SIEMENS

SIMODRIVE 611A
Transistor PWM Inverters and Motors for AC Feed Drives

Installation and Planning Guide Edition 04.99

Manufacturers' Service Documentation

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BP1952

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SECTION 0

PRELIMINARY INFORMATION

Foreword

This document is part of the documentation developed for SIMODRIVE. All documents are available individually. The documentation list, which includes all Advertising Brochures, Catalogs, Overviews, Short Descriptions, User Manuals and Technical Descriptions can be obtained from your local Siemens Office with Order No., location and price.

This Manual does not purport to cover all details or variations in equipment, nor to provide for every possible contingency to be met in connection with installation, operation or maintenance.
Should further information be desired or should particular problems arise, which are not covered sufficiently for the purchaser's purposes, the matter should be referred to the local Siemens sales office.
The contents of this Guide shall neither become part of nor modify any prior or existing agreement, commitment or relationship. The sales contract contains the entire obligation of Siemens. The warranty contained in the contract between the parties is the sole warranty of Siemens. Any statements contained here do not create new warranties nor modify the existing warranty.

Definitions

- **Qualified personnel**

  For the purpose of this Guide and product labels, a ”qualified person” is someone who is familiar with the installation, mounting, start–up and operation of the equipment and the hazards involved. He or she must have the following qualifications:

  – trained and authorized to energize, de–energize, clear, ground and tag circuits and equipment in accordance with established safety procedures.

  – trained in the proper care and use of protective equipment in accordance with established safety procedures.

  – trained in rendering first aid

⚠

Danger

This symbol in the document indicates that death, severe personal injury or substantial property damage **will** result if proper precautions are not taken.

⚠

Warning

This symbol appears in the document if death, severe personal injury or property damage **can** result if proper precautions are not taken.

⚠

Caution

This symbol appears in the document indicating that minor personal injury or material damage **can** result if proper precautions are not taken.

!

Important

This symbol appears in the documentation if a particular issue is significant.

Note

For the purposes of this Guide, ”Note” indicates information about the product or the respective part of the Guide which is essential to highlight.

Important

The listed filter modules/line filters generate a high discharge current through the protective conductor. Due to the high discharge current of the filter, there must be a good permanent connection between the protective conductor of the filter module/line filter and the cabinet.

The measures according to pr EN 50178/94 Part 5.3.2.1 must be implemented, e.g.

1. A copper protective conductor with a minimum cross–section of 10mm^2 should be connected or
2. a second conductor should be connected in parallel to the protective conductor through separate terminals.

This cable must fulfill by itself the requirements for protective conductors according to IEC 364–5–543.

Warning

Operational electrical equipment has parts and components which are at hazardous voltage levels.

Incorrect handling of these units, i. e., not observing the warning information can therefore result in severe bodily injury or material damage.

Only appropriately qualified personnel may commission/start–up this equipment.

This personnel must have in–depth knowledge regarding all of the warning information and service instructions according to this Guide.

Perfect and safe operation of this equipment assumes professional transport, storage, mounting and installation as well as careful operator control and service.

Hazardous axis motion can occur when working with the equipment.

Further, all of the valid national, regional and plant/system–specific regulations must be adhered to.

Note

When handling cables observe the following

- they must not be damaged,
- they must not be stressed and
- they must not come into contact with rotating components**.**

Note

For IT– and TT supply networks, connected measuring equipment and programmers must be referred to the reference potential of the module group.

! **Important**

M600 and M500 are not PE potentials. Hazardous voltages between 300...400V can occur at these terminals with respect to PE. These potentials may not be connected to PE.

Note

”Safe separation” must be provided between the temperature sensor and the motor winding of third–party motors.

Warning

Start–up/commissioning is absolutely prohibited until it has been ensured that the machine, in which the components described here are to be installed, fulfills the regulations/specifications of the Directive 89/392/EEC.

Warning

The information and instructions in all of the documentation supplied and any other instructions must always be observed to eliminate hazardous situations and damage.

- for special versions of the machines and equipment, the information in the associated catalogs and quotation is valid.
- further, all of the relevant national, local and plant/system–specific regulations and specifications must be taken into account.
- all work must be undertaken with the system in a no–voltage condition (powered–down)!

Warning

Perfect and safe operation of this equipment assumes professional transport, storage, mounting and installation as well as careful operator control and service.

Severe bodily injury or material damage could occur if the warning information is not observed.

Warning

After all voltages have been disconnected, hazardous voltages are present for at least 4 minutes.

In order to ensure that no hazardous voltages occur, a voltage measurement should be made. (Generating principle for rotating motors)

Warning

The rated current of the connected motor must match the rated drive converter current, as otherwise motor feeder cable protection is not guaranteed. The cross–section of the motor feeder cable must be dimensioned for the rated drive converter current.

Warning

Before commissioning the 611D, the encoder cable must be checked to ensure that it has no ground faults. If there is a ground fault, uncontrolled movement could occur for pulling loads.
No longer occurs from: 6SN1118–0D□2□–0AA0 Version C.

Note

If a system high voltage test is made, the overvoltage limiting module must be removed in order to prevent the voltage limiting responding.

When configuring the system, the connection between the voltage limiting circuit and the central grounding point should be as short as possible and be low ohmic.

Note

The terminal blocks of the SIMODRIVE 611 modules are exclusively used to electrically connect that particular module; if they are used for any other purpose (e.g. as handle) this can cause damage to the module.

Warning

Operational electrical equipment has parts and components which are at hazardous voltage levels.

Incorrect handling of these units, i.e. not observing the warning information, can therefore lead to death, severe bodily injury or significant material damage.

Only appropriately qualified personnel may commission/start–up this equipment.

This personnel must have in–depth knowledge regarding all of the warning information and service measures according to this Manual.

Perfect, safe and reliable operation of this equipment assumes that it has been professionally transported, stored, mounted and installed as well as careful operator control and service.

Hazardous axis motion can occur when working with the equipment.

Note

When handling cables, observe the following

- they must not be damaged,
- they must not be strained and
- they must not come into contact with rotating components**.**

Note

It is not permissible to connect SIMODRIVE equipment to a supply system with ELCBs (this restriction is permitted acc. to DIN VDE 0160 / 05.88, Section 6.5). When operational, protection against direct contact is provided in a form to allow the unit to be used in enclosed electrical equipment rooms (DIN VDE 0558 Part 1 / 07.87, Section 5.4.3.2.4).

In compliance with DIN VDE 0160 / 05.88, all SIMODRIVE units are subject to a high–voltage test at the time of routing testing. If the electrical equipment of industrial tools is subject to a high–voltage test, all connections must be disconnected so that sensitive electronic components in the SIMODRIVE converter are not damaged
(permissible acc. to DIN VDE 0113 / 06.93, Part 1, Section 20.4).

Warning

Start–up/commissioning is absolutely prohibited until it has been ensured that the machine in which the components described here are to be installed, fulfills the regulations/specifications of the Directive 89/392/EWG.

Warning

The information and instructions in all of the documentation supplied and any other instructions must always be observed to eliminate hazardous situations and damage.

- For special versions of the machines and equipment, the information in the associated catalogs and quotations applies.
- Further, all of the relevant national, local and plant/system–specific regulations and specifications must be taken into account.
- All work should be undertaken with the system in a no–voltage condition!
- For the feed motors, when the rotor is rotating, a voltage is present at the motor terminals (as a result of the integrated permanent magnets).
- The motor must be connected according to the circuit diagram supplied.
- It is not permissible to directly connect the motor to the three–phase supply and this would destroy the motor.
- Surface temperatures of above 100° C can occur at the motor enclosure surface.No temperature–sensitive parts or components, e.g. cables or electronic components may be in contact with or connected to the motor.

Warning

The holding brake is only designed for a limited number of emergency braking operations. It is not permissible to use it as working brake.

ESDS instructions

Components which can be **destroyed** by **electrostatic discharge**

Components which can be destroyed by electrostatic discharge are individual components, integrated circuits, or boards, which when handled, tested or transported, could be destroyed by electrostatic fields or electrostatic discharge. These components are designated as **ESDS** (**E**lectro**S**tatic **D**ischarge **S**ensitive Devices).

Handling ESDS boards:

- When handling components which can be destroyed by electrostatic discharge, it should be ensured that personnel, the work station and packaging are well grounded.
- Electronic boards should only be touched when absolutely necessary.
- Components may only be touched, if
  - you are continuously grounded through an ESDS bracelet,
  - you are wearing ESDS shoes or ESDS shoe grounding strips in conjunction with an ESDS floor surface.
- Boards may only be placed on conductive surfaces (desk with ESDS surface, conductive ESDS foam rubber, ESDS packing bag, ESDS transport containers).
- Boards may not be brought close to data terminals, monitors or television sets (a minimum of 10 cm should be kept between the board and the screen).
- Boards may not be brought into contact with materials which can be charged–up and which are highly insulating, e. g. plastic foils, insulating desktops, articles of clothing manufactured from man–made fibers.
- Measuring work may only be carried out on the boards, if
  - the measuring equipment is grounded (e. g. via the protective conductor) or
  - for floating measuring equipment, the probe is briefly discharged before making measurements (e. g. a bare control housing is touched).

Section 1

611A - Analog Feed Drives

Supply Infeed (NE)

The infeed/regenerative feedback module (I/R module) and the module for the uncontrolled infeed (UE module), is used to feed the DC link. Beyond this, the I/R–, UE–, and the monitoring module (monitoring module) also provide the electronics power supply for the connected modules.

For the I/R module, when braking, the kinetic energy of the drives, fed back into the DC link, is fed back into the line supply.

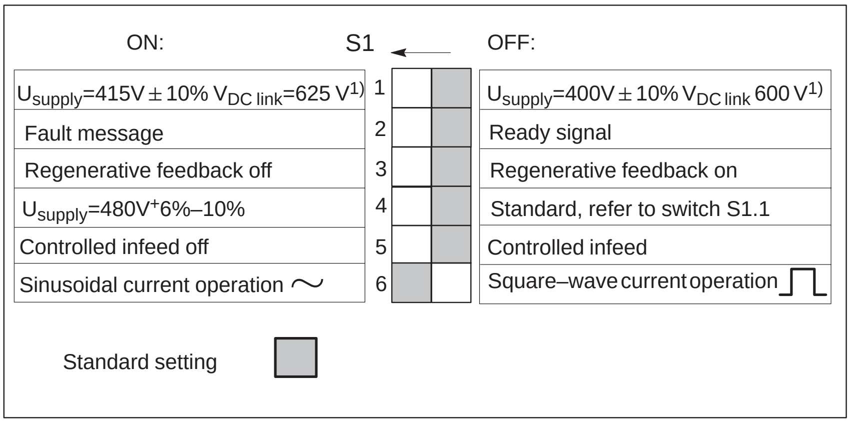
For the UE module, when braking, the drive kinetic energy, fed back into the DC link, is converted into heat in the brake resistors which are either integrated or mounted. This heat is then dissipated to the environment. When required, additional single or several pulsed resistor modules can be used within the configuring limits (pulsed resistor modules) (a pulsed resistor is not integrated in all of the modules).

The I/R–, UE module is located as the first module to the left in the drive group. The monitoring module is located in the drive group, to the left of the modules to be supplied.

To fulfill the CE conformance for the radio interference voltage limit values, filter modules, line filters and screen cables are available.

Function overview and settings

A switch S1 is provided on the upper side of the NE and monitoring module to set the following functions (for UE5 KW on the front panel):



ON:	S1 ←			OFF:
U_{supply}=415V ± 10% $V_{DC\ link}$=625 V[1]	1	☐	▨	U_{supply}=400V ± 10% $V_{DC\ link}$ 600 V[1]
Fault message	2	☐	▨	Ready signal
Regenerative feedback off	3	☐	▨	Regenerative feedback on
U_{supply}=480V$^{+6\%}_{-10\%}$	4	☐	▨	Standard, refer to switch S1.1
Controlled infeed off	5	☐	▨	Controlled infeed
Sinusoidal current operation ∼	6	▨	☐	Square–wave current operation ⎍

Standard setting ▨

Figure 3-1 DIL switch S1

!

Important

For I/R modules, Order No. 6SN114□–1□□0□–0□□**1** the basic setting is for sinusoidal current operation.

!

Important

Terminal 63 (pulse enable) and/or terminal 48 (starting terminal, contactor control) must be de–energized or disconnected before the drive is powered–up or down using the main circuit–breaker or line contactor!

Switch S 1.1 :

OFF: I/R module, V_{supply}=400V ± 10%; $V_{DC\ link}$=600V
UE module V_{supply}=400V ± 10%; $V_{DC\ link}$=V_{supply}•1.35
Monitoring thresholds: (I/R, UE, monitoring modules)
Pulsed resistor on=644V; Pulsed resistor off=618V
$V_{DC\ link}$>>=695V
ON: I/R module V_{supply}=415V ± 10%; $V_{DC\ link}$=625V
UE module V_{supply}=415V ± 10%; $V_{DC\ link}$=V_{supply}•1.35
Monitoring thresholds: (I/R, UE, monitoring modules)
Pulsed resistor on=670V; Pulsed resistor off=640V
$V_{DC\ link}$>>=710V

PW=pulsed resistor

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[1] only possible for the I/R module, monitoring thresholds are increased for all NE modules.

Switch S 1.2 :

OFF: Ready signal (X111 ready relay)
For S1.2=OFF, the relay switches, if the following conditions are fulfilled:

- Internal main contactor CLOSED (terminals NS1 - NS2 connected, terminal 48 enabled)
- Terminal 63, 64=ON (energized)
- No fault present (also not for FD 611 A Standard and resolver and 611 D drives).
- FD with Standard interface or resolver is enabled in the ”ready” setting (terminals 663, 65)
- NCU for 840D must have run–up
- MCU must have run–up

ON: Fault message (X111 ready relay)
For S1.2=ON, the relay switches, if the following conditions are fulfilled:

- Internal main contactor CLOSED (terminals NS1 - NS2 connected, terminal 48 enabled)
- No fault present (also not on FD 611 A Standard and resolver or 611 D drives).
- Feed drive with standard interface or resolver is enabled for the ”Ready” setting (terminals 663, 65)
- NCU for 840D must have run–up
- MCU must have run–up

Switch S 1.3 :

OFF: Standard setting, regenerative feedback active
I/R modules are capable of regenerative feedback.
UE module: The pulsed resistor in the module is effective.

ON: Regenerative feedback disabled
I/R modules: Regenerative feedback is inhibited.
UE module: The pulsed resistor in the module is not effective.

Comment:
This function is only effective for 10kW from
Order No. 6SN1146–1AC00–0AA1, and for UE 5kW, not for
UE 28kW.

Switch S 1.4 :

OFF: Standard setting for all NE modules, refer to S 1.1

ON: V_{supply}=**480V+6% / –10%**; $V_{DC\ link}$=V_{supply}•1.35 for infeed operation
$V_{DC\ link}$=700...750V in regenerative feedback operation
Monitoring thresholds: (I/R–, UE–, monitoring modules)
Pulsed resistor on=744V; Pulsed resistor off=718V
$V_{DC\ link}$>>=795V
S1.4 overwrites the setting of S1.1

Comment: Uncontrolled operation in the infeed direction.

Note

Only in conjunction with modules Order No. 6SN114□–1□□0□–0□□**1**.
For motors with shaft height < 100: Utilized up to max. 60 k values.
Please observe the Planning Guide, Motors.
S1.4 ON overwrites the functions of S1.5 and S1.1.

Switch S 1.5 :

This function is only available in conjunction with I/R modules
Order No.: 6SN114□–1□□0□–0□□**1**
OFF: Standard setting, controlled infeed active

ON: Uncontrolled operation in the infeed direction $V_{DC\ link}=V_{supply}\bullet 1.35$

Switch S 1.6 :

OFF: Square–wave current operation (the line supply is loaded with a square–wave current)

ON: This function is only available in conjunction with I/R modules
Order No.: 6SN114□–1□□0□–0□□**1**
Sinusoidal current operation (the line supply is loaded with sinusoidal current)

Sinusoidal current is only permissible if the following components are available:

I/R 16 kW	**I/R 36 kW**	**I/R 55 kW**	**I/R 80 kW**	**I/R 120 kW**
6SN114□–1B□01–0BA**1**	6SN114□–1B□02–0CA**1**	6SN114□–1B□0□–0DA**1**	6SN114□–1BB00–0EA**1**	6SN114□–1BB01–0FA**1**
HF reactor 16 kW	**HF reactor 36 kW**	**HF reactor 55 kW**	**HF reactor 80kW**	**HF reactor 120kW**
6SN1111–0AA00–0BA□	6SN1111–0AA00–0CA□	6SN1111–0AA00–0DA□	6SN1111–0AA00–1EA□	6SN1111–0AA00–1FA□
Line filter for sinusoidal current [1] 16 kW	**Line filter for sinusoidal current [1] 36 kW**	**Line filter for sinusoidal filter[1] 55 kW**	**Line filter for sinusoidal current[1] 80 kW**	**Line filter for sinusoidal current[1] 120 kW**
6SN1111–0AA01–2BA□	6SN1111–0AA01–2CA□	6SN1111–0AA01–2DA□	6SN1111–0AA01–2EA□	6SN1111–0AA01–2FA□

!

Important

For all of the combinations which are not listed here, only <u>square–wave current operation setting</u> is permissible.

Table 3-1 Power factor

I/R	Sinusoidal current operation	$\cos\varphi \approx 0.98$	$\cos\lambda = 0.97$
I/R	Square–wave current operation	$\cos\varphi \approx 0.98$	$\cos\lambda = 0.89$
UE		$\cos\varphi \approx 0.87$	$\cos\lambda = 0.67$

$\cos\varphi$: The power factor only includes the basic fundamental
$\cos\lambda$: Power factor includes the basic fundamental and harmonic components

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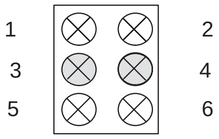
[1] In the line filters for sinusoidal operation, contrary to the filter modules 6SN1111–0AA01–0□A□ for square–wave current, commutating reactors are not included.
The HF commutating reactor must be mounted externally (refer to p. 1-45).
The line filter is required in order to achieve the CE Conformance for the radio interference voltage.

Service and diagnostics

Display elements of the monitoring– and NE modules



1 LED, red	– ±15 V electronics power supply faulted
2 LED, red	– 5 V voltage level faulted
3 LED green	– external enable signals not available (terminal 63 and/or terminal 64 missing)
4 LED yellow	– DC link charged
5 LED, red	– line supply fault (single– or multi–phase supply failure at the terminals U1, V1, W1) 1) – commutating reactor either not available or incorrectly selected, – fault level of the line supply or transformer too low
6 LED red	– DC link overvoltage possible causes: Regenerative feedback off, setting–up operation, line supply fault, for UE pulsed–resistor not operational, line supply voltage too high, dynamic overload condition

Effects:

1 red LED bright:	Pulses for the complete drive group are canceled
2 red LED bright:	Pulses for the complete drive group are canceled
4 yellow LED dark:	xxxx
5 red LED bright:	1) Only the I/R module pulses are canceled (regenerative feedback no longer possible. Axes first continue to run. Ready relay drops–out
6 red LED bright:	Pulses for the complete drive group are canceled

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1) Line supply fault identification time approx. 30ms
Line supply fault is identified for a three–phase voltage < 280V.
For 1–phase supply failure, the drive axes pulses are canceled after approx. 1 min.
(latched signal) valid for Order No. 6SN1114☐–1☐☐0☐–0☐☐**1**

Technical data

Technical data, supply infeed modules

Table 3-2 Technical data, supply infeed modules, internal cooling

Des.	$P_n/P_{s6}/P_{max}$ for supply infeed [kW]	$P_n/P_{s6}/P_{max}$ for regenerative feedback. For UE with internal pulsed resistor [kW]	Input current [A] for 3–ph. 400 V AC, 600 V DC $P_n/P_{s6}/P_{max}$	Max. cross–section [4] [mm^2]	Module width [mm]	Energy of the pulsed resistor for 1 x braking operation
	Power losses[W][1] $Pv_{tot.}/Pv_{ext}/Pv_{int}$		**Output current [A]**		**Weight [kg]**	
Monitoring module	–		–	16/10	50	–
	70/–/70		–		5	–
Pulsed resistor	–	0.3/–/25 [3] (450 V DC)	–	6/4	50	int.: E_{max}= 7.5 kWs
	/310 310/–/10[2]		–		5	ext.: E_{max}= 180 kWs
UE module, 5/10 kW	5/6.5/10	0.2/–/10 [3] (450 V DC)	11.3/14.7/22.6	6/4	50	int.: E_{max}= 13.5 kWs
	/270 270/–/70[2]		9.3/12/18.6 (540 V DC)		6.5	–
UE module, 10/25 kW	10/13/25	0.3/–/25 [3] (450 V DC)	21.8/28.5/54.5	16/10	100	int.: E_{max}= 7.5 kWs
	/450 450/–/150[2]		18.5/24/46.5 (540 V DC)		9.5	–
UE module, 28/50 kW	28/36/50	0.3/–/25 [5] (450 V DC)	58.5/75/104.5	50	200	External 1: E_{max}= 7.5 kWs
	250/–/250		52/67/93 (540 V DC)		13.5	External 2: E_{max}= 180 kWs
I/R module, 16/21 kW	16/21/35	16/21/35	27/35.5/59	16/10	100	–
	320/–/320		26.5/35/58		10.5	–
I/R module, 36/47 kW	36/47/70	36/47/70	60.5/79/117.5	50	200	–
	585/–/585		60/78/116		15.5	–
I/R module, 55/71 kW	55/71/91	55/71/91	92.5/119/153	95 or 2 x 35	300	–
	745/–/745		91/118/151		26	–
I/R module, 55/71 kW pipe connection	55/71/91	55/71/91	92.5/119/153	95 or 2 x 35	300	–
	–/630/115		91/118/151		26	–
I/R module, 80/104 kW pipe connection or radial fan	80/104/131	80/104/131	134/175/220	95 or 2 x 35	300	–
	1280/1090/190		133/173/218		26	–
I/R module, 120/156 kW pipe connection or radial fan[1]	120/156/175	120/156/175	202/262/294	150 or 2 x 50	300	–
	1950/1660/290		200/260/291		28	–

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[1] If pipe cooling is not used, only Pv_{tot} has to be taken into account.

[2] If the internal pulsed resistor is shutdown, for internal cooling, the only power loss is Pv_{int}.

[3] The motor braking energy is converted into heat in the integrted pulsed resistor; a heat barrier may be required, refer to p. 1-34

[4] The 1st number is for cable lugs, the 2nd number is valid for finely–stranded conductors without connector sleeve.

[5] It can be used: a) 0.3/25 kW b) 2 x 0.3/25 kW c) 1.5/25 kW d) 2 x 1.5/25 kW

Table 3-3 Technical data, supply infeed modules, external cooling

Des.	**$P_n/P_{s6}/P_{max}$ for supply infeed [kW]**	**$P_n/P_{s6}/P_{max}$ for regenerative feedback. For UE with internal pulsed resistor [kW]**	**Input current [A] for 3–ph. 400 V AC, 600 V DC $P_n/P_{s6}/P_{max}$**	**Max. cross–section [4] [mm^2]**	**Module width [mm]**	**Energy of the pulsed resistor for 1 x braking operation**
	Losses [W] Pv_{ext}/Pv_{int}		**Output current [A]**		**Weight [kg]**	
UE module, 5/10 kW	5/6.5/10	0.2/–/10 [3] (450 V DC)	11.3/14.7/22.6	6/4	50	int.: E_{max}= 13.5 kWs
	/270 –/–/70[2]		9.3/12/18.6 (540 V DC)		6.5	–
UE module, 10/25 kW	10/13/25	0.3/–/25 [3]	21.8/28.5/54.5	16/10	100	int.: E_{max}= 7.5 kWs
	331/119 31[2]/		18.5/24/46.5 (540 V DC)		9.5	–
I/R module, 16/21 kW	16/21/35	16/21/35	27/35.5/59	16/10	100	–
	270/50		26.5/35/58		10.5	–
UE module, 28/50 kW	28/36/50	0.3/–/25 [5] (450 V DC)	58.5/75/104.5	50	200	External 1: E_{max}= 7.5 kWs
	160/90		52/67/93 (540 V DC)		13.5	External 2: E_{max}= 180 kWs
I/R module, 36/47 kW	36/47/70	36/47/70	60.5/79/117.5	50	200	–
	535/50		60/78/116		15.5	–
I/R module, 55/71 kW	55/71/91	55/71/91	92.5/119/153	95 or 2 x 35	300	–
	630/115		91/118/151		26	–
I/R module, 80/104 kW	80/104/131	80/104/131	134/174/220	95 or 2 x 35	300	–
	1090/190		133/173/218		26	–
I/R module, 120/156 kW	120/156/175	120/156/175	202/262/294	150 or 2 x 50	300	–
	1660/290		200/260/291		28	–

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[1] If pipe cooling is not used, only Pv_{tot} has to be taken into account.

[2] f the internal pulsed resistor is shutdown, for internal coolingthe only power loss is Pv_{int}.

[3] The braking energy of the motors is converted into heat in the integrated/mounted pulsed resistor, if required, a heat barrier may be required, refer to p. 1-34

[4] The 1st number is for cable lugs, the 2nd number is valid for finely–stranded conductors without connector sleeve.

[5] It can be used: a) 0.3/25 kW b) 2 x 0.3/25 kW c) 1.5/25 kW d) 2 x 1.5/25 kW

Definition of powers

P_n, P_{s6}, P_{max}	Data is valid for the total, permitted voltage range of the I/R modules.
P_n	Continuous output of the NE module.
P_{s6}	Output for max. 4 min for an S6 duty cycle.
P_{max}	Peak output.

Refer to the following load duty diagrams for the duty cycle diagrams.

Pv_{total}	Total module power loss;
Pv_{pipe}	Power loss dissipated with pipe cooling;
Pv_{ext}	Power loss dissipated with external cooling;
Pv_{int}	Power loss which cannot be dissipated through pipe– or external cooling. **This power loss remains in the cabinet.**

Supply voltage and frequency

Table 3-4 Supply voltage and frequency

	S1, S4 = OFF Vn = 3–ph. 400V AC	**S1 = ON Vn = 3–ph. 415V AC**	**S4 = ON Vn = 3–ph. 480V AC**
NE modules up to $P_n \leq$ 55kW	3–ph. 360...440V AC 3–ph. 300...360V AC [1] 45...65Hz	3–ph. 373...457V AC 3–ph. 312...373V AC [1] 45...65Hz	3–ph. 432...509V AC 3–ph. 408...432V AC [1] 55...65Hz
I/R modules Pn = 80/120kW power connection: U1, V1, W1	3–ph. 360...440V AC 3–ph. 300...360V AC[1] 45...65Hz	3–ph. 373...457V AC 3–ph. 312...373V AC[1] 45...65Hz	3–ph. 432...509V AC 3–ph. 408...432V AC [1] 55...65Hz
Coil connection: L1, L2	3–ph. 360...457V AC / 45...53Hz 3–ph. 400...510V AC / 57...65Hz		

Cooling type

All I/R modules and the UE 28 kW are force ventilated.

The UE modules 5kW, 10kW, the monitoring module as well as the pulsed resistor module, are self–ventilated.

No ground–fault

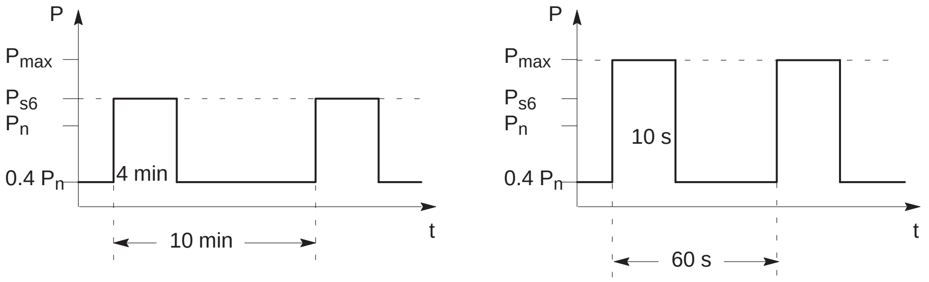
Before powering–up for the first time, the cabinet wiring, motor/encoder feeder cables and the DC link connections must be checked to ensure that they do not have a ground fault.

---

1) The drive power supply can be operated in the range from 3–ph. 323 to 3–ph. 509 V AC. However, for I/R modules, operation of the power supply up to 3–ph. 280 V AC is only valid as long as the I/R module actively controls the DC link voltage 600 V or 625 V and there is a three–conductor connection (as set in the factory).
De–rating to $0.7P_n$. Power supply rating must, under the conditions, also be reduced to 70%.
$\Sigma A_P + \Sigma E_P \leq 0.7 \text{ x } (17+8)$ or for UE 5 kW $\leq 0.7 \text{ x } (7+3.5)$

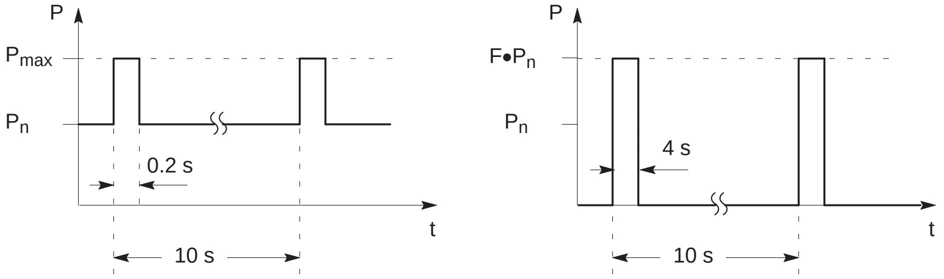
2) In the infeed direction, the DC link voltage is uncontrolled, therefore a 600 V DC link voltage will not be achieved. Observe the restrictions regarding the acceleration time and stall torque of the motors.

Rated load duty cycles for NE modules



S6 duty cycle with pre–loading condition

Peak output duty cycle with pre–loading condition



Peak output duty cycle with pre–loading condition

Peak output duty cycle without pre–loading condition

F: For all NE modules up to Pn ≤ 80 kW, F=1.6
For Pn=120 kW, F=1.4

Figure 3-2

The following rule of thumb is valid:

For load duty cycles with a period T ≤ 10 s:

$$\sqrt{\frac{1}{T}\int_0^T \left(\frac{P_{(t)}}{P_n}\right)^2 dt} < 1.03; \quad P_n < P_{(\tau)} \le P_{max}; \quad \tau \in [0, T]$$

For load duty cycles with a period 10 s < T ≤ 1 min:

$$\sqrt{\frac{1}{T}\int_0^T \left(\frac{P_{(t)}}{P_n}\right)^2 dt} < 0.90; \quad P_n < P_{(\tau)} \le P_{max}; \quad \tau \in [0, T]$$

For load duty cycles with a period 1 min < T ≤ 10 min:

$$\sqrt{\frac{1}{T}\int_0^T \left(\frac{P_{(t)}}{P_n}\right)^2 dt} < 0.89; \quad P_n < P_{(\tau)} \le P_{max}; \quad \tau \in [0, T]$$

$P_{(t)}$ = the instantaneous power demand

De–rating as a function of the installation altitude

All of the specified outputs are valid up to an installation altitude of 1000 m. For an installation altitude > 1000 m, the specified outputs should be reduced according to the diagrams below. For installation altitudes > 2000 m[1] an isolating transformer must be used (refer to Section 2.4).

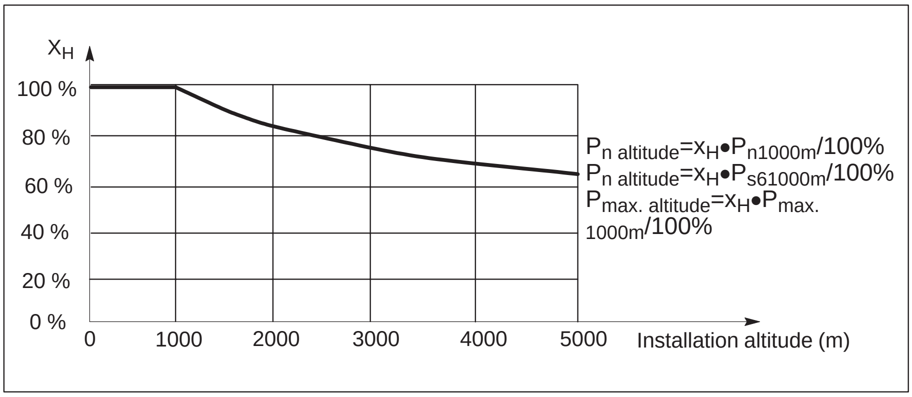


Figure 3-3

Caution: P_n, P_{s6} and P_{max} must be de–rated in the same way.

Table 3-5 UE modules with pulsed resistors

Pulsed resistors, technical data				
	External pulsed resistor 0.3/25 kW	External pulsed resistor 1.5/25 kW	Internal pulsed resistor 0.3/25 kW	Internal pulsed resistor 0.2/10 kW
Order No., pulsed resistor	6SN1113–1AA00–0DA0	6SN1113–1AA00–0CA0	–	–
Integrated in	–	–	UE 10 kW, pulsed resistor module	UE 5 kW
Can be used for	UE module 28 kW	UE module 28 kW	–	–
Can be used for	–	Pulsed resistor module 6SN1113–1AB0□–0BA□	–	–
Pn	0.3 kW	1.5 kW	0.3 kW	0.2 kW
P_{max}	25 kW	25 kW	25 kW	10 kW
E_{max}	7.5 kWs	180 kWs	7.5 kWs	13.5 kWs
Degree of protection	IP 54	IP20	refer to module	refer to module
Dimension drawings, refer to p. 1-161				

---

[1] The rated insulation voltage depends on the installation altitude.

Engineering information is valid for UE 5 kW, 10 kW, 28 kW and pulsed resistor module

Dimensioning the load duty cycles with pulsed resistors

Des.	Units	Explanation
E	Ws	Regenerative feedback energy when braking a motor from n_2 to n_1
T	s	Period of the braking load duty cycle
A	s	Load duration
J	kgm^2	Total moment of inertia (including J motor)
M	Nm	Braking torque
n	RPM	Speed
Pn	W	Continuous rating of the pulsed resistor
P_{max}	W	Peak rating of the pulsed resistor
E_{max}	Ws	Energy of the pulsed resistor for a single braking operation

Load duty cycles for braking operations

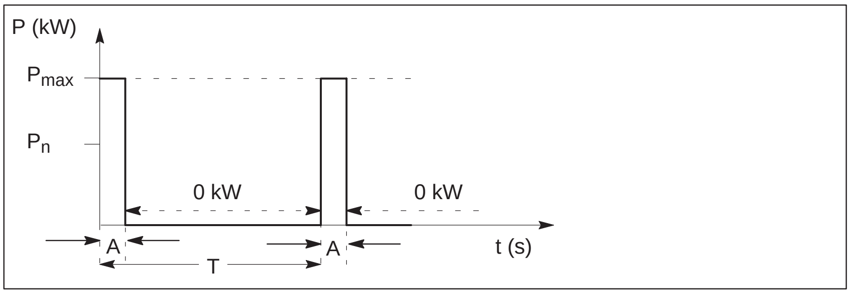


Figure 3-4 Load duty cycle for internal and external pulsed resistors

Table 3-6 Examples

		Pulsed resistor 0.2/10 kW	Pulsed resistor 0.3/25 kW	Pulsed resistor 1.5/25 kW
	E_{max}	13500 Ws [1]	7500 Ws	180000Ws
	Pn	200 W	300 W	1500 W
	P_{max}	10000 W	25000W	25000W
Example	A=	0.2 s	0.12 s	0.6 s
	T=	10 s	10 s	10 s
	A=	1.35 s	0.3 s	7.2 s
	T=	67.5 s	25 s	120 s

All of the following conditions must be fulfilled:

1. $P_{max} \geq M \bullet 2 \bullet \pi \bullet n/60$
2. $Emax \geq E$; $E=J \bullet [(2 \bullet \pi \bullet n_2/60)^2 - (2 \bullet \pi \bullet n_1/60)^2]/2$
3. $P_n \geq E/T$

Note

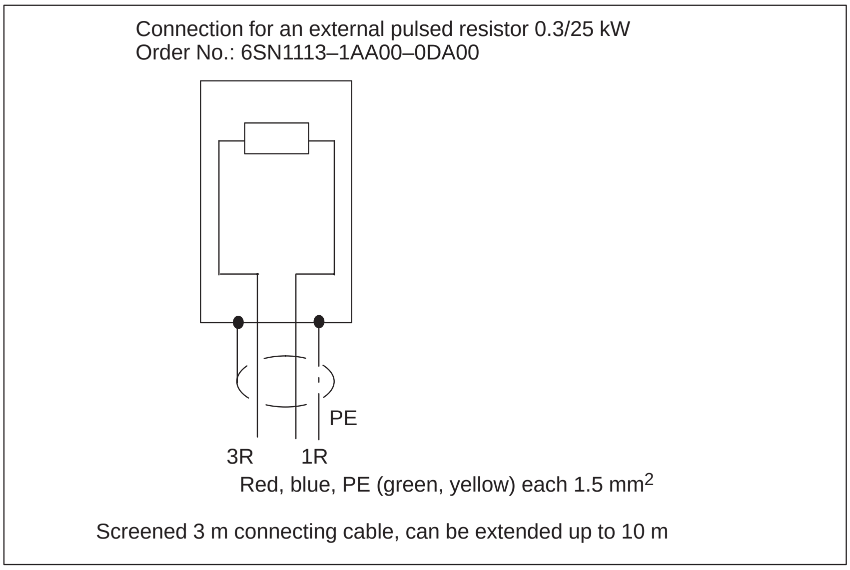
For UE 5 kW and UE 10 kW, it is not possible to connect an external resistor.

---

[1] As a result of the mechanical dimensions, the resistor can accept a relatively high level of energy.

Mounting positions

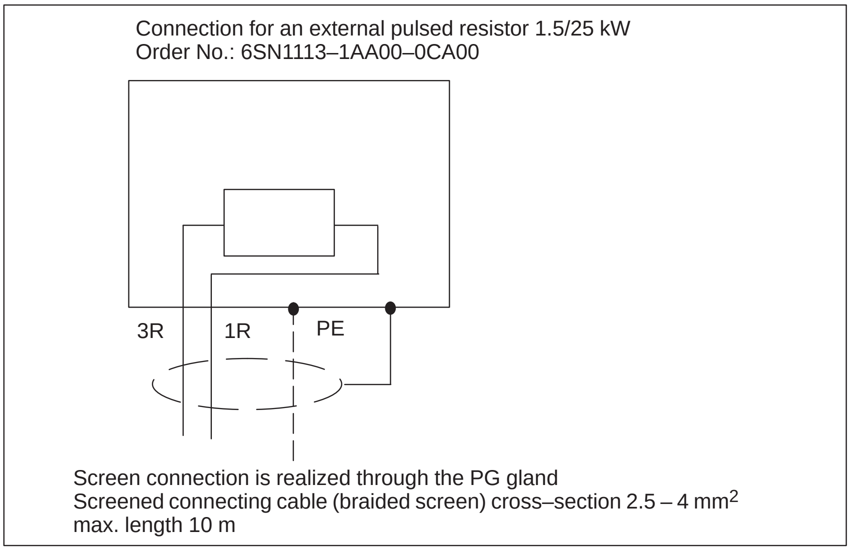
Horizontal and vertical mounting positions are possible.


Connection for an external pulsed resistor 0.3/25 kW
Order No.: 6SN1113–1AA00–0DA00

Red, blue, PE (green, yellow) each 1.5 mm^2

Screened 3 m connecting cable, can be extended up to 10 m

Figure 3-5 Connection for an external pulsed resistor 0.3/25kW


Connection for an external pulsed resistor 1.5/25 kW
Order No.: 6SN1113–1AA00–0CA00

Screen connection is realized through the PG gland
Screened connecting cable (braided screen) cross–section 2.5 – 4 mm^2
max. length 10 m

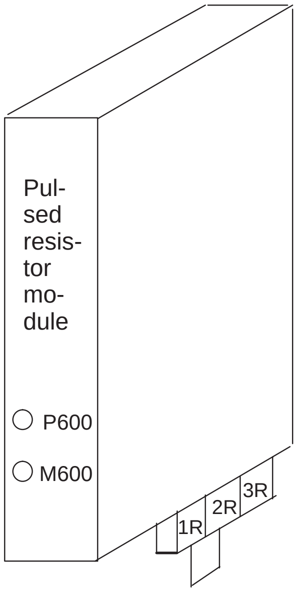
Figure 3-6 Connection for an external pulsed resistor 1.5/25kW

Note

Conductors which are not used in multi–conductor cables must always be connected to PE at both ends.

Pulsed resistor module

Connection types for pulsed resistor modules



Status as supplied:
Connector with a jumper between 1R and 2R
internal resistor active
Order No.: 6SN1113–1AB0□–0□A0□

Figure 3-7 Status of the pulsed resistor module when supplied

---

Note

For the pulsed resistor modules, only the external 1.5/25 kW pulsed resistor can be connected.

The following connection combinations are possible:

Connection of an external 1.5 kW resistor:
Connector without jumper
internal resistor is active
external resistor is active
1) Screen connection as close as possible to the module
Order No.: 6SN1113–1AB0V–0VA0V

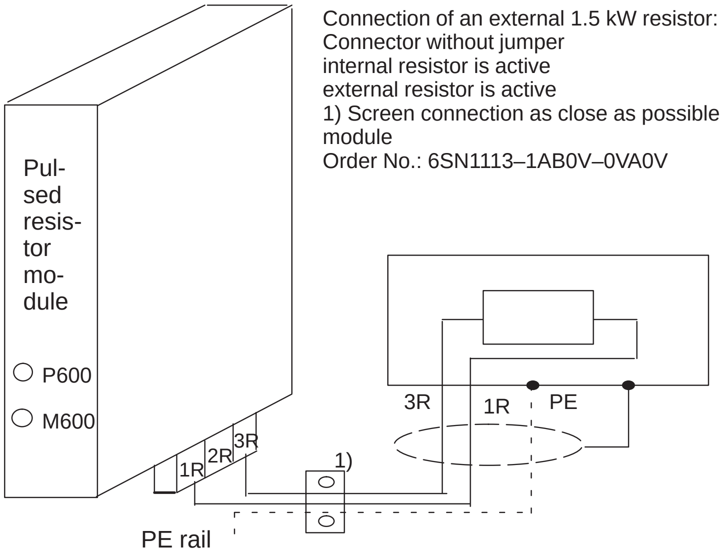


Figure 3-8 Connection of an external 1.5kW pulsed resistor module

No. of pulsed resistor modules connected to the same DC link, refer to Catalog NC60.1

$N \leq C / 500 \mu F$

N = Max. number of pulsed resistor modules (must always be rounded–off

C = DC link capacitance of the drive group in µF

28 kW UE module

Note

The 28 kW UE module does not include a pulsed resistor.

Possibilities of connecting external pulsed resistors to the 28 kW module

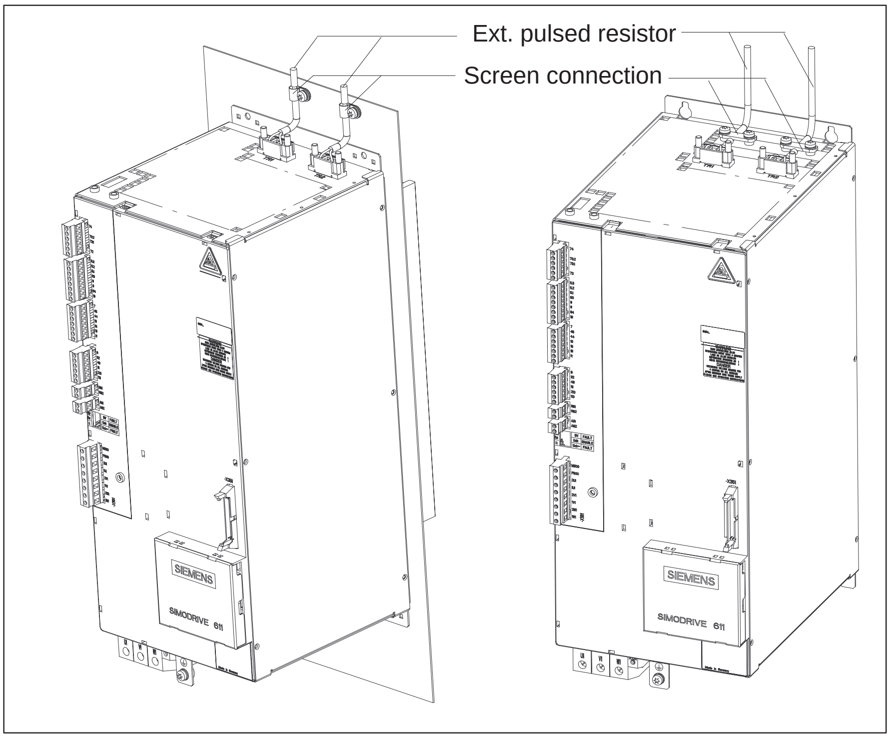
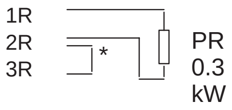
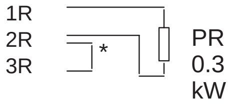
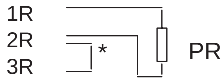
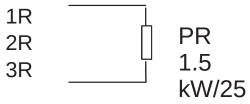
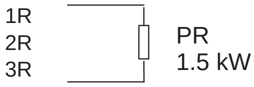
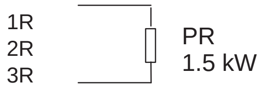


Figure 3-9 Connecting an external pulsed resistor with screen connection

Table 3-7 Permissible methods of connecting an external pulsed resistor to UE 28 kW

Pulsed resistor (PR)	Terminal block TR1	Terminal block TR2
0.3/25 kW		1R 2R 3R
2 x 0.3/25 kW=0.6/50 kW		
1.5/25 kW		1R 2R 3R
2 x 1.5/25 kW=3/50 kW		

* Jumper to code the thermal limiting characteristic

Technical data of the supplementary components

Cooling components

Components	Component Order No.	Supply voltage	Supply current	Observe phase sequence!	Degree of protection	Weight [kg]
Radial blower	6SN1162–0BA02–0AA□	3–ph. 360 to 510 VAC 45 to 65 Hz	0.2 A to 0.3 A	Direction of rotation refer to the arrow on the fan	IP 44	4
Pipe package with pipe and radial fan[1] (refer to Fig. KEIN MERKER)	6SN1162–0BA03–0AA□	3–ph. 360 to 457 VAC 47.5 to 62.5 Hz	1.0 A +20%	Ccw direction of rot. when viewing the rotor	IP 54	8
Pipe and radial fan for I/R 55 kW and 200 A power module [1] (refer to Fig. KEIN MERKER)	6SN1162–0BA03–0CA□	3–ph. 360 to 457 VAC 47.5 to 62.5 Hz	1.0 A +20%	Ccw direction of rot. when viewing the rotor	IP 54	8

Warning

For a radial fan, the ground connection is established as it is directly mounted on the module housing. If this is not the case, a separate ground connection is required.

Note

Observe the phase sequence when connecting–up the fan!

AC fan connection

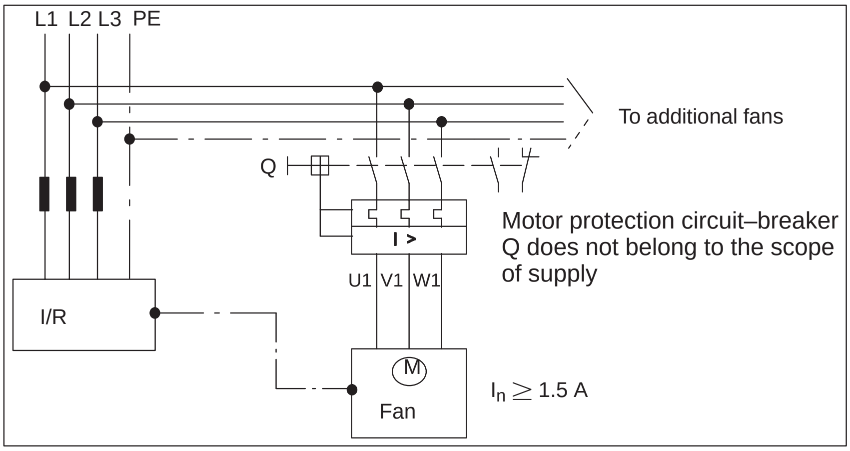


Figure 3-10

Components	Component Order No.	Note
Heat deflection plate	6SN1162–0BA01–0AA0	Required for UE– and pulsed resistor modules for max. utilization of the pulsed resistor (>200 W) (refer to Section 11, Dimension drawings)

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[1] Replacement filter element: Order No. 8MR 1191–0A0
Ordering location: Pfannenberg GmbH
Postfach 80747
21007 Hamburg

Interface overview

Note

When using non–PELV circuits, connected at terminals AS1, AS2, terminals 111, 113 and 213, the connector coding must prevent the connector being incorrectly inserted.
Refer to Catalog NC60.1 for the Order Nos. of the coding plugs.
Only PELV circuits may be connected to terminal 19.

Interface overview NE modules

The interface description is valid for all NE modules with the exception of the UE module 5/10 kW – this interface has its own description (refer to p. 1-42).

Table 3-8

Term. No.	Des.	Function	Type 1)	Typ. voltage/limit values	Max. cross–section	Terminals available in 3)
U1 V1 W1		Supply connection	E	3–ph. 400 V AC	Refer to Section 4.2	I/R, UE
L1 L2		Contactor supply	I I	2–ph. 400 V AC, directly from the supply L1, L2, L3, refer to Sect. 9.2	16mm^2/10mm^2 4) 16mm^2/10mm^2 4)	I/R 80/104 kW, 120/156 kW
PE P600 M600		Protective conductor DC link DC link	I I/O I/O	0 V +300 V –300 V	Bolt Busbar Busbar	I/R, UE, monitoring module, pulsed resistor
⏚		Grounding bar 5)	I/O	–300 V	Busbar	I/R, UE
P600 M600		DC link DC link	I I	+300 V –300 V	16mm^2/10mm^2 4) 16mm^2/10mm^2 4)	Monitoring module
1R, 2R, 3R	TR1, TR2 9)	External resistance connection	I/O	V300	6mm^2/4mm^2 4)	Pulsed resistor; UE 28 kW
	X131	Electronics M	I/O	0 V	16mm^2/10mm^2 4)	I/R, UE. monitoring module

---

1) I = input; O = output; NC = NC contact; NO = NO contact; (for signal, NO = high; NC = low)
2) Terminal 19 is the reference ground (connected inside the module with 10 kΩ to the general reference ground X131/terminal 15)
It is not permissible that terminal 15 is connected to PE or terminal 19, further, no external voltage sources may be connected to terminal 15. Terminal 19 may be connected to X131.
3) I/R = Infeed/regenerative feedback module; UE = Uncontrolled infeed; MM = Monitoring module; PW = Pulse resistor module
4) The 1st number is valid for cable lugs. The 2nd number is valid for finely–stranded conductors without connector sleeve.
5) The grounding bar is used to ground the DC link M rail through 100 kΩ (should preferably be inserted).
6) RESET = Resets the error memory, edge triggered for the complete drive group (Terminal ”R” → Terminal 15 = RESET)
7) Terminals 111-213, positively–driven NC contact (for I/R 16 kW and UE 10 kW, only from Order No.: 6SN114□–1□□0**1**–0□□□)
Terminals 111–113 NO contacts, not positively driven
8) Maximum current load of terminal 9 with respect to 19: 0.5 A.
9) Only for UE 28 kW

Terminals and relay functions

- X111: **READY RELAY:**
  – terminals 72 – 73.1: NO contact in the quiescent state
  – terminals 73.2 – 74: NC contact in the quiescent state

  For S1.2=OFF, the relay switches if the following conditions are fulfilled:
  – internal main contactor CLOSED (terminals NS1–NS2 connected, terminal 48 enabled)
  – terminals 63, 64 =ENERGIZED
  – no fault present (also not on feed drive 611A Standard, or 611D drives)
  – feed drive with Standard interface or resolver is enabled for the ”ready” setting (terminals 663, 65)
  For S1.2=ON, the relay switches if the following conditions are fulfilled:
  – internal main contactor CLOSED (terminal NS1–NS2 connected, terminal 48 enabled)
  – no fault present (also not on feed drive 611A Standard, and 611D drives)
  – feed drive with Standard interface or resolver enabled for this ”ready” setting (terminals 663, 65).

- X121: **I^2t_alarm and motor overtemperature:**
  terminal 5.1 – 5.2: NO contact in the quiescent state
  terminal 5.1 – 5.3: NC contact in the quiescent state
  This relay switches, if:
  – the > heatsink temperature monitoring responds at the I/R
  – the > motor temperature monitoring responds at the 611D feed drive
  > heatsink temperature monitoring responds
  – at the feed drive 611A user–friendly
  > motor temperature monitoring responds
  > heatsink temperature monitoring responds
  > I^2t–temperature monitoring responds (non–latching)
  – at 611A Standard
  > Motor temperature monitoring responds
  > heatsink temperature monitoring responds

- X171: Terminal **NS1–NS2** (coil circuit of the internal line supply– and pre–charging contactor):
  – is used to electrically isolate from the line supply (signal contact, terminals 111–213 must be interrogated)
  – may only be switched if terminal 48 is open–circuit (without any restriction from Order No. 6SN114□–1□□0**1**–0□□□ for 10, 16 and 55kW, from Order No. 6SN114□–1□□0**2**–0□□□ for 36kW, all 80 and 120kW)

- terminal 48: **Start**
  – has the highest priority
  – Sequence: Pre–charging ON interrogation $V_{DC\ link} \geq 310V$ and $V_{DC\ link} \geq \sqrt{2}*V_{supply}–50V$
  – > 500ms pre–charging contactor OUT, interrogation whether OUT, main contactor IN
  >1s internal enable signals (for I/R and module group)
  – saved during pre–charging

- terminal 63: **Pulse enable**
  – has the highest priority for pulse enable of all the modules
  – acts instantaneously (without delay)

- Terminal 64: **Drive enable**
  – acts instantaneously on all modules
  – when the signal is withdrawn, n_{set} is set to 0 for all drives, and
  > for main spindle drive / induction motor module 611 A, the pulses are canceled after a speed, which can be set, is fallen below. The drive is braked along the ramp.

> for feed drives 611 A, after the selected timer stages have expired (as supplied: 240ms) all of the controllers and pulses are inhibited. The drive brakes along the current limit.
> for 611D drives, the pulses are deleted after a selectable speed has been fallen below and/or a time which can be set, has expired. The drive brakes along the set limits. (For spindles, a ramp can be achieved via regenerative limiting [kW])

- terminal 112: **Setting–up operation** (V_{min} 3–ph. 24V AC or 34 V DC)
  – the $V_{DC\ link}$ – closed–loop control is inhibited
  – regenerative feedback is not possible, i.e. when braking, $V_{DC\ link}$ can be >600V!
  – this function is interrogated with the start inhibit signal, terminal AS1–AS2.

Caution

For induction motors, even for low $V_{DC\ link,}$ high speeds can be reached!

- terminals AS1–AS2: **start inhibit signal**
  – terminals AS1–AS2 closed means ”start inhibit is effective” (setting–up operation)
- terminals 111, 113, 213: signal contact, internal line contactor
  – terminals 111 – 113: NO contact
  – terminals 111 – 213: NC contact (for I/R 16kW and UE 10kW only from Order No. 6SN114□–1□□0**1**–0□□□)
- terminal 19: **FR–:**
  – reference ground, enable voltage
  – floating (connected to the general reference ground, terminal 15 via 10kΩ)
  – it is not permissible to connect terminal 19 with terminal 15 (connect to PE rail or X131)
- terminal 9: **FR+:**
  – 24V enable voltage
  – max. load capability of the power supply:500mA (corresponds to 8 slots;1 optocoupler input requires 12mA)
- X 141: **electronic voltages:**

– terminal 7:	P24	+20.4 to 28.8V / 50mA
– terminal 45:	P15	+15V / 10mA
– terminal 44:	N15	–15V / 10mA
– terminal 10:	N24	–20.4 to 28.8V / 50mA
– terminal 15:	M	0V

  – it is not permissible to connect terminal 15 to PE (ground loop)
  – it is not permissible to connect terminal 15 with terminal 19 (short–circuit via reactor, which internally connects terminal 15 with X131)

- terminal **L1–L2 for 80kW and 120kW – I/R**
  – is used to supply the coil of the internal line contactor
  – is supplied directly at the line supply with 2–ph. 400V AC (not between I/R and reactor)
  – fuse: $I_N \geq$ 4 A, type gL
- **Fan connection for 80 and 120kW I/R**
  – 3–ph. 360 to 510V AC , 45–65 Hz directly at the line supply (not between the I/R and reactor)
  – observe the rotating field (phase sequence)!
  – fuse: $I_N \geq$ 1.5 A (motor protection circuit–breaker)

- **6 – conductor connection with additional connection of the power supply at the DC link:**
  – for this operating mode, terminals 2U1, 2V1 and 2W1 of the power supply **must be supplied** with the line supply voltage **between** the series reactor and I/R, otherwise the power supply will be destroyed! This is also valid for the monitoring modules!

- **Monitoring module** with line supply connection **and** additional connection of the power supply to the DC link:
  – for this operating mode, terminals 2U1, 2V1 and 2W1 of the power supply **must be supplied** with the line supply voltage between the series reactor and I/R, as otherwise the power supply will be destroyed.
  – terminal 63 must be switched via the ready relay of the I/R in order to prevent the module, to the right of the monitoring module, starting during pre–charging.

Diagnostic instructions

If a line supply fault is displayed or if the yellow LED is dark, the overvoltage limiting module must be checked.
Procedure:

1. Power–down the drive converter (into a no–voltage condition)
2. Remove the overvoltage limiting module and insert connector X181 on the NE module. If the NE module functions, then the overvoltage limiting module is defect and must be replaced.
   Otherwise, check the line supply and if required, also the NE module/drive group.

Note

In this way, operation can be continued, but **without overvoltage protection.**

---

3. Insert the overvoltage limiting module 566018.9415.00 up to its end stop, and insert connector X181 on the overvoltage limiting module.

■

Table 3-8

Term. No.	Des.	Function	Type 1)	Typ. voltage/limit values	Max. cross–section	Terminals available in 3)
	X151	Equipment bus	I/O	Various	Ribbon cable	I/R, UE, monitoring module, pulsed resistor
M500	X181	DC link power supply	I	DC –300 V	1.5 mm^2	I/R, UE. monitoring module
P500	X181	DC link power supply	I	DC +300 V	1.5 mm^2	
1U1	X181	Output L1	O	3–ph. 400 V AC	1.5 mm^2	
2U1	X181	Input L1	I	3–ph. 400 V AC	1.5 mm^2	
1V1	X181	Output L2	O	3–ph. 400 V AC	1.5 mm^2	
2V1	X181	Input L2	I	3–ph. 400 V AC	1.5 mm^2	
1W1	X181	Output L3	O	3–ph. 400 V AC	1.5 mm^2	
2W1	X181	Input L3	I	3–ph. 400 V AC	1.5 mm^2	
7	X141	P24	O	+20.4...28.8 V/50 mA	1.5 mm^2	I/R, UE. monitoring module
45	X141	P15	O	+15 V/10 mA	1.5 mm^2	
44	X141	N15	O	–15 V/10 mA	1.5 mm^2	
10	X141	N24	O	–20.4...28.8 V/50 mA	1.5 mm^2	
15 2)	X141	M	O	0 V	1.5 mm^2	
R 6)	X141	RESET	I	Term.15/R_E = 10 kΩ	1.5 mm^2	
5.3	X121	Relay contact Group signal I^2t/motor temp.	NC	50 V DC/0.5 A/12 VA max	1.5 mm^2	I/R, UE. monitoring module
5.2	X121		NO	5 V DC/3 mA min	1.5 mm^2	
5.1	X121		I		1.5 mm^2	
63 2)	X121	Pulse enable	I	+13 V...30 V/R_E = 1.5 kΩ	1.5 mm^2	
9 2)8)	X121	Enable voltage	O	+24 V	1.5 mm^2	
9 2)8)	X121	Enable voltage	O	+24 V	1.5 mm^2	
64 2)	X121	Drive enable	I	+13 V...30 V/R_E = 1.5 kΩ	1.5 mm^2	
19		Enable voltage, reference potential		0 V	1.5 mm^2	
74	X111	Relay contact Ready signal	NC	1–ph. 250V AC/50V DC/2A max 5V DC/3mA min	1.5 mm^2	I/R, UE. monitoring module
nc	X111				1.5 mm^2	
73.2	X111		I		1.5 mm^2	
73.1	X111		I		1.5 mm^2	
nc	X111				1.5 mm^2	
72	X111		NO		1.5 mm^2	
					1.5 mm^2	
9 2)8)	X161	Enable voltage	O	+24 V	1.5 mm^2	I/R, UE. monitoring module
112 2)	X161	Setting–up mode/ Standard mode	I	+21 V...30 V/R_E = 1.5 kΩ	1.5 mm^2	

---

1) I = input; O = output; NC = NC contact; NO = NO contact; (for signal, NO = high; NC = low)
2) Terminal 19 is the reference ground (connected inside the module with 10 kΩ to the general reference ground X131/terminal 15)
It is not permissible that terminal 15 is connected to PE or terminal 19, further, no external voltage sources may be connected to terminal 15. Terminal 19 may be connected to X131.
3) I/R = Infeed/regenerative feedback module; UE = Uncontrolled infeed; MM = Monitoring module; PW = Pulse resistor module
4) The 1st number is valid for cable lugs. The 2nd number is valid for finely–stranded conductors without connector sleeve.
5) The grounding bar is used to ground the DC link M rail through 100 kΩ (should preferably be inserted).
6) RESET = Resets the error memory, edge triggered for the complete drive group (Terminal ”R” → Terminal 15 = RESET)
7) Terminals 111-213, positively–driven NC contact (for I/R 16 kW and UE 10 kW, only from Order No.: 6SN114□–1□□0**1**–0□□□)
Terminals 111–113 NO contacts, not positively driven
8) Maximum current load of terminal 9 with respect to 19: 0.5 A.
9) Only for UE 28 kW

Table 3-8

Term. No.	Des.	Function	Type[1]	Typ. voltage/limit values	Max. cross–section	Terminals available in[3]
48[2]	X161	Contactor control	E	+13 V...30 V/R_E = 1.5 kΩ	1.5 mm^2	I/R, UE
111[7]	X161	Signaling contacts	E	+30 V/1 A (111–113)	1.5 mm^2	
213[7]	X161		Ö	1–ph. 250 V AC/50 V DC/ 2 A max	1.5 mm^2	
113[7]	X161	Line contactor	NO	17 V DC/3 mA min	1.5 mm^2	
AS1	X172	Signaling contact	I	250V AC/1A/50V DC/2A max	1.5 mm^2	I/R
AS2	X172	Start inhibit (terminal 112)	NC	5 V DC/10 mA min	1.5 mm^2	
NS1	X171	Coil contact for line–, pre–charging contactor	O	+24 V	1.5 mm^2	I/R, UE
NS2	X171		I		1.5 mm^2	
19	X221	Enable voltage, reference potential	O	0 V	1.5 mm^2	Pulsed resistor
50	X221	Control contact for fast discharge	E	0 V	1.5 mm^2	

---

1) I = input; O = output; NC = NC contact; NO = NO contact; (for signal, NO = high; NC = low)

2) Terminal 19 is the reference ground (connected inside the module with 10 kΩ to the general reference ground X131/terminal 15)
It is not permissible that terminal 15 is connected to PE or terminal 19, further, no external voltage sources may be connected to terminal 15. Terminal 19 may be connected to X131.

3) I/R = Infeed/regenerative feedback module; UE = Uncontrolled infeed; MM = Monitoring module; PW = Pulse resistor module

4) The 1st number is valid for cable lugs. The 2nd number is valid for finely–stranded conductors without connector sleeve.

5) The grounding bar is used to ground the DC link M rail through 100 kΩ (should preferably be inserted).

6) RESET = Resets the error memory, edge triggered for the complete drive group (Terminal ”R” → Terminal 15 = RESET)

7) Terminals 111-213, positively–driven NC contact (for I/R 16 kW and UE 10 kW, only from Order No.: 6SN114□–1□□0**1**–0□□□)
Terminals 111–113 NO contacts, not positively driven

8) Maximum current load of terminal 9 with respect to 19: 0.5 A.

9) Only for UE 28 kW

Interface overview UE module 5/10 kW

Table 3-9

Term. No.	Des.	Function	Type 1)	Typ. voltage/limit values	Max. cross–section
U1 V1 W1	X1	Supply connection	E	3–ph. 400 V AC	4 mm^2 finely–stranded without connector sleeve 6 mm^2 with cable lug
PE ▭ ⏚	– X131 X351	Protective conductor Electronics M Equipment bus Grounding bar 3)	I I I/O I/O	0 V 0 V Various –300 V	M5 thread M4 thread 34–core ribbon cable Busbar
P600 M600		DC link	I/O	+300 V –300 V	Busbar
M500 P500 1U1 2U1 1V1 2V1 1W1 2W1	X181 X181 X181 X181 X181 X181 X181 X181	DC link power supply DC link power supply Output L1 Input L1 Output L2 Input L2 Output L3 Input L3	I I O I O I O I	–300 V +300 V 3–ph. 400 V AC 3–ph. 400 V AC 3–ph. 400 V AC 3–ph. 400 V AC 3–ph. 400 V AC 3–ph. 400 V AC	1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2
5.3 5.2 5.1 nc	X121A X121A X121A X121A	Relay contact Group signal I^{2}t/motor temp.	NC NO I	50 V DC/0.5 A/12 VA max 5 V DC/3 mA min	1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2
74 73.2 73.1 72	X121B X121B X121B X121B	Relay signal Ready/fault	NC I I NO	1–ph. 250 V AC/50 V DC/2 A max 5 V DC/3 mA min	1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2
63 2) 9 2)4) 9 2)4) 64 2) R 5) 19	X141AX 141A X141A X141A X141A X141A	Pulse enable FR+ FR+ Drive enable RESET FR–, reference ground enable voltage	I O O I I O	+13 V...30 V/R_E = 1.5 kΩ +24 V +24 V +13 V...30 V/R_E = 1.5 kΩ Terminal 19/R_E = 10 kΩ	1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2 1.5 mm^2

---

1) I = input; O = output; NC = NC contact; NO = NO contact

2) Terminal 19 is the reference terminal (this is connected in the module with 10 kΩ to general reference ground X131)
It is not permissible to connect terminal 15 with PE or with terminal 19, further, no external voltage sources may be connected to terminal 15. Terminal 19 may be connected to terminal X131.

3) The grounding bar is used to ground the DC link M rail through 100 kΩ (should be preferably inserted).

4) Max. current load of terminal 9 - terminal 19 $\leq$ 1 A

5) RESET = Resets the fault memory, edge triggered for the complete drive group
(terminal ”R” → Terminal 19 = RESET)

Caution: Terminals 7, 45, 44 and 10 are not available for UE 5/10 kW.

Table 3-9

T.– No.	Des.	Function	Type 1)	Typ. voltage/limit values	Max. cross–section
111	X161	Signaling contact Line contactor	I	1–ph. 250 V AC/50 V DC/2 A	1.5 mm^2
213	X161		NC	17 V DC/3 mA min	1.5 mm^2
9[2)4)]	X141B	FR+	O	+24 V	1.5 mm^2
112	X141B	Setting–up no–/standard mode	I	+13 V...30 V/R_E = 1.5 kΩ	1.5 mm^2
48	X141B	Contactor control	I	+13 V...30 V/R_E = 1.5 kΩ	1.5 mm^2
NS1	X141B	Coil contact for line–, pre–charging contactor	O	+24 V	1.5 mm^2
NS2	X141B		I	0/+24 V	1.5 mm^2
15	X141B	M	O	0 V	1.5 mm^2

---

1) I = input; O = output; NC = NC contact; NO = NO contact

2) Terminal 19 is the reference terminal (this is connected in the module with 10 kΩ to general reference ground X131)
It is not permissible to connect terminal 15 with PE or with terminal 19, further, no external voltage sources may be connected to terminal X131.

3) The grounding bar is used to ground the DC link M rail through 100 kΩ (should be preferably inserted).

4) Max. current load of terminal 9 – terminal 19$\leq$ 1 A
Caution: Terminals 7, 45, 44 and 10 are not available for UE 5/10 kW.

Line fuses, commutating reactors, transformers and main switch

Assignment of the line fuses to the NE modules

Fuses must be used which are designed to protect the line supply feeder cables.

The following can be used: NH, D, DO with gL characteristics according to VDE 0636, VDE 0641. Without restricting the performance data of the NE modules, we recommend the SIEMENS fuse types listed below.

Table 3-10

	UE module 5/10 kW	**UE module 10/25 kW**	**UE module 28/50 kW**	**I/R module 16/21 kW**	**I/R module 36/47 kW**	**I/R module 55/71 kW**	**I/R module 80/104 kW**	**I/R module 120/156 KW**
I_{rated} fuse	16 A	25 A	80 A	35 A	80 A	125 A	160 A 2x80 A 1)	250 A 2x125 A 1)
I_{fuse} 0.2 s	>70 A	>100 A	>360 A	>180 A	>360 A	>450 A	>650 A	>865 A
I_{fuse} 4 s	>50 A	>80 A	>260 A	>130 A	>260 A	>350 A	>505 A	>675 A
I_{fuse} 10 s	>42 A	>65 A	>200 A	>100 A	>200 A	>250 A	>360 A	>480 A
I_{fuse} 240 s	>30 A	>40 A	>135 A	>60 A	>135 A	>200 A	>280 A	>380 A
Recommended SIEMENS fuse types								
Rated voltage 415 V . ÷	16 A D01 Neoz./ B.No. 5SE2116	25 A D02 Neoz./ B.No. 5SE2125		35 A D02 Neoz./ B.No. 5SE2135				
Rated voltage 500 V . ÷	16 A DII Diazed/ B.No. 5SB261	25 A DII Diazed/ B.No. 5SB281	80 A DIV Diazed/ B.No. 5SC211	35 A DIII Diazed/ B.No. 5SB411	80 A DIV Diazed/ B.No. 5SC211			
Rated voltage 500 V . ÷	16 A size 00 NH/ B.No. 3NA3805	25 A size 00 NH/ B.No. 3NA3810	80 A size 00 NH/ B.No. 3NA3824	35 A size 00 NH/ B.No. 3NA3814	80 A size 00 NH/ B.No. 3NA3824	125 A size 00 NH/ B.No. 3NA3832	160 A size 1 NH/ B.No. 3NA3136	250 A size 1 NH/B.No. 3NA3144

The fuses/m.c.b.s used must fulfill the conditions of the values in the tables. Fuses/m.c.b.s with lower currents are not recommended when the NE modules are partially utilized, as the maximum current can be drawn from the NE module during transient operations.

The tabulated values must be compared with the values obtained from the current–time characteristic of the fuse used. If the fuse currents from the current–time characteristics for the specified times in the table, are always greater than the tabulated values, then the fuse can be used.

The maximum fuse rating which can be used (I_{rated} fuse) is specified by the maximum cross–section which can be connected at the terminals.

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1) For applications with filter modules (square–wave current filters)

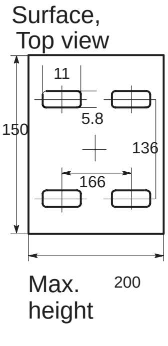
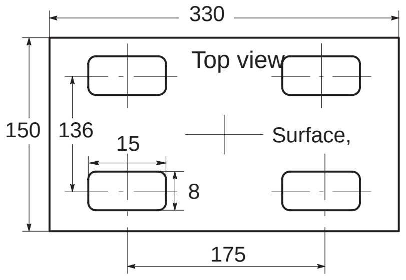
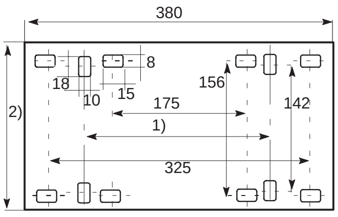
Assignment of the commutating reactors to the NE modules

Note

When using SIMODRIVE filter modules for I/R modules with square–wave operation (refer to p. 1-50), a separate commutating reactor is not required.

For UE 5/10 kW and UE 10/25 kW, commutating reactors are not required.
Operating voltage: 3–ph. 300 to 520 V AC/45 to 65 Hz

Table 3-11

	UE module 28/50 kW	**I/R module 16/21 kW**	**I/R module 36/47 kW**	**I/R module 55/71 kW**	**I/R module 80/104 kW**	**I/R module 120/156 kW**
Type	28 kW commutating HF reactor	16 kW commutating HF reactor	36 kW commutating HF reactor	55 kW commutating HF reactor	80 kW commutating HF reactor	120 kW commutating HF reactor
Order No. 6SN1111– 0AA00–	6SN1111– 1AA00– 0CA0 1)	–0BA☐ 1)	–0CA☐ 1)	–0DA☐ 1)	–1EA☐ 1)	–1FA☐ 1)
L_{phase}	0.15 mH	0.7 mH	0.4 mH	0.27 mH	0.23 mH	0.2 mH
I_n	65 A	30 A	67 A	103 A	150 A	225 A
Volt. drop/ phase	V3.1	8.6 V	12.3 V	12.3 V	V11.1	V15.2
Pv	W70	170 W	250 W	350 W	450 W	590 W
Connection cross–section	Max. 35 mm^2	Max. 16 mm^2	Max. 35 mm^2	Max. 70 mm^2	9mm hole	9mm hole
Weight (max)	6 kg	9 kg	20 kg	26 kg	40 kg	50 kg
Mounting position	Any	Any	Any	Any	Any	Any
Terminal assignment	Output:					
	1U2, 1V2, 1W2					
	Input:					
	1U1, 1V1, 1W1					
Drilling template Dimensions in mm		 Max. height for 16 kW: 145 Max. height for 36 kW: 230 Max. height for 55 kW: 280			 1): 80kW: 224mm 120kW: 264mm 2): 170mm width including connection max . 225mm Footprint/top view	

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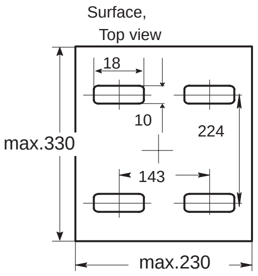
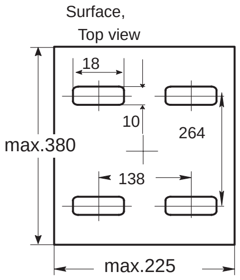
1) Suitable for sinusoidal current– **and square–wave current operation**.

Table 3-12 Assignment of the commutating reactor for only square–wave current operation

	I/R module 80/104 kW	**I/R module 120/156 kW**
Type	80 kW commutating reactor	120 kW commutating reactor
Order No. 6SN1111–0AA00–	–0EA0 (only for square–wave current)	–0FA0 (only for square–wave current)
L_{phase}	0.235 mH	0.215 mH
I_n	150 A	225 A
Volt. drop/phase	11.1 V	15.2 V
Pv	450 W	590 W
Connection cross–section	9 mm drilling	9 mm drilling
Weight	50 kg	61 kg
Mounting position	Any	Any
Terminal assignment	Connections at the top: output	
	1U2, 1V2, 1W2	
	Connections at the bottom: Input	
	1U1, 1V1, 1W1	
Drilling template Dimensions in mm	 Height 290	 Height 340

Permissible operating mode as a function of the commutating reactor used or the filter module used.

Table 3-13 Assignment of the commutating reactor/filter module to the operating mode

	I/R 16 kW	**I/R 36 kW**	**I/R 55 kW**	**I/R 80 kW**	**I/R 120 kW**
Commutating reactor (acc. to Table 3-11)	Squ.–wave/sinus. ⊓ ∼	Squ.–wave/sinus. ⊓ ∼	Squ.–wave/sinus. ⊓ ∼	Squ.–wave/sinus. ⊓ ∼	Squ.–wave/sinus. ⊓ ∼
Commutating reactor (acc. to Table 3–8)				Squ.–wave ⊓	Squ.–wave ⊓
Commutating reactor (6SC611 system)	Squ.–wave ⊓	Squ.–wave ⊓	Squ.–wave ⊓	Squ.–wave ⊓	Squ.–wave ⊓
Filter module (acc. to Table 3-16)	Squ.–wave ⊓	Squ.–wave ⊓	Squ.–wave ⊓	Squ.–wave ⊓	Squ.–wave ⊓

Note

I/R in sinusoidal operation may not be used with other reactors.

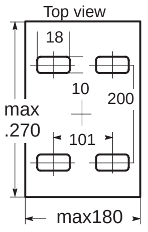
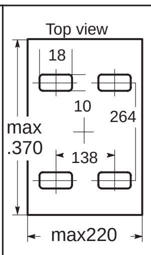
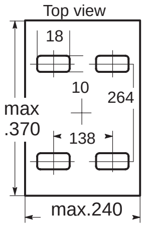
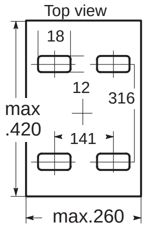
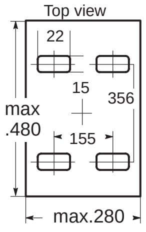
Assignment of the auto–transformer to the I/R modules [2]

Note

When a transformer is used for the I/R module, this does **not** replace the external commutating reactor.

When using a transformer, from NE module ≥ 10kW
Order No.: 6SN114□–1□□0□–0□□**1** an overvoltage limiting module must be used. Order No.: 6SN1111–0AB00–0AA0

Table 3-14 Auto–transformers for 480/440V input voltage

	I/R module 16/21 kW	**I/R module 36/47 kW**	**I/R module 55/71 kW**	**I/R module 80/104 kW**	**I/R module 120/156 kW**
PD type 3–ph. 480/ 440/400 V AC 1)	21 kVA auto–transformer	46.5 kVA auto–transformer	70.3 kVA auto–transformer	104 kVA auto–transformer	155 kVA auto–transformer
Order No. 6SN1111–0AA00–	–0BB□	–0CB0	–0DB0	–0EB0	–0FB□
Pv	170 W	376 W	445 W	550 W	700 W
Max. connection cross–section	16 mm^2	50 mm^2	70 mm^2	9 mm diameter drilling	
Fuse, primary	35 A gL	80 A gL	125 A gL	160 A gL	224 A gL
Weight	26 kg	60 kg	60 kg	80 kg	125 kg
Terminal assignment	1U1 / 1U3 / 1V1 / 1V3 / 1W1 / 1W3 / 2U1 / 2V1 / 2W1 / N			Flat connectors	
	1U1 to 1W1=480 V input, 1U3 to 1W3=440 V input, 2U1 to 2W1=400 V output, N=neutral point				
Drilling template Dimensions in mm	 Max. height 250	 Max. height 330	 Max. height 340	 Max. height 370	 Max. height 440

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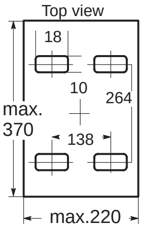
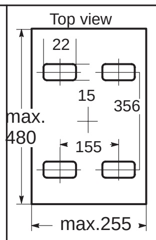
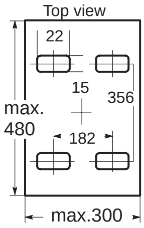
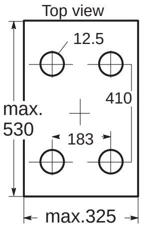
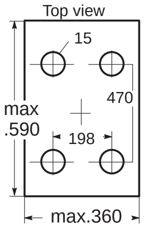
1) The transformers for 3–ph. 480/440/400 V AC can be used at the 480 V tap up to 550 V for a line supply frequency of 57 – 63 Hz.

2) Assignment of the isolating transformers to the I/R modules, refer to Catalog NC 60.1 Part 8.

Table 3-15 Auto–transformer for 220V input voltage 2)

	I/R module 16/21 kW	**I/R module 36/47 kW**	**I/R module 55/71 kW**	**I/R module 80/104 kW**	**I/R module 120/156 kW**
PD type1) 3–ph. 220/400 V AC	21 kVA auto–transformer	46.5 kVA auto–transformer	70.3 kVA auto–transformer	104 kVA auto–transformer	155 kVA auto–transformer
Order No., 6SN1111–0AA00–	–0BC0	–0CC0	–0DC0	–0EC0	–0FC0
Pv	412 W	644 W	790 W	1100 W	1340 W
Max. connection cross–section	Prim 16 mm^2 Sec. 16 mm^2	Prim 70 mm^2 Sec. 50 mm^2	Prim 95 mm^2 Sec. 70 mm^2	9 mm diameter drilling	
Fuse on the primary side	63 A gL	160 A gL	224 A gL	300 A gL	500 A gL
Weight	60 kg	120 kg	135 kg	220 kg	300 kg
Terminal assignment	1U1 to 1W1=220 V input, 2U1 to 2W1=400 V output, N=neutral point				
Max. dimensions Drilling template in mm	 Max. height 330	 Max. height 430	 Max. height 430	 Max. height 520	 Max. height 600

Operating conditions of all transformers and reactors

The following operating conditions are permitted:

- Supply voltage 3–ph. 480/440/400 V AC or 3–ph. 220/400 V AC/45...60 Hz1)
- Temperature range –25°C...40°C (to 55°C with de–rating)
- degree of protection IP00
- humidity rating F according to DIN 40040 for transformers and reactors

The maximum current of transformers/reactors is dependent on the ambient temperature and the installation altitude. The permissible current/power rating of the transformers and reactors is:

I_n (PD) reduced = $c \times I_n$ (PD)

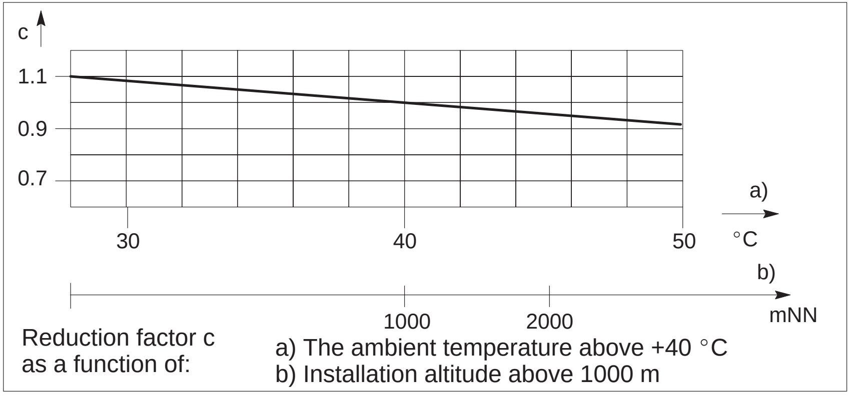


Figure 3-11 Reduction factor c

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1) 3–ph. 240 V AC at 60 Hz ±5% can be used as input voltage.
Note: The secondary voltage increases, and switch S1.1 on the NE modules must be set to ON, refer to p. 1-20.

2) Assignment of the isolating transformers to I/R modules, refer to Catalog NC 60.1 Part 8.

Assignment of the main circuit breakers

Note

At shutdown, terminal 48 of the NE module must be de–energized 10 ms before the contacts to the line supply open.

Circuit breakers or switches with leading auxiliary contacts can be used to ensure that terminal 48 of the NE module is first de–energized before the line contactor or line switch is opened.

Recommendation:
Siemens switches, types 3LC.../3KA5... (from the Catalog SIEMENS ”Low–voltage switchgear”)

For UE modules					
	5 kW	10 kW	28 kW		
Switch type	3LC2047–1TD...	3LC4047–2TD...	3LC6047–2TD...		
For I/R modules					
	16 kW	36 kW	55 kW	80 kW	120 kW
Switch type	3LC4047–2TD...	3LC6047–2TD...	3KA5330–1EE00 + 3SB1400–0A	3KA5530–1EE00 + 3SB1400–0A	3KA5730–1EE00 + 3SB1400–0A

Filter modules and line filter[1)]

In order to maintain the EMC Law, the SIMODRIVE 611 system has filter modules and line filters. An essential prerequisite in maintaining the limit values is that, in addition to the use of filter modules/line filters, the cabinet has been designed and constructed in line with an EMC–correct design. The installation and connection specifications according to pp.1-54~1-56 must be observed.

These EMC limit values can also be fulfilled using other suitable measures; an EMC investigation should be made on a case–for–case basis.

Note

When using filter modules (for I/R modules for square–wave current operation), a separate commutating reactor is not required.

When using an adaptation transformer, this does not mean that the filter module or line filter are not required, i.e. the transformer does not replace a filter module or line filter.

When using filters, which SIEMENS have not released for SIMODRIVE 6SN611, line harmonics and disturbances can occur, which could damage/interfere with other equipment connected to that line supply.

When using line filters (for I/R modules for sinusoidal current operation), the appropriate HF commutating reactor must be connected in series, refer to p. 1-46, Connection diagram Fig. 3-13.

Information regarding machines which are located close to one another at different potentials:
Two machines are located close to one another and are connected to the same distribution through separate cables.

If a SIMODRIVE drive with controlled DC link (I/R module) **without** filter module or line filter, is used in one of the two machines, then potential equalization currents can flow when both machines are connected.

Counter–measure: Directly connect the machines through a short PE cable or use a filter module/line filter in front of the SIMODRIVE drive.

Operating conditions, filter modules/line filters

- Max. supply voltage 3–ph. 456 V AC, 45...66 Hz
- may only be used with supplies with grounded neutral point (TN supply networks).
  When connected to other line supplies, an isolating transformer must be used.
- Current de–rating depending on the installation altitude, according to p.1-29, Fig.3-3.

[1)] Filter modules and line filters are not UL/CSA approved.

Assignment of the filter modules to the I/R modules (only square–wave current operation)

Table 3-16

	I/R module 16/21 kW	**I/R module 36/47 kW**	**I/R module 55/71 kW**	**I/R module 80/104 kW**	**I/R module 120/156 kW**
Filter components	Filter module, 16 kW with integral commutating reactor	Filter module, 36 kW with integral commutating reactor	Filter module, 55 kW with integral commutating reactor	Two 55 kW filter modules with integrated commutating reactor. The filter modules are connected in parallel.	Two 55 kW filter modules with integrated commutating reactor. The filter modules are connected in parallel.
Order No., Filt. module	6SN1111–0AA01–0BA1	6SN1111–0AA01–0CA1	6SN1111–0AA01–0DA0	2x, 6SN1111–0AA01–0DA0	2x, 6SN1111–0AA01–0DA0
Mounting position	Wall– or floor mounting, refer to dimension drawings, Section 12. A mounting bracket set is required for floor mounting.				
Order No., bracket set for floor mounting	6SN1162–0BA06–0AA0	6SN1162–0BA06–0AA0	6SN1162–0BA06–0AA0	2, 6SN1162–0BA06–0AA0	2, 6SN1162–0BA06–0AA0
Order No., heat barrier for wall mounting	6SN1162–0BA07–0AA0	6SN1162–0BA07–0BA0	6SN1162–0BA07–0BA0	2, 6SN1162–0BA07–0BA0	2, 6SN1162–0BA07–0BA0
Order No., heat barrier for floor mounting	6SN1162–0BA07–0AA0	6SN1162–0BA07–0AA0	6SN1162–0BA07–0AA0	2, 6SN1162–0BA07–0AA0	2, 6SN1162–0BA07–0AA0
Module width	150 mm	250 mm	300 mm	2 x 300 mm	2 x 300 mm
Filter Filter	26 kg	40 kg	43 kg	2 x 43 kg	2 x 43 kg
I_{rated} filter	30 A	67 A	103 A	150 A	225 A
P_v filter	290 W	460 W	710 W	1220 W	1420 W
Max. connection cross–section	16/10 mm^2 1) PE, potential bonding: M5 thread	50 mm^2 PE, potential bonding: M8 thread	50 mm^2 PE, potential bonding: M8 thread	2 x 50 mm^2 PE, potential bonding: M8 thread	2 x 50 mm^2 PE, potential bonding: M8 thread
Terminals, supply input	L1, L2, L3, pot. bonding, shield, PE	L1, L2, L3, pot. bonding, shield, PE	L1, L2, L3, pot. bonding, shield, PE	2 x L1, L2, L3, Potential bonding, screen, PE	2 x L1, L2, L3, Potential bonding, screen, PE
Terminals, output	U, V, W shield, PE	U, V, W shield, PE	U, V, W, shield, PE	2 x U, V, W shield, PE	2 x U, V, W shield, PE
I_{rated}, fuse 2)	35 A	80 A	125 A	160 A	250 A
Cooling	Non–ventilated	Non–ventilated	Non–ventilated	Non–ventilated	Non–ventilated
Radio interference suppression EN 55011	Cable–borne noise, limit value class A	Cable–borne noise, limit value class A	Cable–borne noise, limit value class A	Cable–borne noise, limit value class A	Cable–borne noise, limit value class A

Mounting position of the filter modules

The filter modules can be mounted horizontally and vertically (line at the bottom, load at the top).

---

1) The 1st number is for cable lugs, the 2nd number is valid for finely–stranded conductors without endsleeves.

2) The fuse used must have this rated current. Refer to Table 3-10 for recommended fuses.

Assignment of the line filters to the I/R modules

Table 3-17 Assignment of the line filters to the I/R modules

	I/R module 16/21 kW	**I/R module 36/47 kW**	**I/R module 55/71 kW**	**I/R module 80/104 kW**	**I/R module 120/156 kW**
Filter components	Line filter 16 kW	Line filter 36 kW	Line filter 55 kW	Line filter 80 kW	Line filter 120 kW
Order No. Line filter	6SN1111–0AA01–2BA□	6SN1111–0AA01–2CA□	6SN1111–0AA01–2DA□	6SN1111–0AA01–2EA□	6SN1111–0AA01–2FA□
Mounting position	Wall– or floor mounting, refer to dimension drawings, Section 12.				
Module width	Refer to the dimension drawings, Section 12.				
Filter Filter	9 kg	16 kg	19 kg	being prepared	being prepared
I_{rated} filter	30 A	67 A	103 A	150 A	225 A
P_V filter	W70	W90	W110	being prepared	being prepared
Max. connection cross–section	16/10mm^2 1) PE, (M5)	50mm^2 PE, (M8)	50mm^2 PE, (M8)	being prepared	being prepared
Terminals, Line supply input	LINE L1, L2, L3, PE	LINE L1, L2, L3, PE	LINE L1, L2, L3, PE	LINE L1, L2, L3, PE	LINE L1, L2, L3, PE
Terminals, output	LOAD L1, L2, L3	LOAD L1, L2, L3	LOAD L1, L2, L3	LOAD L1, L2, L3	LOAD L1, L2, L3
I_{rated}, fuse 2)	35 A	80 A	125 A	160 A	250 A
Cooling	Non–ventilated	Non–ventilated	Non–ventilated	Non–ventilated	Non–ventilated
Radio interference suppression EN 55011	Cable–borne, limit value Class A	Cable–borne, limit value Class A	Cable–borne, limit value Class A	Cable–borne, limit value Class A	Cable–borne, limit value Class A

Table 3-18 Filter packages

Filter packages	Package 16kW 6SN1111–0AA01–2BB0	Package 36kW 6SN1111–0AA01–2CB0	Package 55kW 6SN1111–0AA01–2DB0	Package 80kW 6SN1111–0AA01–2EB0	Package 120kW 6SN1111–0AA01–2FB0
Contents:					
6SN1111–0AA00 –	16kW HF commutating reactor –0BA□	36kW HF commutating reactor –0CA□	55kW HF commutating reactor –0DA□	80kW HF commutating reactor –1EA□	120kW HF commutating reactor –1FA□
6SN1111–0AA01 –	16 kW line filter –2BA□	36 kW line filter –2CA□	55 kW line filter –2DA□	80 kW line filter –2EA□	120 kW line filter –2FA□

Mounting position of the filter modules

The filter modules can be mounted horizontally and vertically (line at the bottom, load at the top).

---

1) The 1st number is for cable lugs, the 2nd number is for finely–stranded conductors without connector sleeves

2) The fuse used must have this rated current. Refer to Table 3-10 for recommended fuses.

Assignment of the line filters to the UE modules

Table 3-19

	UE module 5/10 kW	**UE module 10/25 kW**	**UE module 28/50 kW**
Filter components	Line filter, 5 kW	Line filter, 10 kW	Line filter, 28 kW
Order No. filter module	6SN1111–0AA01–1BA0	6SN1111–0AA01–1AA0	6SN1111–0AA01–1CA0
Mounting position	Any		
Module width	Refer to Dimension Drawings, Section 12		
Filter Filter	3.8 kg	5.7 kg	12.5 kg
I_{rated} filter	16 A	25 A	65 A
P_v filter	20 W	20 W	W25
Max. connection cross–section	4 mm^2 PE, M6 studs	10 mm^2 PE, M6 studs	50 mm^2 PE, M10 studs
Terminals, Line input	LINE L1, L2, L3, PE	LINE L1, L2, L3, PE	LINE L1, L2, L3, PE
Terminals, output	LOAD L1, L2, L3, PE	LOAD L1, L2, L3, PE	LOAD L1, L2, L3, PE
I_{rated}, fuse (1)	16 A	25 A	80 A
Cooling	Non–ventilated	Non–ventilated	Non–ventilated
Radio interference suppression EN 55011	Cable–borne, limit value Class A	Cable–borne limit value Class A	Cable–borne limit value Class A

---

1) The fuse used must have this rated current. Refer to Table 3-10 for recommended fuses.

Installation and connection regulations

⚠

Caution

The filter modules for I/R modules for square–wave current operation, become extremely hot in the vicinity of the internal module line resistors. If other components are mounted above a filter module (clearance < 400 mm) then a heat barrier can be mounted which deflects the heat away from these components. Also refer to the dimension drawings, Section 12, Order Nos, refer to Table 3-16. (danger of overheating)

⚠

Caution

Ensure that the filter modules/line filters are correctly connected to the line supply, fulfilling all of the necessary regulations and specifications:

LINE L1, L2, L3 for line filters for the UE module and I/R module for sinusoidal current operation.
L1, L2, L3 for filter modules for the I/R module for square–wave current operation.
The filter module could be damaged if this is not observed. Also refer to the connection diagrams 3-12 and following.

!

Important

The listed filter modules/line filters conduct a high discharge current through the protective conductor. As a result of the high filter discharge current, there has to be a good PE connection to the filter module/line filter and the cabinet.

The measures according to pr EN 50178/94 Part 5.3.2.1 must be applied, e.g. protective conductor ($\geq$ 10 mm^2 Cu) or a second conductor must be routed in parallel to the protective conductor, through separate terminals. This conductor must fulfill the requirements for protective conductors according to IEC 364–5–543 itself.

General information

The”EMC Directives for SINUMERIK– and SIROTEC controls” must be observed, refer to the documentation overview on the first inside cover.

Applications

The filter modules/line filters described, are designed to provide interference suppression for SIMODRIVE 611 drive converters; they are not designed to provide interference suppression for other loads in the cabinet. A dedicated filter must be provided for other loads in the cabinet.

If the electronics power supply is connected to a separate line supply, then the feeder cable must be connected through a second filter. The feeder to the electronics power supply (connector X181) must be screened and the screen must be connected at both ends, at the connector side, as close as possible to connector X181, and at the cabinet mounting panel.

The fan units must also be connected to the line supply through a second filter.

Installation in the cabinet

The housings of the drive converter– and filter modules/line filters must be connected through an extremely low–ohmic connection with the rear cabinet panel so that high–frequency noise currents can be conducted. The rear cabinet panel must in turn be connected through a low–ohmic connection to the motors/ machine. The optimum solution is to mount the modules on a common bare metal mounting panel so that there is an electrical connection through the largest possible surface. This mounting panel must then be connected to the motor/machine, also through the largest possible surface area so that a good electrical connection is established. Painted cabinet panels as well as mounting rails or other similar installation equipment with small mounting surfaces do not fulfill this requirement.

The filter modules/line filter must be mounted close to the NE modules (not at the cabinet input, but directly at the NE module); the screened cable connection from the filter module/line filter to the NE module should be as short as possible. The cables leading to the filter module/line filter must be routed separately.

When connecting filter modules in parallel (80 kW and 120 kW), it is adequate to provide one fuse set, which protects both arms. For the rated fuse current, refer to the Table 3-16.

Recommended configurations, refer to Figs. 3-12 and 3–8.

Cable routing

Power– and signal cables must always be separately routed away from each other. In this case, the power cables from the converter module should be routed away towards the bottom and the encoder cable towards the top in order to achieve the largest possible separation.

All of the control cables connected to the function terminals, e. g. terminals 663, 63, 48 etc. should be grouped together and routed away towards the top. Individual cores which are associated with the same signal should be twisted. The function cable assembly is best routed away from the encoder cable assembly. There should be a minimum clearance of $\geq$ 200 mm between the cable assemblies (separate cable ducts).

All cables and conductors inside the cabinet should be routed as close as possible to the cabinet panels as loose random wiring can result in noise being coupled–in (antenna effect). Fault sources in the vicinity should be avoided (contactors, transformers etc.) and if required, a shield should be located between the cable and noise source.

Cables and conductors should not be extended or lengthened through terminals.

To protect the equipment from noise being coupled–in from external noise sources on the filter cable, screened cables must be used up to where the cable is connected to the cabinet terminals.

Power cables

Screened cables must be used for all of the motor– and line supply feeder cables. A covered metal cable duct which is connected through the largest possible surface area, can alternatively be used. In both cases, it should be ensured that the shield/cable duct are connected through the largest possible surface area to the appropriate components (converter module, motor).

Cable screen connection

All of the cable screens must be connected through the largest possible surface area closest to the terminal point; for components, which have no special screen connection, for example, using clamps or serrated bar on the bare metal rear cabinet panel. The cable length between the screen connection point and the terminal must be kept as short as possible.

Screen connecting plates are available on the NE– and power modules to connect the screens of screened power cables. These connecting plates have clamp connections and mounting points for brake terminals (Order No., refer to Table 3-20. Also refer to the dimension drawing ”EMC measures” Section 12).

For the filter modules for I/R modules for square–wave current operation 16 kW, 36 kW and 55 kW, suitable screen connecting plates are included in the scope of supply.

Table 3-20

Module width [mm]	**Shield connecting plate for modules with**	
	internal cooling 6SN1162–0EA00	external cooling 6SN1162–0EB00
50	–0AA0	–0AA0
100	–0BA0	–0BA0
150	–0CA0	–0CA0
200	–0JA0	–0JA0
300	–0DA0	–0DA0
300 for fan/pipe	–0KA0	——

If the motor is equipped with a brake, then the screen of the brake feeder cable must be connected at both ends with the screen of the power cable.

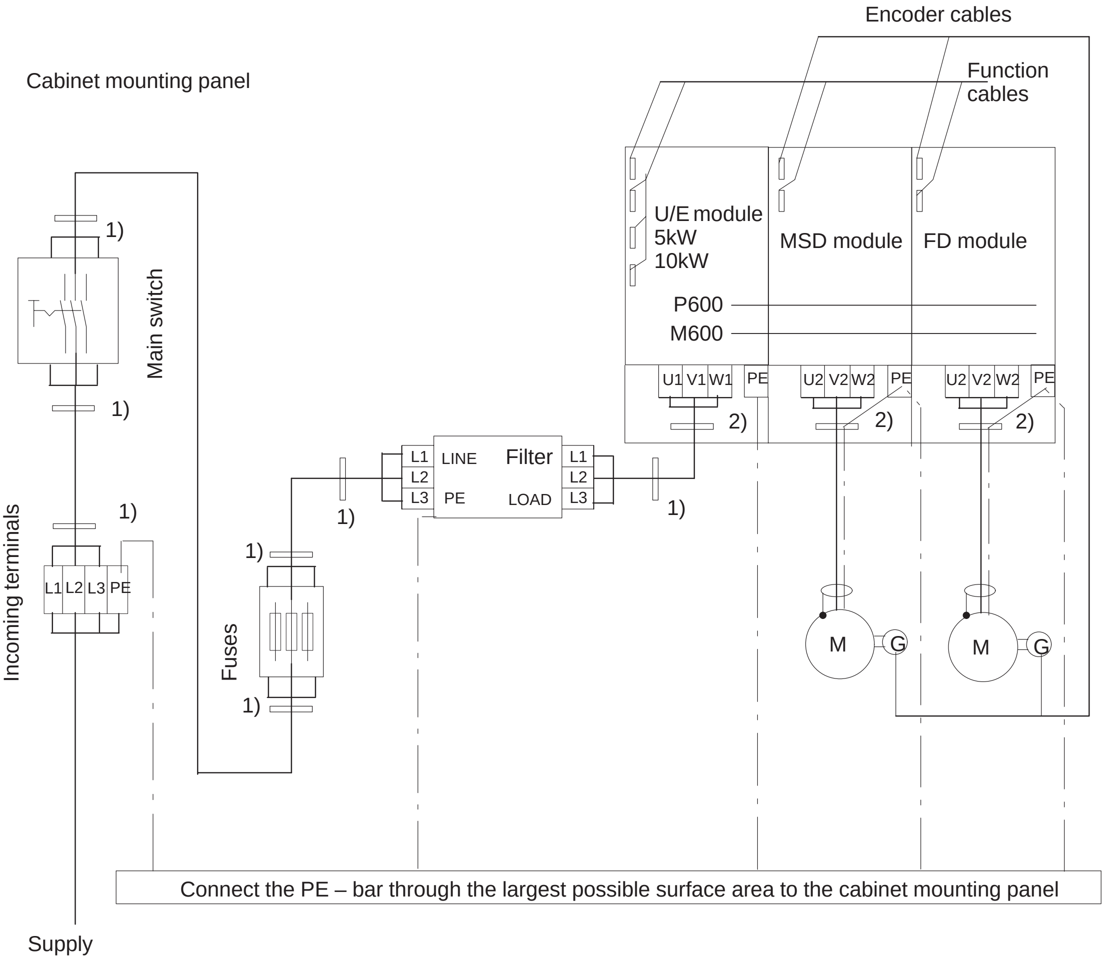
If there is no way of connecting the shield at the motor side, then a gland must be provided in the terminal box which allows the shield to be connected through the largest possible surface area (e. g. UNI IRIS DICHT U71.Pg from the PFLITSCH company).

⚠

Warning

Cable shields and unused cores in power cables (e. g. braking conductors) must be connected to PE potential in order to discharge capacitive cross–coupling charge effects.

If this is not observed, lethal contact voltages can occur, i.e. the voltages could cause serious injury or death.



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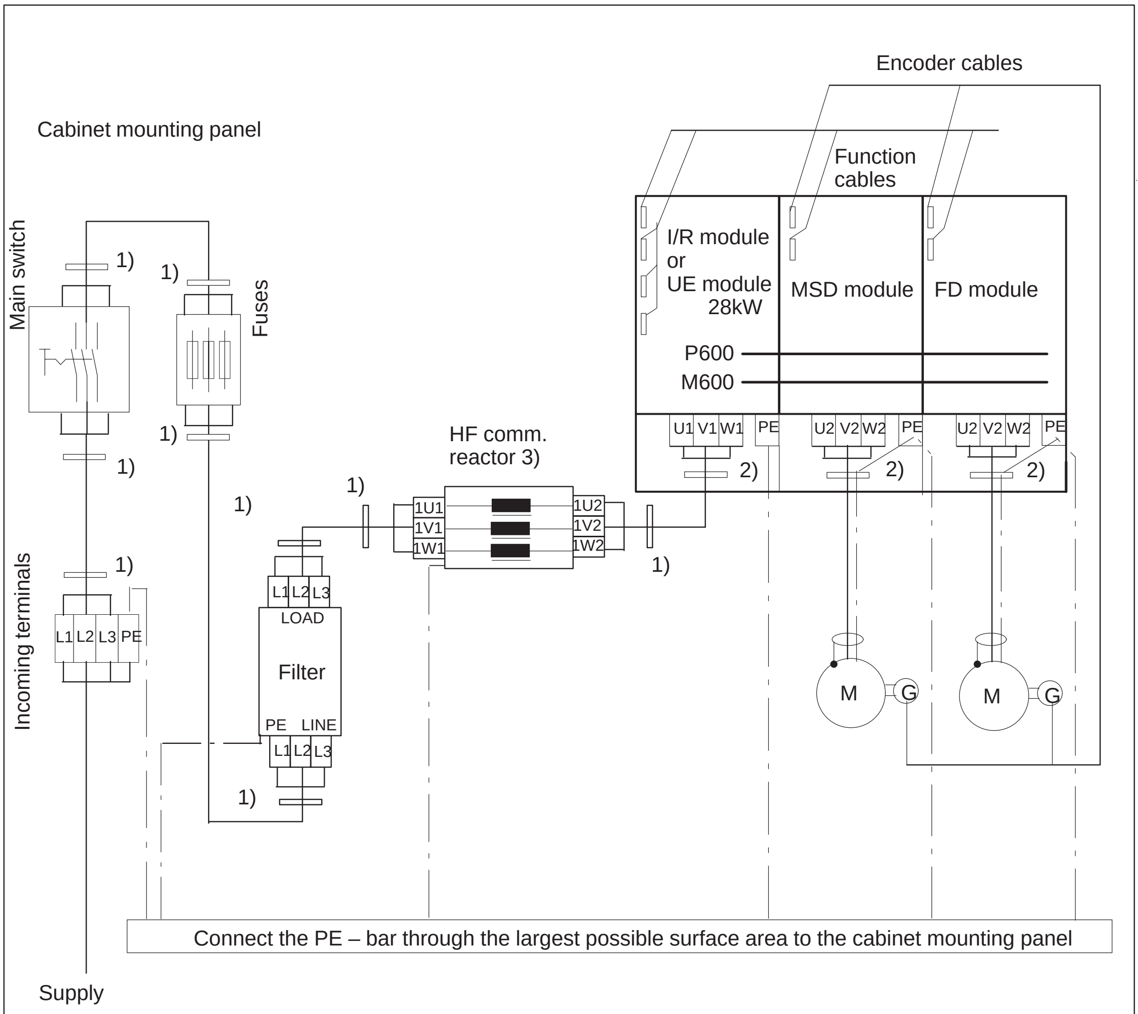
1) Shield connection, connected through the largest possible surface area with the cabinet mounting panel.
2) Shield connection at the module–specific connecting panel

Figure 3-12 Connecting diagram for line filters for 5 kW and 10 kW UE modules

28 kW UE refer to Fig. 3-13



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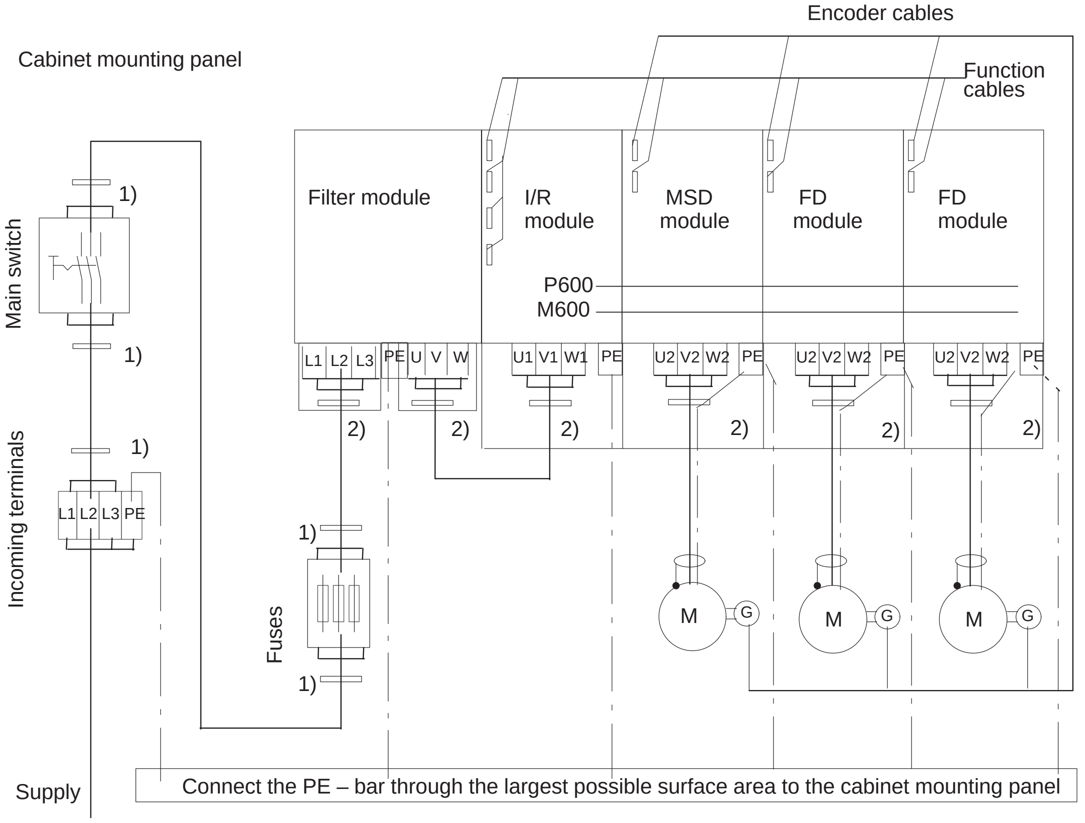
1) Shield connection, connected through the largest possible surface area with the cabinet mounting panel.
2) Shield connection at the module–specific connecting plate
3) For the permissible commutating reactors for I/R module, sinusoidal operation, refer to Sections 3.4.2 and 3.1
Permissible commutating reactor for 28kW UE module, refer to Section 3.4.2

Figure 3-13 Connecting diagram for the line filter for I/R modules, 16kW to 120kW
The connecting diagram is also valid for UE–28kW, but 6–pulse square–wave current flows as a result of the uncontrolled infeed.



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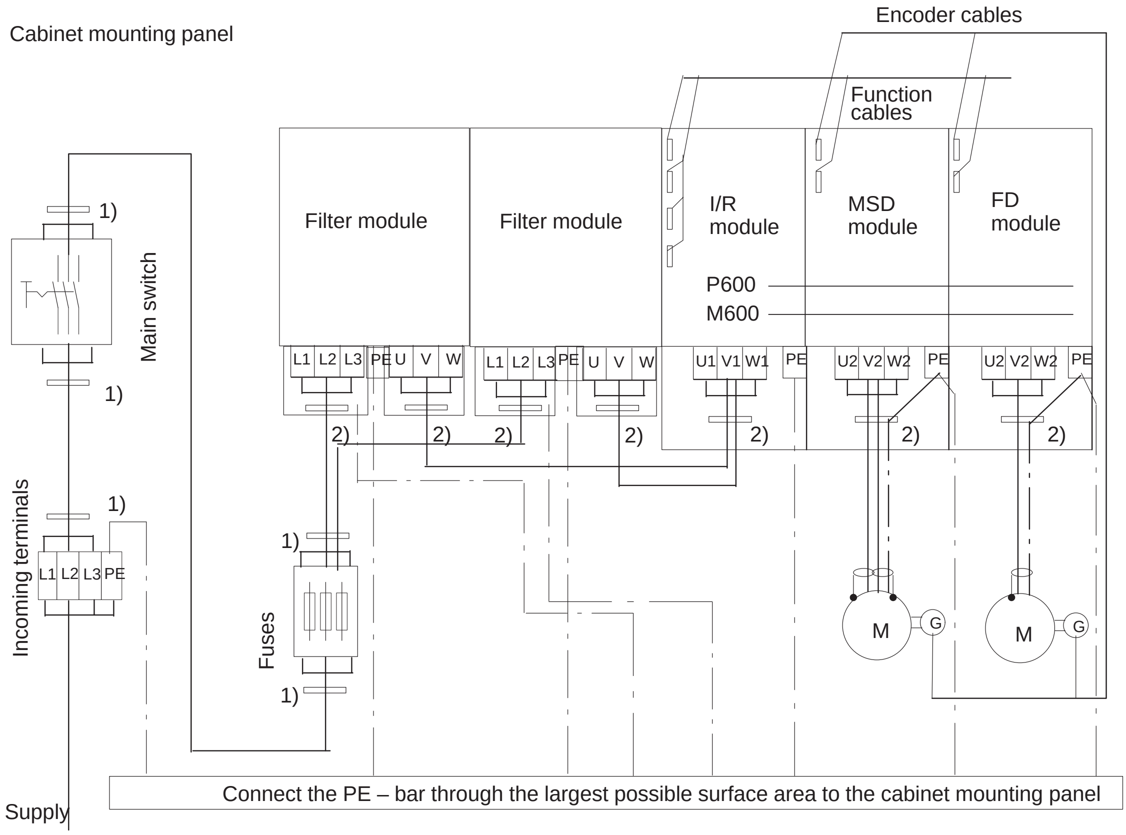
1) Shield connection, connected through the largest possible surface area with the cabinet mounting panel.

2) Shield connection at the module–specific connecting panel.

Figure 3-14 Connecting diagram for filter modules for the I/R modules 16 kW, 36 kW and 55 kW for square–wave current operation



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1) Shield connection, connected through the largest possible surface area with the cabinet mounting panel.
2) Shield connection at the module–specific connecting panel.
3) The potential bonding conductor is an additional protection so that no inadmissibly high contact voltages can occur at the filter module.

Figure 3-15 Connecting diagram for two filter modules, connected in parallel for 80 kW and 120 kW I/R modules for square–wave current applications

!

Important

The filter modules must be connected up with the same phase sequence if they are connected in parallel.

■

Power modules

The current specified on the power modules are normalized values, which refer to all of the control modules. The output currents can be limited by the control module used. After the control module has been inserted, the retaining screws of the module front panel must be tightened–up to guarantee a good electrical connection to the module housing.

Power module, internal cooling

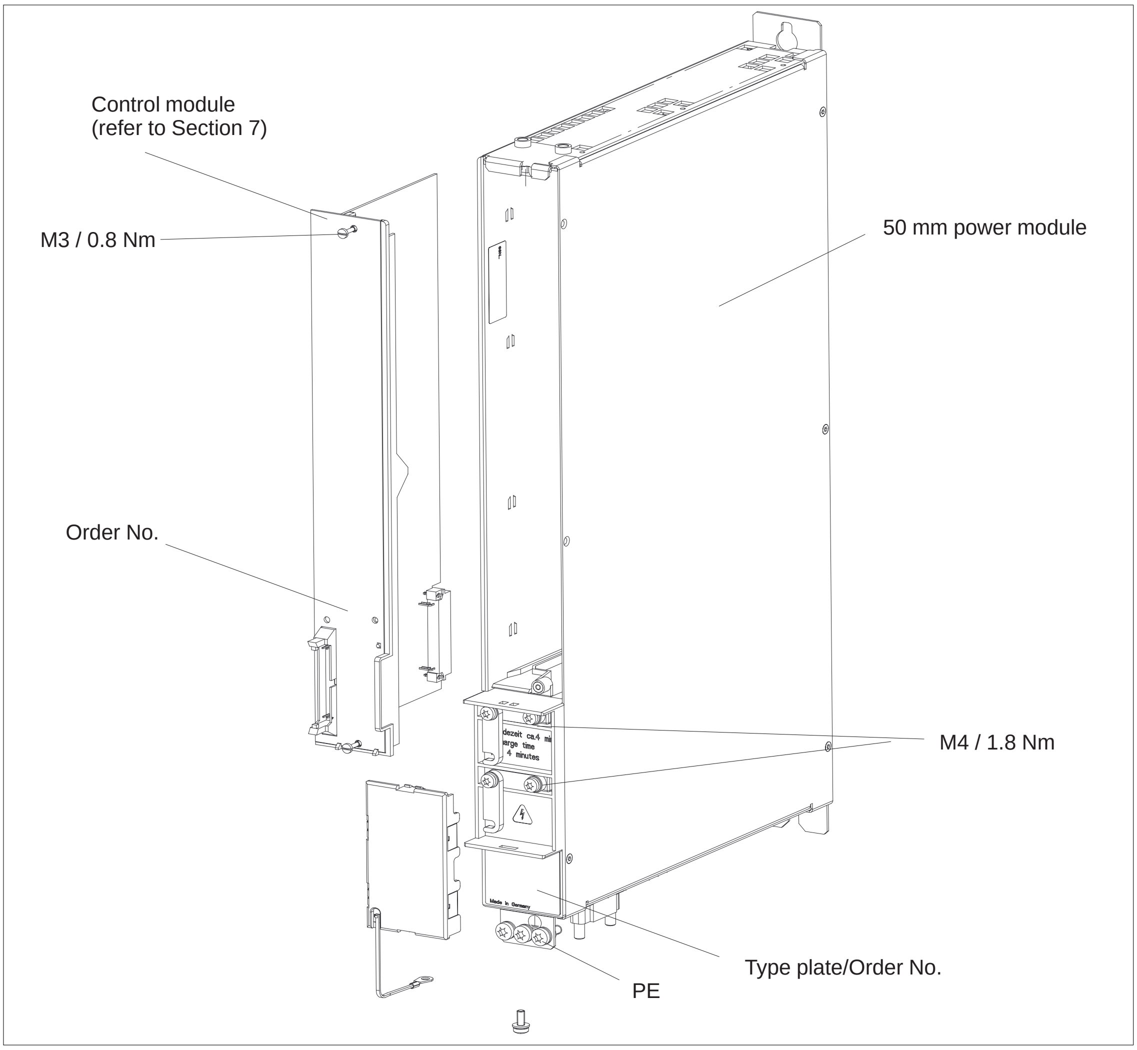

Figure 4-1 Power module with control module

Technical data

Technical data of the power modules

Table 4-1 Technical data, power modules internal cooling

Power module – Current assignment	**Cooling type** $^{5)}$	**Max. conductor cross–section**$^{2)}$ **[mm^2]**	**MSD – analog/ digital $I_n/I_{s6}/I_{max}$ [A]**	**X1** $^{1)}$ **[%]**	**IMM analog $I_n/I_{s6}/I_{max}$ [A]**	**X1** $^{1)}$ **[%]**	**IMM digital $I_n/I_{s6}/I_{max}$ [A]**	**X1** $^{1)}$ **[%]**	**FD analog I_n/I_{max} [A]**	**X1** $^{1)}$ **[%]**	**FD digital I_n/I_{max} [A]**	**X1** $^{1)}$ **[%]**
	Max. width [mm]		**Losses [W] $Pv_{tot.}$**	**f_0** $^{1)}$ **[kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0** $^{1)}$ **[kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0** $^{1)}$ **[kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0** $^{1)}$ **[kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0** $^{1)}$ **[kHz]**
	Weight [kg]											
Power module, int. 8 A	S	6/4	–	–	3/3/3	50	2.8/2.8/ 2.8	50	4/8	55	3/6	55
	50		–	–	30	3.2	30	4.0	35	3.3	35	4
	6.5											
Power module, int. 15 A	S	6/4	–	–	5/5/8	50	4.6/4.6/ 7.3	50	7.5/15	55	5/10	55
	50		–	–	40	3.2	40	4.0	45	3.3	50	4
	6.5											
Power module, int. 25 A	S	6/4	–	–	8/10/16	55	7.4/9.3/ 14.8	55	12.5/25	55	9/18	55
	50		–	–	74	3.2	74	4.0	90	3.3	90	4
	6.5											
Power module, int. 50 A	F	6/4	24/32/ 32	40	24/32/ 32	40	22/29/ 29	40	25/50	40	18/36	40
	50		260	3.2	260	3.2	260	4.0	180	3.3	190	4
	7.5											
Power module, int. 2 × 8 A	S	6/4	–	–	–	–	–	–	2 × 4/8	55	2 × 3/6	55
	50		–	–	–	–	–	–	70	3.3	70	4
	7											
Power module, int. 2 × 15 A	S	6/4	–	–	–	–	–	–	2 × 7.5/ 15	55	2 × 5/10	55
	50		–	–	–	–	–	–	104	3.3	100	4
	7											
Power module, int. 2 × 25 A	F	6/4	–	–	–	–	–	–	2 × 12.5 /25	55	2 × 9/18	55
	50		–	–	–	–	–	–	174	3.3	180	4
	7											
Power module, int. 2 × 50 A	F	6/4	–	–	–	–	–	–	2 × 25/5 0	40	2 × 18/3 6	40
	100		–	–	–	–	–	–	364	3.3	380	4
	13.5											

---

1) X1=current reduction factor, current reduction from the inverter clock frequency f_0 of the power transistors (refer to Fig.4-2)
2) The 1st number is valid for cable lugs, the 2nd number is valid for finely–stranded conductors without conn. sleeves.
3) If pipe cooling is not used, only $Pv_{tot.}$ should be taken into account.
4) $Pv_{total}/Pv_{pipe}/Pv_{internal}$
5) F = force–ventilated, S = self–ventilated

Table 4-1 Technical data, power modules internal cooling

Power module – Current assignment	**Cooling type 5)**	**Max. conductor cross–section2)**	**MSD – analog/digital $I_n/I_{s6}/I_{max}$ [A]**	**X1 1) [%]**	**IMM analog $I_n/I_{s6}/I_{max}$ [A]**	**X1 1) [%]**	**IMM digital $I_n/I_{s6}/I_{max}$ [A]**	**X1 1) [%]**	**FD analog I_n/I_{max} [A]**	**X1 1) [%]**	**FD digital I_n/I_{max} [A]**	**X1 1) [%]**
	Max. width [mm]	**[mm^2]**	**Losses [W] $Pv_{tot.}$**	**f_0 1) [kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0 1) [kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0 1) [kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0 1) [kHz]**	**Losses [W] $Pv_{tot.}$**	**f_0 1) [kHz]**
	Weight [kg]											
Power module Int. 80 A	F	16/10	30/40/51	55	30/40/51	55	28/37/47	55	40/80	50	28/56	50
	100		320	3.2	320	3.2	320	4.0	300	3.3	300	4
	9.5											
Power module, int. 108 A	F	50	45/60/76	55	45/60/76	55	42/56/70	55	–	–	–	
	150		460	3.2	460	3.2	460	4.0	–	–	–	
	13											
Power module, int. 160 A	F	50	60/80/102	50	60/80/102	50	55/73/94	50	80/160	55	56/112	55
	150		685	3.2	685	3.2	685	4.0	655	3.3	645	4
	13											
Power module, int. 200 A	F	95 or 2 x 35	85/110/127	55	85/110/127	55	79/102/117	55	100/200	55	70/140	55
	300		850	3.2	850	3.2	850	4.0	740	3.3	730	4
	26											
Power module, int. 200 A pipe connection	F	95 or 2 x 35	85/110/127	55	85/110/127	55	79/102/117	55	100/200	55	70/140	55
	300		–/750/100 4)	3.2	–/750/100 4)	3.2	–/750/100 4)	4.0	–/650/90 4)	3.3	–/640/90 4)	4
	26											
Power module, int. 300 A 3) pipe connection or radial fan	F	95 or 2 x 35	120/150/193	50	120/150/193	50	110/138/177	50	–	–	–	–
	300		1290/1100/190 4)	3.2	1290/1100/190 4)	3.2	1290/1100/190 4)	4.0	–	–	–	–
	26											
Power module, int.400 A 3) pipe connection or radial fan	F	150 or 2 x 50	200/250/257	50	200/250/257	50	183/229/236	50	–	–	140/210	50
	300		2170/1845/325 4)	3.2	2170/1845/325 4)	3.2	2170/1845/325 4)	4.0	–	–	1660/1910/250 4)	4
	28											

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1) X1=current reduction factor, current reduction from the inverter clock frequency f_0 of the power transistors (refer to Fig.4-2)

2) The 1st number is valid for cable lugs, the 2nd number is valid for finely–stranded conductors without conn. sleeves.

3) If pipe cooling is not used, only $Pv_{tot.}$ should be taken into account.

4) $Pv_{total}/Pv_{pipe}/Pv_{internal}$

5) F = force–ventilated, S = self–ventilated

Table 4-2 Technical data, power modules external cooling

Power module – current assignment	Cooling type 5)	Max. cross–section 2) [mm^2]	MSD – analog/digital $I_n/I_{s6}/I_{max}$ [A]	X1 1) [%]	IMM analog $I_n/I_{s6}/I_{max}$ [A]	X1 1) [%]	IMM digital $I_n/I_{s6}/I_{max}$ [A]	X1 1) [%]	FD – analog I_n/I_{max} [A]	X1 1) [%]	FD – digital I_n/I_{max} [A]	X1 1) [%]
	Max. width [mm]		**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**
	Weight [kg]											
Power module, ext. 8	F	6/4	–	–	3/3/3	50	2.8/2.8/2.8	50	4/8	55	3/6	55
	50		–	–	18/12	3.2	18/12	4.0	21/14	3.3	21/14	4
	6.5											
Power module, ext. 15	F	6/4	–	–	5/5/8	50	4.6/4.6/7.3	50	7.5/15	55	5/10	55
	50		–	–	24/ 16	3.2	24/ 16	4.0	27/18	3.3	31/19	4
	6.5											
Power module, ext. 25 A	F	6/4	–	–	8/10/16	55	7.4/9.3/14.8	55	12.5/25	55	9/18	55
	50		–	–	45/29	3.2	45/29	4.0	55/35	3.3	55/35	4
	6.5											
Power module, ext. 50	F	6/4	24/32/32	40	24/32/32	40	22/29/29	40	25/50	40	18/36	40
	50		171/89	3.2	171/89	3.2	171/89	4.0	118/62	3.3	125/65	4
	7.5											
Power module, ext. 2 × 8	F	6/4	–	–	–	–	–	–	2 × 4/8	55	2 × 3/6	55
	50		–	–	–	–	–	–	43/27	3.3	43/27	4
	7											
Power module, ext. 2 × 15 A	F	6/4	–	–	–	–	–	–	2 × 7.5/15	55	2 × 5/10	55
	50		–	–	–	–	–	–	64/40	3.3	62/38	4
	7											
Power module, ext. 2 × 25 A	F	6/4	–	–	–	–	–	–	2 × 12.5/25	55	2 × 9/18	55
	50		–	–	–	–	–	–	107/67	3.3	111/69	4
	7											
Power module, ext. 2 × 50 A	F	6/4	–	–	–	–	28/37/47	55	2 × 25/50	40	2 × 18/36	40
	100		–	–	–	–	28/32	4.0	240/124	3.3	250/130	4
	13.5											

---

1) X1=current reduction factor, current reduction from the inverter clock frequency f_0 of the power transistors (refer to Fig.4-2)
2) The 1st number is valid for cable lugs, the 2nd number is valid for finely–stranded conductors without conn. sleeves.
3) If pipe cooling is not used, only $Pv_{tot.}$ should be taken into account.
4) $Pv_{total}/Pv_{pipe}/Pv_{internal}$
5) F = force–ventilated, S = self–ventilated

Table 4-2 Technical data, power modules external cooling

Power module – current assignment	**Cooling type 5)**	**Max. cross–section 2) [mm^2]**	**MSD – analog/ digital $I_n/I_{s6}/I_{max}$ [A]**	**X1 1) [%]**	**IMM analog $I_n/I_{s6}/I_{max}$ [A]**	**X1 1) [%]**	**IMM digital $I_n/I_{s6}/I_{max}$ [A]**	**X1 1) [%]**	**FD – analog I_n/I_{max} [A]**	**X1 1) [%]**	**FD – digital I_n/I_{max} [A]**	**X1 1) [%]**
	Max. width [mm] **Weight [kg]**		**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**	**Losses [W] Pv_{ext} / Pv_{int}**	**f_0 1) [kHz]**
Power module, ext. 80 A	F	16/10^2	30/40/51	55	30/40/51	55	42/56/70	55	40/80	50	28/56	50
	100 9.5		288/32	3.2	288/32	3.2	441/19	4.0	270/30	3.3	270/30	4
Power module, ext. W 108 A	F	50	45/60/76	55	45/60/76	55	42/56/70	55	–	–	–	–
	150 13		441/19	3.2	441/19	3.2	441/19	4.0	–	–	–	–
Power module, ext. W 160 A	F	50	60/80/102	50	60/80/102	50	55/73/94	50	80/160	55	56/112	55
	150 13		655/30	3.2	655/30	3.2	655/30	4.0	625/30	3.3	620/25	4
Power module, ext. W 200 A	F	95 or 2 x 35	85/110/127	55	85/110/127	55	79/102/117	55	100/200	55	70/140	55
	300 26		750/100	3.2	750/100	3.2	750/100	4.0	650/90	3.3	640/90	4
Power module, ext. W 300 A	F	95 or 2 x 35	120/150/193	50	120/150/193	50	110/138/177	50	–	–	–	–
	300 26		1100/190	3.2	1100/190	3.2	1100/190	4.0	–	–	–	–
Power module, ext. W 400 A	F	150 or 2 x 50	200/250/257	50	200/250/257	50	183/229/236	50	–	–	140/ 210	50
	300 28		1845/325	3.2	1845/325	3.2	1845/325	4.0	–	–	1410/250	4

---

1) X1=current reduction factor, current reduction from the inverter clock frequency f_0 of the power transistors (refer to Fig.4-2)

2) The 1st number is valid for cable lugs, the 2nd number is valid for finely–stranded conductors without conn. sleeves.

3) If pipe cooling is not used, only $Pv_{tot.}$ should be taken into account.

4) $Pv_{total}/Pv_{pipe}/Pv_{internal}$

5) F = force–ventilated, S = self–ventilated

Definition of the currents

For MSD/IMM digital and MSD/IMM analog: The sinusoidal currents are RMS values.

1. I_n continuous current
2. I_{s6} current for max. 4 min for S6 duty cycle
3. I_{max} peak current (duty cycle, refer to Section 4.2)

For feed drives, analog: Square–wave current,
the current values are the amplitude of the square–wave current.

For feed drives, digital: The sinusoidal currents are RMS values.

1. I_n continuous current
2. I_{max} peak current (duty cycle, refer to Section 4.2)

Definition of the powers

$Pv_{tot.}$	total module power loss
Pv_{pipe}	power loss which can be dissipated through pipe cooling
Pv_{ext}	power loss which can be dissipated through external cooling
Pv_{int}	power loss which is not dissipated via pipe or external cooling This power loss remains in the cabinet

Current reduction dependent on the inverter clock frequency

X1=Current reduction factor, current reduction from the inverter clock frequency f_0 of the power transistors (refer to the technical data).

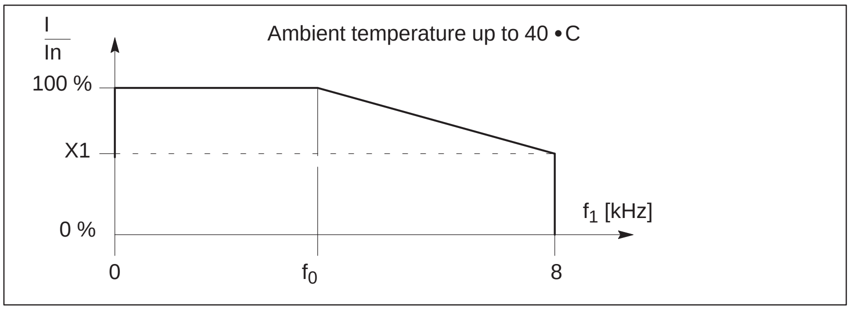


Figure 4-2

Formula:

$$X=100\% - \frac{(100\% - X1) \bullet (f_T - f_0)}{8kHz - f_0}$$

x = the reduction factor obtained [in %] for I_n, I_{s6}, I_{max}
f_T = selected inverter clock frequency

$\Rightarrow In_{fT} = x \bullet In_{f0}/100\ \%$
$\Rightarrow Is6_{fT} = x \bullet Is6_{f0}/100\ \%$
$\Rightarrow Imax_{fT} = x \bullet Imax_{f0}/100\ \%$

Caution: The currents I_n, I_{s6} and I_{max} must be reduced in the same way.

Current reduction as a function of the installation altitude

All of the specified load currents are valid up to 1000 m installation altitudes. For installation altitude > 1000 m, the load currents must be de–rated according to the diagram below.

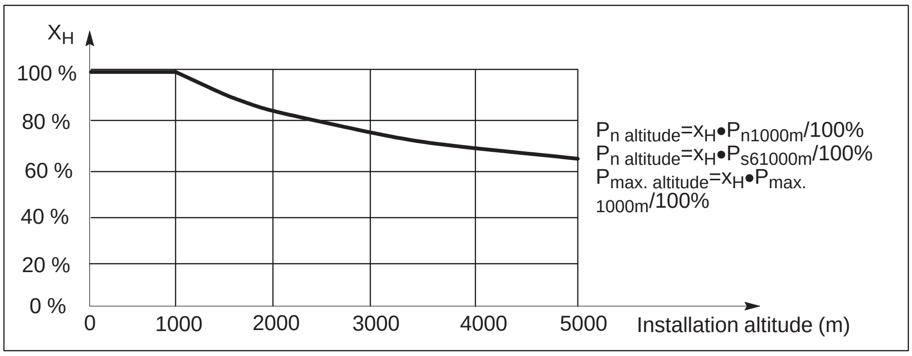


Figure 4-3

Caution: The currents I_n, I_{s6} and I_{max} must be reduced in the same way.

$\Rightarrow I_{n\ alt.} = x_H \bullet I_{n1000\ m}/100\%$
$\Rightarrow I_{s6\ alt.} = x_H \bullet I_{s61000\ m}/100\%$
$\Rightarrow I_{max\ alt.} = x_H \bullet I_{max1000\ m}/100\%$

Example: PM (power module) 50A: with MSD analog control: selected inverter clock frequencies 6.3 kHz; installation altitude 2000 m

$$X=100\% - \frac{(100\% - 40\%) \bullet (6.3\ kHz - 3.2\ kHz)}{8kHz - 3.2\ kHz} = 61.25\%;\ X_H = 83\%$$

$\Rightarrow I_{n6.3\ kHz,\ 2000\ m} = (x \bullet I_{nf0}/100\%) \bullet x_H/100\% = 12\ A$
$\Rightarrow I_{s6.3\ kHz,\ 2000\ m} = (x \bullet I_{s6f0}/100\%) \bullet x_H/100\% = 16\ A$
$\Rightarrow I_{max6.3\ kHz,\ 2000\ m} = (x \bullet I_{maxf0}/100\%) \bullet x_H/100\% = 16\ A$

Permissible currents of the SIMODRIVE power modules for induction motors and main spindle drive applications (various S6 load duty cycles, defined, e.g. S6-25% ⇒ 2.5 min/7.5 min):

Table 4-3 Currents for an inverter clock frequency f_0=3.2 KHz

PM module	8 A *	15 A *	25 A *	50 A **	80 A **	108 A **	160 A **	200 A **	300 A **	400 A **
I_{rated}	A3.0	A5.0	A8.0	A24.0	A30.0	A45.0	A60.0	A85	A120	A200
0.7 • I_{rated}	A2.1	A3.5	A5.6	A16.8	A21.0	A31.5	A42.0	A59.5	A84	A140
I S6-60%	A3.0	A5.0	A8.0	A26.0	A34.0	A50.0	A70.0	A100	A135	225 A
I S6-40%	A3.0	A5.0	A10.0	A32.0	A40.0	A60.0	A80.0	A110	150 A	250 A
I S6-30%	A3.0	A5.2	A10.8	A32.0	A42.1	A62.7	A86.5	A113	A153	A252
I S6-25%	A3.0	A5.4	A11.5	A32.0	A44.2	A65.0	A89.2	A116	A155	A253
I S6-20%	A3.0	A5.7	A12.3	A32.0	A45.7	A67.7	A91.9	A119	A159	A254
I S6-10%	A3.0	A6.6	A14.9	A32.0	A48.6	A72.3	A97.4	A123	A173	A255
I_{max}	A3.0	A8.0	A16.0	A32.0	A51.0	A76.0	A102.0	A127	A193	A257

The 0.7•I_{rated} current has been kept constant.

* Currents are only valid for induction motor applications, analog internal and externalcooling.
Currents are valid for main spindle drive/induction motor applications, analog and for main spindle drive digital, int. and ext. cooling.

Table 4-4 Currents for an inverter clock frequency f_0=4.0 KHz (de–rating)

Power module	**8 A** *	**15 A** *	**25 A** *	**50 A** *	**80 A** *	**108 A** *	**160 A** *	**200 A** *	**300 A** *	**400 A** *
I_{rated}	A2.8	A4.6	A7.4	A22.0	A28.0	A42.0	A55.0	A79.0	A110	A183
0.7• I_{rated}	A2.0	A3.2	A5.2	A15.4	A19.6	A29.4	A38.5	A55.3	A77	A128
I S6-60%	A2.8	A4.6	A7.4	A23.8	A31.7	A46.7	A64.2	A92.9	A124	A206
I S6-40%	A2.8	A4.6	A9.3	A29.0	A37.0	A56.0	A73.0	A102	A138	A229
I S6-30%	A2.8	A4.7	A10.0	A29.0	A38.8	A57.8	A79.7	A104	A140	A231
I S6-25%	A2.8	A4.9	A10.6	A29.0	A40.7	A59.9	A82.2	A107	A142	A232
I S6-20%	A2.8	A5.2	A11.4	A29.0	A42.1	A62.4	A84.7	A110	A146	A233
I S6-10%	A2.8	A6.0	A13.8	A29.0	A44.8	A66.6	A89.8	A113	A159	A234
I_{max}	A2.8	A7.3	A14.8	A29.0	A47.0	A70.0	A94.0	A117	A177	A236

The 0.7•I_{rated} current is kept constant.

* Currents are only valid for induction motor applications digital, int. and ext. cooling.

Observe de–ratings for additional possible clock frequencies and installation altitude.

Technical data of the supplementary components

Refer to p.1-34 for the supplementary components required

Load duty cycle definitions, drive modules index load duty cycles

Rated load duty cycles

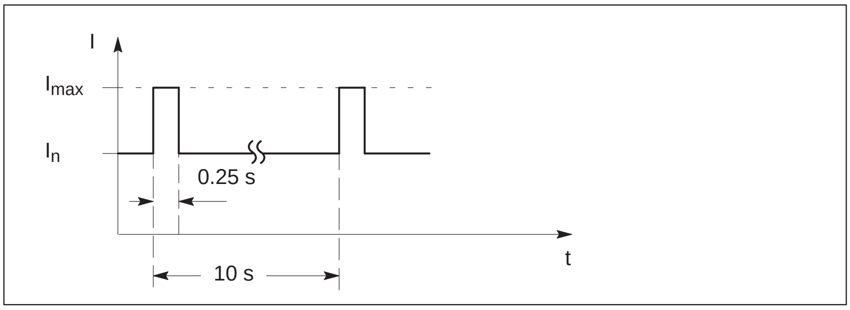


Figure 4-4 Peak current – load duty cycle with pre–loading condition

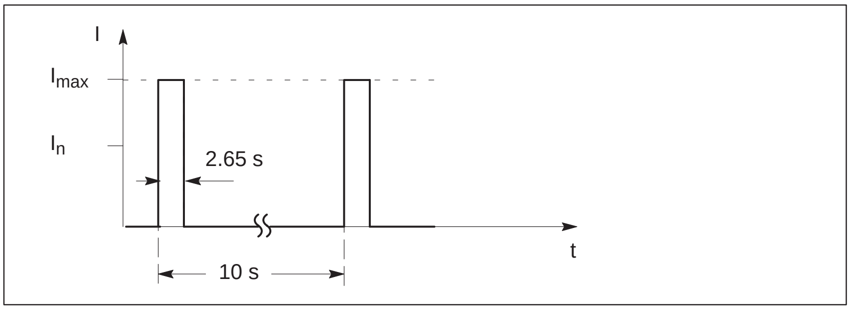


Figure 4-5 Peak current – load duty cycle without pre–loading condition

Rated load duty cycles MSD/IM

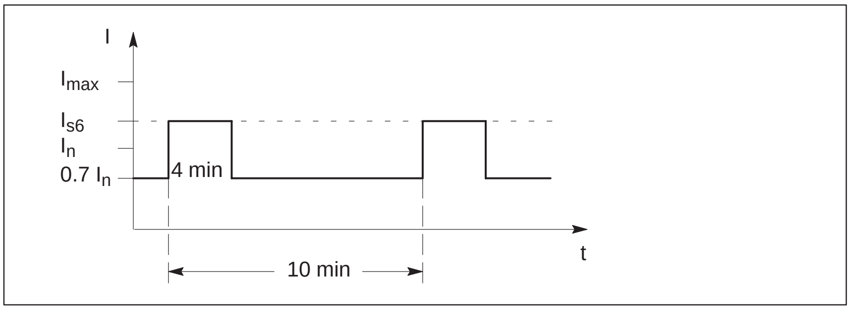


Figure 4-6 S6 load duty cycle with pre–loading condition

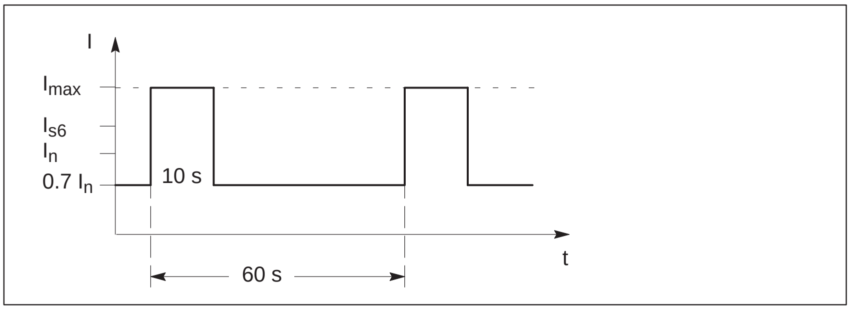


Figure 4-7 S6 peak current – load duty cycle with pre–loading condition

Control components

Feed control with user–friendly interface and analog setpoint interface 6SN1118–0AA11–0AA1

A control module with user–friendly interface is available when using1FT5... motors. It is only available as 1–axis version. An additional **parameter board** is required, which can be used to set all of the axis–specific settings. It can be inserted from the front.

This control board can be optionally expanded with the **main spindle function option board** to be able to handle the requirements of main spindle operation.

Closed–loop feed control with user–friendly interface

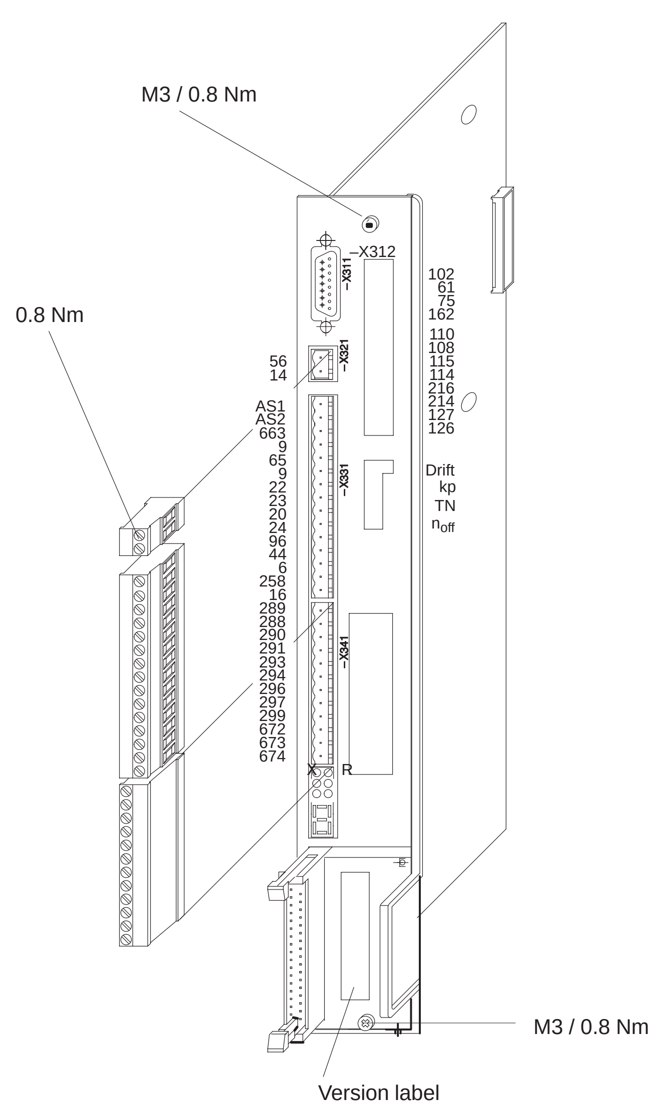


Figure 7-1

Note

When using non–PELV circuits connected to terminals AS1, AS2, the connector must be prevented from being incorrectly inserted using plug coding.

Order No. of the coding, refer to Catalog NC 60.1.

Function overview and settings using the parameter board
6SN1114–0AA01–0AA1

Table 7-1

Parameter	Value range	Setting elements
Speed controller		
Integral action time	T_N = 7...43 ms	Front panel potentiometer T_N, additionally C2
Proportional gain	Kp = 2...150	Front panel potentiometer Kp, additionally R50
Adaptation:		
• Integral action time	T_{Nadap}/T_N = 0.04...1	R34 and front panel potentiometer ADAP
• Proportional gain	Kp_{adap}/Kp = 4...35	R38
• Adaptation range	$n_{x2} – n_{x1}$ = 0 – 0...(65 – 330) mV	R40
Drift compensation (offset)	–30...+30 mV (referred to n_{set})	Front potentiometer, drift
Direction of rotation reversal	Cw/ccw for pos. n_{set}	S2.1
Tachometer adaptation	$V_{tach.}$ = 40...15 V/n_{rated}	Switch S1; additionally R6, R7, R8
Tachometer adjustment	n_{actN} = 2.2...0.7 · n_{act} (n_{act} = 10 V/n_{rated})	Front panel potentiometer tachometer; additionally R3 and R10
Speed setpoint adaptation	$\lvert 100\ \% \cdot 11...5V \rvert = n_{actN}$ or	R5
(speed reduction)	$10\ V = \frac{n_{actN}}{1...100}$ (only term.56/14)	
Inhibit I component	Speed controller without I component	Terminal 6
Limit I component, speed controller	I component fully effective ... ineffective	R52
Current controller		
Adaptation, motor/power module		
Current actual value normalization	I_{max} = 23...100 % · I_{limit}	S2.2....S2.5
Current controller gain	Kp(I) = 0.5...11.5;	S2.6...S2.9; additionally R15, if K_p (I) > 11.5
Current setpoint adaptation	$\lvert I_{max} \rvert$= 10...0 V	R42
Inhibit I component in current–controlled operation	Current controller without I component	R1
Select current–controlled operation	offline online via terminal 22	S2.10 R14
Master/slave operation	Up to 5 slave modules	Terminals 258, S2.10, R42, R44
Response threshold, I^2t limiting, reduction	6...55 % · I_{limit}	R9
Monitoring time, speed controller at its endstop	26...1200 ms	R54
Monitoring, speed controller at its endstop	ON ↔ OFF	R32
External current setpoint limiting (e. g. travel to endstop)	1...100 % · I_{max} Speed controller monitoring OFF	Terminal 96 (variable); R12 (fixed)
Current limiting after the monitoring time, speed controller at its endstop	1...100 % · I_{max}	R2, R32
Current limiting after the I^2t timer has expired	Refer to I^2t limiting in the Start–up Guide	R2/R32
Torque limiting for setting–up operation via terminal 112 (NE module)	1...100 % · I_{max} Speed controller monitoring OFF	R12
Electrical weight equalization	$\lvert I_{set,\ suppl.} \rvert$= 0...50 % · I_{max}	R46/R48

Table 7-1 (continued)

Parameter	Value range	Setting elements
Instantaneous controller/pulse inhibit via terminal 65	Delay after speed controller monitoring time expired ↔ instantaneous	R13
Selection: int. supplementary setpoint 1 through terminal 22 Selection: int. supplementary setpoint 2 through terminal 23	10V...+10V 10V...+10V	R16, R17, R18=setpoint R19, R21, R22=setpoint
Ready/fault signal at terminals 672/673/674		R33
Smoothing: Speed setpoint Speed actual value Speed controller Current setpoint	T = C4 · 10 kΩ T = C5 · 5 kΩ T = C3 · 68 kΩ T = C6 · 1 kΩ	C4 C5 C3 C6

Interface overview, feed control, user–friendly interface

Table 7-2

Term. No.	Desig.	Function	Type 1)	Typ. voltage/ limit values	Max. cross–sect.
56	X321	Speed setpoint 1	I	0V... ± 10V	1.5 mm^2
14	X321	Differential input$^{2)}$	I		1.5 mm^2
AS1	X331	Checkback signal contact	NC	Max. $250V_{AC}$/1A. 30 V_{DC}/2A	1.5 mm^2
AS2	X331	Relay, start inhibit			1.5 mm^2
663	X331	Pulse enable$^{3)}$	I	+21...30 V	1.5 mm^2
9	X331	Enable voltage$^{3)6)}$	O	+24 V	1.5 mm^2
65	X331	Controller enable$^{3)}$	I	+13...30 V	1.5 mm^2
9	X331	Enable voltage$^{3)6)}$	O	+24 V	1.5 mm^2
22	X331	Select int. fixed setpoint 1$^{3)}$/ current–controlled operation	I	+13...30 V	1.5 mm^2
23	X331	Select int. fixed setpoint 2$^{3)}$	I	+13...30 V	1.5 mm^2
20	X331	Speed setpoint$^{2)}$/ current setpoint	I	0V...±10 V	1.5 mm^2
24	X331	(differential input)	I	(340 µs smoothing)	1.5 mm^2
96$^{5)}$	X331	Current setpoint limiting	I	0...±30 V	1.5 mm^2
44$^{5)}$	X331	Electronics voltage	O	–15 V/10 mA	1.5 mm^2
6$^{5)}$	X331	Integrator inhibit, speed controller	I	+13...30 V	1.5 mm^2
258$^{5)}$		Current setpoint (master/slave)			
16$^{5)}$	X331	Norm. current actual value	I/O	0 V...±10 V	1.5 mm^2
	X331		O	0 V...±10 V	1.5 mm^2
289	X341	Relay signals, center contact	I	$^{4)}$	1.5 mm^2
288	X341	Speed controller at its endstop	NO	Max. 30 V/1 A	1.5 mm^2
290	X341		NC	Max. 30 V/1 A	1.5 mm^2
291	X341	I^2t monitoring	NO	Max. 30 V/1 A	1.5 mm^2
293	X341		NC	Max. 30 V/1 A	1.5 mm^2
294	X341	Motor overtemperature	NO	Max. 30 V/1 A	1.5 mm^2
296	X341		NC	Max. 30 V/1 A	1.5 mm^2
297	X341		NO	Max. 30 V/1 A	1.5 mm^2
299	X341	Tachometer/rotor position enc. fault	NC	Max. 30 V/1 A	1.5 mm^2
672	X341	Ready/fault signal	NO	30 V/1 A$^{4)}$	1.5 mm^2
673	X341		I	30 V/1 A	1.5 mm^2
674	X341		NC	30 V/1 A	1.5 mm^2
	X311	Motor encoder			
	X151	Equipment bus			

---

1) I=input; O=output; NC=NC contact; NO=NO contact (for signal NO=high/NC=low)

2) Differential input reference point
The common mode range of the differential input is±24 V with respect to PE potential and may not be exceeded.

3) Reference ground, terminal 19 NE/monitoring module (this may not be connected with the general reference ground, terminal 15)

4) Voltages referred to PE potential

5) Terminal 15 on the NE module is the reference ground

6) Refer to p.1-37

Note

The drive shuts down and the pulses inhibited after approx. 4 s when the ”heat-sink overtemperature” switch responds.

Evaluation of the motor PTC thermistor for temperature monitoring

The SIMODRIVE 611 feed modules with closed–loop control for the 1FT5 servomotors have an evaluation circuit, for the PTC thermistor integrated in the motor winding.

The motors should be protected from inadmissibly high winding temperatures with the monitoring combination (response temperature 150°C).

When the response temperature is reached, it is only signaled at the SIMODRIVE 611 via an individual fault signal, terminals 289/294/296 and centrally via terminals 5.1, 5.2 and 5.3 of the feed module as the drive should not intervene directly in the machining process and disturb operation.

There is no internal system shutdown function to protect the motor. **The user must ensure that the motor can thermally recover immediately after the temperature signal is output, by appropriately designing the adaptation control.** It may be necessary to shut down the motor immediately.

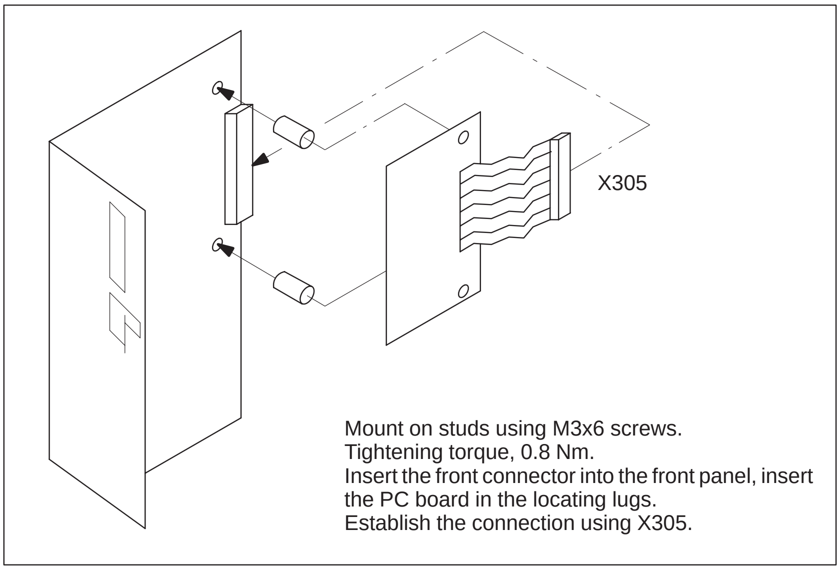
A delay time is not permissible.

If the motor is not thermally monitored, then the complete drive could be destroyed if an overload condition occurs, or if the drive converter was over–dimensioned.

Option board, main spindle functions 6SN1114–0AA02–0AA0

Main spindle functions can also be realized using an option board (main spindle drive option). In this case, the option board should be mounted on the control board (this is only possible in conjunction with the user–friendly interface).

Mounting MSD option



Mount on studs using M3x6 screws.
Tightening torque, 0.8 Nm.
Insert the front connector into the front panel, insert the PC board in the locating lugs.
Establish the connection using X305.

Figure 7-2

Function overview and settings on the MSD option

Table 7-3

Parameter	Value range	Setting elements
Limit value stages NC/NO contacts	The relay outputs of the limit value stages can be defined as NC or NO contacts	0 Ω resistors
$\lvert I_{act}\rvert > I_X$ terminals 110/108	4.5 %...100 %	Pot. R211
$\lvert n_{act}\rvert < n_{min}$ terminals 115/114	0.3 %...1.7 % of n_{max}	Pot. R10
$\lvert n_{act}\rvert < n_X$ terminals 216/214	3 %...100 % of n_{max}	Pot. R43
$n_{set}= n_{set*}$ terminals 127/126	n_{set} difference < 20 mV	Resistor R179
$n < n_{off}$	0.3 %...1.7 % of n_{max}	Pot. R1
Ramp–function generator via terminals 56/14	10 ms...1.1 s 0.1 s...11 s (changeover 1:10)	Potentiometer R20 terminal 102
Tracking	Active/inactive	R270
Drift (main spindle drive operation)	–30 mV...+30 mV (referred to n_{set})	Pot. R96
Proportional gain	Reduce Kp to 0 %...95 %	Pot. R45 + parameter board R25
Integral action time	Extend T_N to 100 %...1500 %	Pot. R44 + parameter board R35
Torque limiting	Start of constant power 23 %...70 % n_{max} Deviation –20 %...+20 % n_{max} Constant limiting 10 %...100 % I_{max} Speed–dependent limiting 1 %...85 % I_{max}	Pot. R214 Pot. R213 Resistor R76 Pot. R225
Changeover speed Main spindle drive ” C–axis operation	0 %...100 % n_{max}	Resistor R77, R78
Select C axis operation, terminal 61	10 V setpoint at terminals 24/20 $\doteq$ 1/10 n_{max} of MSD operation	
Speed actual value image	Normalized n_{rated} corresponds to +10 V	Terminal 75
Current actual value image	Normalized $\lvert I_{actN}\rvert$ = 10 V	Terminal 162 if R160 = 1 k, R207 = open
Power image	Factor 1...3	Resistor R903 Terminal 162 if R160 = open, R207 = 1 k

Interface overview, MSD option

Main spindle drive option (only for user–friendly interface)

Table 7-4

Term. No.	Desig.	Function	Type 1)	Typ. voltage/ limit values	Max. cross–sect.
102	X312	TH = 1:10	I	+13 V...30 V/R_E=1.5 kΩ	1.5 mm^2
61	X312	C–axis operation	I	+13 V...30 V/R_E=1.5 kΩ	1.5 mm^2
75	X312	n_{act}	O	0 V...±10 V	1.5 mm^2
162	X312	P_{act}/I_{act} 2)	O	0 V...±10 V	1.5 mm^2
110	X322	$\lvert I_{act}\rvert > I_X$	NO/NC	30 V/1.0 A max.	1.5 mm^2
108	X322		I	30 V/1.0 A max.	1.5 mm^2
115	X322	$n< n_{min}$	NO/NC	30 V/1.0 A max.	1.5 mm^2
114	X322		I	30 V/1.0 A max.	1.5 mm^2
216	X322	$n < n_X$	NO/NC	30 V/1.0 A max.	1.5 mm^2
214	X322		I	30 V/1.0 A max.	1.5 mm^2
127	X322	$n_{set} = n_{set*}$	NO/NC	30 V/1.0 A max.	1.5 mm^2
126	X322		I	30 V/1.0 A max.	1.5 mm^2

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1) I=input; O=output; NC=NC contact; NO=NO contact (for signal NO=high/NC=low)

2) Depending on the equipping version, power image (series) or current actual value image

Feed control with standard interface and analog setpoint interface 6SN1118–0A☐11–0AA1

Feed control with standard Interface

A control module with standard interface is available for operating1FT5... motors. It is available as 1– and 2–axis version. All of the axis–specific settings are made on the plug–in control module.

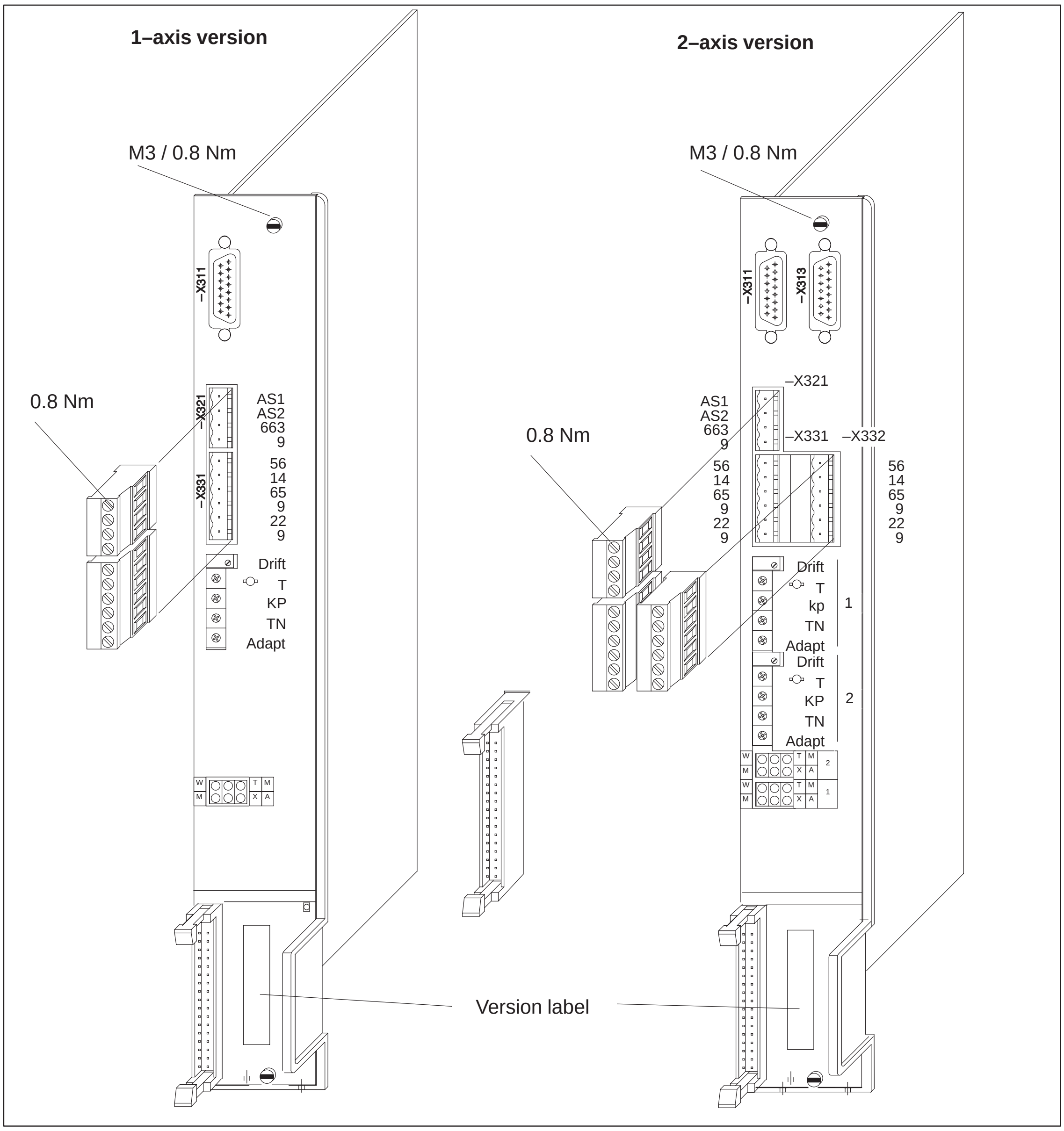

Figure 7-3

Note

When using non–PELV circuits connected to terminals AS1, AS2, the connector must be prevented from being incorrectly inserted using plug coding.

Order No. of the coding, refer to Catalog NC 60.1.

Function overview and settings on the control module

Table 7-5

Parameter	Value range	Setting elements		
Speed controller Integral action time Proportional gain Adaptation, integral action time	 T_N = 7 ... 43 ms Kp = 2 ... 150 T_{Nadap} / TN = 0.04 ... 1	 Front potentiometer T_N Front potentiometer Kp S3.5 (axis 2:S6.5), Front potentiometer ADAP		
Drift compensation (offset)	–30 ... +30 mV (referred to n_{set})	Front potentiometer, drift		
Direction of rotation reversal	Clockwise/counter–clockwise rotation	S2.1 (axis 2:S5.1)		
Tachometer adaptation	$V_{tach.}$ = 40 ... 15 V/n_{rated}	Switch S1 (axis 2:S4)		
Tachometer adjustment	n_{actN} = 2.2 ... 0.7•n_{act} (n_{act} = 10 V/n_{rated})	Front potentiometer, tachometer		
Current controller Current actual value normalization Current controller gain	 I_{max} = 23 ... 100 %•I_{limit} Kp(I) = 0.5 ... 11.5;	 S2.2 ... S2.5 (axis 2:S5.2 ... 5.5) S2.6 ... S2.9 (axis 2:S5.6 ... 5.9)		
Inhibit I component in current–controlled operation	Current controller without I component	S3.8 (axis 2:S6.8)		
Select current–controlled operation	offline online via terminal 22	S2.10 (axis 2:S5.10)		
Supplementary functions				
Master–/slave mode (only 2–axis version)	Master and slave in one module	S3.7 and S6.7		
Central ready/ fault signal at terminals 72/73/74 NE/monitoring module	Relay signal for ready/fault not present	S3.6 (axis 2:S6.6)		
Smoothing:	Can be permanently switched–in	Can be permanently switched–in	variable	
			BKZ axis 1	BKZ axis 2
Speed setpoint	T = 2.2 ms	S3.1 (axis 2: S6.1)	C232	C236
Speed actual value	T = 280 µs	S3.2 (axis 2: S6.2)	C233	C237
Speen Controller	T = 370 µs	S3.3 (axis 2: S6.3)	C231	C235
Current setpoint	T = 110 µs	S3.4 (axis 2: S6.4)	C234	C238
valid from Order No. 6SN1118–0A□11–0AA1	Timer stage ”speed controller at endstop” Tachometer adaptation Adaptation range Speed setpoint adaptation Limiting, I component, speed controller Electronic weight equalization, pos./neg. Response threshold I^2t monitoring	C239 R539, R540, R541 R543 R545 R547 R548/R549 R553	C240 R536, R537, R538 R544 R546 R550 R551/R552 R554	

Interface overview, feed control, standard interface

Table 7-6

Term. No.	Desig.	Function	Type 1)	Typ. voltage/ limit values	Max. cross–sect.
AS1	X321	Checkback signal contact	NC	max. 250 V_{AC}/1 A, 30 V_{DC}/2 A	1.5 mm^2
AS2	X321	Relay, start inhibit			1.5 mm^2
663	X321	Pulse enable2)	I	+21 ... 3o V	1.5 mm^2
9	X321	Enable voltage2)4)	O	+24 V	1.5 mm^2
56.1	X331	Speed setpoint	I	0 V ... ±10 V	1.5 mm^2
14.1	X331	Differential input 3)	I		1.5 mm^2
65.1	X331	Controller enable 2)	I	+13 ... 30 V	1.5 mm^2
9	X331	Enable voltage 2)4)	O	+24 V	1.5 mm^2
22.1	X331	Current–controlled operation 2)	I	+13 ... 30 V	1.5 mm^2
9	X331	Enable voltage 2)4)	O	+24 V	1.5 mm^2
56.2	X332	Speed setpoint	I	0 V ... ±10 V	1.5 mm^2
14.2	X332	Differential input 3)	I		1.5 mm^2
65.2	X332	Controller enable 2)	I	+13 ... 30 V	1.5 mm^2
9	X332	Enable voltage 2)4)	O	+24 V	1.5 mm^2
22.2	X332	Current–controlled operation 2)	I	+13 ... 30 V	1.5 mm^2
9	X332	Enable voltage 2)4)	O	+24 V	1.5 mm^2
	X311	Motor encoder, axis 1			
	X312	Motor encoder, axis 2			
	X151/351	Equipment bus			

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1) I=input; O=output; NC=NC contact; NO=NO contact (for signal: Closed=high, open=low)

2) Reference ground terminal 19 NE/monitoring module (it is not permissible to connect this to the general reference ground, terminal 15)

3) Reference point of the differential input.
The common mode range of the differential input is ±24 V with respect to PE potential and may not be exceeded.

4) Refer to p. 1-40

Note

The drive shuts down and the pulses inhibited after approx. 4 s when the ”heatsink overtemperature” switch responds.

Motor PTC thermistor evaluation for temperature monitoring

The SIMODRIVE 611 feed modules with the control for 1FT5 servomotors are equipped with an evaluation circuit for the PTC thermistor integrated in the motor windings.

The motors should be protected from inadmissibly high winding temperatures with the monitoring combination (response temperature 150°C).

As the drive shouldn’t unpredictably intervene in the cutting process, when the response temperature is reached, this is only signaled to the SIMODRIVE 611, centrally via terminals 5.1, 5.2, and 5.3 of the rectifier module.

There is no internal system shut down function to protect the motor.**The user must ensure that the motor can thermally recover immediately after the signal output, by appropriately designing the adaptation control. It may be necessary to shutdown the motor immediately.**

A delay time is not permissible.

If the motor is not thermally monitored, then the complete drive could be destroyed if an overload condition occurs, or if the drive converter was over–dimensioned.

Short start–up, standard settings

The setting elements for the user–friendly interface are located on the parameter board, for the standard interface, on the control (refer to Section 9 Appendix). The tachometer adaptation, current normalization and current controller gain parameters should be set for a standard start–up.

Tachometer adaptation for motors with tachometer voltages ≤ 16.5 V at rated speed

Only for 1FT503□–□A**F**71 and 1FT504□–□A**F**71 motors

User–friendly– and standard interface

All three contacts, switch S1 (S4 for the 2nd axis standard interface) = ON
Further, an adjustment can be made using discrete resistors.

Current controller settings

The settings for the current limit and current controller gain Kp(I) can be taken from the adaptation tables, Table 1-3 up to Table 1-9. If the required feed module/motor combination cannot be found, the values can be determined using the associated formulas.

User–friendly interface

Parameter board, switch S2

Standard interface

Control board, switch S2 **(S5 for 2nd axis)**

Note

The following setting values are valid for both control versions, as long as, in individual cases, specific reference is not made to differences.

Current actual value normalization

$$\text{Current limit} \;=\; \frac{I_{max}\text{ (adjusted maximum current)}}{I_{limit}\text{ (peak current of the power module)}}\;[\%]$$

Table 1-1 Current limit

S2.x or S5.x to ON	–	2	3	2 3	4	2 4	3 4	2 3 4	5	2 5	3 5	2 3 5	4 5	3 4 5	2 3 4 5
(%)	100	85	68	61	50	46	41	39	36	34	30	29	26	24	23

The current limit must be reduced at least to the peak value permitted for the motor. It may be necessary to reduce it still further depending on the mechanical system which is driven.

Current controller gain Kp(I)

$$\text{Kp(I) t}\quad \frac{I_{max} \cdot L_A}{40}$$

I_{max} =maximum axis current set in A
L_A =motor winding inductance in mH (refer to the configuringguide, AC motors for feed– and main spindledrives)

Table 1-2 Current controller gain

S2.x and S5.x to ON	–	6	7	6 7	8	6 8	7 8	9	6 9	7 9	6 7 9	8 9	7 8 9	6 7 8 9
Kp(I)	0.5	1	2	2.5	4	4.5	5.5	6	6.5	7.5	8	9.5	11	11.5

User–friendly interface

The setting range of the current controller gain can be additionally increased using R15 on the parameter board.

The following formula is valid for S2.6 to S2.9 closed (ON):

$$\text{Kp(I)} \;=\; 11,5 + \frac{1230\ \Omega}{\text{R15}}$$

Adaptation tables

Definition:
o = Contact in the basic OFF setting
x = Contact in the ON setting

Table 1-3 **Adaptation table for feed module 4/8 A**

Servomotor				**Current limit** 1)					**Current controller gain**				
1FT...	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5034–□AK71	0.5	0.93	6000	x	o	x	o	3.68	o	x	o	o	2.0
5036–□AK71	0.75	1.4	6000	o	x	o	o	5.44	o	x	o	o	2.0
5042–□AF71	0.66	0.75	3000	x	o	o	x	2.72	x	x	o	o	2.5
5042–□AK71	0.66	1.2	6000	x	x	o	o	4.88	x	x	o	o	2.5
5044–□AF71	1.3	1.5	3000	o	x	o	o	5.44	x	x	o	o	2.5
5044–□AK71	1.3	2.3	6000	o	o	o	o	8.0	x	o	o	o	1.0
5046–□AF71	2.6	3.0	3000	o	o	o	o	8.0	o	x	o	o	2.0
5062–□AC71	2.2	1.3	2000	o	x	o	o	5.44	x	x	x	x	11.5
5062–□AF71	2.2	2.0	3000	o	o	o	o	8.0	o	x	o	x	7.5
5062–□AG71	2.2	2.7	4000	o	o	o	o	8.0	o	o	x	o	4.0
5062–□AK71	2.2	3.9	6000	o	o	o	o	8.0	x	o	o	o	1.0
5064–□AC71	4.5	2.7	2000	o	o	o	o	8.0	o	x	o	x	7.5
5066–□AC71	6.5	3.9	2000	o	o	o	o	8.0	x	o	x	o	4.5
5070–□AC71	3.0	1.8	2000	o	o	o	o	8.0	x	x	x	x	11.5
5070–□AF71	3.0	2.6	3000	o	o	o	o	8.0	o	x	o	x	7.5
5070–□AG71	3.0	3.6	4000	o	o	o	o	8.0	x	o	x	o	4.5
5071–□AC71	4.5	2.9	2000	o	o	o	o	8.0	x	x	o	x	8.0

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1) The specified value is the maximum permissible current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-4 **Adaptation table for feed module 7.5/15 A**

Servomotor				**Current limit 1)**					**Current controller gain**				
1FT...	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5034–☐AK71	0.5	0.93	6000	o	x	x	x	3.68	o	x	o	o	2.0
5036–☐AK71	0.75	1.4	6000	o	o	o	x	5.44	o	x	o	o	2.0
5042–☐AF71	0.66	0.75	3000	x	x	x	x	3.45	o	o	x	o	4.0
5042–☐AK71	0.66	1.2	6000	x	x	o	x	4.5	o	x	o	o	2.0
5044–☐AF71	1.3	1.5	3000	x	x	x	o	5.85	o	o	x	o	4.0
5044–☐AK71	1.3	2.3	6000	x	x	o	o	9.15	o	x	o	o	2.0
5046–☐AF71	2.6	3.0	3000	x	o	o	o	12.7	o	o	x	o	4.0
5046–☐AK71	2.6	4.7	6000	o	o	o	o	15.0	x	o	o	o	1.0
5062–☐AC71	2.2	1.3	2000	x	o	o	x	5.1	o	x	x	x	11.0
5062–☐AF71	2.2	2.0	3000	o	o	x	o	7.5	x	o	o	x	6.5
5062–☐AG71	2.2	2.7	4000	o	x	o	o	10.2	o	x	x	o	5.5
5062–☐AK71	2.2	3.9	6000	o	o	o	o	15.0	x	x	o	o	2.5
5064–☐AC71	4.5	2.7	2000	o	x	o	o	10.2	o	o	x	x	9.5
5064–☐AF71	4.5	4.1	3000	o	o	o	o	15.0	x	o	o	x	6.5
5064–☐AG71	4.5	5.5	4000	o	o	o	o	15.0	x	x	o	o	2.5
5066–☐AC71	6.5	3.9	2000	o	o	o	o	15.0	o	o	x	x	9.5
5066–☐AF71	6.5	6.0	3000	o	o	o	o	15.0	o	o	x	o	4.0
5070–☐AC71	3.0	1.8	2000	o	o	x	o	7.5	x	x	x	x	11.5
5070–☐AF71	3.0	2.6	3000	o	x	o	o	10.2	o	o	x	x	9.5
5070–☐AG71	3.0	3.6	4000	o	o	o	o	15.0	x	x	o	x	8.0
5070–☐AK71	3.0	5.3	6000	o	o	o	o	15.0	o	o	x	o	4.0
5071–☐AC71	4.5	2.9	2000	x	o	o	o	12.7	x	x	x	x	11.5
5071–☐AF71	4.5	4.3	3000	o	o	o	o	15.0	x	o	o	x	6.5
5071–☐AG71	4.5	5.2	4000	o	o	o	o	15.0	x	o	x	o	4.5
5072–☐AC71	10.0	6.1	2000	o	o	o	o	15.0	x	x	o	x	8.0
5073–☐AC71	7.0	4.3	2000	o	o	o	o	15.0	o	o	x	x	9.5
5073–☐AF71	7.0	6.4	3000	o	o	o	o	15.0	o	o	x	o	4.0
5100–☐AC71	10.0	6.2	2000	o	o	o	o	15.0	o	x	x	o	5.5

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1) The specified value is the maximum permissible current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-5 **Adaptation table for feed module 12.5/25 A**

Servomotor				Current limit [1]					Current controller gain				
1FT...	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5036–☐AK71	0.75	1.4	6000	x	x	x	x	5.75	o	x	o	o	2.0
5044–☐AF71	1.3	1.5	3000	o	x	x	x	6.0	o	o	x	o	4.0
5044–☐AK71	1.3	2.3	6000	o	o	o	x	9.0	o	x	o	o	2.0
5046–☐AF71	2.6	3.0	3000	o	o	x	o	12.5	o	o	x	o	4.0
5046–☐AK71	2.6	4.7	6000	o	x	o	o	17.0	o	x	o	o	2.0
5062–☐AC71	2.2	1.3	2000	x	x	x	x	5.75	x	x	x	x	11.5
5062–☐AF71	2.2	2.0	3000	x	o	o	x	8.5	x	x	o	x	8.0
5062–☐AG71	2.2	2.7	4000	x	o	x	o	10.25	o	x	x	o	5.5
5062–☐AK71	2.2	3.9	6000	x	x	o	o	15.75	x	x	o	o	2.5
5064–☐AC71	4.5	2.7	2000	x	o	x	o	10.25	x	x	x	x	11.5
5064–☐AF71	4.5	4.1	3000	o	x	o	o	17.0	x	o	o	x	6.5
5064–☐AG71	4.5	5.5	4000	o	o	o	o	25.0	o	x	x	o	5.5
5064–☐AK71	4.5	8.0	6000	o	o	o	o	25.0	x	x	o	o	2.5
5066–☐AC71	6.5	3.9	2000	o	x	o	o	17.0	o	o	x	x	9.5
5066–☐AF71	6.5	6.0	3000	o	o	o	o	25.0	x	o	o	x	6.5
5066–☐AG71	6.5	7.9	4000	o	o	o	o	25.0	x	x	o	o	2.5
5066–☐AK71	6.5	11.6	6000	o	o	o	o	25.0	o	x	o	o	2.0
5070–☐AC71	3.0	1.8	2000	o	x	o	x	7.5	x	x	x	x	11.5
5070–☐AF71	3.0	2.6	3000	x	o	x	o	11.5	o	x	x	x	11.0
5070–☐AG71	3.0	3.6	4000	o	x	o	o	17.0	o	o	x	x	9.5
5070–☐AK71	3.0	5.3	6000	o	o	o	o	25.0	x	o	o	x	6.5
5071–☐AC71	4.5	2.9	2000	o	o	x	o	12.5	x	x	x	x	11.5
5071–☐AF71	4.5	4.3	3000	o	x	o	o	17.0	x	x	o	x	8.0
5071–☐AG71	4.5	5.2	4000	o	o	o	o	25.0	x	x	o	x	8.0
5071–☐AK71	4.5	7.9	6000	o	o	o	o	25.0	x	x	o	o	2.5
5072–☐AC71	10.0	6.1	2000	o	o	o	o	25.0	x	x	x	x	11.5
5072–☐AF71	10.0	9.1	3000	o	o	o	o	25.0	o	o	o	x	6.0
5072–☐AG71	10.0	12.0	4000	o	o	o	o	25.0	x	x	o	o	2.5
5073–☐AC71	7.0	4.3	2000	o	x	o	o	17.0	o	o	x	x	9.5
5073–☐AF71	7.0	6.4	3000	o	o	o	o	25.0	x	o	o	x	6.5
5073–☐AG71	7.0	8.1	4000	o	o	o	o	25.0	x	o	x	o	4.5
5073–☐AK71	7.0	12.5	6000	o	o	o	o	25.0	x	o	o	o	1.0
5074–☐AC71	14.0	8.5	2000	o	o	o	o	25.0	x	x	o	x	8.0
5076–☐AC71	18.0	11.5	2000	o	o	o	o	25.0	o	x	x	o	5.5
5100–☐AC71	10.0	6.2	2000	o	o	o	o	25.0	o	o	x	x	9.5
5100–☐AF71	10.0	9.2	3000	o	o	o	o	25.0	o	o	x	o	4.0
5100–☐AG71	10.0	12.5	4000	o	o	o	o	25.0	x	x	o	o	2.5
5101–☐AC71	15.0	9.4	2000	o	o	o	o	25.0	o	x	x	o	5.5
5102–☐AA71	27.0	9.9	1200	o	o	o	o	25.0	x	x	o	x	8.0
5103–☐AC71	19.0	12.0	2000	o	o	o	o	25.0	o	o	x	o	4.0

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1) The specified value is the maximum permissible current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-6 **Adaptation table for feed module 25/50 A**

Servomotor				**Current limit** [1]					**Current controller gain**				
1FT...	M_O [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5044–□AK71	1.3	2.3	6000	o	o	x	x	13.0	x	x	o	o	2.5
5046–□AF71	2.6	3.0	3000	o	x	o	x	15.0	o	o	x	o	4.0
5046–□AK71	2.6	4.7	6000	o	o	x	o	25.0	x	x	o	o	2.5
5062–□AG71	2.2	2.7	4000	x	o	x	x	13.0	x	o	o	x	6.5
5062–□AK71	2.2	3.9	6000	o	x	x	o	19.5	x	o	x	o	4.5
5064–□AC71	4.5	2.7	2000	o	o	x	x	13.0	x	x	x	x	11.5
5064–□AF71	4.5	4.1	3000	x	x	x	o	19.5	x	x	o	x	8.0
5064–□AG71	4.5	5.5	4000	o	o	x	o	25.0	o	x	x	o	5.5
5064–□AK71	4.5	8.0	6000	o	x	o	o	34.0	x	x	o	o	2.5
5066–□AC71	6.5	3.9	2000	x	x	x	o	19.5	x	x	x	x	11.5
5066–□AF71	6.5	6.0	3000	x	x	o	o	30.5	x	x	o	x	8.0
5066–□AG71	6.5	7.9	4000	o	x	o	o	34.0	x	o	x	o	4.5
5066–□AK71	6.5	11.6	6000	o	o	o	o	50.0	o	o	x	o	4.0
5070–□AF71	3.0	2.6	3000	o	x	x	x	12.0	x	x	x	x	11.5
5070–□AG71	3.0	3.6	4000	x	o	o	x	17.0	o	o	x	x	9.5
5070–□AK71	3.0	5.3	6000	o	o	x	o	25.0	x	o	o	x	6.5
5071–□AC71	4.5	2.9	2000	o	o	x	x	13.0	x	x	x	x	11.5
5071–□AF71	4.5	4.3	3000	o	x	x	o	20.5	o	o	x	x	9.5
5071–□AG71	4.5	5.2	4000	o	o	x	o	25.0	x	x	o	x	8.0
5071–□AK71	4.5	7.9	6000	o	x	o	o	34.0	o	o	x	o	4.0
5072–□AC71	10.0	6.1	2000	o	o	x	o	25.0	x	x	x	x	11.5
5072–□AF71	10.0	9.1	3000	x	o	o	o	42.5	o	o	x	x	9.5
5072–□AG71	10.0	12.0	4000	o	o	o	o	50.0	x	o	o	x	6.5
5072–□AK71	10.0	17.5	6000	o	o	o	o	50.0	x	x	o	o	2.5
5073–□AC71	7.0	4.3	2000	o	x	x	o	20.5	x	x	x	x	11.5
5073–□AF71	7.0	6.4	3000	x	x	o	o	30.5	x	x	o	x	8.0
5073–□AG71	7.0	8.1	4000	x	o	o	o	42.5	o	x	o	x	7.5
5073–□AK71	7.0	12.5	6000	o	o	o	o	50.0	x	x	o	o	2.5
5074–□AC71	14.0	8.5	2000	x	o	o	o	42.5	x	x	x	x	11.5
5074–□AF71	14.0	13.0	3000	o	o	o	o	50.0	x	o	o	x	6.5
5074–□AG71	14.0	16.5	4000	o	o	o	o	50.0	x	o	x	o	4.5
5074–□AK71	14.0	25.0	6000	o	o	o	o	50.0	x	o	o	o	1.0
5076–□AC71	18.0	11.5	2000	o	o	o	o	50.0	o	x	x	x	11.0
5076–□AF71	18.0	16.5	3000	o	o	o	o	50.0	x	o	x	o	4.5
5076–□AG71	18.0	21.5	4000	o	o	o	o	50.0	x	x	o	o	2.5
5100–□AC71	10.0	6.2	2000	x	x	o	o	30.5	x	x	x	x	11.5
5100–□AF71	10.0	9.2	3000	x	o	o	o	42.5	x	o	o	x	6.5
5100–□AG71	10.0	12.5	4000	o	o	o	o	50.0	x	o	x	o	4.5
5100–□AK71	10.0	18.0	6000	o	o	o	o	50.0	x	x	o	o	2.5
5101–□AC71	15.0	9.4	2000	x	o	o	o	42.5	o	o	x	x	9.5
5101–□AF71	15.0	14.5	3000	o	o	o	o	50.0	x	o	x	o	4.5
5101–□AG71	15.0	17.5	4000	o	o	o	o	50.0	x	x	o	o	2.5
5102–□AA71	27.0	9.9	1200	x	o	o	o	42.5	x	x	x	x	11.5
5102–□AC71	27.0	16.5	2000	o	o	o	o	50.0	x	o	o	x	6.5
5102–□AF71	27.0	25.0	3000	o	o	o	o	50.0	x	x	o	o	2.5

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1) The specified value is the maximum permissible current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-6 **adaptation table for feed module 25/50 A**

Servomotor				**Current limit** 1)					**Current controller gain**				
1FT...	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5103–□AC71	19.0	12.0	2000	o	o	o	o	50.0	x	x	o	o	8.0
5103–□AF71	19.0	17.5	3000	o	o	o	o	50.0	x	x	o	o	2.5
5103–□AG71	19.0	23.0	4000	o	o	o	o	50.0	o	x	o	x	2.0
5104–□AA71	37.0	14.0	1200	o	o	o	o	50.0	x	x	x	x	11.5
5104–□AC71	37.0	22.5	2000	o	o	o	o	50.0	o	o	x	o	4.0
5106–□AA71	45.0	17.0	1200	o	o	o	o	50.0	x	x	o	x	8.0
5108–□AA71	55.0	20.5	1200	o	o	o	o	50.0	x	o	o	x	6.5
5132–□AA71	60.0	22.5	1200	o	o	o	o	50.0	o	x	o	x	7.5

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1) The specified value is the maximum permissible current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-7 **Adaptation table for feed module 40/80 A**

Servomotor				**Current limit** [1]					**Current controller gain**				
1FT	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
4101–□SK71	20.0	33.0	6000	o	o	o	o	80.0	o	x	o	o	2.0
4101–□SN71	20.0	39.0	8000	o	o	o	o	80.0	x	o	o	o	1.0
4102–□SG71	33.0	35.0	4000	o	o	o	o	80.0	o	o	x	o	4.0
5046–□AK71	2.6	4.7	6000	o	x	o	x	24.0	x	x	o	o	2.5
5062–□AK71	2.2	3.9	6000	o	x	x	x	19.2	o	o	x	o	4.0
5064–□AF71	4.5	4.1	3000	o	x	x	x	19.2	x	x	o	x	8.0
5064–□AG71	4.5	5.5	4000	o	o	o	x	28.8	x	o	o	x	6.5
5064–□AK71	4.5	8.0	6000	o	o	x	o	40.0	o	o	x	o	4.0
5066–□AC71	6.5	3.9	2000	o	x	x	x	19.2	x	x	x	x	11.5
5066–□AF71	6.5	6.0	3000	o	o	o	x	28.2	x	x	o	x	8.0
5066–□AG71	6.5	7.9	4000	o	o	x	o	40.0	o	o	o	x	6.0
5066–□AK71	6.5	11.6	6000	o	x	o	o	54.4	x	o	x	o	4.5
5070–□AK71	3.0	5.3	6000	o	x	o	x	24.0	x	o	o	x	6.5
5071–□AF71	4.5	4.3	3000	o	o	x	x	20.8	o	o	x	x	9.5
5071–□AG71	4.5	5.2	4000	x	o	o	x	27.2	x	x	o	x	8.0
5071–□AK71	4.5	7.9	6000	o	o	x	o	40.0	x	o	x	o	4.5
5072–□AC71	10.0	6.1	2000	o	o	o	x	28.8	x	x	x	x	11.5
5072–□AF71	10.0	9.1	3000	o	o	x	o	40.0	o	o	x	x	9.5
5072–□AG71	10.0	12.0	4000	o	x	o	o	54.4	o	x	o	x	7.5
5072–□AK71	10.0	17.5	6000	o	o	o	o	80.0	o	x	x	o	5.5
5073–□AC71	7.0	4.3	2000	o	o	x	x	20.8	x	x	x	x	11.5
5073–□AF71	7.0	6.4	3000	x	x	x	o	31.2	x	x	o	x	8.0
5073–□AG71	7.0	8.1	4000	o	o	x	o	40.0	x	o	o	x	6.5
5073–□AK71	7.0	12.5	6000	o	x	o	o	54.4	x	x	o	o	2.5
5074–□AC71	14.0	8.5	2000	o	o	x	o	40.0	x	x	x	x	11.5
5074–□AF71	14.0	13.0	3000	o	x	o	o	54.4	o	x	o	x	7.5
5074–□AG71	14.0	16.5	4000	o	o	o	o	80.0	x	o	o	x	6.5
5074–□AK71	14.0	25.0	6000	o	o	o	o	80.0	x	x	o	o	2.5
5074–□SG71	16.0	19.0	4000	o	o	o	o	80.0	o	o	o	x	6.0
5074–□SK71	16.0	28.0	6000	o	o	o	o	80.0	x	x	o	o	2.5
5076–□AC71	18.0	11.5	2000	x	x	o	o	48.8	o	x	x	x	11.0
5076–□AF71	18.0	16.5	3000	x	o	o	o	68.0	x	o	o	x	6.5
5076–□AG71	18.0	21.5	4000	o	o	o	o	80.0	x	o	x	o	4.5
5076–□AK71	18.0	32.0	6000	o	o	o	o	80.0	o	x	o	o	2.0
5076–□SG71	20.5	24.5	4000	o	o	o	o	80.0	o	o	x	o	4.0
5100–□AC71	10.0	6.2	2000	x	x	x	o	31.2	x	x	x	x	11.5
5100–□AF71	10.0	9.2	3000	o	o	x	o	40.0	x	o	o	x	6.5
5100–□AG71	10.0	12.5	4000	o	x	o	o	54.4	o	x	x	o	5.5
5100–□AK71	10.0	18.0	6000	o	o	o	o	80.0	o	o	x	o	4.0
5101–□AC71	15.0	9.4	2000	o	o	x	o	40.0	x	x	o	x	8.0
5101–□AF71	15.0	14.5	3000	o	x	o	o	54.4	o	x	x	o	5.5
5101–□AG71	15.0	17.5	4000	o	o	o	o	80.0	x	o	x	o	4.5
5101–□AK71	15.0	26.5	6000	o	o	o	o	80.0	o	x	o	o	2.0

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1) The specified value is the maximum permisisble current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-7 **Adaptation table for feed module 40/80 A**

Servomotor				**Current limit** [1]					**Current controller gain**				
1FT	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5102–□AA71	27.0	9.9	1200	o	o	x	o	40.0	x	x	x	x	11.5
5102–□AC71	27.0	16.5	2000	o	o	o	o	80.0	o	o	x	x	9.5
5102–□AF71	27.0	25.0	3000	o	o	o	o	80.0	o	o	x	o	4.0
5102–□AG71	27.0	31.5	4000	o	o	o	o	80.0	x	x	o	o	2.5
5103–□AC71	19.0	12.0	2000	o	x	o	o	54.4	x	x	o	x	8.0
5103–□AF71	19.0	17.5	3000	o	o	o	o	80.0	o	o	o	x	6.0
5103–□AG71	19.0	23.0	4000	o	o	o	o	80.0	x	x	o	o	2.5
5104–□AA71	37.0	14.0	1200	o	x	o	o	54.4	x	x	x	x	11.5
5104–□AC71	37.0	22.5	2000	o	o	o	o	80.0	x	o	o	x	6.5
5104–□AF71	37.0	34.0	3000	o	o	o	o	80.0	x	x	o	o	2.5
5106–□AA71	45.0	17.0	1200	o	o	o	o	80.0	x	x	x	x	11.5
5106–□AC71	45.0	26.8	2000	o	o	o	o	80.0	o	x	x	o	5.5
5108–□AA71	55.0	20.5	1200	o	o	o	o	80.0	x	x	x	x	11.5
5108–□AC71	55.0	32.5	2000	o	o	o	o	80.0	x	o	x	o	4.5
5132–□AA71	60.0	22.5	1200	o	o	o	o	80.0	x	x	x	x	11.5
5132–□AC71	60.0	35.5	2000	o	o	o	o	80.0	x	o	x	o	4.5
5132–□SA71	70.0	26.0	1200	o	o	o	o	80.0	x	x	x	x	11.5
5134–□AA71	75.0	28.0	1200	o	o	o	o	80.0	o	o	x	x	9.5
5134–□SA71	90.0	34.0	1200	o	o	o	o	80.0	o	o	x	x	9.5
5136–□AA71	85.0	31.5	1200	o	o	o	o	80.0	o	x	o	x	7.5
5138–□AA71	105.0	39.0	1200	o	o	o	o	80.0	o	o	o	x	6.0

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1) The specified value is the maximum permisisble current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-8 **Adaptation table for feed module 80/160 A**

Servomotor				**Current limit** [1)]					**Current controller gain**				
1FT	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
4101–☐SK71	20.0	33.0	6000	o	o	o	o	160.0	x	o	x	o	4.5
4101–☐SN71	20.0	39.0	8000	o	o	o	o	160.0	x	x	o	o	2.5
4102–☐SG71	33.0	35.0	4000	o	o	o	o	160.0	x	x	o	x	8.0
4102–☐SK71	33.0	47.0	6000	o	o	o	o	160.0	x	o	x	o	4.5
4104–☐SG71	45.0	46.0	4000	o	o	o	o	160.0	o	x	x	o	5.5
4104–☐SK71	45.0	60.0	6000	o	o	o	o	160.0	x	x	o	o	2.5
4106–☐SG71	59.0	56.0	4000	o	o	o	o	160.0	x	o	x	o	4.5
5064–☐AK71	4.5	8.0	6000	o	o	x	x	41.6	x	o	x	o	4.5
5066–☐AG71	6.5	7.9	4000	o	x	x	x	38.4	o	o	o	x	6.0
5066–☐AK71	6.5	11.6	6000	o	o	o	x	57.6	x	o	x	o	4.5
5071–☐AK71	4.5	7.9	6000	o	x	x	x	38.4	x	o	x	o	4.5
5072–☐AF71	10.0	9.1	3000	o	o	x	x	41.6	o	o	x	x	9.5
5072–☐AG71	10.0	12.0	4000	o	o	o	x	57.6	x	x	o	x	8.0
5072–☐AK71	10.0	17.5	6000	o	o	x	o	80.0	o	x	x	o	5.5
5073–☐AG71	7.0	8.1	4000	o	o	x	x	41.6	x	o	o	x	6.5
5073–☐AK71	7.0	12.5	6000	o	x	x	o	65.5	o	o	x	o	4.0
5074–☐AC71	14.0	8.5	2000	o	o	x	x	41.6	x	x	x	x	11.5
5074–☐AF71	14.0	13.0	3000	o	x	x	o	65.6	x	x	o	x	8.0
5074–☐AG71	14.0	16.5	4000	o	o	x	o	80.0	x	o	o	x	6.5
5074–☐AK71	14.0	25.0	6000	x	x	o	o	97.6	x	x	o	o	2.5
5074–☐SG71	16.0	19.0	4000	o	o	x	o	80.0	o	x	x	o	5.5
5074–☐SK71	16.0	28.0	6000	x	x	o	o	97.0	x	x	o	o	2.5
5076–☐AC71	18.0	11.5	2000	o	x	o	x	48.0	o	o	x	x	9.5
5076–☐AF71	18.0	16.5	3000	x	o	x	o	73.6	o	x	o	x	7.5
5076–☐AG71	18.0	21.5	4000	o	x	o	o	108.8	x	o	o	x	6.5
5076–☐AK71	18.0	32.0	6000	o	o	o	o	160.0	o	o	x	o	4.0
5076–☐SG71	20.5	24.5	4000	o	x	o	o	108.8	o	x	x	o	5.5
5076–☐SK71	20.5	36.0	6000	o	o	o	o	160.0	o	o	x	o	4.0
5100–☐AF71	10.0	9.2	3000	x	x	o	x	46.4	x	x	o	x	8.0
5100–☐AG71	10.0	12.5	4000	x	x	x	o	62.4	x	o	o	x	6.5
5100–☐AK71	10.0	18.0	6000	o	o	x	o	80.0	o	o	x	o	4.0
5101–☐AC71	15.0	9.4	2000	o	o	x	x	41.6	o	o	x	x	9.5
5101–☐AF71	15.0	14.5	3000	o	x	x	o	65.6	x	o	o	x	6.5
5101–☐AG71	15.0	17.5	4000	o	o	x	o	80.0	x	o	x	o	4.5
5101–☐AK71	15.0	26.5	6000	x	o	o	o	136.0	o	o	x	o	4.0
5102–☐AA71	27.0	9.9	1200	x	x	o	x	46.4	x	x	x	x	11.5
5102–☐AC71	27.0	16.5	2000	o	o	x	o	80.0	o	o	x	x	9.5
5102–☐AF71	27.0	25.0	3000	o	x	o	o	108.8	o	x	x	o	5.5
5102–☐AG71	27.0	31.5	4000	o	o	o	o	160.0	o	x	x	o	5.5
5102–☐SF71	34.0	31.5	3000	o	x	o	o	108.8	x	o	x	o	4.5
5102–☐SG71	34.0	39.5	4000	o	o	o	o	160.0	x	o	x	o	4.5
5103–☐AC71	19.0	12.0	2000	o	o	o	x	57.6	x	x	o	x	8.0
5103–☐AF71	19.0	17.5	3000	o	o	x	o	80.0	o	o	o	x	6.0
5103–☐AG71	19.0	23.0	4000	o	x	o	o	108.8	x	o	x	o	4.5

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1) The specified value is the maximum permisisble current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-8 **Adaptation table for feed module 80/160 A**

Servomotor				**Current limit** 1)					**Current controller gain**				
1FT	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5104–☐AA71	37.0	14.0	1200	x	x	x	o	62.4	x	x	x	x	11.5
5104–☐AC71	37.0	22.5	2000	o	x	o	o	108.8	o	o	x	x	9.5
5104–☐AF71	37.0	34.0	3000	o	o	o	o	160.0	x	o	o	x	6.5
5104–☐SF71	48.0	44.0	3000	o	o	o	o	160.0	o	x	x	o	5.5
5106–☐AA71	45.0	17.0	1200	o	o	x	o	80.0	x	x	x	x	11.5
5106–☐AC71	45.0	26.8	2000	o	x	o	o	108.0	o	x	o	x	7.5
5106–☐AF71	45.0	42.5	3000	o	o	o	o	160.0	x	o	x	o	4.5
5106–☐SF71	57.0	54.0	3000	o	o	o	o	160.0	o	o	x	o	4.0
5108–☐AA71	55.0	20.5	1200	o	o	x	o	80.0	x	x	x	x	11.5
5108–☐AC71	55.0	32.5	2000	o	o	o	o	160.0	o	o	x	x	9.5
5108–☐AF71	55.0	50.5	3000	o	o	o	o	160.0	o	o	x	o	4.0
5132–☐AA71	60.0	22.5	1200	o	x	o	o	108.8	x	x	x	x	11.5
5132–☐AC71	60.0	35.5	2000	o	o	o	o	160.0	x	x	o	x	8.0
5132–☐AF71	60.0	47.5	3000	o	o	o	o	160.0	o	x	x	o	5.5
5132–☐SA71	70.0	26.0	1200	o	x	o	o	108.8	x	x	x	x	11.5
5132–☐SC71	70.0	41.0	2000	o	o	o	o	160.0	x	x	o	x	8.0
5132–☐SF71	70.0	55.5	3000	o	o	o	o	160.0	x	x	x	o	5.5
5134–☐AA71	75.0	28.0	1200	o	x	o	o	108.8	x	x	x	x	11.5
5134–☐AC71	75.0	47.0	2000	o	o	o	o	160.0	x	o	o	o	6.5
5134–☐SA71	90.0	34.0	1200	o	x	o	o	108.8	x	x	x	x	11.5
5134–☐SC71	90.0	56.0	2000	o	o	o	o	160.0	x	o	o	x	6.5
5136–☐AA71	85.0	31.5	1200	x	o	o	o	136.0	x	x	x	x	11.5
5136–☐AC71	85.0	47.5	2000	o	o	o	o	160.0	x	o	o	x	6.5
5136–☐SA71	110.0	41.0	1200	x	o	o	o	136.0	x	x	x	x	11.5
5136–☐SC71	110.0	61.5	2000	o	o	o	o	160.0	x	o	o	o	6.5
5138–☐AA71	105.0	39.0	1200	o	o	o	o	160.0	x	x	x	x	11.5
5138–☐SA71	140.0	52.0	1200	o	o	o	o	160.0	x	x	x	x	11.5

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1) The specified value is the maximum permisisble current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-9 **Adaptation table for feed module 100/200 A**

Servomotor				**Current limit 1)**					**Current controller gain**				
1FT	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
4101–☐SK71	20.0	33.0	6000	o	x	o	o	136.0	x	x	o	o	2.5
4101–☐SN71	20.0	39.0	8000	x	o	o	o	170.0	x	x	o	o	2.0
4102–☐SG71	33.0	35.0	4000	x	o	o	o	170.0	o	o	x	x	9.5
4102–☐SK71	33.0	47.0	6000	o	o	o	o	200.0	o	x	x	o	5.5
4104–☐SG71	45.0	46.0	4000	o	o	o	o	200.0	x	o	o	x	6.5
4104–☐SK71	45.0	60.0	6000	o	o	o	o	200.0	x	x	o	o	2.5
4106–☐SG71	59.0	56.0	4000	o	o	o	o	200.0	o	x	x	o	5.5
5066–☐AK71	6.5	11.6	6000	o	x	o	x	60.0	x	o	x	o	4.5
5072–☐AG71	10.0	12.0	4000	o	x	o	x	60.0	x	x	o	x	8.0
5072–☐AK71	10.0	17.5	6000	o	x	x	o	82.0	o	x	x	o	5.5
5073–☐AK71	7.0	12.5	6000	o	x	o	x	60.0	o	o	x	o	4.0
5074–☐AF71	14.0	13.0	3000	o	x	o	x	60.0	x	x	o	x	8.0
5074–☐AG71	14.0	16.5	4000	o	x	x	o	82.0	x	o	o	x	6.5
5074–☐AK71	14.0	25.0	6000	o	o	x	o	100.0	x	x	o	o	2.5
5074–☐SG71	16.0	19.0	4000	o	x	x	o	82.0	o	o	o	x	6.0
5074–☐SK71	16.0	28.0	6000	o	o	x	o	100.0	x	x	o	o	2.5
5076–☐AC71	18.0	11.5	2000	o	o	x	x	52.0	x	x	x	x	11.5
5076–☐AF71	18.0	16.5	3000	x	x	x	o	78.0	x	x	o	x	8.0
5076–☐AG71	18.0	21.5	4000	o	o	x	o	100.0	o	x	x	o	5.5
5076–☐AK71	18.0	32.0	6000	o	x	o	o	136.0	x	x	o	o	2.5
5076–☐SG71	20.5	24.5	4000	o	o	x	o	100.0	x	o	x	o	4.5
5076–☐SK71	20.5	36.0	6000	o	x	o	o	136.0	x	x	o	o	2.5
5100–☐AF71	10.0	9.2	3000	x	x	x	x	46.0	x	x	o	x	8.0
5100–☐AG71	10.0	12.5	4000	o	x	o	x	60.0	o	o	o	x	6.0
5100–☐AK71	10.0	18.0	6000	x	o	x	o	92.0	x	o	x	o	4.5
5101–☐AC71	15.0	9.4	2000	x	x	x	x	46.0	o	o	x	x	9.5
5101–☐AF71	15.0	14.5	3000	o	x	o	x	60.0	o	o	o	x	6.0
5101–☐AG71	15.0	17.5	4000	x	o	x	o	92.0	o	o	o	x	6.0
5101–☐AK71	15.0	26.5	6000	o	x	o	o	136.0	o	o	x	o	4.0
5102–☐AA71	27.0	9.9	1200	x	x	x	x	46.0	x	x	x	x	11.5
5102–☐AC71	27.0	16.5	2000	x	x	x	o	78.0	o	o	x	x	9.5
5102–☐AF71	27.0	25.0	3000	o	o	x	o	100.0	x	o	x	o	4.5
5102–☐AG71	27.0	31.5	4000	o	x	o	o	136.0	x	o	x	o	4.5
5102–☐SF71	34.0	31.5	3000	x	x	o	o	122.0	o	x	x	o	5.5
5102–☐SG71	34.0	39.5	4000	o	x	o	o	136.0	o	o	x	o	4.0
5103–☐AC71	19.0	12.0	2000	o	x	o	x	60.0	o	o	x	x	9.5
5103–☐AF71	19.0	17.5	3000	x	o	x	o	92.0	x	o	o	x	6.5
5103–☐AG71	19.0	23.0	4000	x	x	o	o	122.0	o	x	x	o	5.5
5104–☐AA71	37.0	14.0	1200	o	x	o	x	60.0	x	x	x	x	11.5
5104–☐AC71	37.0	22.5	2000	o	o	x	o	100.0	x	x	o	x	8.0
5104–☐AF71	37.0	34.0	3000	o	x	o	o	136.0	o	x	x	o	5.5
5104–☐SF71	48.0	44.0	3000	o	x	o	o	136.0	x	o	x	o	4.5
5106–☐AA71	45.0	17.0	1200	x	x	x	o	78.0	x	x	x	x	11.5
5106–☐AC71	45.0	26.8	2000	x	x	o	o	122.0	x	x	o	x	8.0
5106–☐AF71	45.0	42.5	3000	o	o	o	o	200.0	o	x	x	o	5.5
5106–☐SF71	57.0	54.0	3000	o	o	o	o	200.0	x	o	x	o	4.5

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1) The specified value is the maximum permisisble current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

Table 1-9 **Adaptation table for feed module 100/200 A**

Servomotor				**Current limit** (1)					**Current controller gain**				
1FT	M_o [Nm]	I_o [A]	n_{rated} [RPM]	Contacts				I_{max} [A]	Contacts				Kp(I)
				2	3	4	5		6	7	8	9	
5108–□AA71	55.0	20.5	1200	x	o	x	o	92.0	x	x	x	x	11.5
5108–□AC71	55.0	32.5	2000	o	x	o	o	136.0	x	x	o	x	8.0
5108–□AF71	55.0	50.5	3000	o	o	o	o	200.0	x	o	x	o	4.5
5132–□AA71	60.0	22.5	1200	o	o	x	o	100.0	x	x	x	x	11.5
5132–□AC71	60.0	35.5	2000	x	o	o	o	170.0	o	o	x	x	9.5
5132–□AF71	60.0	47.5	3000	o	o	o	o	200.0	x	o	o	x	6.5
5132–□SA71	70.0	26.0	1200	o	o	x	o	100.0	x	x	x	x	11.5
5132–□SC71	70.0	41.0	2000	x	o	o	o	170.0	o	o	x	x	9.5
5132–□SF71	70.0	55.5	3000	o	o	o	o	200.0	x	o	o	x	6.5
5134–□AA71	75.0	28.0	1200	x	x	o	o	122.0	x	x	x	x	11.5
5134–□AC71	75.0	47.0	2000	o	o	o	o	200.0	x	x	o	x	8.0
5134–□SA71	90.0	34.0	1200	x	x	o	o	122.0	x	x	x	x	11.5
5134–□SC71	90.0	56.0	2000	o	o	o	o	200.0	x	x	o	x	8.0
5136–□AA71	85.0	31.5	1200	o	x	o	o	136.0	x	x	x	x	11.5
5136–□AC71	85.0	47.5	2000	o	o	o	o	200.0	x	x	o	x	8.0
5136–□SA71	110.0	41.0	1200	o	x	o	o	136.0	x	x	x	x	11.5
5136–□SC71	110.0	61.5	2000	o	o	o	o	200.0	x	x	o	x	8.0
5138–□AA71	105.0	39.0	1200	x	o	o	o	170.0	x	x	x	x	11.5
5138–□SA71	140.0	52.0	1200	x	o	o	o	170.0	x	x	x	x	11.5

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1) The specified value is the maximum permissible current of the particular power module – motor combination. It may be necessary to reduce the specified value depending on the driven mechanical system.

■

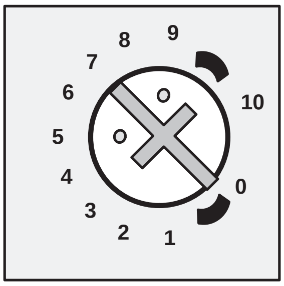
Speed controller optimization

The additional smoothing functions in the speed controller loop (damping mechanical resonance effects) are described in Section 3. Proceed as follows when optimizing the speed controller:

4. Tachometer adjustment
5. Gain Kp
6. Integral action time T_N
7. Adaptation T_N (if required)
8. I–component limiting (if required)
9. Drift compensation (offset)

The unit must be powered–up to optimize the speed controller
Therefore please refer to p. 1-121 ”Power–on”.

The potentiometer scale divisions (in the setting tables) are defined as follows:



The setting shown in the diagram corresponds to 7 scale divisions.

Tachometer adjustment

For motors with tachometer voltages ≤ 16.5 V, it is necessary to also proceed according to p. 1-83, "Tachometer adaptation...".

Potentiometer	**Setting range**
T	$0.7\ n_{rated} \leq 2.2\ n_{act\ N} \leq 2.2\ n_{rated}$

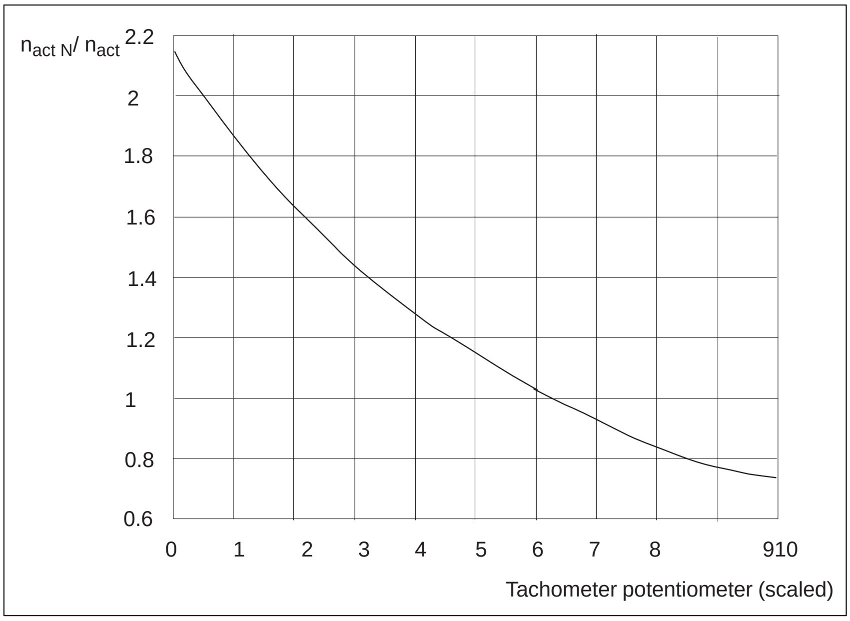


Fig. 2-1 Tachometer adjustment

Extending the setting range using R3 and R10 (only for the user–friendly interface).

Function	**Component**	**Mounted**
$n_{act\ N} > 0.7\ n_{rated}$	Increase R3	0 Ω (as supplied)
$n_{act\ N} < 2.2\ n_{rated}$	Mount R10	Open (as supplied)

Setting the proportional gain Kp without adaptation

The proportional gain Kp of the speed controller can be set using potentiometer Kp. The range can be extended if required using the fixed resistor R50 (only for the user–friendly interface ; R50 = 68 kΩ (as supplied)).
The gain, set using the Kp potentiometer is additionally influenced by the setting of potentiometer T_N.

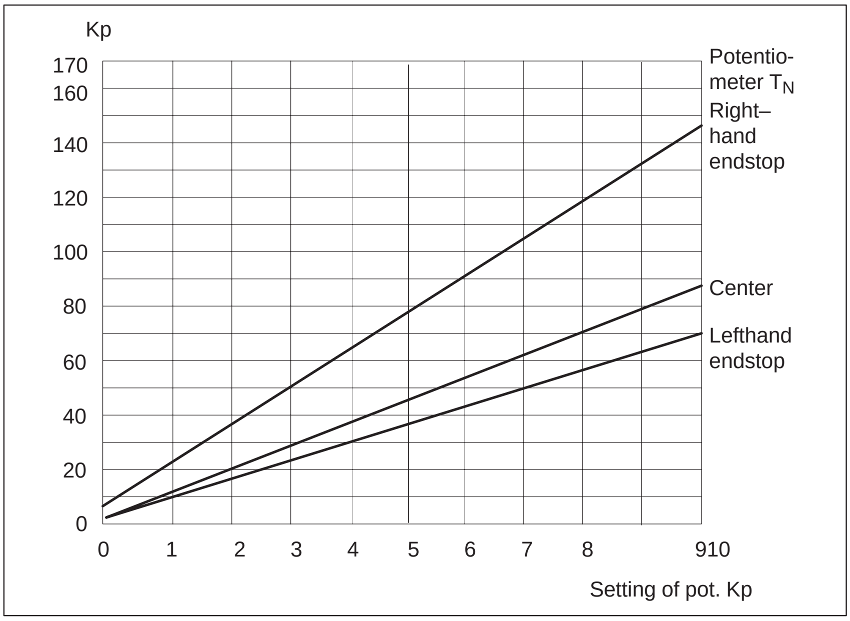


Fig. 2-2 Proportional gain Kp as a function of the Kp and T_N potentiometers

Setting the integral action time T_N without adaptation

The speed controller integral action time is set using potentiometer $T_{N;}$ the range can be, if required, extended using C2 (only for the user–friendly interface).

Fig. 2-3 Integral action time T_N as a function of potentiometer T_N

Integral action time with adaptation (if required)

Adaptation is activated and preset via R34 (only the user–friendly interface), and S3.5 (S6.5 for a 2nd axis) for the standard interface.

R34 = open R34 = mounted	Adaptation inactive (as supplied) Adaptation operates acc. to the following diagrams

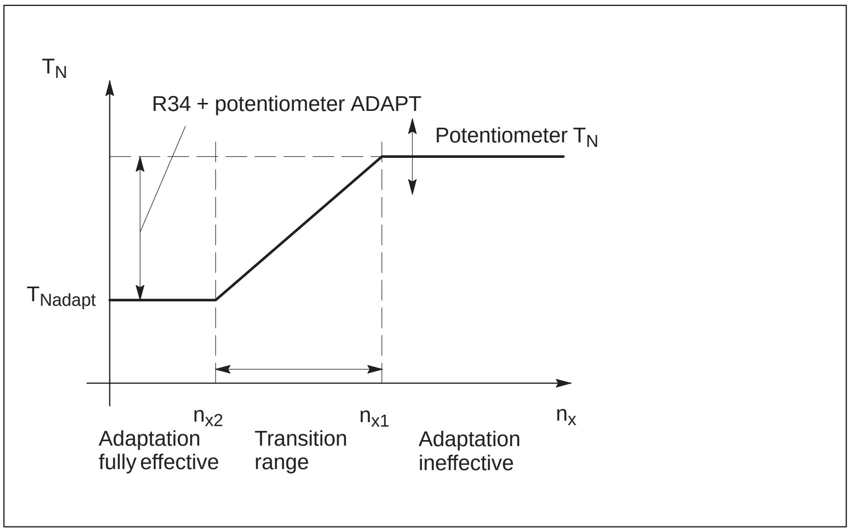


Fig. 2-4 Integral action time dependency

$n_x = |n_{setp.} + n_{act.}|$

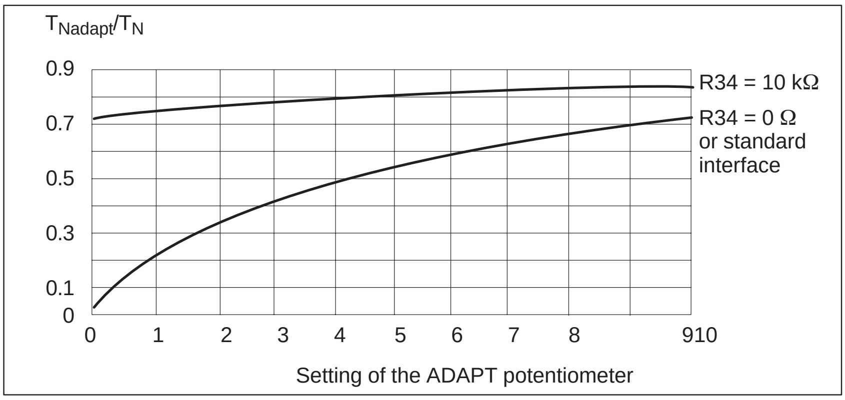


Fig. 2-5 Dependency of adaptation T_N

Proportional gain with adaptation (only user–friendly interface)

!

Important

Offsets can occur in the transition range.

Adaptation is activated and preset using R38 (if required):

R38 = open	Adaptation inactive (as supplied)
R38 = mounted	Adaptation operates acc. to the following diagrams

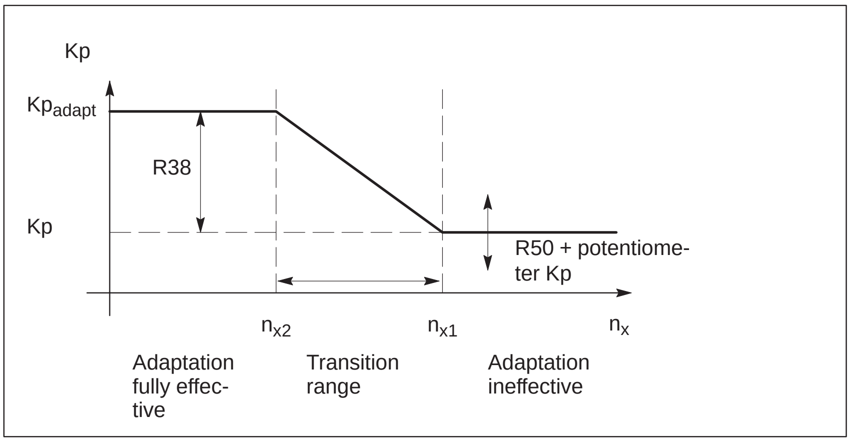


Fig. 2-6 Proportional gain Kp as a function of the speed

$n_x = |n_{setp.} + n_{act.}|$

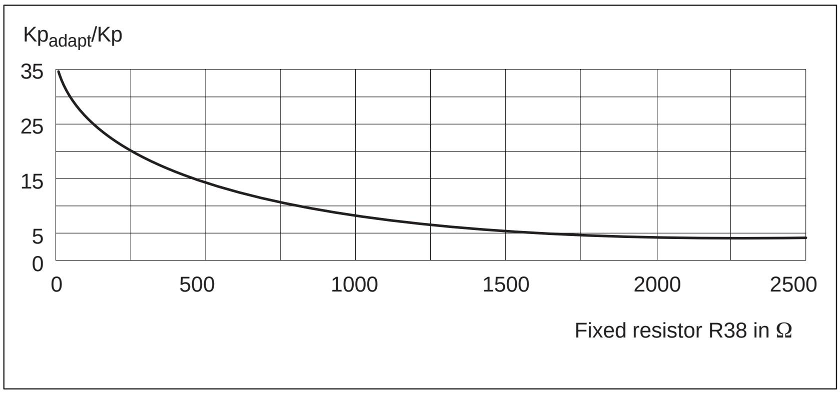


Fig. 2-7 Adaptation Kp as a function of R38 in the ”adaptation fully effective” range

Setting the adaptation range (generally not required)

The adaptation range can be set using the following resistors:

R40	User–friendly interface
R543	Standard interface 1st axis (from Order No. 6SN1118–0AD11–0AA1)
R544	Standard interface 2nd axis (from Order No. 6SN1118–0AE11–0AA1)

R☐ = open	— — — —	Maximum adaptation range (as supplied)
R☐ = inserted	————	Adapt. reduced acc. to the following diagram

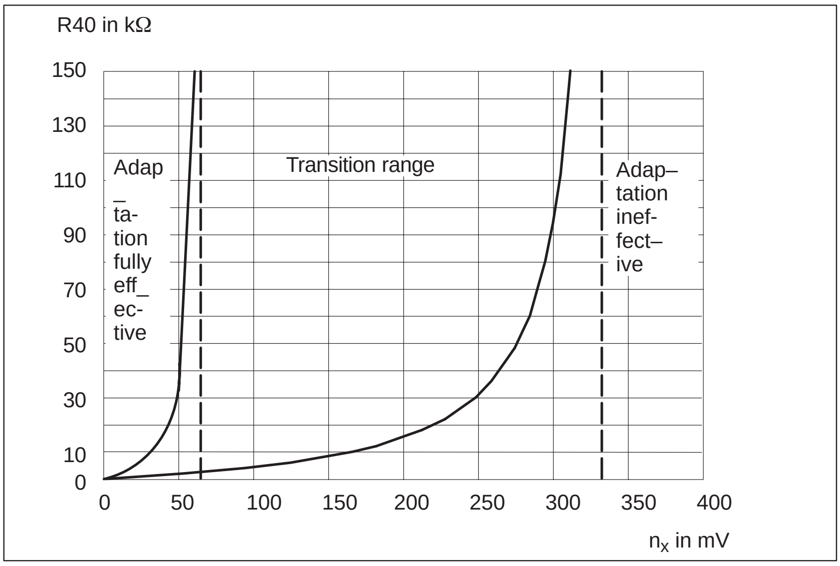


Fig. 2-8 Adaptation range

$n_x = |n_{setp.1} + n_{act.}|$

I component limiting of the speed controller

R52	User–friendly interface
R547	Standard interface 1st axis (from Order No. 6SN1118–0AD11–0AA1)
R550	Standard interface 2nd axis (from Order No. 6SN1118–0AE11–0AA1)

R52 = open	I component fully effective (as supplied)
R52 = 0 Ω	I component ineffective

R52 can be between 100 kΩ and 2 MΩ to limit the speed controller I component, e. g. for slipstick effects.

Drift offset

Adjusted using potentiometer for n_{set} = 0 (terminals 56 and 14 connected)

Potentiometer drift	Control range ± 30 mV

■

Start–up, supplementary functions

Setting elements with standard interface

Setting elements, switch S2 and S3 or S5 and S6 for the 2nd axis

S2/S5 contacts 10 x DIL	OFF	ON
1	Motor **clockwise** direction of rotation for a positive speed setpoint (motor shaft, drive end) at terminal 56/14	Motor **counter–clockwise** direction of rotation for a positive speed setpoint (motor shaft, drive end)1) at terminal 56/14
2...5	Curr. normal. (I_{max}=100 %)1)	Curr. normal. (I_{max} = 23 %)
6...9	Current controller gain (0.5)1)	Current controller gain (11.5)
10	Speed–controlled operation1)	Current–controlled operation

S3/S6 contacts 8 x DIL	Function	OFF	ON
1	Speed setpoint smoothing	No smoothing1)	With τ = 2.2 ms
2	Speed actual value smoothing	No smoothing1)	With τ = 280 µs
3	Speed controller smoothing	No smoothing1)	With τ = 370 µs
4	Current setpoint smoothing	No smoothing1)	With τ = 110 µs
5	Speed contr. adaptation	OFF1)	ON
6	Ready/fault2)	Ready to run signal1)	Fault signal
7	Master/slave3)4)	Master1)	Slave4)
8	Current–controlled operation	With I component	Without I component1)

---

1) As supplied
2) Acts on the BB relay of the NE/monitoring module. If the user–friendly and standard interface are used together, or just the standard interface alone, then the BB relay on the NE module drops–out if there is no enable signal or a fault is present.
3) Function only for 2–axis version
4) The slave axis must be operated in the current–controlled mode with enabled I component.

The following supplementary functions can be set by mounting wired components onto the basic board. (from Order No. 6SN1118–0AD11–0AA**1** (1 axis) and from Order No. 6SN1118–0AE11–0AA**1** (2 axis) .

Function	BKZ axis 1	BKZ axis 2	Value range
Smoothing, speed controller	C231	C235	0 ... 100nF
Smoothing n_{set}	C232	C236	0 ... 2.2 µF
Smoothing n_{act}	C233	C237	0 ... 100nF
Smoothing n_{set}	C234	C238	0 ... 100nF
Timer ”speed controller at its endstop”	C239	C240	0 ... 2.2 µF
Tachometer adaptation	539R, 540R, 541R	R536, R537. R538	0 ... ∞ kΩ, 0.1%, 25ppm/k
Clock frequency PBM	R542	R542	62 kΩ ... ∞
Adaptation range	R543	R544	0 ... ∞ kΩ
Speed setpoint adaptation	R545	R546	0 ... ∞ kΩ
Limiting, speed controller I component	R547	R550	∼ 100 kΩ ... 2 MΩ
Electronic weight equalization, pos./neg.	R548/R549	R551/R552	20 kΩ ... ∞
Response threshold I^2t monitoring	R553	R554	0 ... ∞ kΩ

Axial metal film resistors, type of construction 0204 (RM 7.62 mm) and radial MKT capacitors (RM 5.08 mm) must be located at the positions provided. When adapting the tachometer, it should be observed that the resistors have a relative accuracy of 0.1% to one another and a Tk of < 25 ppm/k.

Note The board could be damaged if the incorrect material is used

Important Only suitably qualified personnel may carry–out soldering work on the board (maintaining the ESD Guidelines).

Dimensioning the setting elements (standard interface)

a) Smoothing functions

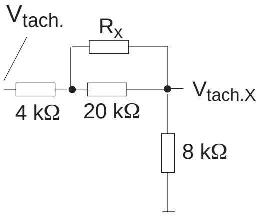
Speed controller: T=C231(C235)•78 kΩ
n_{set}: T=C232(C236)•10 kΩ
n_{act}: T=C233(C236)•∼ 10 kΩ (dependent on the tachometer potentiometer setting)
I_{set}: T=C234(C238)•5 kΩ

b) timer, ”speed controller at its endstop”

The monitoring time is 230 ms as standard, and can be increased, when required, by mounting C239 (C240). The following simple relationship is valid:

$$T_{Zst}=\left(+1.15\ \frac{C239\ (C240)}{\mu F}\right)\bullet 200\ \text{ms}$$

c) Tachometer adaptation
The following equivalent circuit diagram is valid for the individual tachometer voltages:



The tachometer voltage V_{tach} is normally 40 V at rated speed, which results in a voltage$_{tachoX}$ of 10 V. For a rated speed which significantly deviates from the rated motor speed, it is possible to re–dimension corresponding to this criterium.
The following formula is valid:

$$R_x=\frac{\left[5\cdot k\Omega\bullet\left({}^{V_{tach.}}/_{V_{tach.X}}\right)-7.5\cdot k\Omega\right]}{-1\;{}^{1}/_{4}\bullet\left({}^{V_{tach.}}/_{V_{tach.X}}\right)}$$

d) clock frequency PBM
If noise problems occur (the motor makes a whistling sound), then the PWM inverter clock frequency can be changed for both axes together.(Fig. 3–1)
In this case, it must be observed that the available current (I_n, I_{max}) is reduced when the clock frequency is increased (refer to Pj, Section 4.1).

The I^2t limiting is set in the factory to a pulse frequency of 3.3 kHz and a maximum ambient temperature of 40°C. If these values are exceeded (pulse frequency and/or ambient temperature), the response threshold must be adapted (refer to Fig. 3-2).

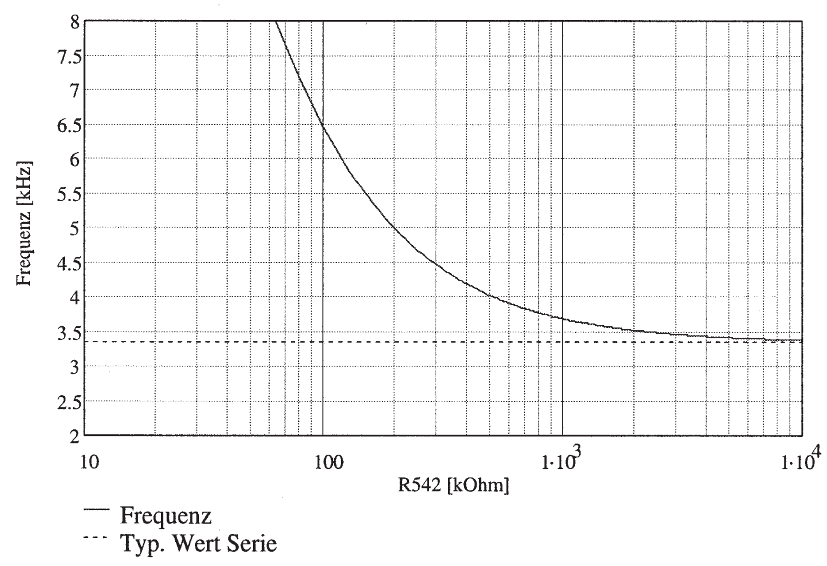
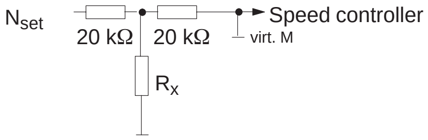


Fig. 3-1

e) Speed setpoint adaptation
If the adjustment range of the tachometer potentiometer is not sufficient (for lower speed range), then the speed setpoint can be adapted via a setpoint voltage divider circuit. The following circuit diagram is valid:



The following relationship is obtained for R545 (R546):

$$R_x = 10 \cdot k\Omega \bullet \frac{n_{required}}{n_{rated} - n_{required}}$$

f) Limiting, speed controller I component (refer to2.7)
The maximum speed controller I component can be limited by mounting R547 (R550).

g) Electronic weight equalization
The value to be set for the electronic weight equalization is obtained from the current setpoint I_{setGwa} which can be measured at the test socket T for the axis to be enabled, at standstill (N_{set}=0).

$$R = \frac{10 \cdot V}{I_{SetGwa}} \bullet 10 \cdot k\Omega \qquad \text{Caution: } I_{SetGwa} \leq 5V \Rightarrow R \geq 20\ k\Omega!$$

After mounting, the value at test socket T must be able to be measured with the same polarity, with the axis inhibited.

h) Response threshold I^2t-monitoring
The I^2t monitoring limits the current setpoint to a thermally permissible value. The response threshold is 55% of the power module peak current, and, when required, can be reduced corresponding to the following characteristic, by mounting R553 (R554):

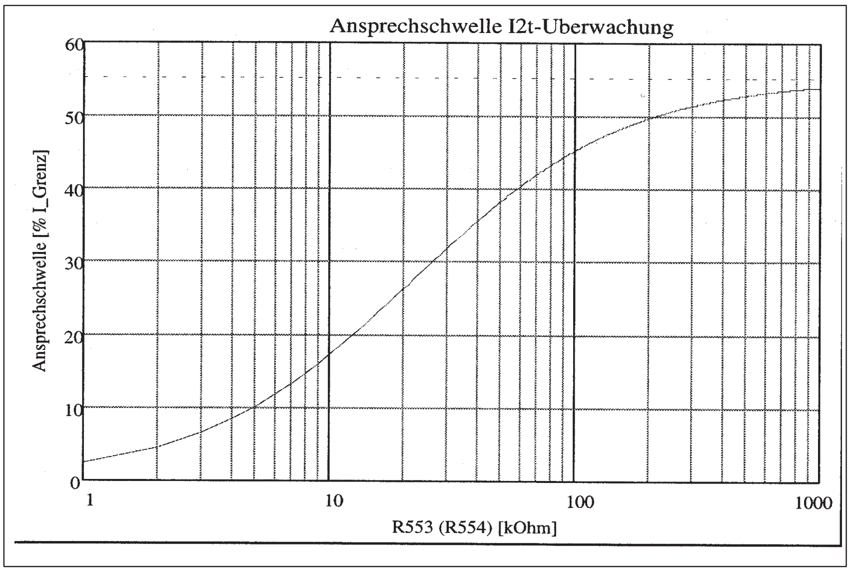


Fig. 3-2

Setting elements with user–friendly interface

Setting elements on the parameter board; terminal = H → jumpered with terminal 9, terminal = L → open.

Function	Component(s)	Effect
Ready/fault Relay terminal 672/673/674	R33 = 0 Ω (as supplied) R33 = open	Ready signal fault signal
Speed/current controlled (permanently selected via switch)	S2: 10 = OFF (as supplied) S2: 10 = ON	Closed–loop speed control closed–loop current control
Speed/current controlled (selected via terminal)	R14 = 0 Ω1); terminal 22 = L R14 = 0 Ω; terminal 22 = H	Closed–loop speed control closed–loop current control
Supplementary setpoint 1 via terminal 22 = H	R16 (as supplied = open)2) R17 (as supplied = open) R18 (as supplied = open)	Voltage divider at 10 V Voltage divider at –10 V Voltage divider at the ref. point
Supplementary setpoint 2 via terminal 23 = H	R21 (as supplied = open)2) R19 (as supplied = open) R22 (as supplied = open)	Voltage divider at 10 V Voltage divider at –10 V Voltage divider at the ref. point
Current–controlled operation with/ without I component	R1 = 0 Ω (as supplied) R1 = open	I component inhibited P I component active PI
Controller– and pulse inhibit via terminal 65	R13 = open (as supplied) R13 = 0 Ω	Delayed Instantaneous
Master-/slave operation: Master operation	R42 + R44 = 0 Ω, S2: 10 = OFF	Master operation, terminal 258 = output
Slave operation	R44 = 0 Ω, R1 + R42 = open, S2: 10 = ON	Slave operation, terminal 258 = input
Timer, speed controller at its endstop	R54 = 360 kΩ (as supplied) R54 as selected	t = 230 ms R54 [kΩ] = $\frac{t\,[ms]}{0.56} - 47$
Monitoring, n controller at n stop	R32 = 0 Ω (as supplied) R32 = open	Monitoring active Monitoring inactive
Direction of rotation reversal (direction of rotation for a positive setpoint at terminal 56/14)	S2: 1 = ON (as supplied) S2: 1 = OFF	Motor ccw, drive shaft end Motor cw, drive shaft end
Speed controller smoothing	C3 (as supplied = open)	τ = C3 · 68 kΩ
Speed setpoint smoothing	C4 (as supplied = open)	τ = C4 · 10 kΩ
Speed actual value smoothing	C5 (as supplied = open)	τ = C5 · 5 kΩ
Current setpoint smoothing	C6 (as supplied = open)	τ = C6 · 1 kΩ
Speed setpoint adaptation2) (only terminal 56/14)	R5 = 20 kΩ (as supplied)	$\lvert 100\% \cdot n_{ACTN} \rvert = 11 ... 5V$
Current setpoint adaptation	R42 (as supplied = 0 Ω)2)	$I_{set} < 10$ V
Travel to endstop (set using R12)	R12 according to Fig. 3–3 Condition: Terminal 96 connected to terminal 44	Limiting according to Fig. 3–3 Speed controller monitoring inactive

---

1) As supplied: R14 = open

2) $R= \frac{N_{set}}{10V} \bullet \left(\frac{N_{rated}}{N_{max}} - 0.5 \right) \bullet 40 \cdot k\Omega$

Function	Component(s)	Effect
Travel to end stop (variable via terminal 96)	R12 = open (as supplied) voltage at terminal 96 according to Fig. 3-4	Limiting acc. to Fig. 3-4, n–contr. monitoring inactive
Setting–up operation (central, via terminal 112 on the NE module)	R12 according to Fig. 3-3 terminal 112 = open (when supplied, terminal 112 to terminal 9)	Limiting according to Fig.KEIN MERKER, Speed controller monitoring inactive
Current reduced after timer, n controller at end stop, has expired	R2 according to Fig. 3-5 R32 = open	Reduction acc. to Fig. 3-5 n–contr. monit. disabled
Current reduced after the I^2t timer has expired	R2 = open (as supplied) R32 = open	S1–duty = 1.1 I_{rated}
Response threshold I^2t	R9 = 30 kΩ (as supplied) R9 according to Fig. 3-6	S1–duty = 1.1 I_{rated} Limiting acc. to Fig. 3-6
Electronic weight equalization[1]	R46 + R48 = open (as supplied) R46 for neg. I set at socket T R48 for pos. I set at socket T	no weight equalization Suppl. I set acc. to Fig. 3-7 Suppl. I set acc. to Fig. 3-7
Tachometer adaptation[2]	R6, R7, R8 tolerance$\leq$ 0.1%	$R_x = \frac{\left[5 \cdot k\Omega \bullet \left(V_{tach.} / V_{tach.X}\right) - 7.5 \cdot k\Omega\right]}{-1 \quad 1/4 \bullet \left(V_{tach.} / V_{tach.X}\right)}$
Clock frequency	R542	Refer to Fig.3-1

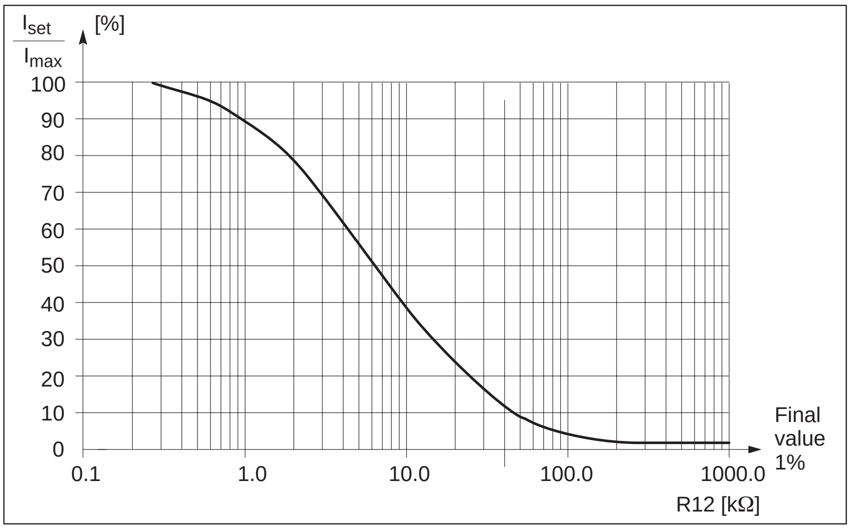


Fig. 3-3 Current setpoint limiting as a function R12, |30 V| $\geq$ terminal 96 $\geq$ |12 V|

---

1)

Warning

For version 4620087701.00 of the control board, for weight compensation, the internal current setpoint must be reduced via R42!

$$R42\ [k\Omega] = \frac{20 \cdot I\ \text{weight equalization}/I_{max}}{1 - I\ \text{weight compensation}/I_{max}}$$

For control boards, from version 4620087701.01 onwards, zero offset cannot be measured after R46 and R48 have been mounted and an axis enabled. If R46 and R48 have been correctly mounted according to Fig. 3-7, the offset must be able to be measured when the axis is inhibited.

2) Refer to p. 1-105, "c) Tachometer adaption".

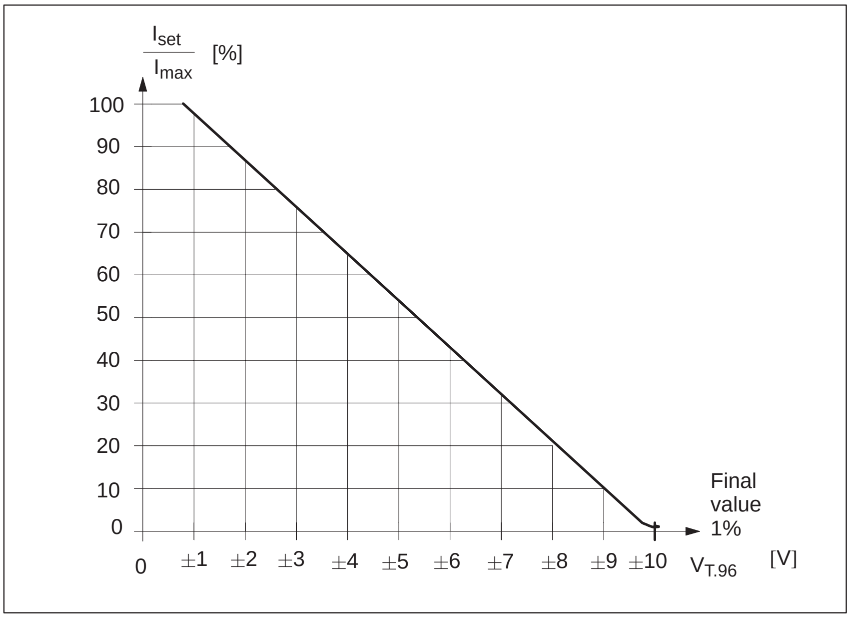


Fig. 3-4 Current setpoint limiting as a function of the voltage at terminal 96 (R12=open)

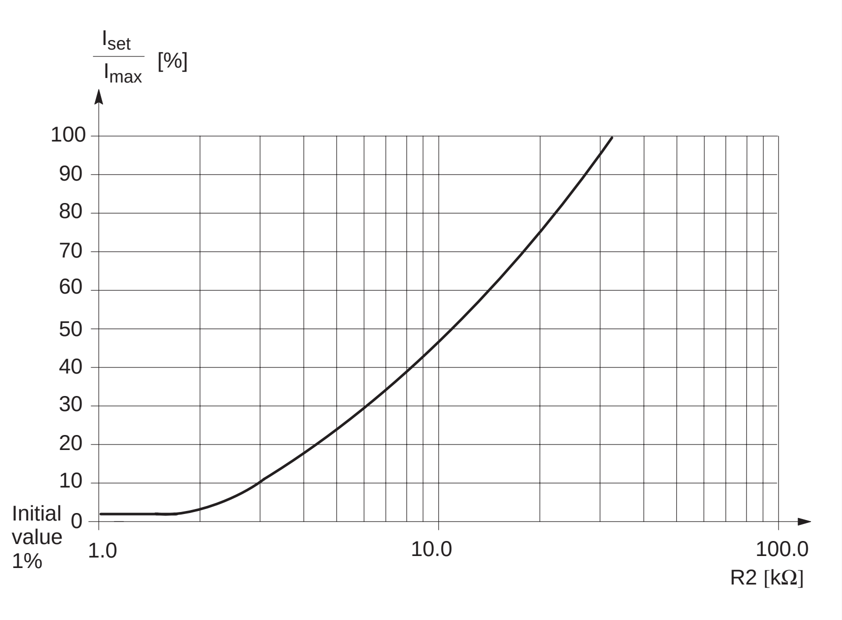


Fig. 3-5 Current setpoint limiting as a function of R2

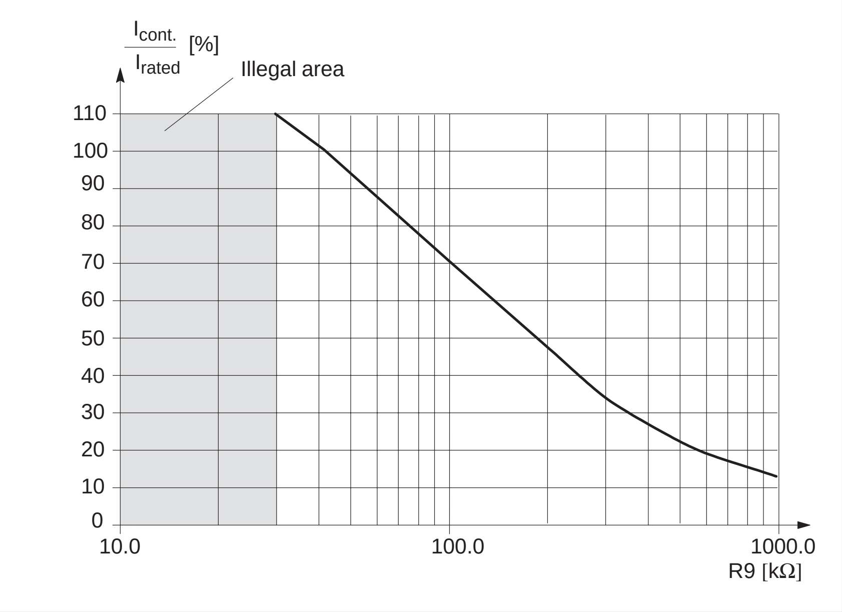


Fig. 3-6 Response threshold I^2t monitoring as a function R9

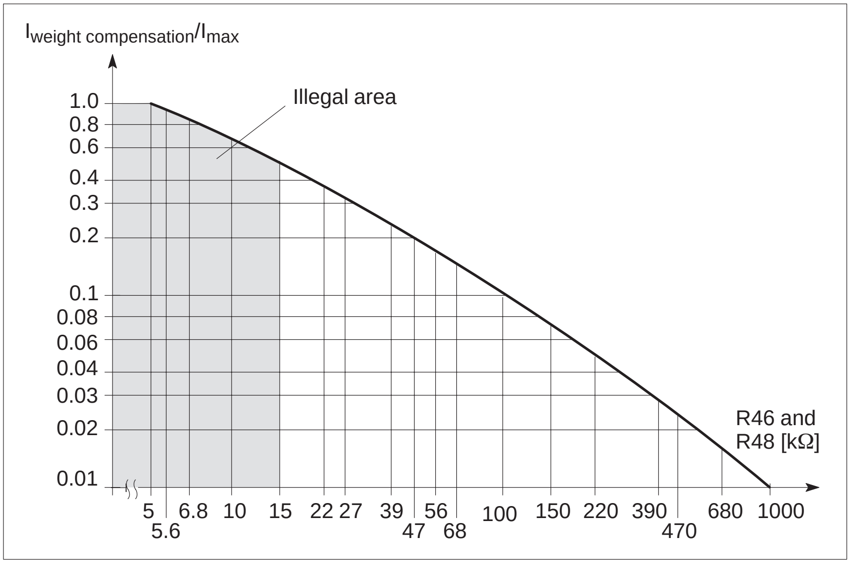


Fig. 3-7 Supplementary current setpoint for electronic weight equalization

Inverter clock frequency PWM

If noise problems occur (the motor makes a whistling sound), the PWM inverter clock frequency can be adapted by mounting R369 on the basic board.
In this case, it must be observed that the available current (I_n, I_{max}) is reduced when the clock frequency is increased. (refer to Pj Section 4.1)
The I2t limiting is designed for a pulse frequency set in the factory to 3.3 kHz and a max. ambient temperature of 40 °C. When this value is exceeded (pulse frequency and/or ambient temperature), the response threshold must be adapted (refer to Fig. 3-2).
The characteristic is valid according to Fig. 3-1.

■

Setpoint interfaces

Definitions:

X	Optimal, taking into account the setpoint input characteristics
☐	Possible
▨	Not permissible, and to some extent also not possible

Table 4-1 Main setpoint–supplementary setpoints

Mode	Setpoint	Term.56/14	Term.24/20	Int. setpoint term.22	Int. setpoint term.23	Socket NZ	Term.258
Speed controlled	Main setpoint	X					▨
	Supplementary setpoint		X	X	X	X	▨
Current controlled	Main setpoint	▨	X				▨
	Supplementary setpoint	▨		X			▨
Slave, I controlled Current setpoint input	Main setpoint	▨	▨	▨	▨	▨	X
	Supplementary setpoint	▨	▨	▨	▨	▨	▨
Main spindle drive option Main spindle drive operation	Main setpoint	X	▨	▨	▨	▨	▨
	Supplementary setpoint	▨	▨	▨	▨	▨	▨
Main spindle drive option C axis	Main setpoint	▨	X	▨	▨	▨	▨
	Supplementary setpoint	▨	▨	X	X	▨	▨

Table 4-2 Motor direction of rotation for a positive setpoint and S2.1 = ON

Mode	Term.56/14	Term.24/20	Term.22	Term.23	Socket NZ	Master/slave term.258
Speed controlled	ccw	cw	R16/18 cw	R19/22 cw	ccw	▨
			R17/18 ccw	R21/22 ccw		
Current controlled	▨	cw	R16/18 cw	R19/22 cw	▨	cw (slave)
			R17/18 ccw	R21/22 ccw		

When viewing the motor shaft, drive end

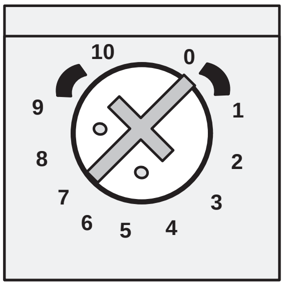
■

Start–up with main spindle drive option

The settings for the control parameters for C–axis operation on the parameter board, control parameters for main spindle drive operation, on the option board.

The main spindle drive option components which have to be modified, are mounted on solder pins (layout, refer to Section 9).

The potentiometer scale divisions (in the setting tables) are defined as follows:



The setting shown in the diagram corresponds to 7 scale divisions.

Pre–settings

Warning

Parameter board changes: Remove R4, R5 and R54 and, if necessary, C4 (when supplied this is not mounted).
If this is not observed, it could result in undesirable axis motion!

Settings with the control board removed

Ramp–up time

Table 5-1 Ramp–up time from 0 V to 10 V in s via terminal 56/14, set using potentiometer R20 and terminal 102

	0	1	2	3	4	5	6	7	8	9	10
Term.102 open	0.01	0.11	0.21	0.31	0.4	0.5	0.6	0.7	0.8	0.9	1.11
Term.102 to term. 9	0.1	1.08	2.07	3.06	4.04	5.03	6.02	7.01	8.01	9.04	11.05

The ramp–up time range via R20 can be changed by modifying R27/R60.

Torque limiting

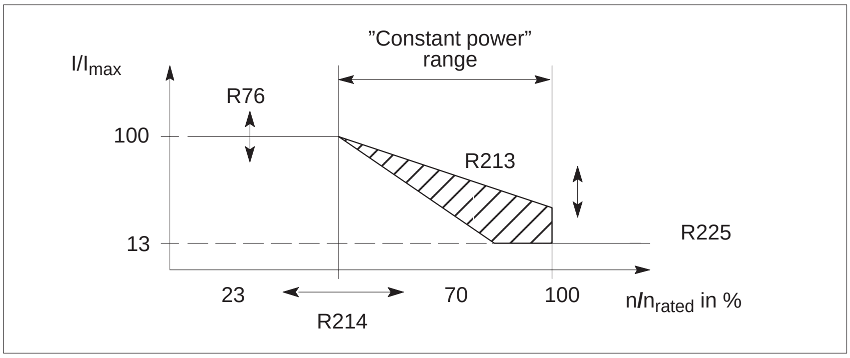


Fig. 5-1 Torque limiting

Table 5-2 Adjustable start of the "constant power" range referred to n_{max} = ±10 V in % via R214

Pot. R214	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Start of the range in %	70	65	60	55	50	45	40	35	30	26	22

Table 5-3 Deviations of the selected power to constant power at the point n_{max} in % via R213

Pot. R213	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Deviation in %	+20					0					–20

Table 5-4 Constant torque limiting I_{set}/I_{max} in % via R76 (solder pins), R76 is open when supplied

R76 in kΩ	**3**	**4.3**	**6.2**	**8.2**	**11**	**15**	**18**	**22**	**27**	**≥36**
I_{set}/I_{max} in %	10	20	30	40	50	60	70	80	90	100

Intermediate values can be determined by interpolating

Table 5-5 Speed–dependent torque limiting I_{set}/I_{max} in % via R225 (solder pins) for R226 = 20 kΩ

R225 in kΩ	**2.4**	**4.7**	**7.5**	**11**	**16**	**22**	**30**	**47**	**70**	**100**
I_{set}/I_{max} in %	1	10	20	30	40	50	60	70	80	85

12 % I_{set}/I_{max} are set as standard. Intermediate values are obtained by interpolating.

Normalization of |M/P| display

Table 5-6 Normalization via potentiometer R903 (when supplied, factor = 1)

Pot. R903	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Normalization Factor	3	2.8	2.6	2.4	2.2	2.0	1.8	1.6	1.4	1.2	1

Relay function, limit value stage output

Terminal selected using 0 Ω resistors

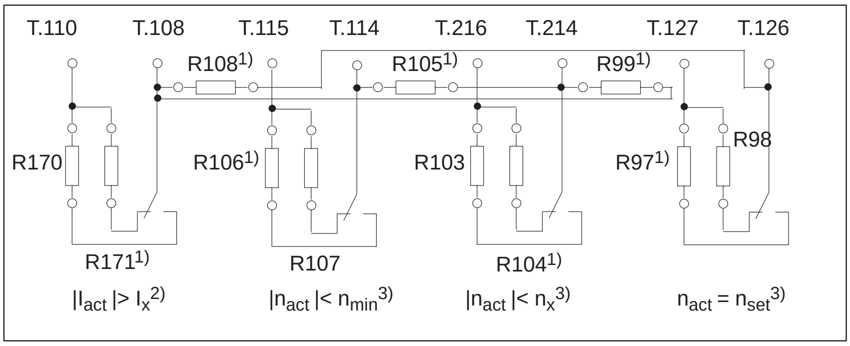


Fig. 5-2 Relay functions

---

1) As supplied
2) Relay drops out
3) Relay pulls–in if the function is fulfilled.

Table 5-7 Limit value functions

Limit value stage	**Range**					**Settings via fixed values**					
$\lvert I_{act}\rvert > I_x$ pot. R211	4.5 %...100 %					Smoothing for relay contact bounce = C87 Suppressed: n_{set} step > 31 mV, R180 = 0 Ω hysteresis = 10 mV, R179 = 2 kΩ					
Pot. R211	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
I_x =in %	100	90	81	71	62	52	43	33	24	14	4.5
$\lvert n_{act}\rvert < n_{min}$ pot. R10	0.3 %...1.7 % n_{max}					Smoothing for relay contact bounce = C68, 400 mV hysteresis (as supplied), inactive for C axis: R100 = 0 Ω (as supplied) R274 = 300 kΩ, corresponds to 20 mV hysteresis					
Pot. R10	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
n_{min}=in %	0.3	0.44	0.58	0.73	0.87	1.02	1.16	1.31	1.45	1.59	1.74
$\lvert n_{act}\rvert < n_x$ pot. R43	3 %...100 % n_{max}					Relay contact bounce smoothing = C68					
Pot. R43	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
n_x=in %	3.4	13	23	34	44	54	64	74	84	94	104
$n_{set} =$ n_{set*}	Only in main spindle operation					Monitoring threshold: n_{set} – diff < 20 mV, R179 = 2 kΩ hysteresis = 10 mV, R180 = 0 Ω extension = 32 ms, C20 = 1 μF					

Functions via fixed values

Table 5-8 Settings via fixed values

Function	**Component(s)**	**Effect**
Ramp–function generator tracking	R270 = 0 Ω (as supplied) R270 = open	Tracking active Tracking inactive
Speed setpoint smoothing	C40	τ [ms] = 10 · C40 [μF]
Correction setpoint for main spindle operation (term.65 brakes to setpoint, term.24)2)	R900 + R901 = open (as supplied) R900 + 901 = 40 kΩ	No correction setpoint Correction setpoint via T.24/20
Current actual value/power display	R160 = open, R207 = 1 kΩ (as supplied) R160 = 1 kΩ, R207 = open	|M/P|–display $\lvert I_{act}\rvert$–display
C–axis/main spindle drive op. setpoint, MSD: term.56/14 setpoint, C axis: term.24/20 or fixed setpoint via term.22 or term.23	Terminal 61 = open Terminal 61 at term.9	Main spindle drive operation C–axis operation Changeover, refer to Fig. 5–3
Changeover speed, term.61	R77/78	1)

---

1) Changeover speed = $\dfrac{R77 \cdot (47000 - R78 \cdot 15)}{R77 \cdot 47\,k\Omega + R78 \cdot (R77 + 47\,k\Omega)}$ [%]

2) ⚠ **Warning:** The pulses are only canceled when the n_{off} threshold is fallen below!

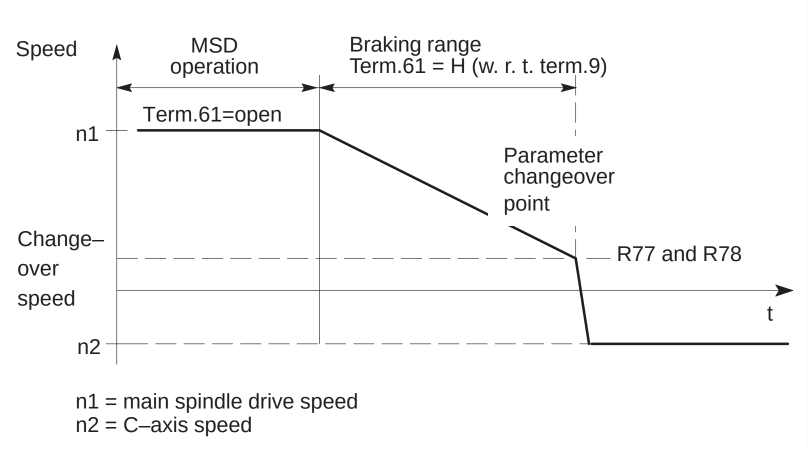


Fig. 5-3 Changeover function, terminal 61

Parameter changeover for C–axis operation

- Closed–loop control parameters, drift setting, setpoint input
- Adaptation enable
- 200 ms timer switched–in
- Several relay functions inhibited
- n_{off} shutdown inhibited

Settings in operation

Setting rule

1. Set the C–axis parameters via the parameter board (tachometer, T_N, K_P, drift).

   C–axis parameters, refer to the speed controller optimization, Section 2
2. Set the main spindle drive parameters via potentiometers on the option board front panel:

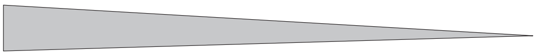
Pot. R44	**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Pot. R35=ccw	2										1
Pot. R35=cw	15										1

Fig. 5-4 Extending the integral action time using pot. R44 and the influence of pot. R35 on the parameter board, extending T_N by a specific factor

Table 5-9 Reducing the proportional gain with pot. R45 and the influence of pot. R25 on the parameter board, reduction of Kp in %

Pot. R45		**0**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Potentiometer R25	**left**	33.1	29.5	26.3	23.3	20.4	17.5	14.6	11.5	8.2	4.5	0.1
	center	90.9	89.4	87.8	85.9	83.7	81	77.5	72.4	64.4	48.7	1.5
	right	95.1	94.3	93.3	92.3	90.9	89.3	87	83.7	77.9	65	2.8

Table 5-10 Lowest speed before controller and pulse inhibit (braking to n_{off} for terminal 64/65 → pulse cancellation) via potentiometer R1

	0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
n_{off} as a % of n_{max}	0.34	0.47	0.61	0.74	0.88	1.02	1.15	1.29	1.42	1.56	1.69

Table 5-11 Drift compensation via potentiometer R96 for $n_{set} = 0$

Potentiometer R96	Control range ±30 mV

Analog outputs

Function	**Terminal**	**Boundary condition**
Speed actual value	Term.75	Non–normalized speed actual value as for test socket ”X”
Power display (utilization)	Term.162	|M/P| display (as supplied) Fig. 5–5, display-|M/P| , Table 5–6, Normalization
Current actual value	Term.162	$\|I_{act}\|$ display by changing–over components (Table 5–8, settings via fixed values)

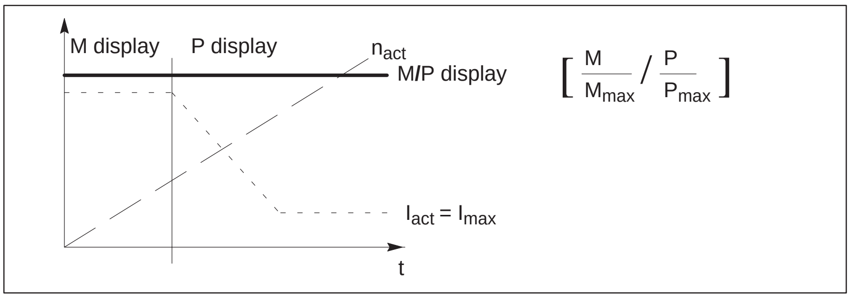
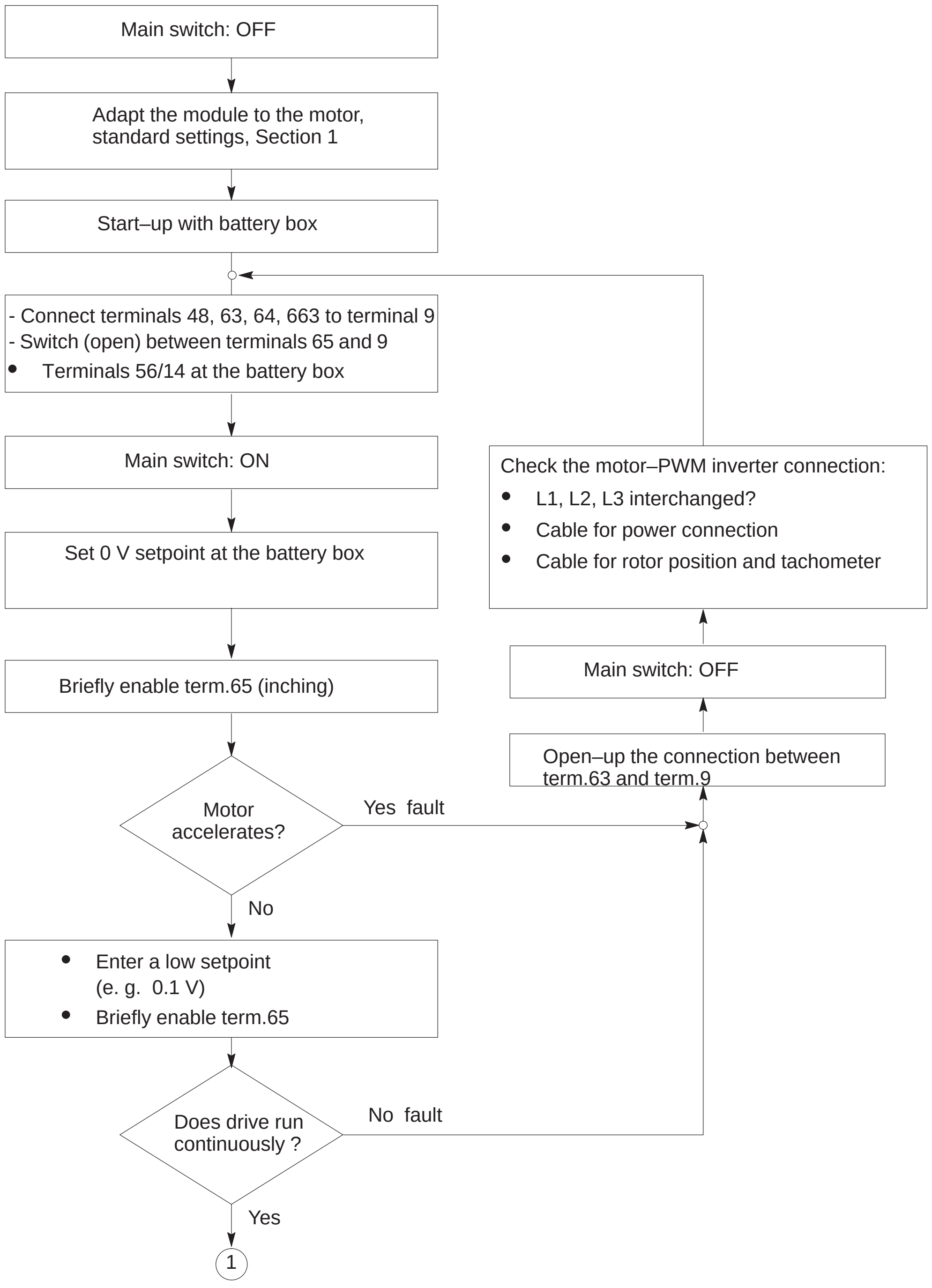
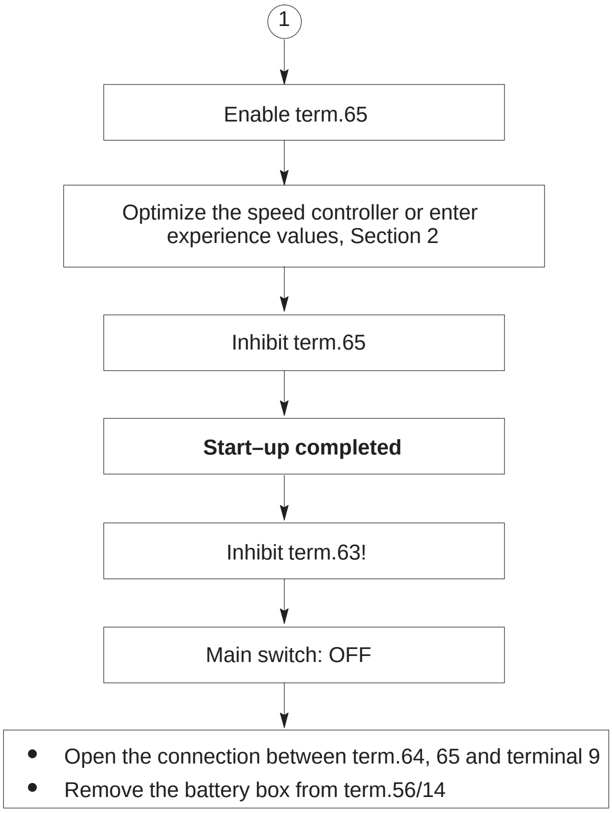


Fig. 5-5 M/P|display

Power–on


Main switch: OFF
Adapt the module to the motor, standard settings, Section 1
Start–up with battery box
- Connect terminals 48, 63, 64, 663 to terminal 9
- Switch (open) between terminals 65 and 9
• Terminals 56/14 at the battery box
Main switch: ON
Set 0 V setpoint at the battery box
Briefly enable term.65 (inching)
Motor accelerates?
Yes fault
No
• Enter a low setpoint (e. g. 0.1 V)
• Briefly enable term.65
Does drive run continuously ?
No fault
Yes
1
Open–up the connection between term.63 and term.9
Main switch: OFF
Check the motor–PWM inverter connection:
• L1, L2, L3 interchanged?
• Cable for power connection
• Cable for rotor position and tachometer

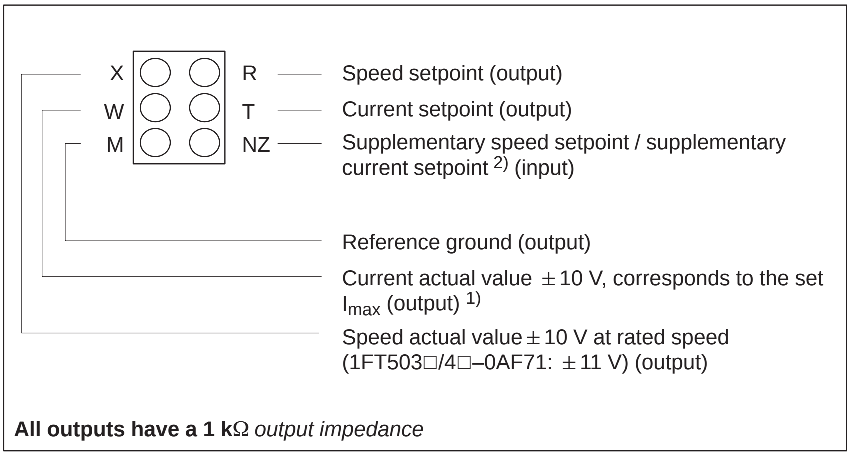

1
Enable term.65
Optimize the speed controller or enter experience values, Section 2
Inhibit term.65
Start–up completed
Inhibit term.63!
Main switch: OFF
• Open the connection between term.64, 65 and terminal 9
• Remove the battery box from term.56/14

Maintenance and diagnostics

Test sockets and display elements of the feed modules

User–friendly interface

Test sockets



All outputs have a 1 kΩ *output impedance*

Fig. 8-1

Operating display

						
Par. board inserted	No	Yes	Yes	Yes	Yes	Yes
Pulse enable 663	–	No	No	Yes	Yes	Yes
Controller enable 65	–	No	Yes	No	Yes	Yes
Current–controlled	No	No	No	No	No	Yes

▨ Speed–controlled operation (standard operation)

---

[1] Setting value I_{max} refer to p. 1-84, "Current actual value normalization".
[2] Depending on the operating mode, speed–/current controlled

Fault display

Fault	1	2	3	4	5	6	7	F
I^2t monitoring or heatsink temperature overtemp.	X				X			
Rot. pos. encoder		X						
Speed controller at its limit					X	X	X	
Tachometer monitoring				X				
$I_{act} = 0$							X	
Motor overtemp.			X					
5 V undervoltage (5 V faulted)								X
Effect:	Current limiting	Pulse cancel.		Pulse cancel.	Pulse cancel.	Pulse cancel.	Pulse cancel.	Pulse cancellation
Signal, NE:	Term. 5.x	–	Term. 5.x	–	–	–	–	–
Message FD:	T.291	T.297+ T.672/ T.674	T.5.x T.294	T.297+ T.672/ T.674	T.672/ T.674	T.288+ T.672/ T.674	T.288+ T.672/ T.674	T.672/ T.674[1]

Sequence when the temperature– or I^2t monitoring responds

- **I^2t monitoring:**
  - an alarm is issued at terminal 5.x of the NE module (non–latching) a minimum of 250 ms before limiting is activated
  - when limiting is activated, fault 1 is displayed and a signal is output at terminal 291 (latching)
- **Heatsink temperature rise monitoring:**
  - an alarm is issued at terminal 5.x of the NE module when the heatsink shutdown temperature is reached (non–latching)
  - the pulses are inhibited, fault 1 is displayed and a signal is output at terminal 291 + terminal 672/terminal 674 after typically 4 s (latching)

Motor overtemperature

SIMODRIVE 611 feed modules with closed–loop control for 1FT5 servomotors are equipped with an evaluation circuit for the PTC thermistors integrated in the motor windings.

The motors are protected from inadmissible high winding temperatures with the monitoring combination (tripping temperature 150 °C).

As the drive shouldn't unpredictably intervene in the machining process, the trip is only signaled to the SIMODRIVE 611 via individual fault signal terminal 289/294/296 (latching) or centrally via terminals 5.1, 5.2 and 5.3 of the infeed module (latching) when the response temperature is reached (the drive is not shutdown).

There is no internal system response to protect the motor. The user must ensure that the motor can thermally recover after the signal has been issued, by appropriately configuring the adaptation control. In this case, it may be required to immediately shutdown the motor.

---

1) Depending on the mode (ready/fault signal)

Continued: Motor overtemperature

A delay time is not permissible.

If the motor is not thermally monitored, when an overload situation occurs or if the drive converter was over dimensioned, the complete drive could be destroyed.

Standard interface

Test sockets and fault displays

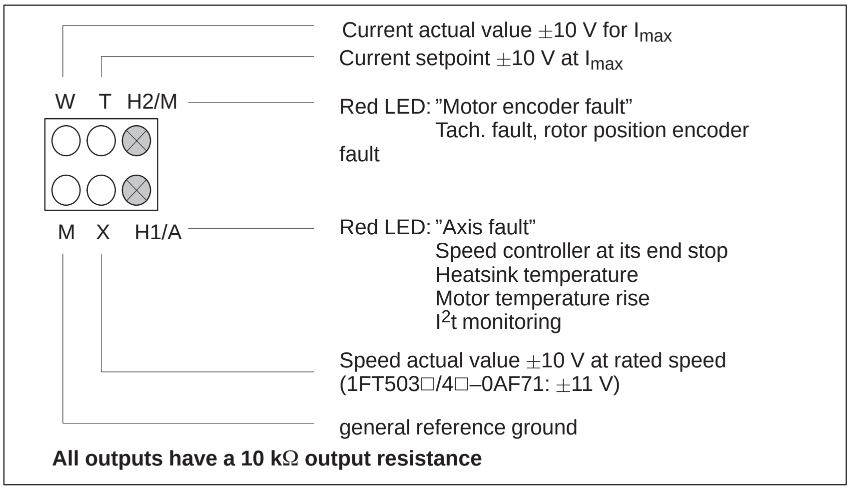


Fig. 8-2

Sequence when the temperature– or I^2t monitoring responds

- **I^2t–monitoring**
  - min. 250 ms before limiting starts, an alarm is issued at terminal 5.x of the NE module (non–latching)
  - fault display H1 is output when limiting starts.
- **Heatsink temperature monitoring:**
  - an alarm is issued at terminal 5.x of the NE module when the heatsink shutdown temperature is reached (non–latching)
  - the pulses are inhibited, fault H1 is displayed and a signal is issued at terminal 72/terminal 73/terminal 74 of the NE module after typically 4 s (latching)

Motor overtemperature

SIMODRIVE 611 feed modules with closed–loop control for 1FT5 servomotors are equipped with an evaluation circuit for the PTC thermistors integrated in the motor windings.

The motors are protected from inadmissible high winding temperatures with the monitoring combination (tripping temperature 150 °C).

As the drive shouldn't unpredictably intervene in the machining process, the trip is only signaled to the SIMODRIVE 611 or centrally via terminals 5.1, 5.2 and 5.3 of the infeed module (latching) as signal when the response temperature is reached (the drive is not shutdown).

There is no internal system response to protect the motor. The user must ensure that the motor can thermally recover after the signal has been issued, by appropriately configuring the adaptation control. In this case, it may be required to immediately shutdown the motor.

A delay time is not permissible.

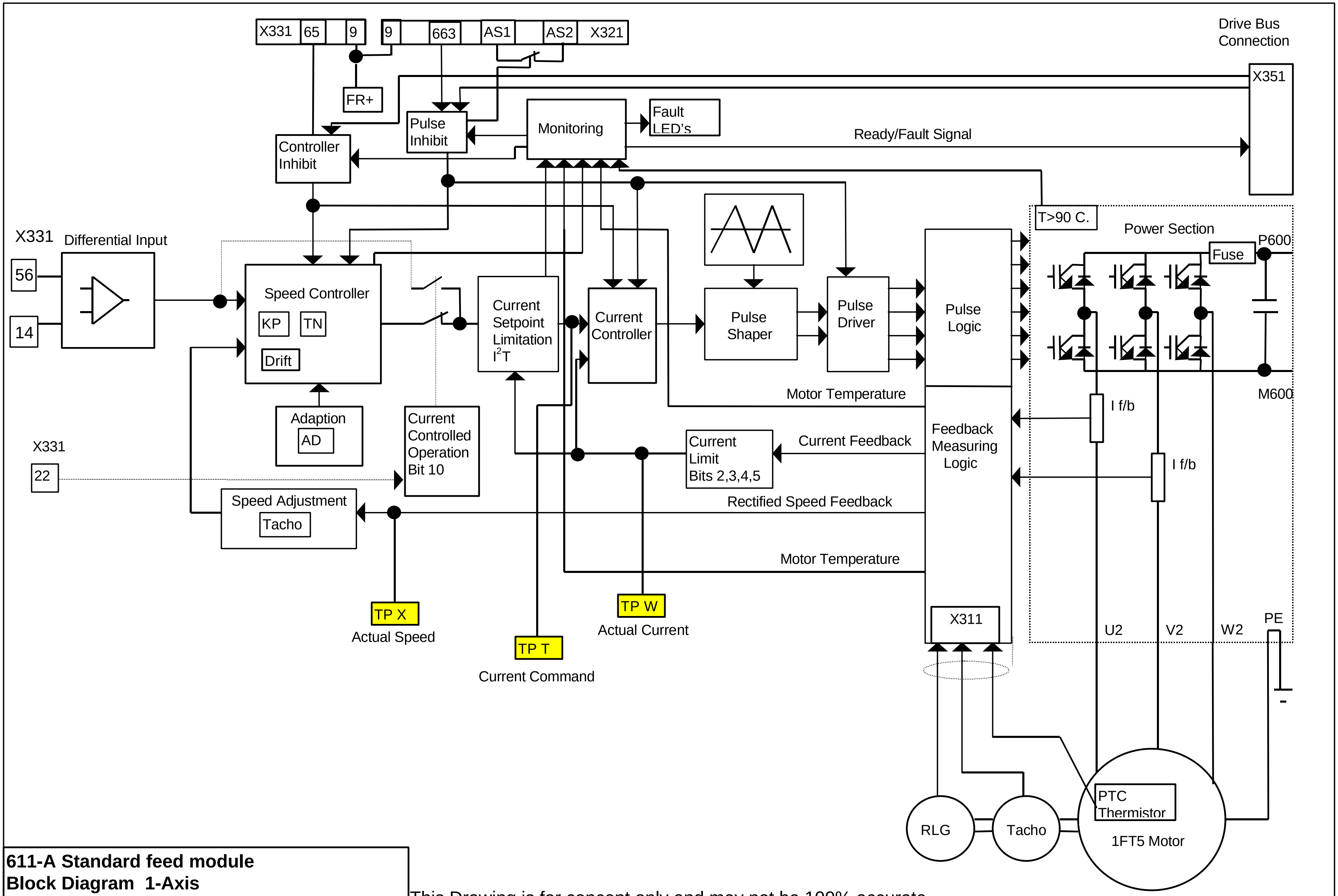
If the motor is not thermally monitored, when an overload situation occurs or if the drive converter was over dimensioned, the complete drive could be destroyed.

Troubleshooting

Table 8-1 Troubleshooting

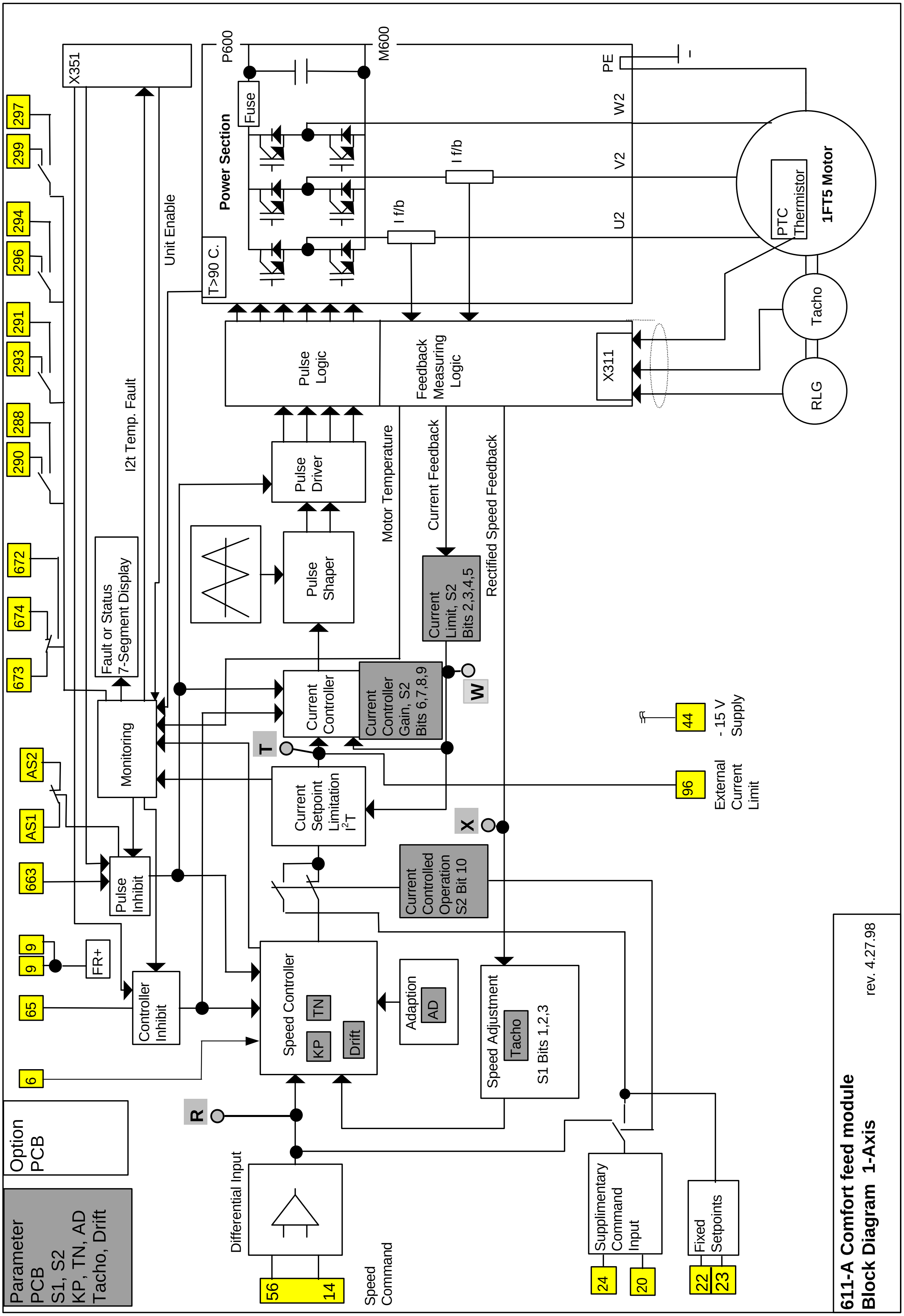
Fault, user–friendly interface	Fault, standard interface	Possible fault cause
1	H1	RMS torque too high? ambient temp. > 40 °C?
2	H2	Actual value cable and shield correctly connected? Motor encoder defective?
3	H1	Motor overloaded, RMS torque too high?
4	H2	Refer to F2
5	H1	Axis mechanically locked? RMS torque too high?
6	H1	Motor incorrectly connected? External moment of inertia too high? RMS to high (mechanically locked)?
7	–	Motor feeder interrupted, motor feeder, short–circuit/ground fault (Vce monitoring stored up to POWER–ON)? Fault cannot be removed → replace module
F	–	5V level faulted → replace module

■



611-A Standard feed module
Block Diagram 1-Axis

This Drawing is for concept only and may not be 100% accurate



611-A Comfort feed module
Block Diagram 1-Axis

rev. 4.27.98

9.3 Block diagram, parameter board

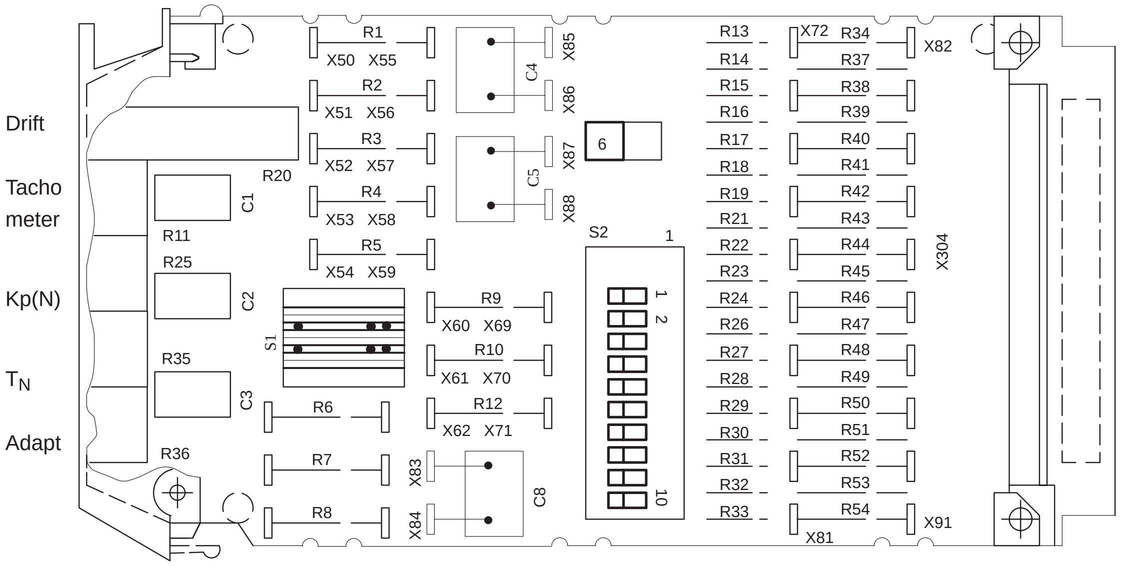
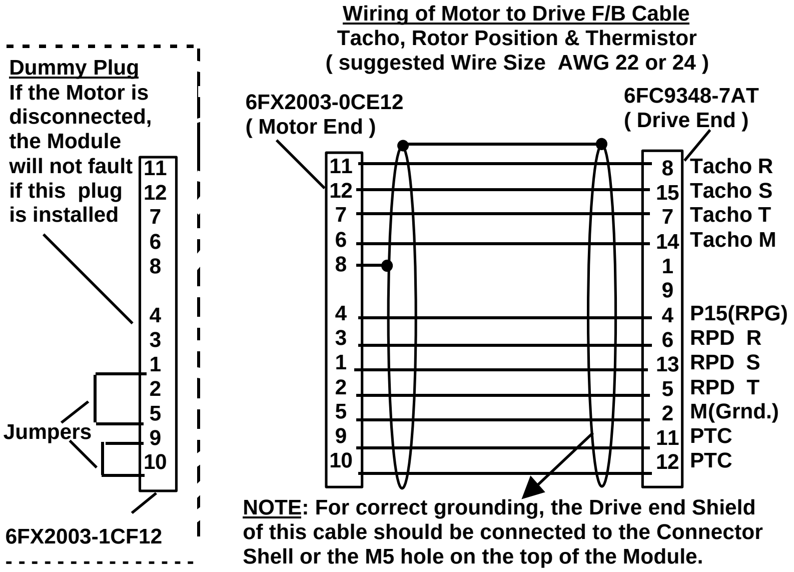


Fig. 9-2 Block diagram, parameter board

Motor to Drive connections

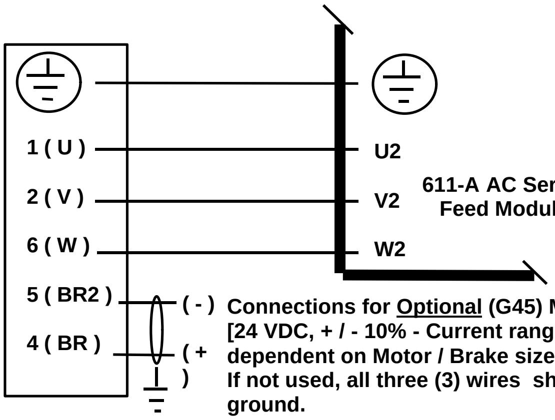
Connector assignment X311 and X313 (2^{nd} Axis)



NOTE: For correct grounding, the Drive end Shield of this cable should be connected to the Connector Shell or the M5 hole on the top of the Module.

Connection of Power Leads – Drive to Motor

Wiring of Motor to Drive Power Cable
(Wire size dependent on Motor Type)



Connections for Optional (G45) Motor Mounted Brake [24 VDC, + / - 10% - Current range 0.4 to 3.25 Amps dependent on Motor / Brake size].
If not used, all three (3) wires should be connected to ground.

NOTE: Motor to Drive connections must be exactly as shown !

Important circuit information

Warning

Terminal 63 (pulse enable) and/or terminal 48 (start terminal, contactor control) must be de–energized before the system is powered–up or down using the main switch or a line contactor!

Warning

If the NE is connected up using a 6–conductor connection (the supply connection for the electronics power supply is separate from that of the power connection), then the jumper, included as standard, in connector X181 must be removed.

- Electrical isolation of the line supply from the power circuit of the drive group via terminals NS1, NS2.

The coil circuit to reliably de–energize the line contactor when an error condition occurs, can be isolated via terminals NS1, NS2.

The terminals must always be jumpered in operation! The DC link will not be pre–charged if the connection is missing when the unit is powered–up.

The NS1, NS2 connection may only be switched when terminal 48 is opened (or simultaneously with terminal 48).

Warning

If the power supply is supplied through P500, M500 at connector X181, a 6–conductor connection (electronic power supply connection before the HF commutating reactor) is not permissible.

	Electronics power supply connection X181	Component	Comments
Connection	2U1—2W1	1U1—1W1 Supply L1 to L3	Not permissible
Possibility to connect–up the electronics power supply	2U1—2W1	1U2—1W2 NE module	Connect–up

---

Note

Axis–specific controller enable terminal 65:
Axis–specific function as for terminal 64 (refer to drive enable, terminal 64)

Axis–specific pulse enable terminal 663:
The start inhibit relay is switched using terminal 663; when it opens, the gating pulses are inhibited, and the motor is switched into a torque–free condition.

Start terminal 48:
This terminal has the highest priority. A defined power–up and power–down sequence is initiated via terminal 48. If terminal 48 is used, terminal 63 and terminal 64 can be directly connected to terminal 9.

If terminal 48 is energized, then the pre–charging sequence is internally initiated. After the DC link has been charged–up, the pre–charging contactor is opened and the main contactor pulls–in. The internal enable signals are then output. If terminal 48 is inhibited, initially, the internal pulse enable signals are inhibited, and then the DC link is electrically isolated from the line supply by opening the internal line contactor.

If terminal 48 is inhibited (de–energized) during charging, the charging is first completed, and terminal 48 is only inhibited after the charging has been completed.

Pulse enable terminal 63:
This terminal has the highest priority for pulse inhibit and enable. The power modules of all the drives are enabled via this terminal. The enable and inhibit signals are instantaneous and act simultaneously on all of the modules including the NE modules. The drives coast down, unbraked if the signal is withdrawn.

Drive enable terminal 64:
The drive modules are enabled using terminal 64. The enable signal acts instantaneously and simultaneously on all modules.

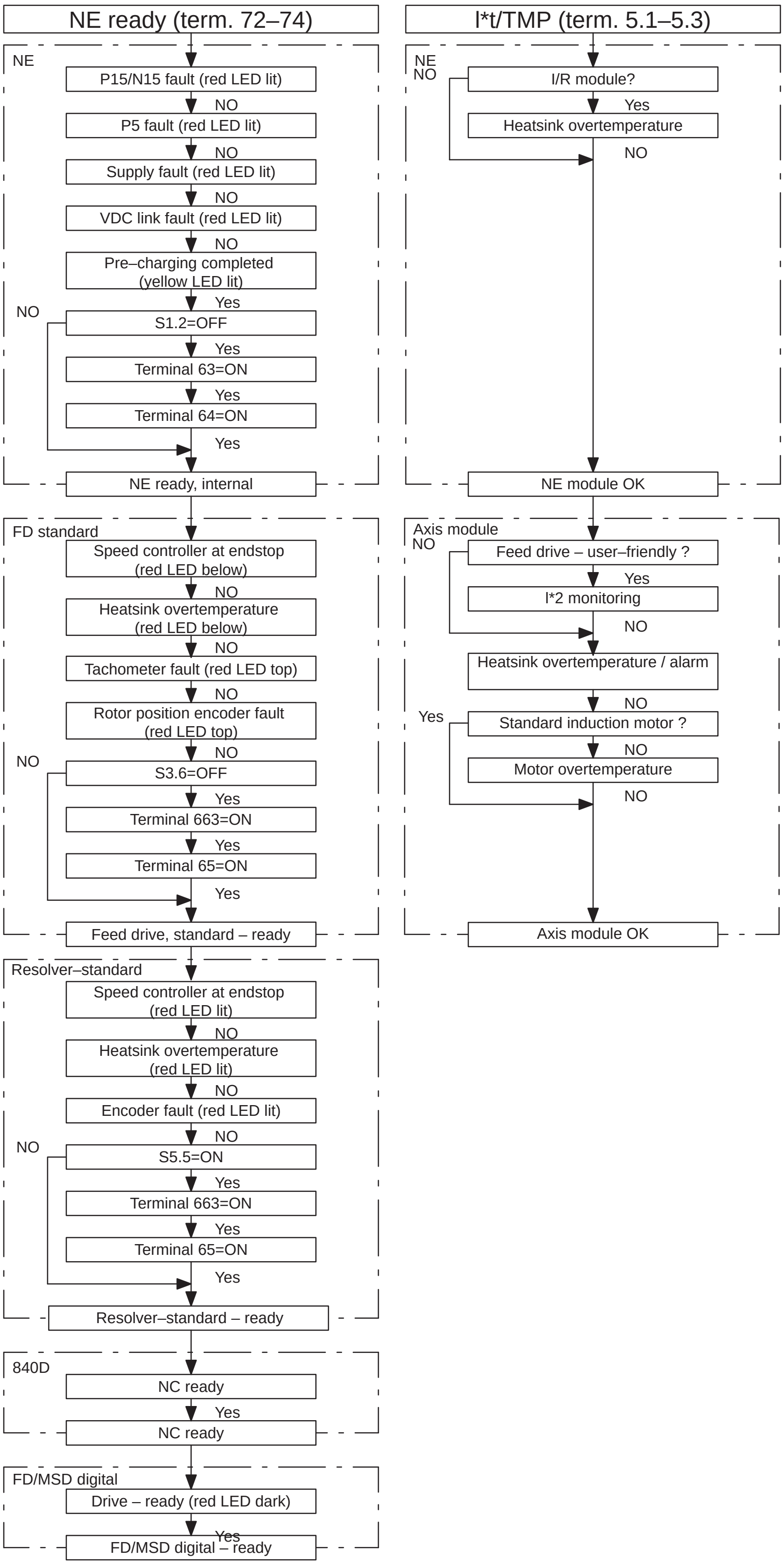
If terminal 64 is de–energized, $n_{set}=0$ is set for all drives and the drives brake as follows.

- For MSD/IMM 611A, the pulses are canceled after an adjustable speed has been fallen below. The drive brakes along a selected ramp.
- For FD 611A, after the ar set timers have expired (as supplied: 240 ms) all of the controllers and pulses are inhibited. The drives brake along the current limit.
- For 611 D drives, the pulses are only canceled after an adjustable speed has been fallen below, or after an adjustable timer has expired. The drives brake along the set limits.

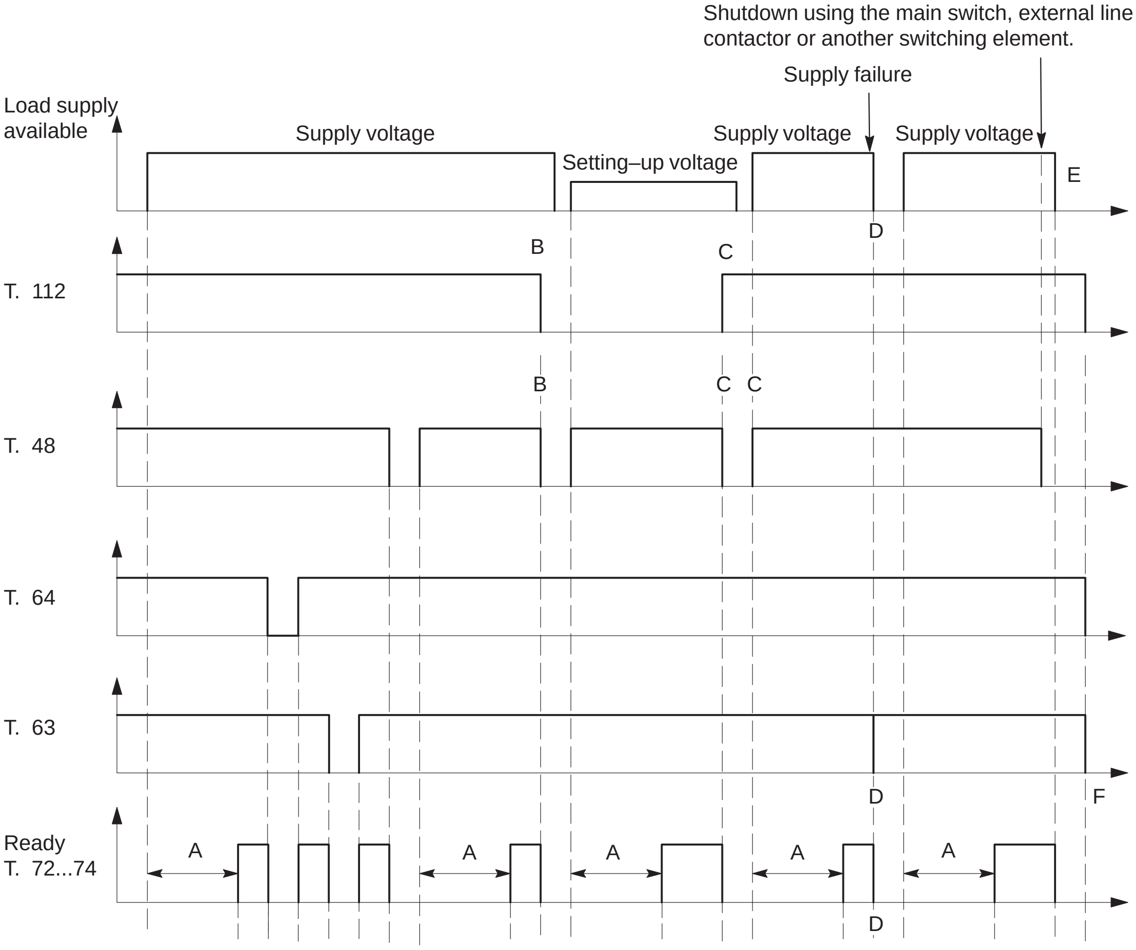
Note

The pulse inhibit via terminal 663, for Order Nos. 6SN1118–0AA11–0AA0, 6SN1118–0AD11–0AA0 and 6SN1118–0AE11–0AA0 (old feed drive Order Nos.) only becomes active after the relay drops–out (40 ms after being actuated). For Order Nos. 6SN1118–0AA11–0AA1, 6SN1118–0AD11–0AA1 and 6SN1118–0AE11–0AA1 (new feed drive Order Nos.), the pulse inhibit becomes effective after max. 1 ms.
These times must be observed when using armature short–circuit contactors or contactors in the motor feeder cable.

Timing diagram, central signals/messages to the NE module



Timing diagram for ready signal in the NE module



A The ready relay can only pull–in, if charging has been completed and the internal line contactor has pulled–in.

B When changing–over from normal operation, terminal 112 energized, into setting–up operation, terminal 112 de–energized, terminal 48 must also be de–energized, either earlier or at the same time. After the internal line contactor has dropped–out, the setting–up voltage can be connected to the power circuit terminals.
Setting–up voltage 34 V...600 V DC or 3–ph. 24 V...3–ph. 420 V AC (refer to Section 9.5).
For setting–up operation, the DC link control in the I/R module is inhibited. The DC link voltage obtained, is the rectified line input voltage; regenerative feedback is not possible ($V_{DC\ link}$ can exceed to over 600 V when braking!).

C When changing–over from setting–up operation, terminal 112 de–energized, in normal operation, terminal 112 energized, terminal 48 must also be de–energized either earlier, or at the same time. After the int. line contactor has dropped–out, the line voltage can be re–connected. Line supply volt., refer to p. 1-62 ~ 1-70 (Technical Data, NE module).

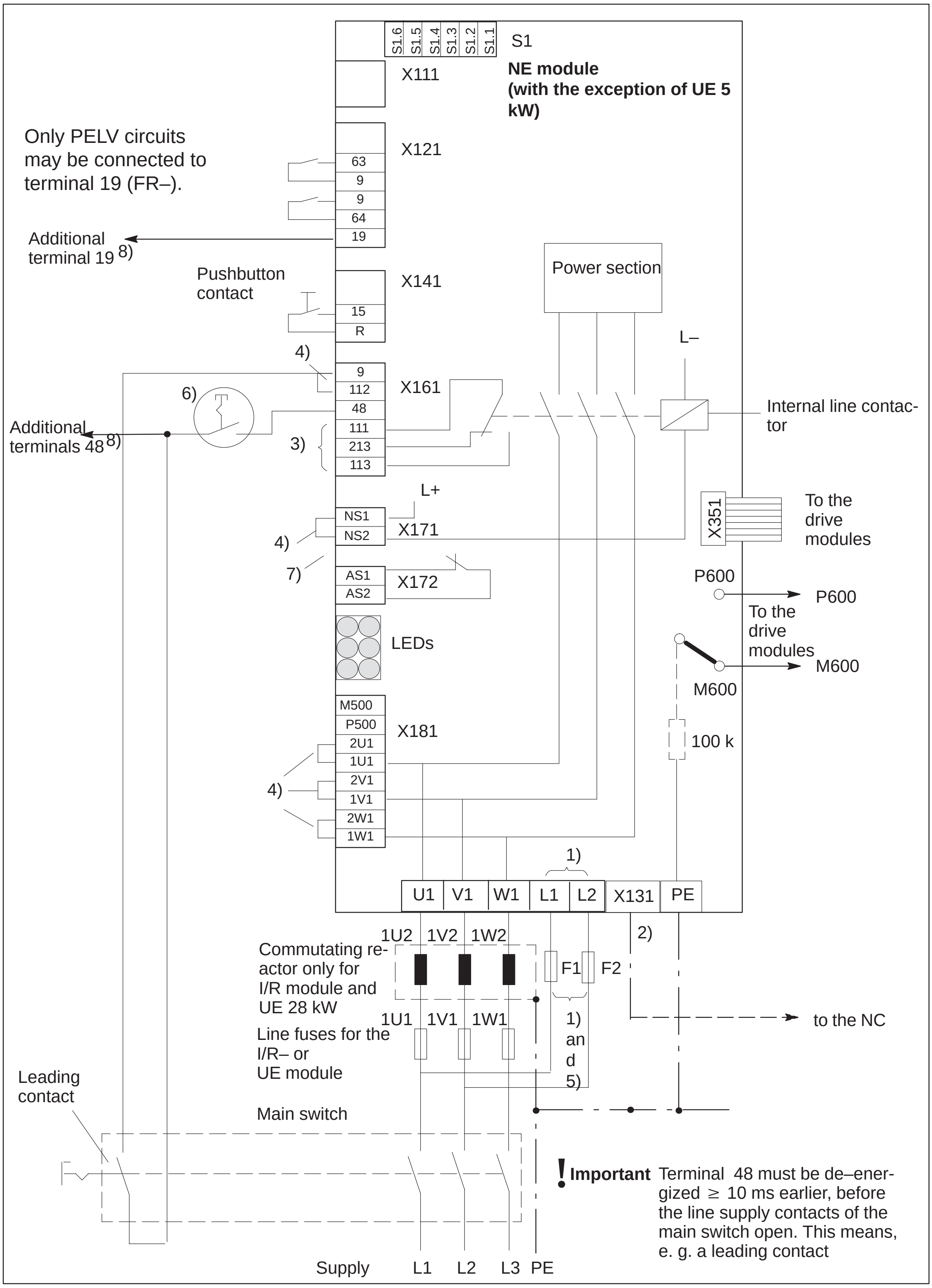
D The I/R module is internally inhibited when the line supply fails. This means that the infeed/regenerative feedback module can no longer regulate the DC link voltage, and regenerative power can no longer be fed back into the supply. The drives are not inhibited. However, the ready relay drops–out, after the supply failure identification time, $t_{N\ OFF}$, approx. 30 ms.

Caution!

E When shutting down the load supply using a main switch or an external line contactor, or using any other switching elements, it must be ensured, that terminal 48 on the NE module is de–energized at least 10 ms prior to this switching operation. This can be achieved, e. g. using a main switch with leading contact or interlocking circuits for the external line contactor or switching element.

F If the DC link voltage falls below 290 V, then all of the modules are inhibited (the drives coast down) and the internal line contactor drops–out.

Three–conductor connection (standard circuit)



! Important Terminal 48 must be de–energized ≥ 10 ms earlier, before the line supply contacts of the main switch open. This means, e. g. a leading contact

Figure 9-1

1. Terminals L1, L2 are only available for the 80/104 kW and 120/156 kW I/R modules.

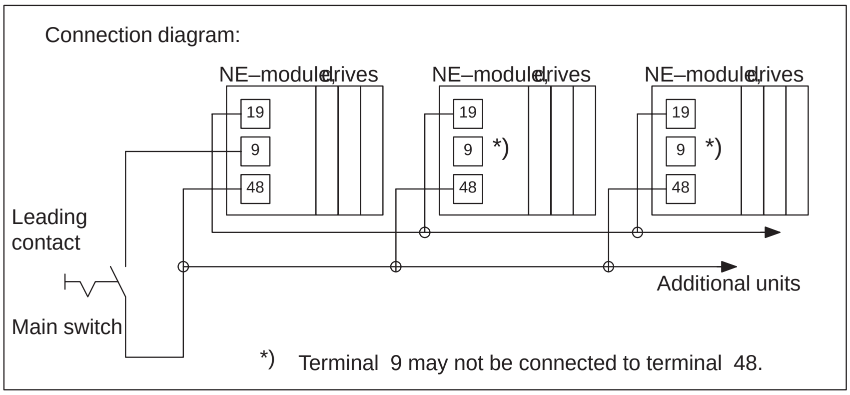
   In this case, $I_{n\ fuse}$ must be $\geq$4 A. Version: gL.
2. For a coupling to a numerical control, X131 must be connected with the NC reference potential. This cable is routed in parallel to the speed setpoint cable. For a digital drive group with 840C/840D, leave terminal X131 open–circuit.
3. Signaling contact, of the internal line contactor
   Terminals 111/113 NO contact
   Terminals 111/213 NC contacts
   Terminals 111/213 positively driven to the load contacts,
   refer to NE modules
4. Jumpers inserted in the equipment when supplied

Caution

5. For the 80/104kW or 120/156kW I/R modules, if the line voltage at terminal L1, L2 fails, or fuses F1, F2 rupture, then the I/R module pulses are inhibited, and the internal line contactor drops–out. This is indicated by the supply fault LED, the ready relay and via the contactor signaling contacts. In this case, to re–close the internal line contactor, terminal 48 must be de–energized, and after $\geq$ 1 sec. re–energized or the drive must be powered–down/powered–up.
6. If an 80/104kW or 120/156kW I/R module is used, jumper terminal 9/48 must be removed, and a switch used (due to Point 5). The switch is not required if the drive converter is powered–down and up again using the main switch (supply).

---

7. Max. cable length for 1.5 mm^2 cross–section: 50 m (2–wire cable)
   This should be linearly decreased for lower cross–sections.
8. A maximum of 6 x terminals 48 may be connected in parallel, to shutdown max. 6 NE modules using a leading contact of the main switch.
   Max. cable length for 1.5 mm^2 cross–section: 150 m (2–conductor cable).
   Linearly reduced for lower cross–sections.



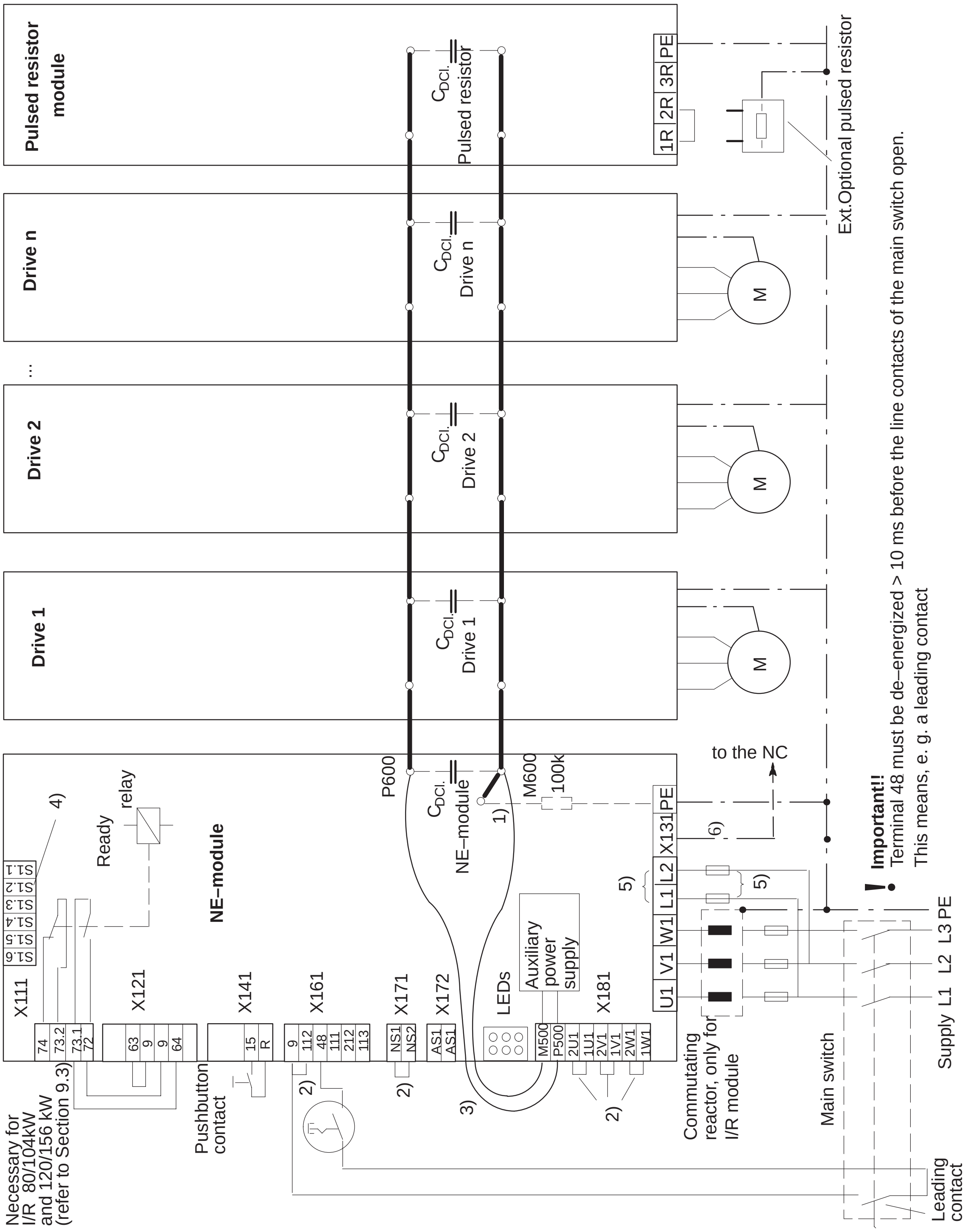
*) Terminal 9 may not be connected to terminal 48.

Figure 9-2

If more than 6 NE modules are to be connected to a main switch, then an external 24V supply must be provided. Current drain terminal 48=35 mA; the minimum input voltage of terminal 48 must be observed (13 V). Additional loads connected to the external 24 V power supply must be provided with an overvoltage limiting circuit
(e.g. free–wheeling diode).

Supply failure buffering/retraction concept for 3–conductor connection

If the power supply is fed through P500, M500 at connector X181, it is not permissible to use a 6–conductor connection (electronics power supply connected before the HF commutating reactor).



Important!! Terminal 48 must be de–energized > 10 ms before the line contacts of the main switch open. This means, e. g. a leading contact

Figure 9-3

1) We recommend that the DC link is connected to ground through the internal resistor.
2) Jumpers are inserted as standard
3) Connect the electronics power supply to the DC link in order that the electronics power supply can be maintained even after a power failure. 2x1.5 mm^2 cable, routed short–circuit proof.
4) If terminal 72 and terminal 73.1 are looped into terminal 9 and terminal 64, then S1.2 must be switched to ON = fault signal, and then the ready signal (terminal 72, 73.1, 73.2 and 74) is independent of terminal and 63 and terminal 64.
5) Terminals L1, L2 are only provided for the following I/R modules: 80/104 kW and 120/156 kW. In this case, $I_{Nfuse\ must\ be} \geq 4$ A.
   Version: gL.
   If L1, L2 go into a no–voltage condition, when the line contactor drops–out, the drive pulses are canceled (terminal 48). In this case, L_1 and L_2 can still be supplied using an uninterruptable power supply (UPS).
   $I_{N\ fuse}$ is defined by the maximum conductor cross–section.
6) For a coupling to a numerical control, connect X131 to the NC reference potential. This cable is routed in parallel to the speed setpoint cable. For a digital drive group with 840C/840D, leave the terminal open–circuit.
   Do not connect for a digital drive group, with 840C.

Monitoring module

If a monitoring module is integrated in the system, terminal 63 on the monitoring module must be looped through via the ready–relay terminal 72 – terminal 73.1 (NO contact) of the NE module.

The ready relay of the NE module must be set to ready (S1.2 OFF setting).

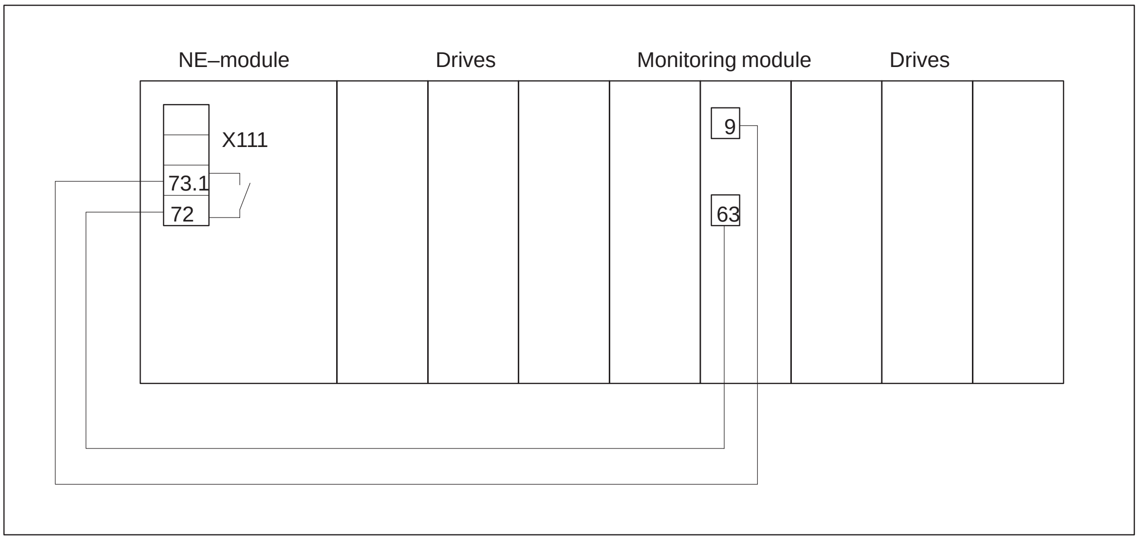


Figure 9-4 Connecting diagram

Supply failure buffering/retraction concept

Procedure

Set switch S1.2 in the NE module (if available, also in the monitoring module) to ON = fault signal (the ready relay is then independent of terminal 63 and terminal 64). If the ready relay drops–out when the power fails, a zero setpoint is entered via terminal 64, and the drives can be braked down to standstill. In this case, the auxiliary power supply, terminal P500 and terminal M500 of connector X181 must be connected to the DC link terminals P600 and M600 of the NE module. The electronics power supply for the control is maintained as long as the auxiliary power supply can be maintained.

When an I/R module is used, an additional pulsed resistor module must be installed in the drive group (if required, an external pulsed resistor), in order to convert the braking energy of the drives into heat (a far higher level of braking energy can be converted into heat using an external pulsed resistor).

When using an UE module, the internal pulsed resistor can also be used and it still remains active even when the power fails. If the internal braking resistor is not adequate (braking energy too high), then an additional pulsed resistor module must also be used.

Dimensioning and engineering the pulsed resistor module and the external pulsed resistor, refer to Section 3.2.

The energy stored in the DC link which can be used is limited. At the supply failure instant:

- for I/R modules: $E_{\text{DC link contents}} = 130 \cdot \Sigma C_{\text{DC link}} - 14$
- for UE modules: $E_{\text{DC link contents}} = 70 \cdot \Sigma C_{\text{DC link}} - 14$

$E_{\text{DC link contents}}$ in Ws, $C_{\text{DC link}}$ in mF,

$\Sigma C_{\text{DC link}}$ = sum of all the DC link capacitances in the system

Refer to Catalog NC 60.1

A line failure identification time of $t_{\text{N OFF}}$ of approx. 30 ms expires before the ready relay indicates that the line supply has completely failed.

The supply is missing in this 30 ms. However, the drives could be in a load duty cycle, by withdrawing power from the DC link. The maximum power drawn during the unfavorable load duty cycle must be specified for this withdrawn power.

The following is valid: $P_{\text{max drawn}}$ [W] $\cdot$ 0.03 s < $E_{\text{DC link}}$.

If this condition is not fulfilled by the time it has been identified that the supply has failed, the DC link voltage may have fallen to < 290 V. At this voltage, the pulse enable of the drive is withdrawn, and the drives coast down.

!

Important

In order that the drive brakes controlled and the contour is still maintained down to standstill, terminal 48 and terminal 63 must be kept energized until the drives come to a standstill.

Start inhibit in the drive modules

!

Important

The functions ”safety stop” and ”setting–up operation” are not safety functions in the sense of the Machinery Directive 89/392/EEC. They only support the measures which have to be untertaken by the user himself.

Using the start inhibit

The ”start inhibit” function is provided in the SIMODRIVE 611 drive modules.

The start inhibit function prevents a feed–, main spindle– or induction motor drive unexpectedly starting from standstill. This circuit macro can be used in the ”safe standstill” machine function. The external machine control must have initiated and guaranteed that the machine has come to a complete standstill beforehand. The power feed from the converter to the motor is interrupted with the start inhibit (motor rotation). This is based on the Draft IEC 204 No. 44/184/CDV from 15.06.95.

The remaining risk, is in this case, if two errors/faults occur simultaneously in the power section; the motor rotates (jolts) through a small angle (1 FT motors: 4 pole 90°, 6 pole 60 °, 8–pole 45 °; induction motors: in the vicinity of the remanence, max. 1 slot pitch, which approximately corresponds to 5 ° 15 °.

Electrical isolation is not provided by the start inhibit function, and it does not provide protection against ”electric shock”.

The complete machine must always be electrically isolated from the line supply through the main switch if any work is to be carried–out on the machine or system, e.g. maintenance service or cleaning work (EN 60204/5.3).

The start inhibit function, when correctly used, must be looped–in in the line contactor circuit or emergency off circuit with the positively–driven signaling contact AS1/AS2. The associated drive must be electrically isolated from the supply if the start inhibit relay function is not plausible, referred to the machine operating mode; e.g. via the line contactor in the infeed module. The start inhibit and the associated operating mode may only be used again after the fault has been removed.

As a result of a hazard analysis/risk analysis which must be executed according to the Machinery Directive 89/392/EEC and EN 292;
pr EN 954; and pr EN 1050, the machine manufacturer must configure the safety circuit for the complete machine taking into account all of the integrated components for his machine types and version of them. This also includes the electric drives.

Mode of operation of the start inhibit

The inverter power section controls the current through the individual motor windings. 1FT5 motors are fed with square–wave currents and 1FT6– and induction motors with sinusoidal currents.

A pulse generating logic clocks the 6 power transistors in a three–phase oriented pulse pattern. An optocoupler is provided in every transistor arm between the gating logic and the power section gating amplifier. These optocouplers provide the electrical isolation.

The start inhibit acts, for each module. A positively–driven relay (permitted according to ZH1/457 to TÜV) acts on the inverter gating on the particular drive module at the input circuits of the optocouplers. A relay contact interrupts the power supply for the optocoupler inputs. Thus, no signals can be transferred through the optocoupler. The pulse generating logic is inhibited through an additional electrically isolated arm. These two active circuits are controlled in parallel from the machine control via terminal 663 (motor start inhibit) for the drive modules, or via terminal 112 (step–up controller, start inhibit) for the supply infeed modules. The status of the relay contact, located in the pulse power supply circuit, is signaled to the external adaptation circuit via a positively–driven NC contact. The signaling contact is accessible at module terminals AS1 and AS2, and the user can interlock it with the safety control. When the start inhibit fails, these start–inhibit signaling contacts must isolate the supply infeed from the supply via the power contactor (line contactor in the supply module).

If the start inhibit circuit is activated, it is no longer possible to control the power transistors in a rotating field orientation. If two power transistors are destroyed (short–circuit) in the most unfavorable constellation, then this results in residual risk .

Note

When the start inhibit is activated, the motor can no longer generate a torque. Drives which do not automatically lock when powered–down (e.g. hanging axes), must be clamped using a mechanical brake.

Note

When a fault condition develops, linear motors can continue to rotate through 180^0 electrical (approx. 56 or 72 mm incl. overshoot) .

Connecting the start inhibit

The start inhibit is controlled in the drive modules via terminal 663, and in the controlled infeed modules, via terminal 112. The start inhibit relay is controlled using the internal/external enable voltage 24 V (enable signal +terminal 9; enable signal –terminal 19). When the relay has dropped–out (terminal 663 open), the start inhibit relay activates the start inhibit function.

Terminal 663 (drive) and 112 (NE) must be energized using a fail–safe signal.

AS1/AS2 closed, means that the ”start inhibit is effective”.
Terminals AS1 and AS2 signal, floating, the start inhibit status.

Warning

The start inhibit relay has maximum pull–in– and drop–out delay times of max. 40 ms. External wiring must be connected to the terminals AS1/AS2 so that it is short–circuit proof and cross–circuit proof.

When using the internal power contactor (e. g. in the infeed module) the cable connection between the connecting terminals and the power contactor must be direct, but reliably electrically isolated from the electronics, to ensure that there is no feedback.

Use, mode of operation and connection of the line contactor

The infeed modules have a standard line contactor, integrated in the module itself. These contactors are dimensioned to be able to conduct and disconnect the maximum permissible peak current of the infeed module. The line contactors are electronically controlled via terminal 48. For safe, reliable electrical isolation, the coil power supply must be interrupted in the direct line contactor coil circuit, accessible externally (via terminals NS1 and NS2) using electro–mechanical switching elements. Thus, the influence of the electronic control has no effect when the unit is disconnected with electrical isolation. The line contactor must always be de–energized via terminal 48 before or at the same time that the NS1/NS2 connection is interrupted.

When the line contactor is opened, there is still residual energy in the DC link which must be taken into account in the risk evaluation.

Use and mode of operation of setting–up operation

The controlled infeed modules (I/R modules) have, in the control to the step–up controller–/regenerative feedback power section, a step–up controller start inhibit. This operates in the same fashion as the drive start inhibit (refer to Sections pp. 1-143, 1-144). When selected via terminal 112, the diode converter is exclusively effective in a B6 circuit configuration. The DC link voltage is proportional to the voltage connected at terminals U1, V1 W1.

Corresponding to the reduced infeed voltages through the transformer, lower DC link voltages are obtained, which in turn influence the maximum possible motor terminal voltage.

Based on the DC link voltage reduction, setting–up operation can only be implemented using 1FT5 motors and square–wave current control.

A risk evaluation must ensure, that no inadmissibly high motor speeds are possible in the setting–up mode due to energy fed back from parallel drives into the DC link. In this case, for example, vertical drives without self–locking mechanical system have to be investigated, which, when a fault occurs, could increase the DC link voltage above the permissible setting–up voltage as a result of the regenerative operation if the axis for instance was too fall. When the setting–up mode is selected, if there is a connection between P500/M500 to the power DC link P600/M600, then this must be reliably interrupted through contacts (refer to below section, "Sequence and Procedure..."). The comments on p. 1-148 must be observed when engineering the system.

Sequence and procedure when using the start inhibit

- The drives must be shutdown before terminal 663 is energized, which initiates the start inhibit.
- The speed setpoint input can be externally disconnected and zero speed setpoint input entered as an additional safety function.
- If a fault condition occurs, all drives, machine, system, must be shutdown and disconnected.
- In order that the power DC link is reliably isolated from the supply, it should be ensured that all connections in parallel to the power infeed are electrically isolated through switching contacts. In this case, if necessary, the possible user–specific external connection between the electronics power supply and power DC link must be taken into account. In order to shut down the drive in a controlled fashion when the power fails, utilizing the energy stored in the DC link, a connection can be established, for instance, between terminals P500/M500 and P600/M600.
- This connection between the electronics power supply and the power DC link must be safely and reliably isolated and remain isolated as otherwise the power DC link could be charged–up through the auxiliary DC link of the electronics power supply. The connection between the power supply and the power DC link is not permissible in the setting–up mode.
- When using a monitoring module which is connected to the power DC link via P500/M500 and is also connected to the line, when the line contactor is opened, either the connection between the line and the monitoring module or the connection between P500/M500 and the power DC link must be disconnected reliably and safely via contacts.

- If a fault occurs when the start inhibit is activated, then this fault must be removed, before the protective devices of the machine or system are moved aside (i.e. personnel enter the hazardous zone). After the fault has been removed, the start inhibit sequence must be repeated to ensure it is functioning correctly.
- Setting–up operation may only be executed by qualified specialist personnel with the safety devices, provided by the machine manufacturer, activated. This mode may only be able to be selected via a mode selector switch which can be locked and it must only be possible to access the machining area using a safety switch, as in this mode, the protective devices are disabled and also the start inhibit functions of the drives are de–activated. Otherwise, all of the drives of the machine and system must, in this case, be automatically isolated from the supply. For hanging axis, it should be ensured that the drive drives are reliably held so that no energy can be fed back into the DC link.

  The relevant regulations for setting–operation must be taken into account.
- The protective devices for the restricted hazardous zone of the drive can now be moved aside (i.e. personnel can enter the hazardous zone).

  If one of the following faults occurs with the protective devices disabled, then **EMERGENCY OFF must always be immediately initiated**.

  In this case, all drives of the machine and system are isolated from the supply through the line contactor.

  The acknowledge contact remains open and the start inhibit is not activated:

  – there is a fault in the external control circuit itself.

  – there is a fault in the signal lines of the acknowledge contact.

If all previous steps have been correctly executed, all of the drives in the restricted working zone are locked–out to prevent drives starting accidentally, and personnel can enter or access the restricted hazardous zone.

Checking the start inhibit

- The following checks must always be made at the first start–up, and, when possible must be repeated at certain intervals during the plant lifetime.

  A check should also be made after longer production standstills. Each individual drive as well as the NE module must be checked.

- The drive impulses must be inhibited by withdrawing the energization voltage at terminal 663. Further, the acknowledge contact of the start inhibit must close.

  The drive then coasts down.

- Disabling the protective devices, e.g. opening the protective doors while the drive is running. If an inadmissible hazard is then created, then the check can be executed as follows:

  The signal line to door contact TK is disconnected while the drive is running. In this case, the line contactor must isolate all of the drives of the machine and system from the supply.

- All possible fault situations, which could occur, must be individually simulated in the signal lines between the acknowledge contacts and the external control as well as the signal evaluation functions of this control.

  In every fault condition, the line contactor must isolate all of the drives of the machine and system from the line supply.

- In the setting–up mode, connect voltage to terminal 112 (terminal 9). The line contactor must then isolate all drives of the machine and system from the supply.

- For the connection between the power supply and the power DC link, for all of the test points, where the line contactor isolates the drives from the supply, the connection between the power supply and the power DC link must be instantaneously and reliably interrupted.

  This connection is not permissible in the setting–up mode.

Comment

The line contactor in the NE module is used when the drives of the machine and system are isolated from the supply when a fault condition occurs. In this case, the power DC link is isolated from the supply. Inthis case, the electronics power supply in the NE module always remains connected to the line supply. All externally wired bypass connections from the supply to the power DC link must also be electrically isolated (p. 1-145 "Sequence and procedure...").

In the setting–up mode, when using an isolating transformer, the isolating transformer secondary may not be grounded. The grounding bar on the NE module is used to ground the DC link M rail through 100 kΩ.

When using an auto–transformer in the setting–up mode, the user must monitor the DC link voltage, and if a fault occurs, which results in an increase in the DC link voltage, all drives of the machine and system must be isolated from the supply.

In the setting–up mode, when a hanging axis drops, it is possible, that the motor can feed power into the DC link, even with the pulses inhibited, and thus increase the DC link voltage.

When changing over from standard– to setting–operation, the DC link first remains at 600 V. The voltage difference between 600 V and the rectified voltage in setting–up operation represents a residual level of energy, which must be considered on a case for case basis. A fault analysis must always be executed before using the start inhibit function.

Application examples

The application examples shown here are only used to explain the functions included in the SIMODRIVE 611 product"Start–up inhibit" and the possible "setting–up operation" possible with restrictions. The recommended external circuitry used directly with the SIMODRIVE 611 is shown in the following application examples. Machine controls and interlocking functions extending beyond this are not taken into account in the application examples illustrated here. The user must change, adapt or expand the circuit macros described here, to fit the individual machine type.

Note

The machine OEM must always carry–out a hazard analysis and risk analysis for the complete machine and its safety control in accordance with EEC Machinery Directive and the equipment safety law. The machine manufacturer, or the sales/marketing party, resident in the EU–Economic community, or their representative, must ensure that the complete machine is in full conformance with CE.

An excerpt of the circuit macro to protect two separate working zones, which are equipped with one or two drive axis, is illustrated in the following application examples. The block diagram of the system to be protected is illustrated in Fig. 9-5.

Application examples 1 and 2 show recommended circuits to protect the system with changeover between standard and setting–up operation.

The following is valid for all circuits:

Only switching contacts may be located between terminals NS1 and NS2. These contacts must be floating.

A uniform two–channel functionality is **not** shown in the following recommended circuits.

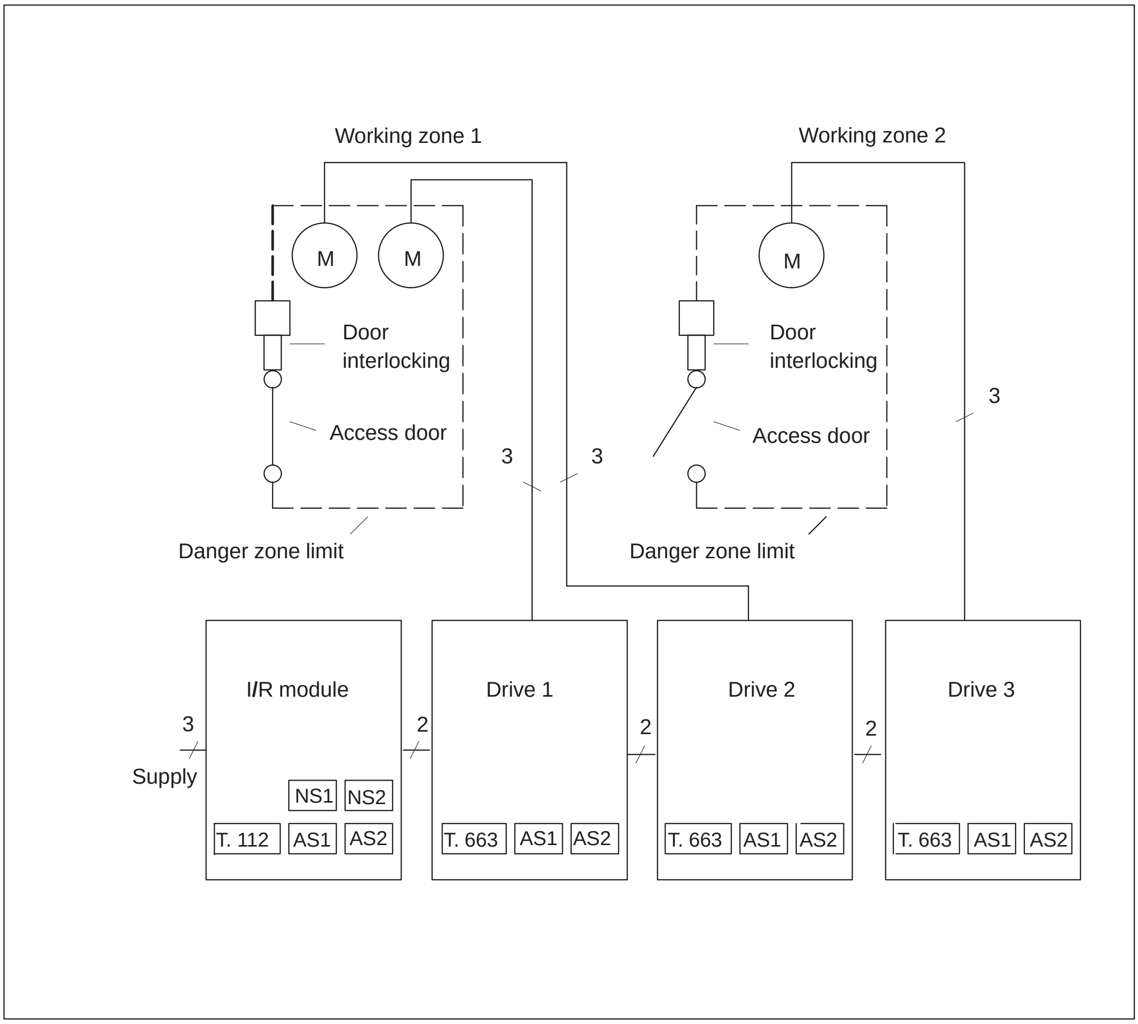


Figure 9-5 Block diagram of the system to be protected

The following explanations are valid for both application example 1 (Fig. 9-6) as well as for application example 2 (Fig. 9-7).

Note

1) The safety relay drop–out time is 40 ms.

---

2) The contactor drop–out time for braking the FD can be up to 200 ms. Longer times can occur using a common braking time for feed drives and main spindle/induction motors.
3) K8 and K9 must be additionally used for separate braking times for main spindle drive/induction motor and feed drives.
4) The contactor contact combination must be looped–in if there are different braking times for the main spindle drives/induction motor– and feed drive modules, which includes the longest braking time. This means, that when using K8, K9 with longer drop–out times than for K6, K7, then instead of K6, K7 – K8, K9 must be looped–into the circuit.
5) The emergency trip is signaled to the PLC.
6) If the machine may only be entered in the setting–up mode, contact S1 (key–actuated switch) must be additionally incorporated.
7) When using a main spindle drive/induction motor module with ramp–function generator – fast stop
8) No commands may be issued which could initiate or result in a hazardous status (VDI 2854 3.3.6).
9) Key–actuated switch S1 is only required for setting–up operation with reduced DC link voltage.
10) Redundancy according to a machine manufacturers fault analysis. Fault analyses must always be made.
11) Power–up frequency of the machine is limited according to the Configuring Guide, Section 9.4.2
12) The individual drives must be switched via terminal 663.
13) Can be used to reduce the contactor deadtimes.

All contacts are illustrated in the quiescent setting.

- in this case, the protective barriers are closed, TK1; TK2
- the start inhibit is activated AS1/AS2
- key–activated switch S1 has been used to select setting–up operation

---

Note

The safety–related monitoring contacts for the start inhibit (AS1; AS2), door contacts (TK) of the machining zone protective device and the safety switch must be cyclically monitored by the machine control to ensure that they are functioning correctly.

Application example 1

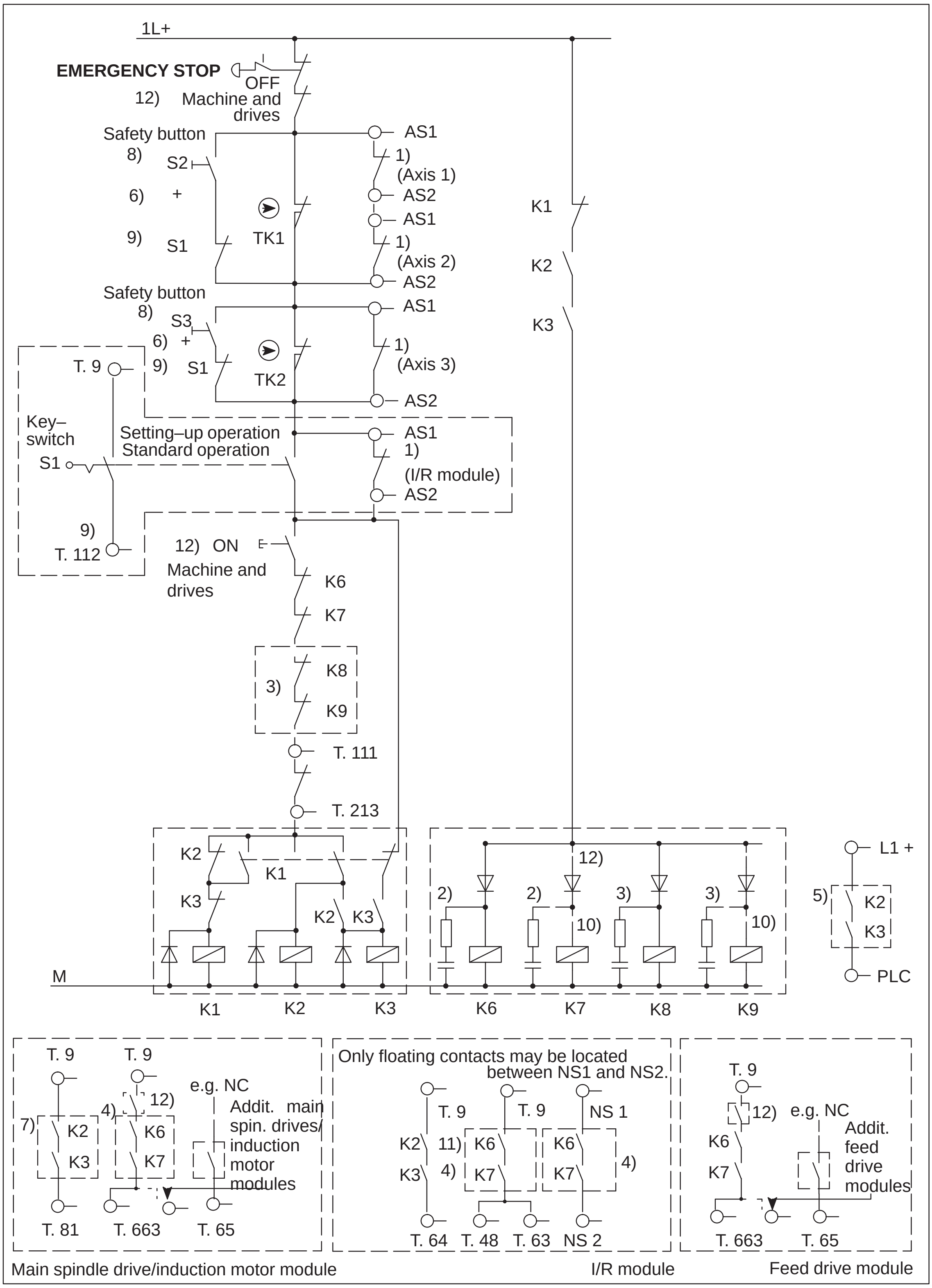


Figure 9-6 Application example 1 (also refer to the information in Section 9.5.9)

Application example 2

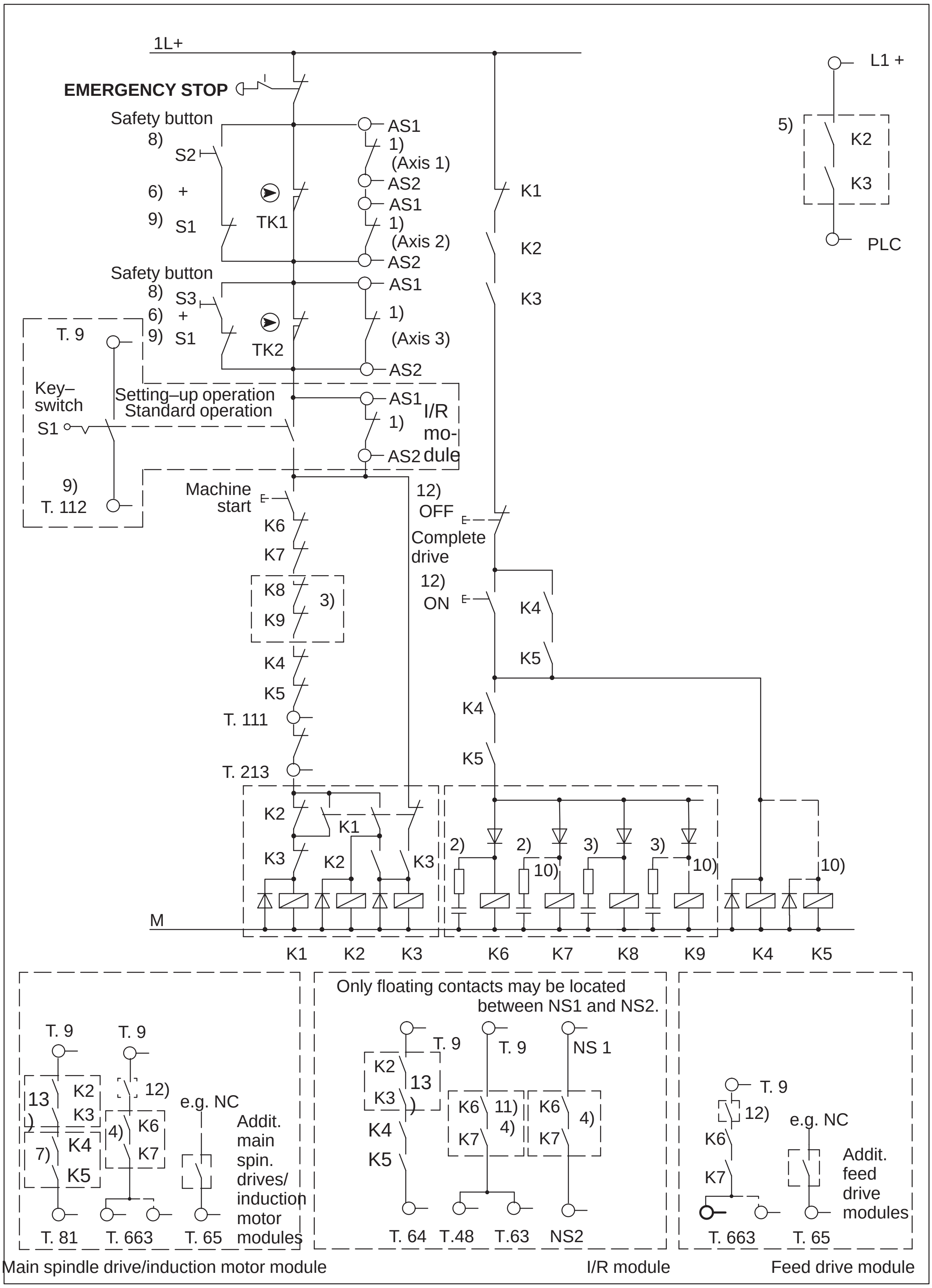


Figure 9-7 Application example 2 (also refer to the information in Section 9.5.9)

Block diagram 1

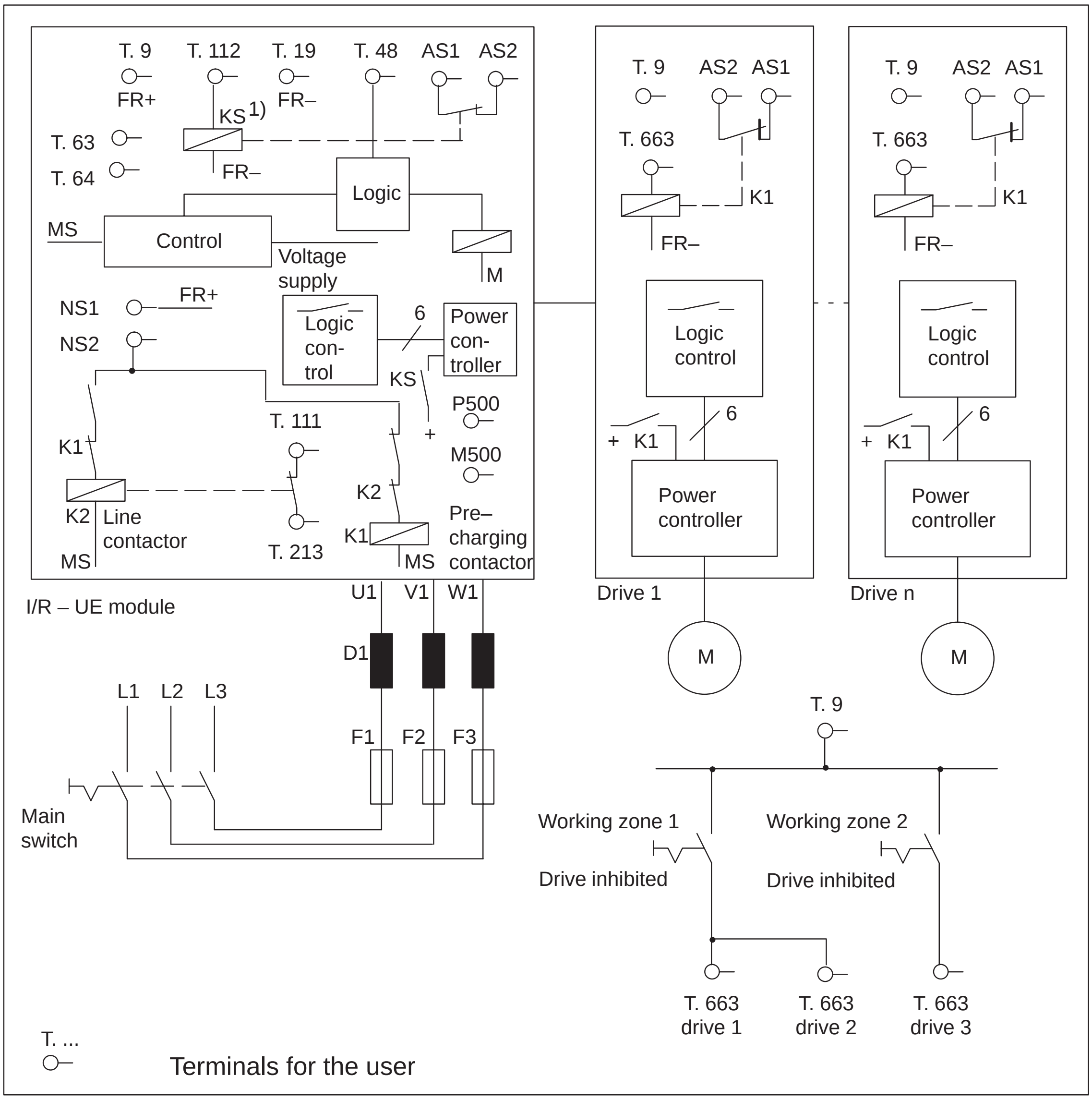


Figure 9-8 Block diagram 1; valid for **UE modules 5/10kW to 28/50kW** and **I/R modules 16/21kW to 55/71kW**

- K1, pre–charging contactor contact, positively driven
- K2, line contactor contact, positively driven
- Terminals 111, 213 NC contacts, positively driven to the NO power contacts
- Terminal P500, M500, terminals for the power supply for the connection to the power DC link
- Only floating contacts may be connected between terminals NS1 and NS2

---

1) Relay KS and terminals AS1, AS2 are not provided for the UE module. As there is no step–up controller in the UE module, the voltage cannot be increased above the rectified line voltage level.

Block diagram 2

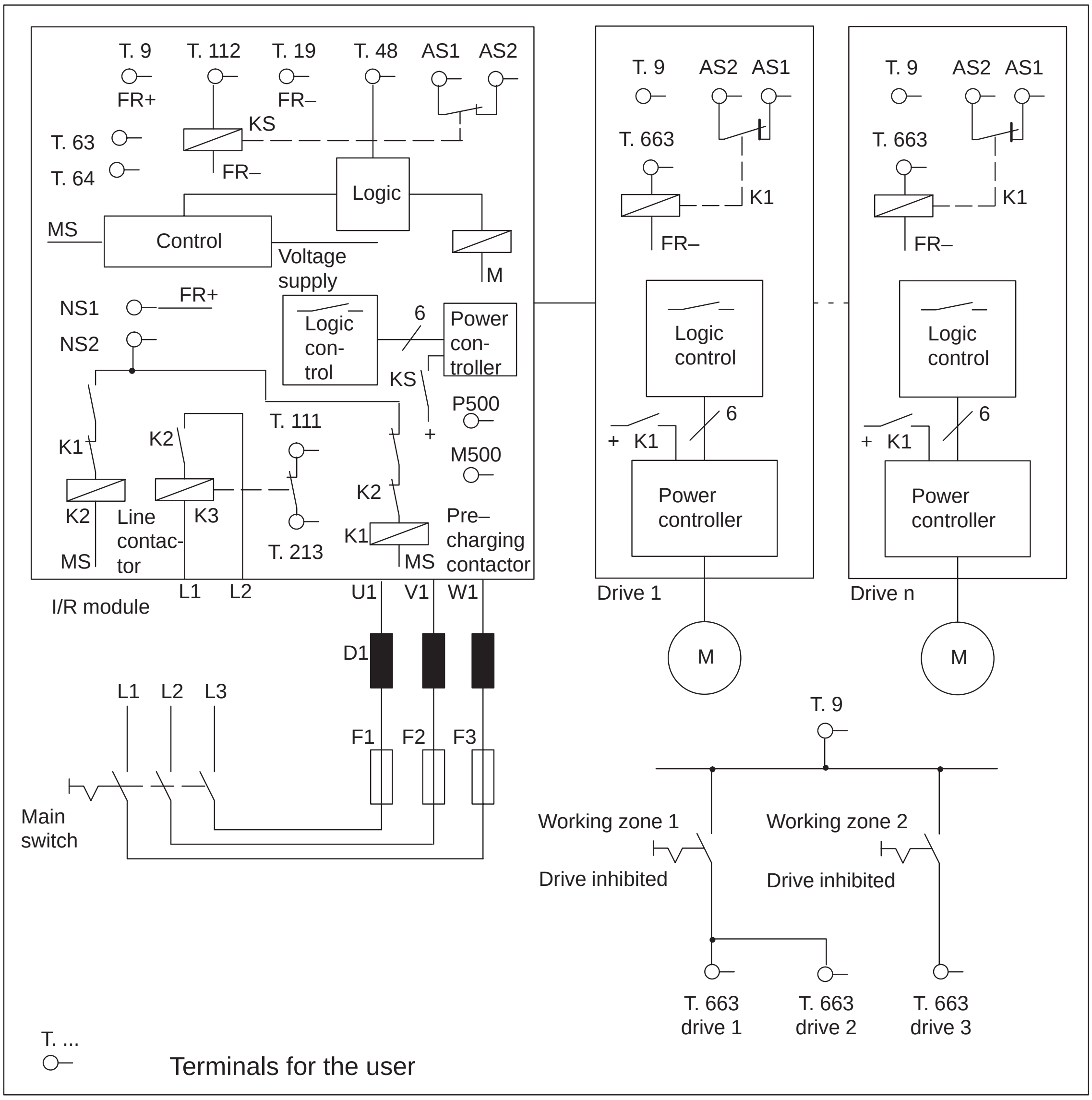


Figure 9-9 Block diagram 2; valid for **I/R module 80/104 kW** and **I/R module 120/156 kW**

- K1, pre–charging contactor contact, positively driven
- K2, holding contactor contact
- K3, line contactor contact, positively driven
- Terminals 111, 213 NC contact positively driven to the NO power contacts
- Terminal P500, M500, terminals for the power supply for the connection to the power DC link
- Only floating switching contacts may be connected between terminals NS1 and NS2.

EMC measures

Screen connection cables

The screens of pre–assembled original manufacturer’s cables are automatically connected when the connector is inserted.
Exceptions:

- Setpoint cable from an analog NC.
  In this case, the screens of the setpoint pairs must be connected to the upper side of the module. The threaded holes can be used for this purpose. (M5x10/3 Nm).
- Drive bus cable from SINUMERIK 840C.
  In this case, the screen is connected to the above mentioned threaded hole using the clamp provided.
- Drive bus– and equipment bus extensions for two–tier designs.
  In this case, the screens at each end of the cable must be connected to the above mentioned threaded holes using the clamps provided.
- Motor power cables
  The screens of the motor power cables are connected to the screen connecting plates (accessories) of the modules using the clamp connectors provided.

Refer to P.1-52 for further measures.

Connecting–up the shield to the front panel

In order to ensure a good connection between the front panel and the housing, the front panel screws must be tightened up to 0.8 Nm.

Connecting the electronics ground

Terminal X131 (electronics ground): Refer to Fig. 9-1.

Protection against overvoltages

A varistor module, Order No. 6SN1111–0AB00–0AA0 can be inserted at connector X181 on the NE module to protect against overvoltage (line supply networks not conforming to VDE (not necessary for UE 5 kW and the monitoring module).

Additional measures

Note

All of the measures described here are only valid for supply networks which are not compatible with VDE. In normal industrial supply networks, it is guaranteed, without having to use other measures that the disturbance and noise values remain below the permissible limits, thus ensuring disturbance–free operation

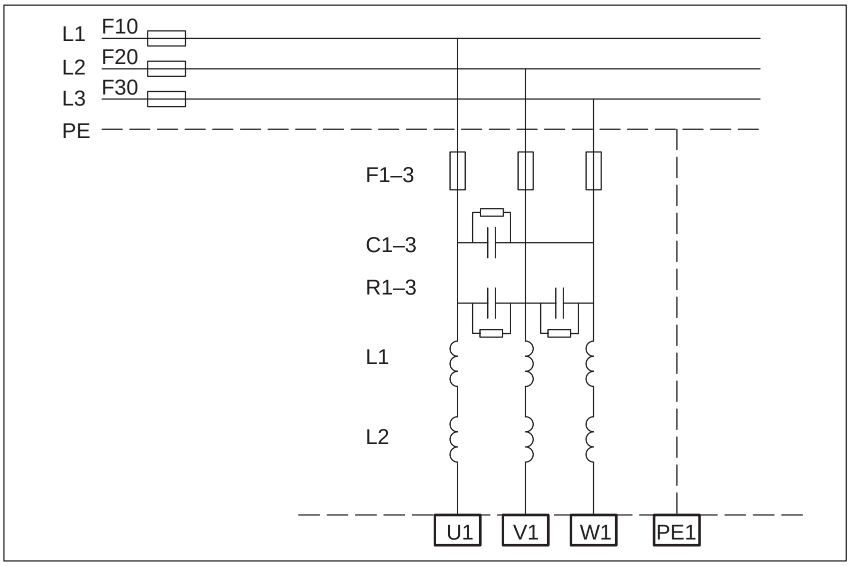


Figure 9-15 Additional EMC measures

The converters are designed for use on industrial supply networks according to VDE 0160. A ratio of PN**/**PA of 1**/**100 is assumed. Under this condition, the series reactor limits the line supply dips, caused by the general converter operating principle, to permissible values, which allows other loads, which are suitable for industrial applications, to be used on the same line supply network.

If there are unfavorable line supplies and/or grounding conditions at the installation site where the equipment is mounted, then in exceptional cases, cable–borne disturbances can occur. These are as a result of excessive line reactance. In cases such as these, filter modules or line filters should be used. (can be used with line supply voltages up to 415V).

Note

We recommend that the pre–assembled cables are used, as perfect screening is required for an optimum EMC connection.

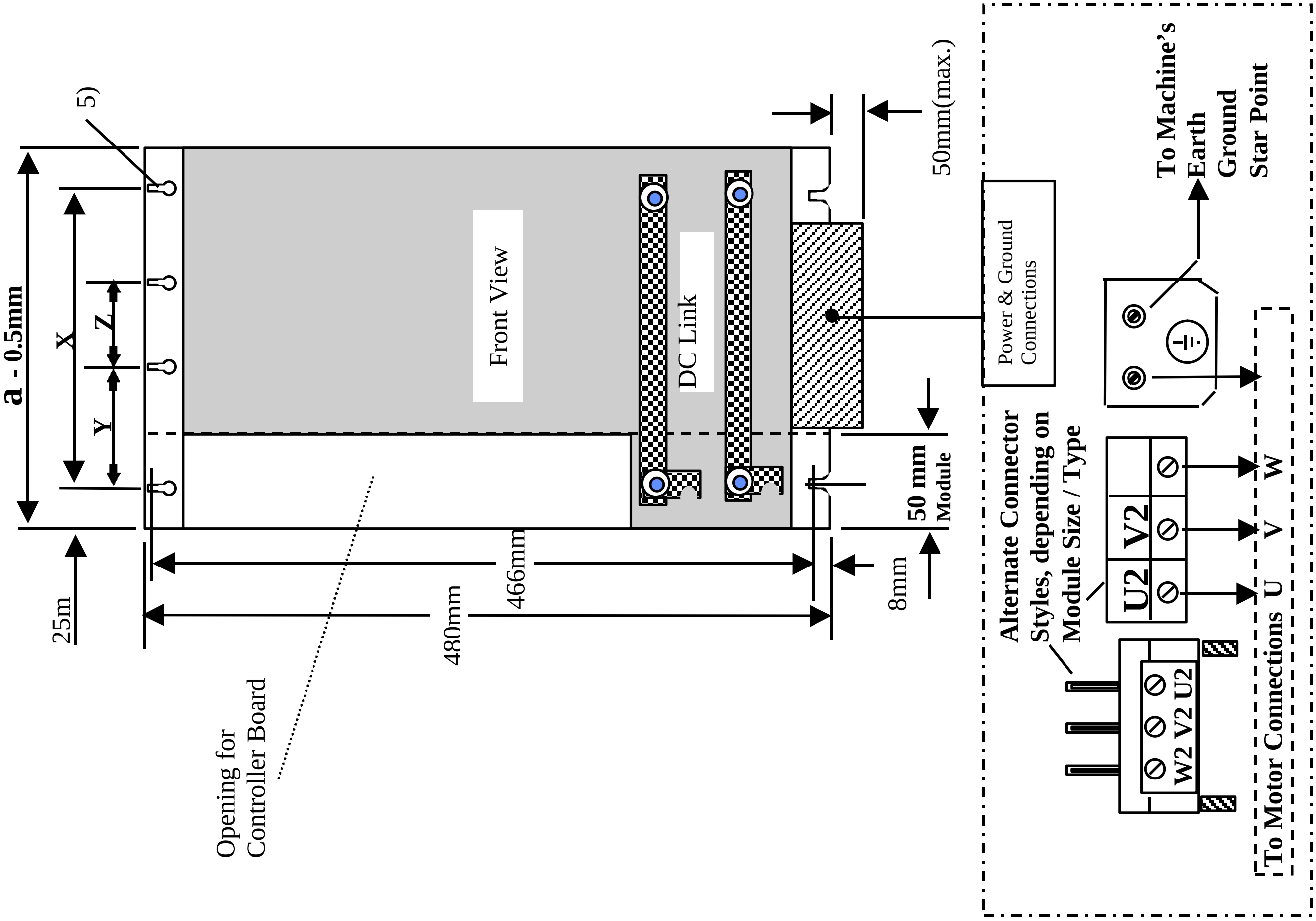
Further, for optimum signal transfer appropriate cable parameters are required. A guarantee for the correction functioning is only given when the original manufacturers cables are used.

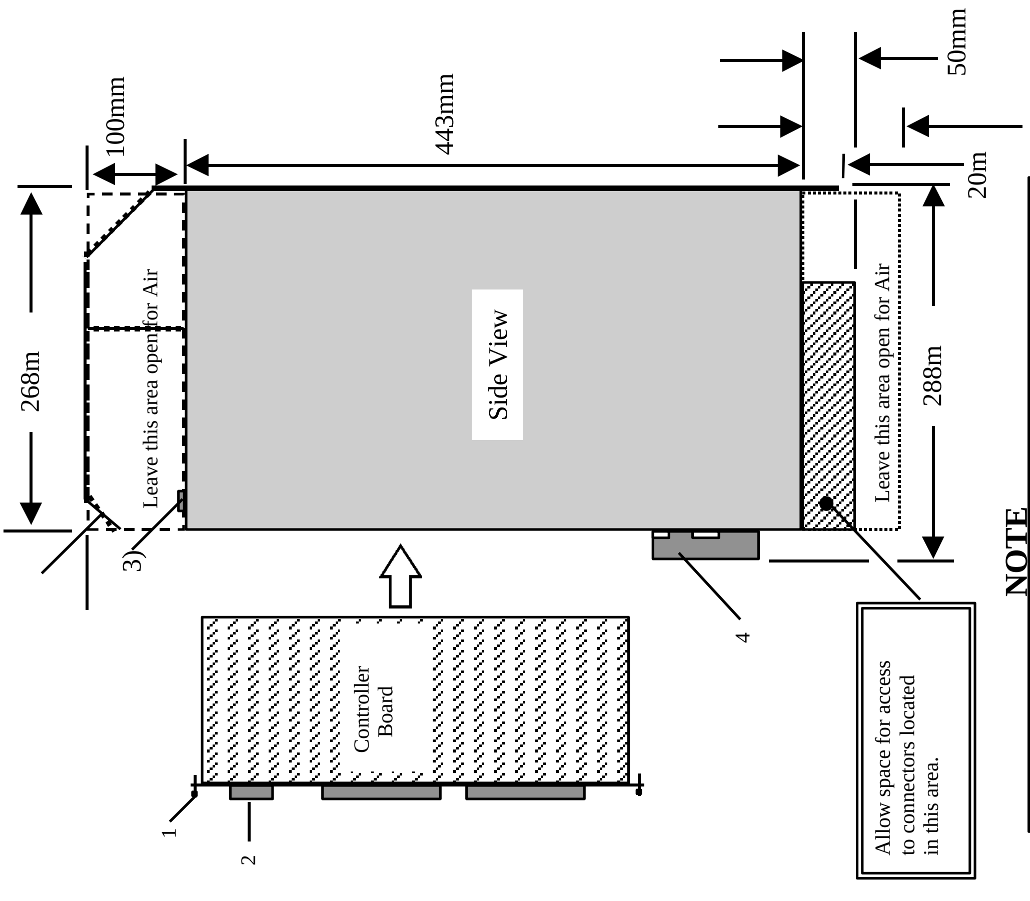
Also refer to the ”EMC Guidelines for SINUMERIK/SIMODRIVE and SIROTEC controls”.

MOUNTING DIMENSIONS

DRIVE MODULE DIMENSIONS

DIMENSION CHART ON FOLLOWING PAGE





NOTE

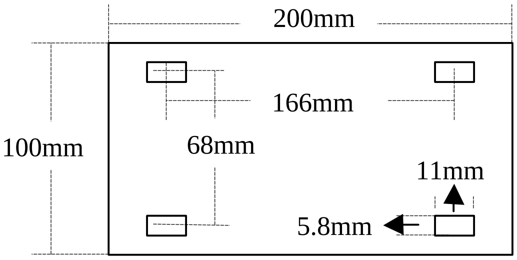
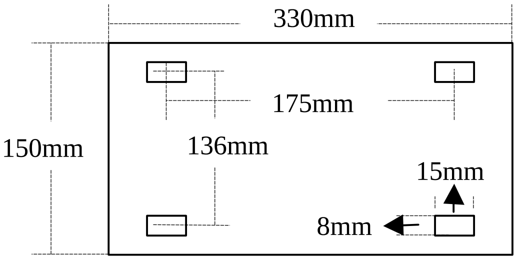
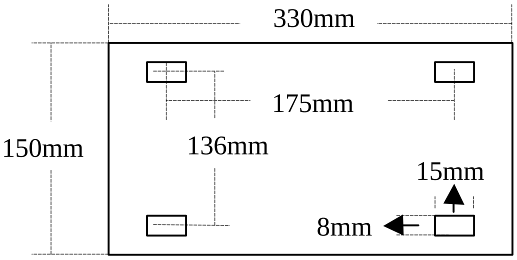
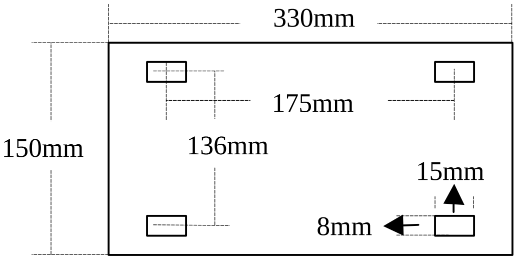
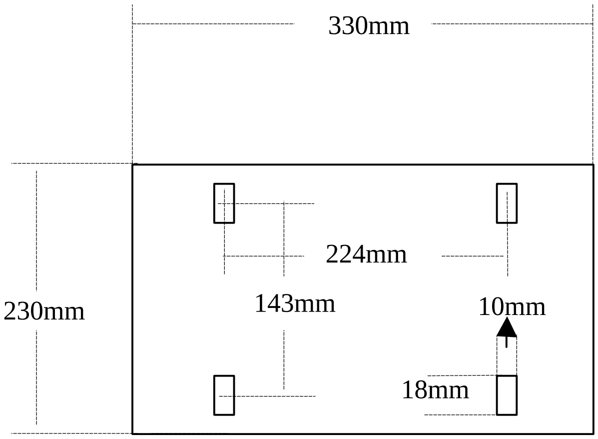
1) Board Retainer Screw - Tighten firmly
2) Connector - Supplied with PCB
3) Threaded Hole for alternate shield connecting point (M5 x 8) [Encoder & Command Line Shield, etc.]
4) DC Link Cover
5) Clearance hole for M5 Screw(all mounting points)
6) Heat Shield for 10KW Power Infeed Module

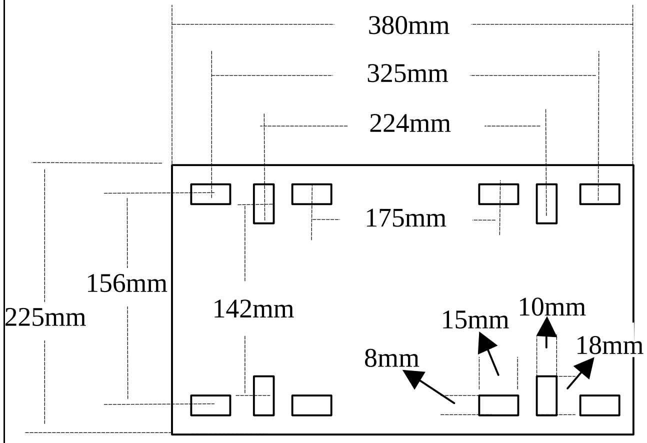
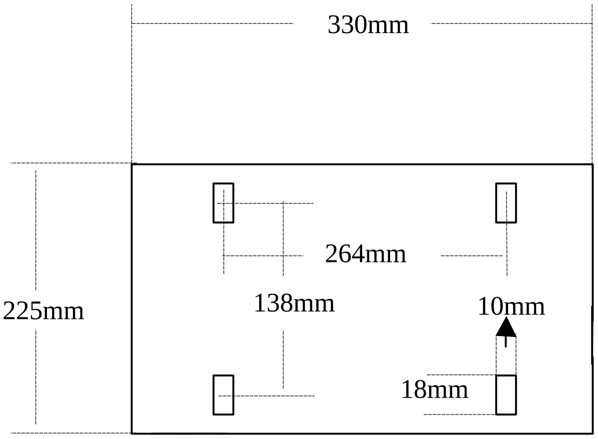
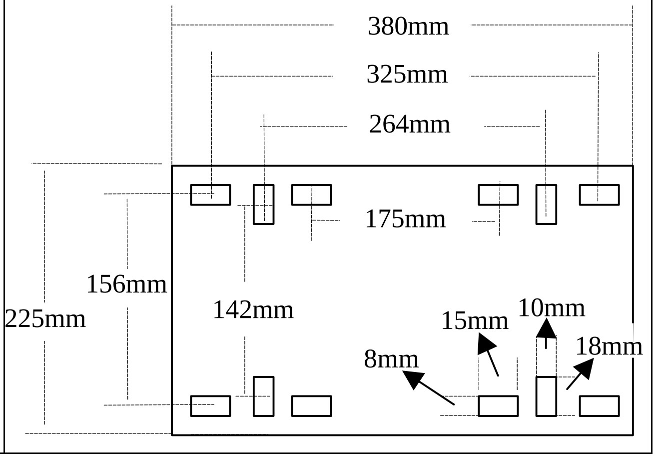
Siemens Energy and Automation, Inc.

Dimension Chart – for Drive Drawings

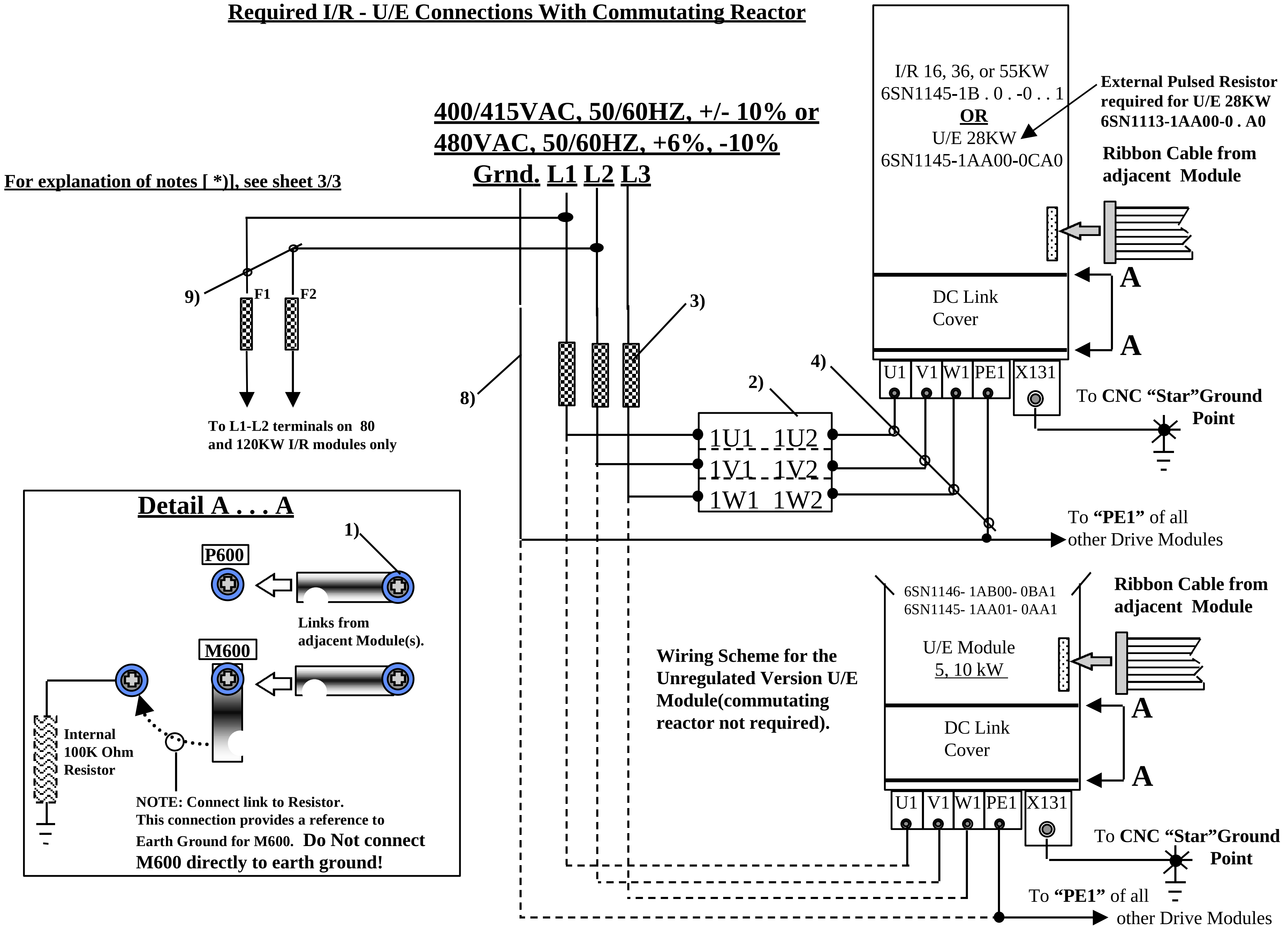
Module Type	Module Rating	Module Width	dim. X	dim. Y	dim. Z	Weight kg(lb's)
Power Infeed (I/R & U/E)	5 KW	50 mm	-	-	-	6.5 (14.3)
(6SN1145- & / or 6SN1146-)	10, 16 KW	100 mm	50 mm	-	-	9.5, 10.5 (21, 23)
	28, 36 KW	200 mm	150 mm	-	-	15.5 (34)
	55, 80, 120 KW	300 mm	250 mm	100 mm	50 mm	26,26,29 (57,57,64)
Monitoring & Pulsed Resistor	All	50 mm	-	-	-	
(6SN1112- & / or 6SN1113-)						
Power Modules (1 Axis)						
6SN1123 - 1AA0_ -	0HA1, 0AA1, 0BA1, 0CA1	50 mm	-	-	-	7.5 (17)
"	0DA1	100 mm	50 mm	-	-	9.5 (21)
"	0EA1, 0LA1	150 mm	100 mm	-	-	13 (29)
"	0FA1, 0JA1, 0KA1	300 mm	250 mm	100 mm	50 mm	26,21,24 (57,46,53)
Power Modules (2 Axis)						
6SN1123 -1AB0_ -	0HA1, 0AA1, 0BA1	50 mm	-	-	-	7 (15.4)
"	0CA1	100 mm	50 mm	-	-	13.5 (30)

REACTOR MOUNTING DIMENSIONS

Reactor Part #	Rated	Height	"Footprint" Dimensions
6SN1111-1AA00-0CA0	**28 kW**	**190mm**	
6SN1111-0AA00-0BA0 **and** **6SN1111-0AA00-0BA1**	**16 kW**	**145mm**	
6SN1111-0AA00-0CA0 **and** **6SN1111-0AA00-0CA1**	**36 kW**	**232mm**	
6SN1111-0AA00-0DA0 **and** **6SN1111-0AA00-0DA1**	**55 kW**	**280mm**	
6SN1111-0AA00-0EA0	**80 kW**	**290mm**	

<table>
<tr><th>Reactor Part #</th><th>Rated</th><th>Height</th><th>“Footprint” Dimensions</th></tr>
<tr><td>6SN1111-0AA00-1EA0</td><td>80 kW</td><td>200mm</td><td>
</td></tr>
<tr><td>6SN1111-0AA00-0FA0</td><td>120 kW</td><td>340mm</td><td>
</td></tr>
<tr><td>6SN1111-0AA00-1FA0</td><td>120 kW</td><td>300mm</td><td>
</td></tr>
</table>

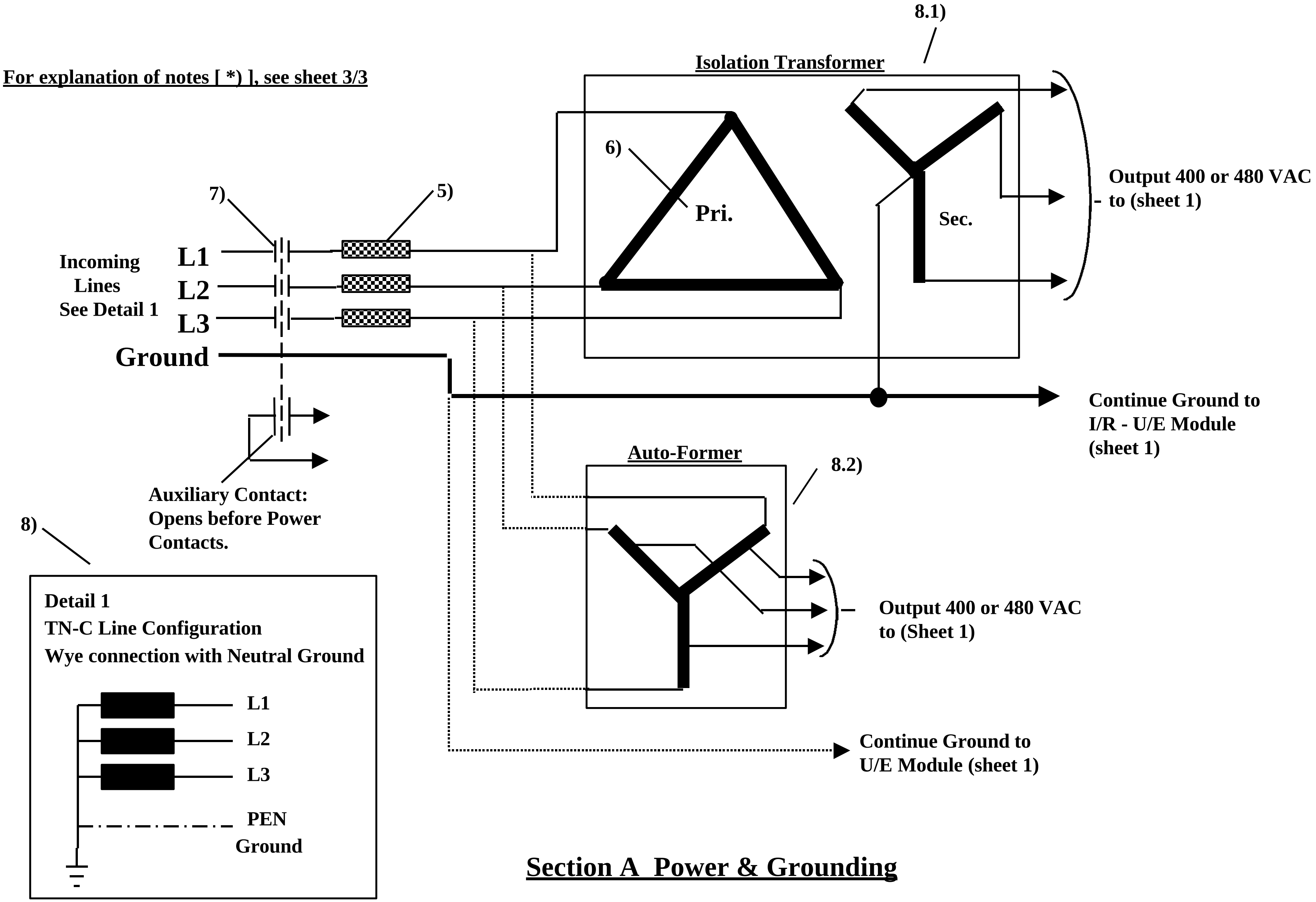
Required I/R - U/E Connections With Commutating Reactor



Section A Power and Grounding

Incoming Line and Suggested Transformer,(if required), Connections

For explanation of notes [*)], see sheet 3/3



Section A Power & Grounding

611-A V3 Power & Grounding Notes

1) Tighten DC Link Screws (Torx T-20) 1.8Nm (16in-lbs)
2) Commutating Reactor should be located as close as possible to the I/R Module.

3) Fuses - Not supplied with system:

Module Rating	Rated Input Current	Suggested Siemens Fuse	Suggested Fuseholder
5 KW	12.5 A	3NA3805	3NH4030
10 KW	24 A	3NA3810	3NH4030
28 KW	65 A	3NA3824	3NH4030
16 KW	27 A	3NA3814	3NH4030
36 KW	60.5 A	3NA3824	3NH4030
55 KW	92.5 A	3NA3832	3NH4030
80 KW	134 A	3NA3136	3NH4230
120 KW	202 A	3NA3144	3NH4230

4) Voltage measurements should be balanced when checked; Line to Line and Line to Ground .

5) Alternate Fuse location. [Note that different fuse ratings may be required at this location vs the fuses in note 3)]
6) Transformer must have an Impedance Voltage rating of >1% , < 3% .

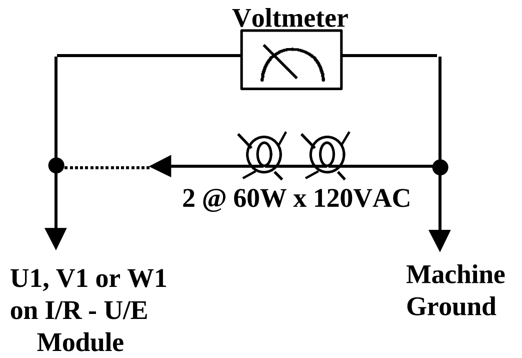
7) **NOTE**: Applies to: 16, 36, 55, 80 & 120 KW I/R Modules Only
In applications where a Contactor, Disconnect, etc., might be opened while the Drive's I/R Module is in the DC Bus Regulating Mode, the Infeed/Regeneration Module must be disabled (terminal 48 or 63) => 10ms prior to the opening of the line contacts. If this instruction is not adhered to, I/R module damage could result. In cases of "brown-out" or loss of Power Company power, a complete circuit remains to absorb the regenerative energy and failures should not occur.

A* Shield connections must be made on both sides of power cables using the highest possible area.

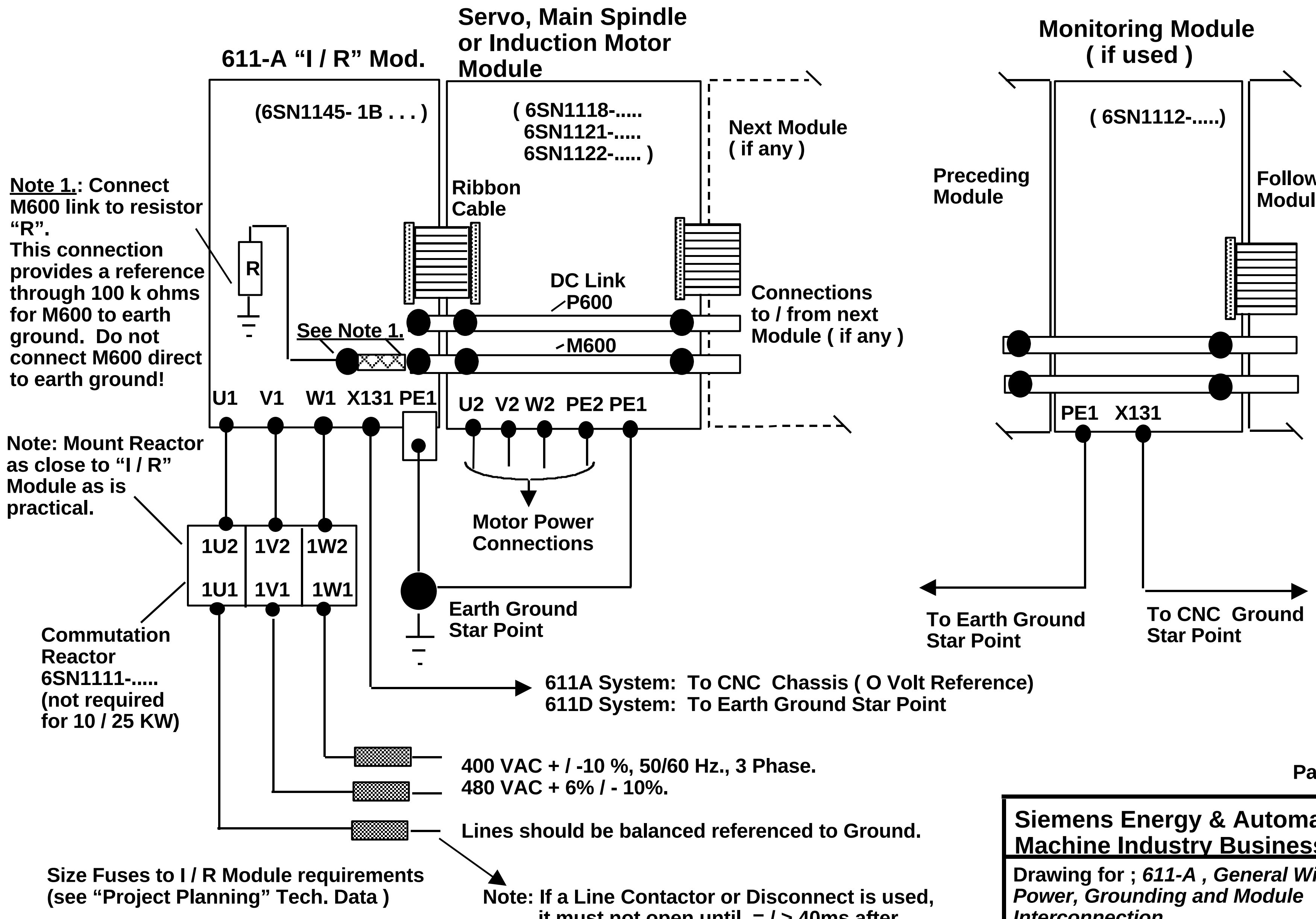
B* Each Power Section must have separate leads from the terminal "⏚" to the machine ground bus.

8) The I/R Module input voltage must be derived from a TN-C, (Wye connection with Neutral Ground,) system. If configuration and voltage specifications are according to requirements, a matching transformer is not required. See Planning Guide for Details.
8.1) If line configuration is not TN-C, an isolation transformer with neutral ground connection is required. See Planning Guide for proper sizing and configuration details.
8.2) If line configuration is TN-C, an auto transformer can be used to provide correct input voltage.

To verify TN-C line neutral connection is present, connect meter as shown and note reading. When lightbulb assembly is connected, reading should not change and bulbs should glow normally. Note: Terminal 48 must be disabled



9) Terminals L1-L2 are only available for the 80 and 120KW I/R modules only. F1-F2 fuses should be greater than or equal to 4A depending upon the maximum cable cross-section. If the input voltage fails or F1-F2 fuses blow, the I/R module pulses are disabled and the internal line contactor drops out. The I/R module will display the line fault LED, and the ready relay and the internal line contactor contacts will drop out. Terminal 48 must be de-energized and can be re-energized again after >1 sec. or if the power is turned off and on again. In this case, the jumper between terminals 9 & 48 must be removed and a switch inserted. The switch is not required if the system is powered off and on again using the main supply circuit breaker.



Note 1.: Connect M600 link to resistor “R”.
This connection provides a reference through 100 k ohms for M600 to earth ground. Do not connect M600 direct to earth ground!

Note: Mount Reactor as close to “I / R” Module as is practical.

Commutation
Reactor
6SN1111-.....
(not required
for 10 / 25 KW)

611A System: To CNC Chassis (O Volt Reference)
611D System: To Earth Ground Star Point

400 VAC + / -10 %, 50/60 Hz., 3 Phase.
480 VAC + 6% / - 10%.

Lines should be balanced referenced to Ground.

Size Fuses to I / R Module requirements
(see “Project Planning” Tech. Data)

Note: If a Line Contactor or Disconnect is used,
it must not open until = / > 40ms after
Term. 63 or 48 is opened !

Section C - Non CE Configuration shown

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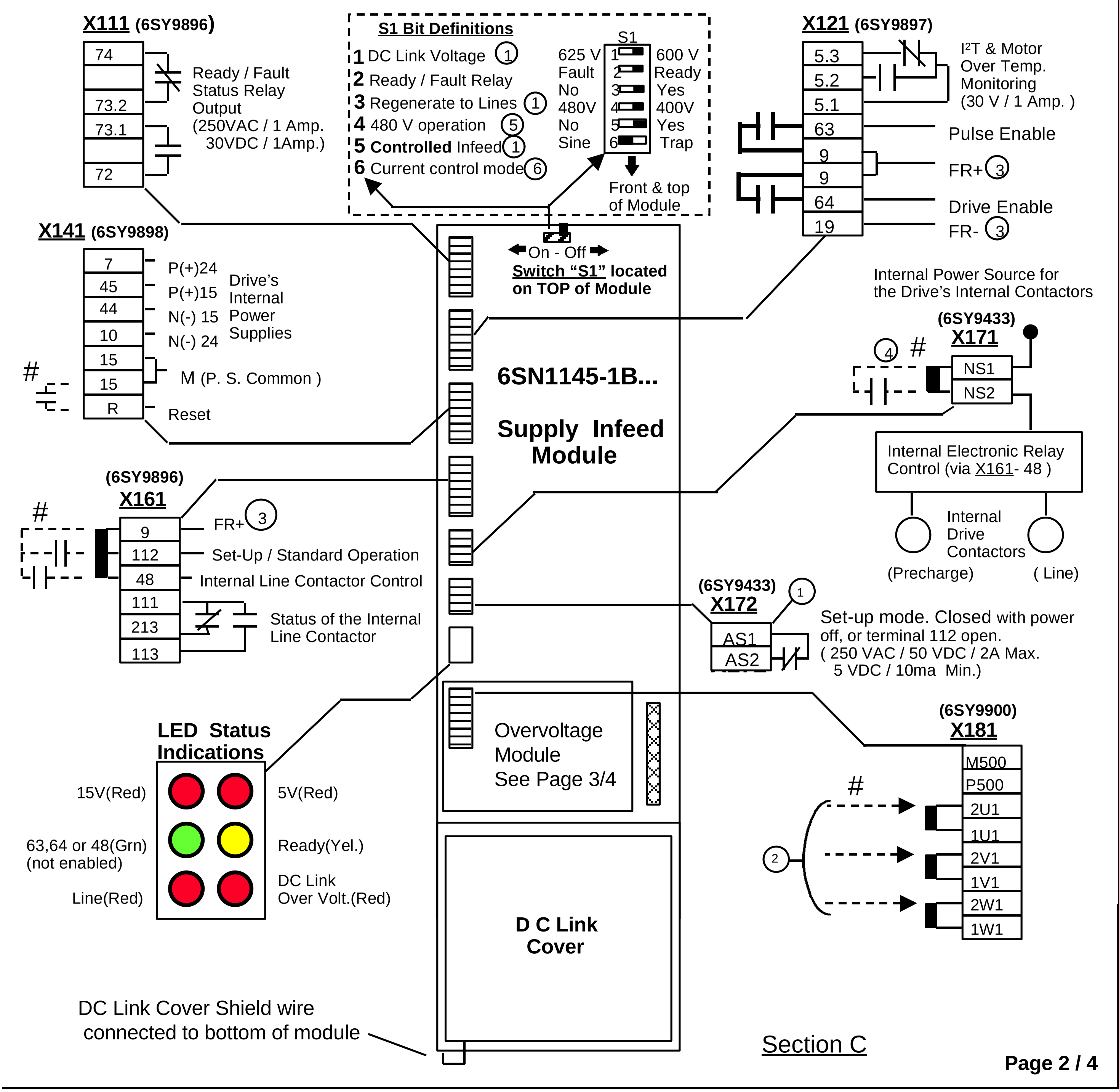
**Siemens Energy & Automation
Machine Industry Business**

Drawing for ; *611-A , General Wiring for Power, Grounding and Module Interconnection*

Date	Revision	Drawn by
8/13/98	Rev. A-5	de/sc/dk



NOTES:

① These functions are not included on the 10,28 KW Unregulated Modules.

② This Optional Input is used only when line voltage is supplied separately to the the L. V. Power Supply. (1 place)

③ FR+ & FR- are internal supplies to be used as a power source for the drive's enables(3 Places). If using an external +24V source for controlling enables, connect the external source's P. S. common to Term.-19

④ NS1 & NS2 are provided for non-electronic control of the drive's internal power relays. They can be used in the E-Stop circuit or in a lock-out circuit to provide a direct interruption of the power supplied to the internal relays. NOTE: Terminal X161- 48 MUST be opened prior to or at the same time as NS1 & NS2, to provide internal shut down of the drive circuits. (1 Place)

⑤ Adapt to line voltage. Standard setting is for 400 V operation.

⑥ Sets type of current control mode. Standard setting is Sinusoidal.

General Notes

Items shown on the left side of the connectors are external connections to be supplied by the installer.

Connections shown with a " # " and not connected are Optional - the one's shown connected are Required for drive operation.

For additional information on terminal definition, use and operation see the "Planning Guide" (Sect. 3.7...).

▮ Indicates Factory supplied "Jumper"

Siemens Energy & Automation
Machine Industry Business

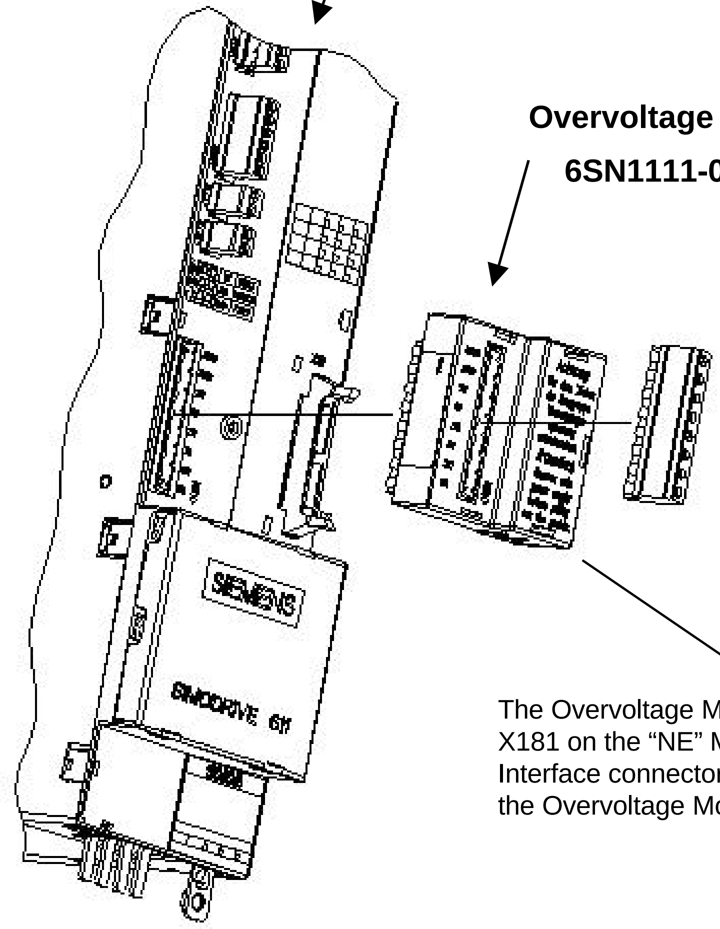
Drawing for: *Interface connections for Supply Infeed Modules (16, 36, & 55 KW)*

Date	*by*	*Revision*
8 / 13 / 98	*de/dk*	*Rev. A5*

NE Module except 5 kW

Overvoltage “Varistor” Module

6SN1111-0AB00-0AA0



The Overvoltage Module is plugged into X181 on the “NE” Module, excepr 5 kW. Interface connector X181 is fed through the Overvoltage Module pin for pin.

Section C

Page 3 / 4

Siemens Energy & Automation
Machine Industry Business

Drawing for ; *611-A , General Wiring for Power, Grounding and Module Interconnection*

Date	Revision	Drawn by
8/13/98	Rev. A-5	de/sc/dk

611-A Power Infeed Module(I/R and UE) Start Up Procedure

<u>Caution</u>: During this procedure High Voltages will be present. Power must be removed from the drive unit (I/R or UE Module) before connecting or disconnecting the P600, M600 DC Bus bars, power connector X181 or equipment bus ribbon cable X351. <u>THE DC BUS VOLTAGE ACROSS BUS BARS P600 AND M600 CAN TAKE UP TO 5 MINUTES TO DISCHARGE TO A SAFE LEVEL AFTER LINE POWER IS REMOVED.</u> Refer to the Interface connections drawing for terminal locations etc. which are mentioned in the following procedure. Terminal X161.48 must always be disconnected at least 10 ms before power down.

A) Be sure power is off and the DC Bus is fully discharged. Disconnect the P600/M600 DC Bus Bars, Connector X181, Equipment Bus Ribbon Cable X351, Enable Interface connectors X121 and X161. Check input power connections on Power Transformer, Line Reactor or filter module, External Fusing and I/R Module. Check machine and modules for proper grounding and transformer neutral connections.

B) Check DIP Switch settings on top of the I/R Module. Factory setting is Bits 1 through 5 all in the <u>off</u> position and Bit 6 in the <u>on</u> position. Caution: some settings depend on line voltage!

C) Power-up, Check line voltage across U1, V1 and W1. Voltage levels <u>must</u> be 3-Phase 360 to 455 VAC or 480 VAC (+6%/-10%). Check line voltage U1 to Gnd, V1 to Gnd, W1 to Gnd. Voltage must be symmetrical (Line to Line Volts / 3) *Check voltage across terminals L1 and L2. L1 must be in phase with U1, L2 must be V1. Terminals L1 and L2 are only present on 80 and 120KW units!*

D) <u>POWER DOWN, wait for the DC Bus to discharge(about 5 minutes)</u>. <u>CAUTION:</u> <u>Be sure that there is no voltage across terminals P600 and M600 before proceeding.</u>

E) Connect the suggested enabling circuit or equivalent for terminals X121.63, X121.64 and X161.48. <u>Do not enable 63, 64 and 48 at this time!</u> Plug in connectors X121, X161, X171 and X181. <u>Note:</u> X171 has factory installed jumpers between terminals NS1 and NS2 and X181 has factory installed jumpers between terminals (1U1-2U1), (1V1-2V1) and (1W1-2W1). If X171 and /or X181 are used in the machine interface, it is suggested that the factory jumper configuration be used at this time.

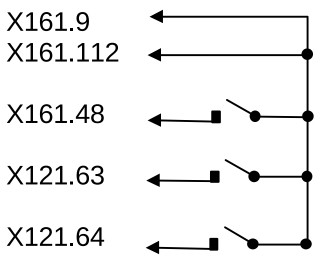
F) Power Up. The green LED should be on, indicating that the Pulse(X121.63) and Drive(X121.64) enable signals are <u>OFF</u>. Auxiliary voltages should be present at X141 terminals 7(+24V), 45(+15V), 44(-15V) and 10(-24V) all with reference to terminal 15 indicating that the low voltage power supply is functioning. Enable supply voltage(+24V) should be present at terminal X121..9 with reference to terminal X121.19. The yellow LED should be off because terminal 48 is not enabled.

G) <u>CAUTION:</u> <u>There will be approximately 500 to 620 VDC across the DC Bus terminals P600 and M600.</u> Enable terminal 48. The Yellow LED should come on, indicating that the internal circuits are OK and the internal DC Bus contactor has closed. Ready/Fault relay terminals X111.72 and 111.73.1 will remain open if S1 Bit 2 = OFF(if S1 Bit 2 = ON the relay terminals will close indicating “no fault”). Overtemperature relay terminals 5.1 and 5.3 will remain closed indicating “no overtemperature” and auxiliary contacts X161.111 and X161.113 should close indicating that the main internal DC Bus contactor is closed.

H) Enable terminals 63 and 64. For I/R Modules, the DC Bus Voltage Regulation function will begin. If S1 Bit1 = off and Bit 4 = off, the DC Bus voltage across terminals P600 and M600 will be 600 VDC. If S1 Bit1 =on and Bit 4 = off, the DC Bus voltage will be 625 VDC. If Bit 4 = on, the DC Bus voltage will be the line to line voltage * √2. For UE Modules, the DC Bus voltage will be the line to line voltage * √2. The green LED will go <u>OFF</u> indicating that the I/R Module is enabled. The Yellow LED should remain on, indicating there are no internal problems. If S1 Bit 2 = OFF, the Ready/Fault relay terminals X111.72 and X111.73.1 will now close.

I) If all steps were successful through step H), the I/R Module is functioning properly. **<u>Disable terminals 48, 63 and 64 and then POWER DOWN.</u> <u>*CAUTION!!*</u> <u>WAIT FOR THE DC BUS VOLTAGE BETWEEN TERMINALS P600 AND M600 TO DISCHARGE TO A SAFE LEVEL BEFORE PROCEEDING.</u> <u>*The Discharge time can be up to 5 Minutes.*</u>** <u>After the DC Bus has safely discharged,</u> the machine interface can be connected and tested.

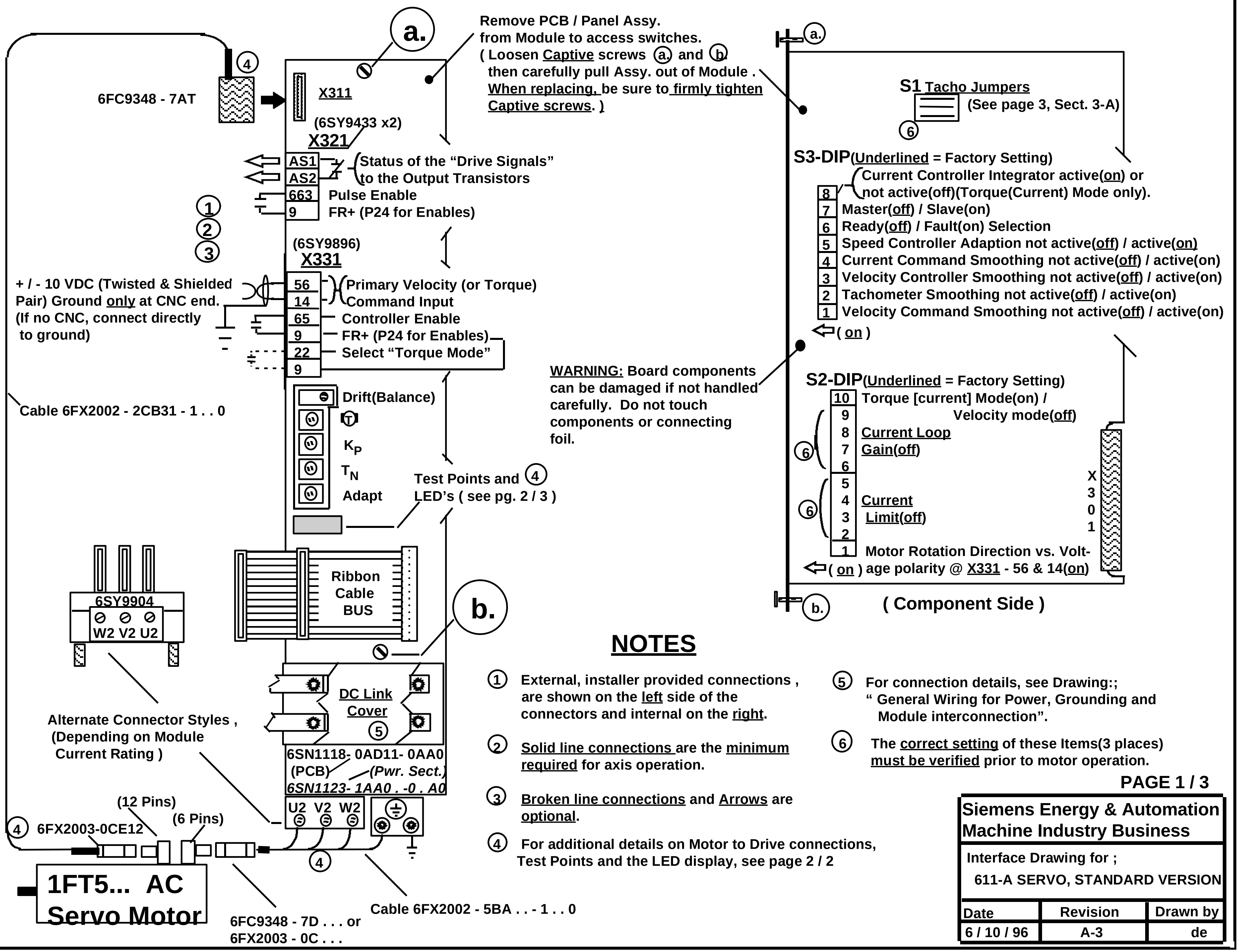
Suggested Enabling Circuit



SIEMENS Energy & Automation
Machine Industry Business

Drawing for: 611-A, General Wiring for Power, Grounding and Module Interconnection - And Quick Start-Up

Date	Revision	Drawn by
8/13/98	A-5	de/dk



NOTES

① External, installer provided connections , are shown on the left side of the connectors and internal on the right.

② Solid line connections are the minimum required for axis operation.

③ Broken line connections and Arrows are optional.

④ For additional details on Motor to Drive connections, Test Points and the LED display, see page 2 / 2

⑤ For connection details, see Drawing:; " General Wiring for Power, Grounding and Module interconnection".

⑥ The correct setting of these Items(3 places) must be verified prior to motor operation.

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Siemens Energy & Automation
Machine Industry Business

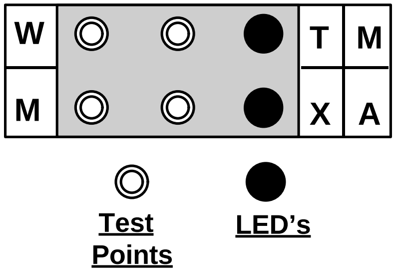
Interface Drawing for ;
611-A SERVO, STANDARD VERSION

Date	Revision	Drawn by
6 / 10 / 96	A-3	de

SECTION F

SECTION F

Test Points and Fault LED's



W - Test Point = Actual Motor Current
(10V = I-max as set in S2-DIP; 2, 3, 4 & 5)

M - Test Point = Common reference for
all Test Points

T - Test Point = Current Command

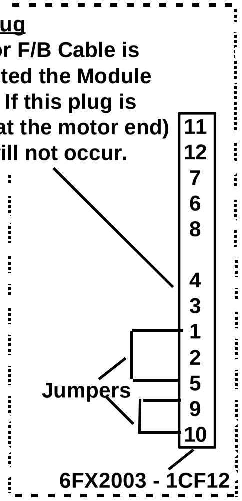
X - Test Point = Actual Motor Speed
(40.0 V Tacho: 10 V = Rated Speed)
(16.5 V Tacho: 11 V = Rated Speed)

M - LED = Motor Fault;
- Motor to Drive Cable
- Tachometer
- Rotor Position Detector

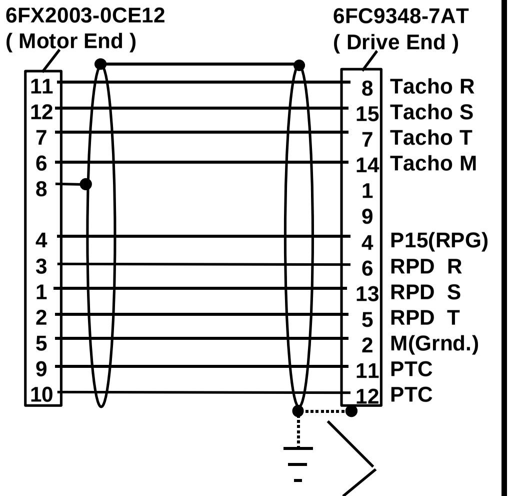
A - LED = Axis(Drive) Fault
- Speed Controller at Limit (> 200ms)
- Drive Heat Sink Overtemperature (> 90° C)
- Motor Overtemperature (> 155° C + / - 5 ° C)
- I^2T Monitoring Activated (I-rms > 1.1 x I-rated)

NOTE: Motor to Drive connections
must be exactly as shown !

Dummy Plug
If the Motor F/B Cable is disconnected the Module will fault. If this plug is installed (at the motor end) the fault will not occur.

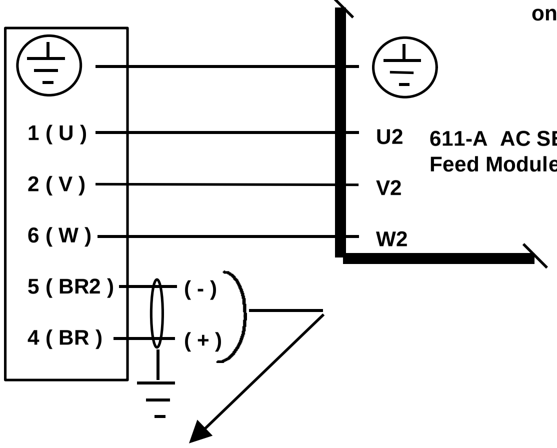


Wiring of Motor to Drive F/B Cable
Tacho, Rotor Position & Thermistor
(suggested Wire Size AWG 22 or 24)



For correct Grounding, the Shield should be connected(on the Drive end) to either the Connector Shell, or the 5mm screw hole on the top of the module.

Wiring of Motor to Drive Power Cable
(Wire size dependent on Motor Type)



Connections for Optional Brake:
[24 VDC + / - 10%; Current range 0.4 to 3.25 Amps., dependent on Motor / Brake size].
If not used, all three (3) wires should be connected to ground.

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Siemens Energy & Automation
Machine Industry Business

Interface Drawing for ;
611-A SERVO, STANDARD VERSION

Date	Revision	Drawn by
6 / 10 / 96	A-3	de

611-A Servo Feed Module(1-Axes Standard Version)

Basic Start Up Procedure

NOTES:

These Steps are REQUIRED prior to powering up the motor. Installation Guide 6SN1197-0AA60-0BP3 is required for this procedure. The following steps assume the DC Link Power Source(I / R Module) is already operational. All Power should be off prior to initiating this procedure. It is also assumed that the this procedure is being performed by an individual with previous Servo System experience. DC Link Power may take some minutes to drain down to a safe level after Power Off.

1) Isolate Modules to the right of this one(if they have not been made operational) by removing the Ribbon Connector that is inserted into this module and opening the DC Link connection "links" to the next Module.

2) Remove the Controller PCB and Front Panel by loosening captive screws "a" and "b"(see page 2) and slowly pulling the assembly out of module.

3) Presetting the Controller(s);

(see page 1 for location and additional information on the following switches)

S1 **A) Setting of the Tachometer Matching Switch.**

- The Motor Nameplate lists the Tachometer information in the following format; " 3 ~ 1FU10 . . - 6 . . nn.n mVmin" which is millivolts per RPM. Multiply "nn.n" times the maximum(rated) Motor RPM(i.e..; C = 2000 RPM, F = 3000 RPM, etc..). If the result is = 40, leave the switches open (as received); if <= 16.5, close all three wire loops.

S2 **B) Bit 1: Sets Motor Direction Vs. Polarity of Command Voltage at X331, Term.'s 56 & 14**

Bit's 2, 3, 4 & 5: Sets Current Limit(Maximum allowable output current) for the Module.

Bit's 6, 7, 8, & 9: Sets Current Loop Proportional Gain

-Determine this Axis' Motor Type and Module Rating. Find the "Adaptation Table" for this Module in the Installation Guide. Go down the first column until you find the appropriate motor. Follow this row across the page to the right and under the column "Current Limit" you will find the settings for Bit's 2, 3, 4 & 5. Under th column "Current Gain" you will find the settings for Bit's 6, 7, 8 & 9. Set contacts 2 through 9 as indicated.

Bit 10: Sets Drive to operate in "Velocity"(off) or "Torque(current)"(on) Mode

S3 **C) The settings on this switch are normally left as received usless required to be changed. Changes are usually necessary in cases where a module is being replaced or where experience with previous similar machines dictates it. See page 1 for functions, pre-settings and switch locations.**

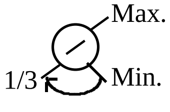
4) Presetting is now complete. Re-Install the Controller PCB into the module, being careful to align it in the car guides and to "seat" it firmly into the rear connector. Firmly tighten retaining screws "a" and "b".

5) The following is a brief discussion of the adjustments;

"Drift" **This adjustment minimizes motor rotation with a "0 V" command when in velocity loop. In this mode it is impossible to guarantee no rotation. When the drive is part of a "Position Loop", this adjustment can assist in minimizing the "Standing(Zero Speed) Following Error" in the higher order controller(CNC, etc..).**

T **The Tachometer adjustment(range about 0.7 . . . 2.2 $n_{RATED)}$ is used in velocity loop mode to scale the motor speed with reference to the voltage applied to the Speed Command input terminals 56 & 14. In "Position Loop" mode it's effect will be to change the following error when running at speed.**

"K_P" & "T_N" **Definitions: "K_P" is the Proportional Gain and "T_N" is the Integral Gain of the Velocity Loop. Preset both adjustments(Axis 1-top and Axis 2-bottom) to 1 / 3 Scale. →**



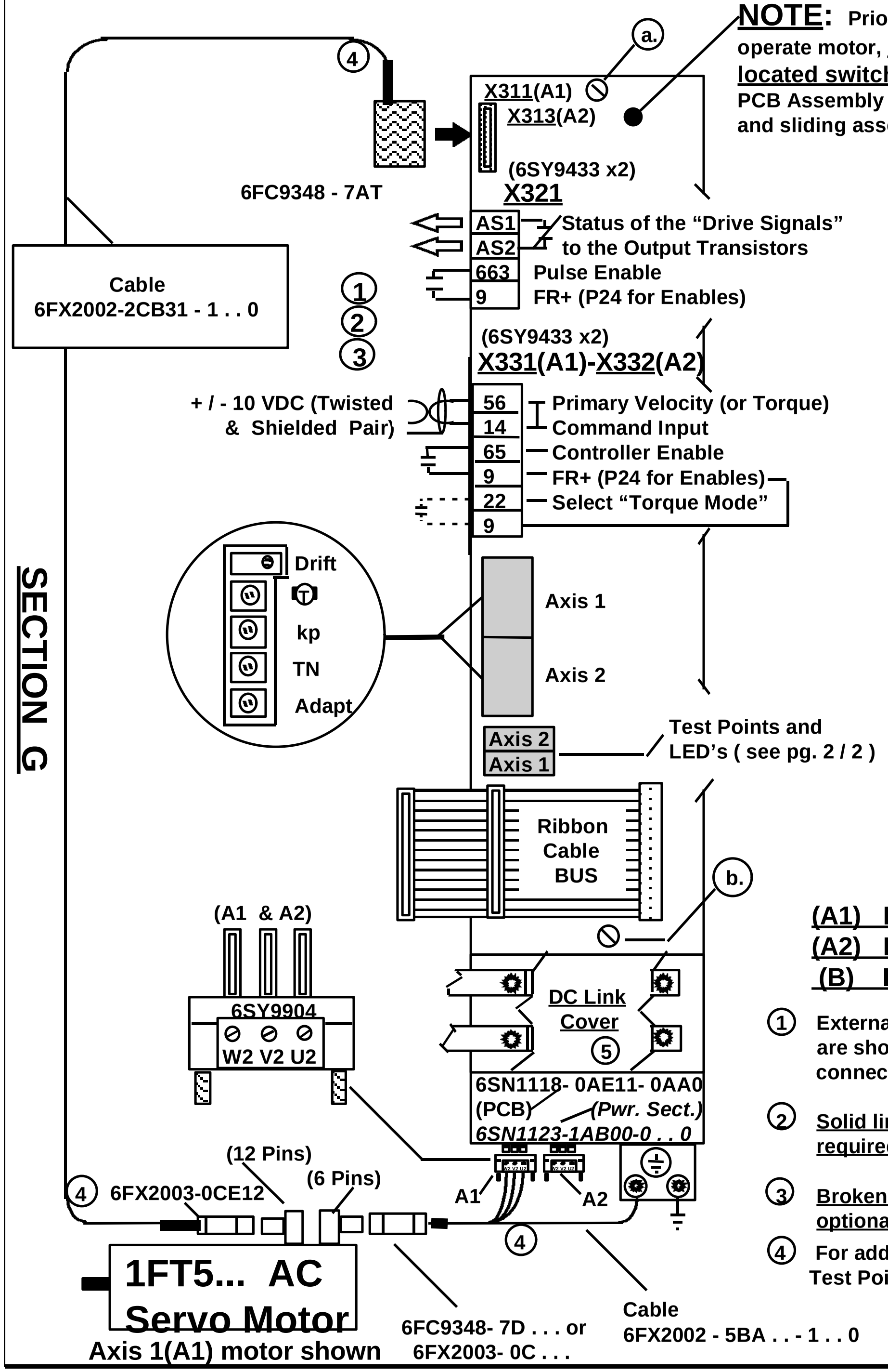
After Power Up(and terminals 663 & 65 on this module have been enabled) the motor should have power applied to it. These adjustments can then be used to match the servo axis performance to the requirements of the machine and the higher order controller(CNC, etc..) if used. They should also be adjusted for optimum operation if used in Velocity Loop mode . In may cases the preset adjustment value may be adequate for acceptable operation.

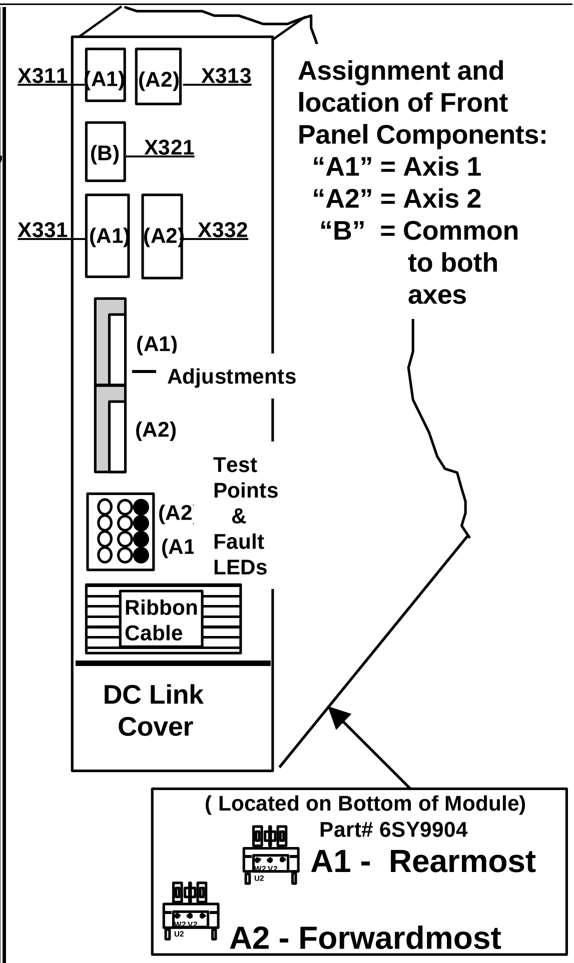
"AD" **Definition: "Low Speed Adaptation", This adjustment is not functional unless S3 bit 5 is on. If activated, AD provides a higher(faster) value of "T_N" to be active at very low speeds.**

6) At this point this portion of the Drive System may be Powered Up and final tuning, etc., accomplished. Powe Up with terminals 663 and 65 open(not enabled). When enabling 663 and 65 for the first time use caution as the motor may turn. Make sure all safety precautions have been taken. DO NOT RECONNECT OR DISCONNECT WIRES OR CONNECTIONS UNLESS POWER IS OFF AND DC LINK HAS DISCHARGED !

SECTION G

NOTE: Prior to applying power or attempting to operate motor, settings must be made on internally located switches. To access, remove Front Panel & PCB Assembly by losening the captive screws ⓐ & ⓑ and sliding assembly out of it's case. When re-installing, be sure to tighten captive screws securely . For location and function of switches, please see page 2 / 2 of this drawing .





NOTES

(A1) Indicates Axis "1"
(A2) Indicates Axis "2"
(B) Indicates Common to both

① External, installer provided connections , are shown on the left side of the connectors and internal on the right.

② Solid line connections are the minimum required for axis operation.

③ Broken lines and Arrows indicate optional connections.

④ For additional details on Motor to Drive connections, Test Points and the LED display, see page 2 / 3

⑤ For connection details, see Drawing:; " General Wiring for Power, Grounding and Module interconnection".

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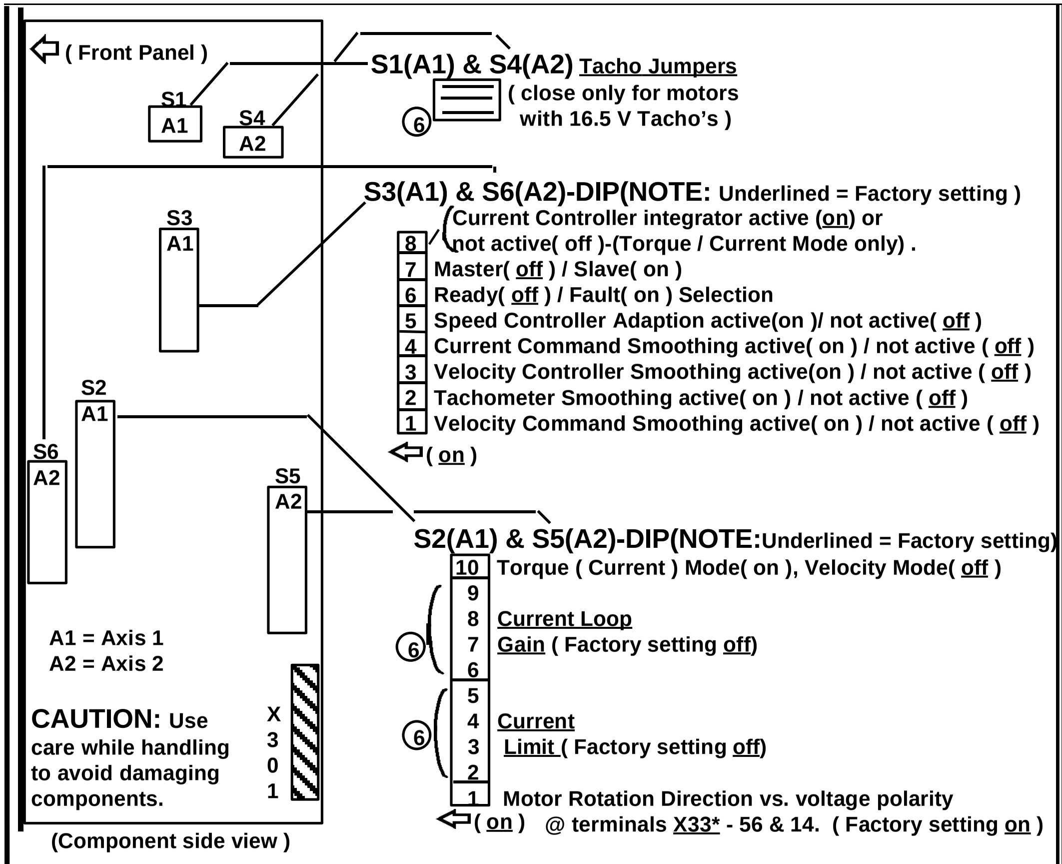
Siemens Energy & Automation
Machine Industry Business

Interface Drawing for ;
611-A SERVO, 2 Axes ,
STANDARD VERSION

Date	Revision	Drawn by
6 / 10 / 96	A-5	de



A1 = Axis 1
A2 = Axis 2

CAUTION: Use care while handling to avoid damaging components.

(Component side view)

S1(A1) & S4(A2) Tacho Jumpers (close only for motors with 16.5 V Tacho's)

S3(A1) & S6(A2)-DIP(NOTE: Underlined = Factory setting)

8 Current Controller integrator active (on) or not active(off)-(Torque / Current Mode only) .
7 Master(off) / Slave(on)
6 Ready(off) / Fault(on) Selection
5 Speed Controller Adaption active(on)/ not active(off)
4 Current Command Smoothing active(on) / not active (off)
3 Velocity Controller Smoothing active(on) / not active (off)
2 Tachometer Smoothing active(on) / not active (off)
1 Velocity Command Smoothing active(on) / not active (off)

S2(A1) & S5(A2)-DIP(NOTE: Underlined = Factory setting)

10 Torque (Current) Mode(on), Velocity Mode(off)
9–6 Current Loop Gain (Factory setting off)
5–2 Current Limit (Factory setting off)
1 Motor Rotation Direction vs. voltage polarity (on) @ terminals X33* - 56 & 14. (Factory setting on)

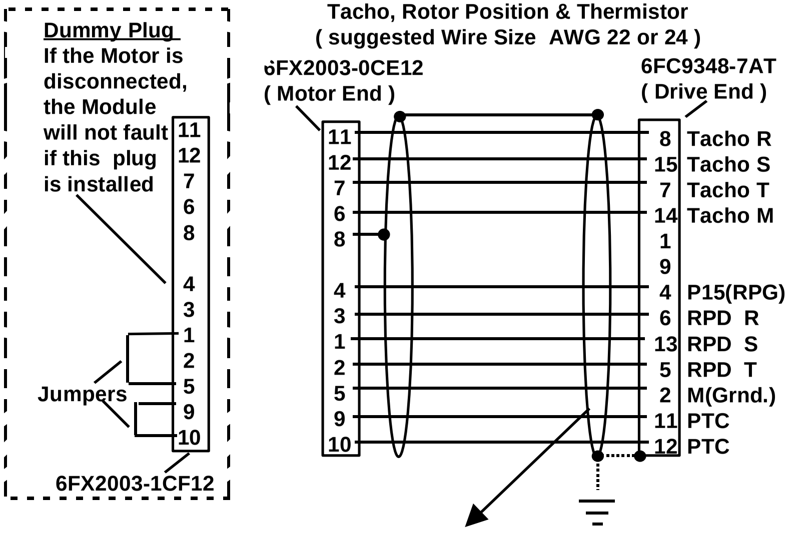
SECTION G

⑥ The correct setting of these Items (3 places) must be verified prior to motor operation. See Installation Guide for correct settings.

NOTE: Motor to Drive connections

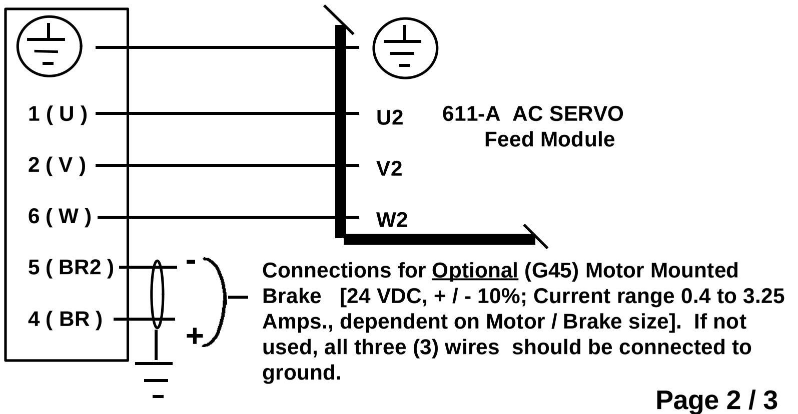
must be exactly as shown !

Wiring of Motor to Drive F/B Cable
Tacho, Rotor Position & Thermistor
(suggested Wire Size AWG 22 or 24)



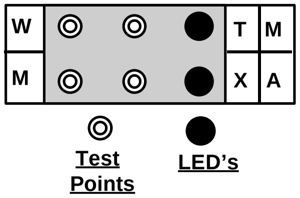
Note: For correct grounding of the Shield, this end should be connected to the Connector Shell or to the M5 screw hole in the top of the Module.

Wiring of Motor to Drive Power Cable (Wire size dependent on Motor Type)



Connections for Optional (G45) Motor Mounted Brake [24 VDC, + / - 10%; Current range 0.4 to 3.25 Amps., dependent on Motor / Brake size]. If not used, all three (3) wires should be connected to ground.

Test Points and Fault LED's
(A1 & A2)



W - Test Point = Actual Motor Current
(10V = I-max as set in S2(A1)-DIP; 2, 3, 4 & 5)
S5(A2)-DIP; 2, 3, 4 & 5)
M - Test Point = Common reference for all Test Points

T - Test Point = Current Command

X - Test Point = Actual Motor Speed
(40.0 V Tacho: 10 V = Rated Speed)
(16.5 V Tacho: 11 V = Rated Speed)

M - LED = Motor Fault;
- Motor to Drive Feed Back Cable
- Tachometer
- Rotor Position Detector

A - LED = Axis(Drive) Fault
- Speed Controller at Limit (> 200ms)
- Drive Heat Sink Overtemperature (> 90º C)
- Motor Overemperature (> 155º C + / - 5 º C)
- I^2T Monitoring Activated (I-rms > 1.1 x I-rated)
- Motor to Drive Power Cable disconnected

NOTE: If Both lights are lit, the Feed Back Cable may be disconnected(motor end ?)

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Siemens Energy & Automation
Machine Industry Business

Interface Drawing for ;
611-A SERVO, 2 Axes,
STANDARD VERSION

Date	Revision	Drawn by
6 / 10 / 96	A-5	de

611-A Servo Feed Module(2-Axes Standard Version)
Basic Start Up Procedure

NOTES:

These Steps are REQUIRED prior to powering up the motor. Installation Guide 6SN1197-0AA60-0BP3 is required for this procedure. The following steps assume the DC Link Power Source(I / R Module) is already operational. All Power should be off prior to initiating this procedure. It is also assumed that the this procedure is being performed by an individual with previous Servo System experience. DC Link Power may take some minutes to drain down to a safe level after Power Off.

1) Isolate Modules to the right of this one(if they have not been made operational) by removing the Ribbon Connector that is inserted into this module and opening the DC Link connection “links” to the next Module.
2) Remove the Controller PCB and Front Panel by loosening captive screws “a” and “b”(see page 2) and slowly pulling the assembly out of module.
3) Presetting the Controller(s);

Axis 1 **Axis 2** (see page 2 for location and additional information on the following switches)

S1 S2 A) Setting of the Tachometer Matching Switch.
- The Motor Nameplate lists the Tachometer information in the following format; “ 3 ~ 1FU10 . . - 6 . . nn.n mVmin” which is millivolts per RPM. Multiply “nn.n” times the maximum(rated) Motor RPM(i.e..; C = 2000 RPM, F = 3000 RPM, etc..). If the result is = 40, leave the switches open (as received); if <= 16.5, close all three wire loops.

S2 S5 B) Bit 1: Sets Motor Direction Vs. Polarity of Command Voltage at X331/332, Term.’s 56 & 14
Bit’s 2, 3, 4 & 5: Sets Current Limit(Maximum allowable output current) for the Module.
Bit’s 6, 7, 8, & 9: Sets Current Loop Proportional Gain
-Determine this Axis’ Motor Type and Module Rating. Find the “Adaptation Table” for this Module in the Installation Guide. Go down the first column until you find the appropriate motor. Follow this row across the page to the right and under the column “Current Limit” you will find the settings for Bit’s 2, 3, 4 & 5. Under th column “Current Gain” you will find the settings for Bit’s 6, 7, 8 & 9. Set contacts 2 through 9 as indicated.
Bit 10: Sets Drive to operate in “Velocity”(off) or “Torque(current)”(on) Mode

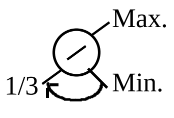
S3 S6 C) The settings on this switch are normally left as received usless required to be changed. Changes are usually necessary in cases where a module is being replaced or where experience with previous similar machines dictates it. See page 2 for functions, pre-settings and switch locations.

4) Presetting is now complete. Re-Install the Controller PCB into the module, being careful to align it in the car guides and to “seat” it firmly into the rear connector. Firmly tighten retaining screws “a” and “b”.
5) The following is a brief discussion of the adjustments;

“Drift” This adjustment minimizes motor rotation with a “0 V” command when in velocity loop. In this mode it is impossible to guarantee no rotation. When the drive is part of a “Position Loop”, this adjustment can assist in minimizing the “Standing(Zero Speed) Following Error” in the higher order controller(CNC, etc..).

T The Tachometer adjustment(range about 0.7 . . . 2.2 $n_{\text{RATED)}}$ is used in velocity loop mode to scale the motor speed with reference to the voltage applied to the Speed Command input terminals 56 & 14. In “Position Loop” mode it’s effect will be to change the following error when running at speed.

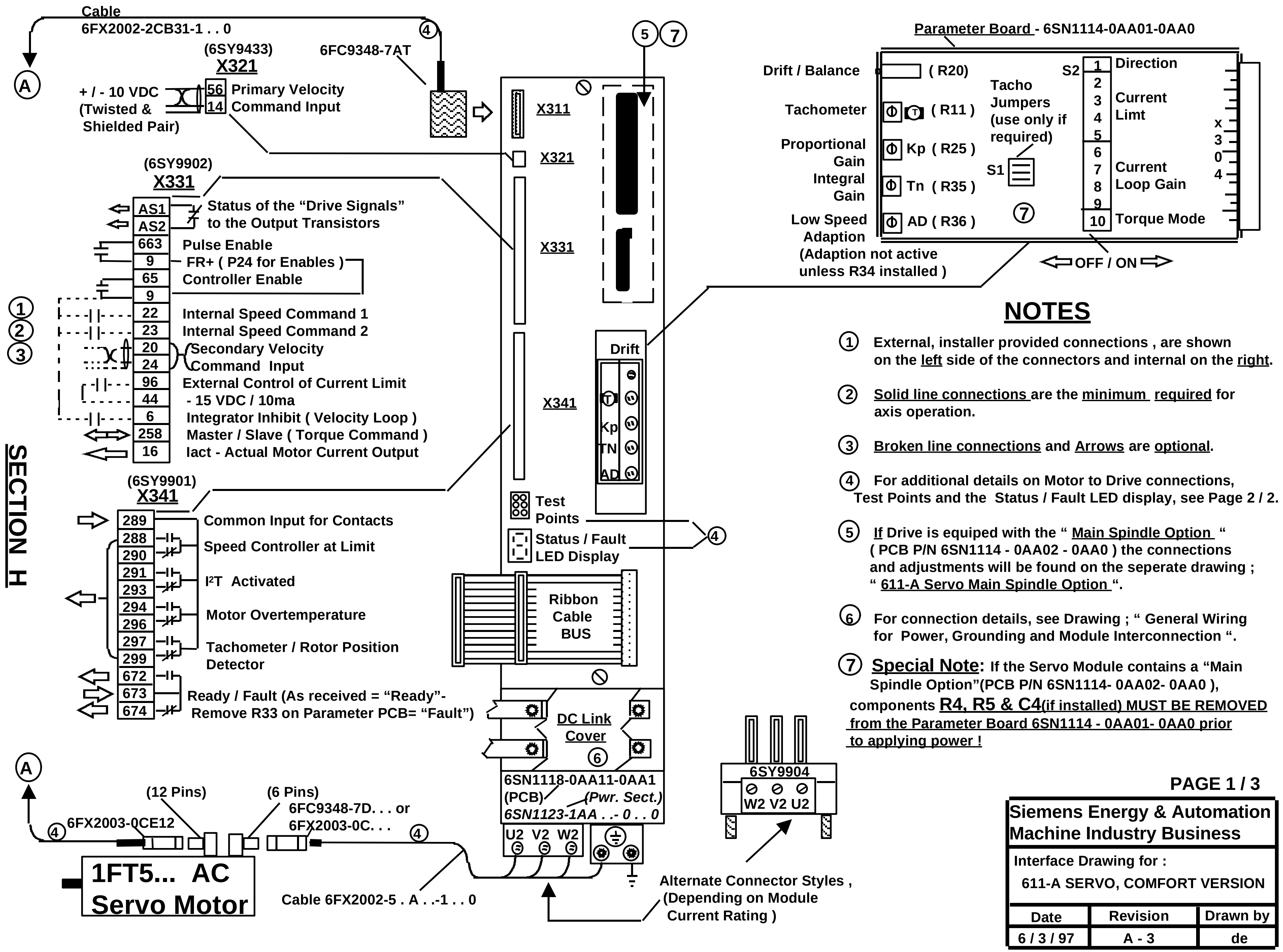
“K_P” & “T_N” Definitions: “K_P” is the Proportional Gain and “T_N” is the Integral Gain of the Velocity Loop. Preset both adjustments(Axis 1-top and Axis 2-bottom) to 1 / 3 Scale. After Power Up(and terminals 663 & 65 on this module have been enabled) the motor should have power applied to it. These adjustments can then be used to match the servo axis performance to the requirements of the machine and the higher order controller(CNC, etc..) if used. They should also be adjusted for optimum operation if used in Velocity Loop mode . In may cases the preset adjustment value may be adequate for acceptable operation.



“AD” Definition: “Low Speed Adaptation”, This adjustment is not functional unless S3 bit 5 is on. If activated, AD provides a higher(faster) value of “T_N” to be active at very low speeds.

6) At this point this portion of the Drive System may be Powered Up and final tuning, etc., accomplished. Powe Up with terminals 663 and 65 open(not enabled). When enabling 663 and 65 for the first time use caution as the motor may turn. Make sure all safety precautions have been taken. DO NOT RECONNECT OR DISCONNECT WIRES OR CONNECTIONS UNLESS POWER IS OFF AND DC LINK HAS DISCHARGED !

SECTION H



NOTES

① External, installer provided connections , are shown on the left side of the connectors and internal on the right.

② Solid line connections are the minimum required for axis operation.

③ Broken line connections and Arrows are optional.

④ For additional details on Motor to Drive connections, Test Points and the Status / Fault LED display, see Page 2 / 2.

⑤ If Drive is equiped with the " Main Spindle Option " (PCB P/N 6SN1114 - 0AA02 - 0AA0) the connections and adjustments will be found on the seperate drawing ; " 611-A Servo Main Spindle Option ".

⑥ For connection details, see Drawing ; " General Wiring for Power, Grounding and Module Interconnection ".

⑦ **Special Note:** If the Servo Module contains a "Main Spindle Option"(PCB P/N 6SN1114- 0AA02- 0AA0), components **R4, R5 & C4**(if installed) MUST BE REMOVED from the Parameter Board 6SN1114 - 0AA01- 0AA0 prior to applying power !

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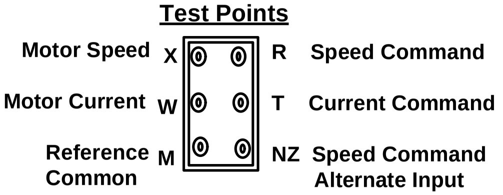
Siemens Energy & Automation
Machine Industry Business

Interface Drawing for :
611-A SERVO, COMFORT VERSION

Date	Revision	Drawn by
6 / 3 / 97	A - 3	de

SECTION H

Test Points



" X " : Voltage @ Rated Speed ;
= 11 VDC if Tacho is rated 16.5 VDC
= 10 VDC if Tacho is rated 40 VDC

" W " : 10 VDC = ;
Module " Imax " as set in Parameter Board by S2, Switches 2,3,4 & 5

" M " : Common reference for all Test Points

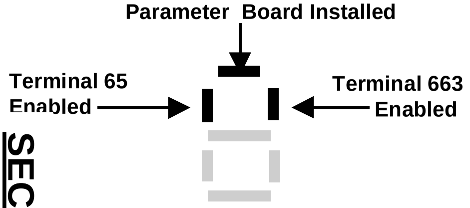
" R " = Voltage at Terminals X321 - 56 / 14 (or command inserted at " NZ ") .

" T " = 10 VDC = (same as Test Point " W ")

"NZ" = Additional input for a speed command

Ready / Fault LED Display

- A - Normal Status Display



- B - Fault Display (Numeric Display; 1 . . . . 7)

1 = I²T is Active
2 = Rotor Position Detector(or Cable) Fault
3 = Motor Overtemperature
4 = Tach Monitoring (or Cable) Fault
5 = I²T active and the Speed Controller is at Limit (Drive in Current Limit > 200 ms)
6 = Speed Controller is at Limit (Drive in Current Limit > 200 ms, without I²T being active) .
7 = Speed Controller is at Limit and the Motor Current = 0

S2(10 Bit Dip Switch) - Decoding of Switch Settings

Bit 1 = Motor Direction : If ON(as shipped), Motor Rotation CCW with + at Terminal 56(in reference to 14)

Current Limit as a % of Module Peak Current

Bit 2 =	☐	■	☐	■	☐	■	☐	■	☐	■	☐	■	☐	☐	■
Bit 3 =	☐	☐	■	■	☐	☐	■	■	☐	☐	■	■	☐	■	■
Bit 4 =	☐	☐	☐	☐	■	■	■	■	☐	☐	☐	☐	■	■	■
Bit 5 =	☐	☐	☐	☐	☐	☐	☐	☐	■	■	■	■	■	■	■
	100	85	68	61	50	46	41	39	36	34	30	29	26	24	23 = % I_{Limit}

■ = On
☐ = Off

Current Loop Proportional Gain (Kp I)

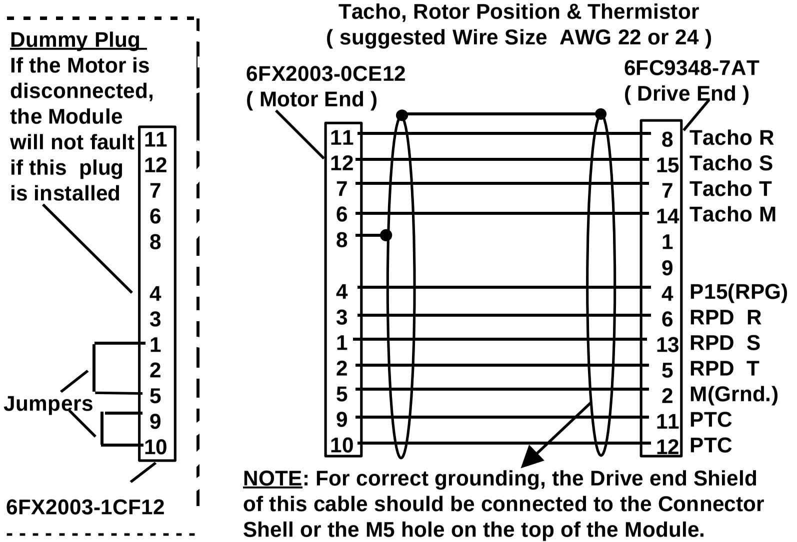
Bit 6 =	☐	■	☐	■	☐	■	☐	■	■	☐	■	☐	☐	■
Bit 7 =	☐	☐	■	■	☐	☐	■	■	☐	■	■	☐	■	■
Bit 8 =	☐	☐	☐	☐	■	■	■	■	☐	☐	☐	■	■	■
Bit 9 =	☐	☐	☐	☐	☐	☐	☐	☐	■	■	■	■	■	■
	0.5	1	2	2.5	4	4.5	5.5	6	6.5	7.5	8	9.5	11	11.5 = Kp I

Bit 10 = If OFF(as delivered), Drive in Velocity Mode.
If ON, Drive in Current(Torque) Mode(Command to 24 & 20)

NOTE: Motor to Drive connections

must be exactly as shown !

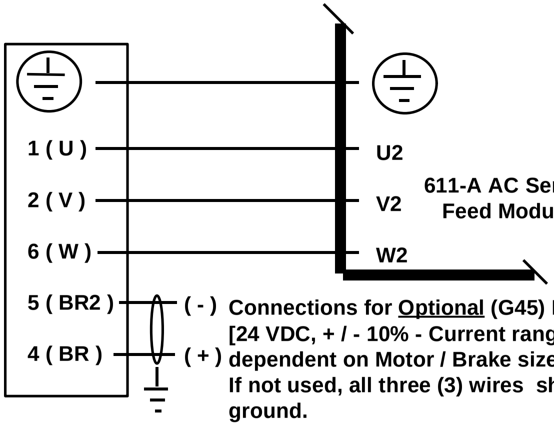
Wiring of Motor to Drive F/B Cable
Tacho, Rotor Position & Thermistor
(suggested Wire Size AWG 22 or 24)



NOTE: For correct grounding, the Drive end Shield of this cable should be connected to the Connector Shell or the M5 hole on the top of the Module.

Wiring of Motor to Drive Power Cable

(Wire size dependent on Motor Type)



Connections for Optional (G45) Motor Mounted Brake [24 VDC, + / - 10% - Current range 0.4 to 3.25 Amps dependent on Motor / Brake size].
If not used, all three (3) wires should be connected to ground.

Page 2 / 3

Siemens Energy & Automation
Machine Industry Business

Interface Drawing for ;
611-A SERVO, COMFORT VERSION

Date	Revision	Drawn by
6 / 3 / 97	A - 3	de

611-A Servo Feed Module(2-Axes Standard Version)
Basic Start Up Procedure

NOTES:

These Steps are REQUIRED prior to powering up the motor. Installation Guide 6SN1197-0AA60-0BP3 is required for this procedure. The following steps assume the DC Link Power Source(I / R Module) is already operational. All Power should be off prior to initiating this procedure. It is also assumed that the this procedure is being performed by an individual with previous Servo System experience. DC Link Power may take some minutes to drain down to a safe level after Power Off.

1) Isolate Modules to the right of this one(if they have not been made operational) by removing the Ribbon Connector that is inserted into this module and opening the DC Link connection "links" to the next Module.
2) Remove the Controller PCB and Front Panel by loosening captive screws "a" and "b"(see page 2) and slowly pulling the assembly out of module.
3) Presetting the Controller(s);

Axis 1 Axis 2 (see page 2 for location and additional information on the following switches)

S1 S2 A) Setting of the Tachometer Matching Switch.

- The Motor Nameplate lists the Tachometer information in the following format;
" 3 ~ 1FU10 . . - 6 . . nn.n mVmin" which is millivolts per RPM. Multiply "nn.n" times the maximum(rated) Motor RPM(i.e..; C = 2000 RPM, F = 3000 RPM, etc..). If the result is = 40, leave the switches open (as received); if <= 16.5, close all three wire loops.

S2 S5 B) Bit 1: Sets Motor Direction Vs. Polarity of Command Voltage at X331/332, Term.'s 56 & 14
Bit's 2, 3, 4 & 5: Sets Current Limit(Maximum allowable output current) for the Module.
Bit's 6, 7, 8, & 9: Sets Current Loop Proportional Gain
-Determine this Axis' Motor Type and Module Rating. Find the "Adaptation Table" for this Module in the Installation Guide. Go down the first column until you find the appropriate motor. Follow this row across the page to the right and under the column "Current Limit" you will find the settings for Bit's 2, 3, 4 & 5. Under th column "Current Gain" you will find the settings for Bit's 6, 7, 8 & 9. Set contacts 2 through 9 as indicated.
Bit 10: Sets Drive to operate in "Velocity"(off) or "Torque(current)"(on) Mode

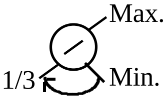
S3 S6 C) The settings on this switch are normally left as received usless required to be changed. Changes are usually necessary in cases where a module is being replaced or where experience with previous similar machines dictates it. See page 2 for functions, pre-settings and switch locations.

4) Presetting is now complete. Re-Install the Controller PCB into the module, being careful to align it in the car guides and to "seat" it firmly into the rear connector. Firmly tighten retaining screws "a" and "b".
5) The following is a brief discussion of the adjustments;

"Drift" **This adjustment minimizes motor rotation with a "0 V" command when in velocity loop. In this mode it is impossible to guarantee no rotation. When the drive is part of a "Position Loop", this adjustment can assist in minimizing the "Standing(Zero Speed) Following Error" in the higher order controller(CNC, etc..).**

T **The Tachometer adjustment(range about 0.7 . . . 2.2 $n_{RATED)}$ is used in velocity loop mode to scale the motor speed with reference to the voltage applied to the Speed Command input terminals 56 & 14. In "Position Loop" mode it's effect will be to change the following error when running at speed.**

"K_P" & "T_N" **Definitions: "K_P" is the Proportional Gain and "T_N" is the Integral Gain of the Velocity Loop. Preset both adjustments(Axis 1-top and Axis 2-bottom) to 1 / 3 Scale.**



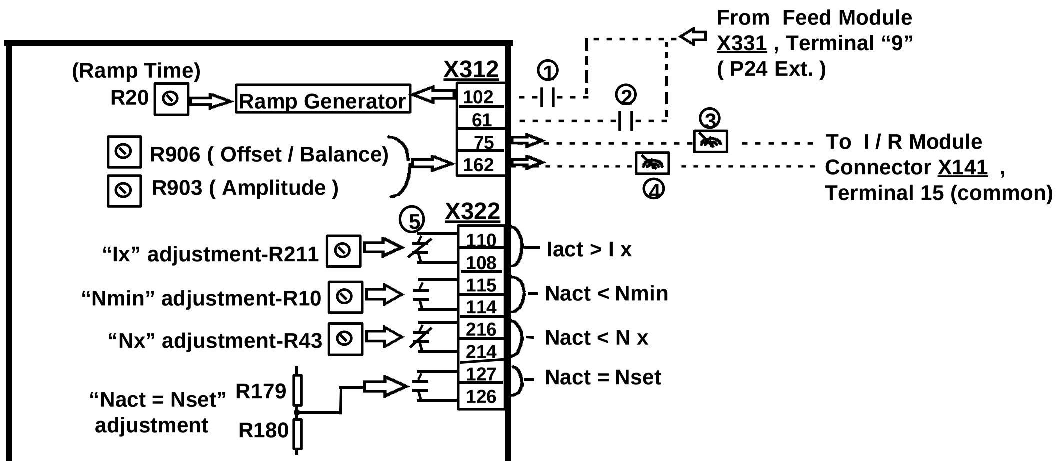
After Power Up(and terminals 663 & 65 on this module have been enabled) the motor should have power applied to it. These adjustments can then be used to match the servo axis performance to the requirements of the machine and the higher order controller(CNC, etc..) if used. They should also be adjusted for optimum operation if used in Velocity Loop mode . In may cases the preset adjustment value may be adequate for acceptable operation.

"AD" **Definition: "Low Speed Adaptation", This adjustment is not functional unless S3 bit 5 is on. If activated, AD provides a higher(faster) value of "T_N" to be active at very low speeds.**

6) At this point this portion of the Drive System may be Powered Up and final tuning, etc., accomplished. Powe Up with terminals 663 and 65 open(not enabled). When enabling 663 and 65 for the first time use caution as the motor may turn. Make sure all safety precautions have been taken. DO NOT RECONNECT OR DISCONNECT WIRES OR CONNECTIONS UNLESS POWER IS OFF AND DC LINK HAS DISCHARGED !

Built in “Main Spindle Option” Board
PCB P/N: 6SN1114 - 0AA02 - 0AA0

NOTE: All external connections are optional (ie; not required for basic operation)



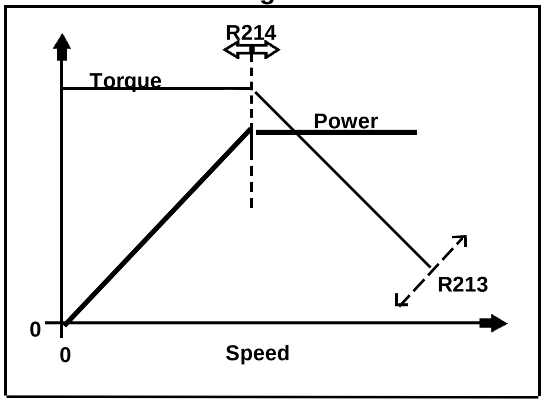
Speed Dependent Current (Torque) Limit
(Sets Constant Power Range)
[See Fig. 1]

- R214 (Speed @ which Current [Torque] reduction starts)
- R213 (Current [Torque] @ maximum Speed)

Main Spindle Mode Adjustments

- R96 (Main Spindle - Drift [Balance])
- R45 (Kp - Main Spindle Proportional Gain)
- R44 (Tn - Main Spindle Integral Gain)
- R1 (Main Spindle - RPM for Pulse Inhibit)

Fig. 1



Special Note: If the Servo Module contains this “Option”, it is imperative that R4, R5 and C4(if installed) be removed from the Parameter Board “6SN1114-0AA01-0AA0” (see section “H”) before applying power.

NOTES:

① Term. # 102: Select Ramp Time Adjustment Range
(open = 0.01 to 1.1 Sec.’s
(closed = 0.1 to 11 Sec.’s

② Term. # 61: Select Servo / Spindle operation (open = Spindle; closed = Servo [“C” Axis])

③ Term. # 75: Actual Speed output ; As delivered, Vout = 9.45 VDC @ Motor Rated Speed . For very accurate requirements, Vout vs. Motor Shaft speed must be measured (relationship is linear).

④ Term. # 162: Actual Current or Actual Power output (Actual Power is factory standard)

⑤ Contacts shown “as supplied ” by the factory. They can be configured “NO or NC” as required

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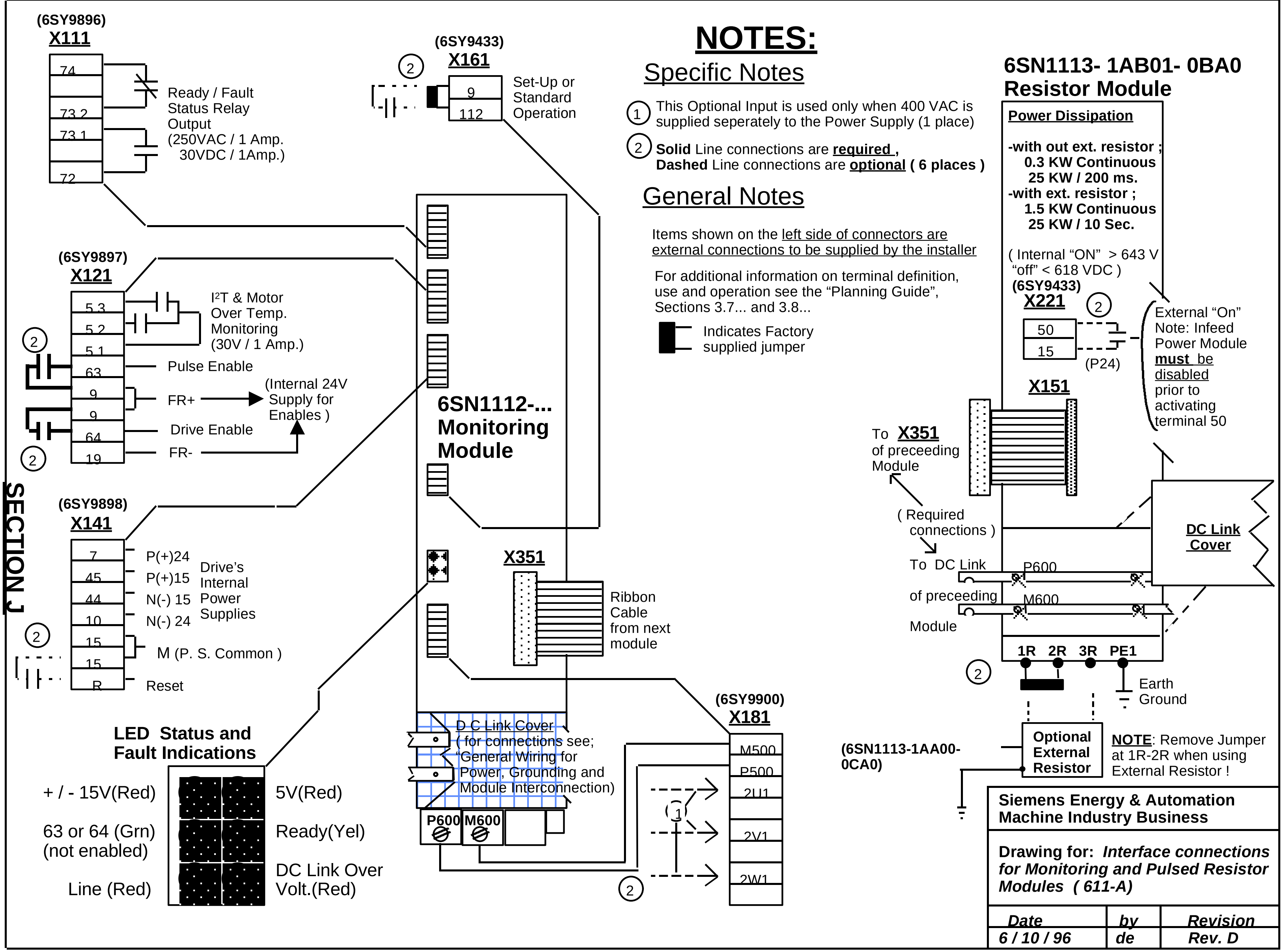
Machine Industry Business

Interface Drawing for : *611-A Servo Main Spindle Option (part of Comfort Version PCB 6SN1118- 0AA11- 0AA1)*

Date	Revision	Drawn by
6 / 10 / 96	Rev. - F	de



NOTES:

Specific Notes

① This Optional Input is used only when 400 VAC is supplied seperately to the Power Supply (1 place)

② **Solid** Line connections are **required** ,
Dashed Line connections are **optional** (6 places)

General Notes

Items shown on the left side of connectors are external connections to be supplied by the installer

For additional information on terminal definition, use and operation see the "Planning Guide", Sections 3.7... and 3.8...

▮ Indicates Factory supplied jumper

6SN1113- 1AB01- 0BA0 Resistor Module

Power Dissipation

-with out ext. resistor ;
0.3 KW Continuous
25 KW / 200 ms.
-with ext. resistor ;
1.5 KW Continuous
25 KW / 10 Sec.

(Internal "ON" > 643 V
"off" < 618 VDC)

NOTE: Remove Jumper at 1R-2R when using External Resistor !

Siemens Energy & Automation
Machine Industry Business

Drawing for: ***Interface connections for Monitoring and Pulsed Resistor Modules (611-A)***

Date	***by***	***Revision***
6 / 10 / 96	***de***	***Rev. D***

COMPONENT LEVEL PART NUMBERS FOR 611-A SINGLE AND DOUBLE AXIS FEED MODULES

9/30/98

	TYPE OF MODULE	RATING	ORIGINAL, COMPLETE MODULE ASSEMBLY	COMPONENT LEVEL PART NUMBERS POWER SECTION	CONTROLLER PCB	SETTING BOARD	MODULE WIDTH
	SINGLE AXIS COMFORT	4/8 A	6SN1130-1AA11-0GA0	6SN1123-1AA00-0HA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
*	COMFORT WITH SPINDLE OPTION	4/8 A	6SN1130-1AA12-0GA0	6SN1123-1AA00-0HA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
**	SINGLE AXIS STANDARD	4/8 A	6SN1130-1AD11-0GA0	6SN1123-1AA00-0HA1	6SN1118-0AD11-0AA1	N / A	50 mm
**	DOUBLE AXIS MODULE	4/8 A	6SN1130-1AE11-0GB0	6SN1123-1AA00-0HA1	6SN1118-0AE11-0AA1	N / A	50 mm
	SINGLE AXIS COMFORT	7.5/15 A	6SN1130-1AA11-0AA0	6SN1123-1AA00-0AA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
*	COMFORT WITH SPINDLE OPTION	7.5/15 A	6SN1130-1AA12-0AA0	6SN1123-1AA00-0AA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
**	SINGLE AXIS STANDARD	7.5/15 A	6SN1130-1AD11-0AA0	6SN1123-1AA00-0AA1	6SN1118-0AD11-0AA1	N / A	50 mm
**	DOUBLE AXIS MODULE	7.5/15 A	6SN1130-1AE11-0AB0	6SN1123-1AA00-0AA1	6SN1118-0AE11-0AA1	N / A	50 mm
	SINGLE AXIS COMFORT	12.5/25 A	6SN1130-1AA11-0BA0	6SN1123-1AA00-0BA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
*	COMFORT WITH SPINDLE OPTION	12.5/25 A	6SN1130-1AA12-0BA0	6SN1123-1AA00-0BA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
**	SINGLE AXIS STANDARD	12.5/25 A	6SN1130-1AD11-0BA0	6SN1123-1AA00-0BA1	6SN1118-0AD11-0AA1	N / A	50 mm
**	DOUBLE AXIS MODULE	12.5/25 A	6SN1130-1AE11-0BB0	6SN1123-1AA00-0BA1	6SN1118-0AE11-0AA1	N / A	50 mm
	SINGLE AXIS COMFORT	25/50 A	6SN1130-1AA11-0CA0	6SN1123-1AA00-0CA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
*	COMFORT WITH SPINDLE OPTION	25/50 A	6SN1130-1AA12-0CA0	6SN1123-1AA00-0CA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	50 mm
**	SINGLE AXIS STANDARD	25/50 A	6SN1130-1AD11-0CA0	6SN1123-1AA00-0CA1	6SN1118-0AD11-0AA1	N / A	50 mm
**	DOUBLE AXIS MODULE	25/50 A	6SN1130-1AE11-0CB0	6SN1123-1AA00-0CA1	6SN1118-0AE11-0AA1	N / A	50 mm
	SINGLE AXIS COMFORT	40/80 A	6SN1130-1AA11-0DA0	6SN1123-1AA00-0DA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	100 mm
*	COMFORT WITH SPINDLE OPTION	40/80 A	6SN1130-1AA12-0DA0	6SN1123-1AA00-0DA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	100 mm
**	SINGLE AXIS STANDARD	40/80 A	6SN1130-1AD11-0DA0	6SN1123-1AA00-0DA1	6SN1118-0AD11-0AA1	N / A	100 mm
	SINGLE AXIS COMFORT	80/160 A	6SN1130-1AA11-0EA0	6SN1123-1AA00-0EA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	150 mm
*	COMFORT WITH SPINDLE OPTION	80/160 A	6SN1130-1AA12-0EA0	6SN1123-1AA00-0EA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	150 mm
**	SINGLE AXIS STANDARD	80/160 A	6SN1130-1AD11-0EA0	6SN1123-1AA00-0EA1	6SN1118-0AD11-0AA1	N / A	150 mm
	SINGLE AXIS COMFORT	100/200 A	6SN1130-1AA11-0FA0	6SN1123-1AA01-0FA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	300 mm
*	COMFORT WITH SPINDLE OPTION	100/200 A	6SN1130-1AA12-0FA0	6SN1123-1AA01-0FA1	6SN1118-0AA11-0AA1	6SN1114-0AA01-0AA0	300 mm
**	SINGLE AXIS STANDARD	100/200 A	6SN1130-1AD11-0FA0	6SN1123-1AA01-0FA1	6SN1118-0AD11-0AA1	N / A	300 mm

* NOTE: THE MAIN SPINDLE OPTION CAN ONLY BE SUPPLIED WITH THE SINGLE AXIS COMFORT VERSION 611-A. MAIN SPINDLE OPTION PCB **(6SN1114-0AA02-0AA0)** MUST ALSO BE ORDERED IN ADDITION TO THE CONTROLLER AND SETTING BOARDS.

_ NOTE:_** NO SETTING BOARD IS USED FOR THE STANDARD OR TWO AXIS VERSION FEED MODULES.

All component level part numbers in the chart reflect the 'V3' version replacement components.

Tightening Torques for Drive Connections

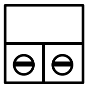
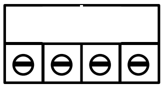
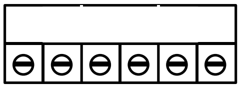
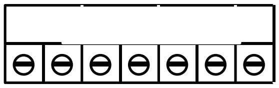
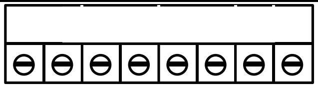
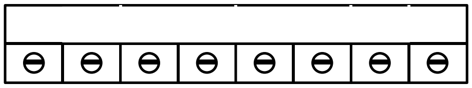
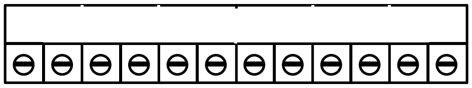
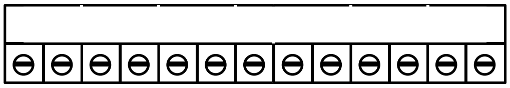
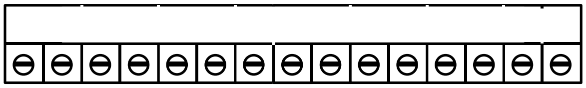
INFEED MODULES		CONNECTION TO CNC GROUND X131		EARTH GROUND PE1		P600,M600 BUS BAR CONNECTIONS		CONTROL X111, 121, 171, 181, 141, 161, 172		INPUT POWER U1,V1,W1	
MODULE #	POWER	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE
6SN1146-1AB00-0BA0	5kW	M4	1.8 Nm	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M3	.5 to .6 Nm
6SN1145-1AA00-0AA0	10 kW	M4	1.8 Nm	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M4	1.5 to 1.8 Nm
6SN1145-1BA00-0BA0	16 kW	M4	1.8 Nm	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M4	1.5 to 1.8 Nm
6SN1145-1BA02-0CA0	36 kW	M4	1.8 Nm	M6	6Nm	M4	1.8 Nm	M3	0.8 Nm	M6	6 to 8 Nm
6SN1145-1BA01-0DA0	55 kW	M4	1.8 Nm	M6	6Nm	M4	1.8 Nm	M3	0.8 Nm	M8	12 to 14 Nm
6SN1145-1BB00-0EA0	80 kW	M4	1.8 Nm	M6	6Nm	M4	1.8 Nm	M3	0.8 Nm	M8	12 to 14 Nm
6SN1145-1BB00-0FA0	120 kW	M4	1.8 Nm	M6	6Nm	M4	1.8 Nm	M3	0.8 Nm	M10	18 to 22 Nm

MONITORING MODULE	EARTH GROUND PE1 CONNECTIONS		P600/M600 TERMINAL CONNECTIONS		P600/M600 BUS BAR CONNECTIONS		CONTROL X111, 121, 141, 181, 161	
MODULE #	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE
6SN1112-1AC01-0AA0	M5	3Nm	M4	1.5 to 1.8 Nm	M4	1.8 Nm	M3	0.8 Nm

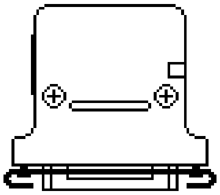
PULSE RESISTOR MOD.	EARTH GROUND PE1		RESISTOR 1R,2R,3R		P600/M600 BUS BAR		CONTROL X221	
MODULE #	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE
6SN1113-1AA00-0AA0	M5	3Nm	M4	1.5 to 1.8 Nm	M4	1.8 Nm	M3	0.8 Nm

POWER SECTION MODULES		EARTH GROUND PE1		P600/M600 BUS BAR CONNECTIONS		CONTROL X412, 421, 431, 432, 441,451		MOTOR OUTPUT U2,V2,W2		CONTROL BOARD MOUNTING SCREWS	
MODULE #	LIMIT	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE	SCREW SIZE	TIGHTENING TORQUE
6SN1123-1AA00-0HA0	8A	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M3	.5 to .6 Nm	M3	0.8 Nm
6SN1123-1AA00-0AA0	15A	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M3	.5 to .6 Nm	M3	0.8 Nm
6SN1123-1AA00-0BA0	25A	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M3	.5 to .6 Nm	M3	0.8 Nm
6SN1123-1AA00-0CA0	50A	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M3	.5 to .6 Nm	M3	0.8 Nm
6SN1123-1AA00-0DA0	80A	M5	3Nm	M4	1.8 Nm	M3	0.8 Nm	M4	1.5 to 1.8 Nm	M3	0.8 Nm
6SN1123-1AA00-0EA0	160A	M6	6Nm	M4	1.8 Nm	M3	0.8 Nm	M6	6 to 8 Nm	M3	0.8 Nm
6SN1123-1AA00-0FA0	200A	M6	6Nm	M4	1.8 Nm	M3	0.8 Nm	M8	12 to 14 Nm	M3	0.8 Nm

Mating Connectors for SimoDrive 611-A Modules

Order Number	Number of Pins	Grid Dimension	
6SY9433	2	5.08 mm	
6SY9432	4	5.08 mm	
6SY9896	6	5.08 mm	
6SY9898	7	5.08 mm	
6SY9897	8	5.08 mm	
6SY9900	8	7.60 mm	
6SY9901	12	5.08 mm	
6SY9903	13	5.08 mm	
6SY9902	15	5.08 mm	

611-A Feed Drive Feedback Connector Order Number	Number of Pins
6FC9348-7AT	15

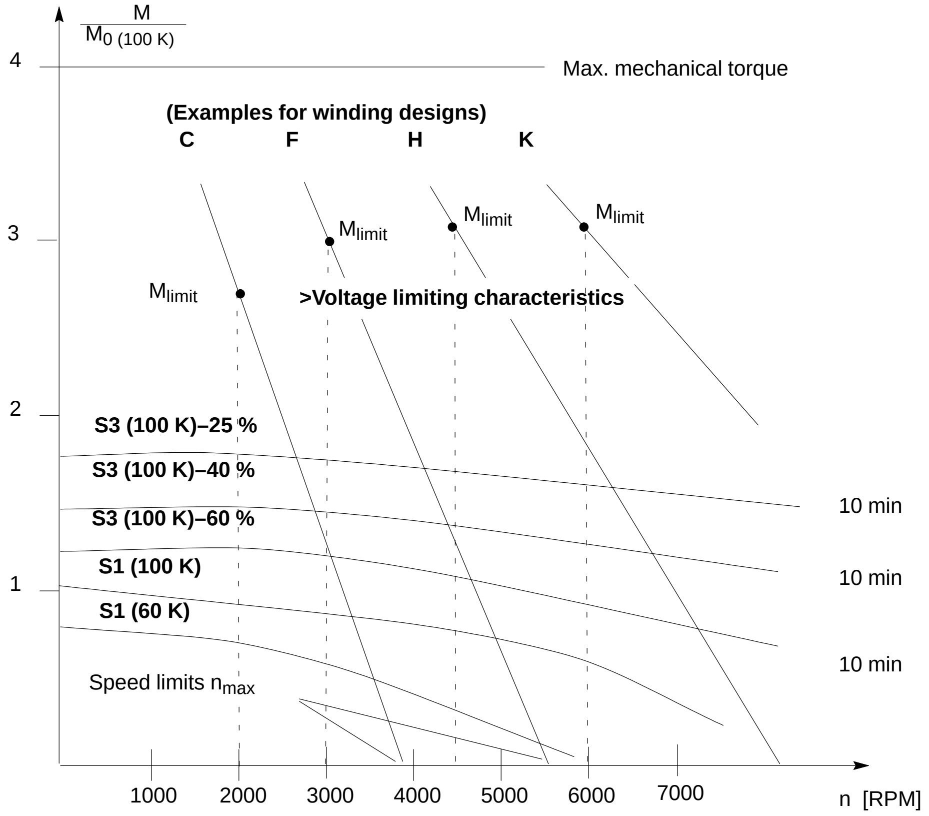


1

Electrical data

1.1 Definitions

Characteristics



Thermal limiting characteristics for

- Continuous operation
  S1 (100 K) and S1 (60 K),
- Intermittent operation
  S3–60 % (100 K), S3–40 % (100 K)
  S3–25 % (100 K)
  for a 10 min duty cycle.

Fig. 1-1 Normalized speed–torque diagram

100 K, 60 K values

100 K or 60 K is the average winding temperature rise.

105 K corresponds to a utilization according to temperature rise class F.

60 K lies within utilization according to temperature rise class B. The 60 K utilization should therefore only be used, if

- the housing temperature must be below 90 °C for safety reasons,
- or if the shaft temperature rise has a negative impact on the mounted machine.

All data is valid for permissible ambient temperature and cooling medium temperature of 40 °C.

Torque characteristics

Several armature circuit designs are possible within any one frame size. The AC servomotors offer a torque characteristic which is constant up to approx. 2000 RPM above which, depending on the type, it is reduced. A high overload capability is provided over the complete speed control range.

The following limits are always valid for the servomotor drive converter module combinations.

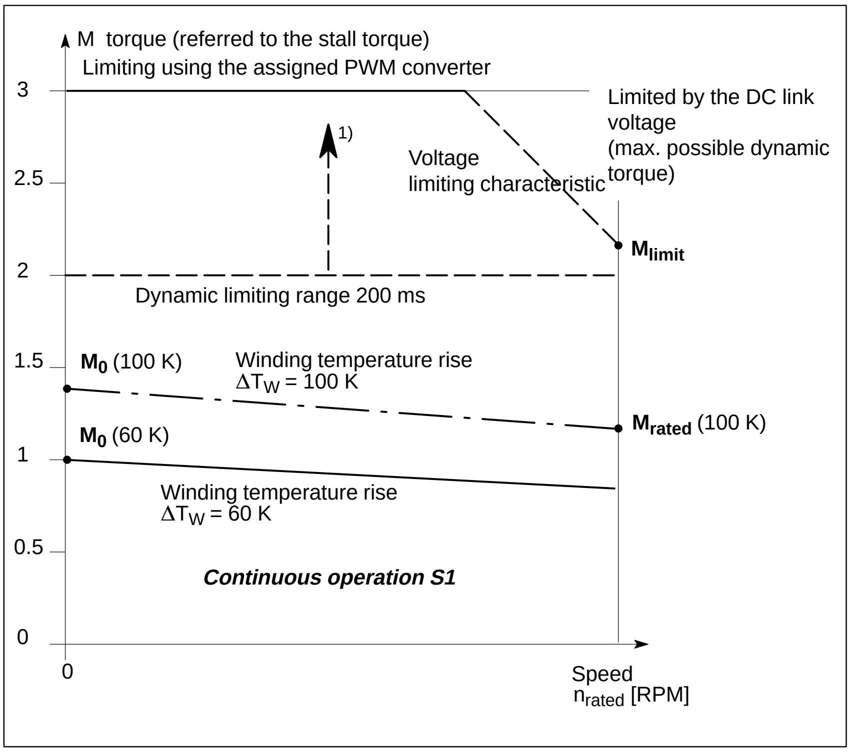


Fig. 1-2 Torque characteristics of the AC servomotors

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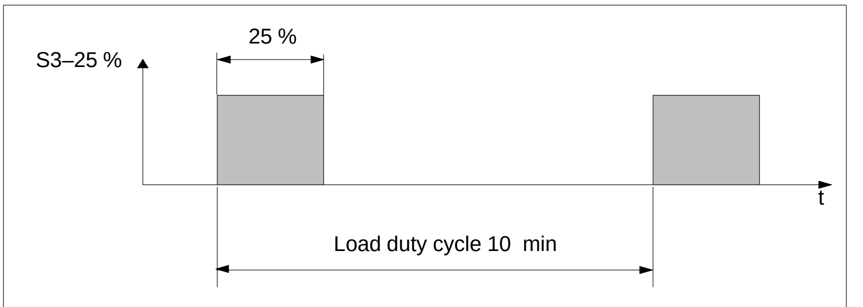
1) Dynamic limiting range 2 ∗ M_0 (60 K) corresponds to the standard drive assignment. Further, the drive converter assignment can be made corresponding to the particular drive application. If an additional overload protection is required for the motor the mechanical limit of the motors is 4 ∗ $M_{0100\ K}$.

Warning

Under fault conditions, the motor can accelerate to n_{max} (according to the technical data), and, for higher supply– or DC link voltages, this speed can be significantly exceeded. Only the dynamic torque, limited by the voltage limiting curve, can occur.

Thermal limiting characteristic

Corresponds in the diagrams to the S1 (100 K) characteristic. The arithmetic average may not be exceeded, even in intermittent operation.



The power–on duration is, acc. to VDE 0530, normalized for 15 %, 25 %, 40 %, 60 %. If no duty cycle is specified, it is 10 min.

Fig. 1-3 Power–on duration in intermittent duty

Voltage limiting characteristic

The motor EMF increases proportionally with increasing speed. Only the difference between the DC link voltage and the increasing motor EMF is available to impress the current.This limits the magnitude of the current which can be impressed at high speeds.

Warning

It is not permissible for the motor to be continuously operated at the voltage limiting characteristic in the range above the S1 characteristic for thermal reasons.

The voltage limiting characteristic of a motor with rated speed 6000 RPM lies far above that of the same motor type with 2000 RPM. However, this motor requires a significantly higher current for the same torque. Thus, it is practical to select the rated speed, so this does not lie too far above the required maximum speed for the particular application. This allows the rating of the drive converter module (current rating) to be minimized.

The voltage limiting characteristics are valid for

1FT5/1FT6	for 600 V and for
1FK6	for 540 V.

Table 1-1 Code letter, winding version

Rated speed [RPM]	**Winding version (10th position of the Order No.)**
1200	A
1500	B
2000	C
3000	F
4000	G
4500	H
6000	K

Shifting the voltage limiting characteristic

In order to be able to identify the motor limits at DC link voltages other than 600 V, the indicated voltage limiting characteristic for the particular armature circuit, must be shifted. A lower DC link voltage is obtained, for example, when operating the motor from uncontrolled supply infeeds. A higher DC link voltage can occur, e.g. if the drive converter is connected to a 480 V supply.

The degree of the shift is obtained as follows:

Along the x axis (speed), for a DC link voltage of $V_{DC\ link\ (new)}$, a shift by the factor: **$V_{DC\ link\ (new)}$/600 V for 1FT5/6**
$V_{DC\ link\ (new)}$/540 V for 1FK6

Example:

If a point (P1) of the particular voltage limiting characteristic is at 3000 RPM, the new voltage limiting characteristic for 490 V runs through (P2):

$$\frac{490\ V}{600\ V} = 0.82$$

3000 RPM $*$ 0.82 = 2460 RPM.

The new voltage limiting characteristic must, for n = 2460 RPM, be drawn in parallel to the existing characteristic.

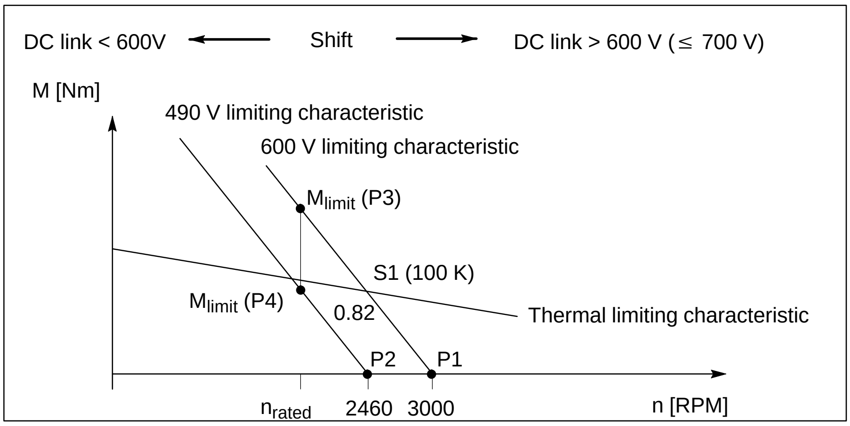


Fig. 1-4 Shifting the voltage limiting characteristics

The new limiting torque with the new limiting characteristic can be calculated according to the following formula:

1FT5:

$$M_{limit\ (new)} = \frac{V_{DC\ link\ (new)} - k_E * n_{rated}/1000}{600\ V - k_E * n_{rated}/1000} * M_{limit}$$

1FT6:

$$M_{limit\ (new)} = \frac{U_{DC\ link\ (new)} - \sqrt{2} * k_E * n_{rated}/1000}{600\ V - \sqrt{2} * k_E * n_{rated}/1000} * M_{limit}$$

1FK6:

$$M_{limit\ (new)} = \frac{U_{DC\ link\ (new)} - \sqrt{2} * k_E * n_{rated}/1000}{540\ V - \sqrt{2} * k_E * n_{rated}/1000} * M_{limit}$$

k_E = Voltage constant from the data sheet
M_{limit} = Limiting torque from the data sheet (P3)
$M_{limit\ (new)}$ = New limiting torque at n_{rated} (P4)
n_{rated} = Rated speed from the data sheet

Check: P4 must lie on the new limiting characteristic which was entered

Stall torque M_0	Thermal limiting torque when the motor is at a standstill, corresponding to the utilization according to 100 K or 60 K . This torque is available at n = 0 for an unlimited time. M_0 is always greater than the rated torque M_{rated}.
Stall current I_0	Motor phase current, in order to generate the particular stall torque. 1FT6 and 1FK6 motors are supplied with sinusoidal currents; 1FT5 motors with squarewave currents. For 1FT5 motors, the current I_0 corresponds to the peak value.
Rated torque M_{rated}	Thermally permissible continuous torque at the motor rated speed.
Rated current I_{rated}	RMS motor phase current, in order to generate the particular rated torque.
Rated output P_{rated}	Power, which is still available at rated speed and rated torque.
Limiting torque M_{limit}	Max. torque, which is still available at rated speed for acceleration.
Limiting current I_{limit}	Motor phase current, in order to generate the limiting torque.
Maximum current I_{max}	This current limit is determined by the magnetic circuit. The magnetic material will be reversibly de–magnetized if it is exceeded, even for a short time.
Mechanical limiting speed n_{max}	The maximum permissible operating speed is n_{max}. It is either defined by the electrical (voltage limiting characteristic) or mechanical (centrifugal forces, bearing stressing). The lower value is always specified in the list data.

Maximum torque M_{max}

Torque, which is generated at the maximum permissible current.

For high–dynamic (fast) operations and sequences, the following maximum accelerating torques are briefly available:

- $M_{max} = 4 * M_0$ (100 K) for shaft heights 36, 48, 63 (non–ventilated)
- $M_{max} = 4 * M_0$ (60 K) for shaft heights 71, 80, 100, 132 (non–ventilated)
- $M_{max} = 2.5 * M_0$ (100 K) for shaft heights 71, 80, 100, 132 (force–ventilated)

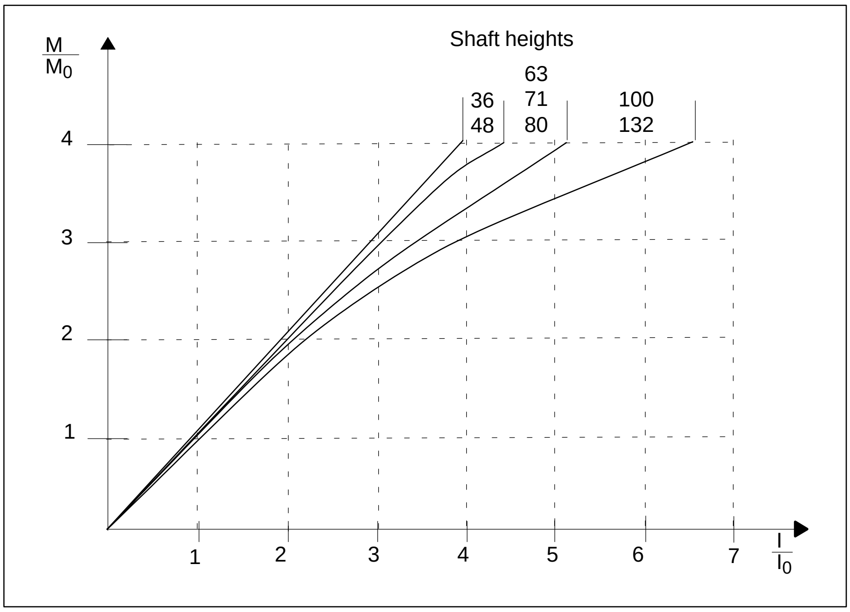


Fig. 1-5 Torque–current characteristics for various shaft heights

The individual characteristics of the individual 1FT5/6 and 1FK6 motor series are combined to form ”typical shaft height ranges”. The lefthand characteristic can be considered as the “best case” and the righthand as “worst case”.

Torque constant k_T

Quotient of the stall torque and stall current. $k_T = M_0/I_0$. The constants are valid to approx. $2 * M_0$.

!

Important

The constants are not valid (motor losses!) when calculating the necessary rated– and accelerating currents.

Further, the steady–state load and the friction torques must be included in the calculation.

Voltage constant k_E

Value of the induced motor voltage at a speed of 1000 RPM. The phase–to–phase motor terminal voltage is specified.

Winding resistance $R_{ph.}$

The resistance of a phase is specified at a room temperature of 20 °C. The winding is in a star configuration.

Inductance L_D

The three–phase inductance $L_D = 1.5 * L_{ph.}$ is specified

Electrical time constant T_{el}

Quotient of the three–phase inductance and winding resistance. $T_{el} = L_D/R_{ph.}$

Mechanical time constant T_{mech}

The mechanical time constant is obtained by the tangent along a theoretical ramp–function starting at the origin.

1FT5: $T_{mech} = 2 * R_{ph.} * J_{mot}/k_T^2$ [s]
1FT6/1FK6: $T_{mech} = 3 * R_{ph.} * J_{mot}/k_T^2$ [s]

J_{mot} = Moment of inertia of the servomotors [kgm^2]
$R_{ph.}$ = Resistance of a stator winding phase [Ohm]
k_T = Torque constant [Nm/A]

Thermal time constant T_{th}

Defines the temperature increase of the motor housing when the motor load is quickly increased (step increase) to the permissible S1 torque. After T_{th}, the motor has reached 63% of its final temperature.

Thermal resistance R_{th}

Describes the power dissipation through the motor enclosure at the rated operating point.

Brake resistor $R_{a\ opt}$

$R_{a\ opt}$ corresponds to the resistance, switched in series to the motor winding externally for each phase, for armature short–circuit braking. If the resistor is 0, the optimum braking is achieved without external resistors, i.e. a direct short–circuit at the terminals.

Braking torque $M_{b\ opt}$

$M_{b\ opt}$ corresponds to the average optimum braking torque, which can be achieved by modifying the resistance value.

Tolerance data

(data going beyond this lie below the achievable measuring accuracy)

Table 1-2 Tolerance data of the motor list data

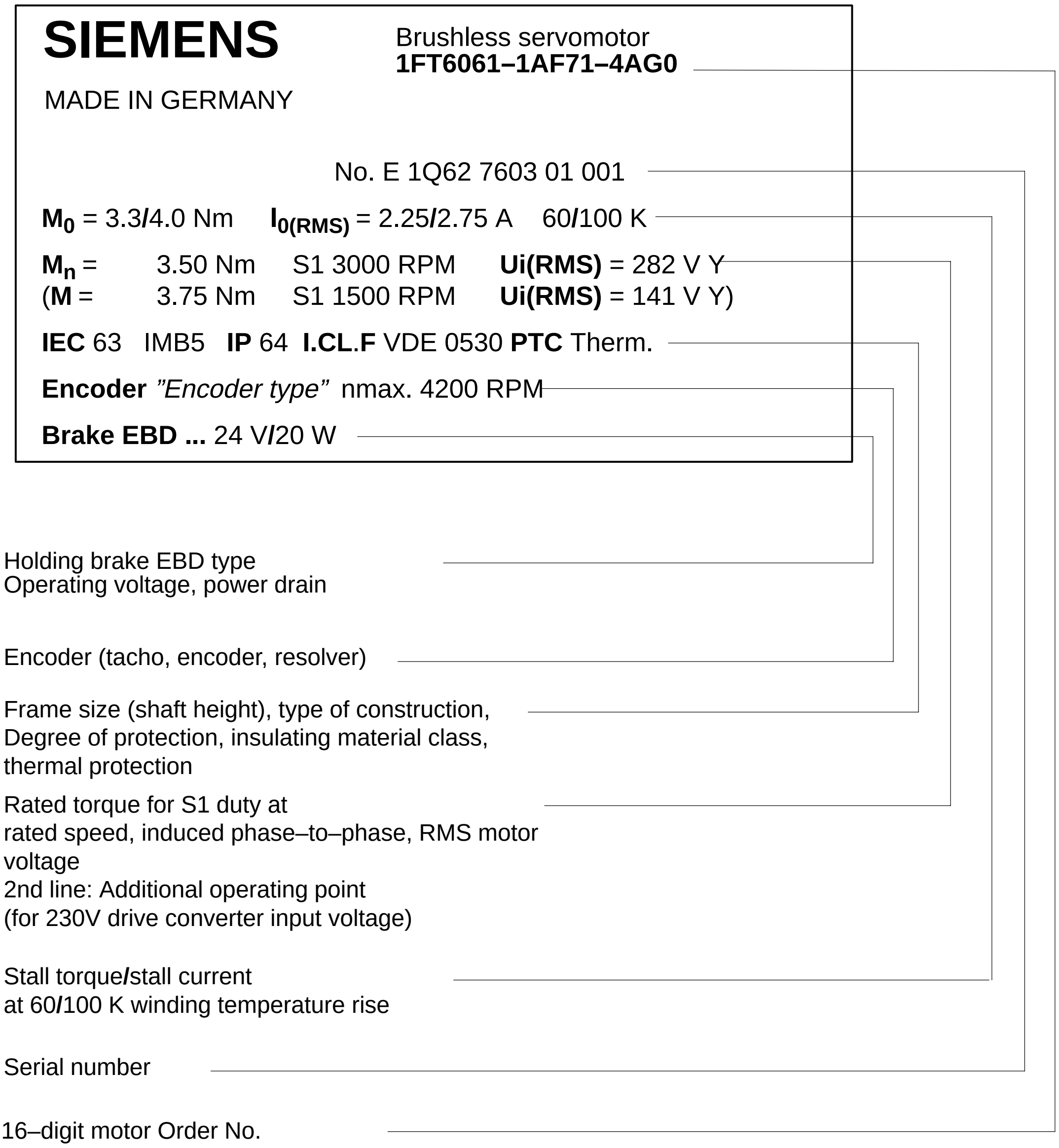
Motor list data		Typ. value	Theoretical value
Stall current	I_0	± 3 %	± 7.5 %
Max. speed	n_{max}	± 3 %	± 7.5 %
Electrical time constant	T_{el}	± 5 %	± 10 %
Torque constant	K_T	± 3 %	± 7.5 %
Voltage constant	K_E	± 3 %	± 7.5 %
Winding resistance	R	± 5 %	± 10 %
Moment of inertia	J_{Mot}	± 2 %	± 10 %

Core types

Core types are a subset of the complete motor spectrum. Core types have shorter delivery times, and in some cases are available ex–stock. The option versions are restricted. They have a different Order designation.

1.2 Rating plate data

Example from the 1FT6 series:



SIEMENS
MADE IN GERMANY

Brushless servomotor
1FT6061–1AF71–4AG0

No. E 1Q62 7603 01 001

M_0 = 3.3**/**4.0 Nm **$I_{0(RMS)}$** = 2.25**/**2.75 A 60**/**100 K

M_n = 3.50 Nm S1 3000 RPM **Ui(RMS)** = 282 V Y
(**M** = 3.75 Nm S1 1500 RPM **Ui(RMS)** = 141 V Y)

IEC 63 IMB5 **IP** 64 **I.CL.F** VDE 0530 **PTC** Therm.

Encoder *”Encoder type”* nmax. 4200 RPM

Brake EBD ... 24 V**/**20 W

Holding brake EBD type
Operating voltage, power drain

Encoder (tacho, encoder, resolver)

Frame size (shaft height), type of construction,
Degree of protection, insulating material class,
thermal protection

Rated torque for S1 duty at
rated speed, induced phase–to–phase, RMS motor voltage
2nd line: Additional operating point
(for 230V drive converter input voltage)

Stall torque**/**stall current
at 60**/**100 K winding temperature rise

Serial number

16–digit motor Order No.

■

Space for notes

Mechanical data

2

2.1 Definitions

Type of construction (acc. to IEC 34–7)

1FT/1FK motors have type of construction IMB5. They can be mounted corresponding to types of construction IM V1 or IM V3 without having to provide any special information when ordering.

For types of construction IM B14, IM V18 and IM V19, threaded glands are provided in mounting holes.

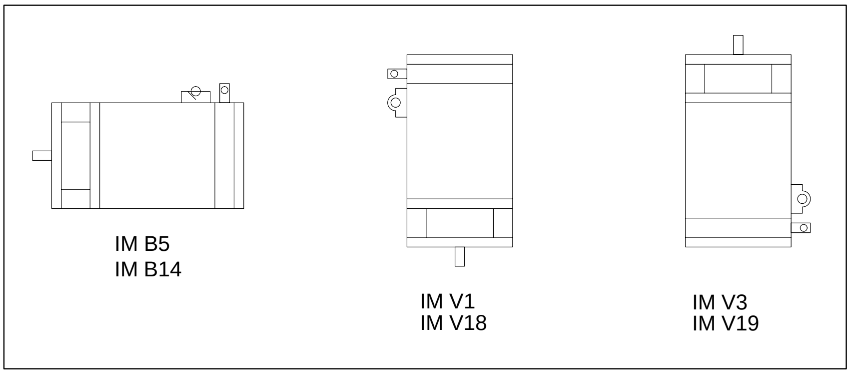


Fig. 2-1 Type of construction

When engineering motors with type of construction IM V3 and IM V19, please observe the permissible axial forces (force due to the weight of the rotor) and especially on the necessary degree of protection.

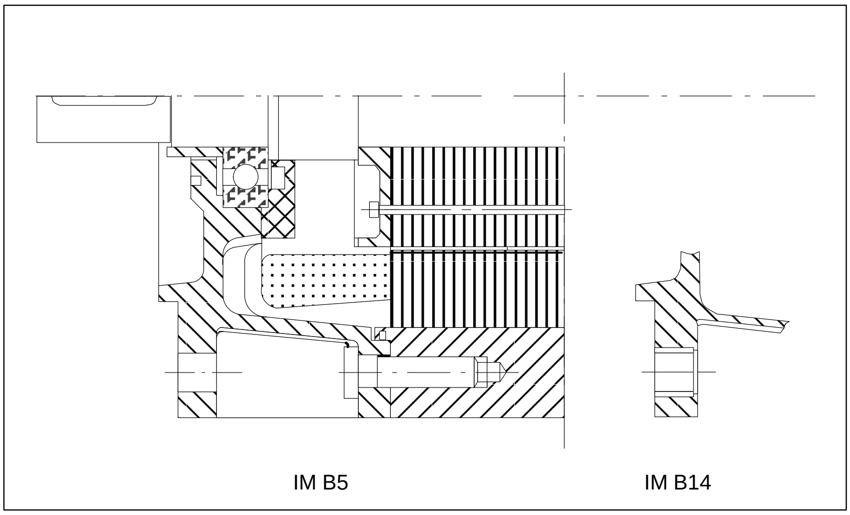


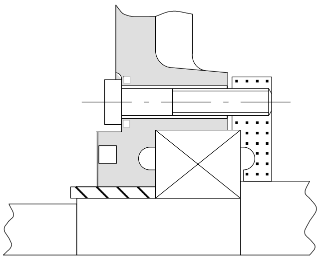
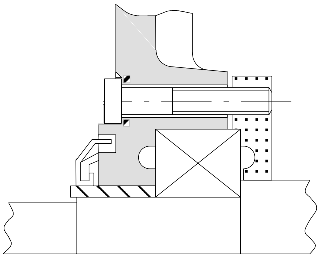
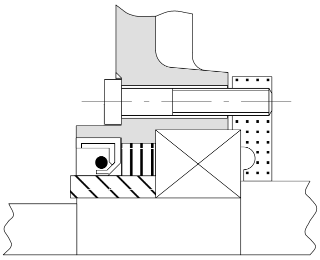
Fig. 2-2 Type of construction IM B5/IM B14 (with threaded gland)

Degree of protection (acc. to EN 60529)

The complete motor is sealed with O rings. This corresponds to a mechanical degree of protection IP 67 for the housing.

The motor shaft sealing can be taken from the overview Table 2-1. All seals use Fluor rubber (FPM).

Table 2-1 Overview, degrees of protection acc. to DIN 40050

Degree of protection EN 60529	Shaft sealing using	Applications
IP 64	Seal 	In continuous operation, it is only permissible that a slight amount of moisture is present in the area of the shaft end flange.
IP 65 (only for 1FT6)	Gamma ring 	The shaft gland is sealed against water spray and cooling–lubricating medium. It is permissible that the gamma ring runs dry (without any lubrication medium). Lifetime 20 000 h
IP 67 (only for 1FT5 and 1FT6*) not for force–ventilated motors *) for 1FK6 DE flange IP67	Radial shaft sealing ring DIN 3760 	For gearbox mounting (for gearboxes which are not sealed) to seal against oil. In order to guarantee the correct functioning, the sealing lip must be adequately cooled using gearbox oil. Lifetime 5000 h
IP 68 (not for 1FK6)	refer to IP 67; further, for the mechanical interfaces (bolts, bearing cover), a whetting–type sealing medium is used.	refer to IP 67

Engineering information when selecting the motor degree of protection

Often, there is no adequate protection against water, as generally oil–containing, penetrating and/or aggressive cooling–lubricating mediums are used.

The following table will help you to select the required degree of protection. In addition to the theoretical DIN regulations, practical experience values have been taken into account. If in doubt, always select the next higher degree of protection.

Table 2-2 Selecting the motor degree of protection

Effect	**Liquids**		
	General workshop environment	**Water, general, cooling–lubricating mediums (95 % H_2O; 5 % oil) oil**	**Penetrating oil; petroleum; aggressive cooling–lubricating medium**
Dry	IP 64	–	–
Environment where liquids and fluids are present	–	IP64[1)]	IP 67
Mist	–	IP 65	IP 67
Spray	–	IP 65	IP 68
Jet	–	IP 67	IP 68
Splash; brief immersion; continuous flooding	–	IP 67	IP 68

IP☐☐ 1st code (0–6): Degree of protection against contact and the ingression/penetration of foreign bodies

2nd code (0–8): Degree of protection against the ingress of water (no protection against oil)

Cooling

Operating temperature range: –15 °C to +40 °C

All of the list data refer to an ambient temperature of 40 °C and assume that the equipment is not mounted so that it is thermally insulated.

Non–ventilated (9. Position of the Order No.: A)

The power loss is dissipated by radiation and natural convection, which means that the motor must be suitably mounted so that adequate heat dissipation is guaranteed.

Higher surface temperatures can occur for the servomotors **(> 100 °C).** When required, provide shock hazard protection.

Forced–ventilation (9. Position of the Order No.: S)

available for selected types (refer to Catalog)

- for 1FT5 for shaft heights 71, 100 and 132,
- for 1FT6 for shaft heights 80, 100 and 132
- forced ventilation is not provided for 1FK6 forced–ventilated motors

It is not permissible that the hot discharged air is drawn in again.

---

1) For the version with holding brake and oil as cooling–lubricating medium: IP 67

Degree of protection:

Motors with separately–driven fan fulfill, acc. to EN 60529, degree of protection IP 64. The IP 65 or IP 67 option cannot be fulfilled if a separately–driven fan is used.

The motor– and shaft height specific version and a description of how the separately–driven fan is connected, is described in the special motor chapters.

The following features regarding non–ventilated motors remain unchanged:

- Encoder system
- Holding brake
- Type of construction, flange dimensions
- Vibration– and shock stressing
- Vibration characteristics
- Moments of inertia
- Natural torsion– and shaft bending frequencies
- Bearing design

Bearing design

The bearings are sealed on both sides and are permanently lubricated. The bearings are designed for operation at a minimum ambient temperature of –15 °C.

The specific versions can be taken from the motor data.

Note

We recommend that the bearings are replaced after approx. 20 000 operating hours, however, at the latest after 5 years.

Shaft end

Table 2-3 Differences in the various cylindrical shaft ends

Characteristics	DIN 748 Shaft end with key (Type a)	DIN 748 Shaft end without keyway (Type b)
Keyway and key (DIN 6885)	X	
Force–locked	X	
Friction–locked, smooth shaft (e.g. shrink connection, clamping sets etc.)		X
No play		X
Favorable for reversing operation and fast acceleration		X
Standard for the motors	1FT5	1FT6 and 1FK6
Optional for the motors	1FT6 and 1FK6	1FT5

Dimensions, refer to the dimension drawings in the specific motor chapters!

Mechanically release

It is not possible to mechanically rotate the axis at the non–drive end of the motor. The motor should be mechanically rotated at the most accessible location (e.g. lead screw).

Radial eccentricity, concentricity and axial eccentricity (acc. to DIN 42955)

Table 2-4 Radial eccentricity of the shaft to the housing axis (referred to the cylindrical shaft ends)

Shaft height	Standard N	Option R
36	0.035 mm	0.018 mm
48 (1FT5)	0.035 mm	0.018 mm
48 (1FT6/1FK6)	0.04 mm	0.021 mm
63	0.04 mm	0.021 mm
71	0.04 mm	0.021 mm
80	0.05 mm	0.025 mm
100	0.05 mm	0.025 mm
132	0.05 mm	0.025 mm

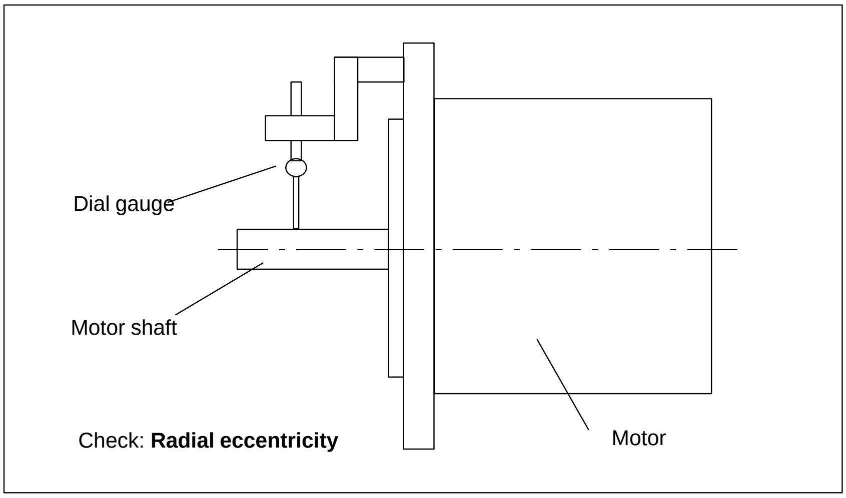


Fig. 2-3 Radial eccentricity check

Table 2-5 Concentricity– and axial eccentricity tolerance of the flange surface to the shaft axis (referred to the centering diameter of the mounting flange

Shaft height	Standard N	Option R
36	0.08 mm	0.04 mm
48	0.08 mm	0.04 mm
63 (1FT5)	0.08 mm	0.04 mm
63 (1FT6/1FK6)	0.1 mm	0.05 mm
71	0.1 mm	0.05 mm
80	0.1 mm	0.05 mm
100	0.1 mm	0.05 mm
132	0.125 mm	0.063 mm

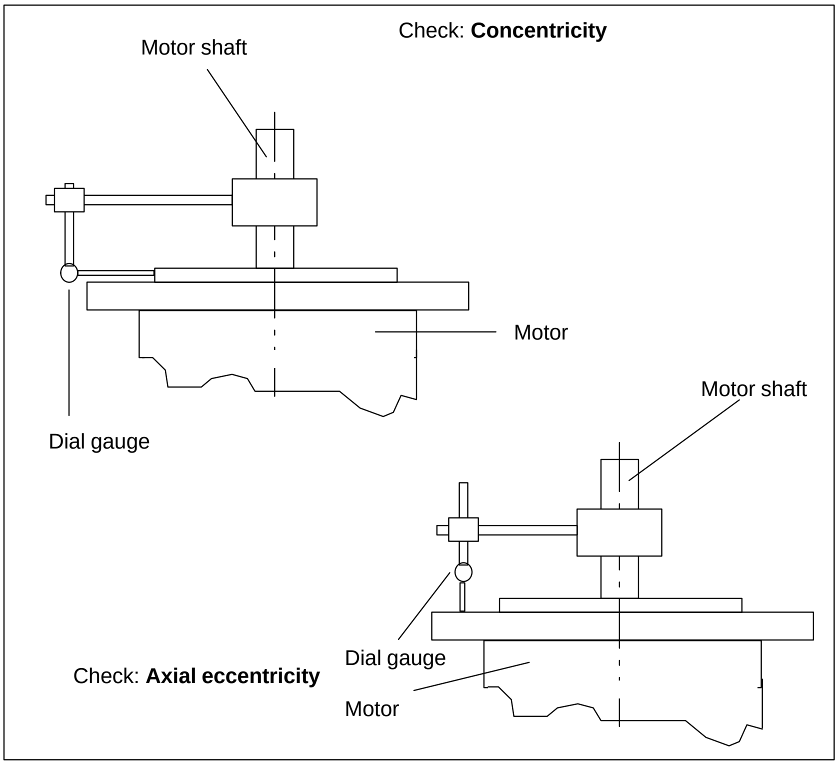


Fig. 2-4 Concentricity and axial eccentricity check

Noise (acc. to DIN 45635)

The noise values are valid when the motor is fed from the SIMODRIVE 611 PWM inverter for non–ventilated and separately–ventilated motors (with the exception of shaft height 132), measured at 1 m.

Table 2-6 Noise

Shaft height	Sound pressure level under no–load conditions dB (A) 0 to 6000 RPM
36	55
48	55
63	65
71	70
80	70
100	70
132	70

Vibration severity (acc. to IEC 34–14)

The specified values refer to the motor alone. The system vibration characteristics, as a result of the mounting type, can increase these values at the motor.

The speeds of 1800 RPM and 3600 RPM and the associated limit values are defined acc. to IEC 34–14. The speeds of 4500 RPM and 6000 RPM and the specified values are defined by the motor manufacturer.

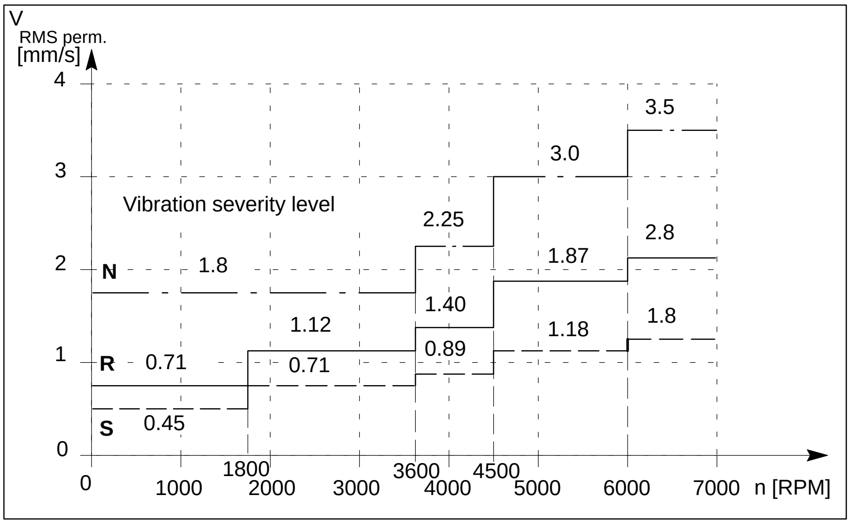


Fig. 2-5 Characteristics of vibration severity level limits for shaft heights 36 to 132

Shock stressing (acc. to DIN 0046, T7)

The maximum briefly permissible radial acceleration levels are specified in the Table 2-7, which do not have a negative impact on the function (not when operational; e.g. during transport):

Table 2-7 Shock stressing

Shaft height	Acceleration
36	1000 m/s^2
48	1000 m/s^2
63	500 m/s^2
71	300 m/s^2
80	300 m/s^2
100	200 m/s^2
132	100 m/s^2

Vibration stressing

The maximum permissible limit values are valid, but with full functionality, only for motors without brake, or with the brake closed.

10 m/s2	axial	(20 Hz to 2 kHz)
30 m/s2	radial	(20 Hz to 2 kHz)

Balancing (acc. to DIN ISO 8821)

For motors **with** key:

1FT5 motors:	Full–key balancing
1FT6/1FK6 motors:	Half–key balancing

Cantilever force stressing

The permissible cantilever forces are shown in the diagrams for the corresponding motors.

Application point of the cantilever forces at the shaft end

- At average operating speeds
- For nominal bearing lifetimes of 20 000 h

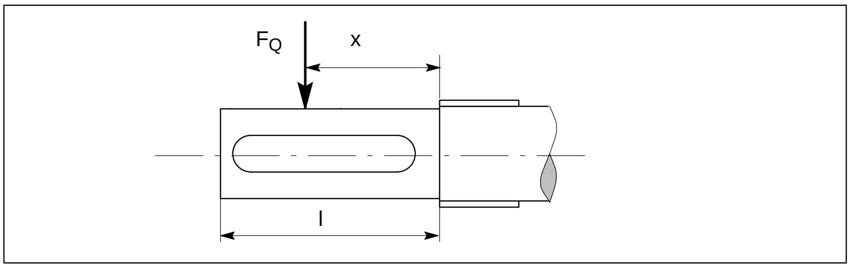


Fig. 2-6 Application point of cantilever forces at the shaft ends of motors

Dimension x:	Distance between the application points of force F_Q and the shaft shoulder in mm.
Dimension l:	Length of the shaft stump in mm.

Calculating the belt pre–tension:

$F_R = 2 * M_0 * c/d_R$

F_R [N]	Belt pre–tension
M_0 [Nm]	Motor stall torque
d_R [m]	Effective diameter of the belt pulley
c	Pre–tensioning factor for the accelerating torque Experience values for toothed belts c = 1.5 to 2.2 Experience values for flat belts c = 2.2 to 3.0

For other designs, the actual forces from the torque to be transferred should be considered.

$F_R \leq F_{qperm.}$

Axial force stressing

The permissible axial forces are shown in the diagrams for the appropriate motors.

Caution

For motors with integrated holding brake, no axial forces are permitted!

When using, e.g. gear wheels with helical teeth as the drive element, in addition to the radial force, the bearing is also subject to an axial force. For axial forces acting towards the motor, the bearing alignment force can be overcome, so that the rotor can move corresponding to the actual bearing axial play (to 0.2 mm).

The permissible axial force can be approximated using the following formula:

$$F_A = 0.35 * F_Q$$

More accurate data can be taken from the diagrams, taking into account the mounting position.

Paint finish

Table 2-8 Paint finish for 1FT5, 1FT6 and 1FK6

1FT5, 1FT6	1FK6
Anthracite (SN30901–614) Two–component epoxy resin paint; No special paint finish is required for the tropics.	Primer finish; without final paint finish

2.2 Mounted/integrated components

Effects of mounting

By mounting the motor to the flange, some of the motor power loss is dissipated through the flange.

- **Mounting design which is not thermally insulating**

  The following mounting conditions are valid for the motor data shown:

Table 2-9 Mounting condition, non–thermally insulating mounting

Shaft height	Steel plate width x height x thickness	Mounting surface [m^2]
36/48	120 x 100 x 40	0.012
63 to 132	450 x 370 x 30	0.17

The heat dissipation conditions are improved for larger mounting surfaces

- **Thermally insulated mounting <u>without</u> additional mounted components**

  The motor torque must be reduced by between 5 % and 10 %. We recommend to configure the system using the M_0(60 K) values.

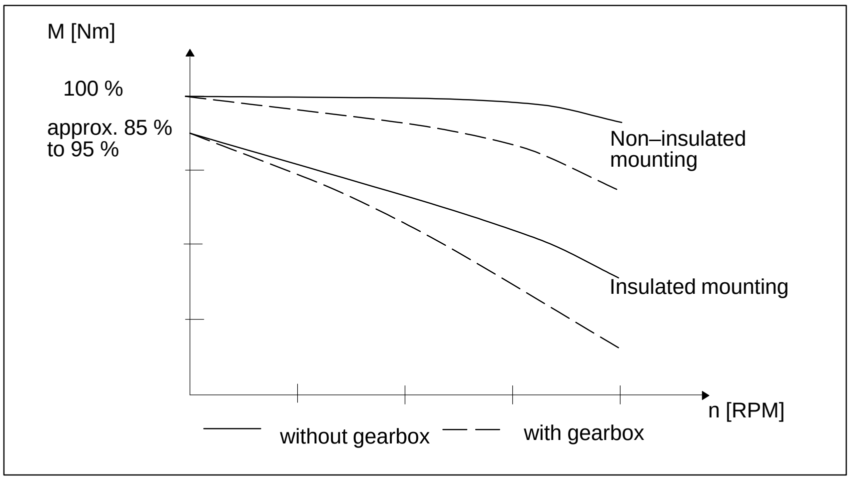


Fig. 2-7 S1 characteristics

- **Thermally insulated mounting <u>with</u> additional mounting components**
  - Holding brake (integrated in the motor)
    Additional torque reduction is not required
  - Gearboxes
    The torque must be reduced (refer to the diagram above)

  Instructions on the rating plate: **“Reduce rating with gearing”**

Dimensioning information regarding the required motor size is provided in the following section.

Gearboxes

We recommend the following motor options:

- Improved radial eccentricity (R) and flange accuracy
- IP 67 (If gearbox oil is in contact with the motor flange)

Technical data should be taken from the gearbox manufacturers catalogs.

Gearbox engineering/dimensioning

1. Selecting the gearbox size

   The following parameters must be taken into account:

   Accelerating torque, continuous torque, number of cycles, cycle type, permissible input speed, mounting position, torsional play, radial– and axial forces

   The motor and gearbox assignment is made as follows:

$$M_{max,\ gear} \geq M_{0(100\ K)} * f * i$$

$M_{max,\ gear}$	Maximum permissible drive–out torque
$M_{0(100\ K)}$	Motor stall torque
i	Ratio
f	Supplementary factor

S1 duty:	f = 2	Factor due to gearbox temperature rise
S3 duty:	f = f1 $*$ f2	
	f1 = 2	for motor accelerating torque
	f2 = 1	for$\leq$ 1000 switching cycles of the gearbox
	f2 > 1	for > 1000 switching cycles (refer to the Gearbox Catalog)

Note

Switching cycles can also be superimposed vibrations/oscillations!

The supplementary factor (f2) is in this case not adequate when dimensioning the gearbox, which can result in gearbox failures.

The complete system must be optimized, so that the superimposed vibrations/oscillations are minimized.

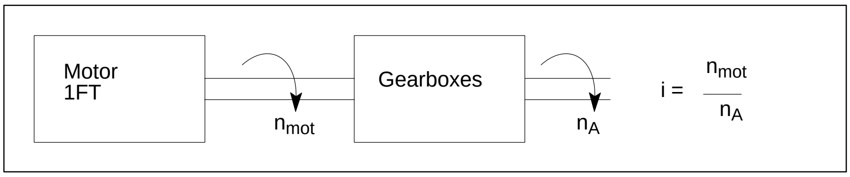


Fig. 2-8 Gearbox engineering/dimensioning

2. Selecting the motor size

   The load torque and the required traversing velocity define the gearbox drive–out torque and the drive speed and therefore also the drive output.

   The required drive output can then be calculated from this data:

   P_{from} [W] = $P_{mot} \cdot \eta_G = (\pi/30) \cdot M_{mot}$ [Nm] $\cdot\ n_{mot}$ [RPM] $\cdot\ \eta_G$

   The gearbox prevents heat from being dissipated through the motor flange, and the gearbox itself generates friction heat.

   The torque must be reduced for S1 duty.

- **Dimensioning for S1 duty**

  The required motor torque is calculated as follows:

$$M_{mot} = \sqrt{\left(\frac{M_{out}}{i * \eta_G} + M_V\right)^2 - M_V^2}$$

$$\text{with MV} = a * b * \frac{n_{mot}}{60}(1 - \eta_G) * \frac{K_T^2}{R_{ph.}}$$

M_V	calculated ”torque loss”
a	**π/**2 for 1FT5 motors fed with squarewave current 1FT5 **π/**3 for 1FT6 motors fed with sinusoidal current
b	0.5 weighting factor for gearbox losses (no dimensions)
n_{mot}	Motor speed [RPM]
K_T	Torque constant $\left[\frac{Nm}{A}\right]$
$R_{ph.}$	Thermal resistance of the motor phase [Ω] = 1.4 $R_{ph.}$ (list)
M_{out}	Gearbox drive–out torque [Nm]
i	Gearbox ratio (i>1)
η_G	Gearbox efficiency
P_{mot}	Motor output [W]
P_{out}	Gearbox drive–out power [W]
M_{mot}	Motor torque [Nm]

  Typical efficiency:

Planetary gearbox	η≈0.94	Single–stage
Spur gearing	η≈0.95	
Cyclo gearbox	η≈0.92	Single–stage
Harmonic drive	η≈0.7	
Worm gear	η≈0.45...0.9	

- **Dimensioning for S3 duty**

  The torque does not have to be reduced.

  $M_{mot} = M_{red} / (i * \eta_G)$

Drive–out couplings

After investigating various drive–out couplings for servomotors in conjunction with SIMODRIVE drive converters, we have identified, that in many cases, the reasons for vibration problems lie in the drive–out couplings.

For this reason, we would like to recommend that ROTEX couplings, from the KTR company, are used, which can guarantee the optimum drive–out characteristics.

The advantages of ROTEX couplings are:

- 2 to 4x the torsional stiffness of a belt–driven gearbox
- No meshing teeth (with respect to belt gearboxes)
- Low moment of inertia
- Optimum control characteristics

Up to the specified torques which can be transferred, mounting without key is considered to be adequate. It should be observed, that the friction locking torques are always adequately dimensioned, corresponding to the particular motor frame size. Please observe that the accelerating torque must also be transferred.

Alternatively, a clamping hub with groove, or the special version with two clamping screws can be used.

The investigations also involve the vibration characteristics. The couplings, assigned to the motors, permit higher gain factors in the speed control loop, which can possibly result in higher k_V values and more uniform motion.

For ROTEX GS, three various plastic pinion wheels, with varying Shore hardnesses:

80 Shore A (soft)
alternatively: 92 Shore A
alternatively: 98 Shore A (hard)

The possible adaptation to existing machine masses and stiffness must be determined in conjunction with the mounted mechanical system.

The KTR company can provide technical information, delivery times and prices.

You can only order the couplings through the KTR company.

Address: KTR
Kupplungstechnik GmbH
Rodder Damm 170; 48432 Rheine
Postfach 1763; 48407 Rheine
Tel.: +49 05971/798–465(426)
FAX: +49 –400

You will find the assignment of the drive couplings to the motors in the appropriate motor chapter.

Holding brake (option)

Holding brake to hold the axis, without play, at standstill or in the no–voltage condition (powered–down).

The permanent magnet, single–disk brake operates according to the fail–safe principle,
i.e. the brake is closed when not energized.

Note

For motors with holding brake, axial forces are not permitted!

The holding brake is **not** a working brake!

For emergency stop purposes, or during power failures, approx. 2000 braking operations can be made (at $J_{external} \leq 3 * J_{mot}$), without the brake armature disk being subject to excessive wear.

Within any one shaft height, slight deviations of the holding torque are possible for motors with a low stall torque.

1FT6 motors with integrated holding brake are longer.

Warning

If the holding brake is not used for a longer period of time, a deposit can form on the brake assembly and armature disk. This can result in a lower holding torque!

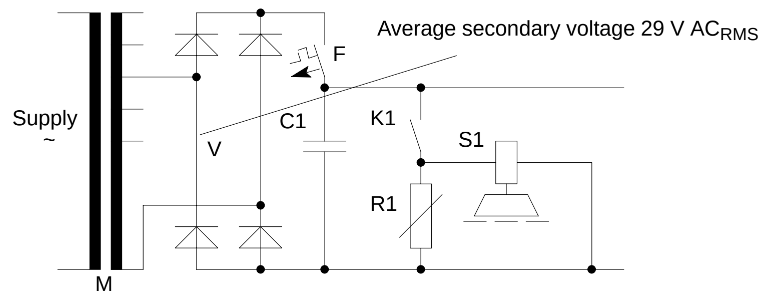
Supply voltage: 24 V DC ± 10 %

To prevent overvoltages at shutdown, and possible noise emission into the environment, the brake feeder cable must be provided with a free–wheeling diode or an adapted varistor.[1)]

In order to prevent noise as a result of pulsating currents after the brake has been applied, when using a Graetz bridge, we recommend that a capacitor with 220 µF/60 V is used. Depending on the connected load, the capacitor increases the voltage, so that the transformer secondary voltage cannot be specified as fixed value. It is practical to have a transformer with 5 secondary taps in steps of approx. 2 V starting from an average secondary voltage 29 V AC_{RMS}.

---

1) A varistor is preferable as the free–wheeling diode will increase the closing time.



C1 – Capacitor
K1 – Contactor contact
S1 – Holding brake
R1 – Varistor (e.g. Q69–X3022 Siemens type 30 V)
F – MCB
M – Single–phase transformer
V – Rectifier

Fig. 2-9 Recommended external power supply circuit for the holding brake

Technical data for the holding brakes are provided in the appropriate motor chapters.

!

Important

The brake connecting cable is included in the power cable. The insulation between the power– and brake connection is designed for the basis insulation (230 V).

To protect the internal logic voltage (PELV)[1] basic insulation must also be provided between the coil and contact of relay K1.

The PELV power supply may not be used for the holding brake (refer to the recommended circuit).

Note

You must always ensure that there is a minimum 24 V –10% available at the connector on the motor side, in order to guarantee that the brake opens correctly.

The voltage drop across the power cable brake conductors must be taken into account. The voltage drop for copper cables can be approximated as follows:

$$dU=0.042*(l/q)*I_{Brake}$$

l =cable length in m
q =brake conductor cross–section in mm^2
I_{Brake} =brake DC current in A
dU =voltage drop along the brake cable in V

Example: 1FK6101 with brake EBD 3.8B I_{Brake}=0.9A, l=50m, q=1mm^2
dU=0.042*50/1*0.9=1.89
i.e. the voltage on the supply side must be a minimum of 24V*0.9+1.89V=23.5 V.

---

[1] Safety extra–low voltage

Space for notes

3

Functions – options

Armature short–circuit braking

The transistor PWM converters can no longer be electrically braked, when the DC link voltage exceeds a specific value, or if the electronics has failed. If the drive represents a danger when it coasts down, the motor can be braked by short–circuiting the armature. The armature short–circuit braking should be made within the traversing range of the feed axis. However, it should be initiated at the latest by the emergency limit switch.

When determining the run–on travel of the feed axis, the friction of the mechanical system and the switching times of the contactors should be taken into account. In order to prevent mechanical damage, mechanical endstops should be provided at the end of the absolute traversing range.

For servomotors with integrated holding brake, the holding brake can be simultaneously de–energized, in order to generate an additional braking force; this braking torque is somewhat delayed.

⚠

Caution

The drive converter pulses must always first be cancelled, before an armature short–circuit contactor is closed. This prevents the contactor contacts burning which could destroy the PWM converter.

⚠

Warning

The setpoint input must always be used for standard operational braking. For EMERGENCY OFF, terminal 64 at the drive converter should be used to initiate braking.

Brake resistors

The servomotor braking torque can be optimized in regenerative operation, using an armature short–circuit with an adapted external resistor circuit. The resistors required externally, are listed in the motor tables.

Ordering address:
Fritzlen GmbH & Co.KG
Gottlieb–Daimler–ph.. 61
71711 Murr
Tel.: +49 07144 / 2724–25

Resistor rating

The resistor ratings can be dimensioned, so that (max. 500 ms), a surface temperature of 300° C can briefly occur. In order to prevent the resistor from being destroyed, the drive may only be braked from rated speed every 2 minutes. If you require other braking cycles, then please specify these when ordering. The external moment of inertia and the motor moment of inertia are decisive when dimensioning the resistors.

The kinetic energy must be specified when ordering so that the resistor rating can be determined.

$$W = \frac{1}{2} * J * \omega^2$$

W	in	[Ws]
J	in	[kgm^2]
ω	in	[s^{-1}]

Braking times and braking travel

In order to calculate the maximum braking times and braking travel, the average braking torque, the complete moment of inertia and the rated speed must be known. The braking time is calculated from the following formula:

Braking time:	$t_B = \frac{J_{tot} * n_{rated}}{9.55 * M_B}$	J [kgm^2] n_N [RPM] M_B [NM]
Moment of inertia:	$J_{tot} = J_M + J_{external}$	t_B [s] s [m]
Braking travel:	$s = \frac{1}{2} V_{max} * t_B$	V_{max} $[\frac{m}{s}]$

!

Important

When calculating the run–on travel, then for example, the friction (include in M_B as supplementary factor), the mechanical transmission elements and the switching delay times of the contactors must be taken into account. In order to prevent mechanical damage, mechanical end stops must be provided at the end of the absolute traversing range of the machine axes.

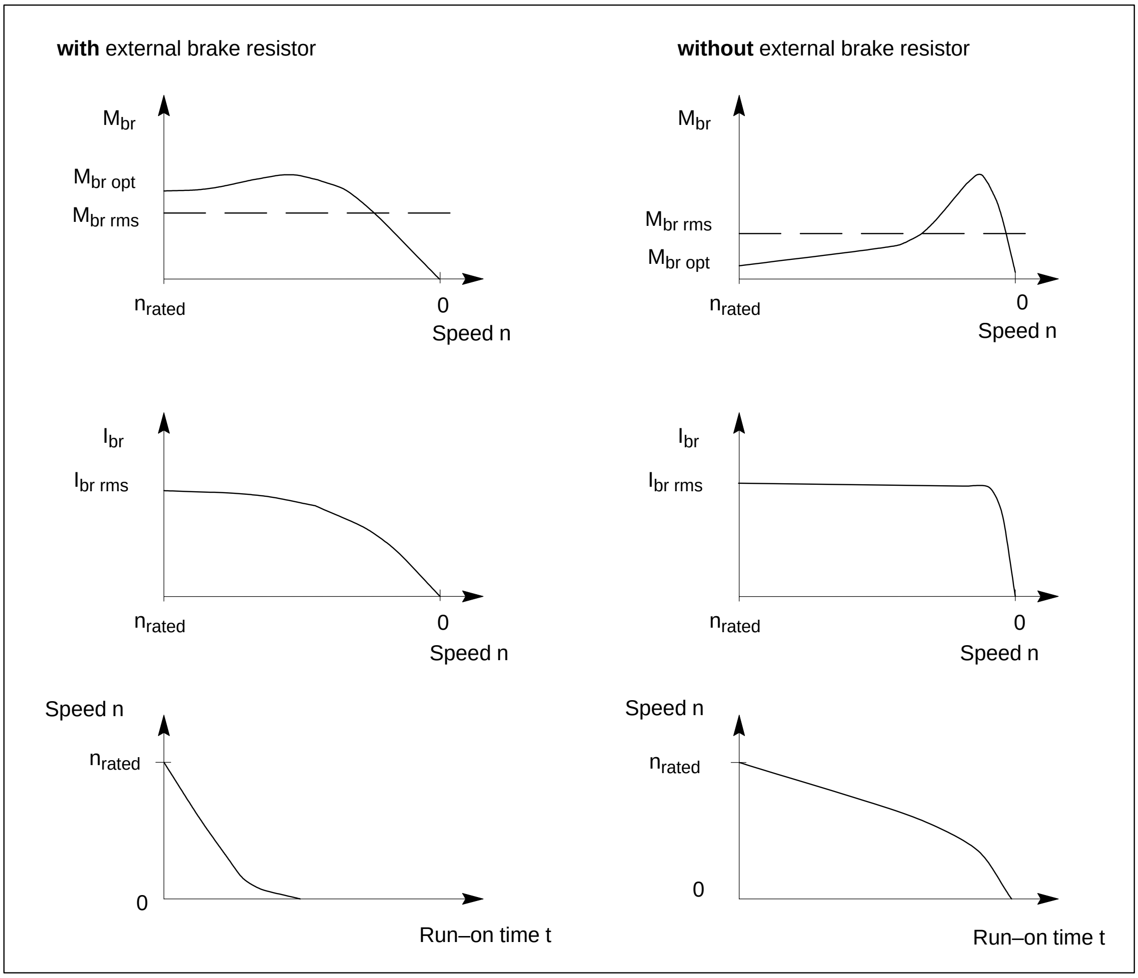


Fig. 3-1 Armature short–circuit braking

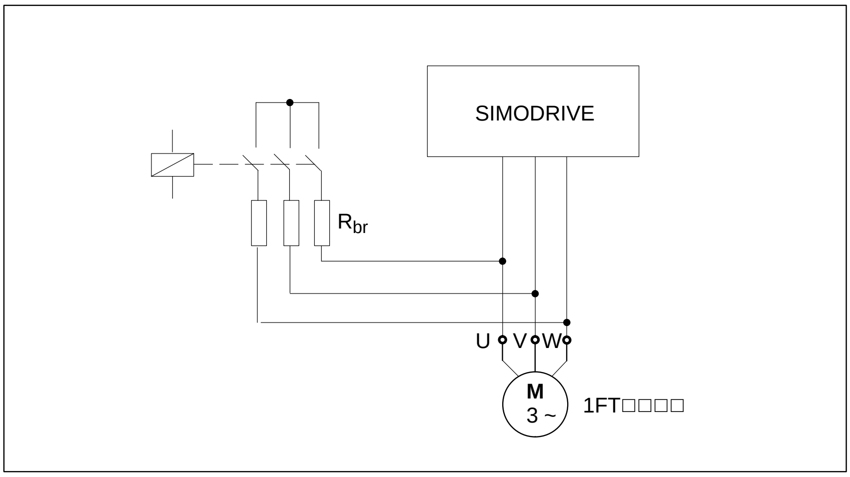


Fig. 3-2 Circuit (principle circuit) for armature short–circuit braking

■

Space for notes

Termination technology

4

Pre–assembled cables save on the assembly time and increase the operational reliability.

4.1 Power cable

Caution

Servomotors cannot be directly connected to the line supply, and should only be used with the assigned SIMODRIVE 611 transistor PWM converters.

Please observe the rating plate data and adequately dimension the connecting cables (tables are included in the Guide), and ensure that these cables are strain–relieved.

For safety–relevant circuits, it should be checked, for every application, whether the internal control devices in the drive converter are adequate to electrically isolate it from the line supply.

When carrying–out any work on the system, it should always be in the no–voltage condition (powered–down)!

Cross–sections

Table 4-1 specifies the permissible current load capability acc. to DIN VDE 0113

Part 1/02.86 “Electrical equipment on industrial machines” for PVC–insulated cables with copper conductors at an ambient temperature of 40° C.

Table 4-1 Current load capability

Motor current [A] (RMS)	**Cross–section for the motor connection [mm^2]**
11.3	1.5
15.7	2.5
20.9	4.0
27.0	6.0
37.4	10.0
50.5	16.0
66.1	25.0
81.8	35.0
99.2	50.0

RMS current:

1FT5: $I_{RMS} = I_0 * \sqrt{2/3}$ (at standstill: $I_{RMS} = I_0$!)

1FT6/1FK6: $I_{RMS} = I_0$

Screening

We recommend that all power cables are screened.

!

Important

Screens should be used in the overall protective grounding concept. Open–circuit or unused cores/electrical cables which can be touched, should be connected to protective ground. If the brake feeder cables in the SIEMENS accessory cables are not used, then the braking cable conductors and screens must be connected to the cabinet ground. (open–circuit cables result in capacitive charges!)

Assignment

The assignment, motor cross–section power connector is specified in the appropriate motor chapters.

4.2 Signal cable

Pre–assembled cables offer many advantages over self–assembled cables. In addition to guaranteeing the correct function and the high quality, there are also cost benefits.

In order to eliminate any effects of noise, the signal cables must be routed separately away from the power cables.

Note

The maximum cable lengths, specified in the connection overviews, must be observed.

Assignment

The signal cables used are described for the appropriate encoders
(refer to Chapter GE).

4.3 Cable versions

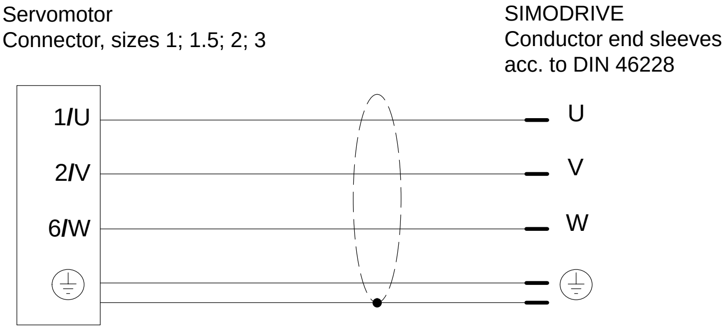
Caution

Observe the current drawn by the motor in your application! Adequately dimension the connecting cables corresponding to VDE 0100 Part 430. VDE 0113 Part 1, VDE 0298 Part 4

Pre–assembled power cable

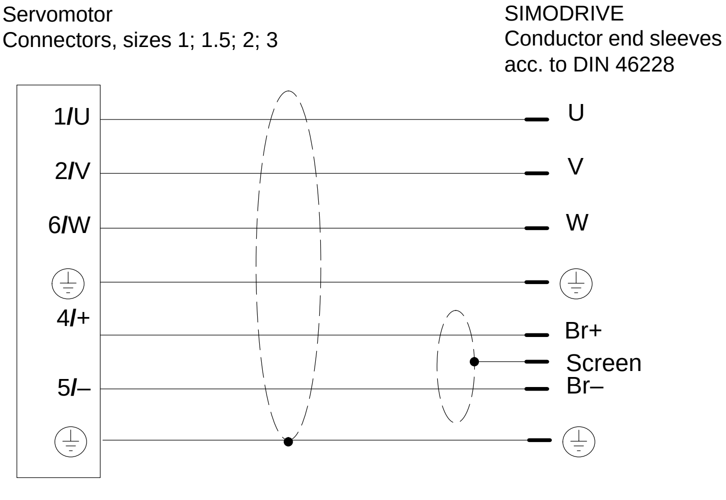
- without brake cables

Order designations: 6FX□002–5CA□□–□□□0 with overall screen
6FX□002–5AA□□–□□□0 without overall screen



- with brake cables

Order designation: 6FX□002–5DA□□–□□□0 with overall screen
6FX□002–5BA□□–□□□0 without overall screen



Note

- Performance– or Standard cables are available.
- The technical data is provided in Catalog NCZ.

Explanation

6FX□002–□□□□□–□□□0

Length
Type, cross–section, connector size
2=Performance/4=Standard cable

Length code

Ordering data	Order No.
Cable, pre–assembled	6FX□ 002–□□□□□–□□□0

Length code:

1 m to 99 m	1
100 m to 199 m	2
200 m to 299 m	3

0 m	A
10 m	B
20 m	C
30 m	D
40 m	E
50 m	F
60 m	G
70 m	H
80 m	J
90 m	K

0 m	A
1 m	B
2 m	C
3 m	D
4 m	E
5 m	F
6 m	G
7 m	H
8 m	J
9 m	K

Examples:

1 m	6FX□ 002–□□□□□–**1AB0**
2 m	6FX□ 002–□□□□□–**1AC0**
5 m	6FX□ 002–□□□□□–**1AF0**
10 m	6FX□ 002–□□□□□–**1BA0**
15 m	6FX□ 002–□□□□□–**1BF0**
18 m	6FX□ 002–□□□□□–**1BJ0**
20 m	6FX□ 002–□□□□□–**1CA0**
25 m	6FX□ 002–□□□□□–**1CF0**
50 m	6FX□ 002–□□□□□–**1FA0**
100 m	6FX□ 002–□□□□□–**2AA0**
150 m	6FX□ 002–□□□□□–**2FA0**

You will find the complete Order designations in Catalog NC Z!

Connector assignments

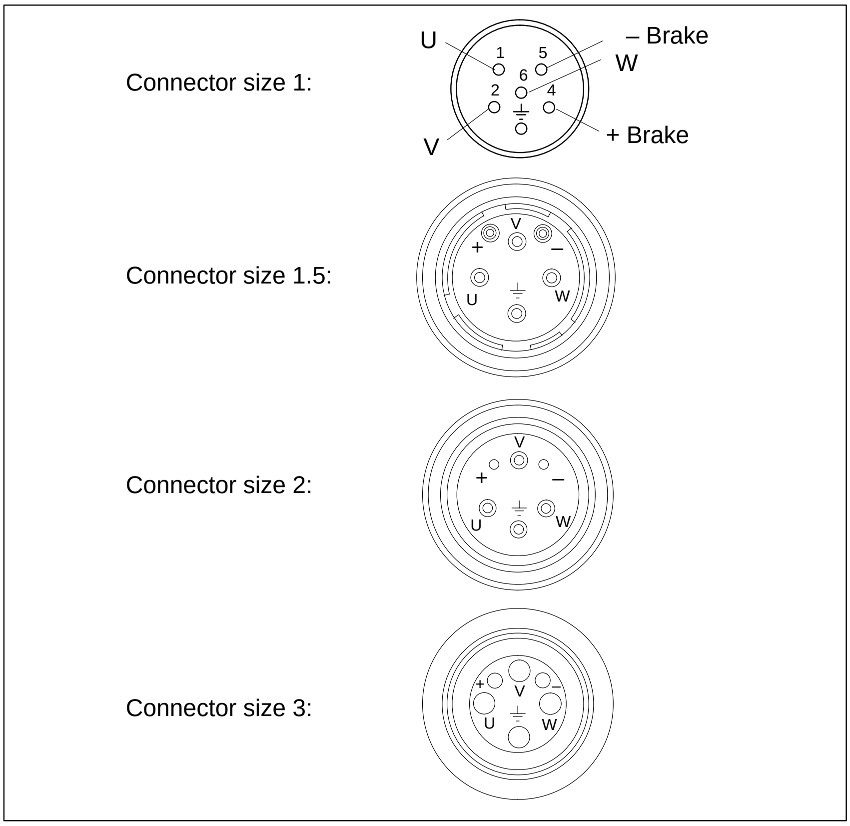


Fig. 4-1 Connector assignments (when viewing the connector side)

■

Space for notes

1FT5...

AC SERVO MOTOR

DESCRIPTIONS

Motor description

1

1.1 Characteristics and technical data

Applications

The 1FT5 series was developed for use on a wide range of machine tools.
In conjunction with the SIMODRIVE 611 analog drive converter system, the motors are admirably suited for, among other things, feed drives on lathes and milling machines, machining centers, for grinding– and special–purpose machines, robots, handling equipment and for woodworking.

They can be directly mounted on feed spindles and on gearboxes with toothed wheels or toothed belts.

Warning

The motors are not suitable for direct on–line operation (they cannot be connected to the line supply).

Characteristics

Depending on the shaft height, the 1FT5 series has stall torques from 0,9 to 185 Nm at rated speeds from 1200 to 6000 RPM. They have a high overload capability over the complete speed range.

Standards, regulations

The appropriate standards, regulations are directly assigned to the functional requirements.

Technical features

The motors are designed for operation on a 600 V DC link and are impressed with squarewave current. Together with the analog SIMODRIVE 611, they form a complete drive system.

For DC link voltages which differ from 600 V (max. 700 V), the voltage limiting characteristic is shifted as described in Chapter ALS/1.1.

Note

If the drive converter is connected to, for example, a 480 V supply, DC link voltages are obtained > 600 V. The following restriction is then obtained: Shaft heights 36, 48, 63, 71 may only be utilized acc. to the ΔT=60 K limit values.

Table 1-1 Motors, standard version

Technical features	Version
Machine type	Permanent–magnet synchronous motors AC servomotors
Type of construction	Acc. to IM B5 (IM V1, IM V3) (acc. to IEC 34–7)
Degree of protection	IP 64 (IEC 34–5)
Cooling	Non–ventilated (acc. to IEC 34–6)
Thermal motor protection	PTC thermistor (acc. to IEC 34–11) in the stator winding
Shaft end	Cylindrical; with keyway and with key (acc. to DIN 748, Part 3); tolerance zone k6

Table 1-1 Motors, standard version

Technical features	Version
Rating plate	For the core types, a second rating plate is provided
Radial eccentricity concentricity and axial eccentricity	Tolerance N (acc. to DIN 42955)
Vibration severity	Degree N (acc. to IEC 34–14; DIN VDE 0530, Part 14)
Balancing	Full–key balancing according to DIN 8821
Bearings	Deep–groove ball bearings with permanent lubrication bearing lifetime > 20000 h Locating bearing at the drive end
Winding insulation	Insulating material class F acc. to DIN VDE 0530 – permits a winding temperature rise of ΔT = 105 K for an ambient temperature of 40 °C.
Installation altitude	≤ 1000 m above sea level, otherwise de–rating (acc. to VDE 0530) 2000 m Factor 0.94 2500 m Factor 0.9
Magnetic materials	Rare–earth materials
Electrical connection	Connectors for power and encoder signals • The connector outlet direction can be selected
Encoder system	Integrated analog tachometer • Speed sensing Magnetic sensor or Hall sensors • Sensing the rotor position

Options

Table 1-2 Options

Technical features	Version
Degree of protection	IP67 (only self–ventilated) (IEC 34–5)
Cooling	Forced–ventilation
Shaft end	Cylindrical (acc. to DIN 748); without key (acc. to DIN 6885); tolerance zone k6
Radial eccentricity, concentricity and axial eccentricity	Tolerance R (acc. to DIN 42955)
Vibration severity	Degree R (acc. to IEC 34–14; DIN VDE 0530, Part 14)
Integrated/mounted components	• Fail–safe holding brake; 24 V supply voltage ± 10% (acc. to DIN 0580 7/79) • Working brake (shaft height 71, 100, 132) • Integrated pulse encoder (shaft height 63–132) • Mounted pulse encoder • Prepared for encoder mounting • Mounted planetary gearbox

Technical data Core types have a grey background.

100 K values are specified in the table.

Rated speed [RPM]	M_0 [Nm]	M_{rated} [Nm]	Motor type 1FT5–	Motor current I_0 [A]	Rated drive converter current[A]	P_{rated} [kW]	Connec-tor size	Cross–section1) [mm^2]	Cable type 6FX□002– 4)
1200	33	31	102–□AA71	12.5	12.5	3.9	2	4x2.5	5□A02–1□□0
	45	40	104–□AA71	17	25	5.0	2	4x2.5	5□A02–1□□0
	55	47	106–0AA71	20.5	25	5.9	2	4x4	5□A12–1□□0
	68	55	108–0AA71	25.5	25¹⁾	6.9	2	4x4	5□A12–1□□0
	75	55	132–0AA71	28	40	6.9	2	4x6	5□A22–1□□0
	90	65	134–0AA71	33.5	40	8.2	2	4x10	5□A32–1□□0
	105	82	136–0AA71	39	40	10.3	2	4x10	5□A32–1□□0
	130	100	138–0AA71	48.5	80	12.6	3	4x16	5□A23–1□□0
	95	85	132–0SA71	35	40	10.7	2	4x10	5□A32–1□□0
	120	115	134–0SA71	45	80	14.5	2	4x10	5□A32–1□□0
	145	135	136–0SA71	54	80	17.0	3	4x16	5□A23–1□□0
	185	170	138–0SA71	69	80	21.4	3	4x25	5□A33–1□□0
2000	2.6	2.4	062–□AC71	1.6	4	0.5	1	4x1.5	5□A01–1□□0
	5.5	4.7	064–□AC71	3.3	4	1.0	1	4x1.5	5□A01–1□□0
	8	6.7	066–□AC71	4.9	7.5	1.4	1	4x1.5	5□A01–1□□0
	12	9.5	072–□AC71	7.3	7.5	2.0	1	4x1.5	5□A01–1□□0
	18	14	074–□AC71	11	12.5	2.9	1	4x1.5	5□A01–1□□0
	22	18.5	076–□AC71	13.5	25	3.9	1	4x1.5	5□A01–1□□0
	33	29	102–□AC71	20.5	25	6.1	2	4x4	5□A12–1□□0
	45	35	104–□AC71	27.5	40	7.3	2	4x6	5□A22–1□□0
	55	39	106–□AC71	33	40	8.2	2	4x10	5□A32–1□□0
	68	42.5	108–□AC71	40	40	8.9	2	4x10	5□A32–1□□0
	75	45	132–0AC71	44	80	9.4	3	4x16	5□A23–1□□0
	90	50	134–0AC71	56	80	10.5	3	4x16	5□A23–1□□0
	105	60	136–0AC71	59	80	12.6	3	4x16	5□A23–1□□0
	95	80	132–0SC71	56	80	16.8	3	4x10	5□A13–1□□0
	120	110	134–0SC71	75	80	23.0	3	4x25	5□A33–1□□0
	145	130	136–0SC71	81	80¹⁾	27.2	3	4x25	5□A33–1□□0
3000	1	1	042–□AF71	1.1	4	0.3	1	4x1.5	5□A01–1□□0
	2	1.9	044–□AF71	2.1	4	0.6	1	4x1.5	5□A01–1□□0
	3.7	3.4	046–□AF71	3.9	4	1.1	1	4x1.5	5□A01–1□□0
	2.6	2.3	062–□AF71	2.4	4	0.7	1	4x1.5	5□A01–1□□0
	5.5	4.3	064–□AF71	5.0	7.5	1.4	1	4x1.5	5□A01–1□□0
	8	6.1	066–□AF71	7.3	7.5	1.9	1	4x1.5	5□A01–1□□0
	12	8.5	072–□AF71	11	12.5	2.7	1	4x1.5	5□A01–1□□0
	18	12.5	074–□AF71	17	25	3.9	1	4x2.5	5□A11–1□□0
	22	16.5	076–□AF71	20	25	5.2	2	4x4	5□A12–1□□0
	33	25	102–□AF71	31	40	7.9	2	4x6	5□A22–1□□0
	45	29	104–0AF71	41.5	40¹⁾	9.1	2	4x10	5□A32–1□□0
	55	28	106–0AF71	52	80	8.8	3	4x16	5□A23–1□□0
	68	20	108–0AF71	62.5	80	6.3	3	4x25	5□A33–1□□0
	40	36	102–0SF71	37	40	11.3	2	4x10	5□A32–1□□0
	58	45	104–0SF71	53	80	14.3	3	4x16	5□A23–1□□0
	70	58	106–0SF71	66	80	18.2	3	4x25	5□A33–1□□0
	75	30	132–0AF71	59	80		3	4x16	5□A23–1□□0
	95	75	132–0SF71	75	80	23.6	3	4x25	5□A33–1□□0

Rated speed [RPM]	M_0 [Nm]	M_{rated} [Nm]	Motor type 1FT5–	Motor current I_0 [A]	Rated drive converter current[A]	P_{rated} [kW]	Connec-tor size	Cross–section[1] [mm^2]	Cable type 6FX□002– [4]
4000	2.6	2.2	062–□AG71	3.2	4	0.9	1	4x1.5	5□A01–1□□0
	5.5	3.8	064–□AG71	6.7	7.5	1.6	1	4x1.5	5□A01–1□□0
	8	5.5	066–□AG71	9.6	12.5	2.3	1	4x1.5	5□A01–1□□0
	12	7.5	072–0AG71	14.4	25	3.1	1	4x2.5	5□A11–1□□0
	18	11	074–0AG71	21.5	25	4.6	2	4x4	5□A12–1□□0
	22	13	076–0AG71	26.0	25[3]	5.4	2	4x6	5□A22–1□□0
	20.5	17	074–0SG71	24.5	25	7.1	2	4x4	5□A12–1□□0
	26	21	076–0SG71	31.0	40	8.8	2	4x6	5□A22–1□□0
	33	10	102–0AG71	38.5	40	4.2	2	4x10	5□A32–1□□0
	40	32	102–0SG71	46.5	40	13.4	3	4x16	5□A23–1□□0
6000	0.9	0.76	034–□AK71	1.6	4	0.5	1	4x1.5	5□A01–1□□0
	1.3	1.0	036–□AK71	2.3	4	0.6	1	4x1.5	5□A01–1□□0
	1.0	0.9	042–□AK71	1.7	4	0.56	1	4x1.5	5□A01–1□□0
	2.0	1.65	044–0AK71	3.4	4	1.0	1	4x1.5	5□A01–1□□0
	3.7	2.7	046–□AK71	6.3	7.5	1.7	1	4x1.5	5□A01–1□□0
	2.6	2.1	062–0AK71	4.6	7.5	1.3	1	4x1.5	5□A01–1□□0
	5.5	3.0	064–0AK71	9.8	12.5	1.9	1	4x1.5	5□A01–1□□0
	8.	4.2	066–0AK71	14.5	25	2.6	1	4x2.5	5□A11–1□□0
	12	5.0	072–0AK71	21.0	25	3.1	2	4x4	5□A12–1□□0
	18	7.0	074–0AK71	32.0	40	4.4	2	4x6	5□A22–1□□0
	22	4.0	076–0AK71	39.0	40	2.5	2	4x10	5□A32–1□□0
	20.5	12	074–0SK71	36.0	40	7.5	2	4x10	5□A32–1□□0
	26	15	076–0SK71	46.0	40[1]	9.4	3	4x16	5□A23–1□□0

1 Core type
0 Not a core type

without brake cable: without overall screen A
with overall screen C
with brake cable: without overall screen B
with overall screen D

Lengths[2] (examples)		
	5 m	AF
	10 m	BA
	15 m	BF
	18 m	BJ
	25 m	CF

Cables are not included with the motors,
they must be separately ordered.
Actual value cable, refer to Chapter Encoders (GE).

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1) Designed for $I_{0rms} = I_{0[100\,k]} \times \sqrt{2/3}$; ambient temperature 40 °C; PVC–insulated cable; brake connection 2 x 1 mm^2.
2) Cables can be supplied in incremental lengths of 1 meter; length code, refer to Chapter AL S/4.3.
3) With the specified power module, the motor cannot be fully utilized to 100 K winding temperature.
4) 2=Performance cable; 4=Standard cable; Technical data, refer to Catalog NC Z

Rated speed [**RPM**]	**M_0** [**Nm**]	**M_{rated}** [**Nm**]	**Motor type** **1FT5–**	**Motor current** **I_0** [**A**]	**Rated drive converter current**[**A**]	**P_{rated}** [**kW**]	**Connec-tor size**	**Cross–section**[1] [**mm^2**]	**Cable type** **6FX□002–** [3]
Motors, short type of construction									
2000	3.5	3.1	070–0AC71	3.1	4	0.65	1	4x1.5	5□A01–1□□0
	5.5	5	071–0AC71	5.2	4	1.0	1	4x1.5	5□A01–1□□0
	9.	8	073–0AC71	8.2	7.5	1.7	1	4x1.5	5□A01–1□□0
	13	12	100–0AC71	12.0	12.5	2.5	2	4x2.5	5□A02–1□□0
	19	17	101–0AC71	18.0	12.5	3.6	2	4x2.5	5□A02–1□□0
	25	22.5	103–0AC71	23.0	25	4.7	2	4x2.5	5□A02–1□□0
3000	3.5	3.0	070–0AF71	3.1	4	0.94	1	4x1.5	5□A01–1□□0
	5.5	4.8	071–0AF71	5.2	7.5	1.5	1	4x1.5	5□A01–1□□0
	9	7.2	073–0AF71	8.2	12.5	2.3	1	4x1.5	5□A01–1□□0
	13	11	100–0AF71	12.0	12.5	3.5	2	4x2.5	5□A02–1□□0
	19	15	101–0AF71	18.0	25	4.7	2	4x2.5	5□A02–1□□0
	25	20	103–0AF71	23.0	25	6.3	2	4x4	5□A12–1□□0

without brake cable:	without overall screen	A
	with overall screen	C
with brake cable:	without overall screen	B
	with overall screen	D

Lengths[2] (examples)	5 m	AF
	10 m	BA
	15 m	BF
	18 m	BJ
	25 m	CF

Power calculation

$$P\ [kW] = \frac{M_0 \times n}{9550}$$

M [Nm]
n [RPM]

Cables are not included with the motors, they must be separately ordered.
Actual value cable, refer to Chapter, Encoders (GE).

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1) Designed for $I_{0rms} = I_{0[100\ k]} \times \sqrt{2/3}$; ambient temperature 40 °C; PVC insulated cable; brake connection 2 x 1 mm^2.
2) Cables can be supplied in incremental lengths of 1 meter; length code, refer to Chapter AL S/4.3.
3) 2=Performance cable; 4=Standard cable; Technical data, refer to Catalog NC Z

1.2 Functions and options

Armature short–circuit braking

Definition, refer to Chapter 3 General information on AC servomotors AL S.

Brake resistors

The optimum braking time is achieved with the design. The braking torques which are obtained are also listed in the tables. The data is valid when braking from the rated speed. If the drive brakes from another speed, then the braking time **cannot** be linearly interpolated. However, the braking times either remain the same or are shorter.

The rating of the resistors must be harmonized with the I^2t load capability, refer to Chapter 3. General information on AC servomotors AL S.

Table 1-3 Resistor braking for motors 1FT5, shaft heights 36 and 48

Motor type	**External brake resistor** R_{opt} [Ω]	**Average braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT5034–☐AK71	– 4.7	1.5 1.5	1.9	4.1 3.9
1FT5036–☐AK71	– 4.7	2.3 2.4	3.0	6.6 6.2
1FT5042–☐AF71	–	1.8	2.3	2.7
1FT5042–☐AK71	– 7.8	1.7 1.8	2.3	4.8 4.5
1FT5044–☐AF71	– 2.8	3.6 3.7	4.5	6.0 5.8
1FT5044–0AK71	– 5.9	2.9 3.6	4.5	10.0 9.2
1FT5046–☐AF71	– 2.7	6.9 7.6	9.4	12.8 11.9
1FT5046–☐AK71	– 3.4	4.9 7.2	9.1	20.6 18.6

Table 1-4 Resistor braking for 1FT5 motors, shaft height 63

Motor type	**External brake resistor** R_{opt} [Ω]	**Average braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT5062–□AC71	–	2.5	3.4	2.9
1FT5062–□AF71	–	2.8	3.5	4.1
1FT5062–□AG71	–	1.9	3.4	6.0
	10.0	2.8		5.4
1FT5062–0AK71	–	1.6	3.5	9.1
	6.8	2.8		8.1
1FT5064–□AC71	–	4.9	7.5	6.4
1FT5064–□AF71	–	4.1	7.5	9.7
1FT5064–□AG71	–	3.5	7.6	13.3
	4.7	6.1		11.9
1FT5064–0AK71	–	2.8	7.6	19.6
	3.9	6.1		17.6
1FT5066–□AC71	–	7.0	11.5	9.8
	5.6	9.2		8.9
1FT5066–□AF71	–	5.4	11.3	14.6
	3.9	8.9		13.1
1FT5066–□AG71	–	4.9	11.5	20.1
	3.3	9.2		18.0
1FT5066–0AK71	–	3.7	11.2	28.8
	2.7	9.0		25.8

Table 1-5 Resistor braking for 1FT5 motors, shaft height 71

Motor type	**External brake resistor** R_{opt} [Ω]	**Average braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT5072–□AC71	–	7.7	12.5	10.8
	4.7	10.0		9.8
1FT5072–□AF71	–	6.5	12.5	16.5
	3.9	10.1		14.7
1FT5072–0AG71	–	5.6	12.6	22.0
	3.3	10.3		19.5
1FT5072–0AK71	–	4.0	12.4	30.5
	2.7	9.8		27.0
1FT5074–□AC71	–	12.3	21.9	19.0
	2.7	17.6		17.0
1FT5074–□AF71	–	10.0	22.0	29.5
	2.2	18.0		26.5
1FT5074–0AG71	–	8.1	21.7	36.5
	3.9	17.0		32.5
1FT5074–0AK71	–	7.0	22.2	59.0
	2.2	18.0		52.5
1FT5076–□AC71	–	16.8	31.4	27.5
	2.2	25.5		24.5
1FT5076–□AF71	–	13.4	31.4	40.5
	1.5	25.0		36.5
1FT5076–0AG71	–	11.5	31.6	54.5
	1.2	25.5		48.5
1FT5076–0AK71	–	8.9	31.6	80.0
	1.0	25.5		71.5

Table 1-6 Resistor braking for 1FT5 motors, shaft height 100

Motor type	**External brake resistor** **R_{opt}** [Ω]	**Average braking torque** **$M_{br\ rms}$** [Nm]	**Max. braking torque** **$M_{br\ max}$** [Nm]	**RMS braking current** **$I_{br\ rms}$** [A]
1FT5102–□AA71	–	34.0	56.5	29.5
	1.8	45.5		26.5
1FT5102–□AC71	–	25.5	56.4	48.5
	1.2	45.0		43.5
1FT5102–□AF71	–	20.5	56.6	75.5
	0.82	45.5		67.5
1FT5102–0AG71	–	18.0	56.4	94.5
	0.82	45.0		84.5
1FT5104–□AA71	–	49.0	82.0	44.0
	1.2	67.5		39.5
1FT5104–□AC71	–	37.0	82.5	73.0
	0.82	68.0		65.5
1FT5104–0AF71	–	27.5	81.5	105.0
	0.68	66.0		94.0
1FT5106–0AA71	–	59.5	105.0	56.5
	1.0	87.0		51.0
1FT5106–□AC71	–	43.0	104.0	89.0
	0.68	84.0		80.0
1FT5106–0AF71	–	33.0	103.0	136.0
	0.47	82.0		122.0
1FT5108–0AA71	–	73.0	126.0	71.0
	0.82	102.0		64.5
1FT5108–□AC71	–	51.0	123.0	105.0
	0.56	100.0		93.0
1FT5108–0AF71	–	43.0	125.0	167.0
	0.39	101.0		149.0

Table 1-7 Resistor braking for 1FT5 motors, shaft height 132 [1)]

Motor type	**External brake resistor** **R_{opt}** [Ω]	**Average braking torque** **$M_{br\ rms}$** [Nm]	**Max. braking torque** **$M_{br\ max}$** [Nm]	**RMS braking current** **$I_{br\ rms}$** [A]
1FT5132–0AA71	–	61.5	123.0	65.0
	1.0	98.5		58.0
1FT5132–0AC71	–	51.0	128.0	114.0
	0.56	101.0		103.0
1FT5132–0AF71	–	35.5	124.0	140.0
	0.56	100.0		125.0
1FT5134–0AA71	–	77.0	160.0	86.5
	0.68	131.0		77.5
1FT5134–0AC71	–	54.5	156.0	137.0
	0.47	124.0		123.0
1FT5136–0AA71	–	94.0	206.0	109.0
	0.56	166.0		98.5
1FT5136–0AC71	–	68.0	204.0	163.0
	0.47	164.0		146.0
1FT5138–0AA71	–	107.0	245.0	130.0
	0.47	197.0		117.0

---

1) When utilized acc. to M_0 (100 K), a brake resistor must be connected in series, to prevent partial de–magnetization.
When utilized acc. to M_0 (60 K) the additional brake resistor is not required.

Table 1-8 Resistor braking for 1FT5 motors, shaft heights 71 and 100 (force–ventilated)

Motor type	**External brake resistor** **R_{opt}** [Ω]	**Average braking torque** **$M_{br\ rms}$** [Nm]	**Max. braking torque** **$M_{br\ max}$** [Nm]	**RMS braking current** **$I_{br\ rms}$** [A]
1FT5074–0SG71	–	8.1	21.7	36.5
	3.9	17.0		32.5
1FT5074–0SK71	–	7.0	22.2	59.0
	2.2	18.0		52.5
1FT5076–0SG71	–	11.5	31.6	54.5
	1.2	25.5		48.5
1FT5076–0SK71	–	8.9	31.6	80.0
	1.1	25.5		71.5
1FT5102–0SF71	–	20.5	56.6	75.5
	0.82	45.5		67.5
1FT5102–0SG71	–	18.0	56.4	94.5
	0.82	45.0		84.5
1FT5104–0SF71	–	27.5	81.5	105.0
	0.68	66.0		94.0
1FT5106–0SF71	–	33.0	103.0	136.0
	0.47	82.0		122.0

Table 1-9 Resistor braking for 1FT5 motors, shaft height 132 (force–ventilated)[1)]

Motor type	**External brake resistor** **R_{opt}** [Ω]	**Average braking torque** **$M_{br\ rms}$** [Nm]	**Max. braking torque** **$M_{br\ max}$** [Nm]	**RMS braking current** **$I_{br\ rms}$** [A]
1FT5132–0SA71	–	61.5	123.0	65.0
	1.0	98.5		58.0
1FT5132–0SC71	–	51.0	128.0	114.0
	0.56	101.0		103.0
1FT5132–0SF71	–	35.5	124.0	140.0
	0.56	100.0		125.0
1FT5134–0SA71	–	77.0	160.0	86.5
	0.68	131.0		77.5
1FT5134–0SC71	–	54.5	156.0	137.0
	0.47	124.0		123.0
1FT5136–0SA71	–	94.0	206.0	109.0
	0.56	166.0		98.5
1FT5136–0SC71	–	68.0	204.0	163.0
	0.47	164.0		146.0
1FT5138–0SA71	–	107.0	245.0	130.0
	0.47	197.0		117.0

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1) When utilized acc. to M_0 (100 K), a brake resistor must be connected in series in order to prevent partial de–magnetization.
When utilized acc. to M_0 (60 K), the additional brake resistor is not required.

Table 1-10 Resistor braking for 1FT5 motors, shaft heights 71 and 100 (short motors)

Motor type	**External brake resistor** R_{opt} [Ω]	**Average braking torque** $M_{br\ rms}$ [Nm]	**Max. braking torque** $M_{br\ max}$ [Nm]	**RMS braking current** $I_{br\ rms}$ [A]
1FT5070–0AC71	–	2.8	3.7	3.0
1FT5070–0AF71	–	2.4	3.6	4.4
1FT5071–0AC71	–	4.3	6.3	5.5
1FT5071–0AF71	–	3.8	6.4	8.5
1FT5073–0AC71	–	7.2	11.3	9.7
	4.7	9.1		8.8
1FT5073–0AF71	–	5.9	11.3	14.7
	3.9	9.1		13.3
1FT5100–0AC71	–	10.0	18.1	15.8
	3.3	14.5		14.3
1FT5100–0AF71	–	8.0	18.0	23.8
	2.7	14.5		21.4
1FT5101–0AC71	–	15.0	29.0	26.0
	2.2	24.0		23.5
1FT5101–0AF71	–	11.9	28.7	39.0
	1.5	23.5		34.5
1FT5103–0AC71	–	21.0	42.4	38.0
	1.5	34.0		34.0
1FT5103–0AF71	–	16.0	42.7	56.5
	1.2	34.5		50.5

Holding brake

Function description, refer to Chapter 2.2 General information on AC servomotors AL S.

The holding brake can be retrofitted! The motor length does not change.

Table 1-11 Technical data of the holding brakes used with 1FT5 motors

Motor type	**Brake type**	**Holding torques** [Nm]		**Dyn. torque** [Nm]	**DC current** [A]	**Power drain** [W]	**Opening time** [ms]	**Closing time**[1] [ms]	**Moment of inertia** [10^{-4} kgm^2]
		20 °C	120 °C	120 °C					
1FT503□	EBD 0.11B	1.2	1.0	0.75	0.3	7.5	20	10	0.07
1FT504□	EBD 0.2B	2.0	1.5	1.3	0.55	13	40	20	0.38
1FT506□	EBD 0.8B	12	10	7	0.65	15.6	55	15	1.06
1FT507□	EBD 2B	28	23	13	0.9	21.3	70	30	7.6
1FT510□	EBD 4B	100	85	43	1.4	32	180	20	32
1FT513□	EBD 8MF	200	140	70	3.3	78	160	70	75
Short motors									
1FT507□	EBD 0.4B	6.5	5	3.5	0.8	19.3	30	15	1.06
1FT510□	EBD 2.2B	20	15	13	0.9	21.3	70	35	9.5

Working brake (option C00)

The working brake operates according to the fail–safe principle, i.e. the brake is closed when in the no–current condition. However, the brake can be released in the no–voltage condition using a manual release lever.

The working brake cannot be ordered in conjunction with integrated or mounted position encoders. Further, the brake can only be mounted on standard non–ventilated motors (not short motors).

Mounting:	Non–drive end
Degree of prot.:	IP 43
Connection:	24 V DC through the terminal box
Circuit:	as for the holding brake
Dimension:	Refer to Chapter 4

The braking torque can be subsequently reduced using the adjustment ring.

Table 1-12 Technical data, working brake (option C00)

Motor type	**Brake type**	**Braking torque at 250 RPM** [Nm]	**Braking torque is reduced using the adjustment ring** [Nm]	**Max. speed** [RPM]	**Rated switching power** [kJ/h]	**Power consumption** [ms]	**Brake closing time** [ms]	**Moment of inertia** [10^{-4} kgm^2]	**Lifetime, operations** [MJ]
1FT507□	13	32	16	4000	460	35	30	5	135
1FT510□	16	60	30	3500	570	55	70	14	280
1FT513□	19	130	75	3000	640	70	80	38	360

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[1] Measured with diode and resistor

Gearboxes

For engineering gearboxes, refer to Chapter 2.2, General information on AC servomotors.

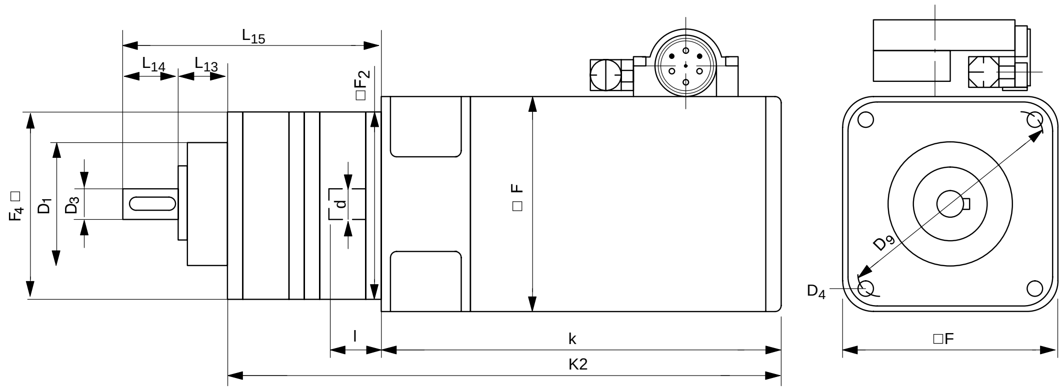

Fig. 1-1 1FT5 motor with planetary gearbox (alpha company) SPG 1 stage dimensions in [mm]

Table 1-13 1FT5 motor with planetary gearbox, (alpha company) SPG 1 stage

Standard motor					Planetary gearbox, 1 stage									Motor with planetary gearbox	
Type	Dimension				Type	Dimension								Dimension	
	k	l	d	□ F		L_{13}	L_{14}	L_{15}	D_1	D_3	D_4	D_9	□ F_4	K_2	□ F_2
1FT5034	181	23	11	70	SPG 060–M01	20	28	129	60	16	5.5	68	62	262	70
1FT5036	206													287	
1FT5042	165	30	14	92	SPG 075–M01	20	36	156	70	22	6.6	85	76	265	90
1FT5044	190													290	
1FT5046	240													340	
1FT5062	241	40	19	115	SPG 100–M01	30	58	202	90	32	9	120	101	355	100
1FT5064	281													395	
1FT5066	321													435	
1FT5072	273	50	24	142	SPG 140–M01	30	82	257	130	40	11	165	141	418	140
1FT5074	323													468	
1FT5076	373													518	
1FT5102	352	58	32	190	SPG 180–M01	30	82	297	160	55	13	215	182	537	190
1FT5104	402													587	
1FT5106	452													637	
1FT5108	502													687	
1FT5132	429	82	48	260	SPG 210–M01	38	105	339	180	75	17	250	212	625	260
1FT5134	479													675	
1FT5136	529													725	
1FT5138	604													800	

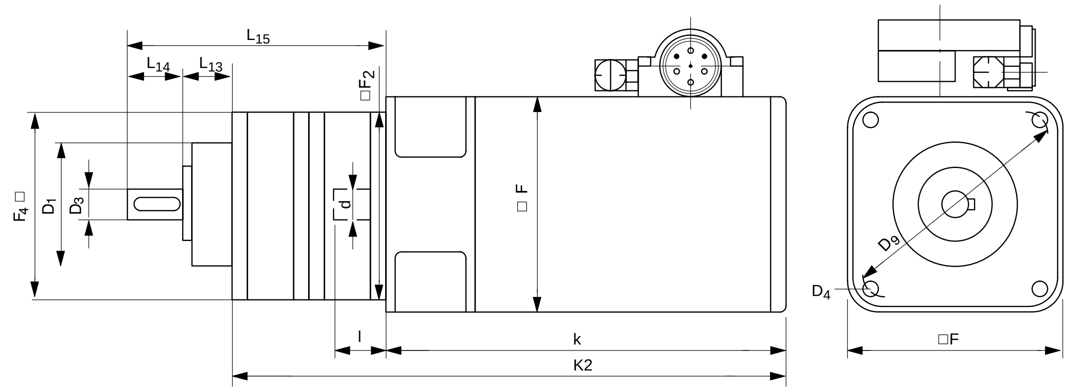

Fig. 1-2 1FT5 motor with planetary gearbox (alpha company) SPG 2 stage – dimensions in [mm]

Table 1-14 1FT5 motor withplanetary gearbox (alpha company) SPG 2 stage

Standard motor					**Planetary gearbox, 2 stage**									**Motor with planetary gearbox**	
Type	**Dimension**				**Type**	**Dimension**								**Dimension**	
	k	**l**	**d**	**□ F**		**L_{13}**	**L_{14}**	**L_{15}**	**D_1**	**D_3**	**D_4**	**D_9**	**□ F_4**	**K**	**□ F_2**
1FT5034	181	23	11	70	SPG 075–M02	20	36	183	70	22	6.6	85	76	308	80
1FT5036	206													333	
1FT5042	165	30	14	92										292	90
1FT5044	190													317	
1FT5042	165	30	14	92	SPG 100–M02	30	58	235	90	32	9	120	101	312	100
1FT5044	190													337	
1FT5046	240													387	
1FT5062	241	40	19	115										388	
1FT5064	281													428	
1FT5064	281	40	19	115	SPG 140–M02	30	82	297	130	40	11	165	141	466	140
1FT5066	321													506	
1FT5072	273	50	24	142										458	
1FT5072	273	50	24	142	SPG 180–M02	30	82	316	160	55	13	215	182	477	140
1FT5074	323													527	
1FT5076	373													577	
1FT5072	273	50	24	142	SPG 210–M02	38	105	359	180	75	17	250	212	489	140
1FT5074	323													539	
1FT5076	373													589	
1FT5102	352	58	32	190										568	190
1FT5076	373	50	24	142	SPG 240–M02	40	130	413	200	85	17	290	240	616	140
1FT5102	352	58	32	190										595	190
1FT5104	402													645	
1FT5106	452													695	
1FT5108	502													745	

Table 1-15 Planetary gearbox, 1 stage (alpha company, SPG series) selection table for 1FT5 motors

Ordering information: **1FT5□□□–0A□71–1–Z V□□** Motor Order No. (standard type) with code **–Z** and Code for mounting the assigned planetary gearbox to the motor

AC servomotor, non–ventilated	Planetary gearbox 1 stage Play ≤ 4 arcmin 2)		Available gearbox ratios *i* =				Max. permissible input speed	Max. permissible output torque	Max. permissible drive shaft load 1)	Gearbox moment of inertia	
Type	Type	Weight approx. kg	4	5	7	10	n_{G1} RPM	M_{G2} Nm	F_r N	J_G for *i*=4 10^{-4} kgm^2	J_G for *i*=10 10^{-4} kgm^2
1FT5034	SPG 060–M01	1.5	X	X	X	X	6000	40	2600	0.14	0.12
1FT5036			X	X	X	X		(32)3)			
1FT5042	SPG 075–M01	2.8	X	X	X	X	6000	100	3800	0.57	0.4
1FT5044			X	X	X	X		(80)3)			
1FT5046			X	X	X	X					
1FT5062	SPG 100–M01	6.2	X	X	X	X	4500	250	6000	2.0	1.3
1FT5064			X	X	X	X		(200)3)			
1FT5066			X	X	X	X					
1FT5072	SPG 140–M01	11.5	X	X	X	X	4000	500	9000	5.7	3.5
1FT5074			X	X	X	X		(400)3)			
1FT5076			X	X	X	X					
1FT5102	SPG 180–M01	27	X	X	X	X	3500	1100	14000	30.6	17.4
1FT5104			X	X	X	X		(880)3)			
1FT5106			X	X	X	X					
1FT5108			X	X	X	X					
1FT5132	SPG 210–M01	45	X	X	X	X	2000	1600	15000	70.0	31.0
1FT5134			X	X	X			(1280)3)			
1FT5136			X	X	X						
1FT5138			X	X							
Code											
Gearbox shaft **with** key			V02	V03	V05	V09					
Gearbox shaft **without** key			V22	V23	V25	V29					

---

1) Nominal values for the maximum permissible drive shaft load at the center of the shaft at a speed of n_{G2}=300 RPM Axial load $F_a=0.5 \cdot F_r$ for SPG 060 to SPG 180; $F_a= F_r$ for SPG 210.

2) For SPG 060 and SPG 075: 6 arcmin

3) Values in brackets (...) for *i*=10

Table 1-16 2–stage planetary gearbox (alpha company, SPG series) selection table for 1FT5 motors

Ordering information: **1FT5□□□–0A□71–1–Z V□□** Motor Order No. (standard type) with codes **–Z** and Code for mounting the assigned planetary gearbox to the motor

AC servo-motor, non–ventilated	**Planetary gearbox 2 stage** Play ≤ 6 arcmin		**Available gearbox ratios *i* =**					Max. permissible input speed	Max. permissible output torque	Max. permissible drive out shaft load [1]	Moment of inertia Gearbox
Type	Type	Weight, approx. kg	16	20	28	40	50	n_{G1} RPM	M_{G2} Nm	F_r N	J_G for *i*=20 10^{-4} kgm^2
1FT5034	SPG 075–M02	3.1	X	X	X	X	X	6000	100	3800	0.47
1FT5036			X	X	X	X	X				
1FT5042			X	X	X	X					0.52
1FT5044			X	X							
1FT5042	SPG 100–M02	7.1					X	4500	250	6000	1.7
1FT5044					X	X	X				
1FT5046			X	X	X	X	X				
1FT5062			X	X	X	X	X				1.8
1FT5064			X	X							
1FT5064	SPG 140–M02	14.5			X	X	X	4000	500	9000	4.4
1FT5066			X	X	X						
1FT5072			X	X							5.1
1FT5072	SPG 180–M02	29			X	X		4000	1100	14000	5.5
1FT5074			X	X	X						
1FT5076			X	X							
1FT5072	SPG 210–M02	51					X	3000	1600	15000	6.25
1FT5074						X	X				
1FT5076					X						
1FT5102			X	X							11.6
1FT5076	SPG 240–M02	61				X	X	3000	3000	22000	19.0
1FT5102					X	X	X				24.2
1FT5104			X	X	X						
1FT5106			X	X	X						
1FT5108			X	X							
Code											
Gearbox shaft **with** key			V12	V13	V15	V16	V17				
Gearbox shaft **without** key			V32	V33	V35	V36	V37				

---

1) Nominal values for the maximum permissible drive shaft load at the shaft center at a speed n_{G2}=300 RPM
Axial load F_a=0.5 · F_r for SPG 075 to SPG 180; F_a= F_r for SPG 210 and SPG 240.

Forced ventilation

The different cooling types – non–ventilated and force ventilated have already been defined in Chapter 2.1 General information (AL).

Degree of protection: IP 64 (acc. to DIN 40 050). IP 67 cannot be fulfilled. It is not permissible that the hot discharged air is drawn–in again.

The separately–driven fan can be retrofitted, whereby you must taken into account the various measures required. Only an authorized workshop may retrofit a fan onto motors, shaft height 100.

Due to the higher torques and therefore the higher phase currents, the motors are in some cases, allocated larger power connectors.

Shaft heights 71, 100 and 132 differ as follows:

- **Shaft height 100 and 132:** Airflow direction from the drive end to the non–drive end

  The air is drawn–in from the non–drive end through the corners of the extruded enclosure by the mounted radial fan.

  The modified dimensions should be taken from the dimension drawings.

Termination technology:	terminal boxes
Supply voltages:	3–ph. 400/460 V AC, 50/60 Hz
Max. current:	0.4 A
Weight of the fan assembly:	approx. 5.6 kg

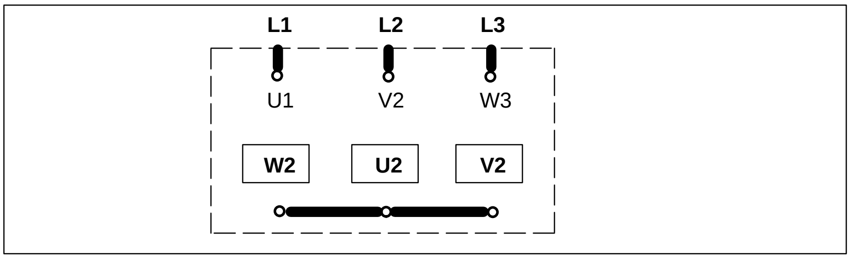

Fig. 1-3 Fan connection, shaft heights 100/132

- **Shaft height 71:** Airflow direction from the non–drive end to the drive end

  The available torque is reduced by approx. 20 % when reversing the airflow direction.

  Mechanical change of the motors over non–ventilated versions:

  - The power connector is positioned 12 mm higher.
  - A sheet steel envelope is placed over the motor enclosure from the non–drive end; the axial fan is installed in this sheet metal envelope. Only some air flows across the motor through the cut–out in the sheet steel at the connectors (3–sided cooling).
  - The motor dimensions should be taken from the dimension drawings.

Termination technology:	Connector[1]
Supply voltage:	1–ph. 230/260 V AC, 50/60 Hz
Maximum current:	0.3 A
Weight of the fan assembly:	approx. 4.8 kg

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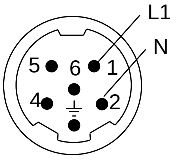
[1] Power connector size 1

Pin assignment: Fan connection (shaft height 71)



Mounting

The following minimum clearances to customer–specific mounted components and the air discharge opening must be maintained:

Table 1-17 Minimum clearance to customer–specific components

Shaft height [mm]	Minimum clearance [mm]
71	20
100	30
132	60

Output coupling

Technical explanations and ordering address, refer to Chapter 2.2 General information AL S.

Table 1-18 Allocating the drive out couplings to the motors

Shaft height	Rotex GS Type	Torques which can be transmitted with 98 Sh–A–GS pinion	
		T_{KN} [Nm]	T_{Kmax} [Nm]
63	24/28	60	120
71	28/32	160	320
100	38/45	325	650

It may be necessary to use other pinions (e.g. Shore hardness 80 Sh–A). This must be optimally harmonized in conjunction with the mounted mechanical system.

Warning

The accelerating torque may not exceed the clamping torque!

1.3 Interfaces

Circuit diagrams

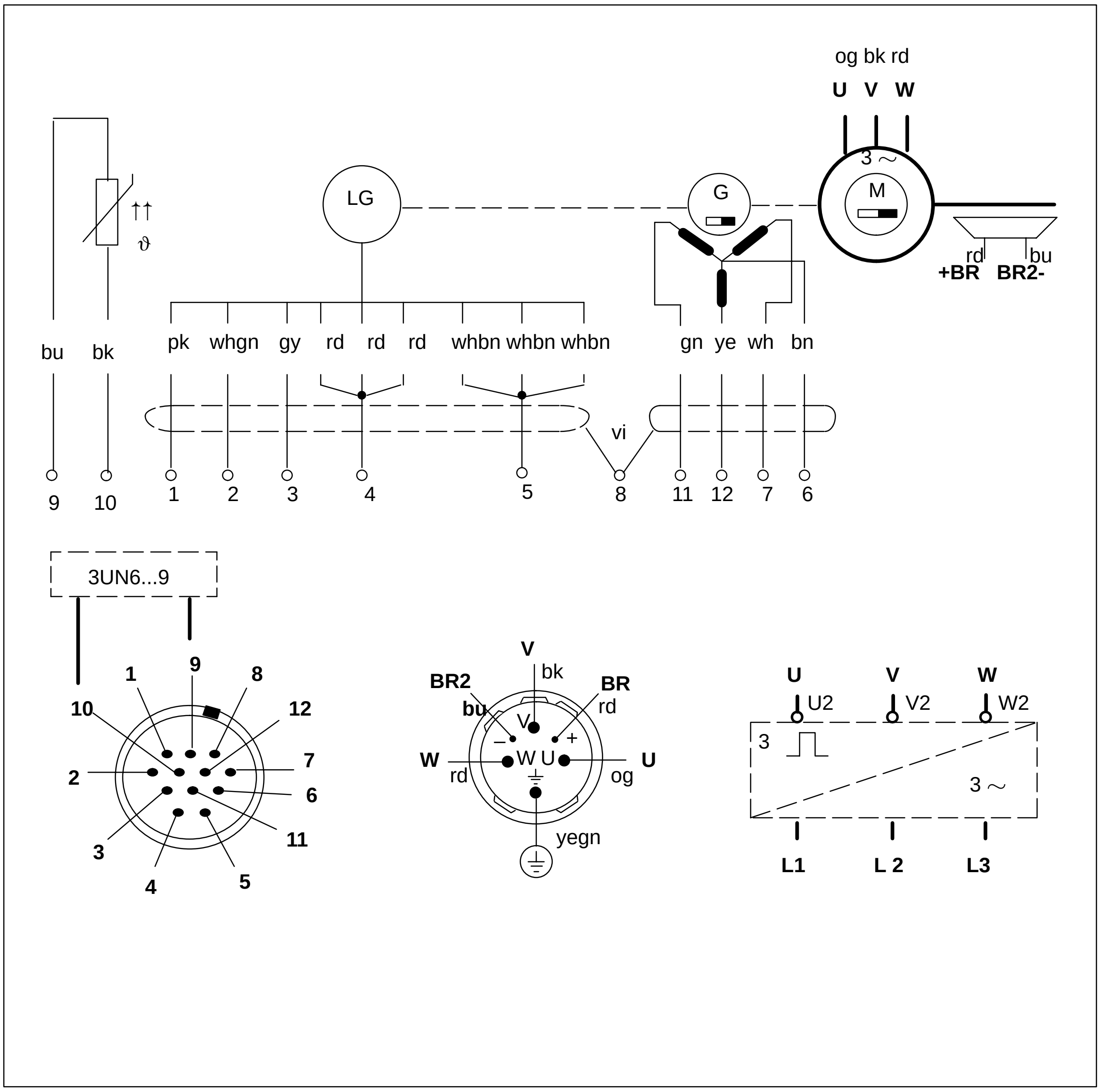


Fig. 1-4 Connection assignment: Power, brake, tachometer, position encoder and PTC thermistor

1.4 Thermal motor protection

Refer to GE Chapter 1

1.5 Encoder

Refer to GE Chapter 1

■

Space for notes

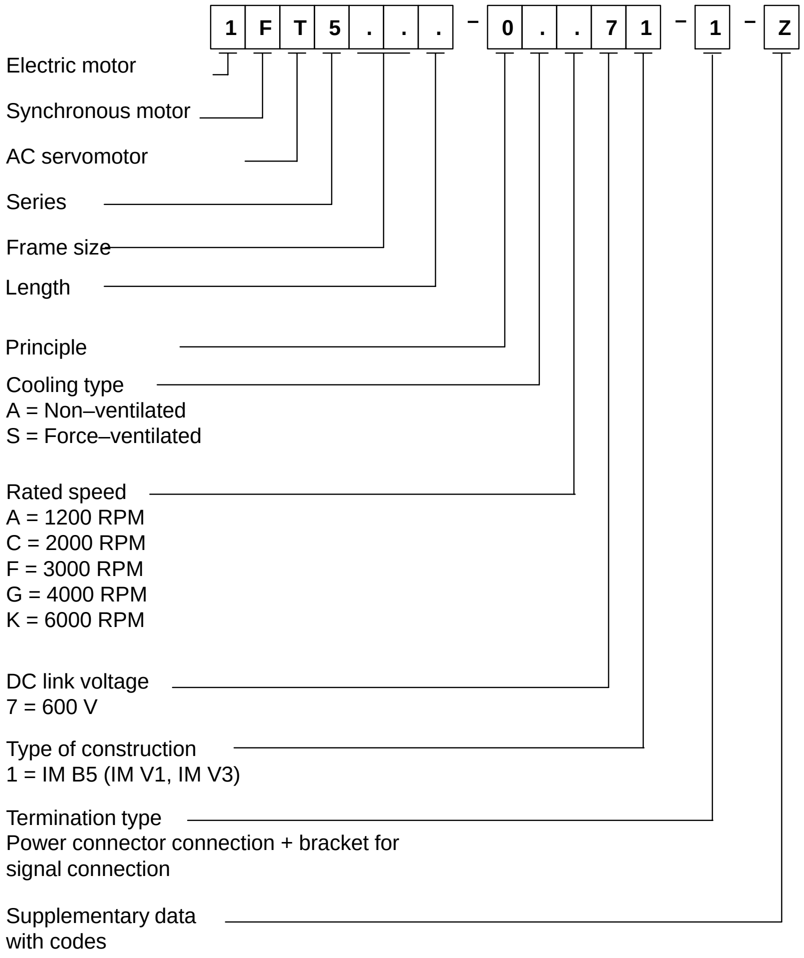
2

Order designations

Order designation (standard)

The order designation consists of a combination of numbers and letters. It is subdivided into four hyphenated blocks.

The first block comprises seven positions and defines the motor type. Additional design features are coded in the second block. The third and fourth blocks are provided for additional data.



Electric motor

Synchronous motor

AC servomotor

Series

Frame size

Length

Principle

Cooling type
A = Non–ventilated
S = Force–ventilated

Rated speed
A = 1200 RPM
C = 2000 RPM
F = 3000 RPM
G = 4000 RPM
K = 6000 RPM

DC link voltage
7 = 600 V

Type of construction
1 = IM B5 (IM V1, IM V3)

Termination type
Power connector connection + bracket for signal connection

Supplementary data
with codes

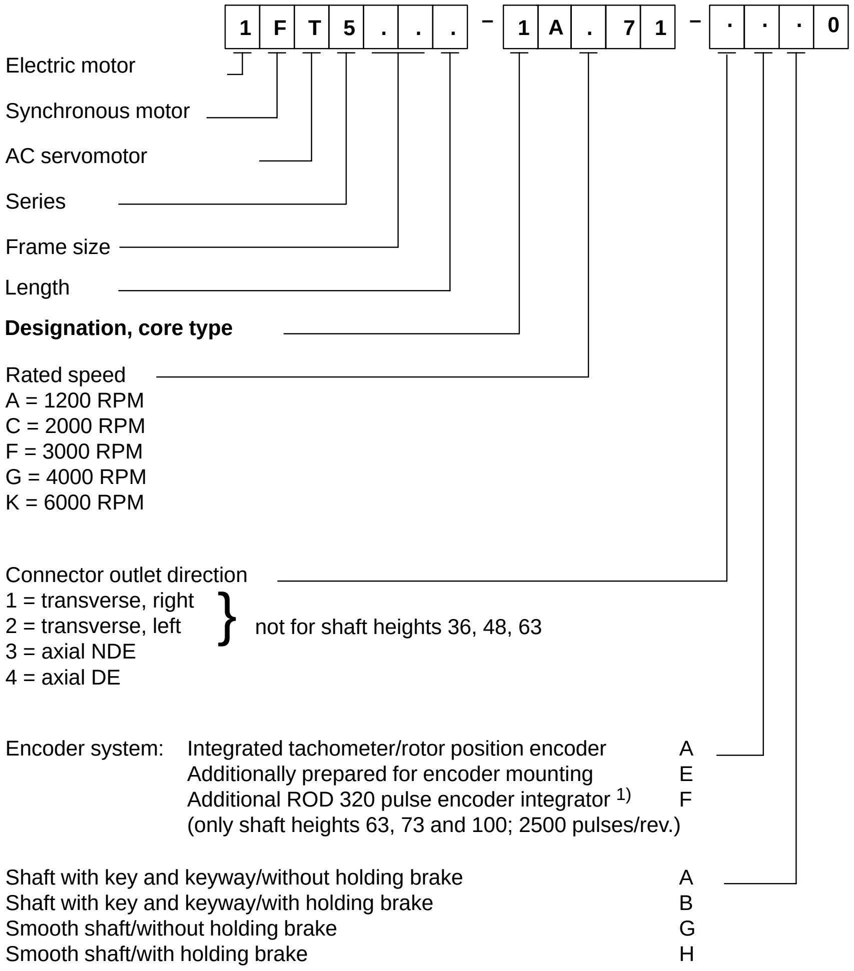
Supplementary data for standard versions and options

Plain text information	**Code**
Degree of protection IP 67 (not for force–ventilated motors) IP 68 (not for force–ventilated motors)	**K93** M24
Second rating plate (standard for core types)	**K31**
Connector outlet direction1) Cable enters from the drive end	**K83**
Rotated through 90° Cable enters from the non–drive end	**K84**
Connector outlet direction1) rotated through 180°	**K85**
Radial shaft sealing ring acc. to DIN 3760	**K18**
Shaft end: Smooth shaft	**K42**
Vibration severity (ISO 2373) Stage R (reduced) 600 to 1800 RPM ≤ 0.71 mm/s >1800 to 3600 RPM ≤ 1.12 mm/s	**K01**
Shaft– and flange accuracy, tolerance R acc. to DIN 42955	**K04**
Motor with mounted pulse encoder 5000 pulses/revolution 2500 pulses/revolution 2000 pulses/revolution 1000 pulses/revolution	 **H28** **H27** **H26** **H22**
Motor is prepared for mounting a pulse encoder with synchronous flange and the following absolute value encoder 2): • ROC 424 Heidenhain company • CE 65/04–418–031 T&R company • CR 58 TWK company • AG 661–21–26 Stegmann company • 6FX2 ... (Siemens)	**G51**
Motor with integrated ROD 320 pulse encoder 3)6) 5000 pulses/revolution 2500 pulses/revolution 2000 pulses/revolution 1250 pulses/revolution	 **H04** **G44** **G42** **H01**
Holding brake (integrated)	**G45**
Motor with mounted planetary gearbox	**V□□**
Mounted working brake 4)	**C00**
Retrofit set prepared for encoder mounting (G51) with mounting instructions 5)	EWN: 519.4033803:1FT5042 to 1FT5046 519.4033801:1FT5062 to 1FT5066 519.4033802:1FT5072 to 1FT5108

---

1) Standard version corresponding to the dimension drawings Chapter 4)
2) For 1FT503□, 1FT504□ only on request; not for force–ventilated motors
3) For 1FT503□, 1FT504□ not possible; not for forced ventilation
4) For 1FT503□, 1FT504□ and 1FT506□ not possible
5) Only a maximum of 2 per motor version can be supplied ex–factory
6) Limiting frequency: 250 kHz; motors may only be designed for a winding temperature rise ΔT=60 K . Cannot be combined with a connector transition direction, axial NDE.

Order designations, core types



1 F T 5 . . . – 1 A . 7 1 – . . . 0

Electric motor

Synchronous motor

AC servomotor

Series

Frame size

Length

Designation, core type

Rated speed
A = 1200 RPM
C = 2000 RPM
F = 3000 RPM
G = 4000 RPM
K = 6000 RPM

Connector outlet direction
1 = transverse, right
2 = transverse, left
3 = axial NDE
4 = axial DE

} not for shaft heights 36, 48, 63 (applies to 1 and 2)

Encoder system:	Integrated tachometer/rotor position encoder	A
	Additionally prepared for encoder mounting	E
	Additional ROD 320 pulse encoder integrator [1] (only shaft heights 63, 73 and 100; 2500 pulses/rev.)	F

Shaft with key and keyway/without holding brake	A
Shaft with key and keyway/with holding brake	B
Smooth shaft/without holding brake	G
Smooth shaft/with holding brake	H

---

[1] Limiting frequency: 250 kHz; motors may only be designed for a winding temperature rise ΔT=60 K. Cannot be combined with a connector transition direction, axial NDE.

Ordering example

When ordering a 1FT5 AC servomotor, for options, it is necessary to specify the Order code ”–Z” and in addition the short designation. For core types, the last ordering block is appropriately supplemented.

The following motor is required:

AC servomotor

- For connection to a SIMODRIVE 611 converter with a 600 DC link voltage
- Rated speed 3000 RPM
- Stall torque, 33 Nm at $\Delta T = 100$ K
- Type of construction: IM B5 (IM V1, IM V3)
- Connection type: Power connector for motor**/**brake, signal connector for the encoder system
- With integrated holding brake
- With mounted ROD 426 pulse encoder (1000 pulses **/**rev.)

The following should be ordered:	**Order No.:**
1FT5 AC servomotor $n_{rated} = 3000$ RPM, $M_0 = 33$ Nm at $\Delta T = 100$ K	**1FT5102–0AF71–1–Z**
Special version: Codes	
• Integrated holding brake	**G45**
• Mounted ROD 426 pulse encoder	**H22**
When ordering, specify the following:	**1FT5102–0AF71–1–Z G45+H22**
Order No., core type:	**1FT5102–1AF71–1EB0** (the same motor, only prepared for encoder mounting)

■

3

Technical data and characteristics

3.1 Speed–torque diagrams

Note

For converter operation on 480 V supply networks, DC link voltages of > 600 V are obtained. The following restrictions apply:

- Motors, shaft heights 36, 48, 63 and 71 may only be utilized to ΔT=60 K . Shaft heights 100 and 132 may still be utilized acc. to ΔT=100 K.
- The shift of the voltage limiting characteristics is described in Chapter ALS/1.1.
- The specified thermal limiting characteristics are referred to ΔT=100 K.

3.1.1 Standard motors

Note

The rotor moment of inertia for 1FT5 motors is specified without tachometer.

Table 3-1 Standard motor 1FT5034

1FT5034				
Technical data	**Code**	**Units**	**–□AK71**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	0.76	
Rated current	I_{rated}	A	1.5	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.7	
Stall torque	$M_{0\ (100\ K)}$	Nm	0.9	
Stall current	$I_{0\ (60\ K)}$	A	1.2	
Stall current	$I_{0\ (100\ K)}$	A	1.6	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	0.74	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.67	
Limit data				
Max. speed	n_{max}	RPM	9000	
Max. torque	M_{max}	Nm	3.6	
Peak current	I_{max}	A	6.5	
Limiting torque	M_{limit}	Nm	1.4	
Physical constants				
Torque constant	k_T	Nm/A	0.58	
Voltage constant	k_E	V/1000 ^{RPM}	70	
Winding resistance	$R_{ph.}$	Ohm	16.3	
Three–phase inductance	L_D	mH	21.8	
Electrical time constant	T_{el}	ms	1.3	
Mechanical time constant	T_{mech}	ms	6.5	
Thermal time constant	T_{th}	min	40	
Weight with brake	m	kg	2.6	
Weight without brake	m	kg	2.4	

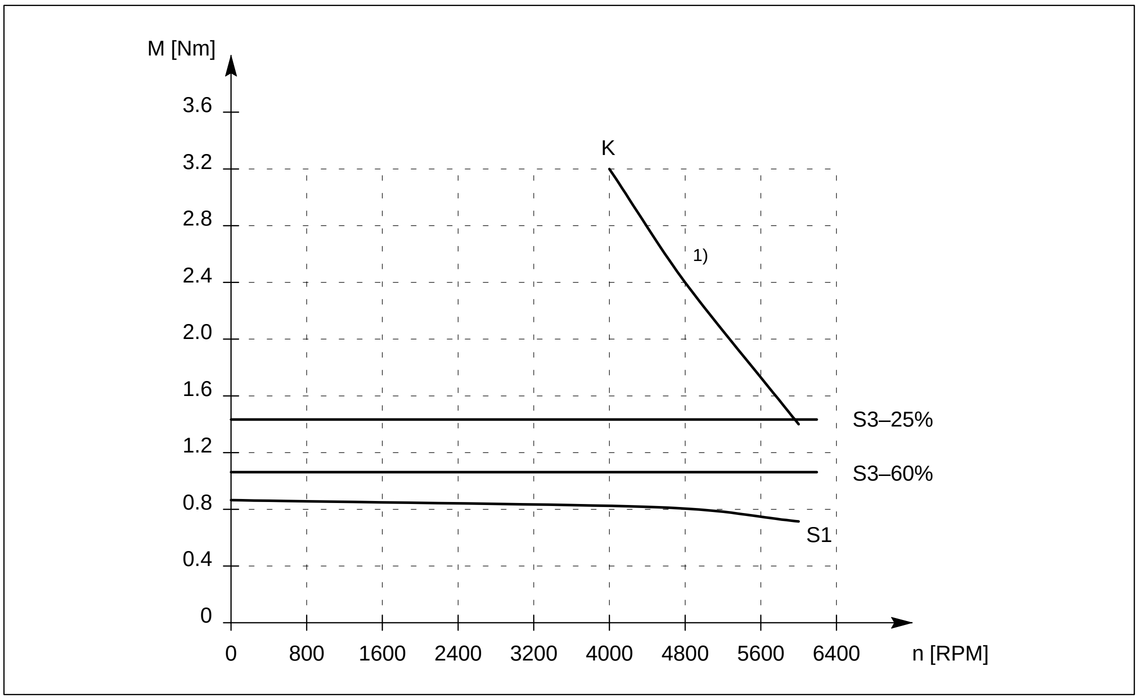


Fig. 3-1 Speed–torque diagram 1FT5034

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1) valid for 600 V DC link voltage

Table 3-2 Standard motor 1FT5036

1FT5036				
Technical data	**Code**	**Units**	**–□AK71**	
Engineering data				
Rated speed	n_{rated}	RPM	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	1.0	
Rated current	I_{rated}	A	2.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	1.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	1.3	
Stall current	$I_{0\ (60\ K)}$	A	1.7	
Stall current	$I_{0\ (100\ K)}$	A	2.3	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	1.03	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	0.96	
Limit data				
Max. speed	n_{max}	RPM	9000	
Max. torque	M_{max}	Nm	5.2	
Peak current	I_{max}	A	9.5	
Limiting torque	M_{limit}	Nm	2.5	
Physical constants				
Torque constant	k_T	Nm/A	0.58	
Voltage constant	k_E	V/1000 RPM	70	
Winding resistance	$R_{ph.}$	Ohm	8.6	
Three–phase inductance	L_D	mH	13.7	
Electrical time constant	T_{el}	ms	1.5	
Mechanical time constant	T_{mech}	ms	4.9	
Thermal time constant	T_{th}	min	45	
Weight with brake	m	kg	3.3	
Weight without brake	m	kg	3.1	

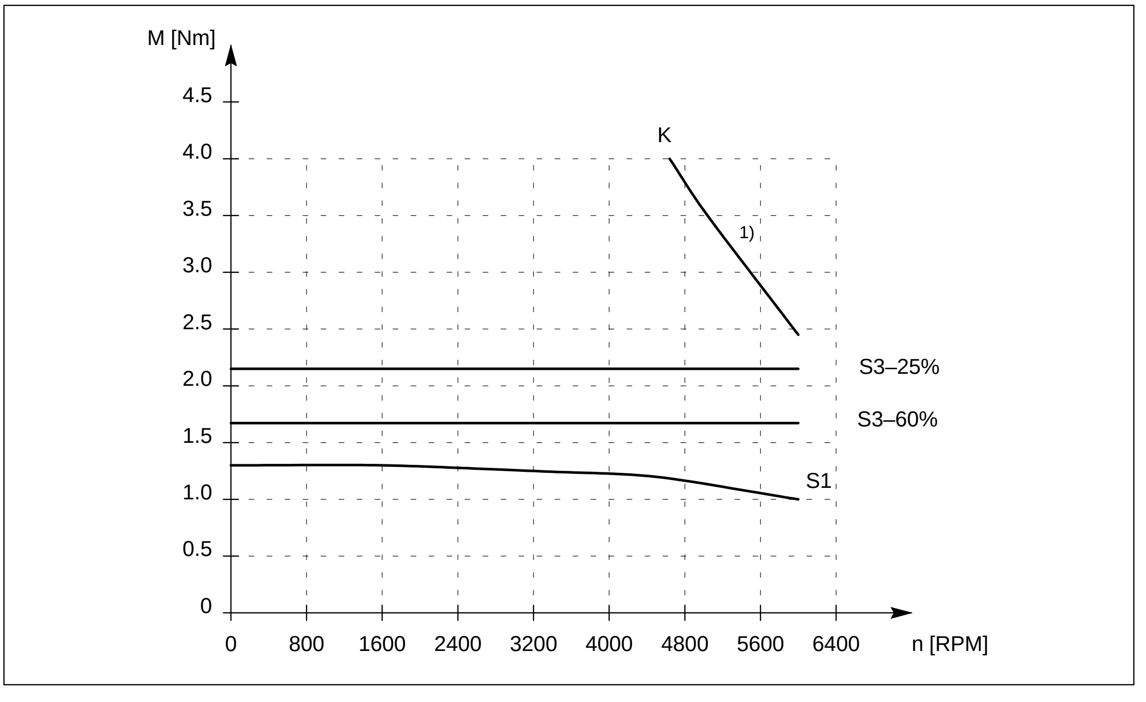

Fig. 3-2 Speed–torque diagram 1FT5036

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1) valid for 600 V DC link voltage

Table 3-3 Standard motor 1FT5042

1FT5042					
Technical data	**Code**	**Units**	**–0AF71**	**–□AK71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	1.0	0.9	
Rated current	I_{rated}	A	1.1	1.6	
Stall torque	$M_{0\ (60\ K)}$	Nm	0.75	0.75	
Stall torque	$M_{0\ (100\ K)}$	Nm	1.0	1.0	
Stall current	$I_{0\ (60\ K)}$	A	0.8	1.3	
Stall current	$I_{0\ (100\ K)}$	A	1.1	1.7	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	2.11	2.11	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	1.73	1.73	
Limit data					
Max. speed	n_{max}	RPM	5500	8300	
Max. torque	M_{max}	Nm	4.0	4.0	
Peak current	I_{max}	A	4.5	7.0	
Limiting torque	M_{limit}	Nm	2.5	1.9	
Physical constants					
Torque constant	k_T	Nm/A	0.95	0.60	
Voltage constant	k_E	V/1000 RPM	115	75	
Winding resistance	$R_{ph.}$	Ohm	28.2	11.8	
Three–phase inductance	L_D	mH	48.4	20.3	
Electrical time constant	T_{el}	ms	1.7	1.7	
Mechanical time constant	T_{mech}	ms	11.0	11.0	
Thermal time constant	T_{th}	min	40	40	
Weight with brake	m	kg	3.5	3.5	
Weight without brake	m	kg	3.2	3.2	

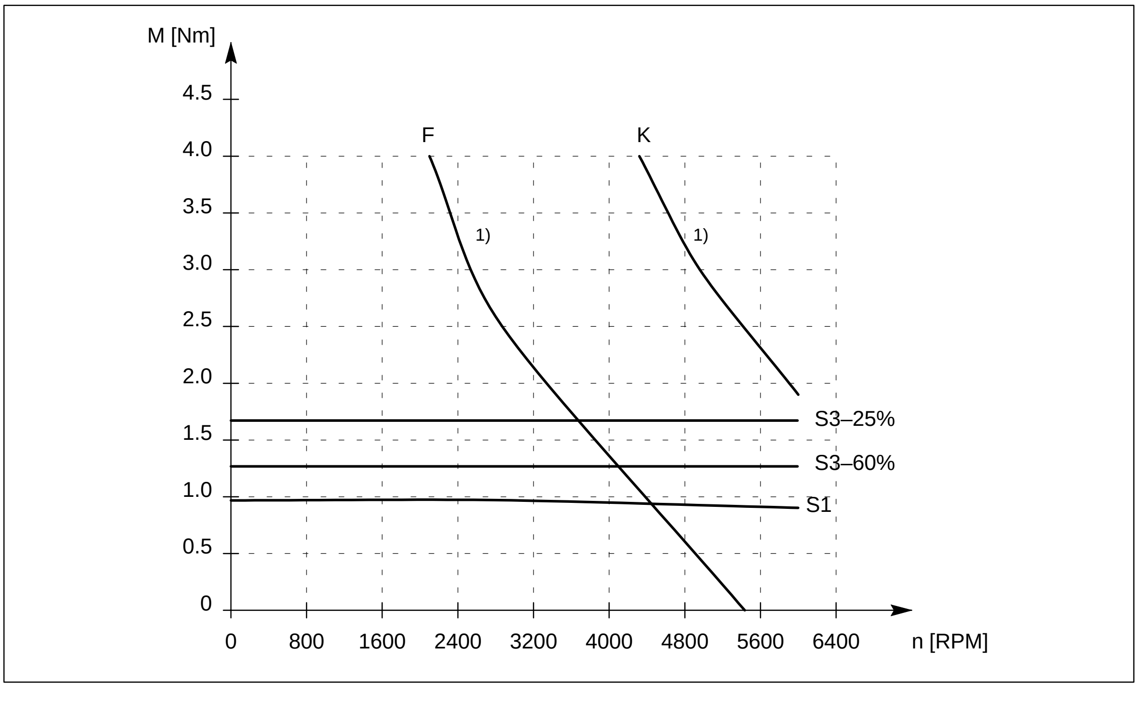

Fig. 3-3 Speed–torque diagram 1FT5042

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1) valid for 600 V DC link voltage

Table 3-4 Standard motor 1FT5044

1FT5044					
Technical data	**Code**	**Units**	**–□AF71**	**–□AK71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	1.9	1.65	
Rated current	I_{rated}	A	2.2	3.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	1.5	1.5	
Stall torque	$M_{0\ (100\ K)}$	Nm	2.0	2.0	
Stall current	$I_{0\ (60\ K)}$	A	1.6	2.5	
Stall current	$I_{0\ (100\ K})$	A	2.1	3.4	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	3.14	3.14	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	2.8	2.8	
Limit data					
Max. speed	n_{max}	RPM	5500	8300	
Max. torque	M_{max}	Nm	8.0	8.0	
Peak current	I_{max}	A	8.5	14.0	
Limiting torque	M_{limit}	Nm	5.0	3.6	
Physical constants					
Torque constant	k_T	Nm/A	0.95	0.60	
Voltage constant	k_E	V/1000 RPM	115	72	
Winding resistance	$R_{ph.}$	Ohm	9.0	3.4	
Three–phase inductance	L_D	mH	24.2	9.5	
Electrical time constant	T_{el}	ms	2.8	2.8	
Mechanical time constant	T_{mech}	ms	5.4	5.4	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	4.5	4.5	
Weight without brake	m	kg	4.2	4.2	

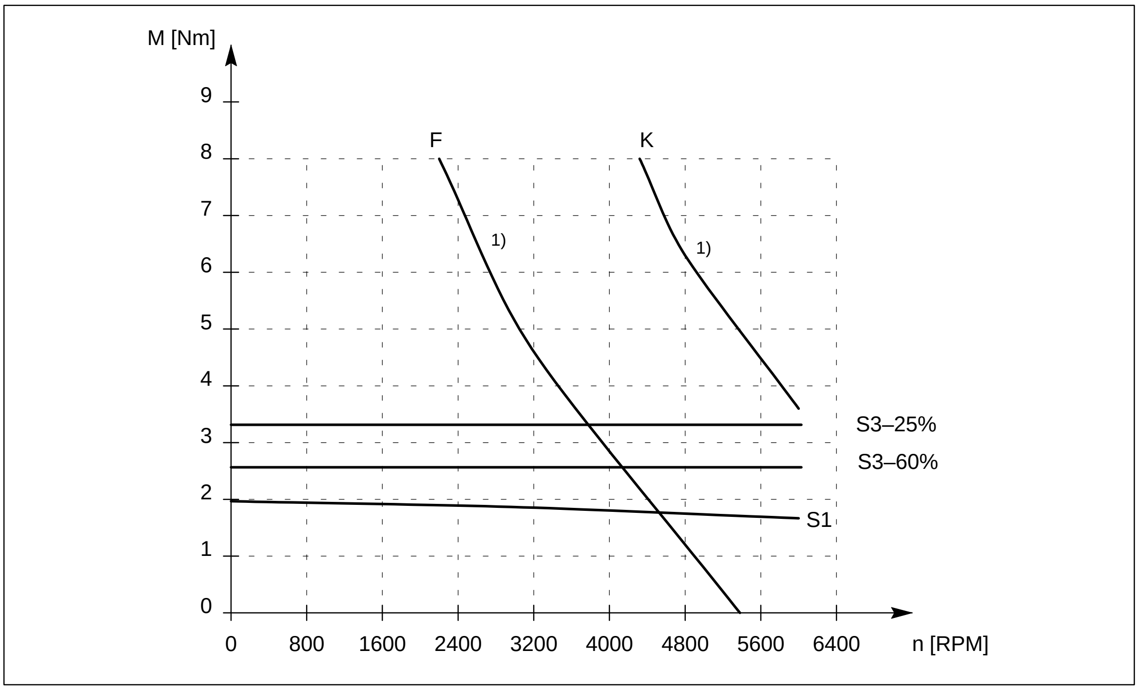

Fig. 3-4 Speed–torque diagram 1FT5044

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1) valid for 600 V DC link voltage

Table 3-5 Standard motor 1FT5046

1FT5046					
Technical data	**Code**	**Units**	**–□AF71**	**–□AK71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	3.4	2.7	
Rated current	I_{rated}	A	3.9	5.1	
Stall torque	$M_{0\ (60\ K)}$	Nm	2.8	2.8	
Stall torque	$M_{0\ (100\ K)}$	Nm	3.7	3.7	
Stall current	$I_{0\ (60\ K)}$	A	3.0	4.8	
Stall current	$I_{0\ (100\ K)}$	A	3.9	6.3	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	5.31	5.31	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	4.93	4.93	
Limit data					
Max. speed	n_{max}	RPM	5500	8300	
Max. torque	M_{max}	Nm	14.8	14.8	
Peak current	I_{max}	A	16.0	26.0	
Limiting torque	M_{limit}	Nm	8.0	6.0	
Physical constants					
Torque constant	k_T	Nm/A	0.95	0.59	
Voltage constant	k_E	V/1000 RPM	115	71	
Winding resistance	$R_{ph.}$	Ohm	3.1	1.2	
Three–phase inductance	L_D	mH	11.7	4.6	
Electrical time constant	T_{el}	ms	3.8	3.8	
Mechanical time constant	T_{mech}	ms	3.4	3.4	
Thermal time constant	T_{th}	min	50	50	
Weight with brake	m	kg	6.7	6.7	
Weight without brake	m	kg	6.4	6.4	

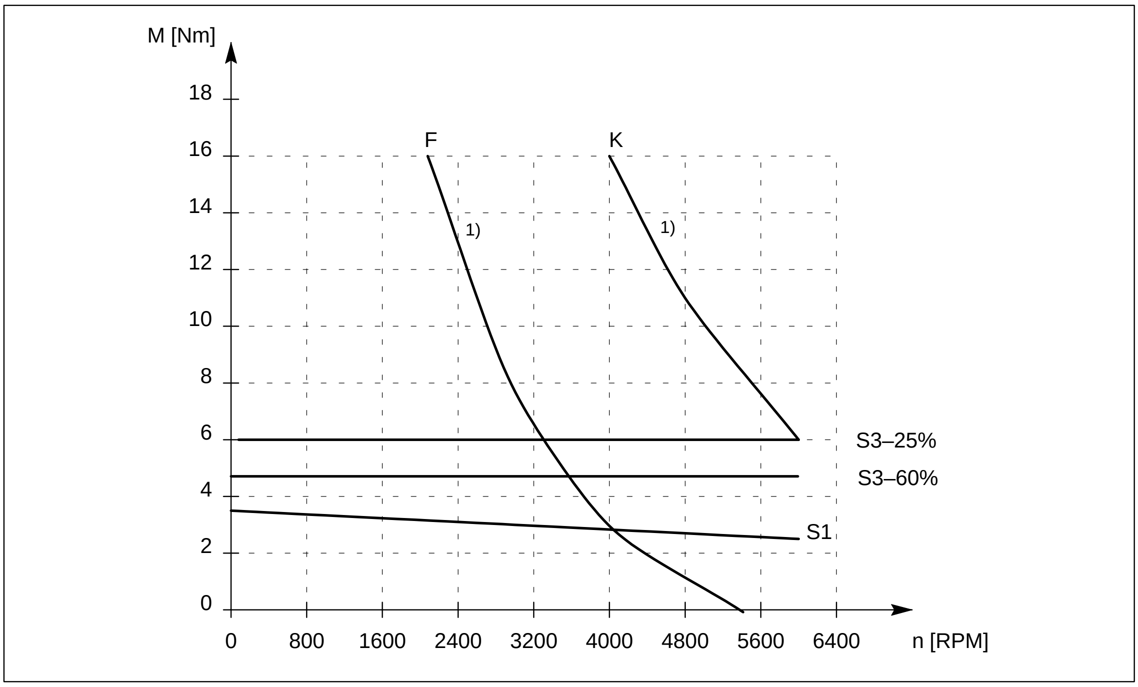

Fig. 3-5 Speed–torque diagram 1FT5046

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1) valid for 600 V DC link voltage

Table 3-6 Standard motor 1FT5062

1FT5062						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	2.4	2.3	2.2	2.1
Rated current	I_{rated}	A	1.6	2.3	2.9	4.1
Stall torque	$M_{0\ (60\ K)}$	Nm	2.2	2.2	2.2	2.2
Stall torque	$M_{0\ (100\ K)}$	Nm	2.6	2.6	2.6	2.6
Stall current	$I_{0\ (60\ K)}$	A	1.3	2.0	2.7	3.9
Stall current	$I_{0\ (100\ K)}$	A	1.6	2.4	3.2	4.6
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	5.76$^{1)}$	5.76$^{1)}$	5.76$^{1)}$	5.76$^{1)}$
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	4.7	4.7	4.7	4.7
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6400	8600
Max. torque	M_{max}	Nm	10.4	10.4	10.4	10.4
Peak current	I_{max}	A	6.6	10.0	13.5	20.0
Limiting torque	M_{limit}	Nm	5.0	5.0	4.9	4.8
Physical constants						
Torque constant	k_T	Nm/A	1.65	1.10	0.82	0.56
Voltage constant	k_E	V/1000 RPM	187	125	93	62
Winding resistance	$R_{ph.}$	Ohm	15.1	7.1	3.8	1.7
Three–phase inductance	L_D	mH	85.3	38.1	21.0	9.3
Electrical time constant	T_{el}	ms	5.6	5.6	5.6	5.6
Mechanical time constant	T_{mech}	ms	6.3	6.3	6.3	6.3
Thermal time constant	T_{th}	min	25	25	25	25
Weight with brake	m	kg	7.5	7.5	7.5	7.5
Weight without brake	m	kg	6.5	6.5	6.5	6.5

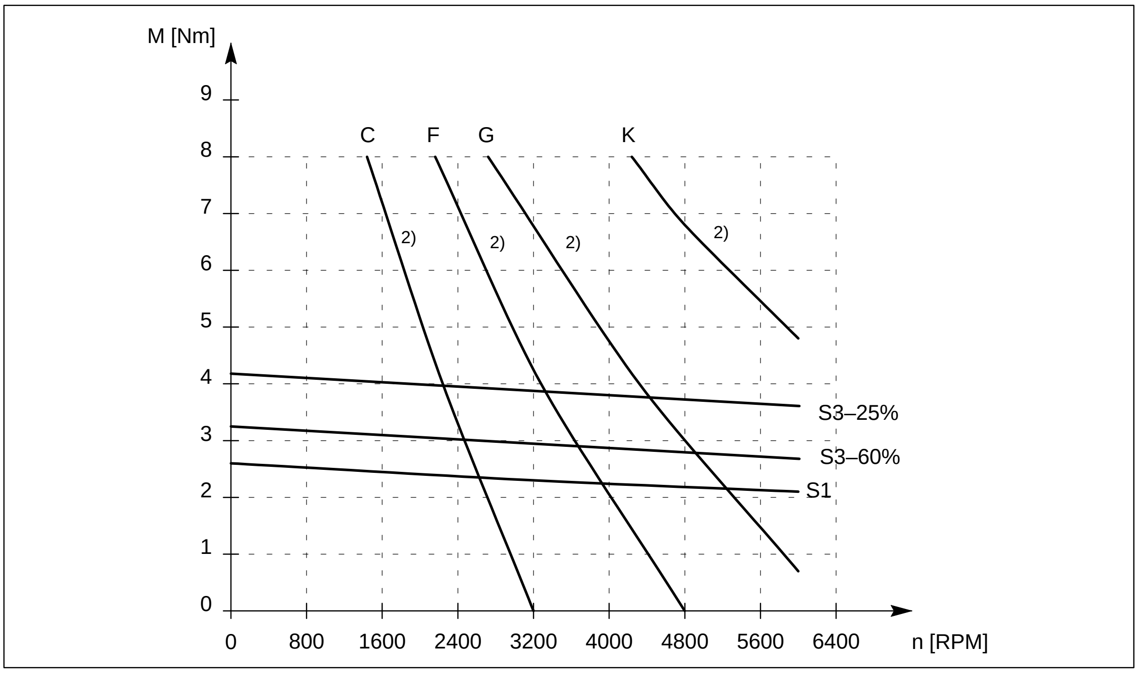

Fig. 3-6 Speed–torque diagram 1FT5062

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1) with standard brake
2) valid for 600 V DC link voltage

Table 3-7 Standard motor 1FT5064

1FT5064						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{\text{rated (100 K)}}$	Nm	4.7	4.3	3.8	3.0
Rated current	I_{rated}	A	3.1	4.2	5.1	5.9
Stall torque	$M_{0\text{ (60 K)}}$	Nm	4.5	4.5	4.5	4.5
Stall torque	$M_{0\text{ (100 K)}}$	Nm	5.5	5.5	5.5	5.5
Stall current	$I_{0\text{ (60 K)}}$	A	2.7	4.1	5.5	8.0
Stall current	$I_{0\text{ (100 K}})$	A	3.3	5.0	6.7	9.8
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	9.36¹⁾	9.36¹⁾	9.36¹⁾	9.36¹⁾
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	8.3	8.3	8.3	8.3
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6400	8600
Max. torque	M_{max}	Nm	22	22	22	22
Peak current	I_{max}	A	14.0	20.0	29.0	42.0
Limiting torque	M_{limit}	Nm	10.0	10.0	9.8	9.6
Physical constants						
Torque constant	k_T	Nm/A	1.65	1.10	0.82	0.56
Voltage constant	k_E	V/1000 RPM	187	125	93	63
Winding resistance	$R_{\text{ph.}}$	Ohm	5.0	2.2	1.2	0.56
Three–phase inductance	L_D	mH	39.3	17.5	9.5	4.4
Electrical time constant	T_{el}	ms	7.5	7.5	7.5	7.5
Mechanical time constant	T_{mech}	ms	3.0	3.0	3.0	3.0
Thermal time constant	T_{th}	min	30	30	30	30
Weight with brake	m	kg	9.5	9.5	9.5	9.5
Weight without brake	m	kg	8.5	8.5	8.5	8.5

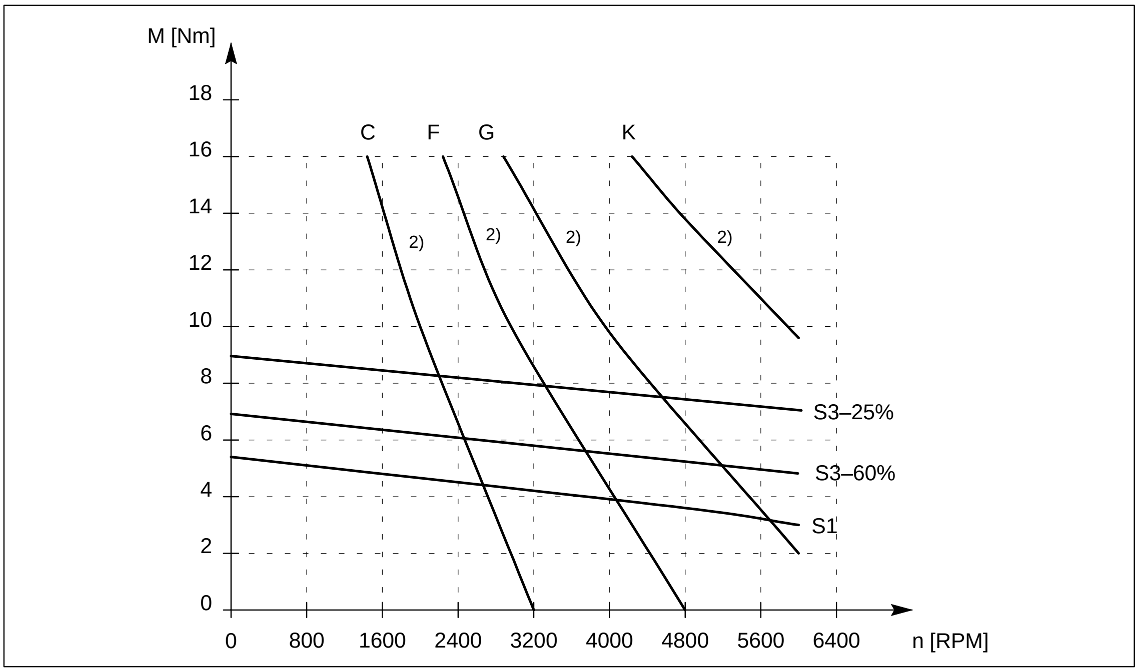

Fig. 3-7 Speed–torque diagram 1FT5064

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1) with standard brake
2) valid for 600 V DC link voltage

Table 3-8 Standard motor 1FT5066

1FT5066						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	6.7	6.1	5.5	4.2
Rated current	I_{rated}	A	4.4	6.1	7.3	8.3
Stall torque	$M_{0\ (60\ K)}$	Nm	6.5	6.5	6.5	6.5
Stall torque	$M_{0\ (100\ K)}$	Nm	8.0	8.0	8.0	8.0
Stall current	$I_{0\ (60\ K)}$	A	3.9	6.0	7.9	11.6
Stall current	$I_{0\ (100\ K)}$	A	4.9	7.3	9.6	14.5
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	12.86 1)	12.86 1)	12.86 1)	12.86 1)
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	11.8	11.8	11.8	11.8
Limit data						
Max. speed	n_{max}	RPM	3200	4900	6400	8600
Max. torque	M_{max}	Nm	32	32	32	32
Peak current	I_{max}	A	20.0	31.0	41.0	61.0
Limiting torque	M_{limit}	Nm	14.8	14.8	14.8	14.4
Physical constants						
Torque constant	k_T	Nm/A	1.65	1.09	0.82	0.56
Voltage constant	k_E	V/1000 RPM	187	123	93	63
Winding resistance	$R_{ph.}$	Ohm	2.8	1.2	0.68	0.37
Three–phase inductance	L_D	mH	25.6	11.4	6.3	3.4
Electrical time constant	T_{el}	ms	9.2	9.2	9.2	9.2
Mechanical time constant	T_{mech}	ms	2.4	2.4	2.4	2.4
Thermal time constant	T_{th}	min	35	35	35	35
Weight with brake	m	kg	11.5	11.5	11.5	11.5
Weight without brake	m	kg	10.5	10.5	10.5	10.5

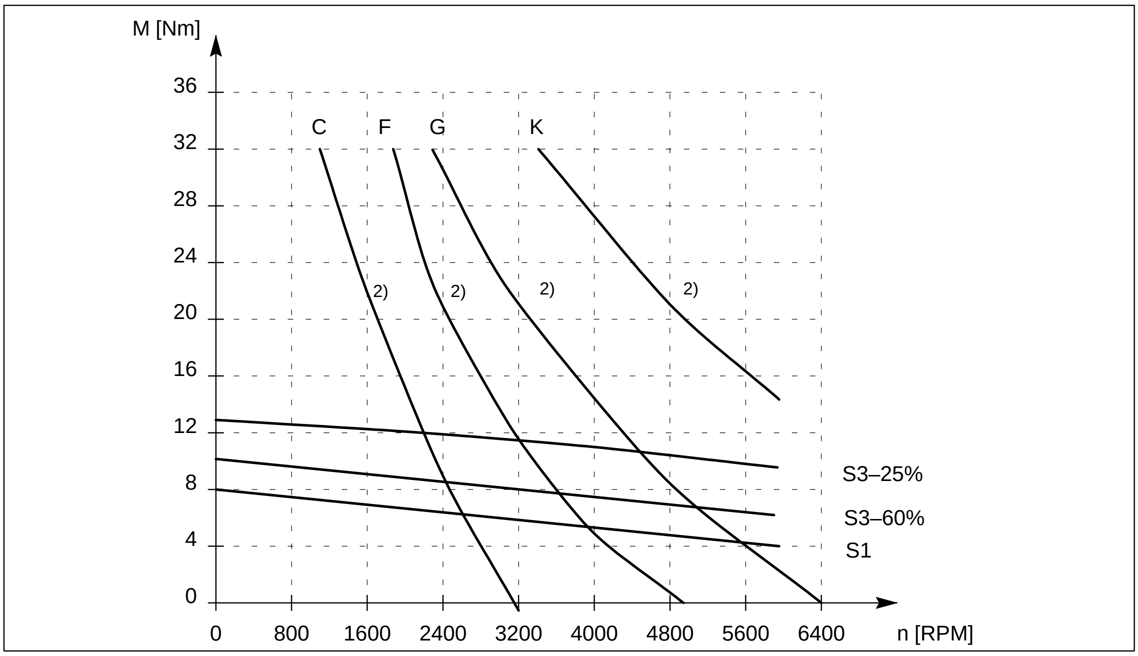

Fig. 3-8 Speed–torque diagram 1FT5066

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1) with standard brake
2) valid for 600 V DC link voltage

Table 3-9 Standard motor 1FT5072

1FT5072						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	9.5	8.5	7.5	5.0
Rated current	I_{rated}	A	6.3	8.4	9.8	9.9
Stall torque	$M_{0\ (60\ K)}$	Nm	10.0	10.0	10.0	10.0
Stall torque	$M_{0\ (100\ K)}$	Nm	12.0	12.0	12.0	12.0
Stall current	$I_{0\ (60\ K)}$	A	6.1	9.1	12.0	17.5
Stall current	$I_{0\ (100\ K)}$	A	7.3	11.0	14.5	21.0
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	30.3$^{1)}$	30.3$^{1)}$	30.3$^{1)}$	30.3$^{1)}$
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	22.8	22.8	22.8	22.8
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6300	7000
Max. torque	M_{max}	Nm	40	40	40	40
Peak current	I_{max}	A	29.0	43.0	60.0	89.0
Limiting torque	M_{limit}	Nm	15.0	16.0	18.0	16.0
Physical constants						
Torque constant	k_T	Nm/A	1.64	1.10	0.84	0.57
Voltage constant	k_E	V/1000 RPM	186	124	95	65
Winding resistance	$R_{ph.}$	Ohm	2.6	1.2	0.63	0.32
Three–phase inductance	L_D	mH	23.2	10.3	5.7	2.9
Electrical time constant	T_{el}	ms	11	11	11	11
Mechanical time constant	T_{mech}	ms	4.4	4.4	4.4	4.4
Thermal time constant	T_{th}	min	35	35	35	35
Weight with brake	m	kg	15	15	15	15
Weight without brake	m	kg	13.5	13.5	13.5	13.5

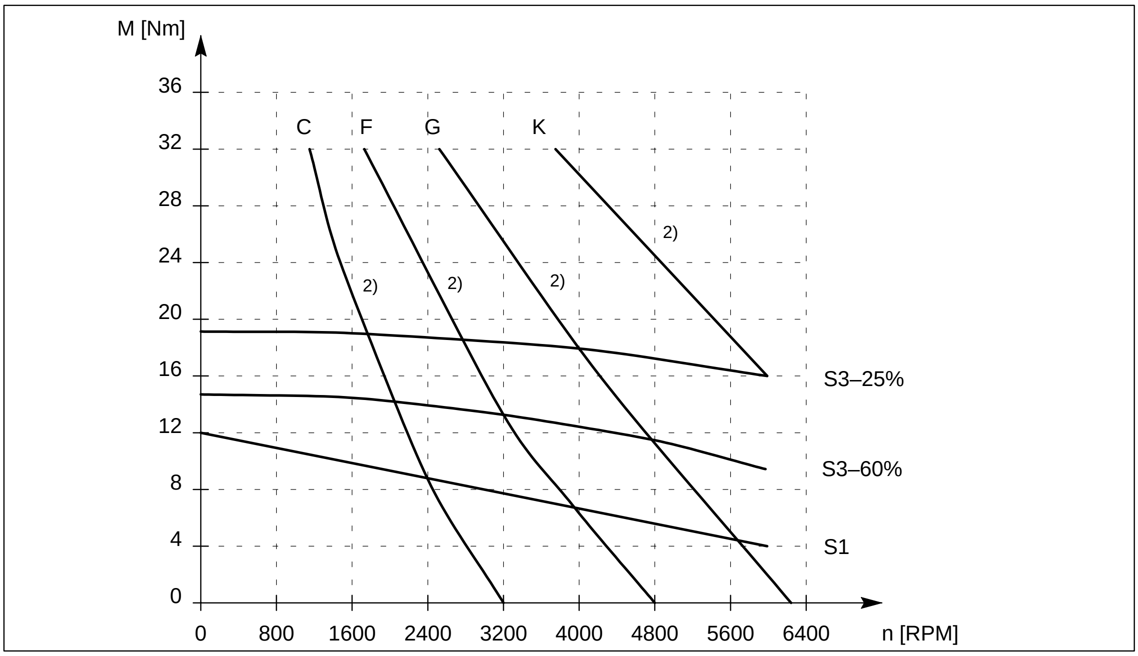

Fig. 3-9 Speed–torque diagram 1FT5072

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1) with standard brake
2) valid for 600 V DC link voltage

Table 3-10 Standard motor 1FT5074

1FT5074						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	14.0	12.5	11.0	7.0
Rated current	I_{rated}	A	9.3	13.0	14.0	14.1
Stall torque	$M_{0\ (60\ K)}$	Nm	14.0	14.0	14.0	14.0
Stall torque	$M_{0\ (100\ K)}$	Nm	18.0	18.0	18.0	18.0
Stall current	$I_{0\ (60\ K)}$	A	8.5	13.0	16.5	25.0
Stall current	$I_{0\ (100\ K)}$	A	11.0	17.0	21.5	32.0
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	44.21)	44.21)	44.21)	44.21)
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	36.7	36.7	36.7	36.7
Limit data						
Max. speed	n_{max}	RPM	3200	4900	6200	7000
Max. torque	M_{max}	Nm	56	56	56	56
Peak current	I_{max}	A	45.0	67.0	90.0	104.0
Limiting torque	M_{limit}	Nm	24.0	24.5	24.5	22.5
Physical constants						
Torque constant	k_T	Nm/A	1.64	1.08	0.85	0.57
Voltage constant	k_E	V/1000 RPM	186	122	96	65
Winding resistance	$R_{ph.}$	Ohm	1.2	0.52	0.33	0.14
Three–phase inductance	L_D	mH	13.2	5.6	3.6	1.5
Electrical time constant	T_{el}	ms	11	11	11	11
Mechanical time constant	T_{mech}	ms	3.3	3.3	3.3	3.3
Thermal time constant	T_{th}	min	40	40	40	40
Weight with brake	m	kg	18.5	18.5	18.5	18.5
Weight without brake	m	kg	17.2	17.2	17.2	17.2

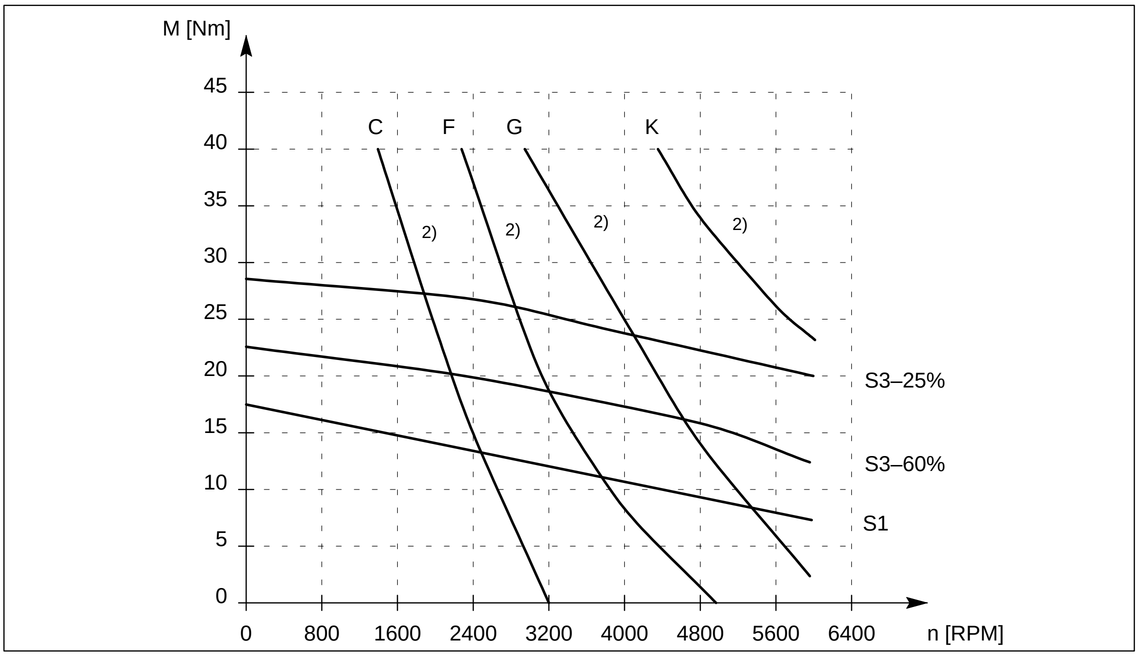

Fig. 3-10 Speed–torque diagram 1FT5074

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1) with standard brake
2) valid for 600 V DC link voltage

Table 3-11 Standard motor 1FT5076

1FT5076						
Technical data	**Code**	**Units**	**–□AC71**	**–□AF71**	**–□AG71**	**–□AK71**
Engineering data						
Rated speed	n_{rated}	RPM	2000	3000	4000	6000
Rated torque	$M_{rated\ (100\ K)}$	Nm	18.5	16.5	13.0	4.0
Rated current	I_{rated}	A	12.0	16.0	17.0	9.0
Stall torque	$M_{0\ (60\ K)}$	Nm	18.0	18.0	18.0	18.0
Stall torque	$M_{0\ (100\ K)}$	Nm	22.0	22.0	22.0	22.0
Stall current	$I_{0\ (60\ K)}$	A	11.5	16.5	21.5	32.0
Stall current	$I_{0\ (100\ K)}$	A	13.5	20.0	26.0	39.0
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	58.4[1]	58.4[1]	58.4[1]	58.4[1]
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	50.9	50.9	50.9	50.9
Limit data						
Max. speed	n_{max}	RPM	3200	4800	6200	7000
Max. torque	M_{max}	Nm	72	72	72	72
Peak current	I_{max}	A	52.0	78.0	110	163
Limiting torque	M_{limit}	Nm	39.0	38.0	36.0	36.0
Physical constants						
Torque constant	k_T	Nm/A	1.63	1.10	0.85	0.57
Voltage constant	k_E	V/1000 RPM	185	125	96	65
Winding resistance	$R_{ph.}$	Ohm	0.75	0.35	0.20	0.093
Three–phase inductance	L_D	mH	9.1	4.2	2.4	1.1
Electrical time constant	T_{el}	ms	12	12	12	12
Mechanical time constant	T_{mech}	ms	2.8	2.8	2.8	2.8
Thermal time constant	T_{th}	min	45	45	45	45
Weight with brake	m	kg	22.5	22.5	22.5	22.5
Weight without brake	m	kg	21	21	21	21

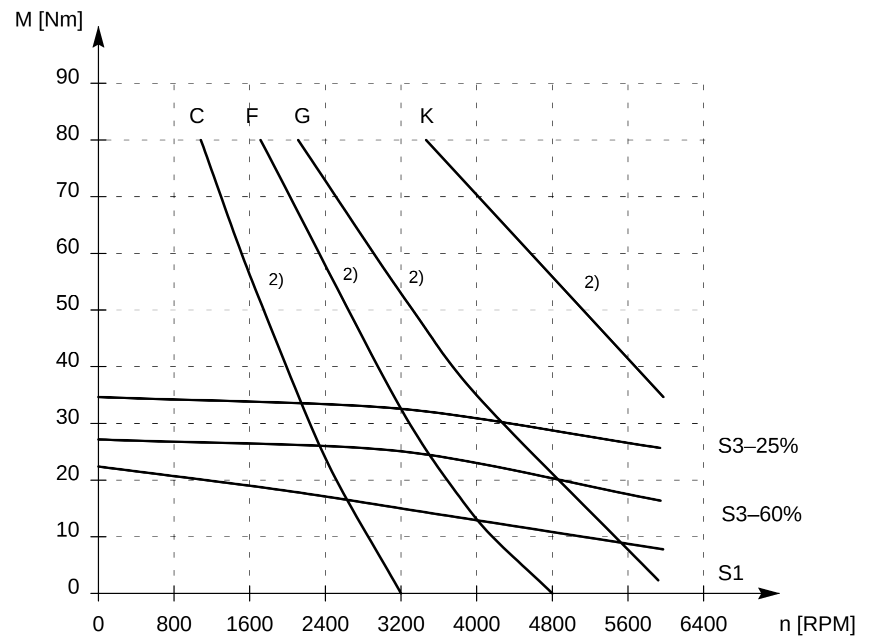

Fig. 3-11 Speed–torque diagram 1FT5076

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1) with standard brake
2) valid for 600 V DC link voltage

Table 3-12 Standard motor 1FT5102

1FT5102						
Technical data	**Code**	**Units**	**–□AA71**	**–□AC71**	**–□AF71**	**–0AG71**
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	4000
Rated torque	$M_{rated\ (100\ K)}$	Nm	31.0	29.0	25.0	10.0
Rated current	I_{rated}	A	12.0	19.0	25.0	13.0
Stall torque	$M_{0\ (60\ K)}$	Nm	27.0	27.0	27.0	27.0
Stall torque	$M_{0\ (100\ K)}$	Nm	33.0	33.0	33.0	33.0
Stall current	$I_{0\ (60\ K)}$	A	9.9	16.5	25.0	31.5
Stall current	$I_{0\ (100\ K})$	A	12.5	20.5	31.0	38.5
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	151	151	151	151
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	136	136	136	136
Limit data						
Max. speed	n_{max}	RPM	1900	3200	4900	6200
Max. torque	M_{max}	Nm	108	108	108	108
Peak current	I_{max}	A	47.0	80.0	120.0	164.0
Limiting torque	M_{limit}	Nm	52.0	57.0	57.0	45.0
Physical constants						
Torque constant	k_T	Nm/A	2.74	1.64	1.08	0.86
Voltage constant	k_E	V/1000 RPM	310	186	122	97
Winding resistance	$R_{ph.}$	Ohm	0.9	0.33	0.14	0.097
Three–phase inductance	L_D	mH	14.2	5.2	2.2	1.4
Electrical time constant	T_{el}	ms	16	16	16	16
Mechanical time constant	T_{mech}	ms	3.3	3.3	3.3	3.3
Thermal time constant	T_{th}	min	45	45	45	45
Weight with brake	m	kg	36	36	36	36
Weight without brake	m	kg	31	31	31	31

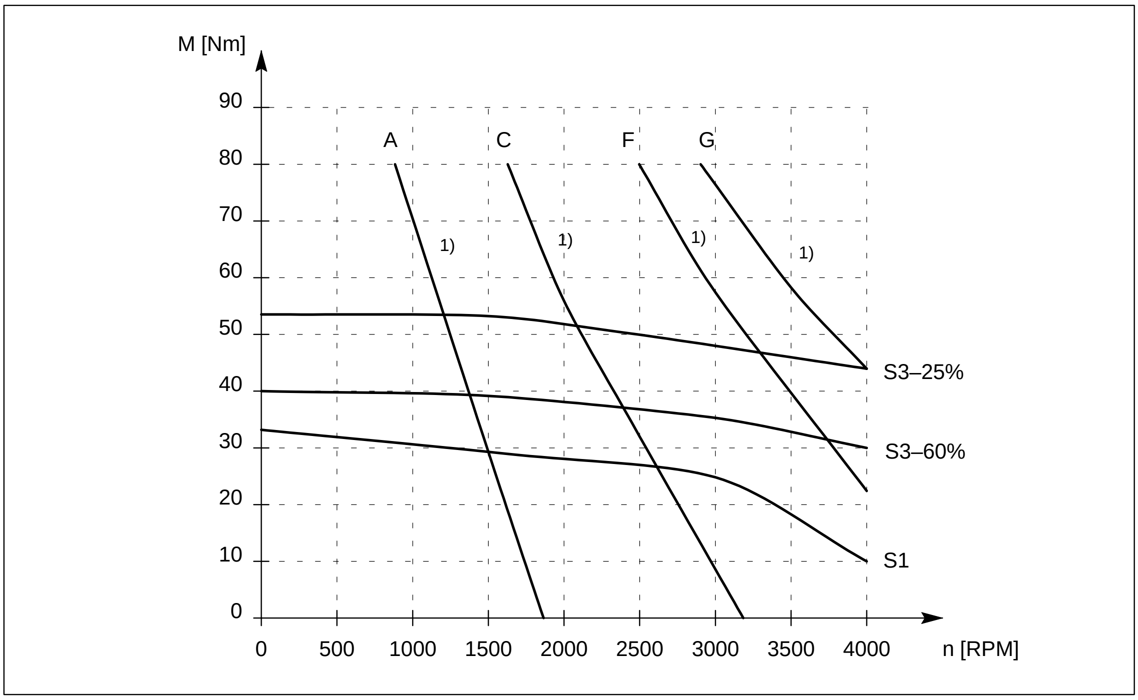

Fig. 3-12 Speed–torque diagram 1FT5102

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1) valid for 600 V DC link voltage

Table 3-13 Standard motor 1FT5104

1FT5104						
Technical data	**Code**	**Units**	**–□AA71**	**–□AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	40.0	35.0	29.0	
Rated current	I_{rated}	A	16.0	23.0	29.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	37.0	37.0	37.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	45.0	45.0	45.0	
Stall current	$I_{0\ (60\ K)}$	A	14.0	22.5	34.0	
Stall current	$I_{0\ (100\ K)}$	A	17.0	27.5	41.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	210	210	210	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	185	185	185	
Limit data						
Max. speed	n_{max}	RPM	1900	3200	4800	
Max. torque	M_{max}	Nm	148	148	148	
Peak current	I_{max}	A	64.0	110.0	164.0	
Limiting torque	M_{limit}	Nm	80.0	78.0	80.0	
Physical constants						
Torque constant	k_T	Nm/A	2.72	1.66	1.09	
Voltage constant	k_E	V/1000 RPM	308	188	123	
Winding resistance	$R_{ph.}$	Ohm	0.56	0.2	0.095	
Three–phase inductance	L_D	mH	9.5	3.5	1.7	
Electrical time constant	T_{el}	ms	18	18	18	
Mechanical time constant	T_{mech}	ms	2.8	2.8	2.8	
Thermal time constant	T_{th}	min	50	50	50	
Weight with brake	m	kg	43	43	43	
Weight without brake	m	kg	39	39	39	

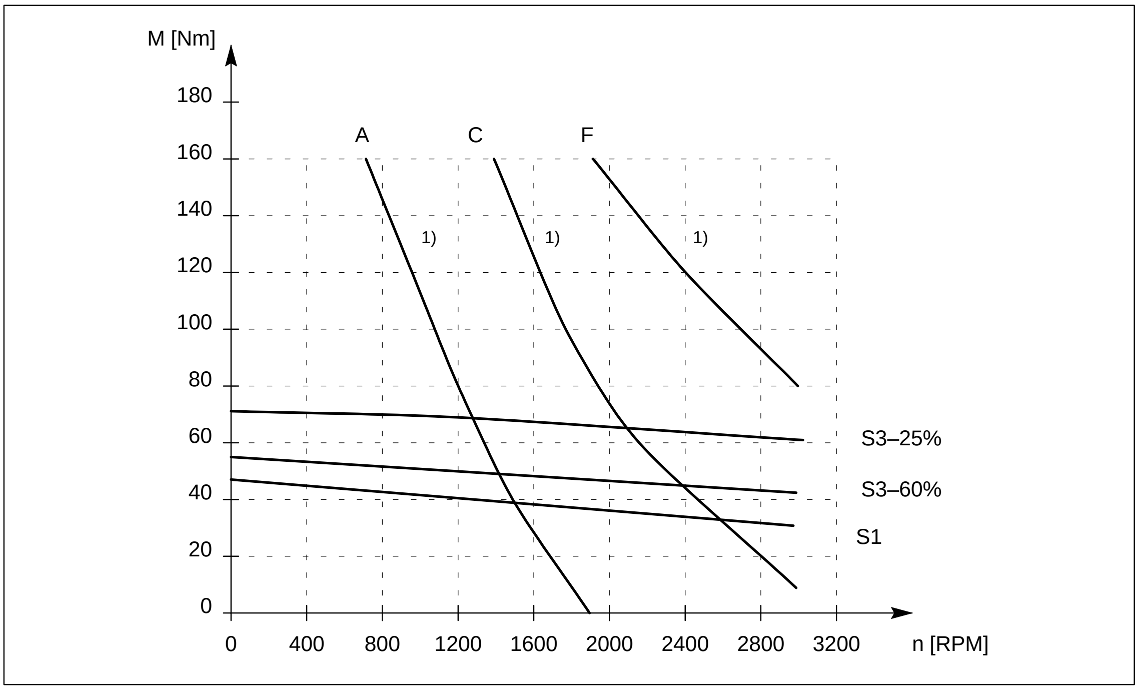

Fig. 3-13 Speed–torque diagram 1FT5104

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1) valid for 600 V DC link voltage

Table 3-14 Standard motor 1FT5106

1FT5106						
Technical data	**Code**	**Units**	**–0AA71**	**–□AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	47.0	39.0	28.0	
Rated current	I_{rated}	A	19.0	25.0	29.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	45.0	45.0	45.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	55.0	55.0	55.0	
Stall current	$I_{0\ (60\ K)}$	A	17.0	26.8	42.5	
Stall current	$I_{0\ (100\ K)}$	A	20.5	33.0	52.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	264	264	264	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	239	239	239	
Limit data						
Max. speed	n_{max}	RPM	1900	3200	5000	
Max. torque	M_{max}	Nm	180	180	180	
Peak current	I_{max}	A	80.0	130.0	200.0	
Limiting torque	M_{limit}	Nm	90.0	98.0	102.0	
Physical constants						
Torque constant	k_T	Nm/A	2.72	1.68	1.06	
Voltage constant	k_E	V/1000 RPM	308	190	120	
Winding resistance	$R_{ph.}$	Ohm	0.39	0.15	0.066	
Three–phase inductance	L_D	mH	7.4	2.9	1.2	
Electrical time constant	T_{el}	ms	19	19	19	
Mechanical time constant	T_{mech}	ms	2.5	2.5	2.5	
Thermal time constant	T_{th}	min	50	50	50	
Weight with brake	m	kg	49	49	49	
Weight without brake	m	kg	45	45	45	

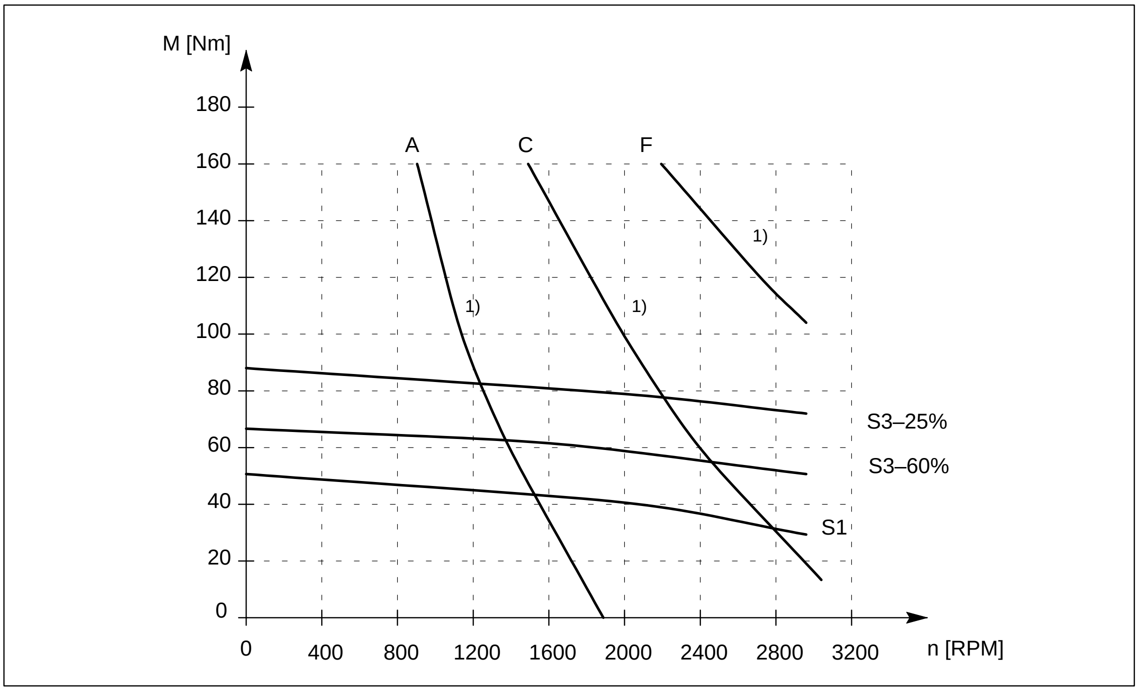

Fig. 3-14 Speed–torque diagram 1FT5106

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1) valid for 600 V DC link voltage

Table 3-15 Standard motor 1FT5108

1FT5108						
Technical data	**Code**	**Units**	**–0AA71**	**–□AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	55.0	42.5	20.0	
Rated current	I_{rated}	A	22.0	27.0	21.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	55.0	55.0	55.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	68.0	68.0	68.0	
Stall current	$I_{0\ (60\ K)}$	A	20.5	32.5	50.5	
Stall current	$I_{0\ (100\ K)}$	A	25.5	40.0	62.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	315	315	315	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	290	290	290	
Limit data						
Max. speed	n_{max}	RPM	2000	3100	4900	
Max. torque	M_{max}	Nm	220	220	220	
Peak current	I_{max}	A	95.0	164.0	247.0	
Limiting torque	M_{limit}	Nm	120.0	120.0	125.0	
Physical constants						
Torque constant	k_T	Nm/A	2.70	1.70	1.09	
Voltage constant	k_E	V/1000 RPM	306	192	123	
Winding resistance	$R_{ph.}$	Ohm	0.29	0.13	0.054	
Three–phase inductance	L_D	mH	5.8	2.5	1.0	
Electrical time constant	T_{el}	ms	19	19	19	
Mechanical time constant	T_{mech}	ms	2.4	2.4	2.4	
Thermal time constant	T_{th}	min	55	55	55	
Weight with brake	m	kg	55	55	55	
Weight without brake	m	kg	51	51	51	

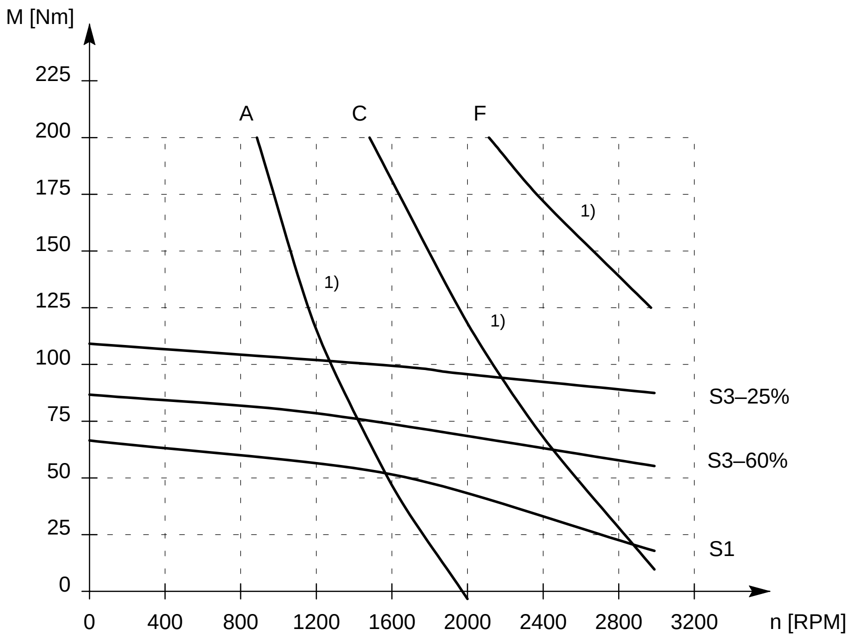

Fig. 3-15 Speed–torque diagram 1FT5108

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1) valid for 600 V DC link voltage

Table 3-16 Standard motor 1FT5132

1FT5132						
Technical data	**Code**	**Units**	**–0AA71**	**–0AC71**	**–0AF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	55.0	45.0	30.0	
Rated current	I_{rated}	A	22.0	29.0	27.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	60.0	60.0	60.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	75.0	75.0	75.0	
Stall current	$I_{0\ (60\ K)}$	A	22.5	35.5	47.5	
Stall current	$I_{0\ (100\ K)}$	A	28.0	44.0	59.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	539	539	539	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	464	464	464	
Limit data						
Max. speed	n_{max}	RPM	2000	3100	3200	
Max. torque	M_{max}	Nm	240	240	240	
Peak current	I_{max}	A	112.0	186.0	236.0	
Limiting torque	M_{limit}	Nm	129.0	115.0	112.0	
Physical constants						
Torque constant	k_T	Nm/A	2.70	1.71	1.27	
Voltage constant	k_E	V/1000 RPM	306	194	144	
Winding resistance	$R_{ph.}$	Ohm	0.28	0.10	0.062	
Three–phase inductance	L_D	mH	6.4	2.3	1.4	
Electrical time constant	T_{el}	ms	23	23	23	
Mechanical time constant	T_{mech}	ms	3.3	3.3	3.3	
Thermal time constant	T_{th}	min	80	80	80	
Weight with brake	m	kg	82	82	82	
Weight without brake	m	kg	75	75	75	

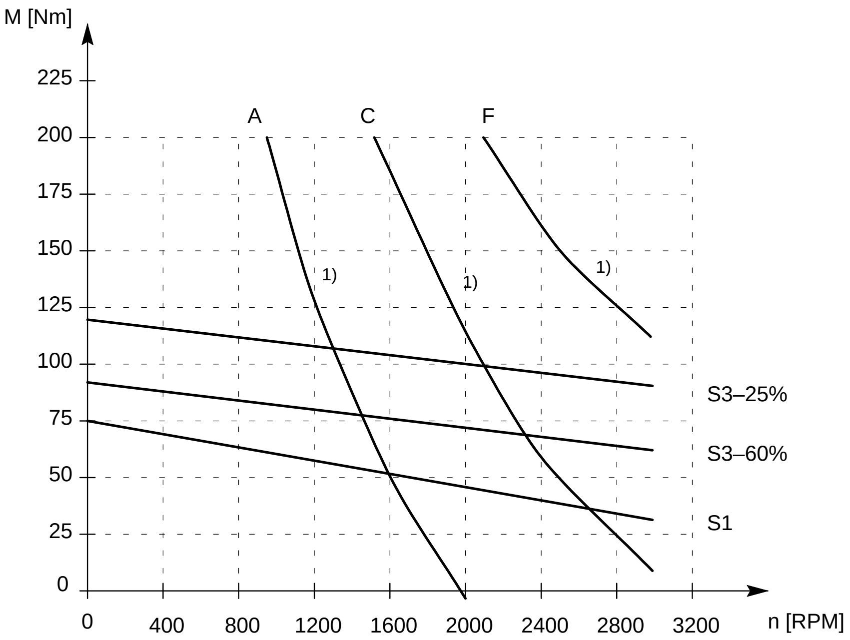

Fig. 3-16 Speed–torque diagram 1FT5132

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1) valid for 600 V DC link voltage

Table 3-17 Standard motor 1FT5134

1FT5134					
Technical data	**Code**	**Units**	**–0AA71**	**–0AC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	65.0	50.0	
Rated current	I_{rated}	A	26.0	34.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	75.0	75.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	90.0	90.0	
Stall current	$I_{0\ (60\ K)}$	A	28.0	47.0	
Stall current	$I_{0\ (100\ K)}$	A	33.5	56.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	665	665	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	590	590	
Limit data					
Max. speed	n_{max}	RPM	2000	3200	
Max. torque	M_{max}	Nm	300	300	
Peak current	I_{max}	A	134.0	222.0	
Limiting torque	M_{limit}	Nm	164.0	156.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.61	
Voltage constant	k_E	V/1000 RPM	306	182	
Winding resistance	$R_{ph.}$	Ohm	0.19	0.073	
Three–phase inductance	L_D	mH	4.8	1.8	
Electrical time constant	T_{el}	ms	25	25	
Mechanical time constant	T_{mech}	ms	3.1	3.1	
Thermal time constant	T_{th}	min	85	85	
Weight with brake	m	kg	102	102	
Weight without brake	m	kg	95	95	

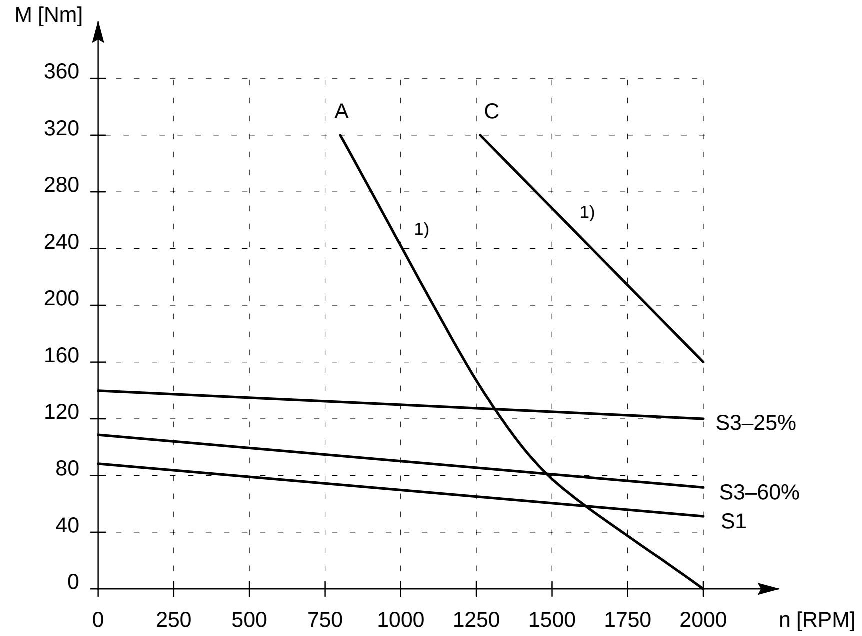

Fig. 3-17 Speed–torque diagram 1FT5134

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1) valid for 600 V DC link voltage

Table 3-18 Standard motor 1FT5136

1FT5136					
Technical data	**Code**	**Units**	**–0AA71**	**–0AC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	82.0	60.0	
Rated current	I_{rated}	A	33.0	37.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	85.0	85.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	105.0	105.0	
Stall current	$I_{0\ (60\ K)}$	A	31.5	47.5	
Stall current	$I_{0\ (100\ K)}$	A	39.0	59.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	791	791	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	716	716	
Limit data					
Max. speed	n_{max}	RPM	1900	2900	
Max. torque	M_{max}	Nm	340	340	
Peak current	I_{max}	A	156.0	234.0	
Limiting torque	M_{limit}	Nm	180.0	170.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.79	
Voltage constant	k_E	V/1000 RPM	306	203	
Winding resistance	$R_{ph.}$	Ohm	0.14	0.063	
Three–phase inductance	L_D	mH	3.8	1.7	
Electrical time constant	T_{el}	ms	27	27	
Mechanical time constant	T_{mech}	ms	2.8	2.8	
Thermal time constant	T_{th}	min	90	90	
Weight with brake	m	kg	122	122	
Weight without brake	m	kg	115	115	

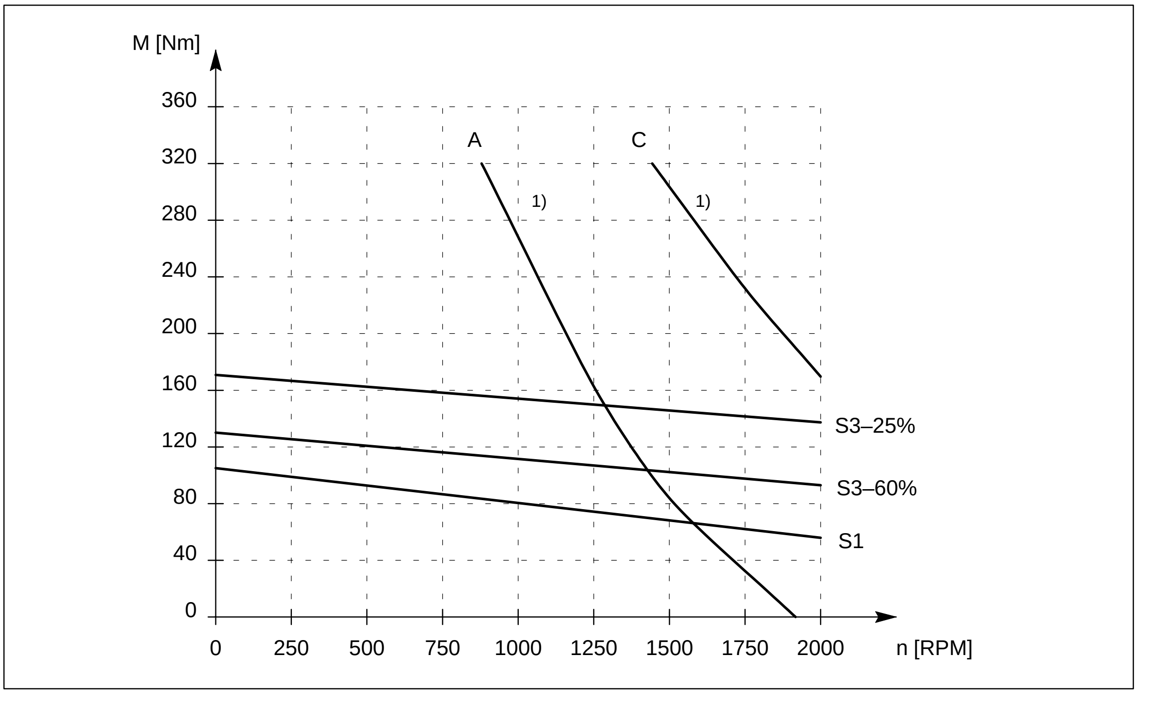

Fig. 3-18 Speed–torque diagram 1FT5136

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1) valid for 600 V DC link voltage

Table 3-19 Standard motor 1FT5138

1FT5138				
Technical data	**Code**	**Units**	**–0AA71**	
Engineering data				
Rated speed	n_{rated}	RPM	1200	
Rated torque	$M_{rated\ (100\ K)}$	Nm	100.0	
Rated current	I_{rated}	A	40.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	105.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	130.0	
Stall current	$I_{0\ (60\ K)}$	A	39.0	
Stall current	$I_{0\ (100\ K)}$	A	48.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	980	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	905	
Limit data				
Max. speed	n_{max}	RPM	2000	
Max. torque	M_{max}	Nm	420	
Peak current	I_{max}	A	194.0	
Limiting torque	M_{limit}	Nm	220.0	
Physical constants				
Torque constant	k_T	Nm/A	2.70	
Voltage constant	k_E	V/1000 RPM	306	
Winding resistance	$R_{ph.}$	Ohm	0.11	
Three–phase inductance	L_D	mH	3.2	
Electrical time constant	T_{el}	ms	29	
Mechanical time constant	T_{mech}	ms	2.7	
Thermal time constant	T_{th}	min	100	
Weight with brake	m	kg	152	
Weight without brake	m	kg	145	

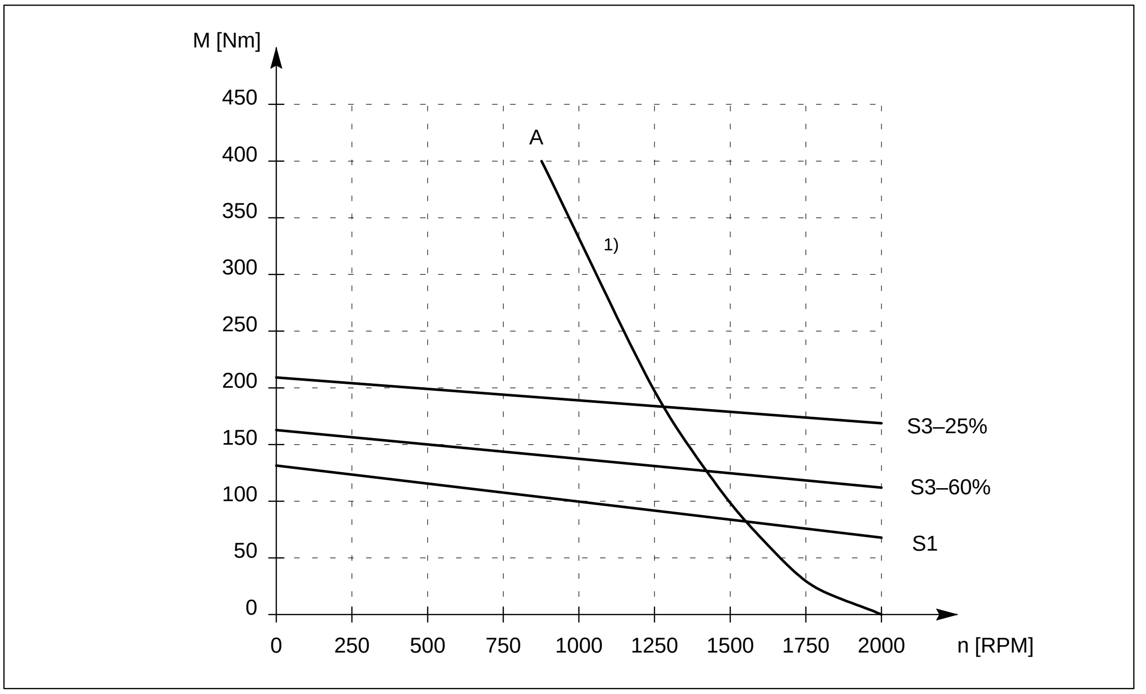

Fig. 3-19 Speed–torque diagram 1FT5138

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1) valid for 600 V DC link voltage

Table 3-20 Standard motor 1FT5074, force–ventilated

1FT5074					
Technical data	**Code**	**Units**	**–0SG71**	**–0SK71**	
Engineering data					
Rated speed	n_{rated}	RPM	4000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	17.0	12.0	
Rated current	I_{rated}	A	22.0	23.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	16.0	16.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	20.5	20.5	
Stall current	$I_{0\ (60\ K)}$	A	19.0	28.0	
Stall current	$I_{0\ (100\ K)}$	A	24.5	36.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	44.2	44.2	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	36.7	36.7	
Limit data					
Max. speed	n_{max}	RPM	6200	7000	
Max. torque	M_{max}	Nm	56	56	
Peak current	I_{max}	A	90.0	104.0	
Limiting torque	M_{limit}	Nm	24.5	22.5	
Physical constants					
Torque constant	k_T	Nm/A	0.85	0.57	
Voltage constant	k_E	V/1000 RPM	96	65	
Winding resistance	$R_{ph.}$	Ohm	0.33	0.14	
Three–phase inductance	L_D	mH	3.6	1.5	
Electrical time constant	T_{el}	ms	11	11	
Mechanical time constant	T_{mech}	ms	3.0	3.0	
Thermal time constant	T_{th}	min	40	40	
Weight with brake	m	kg	23.5	23.5	
Weight without brake	m	kg	22	22	

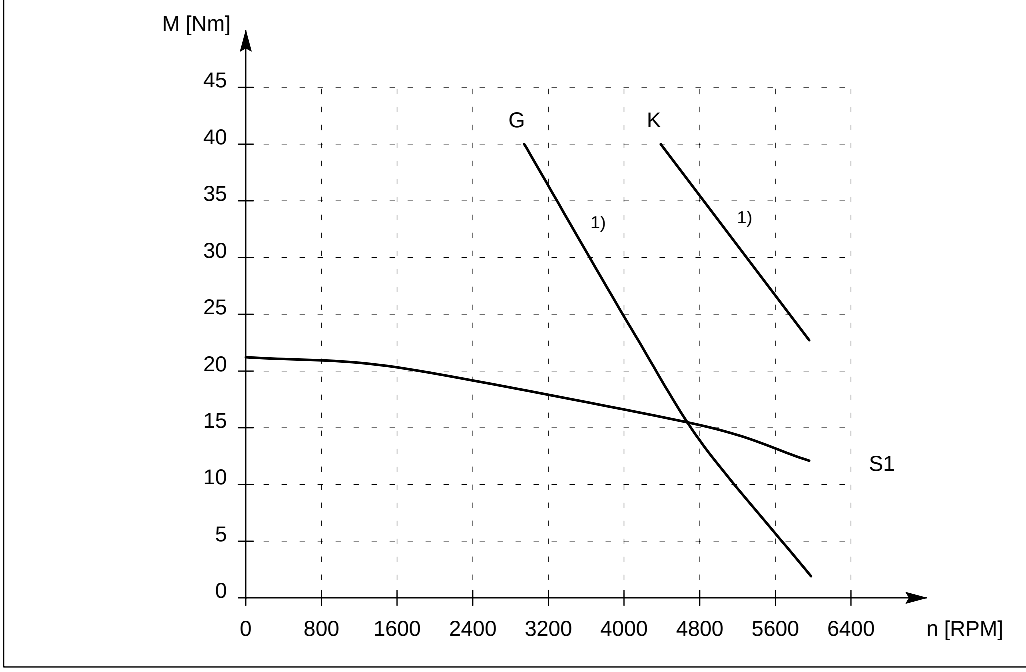

Fig. 3-20 Speed–torque diagram 1FT5074, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-21 Standard motor 1FT5076, force–ventilated

1FT5076					
Technical data	**Code**	**Units**	**–0SG71**	**–0SK71**	
Engineering data					
Rated speed	n_{rated}	RPM	4000	6000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	21.0	15.0	
Rated current	I_{rated}	A	27.0	29.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	20.5	20.5	
Stall torque	$M_{0\ (100\ K)}$	Nm	26.0	26.0	
Stall current	$I_{0\ (60\ K)}$	A	24.5	36.0	
Stall current	$I_{0\ (100\ K)}$	A	31.0	46.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	58.4	58.4	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	50.9	50.9	
Limit data					
Max. speed	n_{max}	RPM	6200	7000	
Max. torque	M_{max}	Nm	72	72	
Peak current	I_{max}	A	110.0	163.0	
Limiting torque	M_{limit}	Nm	36.0	36.0	
Physical constants					
Torque constant	k_T	Nm/A	0.85	0.57	
Voltage constant	k_E	V/1000 RPM	96	65	
Winding resistance	$R_{ph.}$	Ohm	0.20	0.093	
Three–phase inductance	L_D	mH	2.4	1.1	
Electrical time constant	T_{el}	ms	12	12	
Mechanical time constant	T_{mech}	ms	2.9	2.9	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	27.5	27.5	
Weight without brake	m	kg	26	26	

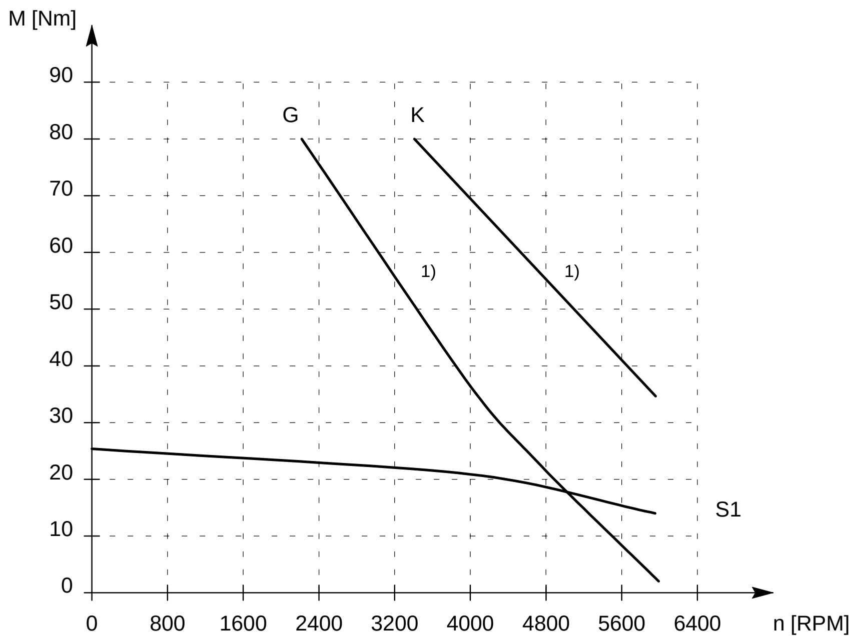

Fig. 3-21 Speed–torque diagram 1FT5076, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-22 Standard motor 1FT5102, force–ventilated

1FT5102					
Technical data	**Code**	**Units**	**–0SF71**	**–0SG71**	
Engineering data					
Rated speed	n_{rated}	RPM	3000	4000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	36.0	32.0	
Rated current	I_{rated}	A	36.0	40.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	34.0	34.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	40.0	40.0	
Stall current	$I_{0\ (60\ K)}$	A	31.5	39.5	
Stall current	$I_{0\ (100\ K})$	A	37.0	46.5	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	161	161	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	136	136	
Limit data					
Max. speed	n_{max}	RPM	4900	6200	
Max. torque	M_{max}	Nm	108	108	
Peak current	I_{max}	A	120.0	164.0	
Limiting torque	M_{limit}	Nm	57.0	45.0	
Physical constants					
Torque constant	k_T	Nm/A	1.08	0.86	
Voltage constant	k_E	V/1000 RPM	122	97	
Winding resistance	$R_{ph.}$	Ohm	0.14	0.097	
Three–phase inductance	L_D	mH	2.2	1.4	
Electrical time constant	T_{el}	ms	16	16	
Mechanical time constant	T_{mech}	ms	3.5	3.5	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	39	39	
Weight without brake	m	kg	35	35	

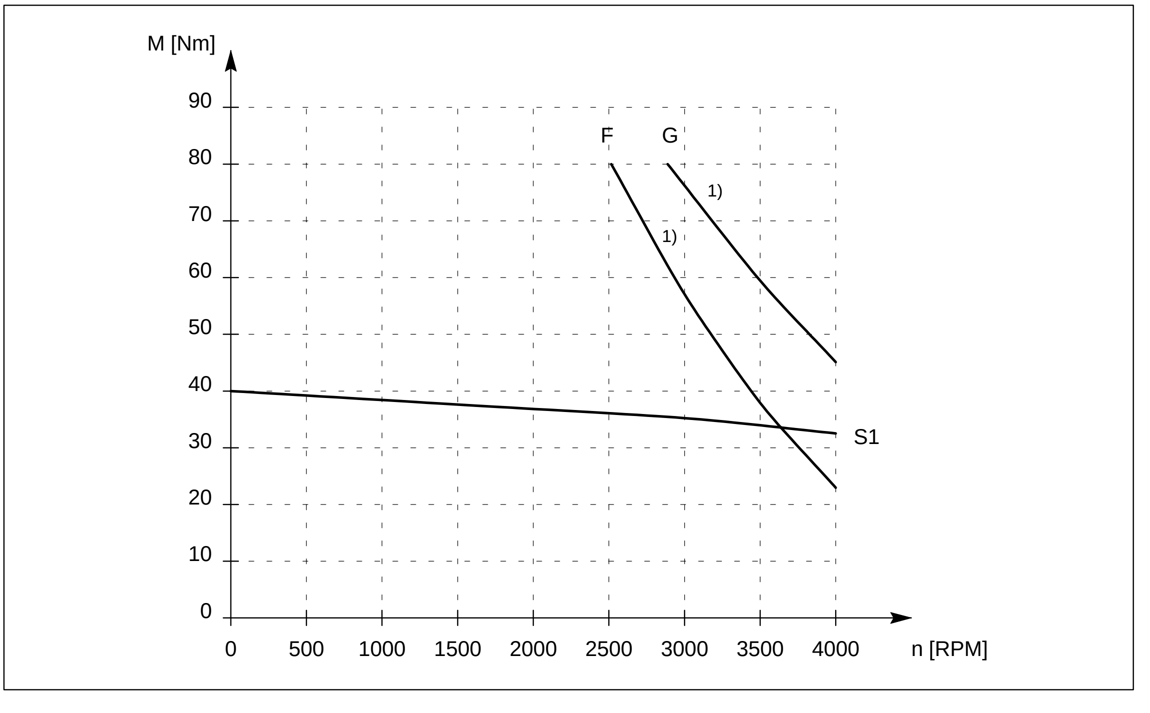

Fig. 3-22 Speed–torque diagram 1FT5102, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-23 Standard motor 1FT5104, force–ventilated

1FT5104				
Technical data	**Code**	**Units**	**–□SF71**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	45.0	
Rated current	I_{rated}	A	45.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	48.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	58.0	
Stall current	$I_{0\ (60\ K)}$	A	44.0	
Stall current	$I_{0\ (100\ K)}$	A	53.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	210	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	185	
Limit data				
Max. speed	n_{max}	RPM	4800	
Max. torque	M_{max}	Nm	148	
Peak current	I_{max}	A	164.0	
Limiting torque	M_{limit}	Nm	80.0	
Physical constants				
Torque constant	k_T	Nm/A	1.09	
Voltage constant	k_E	V/1000 RPM	123	
Winding resistance	$R_{ph.}$	Ohm	0.095	
Three–phase inductance	L_D	mH	1.7	
Electrical time constant	T_{el}	ms	18	
Mechanical time constant	T_{mech}	ms	3.0	
Thermal time constant	T_{th}	min	50	
Weight with brake	m	kg	47	
Weight without brake	m	kg	43	

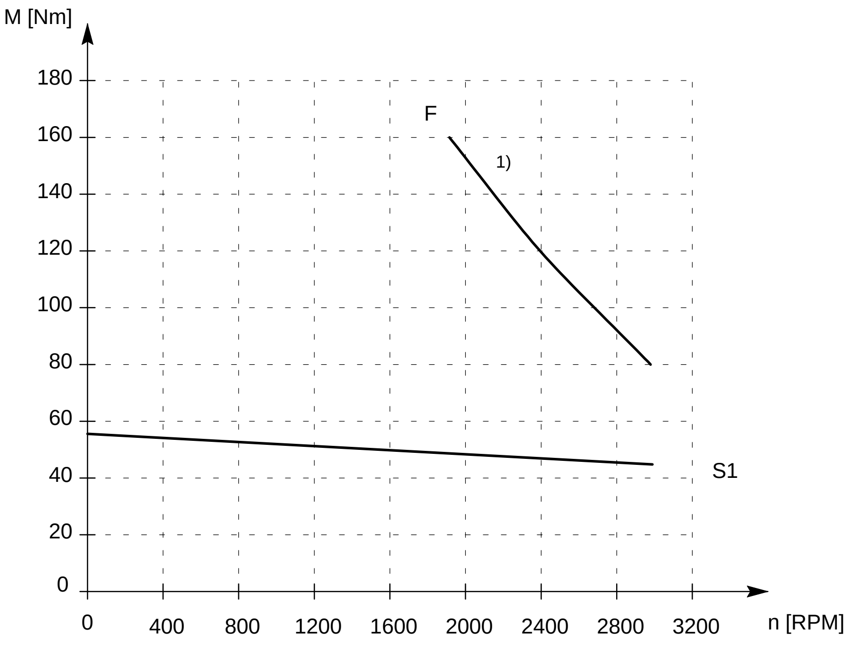

Fig. 3-23 Speed–torque diagram 1FT5104, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-24 Standard motor 1FT5106, force–ventilated

1FT5106				
Technical data	**Code**	**Units**	**–□SF71**	
Engineering data				
Rated speed	n_{rated}	RPM	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	58.0	
Rated current	I_{rated}	A	59.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	57.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	70.0	
Stall current	$I_{0\ (60\ K)}$	A	54.0	
Stall current	$I_{0\ (100\ K)}$	A	66.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	264	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	239	
Limit data				
Max. speed	n_{max}	RPM	5000	
Max. torque	M_{max}	Nm	180	
Peak current	I_{max}	A	200.0	
Limiting torque	M_{limit}	Nm	102.0	
Physical constants				
Torque constant	k_T	Nm/A	1.06	
Voltage constant	k_E	V/1000 RPM	120	
Winding resistance	$R_{ph.}$	Ohm	0.066	
Three–phase inductance	L_D	mH	1.2	
Electrical time constant	T_{el}	ms	19	
Mechanical time constant	T_{mech}	ms	2.8	
Thermal time constant	T_{th}	min	50	
Weight with brake	m	kg	53	
Weight without brake	m	kg	49	

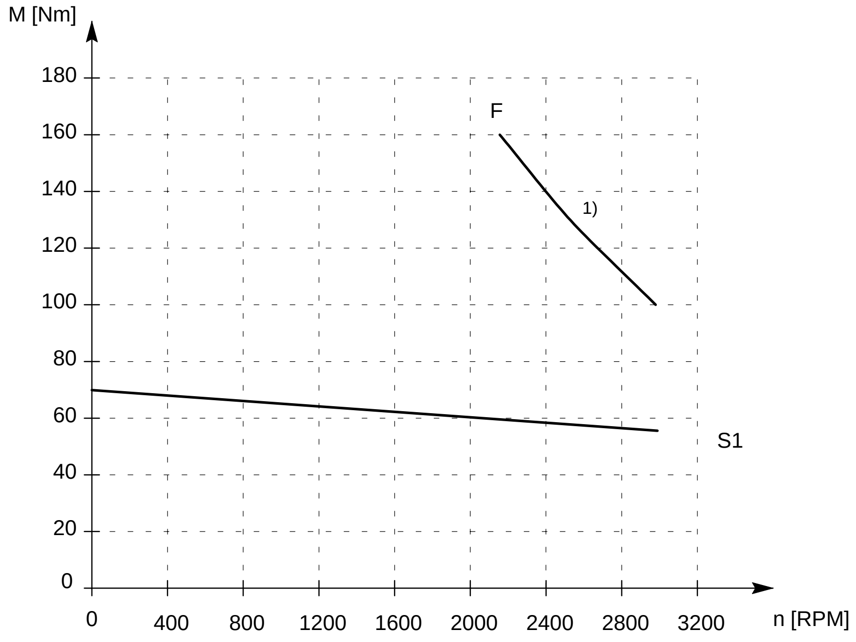

Fig. 3-24 Speed–torque diagram 1FT5106, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-25 Standard motor 1FT5132, force–ventilated

1FT5132						
Technical data	**Code**	**Units**	**–0SA71**	**–0SC71**	**–0SF71**	
Engineering data						
Rated speed	n_{rated}	RPM	1200	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	85.0	80.0	75.0	
Rated current	I_{rated}	A	34.0	50.0	64.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	70.0	70.0	70.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	95.0	95.0	95.0	
Stall current	$I_{0\ (60\ K)}$	A	26.0	41.0	55.5	
Stall current	$I_{0\ (100\ K})$	A	35.0	56.0	75.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	539	539	539	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	464	464	464	
Limit data						
Max. speed	n_{max}	RPM	1900	3000	3200	
Max. torque	M_{max}	Nm	240	240	240	
Peak current	I_{max}	A	112.0	186.0	236.0	
Limiting torque	M_{limit}	Nm	129.0	115.0	110.0	
Physical constants						
Torque constant	k_T	Nm/A	2.70	1.71	1.27	
Voltage constant	k_E	V/1000 RPM	306	194	144	
Winding resistance	$R_{ph.}$	Ohm	0.28	0.10	0.062	
Three–phase inductance	L_D	mH	6.4	2.3	1.4	
Electrical time constant	T_{el}	ms	23	23	23	
Mechanical time constant	T_{mech}	ms	3.5	3.5	3.5	
Thermal time constant	T_{th}	min	80	80	80	
Weight with brake	m	kg	87	87	87	
Weight without brake	m	kg	80	80	80	

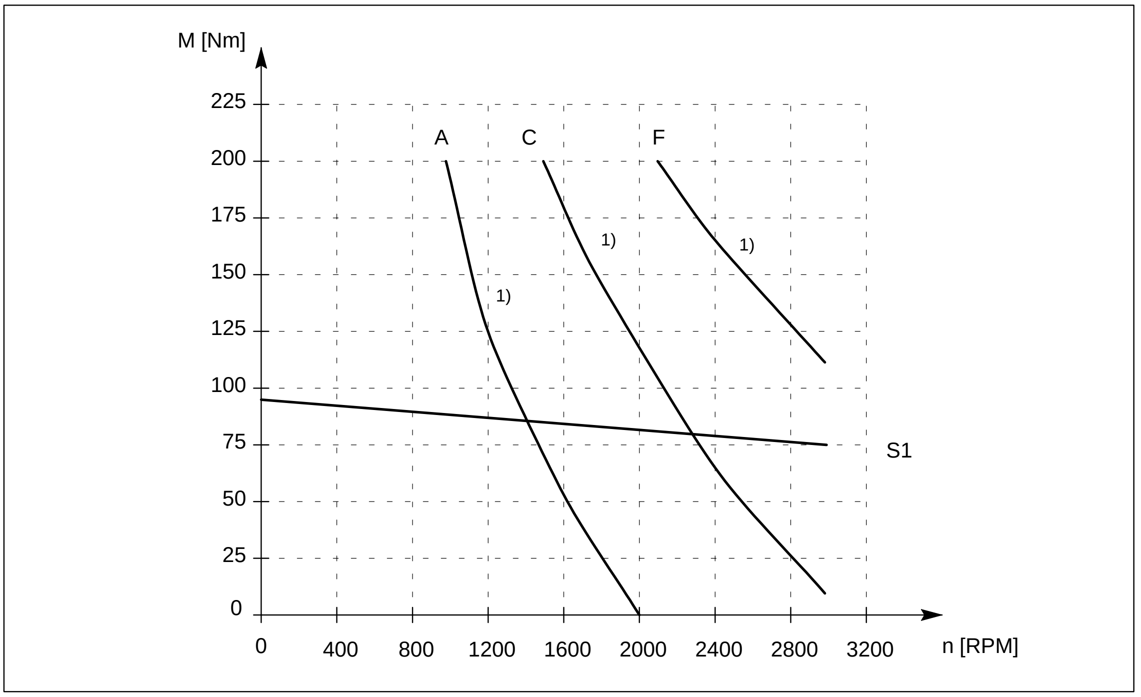

Fig. 3-25 Speed–torque diagram 1FT5132, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-26 Standard motor 1FT5134, force–ventilated

1FT5134					
Technical data	**Code**	**Units**	**–0SA71**	**–0SC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	115.0	110.0	
Rated current	I_{rated}	A	46.0	74.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	90.0	90.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	120.0	120.0	
Stall current	$I_{0\ (60\ K)}$	A	34.0	56.0	
Stall current	$I_{0\ (100\ K)}$	A	45.0	75.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	665	665	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	590	590	
Limit data					
Max. speed	n_{max}	RPM	1900	3200	
Max. torque	M_{max}	Nm	300	300	
Peak current	I_{max}	A	134.0	222.0	
Limiting torque	M_{limit}	Nm	164.0	156.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.61	
Voltage constant	k_E	V/1000 RPM	306	182	
Winding resistance	$R_{ph.}$	Ohm	0.19	0.073	
Three–phase inductance	L_D	mH	4.8	1.8	
Electrical time constant	T_{el}	ms	25	25	
Mechanical time constant	T_{mech}	ms	3.2	3.2	
Thermal time constant	T_{th}	min	85	85	
Weight with brake	m	kg	107	107	
Weight without brake	m	kg	100	100	

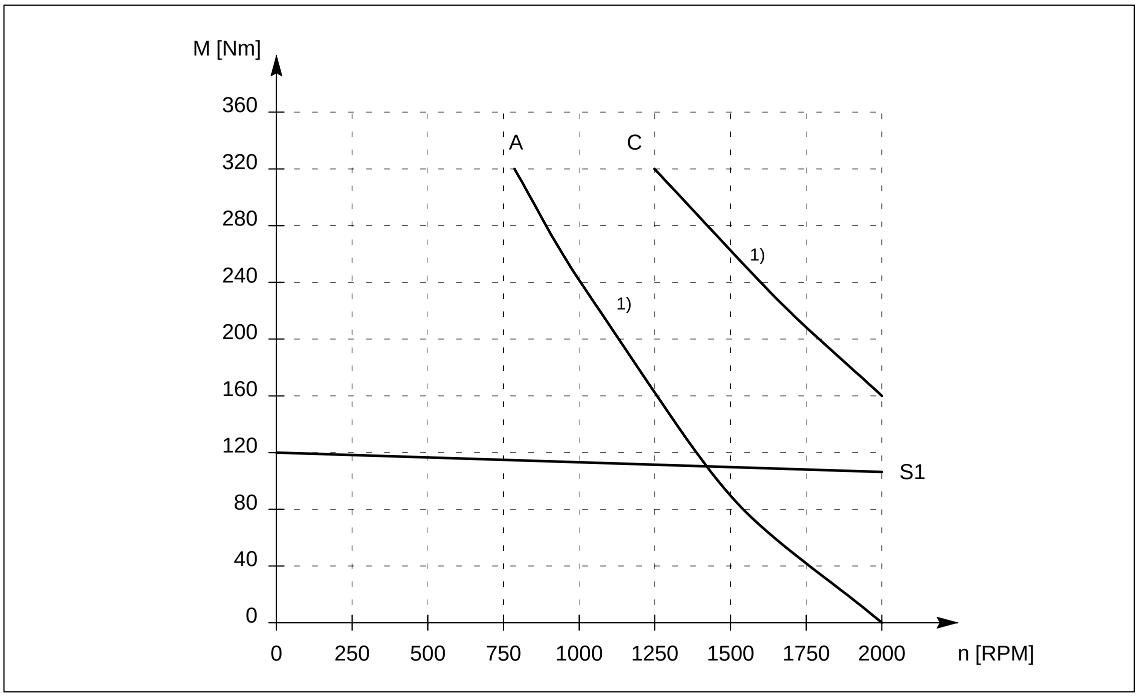

Fig. 3-26 Speed–torque diagram 1FT5134, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-27 Standard motor 1FT5136, force–ventilated

1FT5136					
Technical data	**Code**	**Units**	**–0SA71**	**–0SC71**	
Engineering data					
Rated speed	n_{rated}	RPM	1200	2000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	135.0	130.0	
Rated current	I_{rated}	A	54.0	78.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	110.0	110.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	145.0	145.0	
Stall current	$I_{0\ (60\ K)}$	A	41.0	61.5	
Stall current	$I_{0\ (100\ K)}$	A	54.0	81.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	791	791	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	716	716	
Limit data					
Max. speed	n_{max}	RPM	1900	2900	
Max. torque	M_{max}	Nm	340	340	
Peak current	I_{max}	A	156.0	234.0	
Limiting torque	M_{limit}	Nm	180.0	170.0	
Physical constants					
Torque constant	k_T	Nm/A	2.70	1.79	
Voltage constant	k_E	V/1000 RPM	306	203	
Winding resistance	$R_{ph.}$	Ohm	0.14	0.063	
Three–phase inductance	L_D	mH	3.8	1.7	
Electrical time constant	T_{el}	ms	27	27	
Mechanical time constant	T_{mech}	ms	2.8	2.8	
Thermal time constant	T_{th}	min	90	90	
Weight with brake	m	kg	127	127	
Weight without brake	m	kg	120	120	

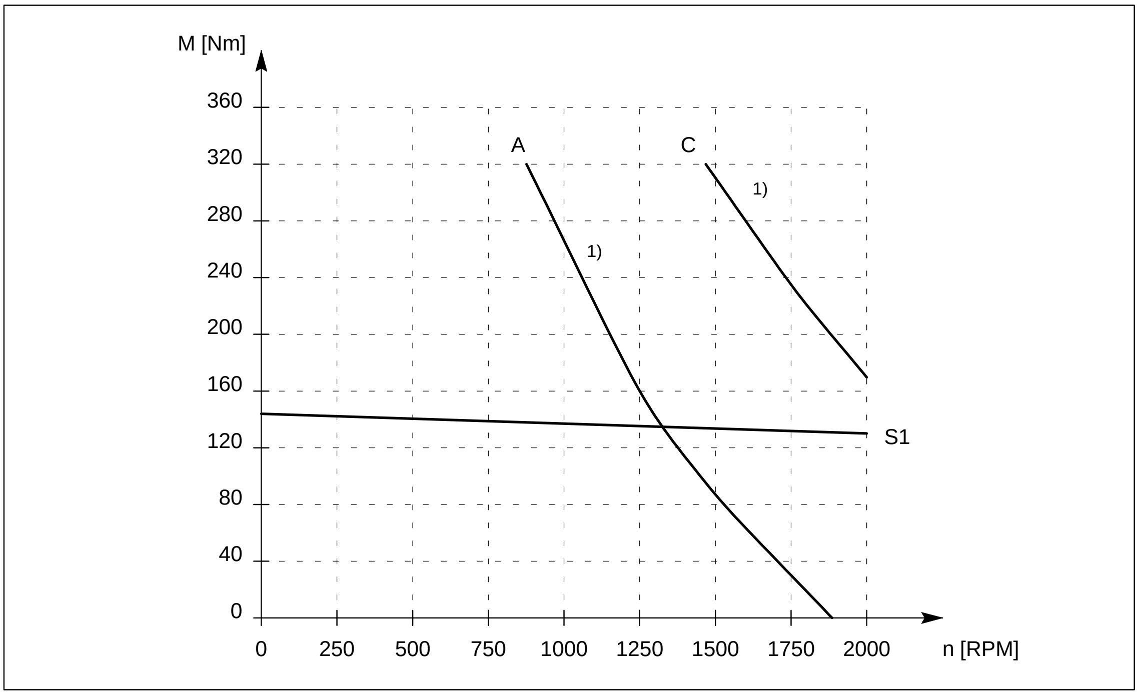

Fig. 3-27 Speed–torque diagram 1FT5136, force–ventilated

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1) valid for 600 V DC link voltage

Table 3-28 Standard motor 1FT5138, force–ventilated

1FT5138				
Technical data	**Code**	**Units**	**–0SA71**	
Engineering data				
Rated speed	n_{rated}	RPM	1200	
Rated torque	$M_{rated\ (100\ K)}$	Nm	170.0	
Rated current	I_{rated}	A	67.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	140.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	185.0	
Stall current	$I_{0\ (60\ K)}$	A	52.0	
Stall current	$I_{0\ (100\ K)}$	A	69.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	980	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	905	
Limit data				
Max. speed	n_{max}	RPM	1900	
Max. torque	M_{max}	Nm	420	
Peak current	I_{max}	A	194.0	
Limiting torque	M_{limit}	Nm	220.0	
Physical constants				
Torque constant	k_T	Nm/A	2.70	
Voltage constant	k_E	V/1000 RPM	306	
Winding resistance	$R_{ph.}$	Ohm	0.11	
Three–phase inductance	L_D	mH	3.2	
Electrical time constant	T_{el}	ms	29	
Mechanical time constant	T_{mech}	ms	2.7	
Thermal time constant	T_{th}	min	100	
Weight with brake	m	kg	157	
Weight without brake	m	kg	150	

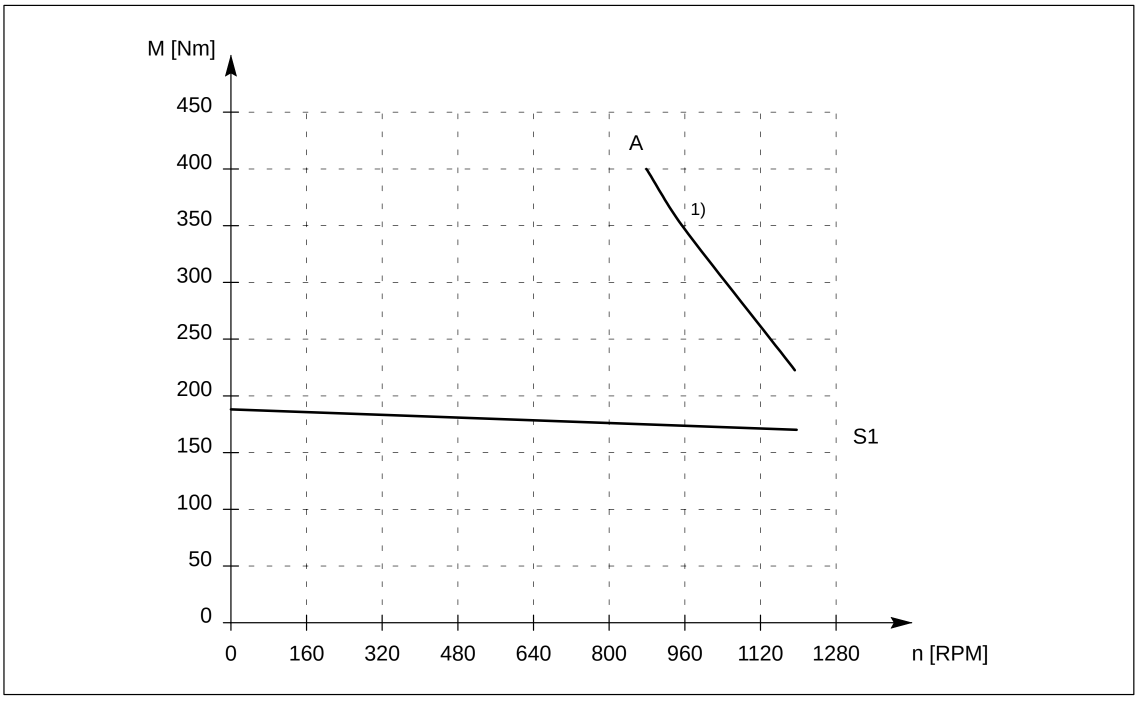

Fig. 3-28 Speed–torque diagram 1FT5138, force–ventilated

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1) valid for 600 V DC link voltage

3.1.2 Short motors

Table 3-29 Short motor 1FT5070

1FT5070					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	3.1	3.0	
Rated current	I_{rated}	A	2.0	2.8	
Stall torque	$M_{0\ (60\ K)}$	Nm	3.0	3.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	3.5	3.5	
Stall current	$I_{0\ (60\ K)}$	A	1.8	2.6	
Stall current	$I_{0\ (100\ K)}$)	A	2.1	3.1	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	16.5	16.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	9.0	9.0	
Limit data					
Max. speed	n_{max}	RPM	3000	4600	
Max. torque	M_{max}	Nm	12	12	
Peak current	I_{max}	A	8.0	12.0	
Limiting torque	M_{limit}	Nm	6.0	6.0	
Physical constants					
Torque constant	k_T	Nm/A	1.72	1.15	
Voltage constant	k_E	V/1000 RPM	195	130	
Winding resistance	$R_{ph.}$	Ohm	16.35	7.86	
Three–phase inductance	L_D	mH	85.2	39.1	
Electrical time constant	T_{el}	ms	5.3	5.3	
Mechanical time constant	T_{mech}	ms	10.2	10.2	
Thermal time constant	T_{th}	min	25	25	
Weight with brake	m	kg	9.0	9.0	
Weight without brake	m	kg	7.5	7.5	

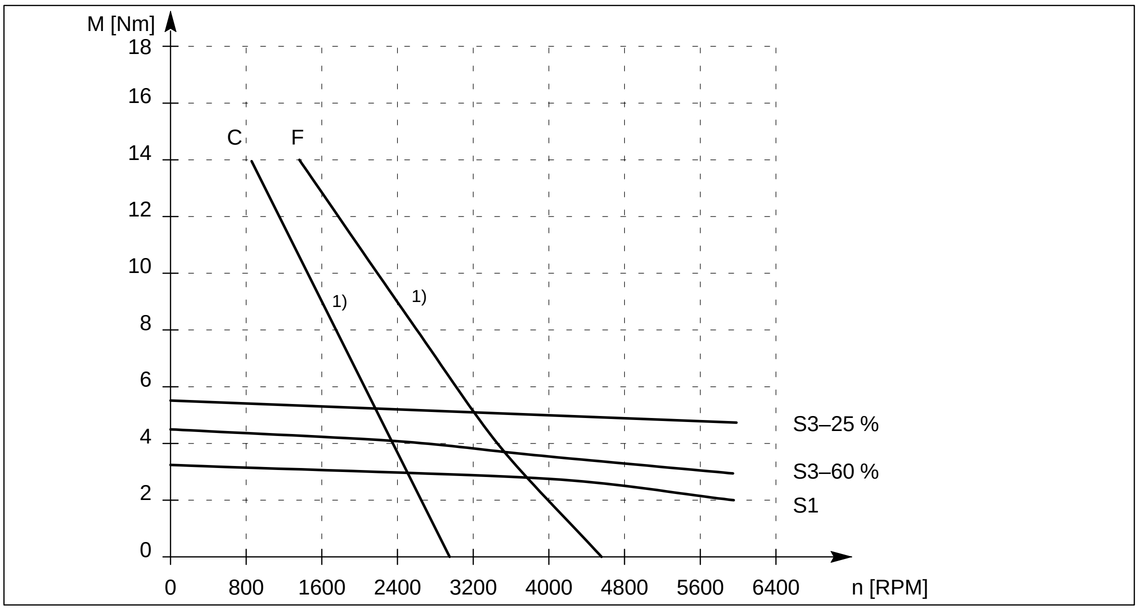

Fig. 3-29 Speed–torque diagram 1FT5070

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1) valid for 600 V DC link voltage

Table 3-30 Short motor 1FT5071

1FT5071					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	5.0	4.8	
Rated current	I_{rated}	A	3.4	5.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	4.5	4.5	
Stall torque	$M_{0\ (100\ K)}$	Nm	5.5	5.5	
Stall current	$I_{0\ (60\ K)}$	A	2.9	4.3	
Stall current	$I_{0\ (100\ K)}$	A	3.5	5.2	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	20.5	20.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	13	13	
Limit data					
Max. speed	n_{max}	RPM	3300	5000	
Max. torque	M_{max}	Nm	18	18	
Peak current	I_{max}	A	13.0	21.0	
Limiting torque	M_{limit}	Nm	8.0	8.0	
Physical constants					
Torque constant	k_T	Nm/A	1.59	1.06	
Voltage constant	k_E	V/1000 RPM	180	120	
Winding resistance	$R_{ph.}$	Ohm	6.44	2.90	
Three–phase inductance	L_D	mH	43.8	18.9	
Electrical time constant	T_{el}	ms	6.8	6.8	
Mechanical time constant	T_{mech}	ms	6.7	6.7	
Thermal time constant	T_{th}	min	30	30	
Weight with brake	m	kg	10	10	
Weight without brake	m	kg	8.5	8.5	

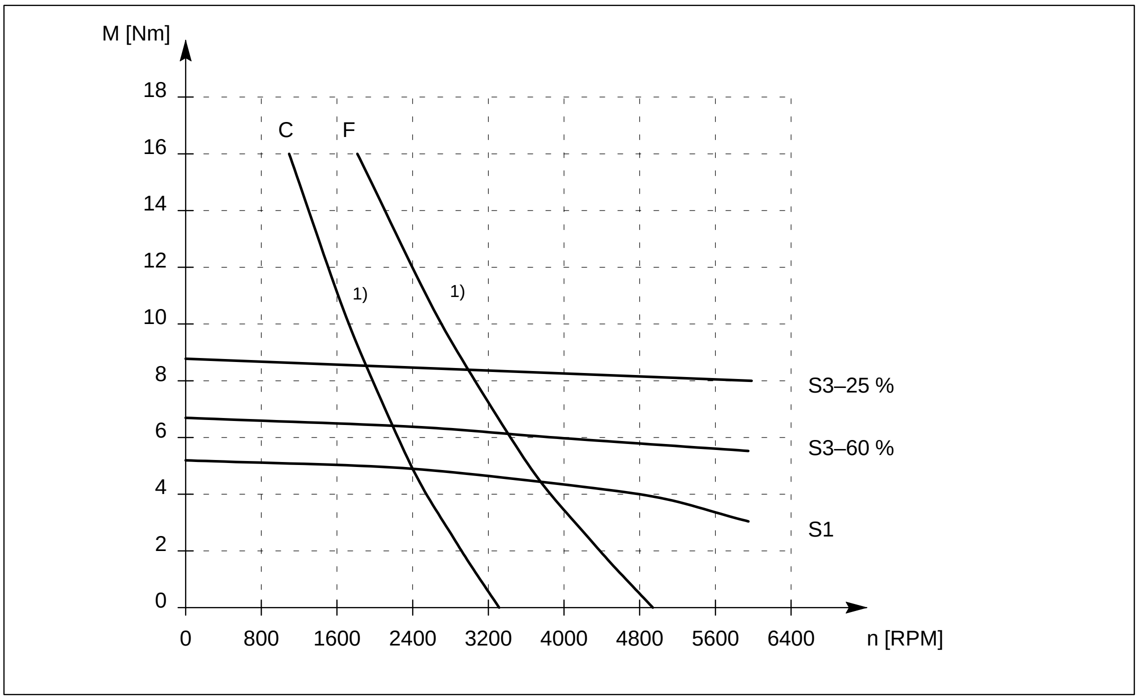

Fig. 3-30 Speed–torque diagram 1FT5071

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1) valid for 600 V DC link voltage

Table 3-31 Short motor 1FT5073

1FT5073					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	8.0	7.2	
Rated current	I_{rated}	A	5.3	7.2	
Stall torque	$M_{0\ (60\ K)}$	Nm	7.0	7.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	9.0	9.0	
Stall current	$I_{0\ (60\ K)}$	A	4.3	6.4	
Stall current	$I_{0\ (100\ K)}$	A	5.5	8.2	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	27.5	27.5	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	20	20	
Limit data					
Max. speed	n_{max}	RPM	3200	4800	
Max. torque	M_{max}	Nm	28	28	
Peak current	I_{max}	A	21.0	32.0	
Limiting torque	M_{limit}	Nm	15.2	15.4	
Physical constants					
Torque constant	k_T	Nm/A	1.64	1.1	
Voltage constant	k_E	V/1000 RPM	186	124	
Winding resistance	$R_{ph.}$	Ohm	3.06	1.35	
Three–phase inductance	L_D	mH	25.7	11.4	
Electrical time constant	T_{el}	ms	8.5	8.5	
Mechanical time constant	T_{mech}	ms	4.5	4.5	
Thermal time constant	T_{th}	min	35	35	
Weight with brake	m	kg	12	12	
Weight without brake	m	kg	10.5	10.5	

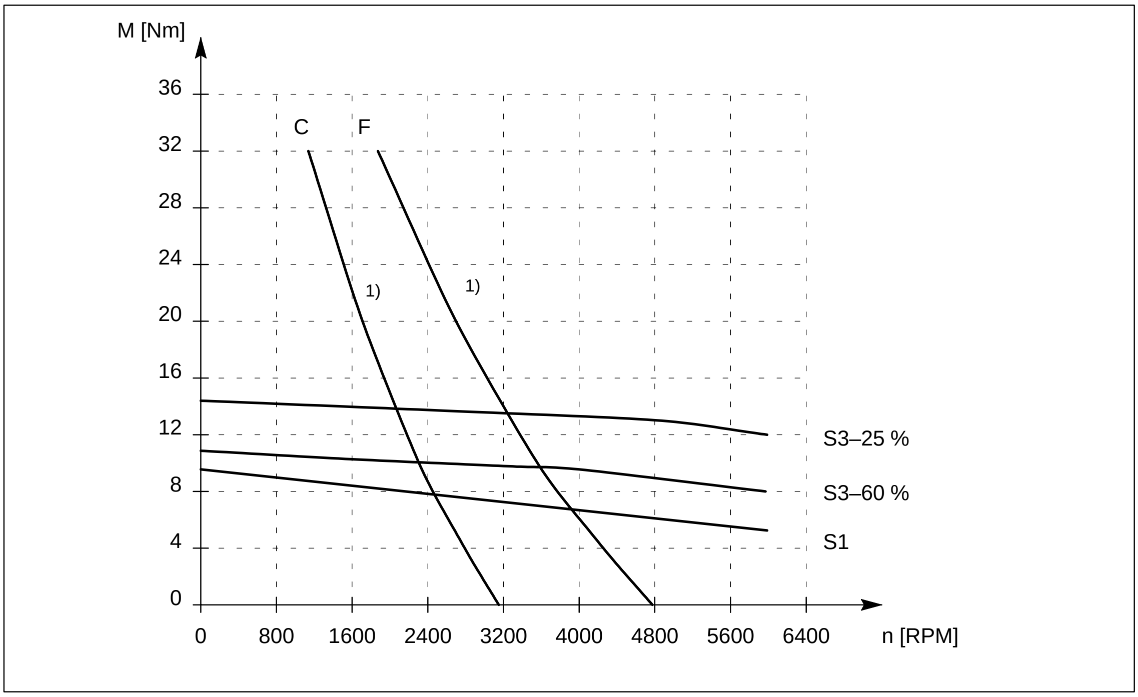

Fig. 3-31 Speed–torque diagram 1FT5073

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1) valid for 600 V DC link voltage

Table 3-32 Short motor 1FT5100

1FT5100					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	12.0	11.0	
Rated current	I_{rated}	A	7.9	11.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	10.0	10.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	13.0	13.0	
Stall current	$I_{0\ (60\ K)}$	A	6.2	9.2	
Stall current	$I_{0\ (100\ K)}$	A	8.0	12.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	84	84	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	59	59	
Limit data					
Max. speed	n_{max}	RPM	3200	4800	
Max. torque	M_{max}	Nm	40	40	
Peak current	I_{max}	A	32.0	47.0	
Limiting torque	M_{limit}	Nm	19.5	20.0	
Physical constants					
Torque constant	k_T	Nm/A	1.63	1.09	
Voltage constant	k_E	V/1000 RPM	185	123	
Winding resistance	$R_{ph.}$	Ohm	1.4	0.62	
Three–phase inductance	L_D	mH	15.7	7.0	
Electrical time constant	T_{el}	ms	11	11	
Mechanical time constant	T_{mech}	ms	6.2	6.2	
Thermal time constant	T_{th}	min	35	35	
Weight with brake	m	kg	19.5	19.5	
Weight without brake	m	kg	15.5	15.5	

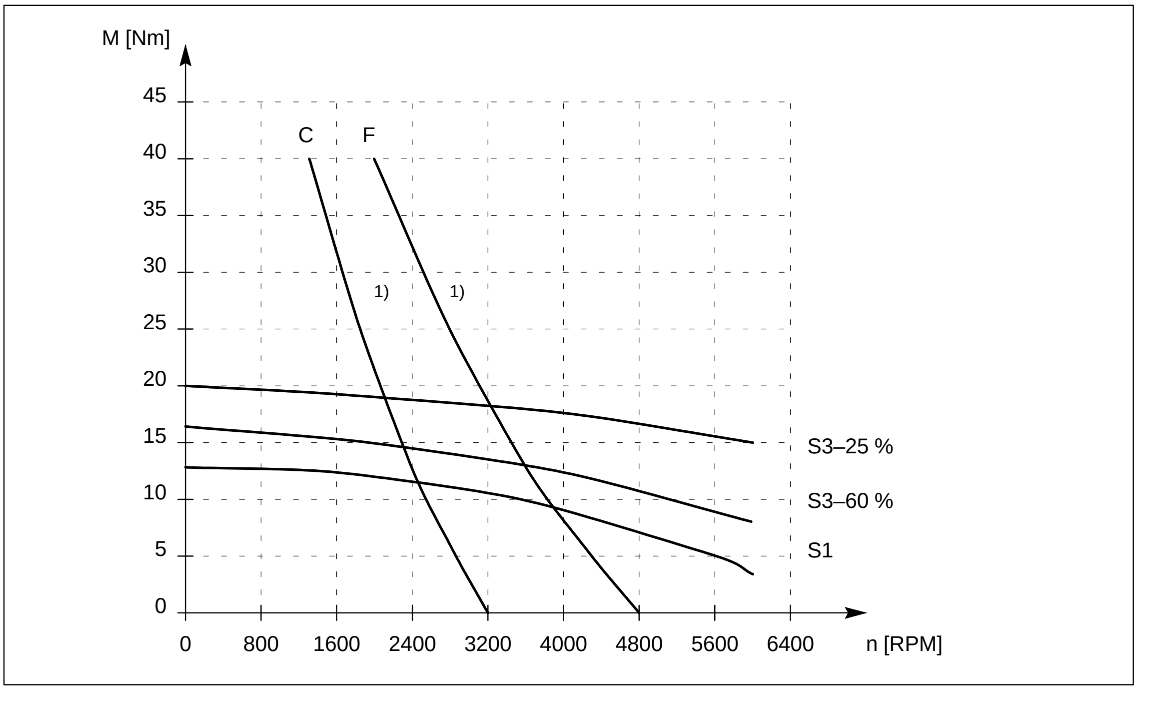

Fig. 3-32 Speed–torque diagram 1FT5100

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1) valid for 600 V DC link voltage

Table 3-33 Short motor 1FT5101

1FT5101					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	17.0	15.0	
Rated current	I_{rated}	A	11.0	15.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	15.0	15.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	19.0	19.0	
Stall current	$I_{0\ (60\ K)}$	A	9.4	14.5	
Stall current	$I_{0\ (100\ K)}$	A	12.0	18.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	110	110	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	85	85	
Limit data					
Max. speed	n_{max}	RPM	2700	4200	
Max. torque	M_{max}	Nm	60	60	
Peak current	I_{max}	A	46.0	66.0	
Limiting torque	M_{limit}	Nm	32.0	35.0	
Physical constants					
Torque constant	k_T	Nm/A	1.61	1.06	
Voltage constant	k_E	V/1000 RPM	182	120	
Winding resistance	$R_{ph.}$	Ohm	0.71	0.33	
Three–phase inductance	L_D	mH	9.4	4.2	
Electrical time constant	T_{el}	ms	14	14	
Mechanical time constant	T_{mech}	ms	4.8	4.8	
Thermal time constant	T_{th}	min	40	40	
Weight with brake	m	kg	23	23	
Weight without brake	m	kg	19	19	

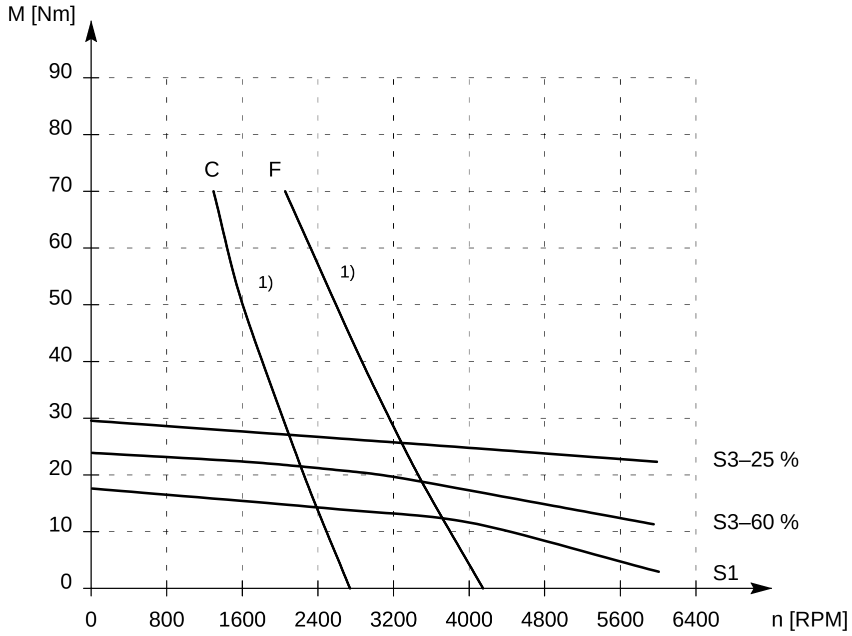

Fig. 3-33 Speed–torque diagram 1FT5101

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1) valid for 600 V DC link voltage

Table 3-34 Short motor 1FT5103

1FT5103					
Technical data	**Code**	**Units**	**–0AC71**	**–0AF71**	
Engineering data					
Rated speed	n_{rated}	RPM	2000	3000	
Rated torque	$M_{rated\ (100\ K)}$	Nm	22.5	20.0	
Rated current	I_{rated}	A	15.0	20.0	
Stall torque	$M_{0\ (60\ K)}$	Nm	19.0	19.0	
Stall torque	$M_{0\ (100\ K)}$	Nm	25.0	25.0	
Stall current	$I_{0\ (60\ K)}$	A	12.0	17.5	
Stall current	$I_{0\ (100\ K)}$	A	16.0	23.0	
Moment of inertia (with brake)	J_{mot}	10^{-4} kgm^2	195	195	
Moment of inertia (without brake)	J_{mot}	10^{-4} kgm^2	110	110	
Limit data					
Max. speed	n_{max}	RPM	2700	4200	
Max. torque	M_{max}	Nm	76	76	
Peak current	I_{max}	A	62.0	93.0	
Limiting torque	M_{limit}	Nm	45.0	45.0	
Physical constants					
Torque constant	k_T	Nm/A	1.60	1.10	
Voltage constant	k_E	V/1000 RPM	181	124	
Winding resistance	$R_{ph.}$	Ohm	0.47	0.20	
Three–phase inductance	L_D	mH	6.5	3.0	
Electrical time constant	T_{el}	ms	17	17	
Mechanical time constant	T_{mech}	ms	3.8	3.8	
Thermal time constant	T_{th}	min	45	45	
Weight with brake	m	kg	26	26	
Weight without brake	m	kg	22	22	

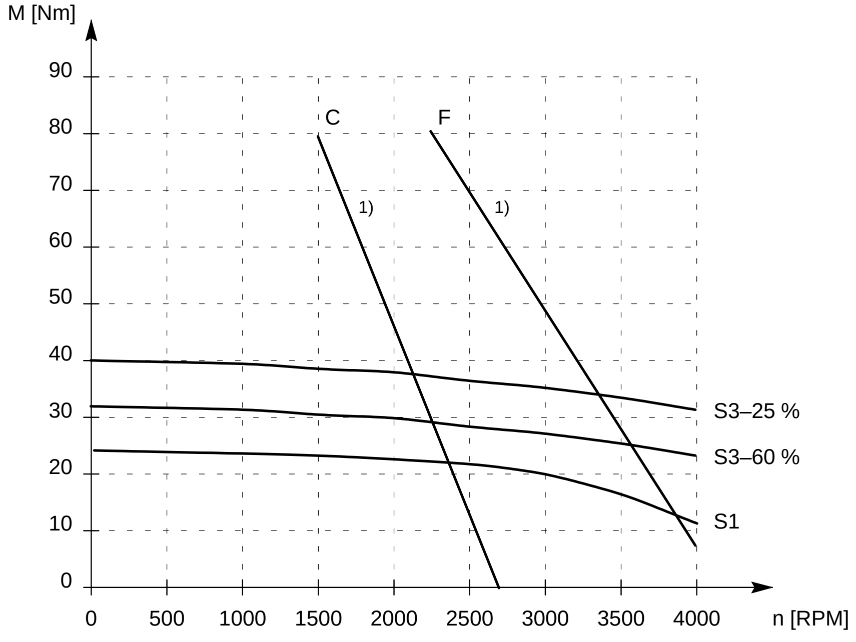

Fig. 3-34 Speed–torque diagram 1FT5103

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1) valid for 600 V DC link voltage

3.2 Cantilever/axial force diagrams

Cantilever force

Definition, refer to Chapter 2.1 General information on AC servomotors AL S.

Axial force

$F_{A\ AS}$ is the absolute permissible force without taking into account the bearing alignment force, the rotor weight, the mounting position as well as force direction.

Caution

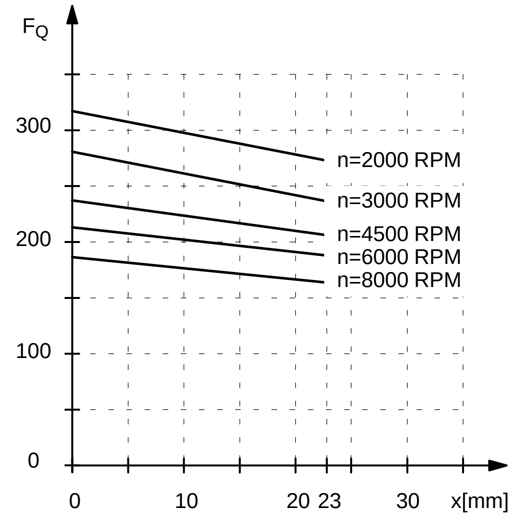
Axial forces are not permissible for motors with integrated holsing brake!

Definition, refer to Chapter 2.1, General information on AC servomotors AL S.

3.2.1 Standard motors

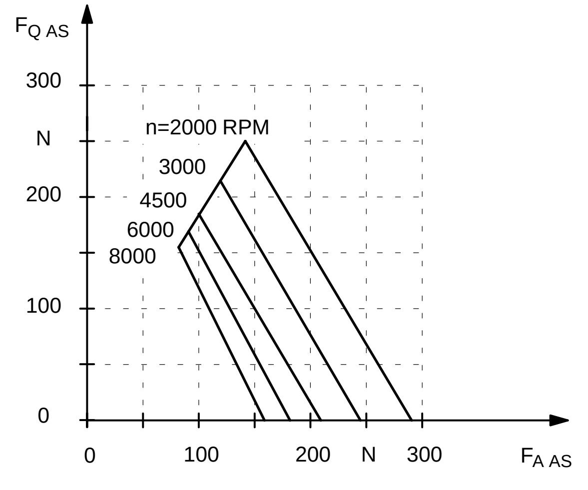
Cantilever force 1FT5034 to 1FT5036

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



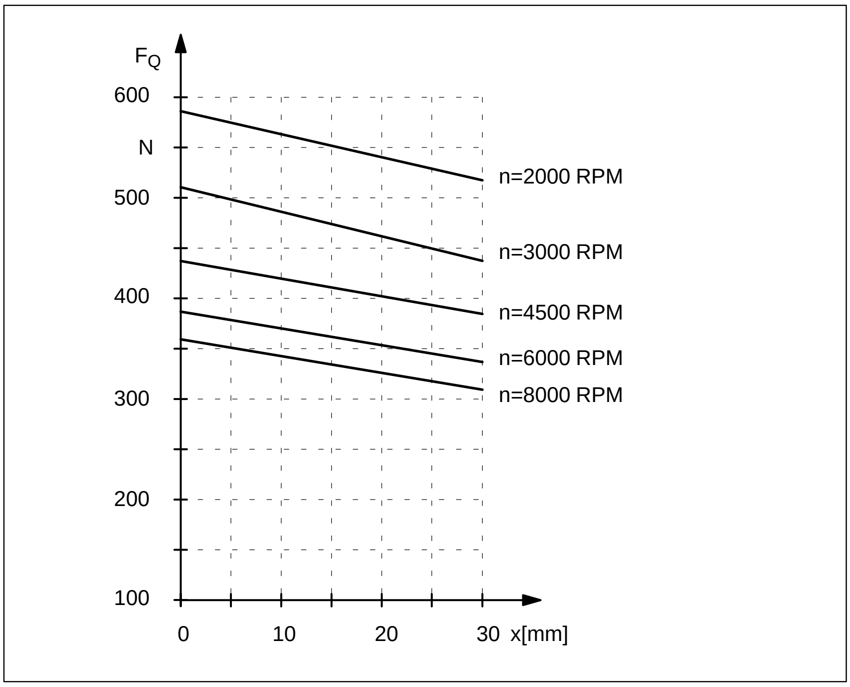
Axial force 1FT5034 to 1FT5036

Permissible axial force as a function of the cantilever force.



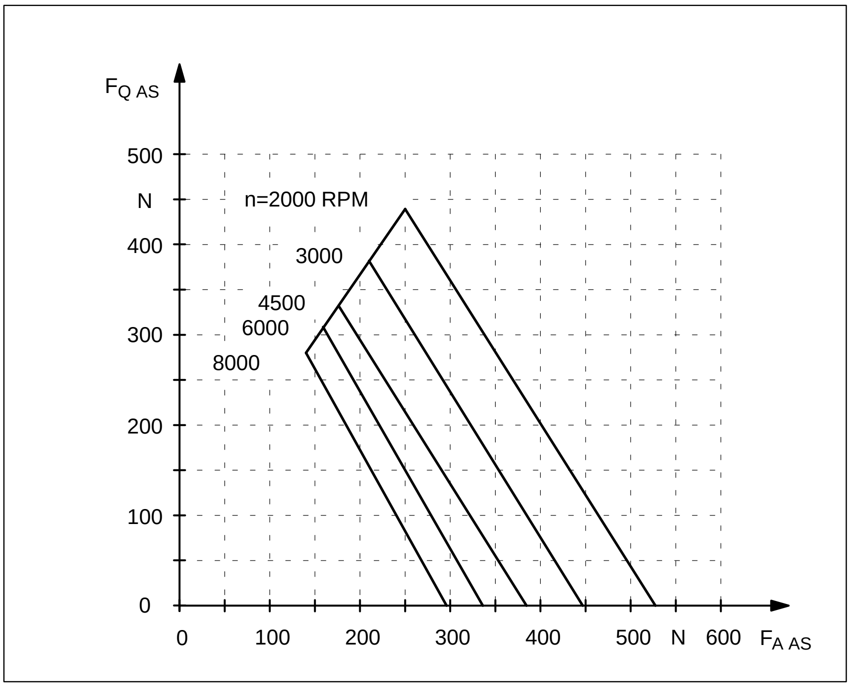
Cantilever force 1FT5042 to 1FT5046

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



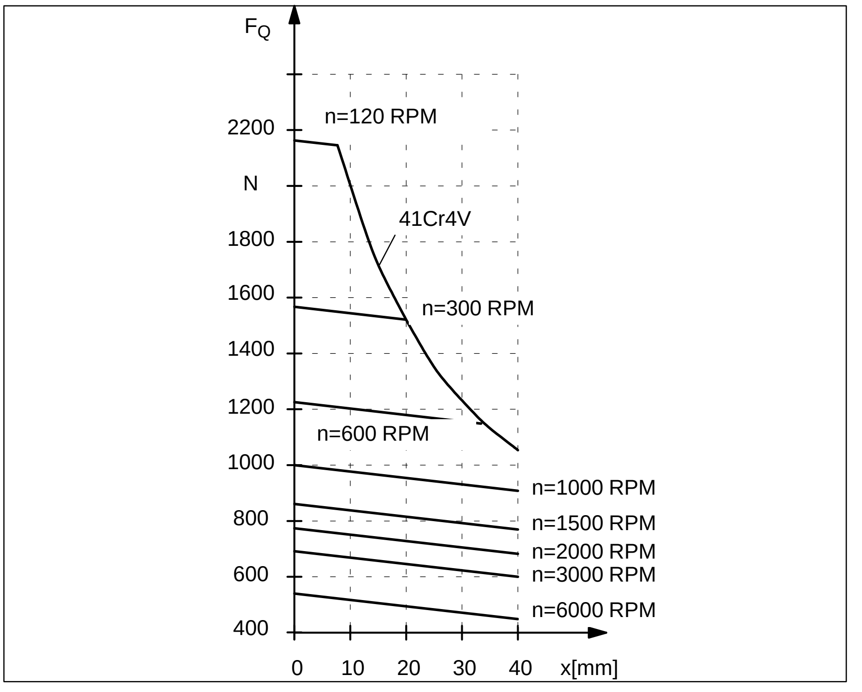
Axial force 1FT5042 to 1FT5046

Permissible axial force as a function of the cantilever force.



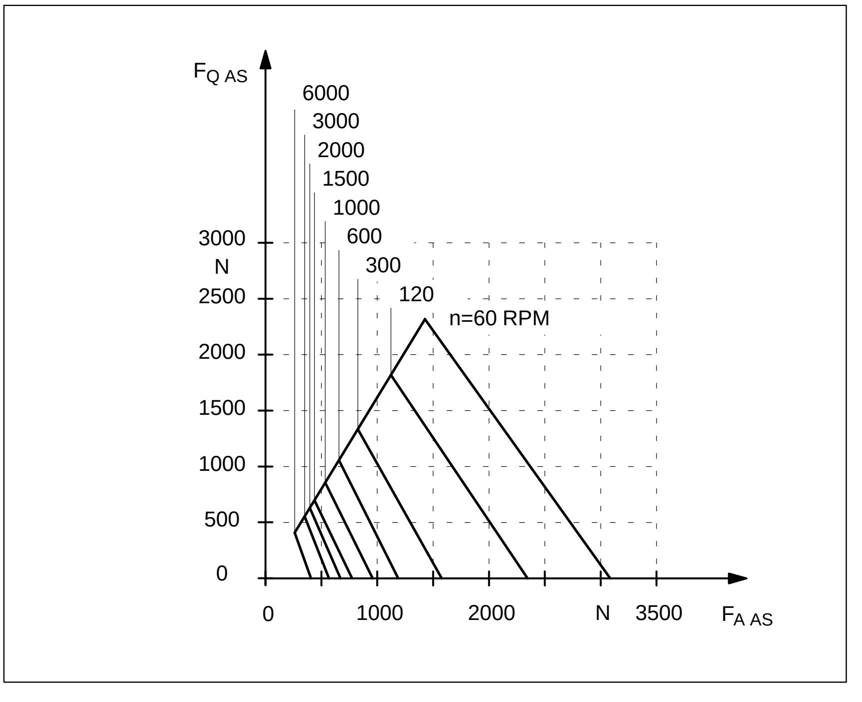
Cantilever force 1FT5062 to 1FT5066

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



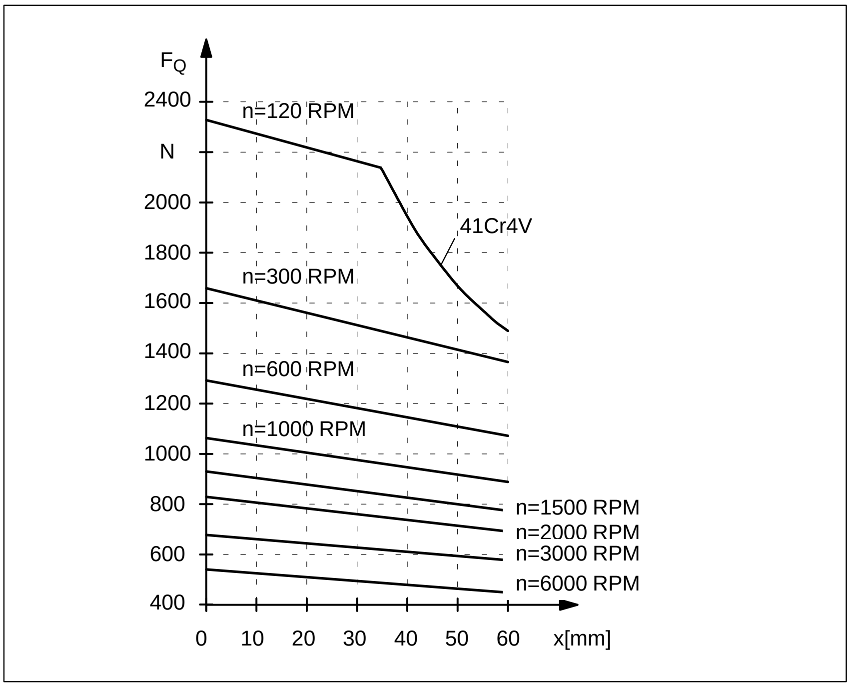
Axial force 1FT5062 to 1FT5066

Permissible axial force as a function of the cantilever force.



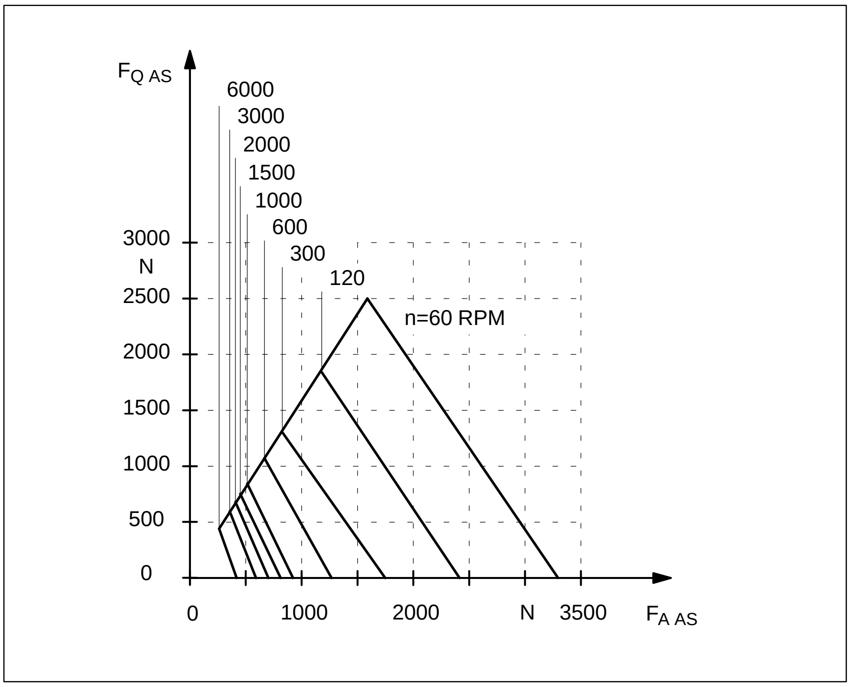
Cantilever force 1FT5072 to 1FT5076

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



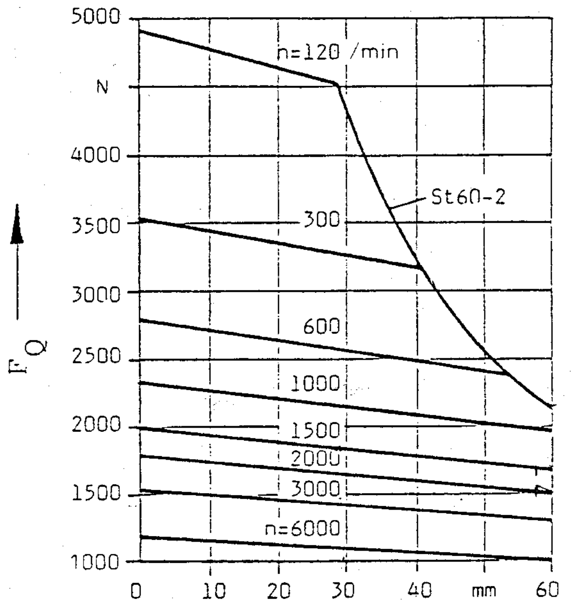
Axial force 1FT5072 to 1FT5076

Permissible axial force as a function of the cantilever force.



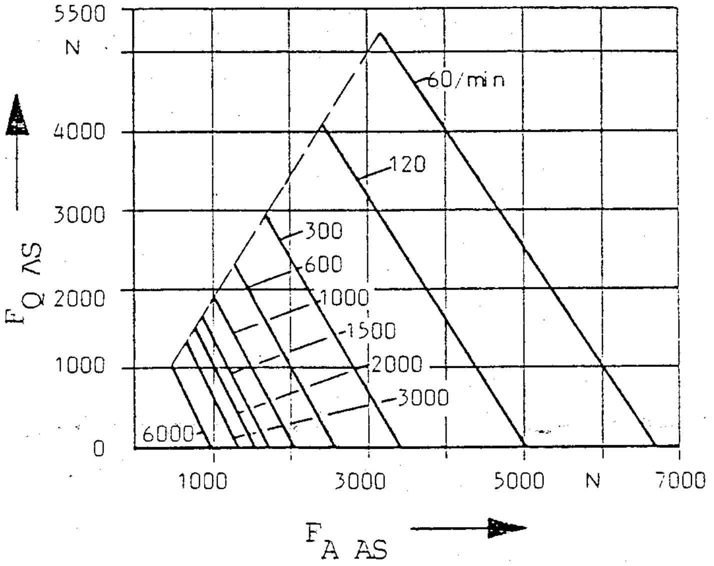
Cantilever force 1FT5102 to 1FT5104

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



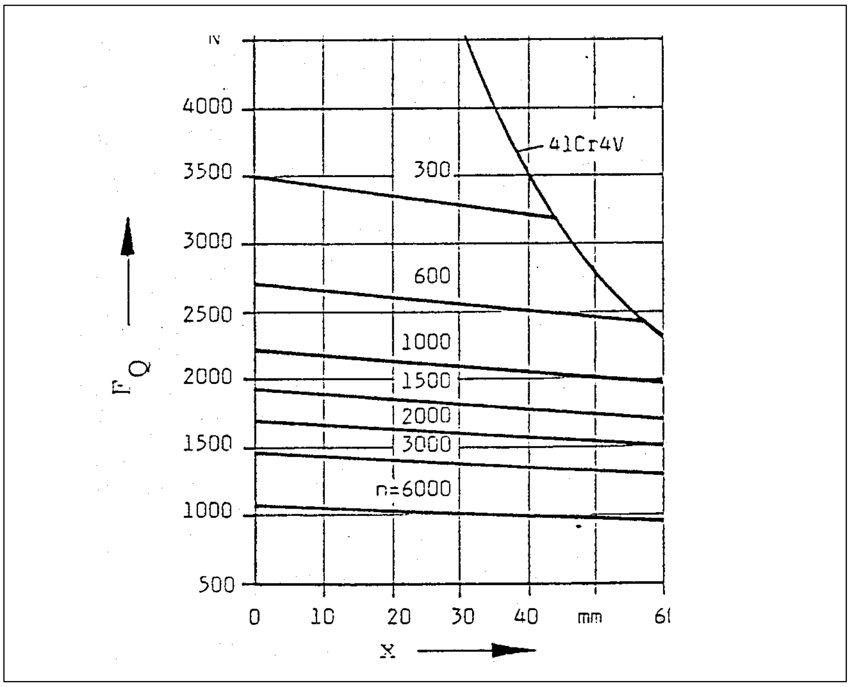
Axial force 1FT5102 to 1FT5104

Permissible axial force as a function of the cantilever force.



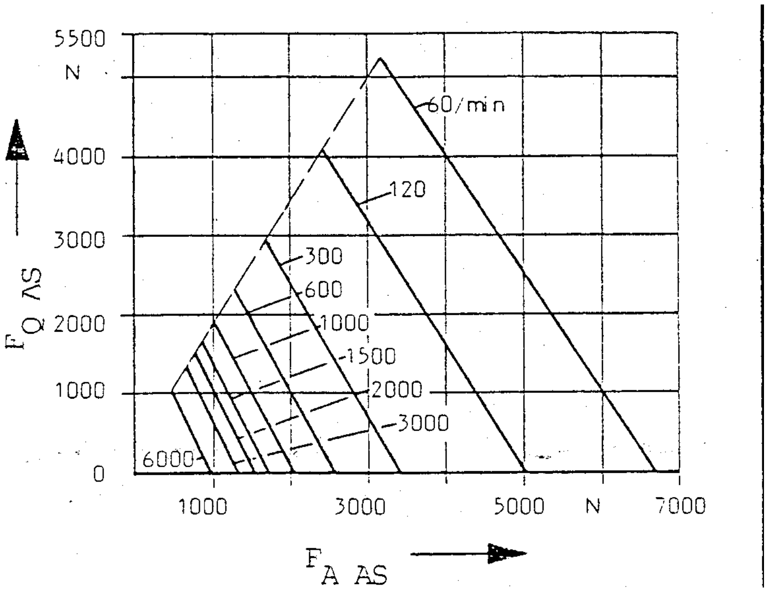
Cantilever force 1FT5106 to 1FT5108

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



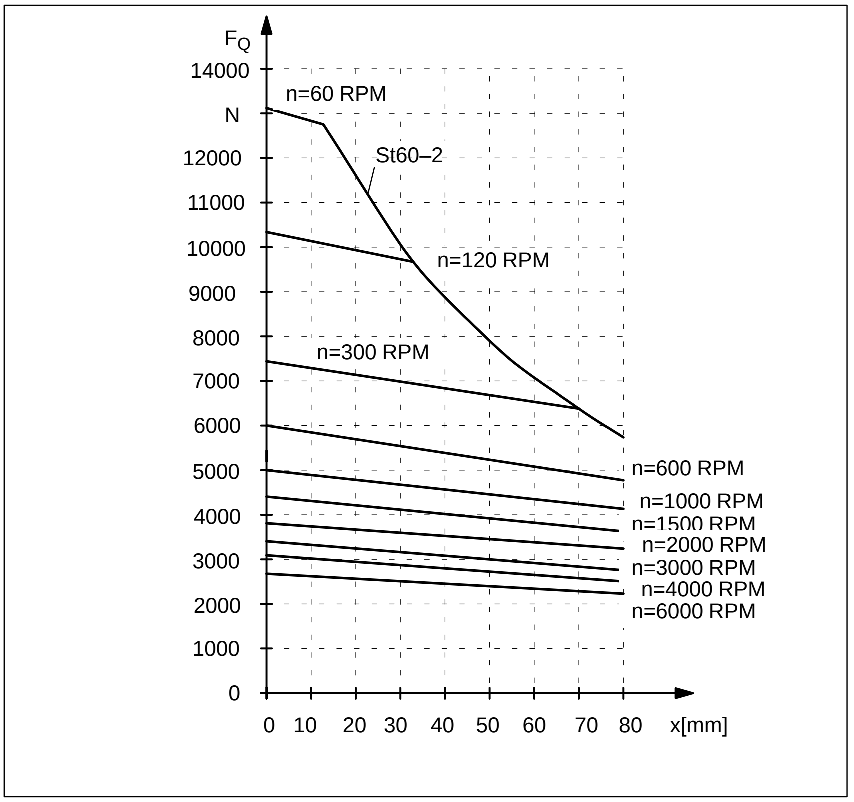
Axial force 1FT5106 to 1FT5108

Permissible axial force as a function of the cantilever force.



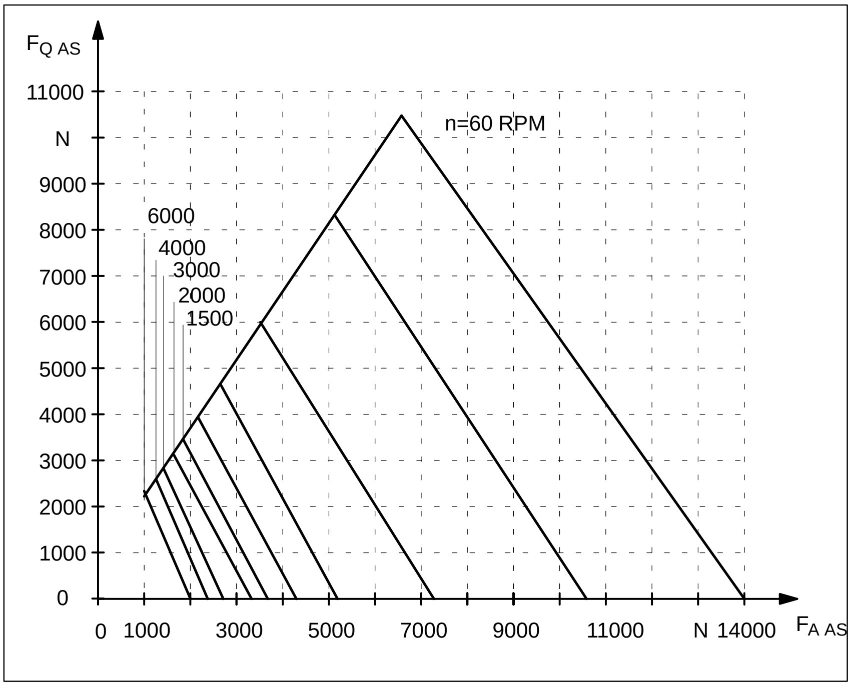
Cantilever force 1FT5132 to 1FT5136

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



Axial force 1FT5132 to 1FT5136

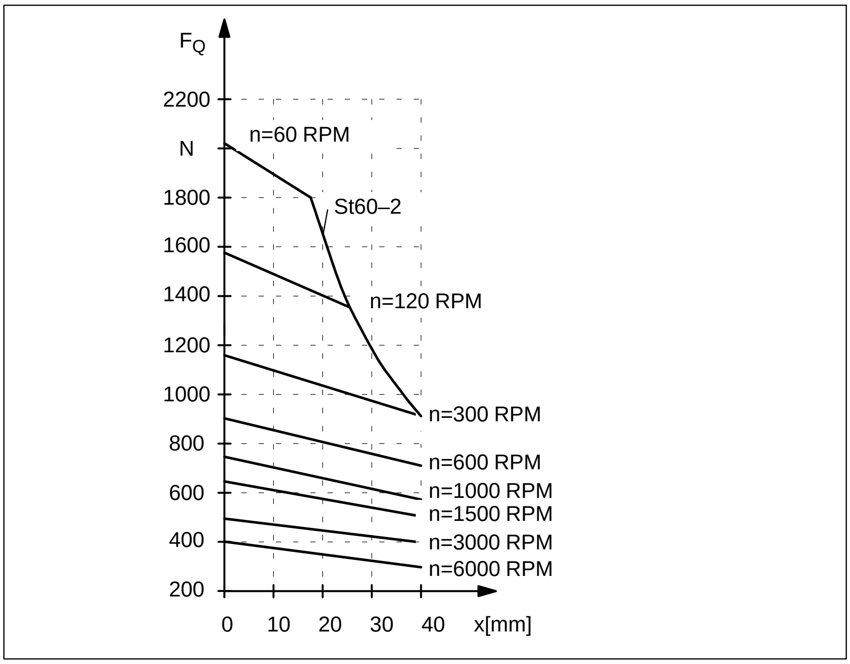
Permissible axial force as a function of the cantilever force.



3.2.2 Short motors

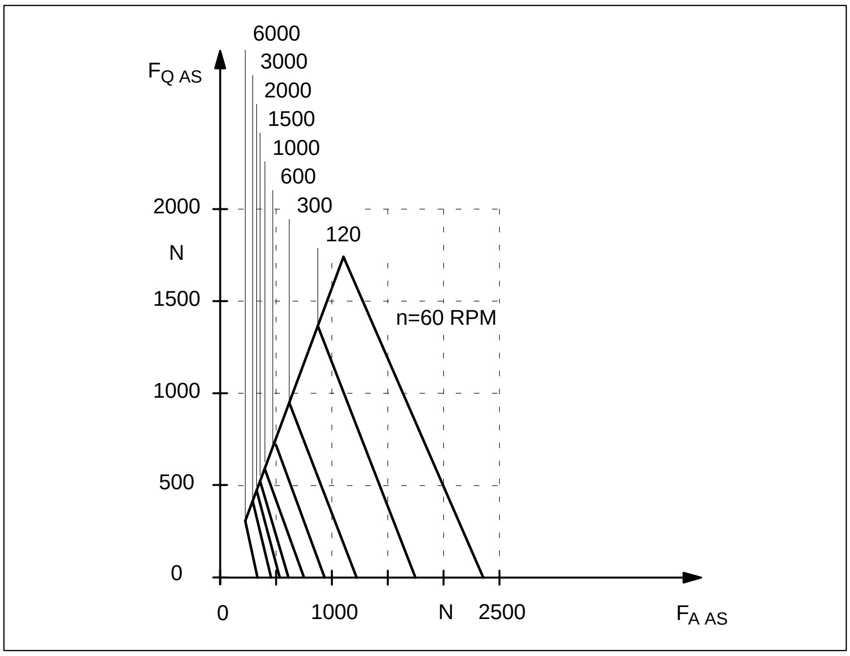
Cantilever force 1FT5070 and 1FT5071

Cantilever force F_Q at distance x from the shaft shoulder for a nominal bearing lifetime of 20,000 hours.



Axial force 1FT5070 and 1FT5071

Permissible axial force as a function of the cantilever force.



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Dimension drawings

4

Note

Siemens AG reserves the right to change motor dimensions within the scope of design improvements without prior notice. Dimension drawings can go out of date. Up–to–date dimension drawings can be requested at no charge.

Standard type of construction, basic version

Standard type of construction, optional pulse encoder mounting

Short type of construction, basic version

Short type of construction, optional pulse encoder mounting

Standard type of construction, optional working brake

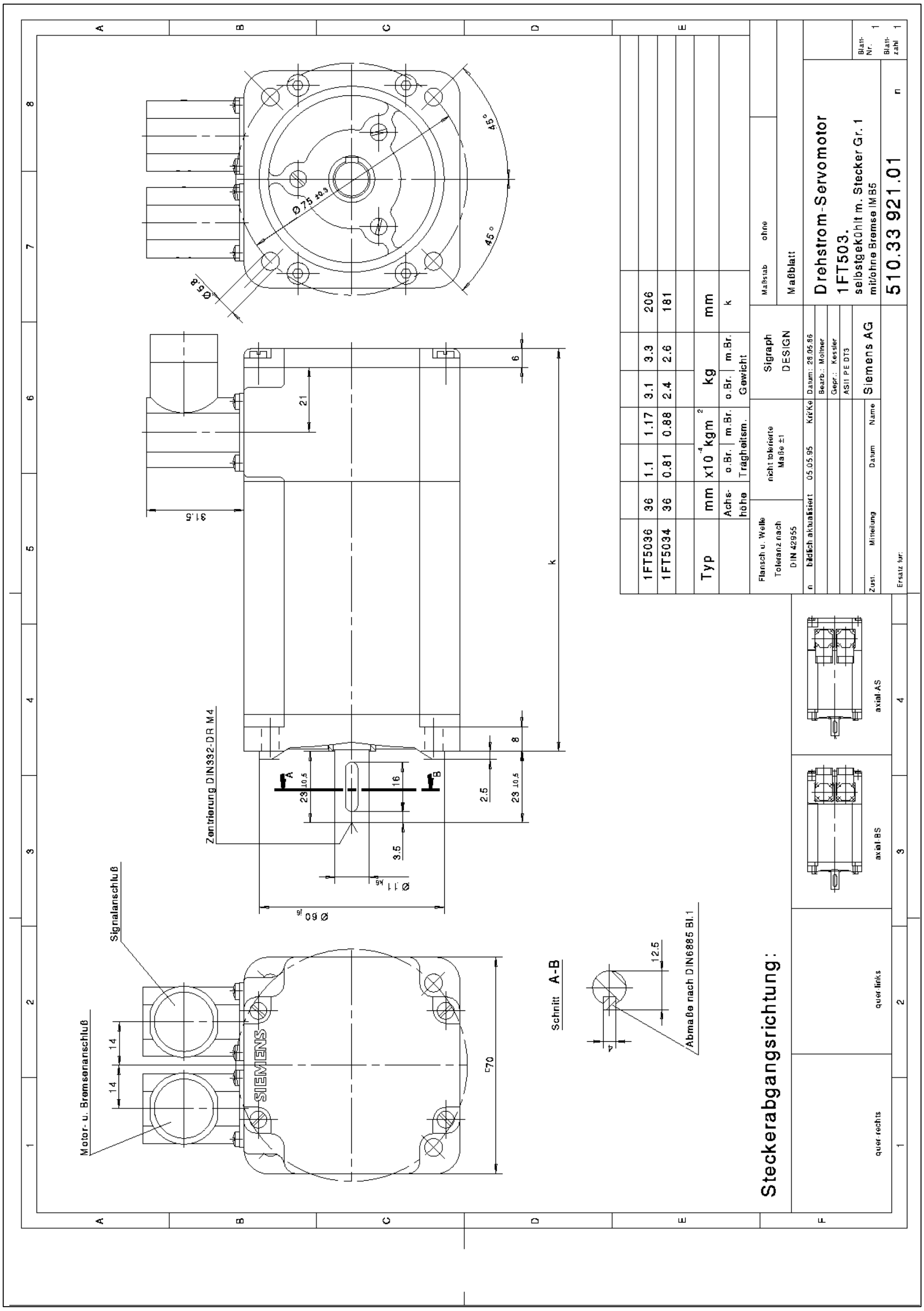


Fig. 4-1 1FT503□ non–ventilated with connector size 1

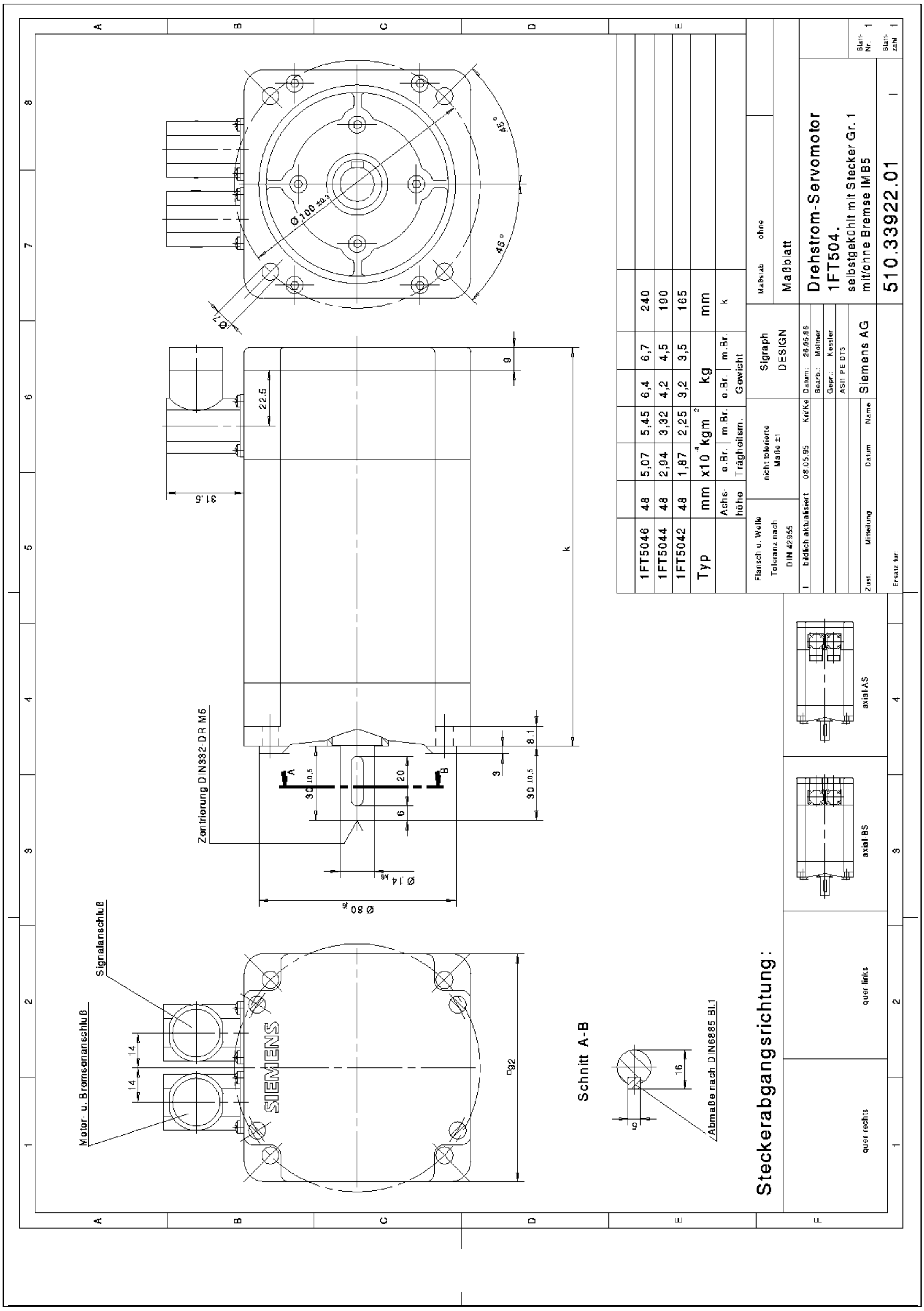


Fig. 4-2 1FT504□ non–ventilated with connector size 1

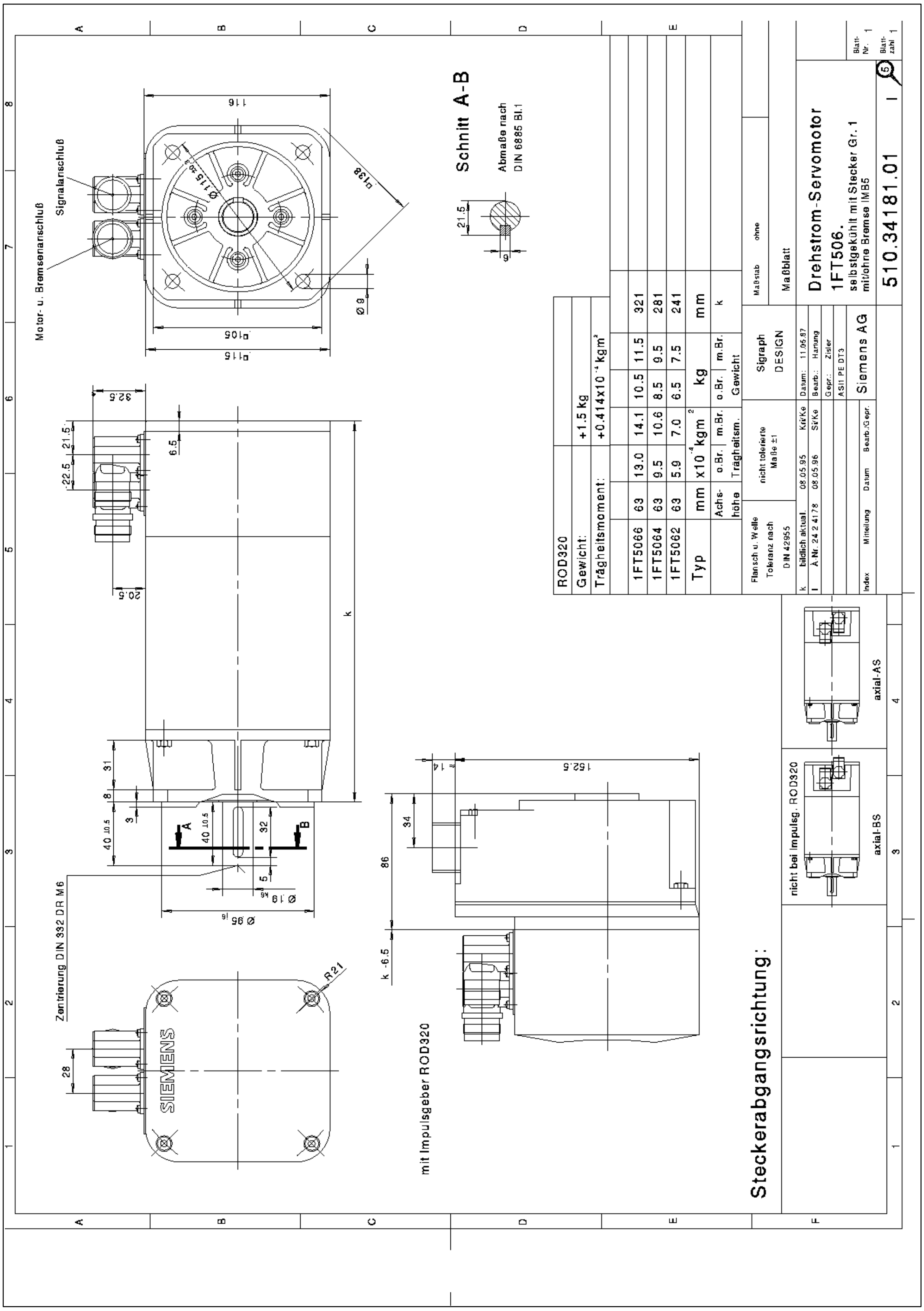
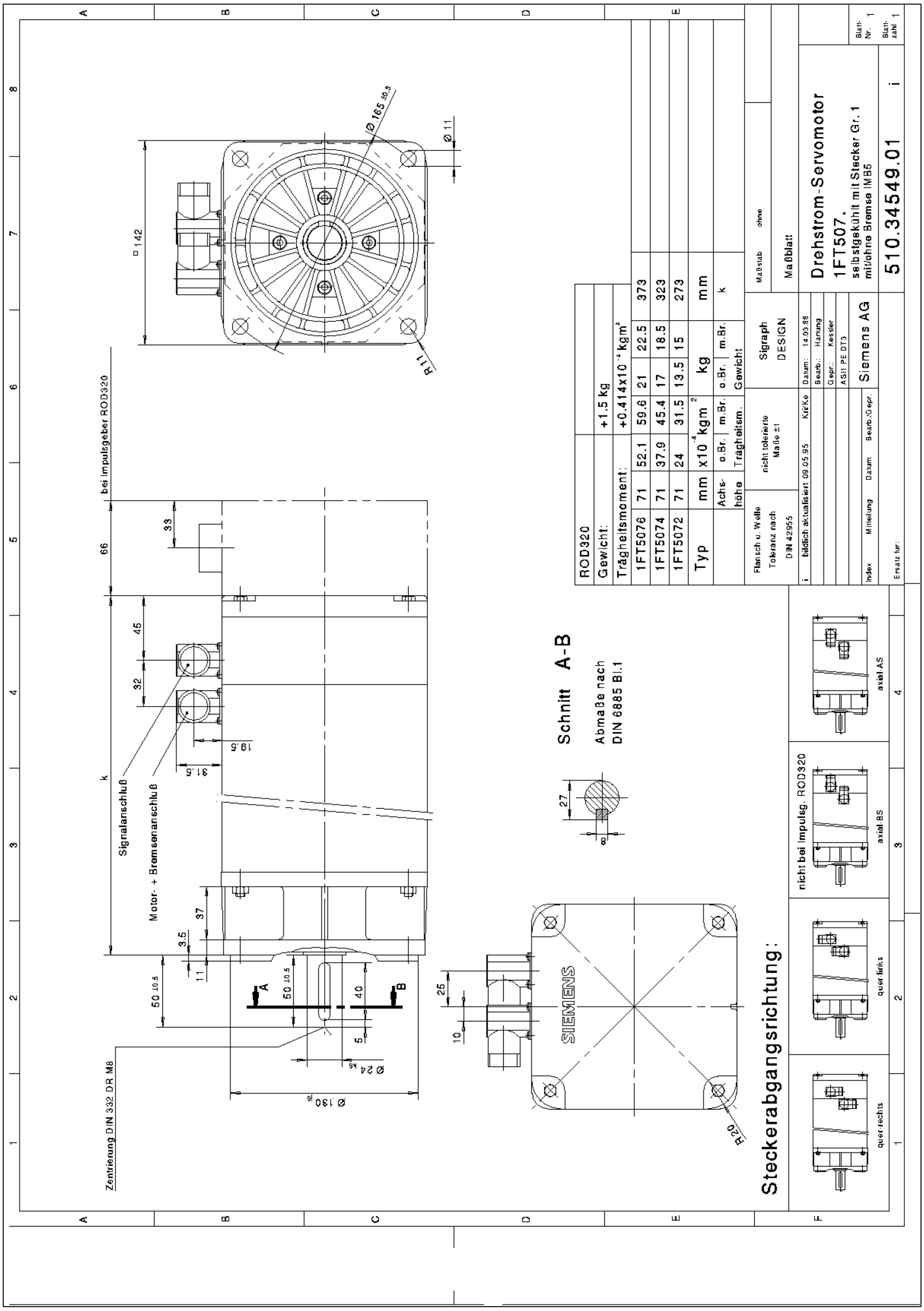
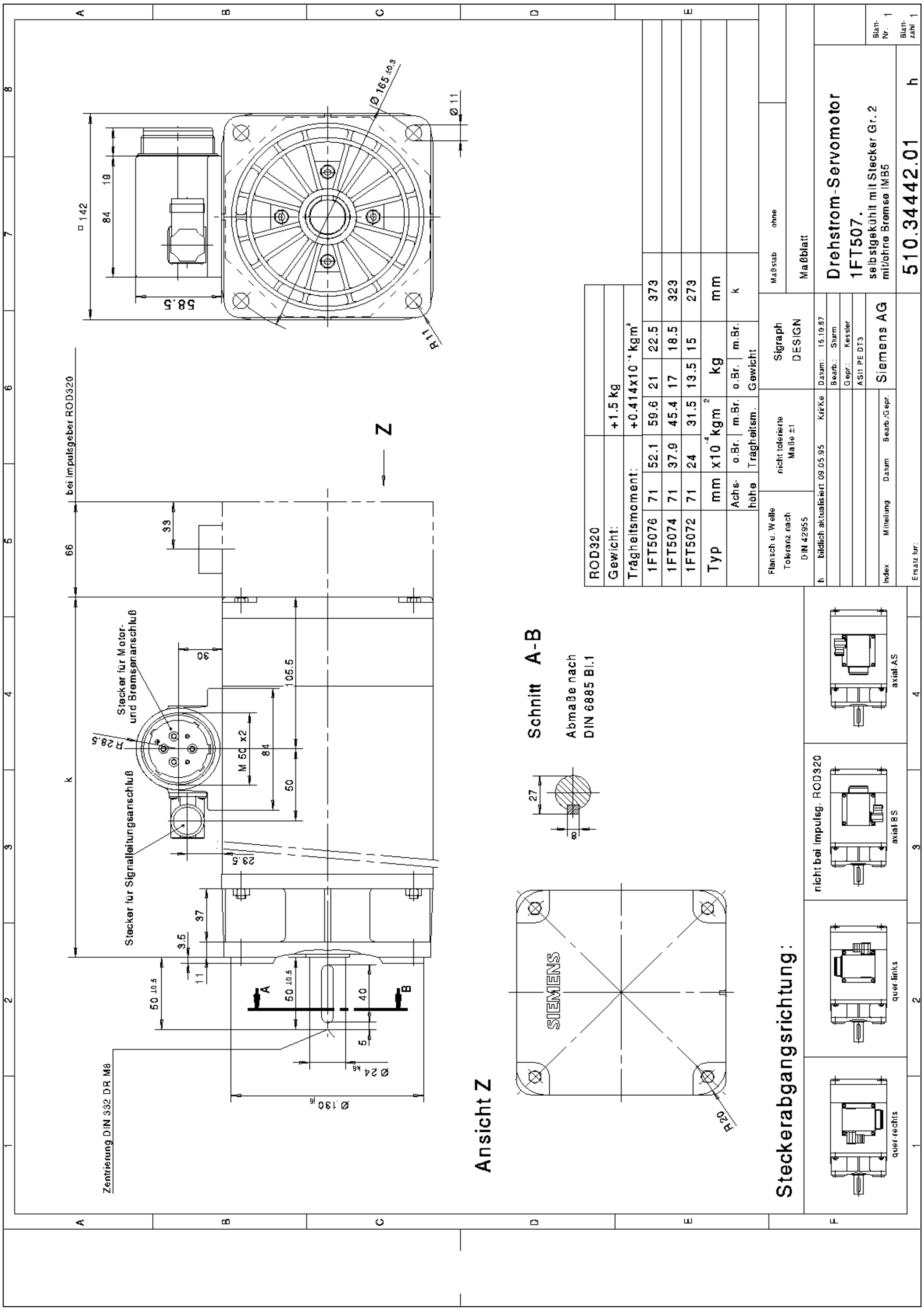


Fig. 4-3 1FT506□ non–ventilated with connector size 1



ROD320						
Gewicht:	+1.5 kg					
Trägheitsmoment:	$+0.414 \times 10^{-4}$ kgm²					
1FT5076	71	52.1	59.6	21	22.5	373
1FT5074	71	37.9	45.4	17	18.5	323
1FT5072	71	24	31.5	13.5	15	273
Typ	mm	$\times 10^{-4}$ kgm²		kg		mm
	Achs-höhe	o.Br.	m.Br.	o.Br.	m.Br.	k
		Trägheitsm.		Gewicht		

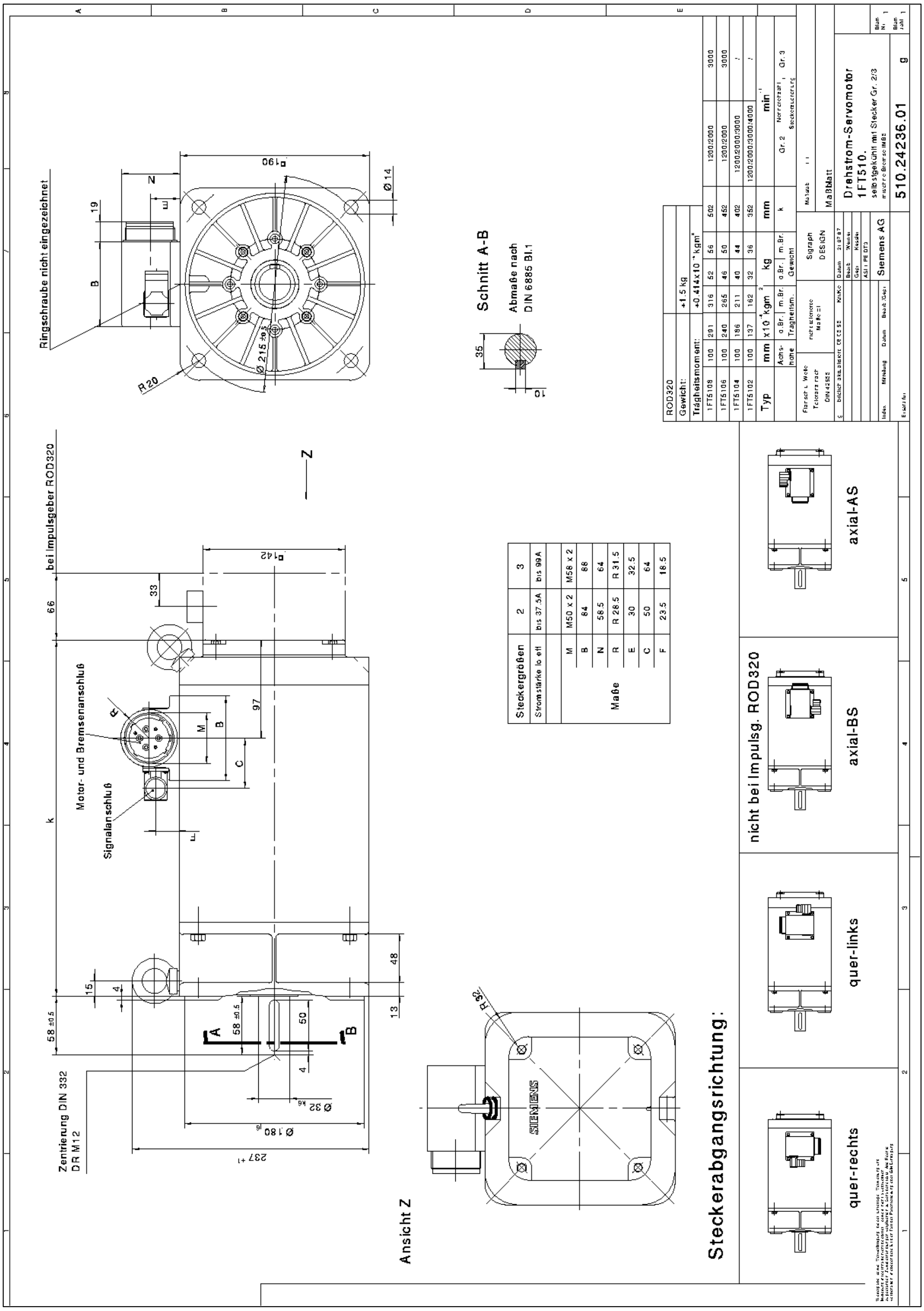
Fig. 4-4 1FT507□ non–ventilated with connector size 1



ROD320
Gewicht: +1.5 kg
Trägheitsmoment: +0.414x10^{-4} kgm^2

Typ	Achshöhe mm	Trägheitsm. x10^{-4} kgm^2 o.Br.	Trägheitsm. x10^{-4} kgm^2 m.Br.	Gewicht kg o.Br.	Gewicht kg m.Br.	k mm
1FT5076	71	52.1	59.6	21	22.5	373
1FT5074	71	37.9	45.4	17	18.5	323
1FT5072	71	24	31.5	13.5	15	273

Fig. 4-5 1FT507□ non–ventilated with connector size 2

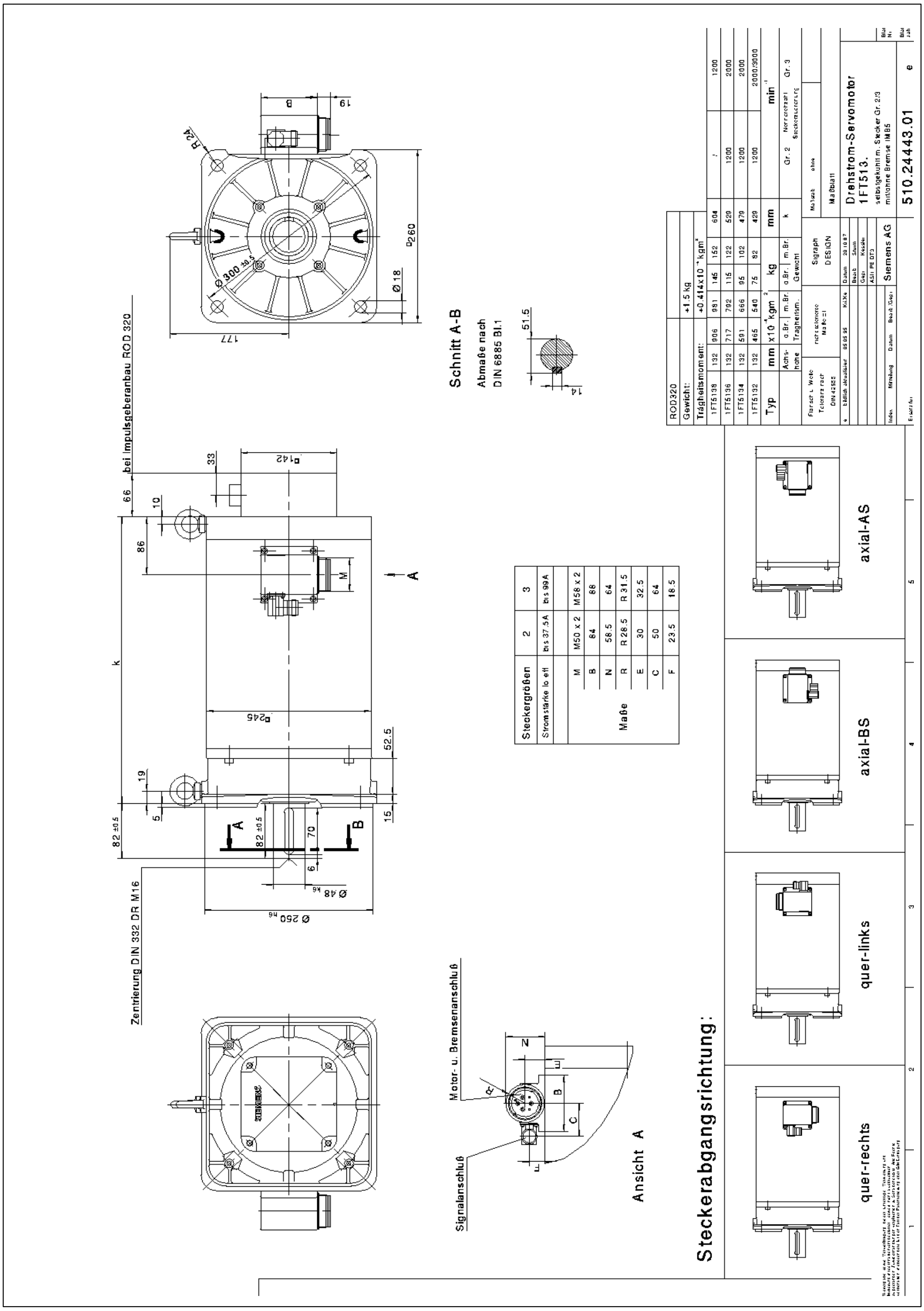


Steckergrößen		2	3
Stromstärke Io eff		bis 37.5A	bis 99A
Maße	M	M50 x 2	M58 x 2
	B	84	88
	N	58.5	64
	R	R 28.5	R 31.5
	E	30	32.5
	C	50	64
	F	23.5	18.5

ROD320
Gewicht: +1.5 kg
Trägheitsmoment: +0.414x10^{-4} kgm^2

Typ	Achshöhe	Trägheitsm. o.Br.	Trägheitsm. m.Br.	Gewicht o.Br.	Gewicht m.Br.	k	Gr. 2	Gr. 3
	mm	x10^{-4} kgm^2		kg		mm	min^{-1}	
1FT5108	100	291	316	52	56	502	1200/2000	3000
1FT5106	100	240	265	46	50	452	1200/2000	3000
1FT5104	100	186	211	40	44	402	1200/2000/3000	/
1FT5102	100	137	162	32	36	352	1200/2000/3000/4000	/

Fig. 4-6 1FT510□ non–ventilated with connector size 2/3

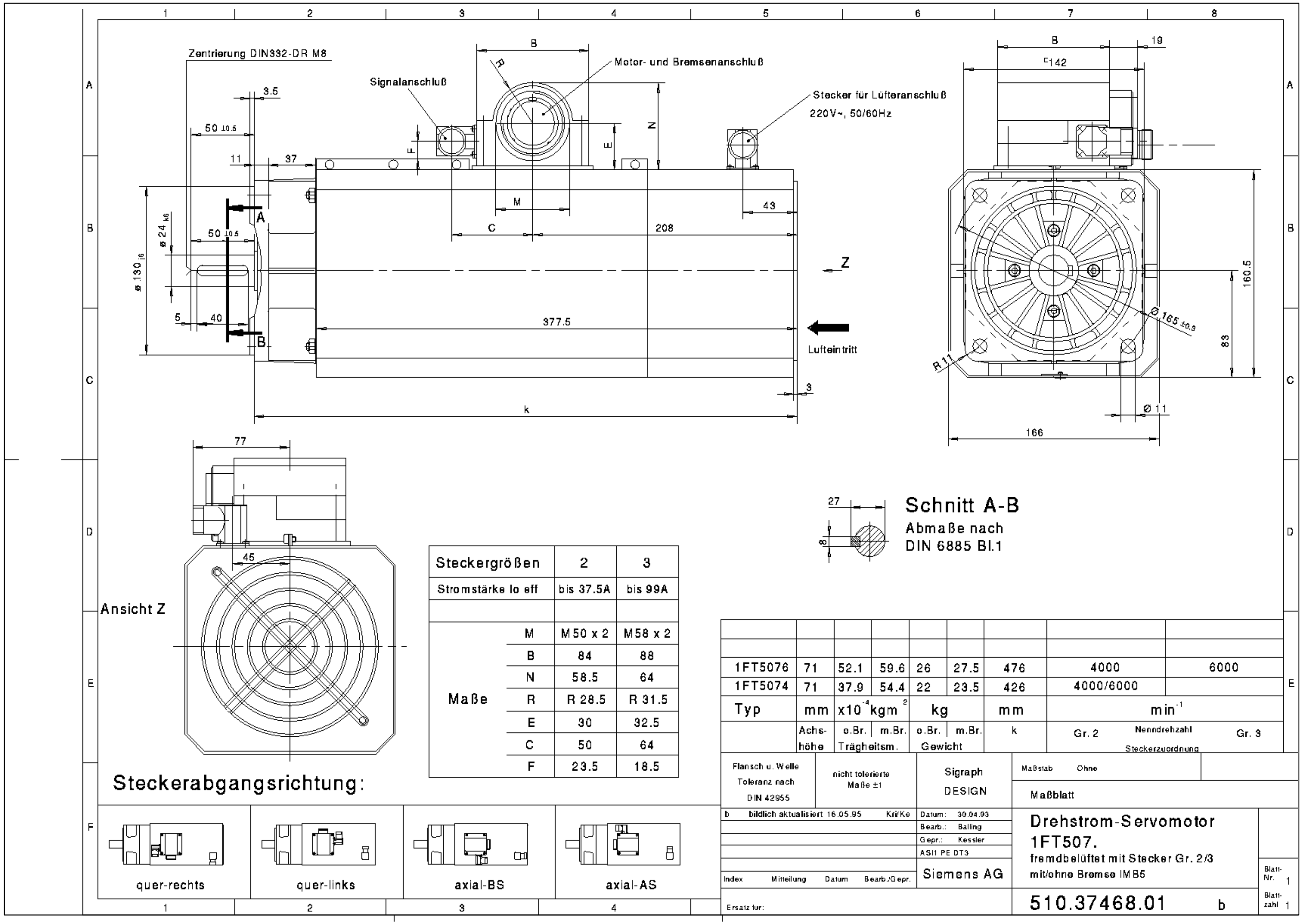


Steckergrößen	2	3
Stromstärke Io eff	bis 37.5A	bis 99A
Maße M	M50 x 2	M58 x 2
B	84	88
N	58.5	64
R	R 28.5	R 31.5
E	30	32.5
C	50	64
F	23.5	18.5

ROD320
Gewicht: +1.5 kg
Trägheitsmoment: +0.414x10⁻⁴ kgm²

Typ	Achshöhe mm	o.Br. Trägheitsm. x10⁻⁴ kgm²	m.Br. Trägheitsm. x10⁻⁴ kgm²	o.Br. Gewicht kg	m.Br. Gewicht kg	k mm	Gr. 2 Nenndrehzahl min⁻¹	Gr. 3 Nenndrehzahl min⁻¹
1FT5138	132	906	981	145	152	604	/	1200
1FT5136	132	717	792	115	122	529	1200	2000
1FT5134	132	591	666	95	102	479	1200	2000
1FT5132	132	465	540	75	82	429	1200	2000;3000

Fig. 4-7 1FT513□ non–ventilated with connector size 2/3



Steckergrößen		2	3
Stromstärke Io eff		bis 37.5A	bis 99A
Maße	M	M50 x 2	M58 x 2
	B	84	88
	N	58.5	64
	R	R 28.5	R 31.5
	E	30	32.5
	C	50	64
	F	23.5	18.5

Typ	Achshöhe	Trägheitsm. o.Br.	Trägheitsm. m.Br.	Gewicht o.Br.	Gewicht m.Br.	k	Nenndrehzahl Steckerzuordnung Gr. 2	Nenndrehzahl Steckerzuordnung Gr. 3
	mm	x10						
1FT5076	71	52.1	59.6	26	27.5	476	4000	6000
1FT5074	71	37.9	54.4	22	23.5	426	4000/6000	

Flansch u. Welle Toleranz nach DIN 42955

nicht tolerierte Maße ±1

Sigraph DESIGN

Maßstab Ohne

Maßblatt

b bildlich aktualisiert 16.05.95 Kri/Ke

Index Mitteilung Datum Bearb./Gepr.

Datum: 30.04.93
Bearb.: Balling
Gepr.: Kessler
ASI1 PE DT3

Siemens AG

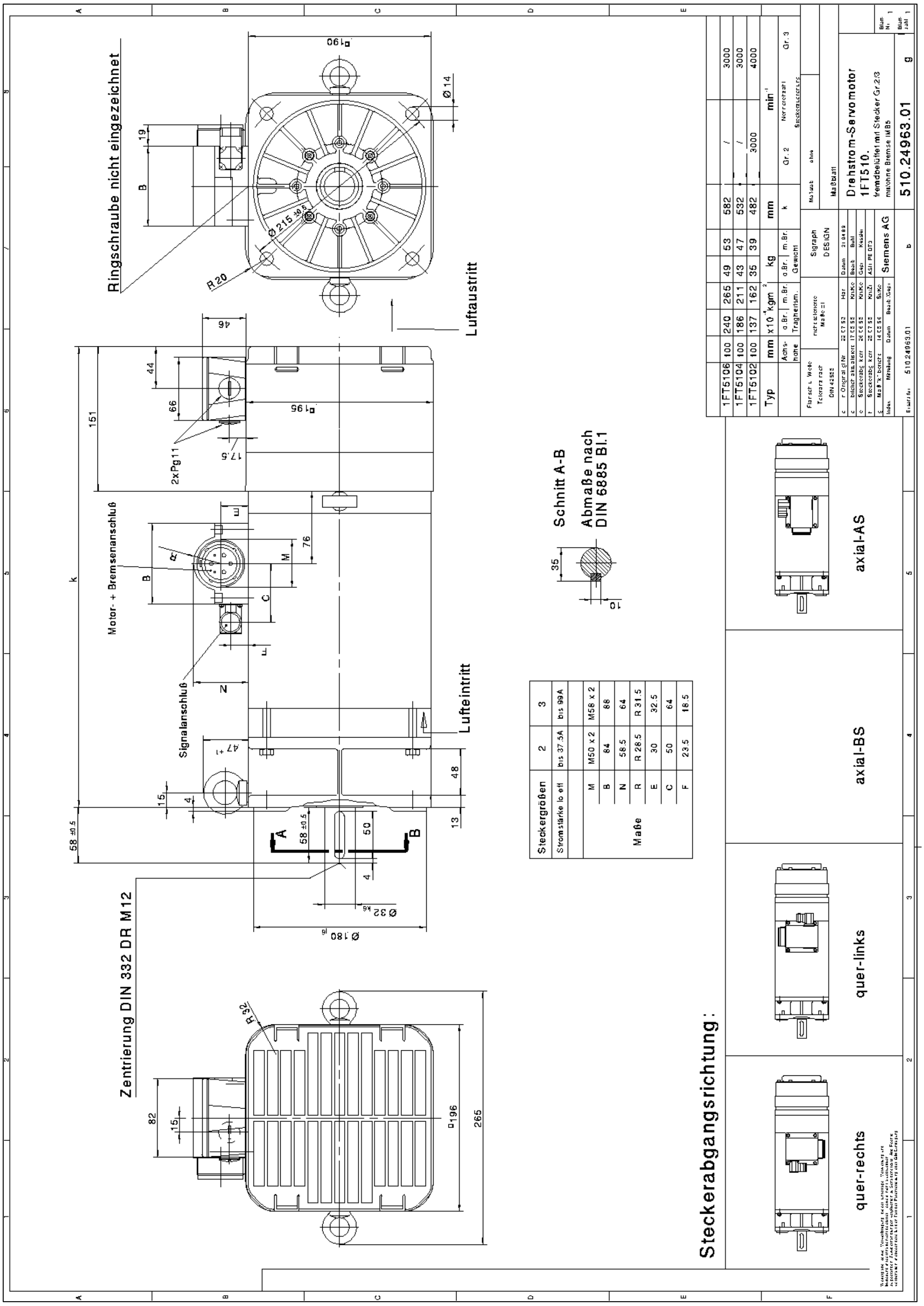
Drehstrom-Servomotor
1FT507.
fremdbelüftet mit Stecker Gr. 2/3
mit/ohne Bremse IMB5

Ersatz für:

510.37468.01 b

Blatt-Nr. 1
Blatt-zahl 1

Fig. 4-8 1FT507□ force–ventilated with connector size 2/3



Typ	Achshöhe mm	Trägheitsm. o.Br. $x10^{-4}$ kgm²	Trägheitsm. m.Br. $x10^{-4}$ kgm²	Gewicht o.Br. kg	Gewicht m.Br. kg	k mm	Nenndrehzahl Steckergröße Gr. 2 min⁻¹	Nenndrehzahl Steckergröße Gr. 3 min⁻¹
1FT5106	100	240	265	49	53	582	/	3000
1FT5104	100	186	211	43	47	532	/	3000
1FT5102	100	137	162	35	39	482	3000	4000

Steckergrößen		2	3
Stromstärke Io eff		bis 37.5A	bis 99A
Maße	M	M50 x 2	M58 x 2
	B	84	88
	N	58.5	64
	R	R 28.5	R 31.5
	E	30	32.5
	C	50	64
	F	23.5	18.5

Fig. 4-9 1FT510□ force–ventilated with connector size 2/3

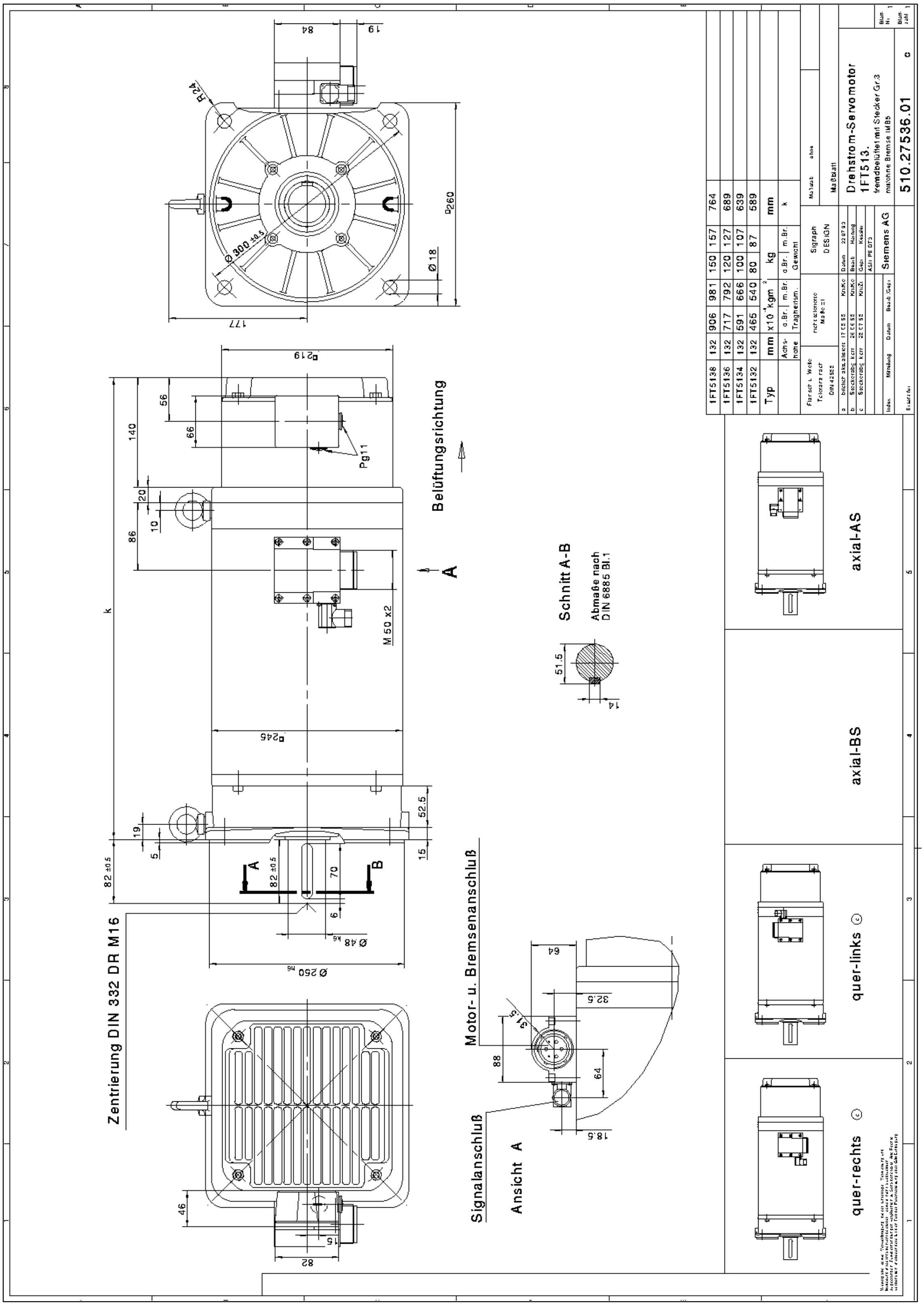


Fig. 4-10 1FT513□ force–ventilated with connector size 2/3

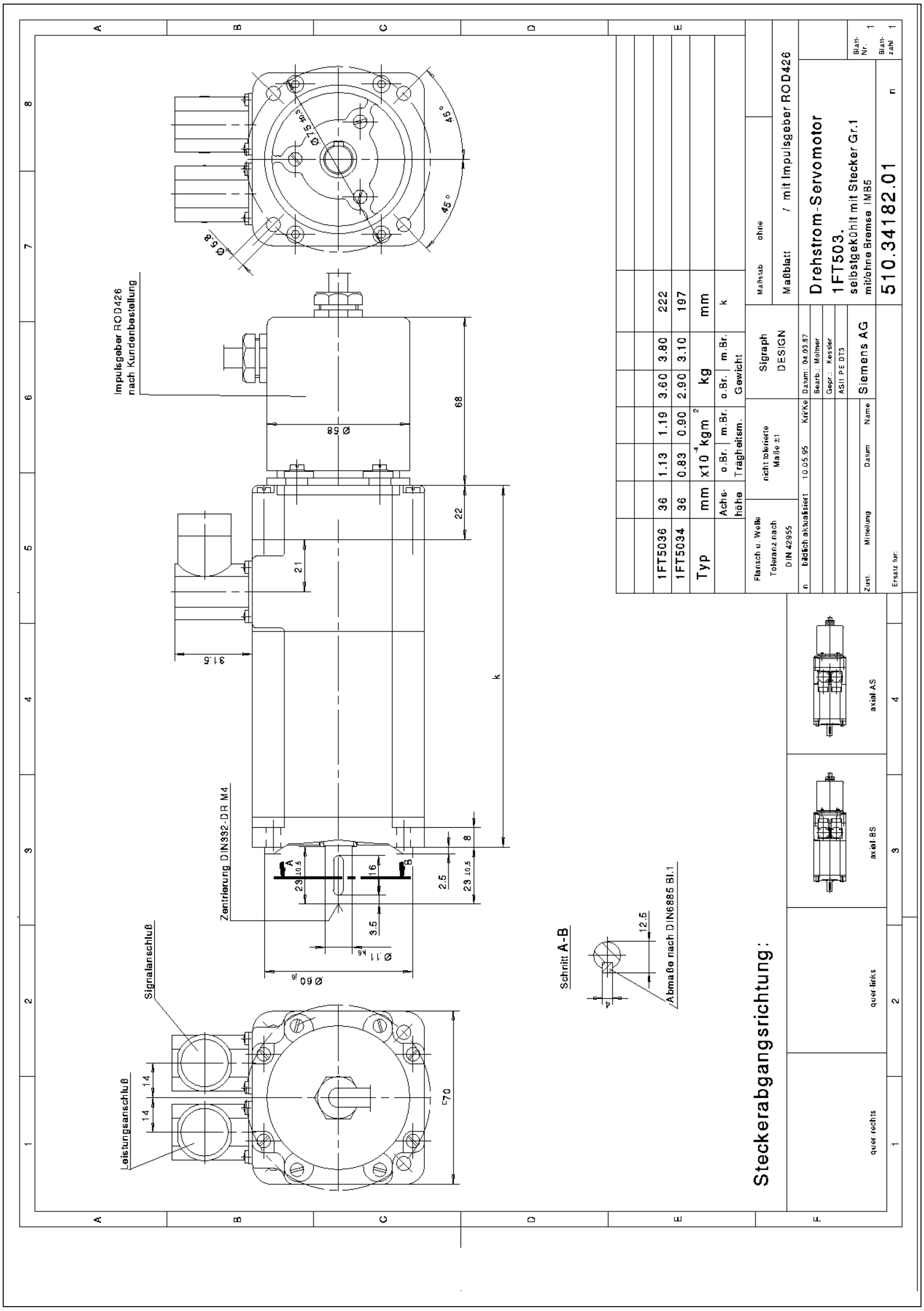
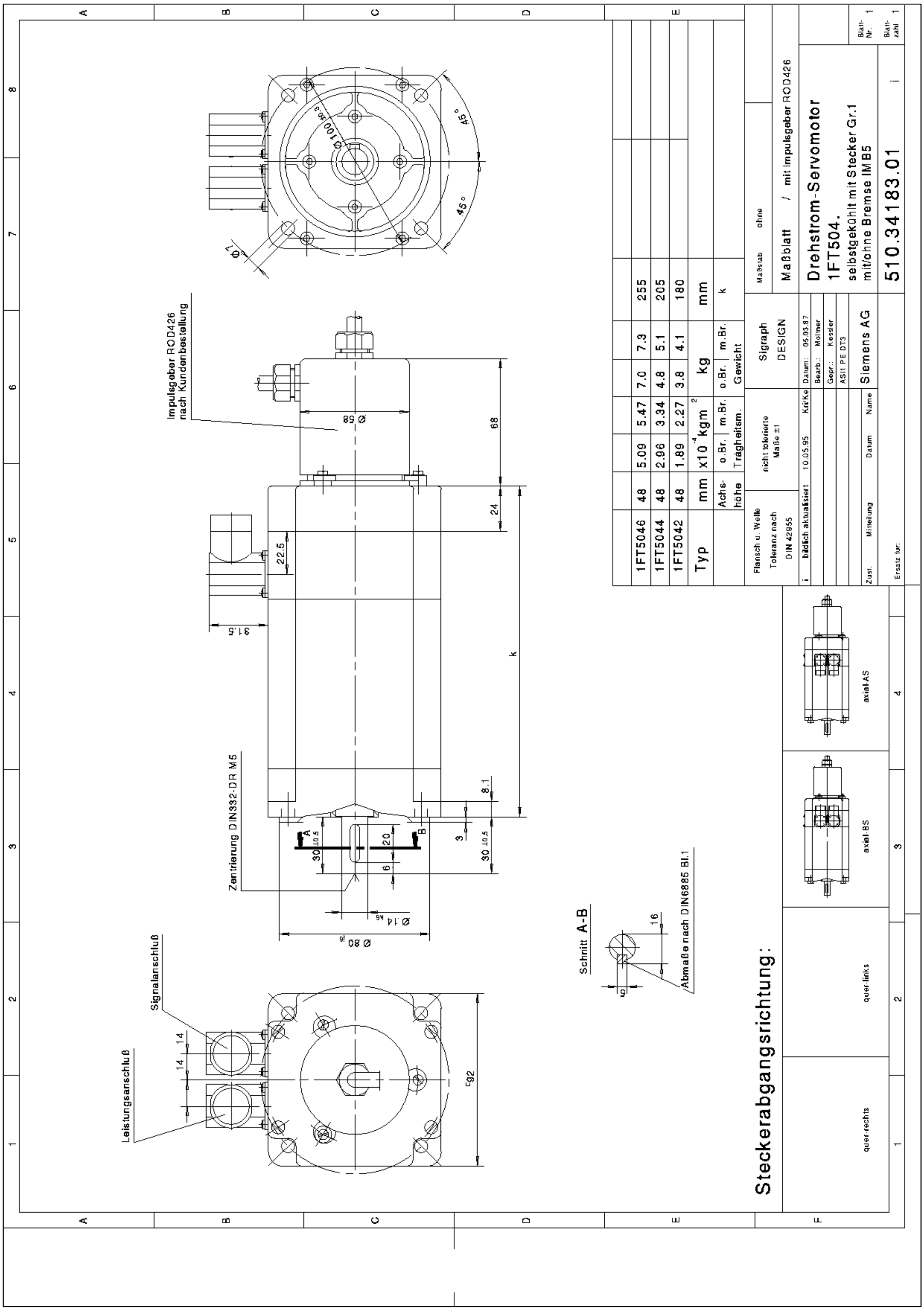
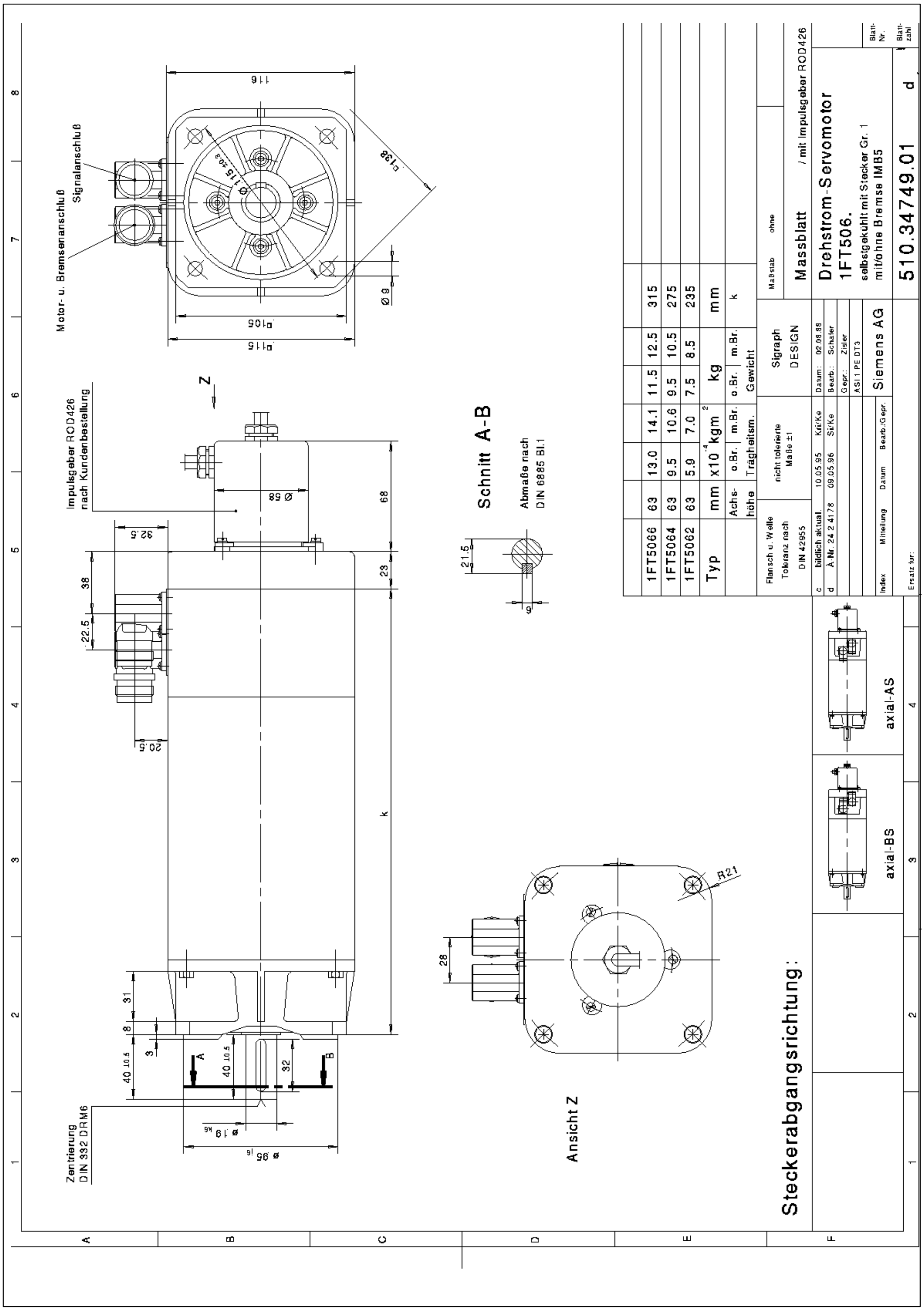


Fig. 4-11 1FT503□ non–ventilated with connector size 1



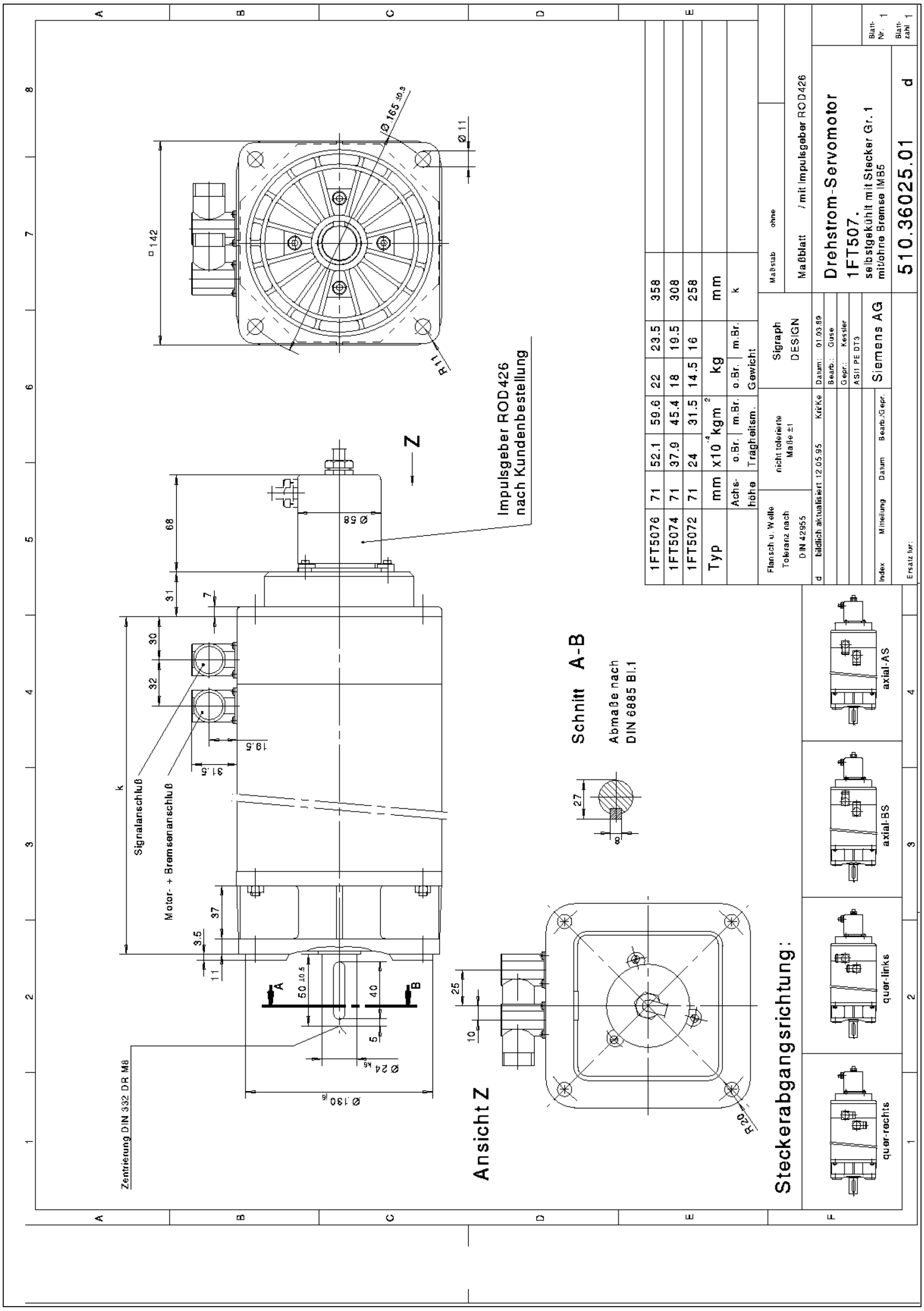
Typ	Achshöhe	Trägheitsm. o.Br.	Trägheitsm. m.Br.	Gewicht o.Br.	Gewicht m.Br.	k
	mm	$x10^{-4} kgm^2$		kg		mm
1FT5046	48	5.09	5.47	7.0	7.3	255
1FT5044	48	2.96	3.34	4.8	5.1	205
1FT5042	48	1.89	2.27	3.8	4.1	180

Fig. 4-12 1FT504□ non–ventilated with connector size 1



Typ	Achshöhe mm	Trägheitsm. $x10^{-4}$ kgm^2 o.Br.	Trägheitsm. $x10^{-4}$ kgm^2 m.Br.	Gewicht kg o.Br.	Gewicht kg m.Br.	k mm
1FT5066	63	13.0	14.1	11.5	12.5	315
1FT5064	63	9.5	10.6	9.5	10.5	275
1FT5062	63	5.9	7.0	7.5	8.5	235

Fig. 4-13 1FT506□ non–ventilated with connector size 1



Typ	Achs-höhe mm	Trägheitsm. x10^{-4} kgm^2 o.Br.	Trägheitsm. x10^{-4} kgm^2 m.Br.	Gewicht kg o.Br.	Gewicht kg m.Br.	k mm
1FT5076	71	52.1	59.6	22	23.5	358
1FT5074	71	37.9	45.4	18	19.5	308
1FT5072	71	24	31.5	14.5	16	258

Fig. 4-14 1FT507□ non–ventilated with connector size 1

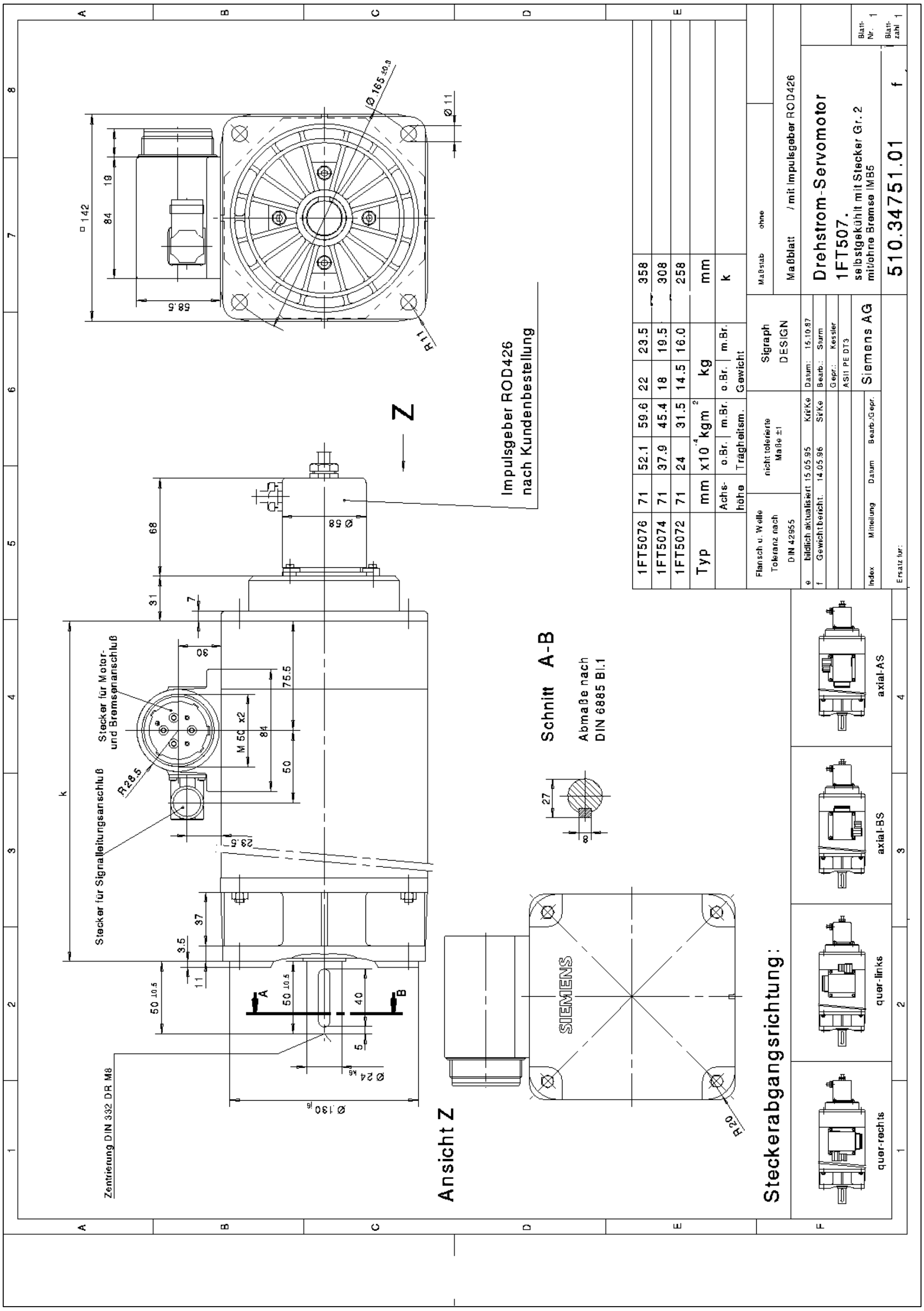
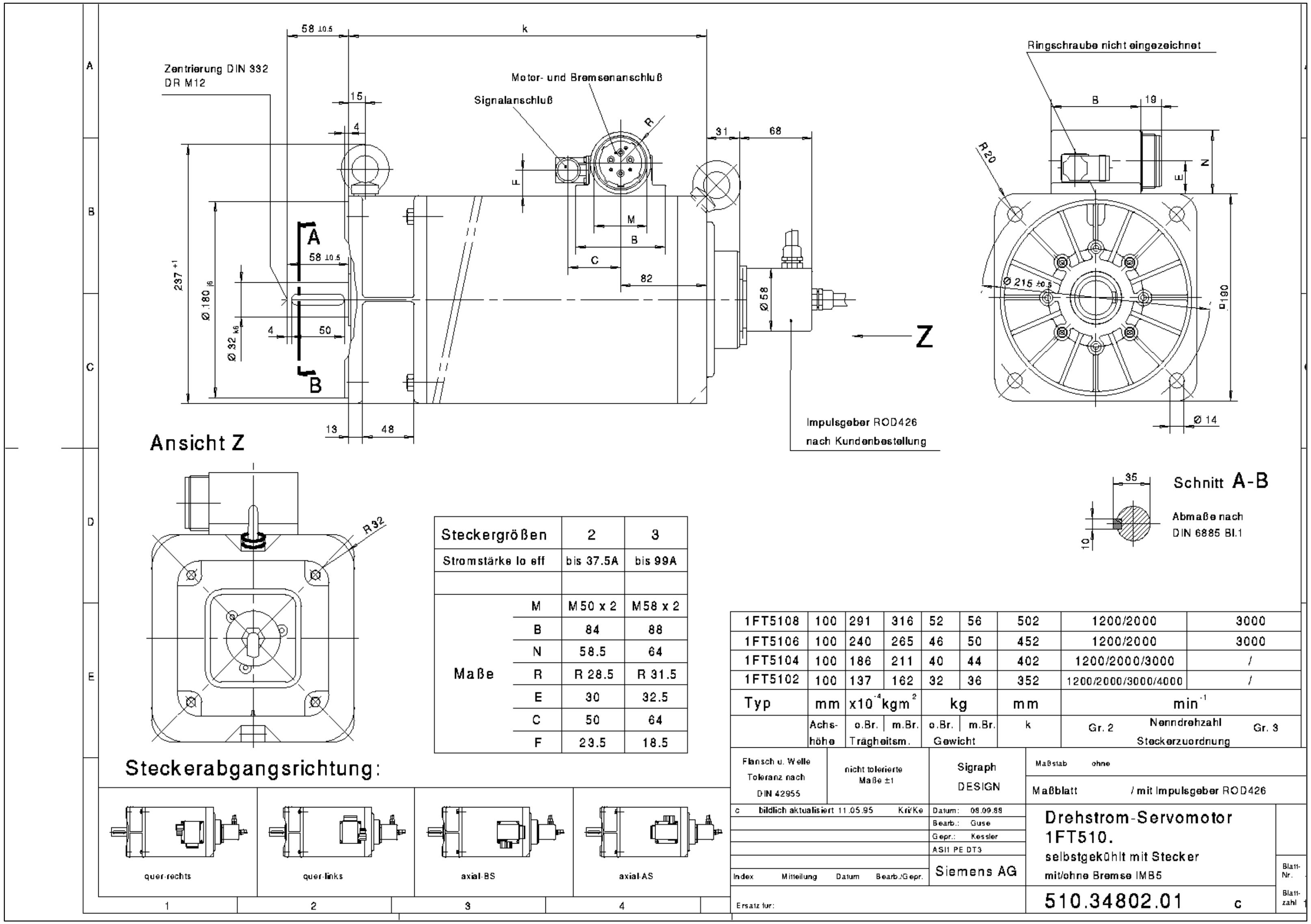


Fig. 4-15 1FT507□ non–ventilated with connector size 2



Steckergrößen		2	3
Stromstärke Io eff		bis 37.5A	bis 99A
Maße	M	M50 x 2	M58 x 2
	B	84	88
	N	58.5	64
	R	R 28.5	R 31.5
	E	30	32.5
	C	50	64
	F	23.5	18.5

Typ	Achshöhe	Trägheitsm. o.Br.	Trägheitsm. m.Br.	Gewicht o.Br.	Gewicht m.Br.	k	Nenndrehzahl Steckerzuordnung Gr. 2	Nenndrehzahl Steckerzuordnung Gr. 3
	mm	$x10^{-4} kgm^2$		kg		mm	min^{-1}	
1FT5108	100	291	316	52	56	502	1200/2000	3000
1FT5106	100	240	265	46	50	452	1200/2000	3000
1FT5104	100	186	211	40	44	402	1200/2000/3000	/
1FT5102	100	137	162	32	36	352	1200/2000/3000/4000	/

Fig. 4-16 1FT510□ non–ventilated with connector

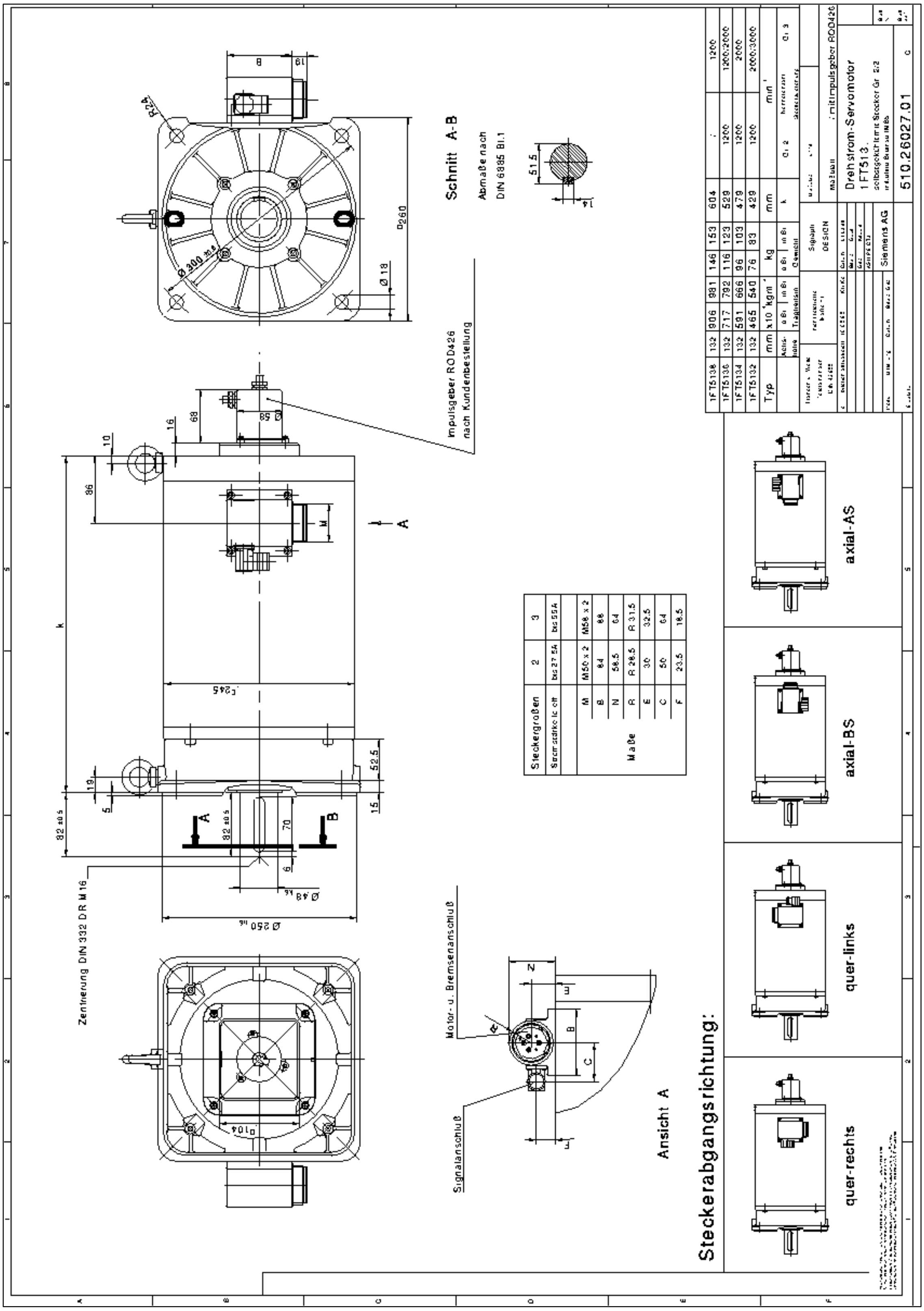
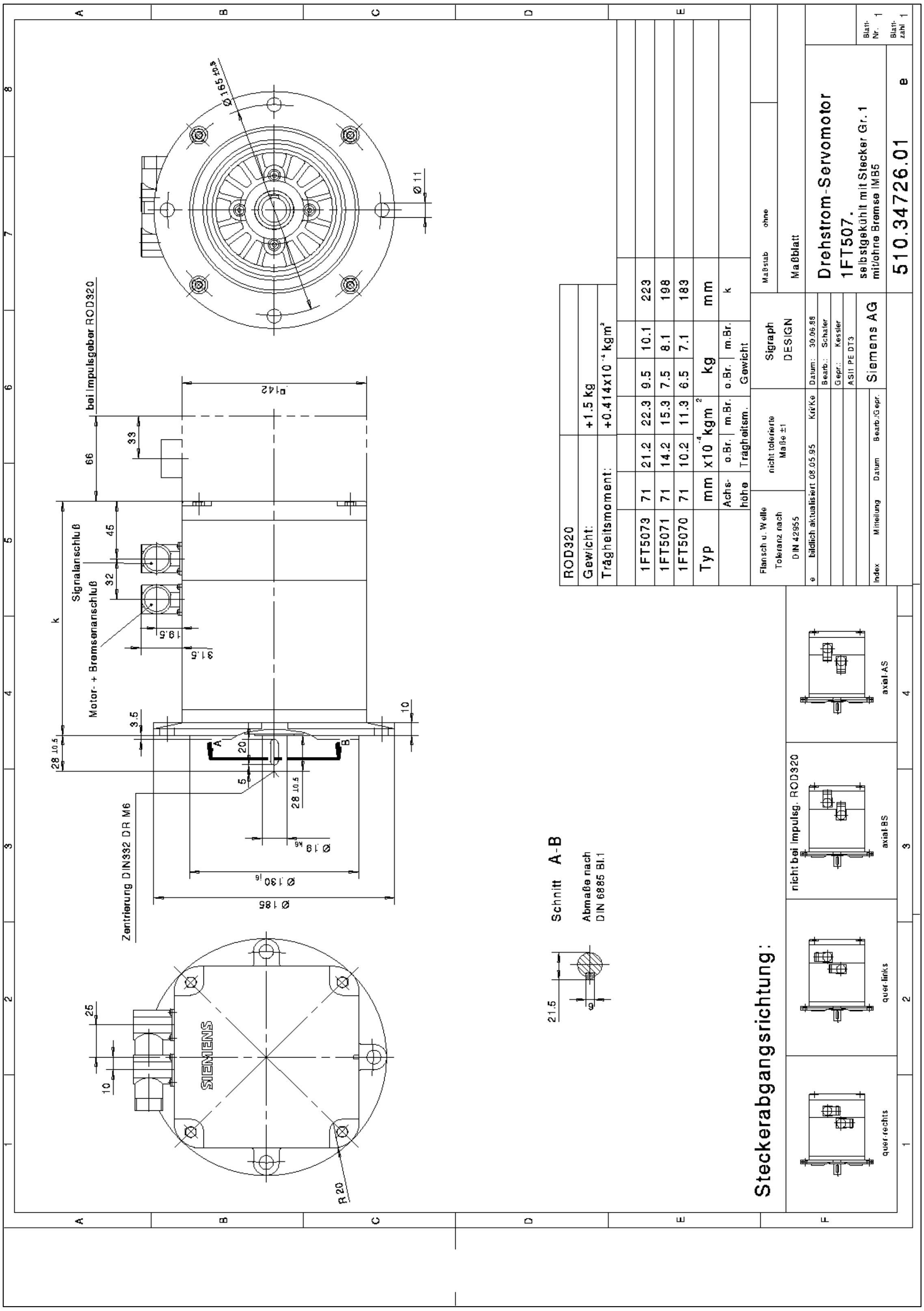


Fig. 4-17 1FT513☐ non–ventilated with connector size 2/3



ROD320						
Gewicht:			+1.5 kg			
Trägheitsmoment:			$+0.414 \times 10^{-4}$ kgm²			
1FT5073	71	21.2	22.3	9.5	10.1	223
1FT5071	71	14.2	15.3	7.5	8.1	198
1FT5070	71	10.2	11.3	6.5	7.1	183
Typ	mm	$\times 10^{-4}$ kgm²		kg		mm
	Achshöhe	o.Br.	m.Br.	o.Br.	m.Br.	k
		Trägheitsm.		Gewicht		

Fig. 4-18 1FT507□ non–ventilated with connector size 1

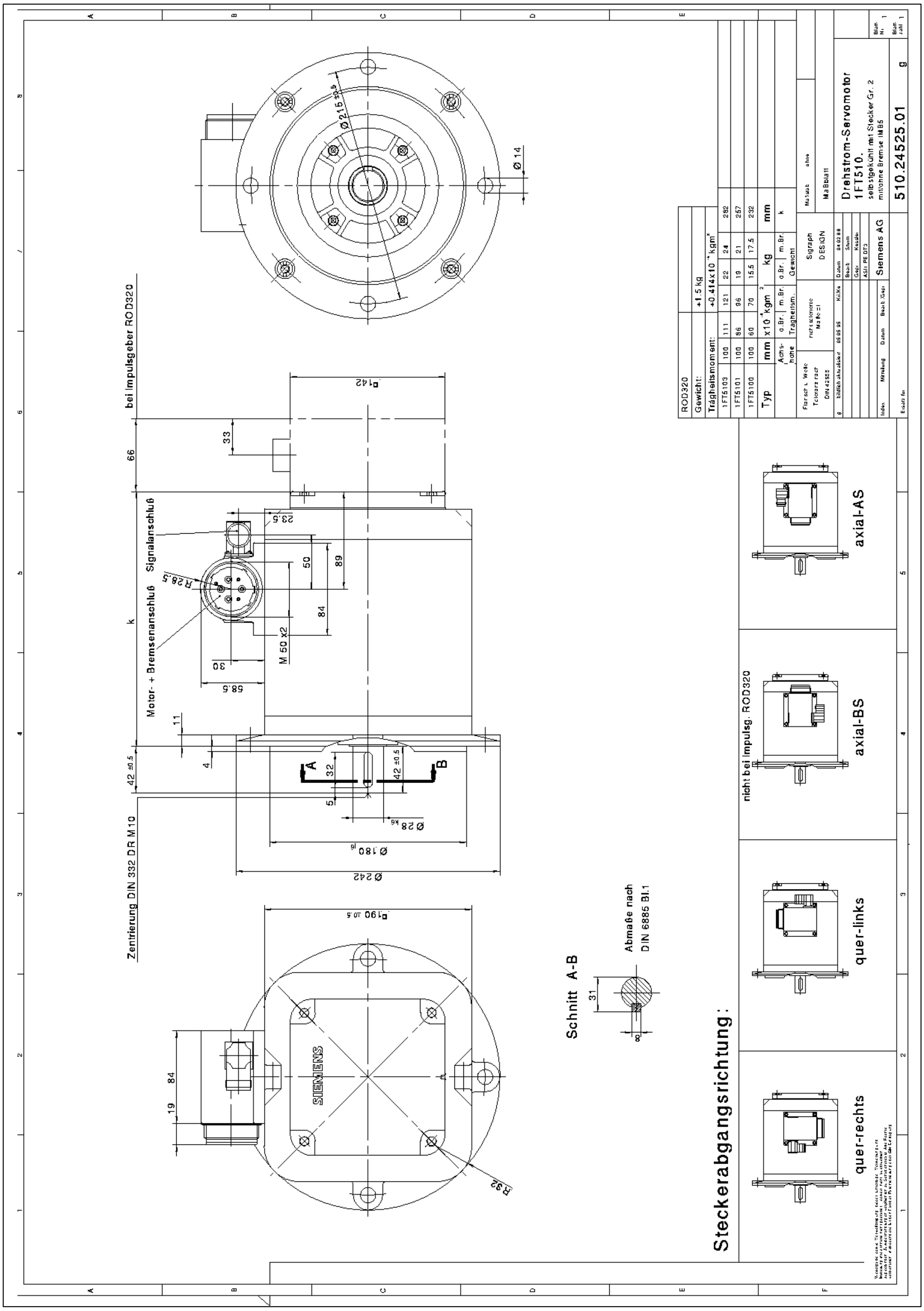
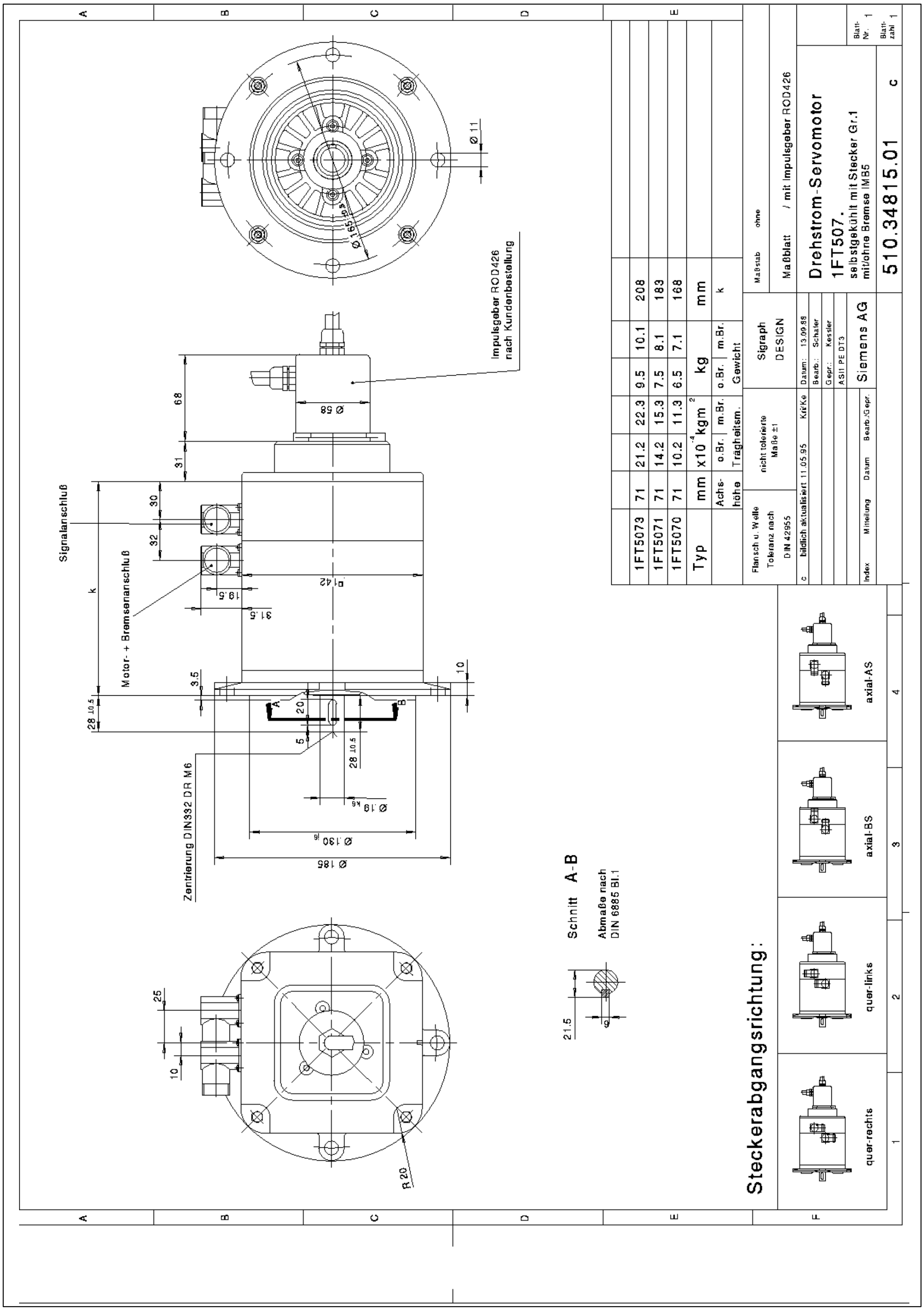


Fig. 4-19 1FT510□ non–ventilated with connector size 2



Typ	Achshöhe	Trägheitsm. o.Br.	Trägheitsm. m.Br.	Gewicht o.Br.	Gewicht m.Br.	k
	mm	$x10^{-4}$ kgm^2		kg		mm
1FT5073	71	21.2	22.3	9.5	10.1	208
1FT5071	71	14.2	15.3	7.5	8.1	183
1FT5070	71	10.2	11.3	6.5	7.1	168

Flansch u. Welle Toleranz nach DIN 42955
nicht tolerierte Maße ±1
Sigraph DESIGN
Maßstab ohne
Maßblatt / mit Impulsgeber ROD426
Datum: 13.09.88
Bearb.: Schafer
Gepr.: Kessler
ASI1 PE DT3
Siemens AG
Drehstrom-Servomotor
1FT507.
selbstgekühlt mit Stecker Gr.1
mit/ohne Bremse IMB5
510.34815.01 c
Blatt-Nr. 1
Blatt-zahl 1
c bildlich aktualisiert 11.05.95 Kri/Ke
Index Mitteilung Datum Bearb./Gepr.

Fig. 4-20 1FT507□ non–ventilated with connector size 1

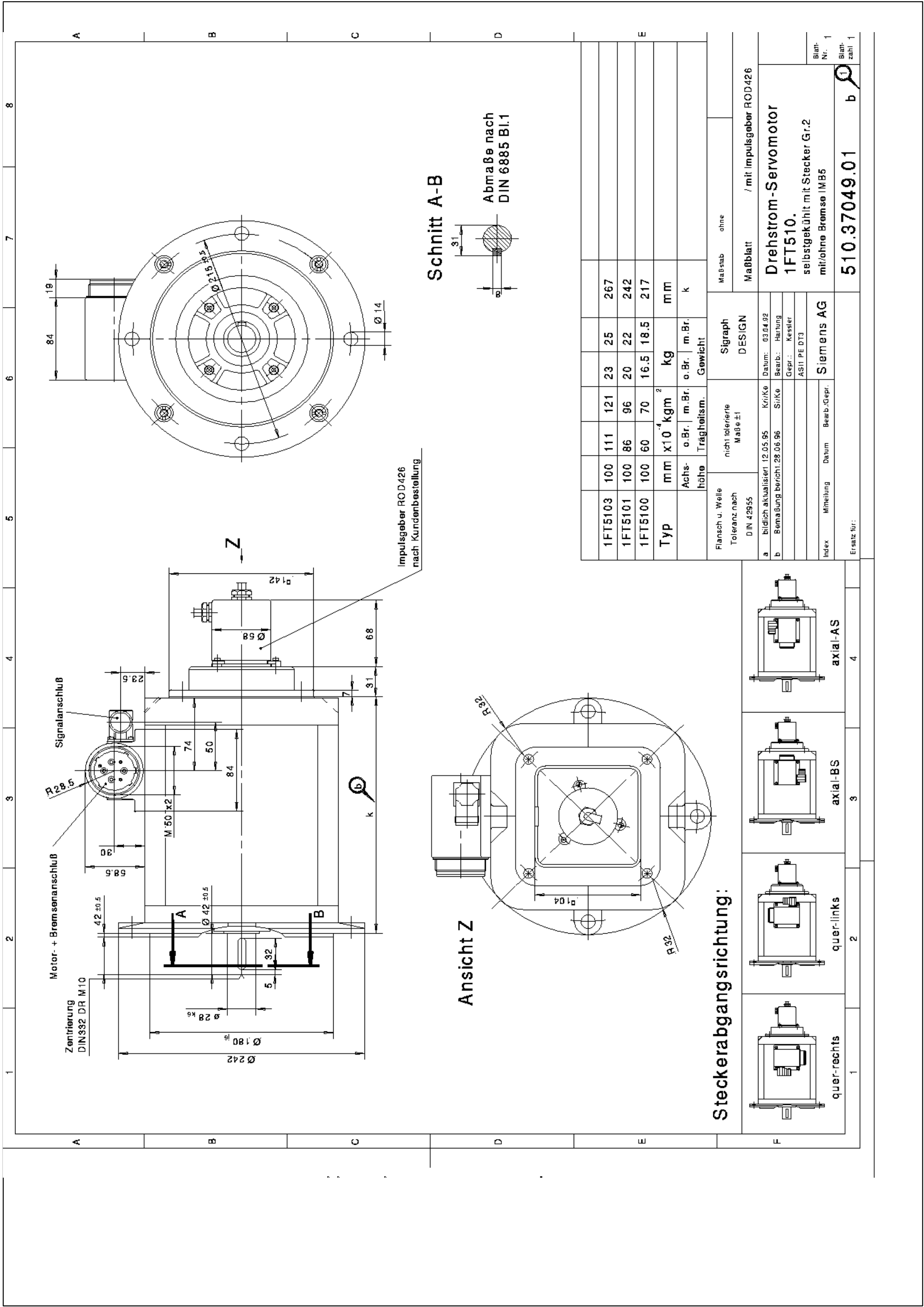
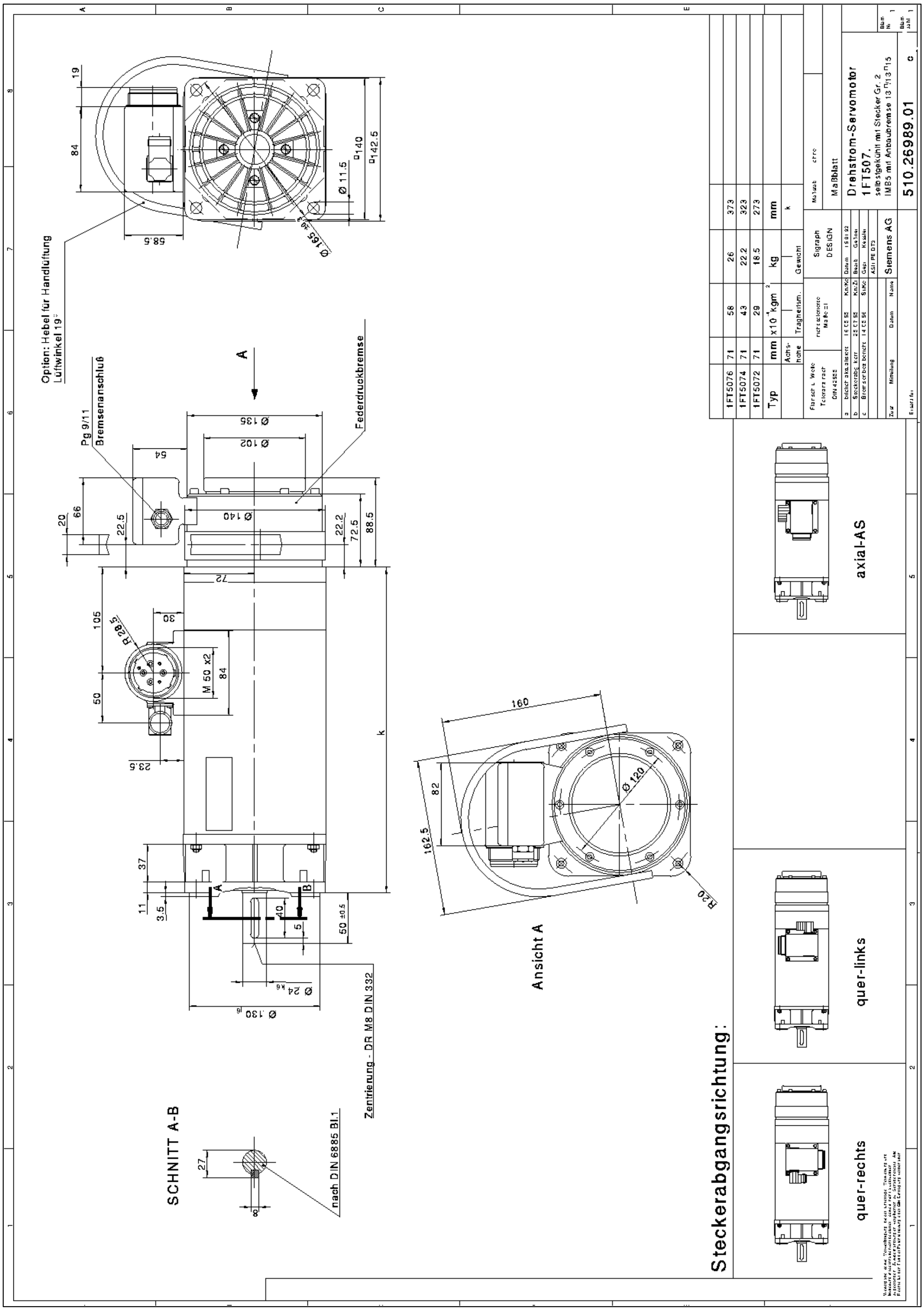
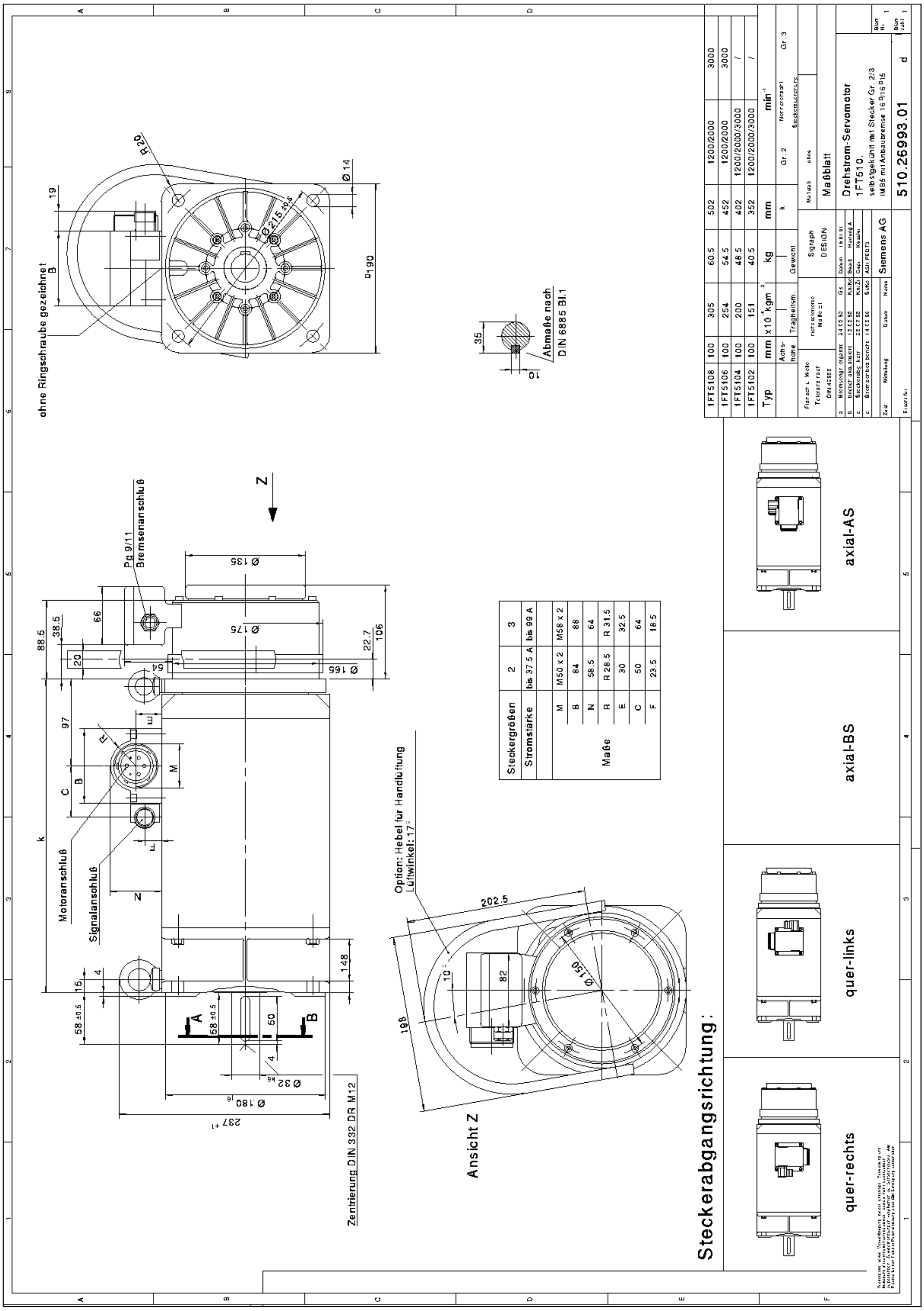


Fig. 4-21 1FT510□ non–ventilated with connector size 2



Typ	Achshöhe mm	Trägheitsm. x10⁻⁴ kgm²	Gewicht kg	k mm
1FT5076	71	58	26	373
1FT5074	71	43	22.2	323
1FT5072	71	29	18.5	273

Fig. 4-22 1FT507□ non–ventilated with connector size 2



Steckergrößen		2	3
Stromstärke		bis 37.5 A	bis 99 A
Maße	M	M50 x 2	M58 x 2
	B	84	88
	N	58.5	64
	R	R 28.5	R 31.5
	E	30	32.5
	C	50	64
	F	23.5	18.5

Typ	Achshöhe mm	Trägheitsm. x10⁻⁴ kgm²	Gewicht kg	k mm	Nenndrehzahl min⁻¹ Gr. 2	Steckergröße Gr. 3
1FT5108	100	305	60.5	502	1200/2000	3000
1FT5106	100	254	54.5	452	1200/2000	3000
1FT5104	100	200	48.5	402	1200/2000/3000	/
1FT5102	100	151	40.5	352	1200/2000/3000	/

Zust	Mitteilung	Datum	Name		
a	Bremsengr. ergänzt	24.05.92	Gs	Datum	16.01.91
b	bildlich aktualisiert	15.05.95	Kn/Ko	Bearb.	Hartung A.
c	Steckerabg. korr.	23.07.95	Kn/Zi	Gepr.	Kessler
c	Bremsenbez. bericht.	14.05.96	Sl/Ko	ASI PEDT3	

Fig. 4-23 1FT510□ non–ventilated with connector size 2/3

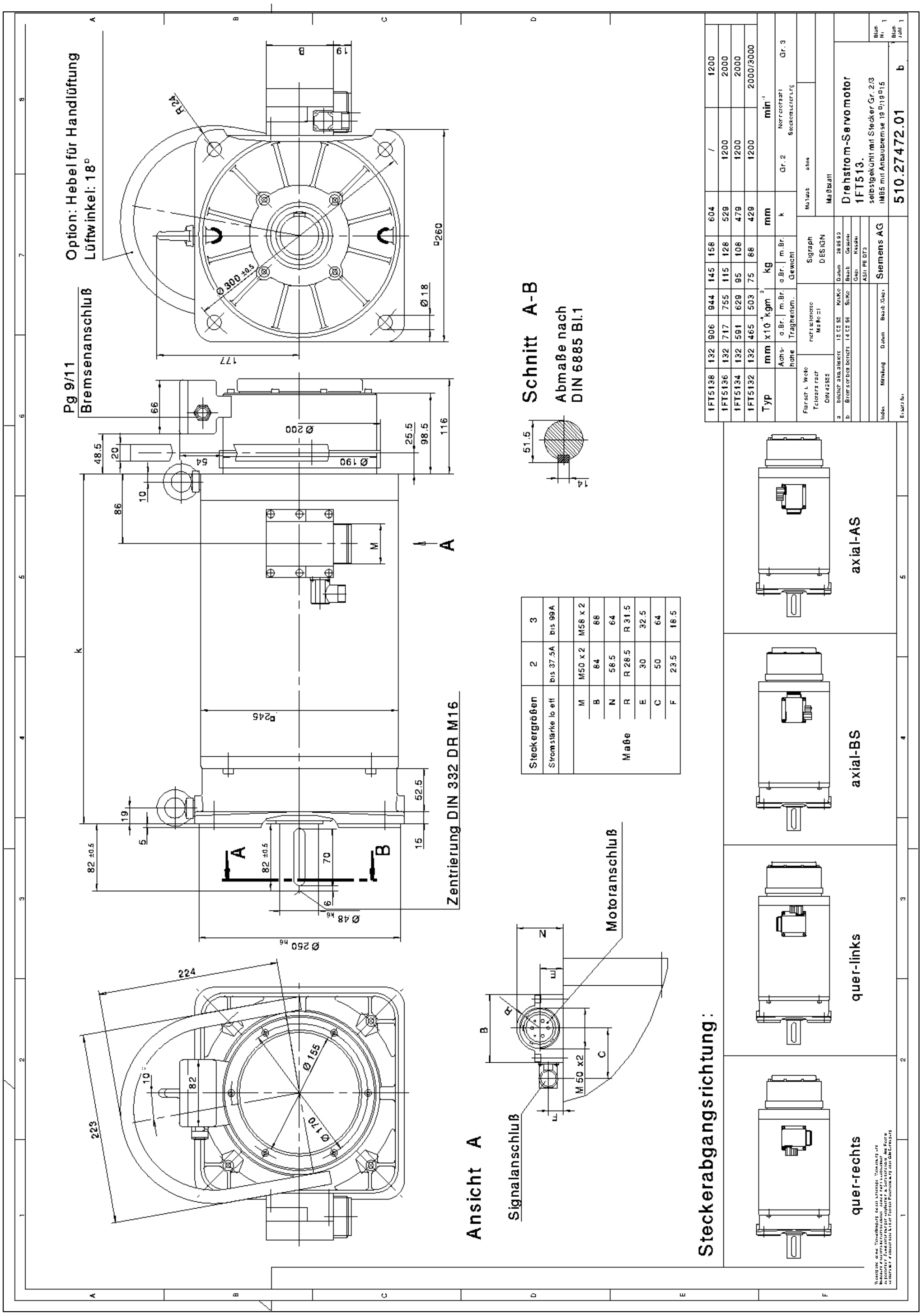


Fig. 4-24 1FT513□ non–ventilated with connector size 2/3

■

FEEDBACK DEVICES
FOR 1FT5...

Motor encoders

1

1.1 Motor 1FT5

Thermistors

Temperature sensor

Type:	Q63100–P426–M135 (Characteristic DIN 44081)
Resistance when cold (20 °C):	< 250 Ohm
Connection:	through the encoder cable
Response temperature:	155 °C ±5 °C
Shaft heights 36 and 48:	2 integrated PTC thermistors (in series)
Shaft heights 63 to 132:	1 integrated PTC thermistor

The change in resistance is **not** proportional to the winding temperature change.

The evaluation circuit signal in the SIMODRIVE converter must be externally evaluated.

High, brief overload conditions require additional protective measures, as a result of the thermal coupling time of the sensor.

The cables for the temperature sensor are included in the encoder cable.

Caution

The integrated temperature sensor protects the servomotors from overload conditions up to $4 * I_{0\ 60\ K}$.

For servomotors (shaft heights 36 and 48), the temperature sensor only protects up to $2 * I_{0\ 60\ K}$.

For thermally critical load situations, e.g. high overload when the motor is at standstill, adequate protection is no longer provided. For example, a thermal overcurrent relay must be provided as additional protection.

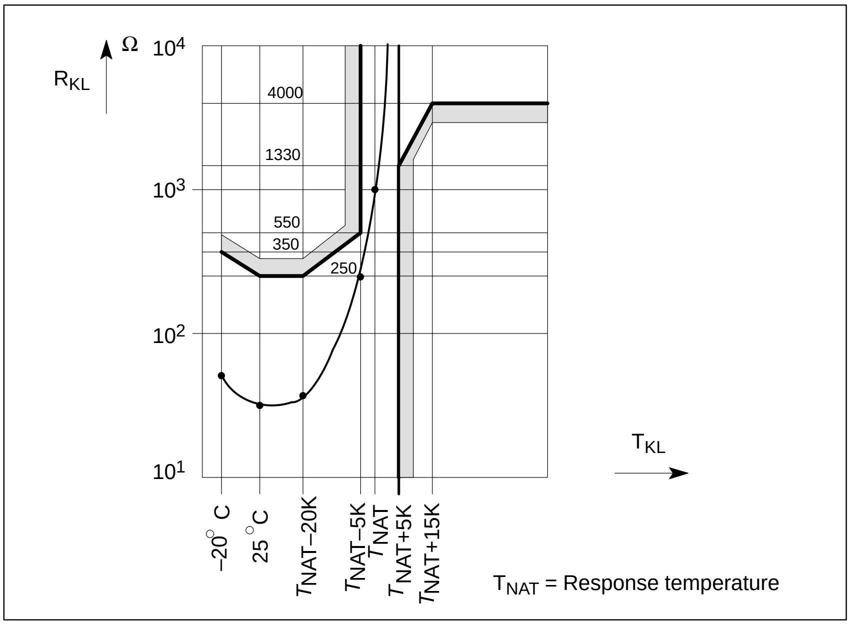


Fig. 1-1 Temperature characteristic

Tachometer system

Version: Brushless analog encoder system

Coupling: On the NDE side through the taper (integrated in the motor)

Application:

- Tachometer for speed actual value sensing;
- Magnetic devices or a Hall switch system as rotor position encoder for inverter control

Output signals:

- Trapezoidal voltage signals from the tachometer
- Absolute signal for the rotor position
  18 pieces of information per motor revolution

Table 1-1 Technical data, tachometer system 1FU

Technical data	**1FU1030** Shaft heights 36 and 48	**1FU1050** Shaft heights 63 to 132
	Hall switch system	Magnetic device
Speed (mech. limiting speed)	8000 RPM	8000 RPM
Peak value, phase voltage at rated speed	16/40 V	40 V
Voltage tolerance	+15 %, –5 %	±8 %
Voltage adjustment/calibration	±20 %	±20 %
Peak ripple	≤ 1 %	≤ 0.5 %
Linearity error	≤ 0.2 %	≤ 0.2 %
Reversing error	≤ 0.2 %	≤ 0.2 %

Encoder cable: 6FX□202–2CB31–□□□0
Performance/Standard Length

Mating connector: 6FX2003–0CE12

Pulse encoder ROD 320.005

Version:	Optical encoder system with different pulse numbers (refer to Catalog)
Coupling:	on the NDE side through the taper (integrated in the motor)
Application:	Indirect measuring system for digital position control loop
Evaluation:	Incremental
Output signals:	Squarewave; RS422 (TTL)

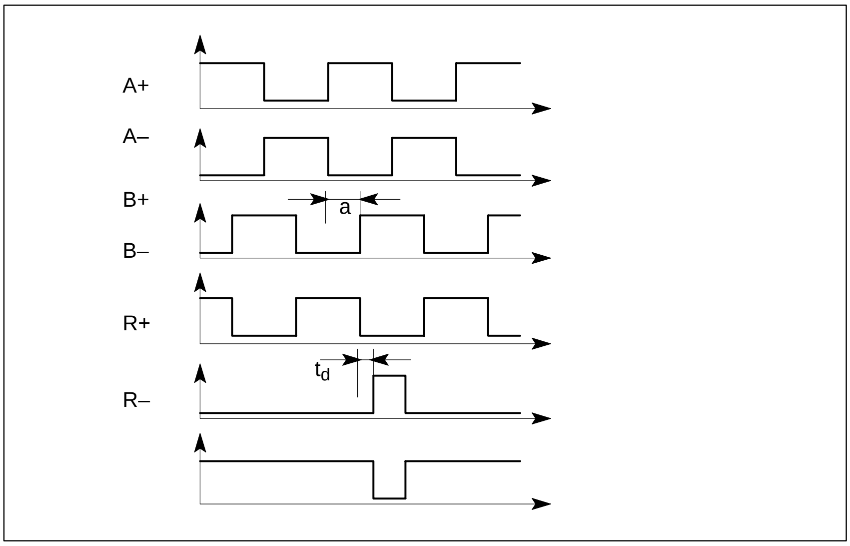


Fig. 1-2 Signal characteristics for clockwise direction of rotation

The servomotors may only be utilized for a temperature rise of ΔT = 60 K.

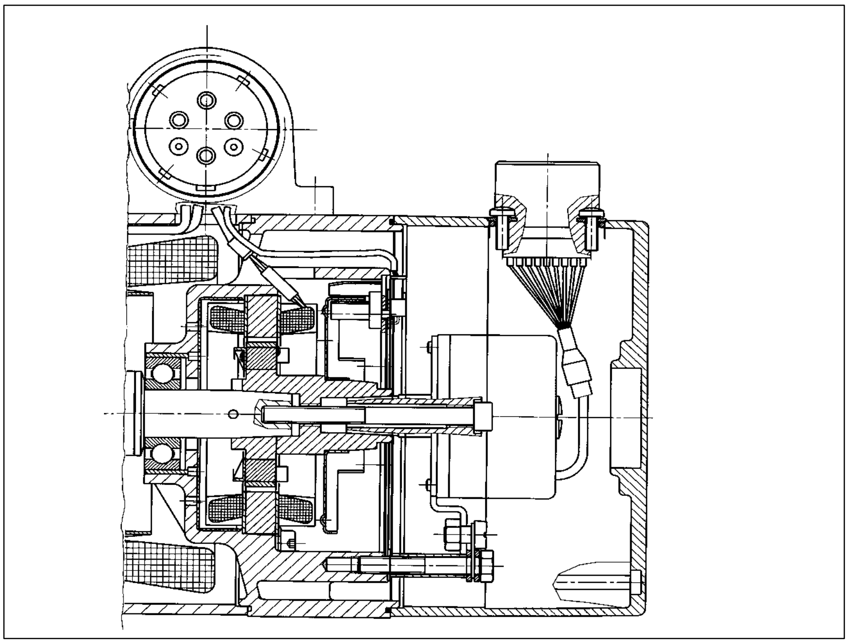


Fig. 1-3 1FT5 servomotor with integrated ROD 320.005 pulse encoder

Table 1-2 Technical data, ROD 320.005 pulse encoder

Mech. speed Electr. speed Operating voltage Current drain Frequency range	max. 8500 RPM dependent on the pulse No.(ref. below) DC 5 V ±5 % ≤ 150 mA (without load) 0 to 300 kHz
Edge clearance Delay U_{a0} to U_{a1} and U_{a2} Output load capability	a ≥ 420 ns $t_d \leq 50$ ns $I_{high} \leq$ DC 20 mA $I_{low} \leq$ DC 20 mA; $C_{load} \leq 1000$ pF
Short–circuit strength	Briefly, all outputs to 0 V; 1 output continuously at≤ 25 °C
Light source	LED which is vibration proof
Operating temperature	–30 °C to +100 °C
Intrinsic moment of inertia	$0.035 * 10^{-4}$ kgm^2
Ground	0.25 kg

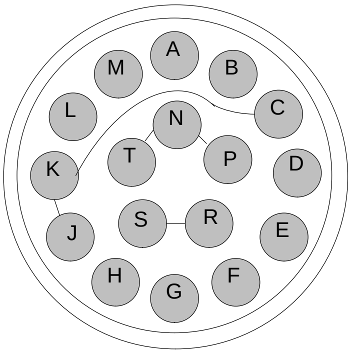
Maximum electrical speed:

$$n_{max} = \frac{f_g * 10^3 * 60}{\text{Pulse number}} \; [\text{RPM}]$$

f_g [kHz] Limiting frequency (–3dB)

Connection, 17–pin flange–mounted socket (connector pins)

PIN–No.	Signal
A	A+
B	B+
C, J, K	+5 V
D	A–
E	B–
F	R+
G	R–
H	Screen
N, P, T	0 V
R, S	Jumper
L	$\overline{\text{Uas}}$[1]



When viewing the connector side (pins)

Mating connector: 6FC9348–7AV01 (socket)

Pre–assembled cables: Refer to Catalog NC Z

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[1] Noise signal: LED monitoring

1.1.2 Mounted encoders

Incremental encoders ROD426

Version:	Optical encoder system with different pulse numbers- (refer to Catalog)
Coupling:	On the NDE side through a compression– or spring–loaded coupling (mounted on the motor); synchronous flange
Application:	Indirect measuring system for the digital closed–loop control circuit
Evaluation:	Incremental
Output signals:	Squarewave; RS422 (TTL) 2 channels, displaced through 90° electrical 1 zero pulse per revolution

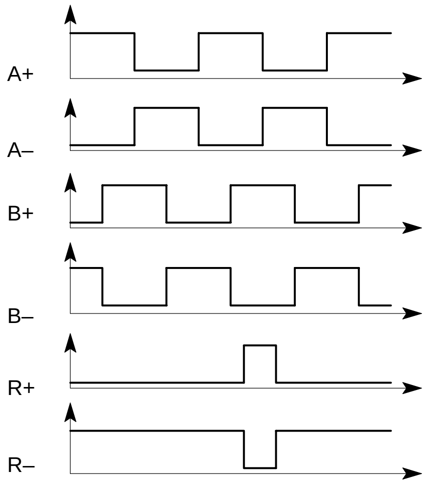


Fig. 1-4 Signal characteristics for a clockwise direction of rotation

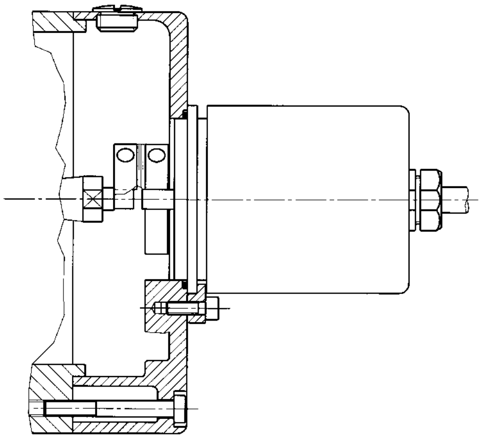


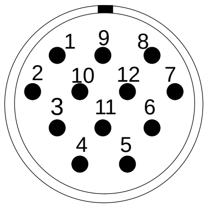
Fig. 1-5 1FT5 servomotor with mounted rotary encoder

Table 1-3 Technical data, ROD 426 pulse encoder

Speed Operating voltage Current drain Frequency range	max. 12 000 RPM/ DC 5 V ±5 % ≤ 150 mA (without load) 0 kHz to 300 kHz
Signal level Minimum edge clearance U_{a1} to U_{a2} Electrical resolution	RS 422 (TTL) ≥ 0.45µs at 300 kHz 500 to 5000 pulses/revolution (corresponds to the resolution of a pulse disk); for external multiplication up to 20 000 pulses/revolution
Degree of protection (acc. to DIN 40050)	• without shaft input: IP 67 • with shaft input: IP 64
Operating temperature Storage temperature	–30 °C to +100 °C –30 °C to +80 °C
Vibration stressing (acc. to DIN IEC 68–2–6) Shock stressing (acc. to DIN IEC 68–2–29)	100 m/s^2 (50...2000 Hz) 1000 m/s^2 (11 ms)
Moment of inertia of the mounted encoder including coupling and motor shaft	$0.0175 * 10^{-4}$ kgm^2
Moment of inertia of the encoder	$1.45 * 10^{-6}$ kgm^2
Weight	0.25 kg

12–pin connection (connector pins)

PIN No.	Signal
1	B–
2	+5 V Sense
3	R+
4	R–
5	A+
6	A–
7	$\overline{\text{Uas}}$1)
8	B+
9	not connected
10	0 V
11	0 V Sense
12	+5 V



When viewing the connector side (pins)

Mating connector: 6FX2003–0CE12 (socket)

Pre–assembled cables: Refer to Catalog NC Z

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1) Noise signal: LED monitoring

Prepared for encoder mounting, synchronous flange

For encoders with synchronous flange (ROD 426 mounting–compatible).

Order designation: G51

Version: Shaft heights 36 and 48 with VMA coupling
Shaft heights 63 to 132 with spring–disk coupling

The following encoders can be mounted:

SIMODRIVE Sensor incremental encoders with synchronous flange

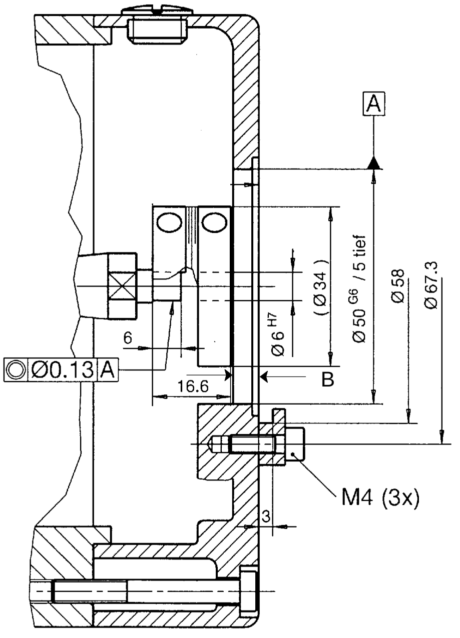
- 6FX2001–2□□□ with RS 422 (TTL)
- 6FX2001–3□□□ with sinusoidal $1V_{pp}$
- 6FX2001–4□□□ with HTL

as well as mounting–compatible encoders

SIMODRIVE Sensor absolute value encoders with synchronous flange

- 6FX2001–5□□□ with SSI or Profibus DP

as well as mounting–compatible encoders.



Type	B ±1
1FT503□	5.9
1FT504□	7.1
1FT506□	6.3
1FT507□	5.9
1FT510□	5.9
1FT513□	5.9

Fig. 1-6 Mounting absolute angle encoders with standard pulse encoder flange onto motors 1FT503□ to 1FT513□