYCO hybrid connector	
	8BVE/8CVI connection cables	
8CCH0002.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 2 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	
8CCH0005.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 5 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	
8CCH0007.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 7 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	
8CCH0010.11120-1	Hybrid cable for connecting 8BVE to 8CVI or 8DI, length 10 m, 2x 2x 0.34 mm² + 4x 0.75 mm² + 5x 2.5 mm², 1x female 15-pin TYCO connector	

Table 2: 8DIcde.ffggg0i00-1 - Order data

3 Technical data

General information

Product ID	
General information	
Module type	ACOPOSmotor module
Maximum current load of 19-pin hybrid connector Power contacts	Max. 20 A at 40°C

Certification
    CE
    cULus
    FSC
	Yes
	Yes [1]
	Yes [1]

Support	
Software ACP10	V2.422 or higher
Thermal characteristics	

Methods of cooling in accordance with EN 60034-6 (IC code)
    Standard
    With 8ZBDF fan kit installed
	Self-cooled; no separate surface cooling (IC4A0A0)
	Externally-cooled; surface cooling with independent cooling module attached (IC4A0A6)

Operating conditions	
Construction and mounting arrangement type in accordance with EN 60034-7 (IM code)	Horizontal (IM3001); Vertical, motor stands on the machine (IM3031)
Reduction of the nominal current and stall current at installation altitudes over 500 m above sea level	10% per 1000 m
Reduction of the continuous power at installation altitudes over 500 m above sea level	10% per 1000 m

Installation at elevations above sea level
    Nominal
    Maximum [2]
	0 to 500 m
	4000 m

Degree of pollution in accordance with EN 60664-1	2 (non-conductive pollution)
Overvoltage category in accordance with IEC 60364-4-443:1999	III
EN 60529 protection [3]	Without optional oil seal: IP64 With optional oil seal: IP65 With 8ZDFB fan kit installed: IP24
Environmental conditions	

Temperature
    Operation
        Nominal
        Maximum
    Storage
    Transport
    Max. flange temperature
	
	5 to 40°C
	55°C [4]
	-25 to 55°C
	-25 to 70°C
	65°C

Relative humidity
    Operation
    Storage
    Transport
	
	5 to 85%, non-condensing
	5 to 95%, non-condensing
	Max. 95% at 40°C

Mechanical characteristics	
Motor paint	Water-based paint, RAL 2005 flat
Inverter paint	Electrophoretic deposition (EPD), black
Vibration severity in accordance with EN 60034-14	Vibration severity grade A [5]
Roller bearing, dynamic load ratings and nominal service life	Based on DIN ISO 281
Shaft end in accordance with DIN 748	Form E
Oil seal in accordance with DIN 3760	Form A
Key and keyway in accordance with DIN 6885-1	Keyway form N1; key form A
Balancing the shaft in accordance with DIN ISO 8821	Half-key arrangement
Mounting flange in accordance with DIN 42948	Form A
Smooth rotation of shaft end, coaxial properties and mounting flange plane in accordance with DIN 42955	Tolerance R

Table 3: General technical data

1) Starting with revision C1.
2) Continuous operation at altitudes ranging from 500 m to 4000 m above sea level is possible (taking the specified continuous current reductions into consideration). Requirements that go above and beyond this must be arranged with B&R.
3) The specified level of protection is only in place if all connectors on the module that are not being used are closed with suitable caps or covers. Suitable caps and covers are available as optional accessories (X67AC0M08, X67AC0M12, 8CXC000.0000-00). The module is rated at IP20 when delivered.
4) Continuous operation at ambient temperatures ranging from 40°C to max. 55°C is possible (taking the specified continuous torque reductions into consideration), but this will result in a shorter service life.
5) Vibration severity grade B on request.

Inverter module

Product ID	8DIcde.ffggg7i00-1	8DIcde.ffggg0i00-1
DC bus connection		
Voltage		
Nominal	750 VDC	
Continuous power consumption [1]	$(P_N/0.97) + P_{IM}$	
DC bus capacitance	Size 3 (8DI3x): 10 µF Size 4 (8DI4x): 15 µF Size 5 (8DI5x): 24 µF	
Design	19-pin male hybrid connector [2]	
Cable length		
Maximum	30 m	
24 VDC supply		
Input voltage	24 VDC +20% / -25%	
Input capacitance	120 µF	
Max. power consumption	10 W + $P_{Holding\ brake}$ + $P_{24\ VDC\ Out\ 1}$[0 ... 96 W] + $P_{24\ VDC\ Out\ 2}$[0 ... 12 W]	
Design	19-pin male hybrid connector [2]	
Cable length		
Maximum	30 m	
24 VDC Out 1		
Output voltage	Depends on the 24 VDC supply	-
Continuous current	Max. 4 A	-
Protection	Electronic	-
Design		
24 VDC	M8 connector	-
COM	M8 connector	-
24 VDC Out 2		
Output voltage	Depends on the 24 VDC supply	-
Continuous current	Max. 0.5 A	-
Protection	Electronic	-
Design		
24 VDC	M12 connector	-
COM	M12 connector	-
Motor connection		
Nominal switching frequency	5 kHz	
Possible switching frequencies [3]	5 / 10 / 20 kHz	
Max. output frequency	598 Hz [4]	
Motor holding brake connection		
Quantity	1	
Continuous current	1 A	
Max. switching frequency	0.5 Hz	
Response threshold for undervoltage monitoring	24 VDC -25%	
Fieldbus		
Type	POWERLINK V1/V2 100 Base-T (ANSI/IEE 802.3)	
Design	Internal 2-port hub, 2x 19-pin male hybrid connector	
Cable length	Max. 100 m between two stations (segment length)[5]	
Transfer rate	100 Mbit/s	
Enable inputs		
Quantity	2	
Wiring	Sink	
Electrical isolation		
Input - Inverter module	Yes	
Input - Input	Yes	
Input voltage		
Nominal	24 VDC	
Maximum	30 VDC	
Input current at nominal voltage	80 mA	
Switching threshold		
Low	<5 V	
High	>15 V	
Switching delay at nominal input voltage		
Enable 1 -> 0, PWM off	12 ms	
Enable 0 -> 1, ready for PWM	1 ms	
Modulation compared to ground potential	Max. ±38 V	
Design	19-pin male hybrid connector [2]	
Trigger inputs		
Quantity	2	-
Wiring	Sink	-
Electrical isolation		
Input - Inverter module	No	-
Input - Input	No	-
Input voltage		
Nominal	24 VDC	-
Maximum	30 VDC	-

Table 4: 8DIcde.ffggg7i00-1, 8DIcde.ffggg0i00-1 - Technical data

Product ID	8DIcde.ffggg7i00-1	8DIcde.ffggg0i00-1
Switching threshold		
Low	<5 V	-
High	>15 V	-
Input current at nominal voltage	5 mA	-
Switching delay		
Positive edge	In preparation	-
Negative edge	In preparation	-
Modulation compared to ground potential	Max. ±38 V	-
Design	M12 connector	-
Support		
Software		
ACP10	V2.43 or higher	

Table 4: 8DIcde.ffggg7i00-1, 8DIcde.ffggg0i00-1 - Technical data

1) Valid in the following conditions: 750 VDC DC bus voltage, 5 kHz switching frequency, 40°C ambient temperature, installation altitude <500 m above sea level, no derating due to cooling type.
2) It is important to note that the 19-pin hybrid connector is designed for max. 5 connection cycles.
3) B&R recommends operating the module at its nominal switching frequency. Operating the module at a higher switching frequency for application-specific reasons reduces the continuous current and increases the CPU load.
4) The module's electrical output frequency (SCTRL_SPEED_ACT * MOTOR_POLEPAIRS) is monitored to protect against dual use in accordance with EC 428/2009 | 3A225. If the electrical output frequency of the module exceeds the limit value of 598 Hz uninterrupted for more than 0.5 s, then the current movement is aborted and error 6060 is output (Power element: Limit speed exceeded).
5) Limited to 30 m when using hybrid cables.

Motor

Product ID	8DI330.ff045hi00-1
Motor	
Nominal speed n_N [rpm]	4500
Number of pole pairs	4
Nominal torque M_n [Nm]	1.17
Nominal power P_N [W]	551
Nominal current I_N [A]	1.08
Stall torque M_0 [Nm]	2.4
Stall current I_0 [A]	2.22
Maximum torque M_{max} [Nm]	6.12
Maximum current I_{max} [A]	5.67
Maximum speed n_{max} [rpm]	6600
Torque constant K_T [Nm/A]	1.08
Voltage constant K_E [V/1000 rpm]	65.97
Stator resistance R_{2ph} [Ω]	4.81
Stator inductance L_{2ph} [mH]	19.81
Thermal time constant t_{therm} [min]	34
Moment of inertia J [kgcm²]	0.95
Weight without brake m [kg]	4.7

Table 5: 8DI330.ff045hi00-1 - Technical data

4 - Speed-torque characteristic curve
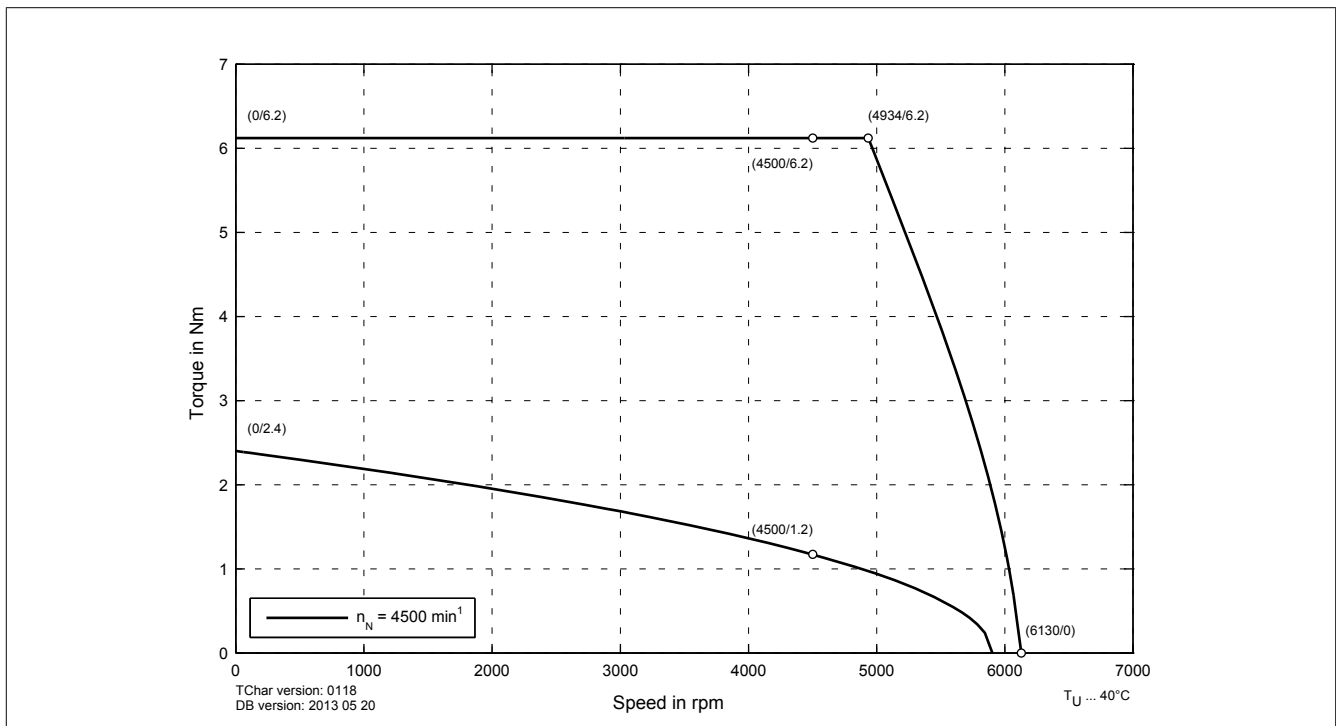
at DC bus voltage of 560 VDC

Figure 1: 8DI33e.ffggghi00-1 at 560 VDC DC bus voltage - Speed-torque characteristic curve
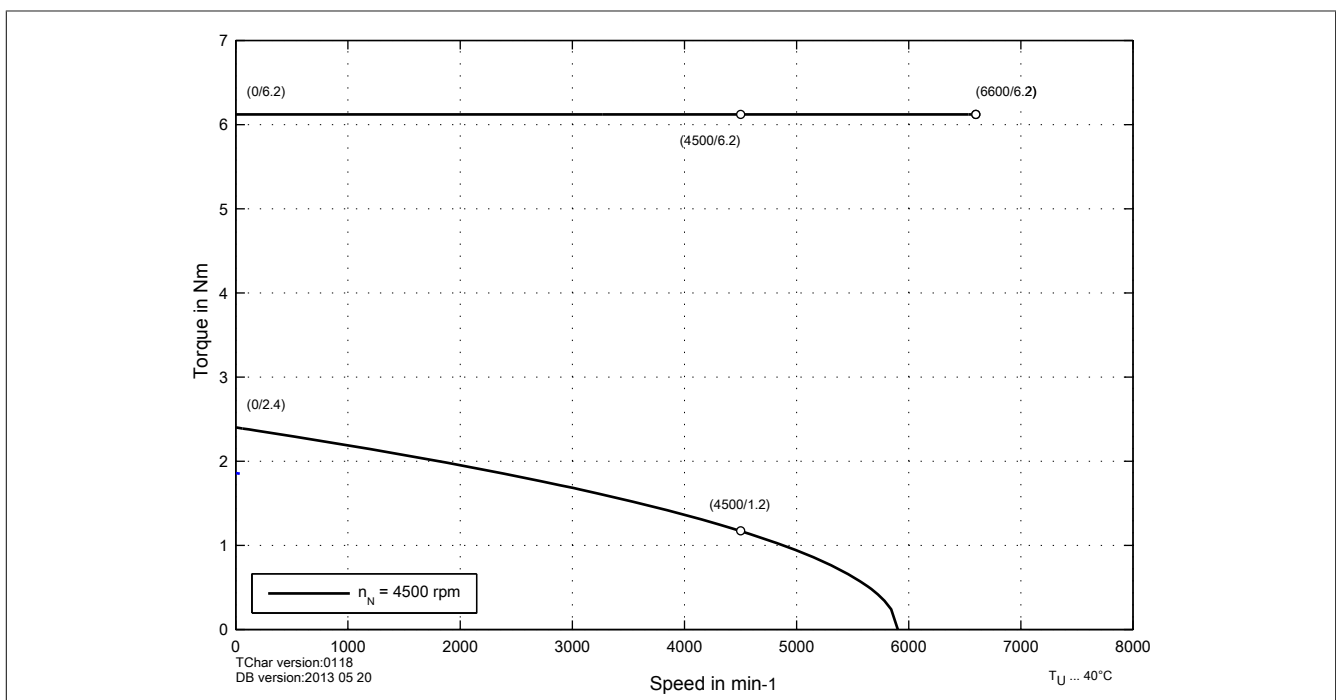
at DC bus voltage of 750 VDC

Figure 2: 8DI33e.ffggghi00-1 at 750 VDC DC bus voltage - Speed-torque characteristic curve
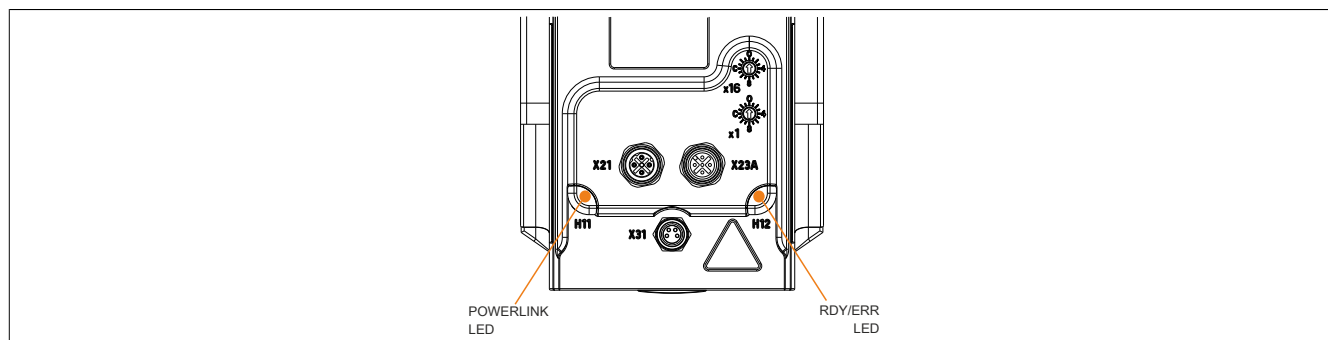
5 Status indicators

Figure 3: 8DI - Status indicators

5.1 POWERLINK - LED status indicators

| Labeling	Color	Function	Description	
H11	Green/Red	Ready/Error	LED not lit	The module is not receiving power or initialization of the network interface has failed.
			Red (lit)	The POWERLINK station number of the module is 0.
			Red/Green, blinking	The client is in an error state (drops out of cyclic operation).
			Green (blinking) (single)	The client detects a valid POWERLINK frame on the network.
			Green (blinking) (2x)	Cyclic operation on the network is taking place, but the client itself is not yet a participant.
			Green (blinking) (3x)	Cyclic operation of the client is in preparation.
			Green (lit)	The client is participating in cyclic operation.
			Green (flickering)	The client is not participating in cyclic operation and also does not detect any other stations on the network participating in cyclic operation.

Table 6: POWERLINK - LED status indicators

5.2 RDY/ERR - LED status indicators

| Labeling	Color	Function	Description	
H12	Green	Ready	Green (lit)	The module is operational and the power stage can be enabled (operating system present and booted, no permanent or temporary errors).
			Green (blinking)	The module is not ready for operation. **Examples:** • No signal on one or both enable inputs • DC bus voltage outside the tolerance range • Overtemperature on the motor (temperature sensor) • Motor feedback not connected or defective • Motor temperature sensor not connected or defective • Overtemperature on the module (IGBT junction, heat sink, etc.) • Disturbance on network
	Red	Error	Red (lit)	There is a permanent error on the module. **Examples:** • Permanent overcurrent • Invalid data in EPROM

Table 7: RDY/ERR - LED status indicators

6 Dimension diagrams and installation dimensions
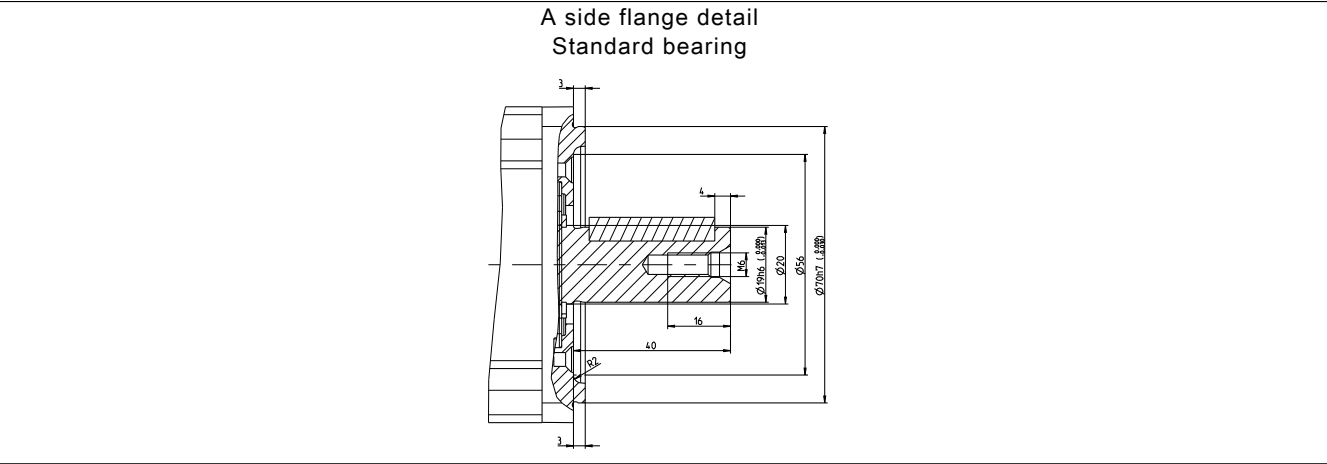
8DI330.ffggg7i00-1

8DI330.ffggg0i00-1
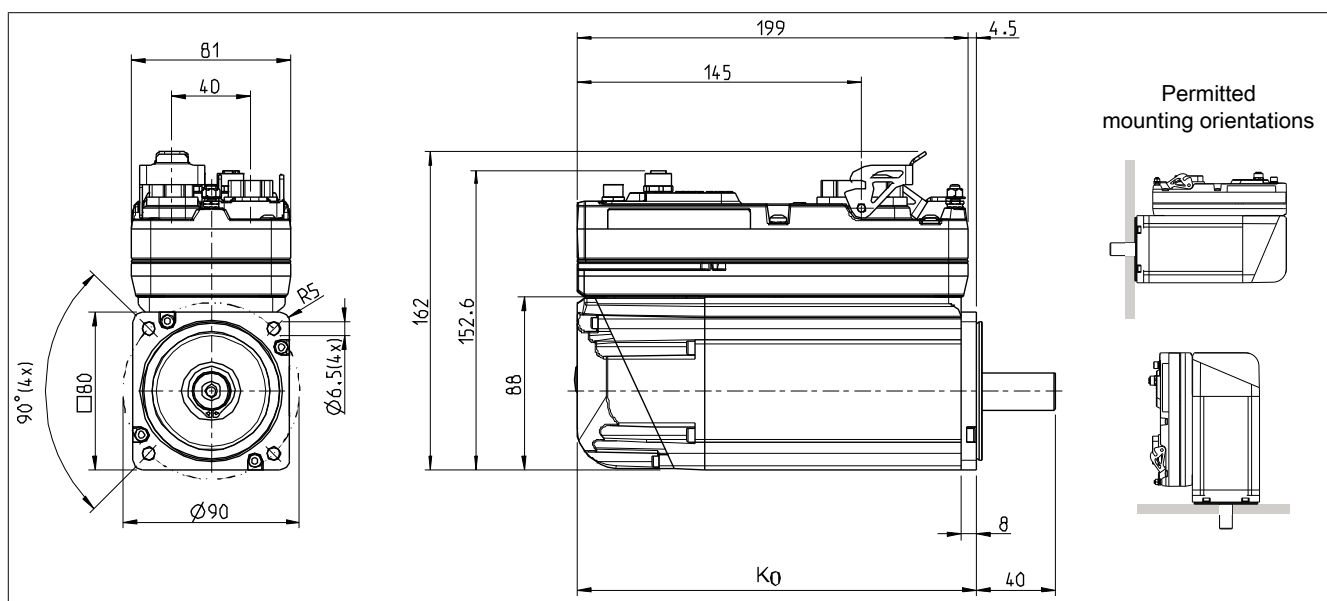
A side flange detail
Standard bearing
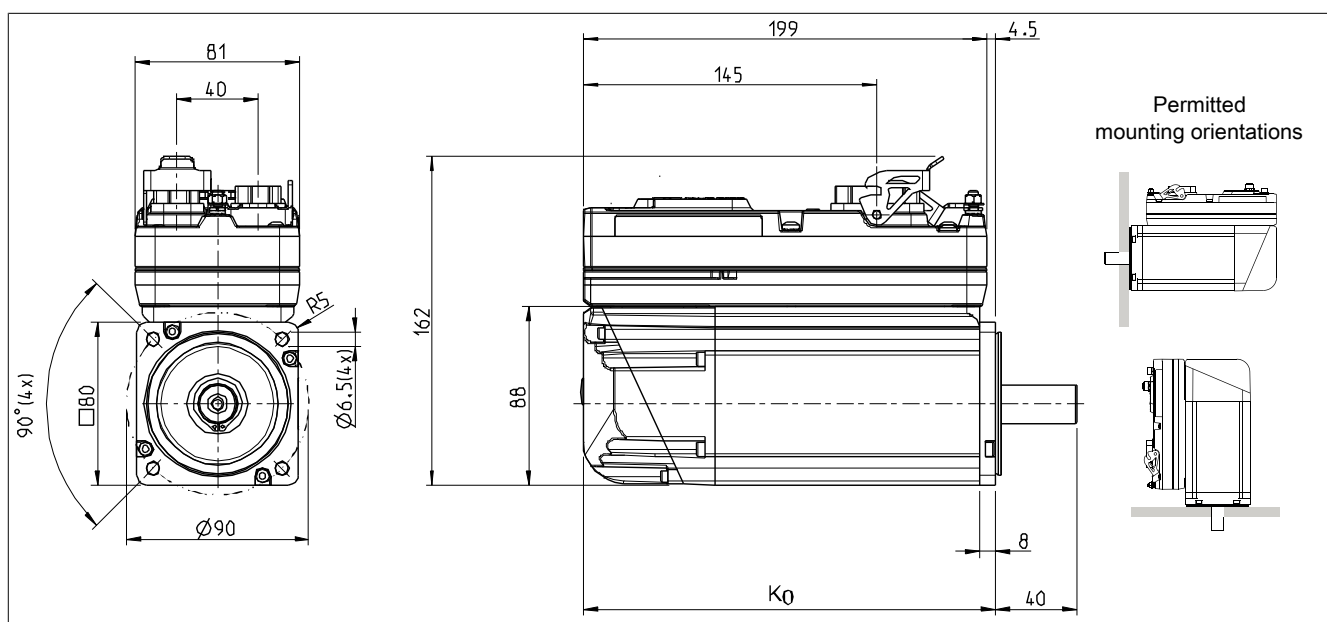
Figure 4: Flange details

ACOPOSmotor module	Length K_0 [mm]	Extension of K_0 depending on motor option [mm]	
		Holding brake	Oil seal
8DI330.ffggghi00-1	203.5	27	5

7 Pinout

Danger!

Before performing service work, disconnect the power supply and wait 5 minutes to ensure that the DC bus of the drive system has discharged. Observe regulations!

Warning!

Drive systems can carry high levels of electrical voltage.
Never remove or insert the connector when a high voltage is present.

Information:

To satisfy UL/CSA requirements, components of B&R drive systems are only permitted to be wired with copper wires with a permitted wire temperature of at least 75°C.
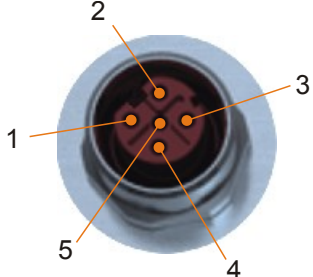
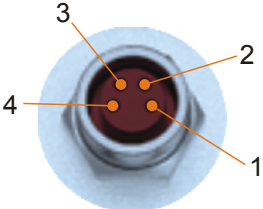## 7.1 Overview
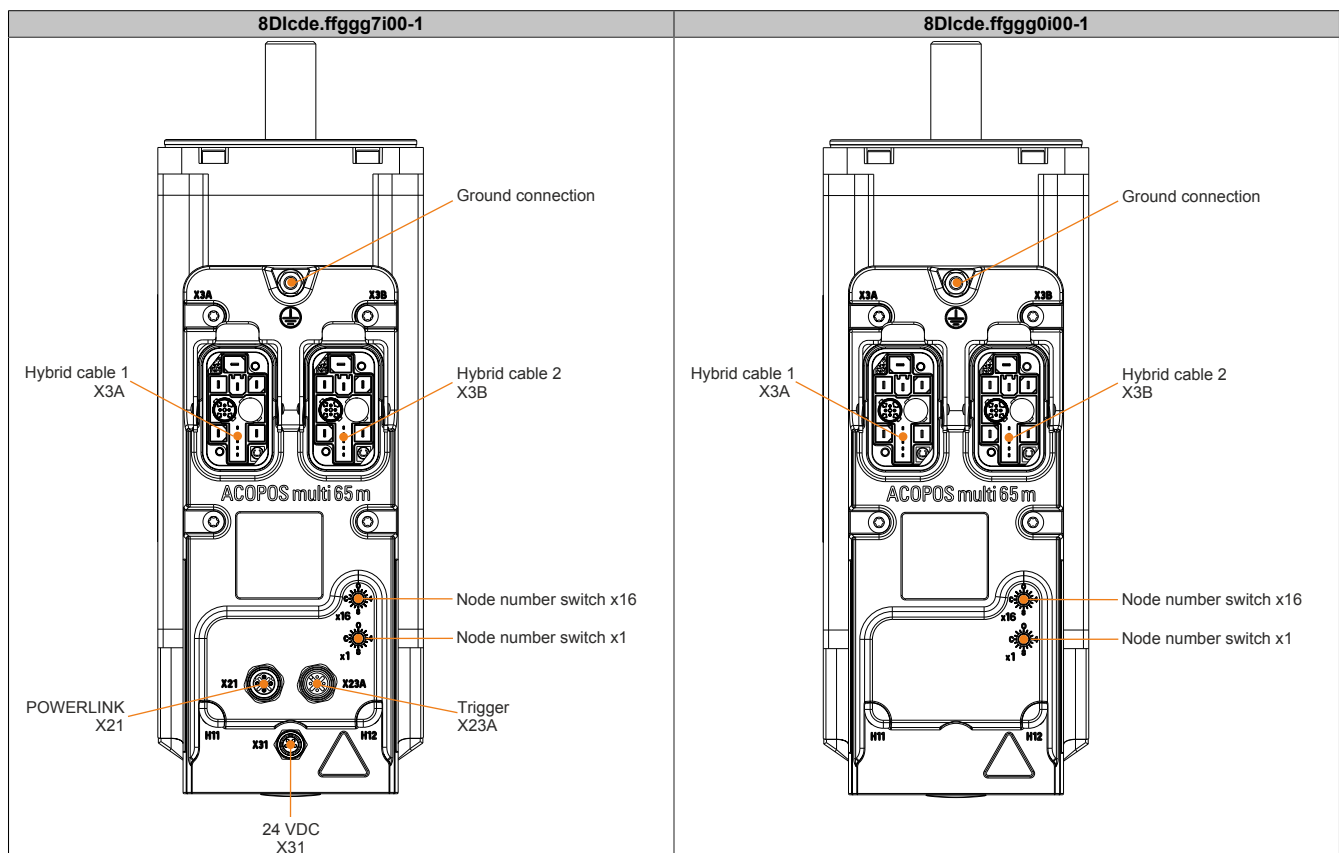
7.2 X21 (POWERLINK)

Figure	Pin	Description	Function
	1	TXD	Transmit data
	2	RXD	Receive data
	3	TXD\	Transmit data inverted
	4	RXD\	Receive data inverted

7.3 X23A (trigger)

Figure	Pin	Description	Function
	1	+24 V	Sensor/actuator supply 24 VDC [1]
	2	Trigger1	Trigger input 1
	3	GND	GND
	4	Trigger2	Trigger input 2
	5	---	---

1)   Sensors/Actuators are not permitted to be supplied externally.

7.4 X31 (24 VDC routing)

Figure	Pin	Description	Function
	1	24 VDC I/O	24 VDC I/O supply
	2	24 VDC I/O	24 VDC I/O supply
	3	GND	24 VDC I/O supply 0 V
	4	GND	24 VDC I/O supply 0 V

7.5 Ground connection (PE)

The protective ground conductor is connected to the M5 threaded bolt provided using a cable lug.
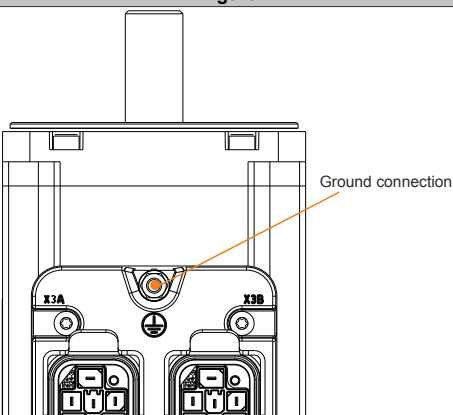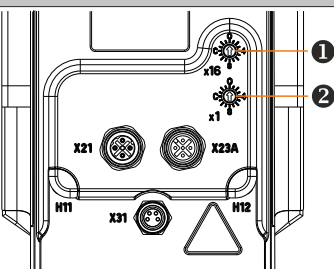
Figure	Pin	Name	Function
	---	PE	Protective ground conductor

Terminal cross sections	[mm²]	AWG
Cable lug for M5 threaded bolt	0.25 - 16	23 - 5

Table 8: Ground connection (PE)

8 Setting the POWERLINK node number

The POWERLINK node number can be set using the two HEX rotary code switches located on top of the module:

Figure	Rotary code switches	POWERLINK node number
	1	16s position (high)
	2	1s position (low)
	Changed POWERLINK node numbers will not take effect until the drive system is restarted.	

Information:

In principle, node numbers between $01 and $FD are permitted. However, node numbers between $F0 and $FD are intended for future system expansions. To ensure compatibility, these node numbers should be avoided.

Node numbers $00, $FE and $FF are reserved and may therefore not be set.