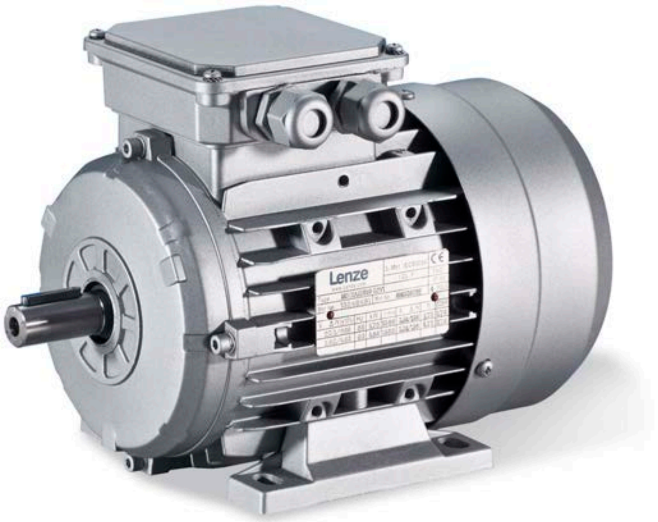
Lenze

MF three-phase AC motor, inverter-optimized



Contents

About this document

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.

Further documents

Information and tools with regard to the Lenze products can be found on the Internet:
www.lenze.com → Downloads

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.

Product information

Product description

Three-phase AC motor for inverter operation

In a power range from 0.55 to 22 kW, Lenze offers inverter-compatible three-phase AC motors for more extensive tasks.

The energy-efficient, inverter-optimized MF three-phase AC motors are particularly suitable for tasks that demand large setting ranges with minimal sizes.

Customer benefit

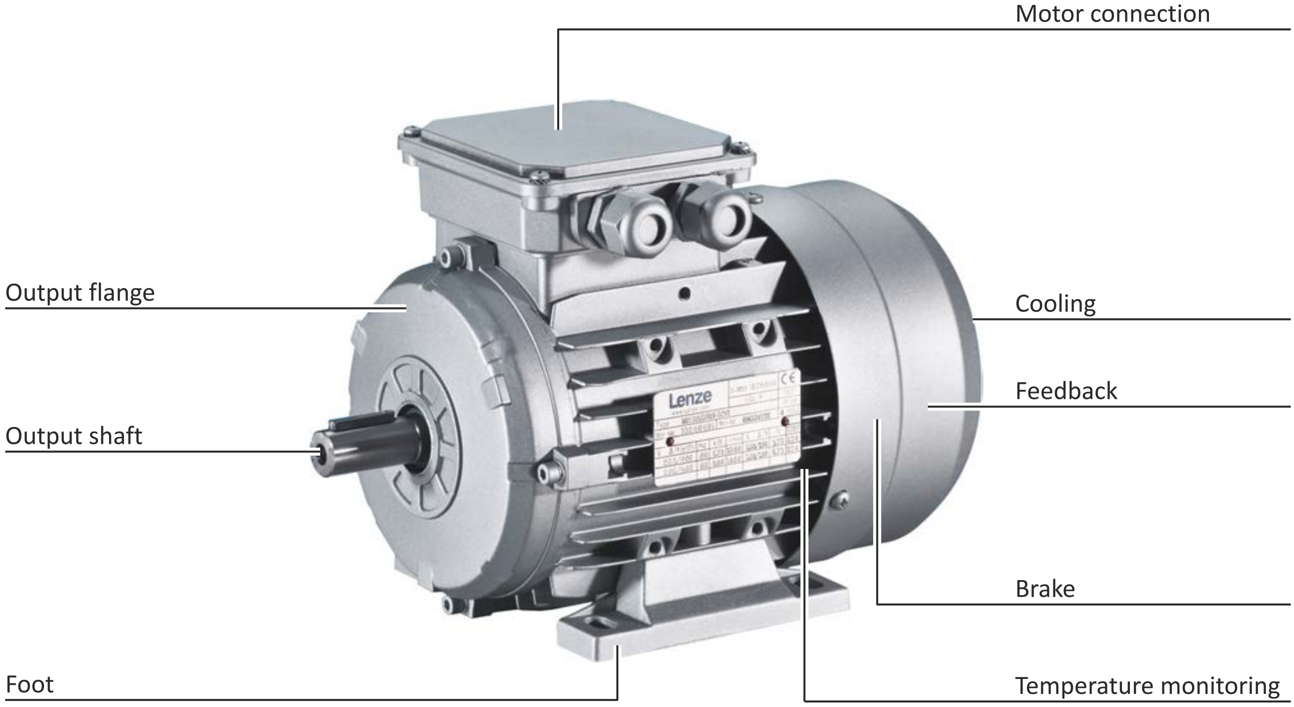
- Exceed efficiency class IE2
- Four-pole motors in the designs B3, B5 and B14
- Setting range up to 1:24 with constant torque
- More dynamic than conventional three-phase AC motors
- Optimized for use as geared motors with g500 gearboxes and i510 cabinet, i550 cabinet, i550 protec and i550 motec frequency inverters

Identification of the products

Three-phase AC motor product name

Meaning	Variant	Product name							
Product family		MF							
Wildcard	Cooling		□						
Internal code				MA					
Wildcard	Brake Feedback				□□				
Size						063 080 090 100 112 132			
Overall length								1 ... 4	
Number of pole pairs	4-pole								2

Features


Motor connection
Output flange
Cooling
Feedback
Output shaft
Brake
Foot
Temperature monitoring

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.

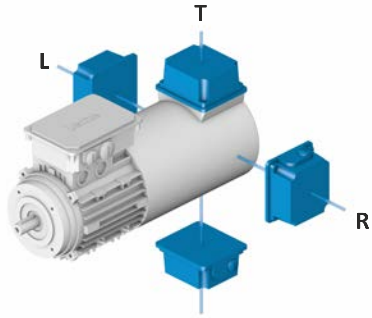
Motor		MF□MA□□						
		063-32	**063-42**	**071-32**	**071-42**	**080-32**	**080-42**	**090-32**
Technical data								
Rated power	kW	0.55	0.75	1.1	1.5	2.2	3.0	4.0
Color		**Unpainted** Primed RAL colors						
Surface and corrosion protection		**Without** Different types of OKS						
Dimensions								
Design		B3/B14/B5						
Solid shaft with featherkey	mm	11 x 23		14 x 30		19 x 40		24 x 50
Output flange	mm	FT75 FF115		FT85 FF130		FT100 FT130 FF165		FT115 FT130 FF165
Cooling		**Integral fan** Blower						
Product extensions								
Connection method		Y/Δ						Y
Connection type		**Terminal box** ICN connector HAN 10E connector HAN modular connector						
Spring-applied brake		**Without** With						
Feedback		**Without** Resolver Incremental encoder Absolute value encoder						
Temperature monitoring		**TKO thermal contact** PT1000 temperature sensor PTC thermistor						

Motor		MF□MA□□					
		100-12	**100-32**	**112-22**	**132-12**	**132-22**	**132-32**
Technical data							
Rated power	kW	5.5	7.5	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** Blower					
Product extensions							
Connection method		Y					
Connection type		**Terminal box**					
		ICN connector	ICN connector				
		HAN 10E connector	HAN 10E connector	HAN 10E connector			
		HAN modular connector	HAN modular connector	-	HAN modular connector	HAN modular connector	HAN modular connector
Spring-applied brake		**Without** With					
Feedback		**Without** Resolver Incremental encoder Absolute value encoder					
Temperature monitoring		**TKO thermal contact** PT1000 temperature sensor PTC thermistor					

Mounting positions

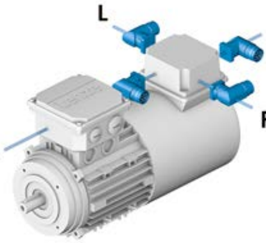
Positions of the terminal boxes/connectors

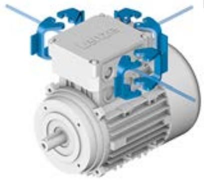
Blower terminal box
with/without ICN connector



Positions of the connections

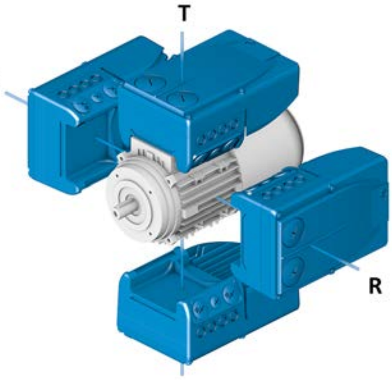
Power terminal box	Blower terminal box	HAN connector
ICN cable glands/connectors	ICN cable glands/connectors	



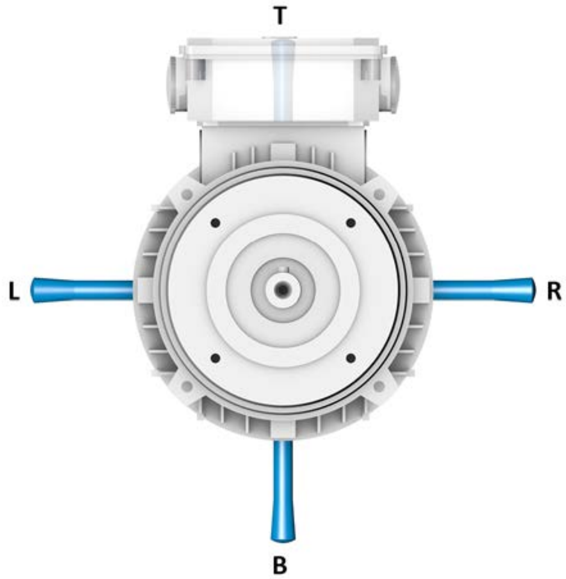


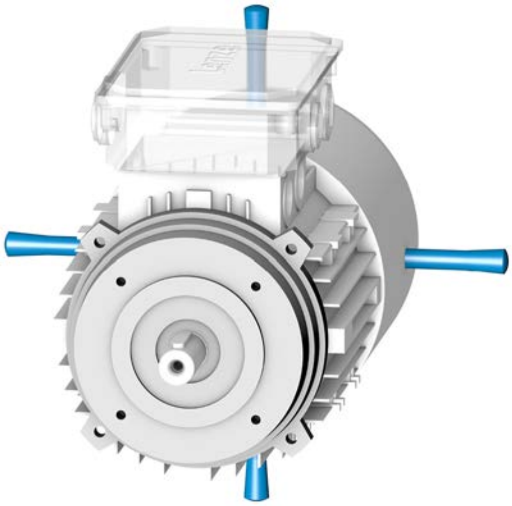
Positions of the i550/8400 motec frequency inverters

Positions of i550/8400 motec	Positions of the connectors
	8400 motec I/O connection



Position of the manual release lever





Safety instructions

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!

Application as directed

- The product is a 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 only be operated on the inverter.
- Built-in brakes must not be used as safety brakes.
- The product must not be operated in private areas, in potentially explosive atmospheres and in areas with harmful gases, oils, acids and radiation.

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!

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 sensors are no 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 a current-dependent motor protection switch.
  - 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.

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.

Information on project planning

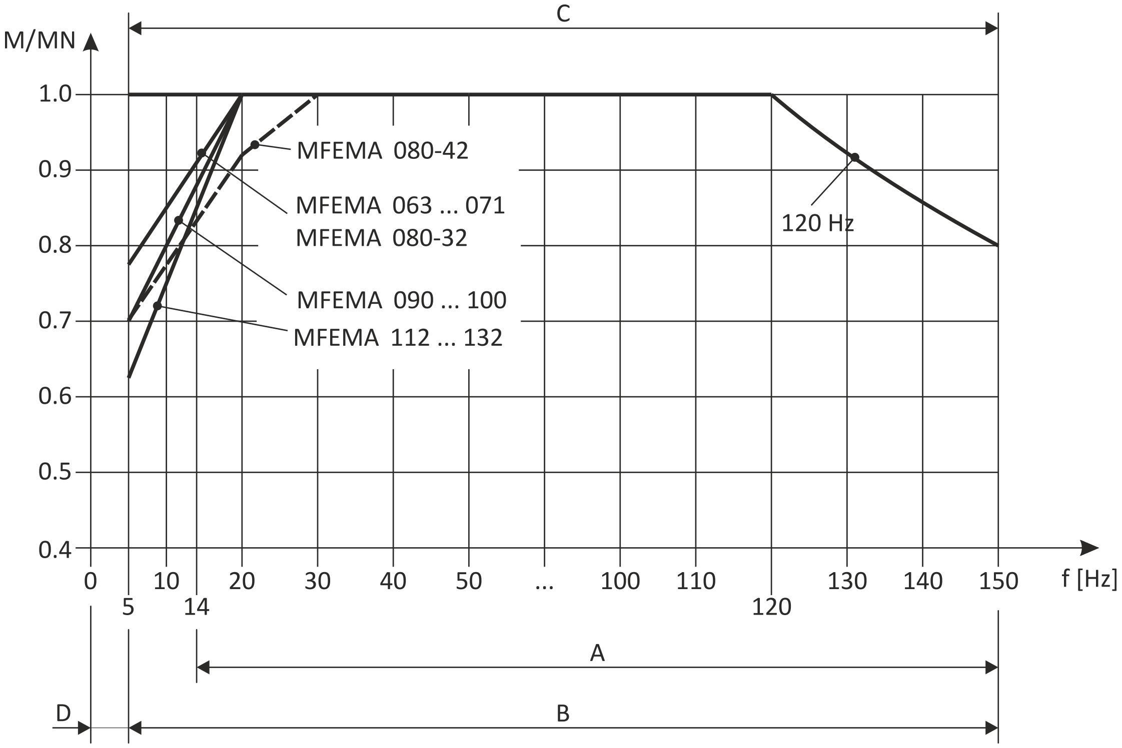
General information

Torque reduction at low motor frequencies

At low motor frequencies (usually < 20 Hz) and with an integral fan, the motor is not cooled sufficiently at the rated torque. The motor can be operated from 5 Hz by reducing the torque accordingly.

Constant cooling takes place over the entire speed range in motors with a blower. This means that they can be used with their rated torque from 5 Hz.

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



A	Operation with integral fan and brake
B	Operation with integral fan and "holding current reduction" brake control
C	Operation with blower
D	Operation below 5 Hz is possible depending on the application and the control mode. Verification of the application by Lenze required.

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

Inverter operation
↓
Check operating conditions
↓
Define required input variables
↓
Determine correction factor
Operating modes and operating time
Ambient temperature and installation height
↓
Determine product on the basis of the acting forces
↓
Calculate required drive power
↓
Calculate setting range Define rated point Blower required?
↓
Check and select product
↓
Final configuration

Check operating conditions

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

▶ Standards and operating conditions 📖 30
▶ Surface and corrosion protection 📖 23

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 📖 98

Installation height amsl			
≤ 1000 m	≤ 2000 m	≤ 3000 m	≤ 4000 m
Correction factor			
k_H	k_H	k_H	k_H
1	0.95	.90	.85

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 < 17 teeth = 1.15	≥ 20 teeth = 1.0 < 20 teeth = 1.25 < 13 teeth = 1.4	With belt tightener= 2.0 - 2.5 Without belt tightener= 2.5 - 3.0	1.5 - 2.0
			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			$F_{ax} \leq F_{ax,max}$	

dw Effective diameter of transmission element

▶ Radial forces and axial forces 📖 32

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 and determine rated point

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

Cooling	Setting range	Rated point
Integral fan	≤ 6 (20 - 120 Hz)	120 Hz
Blower	≤ 24 (5 - 120 Hz)	120 Hz
Integral fan (reduced torque)		

Operation on the inverter 📖 19

Check and select product

Rated data	Check	Unit	Note
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

Final configuration

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

More information about the final configuration:

▸ The modular system 📖 11

▸ Product extensions 📖 56

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 • 2K PUR priming coat • 2K-PUR top coat		110 ... 160 µm
OKS-L (large)	Comparable to C3			140 ... 200 µm

Mechanical installation

Important notes

- Install the product according to the information in the chapter "Standards and operating conditions".

  ▸ Standards and operating conditions 📖 30
- 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!

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.

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.

Electrical installation

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 mm^2 with Cu or 16 mm^2 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 🕮 56

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

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.

Technical data

Notes regarding the given data

Catalog data

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

- Operating time per day = 8 hrs (100 % ED)
- Ambient temperature = -30 ... +40 °C
- Site altitude ≤ 1000 m above sea level
- The specified rated data apply to the 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.

Standards and operating conditions

Conformities and approvals

More information and certificates of approval can be found under

MF three-phase AC motors (Lenze.com)

Europe					
Country	**Conformity/ approval**	**Law/standard**	**Description**	**Special feature**	**Product representation**
Eurasian Economic Union (EAC)	EAC	TP TC 004/2011	Eurasian conformity: safety of low voltage equipment	-	EAC mark
		TP TC 020/2011	Eurasian conformity: electromagnetic compatibility		
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/T 26572	Requirements on concentration limits for certain restricted substances in electrical and electronic products	-	EFUP mark
	CCC	GB 12350	Safety requirements of small power motors		CCC mark

Protection of persons and device protection

Degree of protection			
-	EN IEC 60529,EN IEC 60034-5	IP54	Information applies to the mounted and ready-for-use state
		IP55	Not with RS1 resolver
			Not with HTL incremental IG128-24V-H
			Information applies to the mounted and ready-for-use state
		IP65	Not with RS1 resolver
			Not with HTL incremental IG128-24V-H
			Not with brake
			Information applies to the mounted and ready-for-use state
		IP66	Not with RS1 resolver
			Not with HTL incremental IG128-24V-H
			Not with brake
			Information applies to the mounted and ready-for-use state

EMC data

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

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

Environmental conditions

Climate			
Operation	EN 60721-3-3:1995 + A2:1997	-	-
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 (-20 ...+40 °C)	

Air humidity			
-	-	Average relative humidity 85 %	Without condensation

Site altitude		
0 … 1000 m amsl	-	Without current derating
1000 … 4000 m amsl		Reduce power by 5 %/1000 m

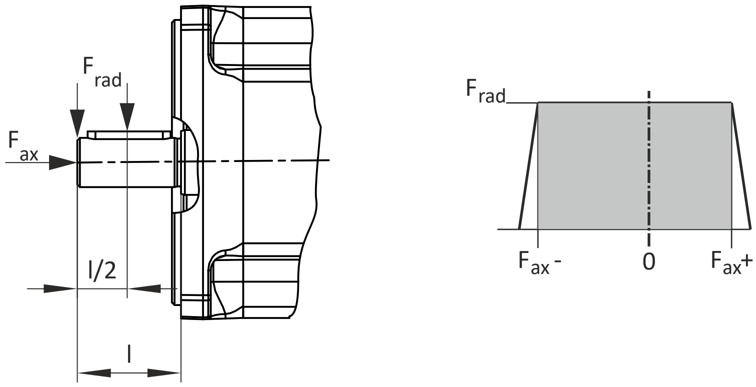
Vibration resistance		
Operation	EN 60721-3-3:1995 + A2:1997	3M5

Radial forces and axial forces

The values of the bearing service life L_{10h} refer to an average speed of 2000/3500 rpm of the motor. Depending on the ambient temperatures, they are additionally limited by the grease service life.

The specifications of the axial forces refer to the max. radial force with corresponding bearing service life.

Application of forces



Application of force at l/2

Forces at medium speed 2000 rpm

Motor			**MFXMA**									
Size			**063-32**	**063-42**	**071-32**	**071-42**	**080-32**	**080-42**	**090-32**	**100-12**	**100-32**	**112-22**
Bearing service life 10000 h												
Radial force	F_{rad}	N	600	600	740	740	960	960	1050	1490	1490	2250
Min. axial force	$F_{ax,-}$	N	-600	-600	-800	-800	-1090	-1090	-1160	-1490	-1490	-2330
Max. axial force	$F_{Fax,+}$	N	300	300	470	470	580	580	630	910	910	1340
Bearing service life 20000 h												
Radial force	F_{rad}	N	470	470	590	590	770	770	840	1190	1190	1790
Min. axial force	$F_{ax,-}$	N	-480	-480	-630	-630	-860	-860	-920	-1160	-1160	-1830
Max. axial force	$F_{Fax,+}$	N	180	180	300	300	350	350	390	580	580	840
Bearing service life 30000 h												
Radial force	F_{rad}	N	410	410	510	510	670	670	730	1050	1050	1570
Min. axial force	$F_{ax,-}$	N	-430	-430	-550	-550	-760	-760	-800	-1010	-1010	-1600
Max. axial force	$F_{Fax,+}$	N	120	120	220	220	250	250	280	430	430	610
Bearing service life 50000 h												
Radial force	F_{rad}	N	350	350	430	430	570	570	620	890	890	1330
Min. axial force	$F_{ax,-}$	N	-370	-370	-470	-470	-650	-650	-690	-860	-860	-1360
Max. axial force	$F_{Fax,+}$	N	70	70	140	140	140	140	160	270	270	370

Motor			**MFXMA**		
Size			**132-12**	**132-22**	**132-32**
Bearing service life 10000 h					
Radial force	F_{rad}	N	3300	3300	3300
Min. axial force	$F_{ax,-}$	N	-2150	-2150	-2150
Max. axial force	$F_{Fax,+}$	N	1190	1190	1190
Bearing service life 20000 h					
Radial force	F_{rad}	N	2640	2640	2640
Min. axial force	$F_{ax,-}$	N	-1670	-1670	-1670
Max. axial force	$F_{Fax,+}$	N	710	710	710
Bearing service life 30000 h					
Radial force	F_{rad}	N	2320	2320	2320
Min. axial force	$F_{ax,-}$	N	-1440	-1440	-1440
Max. axial force	$F_{Fax,+}$	N	480	480	480
Bearing service life 50000 h					
Radial force	F_{rad}	N	1970	1970	1970
Min. axial force	$F_{ax,-}$	N	-1210	-1210	-1210
Max. axial force	$F_{Fax,+}$	N	250	250	250

Forces at medium speed 3500 rpm

Motor			MFXMA									
Size			**063-32**	**063-42**	**071-32**	**071-42**	**080-32**	**080-42**	**090-32**	**100-12**	**100-32**	**112-22**
Bearing service life 10000 h												
Radial force	F_{rad}	N	500	500	610	610	800	800	880	1250	1250	1870
Min. axial force	$F_{ax,-}$	N	-430	-430	-580	-580	-790	-790	-830	-1060	-1060	-1680
Max. axial force	$F_{Fax,+}$	N	270	270	250	250	280	280	310	480	480	700
Bearing service life 20000 h												
Radial force	F_{rad}	N	400	400	490	490	640	640	700	1000	1000	1500
Min. axial force	$F_{ax,-}$	N	-330	-330	-490	-490	-640	-640	-670	-840	-840	-1500
Max. axial force	$F_{Fax,+}$	N	180	180	130	130	130	130	150	250	250	360
Bearing service life 30000 h												
Radial force	F_{rad}	N	350	350	430	430	560	560	610	870	870	1310
Min. axial force	$F_{ax,-}$	N	-290	-290	-430	-430	-570	-570	-600	-740	-740	-1190
Max. axial force	$F_{Fax,+}$	N	140	140	80	80	60	60	70	150	150	200
Bearing service life 50000 h												
Radial force	F_{rad}	N	290	290	360	360	480	480	520	740	740	1110
Min. axial force	$F_{ax,-}$	N	-240	-240	-360	-360	-500	-500	-520	-630	-630	-1030
Max. axial force	$F_{Fax,+}$	N	90	90	30	30	0	0	0	50	50	40

Motor			MFXMA		
Size			**132-12**	**132-22**	**132-32**
Bearing service life 10000 h					
Radial force	F_{rad}	N	2750	2750	2750
Min. axial force	$F_{ax,-}$	N	-1400	-1400	-1400
Max. axial force	$F_{Fax,+}$	N	440	440	440
Bearing service life 20000 h					
Radial force	F_{rad}	N	2200	2200	2200
Min. axial force	$F_{ax,-}$	N	-1100	-1100	-1100
Max. axial force	$F_{Fax,+}$	N	130	130	130
Bearing service life 30000 h					
Radial force	F_{rad}	N	1700	1700	1700
Min. axial force	$F_{ax,-}$	N	-980	-980	-980
Max. axial force	$F_{Fax,+}$	N	20	20	20
Bearing service life 50000 h					
Radial force	F_{rad}	N			
Min. axial force	$F_{ax,-}$	N			
Max. axial force	$F_{Fax,+}$	N			

Application of force at l

Forces at medium speed 2000 rpm

Motor			MFXMA									
Size			**063-32**	**063-42**	**071-32**	**071-42**	**080-32**	**080-42**	**090-32**	**100-12**	**100-32**	**112-22**
Bearing service life 10000 h												
Radial force	F_{rad}	N	400	400	680	680	880	880	940	1350	1350	2040
Min. axial force	$F_{ax,-}$	N	-600	-600	-800	-800	-1090	-1090	-1160	-1490	-1490	-2330
Max. axial force	$F_{Fax,+}$	N	300	300	470	470	580	580	630	910	910	1340
Bearing service life 20000 h												
Radial force	F_{rad}	N	370	370	540	540	700	700	750	1080	1080	1620
Min. axial force	$F_{ax,-}$	N	-480	-480	-630	-630	-860	-860	-920	-1160	-1160	-1830
Max. axial force	$F_{Fax,+}$	N	180	180	300	300	350	350	390	580	580	840
Bearing service life 30000 h												
Radial force	F_{rad}	N	320	320	470	470	610	610	660	940	940	1420
Min. axial force	$F_{ax,-}$	N	-430	-430	-550	-550	-760	-760	-800	-1010	-1010	-1600
Max. axial force	$F_{Fax,+}$	N	120	120	220	220	250	250	280	430	430	610
Bearing service life 50000 h												
Radial force	F_{rad}	N	300	300	400	400	520	520	560	800	800	1210
Min. axial force	$F_{ax,-}$	N	-370	-370	-470	-470	-650	-650	-690	-860	-860	-1360
Max. axial force	$F_{Fax,+}$	N	70	70	140	140	140	140	160	270	270	370

Motor			MFXMA		
Size			**132-12**	**132-22**	**132-32**
Bearing service life 10000 h					
Radial force	F_{rad}	N	3020	3020	3020
Min. axial force	$F_{ax,-}$	N	-2150	-2150	-2150
Max. axial force	$F_{Fax,+}$	N	1190	1190	1190
Bearing service life 20000 h					
Radial force	F_{rad}	N	2420	2420	2420
Min. axial force	$F_{ax,-}$	N	-1670	-1670	-1670
Max. axial force	$F_{Fax,+}$	N	710	710	710
Bearing service life 30000 h					
Radial force	F_{rad}	N	2120	2120	2120
Min. axial force	$F_{ax,-}$	N	-1440	-1440	-1440
Max. axial force	$F_{Fax,+}$	N	480	480	480
Bearing service life 50000 h					
Radial force	F_{rad}	N	1800	1800	1800
Min. axial force	$F_{ax,-}$	N	-1210	-1210	-1210
Max. axial force	$F_{Fax,+}$	N	250	250	250

Forces at medium speed 3500 rpm

Motor			**MFXMA**									
Size			**063-32**	**063-42**	**071-32**	**071-42**	**080-32**	**080-42**	**090-32**	**100-12**	**100-32**	**112-22**
Bearing service life 10000 h												
Radial force	F_{rad}	N	460	460	570	570	730	730	790	1120	1120	1690
Min. axial force	$F_{ax,-}$	N	-410	-410	-560	-560	-750	-750	-790	-1000	-1000	-1600
Max. axial force	$F_{Fax,+}$	N	260	260	230	230	250	250	270	420	420	610
Bearing service life 20000 h												
Radial force	F_{rad}	N	370	370	450	450	580	580	630	900	900	1350
Min. axial force	$F_{ax,-}$	N	-320	-320	-450	-450	-610	-610	-640	-800	-800	-1280
Max. axial force	$F_{Fax,+}$	N	170	170	120	120	100	100	120	210	210	300
Bearing service life 30000 h												
Radial force	F_{rad}	N	320	320	400	400	510	510	550	790	790	1190
Min. axial force	$F_{ax,-}$	N	-280	-280	-400	-400	-550	-550	-570	-700	-700	-1140
Max. axial force	$F_{Fax,+}$	N	130	130	70	70	40	40	50	120	120	150
Bearing service life 50000 h												
Radial force	F_{rad}	N	270	270	330	330				670	670	1000
Min. axial force	$F_{ax,-}$	N	-240	-240	-350	-350				-600	-600	-1000
Max. axial force	$F_{Fax,+}$	N	80	80	20	20				20	20	0

Motor			**MFXMA**		
Size			**132-12**	**132-22**	**132-32**
Bearing service life 10000 h					
Radial force	F_{rad}	N	2520	2520	2520
Min. axial force	$F_{ax,-}$	N	-1300	-1300	-1300
Max. axial force	$F_{Fax,+}$	N	330	330	330
Bearing service life 20000 h					
Radial force	F_{rad}	N	2020	2020	2020
Min. axial force	$F_{ax,-}$	N	-1020	-1020	-1020
Max. axial force	$F_{Fax,+}$	N	60	60	60
Bearing service life 30000 h					
Radial force	F_{rad}	N	1300	1300	1300
Min. axial force	$F_{ax,-}$	N	-960	-960	-960
Max. axial force	$F_{Fax,+}$	N	0	0	0
Bearing service life 50000 h					
Radial force	F_{rad}	N			
Min. axial force	$F_{ax,-}$	N			
Max. axial force	$F_{Fax,+}$	N			

Rated data

Rated data 120 Hz

Motor			MF☐MA☐☐				
			063-32	**063-42**	**071-32**	**071-42**	**080-32**
Rated power	P_{rated}	kW	0.55	0.75	1.1	1.5	2.2
Rated speed	n_{rated}	rpm	3440	3400	3490	3450	3500
Max. speed	n_{max}	rpm	4500	4500	4500	4500	4500
Max. torque	M_{max}	Nm	6.00	8.00	12.0	16.0	24.0
Rated voltage							
Delta	$V_{N, \Delta}$	V	200	210	200	205	200
Star	$V_{N, Y}$	V	345	370	345	360	345
Rated current							
Delta	$I_{N, \Delta}$	A	3.20	4.00	5.50	6.80	9.10
Star	$I_{N, Y}$	A	1.80	2.30	3.20	3.90	5.30
Rated torque	M_{rated}	Nm	1.53	2.11	3.01	4.15	6.00
Power factor	cos ϕ		0.68	0.69	0.77	0.8	0.86
Efficiency							
at 75 % P_{rated}	η		0.750	0.796	0.814	0.828	0.843
at 100 % P_{rated}	η		0.750	0.796	0.814	0.828	0.843
Moment of inertia	J	kgcm²	3.70	3.70	12.8	12.8	28.0
Weight	m	kg	4.40	4.40	6.40	6.40	11.0

Motor			MF☐MA☐☐				
			080-42	**090-32**	**100-12**	**100-32**	**112-22**
Rated power	P_{rated}	kW	3	4	5.5	7.5	11
Rated speed	n_{rated}	rpm	3480	3480	3525	3515	3530
Max. speed	n_{max}	rpm	4500	4500	4500	4500	4500
Max. torque	M_{max}	Nm	32.0	44.0	60.0	80.0	120
Rated voltage							
Delta	$V_{N, \Delta}$	V	210	-	-	-	-
Star	$V_{N, Y}$	V	370	370	340	375	370
Rated current							
Delta	$I_{N, \Delta}$	A	11.4	-	-	-	-
Star	$I_{N, Y}$	A	6.60	8.50	12.9	15.9	23.5
Rated torque	M_{rated}	Nm	8.20	10.9	14.9	20.3	29.7
Power factor	cos ϕ		0.86	0.85	0.81	0.81	0.78
Efficiency							
at 75 % P_{rated}	η		0.855	0.870	0.879	0.889	0.898
at 100 % P_{rated}	η		0.855	0.866	0.877	0.887	0.898
Moment of inertia	J	kgcm²	28.0	32.0	61.0	61.0	107
Weight	m	kg	11.0	18.0	26.5	26.5	38.0

Technical data

Rated data

Rated data 120 Hz

Motor			MF□MA□□		
			132-12	132-22	132-32
Rated power	P_{rated}	kW	15	18.5	22
Rated speed	n_{rated}	rpm	3560	3560	3550
Max. speed	n_{max}	rpm	4500	4500	4500
Max. torque	M_{max}	Nm	160	200	240
Rated voltage					
Delta	$V_{N, \Delta}$	V	-	-	-
Star	$V_{N, Y}$	V	370	360	380
Rated current					
Delta	$I_{N, \Delta}$	A	-	-	-
Star	$I_{N, Y}$	A	31.2	39.0	44.5
Rated torque	M_{rated}	Nm	40.3	49.6	59.2
Power factor	cos φ		0.84	0.84	0.83
Efficiency					
at 75 % P_{rated}	η		0.889	0.899	0.905
at 100 % P_{rated}	η		0.906	0.912	0.916
Moment of inertia	J	kgcm²	336	336	336
Weight	m	kg	66.0	66.0	66.0

Motor – inverter assignment

Rated frequency 120 Hz

Supply voltage 3x 230/240 V

Motor		Frequency inverter				
Rated power	**MF□MA□□**	**i510 cabinet**	**i550 cabinet**	**i550 protec**	**i550 motec**	**8400 motec**
P_{rated}						
kW						
0.55	063-32	i510-C0.55/230-2	i550-C0.55/230-2	i550-P0.55/230-1	i550-M0.55/230-3	-
0.75	063-42	i510-C0.75/230-2	i550-C0.75/120-1	i550-P0.75/230-2	i550-M0.75/230-3	-
1.1	071-32	i510-C1.1/230-2	i550-C1.1/230-2	i550-P1.1/120-1	i550-M1.1/230-3	-
1.5	071-42	i510-C1.5/230-2	i550-C1.5/230-1	i550-P1.5/230-1	i550-M1.5/230-3	-
2.2	080-32	i510-C2.2/230-2	i550-C2.2/230-1	i550-P2.2/230-2	i550-M2.2/230-3	-
3	080-42	i510-C4.0/230-3	i550-C4.0/230-3	i550-P4.0/230-3	i550-M3.0/230-3	-

Supply voltage 3x 400/480 V

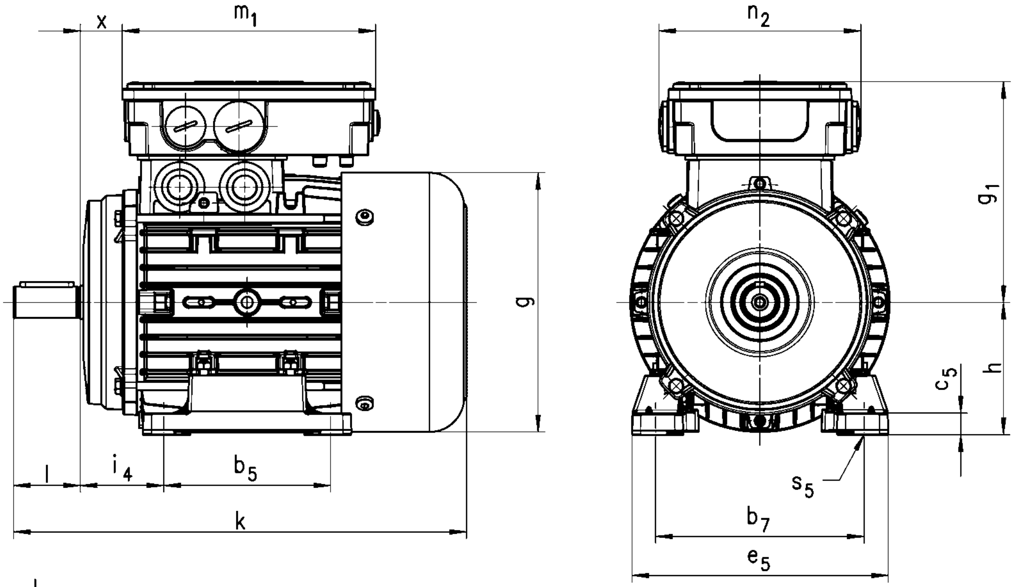
Motor		Frequency inverter				
Rated power	**MF□MA□□**	**i510 cabinet**	**i550 cabinet**	**i550 protec**	**i550 motec**	**8400 motec**
P_{rated}						
kW						
0.55	063-32	i510-C0.55/400-3	i550-C0.55/400-3	i550-P0.55/400-3	i550-M0.55/400-3	E84DVB□5514S□□□2□
0.75	063-42	i510-C0.75/400-3	i550-C0.75/400-3	i550-P0.75/400-3	i550-M0.75/400-3	E84DVB□7514S□□□2□
1.1	071-32	i510-C1.1/400-3	i550-C1.1/400-3	i550-P1.1/400-3	i550-M1.1/400-3	E84DVB□1124S□□□2□
1.5	071-42	i510-C1.5/400-3	i550-C1.5/400-3	i550-P1.5/400-3	i550-M1.5/400-3	E84DVB□1524S□□□2□
2.2	080-32	i510-C2.2/400-3	i550-C2.2/400-3	i550-P2.2/400-3	i550-M2.2/400-3	E84DVB□2224S□□□2□
3	080-42	i510-C3.0/400-3	i550-C3.0/400-3	i550-P3.0/400-3	i550-M3.0/400-3	E84DVB□3024S□□□2□
4	090-32	i510-C4.0/400-3	i550-C4.0/400-3	i550-P4.0/400-3	i550-M4.0/400-3	E84DVB□4024S□□□2□
5.5	100-12	i510-C5.5/400-3	i550-C5.5/400-3	i550-P5.5/400-3	i550-M5.5/400-3	E84DVB□5524S□□□2□
7.5	100-32	i510-C7.5/400-3	i550-C7.5/400-3	i550-P7.5/400-3	i550-M7.5/400-3	E84DVB□7524S□□□2□
11	112-22	i510-C11/400-3	i550-C11/400-3	i550-P11/400-3	i550-M11/400-3	-
15	132-12	-	i550-C15/400-3	i550-P15/400-3	i550-M15/400-3	-
18.5	132-22	-	i550-C18/400-3	i550-P18/400-3	i550-M18/400-3	-
22	132-32	-	i550-C22/400-3	i550-P22/400-3	-	-

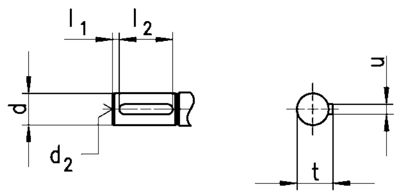
Dimensions

Basic dimensions

Self-ventilated motors

Design B3



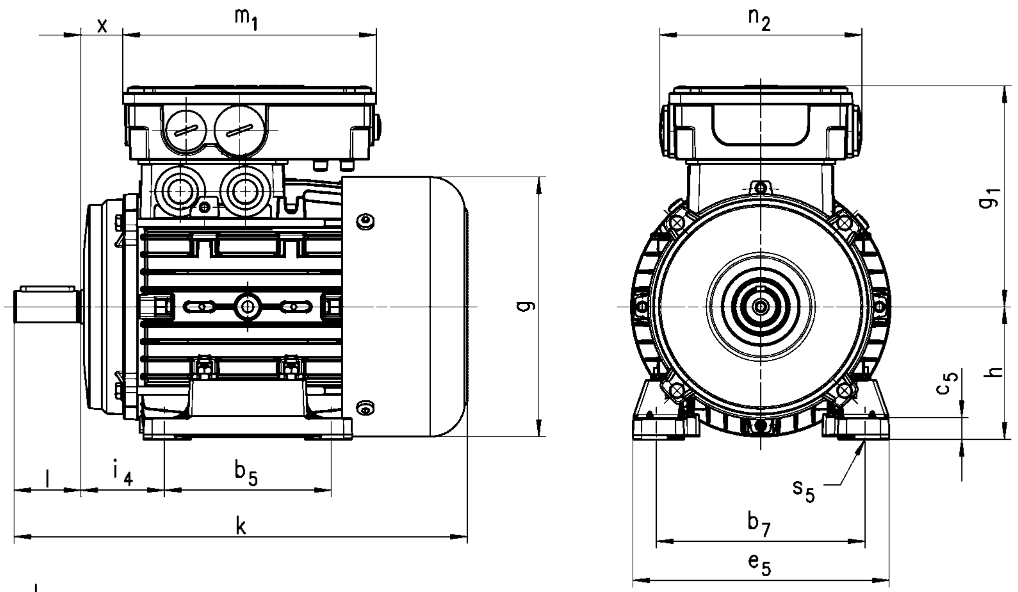


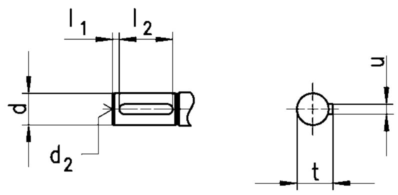
Motor	MFEMAXX	MFEMABR	MFEMARS MFEMAIG MFEMAAG					
	k	k	k	g	g1	x	m1	n2
	mm	mm	mm	mm	mm	mm	mm	mm
063	215	271	271	123	109	17	136	103
071	246	297	297	139	118	24	136	103
080	272	345	369	156	132	25	152	121
090	337	399	418	176	137	29	152	121
100	382	458	463	194	147	36	152	121
112	392	482	472	218	158	38	152	121
132	497	576	599	258	187	51	194	125

Motor	b7	i4	b5	e5	h	c5	s5	d	d	d2	l	l1	l2	t	u
								j6	k6						
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	100	40	80	120	63	10	7.0	11	-	M4	23	3.5	16	12.5	4.0
071	112	45	90	134	71	11	7.0	14	-	M5	30	4.0	22	16.0	5.0
080	125	50	100	154	80	13	10.0	19	-	M6	40	4.0	32	21.5	6.0
090	140	56	125	174	90	13	10.0	24	-	M8	50	5.0	40	27.0	8.0
100	160	63	140	194	100	15	12.0	28	-	M10	60	5.0	50	31.0	8.0
112	190	70	140	223	112	14	12.0	28	-	M10	60	5.0	50	31.0	8.0
132	216	89	178	260	132	16	12.0	-	38	M12	80	5.0	70	41.0	10.0

Self-ventilated motors

Design B3



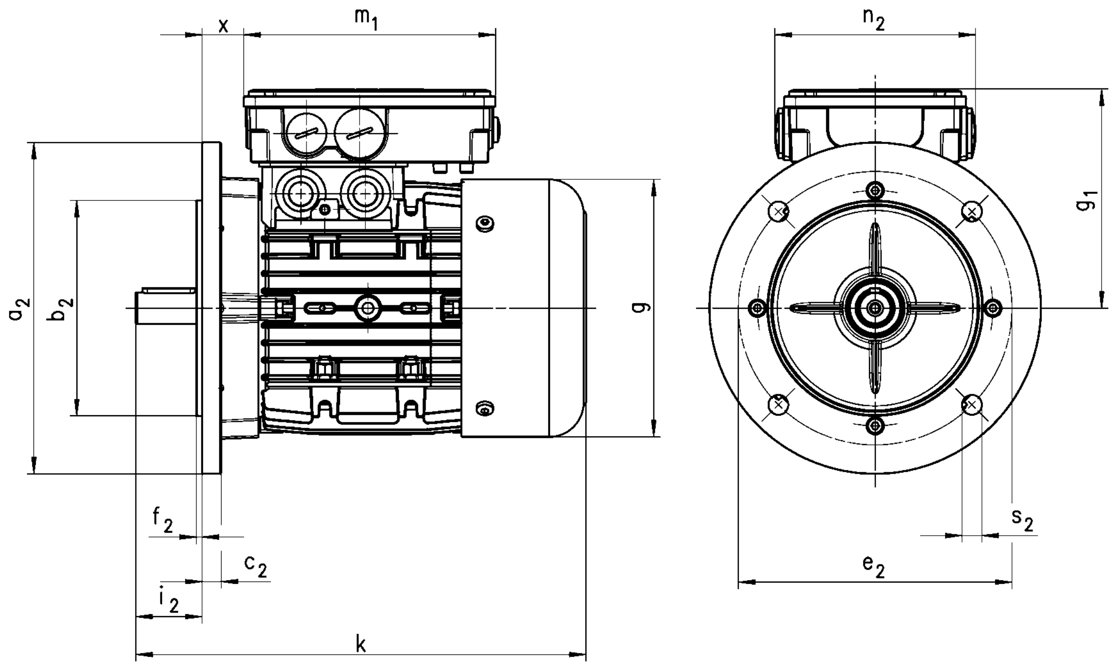


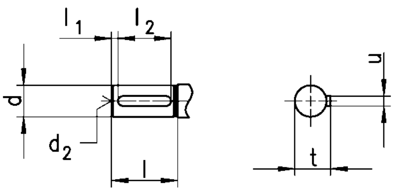
Motor	MFEMABS MFEMABI MFEMABA					
	k	g	g1	x	m1	n2
	mm	mm	mm	mm	mm	mm
063	318	123	109	8	194	125
071	338	139	118	13	194	125
080	383	156	132	21	194	125
090	436	176	137	28	194	125
100	479	194	147	35	194	125
112	512	218	158	37	194	125
132	621	258	187	51	194	125

Motor	b7	i4	b5	e5	h	c5	s5	d	d	d2	l	l1	l2	t	u
								j6	k6						
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	100	40	80	120	63	10	7.0	11	-	M4	23	3.5	16	12.5	4.0
071	112	45	90	134	71	11	7.0	14	-	M5	30	4.0	22	16.0	5.0
080	125	50	100	154	80	13	10.0	19	-	M6	40	4.0	32	21.5	6.0
090	140	56	125	174	90	13	10.0	24	-	M8	50	5.0	40	27.0	8.0
100	160	63	140	194	100	15	12.0	28	-	M10	60	5.0	50	31.0	8.0
112	190	70	140	223	112	14	12.0	28	-	M10	60	5.0	50	31.0	8.0
132	216	89	178	260	132	16	12.0	-	38	M12	80	5.0	70	41.0	10.0

Self-ventilated motors

Design B5



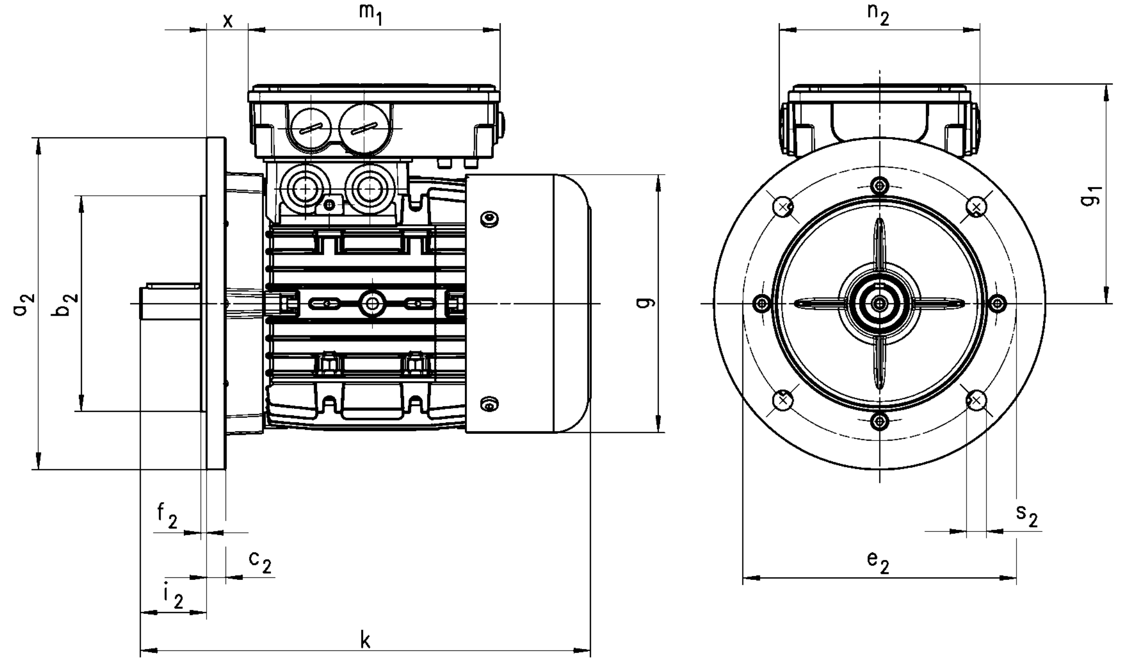


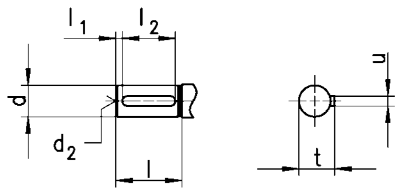
Motor	MFEMAXX	MFEMABR	MFEMARS MFEMAIG MFEMAAG					
	k	k	k	g	g1	x	m1	n2
	mm	mm	mm	mm	mm	mm	mm	mm
063	215	271	271	123	109	17	136	103
071	246	297	297	139	118	24	136	103
080	272	345	369	156	132	25	152	121
090	337	399	418	176	137	29	152	121
100	382	458	463	194	147	36	152	121
112	392	482	472	218	158	38	152	121
132	497	576	599	258	187	51	194	125

Motor	Flange	a2	b2	c2	e2	f2	s2	i2	d	d	d2	l	l1	l2	t	u
			j6					-0.6 ... 0.5	j6	k6						
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	FF115	140	95	10	115	3.0	10.0	23.0	11	-	M4	23	3.5	16	12.5	4.0
071	FF130	160	110	10	130	3.5	10.0	30.0	14	-	M5	30	4.0	22	16.0	5.0
080	FF165	200	130	11	165	3.5	12.0	40.0	19	-	M6	40	4.0	32	21.5	6.0
090	FF165	200	130	11	165	3.5	12.0	50.0	24	-	M8	50	5.0	40	27.0	8.0
100	FF215	250	180	15	215	3.5	12.0	60.0	28	-	M10	60	5.0	50	31.0	8.0
112	FF215	250	180	15	215	4.0	14.5	60.0	28	-	M10	60	5.0	50	31.0	8.0
132	FF265	300	230	20	265	4.0	14.5	80.0	-	38	M12	80	5.0	70	41.0	10.0

Self-ventilated motors

Design B5



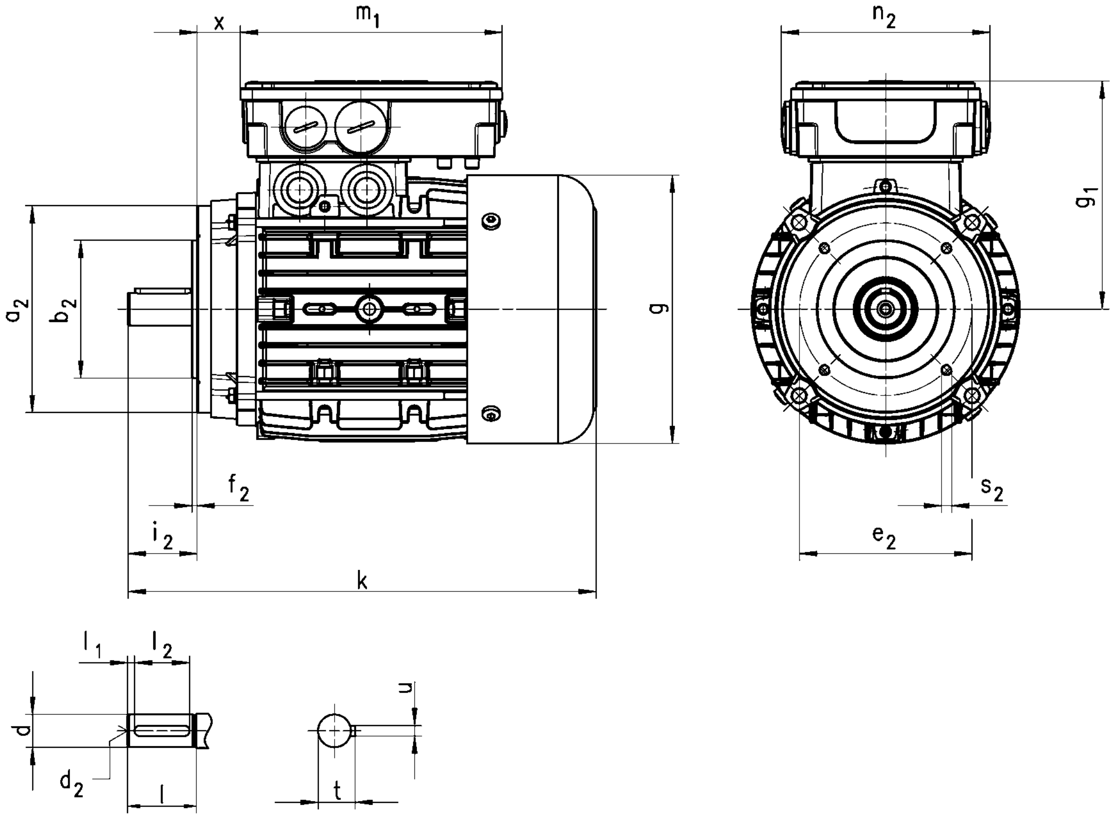


Motor	MFEMABS MFEMABI MFEMABA					
	k	**g**	**g1**	**x**	**m1**	**n2**
	mm	**mm**	**mm**	**mm**	**mm**	**mm**
063	318	123	109	8	194	125
071	338	139	118	13	194	125
080	383	156	132	21	194	125
090	436	176	137	28	194	125
100	479	194	147	35	194	125
112	512	218	158	37	194	125
132	621	258	187	51	194	125

Motor	Flange	a2	b2	c2	e2	f2	s2	i2	d	d	d2	l	l1	l2	t	u
			j6					**-0.6 ... 0.5**	**j6**	**k6**						
		mm	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**	**mm**
063	FF115	140	95	10	115	3.0	10.0	23.0	11	-	M4	23	3.5	16	12.5	4.0
071	FF130	160	110	10	130	3.5	10.0	30.0	14	-	M5	30	4.0	22	16.0	5.0
080	FF165	200	130	11	165	3.5	12.0	40.0	19	-	M6	40	4.0	32	21.5	6.0
090	FF165	200	130	11	165	3.5	12.0	50.0	24	-	M8	50	5.0	40	27.0	8.0
100	FF215	250	180	15	215	3.5	12.0	60.0	28	-	M10	60	5.0	50	31.0	8.0
112	FF215	250	180	15	215	4.0	14.5	60.0	28	-	M10	60	5.0	50	31.0	8.0
132	FF265	300	230	20	265	4.0	14.5	80.0	-	38	M12	80	5.0	70	41.0	10.0

Self-ventilated motors

Design B14

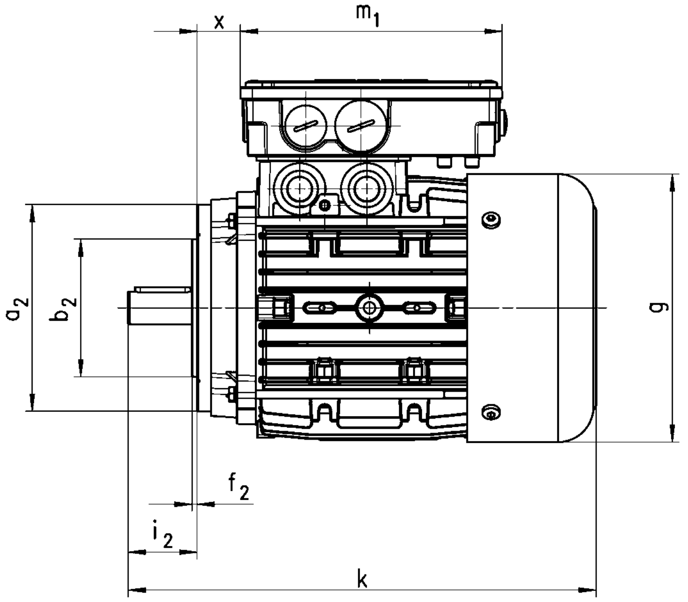


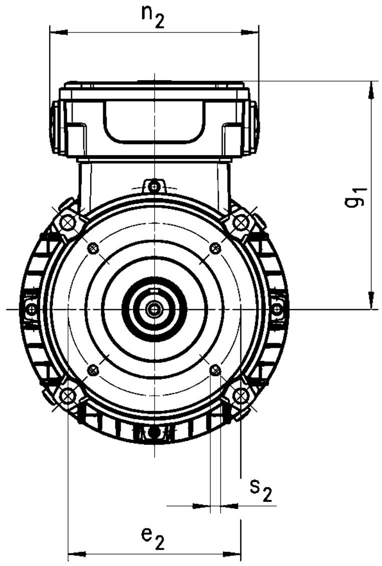
Motor	MFEMAXX	MFEMABR	MFEMARS MFEMAIG MFEMAAG					
	k	k	k	g	g1	x	m1	n2
	mm	mm	mm	mm	mm	mm	mm	mm
063	215	271	271	123	109	17	136	103
071	246	297	297	139	118	24	136	103
080	272	345	369	156	132	25	152	121
090	337	399	418	176	137	29	152	121
100	382	458	463	194	147	36	152	121
112	392	482	472	218	158	38	152	121

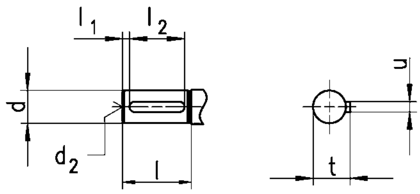
Motor	Flange	a2	b2	e2	f2	s2	i2	d	d2	l	l1	l2	t	u
			j6				-0.6 ... 0.5	j6						
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	FT75	90	60	75	2.5	M5x10	23.0	11	M4	23	3.5	16	12.5	4.0
071	FT85	105	70	85	2.5	M6x10	30.0	14	M5	30	4.0	22	16.0	5.0
080	FT100	120	80	100	3.0	M6x12	40.0	19	M6	40	4.0	32	21.5	6.0
	FT130	160	110	130	3.5	M8x14	40.0							
090	FT115	140	95	115	3.0	M8x16	50.0	24	M8	50	5.0	40	27.0	8.0
	FT130	160	110	130	3.5	M8x16	50.0							
100	FT130	160	110	130	3.5	M8x14	60.0	28	M10	60	5.0	50	31.0	8.0
112	FT130	160	110	130	3.5	M8x16	60.0	28	M10	60	5.0	50	31.0	8.0

Self-ventilated motors

Design B14





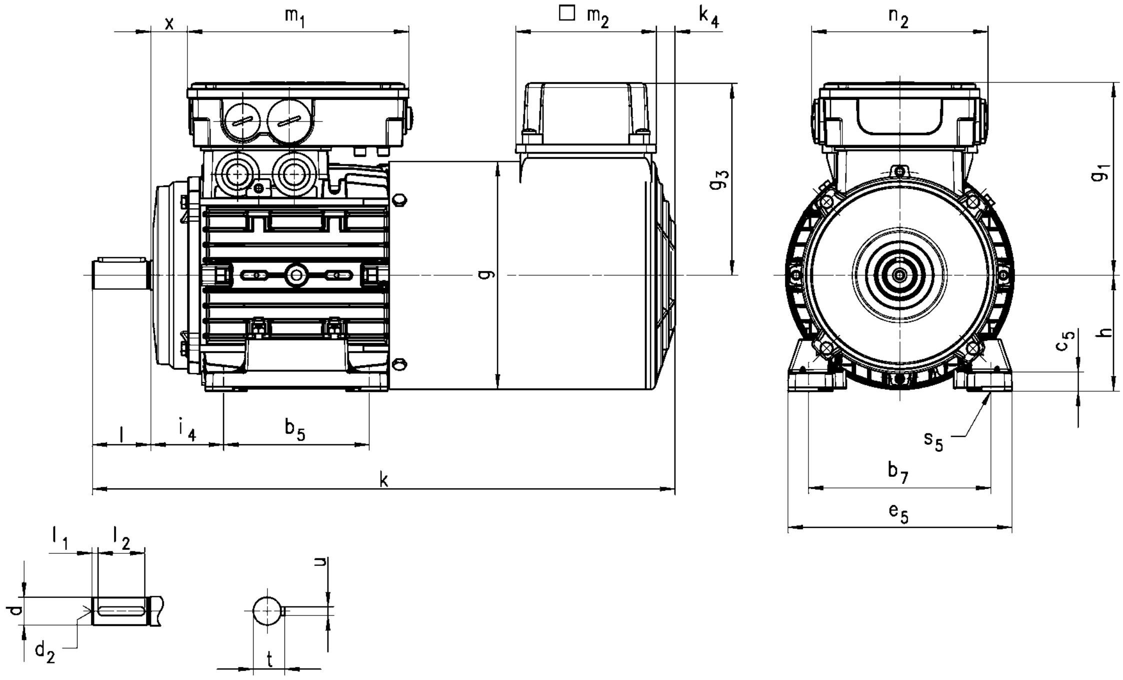


Motor	MFEMABS MFEMABI MFEMABA					
	k	g	g1	x	m1	n2
	mm	mm	mm	mm	mm	mm
063	318	123	109	8	194	125
071	338	139	118	13	194	125
080	383	156	132	21	194	125
090	436	176	137	28	194	125
100	479	194	147	35	194	125
112	512	218	158	37	194	125

Motor	Flange	a2	b2	e2	f2	s2	i2	d	d2	l	l1	l2	t	u
			j6				-0.6 ... 0.5	j6						
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	FT75	90	60	75	2.5	M5x10	23.0	11	M4	23	3.5	16	12.5	4.0
071	FT85	105	70	85	2.5	M6x10	30.0	14	M5	30	4.0	22	16.0	5.0
080	FT100	120	80	100	3.0	M6x12	40.0	19	M6	40	4.0	32	21.5	6.0
	FT130	160	110	130	3.5	M8x14	40.0							
090	FT115	140	95	115	3.0	M8x16	50.0	24	M8	50	5.0	40	27.0	8.0
	FT130	160	110	130	3.5	M8x16	50.0							
100	FT130	160	110	130	3.5	M8x14	60.0	28	M10	60	5.0	50	31.0	8.0
112	FT130	160	110	130	3.5	M8x16	60.0	28	M10	60	5.0	50	31.0	8.0

Forced ventilated motors

Design B3

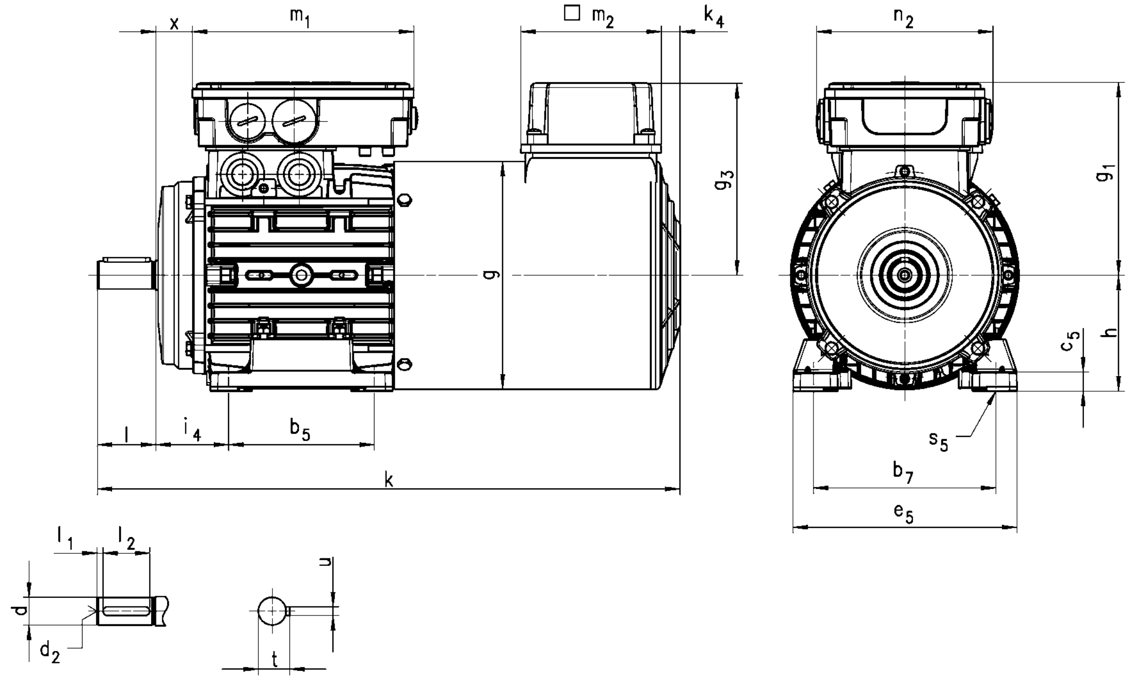


Motor	MFFMAXX	MFFMABR	MFFMARS MFFMAIG MFFMAAG								
	k	k	k	g	g1	x	m1	n2	g3	k4	m2
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	345	385	345	123	109	17	136	103	115	0	105
071	373	410	373	138	118	24	136	103	122	0	105
080	400	455	400	156	132	25	152	121	133	0	105
090	460	512	460	176	137	29	152	121	141	0	105
100	491	552	491	194	147	36	152	121	150	0	105
112	495	575	575	218	158	38	152	121	162	0	105
132	612	698	698	257	187	51	194	125	182	0	105

Motor	b7	i4	b5	e5	h	c5	s5	d	d	d2	l	l1	l2	t	u
								j6	k6						
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	100	40	80	120	63	10	7.0	11	-	M4	23	3.5	16	12.5	4.0
071	112	45	90	134	71	11	7.0	14	-	M5	30	4.0	22	16.0	5.0
080	125	50	100	154	80	13	10.0	19	-	M6	40	4.0	32	21.5	6.0
090	140	56	125	174	90	13	10.0	24	-	M8	50	5.0	40	27.0	8.0
100	160	63	140	194	100	15	12.0	28	-	M10	60	5.0	50	31.0	8.0
112	190	70	140	223	112	14	12.0	28	-	M10	60	5.0	50	31.0	8.0
132	216	89	178	260	132	16	12.0	-	38	M12	80	5.0	70	41.0	10.0

Forced ventilated motors

Design B3

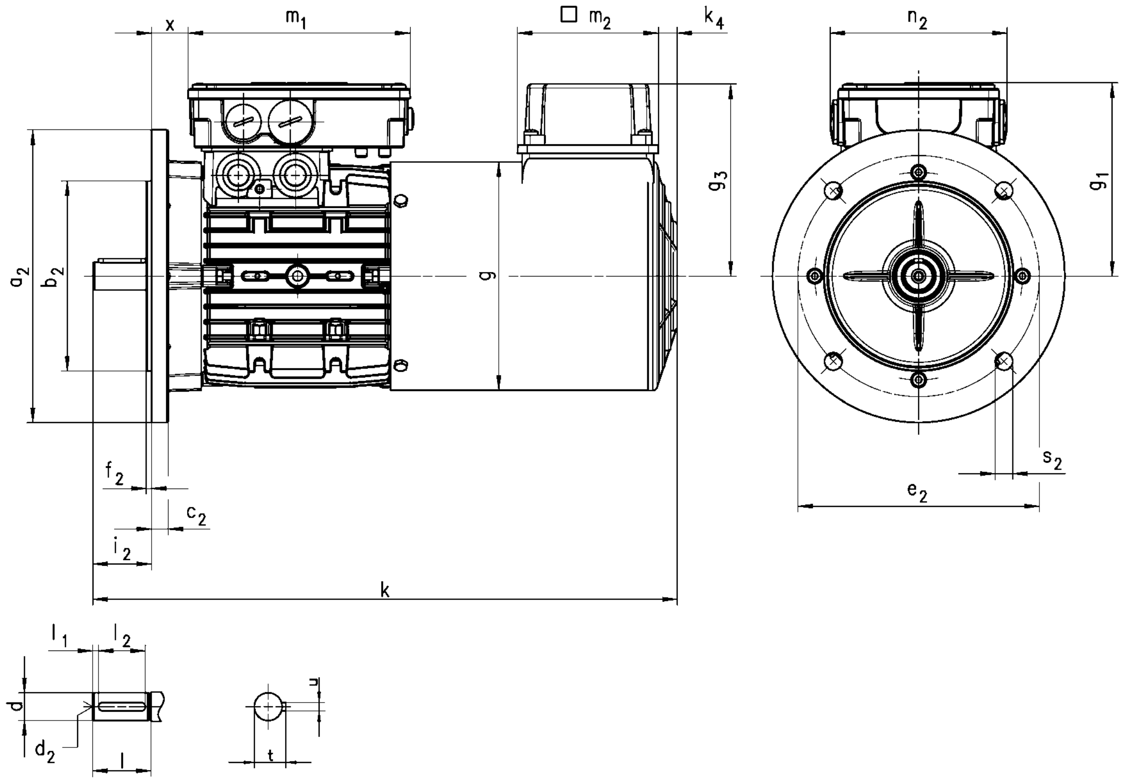


Motor	MFFMABS MFFMABI MFFMABA								
	k	g	g1	x	m1	n2	g3	k4	m2
	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	385	123	109	8	194	125	115	0	105
071	410	138	118	13	194	125	122	0	105
080	455	156	132	21	194	125	133	0	105
090	512	176	137	28	194	125	141	0	105
100	552	194	147	35	194	125	150	0	105
112	575	218	158	37	194	125	162	0	105
132	698	257	187	51	194	125	182	0	105

Motor	b7	i4	b5	e5	h	c5	s5	d	d	d2	l	l1	l2	t	u
								j6	k6						
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	100	40	80	120	63	10	7.0	11	-	M4	23	3.5	16	12.5	4.0
071	112	45	90	134	71	11	7.0	14	-	M5	30	4.0	22	16.0	5.0
080	125	50	100	154	80	13	10.0	19	-	M6	40	4.0	32	21.5	6.0
090	140	56	125	174	90	13	10.0	24	-	M8	50	5.0	40	27.0	8.0
100	160	63	140	194	100	15	12.0	28	-	M10	60	5.0	50	31.0	8.0
112	190	70	140	223	112	14	12.0	28	-	M10	60	5.0	50	31.0	8.0
132	216	89	178	260	132	16	12.0	-	38	M12	80	5.0	70	41.0	10.0

Forced ventilated motors

Design B5

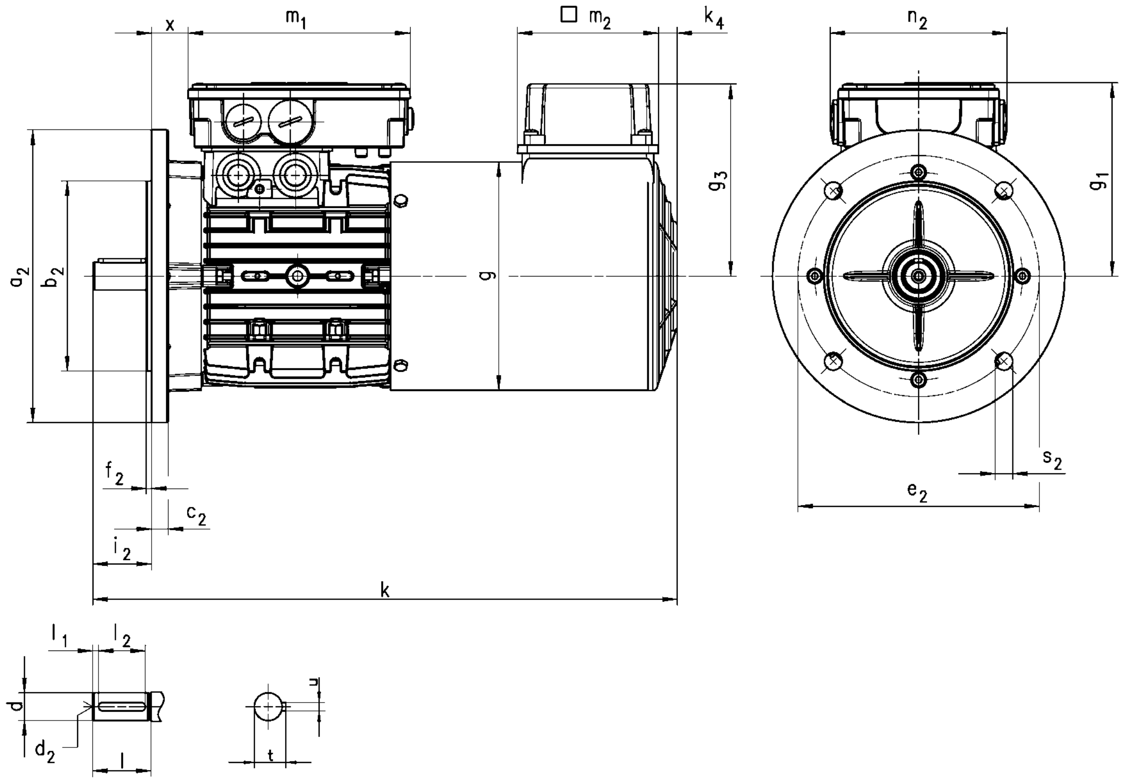


Motor	MFFMAXX	MFFMABR	MFFMARS MFFMAIG MFFMAAG								
	k	k	k	g	g1	x	m1	n2	g3	k4	m2
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	345	385	345	123	109	17	136	103	115	0	105
071	373	410	373	138	118	24	136	103	122	0	105
080	400	455	400	156	132	25	152	121	133	0	105
090	460	512	460	176	137	29	152	121	141	0	105
100	491	552	491	194	147	36	152	121	150	0	105
112	495	575	575	218	158	38	152	121	162	0	105
132	612	698	698	257	187	51	194	125	182	0	105

Motor	Flange	a2	b2	c2	e2	f2	s2	i2	d	d	d2	l	l1	l2	t	u
			j6					-0.6 ... 0.5	j6	k6						
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	FF115	140	95	10	115	3.0	10.0	23.0	11	-	M4	23	3.5	16	12.5	4.0
071	FF130	160	110	10	130	3.5	10.0	30.0	14	-	M5	30	4.0	22	16.0	5.0
080	FF165	200	130	11	165	3.5	12.0	40.0	19	-	M6	40	4.0	32	21.5	6.0
090	FF165	200	130	11	165	3.5	12.0	50.0	24	-	M8	50	5.0	40	27.0	8.0
100	FF215	250	180	15	215	3.5	12.0	60.0	28	-	M10	60	5.0	50	31.0	8.0
112	FF215	250	180	15	215	4.0	14.5	60.0	28	-	M10	60	5.0	50	31.0	8.0
132	FF265	300	230	20	265	4.0	14.5	80.0	-	38	M12	80	5.0	70	41.0	10.0

Forced ventilated motors

Design B5

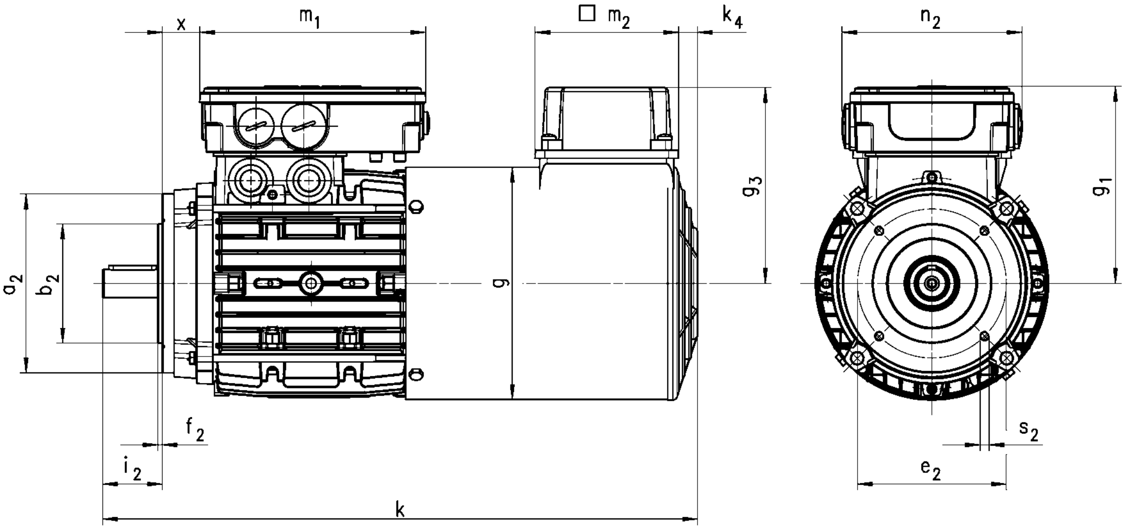


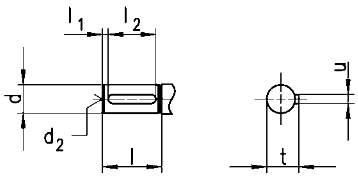
Motor	MFFMABS MFFMABI MFFMABA								
	k	g	g1	x	m1	n2	g3	k4	m2
	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	385	123	109	8	194	125	115	0	105
071	410	138	118	13	194	125	122	0	105
080	455	156	132	21	194	125	133	0	105
090	512	176	137	28	194	125	141	0	105
100	552	194	147	35	194	125	150	0	105
112	575	218	158	37	194	125	162	0	105
132	698	257	187	51	194	125	182	0	105

Motor	Flange	a2	b2	c2	e2	f2	s2	i2	d	d	d2	l	l1	l2	t	u
			j6					-0.6 ... 0.5	j6	k6						
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	FF115	140	95	10	115	3.0	10.0	23.0	11	-	M4	23	3.5	16	12.5	4.0
071	FF130	160	110	10	130	3.5	10.0	30.0	14	-	M5	30	4.0	22	16.0	5.0
080	FF165	200	130	11	165	3.5	12.0	40.0	19	-	M6	40	4.0	32	21.5	6.0
090	FF165	200	130	11	165	3.5	12.0	50.0	24	-	M8	50	5.0	40	27.0	8.0
100	FF215	250	180	15	215	3.5	12.0	60.0	28	-	M10	60	5.0	50	31.0	8.0
112	FF215	250	180	15	215	4.0	14.5	60.0	28	-	M10	60	5.0	50	31.0	8.0
132	FF265	300	230	20	265	4.0	14.5	80.0	-	38	M12	80	5.0	70	41.0	10.0

Forced ventilated motors

Design B14



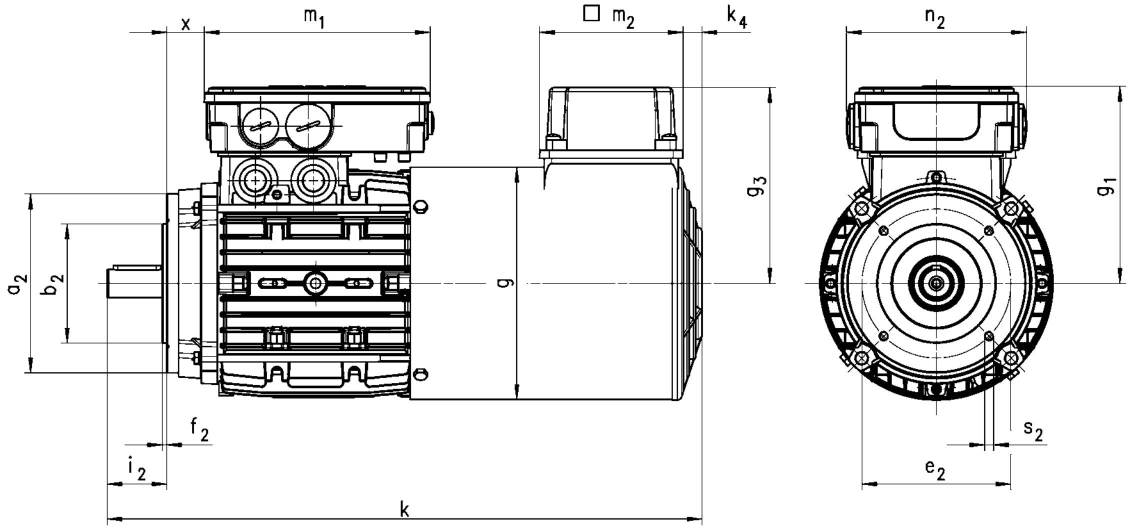


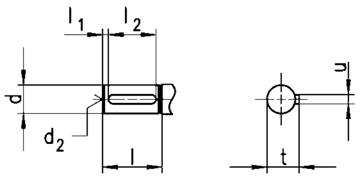
Motor	MFFMAXX	MFFMABR	MFFMARS MFFMAIG MFFMAAG								
	k	k	k	g	g1	x	m1	n2	g3	k4	m2
	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	345	385	345	123	109	17	136	103	115	0	105
071	373	410	373	138	118	24	136	103	122	0	105
080	400	455	400	156	132	25	152	121	133	0	105
090	460	512	460	176	137	29	152	121	141	0	105
100	491	552	491	194	147	36	152	121	150	0	105
112	495	575	575	218	158	38	152	121	162	0	105

Motor	Flange	a2	b2	e2	f2	s2	i2	d	d2	l	l1	l2	t	u
			j6				-0.6 ... 0.5	j6						
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	FT75	90	60	75	2.5	M5x10	23.0	11	M4	23	3.5	16	12.5	4.0
071	FT85	105	70	85	2.5	M6x10	30.0	14	M5	30	4.0	22	16.0	5.0
080	FT100	120	80	100	3.0	M6x12	40.0	19	M6	40	4.0	32	21.5	6.0
	FT130	160	110	130	3.5	M8x14	40.0							
090	FT115	140	95	115	3.0	M8x16	50.0	24	M8	50	5.0	40	27.0	8.0
	FT130	160	110	130	3.5	M8x16	50.0							
100	FT130	160	110	130	3.5	M8x14	60.0	28	M10	60	5.0	50	31.0	8.0
112	FT130	160	110	130	3.5	M8x16	60.0	28	M10	60	5.0	50	31.0	8.0

Forced ventilated motors

Design B14





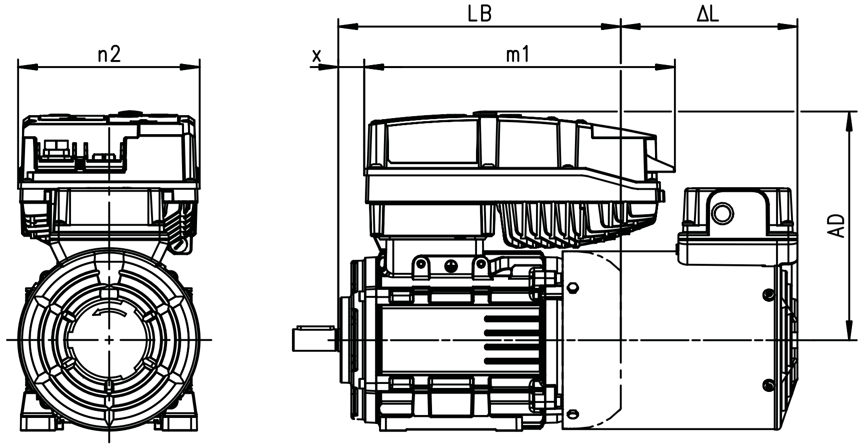
Motor	MFFMABS MFFMABI MFFMABA								
	k	g	g1	x	m1	n2	g3	k4	m2
	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	385	123	109	8	194	125	115	0	105
071	410	138	118	13	194	125	122	0	105
080	455	156	132	21	194	125	133	0	105
090	512	176	137	28	194	125	141	0	105
100	552	194	147	35	194	125	150	0	105
112	575	218	158	37	194	125	162	0	105

Motor	Flange	a2	b2	e2	f2	s2	i2	d	d2	l	l1	l2	t	u
			j6				-0.6 ... 0.5	j6						
		mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm	mm
063	FT75	90	60	75	2.5	M5x10	23.0	11	M4	23	3.5	16	12.5	4.0
071	FT85	105	70	85	2.5	M6x10	30.0	14	M5	30	4.0	22	16.0	5.0
080	FT100	120	80	100	3.0	M6x12	40.0	19	M6	40	4.0	32	21.5	6.0
	FT130	160	110	130	3.5	M8x14	40.0							
090	FT115	140	95	115	3.0	M8x16	50.0	24	M8	50	5.0	40	27.0	8.0
	FT130	160	110	130	3.5	M8x16	50.0							
100	FT130	160	110	130	3.5	M8x14	60.0	28	M10	60	5.0	50	31.0	8.0
112	FT130	160	110	130	3.5	M8x16	60.0	28	M10	60	5.0	50	31.0	8.0

Integrated inverters

i550 motec

Supply voltage 3x 230/240 V



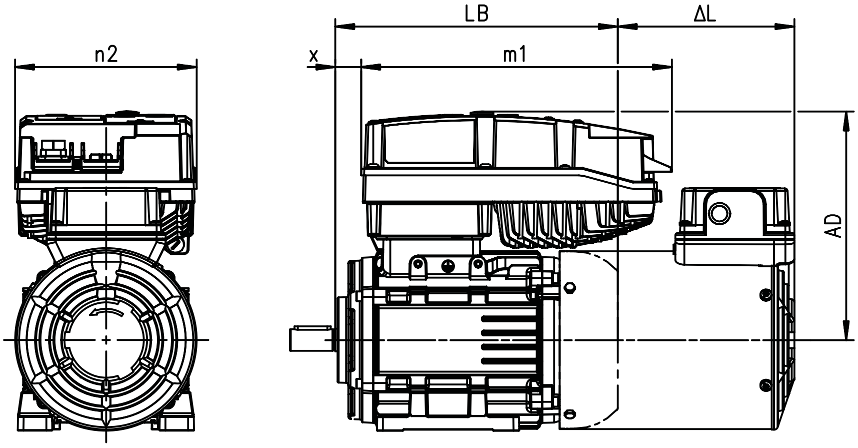
8801671-1

Rated frequency 120 Hz

Motor	Frequency inverter				
MF☐MA☐☐	i550 motec				
		g_1	m_1	n_2	x
		mm	mm	mm	mm
063-32	i550-M0.55/230-3	180	265	159	3
063-42	i550-M0.75/230-3	180	265	159	3
071-32	i550-M1.1/230-3	188	265	159	12
071-42	i550-M1.5/230-3	188	265	159	12
080-32	i550-M2.2/230-3	215	265	159	19
080-42	i550-M3.0/230-3	215	265	159	19

i550 motec

Supply voltage 3x 400/480 V



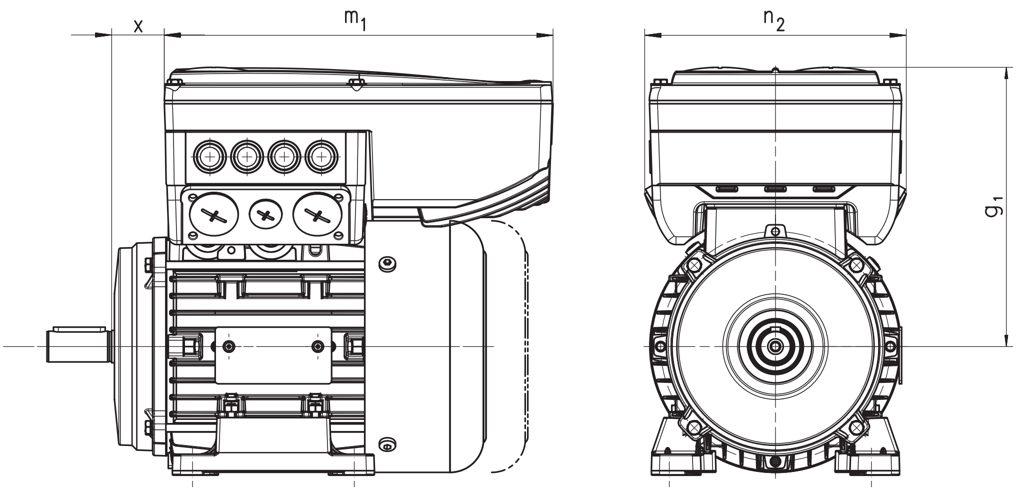
8801671-1

Rated frequency 120 Hz

Motor	Frequency inverter				
MF□MA□□	**i550 motec**				
		g_1	**m_1**	**n_2**	**x**
		mm	**mm**	**mm**	**mm**
063-32	i550-M0.55/400-3	180	265	159	3
063-42	i550-M0.75/400-3	180	265	159	3
071-32	i550-M1.1/400-3	188	265	159	12
071-42	i550-M1.5/400-3	188	265	159	12
080-32	i550-M2.2/400-3	197	265	159	19
080-42	i550-M3.0/400-3	215	265	159	19
090-32	i550-M4.0/400-3	228	265	159	23
100-12	i550-M5.5/400-3	228	265	159	30
100-32	i550-M7.5/400-3	256	359	211	30
112-22	i550-M11/400-3	256	359	211	32
132-12	i550-M15/400-3	337	443	280	2
132-22	i550-M18/400-3	337	443	280	2

8400 motec

Supply voltage 3x 400/480 V



Rated frequency 120 Hz

Motor	Frequency inverter				
MF☐MA☐☐	8400 motec				
		g_1	m_1	n_2	x
		mm	mm	mm	mm
063-32	E84DVB☐5514S☐☐☐2☐	154	240	161	23.5
063-42	E84DVB☐7514S☐☐☐2☐	154	240	161	23.5
071-32	E84DVB☐1124S☐☐☐2☐	163	240	161	29.5
071-42	E84DVB☐1524S☐☐☐2☐	163	240	161	29.5
080-32	E84DVB☐2224S☐☐☐2☐	201	260	176	31.5
080-42	E84DVB☐3024S☐☐☐2☐	201	260	176	31.5
090-32	E84DVB☐4024S☐☐☐2☐	261	325	195	23.5
100-12	E84DVB☐5524S☐☐☐2☐	272	325	195	30
100-32	E84DVB☐7524S☐☐☐2☐	272	325	195	30

Weights

Basic weights

The basic weights are listed in the rated data.

▶ Rated data 📖 37

Observe ▶ Additional weights 📖 55!

Additional weights

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

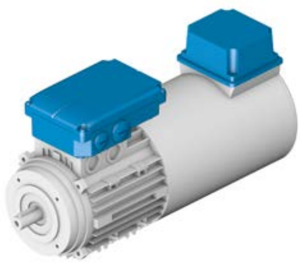
Product extensions

Motor connection

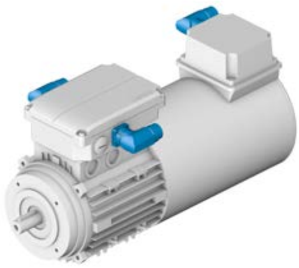
Connection options

The motor are equipped with a terminal box by default.

Alternatively, different connectors can be selected for fast commissioning or maintenance.



Terminal box with cable gland



Terminal box with ICN connector

HAN connector

Frequency inverter operation

For frequency inverter operation, the base frequencies were set to the following rated voltages:

Rated frequency	Motor	Power	Rated voltage	Circuit
Hz		kW	V	
120	MF☐MA☐☐063-32 ... MF☐MA☐☐080-32	0.55 ... 3.0	200	Δ
	MF☐MA☐☐080-42 ... MF☐MA☐☐132-32	4.0 ... 22.0	350	Y

Assignment of the terminal boxes

Assignment of the terminal boxes with temperature monitoring

Motor	MF☐MA☐☐						
	063-32	071-32	080-32	090-32	100-12	112-22	132-12
	063-42	071-42	080-42		100-32		132-22
							132-32
Without product extensions							
Terminal box	KK2	KK2	KK2	KK2	KK2	KK2	KK3
ICN connector							
Power	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23	-	-
Terminal box	KK2	KK2	KK2	KK2	KK2	-	-
Product extension - brake							
Terminal box	KK2	KK2	KK2	KK2	KK2	KK2	KK3
ICN connector							
Power/brake	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23	-	-
Terminal box	KK2	KK2	KK2	KK2	KK2	-	-
Product extension - feedback							
Terminal box	KK2	KK2	KK2	KK2	KK2	KK2	KK3
ICN connector							
Power/brake	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23	-	-
Feedback	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23	-	-
Terminal box	KK2	KK2	KK2	KK2	KK2	-	-
Product extension - brake + feedback							
Terminal box	KK3	KK3	KK3	KK3	KK3	KK3	KK3
ICN connector							
Power/brake	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23	-	-
Feedback	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23	ICN-M23
Terminal box	KK2	KK2	KK2	KK2	KK2	KK2	KK3
Product extension - blower							
Terminal box	●	●	●	●	●	●	●
Power connector	ICN-M17	ICN-M17	ICN-M17	ICN-M17	ICN-M17	ICN-M17	ICN-M17

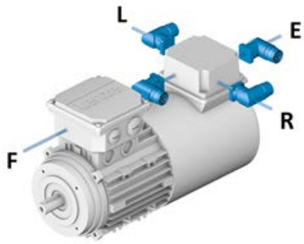
Assignment of the terminal boxes with two temperature monitors

Motor	MF☐MA☐☐						
	063-32	071-32	080-32	090-32	100-12	112-22	132-12
	063-42	071-42	080-42		100-32		132-22
							132-32
Without product extensions							
Terminal box	KK2	KK2	KK2	KK2	KK2	KK2	KK3
Product extension - brake							
Terminal box	KK2	KK2	KK2	KK2	KK2	KK2	KK3
Product extension - feedback							
Terminal box	KK2	KK2	KK2	KK2	KK2	KK2	KK3
Product extension - brake + feedback							
Terminal box	KK3	KK3	KK3	KK3	KK3	KK3	KK3

Positions of the connectors

Positions on the motor terminal box

Positions on the blower terminal box



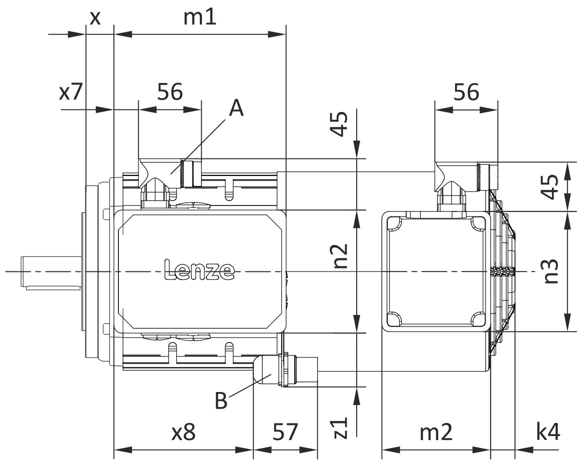
Terminal box	Positions	Note
Motor terminal box KK2		
Cable glands	L and R	-
ICN connector: Power/brake	L or R	-
ICN connector: Feedback	L or R	The feedback connector is mounted on the terminal box via a plate and is located opposite the power connector.
Motor terminal box KK3		
Cable glands	L and R	-
ICN connector: Feedback	L or R	The feedback connector is mounted on the terminal box via a plate.
Blower terminal box		
Cable glands	L, E or R	-
ICN connector	L, E or R	--

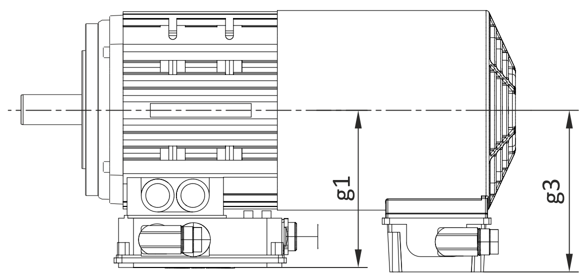
Dimensions of KK2/KK3 power terminal box with ICN connector

Power/brake connection: Position A.

Feedback connection: Position B.

For the motors MF☐MA☐☐112-22 ... 132-32 only the connector for the feedback connection is available! The connection for power/brake is made via cable glands.





Motor		MF☐MA☐☐						
		063-32	071-32	080-32	090-32	100-12	112-22	132-12
		063-42	071-42	080-42		100-32		132-22
								132-32
Motor terminal box		KK2	KK2	KK2	KK2	KK2	KK2	KK3
g1	mm	107	118	132	137	147	158	187
x	mm	17	24	25	29	36	38	51
m1	mm	136	136	152	152	152	152	195
n2	mm	103	103	121	121	121	121	125
x7	mm	16	16	23	23	23	-	-
x8	mm	109	109	125	125	125	125	166
z1, max	mm	43	43	41	41	41	41	71
Blower terminal box								
g3	mm	115	122	133	141	150	162	182
k4	mm	0	0	0	0	0	0	0
m2	mm	105	105	105	105	105	105	105
n3	mm	105	105	105	105	105	105	105

Assignment of the connectors HAN

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

The designs HAN 10E or HAN modular with two power modules (16 A or 40 A) are available.

> The HAN 10E connector is only available for motors with the connection method Y/Δ.
>
> An additional rectifier can be connected with HAN modular.

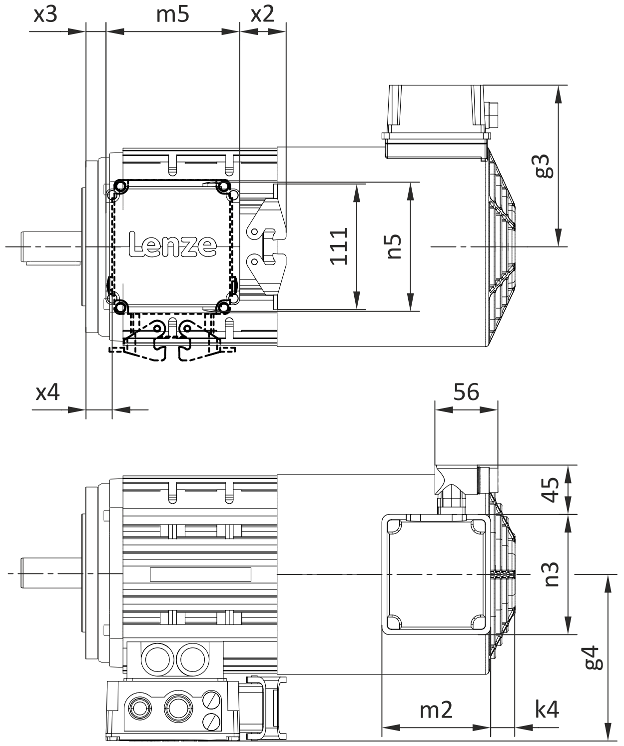
> Feedback in conjunction with the HAN plug connector or the integrated i550 motec and 8400 motec is only available with the IG128-24V-H add-on incremental encoder (with 0.5 m cable and M12 plug connector).

Motor	**MF☐MA☐☐**						
	063-32	**071-32**	**080-32**	**090-32**	**100-12**	**112-22**	**132-12**
	063-42	**071-42**	**080-42**		**100-32**		**132-22**
HAN 10E connector							
Connection: • Power • Brake • Temperature monitoring TK0 or PT1000	•	•	•	•	•	-	-
HAN modular connector							
Connection: • Power • Brake • Temperature monitoring TK0 or PT1000	•	•	•	•	•	-	•

Positions of the connections

HAN connector positions

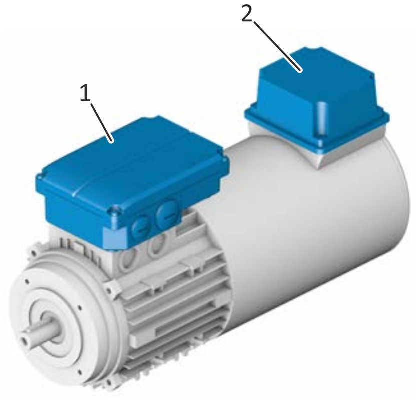
Dimensions of HAN connector



Motor		MF☐MA☐☐						
		063-32	**071-32**	**080-32**	**090-32**	**100-12**	**112-22**	**132-12**
		063-42	**071-42**	**080-42**		**100-32**		**132-22**
HAN connector Power/brake								
g4	mm	120	129	138	143	157	-	233
x3	mm	11	16	18	22	29	-	48
x4	mm	12	17	26	30	37	-	18
x2	mm	41	41	41	41	41	-	47
m5	mm	118	118	118	118	118	-	120
n5	mm	102	102	102	102	102	-	180
Blower terminal box								
g3	mm	115	122	133	141	150	-	182
k4	mm	0	0	0	0	0	-	0
m2	mm	105	105	105	105	105	-	105
n3	mm	105	105	105	105	105	-	105

Connection via terminal box

Position of the connections

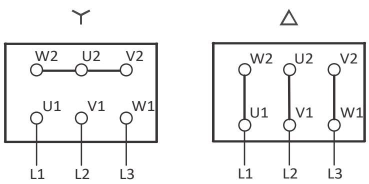


Position	Meaning	Note
1	Power connection Brake connection PE connection Feedback connection Connection of temperature monitoring	
2	Blower connection	When ordering, specify the mounting position of the terminal box: • Shown here: "T" • "L", "R" or "B" If required, the terminal box can be rotated step by step by 90 ° after loosening the screws in the terminal box.

Power connection

Bridge arrangement

Y/Δ circuit

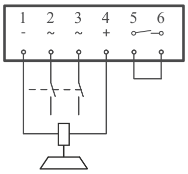


Terminal box, power		
Contact	**Name**	**Meaning**
PE	PE	PE conductor
U1	L1	Motor winding phase
V1	L2	
W1	L3	

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

Feedback connection

Resolver		
Contact	**Name**	**Meaning**
B1	+Ref	Transformer windings (reference windings)
B2	-Ref	
B3	+VCC ETS	Power supply: electronic nameplate (Only for model with electronic nameplate ETS)
B4	+COS	Cosine stator winding
B5	-COS	
B6	+SIN	Sine stator winding
B7	-SIN	
B8		Not assigned

Incremental encoder HTL/TTL		
Contact	**Name**	**Meaning**
+	+ UB	Supply +
-	GND	Mass
A	A/+COS	Track A / + COS
A¯	A¯/Ref COS	Track A inverse / - COS
B	B/+SIN	Track B / + SIN
B¯	B¯/Ref SIN	Track B inverse/-SIN
0	0	Zero track / + RS485
0¯	0¯	Zero track inverse / - RS485

Incremental encoder SinCos absolute value encoder with Hiperface©		
Contact	**Designation**	**Meaning**
B1	+ UB	Supply +
B2	GND	Mass
B3	A	Track A/+COS
B4	A¯	Track A inverse/-COS
B5	B	Track B/+SIN
B6	B¯	Track B inverse/-SIN
B7	Z	Zero track/+RS485
B8	Z¯	Zero track inverse/-RS485
B10		Incremental encoder shield

Connection of temperature monitoring

Contact	Name	Meaning
TB1		Thermal contact TCO
TB2		
1TP1		PTC thermistor 150
1TP2		
2TP1		PTC thermistor 130
2TP2		
R1	+	Thermal detectors PT1000 +
R2	-	Thermal detectors PT1000 -

Blower connection

1-phase		
Contact	**Name**	**Meaning**
PE	PE	PE conductor
U1	L1	Mains connection
U2	N	

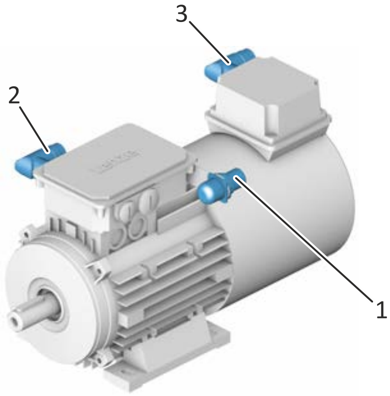
three-phase			
Contact	**Name**	**Meaning**	**Note**
PE	PE	PE conductor	
U1	L1	Mains connection	Pay attention to the direction of rotation! Swap L1 and L2 if the direction of rotation is incorrect.
V1	L2		
W1	L3		

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

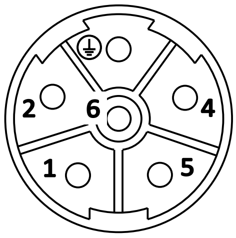


Position	Meaning	Note
1	ICN-M23 connector, 6-pole • Power connection • Brake connection • PE connection	When ordering, specify the mounting position of the connector: • Shown here: "T" • Opposite "L
	In addition to connector ICN-M23, 8-pole: • Connection of TKO temperature monitoring	Caution: Max. brake supply voltage ≤ 230 V
2	ICN-M23 connector • Feedback connection • Connection of PT1000 temperature sensor	The mounting position of the feedback connector is located on the opposite side from the power connection (position L/R).
3	ICN-M17 connector • Blower connection	When ordering, specify the mounting position of the terminal box: • Shown here: "T" • L, R or B If required, the terminal box can be rotated step by step by 90 ° after loosening the screws in the terminal box.

Power and brake connection

ICN-M23 connector assignment

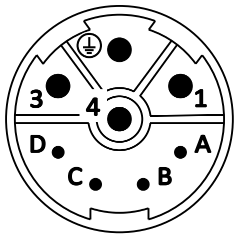
6-pole



M23 6-pole		
Contact	**Name**	**Meaning**
1	BD1	DC +/AC brake
2	BD2	DC -/AC brake
PE	PE	PE conductor
4	U	Power phase U
5	V	Power phase V
6	W	Power phase W

ICN-M23 connector assignment

8-pole

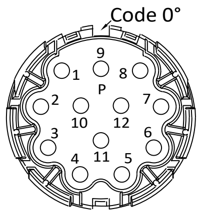


M23 8-pole		
Contact	**Name**	**Meaning**
1	U	Power phase U
PE	PE	PE conductor
3	W	Power phase W
4	V	Power phase V
A	TB1	Temperature monitoring: TCO
B	TB2	Temperature monitoring: TCO
C	BD1 / BA1	Brake DC +/AC ≤ 230 V
D	BD2 / BA2	Brake DC-/AC ≤ 230V

Feedback and temperature monitoring connection

ICN-M23 connector assignment

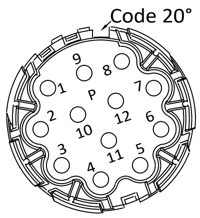
Resolver



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	+	Temperature monitoring: PT1000
12	-	Temperature monitoring: PT1000

ICN-M23 connector assignment

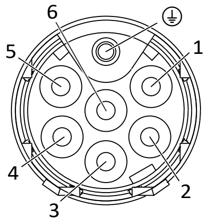
Incremental and SinCos absolute value encoder Hiperface©



ICN M23 for encoders		
Contact	**Name**	**Meaning**
1	B	Track B / +SIN
2	$\overline{A}$	Track A inverse /-COS
3	A	Track A / + COS
4	+UB	Supply +
5	GND	Mass
6	$\overline{Z}$	Zero track inverse /-RS485
7	Z	Zero track / + RS485
8		Not assigned
9	$\overline{B}$	Track B inverse/-SIN
10		Not assigned
11	+	Temperature monitoring: PT1000
12	-	Temperature monitoring: PT1000

Blower

Pin assignment ICN-M17

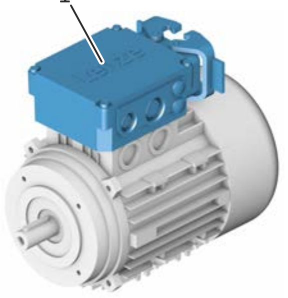


M17 for blowers 1-ph		
Contact	**Name**	**Meaning**
PE	PE	PE conductor
1	U1	Fan
2	U2	Fan
3		Not assigned
4		Not assigned
5		Not assigned
6		Not assigned

M17 for blowers 3-ph		
Contact	**Name**	**Meaning**
PE	PE	PE conductor
1	U	Power phase U
2		Not assigned
3	V	Power phase V
4		Not assigned
5		Not assigned
6	W	Power phase W

Connection via HAN connector

Position of the connections



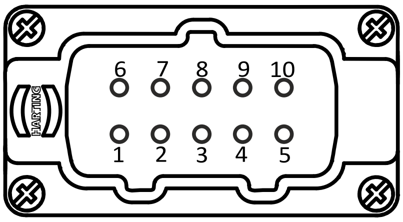
Note	Meaning
1	Power connection Brake connection PE connection Connection of temperature monitoring
	Additionally for HAN-Modular: • Rectifier connection

HAN 10E connector

The motor connection is specified in the counter plug.

The connector is only suitable for motors with the connection method Y/Δ.

HAN 10E connector assignment



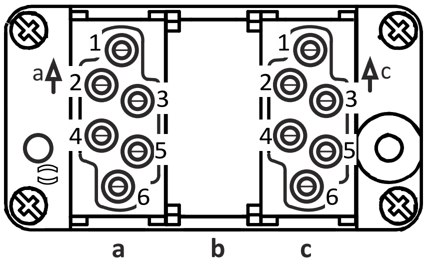
Bridge arrangement in the HAN 10E mating connector		
Contact	**Name**	**Meaning**
6-7-8	Y	Connection
1-6 2-7 3-8	Δ	

HAN 10 E		
Contact	**Name**	**Meaning**
1	U1	Motor winding phase
2	V1	
3	W1	
4	+/AC	Brake
5	-/AC	
6	W2	Motor winding phase
7	U2	
8	V2	
9	TKO/+PT1000	Temperature monitoring
10	TKO/-PT1000	

HAN modular connector

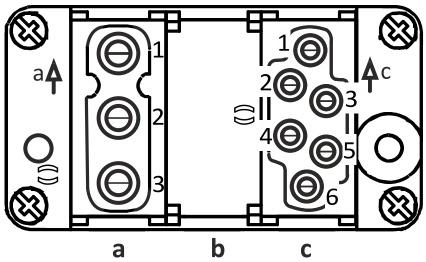
The motor connection is specified in the terminal box.

HAN modular 16 A pin 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/+PT1000	Temperature monitoring
	2	+/AC	Brake
	3	-/AC	
	4	Schaltkontakt	Rectifier
	5		
	6	TKO/-PT1000	Temperature monitoring

HAN modular 40 A pin assignment

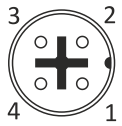


HAN modular 40 A			
Module	**Contact**	**Name**	**Meaning**
a	1	U1	Motor winding phase
	2	V1	
	3	W1	
b			Blank module
c	1	TKO/+PT1000	Temperature monitoring
	2	+/AC	Brake
	3	-/AC	
	4	Schaltkontakt	Rectifier
	5		
	6	TKO/-PT1000	Temperature monitoring

Connection via M12 connector

M12 pin assignment

Incr. encoder IG128-24V-H



ICN M12		
Contact	**Name**	**Meaning**
1	+UB	Supply +
2	B	Track B
3	GND	Mass
4	A	Track A

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, application brakes or safety brakes.

Overview

Versions	IP54/55 protection	
	Standard	LongLife
Controllers	DC supply AC supply via rectifier in the terminal box	
Supply voltages		
DC voltage	DC 24 V ±10 % DC 103 V ±10 % DC 127 V ±10 % DC 180 V ±10 % DC 205 V ±10 % DC 215 V ±10 % AC 460 V ±10 %	
Mains voltage	AC 230 V ±10 % AC 400 V ±10 % AC 460 V ±10 %	
Switching cycles		
Repetitive	1×10^6	10×10^6
Reversing	1×10^6	15×10^6
Friction lining	Low-wear	
Options	Manual release UL/CSA-approved	

Control	Without rectifier	Half-wave rectifier	Bridge rectifier	Bridge/half-wave rectifier
		6-pole	6-pole	6-pole
Supply voltages	24 V DC DC 180 V DC 205 V	AC 230 V AC 400 V AC 460 V	AC 230 V	AC 230 V AC 400 V
Approval		UL / CSA		
Options				Holding current lowering Overexcitation

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.

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:
  - Half-wave rectifier, 6-pole
  - Bridge rectifier, 6-pole
  - Bridge/half-wave rectifier, 6-pole

    With the holding current reduction or overexcitation option

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:

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

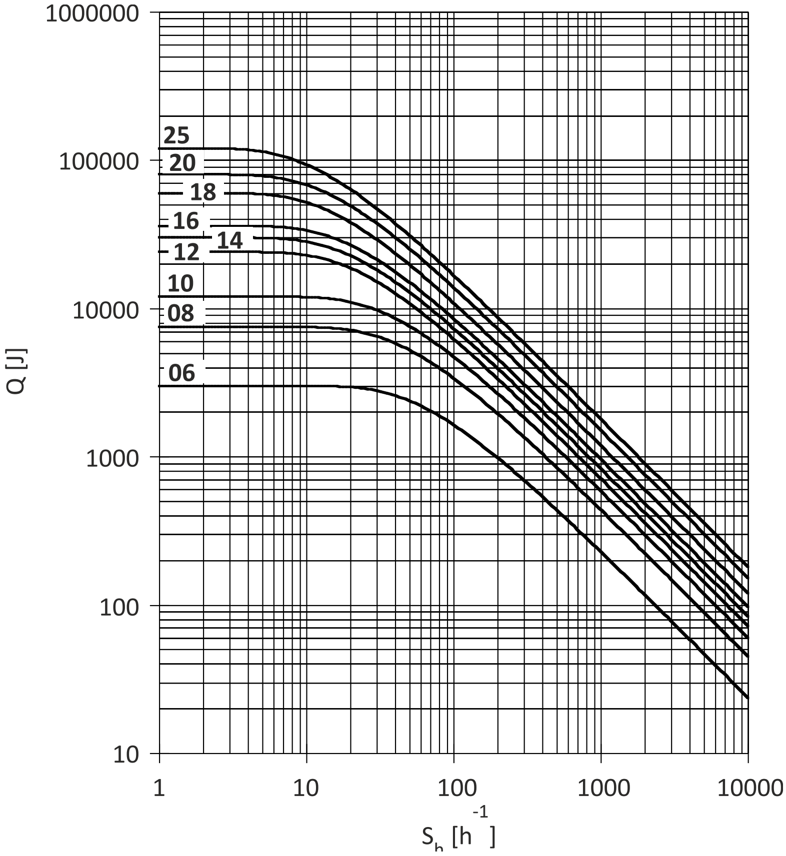
AC or DC voltage switching

Brakes can be switched both before the rectifier (AC voltage switching) as well as after the rectifier (DC voltage switching). The choice of control system influences the engagement time of the armature plate, inter alia.

AC switching increases the engagement time by a factor of 5 to 10 compared to DC switching. This is to be observed taken into account when choosing the control system. DC switching is possible by simply removing a bridge and using the switching contact connection. However, this calls for two additional cores in the control cabinet.

DC switching is particularly expedient for lifting applications because a short engagement time is necessary here to guarantee a secure hold without any prior slipping of the load.

Permissible friction energy



Q	Switching energy per switching cycle
S_h	Switching rate
06 ... 25	Brake size

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.

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.

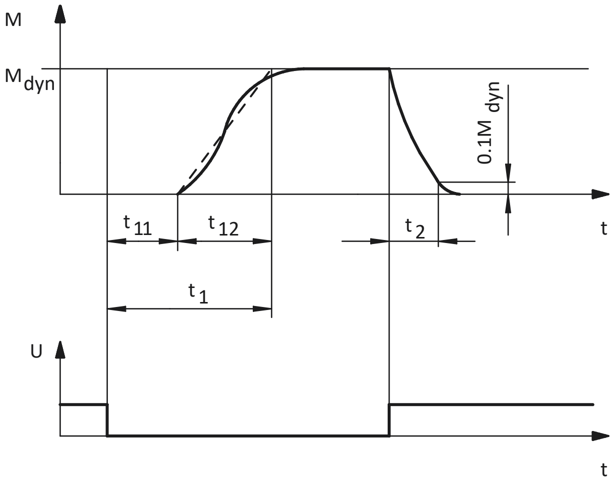
Assignment of braking torques

<table>
<tr><th rowspan="3">Motor</th><th colspan="6">Single brake</th></tr>
<tr><th>06</th><th>08</th><th>10</th><th>12</th><th>14</th><th>16</th></tr>
<tr><th>Nm</th><th>Nm</th><th>Nm</th><th>Nm</th><th>Nm</th><th>Nm</th></tr>
<tr><td>MF 063-32</td><td rowspan="4">2.5
4</td><td rowspan="2"></td><td rowspan="4"></td><td rowspan="7"></td><td rowspan="9"></td><td rowspan="10"></td></tr>
<tr><td>MF 063-42</td></tr>
<tr><td>MF 071-32</td><td>3.5</td></tr>
<tr><td>MF 071-42</td><td rowspan="4">3.5
8</td></tr>
<tr><td>MF 080-32</td><td rowspan="9"></td><td>7</td></tr>
<tr><td>MF 080-42</td><td>7
16</td></tr>
<tr><td>MF 090-32</td><td>7
16
23</td></tr>
<tr><td>MF 100-12</td><td rowspan="6"></td><td rowspan="2">7
16</td><td>14
32</td></tr>
<tr><td>MF 100-32</td><td>14
32
46</td></tr>
<tr><td>MF 112-22</td><td rowspan="4"></td><td>14
32</td><td rowspan="4">35
60</td></tr>
<tr><td>MF 132-12</td><td rowspan="3"></td><td>60
80</td></tr>
<tr><td>MF 132-22</td><td rowspan="2">60
80
100</td></tr>
<tr><td>MF 132-32</td></tr>
</table>

<table>
<tr><th rowspan="3">Motor</th><th colspan="4">Single brake LongLife</th></tr>
<tr><th>06</th><th>08</th><th>10</th><th>12</th></tr>
<tr><th>Nm</th><th>Nm</th><th>Nm</th><th>Nm</th></tr>
<tr><td>MF 063-32</td><td rowspan="4">4</td><td rowspan="2"></td><td rowspan="4"></td><td rowspan="7"></td></tr>
<tr><td>MF 063-42</td></tr>
<tr><td>MF 071-32</td><td>3.5</td></tr>
<tr><td>MF 071-42</td><td>3.5
8</td></tr>
<tr><td>MF 080-32</td><td rowspan="5"></td><td rowspan="3">8</td><td>7</td></tr>
<tr><td>MF 080-42</td><td rowspan="2">7
16</td></tr>
<tr><td>MF 090-32</td></tr>
<tr><td>MF 100-12</td><td rowspan="2"></td><td rowspan="2">16</td><td rowspan="2">14
32</td></tr>
<tr><td>MF 100-32</td></tr>
</table>

Rated data

Switching times of the spring-applied brakes



t_1	Engagement time	t_{11}	Delay time during linking
t_2	Disengagement time (up to M = 0.1 M_{dyn})	t_{12}	Rise time of the braking torque
M_{dyn}	Braking torque at constant speed	U	Voltage

Rated data, Single brake, IP54/55

Brake 06, 08

Brake		**06**		**08**	
Braking torque		**2.5**	**4**	**3.5**	**8**
Power input					
DC 24 V	W	20	20	25	25
DC 103 V	W	20	20	25	25
DC 127 V	W	20	20	27	27
DC 180 V	W	20	20	25	25
DC 205 V	W	20	20	25	25
DC 215 V	W	20	20	25	25
AC 230 V	W	20	20	25	25
AC 400 V	W	20	20	25	25
AC 460 V	W	20	20	25	25
Cold Brake AC 230V	W	20	20	25	25
Cold Brake AC 400V	W	23	23	27	27
Overexcitation AC 230 V	W	20	20	25	25
Overexcitation AC 400 V	W	20	20	25	25
Moment of inertia	$kgcm^2$	0.15	0.15	0.61	0.61
Braking torque is static	Nm	2.5	4	3.5	8
Min. static braking torque tolerance	%	-25	-25	-25	-25
Max. static braking torque tolerance	%	35	35	35	35
Dynamic braking torque					
100 rpm	Nm	2.5	4.0	3.5	8.0
1000 rpm	Nm	2.3	3.7	3.1	7.1
1200 rpm	Nm	2.3	3.6	3.0	7.0
1500 rpm	Nm	2.2	3.5	3.0	6.8
1800 rpm	Nm	2.2	3.4	2.9	6.6
2500 rpm	Nm	2.1	3.3	2.8	6.4
3000 rpm	Nm	2.0	3.2	2.7	6.2
3600 rpm	Nm	2.0	3.2	2.7	6.1
Min. dynamic braking torque tolerance	%	-25	-25	-25	-25
Max. dynamic braking torque tolerance	%	35	35	35	35
Friction energy					
100 rpm	kJ	3	3	7.5	7.5
1000 rpm	kJ	3	3	7.5	7.5
1200 rpm	kJ	3	3	7.5	7.5
1500 rpm	kJ	3	3	7.5	7.5
1800 rpm	kJ	3	3	7.5	7.5
2500 rpm	kJ	3	3	7.5	7.5
3000 rpm	kJ	3	3	7.5	7.5
3600 rpm	kJ	3	3	7.5	7.5
Maximum speed - operation	rpm	3600	3600	3600	3600
Maximum speed - idle state	rpm	10000	10000	10000	10000

Brake		**06**		**08**	
Braking torque		**2.5**	**4**	**3.5**	**8**
Delay time t11					
DC voltage	ms	25	15	14	15
AC mains voltage	ms	25	15	14	15
Cold Brake AC 230V	ms	24	16	22	25
Cold Brake AC 400V	ms	27	19	28	28
Overexcitation AC 230 V	ms	31	20	33	31
Overexcitation AC 400 V	ms	24	16	22	25
Rise time t12					
DC voltage	ms	13	13	10	16
AC mains voltage	ms	13	13	10	16
Cold Brake AC 230V	ms	12	14	16	27
Cold Brake AC 400V	ms	14	16	20	30
Overexcitation AC 230 V	ms	16	17	24	33
Overexcitation AC 400 V	ms	12	14	16	27
Engagement time t1					
DC voltage	ms	38	28	24	31
AC mains voltage	ms	38	28	24	31
Cold Brake AC 230V	ms	36	30	38	52
Cold Brake AC 400V	ms	41	35	48	58
Overexcitation AC 230 V	ms	47	37	57	64
Overexcitation AC 400 V	ms	36	30	38	52
Disengagement time t2					
DC voltage	ms	30	45	37	57
AC mains voltage	ms	30	45	37	57
Cold Brake AC 230V	ms	30	45	37	57
Cold Brake AC 400V	ms	21	30	24	36
Overexcitation AC 230 V	ms	17	22	18	26
Overexcitation AC 400 V	ms	17	22	18	26
Overexcitation time					
Cold Brake AC 230V	ms	300	300	300	300
Cold Brake AC 400V	ms	300	300	300	300
Overexcitation AC 230 V	ms	300	300	300	300
Overexcitation AC 400 V	ms	300	300	300	300
Friction energy QBW					
DC voltage	MJ	113.1	84.8	210.4	157.8
AC mains voltage	MJ	113.1	84.8	210.4	157.8
Cold Brake AC 230V	MJ	113.1	84.8	210.4	157.8
Cold Brake AC 400V	MJ	113.1	113.1	210.4	210.4
Overexcitation AC 230 V	MJ	113.1	113.1	210.4	210.4
Overexcitation AC 400 V	MJ	113.1	84.8	210.4	157.8
Reversing cycles		1x 10^6	1x 10^6	1x 10^6	1x 10^6
Repetitive cycles		1x 10^6	1x 10^6	1x 10^6	1x 10^6

Rated data, Single brake, IP54/55

Brake 10, 12

Brake		**10**			**12**		
Braking torque		**7**	**16**	**23**	**14**	**32**	**46**
Power input							
DC 24 V	W	30	30	30	40	40	40
DC 103 V	W	32	32	32	40	40	40
DC 127 V	W	30	30	30	40	40	40
DC 180 V	W	32	32	32	40	40	40
DC 205 V	W	33	33	33	40	40	40
DC 215 V	W	30	30	30	40	40	40
AC 230 V	W	33	33	33	40	40	40
AC 400 V	W	32	32	32	40	40	40
AC 460 V	W	33	33	33	40	40	40
Cold Brake AC 230V	W	33	33	33	40	40	40
Cold Brake AC 400V	W	30	30	30	42	42	42
Overexcitation AC 230 V	W	32	32	32	40	40	40
Overexcitation AC 400 V	W	32	32	32	40	40	40
Moment of inertia	kgcm²	2	2	2	4.5	4.5	4.5
Braking torque is static	Nm	7	16	23	14	32	46
Min. static braking torque tolerance	%	-25	-25	-25	-25	-25	-25
Max. static braking torque tolerance	%	35	35	35	35	35	35
Dynamic braking torque							
100 rpm	Nm	7.0	16	23	14	32	46
1000 rpm	Nm	6.1	14	20	12	28	40
1200 rpm	Nm	6.0	14	20	12	27	39
1500 rpm	Nm	5.8	13	19	11	26	38
1800 rpm	Nm	5.7	13	19	11	26	37
2500 rpm	Nm	5.5	12	18	11	24	35
3000 rpm	Nm	5.3	12	17	11	24	35
3600 rpm	Nm	5.2	12	17	10	23	34
Min. dynamic braking torque tolerance	%	-25	-25	-25	-25	-25	-25
Max. dynamic braking torque tolerance	%	35	35	35	35	35	35
Friction energy							
100 rpm	kJ	12	12	12	24	24	24
1000 rpm	kJ	12	12	12	24	24	24
1200 rpm	kJ	12	12	12	24	24	24
1500 rpm	kJ	12	12	12	24	24	24
1800 rpm	kJ	12	12	12	24	24	24
2500 rpm	kJ	12	12	12	24	24	24
3000 rpm	kJ	12	12	12	24	24	24
3600 rpm	kJ	12	12	12	7	7	7
Maximum speed - operation	rpm	3600	3600	3600	3600	3600	3600
Maximum speed - idle state	rpm	10000	10000	10000	10000	10000	10000

Brake		10			12		
Braking torque		**7**	**16**	**23**	**14**	**32**	**46**
Delay time t11							
DC voltage	ms	20	28	10	21	28	16
AC mains voltage	ms	20	28	10	21	28	16
Cold Brake AC 230V	ms	35	31	24	49	48	27
Cold Brake AC 400V	ms	47	34	27	64	55	42
Overexcitation AC 230 V	ms	52	44	29	73	62	54
Overexcitation AC 400 V	ms	35	31	24	49	48	27
Rise time t12							
DC voltage	ms	17	19	19	19	25	25
AC mains voltage	ms	17	19	19	19	25	25
Cold Brake AC 230V	ms	30	21	46	44	43	42
Cold Brake AC 400V	ms	40	23	51	58	49	66
Overexcitation AC 230 V	ms	44	30	55	66	55	84
Overexcitation AC 400 V	ms	30	21	46	44	43	42
Engagement time t1							
DC voltage	ms	37	47	29	40	53	41
AC mains voltage	ms	37	47	29	40	53	41
Cold Brake AC 230V	ms	65	52	70	93	91	69
Cold Brake AC 400V	ms	87	57	78	122	104	108
Overexcitation AC 230 V	ms	96	74	84	139	117	138
Overexcitation AC 400 V	ms	65	52	70	93	91	69
Disengagement time t2							
DC voltage	ms	57	76	109	65	115	193
AC mains voltage	ms	57	76	109	65	115	193
Cold Brake AC 230V	ms	57	76	109	65	115	193
Cold Brake AC 400V	ms	40	53	72	48	78	114
Overexcitation AC 230 V	ms	31	41	53	38	59	81
Overexcitation AC 400 V	ms	31	41	53	38	59	81
Overexcitation time							
Cold Brake AC 230V	ms	300	300	300	300	300	300
Cold Brake AC 400V	ms	300	300	300	300	300	300
Overexcitation AC 230 V	ms	300	300	300	300	300	300
Overexcitation AC 400 V	ms	300	300	300	300	300	300
Friction energy QBW							
DC voltage	MJ	264	264	198	706.2	529.6	353.1
AC mains voltage	MJ	264	264	198	706.2	529.6	353.1
Cold Brake AC 230V	MJ	264	264	198	706.2	529.6	353.1
Cold Brake AC 400V	MJ	264	264	264	706.2	706.2	706.2
Overexcitation AC 230 V	MJ	264	264	264	706.2	706.2	706.2
Overexcitation AC 400 V	MJ	264	264	198	706.2	529.6	353.1
Reversing cycles		1x 10^6	1x 10^6	1x 10^6	1x 10^6	1x 10^6	1x 10^6
Repetitive cycles		1x 10^6	1x 10^6	1x 10^6	1x 10^6	1x 10^6	1x 10^6

Rated data, Single brake, IP54/55

Brake 14, 16

Brake		14		16		
Braking torque		**35**	**60**		**80**	**100**
Power input						
DC 24 V	W	50	50	55	55	55
DC 103 V	W	53	53	56	56	56
DC 127 V	W	50	50	55	55	55
DC 180 V	W	53	53	55	55	55
DC 205 V	W	53	53	56	56	56
DC 215 V	W	53	53	55	55	55
AC 230 V	W	53	53	56	56	56
AC 400 V	W	53	53	55	55	55
AC 460 V	W	53	53	56	56	56
Cold Brake AC 230V	W	53	53	56	56	56
Cold Brake AC 400V	W	54	54	55	55	55
Overexcitation AC 230 V	W	53	53	56	56	56
Overexcitation AC 400 V	W	53	53	55	55	55
Moment of inertia	kgcm²	6.3	6.3	15	15	15
Braking torque is static	Nm	35	60	60	80	100
Min. static braking torque tolerance	%	-25	-25	-25	-25	-25
Max. static braking torque tolerance	%	35	35	35	35	35
Dynamic braking torque						
100 rpm	Nm	35	60	60	80	100
1000 rpm	Nm	30	51	50	66	83
1200 rpm	Nm	29	50	49	65	81
1500 rpm	Nm	28	49	47	62	78
1800 rpm	Nm	28	47	46	62	77
2500 rpm	Nm	26	45	44	58	73
3000 rpm	Nm	26	44	43	57	71
3600 rpm	Nm	-	-	-	-	-
Min. dynamic braking torque tolerance	%	-25	-25	-25	-25	-25
Max. dynamic braking torque tolerance	%	35	35	35	35	35
Friction energy						
100 rpm	kJ	30	30	36	36	36
1000 rpm	kJ	30	30	36	36	36
1200 rpm	kJ	30	30	36	36	36
1500 rpm	kJ	30	30	36	36	36
1800 rpm	kJ	30	30	36	36	36
2500 rpm	kJ	30	30	36	36	36
3000 rpm	kJ	18	18	11	11	11
3600 rpm	kJ	-	-	-	-	-
Maximum speed - operation	rpm	3000	3000	3000	3000	3000
Maximum speed - idle state	rpm	10000	10000	10000	10000	10000

Brake		**14**		**16**		
Braking torque		**35**	**60**		**80**	**100**
Delay time t11						
DC voltage	ms	37	17	53	27	22
AC mains voltage	ms	37	17	53	27	22
Cold Brake AC 230V	ms	61	33	114	58	41
Cold Brake AC 400V	ms	69	43	133	74	56
Overexcitation AC 230 V	ms	76	47	145	89	70
Overexcitation AC 400 V	ms	61	33	114	58	41
Rise time t12						
DC voltage	ms	22	25	30	30	30
AC mains voltage	ms	22	25	30	30	30
Cold Brake AC 230V	ms	36	47	65	64	56
Cold Brake AC 400V	ms	41	63	75	82	76
Overexcitation AC 230 V	ms	45	69	82	99	95
Overexcitation AC 400 V	ms	36	47	65	64	56
Engagement time t1						
DC voltage	ms	59	42	83	57	52
AC mains voltage	ms	59	42	83	57	52
Cold Brake AC 230V	ms	97	80	179	122	97
Cold Brake AC 400V	ms	110	106	208	156	132
Overexcitation AC 230 V	ms	121	116	227	188	165
Overexcitation AC 400 V	ms	97	80	179	122	97
Disengagement time t2						
DC voltage	ms	148	210	169	220	297
AC mains voltage	ms	148	210	169	220	297
Cold Brake AC 230V	ms	148	210	169	220	297
Cold Brake AC 400V	ms	98	131	125	154	191
Overexcitation AC 230 V	ms	71	92	100	119	141
Overexcitation AC 400 V	ms	71	92	100	119	141
Overexcitation time						
Cold Brake AC 230V	ms	300	300	1300	1300	1300
Cold Brake AC 400V	ms	300	300	300	300	300
Overexcitation AC 230 V	ms	300	300	300	300	300
Overexcitation AC 400 V	ms	300	300	1300	1300	1300
Friction energy QBW						
DC voltage	MJ	761.4	571	965.7	965.7	643.8
AC mains voltage	MJ	761.4	571	965.7	965.7	643.8
Cold Brake AC 230V	MJ	761.4	571	965.7	965.7	643.8
Cold Brake AC 400V	MJ	761.4	761.4	965.7	965.7	965.7
Overexcitation AC 230 V	MJ	761.4	761.4	965.7	965.7	965.7
Overexcitation AC 400 V	MJ	761.4	571	965.7	965.7	643.8
Reversing cycles		1x 10^6	1x 10^6	1x 10^6	1x 10^6	1x 10^6
Repetitive cycles		1x 10^6	1x 10^6	1x 10^6	1x 10^6	1x 10^6

Rated data, Single brake LongLife, IP54/55

Brake 06, 08

Brake		06	08	
Braking torque		**4**	**3.5**	**8**
Power input				
DC 24 V	W	20	25	25
DC 103 V	W	20	25	25
DC 127 V	W	20	27	27
DC 180 V	W	20	25	25
DC 205 V	W	20	25	25
DC 215 V	W	20	25	25
AC 230 V	W	20	25	25
AC 400 V	W	20	25	25
AC 460 V	W	20	25	25
Cold Brake AC 230V	W	20	25	25
Cold Brake AC 400V	W	23	27	27
Overexcitation AC 230 V	W	20	25	25
Overexcitation AC 400 V	W	20	25	25
Moment of inertia	$kgcm^2$	0.15	0.61	0.61
Braking torque is static	Nm	4	3.5	8
Min. static braking torque tolerance	%	-25	-25	-25
Max. static braking torque tolerance	%	35	35	35
Dynamic braking torque				
100 rpm	Nm	4.0	3.5	8.0
1000 rpm	Nm	3.7	3.1	7.1
1200 rpm	Nm	3.6	3.0	7.0
1500 rpm	Nm	3.5	3.0	6.8
1800 rpm	Nm	3.4	2.9	6.6
2500 rpm	Nm	3.3	2.8	6.4
3000 rpm	Nm	3.2	2.7	6.2
3600 rpm	Nm	3.2	2.7	6.1
Min. dynamic braking torque tolerance	%	-25	-25	-25
Max. dynamic braking torque tolerance	%	35	35	35
Friction energy				
100 rpm	kJ	3	7.5	7.5
1000 rpm	kJ	3	7.5	7.5
1200 rpm	kJ	3	7.5	7.5
1500 rpm	kJ	3	7.5	7.5
1800 rpm	kJ	3	7.5	7.5
2500 rpm	kJ	3	7.5	7.5
3000 rpm	kJ	3	7.5	7.5
3600 rpm	kJ	3	7.5	7.5
Maximum speed - operation	rpm	3600	3600	3600
Maximum speed - idle state	rpm	10000	10000	10000

Brake		06	08	
Braking torque		**4**	**3.5**	**8**
Delay time t11				
DC voltage	ms	15	14	15
AC mains voltage	ms	15	14	15
Cold Brake AC 230V	ms	16	22	25
Cold Brake AC 400V	ms	19	28	28
Overexcitation AC 230 V	ms	20	33	31
Overexcitation AC 400 V	ms	16	22	25
Rise time t12				
DC voltage	ms	13	10	16
AC mains voltage	ms	13	10	16
Cold Brake AC 230V	ms	14	16	27
Cold Brake AC 400V	ms	16	20	30
Overexcitation AC 230 V	ms	17	24	33
Overexcitation AC 400 V	ms	14	16	27
Engagement time t1				
DC voltage	ms	28	24	31
AC mains voltage	ms	28	24	31
Cold Brake AC 230V	ms	30	38	52
Cold Brake AC 400V	ms	35	48	58
Overexcitation AC 230 V	ms	37	57	64
Overexcitation AC 400 V	ms	30	38	52
Disengagement time t2				
DC voltage	ms	45	37	57
AC mains voltage	ms	45	37	57
Cold Brake AC 230V	ms	45	37	57
Cold Brake AC 400V	ms	30	24	36
Overexcitation AC 230 V	ms	22	18	26
Overexcitation AC 400 V	ms	22	18	26
Overexcitation time				
Cold Brake AC 230V	ms	300	300	300
Cold Brake AC 400V	ms	300	300	300
Overexcitation AC 230 V	ms	300	300	300
Overexcitation AC 400 V	ms	300	300	300
Friction energy QBW				
DC voltage	MJ	84.8	210.4	157.8
AC mains voltage	MJ	84.8	210.4	157.8
Cold Brake AC 230V	MJ	84.8	210.4	157.8
Cold Brake AC 400V	MJ	113.1	210.4	210.4
Overexcitation AC 230 V	MJ	113.1	210.4	210.4
Overexcitation AC 400 V	MJ	84.8	210.4	157.8
Reversing cycles		$15x\ 10^6$	$15x\ 10^6$	$15x\ 10^6$
Repetitive cycles		$10x\ 10^6$	$10x\ 10^6$	$10x\ 10^6$

Rated data, Single brake LongLife, IP54/55

Brake 10, 12

Brake		**10**		**12**	
Braking torque		**7**	**16**	**14**	**32**
Power input					
DC 24 V	W	30	30	40	40
DC 103 V	W	32	32	40	40
DC 127 V	W	30	30	40	40
DC 180 V	W	32	32	40	40
DC 205 V	W	33	33	40	40
DC 215 V	W	30	30	40	40
AC 230 V	W	33	33	40	40
AC 400 V	W	32	32	40	40
AC 460 V	W	33	33	40	40
Cold Brake AC 230V	W	33	33	40	40
Cold Brake AC 400V	W	30	30	42	42
Overexcitation AC 230 V	W	32	32	40	40
Overexcitation AC 400 V	W	32	32	40	40
Moment of inertia	kgcm²	2	2	4.5	4.5
Braking torque is static	Nm	7	16	14	32
Min. static braking torque tolerance	%	-25	-25	-25	-25
Max. static braking torque tolerance	%	35	35	35	35
Dynamic braking torque					
100 rpm	Nm	7.0	16	14	32
1000 rpm	Nm	6.1	14	12	28
1200 rpm	Nm	6.0	14	12	27
1500 rpm	Nm	5.8	13	11	26
1800 rpm	Nm	5.7	13	11	26
2500 rpm	Nm	5.5	12	11	24
3000 rpm	Nm	5.3	12	11	24
3600 rpm	Nm	5.2	12	10	23
Min. dynamic braking torque tolerance	%	-25	-25	-25	-25
Max. dynamic braking torque tolerance	%	35	35	35	35
Friction energy					
100 rpm	kJ	12	12	24	24
1000 rpm	kJ	12	12	24	24
1200 rpm	kJ	12	12	24	24
1500 rpm	kJ	12	12	24	24
1800 rpm	kJ	12	12	24	24
2500 rpm	kJ	12	12	24	24
3000 rpm	kJ	12	12	24	24
3600 rpm	kJ	12	12	7	7
Maximum speed - operation	rpm	3600	3600	3600	3600
Maximum speed - idle state	rpm	10000	10000	10000	10000

Brake		**10**		**12**	
Braking torque		**7**	**16**	**14**	**32**
Delay time t11					
DC voltage	ms	20	28	21	28
AC mains voltage	ms	20	28	21	28
Cold Brake AC 230V	ms	35	31	49	48
Cold Brake AC 400V	ms	47	34	64	55
Overexcitation AC 230 V	ms	52	44	73	62
Overexcitation AC 400 V	ms	35	31	49	48
Rise time t12					
DC voltage	ms	17	19	19	25
AC mains voltage	ms	17	19	19	25
Cold Brake AC 230V	ms	30	21	44	43
Cold Brake AC 400V	ms	40	23	58	49
Overexcitation AC 230 V	ms	44	30	66	55
Overexcitation AC 400 V	ms	30	21	44	43
Engagement time t1					
DC voltage	ms	37	47	40	53
AC mains voltage	ms	37	47	40	53
Cold Brake AC 230V	ms	65	52	93	91
Cold Brake AC 400V	ms	87	57	122	104
Overexcitation AC 230 V	ms	96	74	139	117
Overexcitation AC 400 V	ms	65	52	93	91
Disengagement time t2					
DC voltage	ms	57	76	65	115
AC mains voltage	ms	57	76	65	115
Cold Brake AC 230V	ms	57	76	65	115
Cold Brake AC 400V	ms	40	53	48	78
Overexcitation AC 230 V	ms	31	41	38	59
Overexcitation AC 400 V	ms	31	41	38	59
Overexcitation time					
Cold Brake AC 230V	ms	300	300	300	300
Cold Brake AC 400V	ms	300	300	300	300
Overexcitation AC 230 V	ms	300	300	300	300
Overexcitation AC 400 V	ms	300	300	300	300
Friction energy QBW					
DC voltage	MJ	264	264	706.2	529.6
AC mains voltage	MJ	264	264	706.2	529.6
Cold Brake AC 230V	MJ	264	264	706.2	529.6
Cold Brake AC 400V	MJ	264	264	706.2	706.2
Overexcitation AC 230 V	MJ	264	264	706.2	706.2
Overexcitation AC 400 V	MJ	264	264	706.2	529.6
Reversing cycles		15x 10^6	15x 10^6	15x 10^6	15x 10^6
Repetitive cycles		10x 10^6	10x 10^6	10x 10^6	10x 10^6

Option: Reduction of the holding current (cold brake)

By reducing the holding current, the bridge/half-wave rectifier reduces the power consumption of the open brake. As the brake heats up less, this control is referred to as a “Cold Brake”. This is necessary at low speeds in order to counteract impermissible heating. This means that no blower is required even with a speed setting range below 14 Hz. In addition, only a quarter of the braking power is required, thus saving energy.

Option: Short-time overexcitation of the brake coil

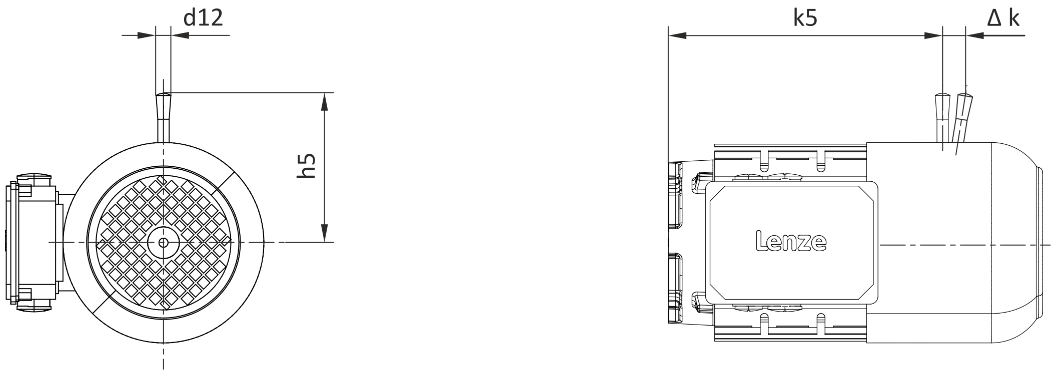
The disengagement time can be reduced by triggering the brake coil with twice the rated voltage for an overexcitation time. The brake releases much faster and the wear on the friction lining decreases. As a result of these features, this control variant is particularly ideal for hoist applications.

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.

A lockable manual release lever can be ordered as an option. This is equipped with a clamping device to hold the brake in the released position.

Dimensions of manual release lever



Product	Brake	Dimensions			
		k5	Δ k	h5	d12
		mm	mm	mm	mm
MF☐MA☐☐063-32 MF☐MA☐☐063-42	06	169	29	107	13.0
MF☐MA☐☐071-32 MF☐MA☐☐071-42	06	185	29	107	13.0
	08	186	27	136	13.0
MF☐MA☐☐080-32 MF☐MA☐☐080-42	08	223	27	136	13.0
	10	234	28	132	13.0
MF☐MA☐☐090-32	08	256	27	136	13.0
	10	267	28	132	13.0
MF☐MA☐☐100-12 MF☐MA☐☐100-32	10	305	28	132	13.0
	12	307	37	161	13.0
MF☐MA☐☐112-22	12	309	37	161	13.0
	14	313	41	195	24.0
MF☐MA☐☐132-12 MF☐MA☐☐132-22 MF☐MA☐☐132-32	14	398	41	195	24.0
	16	398	45	240	24.0

Options

The spring-applied brakes can be used as service brakes or holding brakes. Emergency stops are possible.

The spring-applied brake is available as a LongLife version for applications with very high switching frequencies.

The brake mechanism is reinforced. Up to 10 million repetitive or 15 million reversing switching cycles are possible.

Feedback

NOTICE

Three-phase AC motors with feedback cannot be used for speed-dependent safety functions in conjunction with the SM 301 safety module.

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.

The TTL incremental encoder can generate a higher number of pulses. 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

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**
Accuracy	'	-10 ... 10
Absolute positioning		1 revolution
Max. input voltage		
DC	V	10
Max. input frequency	kHz	4
Ratio		
Stator / rotor		0.3 ± 5%
Rotor impedance	Ω	51 + j90
Stator impedance	Ω	102 + j150
Impedance	Ω	44 + j76
Min. insulation resistance		
At DC 500 V	MΩ	10
Number of pole pairs		1

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 motec and 8400 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**	**IG512-24V-H**	**IG1024-24V-H**	**IG2048-24V-H**
Design			Mounting	Mounting	Mounting	Mounting
Pulses			128	512	1024	2048
Output signals			HTL	HTL	HTL	HTL
Interfaces			A, B	A, B; N; Ai, Bi; Ni	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	8	8	8
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
Limit frequency	f_{max}	kHz	30	160	160	160

TTL incremental encoder

Feedback type			**Encoder**		**TTL-Inkremental**
Feedback			**IG512-5V-T**	**IG1024-5V-T**	**IG2048-5V-T**
Design			Mounting		
Pulses			512	1024	2048
Output signals			TTL	TTL	TTL
Interfaces			A, B; N; Ai, Bi; Ni	A, B; N; Ai, Bi; Ni	A, B; N; Ai, Bi; Ni
Absolute revolution			0	0	0
Min. accuracy		'	-2	-2	-2
Max. accuracy		'	2	2	2
Min. DC input voltage	$V_{in,min}$	V	4.75	4.75	4.75
Max. DC input voltage	$V_{in,max}$	V	5.25	5.25	5.25
Max. current consumption	I_{max}	A	0.15	0.15	0.15
Limit frequency	f_{max}	kHz	300	300	300

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.

Feedback type			**SinCos absolute value encoder**
Feedback			**AM1024-8V-H**
Design			Mounting
Encoder type			Multi-turn
Pulses			1024
Output signals			SinCos 1 Vss
Interfaces			Hiperface
Absolute revolution			4096
Min. accuracy		'	-0.8
Max. accuracy		'	0.8
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
Limit frequency	f_{max}	kHz	200

Blower

The motor is optionally available with a blower for operation with the rated torque and low motor speeds or a higher switching frequency.

The blower cools the motor independent of the motor speed.

If a blower is used, the torque does not have to be reduced if operated below 20 Hz.

> A higher powered motor with simultaneous derating can be used in many cases instead of a blower.

Torque reduction at low motor frequencies ▶ General information 19

Standard version

Rated data50Hz, 230/400V

Motor series			MFXMA								
Size			**063**			**071**			**080**		
Number of phases			1	3	3	1	3	3	1	3	3
Wiring			-	Delta	Star	-	Delta	Star	-	Delta	Star
Rated voltage	V_{rated}	V	230	230	400	230	230	400	230	230	400
Rated power	P_{rated}	kW	0.034	0.015	0.015	0.035	0.016	0.016	0.036	0.02	0.02
Rated current	I_{rated}	A	0.15	0.083	0.05	0.15	0.083	0.05	0.16	0.088	0.05

Motor series			MFXMA								
Size			**090**			**100**			**112**		
Number of phases			1	3	3	1	3	3	1	3	3
Wiring			-	Delta	Star	-	Delta	Star	-	Delta	Star
Rated voltage	V_{rated}	V	230	230	400	230	230	400	230	230	400
Rated power	P_{rated}	kW	0.038	0.036	0.036	0.044	0.043	0.043	0.05	0.054	0.054
Rated current	I_{rated}	A	0.19	0.19	0.11	0.2	0.19	0.11	0.23	0.2	0.11

Motor series			MFXMA		
Size			**132**		
Number of phases			1	3	3
Wiring			-	Delta	Star
Rated voltage	V_{rated}	V	230	230	400
Rated power	P_{rated}	kW	0.095	0.091	0.091
Rated current	I_{rated}	A	0.42	0.33	0.19

Rated data60Hz, 265/460V

Motor series			MFXMA								
Size			**063**			**071**			**080**		
Number of phases			1	3	3	1	3	3	1	3	3
Wiring			-	Delta	Star	-	Delta	Star	-	Delta	Star
Rated voltage	V_{rated}	V	265	265	460	265	265	460	265	265	460
Rated power	P_{rated}	kW	0.05	0.018	0.018	0.052	0.02	0.02	0.055	0.028	0.028
Rated current	I_{rated}	A	0.19	0.09	0.05	0.2	0.09	0.05	0.21	0.09	0.05

Motor series			MFXMA								
Size			**090**			**100**			**112**		
Number of phases			1	3	3	1	3	3	1	3	3
Wiring			-	Delta	Star	-	Delta	Star	-	Delta	Star
Rated voltage	V_{rated}	V	265	265	460	265	265	460	265	265	460
Rated power	P_{rated}	kW	0.058	0.047	0.047	0.069	0.059	0.059	0.085	0.074	0.074
Rated current	I_{rated}	A	0.22	0.19	0.11	0.26	0.19	0.11	0.32	0.21	0.12

Motor series			MFXMA		
Size			**132**		
Number of phases			1	3	3
Wiring			-	Delta	Star
Rated voltage	V_{rated}	V	265	265	460
Rated power	P_{rated}	kW	0.156	0.134	0.134
Rated current	I_{rated}	A	0.59	0.36	0.21

Temperature monitoring

Thermal contacts TC0

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	-5
Max. switching temperature		°C	5
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	40
Max. DC switching voltage		V	12

PTC thermistor

The PTC thermistor is operated in conjunction with a tripping unit. If the motor becomes too hot, the motor can be switched off with the aid of a contactor. In contrast to the thermal contact, a quick restart is possible.

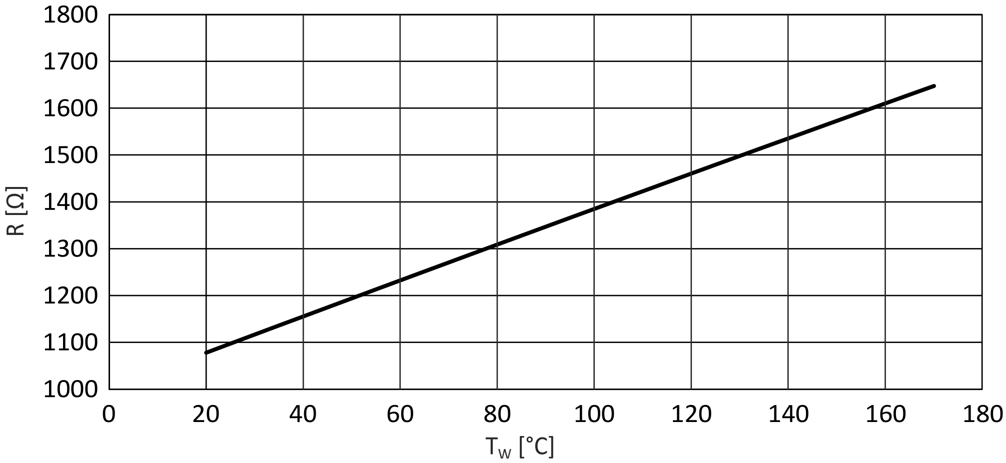
Functional principle			**Sprunghafte Widerstandsänderung**
Operating temperature		°C	155
Min. switching temperature		°C	-5
Max. switching temperature		°C	5
Temperature		°C	-20
Rated resistance			
155 °C			1330
140 °C			550
-20 °C			100

Thermal detectors PT1000

The thermal detector used continuously monitors the motor temperature. The temperature information is transferred to the inverter using the system cable of the feedback system. **This is not a full motor protection!**

This makes it possible to determine the motor temperature in the permissible operating range with great accuracy.

When supplying the thermal sensors with a measurement current of 1 mA, the connection between the temperature and the resistance measured applies.



R	Resistance
T_W	Winding temperature

Environmental notes and recycling

Lenze has been certified to the worldwide environmental management standard for many years (DIN EN ISO 14001). As part of our environmental policy and the associated climate responsibility, please note the following information on hazardous ingredients and the recycling of Lenze products and their packaging:

CE	Lenze products are partly subject to the EU Directive on the restriction of certain hazardous substances in electrical and electronic equipment 2011/65/EU: RoHS Directive [UKCA: S.I. 2012/3032 - The Restriction of the Use of Certain Hazardous Substances in Electrical and Electronic Equipment Regulations 2012] . This is documented accordingly in the EU declaration of conformity and with the CE mark.
	Lenze products are not subject to EU Directive 2012/19/EU: Directive on waste electrical and electronic equipment (WEEE) [UKCA: S.I. 2013/3113 - The Waste Electrical and Electronic Equipment Regulations 2013] , but some contain batteries/rechargeable batteries in accordance with EU Directive 2006/66/EC: Battery Directive [UKCA: S.I. 2009/890 - The Waste Batteries and Accumulators Regulations 2009] . The disposal route, which is separate from household waste, is indicated by corresponding labels with the "crossed-out trash can". Any batteries/rechargeable batteries included are designed to last the life of the product and do not need to be replaced or otherwise removed by the end user.
21 PAP	Lenze products are usually sold with cardboard or plastic packaging. This packaging complies with EU Directive 94/62/EC: Directive on packaging and packaging waste [UKCA: S.I. 1997/648 - The Producer Responsibility Obligations (Packaging Waste) Regulations 1997] . The required disposal route is indicated by material-specific labels with the "recycling triangle". Example: "21 - other cardboard"
REACH	Lenze products are subject to REGULATION (EC) No 1907/2006: REACH Regulation [UKCA: S.I. 2008/2852 - The REACH Enforcement Regulations 2008] . When used as intended, exposure of substances to humans, animals and the environment is excluded.

Lenze products are industrial electrical and electronic products and are disposed of professionally. Both the mechanical and electrical components such as electric motors, gearboxes or inverters contain valuable raw materials that can be recycled and reused. Proper recycling and thus maintaining the highest possible level of recyclability is therefore important and sensible from an economic and ecological point of view.

- Coordinate professional disposal with your waste disposal company.
- Separate mechanical and electrical components, packaging, hazardous waste (e.g. gear oils) and batteries/rechargeable batteries wherever possible.
- Dispose of the separated waste in an environmentally sound and proper manner (no household waste or municipal bulky waste).

What?	Material	Disposal instructions
Pallets	Wood	Return to manufacturers, freight forwarders or reusable materials collection system
Packaging material	Paper, cardboard, pasteboard, plastics	Collect and dispose of separately
Products		
Electronic devices	Metal, plastics, circuit boards, heatsinks	As electronic waste give to professional disposer for recycling
Gearbox	Oil	Drain oil and dispose of separately
	Casting, steel, aluminium	Dispose as metal scrap
Motors	Casting, copper, rotors, magnets, potting compound	As engine scrap give to professional disposer for recycling
Dry-cell batteries/rechargeable batteries		As used batteries give to professional disposer for recycling

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

www.Lenze.com → search word: "Sustainability"

Appendix

Good to know

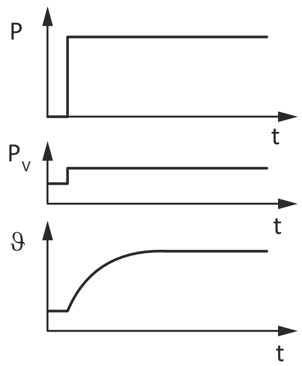
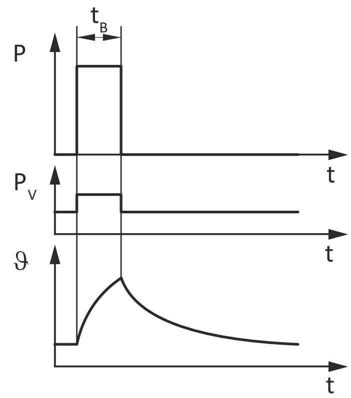
Operating modes of the motor

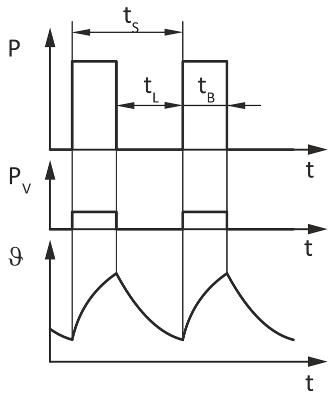
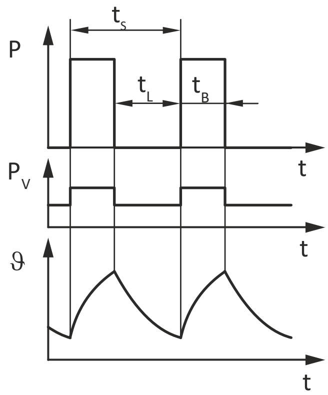
Operating modes S1 ... S10 as specified by EN 60034-1 describe the basic stress of an electrical machine.

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	P_V	Power loss
t	Time	t_B	Load period
t_L	Idle time	t_S	Cycle duration
ϑ	Temperature		

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 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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