РУКОВОДСТВО ПО ЭКСПЛУАТАЦИИ

Серводрайверы, серводвигатели и кабели HIWIN

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2. General information

2.1 General information about HIWIN servo drive D1-N

The universal servo drive D1-N controls both linear and torque motors and rotary servo motors.

- Peak current of 9, 18, 36 and 90 A
- Integrated STO safety function
- EtherCAT CoE and EtherCAT mega-ulink

2.2 General information about HIWIN servo drive D2T

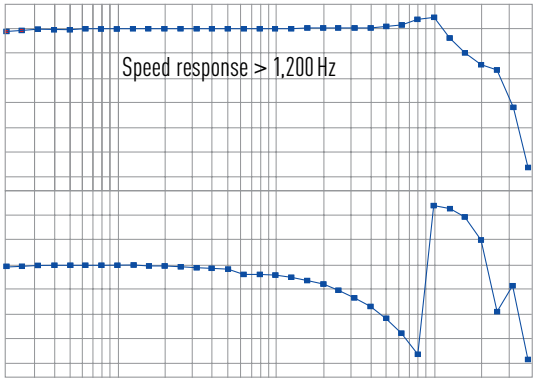
For efficient and economical use, for example in belt and spindle axles, specially adapted to HIWIN rotary servo motors.

- 100 W, 400 W and 1,000 W
- EtherCAT CoE and EtherCAT mega-ulink
- UL-certified

2.3 General properties of HIWIN servo drives

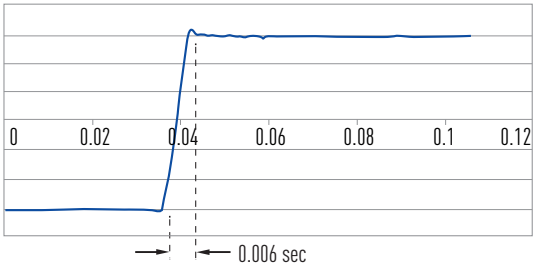
Large controller bandwidth

The optimised motion control algorithms and the fact that the controller can only be adapted to the application by a superordinate amplification factor (common gain) results in a very short response time that meets all the requirements of a highly dynamic motion profile.



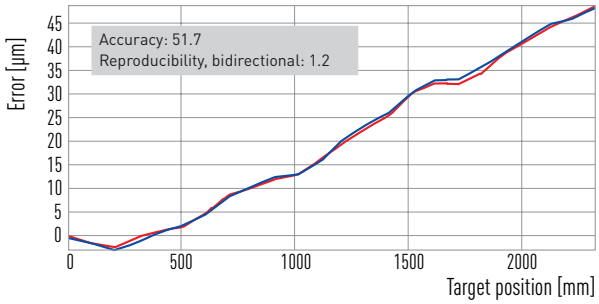
High acceleration dynamics

The fully digital vector-controlled current controller allows an extremely high servo performance to be achieved. Changing from –3,000 rpm to +3,000 rpm takes just 0.006 seconds.

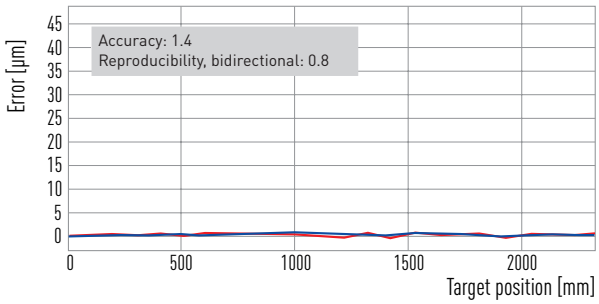


Error compensation

The servo drives feature sophisticated error compensation to optimise the position accuracy of the mechanical drive system. The error correction table can contain up to 16,000 entries.



Without error compensation



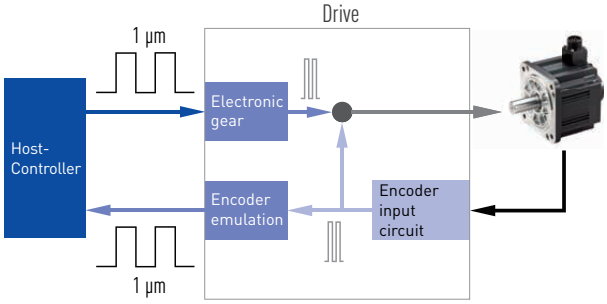
With error compensation

Vibration suppression

The mechanical vibration of the complete system that arises during motion can be very effectively reduced by the vibration suppression function of the servo drive.

Electronic gear and encoder emulation

The servo drives offer a host of features. For example, the built-in electronic gear adjusts the frequency of the control pulses from the higher-level control for processing in the drive. Another feature is the encoder emulation. This allows the resolution of encoder signals sent to the higher-level control to be adapted, avoiding compatibility problems between the resolution of the encoder and the higher-level control.



2.4 "Lightening" commissioning software

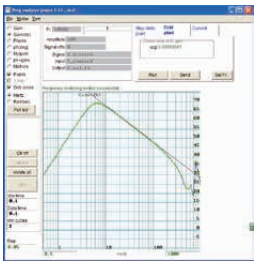
The HIWIN commissioning software Lightening provides a range of tools to optimise control behaviour. These include a real-time oscilloscope, frequency analysis tools (FFT and Bode diagram), error compensation and configuration of inputs and outputs.

Error compensation tool

To optimise the position accuracy of the drive, the error compensation tool enters measured values generated in a reference measurement by a high-precision laser interferometer in the error correction table. This compensates for lead deviations of a ballscrew or encoder error, for example.

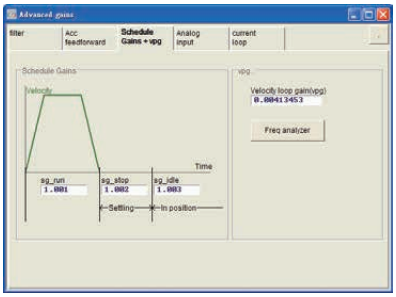
Controller optimisation tool

The drive is a powerful, easy-to-use tool for frequency optimisation of the control circuit. The frequency response of the controller is shown as a graph. This graphical support makes it relatively straightforward to optimise the overall behaviour of the control circuit.



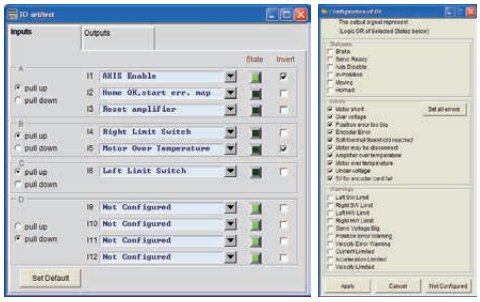
Superordinate amplification factor: common gain

Once the individual amplification factors have been defined by the various software tools, further optimisation is achieved with the superordinate amplification factor of common gain. The common gain can be defined for the motion phase, the engaging phase and holding the position.



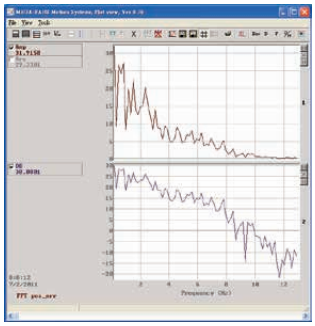
I/O center

The I/O center makes it easy to organise the various I/O functions of the drive's digital inputs and outputs and therefore adapt them to different hardware interfaces of the user's higher-level controls. In the I/O centre you can also check the status of inputs and outputs and invert the signals.



Analysis tool

The analysis tool allows you to display, analyse and rectify resonance vibrations in the driveline. With graphical support the resonance frequency can be determined with an FFT analysis and corrected with an appropriate filter (low pass or notch).



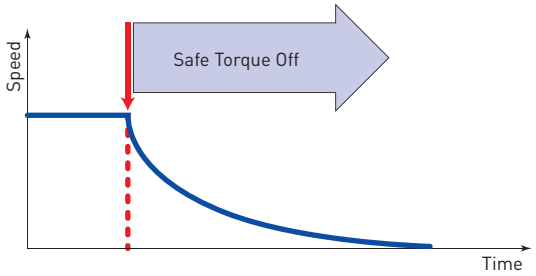
3. D1-N servo drive

The servo drive D1-N supports rotary servo motors, linear and torque motors and therefore the entire range of HIWIN motor types. The wide range of supported encoder interfaces (digital, analogue $1V_{PP}$, EnDat 2.2, BiSS C, HIWIN resolver) and analogue and digital Hall sensors allow the D1-N to be used in many different ways, especially with linear motors in conjunction with various position measuring systems. Motors made by other manufacturers with the named encoder interfaces can also be easily controlled with the D1-N.

The available communication interfaces are EtherCAT CoE (see Page 16), EtherCAT mega-ulink (see Page 16), step direction, and a ± 10 V interface.

EtherCAT®

The STO safety function (safe torque off) complies with IEC61800-5-2 (certified by TÜV Nord) and is directly integrated in the drive. In the event of an error, the motor current and therefore the torque on the motor can therefore be safely cut off via the D1-N without having to interrupt the supply voltage on the drive. Elaborate hardware for cutting off the supply voltage is not needed, and even the process of switching back on again is considerably faster and smoother.



All connections on the D1-N servo drive are labelled and designed as plug-in connections. The wire strands for the I/O signals can be attached directly to the spring terminals. This eliminates the time-consuming process of fitting screws, allowing the device to be replaced more quickly. Error diagnosis can be performed on the device itself thanks to an alphanumeric display. The Lightening software allows the D1-N to be quickly and conveniently configured and started up with the help of a mini USB interface. The software can be downloaded free from www.hiwin.de.

3.1 Interfaces D1-N

Intermediate circuit voltage and brake resistor connection

EtherCAT

Power supply

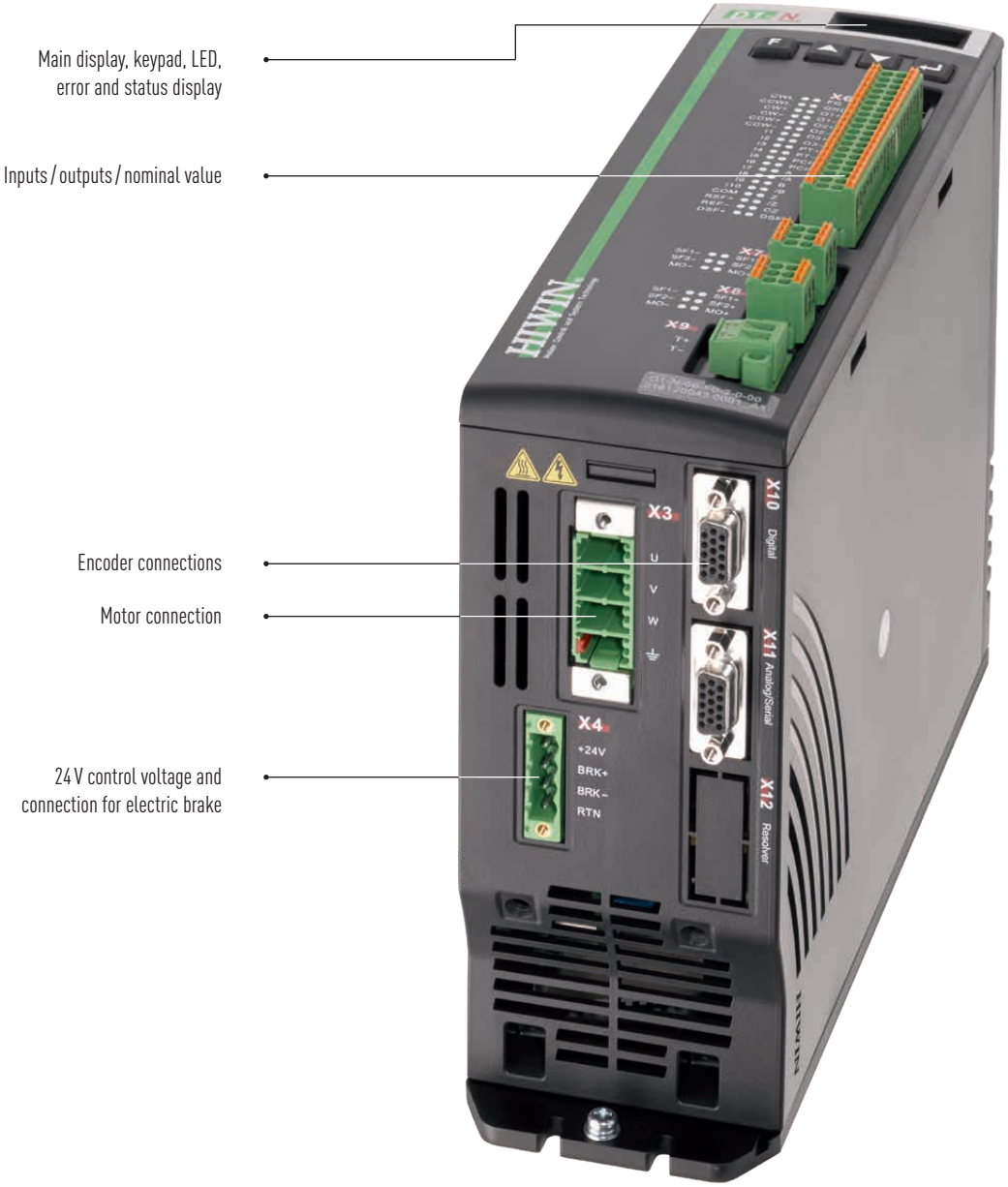
USB interface

The "Lightening" commissioning software can be downloaded from our website **www.hiwin.de**.

STO (Safe Torque Off)

STO daisy chain

Motor temperature monitoring



3.2 Order code D1-N

D1-N	18	E	0	2	0

Type:
D1-N

Peak current (amplitude value):
09: 9 A
18: 18 A
36: 36 A
90: 90 A

Communication:
E: EtherCAT CoE (standard)
F: EtherCAT mega-ulink
S: Step/direction, ± 10 V interface

Heat sink:
0: Without heat sink
1: With heat sink

Power supply:
2: 230 VAC, 1 or 3 phases (09 A, 18 A, 36 A)
6: 230 – 400 VAC, 1 – 3 phases (90 A)

Encoder:
0: EnDat 2.2, analogue 1 V_{PP}; digital TTL
2: Analogue 1 V_{PP}; digital TTL
5: BiSS C

3.3 Technical data D1-N

Table 3.1 **Technical data D1-N**

HIWIN servo drive D1-N				D1N-09	D1N-18	D1N-36	D1N-90
Power supply		**Voltage**		220 to 240 VAC ± 10 %			220 to 400 VAC ± 10 %
		Frequency		50 to 60 Hz ± 5 %			
		Number of phases		1 or 3			3
		Control voltage		24 VDC ± 10 %			
		Maximum control current		1.5 A			
Output current		**Continuous current (effective)**		2.1 A	4.2 A	8.5 A	21 A
		Peak current (effective)		6.4 A	12.7 A	25.5 A	63.6 A
		Maximum duration of peak current		1 second			
Type of control				IGBT PWM vector control			
Switching frequency				16 kHz			8 kHz
Motor types supported				Linear motors, torque motors, AC servo motors			
Encoder interface		**Supply voltage of encoders**		+5 VDC ± 5 %, 500 mA			
		Analogue encoder		Sin/Cos 1 V_{PP} (Z, /Z, differential); max. input frequency < 1 MHz			
		Digital encoder		TTL (A, /A, B, /B, Z, /Z, differential), for 13-bit encoder only; max. input frequency < 5 MHz			
		HIWIN resolver		Option			
		EnDat 2.2		Standard			
		BiSS C		Standard			
		Hall sensors		Digital (A, B, C), 120° offset			
Encoder output		**Encoder output (buffered)**		Forwarding of incoming encoder signals, incl. quadrupling (max. 18 000 000 incr/s, RS422 differential)			
		Encoder emulation		Forwarding of incoming encoder signals, can be scaled in any way (max. 18 000 000 incr/s, RS422 differential)			
Nominal value inputs	**Position regulation**	**Digital**	**Function**	Step/direction, CW/CCW, AB signals (quad.)			
			Input frequencies	Differential: 4,000,000 incr/s			
				Single end: 500,000 incr/s			
	Speed control	**Analogue**	**Input resistance**	10 kΩ			
			Input voltage	±10 VDC			
			Resolution	12-bit			
		Digital	**Function**	Step/direction, CW/CCW			
			PWM frequency	Min. 36.5 kHz, max. 100 kHz			
			Min. pulse duration	220 ns			
	Torque control	**Analogue**	**Input resistance**	10 kΩ			
			Input voltage	±10 VDC			
			Resolution	12-bit			
		Digital	**Function**	Step/direction, CW/CCW			
			PWM frequency	Min. 36.5 kHz, max. 100 kHz			
			Min. pulse duration	220 ns			
	EtherCAT		**Functions**	PDO communication (flexible mapping) SDO communication Distributed clocks			
			CiA402 modes	Profile Position Mode (1) Profile Velocity Mode (2) Cyclic Synchronous Position Mode (8) Cyclic Synchronous Velocity Mode (9) Homing (6)			

Table 3.1 **Technical data (continued)**

HIWIN servo drive D1-N		D1N-09	D1N-18	D1N-36	D1N-90
Inputs / outputs which can be parameterised	**10 digital inputs**	Function can be freely selected			
	3 digital outputs	Function can be freely selected			
	Brake control	24 VDC, max. 1 A			
	Capture input	Response time < 7 ns (PCP input)			
	Cam controller	Response time < 7 ns (PT output), 5 VDC			
DC intermediate circuit	**Overvoltage**	+HV > 404 VDC			+HV > 800 VDC
	Undervoltage	+HV < 60 VDC			+HV < 158 VDC
Brake resistor	**Connection**	Internal (50 Ω/150 W) and/or external			External only
	Activation threshold	+HV > 390 VDC			+HV > 735 VDC
	Deactivation threshold	+HV < 380 VDC			+HV < 695 VDC
	Tolerance	±5 %			
Cooling	**External heat sink**	No	No	Yes	Yes
	Integrated fan	No	Yes	Yes	Yes
EMC filter		No integrated EMC filter			
Safety function		STO (Safe Torque Off)			
User interface		LCD, 4-button control panel			
Parameterisation interface		USB 2.0			
Weight		2.05 kg	2.20 kg	3 kg	5.8 kg
Ambient conditions	**Ambient temperature**	Operation: 0 to 50 °C (above 50 °C with air conditioning); Transport/storage: –25 to 65 °C			
	Air humidity	0 to 90 %, non-condensing			
	Operating altitude	Up to 1,000 m above sea level			
	Vibrations	1 G (10 to 500 Hz)			
	Protection class	IP20			
	Contamination level	2			

3.4 Options D1-N

EtherCAT interface

The D1-N servo drive supports the Ethernet-based EtherCAT field bus system. EtherCAT is an open technology which is regulated in international standards IEC 61158, IEC 61784 and ISO 15745-4. EtherCAT is a very fast industrial Ethernet system, also suited to use in time-critical motion control applications. The D1-N supports the CoE (CANoverEtherCAT) protocol and can therefore be integrated in any EtherCAT master controller which supports this protocol. Furthermore, the D1-N works according to the standardised drive profile CiA 402 and can therefore be easily integrated into the TwinCAT control software of Beckhoff as an NC axis.

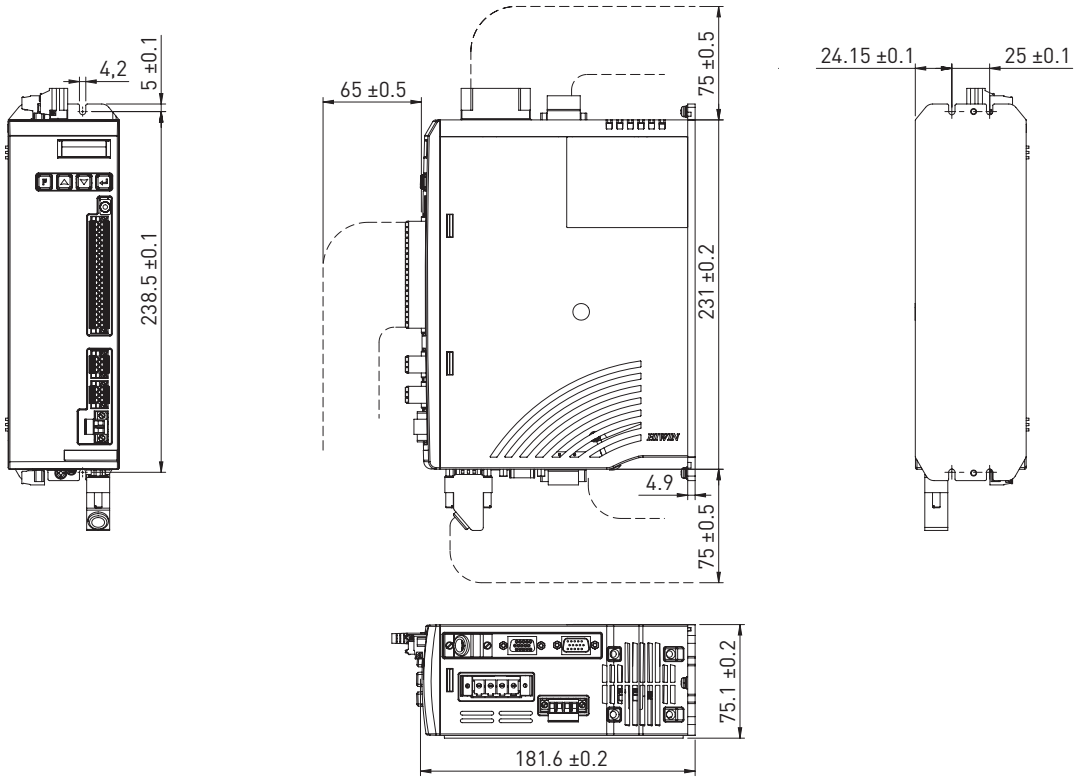
EtherCAT®

mega-ulink interface

The D1-N servo drive supports the proprietary protocol mega-ulink, which is based on EtherCAT. The EtherCAT mega-ulink interface can be used for communication and control between the industrial PC and servo drive. Communication takes place via the standard Ethernet interface on the PC and the EtherCAT interface on the drive. A dll library (MPI.dll) handles communication and control between PC and drive controller. A detailed description of this library and how to use it is available at www.hiwin.de.

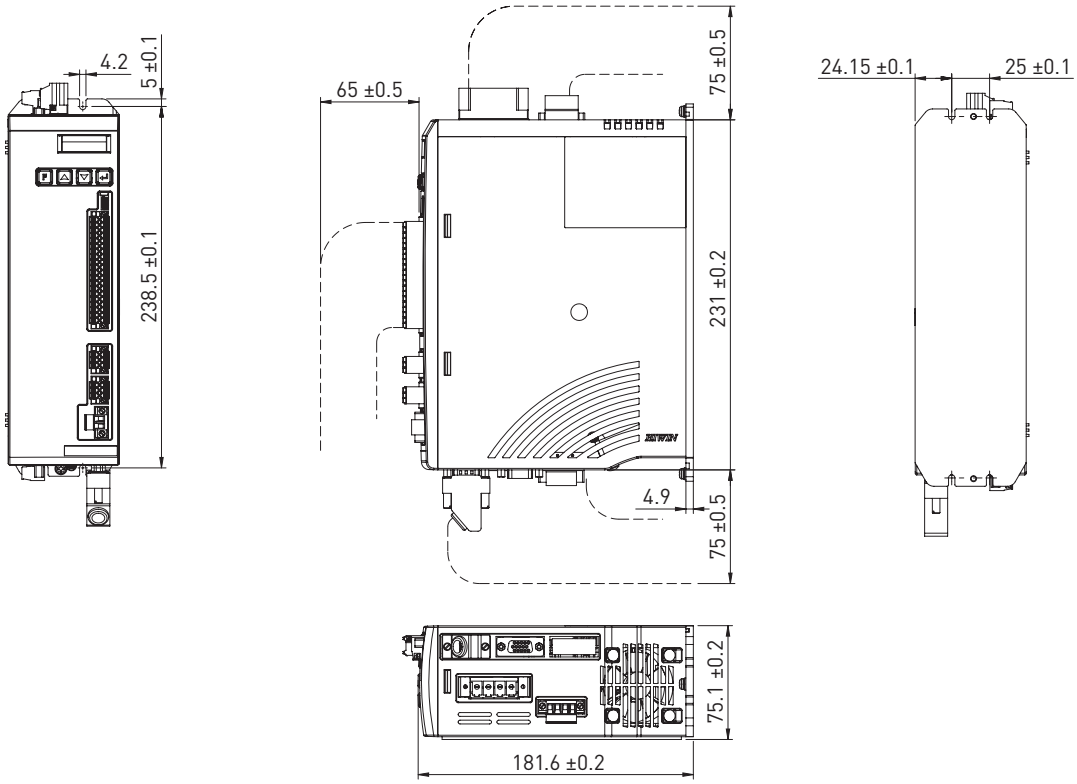
3.5 Dimensions D1-N

D1-N-09



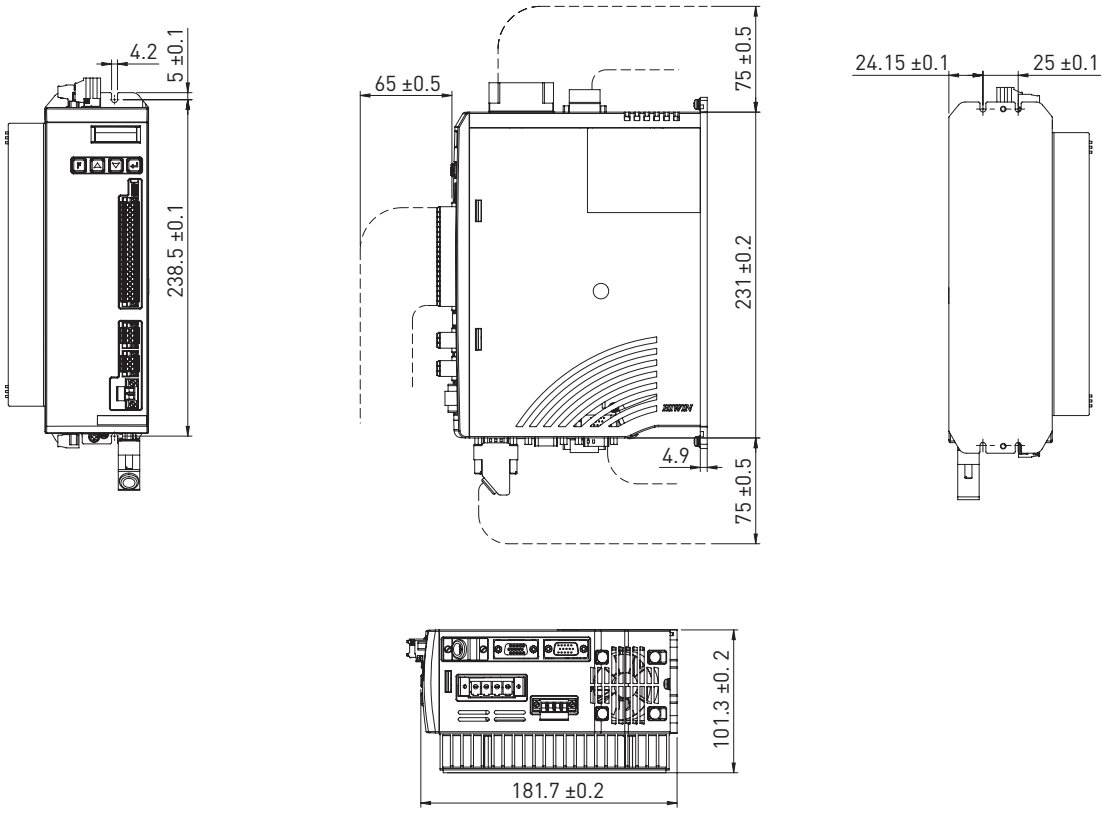
Unit: mm

D1-N-18



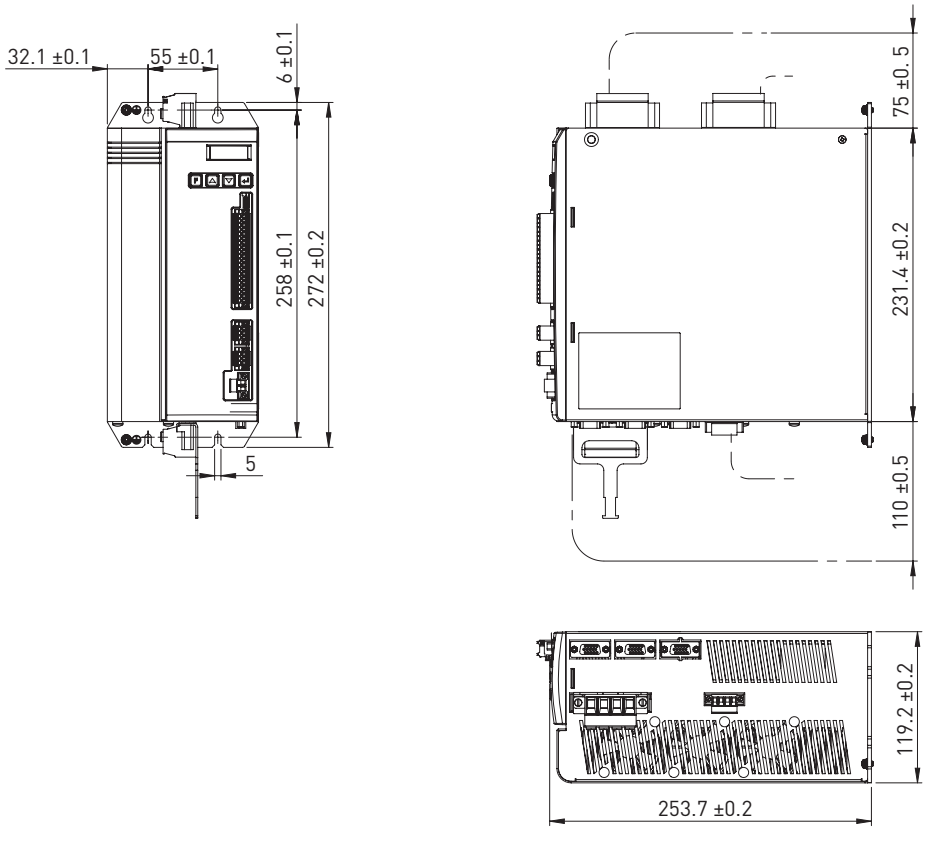
Unit: mm

D1-N-36



Unit: mm

D1-N-90



Unit: mm

3.6 Accessories D1-N

3.6.1 Cables

Table 3.2 **Parameterisation cable for D1-N servo drive**

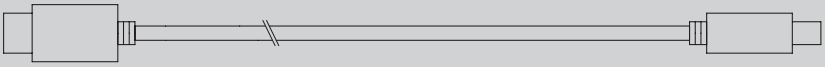
Article number	Designation	Connector	Figure	Length
8-10-0864	USB parameterisation cable	CN3		2 m

Table 3.3 **Motor cables for D1-N servo drive**

Article number	Length [m]	Motor type	Description
8-10-0069	3	Linear motor	HIWIN motor cable, suitable for drag chains, 1,5 mm², with M23 connector on motor side, with open ends on D1-N side
8-10-0070	5		
8-10-0071	8		
8-10-0072	10		
8-10-0593	3	Linear motor	HIWIN motor cable, suitable for drag chains, 2,5 mm², with M23 connector on motor side, with open ends on D1-N side
8-10-0594	5		
8-10-0595	8		
8-10-0596	10		
8-10-0109	3	Torque motor	HIWIN motor cable, suitable for drag chains, 1,5 mm², with M17 connector on motor side, with open ends on D1-N side
8-10-0110	5		
8-10-0111	8		
8-10-0112	10		

Table 3.4 **Encoder cables for D1-N servo drive**

Article number	Length [m]	Motor type	Description
8-10-0685	3	Analogue	HIWIN encoder cable, suitable for drag chains, with M17 connector on motor side, with Sub-D connector for X11 on D1-N side
8-10-0686	5		
8-10-0687	7		
8-10-0688	10		
8-10-0690	3	Digital	HIWIN encoder cable, suitable for drag chains, with M17 connector on motor side, with Sub-D connector for X10 on D1-N side
8-10-0691	5		
8-10-0692	7		
8-10-0693	10		

3.6.2 Connector

Table 3.5 **Connector set for D1-N servo drive**

Article number	Designation	Type	Contacts	Quantity
8-10-0800 D1-N-09, D1-N-18, D1-N-36	X1: Power supply	Connector	4	1
	X2: Brake resistor	Connector	4	1
	X3: Motor connection	Connector	4	1
	X4: Control voltage	Connector	4	1
8-10-0897 D1-N-90	X6: Inputs/outputs	Connector	20	1
	X7/X8: Safety functions	Connector	3	2
	X9: Temperature sensor	Connector	2	1
	X10/X11: Encoder	Sub-D connector	15	2
	X12: Encoder	Sub-D socket	15	1
	Motor connector shielding	Hose clip	1	1

The appropriate set of connectors is supplied with each D1-N servo drive

3.6.3 Brake resistor

Drives with a 230 V supply are fitted with an internal 150 W brake resistor. If this resistance is not sufficient, the brake power can be increased with the following external brake resistor. For drives with a 400 V supply without an internal brake resistor, the following brake resistor can also be used if required.

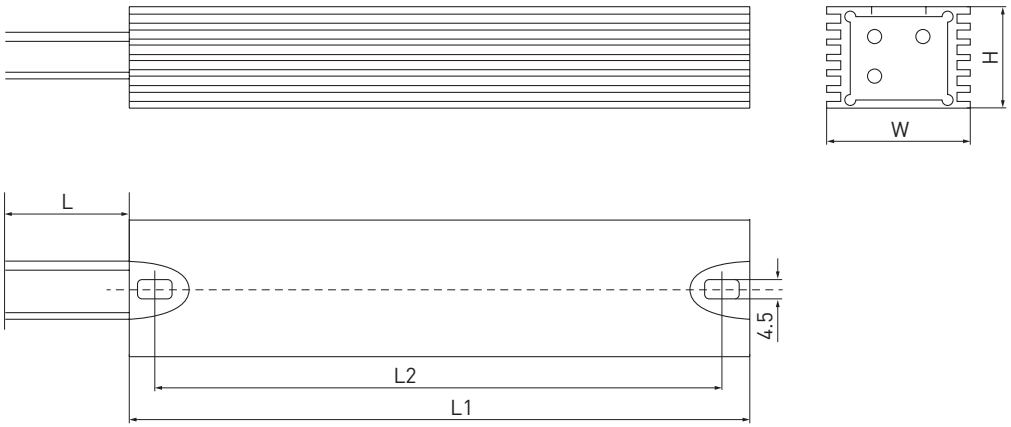


Table 3.6 **Brake resistor for D1-N servo drive**

Article number	Designation	Resistance [Ω]	Nominal power [W]	Weight [g]	L1 [mm]	L2 [mm]	W [mm]	H [mm]	L [mm]
8-09-0015	Brake resistor	80	300	305	155	144	36	27	600

Unit: mm

3.6.4 Mains filter

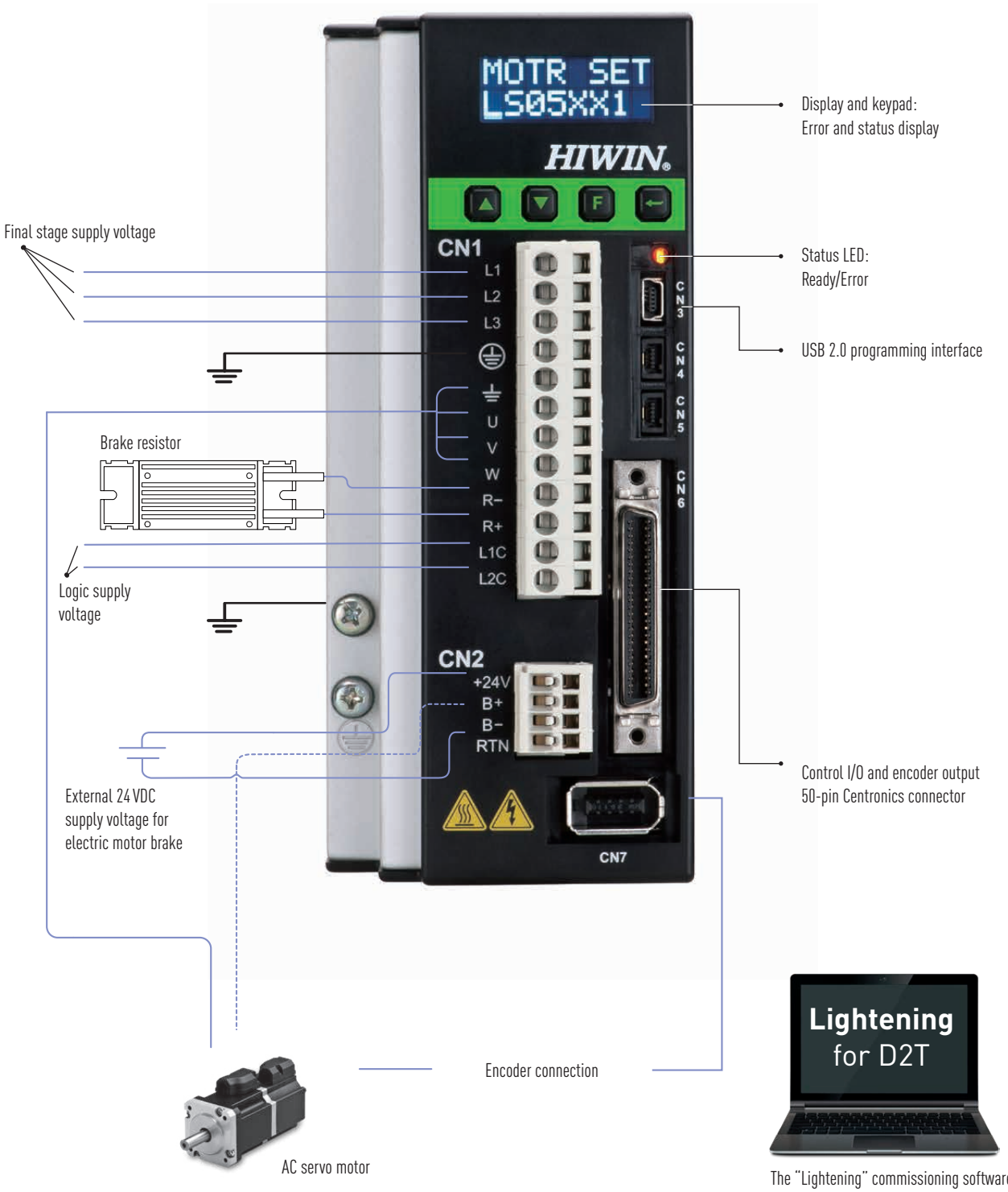
Table 3.7 **Mains filter for D1-N servo drive**

Article number	Designation	Type	Nominal current [A]	Leakage current [mA]	Quantity
8-09-0485	D1-N mains filter, 1-phase	FN2412-8-44	8.0	3.4	1
	Ferrite core				2
8-09-0379	D1-N mains filter, 3-phase	FN3258-7-45	8.0	33	1
	Ferrite core				2

4. D2T servo drive

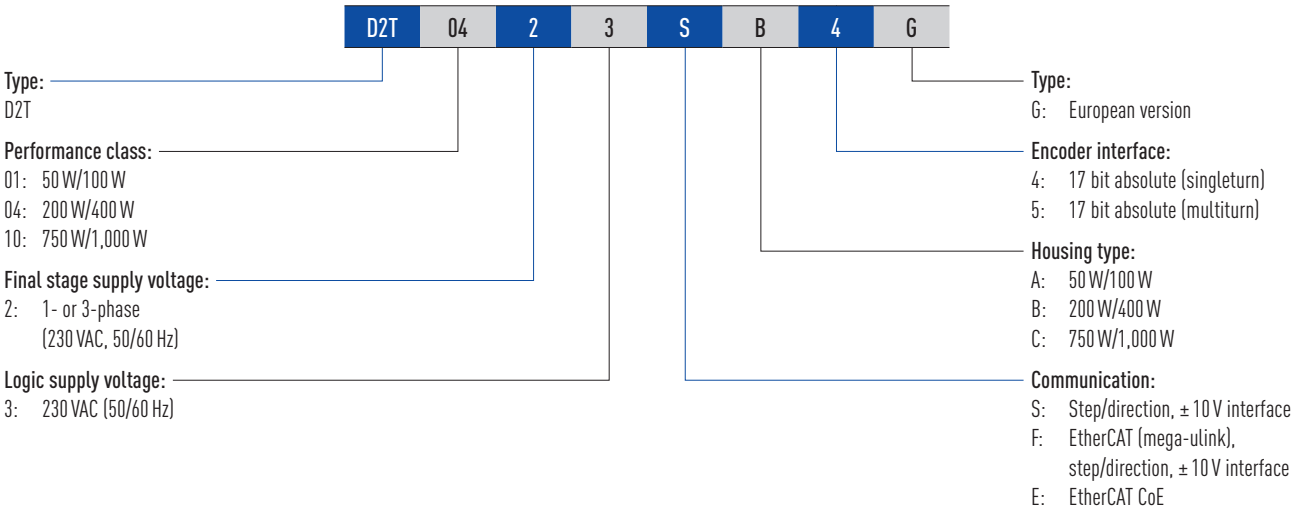
The vector-controlled, fully digital HIWIN D2T servo drives are specially designed to work with HIWIN servo motors. Different versions and performance classes are available for different types of application. For easy installation and commissioning there are ready-assembled motor and encoder cables and the free HIWIN commissioning software "Lightening".

4.1 Interfaces D2T



The "Lightening" commissioning software can be downloaded from our website **www.hiwin.de.**

4.2 Order code D2T



4.3 Technical data D2T

Table 4.1 **Technical data D2T**

HIWIN D2T servo drive amplifier				D2T-0123	D2T-0423	D2T-1023
Power supply		**Final stage supply voltage and frequency**		200 to 240 VAC (± 10 %)/50 to 60 Hz (± 5 %)		
		Number of phases		1 or 3		
		Power consumption of final stage		1.5 A_{eff}	4.1 A_{eff}	7.5 A_{eff}
		Logic supply voltage and frequency		200 to 240 VAC (± 10 %)/50 to 60 Hz (± 5 %) 1-phase only		
		Power consumption of logic supply		0.5 A max.		
Output current		**Continuous current (effective)**		0.9 A	2.5 A	5.1 A
		Peak current (effective)		2.7 A	7.5 A	15.3 A
		Maximum duration of peak current		1 second		
Type of control				IGBT PWM vector control		
Controller sampling rate				Current, speed and position controllers: 15 kHz: standard and mega-ulink 16 kHz: EtherCAT (CoE)		
Motor types supported				AC servo motors		
Status LED				Red: Error; Green: Ready		
Operating modes	**Position control**	**Inputs/outputs**		Low-speed pulse inputs (CN6 pins: 3, 4, 5, 6) High-speed pulse inputs (CN6 pins: 44, 45, 46, 47)		
		Function		Step/direction; CW/CCW; AB signals (4 × evaluation)		
		Maximum input frequency		Low-speed (optocoupler): 500 kHz High-speed (different.): 4 MHz		
		Electric gear		Ratio: pulses/counts pulses: 1 – 2,147,483,647 counts: 1 – 2,147,483,647		
	Speed/torque control	**Analogue**	**Input resistance**	10 kΩ		
			Input voltage	±10 VDC		
			Resolution	12-bit		
		Digital	**PWM**	Via low-speed pulse inputs		
			Frequency	Min. 36.5 kHz; max. 100 kHz		
			Min. pulse duration	220 ns		
Encoder interface		**Operating voltage**		+ 5 VDC ± 5 % at 400 mA		
		Input	**Signal type**	A, /A, B, /B, Z, /Z, differential signals		
			Bandwidth	After 4-fold evaluation 5 million incr/s		

Table 4.1 **Technical data (continued)**

HIWIN servo drive D2T			D2T-0123	D2T-0423	D2T-1023
Encoder interface	**Input**	**Option**	Dual loop with rotatory 17-bit absolute encoder and AqB linear encoder (not for D2T-xxxx-E-)		
	Output	**Signal type**	A, /A, B, /B, Z, /Z, differential TTL		
		Resolution	After 4-fold evaluation 8 million incr/s		
Encoder simulation output			Max. 18 million incr/s, RS422 differential; adjustable scaling		
Communication	**Interface**		USB 2.0		
Parameterisable I/O interface	**Digital inputs**		[I1 to I10], (single-end, optocoupler), 12–24 VDC		
	Digital outputs		[O1 to O5], (optocoupler), 24 VDC, 100 mA		
	Analogue outputs		2 (1 × speed, 1 × torque)		
	Brake output		BRAKE [CN2_BRK], max. 1 ADC		
Feedback	**Resistance**		External		
	Activation threshold		+ HV > 370 VDC		
	Deactivation threshold		+ HV < 360 VDC		
	Tolerance		± 5 %		
Monitoring functions			Short circuit, overvoltage (> 390 VDC ± 5 %), undervoltage (< 60 VDC), position error, encoder error, motor phase monitoring, overtemperature D2T (IGBT > 90 °C ± 1 °C), motor overtemperature		
Autotuning			With automatic mass inertia calculation		
Error mapping	**Method**		Compensation table for correcting position errors through linear interpolation		
	Table entries		Max. 5,000		
	Activation		Following successful referencing or via digital input signal		
VSF (vibration suppression)			0.1 Hz to 200 Hz		
Other functions			Friction compensation, gear play compensation		
External EtherCAT adapter (option)			EtherCAT with mega-ulink protocol		
Ambient conditions	**Operating temperature**		0 to 40 °C (above 55 °C only with air conditioning)		
	Storage temperature		–20 °C to +65 °C		
	Air humidity		0 to 90 % (non-condensing and frost free)		
	Operating altitude		< 1,000 m above sea level		
	Vibration		10 m/s^2 (10 to 500 Hz)		
	Protection class		IP20		

4.4 Options D2T

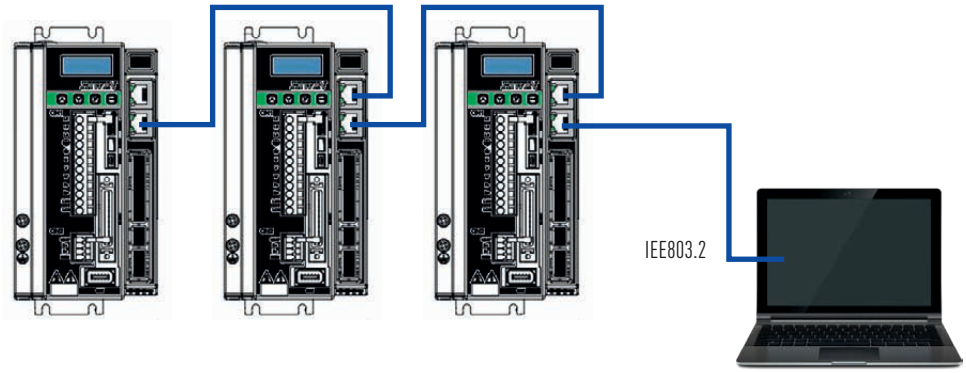
EtherCAT interface

The D2T servo drive supports the Ethernet-based EtherCAT field bus system. EtherCAT is an open technology which is regulated in international standards IEC 61158, IEC 61784 and ISO 15745-4. EtherCAT is a very fast industrial Ethernet system, also suited to use in time-critical motion control applications. The D2T supports the CoE (CANoverEtherCAT) protocol and can therefore be integrated in any EtherCAT master controller which supports this protocol. Furthermore, the D2T works according to the standardised drive profile CiA 402 and can therefore be easily integrated into the TwinCAT control software of Beckhoff as an NC axis.

EtherCAT®

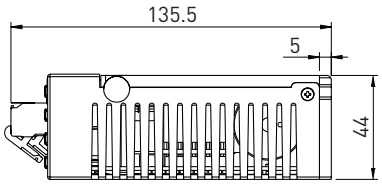
mega-ulink interface

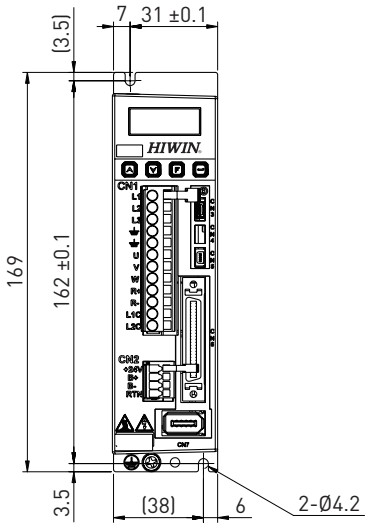
The D2T servo drive supports the proprietary protocol mega-ulink, which is based on EtherCAT. The EtherCAT mega-ulink interface can be used for communication and control between the industrial PC and servo drive. Communication takes place via the standard Ethernet interface on the PC and the EtherCAT mega-ulink interface on the drive. A dll library (MPI.dll) handles communication and control between PC and drive controller. A detailed description of this library and how to use it is available at www.hiwin.de.

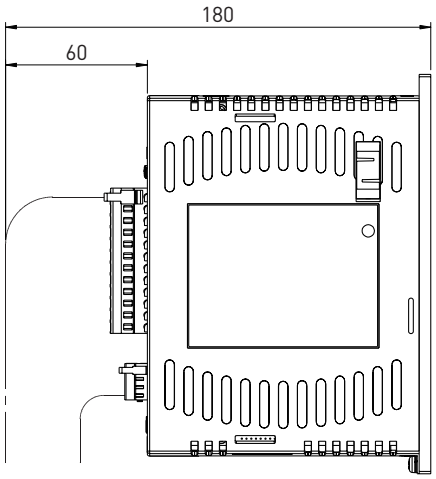


4.5 Dimensions D2T (standard version)

Housing type A

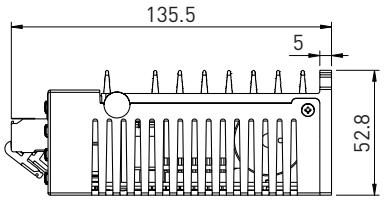


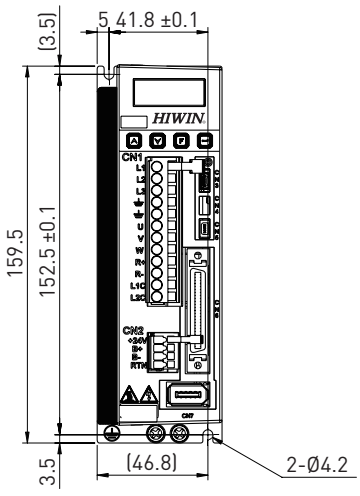


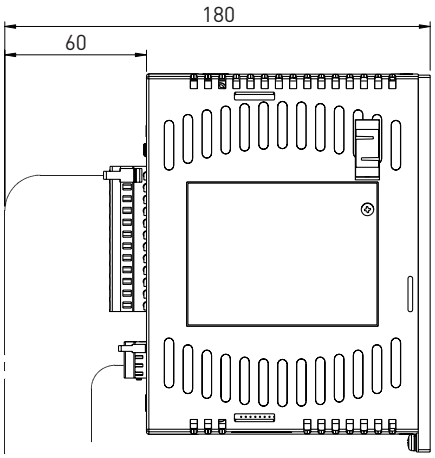


Unit: mm

Housing type B

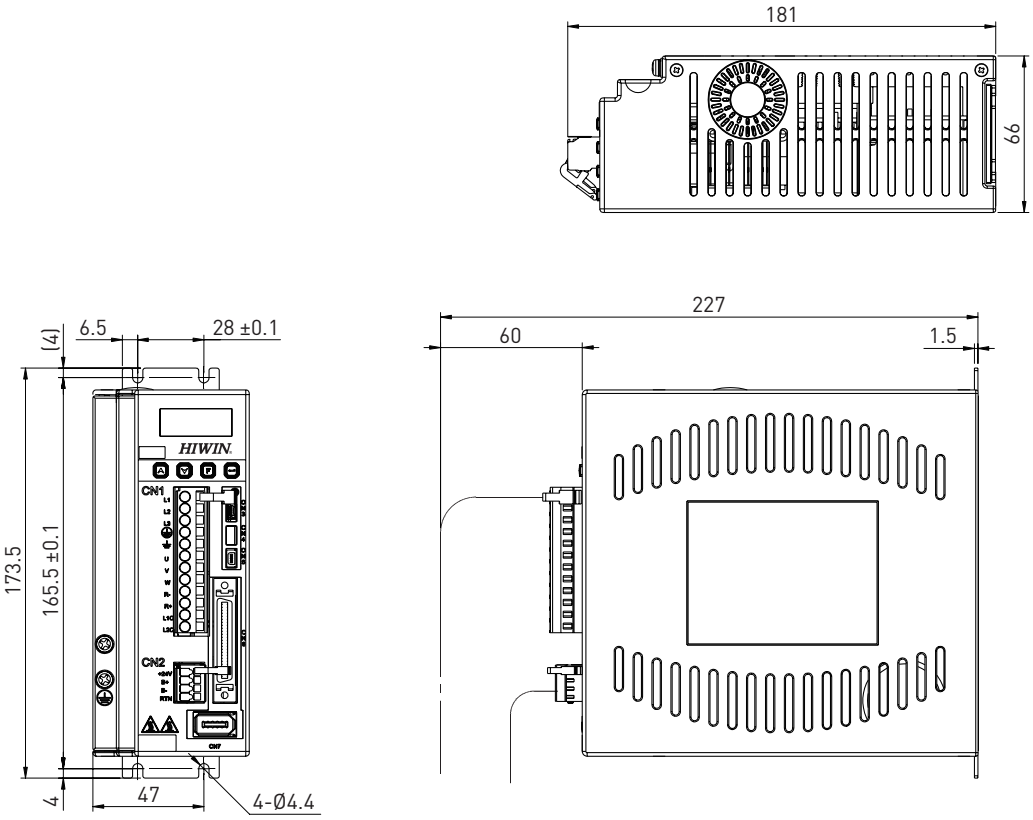






Unit: mm

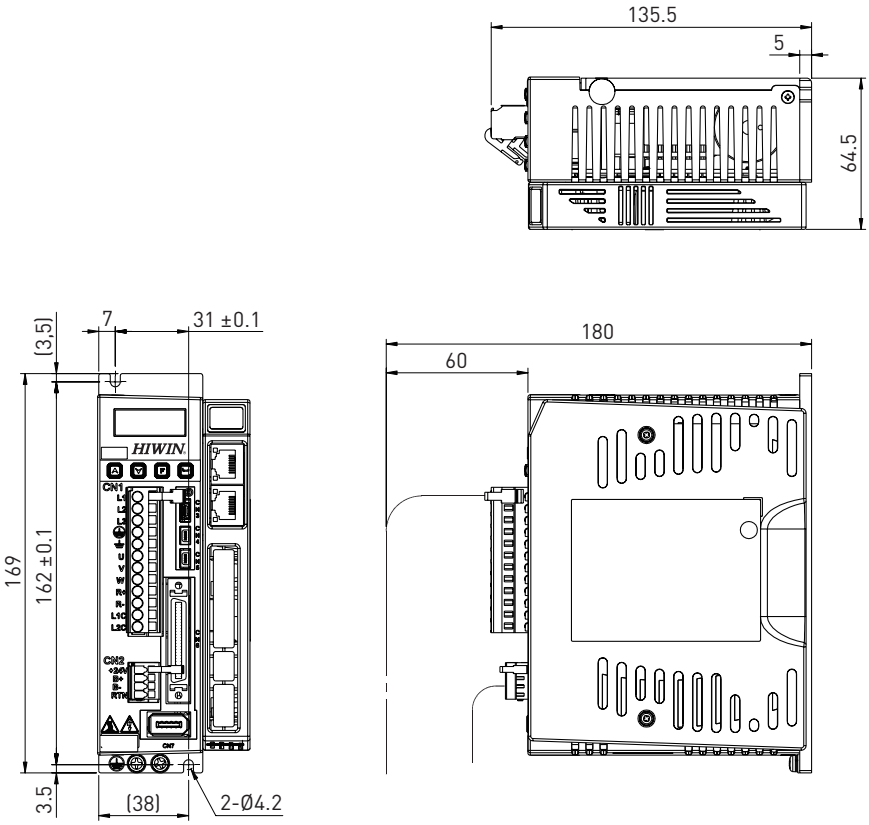
- **Housing type C**



Unit: mm

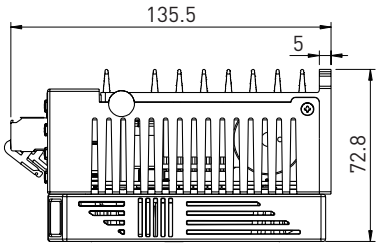
4.6 Dimensions D2T (mega-ulink version)

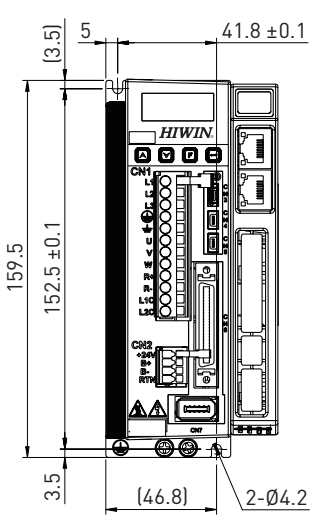
- **Housing type A**

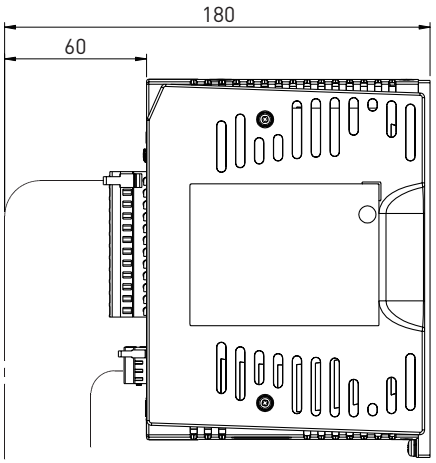


Unit: mm

Housing type B

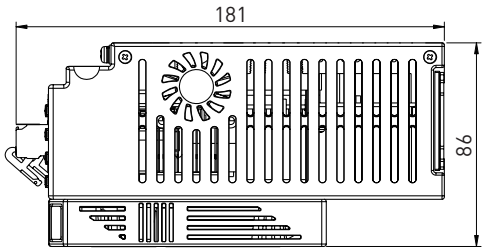


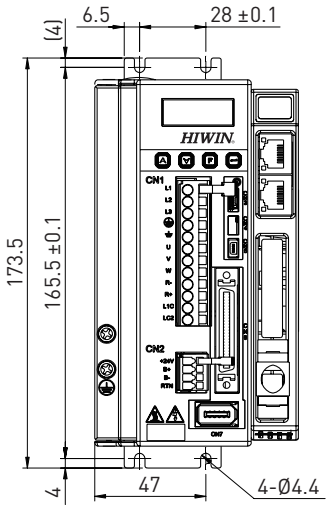


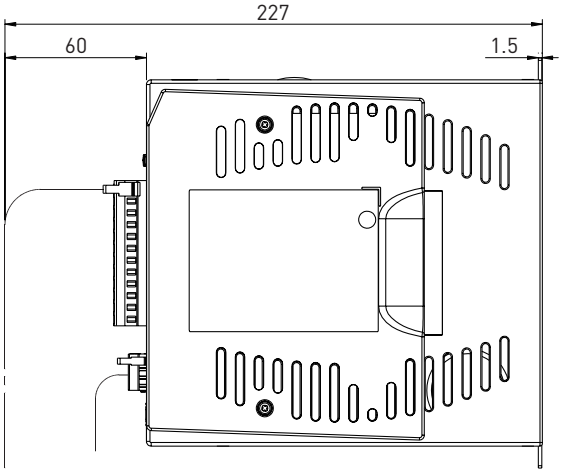


Unit: mm

Housing type C





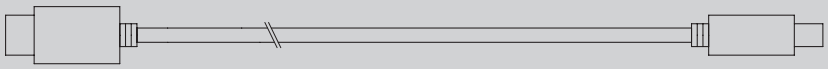
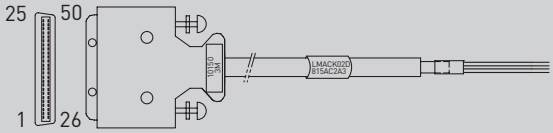


Unit: mm

4.7 Accessories D2T

4.7.1 Cables

Table 4.2 **Cables for D2T servo drive**

Article number	Designation	Connector	Figure	Length
8-10-0864	USB parameteri-sation cable	CN3		2 m
8-10-0763	Control I/O and encoder output	CN6		3 m

4.7.2 Connectors

Table 4.3 **Connector set for D2T servo drive**

Article number	Designation	Type	Contacts	Quantity
D2-CK3	CN1	WAGO 721-122/026-000	12	1
	CN2	WAGO 734-104	4	1
	CN6	3M 10150-3000PE+10350-52A0-008	50	1

Connector set D2-CK3 is supplied with each D2T drive

4.7.3 Brake resistor

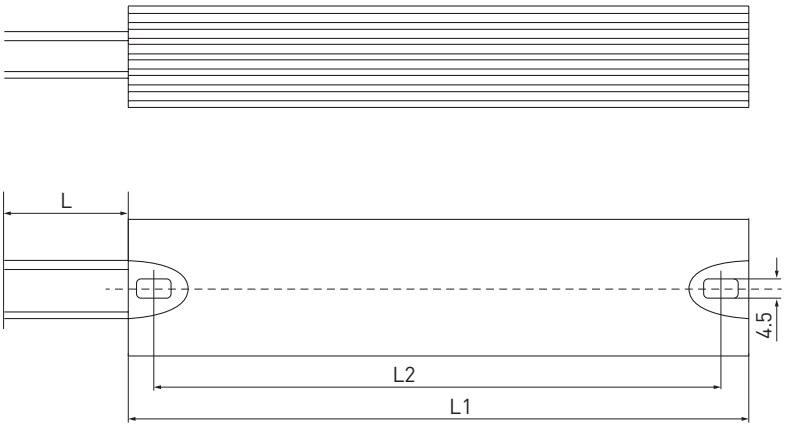


Table 4.4 **Brake resistor for D2T servo drive**

Article number	Designation	Resistance [Ω]	Nominal power [W]	Weight [g]	L1 [mm]	L2 [mm]	W [mm]	H [mm]	L [mm]
8-09-0015	Brake resistor	80	300	305	155	144	36	27	600

Unit: mm

4.7.4 Mains filter

Table 4.5 **Mains filter for D2T servo drive**

Article number	Designation	Type	Nominal current [A]	Leakage current [mA]	Quantity
8-09-0439	D2T mains filter, 1-phase, 50 to 400 W	FN2090-6-06	6	0.67	1
	Ferrite core	KFC-130-B			2
8-09-0374	D2T mains filter, 1-phase, 750 to 1,000 W	FN2090-10-06	10	0.67	1
	Ferrite core	KFC-130-B			2
8-09-0440	D2T mains filter, 3-phase	FN3025HL-20-71	20	0.40	1
	Ferrite core	KFC-130-B			2

5. AC servo motors

HIWIN FR highly dynamic AC synchronous servo motors deliver high torques across the entire speed range. Because they have minimal mass inertia moment, they are also suitable for demanding dynamic drive tasks such as high-frequency reversing. The special stator/rotor structure of the FR series achieves very low torque ripple and high power density in a compact form.

5.1 Characteristics

Table 5.1 **General characteristics**

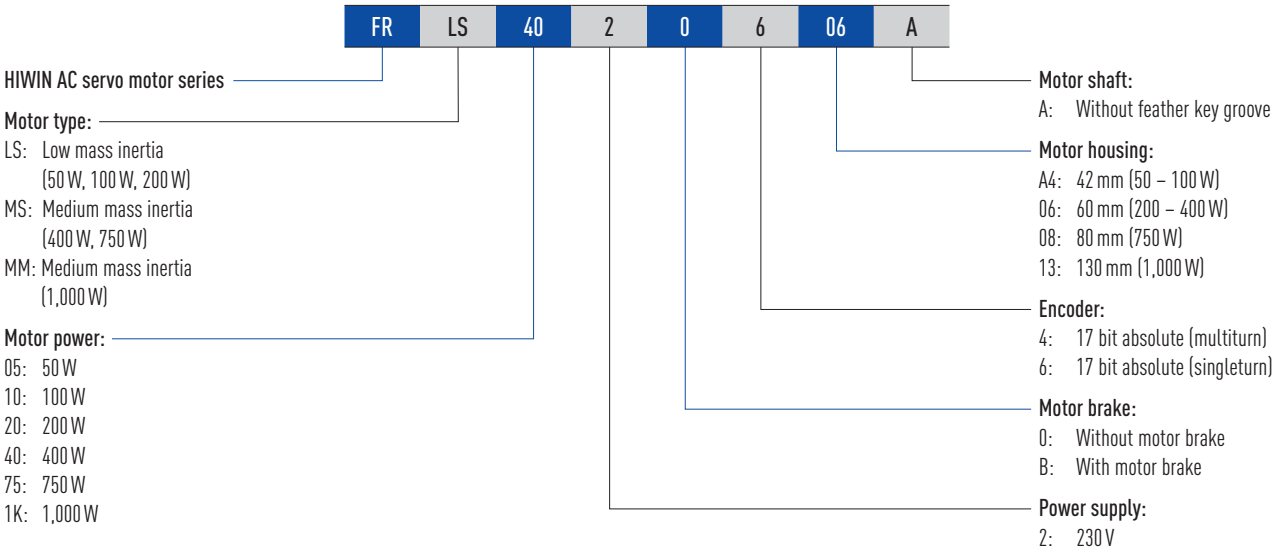
Size	50 W	100 W	200 W	400 W	750 W	1,000 W
Motor type	Permanently excited synchronous servo motor					
Magnets	Neodymium iron boron magnets					
Housing	Aluminium					
Colour	Black					
Motor protection class	IP65					
Connector protection class	IP20					IP65
Motor shaft protection class	IP40 (optional IP65)					
Insulation class	Class A					
Shaft end	Without feather key groove, with centric threaded hole					
Peak torque	3 × nominal torque					
Service life	> 20,000 h (at nominal load)					
Motor connection	Cable (300 mm) with ready-assembled connector					Connector
Encoder connection	Cable (300 mm) with ready-assembled connector					Connector
Cooling	Convective					
Thermal monitoring	Not available					
Encoder	17-bit absolute (single or multi turn)					

Table 5.2 **Ambient conditions**

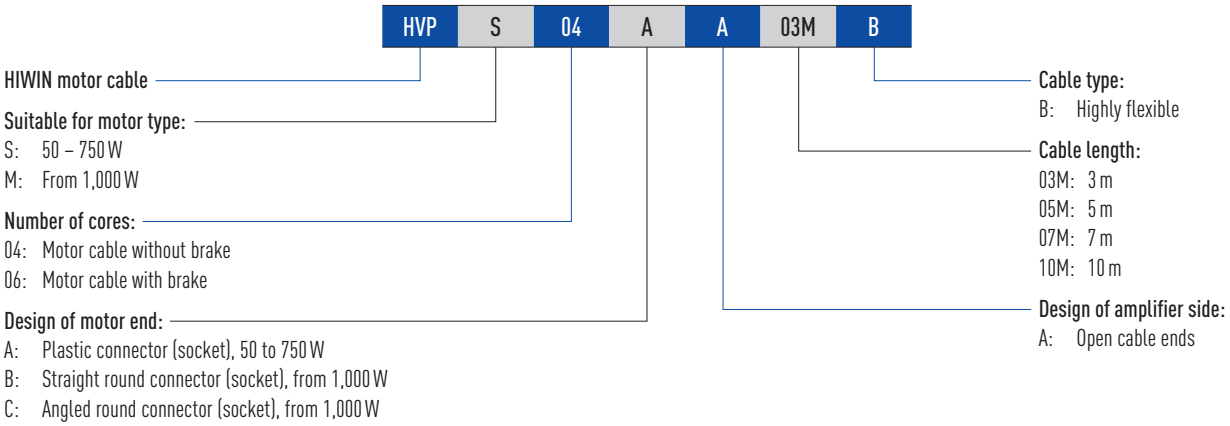
Size	50 W	100 W	200 W	400 W	750 W	1,000 W
Ambient temperature	0 °C to 40 °C					
Storage temperature	–15 °C to 70 °C					
Air humidity	Up to 80 % relative air humidity					
Max. Max. installation height	1,000 m above sea level					

5.2 Order code

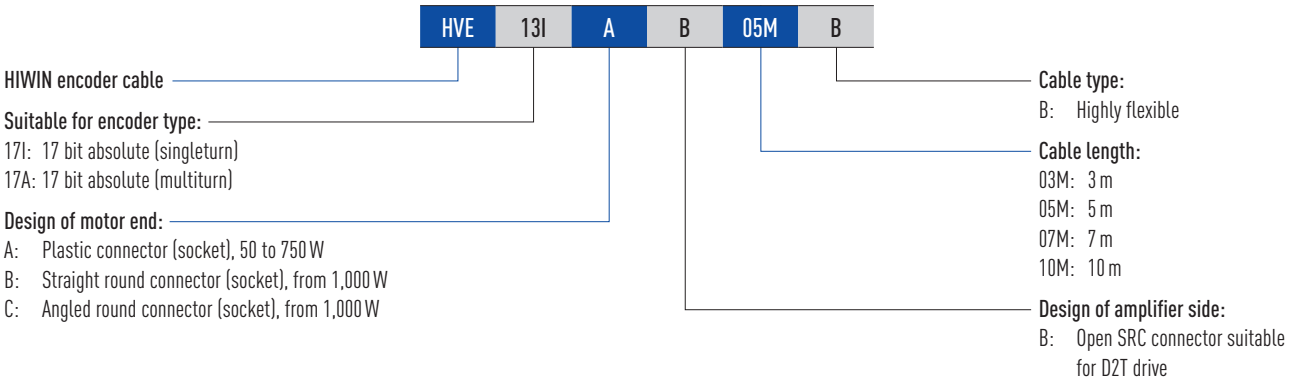
Motor



Motor cable



Encoder cable



5.3 Motor data

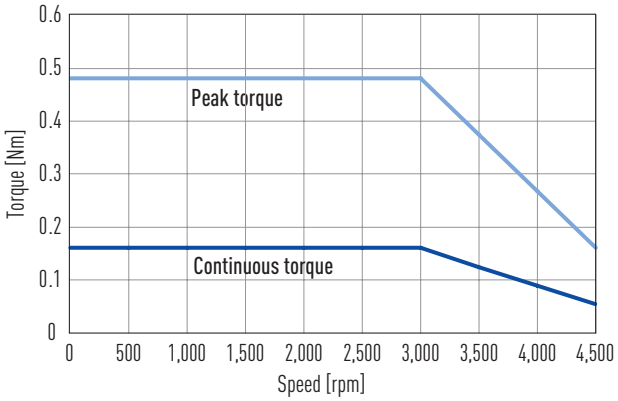
5.3.1 AC servo motor FRLS 50 W

Table 5.3 **Technical data FRLS 50 W**

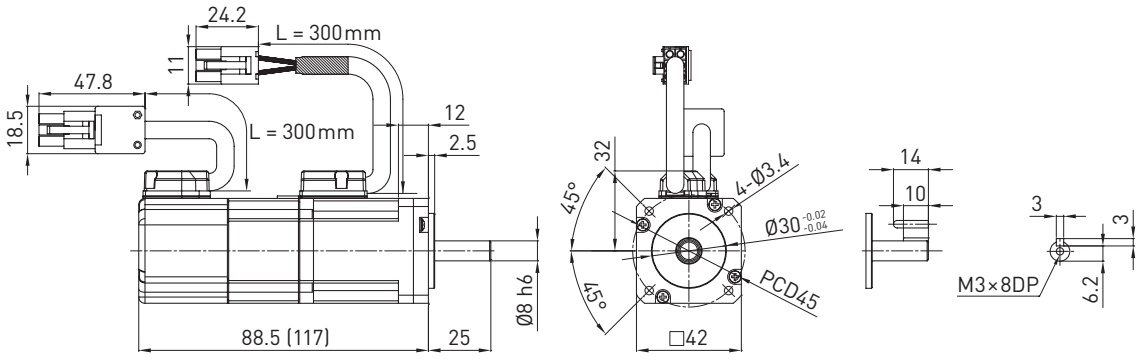
Motor data	Symbol	Unit	FRLS052 _ _A4 _
Nominal voltage	V	VAC	220
Nominal power	W	W	50
Nominal torque	T_C	Nm	0.16
Nominal current	I_C	A_{eff}	0.9
Peak torque for 1 sec.	T_P	Nm	0.48
Peak current for 1 sec.	I_P	A_{eff}	2.7
Nominal speed	n_N	rpm	3,000
Maximum speed for 1 sec.	n_{max}	rpm	4,500
Torque constant	K_T	Nm/A_{eff}	0.178
Voltage constant	K_e	V_{eff}/(1,000 rpm)	10.74
Winding resistance [1]	R	Ω	4.7
Winding inductance [1]	L	mH	4.7
Mass inertia of rotor	J	$kgm^2 \times 10^{-4}$	0.02
Mass inertia of rotor with brake	J	$kgm^2 \times 10^{-4}$	0.022
Motor weight	M	kg	0.45
Motor weight with brake	M	kg	0.58
Motor insulation class			A
Motor brake (optional) [2]			
Braking torque (static)	T_b	Nm	0.3
Power supply	V	VDC	24 ± 10 %
Power consumption	A	A	0.3
Rated input	W	W	6.0
Response time open	t_O	ms	30.0
Response time close	t_R	ms	20.0

[1] Line to line
[2] The motor brakes are holding brakes only, not operating brakes

Torque-speed curve FRLS 50 W



Dimensions FRLS 50 W:



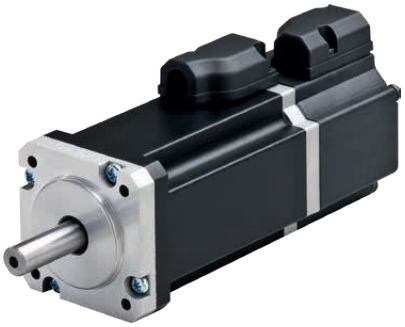
Values in brackets apply
to model with motor brake

5.3.2 AC servo motor FRLS 100 W

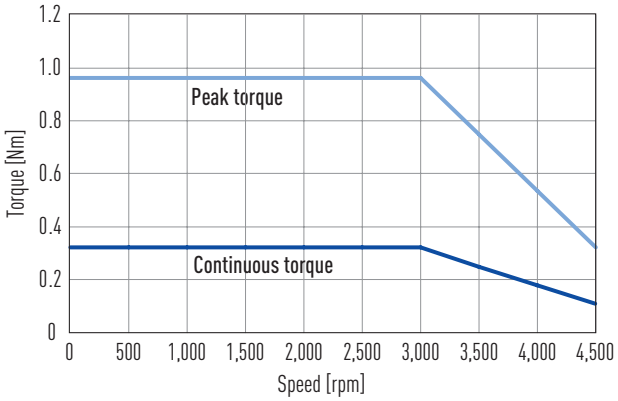
Table 5.4 **Technical data FRLS 100 W**

Motor data	Symbol	Unit	FRLS102 _ _A4 _
Nominal voltage	V	VAC	220
Nominal power	W	W	100
Nominal torque	T_C	Nm	0.32
Nominal current	I_C	A_{eff}	0.9
Peak torque for 1 sec.	T_P	Nm	0.96
Peak current for 1 sec.	I_P	A_{eff}	2.7
Nominal speed	n_N	rpm	3,000
Maximum speed for 1 sec.	n_{max}	rpm	4,500
Torque constant	K_T	Nm/A_{eff}	0.356
Voltage constant	K_e	V_{eff}/(1,000 rpm)	21.98
Winding resistance [1]	R	Ω	8
Winding inductance [1]	L	mH	8,45
Mass inertia of rotor	J	$kgm^2 \times 10^{-4}$	0.036
Mass inertia of rotor with brake	J	$kgm^2 \times 10^{-4}$	0.038
Motor weight	M	kg	0.63
Motor weight with brake	M	kg	0.76
Motor insulation class			A
Motor brake (optional) [2]			
Braking torque (static)	T_b	Nm	0.3
Power supply	V	VDC	24 ± 10 %
Power consumption	A	A	0.3
Rated input	W	W	6.0
Response time open	t_O	ms	30.0
Response time close	t_R	ms	20.0

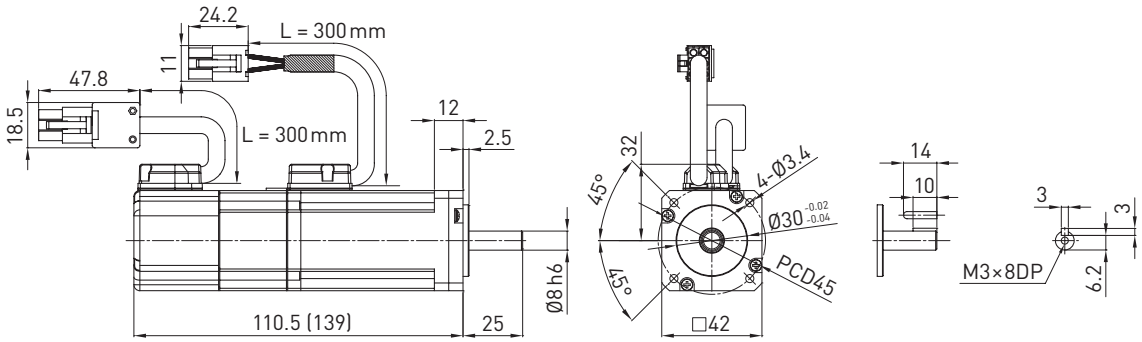
[1] Line to line
[2] The motor brakes are holding brakes only, not operating brakes



Torque-speed curve FRLS 100 W:



Dimensions FRLS 100 W:



Values in brackets apply
to model with motor brake

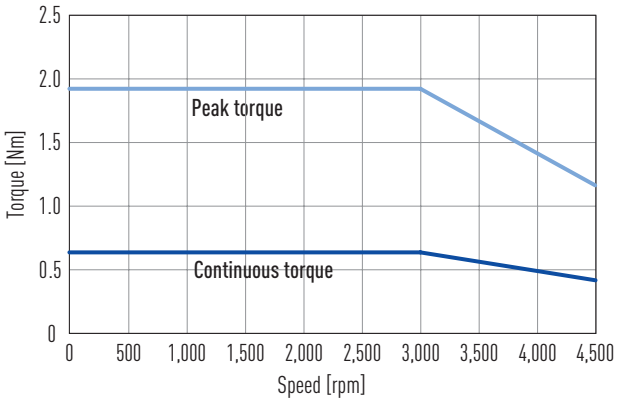
5.3.3 AC servo motor FRLS 200 W

Table 5.5 **Technical data FRLS 200 W**

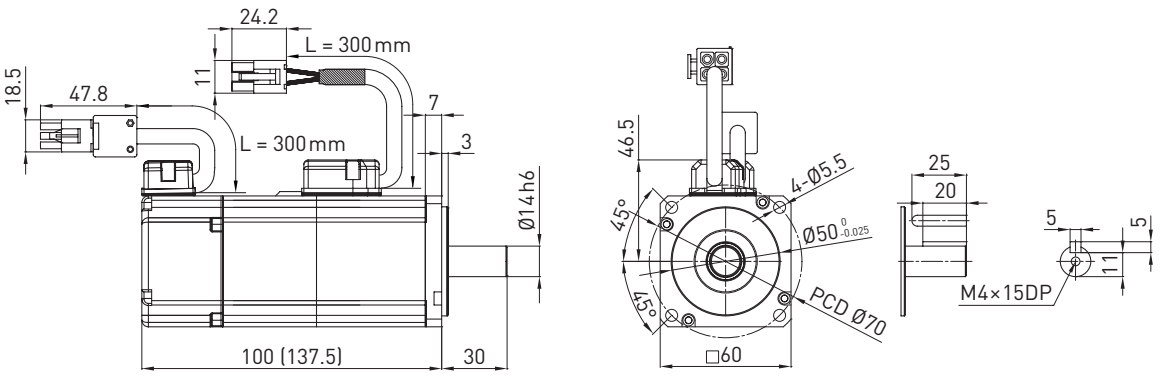
Motor data	Symbol	Unit	FRLS202 _ _06_
Nominal voltage	V	VAC	220
Nominal power	W	W	200
Nominal torque	T_C	Nm	0.64
Nominal current	I_C	A_{eff}	1.7
Peak torque for 1 sec.	T_P	Nm	1.92
Peak current for 1 sec.	I_P	A_{eff}	5.1
Nominal speed	n_N	rpm	3,000
Maximum speed for 1 sec.	n_{max}	rpm	4,500
Torque constant	K_T	Nm/A_{eff}	0.43
Voltage constant	K_e	V_{eff}/(1,000 rpm)	26
Winding resistance [1]	R	Ω	4,3
Winding inductance [1]	L	mH	13
Mass inertia of rotor	J	$kgm^2 \times 10^{-4}$	0.17
Mass inertia of rotor with brake	J	$kgm^2 \times 10^{-4}$	0.21
Motor weight	M	kg	0.95
Motor weight with brake	M	kg	1.5
Motor insulation class			A
Motor brake (optional) [2]			
Braking torque (static)	T_b	Nm	1.3
Power supply	V	VDC	24 ± 10 %
Power consumption	A	A	0.3
Rated input	W	W	7.7
Response time open	t_O	ms	30.0
Response time close	t_R	ms	20.0

[1] Line to line
[2] The motor brakes are holding brakes only, not operating brakes

Torque-speed curve FRLS 200 W:



Dimensions FRLS 200 W:



Values in brackets apply
to model with motor brake

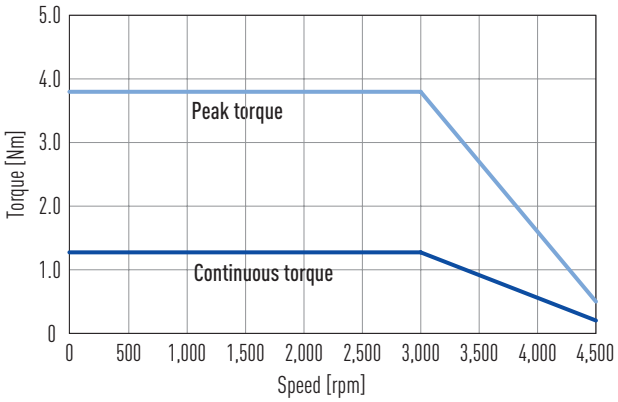
5.3.4 AC servo motor FRMS 400 W

Table 5.6 **Technical data FRMS 400 W**

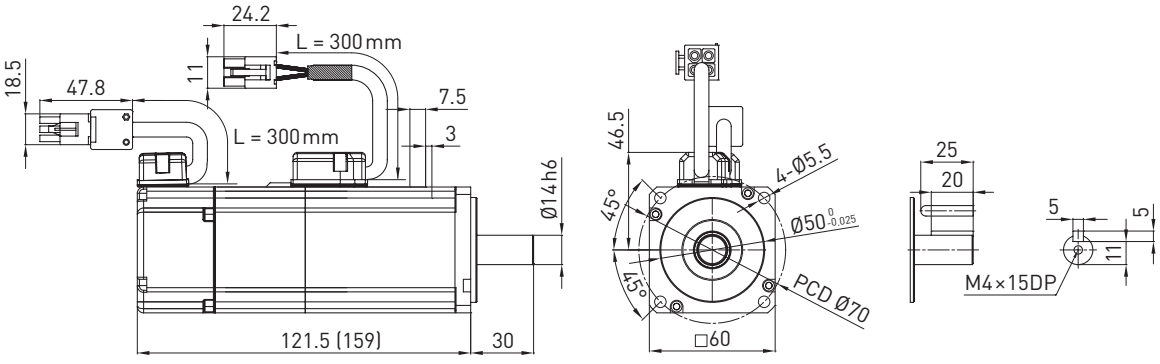
Motor data	Symbol	Unit	FRMS402 _ _06 _
Nominal voltage	V	VAC	220
Nominal power	W	W	400
Nominal torque	T_C	Nm	1.27
Nominal current	I_C	A_{eff}	2.6
Peak torque for 1 sec.	T_P	Nm	3.81
Peak current for 1 sec.	I_P	A_{eff}	7.8
Nominal speed	n_N	rpm	3,000
Maximum speed for 1 sec.	n_{max}	rpm	4,500
Torque constant	K_T	Nm/A_{eff}	0.48
Voltage constant	K_e	V_{eff}/(1,000 rpm)	29.61
Winding resistance [1]	R	Ω	4.13
Winding inductance [1]	L	mH	9.9
Mass inertia of rotor	J	$kgm^2 \times 10^{-4}$	0.44
Mass inertia of rotor with brake	J	$kgm^2 \times 10^{-4}$	0.48
Motor weight	M	kg	1.31
Motor weight with brake	M	kg	1.86
Motor insulation class			A
Motor brake (optional) [2]			
Braking torque (static)	T_b	Nm	1.3
Power supply	V	VDC	24 ± 10 %
Power consumption	A	A	0.3
Rated input	W	W	7.7
Response time open	t_O	ms	30.0
Response time close	t_R	ms	20.0

[1] Line to line
[2] The motor brakes are holding brakes only, not operating brakes

Torque-speed curve FRMS 400 W:



Dimensions FRMS 400 W:



Values in brackets apply
to model with motor brake

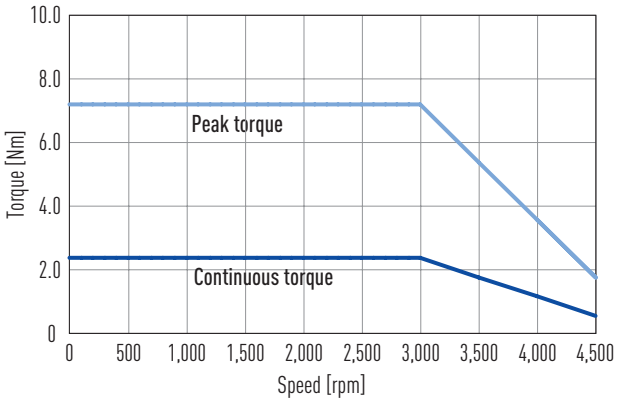
5.3.5 AC servo motor FRMS 750 W

Table 5.7 **Technical data FRMS 750 W**

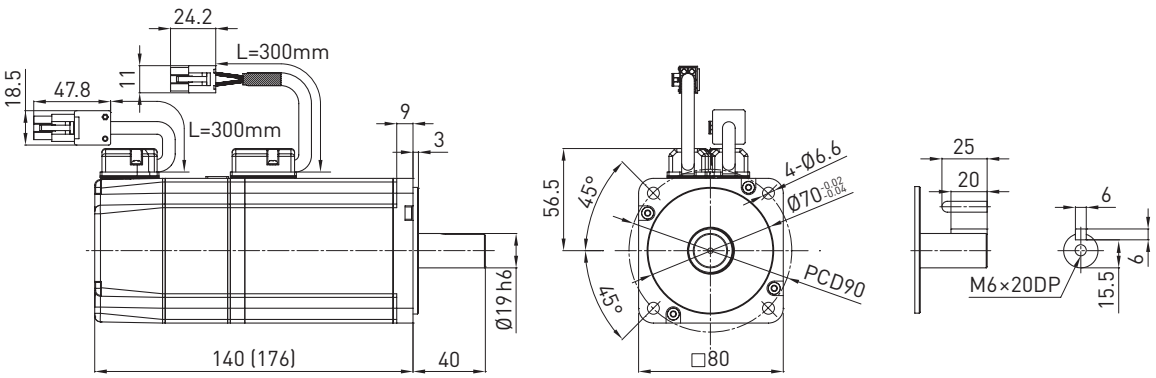
Motor data	Symbol	Unit	FRMS752 _ _08_
Nominal voltage	V	VAC	220
Nominal power	W	W	750
Nominal torque	T_C	Nm	2.4
Nominal current	I_C	A_{eff}	5.1
Peak torque for 1 sec.	T_P	Nm	7.2
Peak current for 1 sec.	I_P	A_{eff}	15.3
Nominal speed	n_N	rpm	3,000
Maximum speed for 1 sec.	n_{max}	rpm	4,500
Torque constant	K_T	Nm/A_{eff}	0.47
Voltage constant	K_e	V_{eff}/(1,000 rpm)	28.4
Winding resistance [1]	R	Ω	0.813
Winding inductance [1]	L	mH	3.4
Mass inertia of rotor	J	$kgm^2 \times 10^{-4}$	1.4
Mass inertia of rotor with brake	J	$kgm^2 \times 10^{-4}$	1.46
Motor weight	M	kg	2.66
Motor weight with brake	M	kg	3.32
Motor insulation class			A
Motor brake (optional) [2]			
Braking torque (static)	T_b	Nm	2.4
Power supply	V	VDC	24 ± 10 %
Power consumption	A	A	0.4
Rated input	W	W	8.6
Response time open	t_O	ms	45.0
Response time close	t_R	ms	10.0

[1] Line to line
[2] The motor brakes are holding brakes only, not operating brakes

Torque-speed curve FRMS 750 W:



Dimensions FRMS 750 W:



Values in brackets apply
to model with motor brake

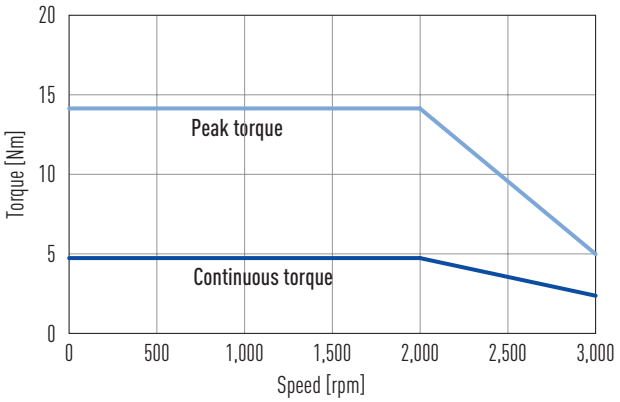
5.3.6 AC servo motor FRMM 1,000 W

Table 5.8 **Technical data FRMM 1,000 W**

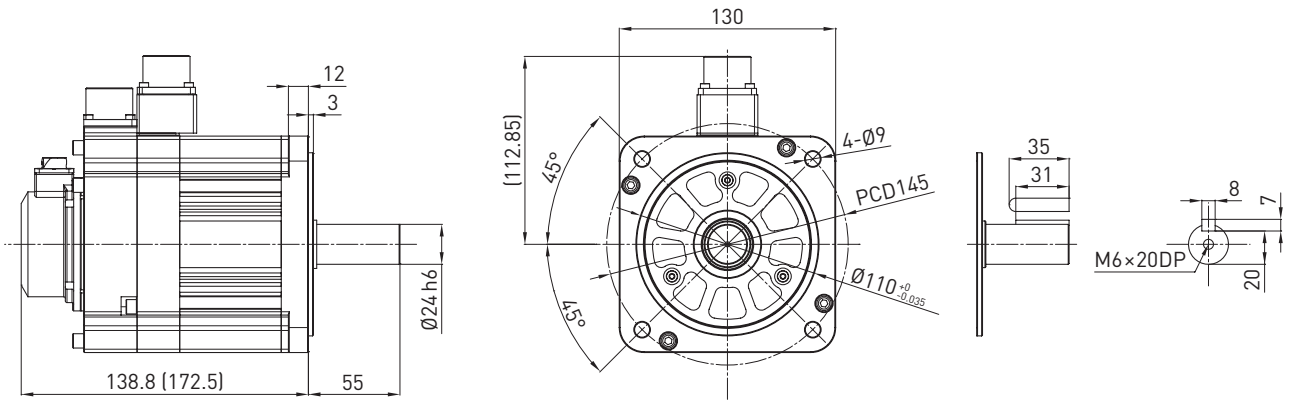
Motor data	Symbol	Unit	FRMM1K2 _ _13 _
Nominal voltage	V	VAC	220
Nominal power	W	W	1,000
Nominal torque	T_C	Nm	4.77
Nominal current	I_C	A_{eff}	5.1
Peak torque for 1 sec.	T_P	Nm	14.3
Peak current for 1 sec.	I_P	A_{eff}	15.3
Nominal speed	n_N	rpm	2,000
Maximum speed for 1 sec.	n_{max}	rpm	3,000
Torque constant	K_T	Nm/A_{eff}	0.94
Voltage constant	K_e	V_{eff}/(1,000 rpm)	54.7
Winding resistance [1]	R	Ω	0.81
Winding inductance [1]	L	mH	8
Mass inertia of rotor	J	$kgm^2 \times 10^{-4}$	7.6
Mass inertia of rotor with brake	J	$kgm^2 \times 10^{-4}$	8.7
Motor weight	M	kg	5.4
Motor weight with brake	M	kg	6.2
Motor insulation class			A
Motor brake (optional) [2]			
Braking torque (static)	T_b	Nm	10
Power supply	V	VDC	24 ± 10 %
Power consumption	A	A	0.6
Rated input	W	W	13.4
Response time open	t_O	ms	80.0
Response time close	t_R	ms	30.0

[1] Line to line
[2] The motor brakes are holding brakes only, not operating brakes

Torque-speed curve FRMM 1,000 W:



Dimensions FRMM 1,000 W:



Values in brackets apply
to model with motor brake

5.4 Options

5.4.1 Motor brake

Table 5.9 **Motor brake specifications for HIWIN servo motors**

Motor type	Unit	50 W	100 W	200 W	400 W	750 W	1,000 W
Braking torque (static)	Nm	0.3	0.3	1.3	1.3	2.4	10.0
Maximum speed n_{max}	rpm	4,500	4,500	4,500	4,500	4,500	3,000
Power supply	VDC	24 ± 10 %	24 ± 10 %	24 ± 10 %	24 ± 10 %	24 ± 10 %	24 ±10 %
Power consumption	A	0.3	0.3	0.3	0.3	0.4	0.6
Rated input	W	6.0	6.0	7.7	7.7	8.6	13.4
Response time open	ms	30.0	30.0	30.0	30.0	45.0	80.0
Response time close	ms	20.0	20.0	20.0	20.0	10.0	30.0

Please note: The motor brakes are holding brakes only, not operating brakes

5.5 Accessories

5.5.1 Motor and encoder connectors

In HIWIN servo motors rated between 50 W and 750 W, the motor and encoder cables are routed directly out of the motor. For ease of installation the motor and encoder connectors are fitted on the end of the 300 mm cable and ready to connect. As of 1,000 W motors the motor and encoder connectors are fitted on the motor housing, see Fig. 5.1 (motor and encoder connectors).

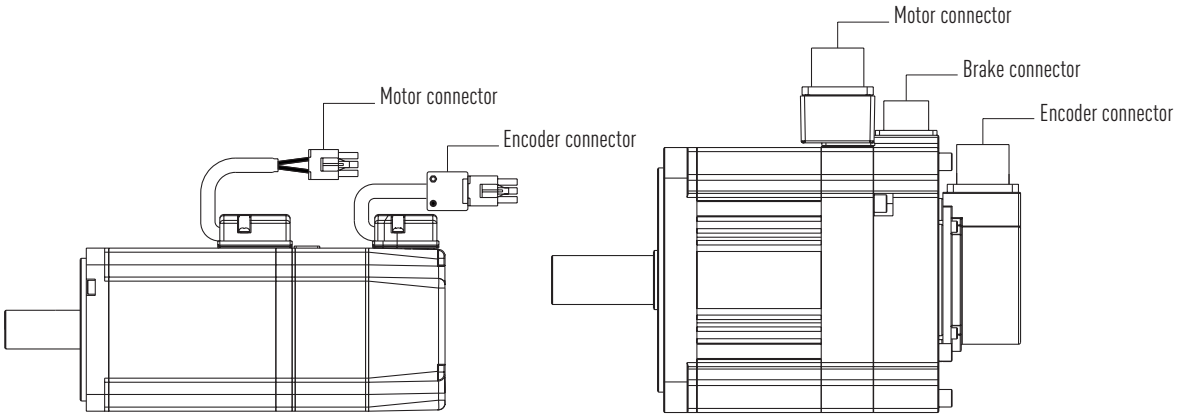


Fig. 5.1 **Overview of motor and encoder connectors**

Different connectors are used for HIWIN servo motors depending on the size and model. The assignment of individual connectors is described in the tables below.

- **Motor connector for 50 W – 750 W motors**

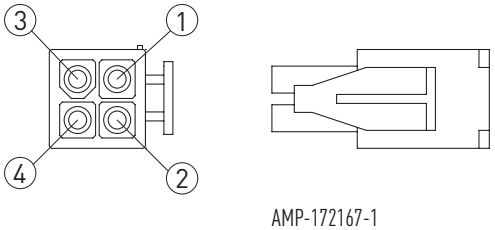


Fig. 5.2 **Connector assignment without brake, motor connector for 50 W – 750 W motors**

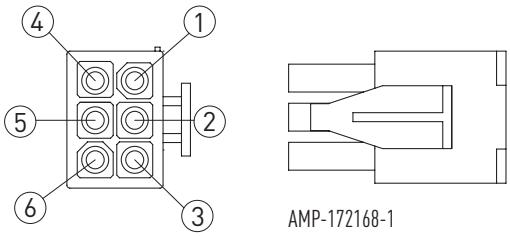


Fig. 5.3 **Connector assignment with brake, motor connector for 50 W – 750 W motors**

Table 5.10 **Assignment of motor connector for 50 W – 750 W motors**

Signal	AMP-172167-1 (without brake)	AMP-172168-1 (with brake)
U	3	3
V	2	2
W	1	1
GND	4	4
B+	–	5
B–	–	6

Motor connector, 1,000 W and above

Motors of 1,000 W and above with a motor brake have an additional, separate brake connector (see Fig. 5.5).

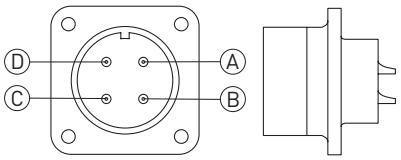


Fig. 5.4 **Assignment of motor connector, 1,000 W and above**

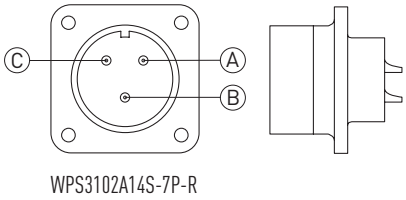


Fig. 5.5 **Connector assignment for brake, 1,000 W and above**

Table 5.11 **Assignment of motor connector, 1,000 W and above**

Signal	WPS3102A18-10P-R	WPS3102A14S-7P-R
U	A	–
V	B	–
W	C	–
GND	D	–
B+	–	A
B–	–	C

- **Encoder connector, 50 W – 750 W**

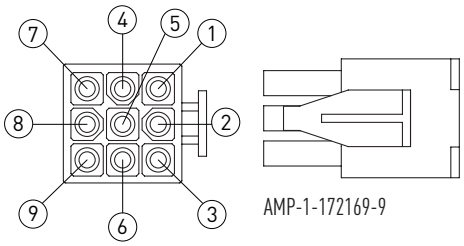


Fig. 5.7 **Encoder connector, 50 W – 750 W**

Table 5.12 **Assignment of encoder connector, 50 W – 750 W**

Function	17 bit absolute (singleturn)	17 bit absolute (multiturn)	AMP-172169-9
Power supply	5 V ± 5 %		1
	0 V		2
Data	SC+	–	3
	SC–	–	4
	–	VB (battery)	5
	–	GND (battery)	6
	MA+	SD+	7
	MA–	SD–	8
Shielding	Shielding		9

- **Encoder connector, 1,000 W and above**

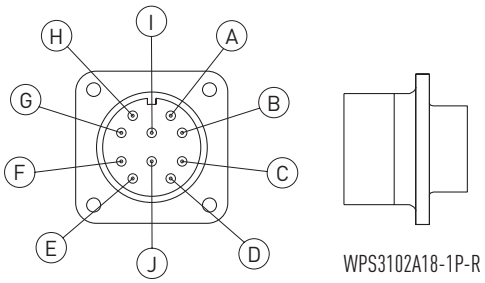


Fig. 5.6 **Encoder connector, 1,000 W and above**

Table 5.13 **Assignment of encoder connector, 1,000 W and above**

Function	17 bit absolute (singleturn)	17 bit absolute (multiturn)	WPS3102A18-1P-R
Power supply	5 V ± 5 %		A
	0 V		B
Data	SC+	–	C
	SC–	–	D
	–	VB (battery)	E
	–	GND (battery)	F
	MA+	SD+	G
	MA–	SD–	H
Shielding	Shielding		I

5.5.2 Motor and encoder cables

- **Motor cables**

Table 5.14 **Motor cables for 50 W – 750 W motors without brake**

Article number	Order code	Length
8-10-0627	HVPS04AA03MB	3 m
8-10-0628	HVPS04AA05MB	5 m
8-10-0629	HVPS04AA07MB	7 m
8-10-0630	HVPS04AA10MB	10 m

Table 5.15 **Motor cables for 50 W – 750 W motors with brake**

Article number	Order code	Length
8-10-0623	HVPS06AA03MB	3 m
8-10-0624	HVPS06AA05MB	5 m
8-10-0625	HVPS06AA07MB	7 m
8-10-0626	HVPS06AA10MB	10 m

Table 5.16 **Motor cables for 1,000 W motors and above without brake**

Article number	Order code	Length
8-10-0851	HVPM04CA03MB	3 m
8-10-0852	HVPM04CA05MB	5 m
8-10-0853	HVPM04CA07MB	7 m
8-10-0854	HVPM04CA10MB	10 m

Motor cables with straight connector on request

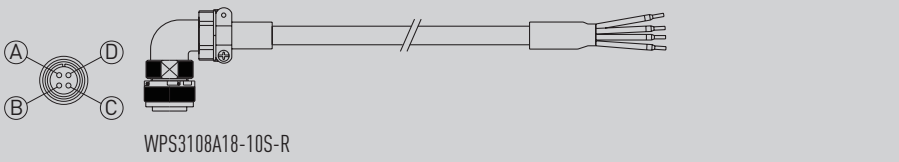
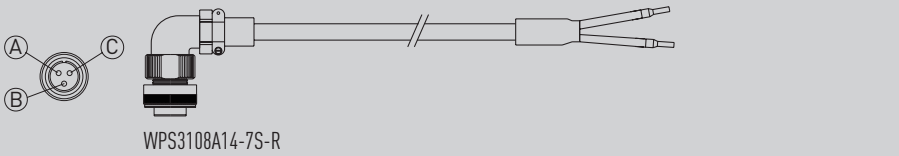


Table 5.17 **Brake cables for 1,000 W motors and above with brake**

Article number	Order code	Length
8-10-0855	HVPM02CA03MB	3 m
8-10-0856	HVPM02CA05MB	5 m
8-10-0857	HVPM02CA07MB	7 m
8-10-0858	HVPM02CA10MB	10 m

Motor cables with straight connector on request



Encoder cables

Table 5.18 **Encoder cables 17 bit absolute (singleturn) for 50 W – 750 W motors, D2T drive**

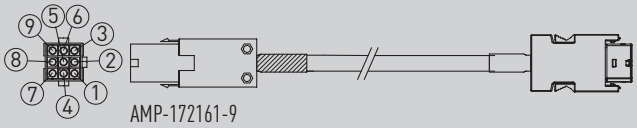
Article number	Order code	Length	
8-10-0983	HVE17IAB03MB	3 m	
8-10-0984	HVE17IAB05MB	5 m	
8-10-0985	HVE17IAB07MB	7 m	
8-10-0986	HVE17IAB10MB	10 m	

Table 5.19 **Encoder cables 17 bit absolute (multiturn) for 50 W – 750 W motors, D2T drive**

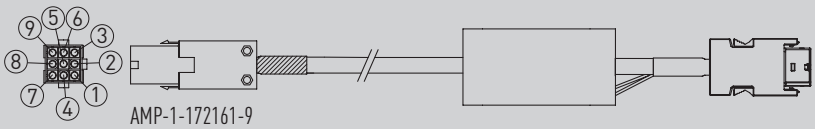
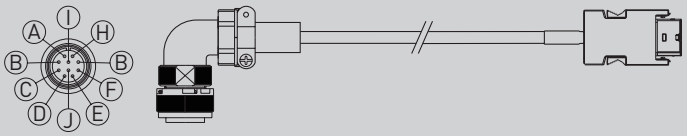
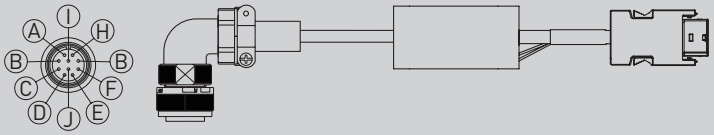
Article number	Order code	Length	
8-10-0987	HVE17AAB03MB	3 m	
8-10-0988	HVE17AAB05MB	5 m	
8-10-0989	HVE17AAB07MB	7 m	
8-10-0990	HVE17AAB10MB	10 m	

Table 5.20 **Encoder cables 17 bit absolute (singleturn) for 1,000 W motors and above, D2T drive**

Article number	Order code	Length	
8-10-0991	HVE17ICB03MB	3 m	
8-10-0992	HVE17ICB05MB	5 m	
8-10-0993	HVE17ICB07MB	7 m	
8-10-0994	HVE17ICB10MB	10 m	

Encoder cables with straight connector on request

Table 5.21 **Encoder cables 17 bit absolute (multiturn) for 1,000 W motors and above, D2T drive**

Article number	Order code	Length	
8-10-0995	HVE17ACB03MB	3 m	
8-10-0996	HVE17ACB05MB	5 m	
8-10-0997	HVE17ACB07MB	7 m	
8-10-0998	HVE17ACB10MB	10 m	

Encoder cables with straight connector on request

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