



Lenze Smart Geared Motors

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About Lenze

The 5 phases

Lenze makes many things easy for you.

With our motivated and committed approach, we work together with you to create the best possible solution and set your ideas in motion - whether you are looking to optimise an existing machine or develop a new one. We always strive to make things easy and seek perfection therein. This is anchored in our thinking, in our services and in every detail of our products. It's as easy as that!

1 Developing ideas

Are you looking to build the best machine possible and already have some initial ideas? Then get these down on paper together with us, starting with small innovative details and stretching all the way to completely new machines. Working together, we will develop an intelligent and sustainable concept that is perfectly aligned with your specific requirements.

2 Drafting concepts

We see welcome challenges in your machine tasks, supporting you with our comprehensive expertise and providing valuable impetus for your innovations. We take a holistic view of the individual motion and control functions here and draw up consistent, end-to-end drive and automation solutions for you - keeping everything as easy as possible and as extensive as necessary.

3 Implementing solutions

Our easy formula for satisfied customers is to establish an active partnership with fast decision making processes and an individually tailored offer. We have been using this principle to meet the ever more specialised customer requirements in the field of machine engineering for many years.

4 Manufacturing machines

Functional diversity in perfect harmony: as one of the few full-range providers in the market, we can provide you with precisely those products that you actually need for any machine task — no more and no less. Our L-force product portfolio a consistent platform for implementing drive and automation tasks, is invaluable in this regard

5 Ensuring productivity

Productivity, reliability and new performance peaks on a daily basis these are our key success factors for your machine. After delivery, we offer you cleverly devised service concepts to ensure continued safe operation. The primary focus here is on technical support, based on the excellent application expertise of our highly-skilled and knowledgeable after-sales team.



Portfolio overview

Lenze products undergo the most stringent testing in our own laboratory. This allows us to ensure that you will receive consistently high quality and a long service life. In addition to this, five logistics centres ensure that the Lenze products you select are available for quick delivery anywhere across the globe.

As easy as that.

Controlling and visualising events	Automating and visualising machine modules	Automating and visualising machines
Logic Control	Machine module-Control	Machine Control
Visualisation		
Controllers		
Time and event-controlled motion	Speed and torque-controlled motion	Position-controlled single-axis and multi-axis motion
Mains operation	Inverter operation	Servo inverter operation
Inverters		
Motors		
Gearboxes		



About this document



Information and tools with regard to the Lenze products can be found on the Internet:
<http://www.lenze.com> → Download

Document description

This document is addressed to anyone who wants to plan three-phase motors/geared motors with the described products.

The data and information compiled here serve to support you in dimensioning and selecting and preparing the electrical and mechanical installation. You will receive information on product extensions and accessories.

More information

For certain tasks, more information is available in additional documents.

Document	Contents/topics
Mounting and switch-on instructions	Basic information for the mechanical and electrical installation • Is supplied with each component.



Notations and conventions

This document uses the following conventions to distinguish different types of information:

Numbers			
	Decimal separator	Point	In general, the decimal point is used. Example: 1 234.56
Warning			
	UL warning	UL	Are used in English and French.
	UR warning	UR	
Text			
	Programs	» «	Software Example: »Engineer«, »EASY Starter«
Icons			
	Page reference		Reference to another page with additional information Example:  16 = see page 16
	Documentation reference		Reference to another documentation with additional information Example:  EDKxxx = see documentation EDKxxx

Layout of the safety instructions

DANGER!

This note refers to an imminent danger which, if not avoided, may result in death or serious injury.

WARNING!

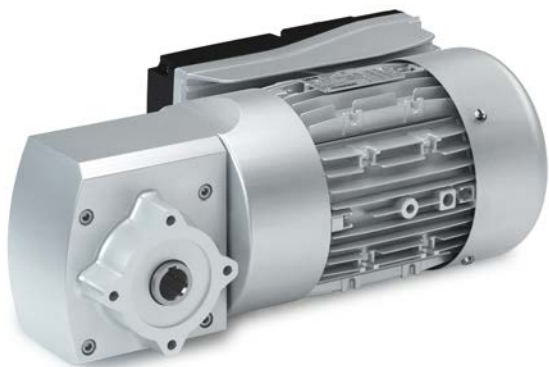
This note refers to a danger which, if not avoided, may result in death or serious injury.

CAUTION!

This note refers to a danger which, if not avoided, may result in minor or moderate injury.

NOTICE

This note refers to a danger which, if not avoided, may result in damage to material assets.



Lenze Smart Geared Motors

Lenze Smart Motor M5EMA - bevel gearbox g350-B

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Product information

The new freedom in motion for engineers. Lenze Smart Products reduce the number of different drives by up to 70 %. Without contactor and starter, with freely adjustable fixed speeds and many integrated functions for technical material-handling applications. The Lenze Smart motor also fulfils the highest requirements regarding energy efficiency and can be conveniently operated by means of a smart phone.

Reduction in the number of variants made easy

Before now, different output speeds (e.g. for different conveying speeds) were enabled by different gearbox ratios or, in the case of very large differences, by means of the number of pole pairs of the motors. This led to a large number of different drive variants..

Things are different with the Lenze Smart Products: Due to the possibility of freely adjusting the motor speed within a range from 45 – 221.2 rpm, very different speeds can be enabled with one single drive variant. The cost and effort involved in design, selection, procurement and storage are thus reduced considerably.

Highlights

- Efficient and usable worldwide
- Usable in all mounting positions, reduces number of variants
- Easy modification of the mechanical connection on site reduces the number of variants
- Freely adjustable speed reduces the number of different drives
- Integrated soft start function
- Less wiring thanks to electronic contactor and motor protection function
- Excellent energy efficiency
- Can be operated with an NFC-capable smartphone and Lenze app
- Brake control unit optional for low-wear brake control



Application ranges

- Conveying and travelling drives



Product description

Easy adjustment

NFC technology (NFC = Near Field Communication) is used to adapt the Lenze Smart Products to the application as well as for diagnostics). The drive can be adjusted very easily without opening the terminal box, without voltage supply and without time-consuming addressing.

Only an NFC-capable Android smartphone or the Lenze NFC adapter for PCs is needed as a tool. The data can therefore be read and written when the drive is in a de-energised state – via password protection, of course.

Data that can be set

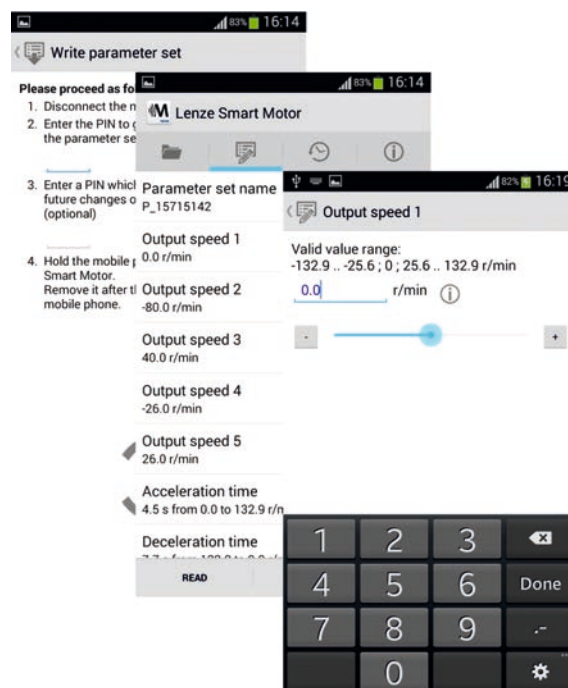
- Name of data record (e.g. the designation of the drive in your documentation)
- Speed and rotating direction 1 (also controllable without digital inputs)
- Speed and rotating direction 2-5 (controllable by means of digital inputs)
- Acceleration time
- Deceleration time
- Energy-saving function

Readable data

- Identification data (Lenze material number and serial number, type designation, software version)
- Fault messages
- Operating and power-on hours

Adjustment by means of a smartphone

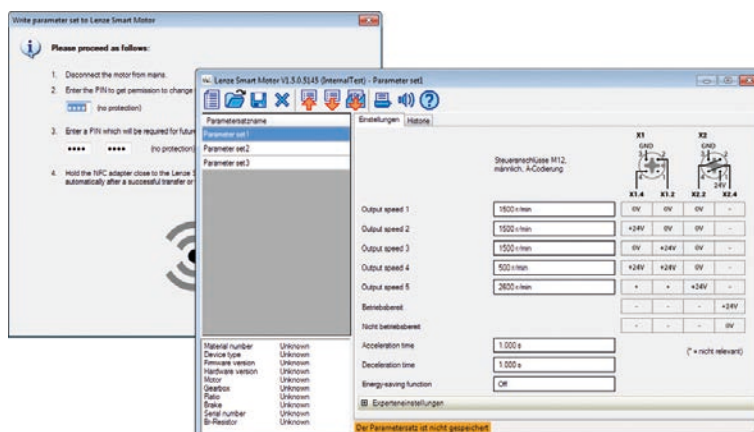
The Lenze Smart Products can be adjusted with an Android smartphone. The corresponding app in German and English can be obtained from www.Lenze.com or the Google Store. For convenience, the data records created can be archived on the smartphone and repeatedly transferred to the Lenze Smart Products for different applications.





Adjusting with a PC

With the EASY Starter engineering tool (expanded version, "EASY Advanced" or "Engineer HighLevel" software licence needed) can be used to adjust the Lenze Smart Products. The relevant version can be easily downloaded from www.Lenze.com. As the settings are very simple and clear, there is an easy-to-use dialog box, which can be opened directly via the Navigator. The corresponding button is directly accessible in the Navigation bar. Analogously to other product settings, the parameter values. can be archived.



Starting and stopping smoothly and gently

An acceleration ramp and – in contrast to a conventional starter – a deceleration ramp can be set for Lenze Smart Products. This ensures that the conveyed material is handled in a defined and jerk-free manner..

Contactors and motor protection functions integrated

The Lenze Smart Products can be started and stopped by mean of digital inputs. It is also possible to switch between different speeds and rotating directions. Up to 5 different speed modes (e.g. creep speed and normal speed in both directions as well as stopping) can be used for a motor. Reversing-contactor changes and pole changes are thus a thing of the past.

In addition, motor-protections devices are not needed as monitoring of temperature, short circuits, earth faults and phase failures has already been integrated.

Easy installation

Connection takes place completely from the outside by means of connectors.

The Lenze Smart Products come with an especially clever connecting technology – Phoenix Contact QUICKON. Electrical installation is therefore very easy without special tools and requires less than one minute.

As a standard feature, the digital inputs and outputs are connected at M12 sockets of the type currently available on the market.

Already existing signal cables can often be reused.

Worldwid and efficient

The drive can be used worldwide:

- In all 3-phase networks with 400 ... 480 V and a supply voltage of 50 ... 60 Hz.
- In ambient temperature of -30 ... +40 °C.
- Is suitable for many approvals.

With IES2, the Lenze Smart Products fulfil the highest efficiency requirement.

If very little torque is needed in the partial-load operational range, the integrated energy-saving function intervenes and improves the energy consumption.

Product information

Product description



Application examples

Belt ejectors	Belt conveyors

Equipment

The equipment includes all extensions of the product that are available as standard features.

The output side (see picture) of the gearbox includes a hollow shaft and a flange that is integrated in the housing and that has threaded holes and a centering feature.

Optionally, a solid shaft that can be inserted into the hollow shaft as well as a second flange easily mounted with four screws or a torque plate are available.

If there are different mechanical connections in your machine, the drive can adapted locally so that the number of different materials is reduced.

Brake resistor

External: MSEMA□□080

Internal: MSEMA□□063

Output shaft

Hollow shaft
Solid shaft can be inserted

Housing type

Threaded pitch circle with centering

Output flange

Torque plate

Spring-applied brake

Standard

Cooling

Integral fan

PE

Adjustment of speeds

Via Smartphone
Via PC with NFC adapter

X1, X2 control connection

M12 connector

X3 mains connection

QUICKON connector





The modular system

Geared motors up to 75 Nm

Gearbox		g350-B25	g350-B50	g350-B75
Motor		MSEMA□□063-42	MSEMA□□063-42	MSEMA□□080-32
Technical data				
Max. output torque	Nm	25	50	75
Rated torque	Nm	19.3	19.3	55.2
Output speed	rpm	42.6 ... 221.2		
Mounting position		Universal		
Colour		Unpainted		
Surface and corrosion protection		Without		

gearbox data

Gearbox		g350-B25	g350-B50	g350-B75
Dimensions				
Hollow shaft with keyway	mm	16	20	20
Product extensions				
Solid shaft with featherkey	mm	16 x 40	20 x 40	20 x 40
Output flange	mm	FT65/FF100	FT87/FF100	FT100/FF130
Torque plate		Can be mounted on the threaded pitch circle of the housing		
Gearbox version		With centering (HCR)		
Lubricant		CLP HC 220 USDA H1 (Synthetic oil, suitable for the food industry)		

Motor data

Motor		MSEMA□□063-42	MSEMA□□080-32
Conformity		CE, EAC	
Approval		CCC, cULus	
Cooling		Integral fan	
Degree of protection			
EN 60529		IP55	
NEMA 250		Type 4 indoor only Type 12	
Motor connection			
Power connection		QUICKON connector	
Control connection		M12 connector	
Brake			
Without spring-applied brake		Without brake resistor	
With spring-applied brake		Brake type: Standard Brake resistor: Integrated	Brake type: Standard Brake resistor: External
Feedback		Without	
Temperature monitoring		Internal	
Monitoring and protective measures		Short circuit (to a limited extent), fault acknowledgement Earth fault (to a limited extent), fault acknowledgement necessary Overvoltage Overcurrent Motor overtemperature Mains phase failure Protection in the event of cyclical power-supply switching Motor stalling	

Product information

The name of the product



The name of the product

The name of the gearbox and motor is used as the designation for the geared motor.

Example: Geared motor g350-B25 MSEMA□□063-42.

Product series		Version	Max. output torque	Gearbox
			Nm	
g350	-	B	25	g350-B25
			50	g350-B50
			75	g350-B75

Product series	Version	Size		Overall length	Number of pole pairs	Motor
MSEMA	XX (without built-on accessories)	063	-	4	2	MSEMAXX063-42
		080		3		MSEMAXX080-32
	BR (with brake)	063		4		MSEMABR063-42
		080		3		MSEMABR080-32



Project planning

Notes regarding the given data

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

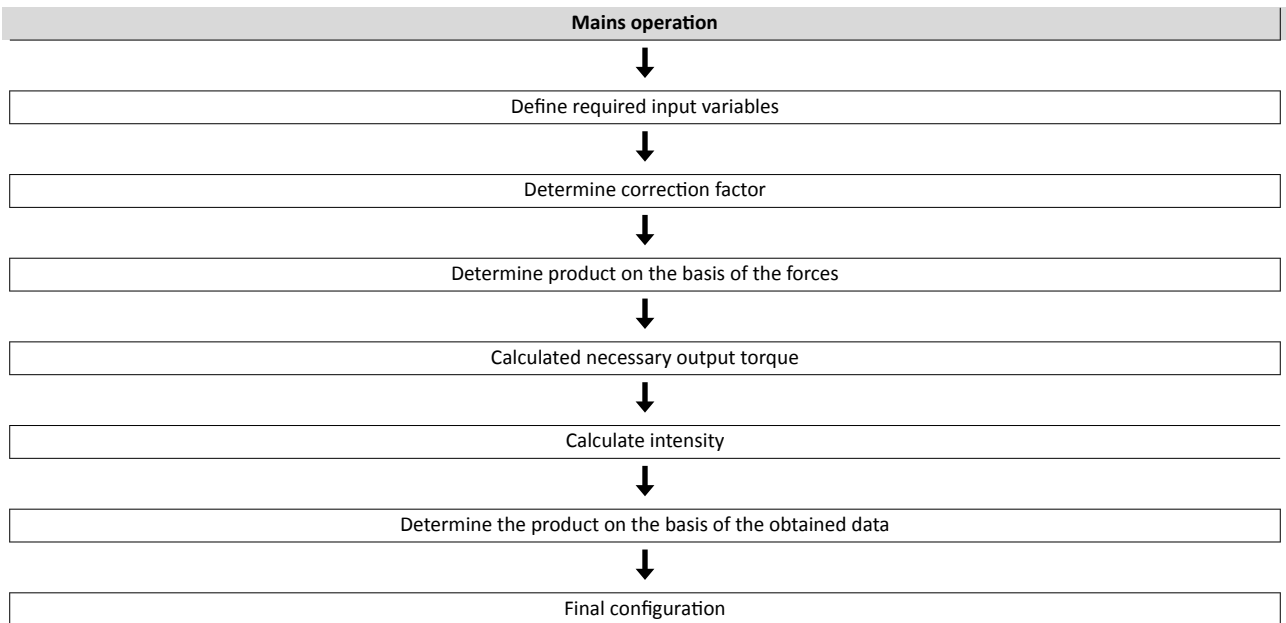
- Operating time per day = 8 hrs (100 % ED)
- Duty class up to 10 switching operations per hr
- $T_U = -30 \dots +40 \text{ }^{\circ}\text{C}$
- Site altitude $\leq 1000 \text{ m}$ above sea level
- The selection tables indicate the mechanically permissible power levels and torques.
- The ratings apply to the operating mode S1 (acc. to EN 60034).



In the case of other operating conditions, the achievable values can differ from those name. In the case of extreme operating conditions, please ask the Lenze sales company that is responsible for you..



Project planning process





Dimensioning

Necessary input variables

Mains operation			
Max. load torque	$M_{L,max}$	Nm	
Max. load speed	$n_{L,max}$	rpm	
External moments of inertia	J_{ext}	kgcm ²	
Operating time / day	BD	h	
Switching operations per hour	S_h	1/h	

Determine correction factor

Site altitude Amsl	H	m	≤ 1000	≤ 2000	≤ 3000	≤ 4000
Correction factor	k_H		1	0.95	0.9	0.85

Determine product on the basis of the forces

Transmission element			Gear wheels	Sprockets	Toothed belt pulleys (depending on the pre-loading)	Narrow V-belt (depending on the preloading)
Additional radial force factor	f_z		≥ 17 teeth = 1.0	≥ 20 teeth = 1.0	With belt tightener= 2.0 - 2.5	1.5 - 2.0
			< 17 teeth = 1.15	< 20 teeth = 1.25	Without belt tightener= 2.5 - 3.0	
				< 13 teeth = 1.4		
			Calculation		Check	
Radial force	F_{rad}	N	$F_{rad} = 2000 \times \frac{M_{L,max} \times f_z}{dw}$		$F_{rad} \leq f_w \times F_{rad,max}$	
Axial force	F_{ax}	N			$F_{ax} \leq F_{rad,max} \times 0.5$	

dw Effective diameter of transmission element

► Radial forces and axial forces 26

Calculate output torque

			Calculation
Necessary output torque	M_2	Nm	$M_2 \geq \frac{M_{L,max}}{k_H}$

Calculate intensity

		Calculation	
Intensity	F_I	$F_I = \frac{\frac{J_L}{2} + J_M + J_B + J_Z}{J_M + J_B + J_Z} \leq 1.25$	

i Ratio of gearbox

J_B Moment of inertia of brake

J_L Moment of inertia of the load

J_Z Additional moment of inertia (handwheel, 2nd shaft end ...)

J_M Moment of inertia of motor

Determine the product on the basis of the data obtained from the selection tables

Selection table		Check
Output speed n_2	rpm	$n_{L,max} \approx n_2$
Output torque M_2	Nm	$M_{L,max} \leq M_2$

Selection tables 29



Final configuration

Check operating conditions	Operating temperature Degree of protection Supply voltage Approvals Conformity
Specify product extensions and check connection dimensions	Output shaft Output flange, centering with threaded pitch circle Torque plate Brake
Select accessories	NFC adapter QUICKON connector



Safety instructions

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

Observe all specifications of the corresponding documentation supplied. This is the precondition for safe and trouble-free operation and for obtaining the product features specified.

Please observe the specific safety information in the other sections!

Application as directed

- The product must only be operated under the operating conditions prescribed in this documentation.
- The product meets the protection requirements of 2014/35/EU: Low-Voltage Directive 2014/35/EU: Low-Voltage Directive.
- The product is not a machine in terms of 2006/42/EC: Machinery Directive 2006/42/EC: Machinery Directive.
- Commissioning or starting the operation as directed of a machine with the product is not permitted until it has been ensured that the machine meets the regulations of the EC Directive 2006/42/EC: Machinery Directive 2006/42/EC: Machinery Directive; observe EN 60204-1 EN 60204-1.
- Commissioning or starting the operation as directed is only allowed when there is compliance with the EMC Directive 2014/30/EU 2014/30/EU.
- The harmonised standard EN 61800-5-1 EN 61800-5-1 is used for the inverters.
- The product is not a household appliance, but is only designed as component for commercial or professional use in terms of EN 61000-3-2 EN 61000-3-2.
- The product can be used according to the technical data if drive systems have to comply with categories according to EN 61800-3 EN 61800-3.

In residential areas, the product may cause EMC interferences. The operator is responsible for taking interference suppression measures.

- The harmonised standard IEC/EN 60034 is used for the three-phase motors.
- Do not use the built-in brakes as fail-safe brakes. Disruptive factors that cannot be influenced can cause the brake torque to be reduced.

Project planning

Safety instructions
Handling



Handling

Transport, storage

Comply with the instructions for transport, storage and proper handling. Ensure careful handling and avoid mechanical overloading. Do not bend any components during transport and handling and do not change the insulation clearances. Do not touch any electronic components and contacts. Do not damage or destroy any electrical components as doing so can cause a health hazard!

The storage location must be free of vibrations and shocks ($V_{\text{eff}} < 0.2 \text{ mm/s}$) in order to avoid roller-bearing damage when equipment is at a standstill.

When the product is being stored, temperature changes with condensation formation are to be avoided.

Shafts and bright surfaces are delivered with protection against corrosion.

Installation

The technical data and supply conditions can be obtained from the nameplate and the documentation. They must be strictly observed.

You must install the product in accordance with the regulations indicated in the associated documentation. Adhere to the climatic conditions as indicated in the technical data.

Ambient media – especially chemical aggressive media – can attack shaft sealing rings and paintwork (general plastics). Abrasive media can damage the shaft sealing rings. If this happens, consult the responsible branch office of Lenze.

Electrical connection

When working on energised products, comply with the applicable national accident prevention regulations.

The electrical installation work must be carried out according to the appropriate regulations (e. g. cable cross-sections, fuses, PE connection). Additional information can be obtained from the documentation.

The documentation contains instructions on EMC-compliant installation. Comply with these instructions in the case of CE-labelled products as well. The manufacturer of the system or machine is responsible for adherence to the limits required in connection with EMC laws.

operation

Where appropriate, you must equip the system/machine with additional monitoring and protective devices. Comply with the safety regulations and other regulations applicable at the place of operation.

After the product has been separated from the supply voltage, refrain from immediately touching the live parts and power connections of the device because capacitors may have been charged. Take note of the corresponding information plates on the product.

Deposited dirt or dust prevent head dissipation (cooling). Remove any such deposits at regular intervals.

Maintenance and servicing

The products are maintenance-free if the prescribed conditions of use are complied with.

Disposal

The products and accessories must be properly disposed of in accordance with the applicable regulations. The products contain raw materials that can be recycled such as metals, plastics and electronic components.



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!

Protection of persons

It is not permissible for the product to perform functions for the protection of persons and machine without a higher-level safety system..

Before working on the product, check that all power terminals have been deenergised. High-frequency voltages can be capacitively transferred to the motor housing due to inverter feeding. Carefully earth the product at the marked places.

Where appropriate, you must equip the system/machine with additional monitoring and protective devices in accordance with the respectively applicable safety requirements. Danger of injury due to rotating parts. Before working on the product, wait until the drive comes to a standstill.

Installed brakes are no fail-safe brakes.

Surface and corrosion protection

The motors can be used for the following ambient conditions:

- Indoor installation, no special corrosion protection necessary
- Painting by customer possible



Aluminium parts are not coated, fan cowls are zinc-coated or primed with grey paint. Slight colour differences of the components are possible.

Lubricants

The motors are delivered filled with a lubricant so that they remain lubricated for their entire service life



The amount and type of lubricant contained are shown on the nameplate.

Gearboxes and geared motors from Lenze are delivered filled with a lubricant specifically chosen for the drive and the type of construction. The amount of lubricant depends on the mounting position and the design (both to be indicated when ordering)..

The amount and type of lubricant in the gearbox are indicated on the nameplate.

Technical data

Standards and operating conditions
Conformities/approvals



Technical data

Standards and operating conditions

Conformities/approvals

Conformity		
CE	2014/35/EU	Low-Voltage Directive
	2014/30/EU	EMC Directive (reference: CE-typical drive system)
EAC	TR TC 004/2011	Eurasian conformity: safety of low voltage equipment
	TP TC 020/2011	Eurasian conformity: electromagnetic compatibility of technical means
Approval		
CCC		GB Standard 12350-2009
cULus	UL 61800-5-1	for USA and Canada (requirements of the CSA 22.2 No. 14) Industrial Control Equipment, Lenze File No. E132659

Protection of persons and device protection

Degree of protection		
IP55	EN 60529	
Type 4 indoor only	NEMA 250	
Type 12		
Insulation resistance		
Overvoltage category III	EN 61800-5-1	Site altitude 0 ... 2000 m above sea level
Overvoltage category II	EN 61800-5-1	Site altitude more than 2000 m above sea level: External measures for compliance with overvoltage category II are necessary, e.g. connection of an isolating transformer upstream , connection of an overvoltage protection device upstream
Protective insulation of control circuits		
Safe separation from the mains supply by means of double/increased insulation for digital inputs and outputs	EN 61800-5-1	Site altitude 0 ... 2000 m above sea level
Upstream connection of overvoltage protection device	EN 61800-5-1	Site altitude more than 2000 m above sea level: Additional external separating measures necessary for purposes of safe separation.
Protective measures against		
Short circuit	EN 61800-5-1	To a limited extent, fault acknowledgement necessary
earth fault	EN 61800-5-1	To a limited extent, fault acknowledgement necessary
Overvoltage		Yes
Motor stalling		Yes
Motor overtemperature		I ² xt-monitoring
Leakage current		
> 3.5 mA AC, > 10 mA DC	EN 61800-5-1	Observe regulations and safety instructions!
Equipotential bonding		Additional M5 thread with terminal at the terminal box for connection of a 6 mm ² PE cable
Total fault current		
Residual current operated switch 30 mA, Type B		In TN power supply systems
Cyclic mains switching		
3 times a minute, max. 20 times per hour		Mains switching 3 times in one minute must be followed by a pause of 9 minutes.
Starting current		
5.6 A mains power-on current		



EMC data

Actuation on public supply systems		
Implement measures to limit the radio interference to be expected:		The machine or plant manufacturer is responsible for compliance with the requirements for the machine/plant!
< 1 kW: with mains choke	EN 61000-3-2	
> 1 kW at mains current ≤ 16 A: without additional measures		
Mains current > 16 A: with mains choke or mains filter, with dimensioning for rated power. Rsce ≥ 120 is to be met.	EN 61000-3-12	RSCE: short-circuit power ratio at the connection point of the machine/plant to the public network.
Noise emission		
Category C2	EN 61800-3	
Noise immunity		
Meets requirement in compliance with	EN 61800-3	

Environmental conditions

Energy efficiency		
Class IES2	EN 50598-2	
Climate		
1K3 (-30 °C ... +60 °C)	EN 60721-3-1	Storage, < 3 months
1K3 (-30 °C ... +40 °C)	EN 60721-3-1	Storage, > 3 months
2K3 (-30 °C ... +70 °C)	EN 60721-3-2	Transport
3K3 (-30 °C ... +40 °C) In the case of very low-temperature applications without condensation	EN 60721-3-3	operation
Site altitude		
0 ... 1000 m a.m.s.l.		Without power reduction
1000 ... 4000 m a.m.s.l.		Reduce rated output current by 5 %/1000 m
Degree of pollution		
Degree of pollution 2	EN 61800-5-1	
Vibration resistance		
2M2	EN 60721-3-2	Transport
3M4	EN 60721-3-3	operation
Vibration severity		
A	EN 60034-14	

Electrical supply conditions

Possibility of connection to different types of mains power supply enables worldwide use.

The following is supported:

- 3-phase mains connection 400 V
- 3-phase mains connection 480 V

Type of mains power supply		
TT		Mains power supplies with earthed start point Voltage against earth: max. 300 V
TN		

Technical data

Radial forces and axial forces



Radial forces and axial forces

Permissible axial force

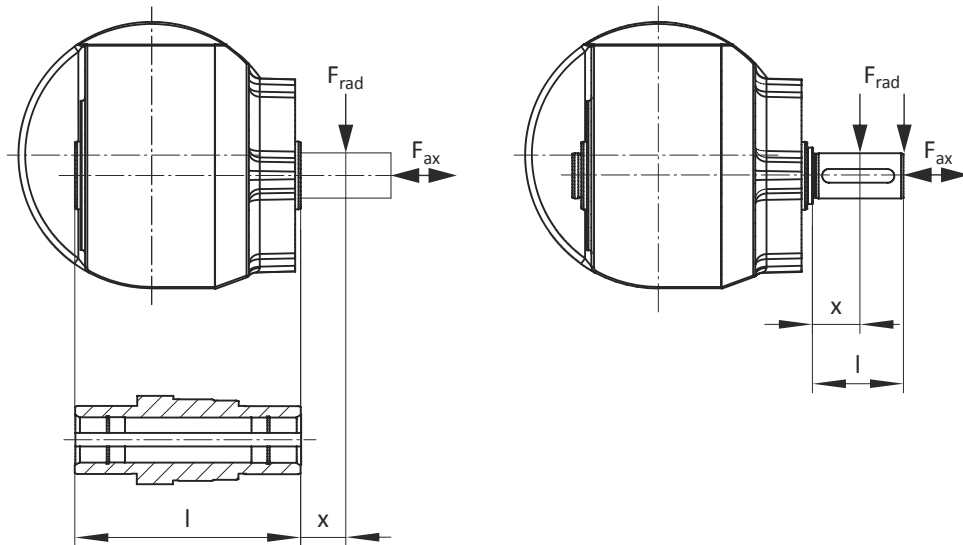
If there is no radial force, the maximum axial force is 50% of the value in the table $F_{rad,max}$

$$F_{ax, zul} = 0.5 \times F_{rad,max}$$

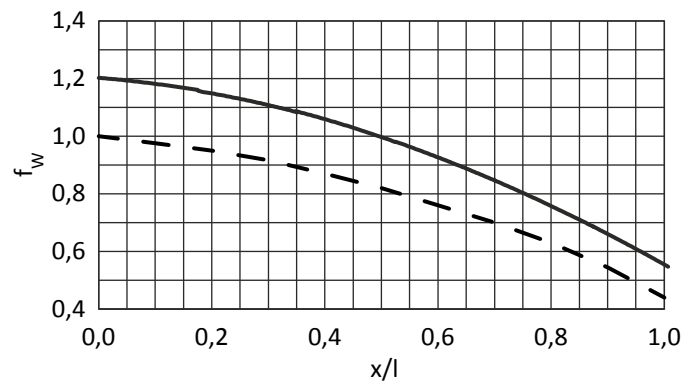


If there is a combination of radial force and axial force (F_{rad} und $F_{ax} \neq 0$), please consult your responsible branch office of Lenze.

Application of forces



Additional load factor f_w on the drive shaft



— Solid shaft
- - - Hollow shaft

The values given in the tables relate to the force application point at the centre of the shaft end and are minimum values that have been calculated according to the most unfavourable conditions (force application angle, mounting position, direction of rotation). The values have been calculated with a load capacity of $c = 1.0$.



In the case of different conditions of use, considerably greater forces can be transmitted. If so, consult the Lenze branch office.



Technical data

Radial forces and axial forces

Max. radial force, hollow shaft

Gearbox	n_2				
	rpm				
	221.2	160	100	63	42.6
	$F_{rad,max}$				
	N				
g350-B25	1600	1700	1,900	1,900	1,900
g350-B50	1800	2000	2200	2400	2400
g350-B75	3000	3300	3600	3600	3600

Max. radial force, solid shaft without flange

Gearbox	n_2				
	rpm				
	221.2	160	100	63	42.6
	$F_{rad,max}$				
	N				
g350-B25	1550	1700	1,900	1,900	1,900
g350-B50	1800	2000	2200	2400	2400
g350-B75	2900	3100	3,400	3,400	3,400

Max. radial force, solid shaft with flange

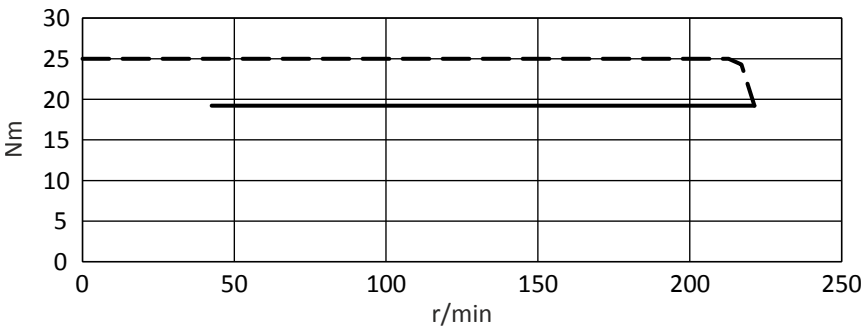
Gearboxes	n_2				
	rpm				
	221.2	160	100	63	42.6
	$F_{rad,max}$				
	N				
g350-B25	1450	1600	1800	1800	1800
g350-B50	1700	1,900	2100	2300	2300
g350-B75	2800	3000	3300	3300	3300



Starting torques

g350-B25

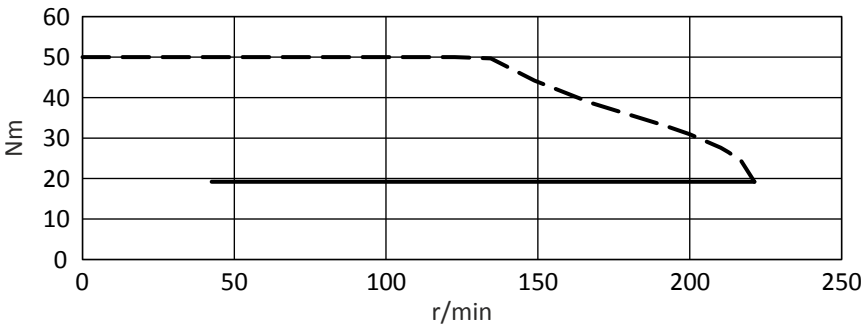
MSEMA□□063-42



--- Starting torque
— Output torque

g350-B50

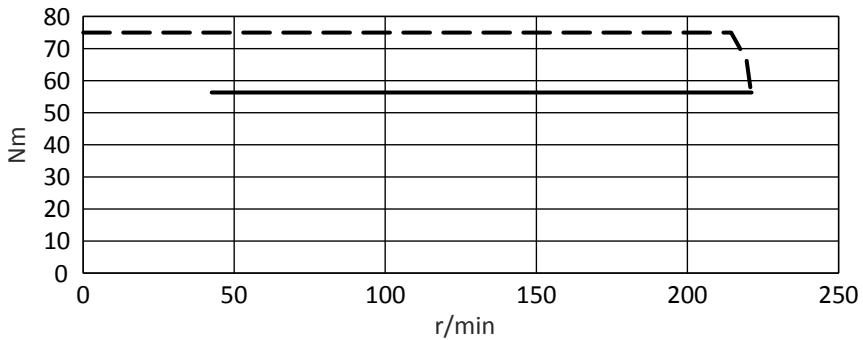
MSEMA□□063-42



--- Starting torque
— Output torque

g350-B75

MSEMA□□080-32



--- Starting torque
— Output torque



Selection tables

Mains operation						i	Geared motor	
Min. output speed		Max. output speed		Starting torque				
n ₂₁	M ₂	n ₂	M ₂	M _{a,1}	M _{a,2}			
rpm	Nm	rpm	Nm	Nm	Nm			
42.6	19.3	221.2	19.3	25.0	26.7	11.750	g350-B25	MSEMA□□063-42
	19.3		19.3	50.0	50.0		g350-B50	MSEMA□□063-42
	55.2		55.2	75.0	102.2		g350-B75	MSEMA□□080-32

$M_{a,1}$ Maximum permissible starting torque that is available for up to 5 million switching cycles

$M_{a,2}$ Maximum permissible starting torque that is available for up to 500,000 switching cycles

Technical data

Dimensions



Dimensions



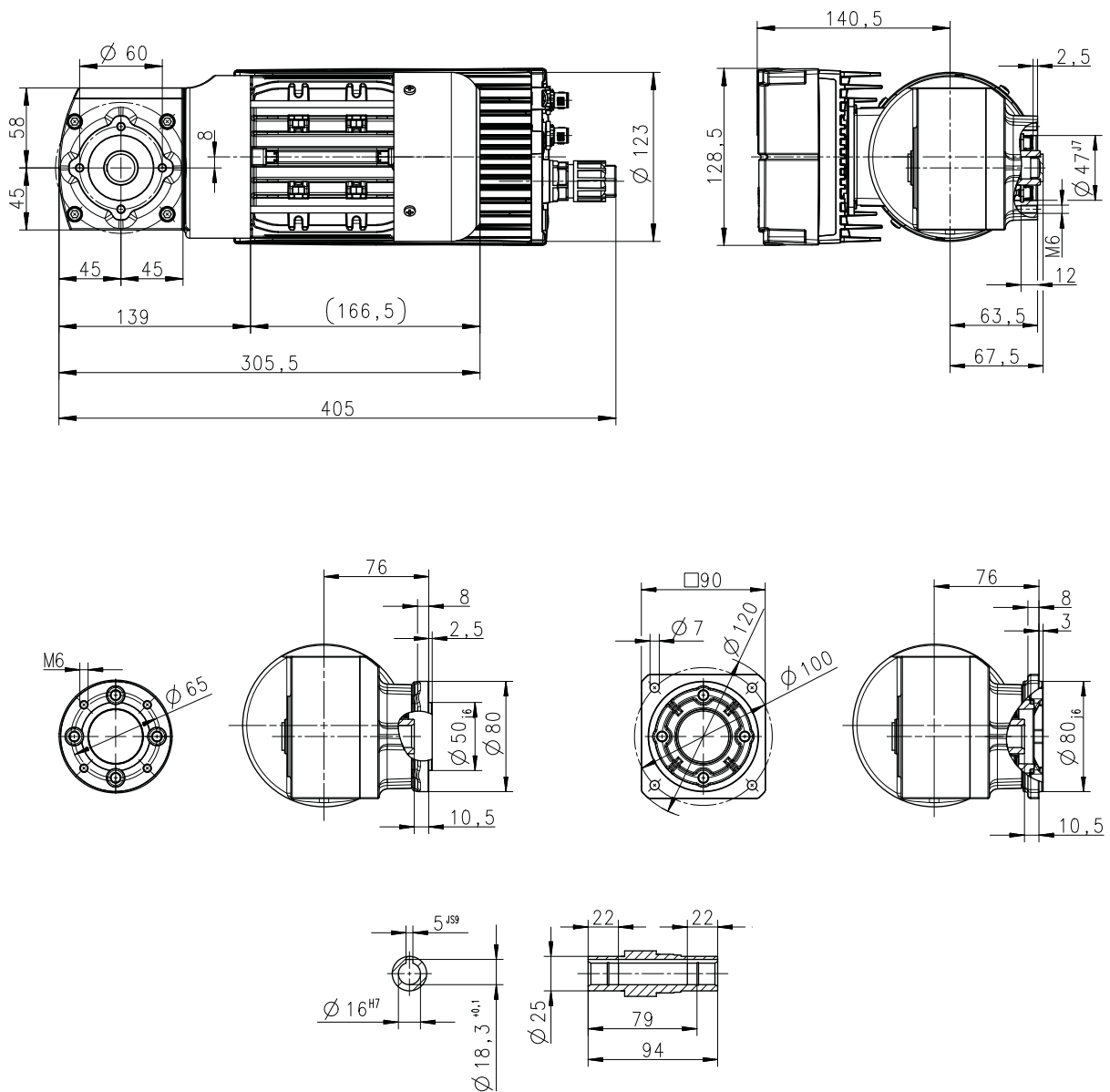
The dimensions are given in mm.
Some of the representations contain mounted product extensions.

g350-B25

MSEMA□□063-42

Dimensions with hollow shaft, without brake

Product extension: Flange FT65 or FF100



8800515-00



Technical data

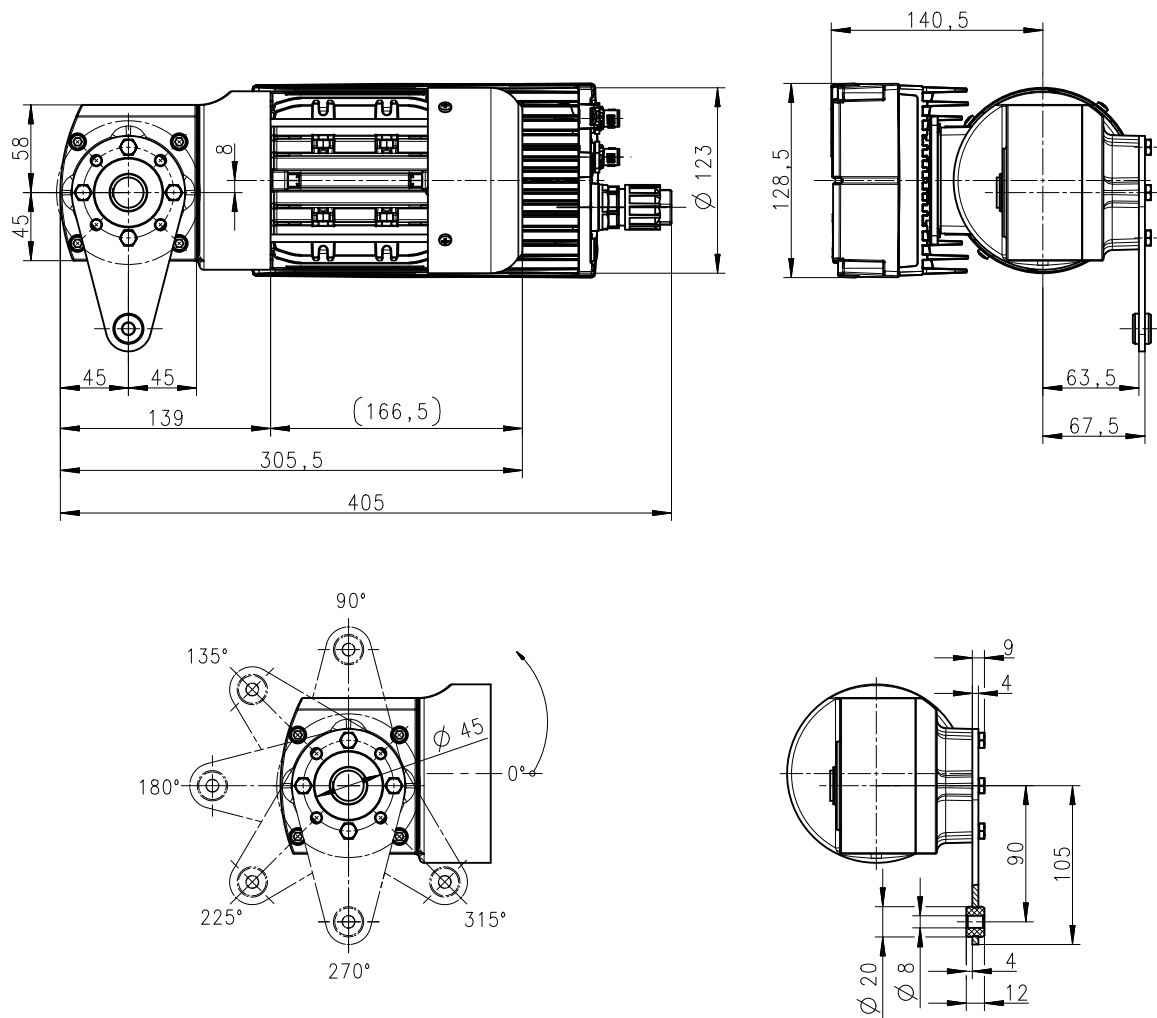
Dimensions

g350-B25

MSEMA□□063-42

Dimensions with hollow shaft, without brake

Product extension: Torque plate



8800517-00

Technical data

Dimensions

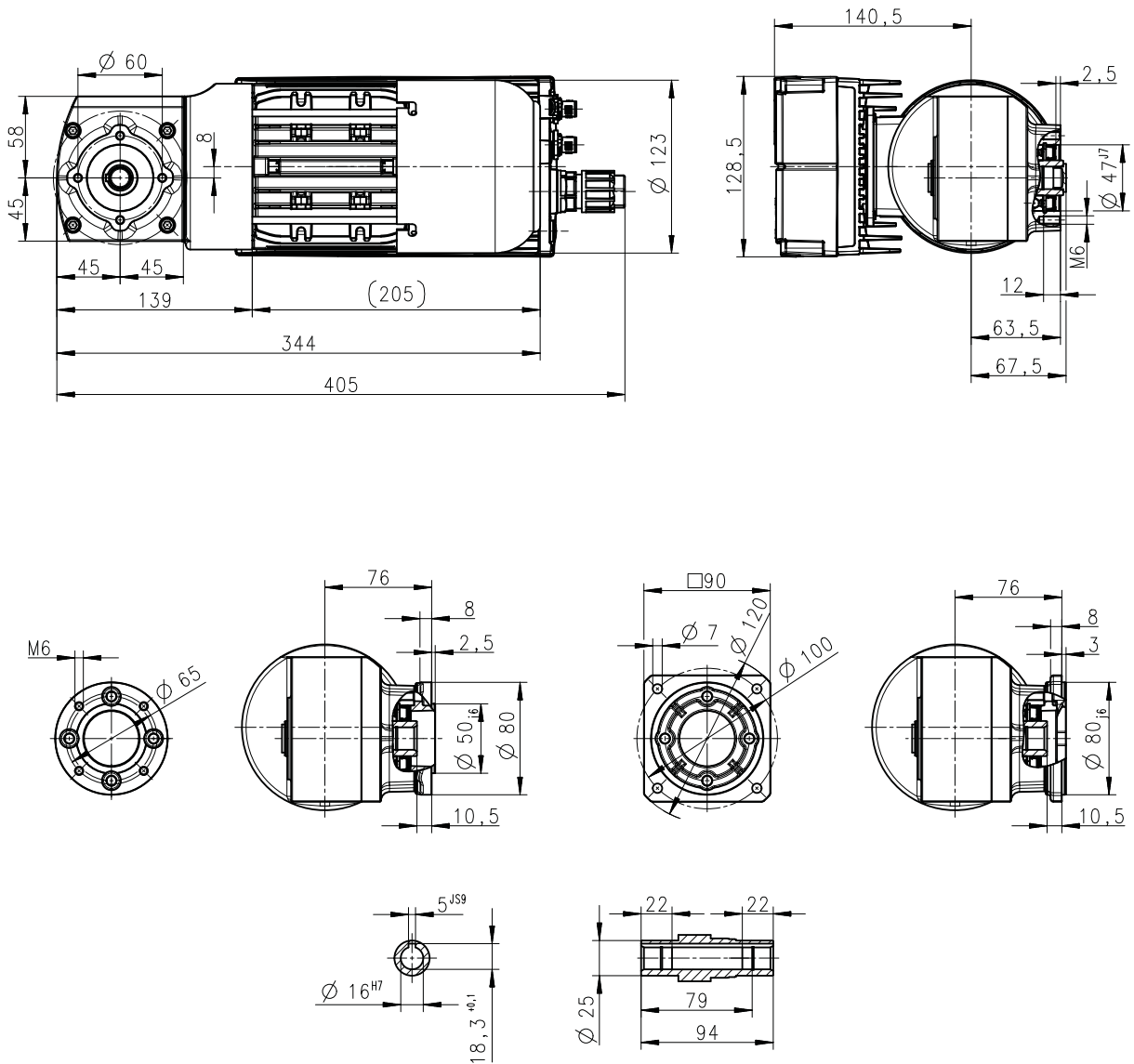


g350-B25

MSEMA□□063-42

Dimensions with hollow shaft and brake

Product extension: Flange FT65 or FF100



8800518-00



Technical data

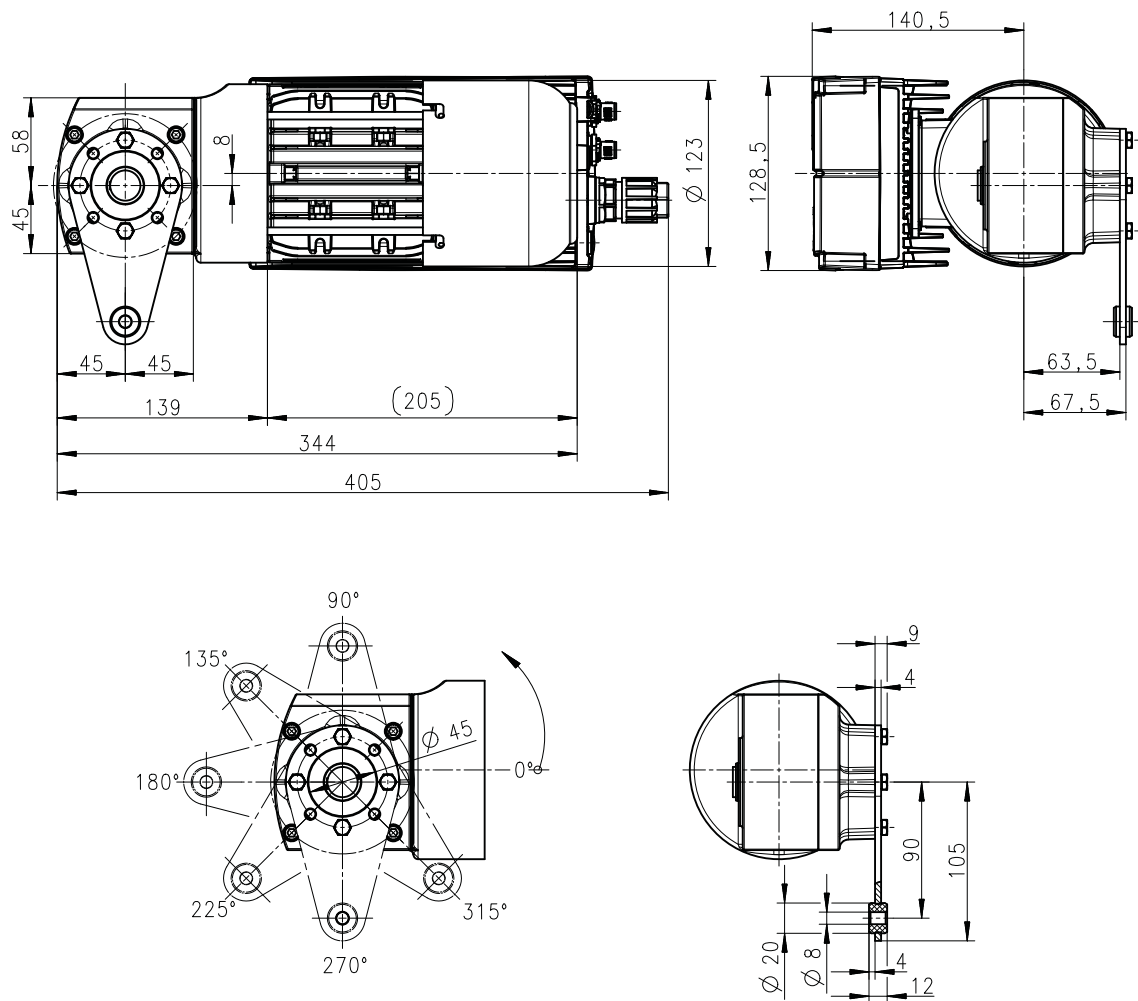
Dimensions

g350-B25

MSEMA□□063-42

Dimensions with hollow shaft and brake

Product extension: Torque plate



8800520-00

Technical data

Dimensions

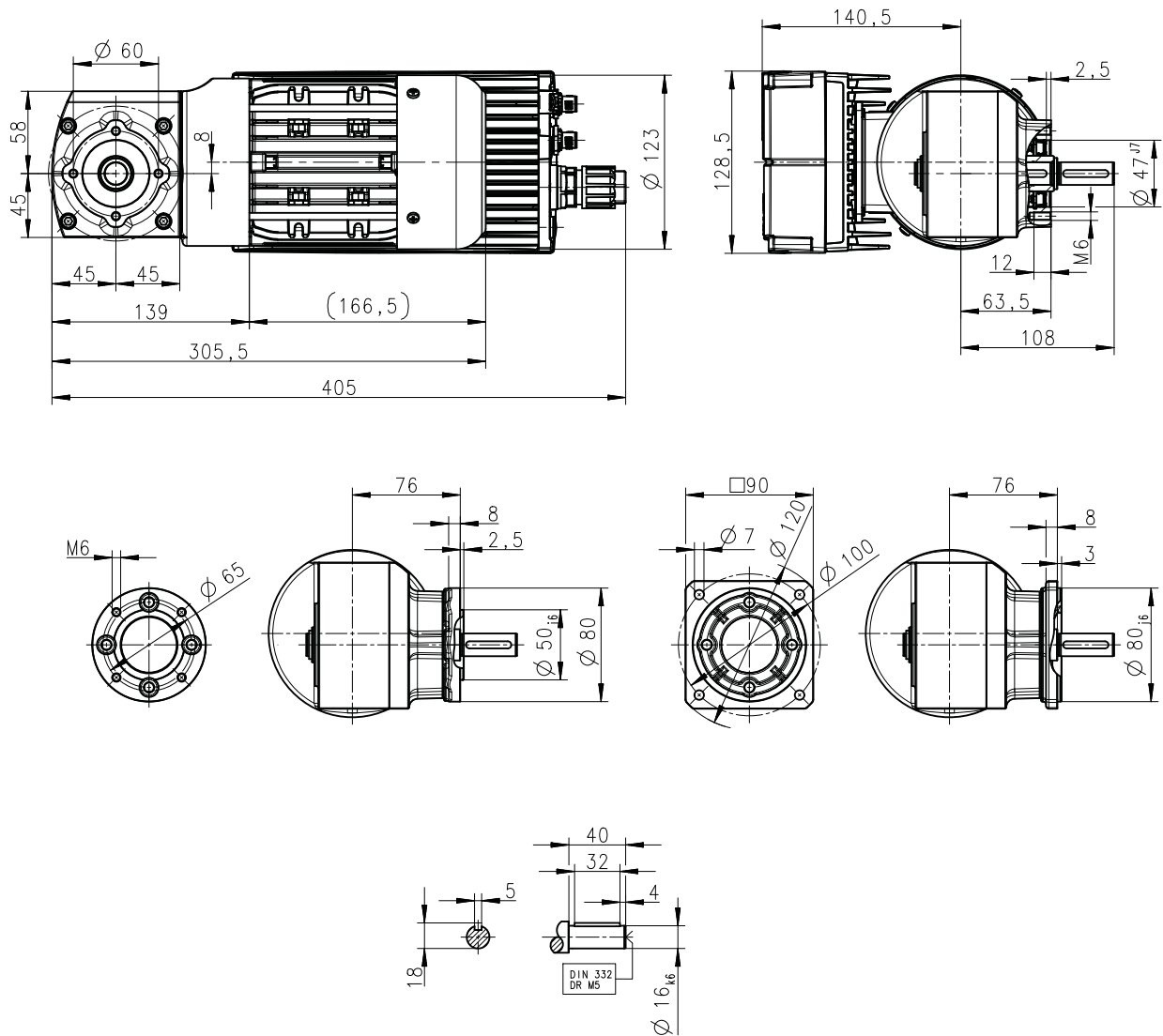


g350-B25

MSEMA□□063-42

Dimensions without brake

Product extension: Solid shaft, flange FT65 or FF100



8800516-00



Technical data

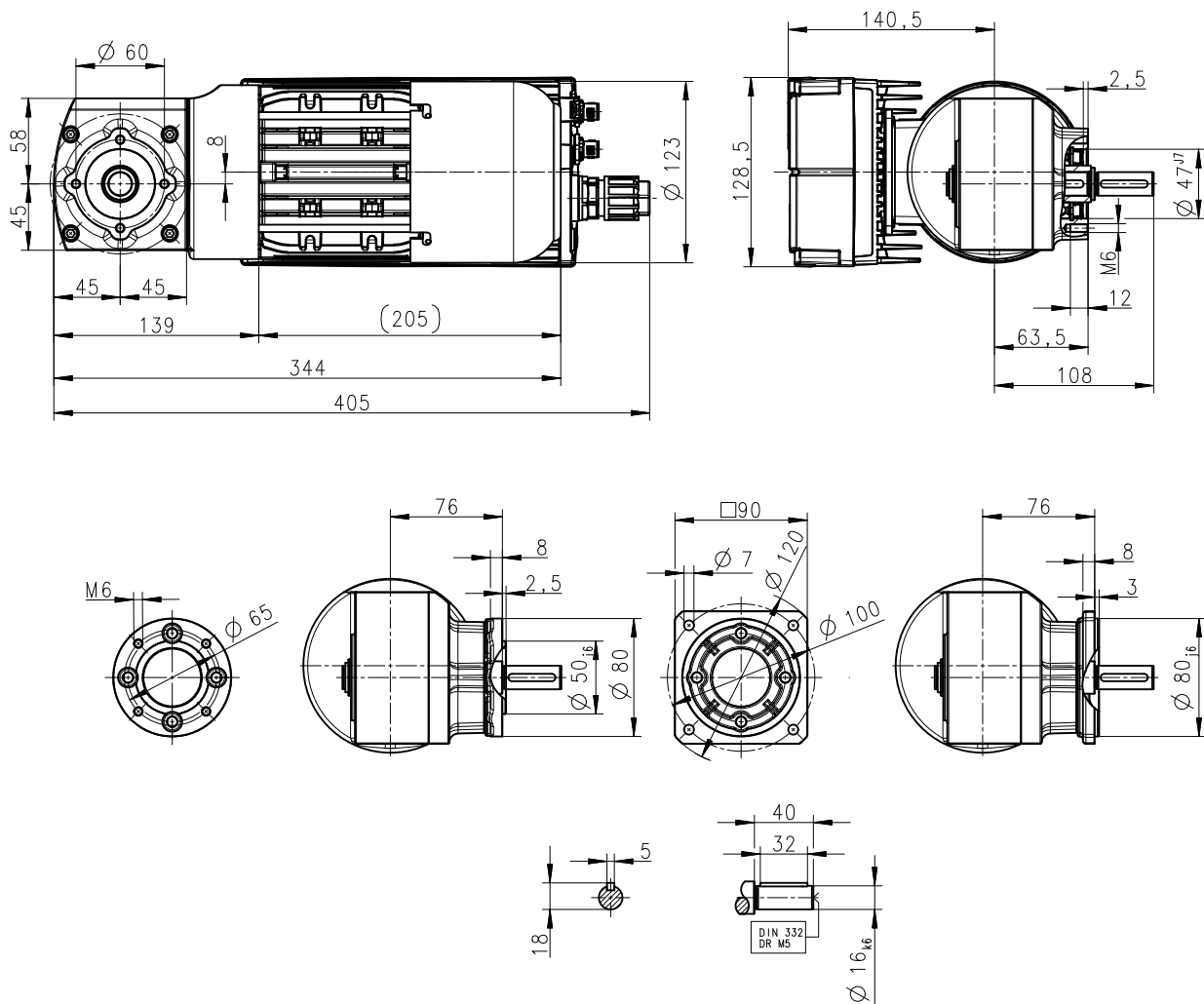
Dimensions

g350-B25

MSEMA□□063-42

Dimensions with brake

Product extension: Solid shaft, flange FT65 or FF100



8800519-00

Technical data

Dimensions

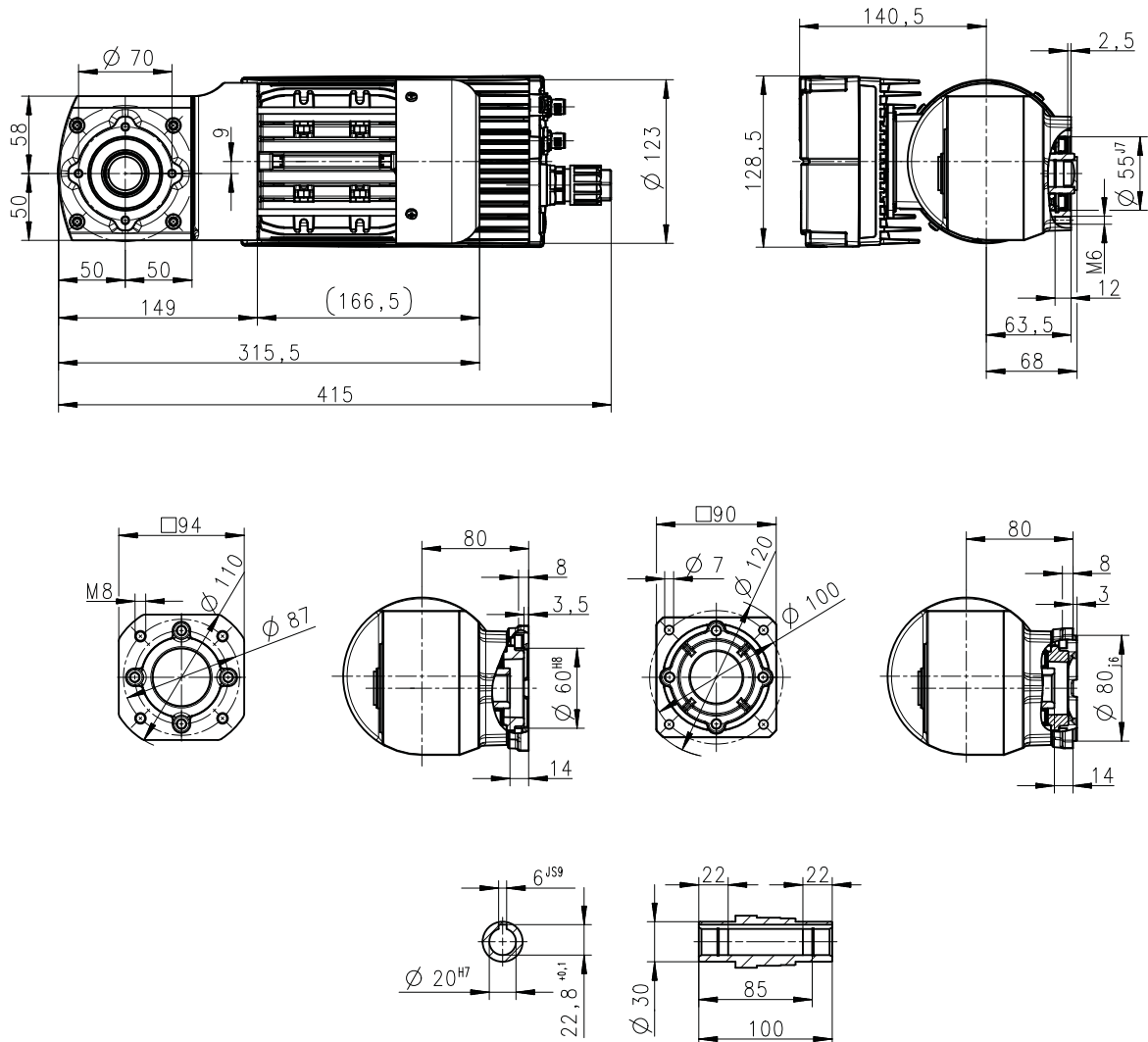


g350-B50

MSEMA □ □ 063-42

Dimensions with hollow shaft, without brake

Product extension: Flange FT87 or FF100



8800521-00



Technical data

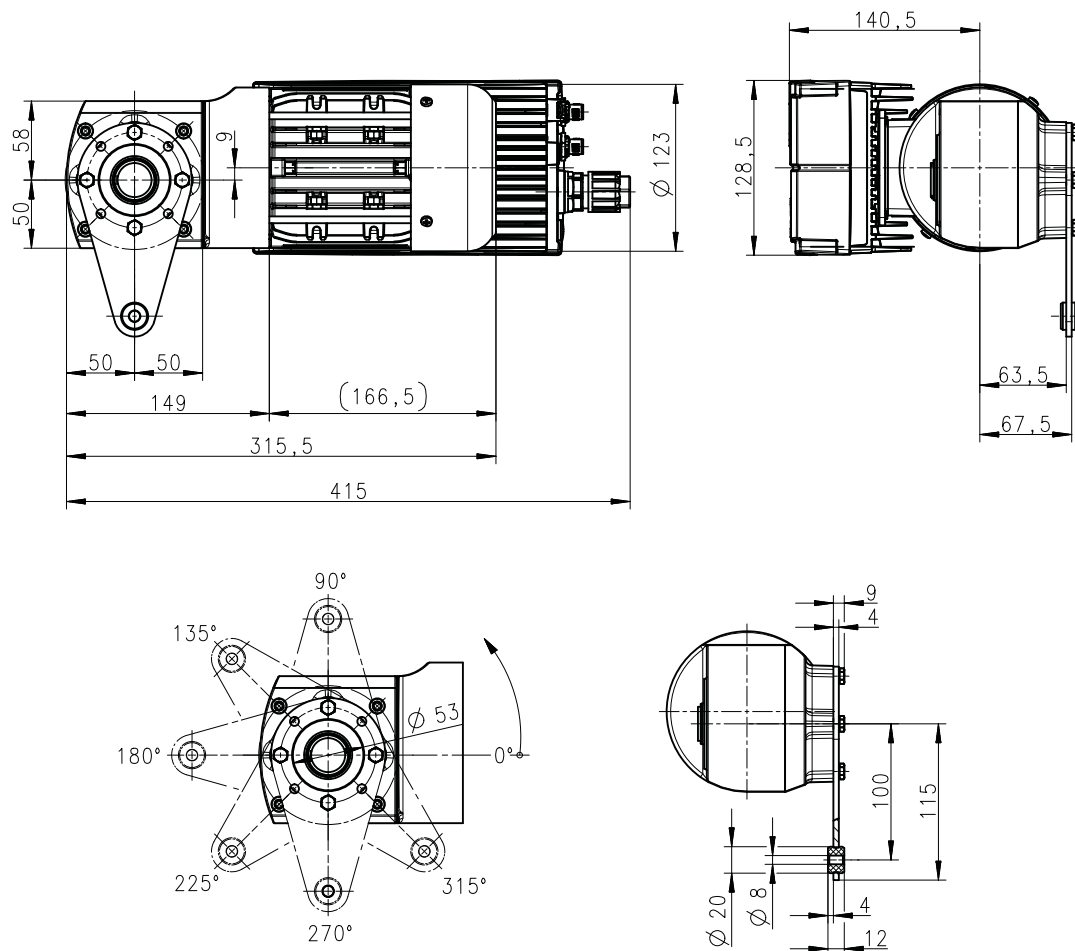
Dimensions

g350-B50

MSEMA□□063-42

Dimensions with hollow shaft, without brake

Product extension: Torque plate



8800523-00

Technical data

Dimensions

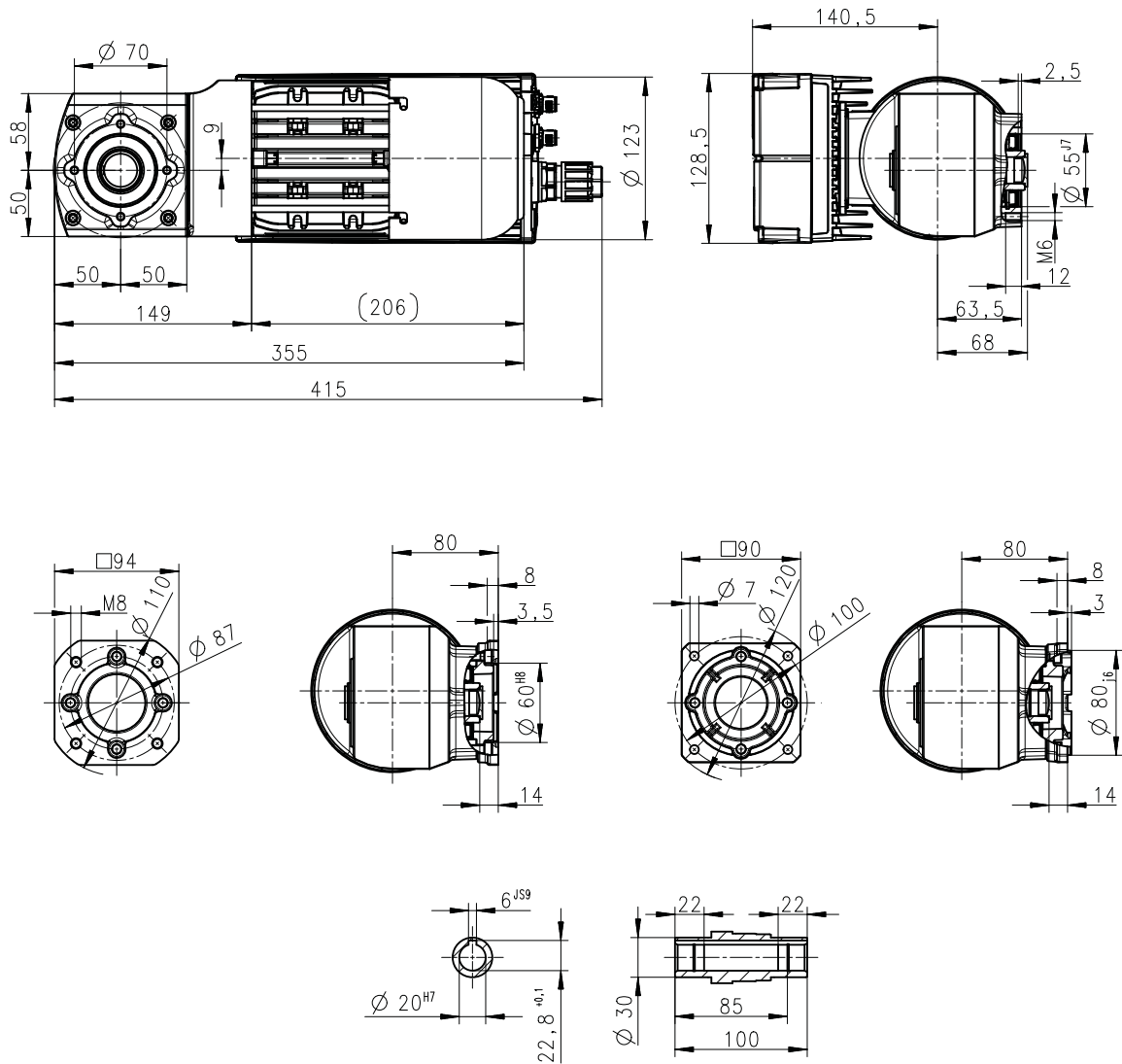


g350-B50

MSEMA□□063-42

Dimensions with hollow shaft and brake

Product extension: Flange FT87 or FF100



8800524-00



Technical data

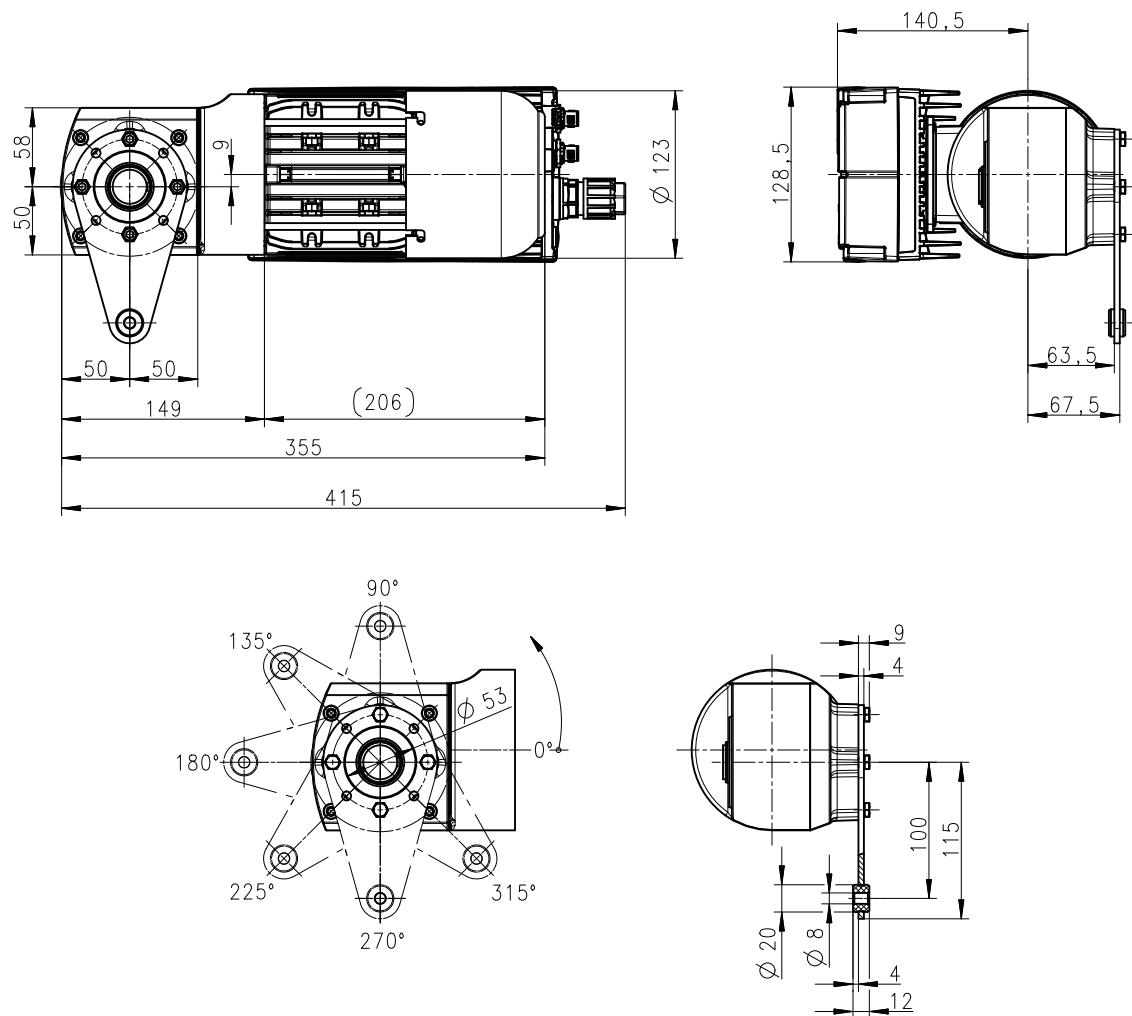
Dimensions

g350-B50

MSEMA□□063-42

Dimensions with hollow shaft and brake

Product extension: Torque plate



8800526-00

Dimensions

Dimensions

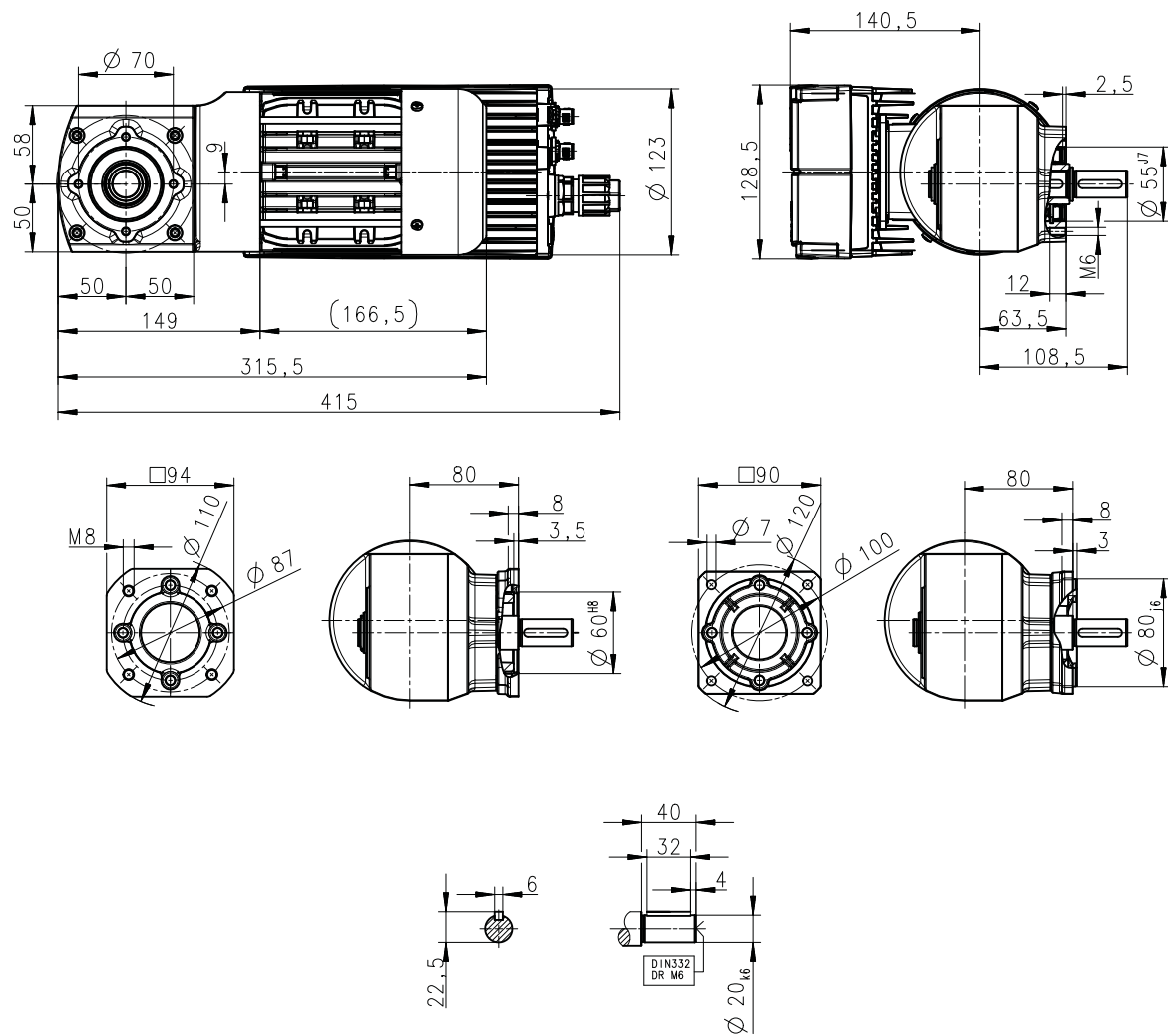


g350-B50

MSEMA 00063-42

Dimensions without brake

Product extension: Solid shaft, flange FT87 or FF100



8800522-00



Technical data

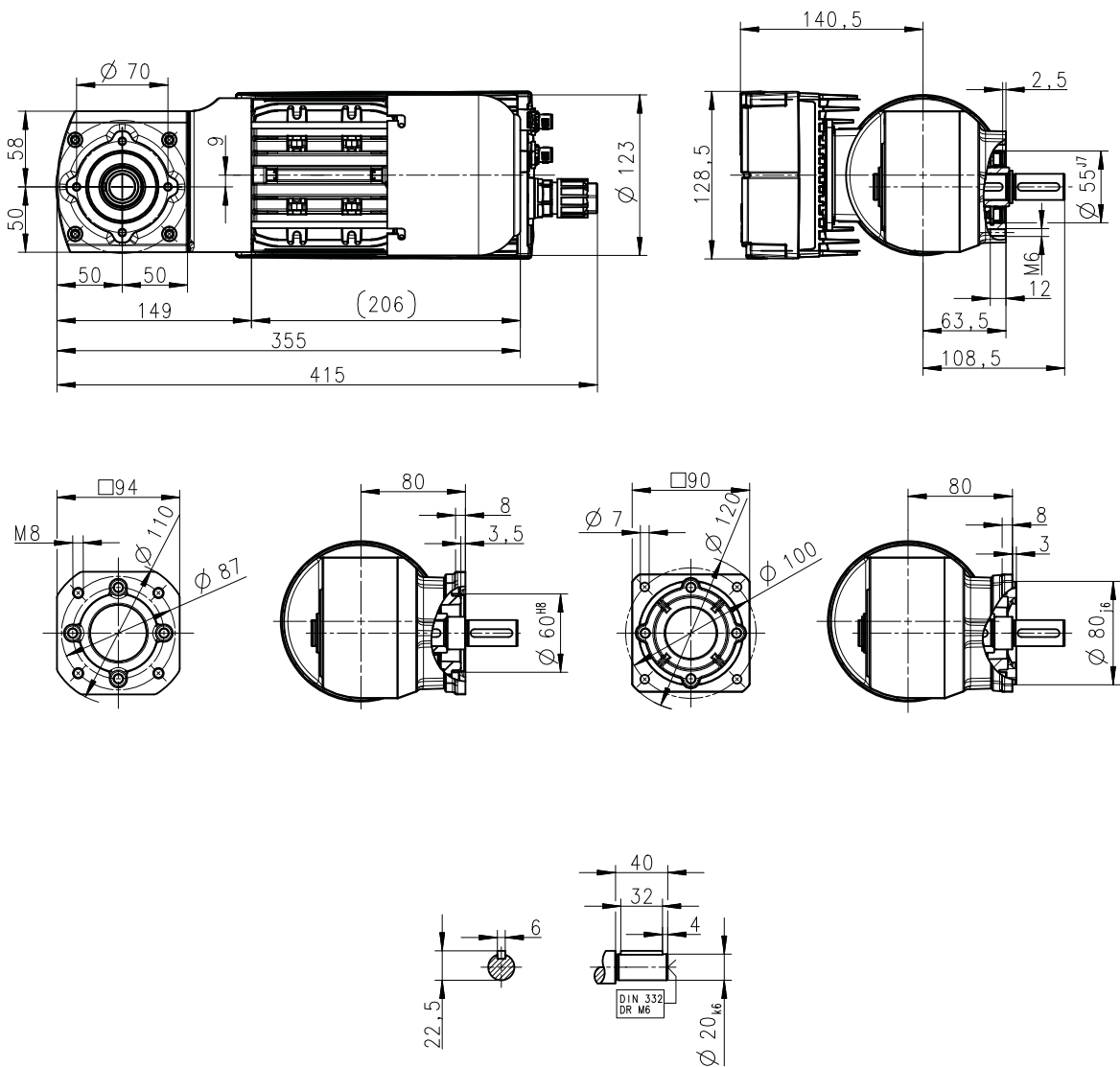
Dimensions

g350-B50

MSEMA□□063-42

Dimensions with brake

Product extension: Solid shaft, flange FT87 or FF100



8800525-00

Technical data

Dimensions

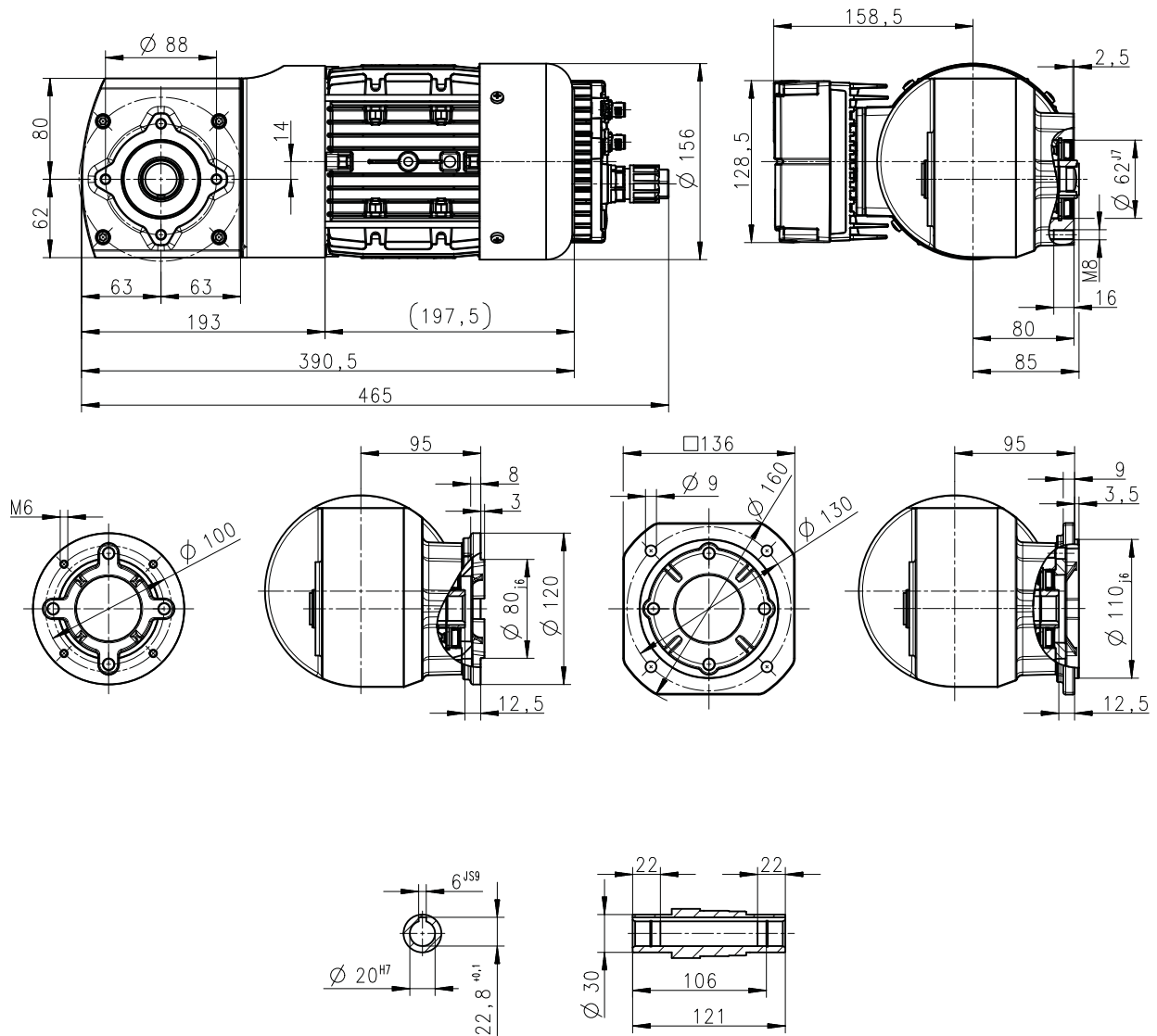


g350-B75

MSEMA□□080-32

Dimensions with hollow shaft, without brake

Product extension: Flange FT100 or FF130



8800527-00



Technical data

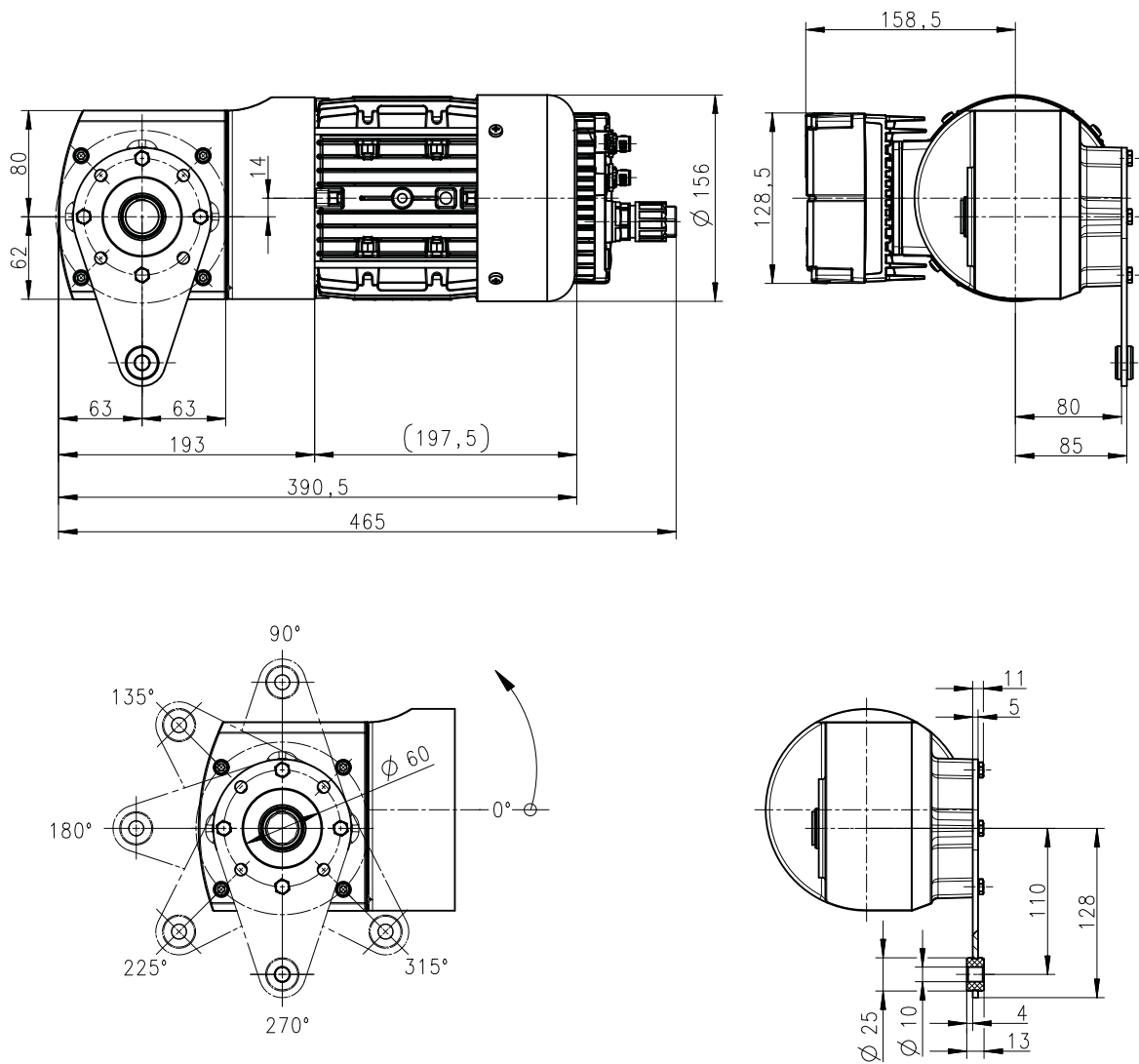
Dimensions

g350-B75

MSEMA□□080-32

Dimensions with hollow shaft, without brake

Product extension: Torque plate



8800529-00

Dimensions

Dimensions

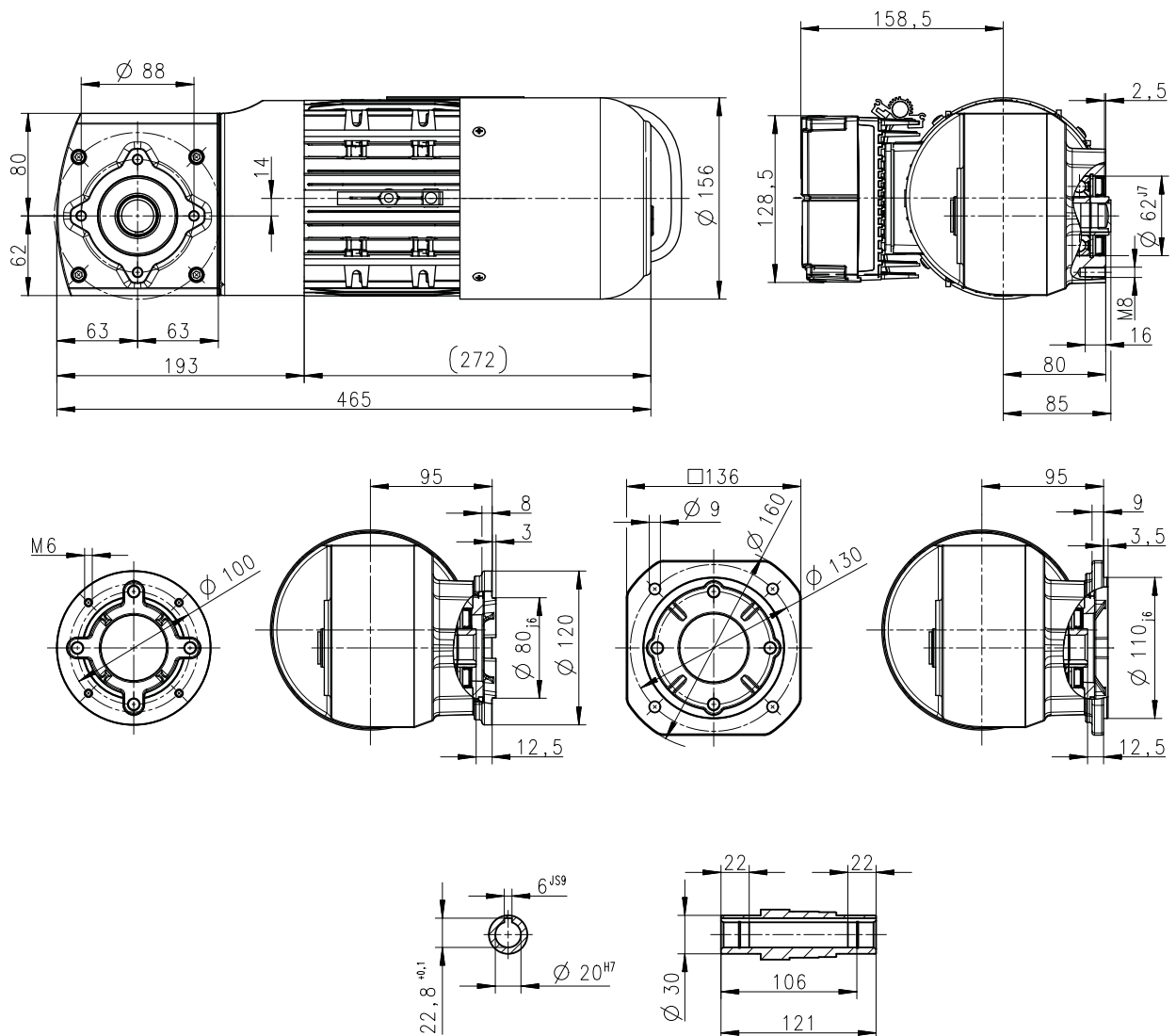


g350-B75

MSEMA 00080-32

Dimensions with hollow shaft and brake

Product extension: Flange FT100 or FF130



8800530-00



Technical data

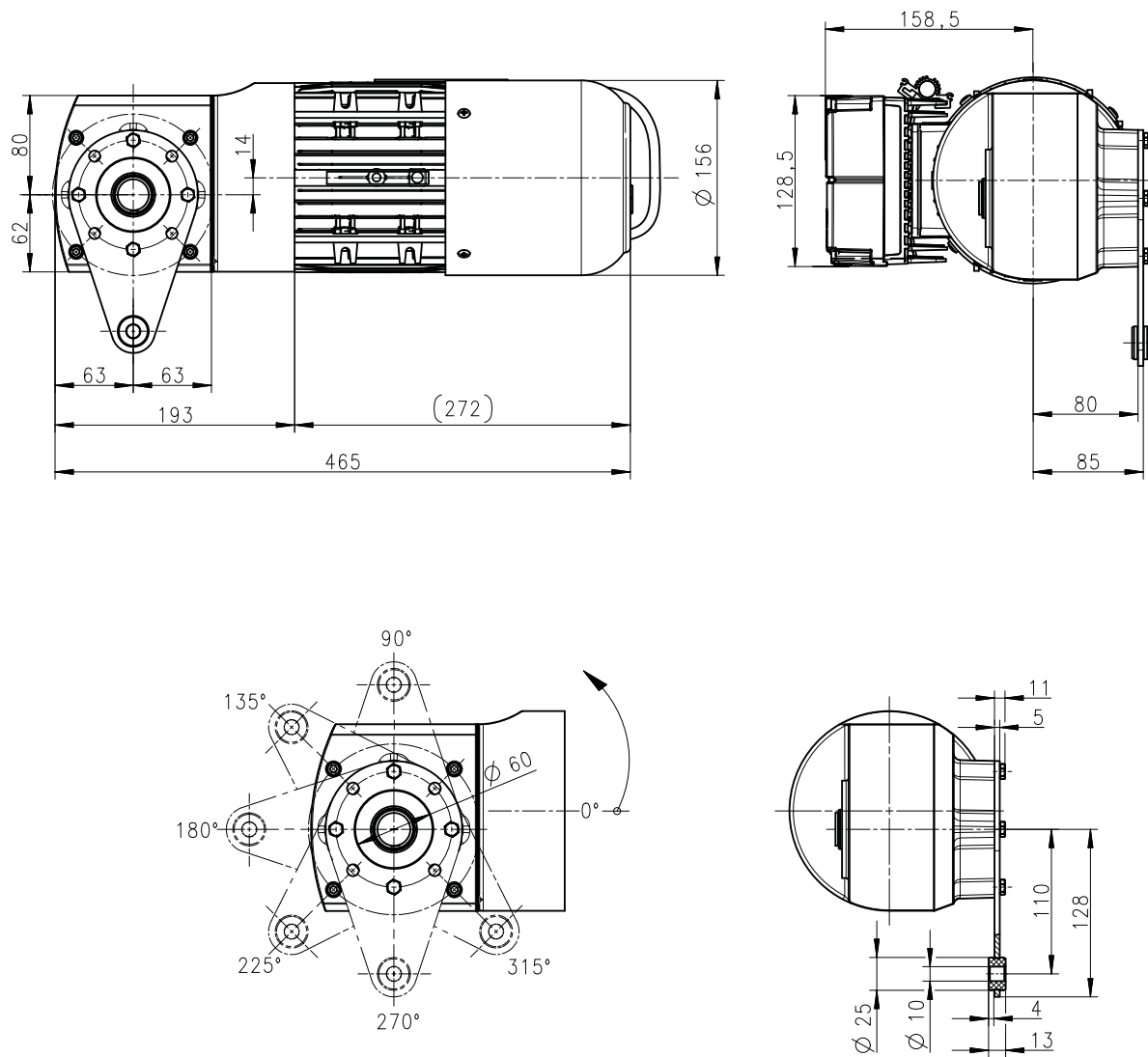
Dimensions

g350-B75

MSEMA□□080-32

Dimensions with hollow shaft and brake

Product extension: Torque plate



8800532-00

Technical data

Dimensions

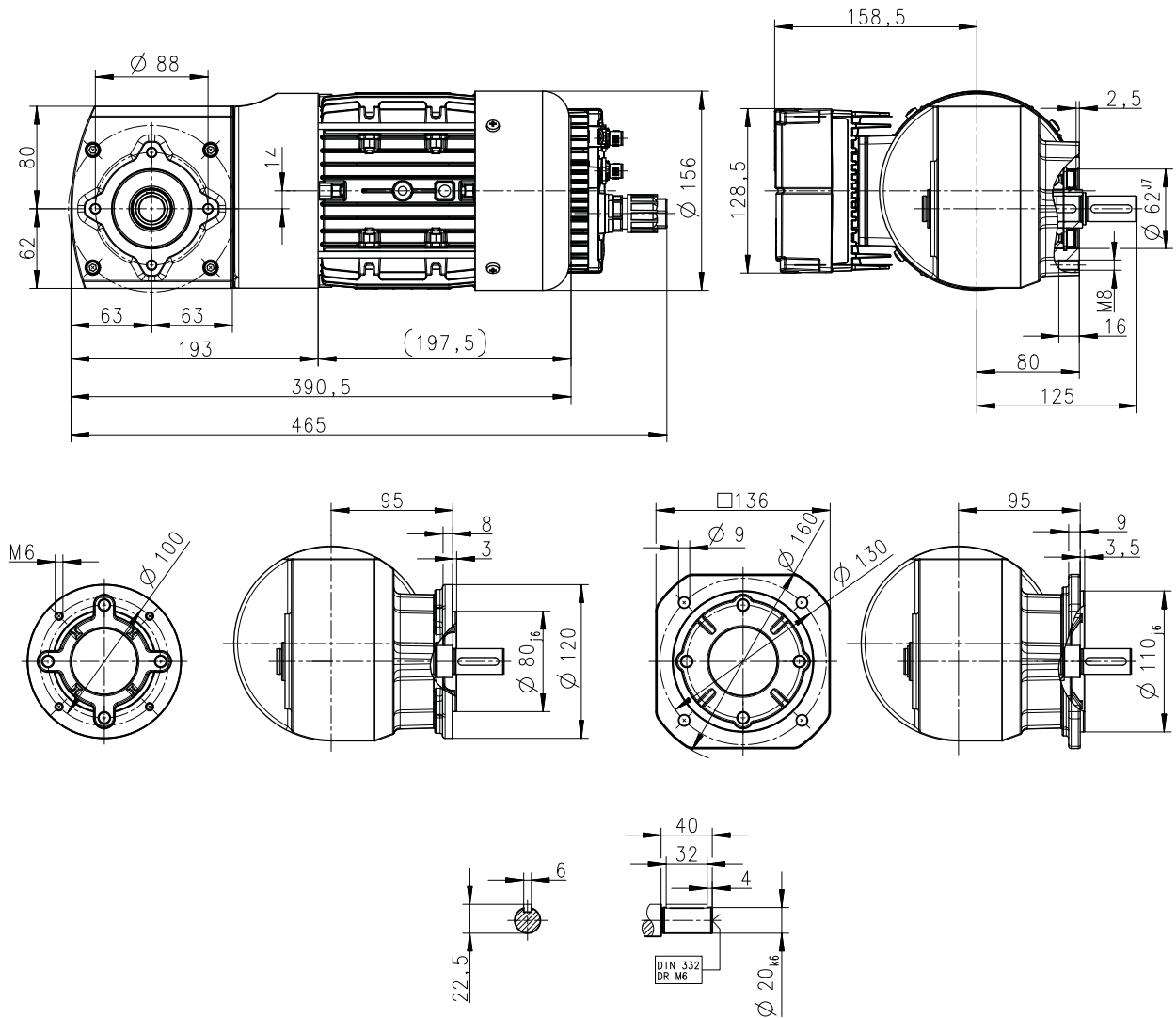


g350-B75

MSEMA □ □ 080-32

Dimensions without brake

Product extension: Solid shaft, flange FT100 or FF130



8800528-00



Technical data

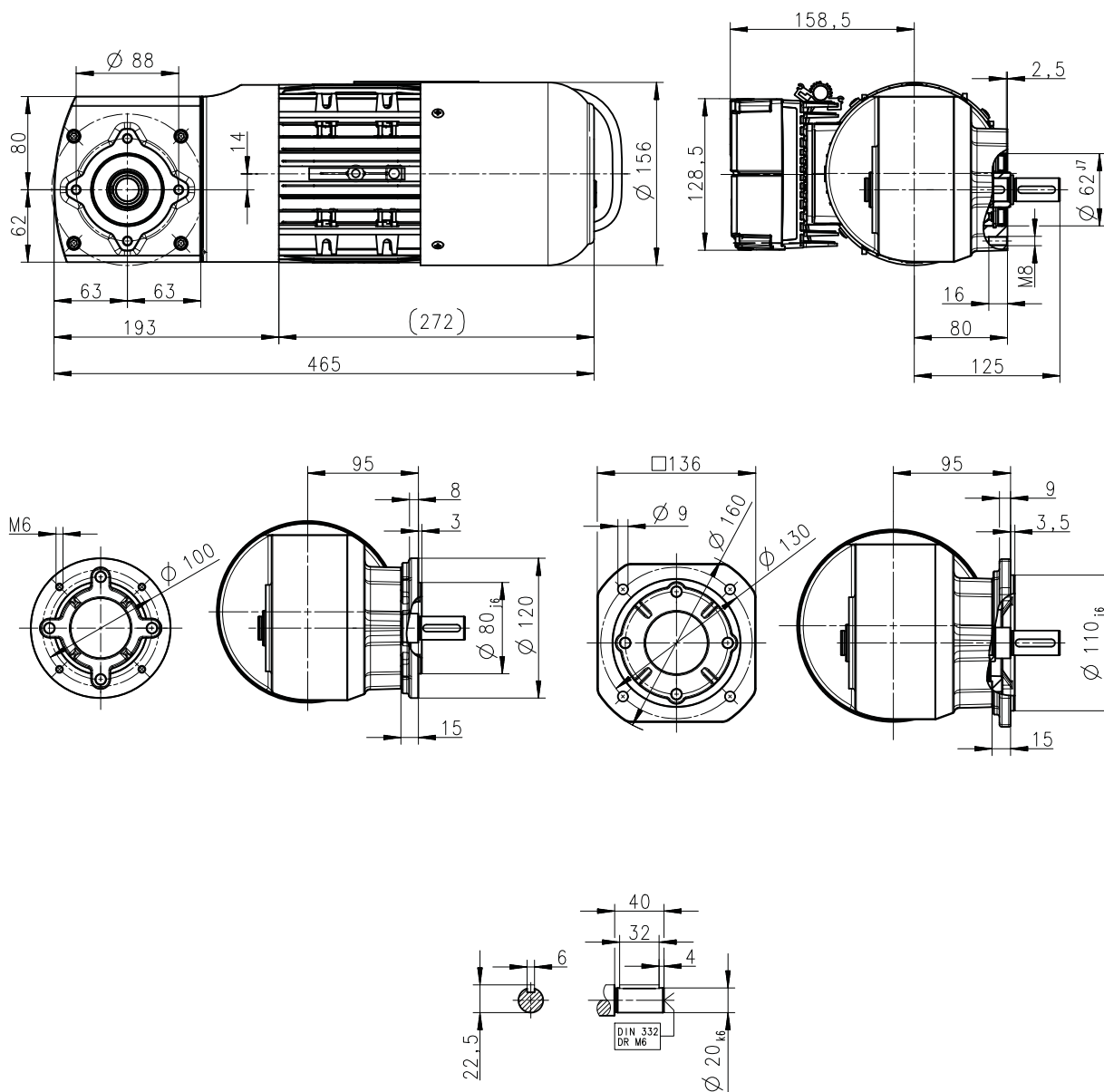
Dimensions

g350-B75

MSEMA □ □ 080-32

Dimensions with brake

Product extension: Solid shaft, flange FT100 or FF130



8800531-00



Weights

Geared motor		g350-B25 MSEMA□□063-42	g350-B50 MSEMA□□063-42	g350-B75 MSEMA□□080-32
Mass				
Without brake	kg	8.4	8.9	18.1
With brake	kg	9.4	9.9	19.8

Additional weights for gearboxes

Gearboxes		g350-B25	g350-B50	g350-B75
Mass				
Solid shaft	kg	0.21	0.35	0.40
Solid shaft for flange	kg	0.24	0.39	0.44
Flange FT65	kg	0.11		
Flange FT87	kg		0.21	
Flange FT100	kg			0.25
Flange FF100	kg	0.16	0.19	
Flange FF130	kg			0.40
Torque plate	kg	0.16	0.21	0.28

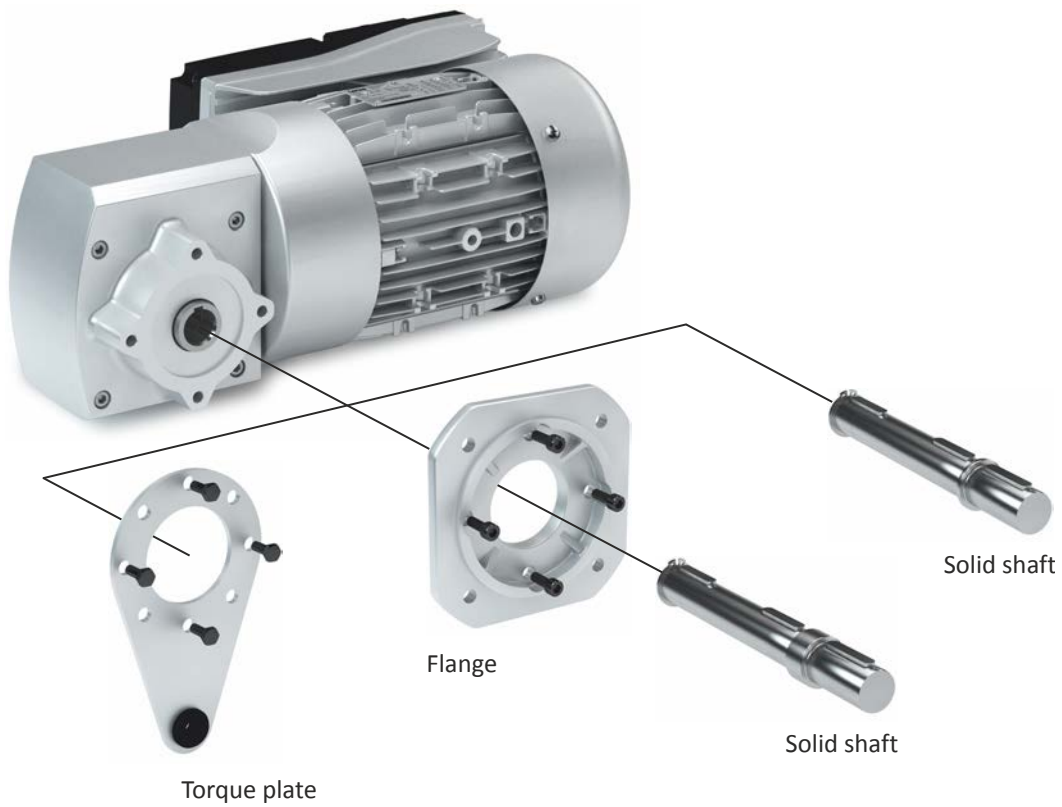


Product extensions

Overview



Either a flange or a torque plate can be mounted at the threaded pitch circle.



Product extensions

Mechanical extension
Shafts



Mechanical extension

Shafts

A solid shaft that can be inserted into the hollow shaft is available as an option.



Depending on the version (with/without flange), different solid shafts are used.



Solid shaft				
Gearboxes	Version	Dimension d x l	VPE	Order code
		mm	Piece	
g350-B25	Without flange	16 x 40	1	13518759
	For flange	16 x 40	1	13518756
g350-B50	Without flange	20 x 40	1	13518761
	For flange	20 x 40	1	13518760
g350-B75	Without flange	20 x 40	1	13518763
	For flange	20 x 40	1	13518762



Product extensions

Mechanical extension
Flanges

Flanges

As an option, flanges can be mounted on the housing by means of four bolts.



Flange				
Gearboxes	Version	Dimension Outside diameter	VPE	Order code
		mm	Piece	
g350-B25	FT65	80	1	13518764
	FF100	120	1	13518765
g350-B50	FT87	110	1	13518766
	FF100	120	1	13518767
g350-B75	FT100	120	1	13518768
	FF130	160	1	13518769

Product extensions

Mechanical extension

Torque plates



Torque plates

Torque plate on threaded pitch circle

Torque support is usually provided by means of the flange.

The torque plates that can be fitted are another simple possibility. In this case, torque support is provided only via one point and is suitable for shaft-mounted gearboxes, among other things. Integrated rubber buffers ensure stress-free installation and absorb any slight impacts.

Mounting is carried out with the help of four bolts in different position on the housing.



Torque plate		
Gearboxes	VPE	Order code
	Piece	
g350-B25	1	13518585
g350-B50	1	13518588
g350-B75	1	13518589



Product extensions

Brakes
Spring-applied brakes

Brakes

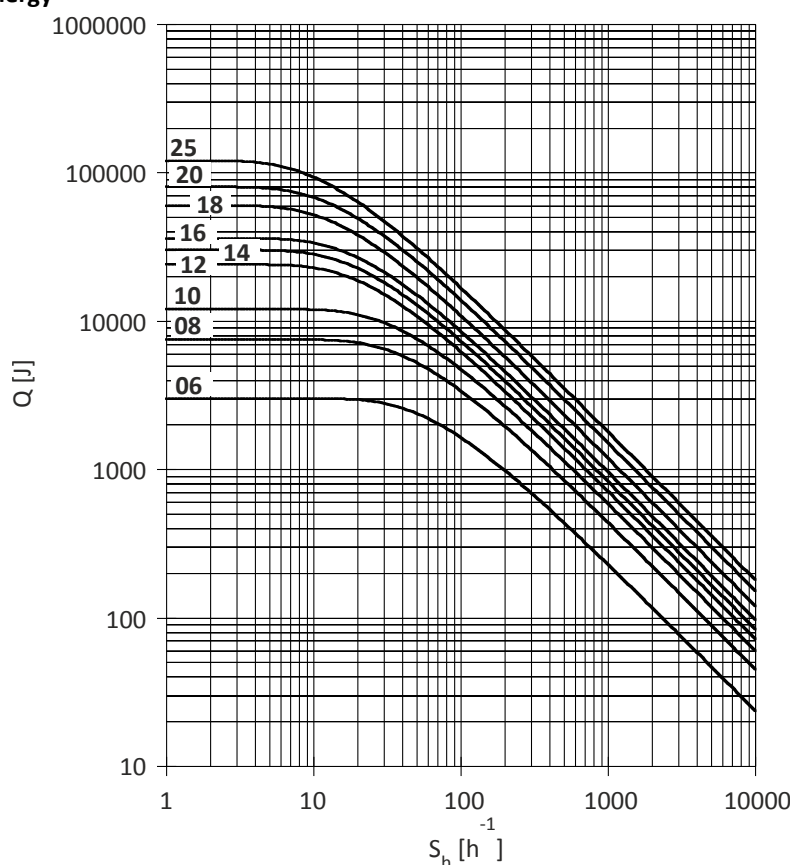
Spring-applied brakes

The motors with brake are equipped with a spring-applied brake. It becomes active when the supply voltage is switched off (closed-circuit principle).

Features

Designs	
Standard	1 x 10 ⁶ switching cycles, repeating 1 x 10 ⁶ switching cycles, repeating
Triggering	Via internal electronics Holding brake, active when equipment deenergised
Degree of protection	IP55
Friction lining	Asbestos-free, low-wear design

Permissible friction energy



Q Switching energy per switching cycle

S_h Switching rate

06 ... 25 Brake size

Assignment of the brake

Motor		MSEMA □ □ 063-42	MSEMA □ □ 080-32
Brake size		06	08
Characteristic torque			
Standard	Nm	4.0	8.0

Product extensions

Brakes
Spring-applied brakes



Rated data with standard braking torque

Motor			MSEMA□□063-42	MSEMA□□080-32
Brake size			06	08
Power input	P_{in}	kW	0.020	0.025
Braking torque at output speed				
8.5 rpm	M_B	Nm	4.00	8.00
85 rpm	M_B	Nm	3.70	7.20
102 rpm	M_B	Nm	3.60	7.00
128 rpm	M_B	Nm	3.50	6.80
153 rpm	M_B	Nm	3.40	6.70
221 rpm	M_B	Nm	3.20	6.30
Maximum switching energy at output speed				
8.5 rpm	Q_E	KJ	3.00	7.50
85 rpm	Q_E	KJ	3.00	7.50
102 rpm	Q_E	KJ	3.00	7.50
128 rpm	Q_E	KJ	3.00	7.50
153 rpm	Q_E	KJ	3.00	7.50
221 rpm	Q_E	KJ	3.00	7.50
Transition operating frequency	$S_{h\ddot{u}}$	1/h	79.0	50.0



Accessories

Overview



NFC adapter



QUICKON connector with nut

Brake resistors

Lenze Smart Products can be braked in a guided manner on the basis of a ramp. If large amounts of regenerative energy are produced during braking, they must be absorbed by a brake resistor.

In the case of the MSEMABR063-42, the brake resistor has been integrated.

In the case of the MSEMABR080-32, the brake resistor is mounted on the long side of the terminal box.



The brake resistor and the brake are combined in one version. Assembly and parameterisation are carried out in the factory.

Motor		MSEMABR063-42	MSEMABR080-32
Brake resistor		Internal	External
Rated resistance	Ω	400	390
Rated power	W	10	20
Thermal capacity	Ws	100	250



NFC adapter

The settings of the Lenze Smart Products can be made with an NFC-capable Android smart-phone or a PC. If a PC is used to make the settings, the »EASY Starter« engineering tool must be used to do this (»EASY Advanced« software licence). Communication takes place via the NFC adapter. The adapter is connected to the PC at the USB interface.



NFC adapter		
Version	VPE	Order code
	Piece	
Voltage supply on the input side via USB connection of the PC Diagnostic LEDs hot plug-capable	1	EZAETF001

QUICKON connector

Nuts for QUICKON connection

For fast and easy QUICKON connection, the following nuts (counterparts) can be fitted to the connecting cable. No special tools are needed for installation, only standard tools for stripping the cable.



In the case of the capability for frequent connections (>10 times), QUICKON connector with nut is to be used.



Fig. 1: QUICKON connector with QUICKON nut

QUICKON nut		
Version	VPE	Order code
	Piece	
Cable diameter: 6 ... 10 mm	1	EWS0088
Cable diameter: 9 ... 14 mm	1	EWS0089

QUICKON connector with QUICKON nut		
Version	VPE	Order code
	Piece	
Can be plugged in and disconnected safe from touch		
Cable diameter: 6 ... 10 mm	1	EWS0090
Cable diameter: 9 ... 14 mm	1	EWS0091



Mounting/ installation

More data and information for the mechanical and electrical installation can be found here:

- [Standards and operating conditions](#)  24
- [Dimensions](#)  30



The associated documentation provided with the product contains detailed information on technical data, mechanical mounting and electrical wiring/ cabling.

Mounting location

- The mounting location and material must ensure a durable mechanical connection.
- The mounting surfaces must be plane, torsionally rigid and free from vibrations.
- In case of continuous vibrations or shocks use vibration dampers.
- The reaction torque of the product must be braced. Bracing by means of a torque plate or flange attachment are examples of suitable measures.

Measures for cooling during operation

- If the cooling air is contaminated (fluff, dust, soot, grease, aggressive gases), take adequate countermeasures.
 - Arrange for regular cleaning.
- If required, implement a separate air guide.

Mounting/ installation

Electrical installation
Important notes



Electrical installation

Important notes

DANGER!

Dangerous electrical voltage

The product's power connections can still be carrying voltage when the mains supply has been switched off.

Possible consequences: Death or severe injuries when touching the power terminals.

- ▶ Do not touch the power connections immediately. Take note of the corresponding warning plates on the product.
 - ▶ Check to make sure that all power connections are deenergised.
-

DANGER!

Dangerous electrical voltage

The leakage current against earth (PE) is $> 3.5 \text{ mA AC}$ or $> 10 \text{ mA DC}$.

Possible consequences: Death or severe injuries when touching the device in the event of an error.

- ▶ Implement the measures required in EN 61800-5-1, especially:
 - ▶ Fixed installation
 - ▶ The PE connection must comply with the standards (PE conductor diameter $\geq 10 \text{ mm}^2$ or use a double PE conductor)
-

NOTICE

No protection against excessively high mains voltage

The mains input is not fused internally.

Possible consequences: Destruction of the product in the event of excessively high mains voltage.

- ▶ Take note of the maximum permissible mains voltage.
 - ▶ On the mains supply side, use fuses to adequately protect the product against mains fluctuations and voltage peaks.
-



Mains connection

Connection to the mains is achieved by means of the QUICKON connection, which has been prepared at the terminal box. The connection is located on the fan side and is easy to gain access to.

[Equipment](#) 14

The QUICKON connection enables fast and easy connection of motors. The equipment is easy to cable by means of a connecting cable with the QUICKON nut.



QUICKON nuts and QUICKON connectors with QUICKON nuts are available as accessories.

X3 mains connection with QUICKON connector

Pin assignment			
Con- tact	Name	Meaning	
1	L1	Mains connection Phase L1	
2	L2	Mains connection Phase L2	
3	L3	Mains connection Phase L3	
4	PE	PE conductor	

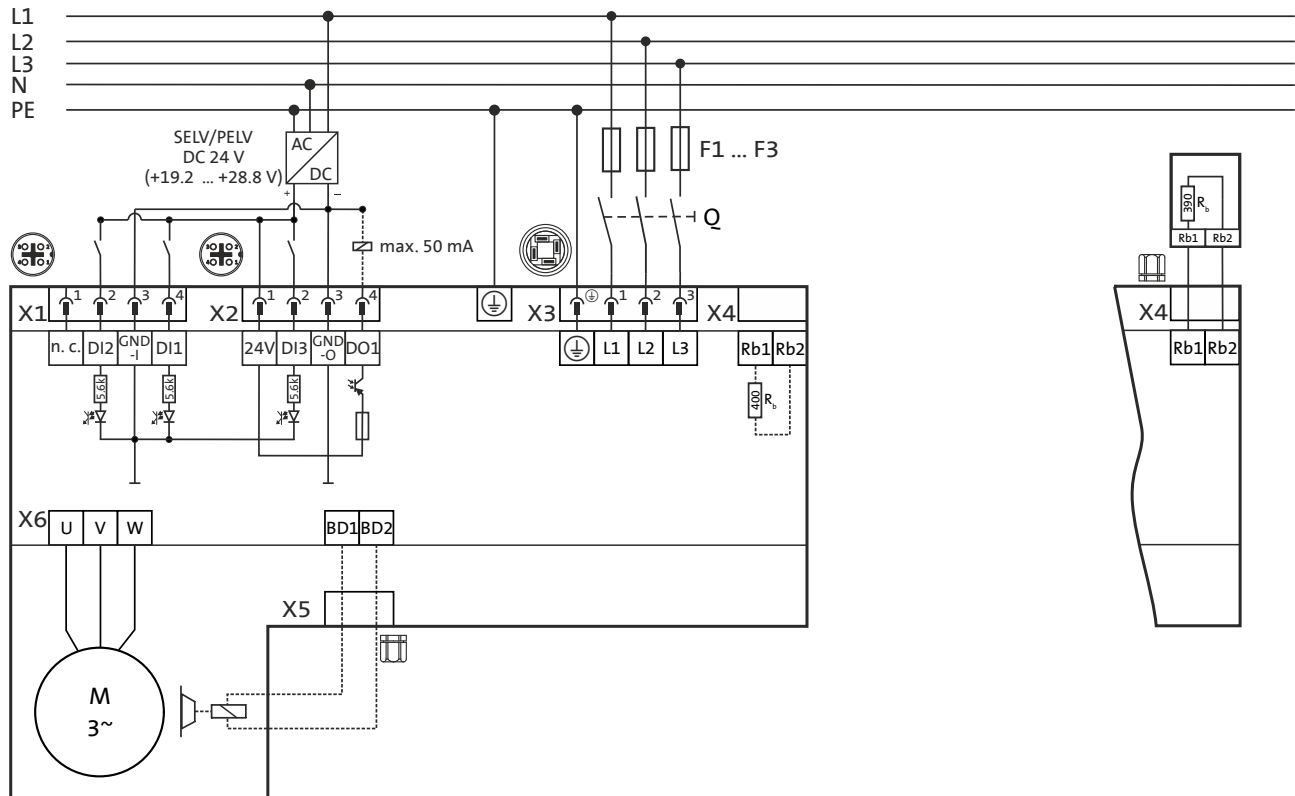
Mounting/ installation

Electrical installation
Mains connection



3-phase mains connection 400 V

Connection for single drive according to EN 60204-1



Fuse data (F1 ... F3)			
Motor		MSEMA□□063-42	MSEMA□□080-32
Cable installation in compliance with		EN 60204-1	
Installation method		B2	
Fuse			
Characteristics		gG/gL	
Typ. rated current	A	6	10
Max. rated current	A	16	16
Semiconductor fuse			
Characteristics		gRL	
Typ. rated current	A	6	10
Max. rated current	A	16	16
Circuit breaker			
Characteristics		C	
Typ. rated current		6	10
Max. rated current	A	16	16

► Motor data [67](#)

- Use of copper cables insulated with PVC
 - Conductor temperature < 70 °C, ambient temperature < 40 °C
- No bundling of cables or wires, three wires under load.

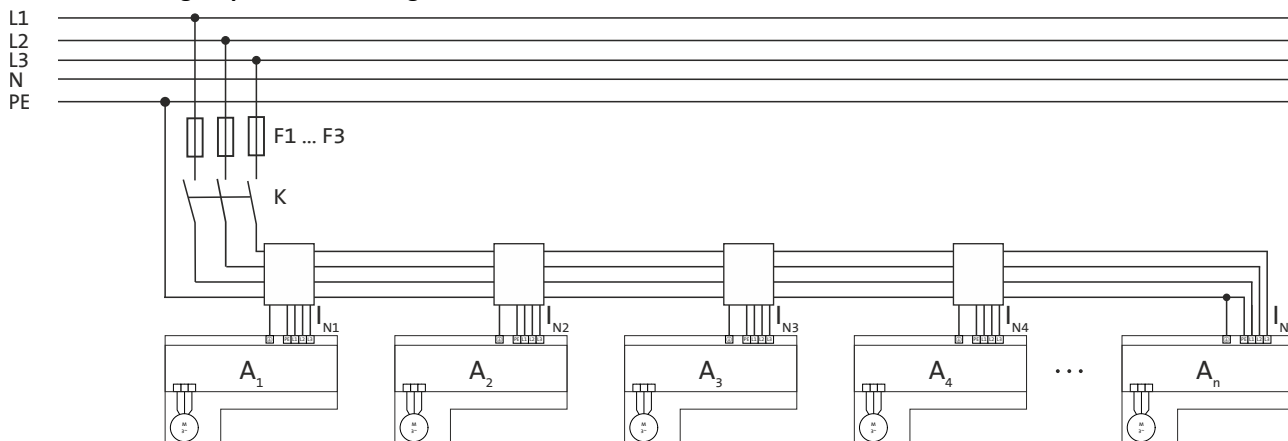


Mounting/ installation

Electrical installation
Mains connection

Mains connection QUICKON connector			
Motor		MSEMA□□063-42	MSEMA□□080-32
Connection		X3	
Laying system		B2	
Connection type		QUICKON connector	
cable cross-section			
Typ.	mm ²	1.0	1.5
Min.	mm ²	1.0	2.5
Max.	mm ²	1.0	2.5

Connection for group drive according to EN 60204-1



Max. total rated mains currents at 40 °C			
Cable installation in compliance with		EN 60204-1	
Laying system		B2	
cable cross-section	mm ²	1.5	2.5
$I_{N1} + I_{N2} + I_{N3} + I_{Nn}$	A	7.6	12.2
Fuse			
Characteristics		gG/gL	
Typ. rated current	A	---	---
Max. rated current	A	10	16
Circuit breaker			
Characteristics		gRL	
Typ. rated current	A	---	---
Max. rated current	A	10	16

► Motor data [67](#)

- Use of copper cables insulated with PVC
 - Conductor temperature < 70 °C, ambient temperature < 40 °C
- No bundling of cables or wires, three wires under load.
- Typical utilisation 80 %

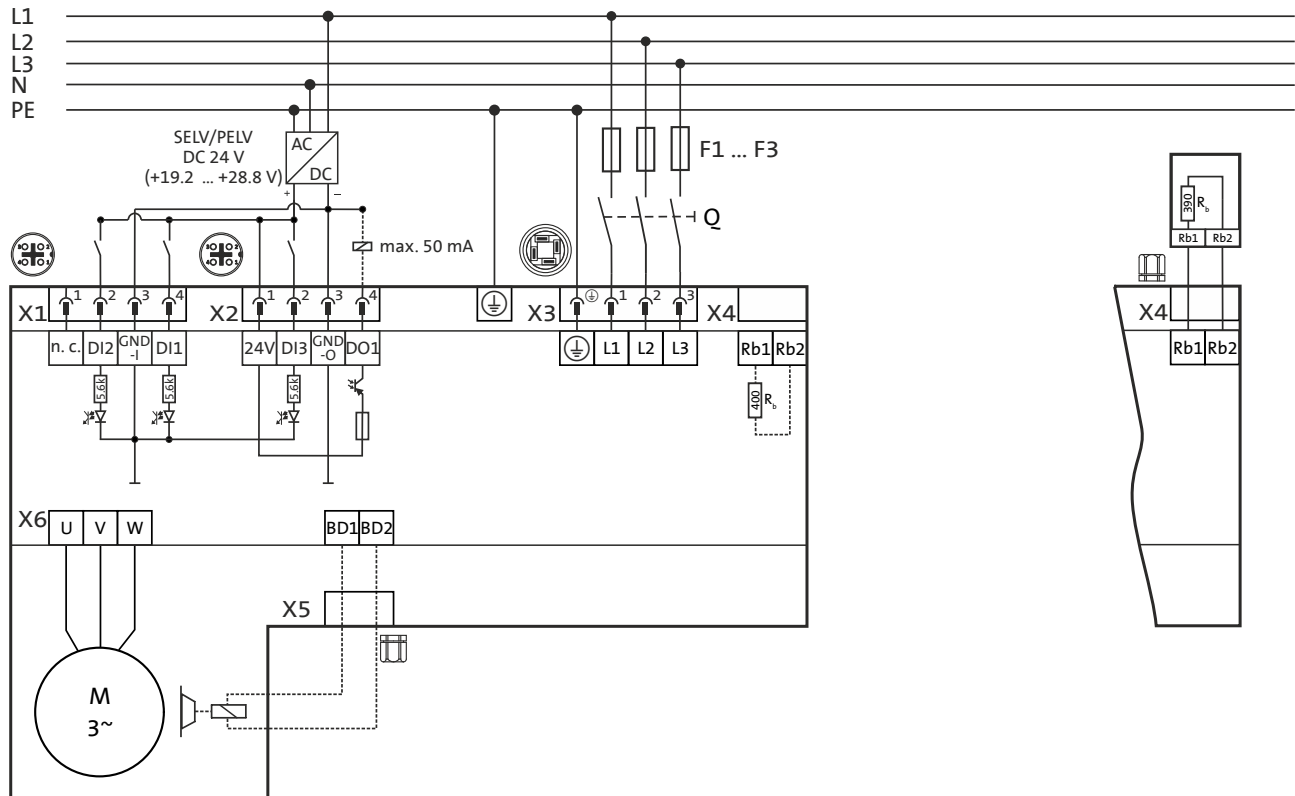
Mounting/ installation

Electrical installation
Mains connection



3-phase mains connection 480 V

Connection for single drive according to UL 61800-5-1



Fuse data (F1 ... F3)			
Motor		MSEMA□□063-42	MSEMA□□080-32
Cable installation in compliance with		UL 61800-5-1	
Fuse			
Standard		UL 248	
Typ. rated current	A	3	6
Max. rated current	A	3	10
Semiconductor fuse			
Standard		UL 248	
Typ. rated current	A	3	6
Max. rated current	A	3	10
Circuit breaker			
Standard		UL 489	
Typ. rated current		15	15
Max. rated current	A	15	15

► Motor data [67](#)

- Use UL-approved cables:
 - Conductor temperature < 75 °C, ambient temperature < 40 °C
- Operation from mains supply 5 kA rms SCCR:
 - Use current-limited UL-approved fuses (UL 248) or automatic circuit breakers (UL 489), voltage ≥480 V.
- Operation from mains supply 200 kA rms SCCR:
 - Use current-limiting UL-approved fuses (UL 248), current limiting rating von 200 kA rms to max. 5 kA rms, e.g. 15 A class CC.

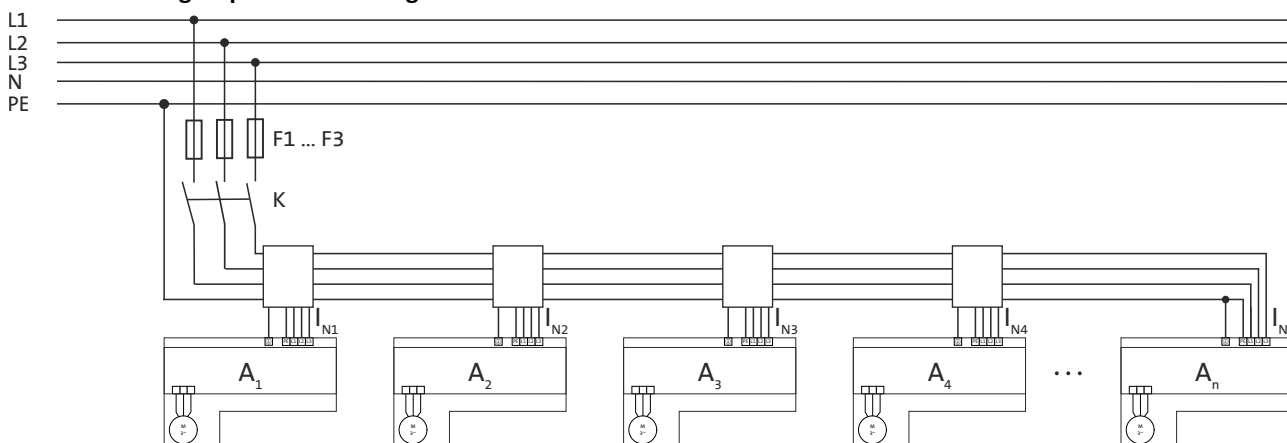


Mounting/ installation

Electrical installation
Mains connection

Mains connection with QUICKON connector			
Motor		MSEMA□□063-42	MSEMA□□080-32
Connection		X3	
Connection type		QUICKON connector	
cable cross-section			
Typ.	AWG	14	14
Min.	AWG	16	16
Max.	AWG	14	14

Connection for group drive according to UL 61800-5-1



Max. total rated mains currents at 40 °C			
Cable installation in compliance with		UL 61800-5-1	
Laying system			
cable cross-section	AWG	16	14
$I_{N1} + I_{N2} + I_{N3} + I_{Nn}$	A	8.0	12.0
Fuse			
Characteristics			
Typ. rated current	A	---	---
Max. rated current	A	10	15
Circuit breaker			
Characteristics			
Typ. rated current	A	---	---
Max. rated current	A	10	15

► Motor data [67](#)

- Use UL-approved cables:
 - Conductor temperature < 75 °C, ambient temperature < 40 °C
- Typical utilisation 80 %
- Operation from mains supply 5 kA rms SCCR:
 - Use current-limiting UL-approved fuses (UL 248) or automatic circuit breakers (UL 489), voltage ³ 480 V.
- Operation from mains supply 200 kA rms SCCR:
 - Use current-limiting UL-approved fuses (UL 248), current limiting rating von 200 kA rms to max. 5 kA rms, e.g. 15 A class CC.
 - It must be ensured that the Lenze Smart Motor is not installed in a control cabinet.

Mounting/ installation

Electrical installation
Control connections



Control connections

Control connections with M12 connectors

Via the digital inputs of the two M12 control connections, it is possible to switch between different speeds and directions of rotation. Up to 5 different speed settings (e.g. creep speed and normal speed in both directions, as well as stop) can thus be selected. In addition, the operating state is indicated via a digital output.

Control connection X1 with M12 connector, A-coded, pins

Pin assignment			
Con-tact	Name	Meaning	
1	n.c.		
2	DI2	Digital input 2	
3	GND-I	Earth of digital inputs	
4	DI1	Digital input 1	

Control connection X2 with M12 connector, A-coded, pins

Pin assignment			
Con-tact	Name	Meaning	
1	24 V	24 V-supply (DO1 supply)	
2	DI3	Digital input 3 (reference X1;3 = GND-I)	
3	GND-O	Earth of digital outputs	
4	DO1	Digital output 1	



Purchase order

Order code

The output side of the gearbox features a hollow shaft and a flange that has threaded holes and centering and that is integrated in the housing.



Product extensions and accessories are to be ordered separately.

Geared motors with hollow shaft and centering

Geared motor without brake		Max. torque	Product code		VPE	Order code
		Nm			Piece	
g350-B25	MSEMA□□063-42	25	G35AB025MHCR1C	MSEMAXX063-42C15	1	13523171
g350-B50	MSEMA□□063-42	50	G35AB050MHCR1C	MSEMAXX063-42C15	1	13523227
g350-B75	MSEMA□□080-32	75	G35AB075MHCR1C	MSEMAXX080-32C15	1	13523552

Geared motor with brake		Max. torque	Product code		VPE	Order code
		Nm			Piece	
g350-B25	MSEMA□□063-42	25	G35AB025MHCR1C	MSEMABR063-42C15	1	13523480
g350-B50	MSEMA□□063-42	50	G35AB050MHCR1C	MSEMABR063-42C15	1	13523481
g350-B75	MSEMA□□080-32	75	G35AB075MHCR1C	MSEMABR080-32C15	1	13523553

Product extensions

Solid shaft				
Gearboxes	Version	Dimension d x l	VPE	Order code
		mm	Piece	
g350-B25	Without flange	16 x 40	1	13518759
	For flange	16 x 40	1	13518756
g350-B50	Without flange	20 x 40	1	13518761
	For flange	20 x 40	1	13518760
g350-B75	Without flange	20 x 40	1	13518763
	For flange	20 x 40	1	13518762

Flange				
Gearboxes	Version	Dimension Outside diameter	VPE	Order code
		mm	Piece	
g350-B25	FT65	80	1	13518764
	FF100	120	1	13518765
g350-B50	FT87	110	1	13518766
	FF100	120	1	13518767
g350-B75	FT100	120	1	13518768
	FF130	160	1	13518769

Torque plate			
Gearboxes			Order code
			Piece
g350-B25			1
g350-B50			1
g350-B75			1

Purchase order

Order code



Accessories

NFC adapter		
Version	VPE	Order code
	Piece	
Voltage supply on the input side via USB connection of the PC Diagnostic LEDs hot plug-capable	1	EZAETF001

QUICKON nut		
Version	VPE	Order code
	Piece	
Cable diameter: 6 ... 10 mm	1	EWS0088
Cable diameter: 9 ... 14 mm	1	EWS0089

QUICKON connector with QUICKON nut		
Version	VPE	Order code
	Piece	
Can be plugged in and disconnected safe from touch		
Cable diameter: 6 ... 10 mm	1	EWS0090
Cable diameter: 9 ... 14 mm	1	EWS0091



Appendix

Motor data

Motor		MSEMA □ □ 063-42	MSEMA □ □ 080-32
Mains voltage	V	3 400 ... 480 AC	3 400 ... 480 AC
Rated power	kW	0.47	1.36
Output current			
400 V	A	1.0	2.8
480 V	A	0.8	2.3
Power factor			
cos φ		0.99	0.99
Efficiency			
Partial load η75 %	%	65.0	73.0
Full load η100 %	%	66.0	74.0
Moment of inertia			
Without brake	kgcm ²	3.700	28.000
With brake	kgcm ²	3.715	28.061



Good to know

Approvals/directives

CCC	China Compulsory Certification documents the compliance with the legal product safety requirements of the PR of China - GB standards.
c _{CSA} _{US}	CSA certificate, tested according to US and Canada standards
CE	Communauté Européenne documents the declaration of the manufacturer that EC Directives are complied with.
CEL	China Energy Label documents the compliance with the legal energy efficiency requirements for motors, tested according to PR of China standards
CSA	Canadian Standards Association CSA certificate, tested according to Canada standards
UL ^{Energy} _{US CA}	Energy Verified Certificate Determining the energy efficiency according to CSA C390 for products within the scope of energy efficiency requirements in the USA and Canada
c _{UL} _{US}	UL certificate for products, tested according to US and Canada standards
c _{UR} _{US}	UL certificate for components, tested according to US and Canada standards
EAC	Customs union Russia / Belarus / Kazakhstan certificate documents the declaration of the manufacturer that the specifications for the Eurasian conformity (EAC) required for placing electronic and electromechanical products on the market of the entire territory of the Customs Union (Russia, Belarus, Kazakhstan) are complied with.
UL	Underwriters Laboratory Listed Product
UR	UL certificate for components, tested according to US standards



Operating modes of the motor

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

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

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

The most important operating modes

Continuous operation S1	Short-time operation S2
Operation with a constant load until the motor reaches the thermal steady state. The motor may be actuated continuously with its rated power.	Operation with constant load; however, the motor does not reach the thermal steady state. During the following standstill, the motor winding cools down to the ambient temperature again. The increase in power depends on the load duration.
Intermittent operation S3	Non-intermittent periodic operation S6
Sequence of identical duty cycles comprising operation with a constant load and subsequent standstill. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/downtime ratio.	Sequence of identical duty cycles comprising operation with a constant load and subsequent no-load operation. The motor cools down during the no-load phase. Start-up and braking processes do not have an impact on the winding temperature. The steady-state is not reached. The guide values apply to a cycle duration of 10 minutes. The power increase depends on the cycle duration and on the load period/idle time ratio.

P Power
t Time
 t_L Idle time
 ϑ Temperature

P_V Power loss
 t_B Load period
 t_S Cycle duration

Appendix

Good to know
Enclosures



Enclosures

The degree of protection indicates the suitability of a motor for specific ambient conditions with regard to humidity as well as the protection against contact and the ingress of foreign particles. The degrees of protection are classified by EN 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 similar.	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 similar.	3	Protection against spraying water, up to 60° to the vertical
4	Protection against granular foreign particles, $d > 1$ mm, keeping away tools, wire or similar.	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).

