

IE5 m650-U three-phase AC motors



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1 About this document

WARNING!

Read this documentation carefully before starting any work.

► Please observe the safety instructions!



1.1 Document description

This document addresses to all persons who want to carry out any configurations with the products described.

The data and information compiled in this document serve to support you in the dimensioning and selection processes and in carrying out the electrical and mechanical installation. You will receive information regarding product extensions and accessories.

- The document includes safety instructions which must be observed.
- All persons working on and with the drives must have the documentation at hand during work and observe the information and notes relevant for it.
- The documentation must always be complete and in a perfectly readable state.



1.2 Further documents



Information and tools with regard to the Lenze products can be found on the Internet:

www.Lenze.com → Downloads



1.3 Notations and conventions

Conventions are used in this document to distinguish between different types of information.

Numeric notation		
Decimal separator	Point	Generally shown as a decimal point. Example: 1 234.56
Warnings		
UL Warnings	UL	Are used in English and French.
UR warnings	UR	
Text		
Engineering Tools	" "	Software Example: "EASY Starter", "PLC Designer"
Icons		
Page reference		Reference to another page with additional information. Example:  16 = see page 16
Documentation reference		Reference to other documentation with additional information. Example:  EDKxxx = see documentation EDKxxx

Layout of the safety instructions

DANGER!

Indicates an extremely hazardous situation. Failure to comply with this instruction will result in severe irreparable injury and even death.

WARNING!

Indicates an extremely hazardous situation. Failure to comply with this instruction may result in severe irreparable injury and even death.

CAUTION!

Indicates a hazardous situation. Failure to comply with this instruction may result in slight to medium injury.

NOTICE

Indicates a material hazard. Failure to comply with this instruction may result in material damage.



2 Product information

2.1 Product description

m550-U, m550-V and m650-U three-phase motors for inverter operation

In a power range from 0.25 to 22 kW, Lenze offers inverter-compatible three-phase AC motors for more extensive tasks.

- m550-U: future-proof and compact with 40% reduced motor loss
- m550-V: maximum energy savings and compact with 60% reduced motor loss
- m650-U: application for dynamic requirements with 40% reduced motor loss

These motors differ in terms of efficiency class and can be used for the versions required for sensorless inverter operation.

- m550-U IE5 in the power range 0.37 ... 22 kW
- m550-V IE6 in the power range 0.25 ... 7.5 kW
- m650-U IE5 in the power range 0.75 ... 22 kW

Customer benefit

- Different efficiency classes for the greatest economic benefit
- Space saving thanks to compact direct mounting on Lenze gearboxes
- Market-oriented modular system enables universal use for extensive machine tasks
- Standard market connectors ensure fast connection, even when servicing is required



m650-U80/M4 three-phase AC motor



2.2 Identification of the products

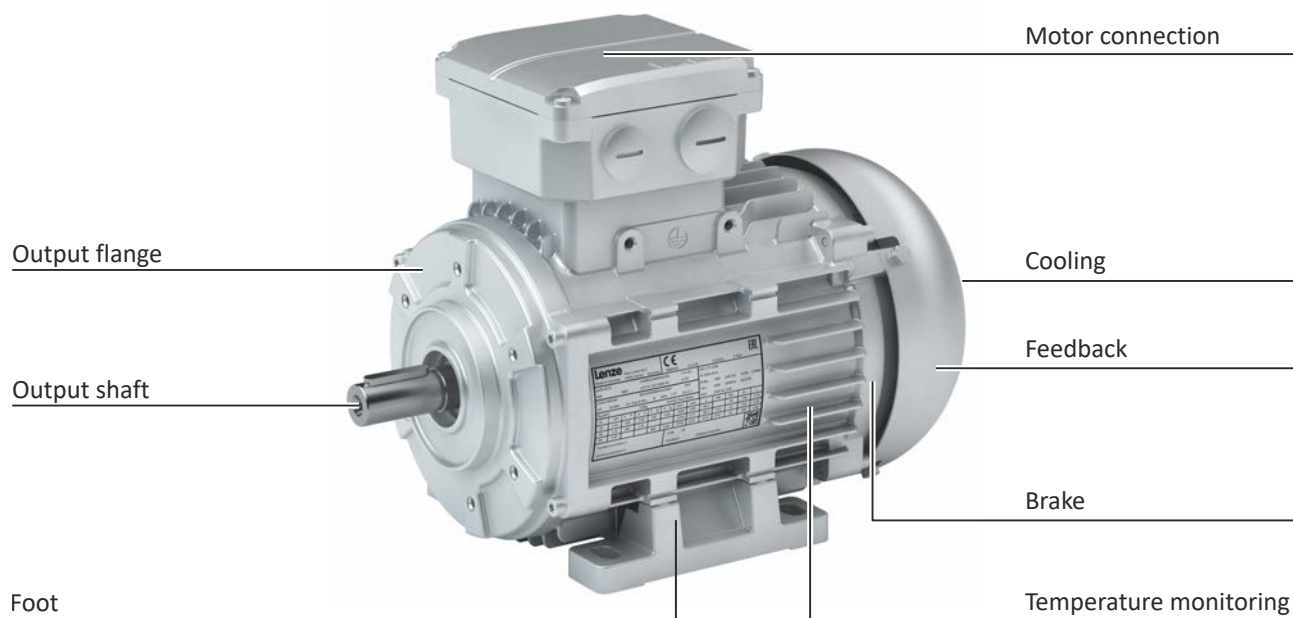
Three-phase AC motor product name

Example	m550	-	V	80	/	S	4
Meaning	Variant	Product name					
Product family		m550					
		m650					
Efficiency class	IE5			U			
	IE6			V			
Size					63 71 80 90 100 112 132		
Motor length	Short					S	
	Medium					M	
	Long					L	
Number of pole pairs	4-pole						4



2.3 Features

The following figure provides an overview of the elements and connections on the product. Their position, size and appearance may vary.





2.4 The modular system



Values printed in bold are standard designs. Values that are not printed in bold are potential extensions, some of them including a surcharge.



Product information

The modular system

Motor		m650-U							
		63/L4	71/M4	71/L4	080/M4	090/M4	090/L4	100/M4	100/L4
Technical data									
Rated power	kW	0.75	1.1	1.5	2.2	3.0	4.0	5.5	7.5
Color		Unpainted Primed/RAL colors							
Surface and corrosion protection		Without Different types of OKS							
Dimensions									
Design		B3/B14/B5							
Solid shaft with featherkey	mm	11 x 23	14 x 30		19 x 40	24 x 50		28 x 60	
Output flange	mm	FT75 FF115	FT85 FF130		FT100 FT130 FF165	FT115 FT130 FF165		FT130 FF215	
Cooling		Integral fan							
Product extensions									
Connection method		Y							
Connection type		Terminal box M23 connector Han-Modular connector							
Spring-applied brake		Without Holding brake							
Feedback		Without Resolver Incremental encoder Incremental encoder with safety functions Absolute value encoder							
Temperature monitoring		TCO thermal contact							

Motor		m650-U			
		112/M	132/S4	132/M4	132/L4
Technical data					
Rated power	kW	11.0	15.0	18.5	22.0
Color		Unpainted Primed/RAL colors			
Surface and corrosion protection		Without Different types of OKS			
Dimensions					
Design		B3/B14/B5	B3/B5		
Solid shaft with featherkey	mm	28 x 60	38 x 80		
Output flange	mm	FT130 FF215	FF265		
Cooling		Integral fan			
Product extensions					
Connection method		Y			
Connection type		Terminal box M23 connector Han-Modular connector			
Spring-applied brake		Without Holding brake			
Feedback		Without Resolver Incremental encoder Incremental encoder with safety functions Absolute value encoder			
Temperature monitoring		TCO thermal contact			

Product information

The modular system
Mounting positions



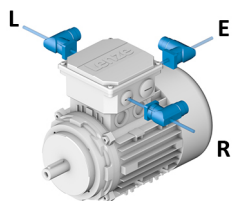
2.4.1 Mounting positions

Positions of the connectors

Power terminal box

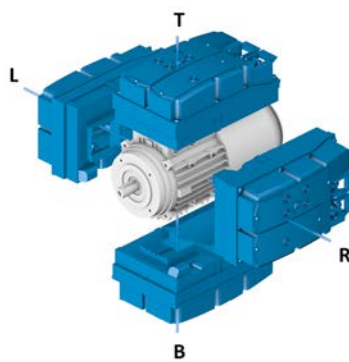
Han connector

Cable glands/M23 connector

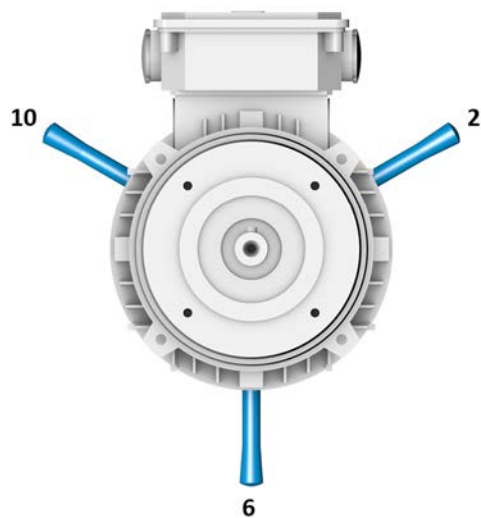


Positions of the i550/i650 motec frequency inverters

Positions of the i550/i650 motec



Manual release lever position





3 Safety instructions

3.1 Basic safety instructions

Disregarding the following basic safety instructions and safety information may lead to severe personal injury and damage to property!

- Only use the product as directed.
- Never commission the product in the event of visible damage.
- Never modify the product technically.
- Never commission the product before assembly has been completed.
- Never operate the product without the required covers.
- Connect/disconnect all pluggable connections only in deenergized condition!
- Only remove the product from the installation in the deenergized state.
- The product can – depending on their degree of protection – have live, movable or rotating parts during or after operation. Surfaces can be hot.
- Observe the specifications of the corresponding documentation. This is the condition for safe and trouble-free operation and the achievement of the specified product features.
- The procedural notes and circuit details given in the associated documentation are suggestions and their transferability to the respective application has to be checked. The manufacturer of the product does not take responsibility for the suitability of the process and circuit proposals.
- All work with and on the product may only be carried out by qualified personnel. IEC 60364 and CENELEC HD 384 define the qualifications of these persons:
 - They are familiar with installing, mounting, commissioning, and operating the product.
 - They have the corresponding qualifications for their work.
 - They know and can apply all regulations for the prevention of accidents, directives, and laws applicable at the place of use.

Please observe the specific safety information in the other sections!



3.2 Application as directed

- The product is a piece of professional equipment intended for use by trades, specific professions or industry, and not for sale to the general public. IEC 60050 [IEV 161-05-05]
- To prevent personal injury and damage to property, higher-level safety and protection systems must be used!
- All transport locks must be removed.
- Mounted eye bolts on the motor are not suitable for transporting geared motors.
- The product may only be operated under the specified operating conditions and in the specified mounting positions.
- The product may be operated on the inverter.
- The product must not be operated in private areas, in potentially explosive atmospheres and in areas with harmful gases, oils, acids and radiation.



3.3 Foreseeable misuse

- Use in potentially explosive atmospheres
- Use in aggressive environments (acids, gases, vapors, dusts, oils)
- Use under water
- Use under radiation
- Operation on a frequency-rigid mains (public AC system)



3.4 Residual hazards

Even if notes given are taken into consideration and protective measures are implemented, the occurrence of residual risks cannot be fully prevented.

The user must take the residual hazards mentioned into consideration in the risk assessment for his/her machine/system.

If the above is disregarded, this can lead to severe injuries to persons and damage to property!

The user must take the residual hazards mentioned into consideration in the risk assessment for his/her machine/system.

If the above is disregarded, this may result in injuries to persons and material damage!

Product

Observe the warning labels on the product!



Dangerous electrical voltage:

Before working on the product, make sure there is no voltage applied to the power terminals! After mains disconnection, the power terminals will still carry the hazardous electrical voltage for the time given next to the symbol!



Electrostatic sensitive devices:

Before working on the product, the staff must ensure to be free of electrostatic charge!



High leakage current:

Carry out fixed installation and PE connection in compliance with:
EN 61800-5-1 / EN 60204-1



Hot surface:

Use personal protective equipment or wait until the device has cooled down!

Motor protection

- Installed temperature contacts are not full protection for the machine.
 - If necessary, limit the maximum current. Parameterize the inverter so that it will be switched off after some seconds of operation with $I > I_{rated}$, especially if there is a risk of blocking.
 - Integrated overload protection does not prevent overloading under all conditions.
- The fuses are no motor protection.
 - Use the built-in temperature sensors.
- Too high torques cause a fraction of the motor shaft.
 - Do not exceed the maximum torques according to the technical data on the nameplate.
- Lateral forces on the motor shaft are possible.
 - Align the shafts of motor and driven machine exactly to each other.
- Demagnetization of the magnets leads to permanent damage
 - Exceeding the maximum current can lead to demagnetization of the magnets and thus to permanent damage to the motor.
 - The maximum current must be limited in the frequency inverter.



Protection of persons

- The power terminals may carry voltage in the switched-off state or when the motor is stopped.
 - Before working, check whether all power terminals are deenergized.
- Voltages may occur on the drive components (e.g. capacitive, caused by inverter supply).
 - Careful earthing in the marked positions of the components must be carried out.
- There is a risk of burns from hot surfaces.
 - Provide protection against accidental contact.
 - Use personal protective equipment or wait until the device has cooled down.
 - Prevent contact with flammable substances.
- There is a risk of injury due to rotating parts.
 - Before working on the drive system, ensure that the motor is at a standstill.
- There is a risk of accidental start-up or electric shock.



4 Information on project planning

4.1 General information

Operation on a frequency inverter

The m550-U, m550-V, and m650-U synchronous motors are optimized for sensorless operation with the i5xx and i6xx frequency inverters. With a frequency inverter operated at 400 V - 480 V, the motor can be operated continuously and efficiently at rated torque in the speed range up to 1860 rpm (m550) or up to 3720 rpm (m650).

On delivery, the frequency inverters are preset for the operation of asynchronous motors. Exceptions are the mounted i550/i650 motec units by Lenze.

Permanent position control during standstill under load can lead to increased gearbox wear.

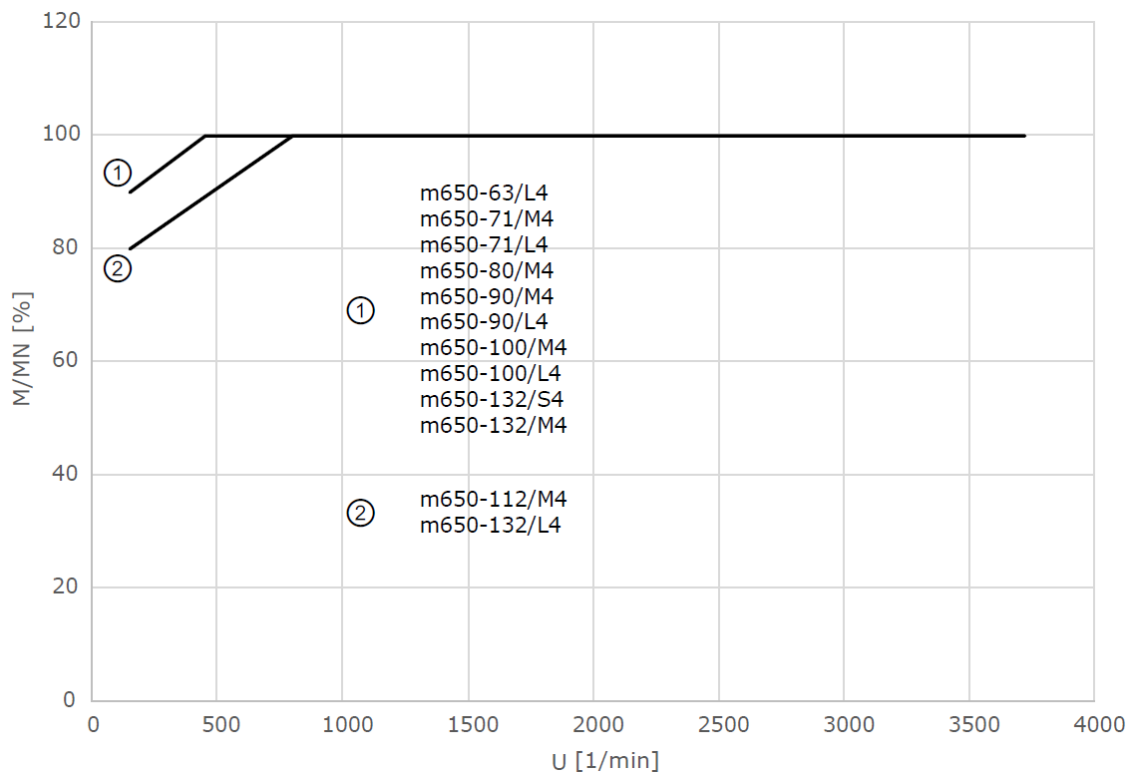
Ensure that the frequency inverter is operated with the correct motor parameters and in SLSM operating mode.

Further information can be found in the frequency inverter documentation.

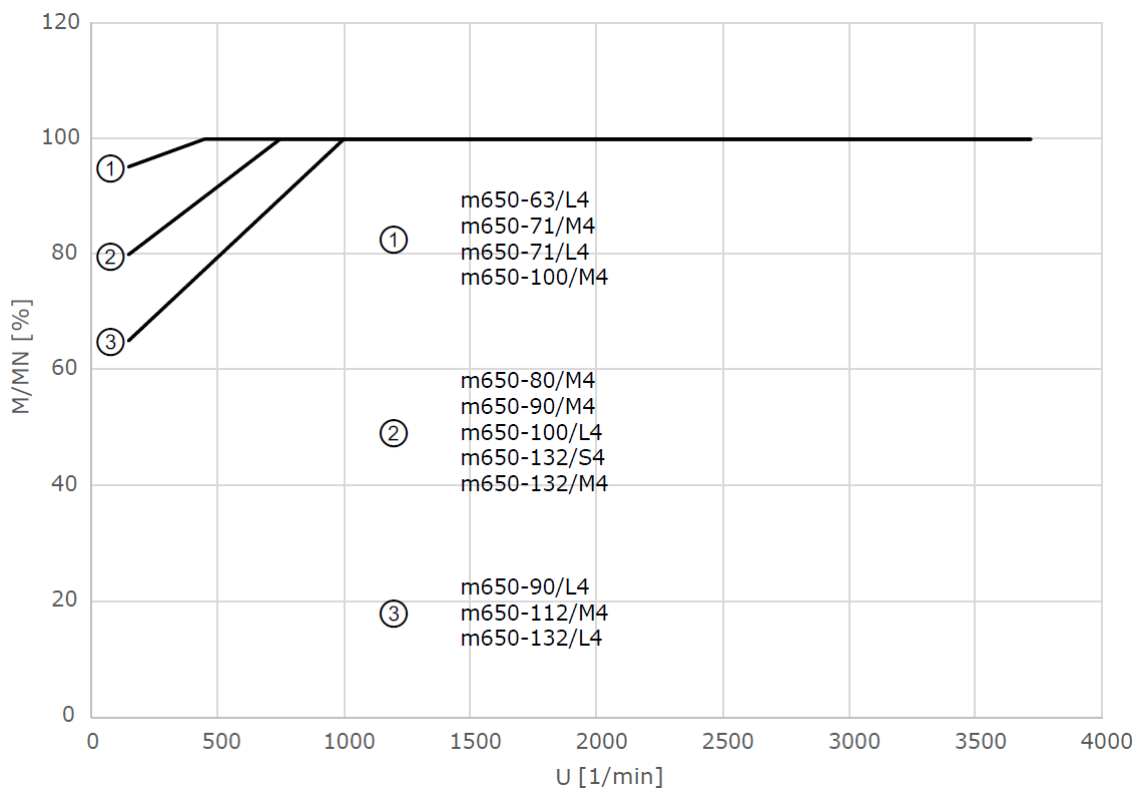


The diagram shows the motor size-dependent torque reduction for self-ventilated motors, taking into account the thermal behavior during operation on the inverter.

Derating wall/control cabinet-mounted inverters in S1 operating mode



Derating i5x0motec/i6x0motec as a drive package in S1 operating mode





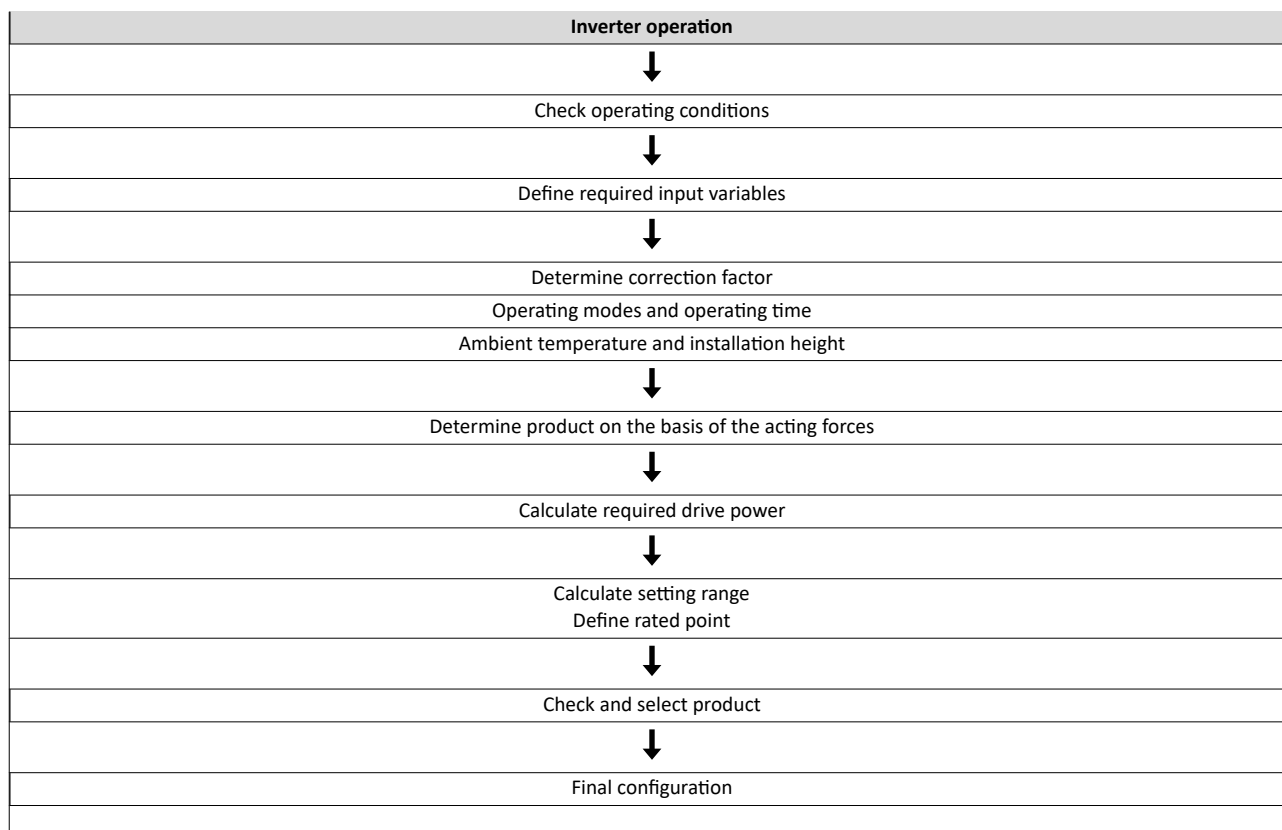
4.2 Drive dimensioning

In order to carry out an accurate drive dimensioning process, you can use our configuring software, the »EASY System Designer«.

With the »EASY System Designer«, you can design the drive both quickly and to a high quality. The software contains profound and proven expertise with regard to drive applications and mechatronic drive components.

Please get in touch with your Lenze representative.

Workflow



Check operating conditions

Check
Approvals Conformities Supply voltage Degree of protection Ambient temperature Surface protection

► [Standards and operating conditions](#) 33

► [Surface and corrosion protection](#) 25



Define required input variables

Necessary input variables	Note	Symbol	Unit
Ambient temperature		T_v	°C
Site altitude Amsl		H	m
Radial force		F_{rad}	rated
axial force		F_{ax}	rated
Transmission element at the output	Gear wheels, sprockets ...		
Effective diameter of the transmission element		d_w	mm
Load torque		$M_{L,max}$	Nm
Load speed		$n_{L,max}$	rpm
	With inverter operation	$n_{L,min}$	rpm

Determine correction factor

Operating modes S1, S2, S3, S6, and operating time							
Operating mode S1		Operating mode S2		Operating mode S3		Operating mode S6	
ED	k_L	ED	k_L	ED	k_L	ED	k_L
%		min		%		%	
100	1.0	10	1.4 - 1.5	15	1.4 - 1.5	15	1.5 - 1.6
		30	1.15 - 1.2	25	1.3 - 1.4	25	1.4 - 1.5
		60	1.07 - 1.1	40	1.15 - 1.2	40	1.3 - 1.4
		90	1.0 - 1.05	60	1.05 - 1.1	60	1.15 - 1.2

► Operating modes of the motor [99](#)

Installation altitude amsl	
≤ 1000 m	≤ 2000 m
Correction factor	
k_H	k_H
1	0.95

Ambient temperature		
≤ 40 °C	≤ 45 °C	≤ 50 °C
Correction factor		
k_{TU}	k_{TU}	k_{TU}
1	0.95	0.90

Determine product on the basis of the forces

Transmission element			Gear wheels	Sprockets	Toothed belt pulleys (depending on the preloading)	Narrow V-belt (depending on the preloading)
Additional radial force factor	f_z		≥ 17 teeth = 1.0	≥ 20 teeth = 1.0	With belt tightener= 2.0 - 2.5	1.5 - 2.0
			< 17 teeth = 1.15	< 20 teeth = 1.25	Without belt tightener= 2.5 - 3.0	
				< 13 teeth = 1.4		
			Calculation			Check
Radial force	F_{rad}	N	$F_{rad} = 2000 \times \frac{M_{L,max} \times f_z}{dw}$			$F_{rad} \leq F_{rad,max}$
Axial force	F_{ax}	N				$F_{ax} \leq F_{ax,max}$

d_w Effective diameter of transmission element

► Radial forces and axial forces [35](#)



Calculate required drive power

	Calculation	Symbol	Unit
Drive power	$P_1 = \frac{M_{L,max} \times n_{L,max}}{9549 \times k_L \times k_H \times k_{TU}}$	P_1 Input fields	kW

► [Rated data](#) 37

Calculate setting range (inverter operation) and determine rated point

	Calculation
Setting range	$V = \frac{n_{L,max}}{n_{L,min}}$

Cooling	Setting range	Rated point
Integral fan	≤ 8 (15 - 124 Hz)	124 Hz
Integral fan (reduced torque)	≤ 124 (1 - 124 Hz)	124 Hz

Operation on the inverter 20

Inverter operation: Check and select product

Rated data	Check	Unit	Note
Rated frequency	62/124	Hz	Depending on the motor version
Rated power	$P_{rated} \geq P_1$	kW	
Rated torque	$M_{rated} \geq M_{L,max}$	Nm	
Rated speed	$n_{rated} \geq n_{L,max}$	rpm	

► [Rated data](#) 37



4.3 Final configuration

	Check
Connection dimensions	Output shaft Output flange
Product extensions	Motor connection (connector/terminal box) Brake Temperature monitoring

Further information on final project planning:

► [The modular system](#) 12

► [Product extensions](#) 69

4.3.1 Surface and corrosion protection

Depending on the ambient conditions, the surface and corrosion protection system (called OKS) offers tailor-made solutions for optimum protection.

Various surface coatings ensure reliable functioning even at high air humidity, in outdoor installations, or in the presence of atmospheric contamination. Any color from the "RAL Classic" collection can be chosen for the top coat.

For indoor installation in buildings and if no special corrosion protection is required, the products are also available unpainted (without surface and corrosion protection system).

Surface and corrosion protection	Applications	Type
without OKS (unpainted)	- Indoor installation, no special corrosion protection necessary - Painting by customer	Standard
OKS-G (primed)	Dependent on subsequent top coat applied	Optional
OKS-S (small)	- Standard applications - Indoor installation in heated buildings - Air humidity up to 90%	
OKS-M (medium)	- Indoor installation in unheated buildings - Covered, protected outdoor installation - Air humidity up to 95%	
OKS-L (large)	- Outdoor installation - Air humidity above 95% - Chemical industrial plants - Food industry	

Surface and corrosion protection	Corrosivity category	Surface coating	Color	Coating thickness
	DIN EN ISO 12944-2	Design		
Without OKS (unpainted)	-	Dip priming of the gray cast iron parts	-	30 ... 50 µm
OKS-G (primed)	-	- Dip priming of the gray cast iron parts 2K PUR priming coat	-	80 ... 120 µm
OKS-S (small)	Comparable to C1	- Dip priming of the gray cast iron parts 2K-PUR top coat	- Standard: RAL 7012 - Optional: According to RAL Classic possible	80 ... 120 µm
OKS-M (medium)	Comparable to C2	Dip priming of the gray cast iron parts		110 ... 160 µm
OKS-L (large)	Comparable to C3	2K PUR priming coat 2K-PUR top coat		140 ... 200 µm



4.3.2 Temperature ranges

Temperature packages

The following temperature packages are available to suit your ambient conditions:

- Standard

On request:

- Deep-freeze
- Wide range



Observe the instructions given for the temperature packages!

For ambient temperatures $< 0\text{ °C}$ or $> +40\text{ °C}$ please contact your responsible Lenze sales company.

Temperature packages	
Standard	
Ambient temperature	$0\text{ °C} \dots +40\text{ °C}$
Deep-freeze	
Ambient temperature	$0\text{ °C} \dots +10\text{ °C}$
Wide range	
Ambient temperature	$0\text{ °C} \dots +40\text{ °C}$



5 Mechanical installation

5.1 Important notes

- Install the product according to the information in the chapter "Standards and operating conditions".
 - ▶ [Standards and operating conditions](#)  33
- The technical data and the data regarding the supply conditions can be found on the nameplate and in this documentation.
- Ambient media – especially chemically aggressive ones – may damage shaft sealing rings, lacquers and plastics.
- Lenze offers special surface and corrosion protection in this case.

NOTICE

Bearing damage caused by unbalance!

Shafts with keyway are balanced with a half featherkey!

▶ Balance transmission elements with a half featherkey!



5.2 Transport

Preconditions

- Ensure appropriate handling.
- Make sure that all component parts are securely mounted. Secure or remove loose component parts.
- Only use safely fixed transport aids (e.g., eye bolts or support plates).
- Do not damage any components during transport.
- Avoid electrostatic discharges on electronic components and contacts.
- Avoid impacts.
- Check the carrying capacity of the hoists and load handling devices. The weights can be found in the shipping documents.
- Secure the load against tipping and falling down.
- Standing beneath suspended loads is prohibited.



5.3 Installation

Mounting surfaces

- The mounting surfaces must be plane, torsionally rigid and free from vibrations.
- The mounting areas must be suited to absorb the forces and torques generated during operation.
- Ensure an unhindered ventilation.
- For versions with a fan, keep a minimum distance of 10 % from the outside diameter of the fan cover in intake direction.



6 Electrical installation

6.1 Important notes

DANGER!

Risk of injury and risk of burns from dangerous voltage

Power terminals may also carry voltage in the switched-off state or when the motor is stopped and may cause life-threatening cardiac arrhythmia and serious burns.

- ▶ Disconnect the product from the mains.
- ▶ Check that the power terminals are deenergized before starting work.

-
- When working on energized products, comply with the applicable national accident prevention regulations.
 - The electrical installation must be carried out according to the appropriate regulations (e.g. cable cross-sections, fuses, PE connection).
 - The manufacturer of the system or machine is responsible for adherence to the limits required in connection with EMC legislation.

Connection for high leakage current

If the leakage current is greater than 3.5 mA for alternating current or greater than 10 mA for direct current, the standard EN 61800-5-1 requires that at least one or more of the following measures be met:

- The minimum PE conductor cross-section is 10 mm² with Cu or 16 mm² with Al.
- Attachment of an additional protective grounding conductor with the same cross-section as the original protective grounding conductor.
 - Do not place the additional terminal on the same terminal.
- Provide automatic disconnection of the mains in case of interruption of the protective conductor.

▶ [Connection options](#)  69

Operation on an external inverter

A max. pulse voltage amplitude of $U_{pk} = 1560$ V at the motor terminals must not be exceeded. Here, the minimum pulse rise time must be $t_r = 0.1$ μs.

If it cannot be ruled out that the permissible voltage peaks will be exceeded or that the minimum pulse rise time will not be reached, the following measures must be initiated:

- Reduction of the DC-bus voltage (threshold for brake chopper voltage)
- Use of filters, chokes
- Use of special motor cables



6.2 Preparation



The notes for the electrical connection can be found in
in the terminal box (if motors with a terminal box are used).
the connection plan (if motors with connectors are used).

EMC-compliant wiring



The EMC-compliant wiring is described in detail in the documentation of the Lenze
inverters.



7 Technical data

7.1 Notes regarding the given data

Catalog data

The power values, torques and speeds specified in the catalog are rounded values and apply to

- Operating time per day = 8 hrs (100 % ED)
- Ambient temperature = 0 °C ... +40 °C
- Installation altitude ≤ 2000 m amsl
- The specified rated data apply to operating mode S1 (acc. to EN 60034-1).

NOTICE

In case of other operating conditions, the achievable values can differ for those mentioned.

► In case of extreme operating conditions, please get in touch with your Lenze representative.



7.2 Standards and operating conditions

7.2.1 Conformities and approvals

Europe					
Country	Conformity/ approval	Law/standard	Description	Special feature	Product representation
European Union	CE	2006/42/EC	Machinery Directive	Only for safety- relevant components	CE mark
		2011/65/EU	RoHS	-	
		2014/30/EU	EMC Directive		
		2014/35/EU	Low-Voltage Directive		
Great Britain	UKCA	S.I. 2008/1597	The Supply of Machinery (Safety) Regulations 2008	Only for safety- relevant components	UKCA mark
		S.I. 2012/3032	The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012	-	
		S.I. 2016/1091	The Electromagnetic Compatibility Regulations 2016		
		S.I. 2016/1101	The Electrical Equipment (Safety) Regulations 2016		

America					
Country	Conformity/ approval	Law/standard	Description	Special feature	Product representation
Canada	CSA	CSA 22.1 No. 100	CSA Standard for Motors and Generators	-	cURus mark
USA	UL	UL 1004-1	UL Standard for Rotating Electrical Machines		

Asia					
Country	Conformity/ approval	Law/standard	Description	Special feature	Product representation
China	-	GB 30253	Minimum allowable values of energy efficiency and energy efficiency grades for permanent magnet synchronous motors	-	CEL mark
		GB/T 26572	Requirements on concentration limits for certain restricted substances in electrical and electronic products		EFUP mark

7.2.2 Protection of persons and device protection

Degree of protection			
EN	EN IEC 60529, EN IEC 60034-5	IP54 IP55	Information applies to the mounted and ready-for-use state
Permissible voltage			
-	IEC 60034-18-41	IVIC C	At 500 V
Temperature class			
-	EN IEC 60034-1	F (155 °C)	Insulation system
Utilization		B (130 °C)	Utilization

7.2.3 EMC data

Interference immunity		
-	EN IEC 60034-1	A final overall assessment of the drive system is indispensable
Noise emission		
-	EN IEC 60034-1	A final overall assessment of the drive system is indispensable

Technical data

Standards and operating conditions
Environmental conditions



7.2.4 Environmental conditions

Climate			
Storage	EN 60721-3-1:1997	1K3 (-25 ... +60 °C)	
Transport	EN 60721-3-2:1997	2K3 (-25 ... +70 °C)	
Operation	EN 60721-3-3:1995 + A2:1997	3K3 (0 ... +40 °C)	
	-	-30 ... +10 °C	On request!
		-30 ... +40 °C	
Air humidity			
-	-	Average relative humidity 85 %	Without condensation
Energy efficiency			
Efficiency level	EN IEC 60034-30-2	Energy efficiency class IE5	
Installation altitude			
0 ... 2000 m amsl	-	Without current derating	
Vibration resistance			
Operation	EN 60721-3-3:1995 + A2:1997	3M5	



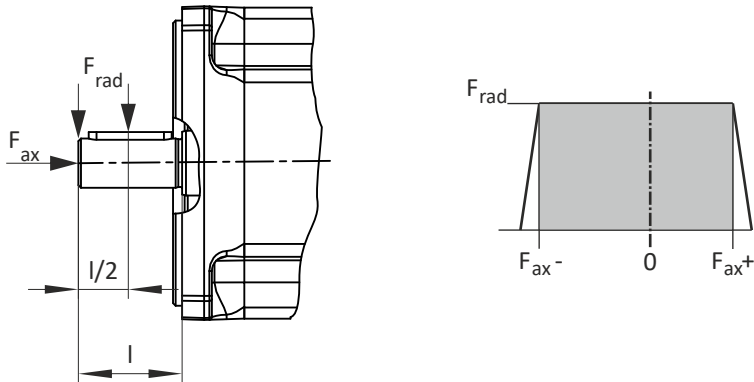
7.3 Radial forces and axial forces



The values for the bearing service life L_{10h} refer to an average speed of 2000 rpm for the motor. Depending on the ambient temperatures, they are additionally limited by the grease lifetime.

Data for axial forces refer to the maximum radial force with the corresponding bearing service life.

Application of forces



Application of force at $l/2$

Motor			m650-U					
Size			063	071	080	090	100	112
Bearing service life 10000 h								
Radial force	F _{rad}	rated	400	700	880	1150	1500	2100
Min. axial force	F _{ax,-}	rated	-200	-400	-510	-620	-700	-850
Max. axial force	F _{Fax,+}	rated	400	600	680	1070	1200	1350
Bearing service life 20000 h								
Radial force	F _{rad}	rated	280	590	770	850	1170	1700
Min. axial force	F _{ax,-}	rated	-140	-270	-320	-470	-500	-550
Max. axial force	F _{Fax,+}	rated	340	470	490	930	1000	1050
Bearing service life 30000 h								
Radial force	F _{rad}	rated	230	500	640	730	1050	1430
Min. axial force	F _{ax,-}	rated	-110	-230	-260	-370	-390	-400
Max. axial force	F _{Fax,+}	rated	310	430	430	830	890	900

Motor			m650-U					
Size			132					
Bearing service life 10000 h								
Radial force	F _{rad}	rated	2600					
Min. axial force	F _{ax,-}	rated	-930					
Max. axial force	F _{Fax,+}	rated	1550					
Bearing service life 20000 h								
Radial force	F _{rad}	rated	2000					
Min. axial force	F _{ax,-}	rated	-660					
Max. axial force	F _{Fax,+}	rated	1290					
Bearing service life 30000 h								
Radial force	F _{rad}	rated	1700					
Min. axial force	F _{ax,-}	rated	-530					
Max. axial force	F _{Fax,+}	rated	1160					



Application of force at I

Motor			m650-U					
Size			063	071	080	090	100	112
Bearing service life 10000 h								
Radial force	F _{rad}	rated	370	650	800	1050	1350	1900
Min. axial force	F _{ax,-}	rated	-200	-400	-510	-620	-700	-850
Max. axial force	F _{Fax,+}	rated	400	600	680	1070	1200	1350
Bearing service life 20000 h								
Radial force	F _{rad}	rated	260	550	700	770	1050	1500
Min. axial force	F _{ax,-}	rated	-140	-270	-320	-470	-500	-550
Max. axial force	F _{Fax,+}	rated	340	470	490	930	1000	1050
Bearing service life 30000 h								
Radial force	F _{rad}	rated	210	460	580	670	950	1300
Min. axial force	F _{ax,-}	rated	-110	-230	-260	-370	-390	-400
Max. axial force	F _{Fax,+}	rated	310	430	430	830	890	900

Motor			m650-U					
Size			132					
Bearing service life 10000 h								
Radial force	F _{rad}	rated	2350					
Min. axial force	F _{ax,-}	rated	-930					
Max. axial force	F _{Fax,+}	rated	1560					
Bearing service life 20000 h								
Radial force	F _{rad}	rated	1800					
Min. axial force	F _{ax,-}	rated	-660					
Max. axial force	F _{Fax,+}	rated	1290					
Bearing service life 30000 h								
Radial force	F _{rad}	rated	1500					
Min. axial force	F _{ax,-}	rated	-530					
Max. axial force	F _{Fax,+}	rated	1160					



7.4 Rated data

Motor			m650-U				
			63/L4	71/M4	71/L4	80/M4	90/M4
Rated power	P_{rated}	kW	0.75	1.1	1.5	2.2	3
Rated speed	n_{rated}	rpm	3720	3720	3720	3720	3720
Max. speed	n_{max}	rpm	4500	4500	4500	4500	4500
Rated voltage	V_{rated}	V	292	310	316	305	310
Rated current	I_{rated}	A	1.81	2.55	3.25	4.89	6.50
Standstill current	I_0	A	2.10	3.00	4.10	5.20	7.60
Max. current	I_{max}	A	5.00	6.70	8.85	12.5	17.7
Rated torque	M_{rated}	Nm	1.90	2.80	3.90	5.60	7.70
Standstill torque	M_0	Nm	2.10	3.40	4.80	6.00	9.15
Max. torque	M_{max}	Nm	4.75	7.1	9.6	13.2	19.4
Power factor	$\cos \phi$		0.93	0.95	0.95	0.96	0.96
Efficiency							
at 50% P_{rated}	η		0.908	0.897	0.897	0.884	0.885
at 75% P_{rated}	η		0.889	0.883	0.906	0.903	0.903
at 100% P_{rated}	η		0.846	0.862	0.874	0.889	0.899
Moment of inertia	J	kgcm ²	3.24	8.75	11.1	21.1	35.8
Weight	m	kg	5.1	7.3	8.5	10.6	13.9
Power losses							
25; 25	$P_V (n; M)$	%	1.2	1.4	0.9	1.1	1.8
25; 100	$P_V (n; M)$	%	10.3	7.6	6.0	6.6	5.5
50; 25	$P_V (n; M)$	%	1.6	2.0	1.6	2.6	2.5
50; 50	$P_V (n; M)$	%	3.5	3.4	2.8	3.7	3.4
50; 100	$P_V (n; M)$	%	10.9	8.6	7.0	7.9	6.9
90; 50	$P_V (n; M)$	%	5.1	5.7	5.7	6.6	6.5
90; 100	$P_V (n; M)$	%	12.7	11.3	9.5	11.0	10.2
100; 100	$P_V (n; M)$	%	13.5	14.6	11.3	11.8	11.5
Power losses							
25; 25	$P_V (n; M)$	W	9	15	14	25	54
25; 100	$P_V (n; M)$	W	77	84	90	57	164
50; 25	$P_V (n; M)$	W	12	22	24	57	75
50; 50	$P_V (n; M)$	W	26	37	42	81	103
50; 100	$P_V (n; M)$	W	82	95	105	174	207
90; 50	$P_V (n; M)$	W	38	63	86	145	194
90; 100	$P_V (n; M)$	W	95	124	142	241	307
100; 100	$P_V (n; M)$	W	101	161	169	259	345



Motor			m650-U				
			90/L4	100/M4	100/L4	112/M4	132/S4
Rated power	P_{rated}	kW	4	5.5	7.5	11	15
Rated speed	n_{rated}	rpm	3720	3720	3720	3720	3720
Max. speed	n_{max}	rpm	4500	4500	4500	4500	4500
Rated voltage	V_{rated}	V	325	314	325	310	316
Rated current	I_{rated}	A	8.15	11.5	14.8	23.1	29.6
Standstill current	I_0	A	8.80	13.3	16.7	22.4	31.7
Max. current	I_{max}	A	22.3	32.7	43.5	62.4	80.3
Rated torque	M_{rated}	Nm	10.3	14.1	19.3	28.2	38.5
Standstill torque	M_0	Nm	11.2	16.4	21.3	27.4	41.5
Max. torque	M_{max}	Nm	25.75	36.1	49.7	71	99.4
Power factor	$\cos \phi$		0.96	0.95	0.96	0.96	0.99
Efficiency							
at 50% P_{rated}	η		0.900	0.926	0.943	0.949	0.924
at 75% P_{rated}	η		0.910	0.930	0.947	0.920	0.952
at 100% P_{rated}	η		0.907	0.916	0.924	0.932	0.937
Moment of inertia	J	kgcm ²	45.9	75.9	97.5	151.8	320.4
Weight	m	kg	16	21.7	25.6	31.8	50.7
Power losses							
25; 25	$P_V (n; M)$	%	1.0	0.6	0.5	0.8	0.7
25; 100	$P_V (n; M)$	%	4.8	3.7	3.4	3.7	3.0
50; 25	$P_V (n; M)$	%	2.1	1.1	1.0	1.7	1.5
50; 50	$P_V (n; M)$	%	2.9	1.9	1.6	2.3	2.0
50; 100	$P_V (n; M)$	%	6.0	4.5	4.0	4.7	3.9
90; 50	$P_V (n; M)$	%	5.6	4.0	3.0	4.4	4.1
90; 100	$P_V (n; M)$	%	8.8	6.7	5.5	6.9	6.2
100; 100	$P_V (n; M)$	%	10.1	7.8	6.2	7.6	6.2
Power losses							
25; 25	$P_V (n; M)$	W	40	31	38	86	101
25; 100	$P_V (n; M)$	W	190	204	255	411	221
50; 25	$P_V (n; M)$	W	82	63	74	183	221
50; 50	$P_V (n; M)$	W	117	103	120	251	300
50; 100	$P_V (n; M)$	W	239	246	298	515	591
90; 50	$P_V (n; M)$	W	222	221	227	479	617
90; 100	$P_V (n; M)$	W	353	370	415	761	930
100; 100	$P_V (n; M)$	W	402	428	463	836	1010



Technical data

Rated data

Motor			m650-U	
			132/M4	132/L4
Rated power	P_{rated}	kW	18.5	22
Rated speed	n_{rated}	rpm	3720	3720
Max. speed	n_{max}	rpm	4500	4500
Rated voltage	V_{rated}	V	336	330
Rated current	I_{rated}	A	34.5	41.4
Standstill current	I_0	A	39.6	39.6
Max. current	I_{max}	A	109	109
Rated torque	M_{rated}	Nm	47.5	56.5
Standstill torque	M_0	Nm	54.9	54.9
Max. torque	M_{max}	Nm	141.9	141.9
Power factor	$\cos \phi$		0.99	0.99
Efficiency				
at 50% P_{rated}	η		0.945	0.957
at 75% P_{rated}	η		0.942	0.957
at 100% P_{rated}	η		0.942	0.944
Moment of inertia	J	kgcm ²	416.2	416.2
Weight	m	kg	60.8	60.8
Power losses				
25; 25	$P_V (n; M)$	%	0.4	0.4
25; 100	$P_V (n; M)$	%	2.4	3.0
50; 25	$P_V (n; M)$	%	0.8	0.7
50; 50	$P_V (n; M)$	%	1.3	1.3
50; 100	$P_V (n; M)$	%	2.9	3.4
90; 50	$P_V (n; M)$	%	2.7	2.5
90; 100	$P_V (n; M)$	%	4.5	4.7
100; 100	$P_V (n; M)$	%	6.1	4.2
Power losses				
25; 25	$P_V (n; M)$	W	81	72
25; 100	$P_V (n; M)$	W	651	453
50; 25	$P_V (n; M)$	W	163	156
50; 50	$P_V (n; M)$	W	283	243
50; 100	$P_V (n; M)$	W	751	545
90; 50	$P_V (n; M)$	W	540	500
90; 100	$P_V (n; M)$	W	1031	827
100; 100	$P_V (n; M)$	W	1124	923

Technical data

Rated data

Inverter operation 124 Hz



7.4.1 Inverter operation 124 Hz

Motor			m650-U				
			63/L4	71/M4	71/L4	80/M4	90/M4
Rated power	P_{rated}	kW	0.75	1.1	1.5	2.2	3
Rated speed	n_{rated}	rpm	3720	3720	3720	3720	3720
Max. speed	n_{max}	rpm	4500	4500	4500	4500	4500
Rated voltage	V_{rated}	V	292	310	316	305	310
Rated current	I_{rated}	A	1.81	2.55	3.25	4.89	6.50
Standstill current	I_0	A	2.10	3.00	4.10	5.20	7.60
Max. current	I_{max}	A	5.00	6.70	8.85	12.5	17.7
Rated torque	M_{rated}	Nm	1.90	2.80	3.90	5.60	7.70
Standstill torque	M_0	Nm	2.10	3.40	4.80	6.00	9.15
Max. torque	M_{max}	Nm	4.75	7.1	9.6	13.2	19.4
Power factor	$\cos \phi$		0.93	0.95	0.95	0.96	0.96
Efficiency							
at 50% P_{rated}	η		0.908	0.897	0.897	0.884	0.885
at 75% P_{rated}	η		0.889	0.883	0.906	0.903	0.903
at 100% P_{rated}	η		0.846	0.862	0.874	0.889	0.899
Moment of inertia	J	kgcm ²	3.24	8.75	11.1	21.1	35.8
Weight	m	kg	5.1	7.3	8.5	10.6	13.9
Power losses							
25; 25	$P_V (n; M)$	%	1.2	1.4	0.9	1.1	1.8
25; 100	$P_V (n; M)$	%	10.3	7.6	6.0	6.6	5.5
50; 25	$P_V (n; M)$	%	1.6	2.0	1.6	2.6	2.5
50; 50	$P_V (n; M)$	%	3.5	3.4	2.8	3.7	3.4
50; 100	$P_V (n; M)$	%	10.9	8.6	7.0	7.9	6.9
90; 50	$P_V (n; M)$	%	5.1	5.7	5.7	6.6	6.5
90; 100	$P_V (n; M)$	%	12.7	11.3	9.5	11.0	10.2
100; 100	$P_V (n; M)$	%	13.5	14.6	11.3	11.8	11.5
Power losses							
25; 25	$P_V (n; M)$	W	9	15	14	25	54
25; 100	$P_V (n; M)$	W	77	84	90	57	164
50; 25	$P_V (n; M)$	W	12	22	24	57	75
50; 50	$P_V (n; M)$	W	26	37	42	81	103
50; 100	$P_V (n; M)$	W	82	95	105	174	207
90; 50	$P_V (n; M)$	W	38	63	86	145	194
90; 100	$P_V (n; M)$	W	95	124	142	241	307
100; 100	$P_V (n; M)$	W	101	161	169	259	345



Technical data

Rated data
Inverter operation 124 Hz

Motor			m650-U				
			90/L4	100/M4	100/L4	112/M4	132/S4
Rated power	P_{rated}	kW	4	5.5	7.5	11	15
Rated speed	n_{rated}	rpm	3720	3720	3720	3720	3720
Max. speed	n_{max}	rpm	4500	4500	4500	4500	4500
Rated voltage	V_{rated}	V	325	314	325	310	316
Rated current	I_{rated}	A	8.15	11.5	14.8	23.1	29.6
Standstill current	I_0	A	8.80	13.3	16.7	22.4	31.7
Max. current	I_{max}	A	22.3	32.7	43.5	62.4	80.3
Rated torque	M_{rated}	Nm	10.3	14.1	19.3	28.2	38.5
Standstill torque	M_0	Nm	11.2	16.4	21.3	27.4	41.5
Max. torque	M_{max}	Nm	25.75	36.1	49.7	71	99.4
Power factor	$\cos \phi$		0.96	0.95	0.96	0.96	0.99
Efficiency							
at 50% P_{rated}	η		0.900	0.926	0.943	0.949	0.924
at 75% P_{rated}	η		0.910	0.930	0.947	0.920	0.952
at 100% P_{rated}	η		0.907	0.916	0.924	0.932	0.937
Moment of inertia	J	kgcm ²	45.9	75.9	97.5	151.8	320.4
Weight	m	kg	16	21.7	25.6	31.8	50.7
Power losses							
25; 25	$P_V (n; M)$	%	1.0	0.6	0.5	0.8	0.7
25; 100	$P_V (n; M)$	%	4.8	3.7	3.4	3.7	3.0
50; 25	$P_V (n; M)$	%	2.1	1.1	1.0	1.7	1.5
50; 50	$P_V (n; M)$	%	2.9	1.9	1.6	2.3	2.0
50; 100	$P_V (n; M)$	%	6.0	4.5	4.0	4.7	3.9
90; 50	$P_V (n; M)$	%	5.6	4.0	3.0	4.4	4.1
90; 100	$P_V (n; M)$	%	8.8	6.7	5.5	6.9	6.2
100; 100	$P_V (n; M)$	%	10.1	7.8	6.2	7.6	6.2
Power losses							
25; 25	$P_V (n; M)$	W	40	31	38	86	101
25; 100	$P_V (n; M)$	W	190	204	255	411	221
50; 25	$P_V (n; M)$	W	82	63	74	183	221
50; 50	$P_V (n; M)$	W	117	103	120	251	300
50; 100	$P_V (n; M)$	W	239	246	298	515	591
90; 50	$P_V (n; M)$	W	222	221	227	479	617
90; 100	$P_V (n; M)$	W	353	370	415	761	930
100; 100	$P_V (n; M)$	W	402	428	463	836	1010

Technical data

Rated data

Inverter operation 124 Hz



Motor			m650-U	
			132/M4	132/L4
Rated power	P_{rated}	kW	18.5	22
Rated speed	n_{rated}	rpm	3720	3720
Max. speed	n_{max}	rpm	4500	4500
Rated voltage	V_{rated}	V	336	330
Rated current	I_{rated}	A	34.5	41.4
Standstill current	I_0	A	39.6	39.6
Max. current	I_{max}	A	109	109
Rated torque	M_{rated}	Nm	47.5	56.5
Standstill torque	M_0	Nm	54.9	54.9
Max. torque	M_{max}	Nm	141.9	141.9
Power factor	$\cos \phi$		0.99	0.99
Efficiency				
at 50% P_{rated}	η		0.945	0.957
at 75% P_{rated}	η		0.942	0.957
at 100% P_{rated}	η		0.942	0.944
Moment of inertia	J	kgcm ²	416.2	416.2
Weight	m	kg	60.8	60.8
Power losses				
25; 25	$P_V(n; M)$	%	0.4	0.4
25; 100	$P_V(n; M)$	%	2.4	3.0
50; 25	$P_V(n; M)$	%	0.8	0.7
50; 50	$P_V(n; M)$	%	1.3	1.3
50; 100	$P_V(n; M)$	%	2.9	3.4
90; 50	$P_V(n; M)$	%	2.7	2.5
90; 100	$P_V(n; M)$	%	4.5	4.7
100; 100	$P_V(n; M)$	%	6.1	4.2
Power losses				
25; 25	$P_V(n; M)$	W	81	72
25; 100	$P_V(n; M)$	W	651	453
50; 25	$P_V(n; M)$	W	163	156
50; 50	$P_V(n; M)$	W	283	243
50; 100	$P_V(n; M)$	W	751	545
90; 50	$P_V(n; M)$	W	540	500
90; 100	$P_V(n; M)$	W	1031	827
100; 100	$P_V(n; M)$	W	1124	923



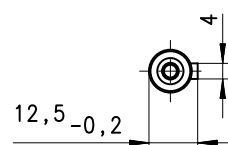
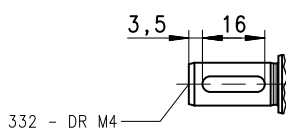
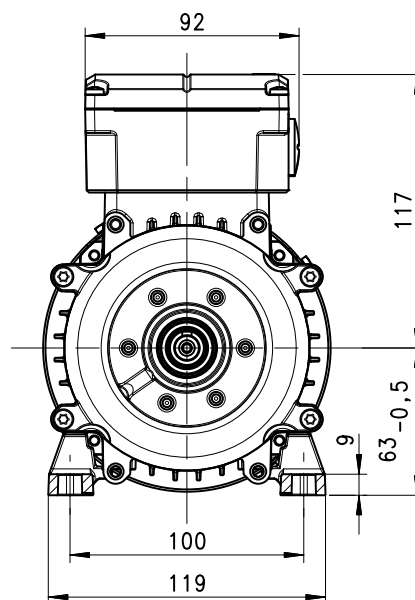
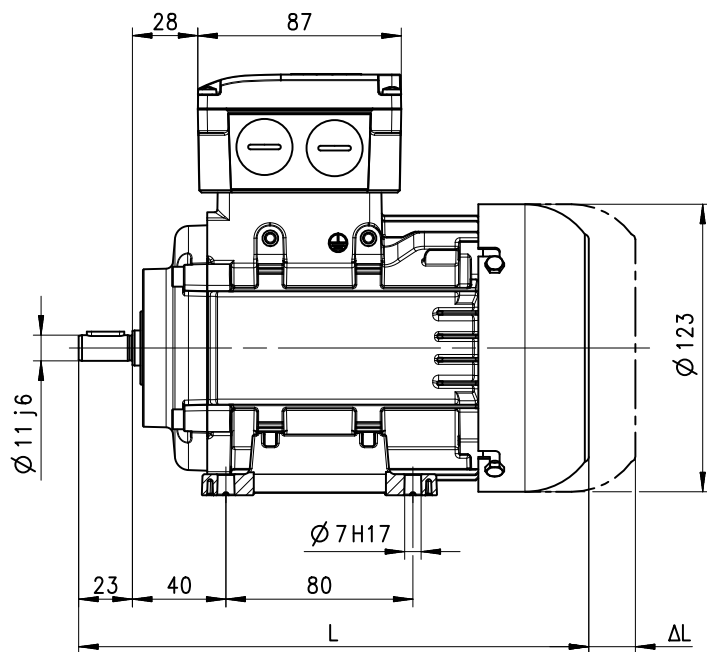
7.5 Dimensions

7.5.1 Basic dimensions

m650-U63

Self-ventilated motors

Design B3



8801818-01

Motor			m650-U63/L4
Motor length	L	mm	219

Δ L ▶ Additional lengths  67

Technical data

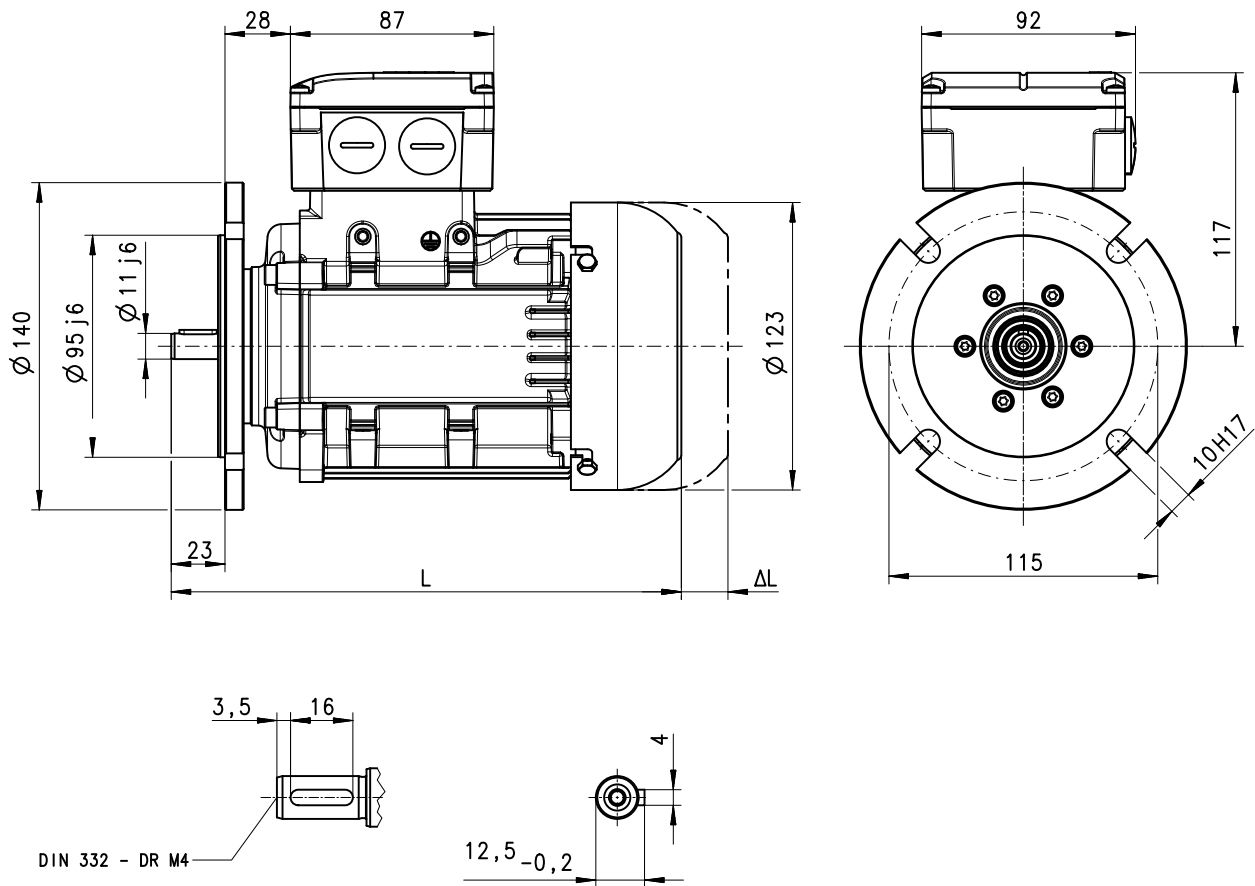
Dimensions
Basic dimensions



m650-U63

Self-ventilated motors

Design B5



8801819-01

Motor			m650-U63/L4
Motor length	L	mm	219

ΔL ▶ [Additional lengths](#) 67



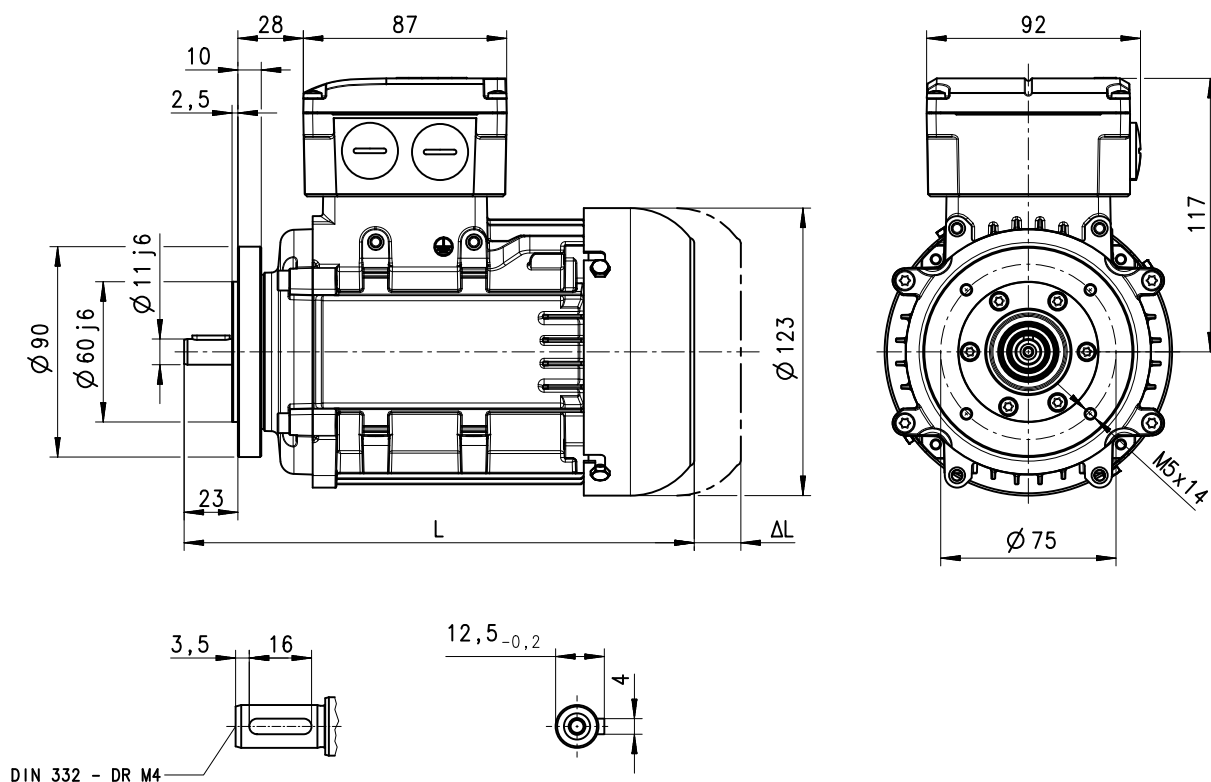
Technical data

Dimensions
Basic dimensions

m650-U63

Self-ventilated motors

Design B14



8801820-01

Motor			m650-U63/L4
Motor length	L	mm	219

ΔL ▶ [Additional lengths](#) 67

Technical data

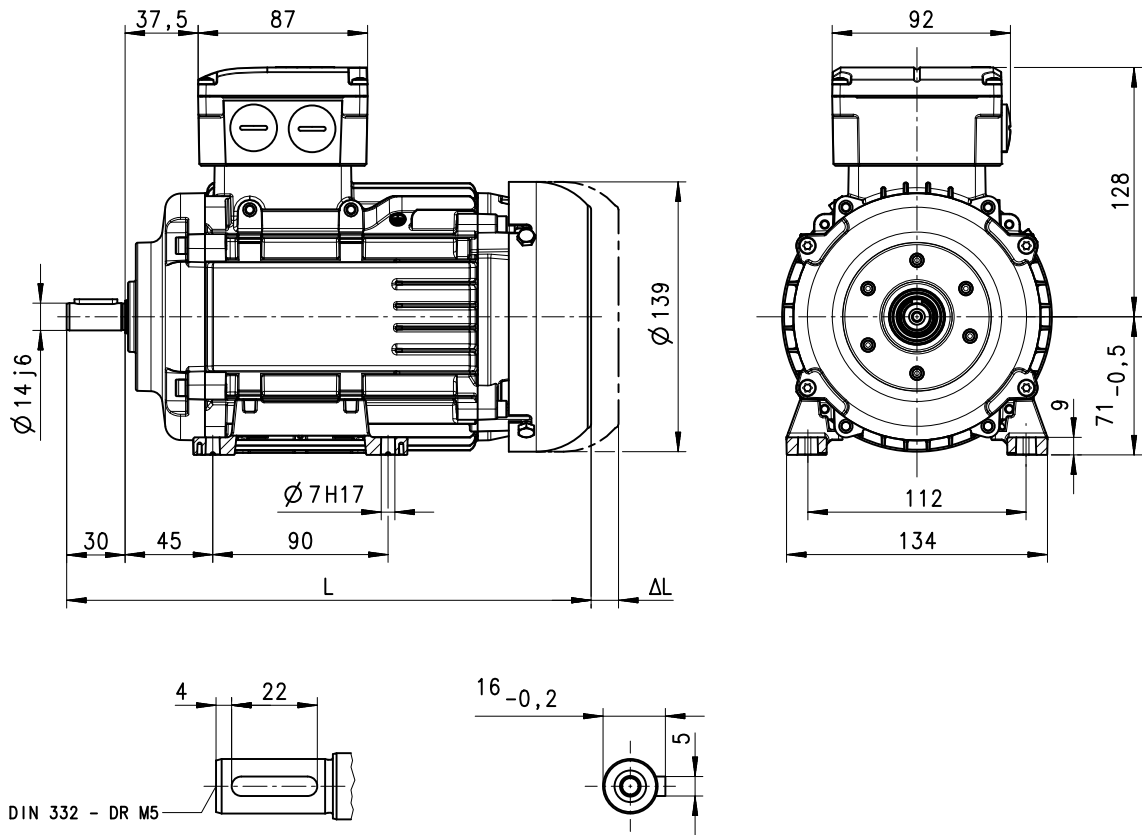
Dimensions
Basic dimensions



m650-U71

Self-ventilated motors

Design B3



8801821-01

Motor			m650-U71/M4	m650-U71/L4
Motor length	L	mm	269	

ΔL ▶ [Additional lengths](#) 67



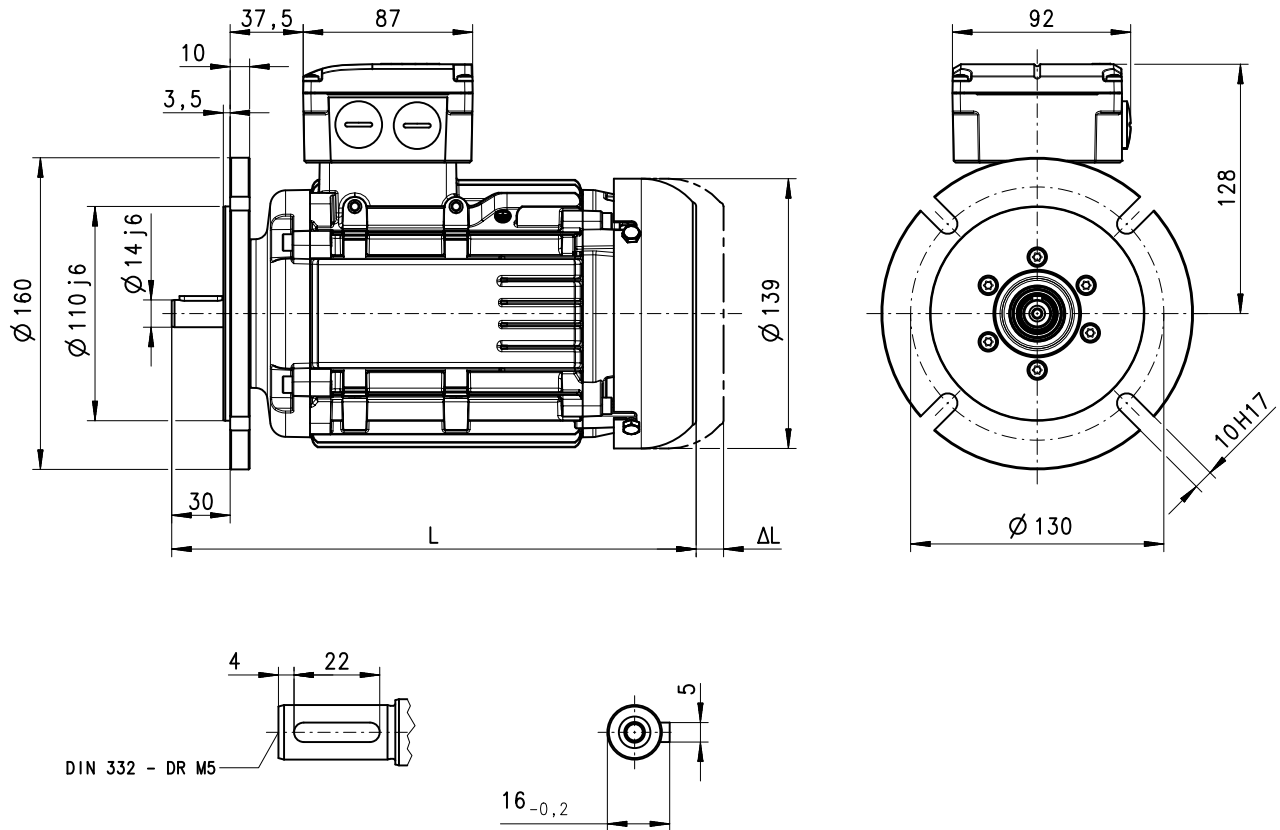
Technical data

Dimensions
Basic dimensions

m650-U71

Self-ventilated motors

Design B5



8801822-01

Motor			m650-U71/M4	m650-U71/L4
Motor length	L	mm	269	

ΔL ▶ [Additional lengths](#) [67](#)

Technical data

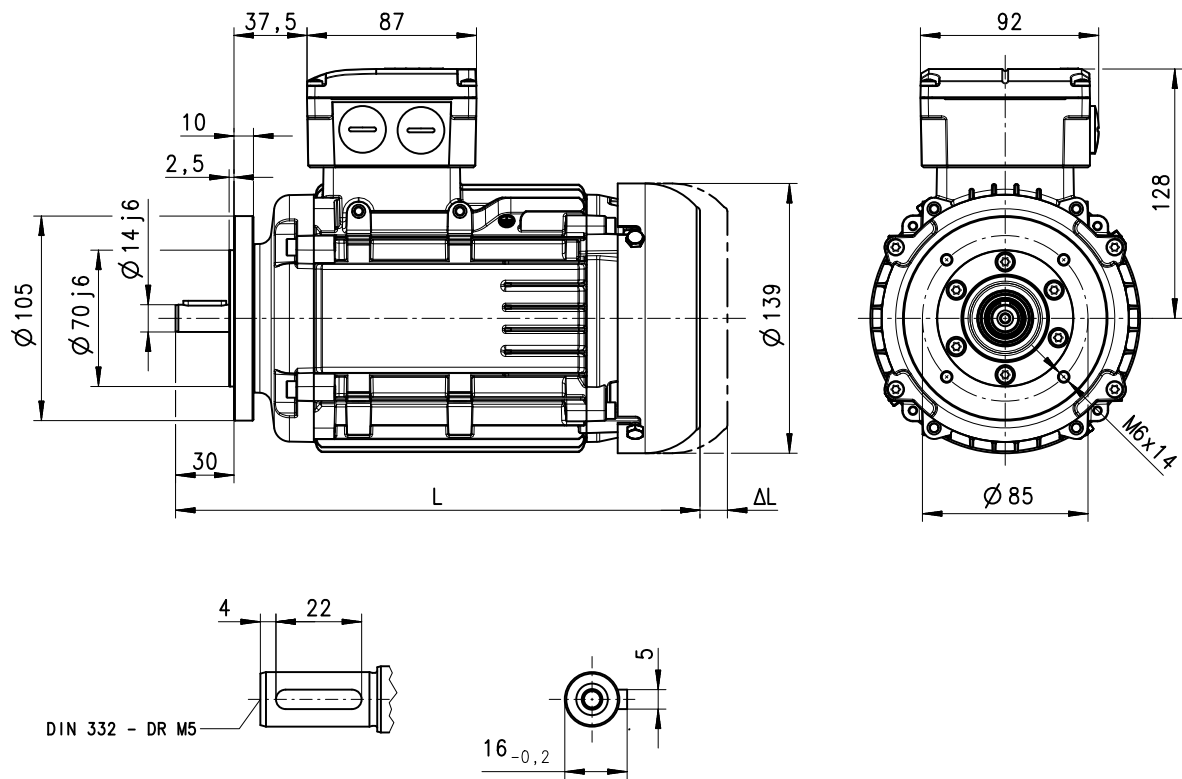
Dimensions
Basic dimensions



m650-U71

Self-ventilated motors

Design B14



8801823-00

Motor			m650-U71/M4	m650-U71/L4
Motor length	L	mm	269	

ΔL ▶ [Additional lengths](#) 67



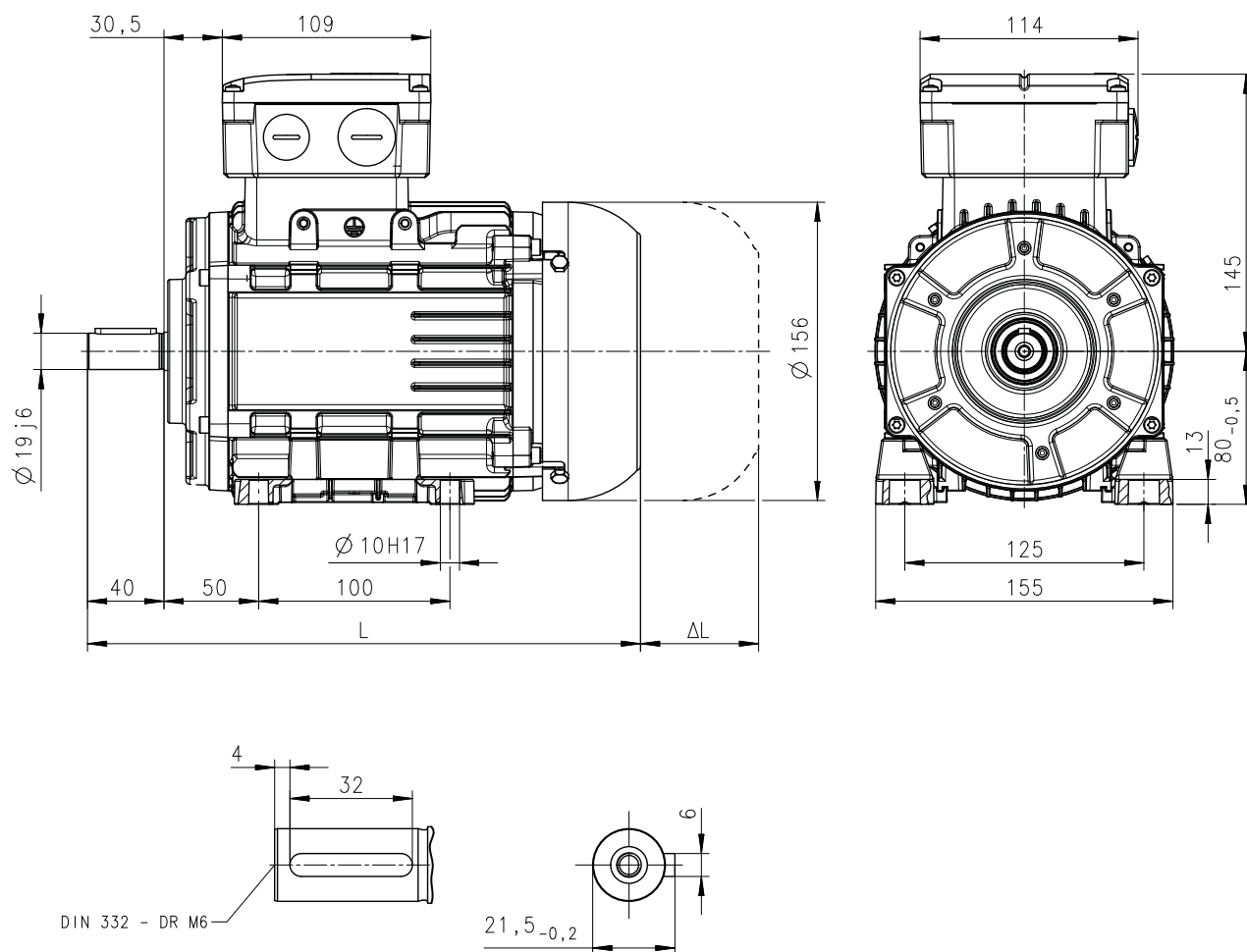
Technical data

Dimensions
Basic dimensions

m650-U80

Self-ventilated motors

Design B3



DIN 332 - DR M6

8800861-00

Motor			m650-U80/M4
Motor length	L	mm	290

ΔL ▶ [Additional lengths](#) 67

Dimensions

Basic dimensions

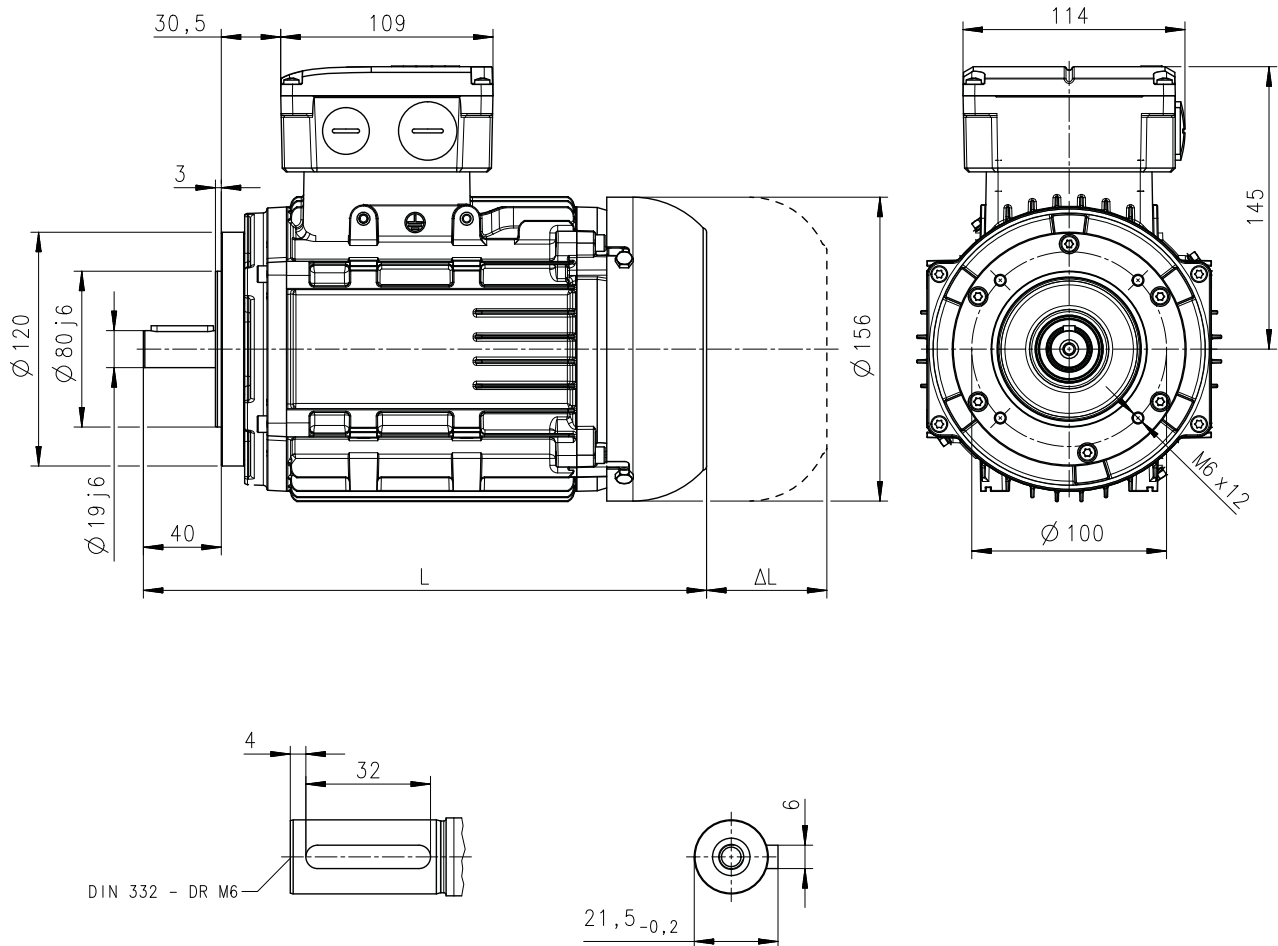




m650-U80

Self-ventilated motors

Design B14 (FT100)



8800863-00

Motor			m650-U80/M4
Motor length	L	mm	290

ΔL ▶ [Additional lengths](#) 67

Technical data

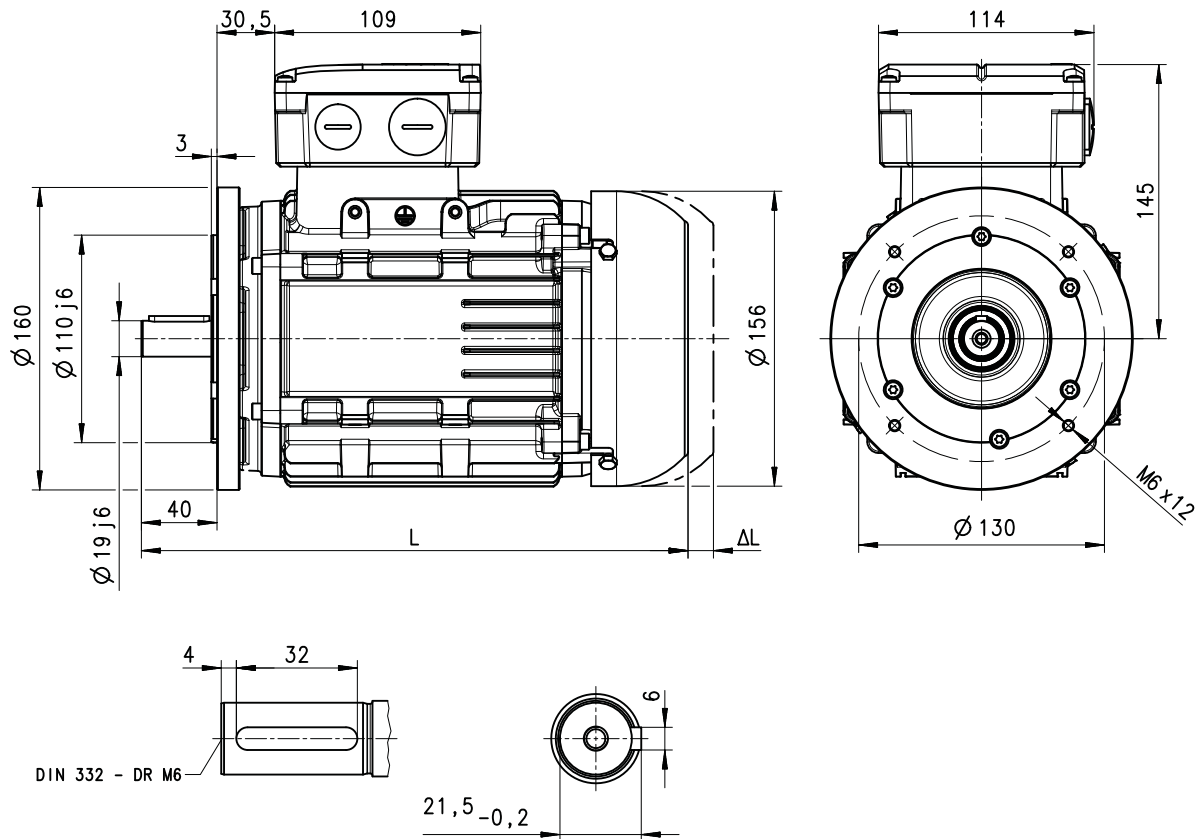
Dimensions
Basic dimensions



m650-U80

Self-ventilated motors

Design B14 (FT130)



8801579-00

Motor			m650-U80/M4
Motor length	L	mm	290

ΔL ▶ [Additional lengths](#) 67



Design B3

8800917-00

Motor			m650-U90/M4	m650-U90/L4
Motor length	L	mm	355	

Δ L ▶ Additional lengths 67

Technical data

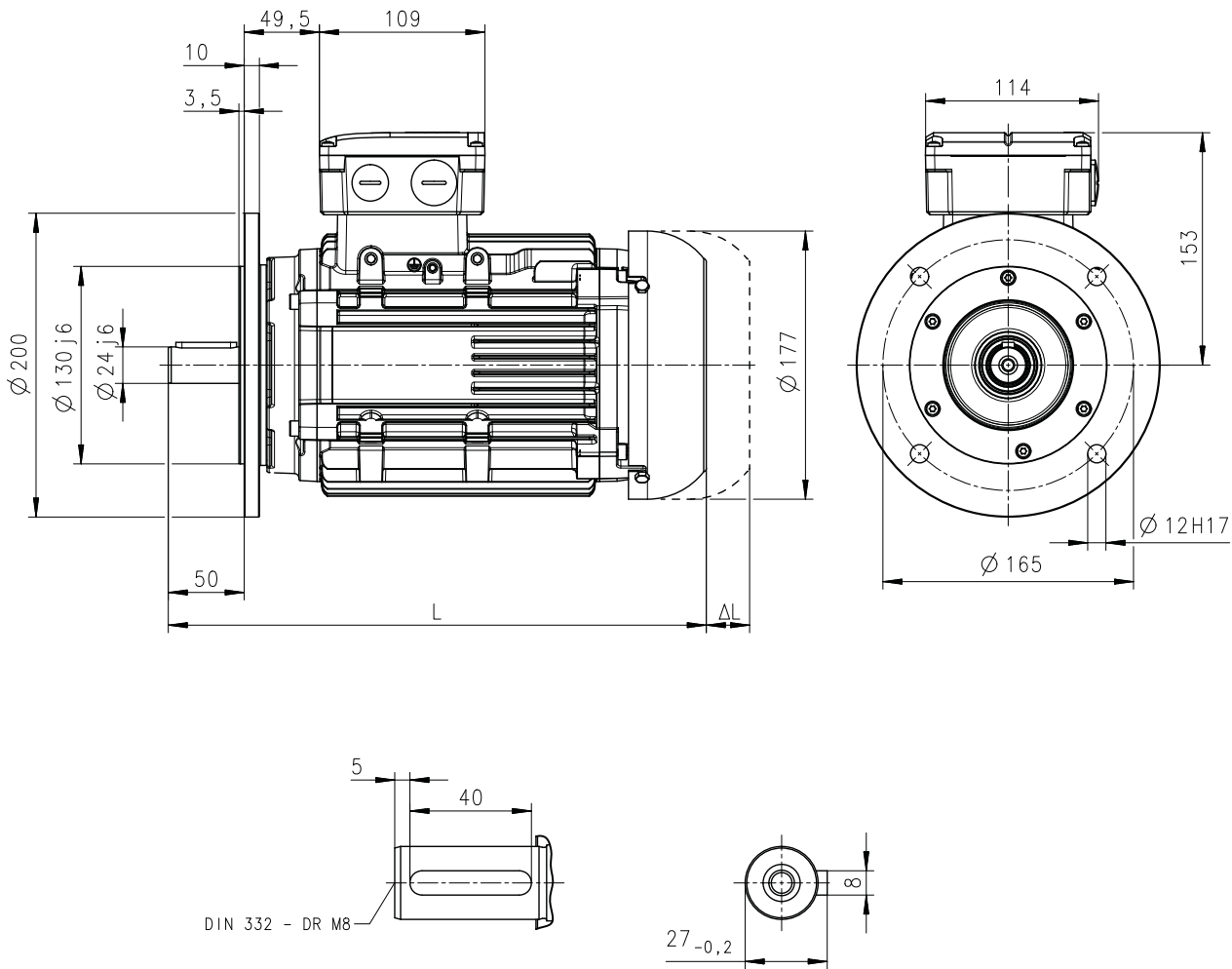
Dimensions
Basic dimensions



m650-U90

Self-ventilated motors

Design B5



8800918-00

Motor			m650-U90/M4	m650-U90/L4
Motor length	L	mm	355	

ΔL ▶ Additional lengths 67



Technical data

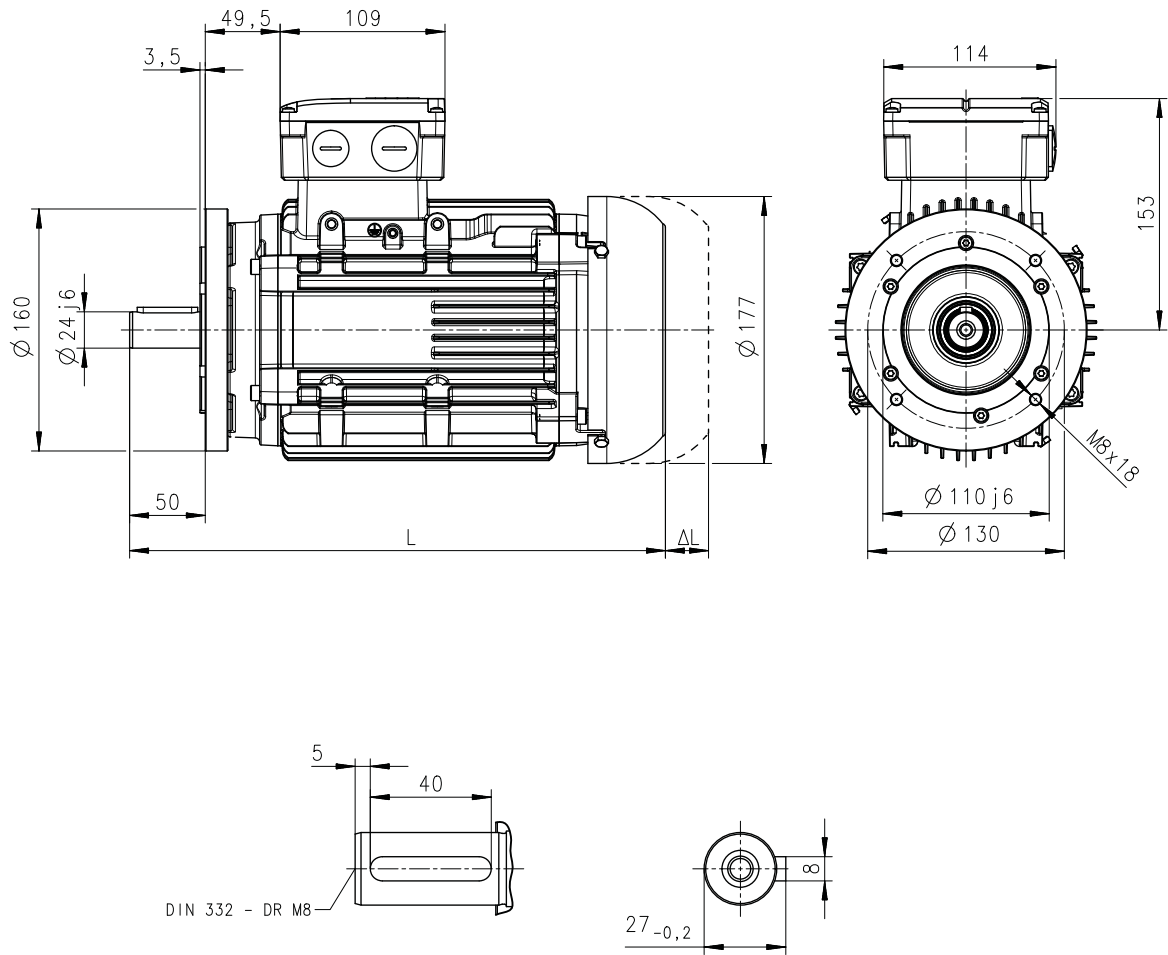
Dimensions
Basic dimensions



m650-U90

Self-ventilated motors

Design B14 (FT130)



8800920-00

Motor			m650-U90/M4	m650-U90/L4
Motor length	L	mm	355	

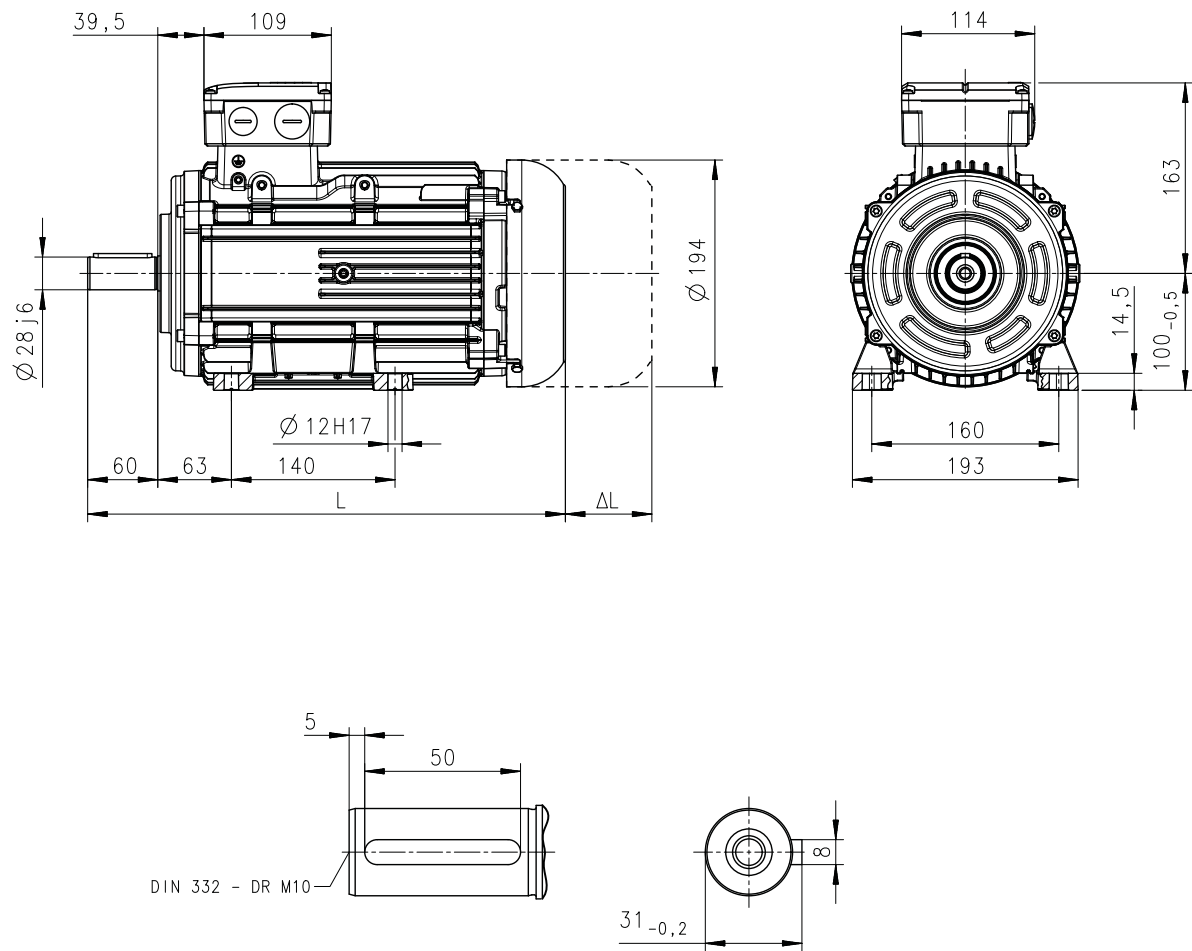
ΔL ▶ [Additional lengths](#)  67



m650-U100

Self-ventilated motors

Design B3



8800914-00

Motor			m650-U100/M4	m650-U100/L4
Motor length	L	mm	409	

ΔL ▶ Additional lengths [67](#)

Technical data

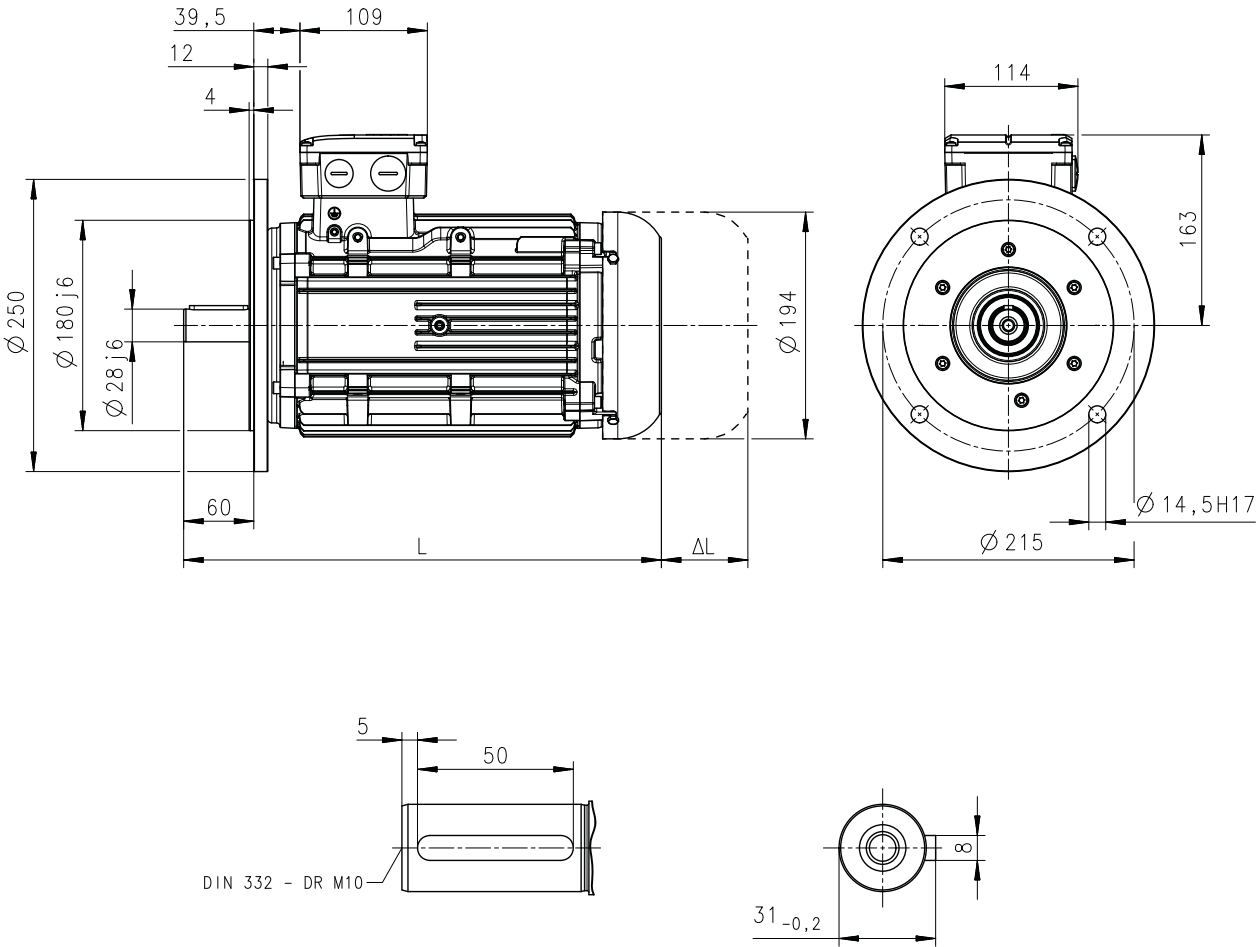
Dimensions
Basic dimensions



m650-U100

Self-ventilated motors

Design B5



8800915-00

Motor			m650-U100/M4	m650-U100/L4
Motor length	L	mm	409	

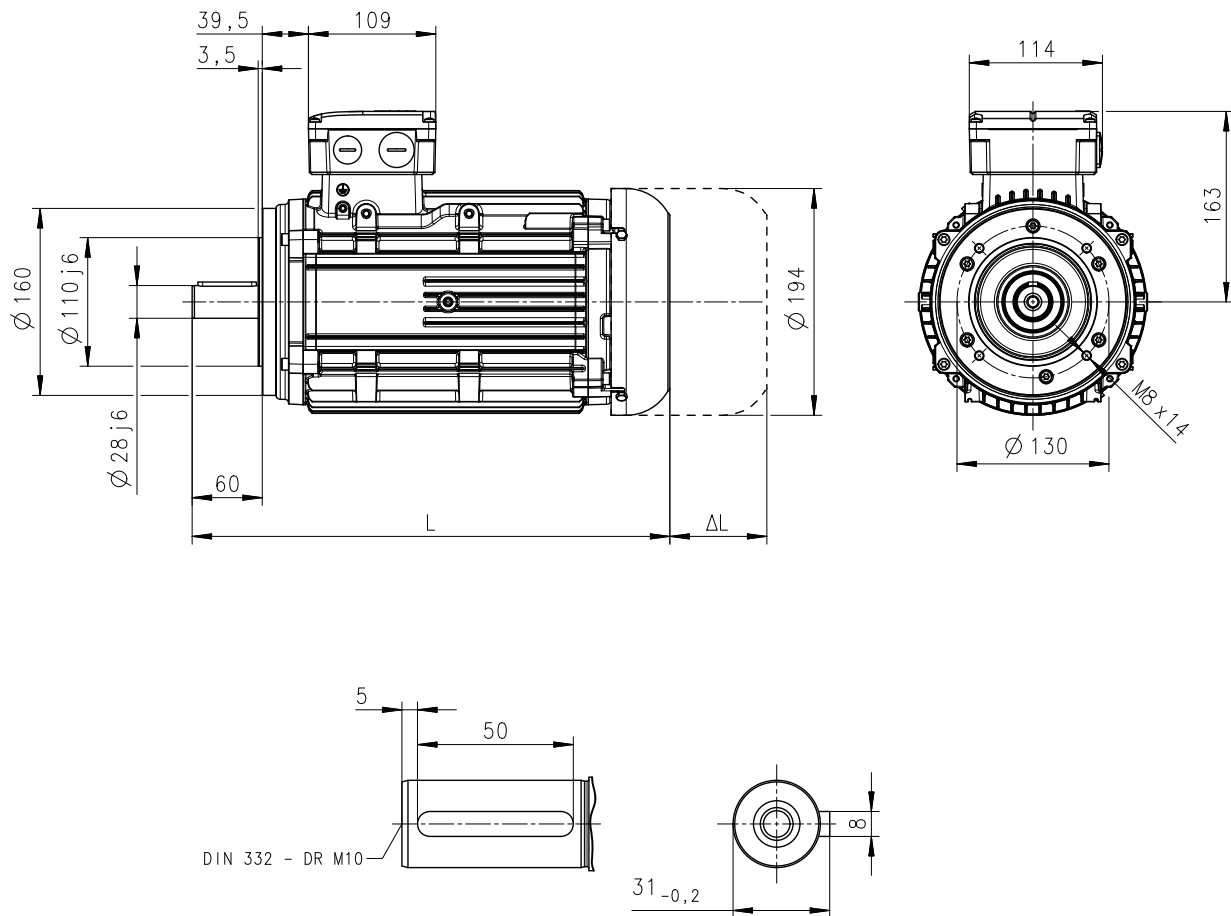
ΔL ▶ Additional lengths 67



m650-U100

Self-ventilated motors

Design B14



8800916-00

Motor			m650-U100/M4	m650-U100/L4
Motor length	L	mm	409	

ΔL ▶ Additional lengths  67

Technical data

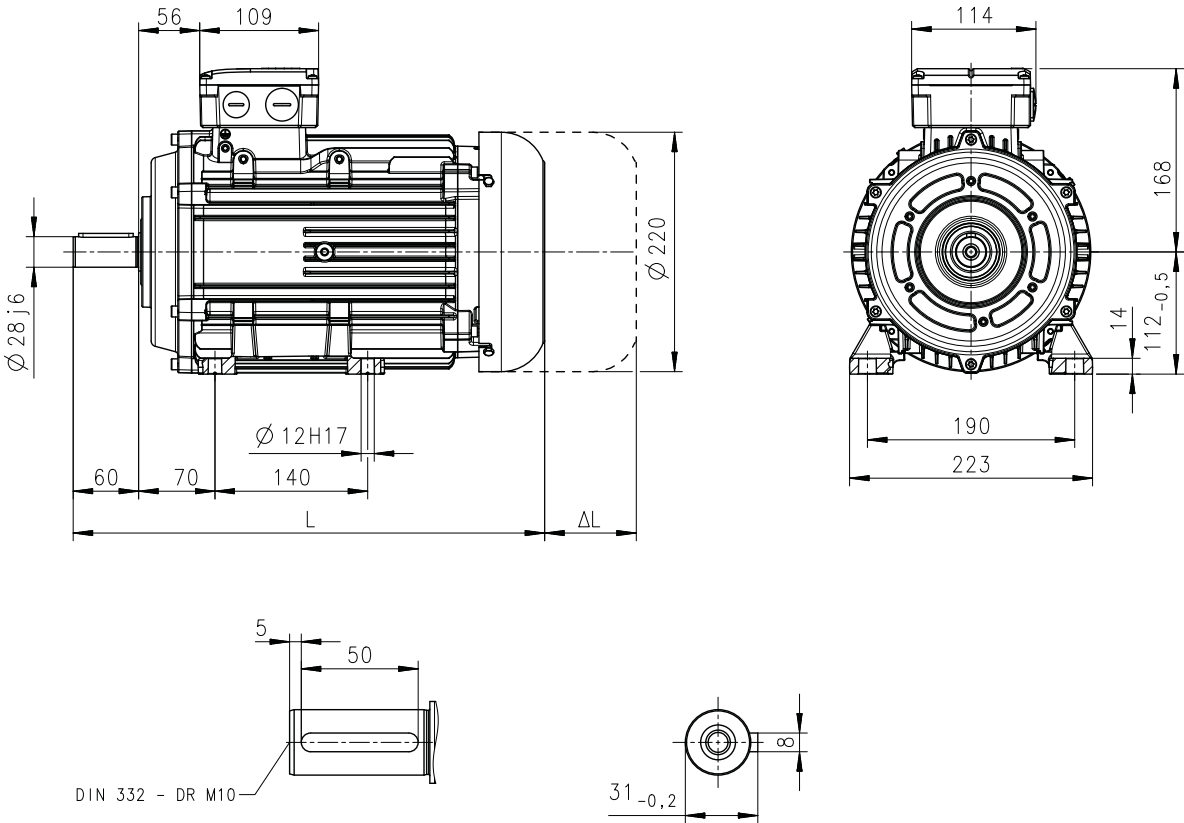
Dimensions
Basic dimensions



m650-U112

Self-ventilated motors

Design B3



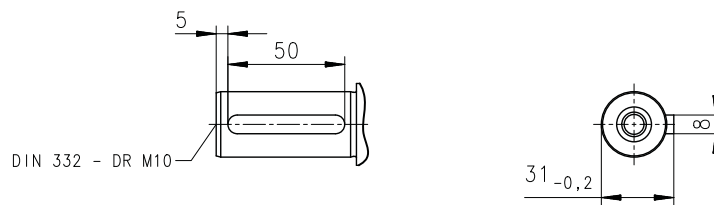
8800964-00

Motor			m650-U112/M4
Motor length	L	mm	433

ΔL ▶ [Additional lengths](#)  67



Design B5



Motor			m650-U112/M4
Motor length	L	mm	433

61

Technical data

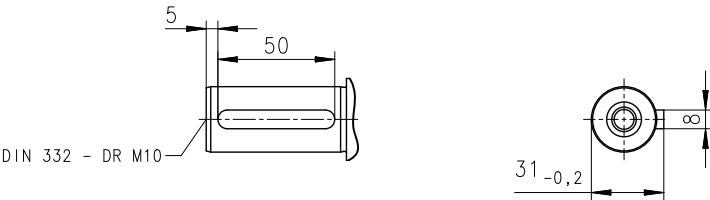
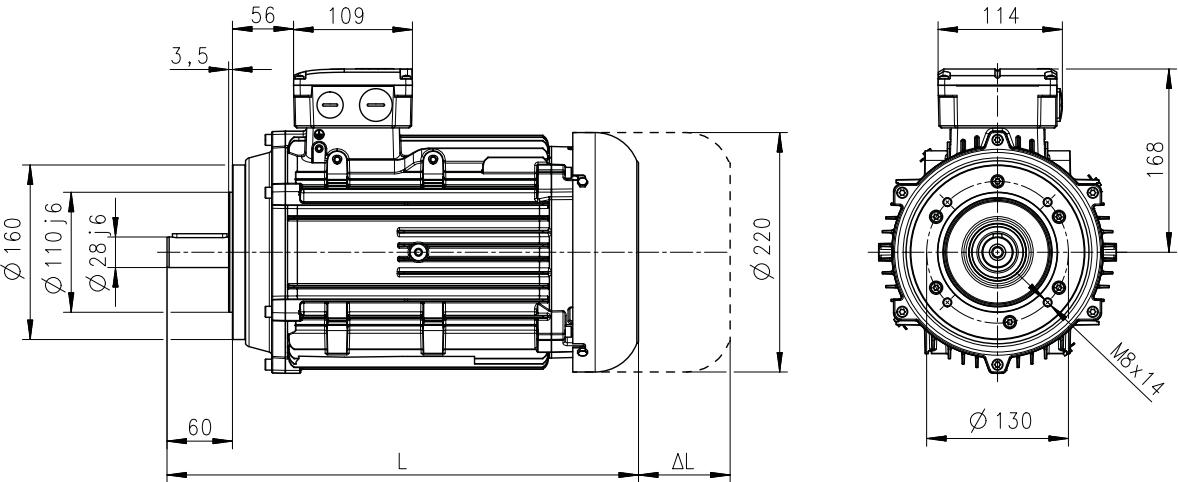
Dimensions
Basic dimensions



m650-U112

Self-ventilated motors

Design B14



8800966-00

Motor			m650-U112/M4
Motor length	L	mm	433

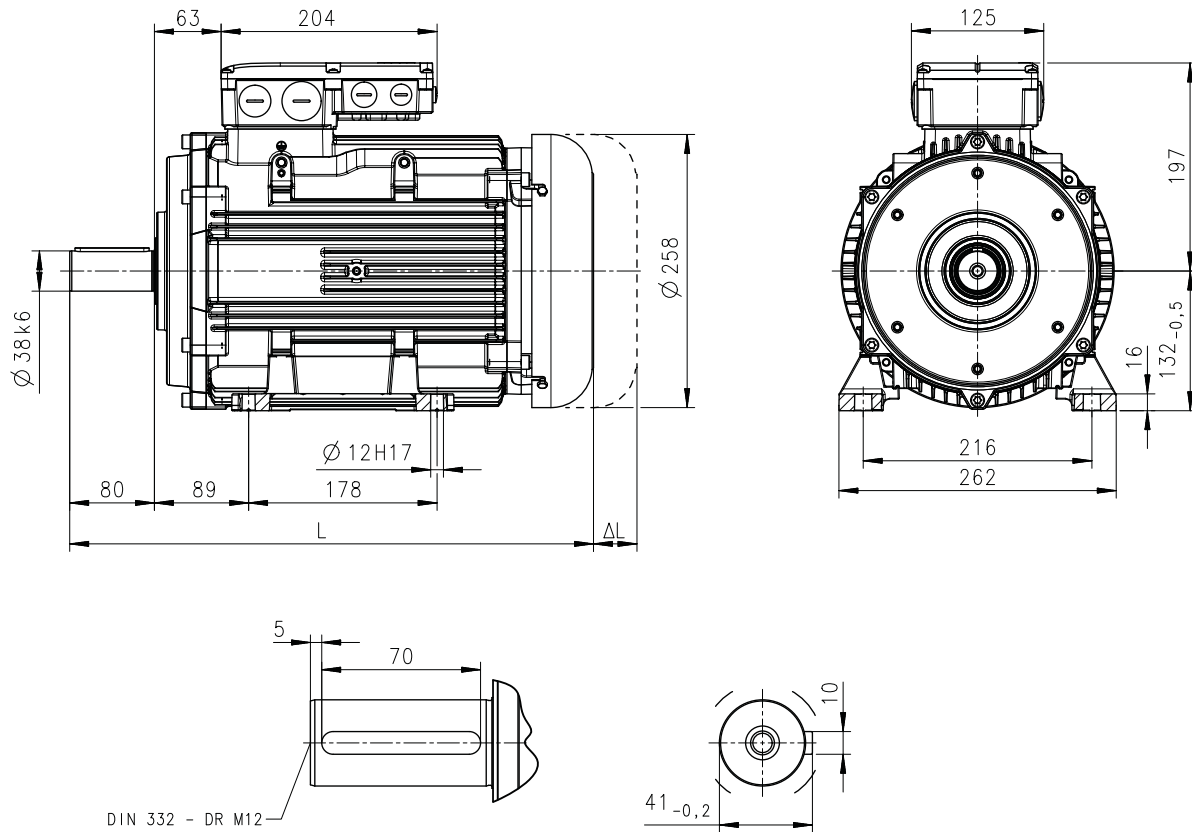
ΔL ▶ Additional lengths  67



m650-U132

Self-ventilated motors

Design B3



8800948-00

Motor			m650-U132/S4	m650-U132/M4	m650-U132/L4
Motor length	L	mm	495		

ΔL ▶ [Additional lengths](#) 67

Technical data

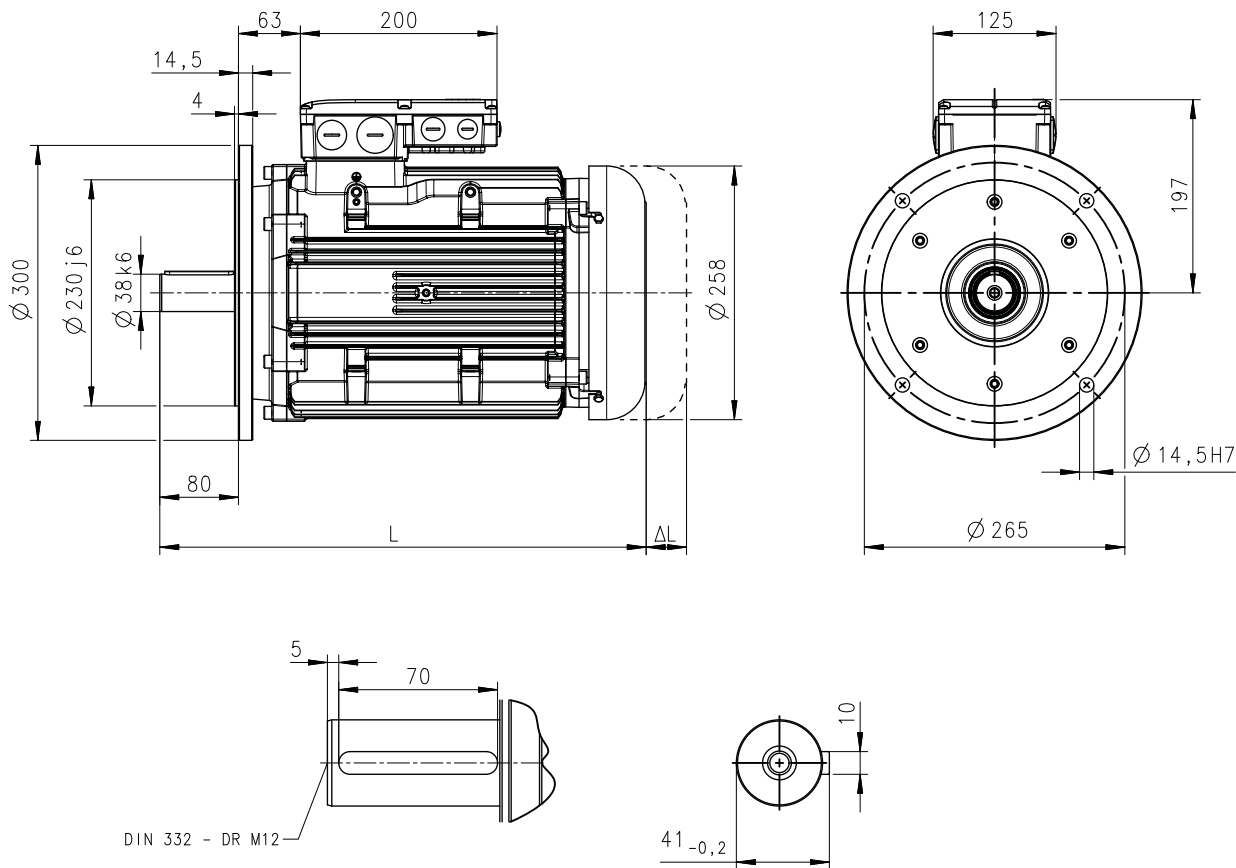
Dimensions
Basic dimensions



m650-U132

Self-ventilated motors

Design B5



8800949-00

Motor			m650-U132/S4	m650-U132/M4	m650-U132/L4
Motor length	L	mm	495		

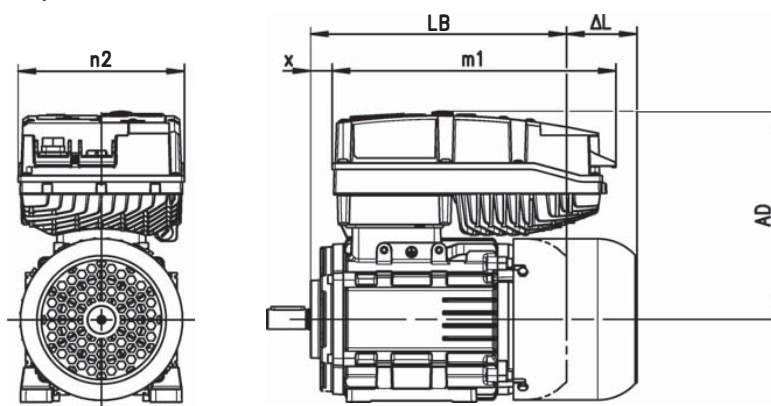
ΔL ▶ [Additional lengths](#) 67



7.5.2 Integrated inverters

i550/i650 motec

Supply voltage 3x 400/480 V



8801782-01

Rated frequency 124 Hz

Motor	i550 motec	AD	m1	n2	x
		g_1	m_1	n_2	x
		mm	mm	mm	mm
m650-U63/L4	i550-M0.75/400-3	179	265	160	11
m650-U63/L4	i550-M0.55/400-3	179	265	160	11
m650-U71/M4	i550-M1.1/400-3	190	265	160	21
m650-U71/M4	i550-M0.75/400-3	190	265	160	21
m650-U71/L4	i550-M1.5/400-3	190	265	160	21
m650-U71/L4	i550-M2.2/400-3	190	265	160	21
m650-U71/L4	i550-M1.1/400-3	190	265	160	21
m650-U80/M4	i550-M2.2/400-3	203	265	160	25
m650-U80/M4	i550-M1.5/400-3	203	265	160	25
m650-U80/M4	i550-M3.0/400-3	221	265	160	23
m650-U90/M4	i550-M2.2/400-3	211	265	160	44
m650-U90/M4	i550-M3.0/400-3	229	265	160	44
m650-U90/M4	i550-M4.0/400-3	229	265	160	44
m650-U90/L4	i550-M4.0/400-3	229	265	160	44
m650-U90/L4	i550-M5.5/400-3	229	265	160	44
m650-U90/L4	i550-M3.0/400-3	229	265	160	44
m650-U100/M4	i550-M5.5/400-3	239	265	160	34
m650-U100/M4	i550-M4.0/400-3	239	265	160	34
m650-U100/M4	i550-M7.5/400-3	264	362	211	21
m650-U100/L4	i550-M5.5/400-3	239	265	160	34
m650-U100/L4	i550-M7.5/400-3	264	362	211	21
m650-U100/L4	i550-M11/400-3	264	362	211	21
m650-U112/M4	i550-M11/400-3	269	362	211	39
m650-U112/M4	i550-M7.5/400-3	269	362	211	39
m650-U132/S4	i550-M11/400-3	289	362	211	48
m650-U132/S4	i550-M15/400-3	341	443	280	27
m650-U132/S4	i550-M18/400-3	341	443	280	27
m650-U132/M4	i550-M18/400-3	341	443	280	27
m650-U132/M4	i550-M22/400-3	341	443	280	27
m650-U132/M4	i550-M15/400-3	341	443	280	27
m650-U132/L4	i550-M22/400-3	341	443	280	27
m650-U132/L4	i550-M30/400-3	341	443	280	27
m650-U132/L4	i550-M18/400-3	341	443	280	27

Technical data

Dimensions
Integrated inverters



Motor	i650 motec	AD	m1	n2	x
		g_1	m_1	n_2	x
		mm	mm	mm	mm
m650-U63/L4	i650-M0.75/400-3	179	265	160	11
m650-U63/L4	i650-M0.55/400-3	179	265	160	11
m650-U71/M4	i650-M1.1/400-3	190	265	160	21
m650-U71/M4	i650-M0.75/400-3	190	265	160	21
m650-U71/L4	i650-M1.5/400-3	190	265	160	21
m650-U71/L4	i650-M2.2/400-3	190	265	160	21
m650-U71/L4	i650-M1.1/400-3	190	265	160	21
m650-U80/M4	i650-M2.2/400-3	203	265	160	25
m650-U80/M4	i650-M3.0/400-3	221	265	160	23
m650-U80/M4	i650-M1.5/400-3	203	265	160	25
m650-U90/M4	i650-M3.0/400-3	229	265	160	44
m650-U90/M4	i650-M4.0/400-3	229	265	160	44
m650-U90/M4	i650-M2.2/400-3	211	265	160	44
m650-U90/L4	i650-M4.0/400-3	229	265	160	44
m650-U90/L4	i650-M5.5/400-3	229	265	160	44
m650-U90/L4	i650-M3.0/400-3	229	265	160	44
m650-U100/M4	i650-M5.5/400-3	239	265	160	34
m650-U100/M4	i650-M7.5/400-3	264	362	211	21
m650-U100/M4	i650-M4.0/400-3	239	265	160	34
m650-U100/L4	i650-M7.5/400-3	264	362	211	21
m650-U100/L4	i650-M11/400-3	264	362	211	21
m650-U100/L4	i650-M5.5/400-3	239	265	160	34
m650-U112/M4	i650-M11/400-3	269	362	211	39
m650-U112/M4	i650-M7.5/400-3	269	362	211	39
m650-U132/S4	i650-M15/400-3	341	443	280	27
m650-U132/S4	i650-M18/400-3	341	443	280	27
m650-U132/S4	i650-M11/400-3	289	362	211	48
m650-U132/M4	i650-M18/400-3	341	443	280	27
m650-U132/M4	i650-M22/400-3	341	443	280	27
m650-U132/M4	i650-M15/400-3	341	443	280	27
m650-U132/L4	i650-M22/400-3	341	443	280	27
m650-U132/L4	i650-M30/400-3	341	443	280	27
m650-U132/L4	i650-M18/400-3	341	443	280	27

Dimensions LB and ΔL ▶ [Basic dimensions](#) 43



7.5.3 Additional lengths

Self-ventilated motors

Motor			m650-U						
			63/L4	71/M4	80/M4	90/M4	100/M4	112/M4	132/S4
				71/L4		90/L4	100/L4		132/M4
									132/L4
Without feedback/brake									
Protection class IP54/IP55	Δ L	mm	0	0	0	0	0	0	0
With integrated feedback									
Protection class IP54/IP55	Δ L	mm	23	9	7	7	13	0	9
With mounted feedback									
Protection class IP54/IP55	Δ L	mm	85	75	68	63	74	77	91
With spring-applied brake									
Protection class IP54/IP55	Δ L	mm	61	60	68	63	74	77	91
With spring-applied brake and integrated feedback									
Protection class IP54/IP55	Δ L	mm	61	60	68	63	74	77	91
With spring-applied brake and mounted feedback									
Protection class IP54/IP55	Δ L	mm	135	128	136	131	145	148	162



7.6 Weights

7.6.1 Basic weights



The basic weights are listed in the rated data.

► [Rated data](#)  37

Observe ► [Additional weights](#)  68!

7.6.2 Additional weights



Add the individual additional weights to the basic weight depending on the design.

Motors

Motor			m650-U						
			63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4	132/S4 132/M4 132/L4
Self-ventilated fan cover									
Spring-applied brake									
06	m	kg	1.5	1.5					
08	m	kg			2.2	2.2			
10	m	kg				3.9	3.9		
12	m	kg						5.6	
14	m	kg							8.5
16	m	kg							
18	m	kg							
20	m	kg							
Manual release lever	m	kg	0.1	0.1	0.2	0.2	0.2	0.4	0.5
Feedback	m	kg	0.5	0.5	0.5	0.5	0.5	0.5	0.5



8 Product extensions

8.1 Motor connection

8.1.1 Connection options

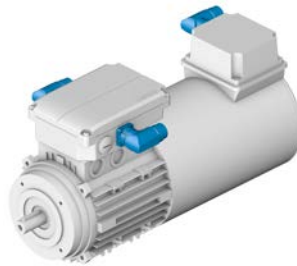


The motors are equipped with a terminal box as standard.

Alternatively, various connectors can be selected for quick commissioning or maintenance.



Terminal box with cable gland



Terminal box with M23 connector



Han connector

The three-phase motors are intended for operation on the inverter.

Frequency inverter operation

For frequency inverter operation, the cut-off frequencies have been set to the following rated voltages:

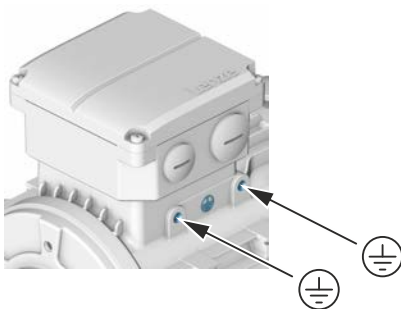
Rated frequency	Rated voltage	Circuit
Hz	V	
124	400	Y

Second ground connection on the motor

According to the EN 61800-5-1 standard, additional measures are required for the protective earth connection if the leakage current is greater than 3.5 mA for alternating current or greater than 10 mA for direct current.

► [Important notes](#) 30

A possible measure is the execution via a second ground connection.



Scope of delivery when a second ground connection is selected:

- Toothed lock washer
- Washer
- Fixing screw



An additional grounding cable is not included in the scope of delivery.

The dimensioning of the grounding is done by the customer.

Product extensions

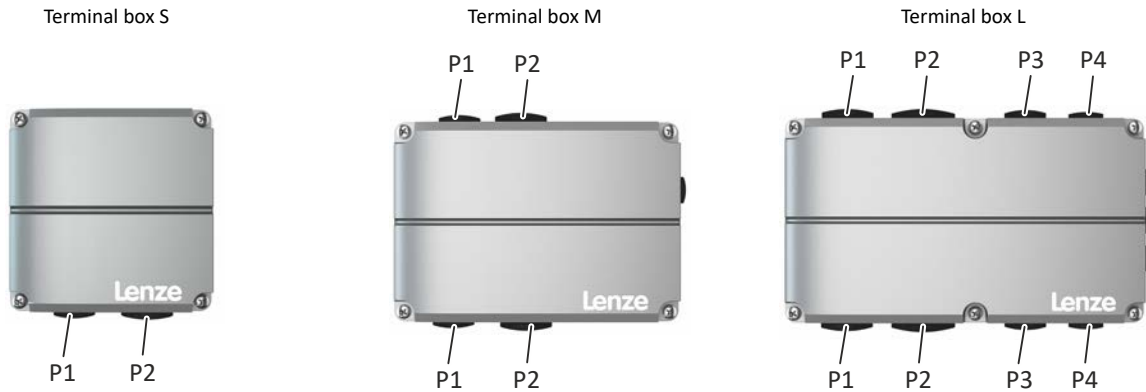
Motor connection
Assignment of the terminal boxes



8.1.2 Assignment of the terminal boxes

Depending on the product extension of the motor, different terminal box sizes (S, M or L) are used.

The M23 connectors are mounted on the terminal boxes (S, M and L) in the positions described.

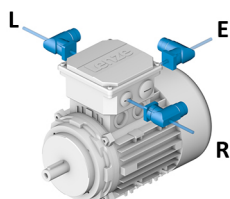


Motor	m650-U						
	63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4	132/S4 132/M4 132/L4
Without product extensions							
Terminal box	S	S	S	S	S	S	L
Power: M23 connector	P1	P1	P1	P1	P1	P1	P1
Product extension - brake							
Terminal box	M	M	M	M	M	M	L
Power + brake: M23 connector	P2	P2	P1	P1	P1	P1	P1
Product extension - brake + feedback							
Terminal box	L	L	L	L	L	L	L
Power + brake: M23 connector	P1	P1	P1	P1	P1	P1	P1
Feedback: M23 connector	P3	P3	P3	P3	P3	P3	P3
Feedback: M12 connector	P4	P4	P4	P4	P4	P4	P4



Positions of the connectors

Positions on the motor terminal box



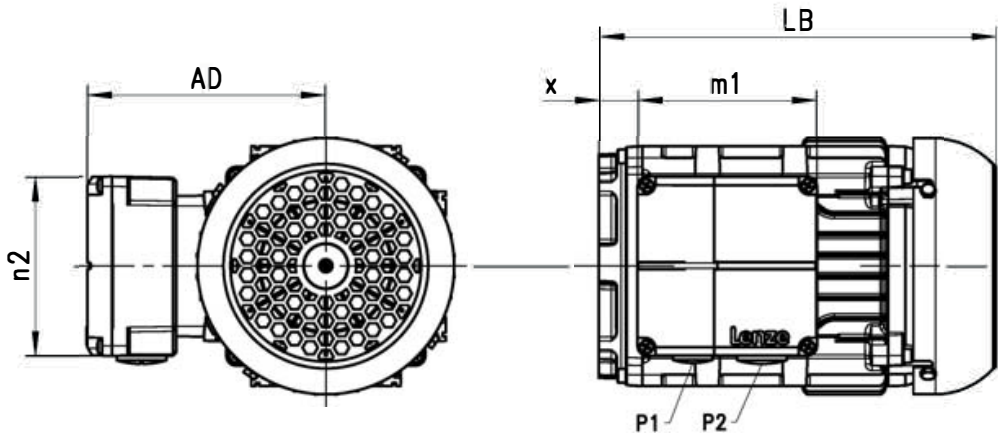
Terminal box	Positions	Note
Motor terminal box S		
Cable glands	L, E or R	
M23 connector: Power	L, E or R	
Motor terminal box M		
Cable glands	L and R	
M23 connector: Power/brake	L or R	
Motor terminal box L		
Cable glands	L and R	The plug connectors for power and brake can be arranged on the same side or on the opposite side
M23 connector: Power/brake	L or R	

Product extensions

Motor connection
Assignment of the terminal boxes



Dimensions of "S" power terminal box



8801784 00

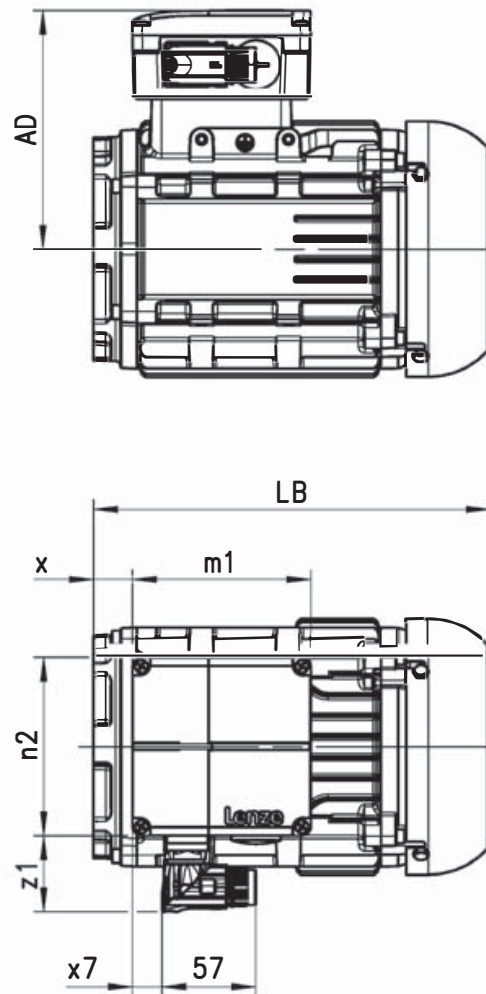
Motor		m650-U					
		63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4
Motor terminal box							
AD	mm	117	128	145	153	163	168
x	mm	22	17	24	30	39	45
m ₁	mm	87	87	109	109	109	109
n ₂	mm	87	87	109	109	109	109
P ₁	mm	M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5
P ₂	mm	-	-	M25x1.5	M25x1.5	M25x1.5	M25x1.5

Dimensions LB ▶ [Basic dimensions](#) 43

Dimensions Δ L ▶ [Additional lengths](#) 67



Dimensions of "S" power terminal box with M23 connector



8801787-00

Motor		m650-U					
		63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4
Motor terminal box							
AD	mm	117	128	145	153	163	168
x	mm	22	17	24	30	39	45
m ₁	mm	87	87	109	109	109	109
n ₂	mm	87	87	109	109	109	109
ICN connector Power							
x ₇	mm	13	13	18	18	18	18
z ₁	mm	42	42	42	42	42	42

Dimensions LB ▶ [Basic dimensions](#) 43

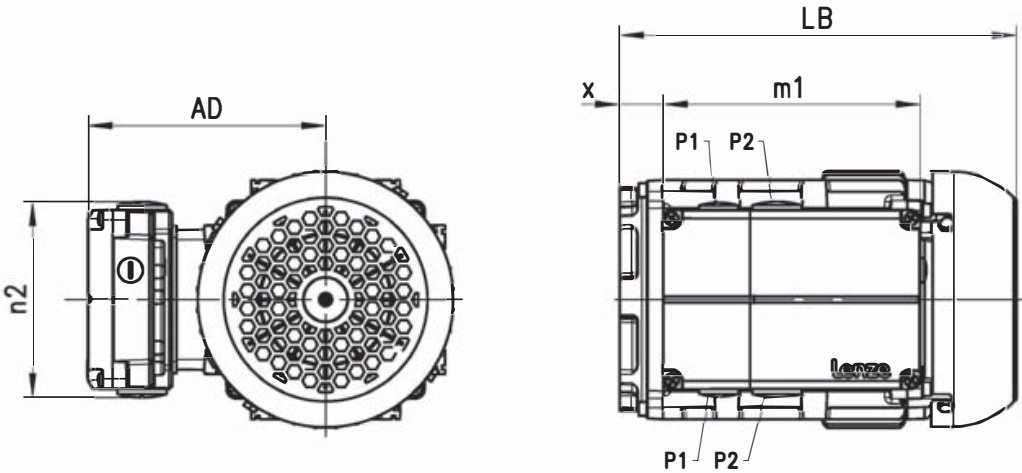
Dimensions Δ L ▶ [Additional lengths](#) 67

Product extensions

Motor connection
Assignment of the terminal boxes



Dimensions of "M" power terminal box



8801785-00

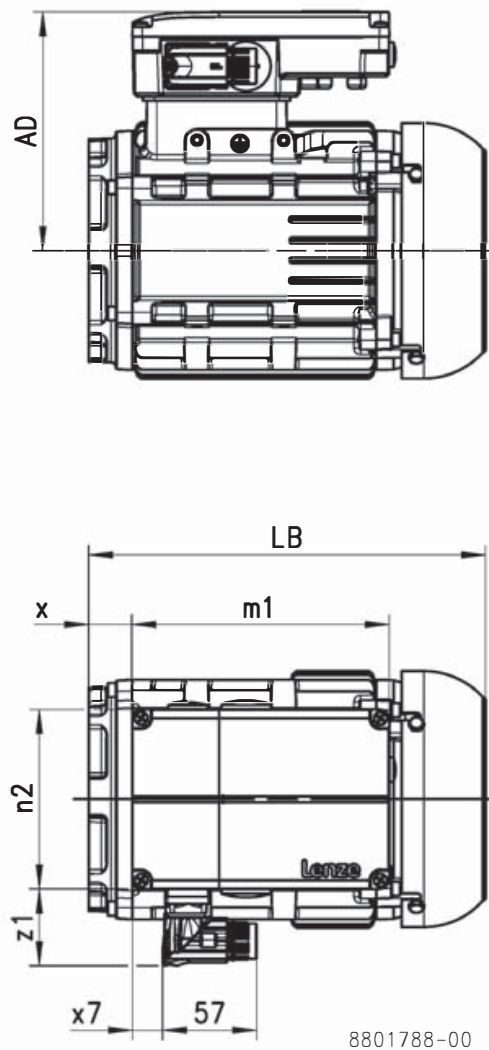
Motor		m650-U					
		63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4
Motor terminal box							
AD	mm	113	124	145	153	163	168
x	mm	21	16	27	34	43	49
m ₁	mm	141	141	157	157	157	157
n ₂	mm	110	110	110	110	110	110
P ₁	mm	M16x1.5	M16x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5
P ₂	mm	M20x1.5	M20x1.5	M25x1.5	M25x1.5	M25x1.5	M25x1.5

Dimensions LB ▶ [Basic dimensions](#) 43

Dimensions Δ L ▶ [Additional lengths](#) 67



Dimensions of "M" power terminal box with M23 connector



8801788-00

Motor		m650-U					
		63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4
Motor terminal box							
AD	mm	113	124	145	153	163	168
x	mm	21	16	27	34	43	49
m ₁	mm	141	141	157	157	157	157
n ₂	mm	110	110	110	110	110	110
ICN connector Power/brake							
x ₇	mm	45.3	45.3	18	18	18	18
z ₁	mm	42	42	42	42	42	42
ICN connector Feedback							
x ₇	mm	45.3	45.3	53.5	53.5	53.5	53.5
z ₁	mm	42	42	46	46	46	46

Dimensions LB ▶ [Basic dimensions](#) 43

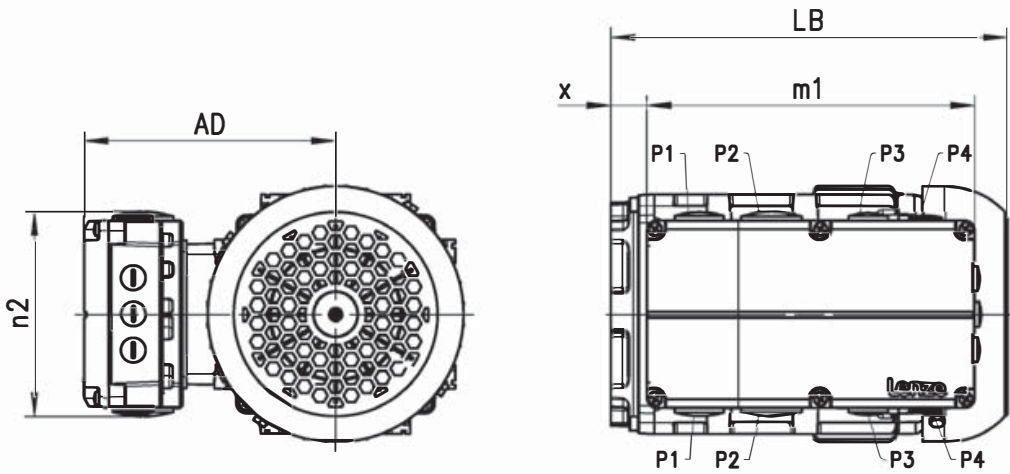
Dimensions Δ L ▶ [Additional lengths](#) 67

Product extensions

Motor connection
Assignment of the terminal boxes



Dimensions of "L" power terminal box



8801786-00

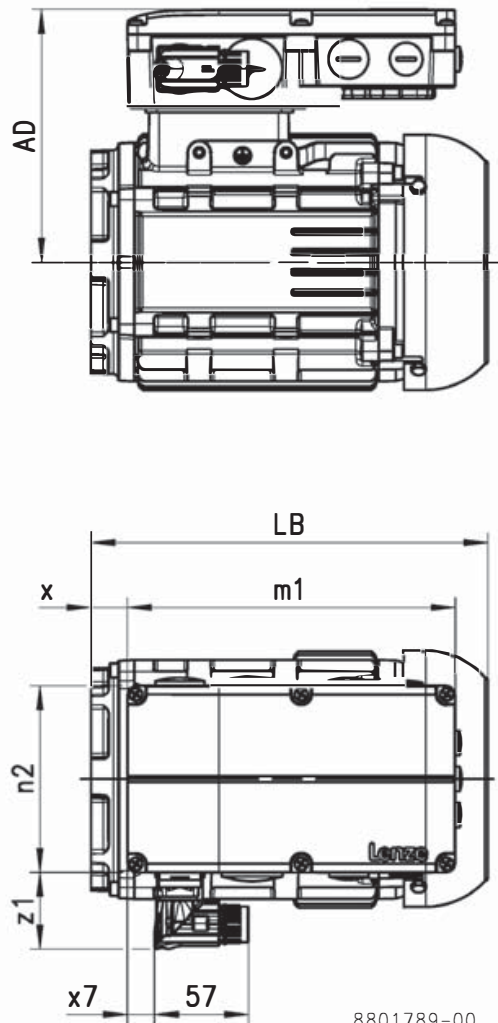
Motor		m650-U						
		63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4	132/S4 132/M4 132/L4
Motor terminal box								
AD	mm	113	141	154	162	172	177	197
x	mm	9	4	22	29	39	44	73
m ₁	mm	141	200	200	200	200	200	200
n ₂	mm	110	114	114	114	114	114	114
P ₁	mm	M25x1.5	M25x1.5	M25x1.5	M25x1.5	M25x1.5	M25x1.5	M25x1.5
P ₂	mm	M32x1.5	M32x1.5	M32x1.5	M32x1.5	M32x1.5	M32x1.5	M32x1.5
P ₃	mm	M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5	M20x1.5
P ₄	mm	M16x1.5	M16x1.5	M16x1.5	M16x1.5	M16x1.5	M16x1.5	M16x1.5

Dimensions LB ▶ [Basic dimensions](#) 43

Dimensions Δ L ▶ [Additional lengths](#) 67



Dimensions of "L" power terminal box with M23 connector



8801789-00

Motor		m650-U						
		63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4	132/S4 132/M4 132/L4
Motor terminal box								
AD	mm	113	141	154	162	172	177	197
x	mm	9	4	22	29	39	44	73
m ₁	mm	141	200	200	200	200	200	200
n ₂	mm	110	114	114	114	114	114	114
ICN connector Power/brake								
x ₇	mm	16	16	16	16	16	16	16
z ₁	mm	46	46	46	46	46	46	46
ICN connector Feedback								
x ₇	mm	120	120	120	120	120	120	120
z ₁	mm	42	42	42	42	42	42	42

Dimensions LB ▶ [Basic dimensions](#) 43

Dimensions Δ L ▶ [Additional lengths](#) 67



8.1.3 Assignment of the connectors Han

The power, brake and temperature monitoring can be connected in the Han connector.

The Han-Modular versions are available with two power modules (16 A or 40 A).

- 

A rectifier can also be connected to the Han-Modular connector.
- 

Feedback in conjunction with the Han plug connector or the integrated i550/i650 motec is only available with the IG128-24V-H add-on incremental encoder (with 0.5 m cable and M12 plug connector).

Motor	m650-U						
	63/L4	71/M4 71/L4	80/S4 80/M4	90/M4 90/L4	100/M4 100/L4	112/M4	132/S4 132/M4 132/L4
Han-Modular connector							
Connection: • Power • Brake • Temperature monitoring TK0	•	•	•	•	•	•	•

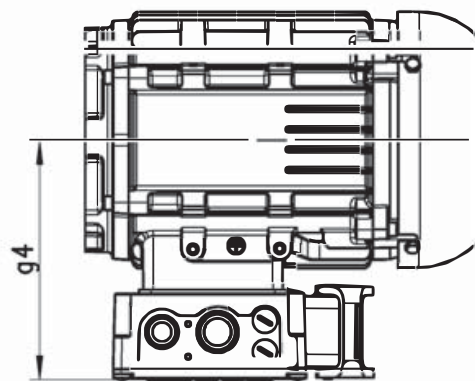
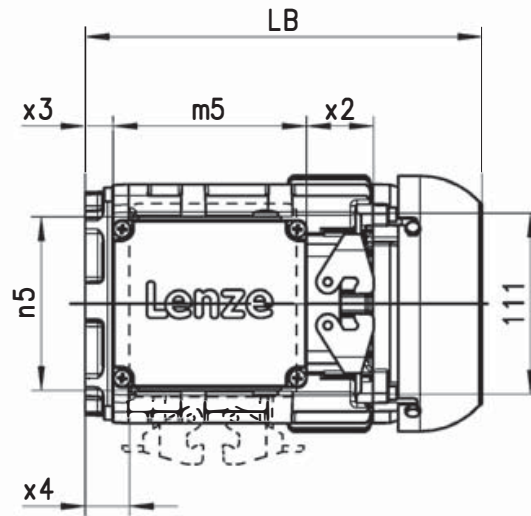
Positions of the connectors

Positions of the Han connector





Dimensions of HAN connector



8801790-00

Motor		m650-U						
		63/L4	71/M4 71/L4	80/M4	90/M4 90/L4	100/M4 100/L4	112/M4	132/S4 132/M4 132/L4
HAN connector								
Power/brake								
g_4	mm	123	134	147	155	165	170	237
x_2	mm	41	41	41	41	41	41	47
x_3	mm	6	1	19	25	34.5	40	39
m_5	mm	118	118	118	118	118	118	120
x_4	mm	7	2	20	26	35.5	41	9
n_5	mm	106	106	106	106	106	106	180

Dimensions LB ▶ [Basic dimensions](#) 43

Dimensions ΔL ▶ [Additional lengths](#) 67

Product extensions

Motor connection
Connection via terminal box



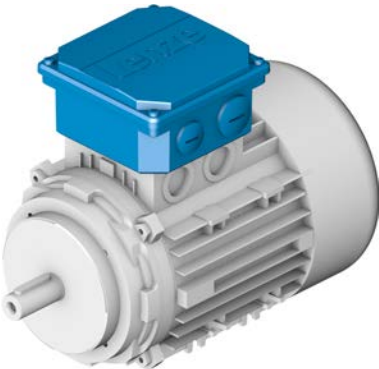
8.1.4 Connection via terminal box

Cable glands



The opening cutouts for the cable glands are closed with plugs.
As the cable glands are only arranged on one side of the motor terminal box "S", the position of the cable glands must be specified.
The motor terminal box "M" and "L" have openings on both sides.

Position of the connections



Position	Meaning	Note
1	Power connection Brake connection PE connection Feedback connection Temperature monitoring connection	For the terminal box "S", the position of the cable connections "L", "R" or "E" must be specified.



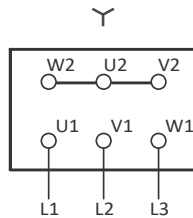
Product extensions

Motor connection
Connection via terminal box

Power connections

Bridge arrangement

Y circuit

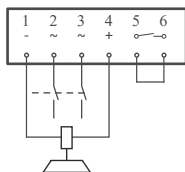


Terminal box, power		
Contact	Name	Meaning
PE	PE	PE conductor
U1	L1	Motor winding phase
V1	L2	
W1	L3	

DC brake connection

Contact	Name	Meaning
BD1	+	Brake +
BD2	-	Brake -

Connection of brake AC



Connection via rectifiers		
Contact	Name	Meaning
~	L1	Mains
~	N	
+	+	Holding brake (factory-wired)
-	-	
		Switching contact - DC switching

Temperature monitoring connection

Contact	Name	Meaning
TB1		TCO thermal contact
TB2		

Product extensions

Motor connection
Connection via connector



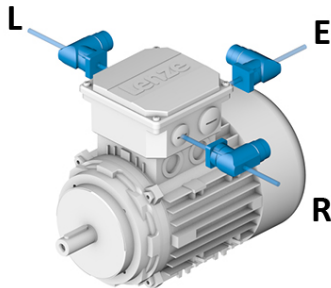
8.1.5 Connection via connector



Preassembled Lenze system cables are available for fast and error-free connection of Lenze motors to Lenze inverters.

Details and data can be found in the "Accessories" brochure on the Internet.

Position of the connections



Position	Meaning	Note
L, E and R	Additionally for the 8-pole M23 connector: • Temperature monitoring connection - TCO thermal contact • Brake supply connection	Caution: Max. brake supply voltage ≤ 230 V
L	M23 connector: • Feedback connection	The mounting position for the feedback connector is on the opposite side to the power connection (position L/R).



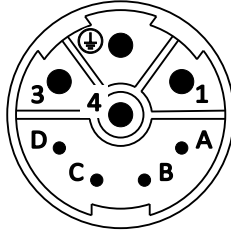
Product extensions

Motor connection
Connection via connector

Power and brake connection

M23 connector assignment

8-pole



M23 8-pole		
Contact	Name	Meaning
PE	PE	PE conductor
A	TB1	Temperature monitoring: TCO
B	TB2	Temperature monitoring: TCO
C	BD1 / BA1	Brake DC +/-AC ≤ 230 V
D	BD2 / BA2	Brake DC-/AC ≤ 230V
1	U	Power phase U
3	W	Power phase W
4	V	Power phase V

Product extensions

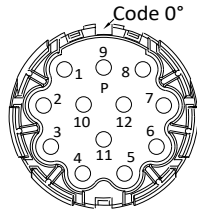
Motor connection
Connection via connector



Feedback and temperature monitoring connection

ICN-M23 connector assignment

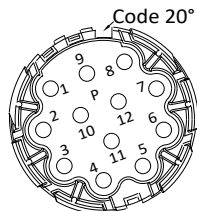
Resolver



M23 for resolvers		
Contact	Name	Meaning
1	+Ref	Transformer windings
2	-Ref	Transformer windings
3	+VCC ETS	Supply: Electronic nameplate (Only for motors and inverters that support this function)
4	+COS	Cosine stator windings
5	-COS	Cosine stator windings
6	+SIN	Sine stator windings
7	-SIN	Sine stator windings
8		Not assigned
9		Not assigned
10		Not assigned
11	+	Not assigned
12	-	Not assigned

ICN-M23 connector assignment

Incremental and SinCos absolute value encoder Hiperface®

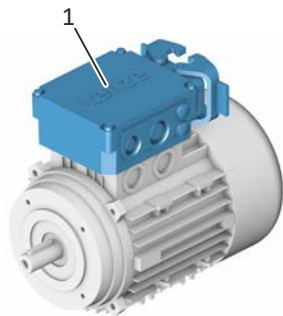


ICN M23 for encoders		
Contact	Name	Meaning
1	B	Track B / +SIN
2	A ⁻	Track A inverse / -COS
3	A	Track A / + COS
4	+UB	Supply +
5	GND	Mass
6	Z ⁻	Zero track inverse / -RS485
7	Z	Zero track / + RS485
8		Not assigned
9	B ⁻	Track B inverse/-SIN
10		Not assigned
11	+	Not assigned
12	-	Not assigned



8.1.6 Connection via Han connector

Position of the connections



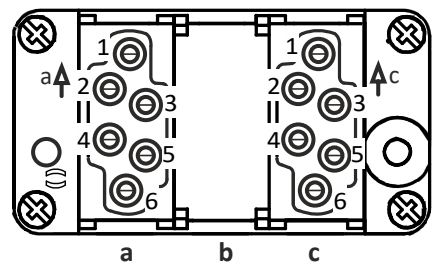
Position	Meaning
1	Power connection Brake connection PE connection Temperature monitoring connection
	Additionally for the Han-Modular: • Rectifier connection

Han-Modular connector



The motor circuit is defined in the terminal box.

Han-Modular 16 A connector assignment



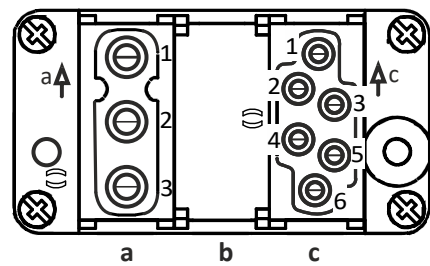
Han-modular 16 A			
Module	Contact	Name	Meaning
a	1	U1	Motor winding phase
	2	V1	
	3	W1	
b			Blank module
c	1	TKO	Temperature monitoring
	2	+/-AC	Brake
	3	-/-AC	
	4	Schaltkontakt	Rectifier
	6	TKO	Temperature monitoring

Product extensions

Motor connection
Connection via Han connector



Han-Modular 40 A connector assignment



Han-modular 40 A			
Module	Contact	Name	Meaning
a	1	U1	Motor winding phase
	2	V1	
	3	W1	
b			Blank module
c	1	TKO	Temperature monitoring
	2	+/-AC	Brake
	3	-/-AC	
	4	Schaltkontakt	Rectifier
	5		
	6	TKO	Temperature monitoring



8.2 Spring-applied brakes

The motors can be ordered with a spring-applied brake to allow stopping or deceleration of the moving masses. The spring-applied brake operates according to the closed-circuit principle. In the deenergized state, the brake is closed. The spring-applied brakes can be used as holding brakes.

Overview

The following table shows the possible versions of the spring-applied brakes.

Versions		Holding brake
		Single brake IP54/55
Standard		•
Supply voltages		
	DC supply	
	DC 24 V $\pm 10\%$	•
	DC 180 V ... 205 V $>10\%$	•
	AC supply via rectifier in the terminal box	
	AC 230 V $\pm 10\%$	•
	AC 400 V ... 460 V $>10\%$	•
Friction lining		
	Standard	•
Options		
	Manual release	•
	UL/CSA-approved	•
	Low noise during operation (noise-reduced rotor)	•
	Cover ring	•

Control	Without rectifier	Bridge/half-wave rectifier
		6-pole
Supply voltages	24 V DC DC 180 ... 205 V	AC 230 V AC 400 ... 460 V



8.2.1 Information on project planning

Important notes

DANGER!

Malfunction of the brake

Even small amounts of oil or grease on the friction surfaces reduce the braking torque considerably.

Possible consequences: Death or severe injuries

► Always keep the friction surfaces free of oil and grease.

Emergency stops

A maximum of 100 emergency stops are possible from $n = 2700$ rpm.



Connection

NOTICE

If used as a service brake, the braking torques are dependent on the motor speed to be braked.

- During braking from a high speed and in the event of emergency stops, the braking torque is significantly reduced.

Connection of the spring-applied brake

The spring-applied brakes can be ordered for connection to AC or DC voltage.

Connection to AC voltage

- A rectifier is required to convert the AC voltage into a DC voltage.
- The rectifier is included in the scope of supply. It is mounted in the terminal box of the motor.
- Available rectifiers:
 - Bridge rectifier, 6-pole

Connection to DC voltage

- No rectifier is required.
- A freewheeling diode or a spark suppressor must be used to prevent high induction peaks.

Motor supply cables

If long motor supply cables are used, pay attention to the ohmic voltage drop along the cable and compensate for it with a higher voltage at the input end of the cable.

The following applies to Lenze system cables:

$U[V] = U_B[V] + 0.08 \frac{[V]}{[A] \times [m]} \times I_{Lg}[m] \times I_B[A]$	U	V	Resulting supply voltage
	U_B	V	Rated voltage of the brake
	I_{Lg}	m	Cable length
	I_B	A	Rated current of the brake

Switching on the AC or DC side

Brakes can be switched both upstream of the rectifier (AC-side switching) and downstream of the rectifier (DC-side switching). The choice of control influences, among other things, the engagement time of the armature plate.

With switching on the AC side, the connection time increases by a factor of 5 to 10 compared to switching on the DC side. This must be taken into account when selecting the control. By simply removing a bridge and using the connections of the switching contact, DC-side switching is possible. However, this requires two additional wires in the control cabinet.

Product extensions

Spring-applied brakes
Spring-applied holding brake
Assignment of braking torques



8.2.2 Spring-applied holding brake

The spring-applied brakes are pure holding brakes. Emergency stops are possible.

⚠ DANGER!

An emergency stop during operation can cause the holding brake to malfunction.

Possible consequences: Personal injury and/or damage to property.

- After an emergency stop, check the air gap and the friction lining for damage.
- If the air gap is too large or the friction lining is damaged, replace the brake rotor.

8.2.2.1 Assignment of braking torques

For optimum adaptation of the brake motor to the application, spring-applied brakes with several braking torques are available for each motor frame size.

Motor	Single brake				
	HBR 06	HBR 08	HBR 10	HBR 12	HBR 14
	Nm	Nm	Nm	Nm	Nm
m650-U63/L4	4				
m650-U71/M4					
m650-U71/L4					
m650-U80/M4		8			
m650-U90/M4					
m650-U90/L4			16		
m650-U100/M4			23		
m650-U100/L4			32		
m650-U112/M4					
m650-U132/S4					
m650-U132/M4					
m650-U132/L4					
					60

8.2.2.2 Rated data

Holding brake		HBR 06	HBR 08	HBR 10	HBR 10	HBR 12	HBR 14
Braking torque is static	Nm	4	8	16	23	32	60
Moment of inertia	kgcm ²	0.128	0.401	2	2	4.5	6.3
Power input							
DC 24 V	W	20	25	30	30	40	50
DC 180 V ... 205 V	W	20	25	30	30	40	53
AC 230 V	W	20	25	30	30	40	53
AC 400 V ... 460 V	W	20	25	30	30	40	53
Min. static braking torque tolerance	%	0	0	0	0	0	0
Max. static braking torque tolerance	%	80	80	80	80	80	80
Reversing cycles		1000000	1000000	1000000	1000000	1000000	1000000
Repetitive cycles		1000000	1000000	1000000	1000000	1000000	1000000
Maximum switching energy	J	3000	7500	12000	12000	24000	30000



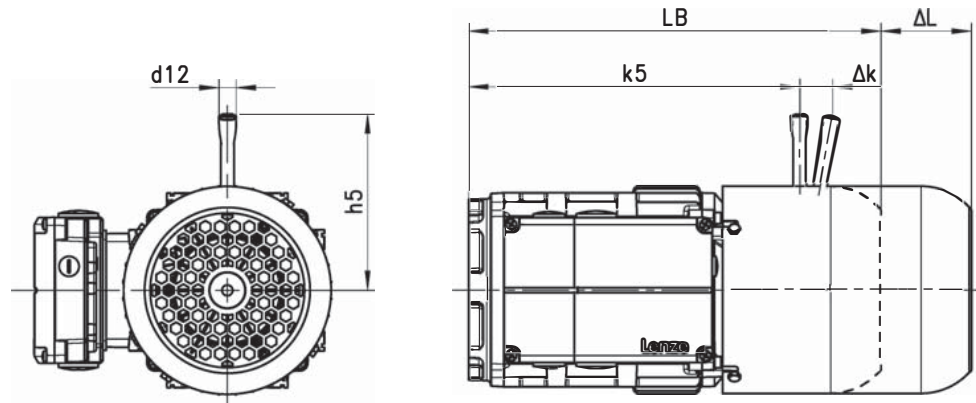
Product extensions

Spring-applied brakes
Spring-applied holding brake

Option: Manual release

The brake can be ordered with a manual release lever to facilitate positioning and maintenance work. The brake can be released manually in deenergized mode by actuating the manual release lever.

Dimensions of manual release lever



8801827-01

Motor	Brake	Dimensions			
		k_5	Δk	h_5	d_{12}
		mm	mm	mm	mm
m650-U63/L4	HBR 06	193	25	107	13
m650-U71/M4 m650-U71/L4	HBR 06	211	25	107	13
m650-U80/M4	HBR 08	231	27	116	13
m650-U90/M4	HBR 08	270	27	116	13
m650-U90/L4	HBR 10	286	23	131	13
m650-U100/M4 m650-U100/L4	HBR 10	344	23	131	13
m650-U112/M4	HBR 12	345	37	161	13
m650-U132/S4 m650-U132/M4 m650-U132/L4	HBR 14	408	53	229	20

Dimensions LB ▶ [Basic dimensions](#) 43

Dimensions ΔL ▶ [Additional lengths](#) 67



8.3 Feedback

The motor can be equipped with the following feedback systems for speed control via an inverter:

A resolver, incremental encoder and SinCos absolute value encoder are optionally available to evaluate the speed and position of the motor shaft.

The resolver can be used to measure an absolute value within one revolution of the rotor. A SinCos absolute value encoder is used if not only the angle within one revolution is to be made available immediately but also the revolution within a set range. The SinCos absolute value encoder detects not only the speed and rotor position but also the position of the machine. It consists of a speed sensor system, for example TTL, and an absolute value information recorder, for example Hyperface.

The HTL incremental encoder is used in the frequency inverter range for less dynamic applications.

It is used for dynamic applications with very high requirements regarding accuracy. If the absolute angular position of the drive is required directly after the system is switched on without performing additional homing, this can be realized via a resolver or SinCos absolute value encoder.



Resolver, absolute encoder and the IG128-24V-H add-on incremental encoder are mounted behind the B-bearing shield under the fan cover.

All other incremental encoders are integrated in the B-bearing shield, which usually makes the drive shorter.

Feedbacks in the environment of functional safety

Motors can perform speed-dependent safety functions for safe speed and/or safe relative position monitoring in a drive system by Lenze inverters or Controllers. In case of inverters, these functions are implemented by integrable safety modules and in case of Controllers by the additionally required Safety Controller.

When planning systems/installations of this kind, always observe the following:

- When using just one single feedback system in the environment of these safety applications, the applicable safety engineering standard EN 61800-5-2 (adjustable speed electrical power drive systems - Part: 5-2: Safety requirements - Functional) stipulates special requirements for the connection between feedback system and motor shaft.
- This is due to the fact that two-channel safety systems at this point in the mechanical system are actually designed as single-channel systems. If this mechanical connection is designed with considerable overdimensioning, the standard permits exclusion of the fault "encoder-shaft breakage" or "encoder-shaft slip". As such, the permissible angular acceleration limit values must not be exceeded for the individual drive solutions.

You can find the limit values in the corresponding feedback data of the individual motor ranges.

Speed-dependent safety functions

Examples of speed-dependent safety functions:

- Safe stop 1 (SS1)
- Safe operational stop (SOS)
- Safely limited speed (SLS)
- Safe maximum speed (SMS)
- Safe direction (SDI)
- Operation mode selector (OMS) with confirmation (ES)
- Safe speed monitor (SSM)
- Safely limited increment (SLI)



8.3.1 Resolver

The stator-supplied, 2-pole resolver with two stator windings shifted by 90 degrees and a rotor winding with a transformer winding can record both the speed and the rotor position, just like a single-turn absolute value encoder. The rotor position can be determined within one mechanical motor revolution after a voltage failure.

Feedback type			Resolver
Feedback			RS1
Speed-dependent safety functions			Nein
Design			Mounting
Resolution - angle		'	0.8
Min. accuracy		'	-10
Max. accuracy		'	10
Absolute positioning			1 revolution
Max. speed	$n_{\max}$	rpm	8000
Max. DC input voltage	$V_{\text{in,max}}$	V	10
Max. input frequency	$f_{\text{in,max}}$	kHz	4
Ratio stator/rotor			0.3
Min ratio tolerance		%	-5
Max ratio tolerance		%	5
Rotor impedance	Z_{ro}	Ω	51+j90
Stator impedance	Z_{so}	Ω	102+j150
Impedance	Z_{rs}	Ω	44+j76
Min. insulation resistance at DC 500 V	R_{min}	M Ω	10
Number of pole pairs			1
Max. angle error Min		'	-10
Max. angle error Max		'	10



8.3.2 Incremental encoder

Incremental encoders can be used for speed measurement. Homing is required in order to enable positioning later.

Incremental HTL encoder



Feedback in conjunction with the Han plug connector or the integrated i550/i650 motec is only available with the IG128-24V-H add-on incremental encoder (with 0.5 m cable and M12 plug connector).

Feedback type			Encoder			
Feedback			IG128-24V-H		IG1024-24V-H	IG2048-24V-H
Design			Mounting	integrated	integrated	integrated
Pulses			128	128	1024	2048
Output signals			HTL	HTL	HTL	HTL
Interfaces			A, B	A, B	A, B; N; Ai, Bi; Ni	A, B; N; Ai, Bi; Ni
Absolute revolution			0	0	0	0
Min. accuracy		'	-22.5	-2	-2	-2
Max. accuracy		'	22.5	2	2	2
Min. DC input voltage	$V_{in,min}$	V	8	10	10	10
Max. DC input voltage	$V_{in,max}$	V	26	30	30	30
Max. current consumption	I_{max}	A	0.04	0.15	0.15	0.15
Cut-off frequency	f_{max}	kHz	30	200	200	200

SinCos-incremental encoder with safety functions



The connection of the safety sensors to the terminal box is only available in conjunction with a M23 connector.

Feedback type			Encoder	
Feedback			IG2048-5V-V2	IG2048-5V-V3
Design			Mounting	
Pulses			2048	2048
Output signals			SinCos 1 Vss	SinCos 1 Vss
Interfaces			SinCos	SinCos
Absolute revolution			0	0
Min. accuracy			-	-
Max. accuracy			-	-
Min. DC input voltage	$V_{in,min}$	V	4.75	4.75
Max. DC input voltage	$V_{in,max}$	V	5.25	5.25
Max. current consumption	I_{max}	A	0.07	0.07
Cut-off frequency	f_{max}	kHz	400	400
Max. Safety Integrity Level			SIL 2	SIL 3
Max. Safety Performance Level			d	e



8.3.3 Absolute value encoder

Absolute value encoders can detect the speed, the rotor position, and the machine position with a very high resolution. They are used for the positioning of dynamic applications and do not require homing.

SinCos absolute value encoder

Feedback type			SinCos absolute value encoder
Feedback			AM1024-8V-H
Speed-dependent safety functions			Nein
Design			Mounting
Encoder type			Multi-turn
Resolution		bit	-
Pulses			1024
Output signals			SinCos 1 Vss
Interfaces			Hiperface
Absolute revolution			4096
Resolution - angle			0.4
Min. accuracy		'	-0.8
Max. accuracy		'	0.8
Fehlergrenze Positionswert			
System accuracy			-
Integral nonlinearity			-
Min. DC input voltage	$V_{in,min}$	V	7
Max. DC input voltage	$V_{in,max}$	V	12
Max. current consumption	I_{max}	A	0.08
Cut-off frequency	f_{max}	kHz	200



8.4 Temperature monitoring



The temperature sensors are integrated in the windings. The use of an additional motor protection switch is recommended.

8.4.1 Thermal contacts TCO

The TCO thermal contact (thermal break contact) is a bimetallic switch. The thermal contact monitors the motor winding temperature; e.g., at excessively high temperatures, it switches the upstream motor relay. The motor is disconnected from the line voltage and coasts down via the relay.

Functional principle			Normally-closed contact
Operating temperature		°C	150
Min. switching temperature		°C	145
Max. switching temperature		°C	155
Min. reset temperature		°C	90
Max. reset temperature		°C	135
Max. AC switching current		A	2.5
Max. AC switching voltage		V	250
Max. DC switching current		A	2.5
Max. DC switching voltage		V	12



9 Product codes

Motor product code

Example		M	65	A	U	063	M	04	5	E	0	0	C	C
Product type	Motor	M												
Product family			65											
Generation				A										
Efficiency class	IE5				U									
Size						063 071 080 090 100 112 132								
Overall length	Short						S							
	Medium						M							
	Long						L							
Number of poles	4-pole							04						
Degree of protection	IP54/IP55								5					
Cooling	Integral fan									E				
Brake	Without										0			
	Spring-applied brake										F			
Feedback	Without											0		
	Absolute value encoder											A		
	Incremental encoder											E		
	Resolver											R		
Approvals	None												N	
	CE												C	
	CE, CCC												3	
	CE, cULus												L	
	CE, cULus, CCC												5	
	CE, cURus												U	
	CE, cURus, CCC												W	
Design type	Internal key													C



10 Environmental notes and recycling

Lenze products are intended for use by companies in industrial environments. This means that they are also subject to requirements regarding recycling and disposal. Both mechanical and electrical components such as electric motors, gearboxes, and inverters contain valuable raw materials that can be recycled and reused. Proper recycling is important and sensible from both an economic and ecological perspective.

For information on the proper disposal and legal requirements of our products, please refer to the information on the respective product page on the Internet:

<https://www.lenze.com/en-de/products>

If you require support, please contact your local branch:

<https://www.lenze.com/en-de/company/global-presence>

Note: By disposing of devices and packaging properly, you are helping us to protect the environment and conserve resources.



Further information on Lenze's environmental and climate responsibility and on the topic of energy efficiency can be found on the Internet:

<https://www.lenze.com/en-de/company/sustainability>



11 Appendix

11.1 Good to know

11.1.1 Operating modes of the motor

Operating modes S1 ... S10 as specified by EN 60034-1 describe the basic stress of an electrical machine.

In continuous operation a motor reaches its permissible temperature limit if it outputs the rated power dimensioned for continuous operation. However, if the motor is only subjected to load for a short time, the power output by the motor may be greater without the motor reaching its permissible temperature limit. This behaviour is referred to as overload capacity.

Depending on the duration of the load and the resulting temperature rise, the required motor can be selected reduced by the overload capacity.

The most important operating modes

Continuous operation S1	Short-time operation S2
Operation with a constant load until the motor reaches the thermal steady state. The motor may be actuated continuously with its rated power.	Operation with constant load; however, the motor does not reach the thermal steady state. During the following standstill, the motor winding cools down to the ambient temperature again. The increase in power depends on the load duration.



Intermittent operation S3	Non-intermittent periodic operation S6
Sequence of identical duty cycles comprising operation with a constant load and subsequent standstill. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/downtime ratio.	Sequence of identical duty cycles comprising operation with a constant load and subsequent no-load operation. The motor cools down during the no-load phase. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/idle time ratio.
P Power t Time t_L Idle time θ Temperature	P_V Power loss t_B Load period t_S Cycle duration

11.1.2 Enclosures

The protection class indicates the suitability of a product for specific ambient conditions with regard to humidity as well as the protection against contact and the ingress of foreign particles. The protection classes are classified in the EN IEC 60034-5/EN IEC 60529.

The first code number after the code letters IP indicates the protection against the ingress of foreign particles and dust. The second code number refers to the protection against the ingress of humidity.

Code number 1	Degree of protection	Code number 2	Degree of protection
0	No protection	0	No protection
1	Protection against the ingress of foreign particles $d > 50$ mm. No protection in case of deliberate access.	1	Protection against vertically dripping water (dripping water).
2	Protection against medium-sized foreign particles, $d > 12$ mm, keeping away fingers or the like.	2	Protection against diagonally falling water (dripping water), 15° compared to normal service position.
3	Protection against small foreign particles $d > 2.5$ mm. Keeping away tools, wires or the like.	3	Protection against spraying water, up to 60° from vertical.
4	Protection against granular foreign particles, $d > 1$ mm, keeping away tools, wire or the like.	4	Protection against spraying water from all directions.
5	Protection against dust deposits (dust-protected), complete protection against contact.	5	Protection against water jets from all directions.
6	Protection against the ingress of dust (dust-proof), complete protection against contact.	6	Protection against choppy seas or heavy water jets (flood protection).

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