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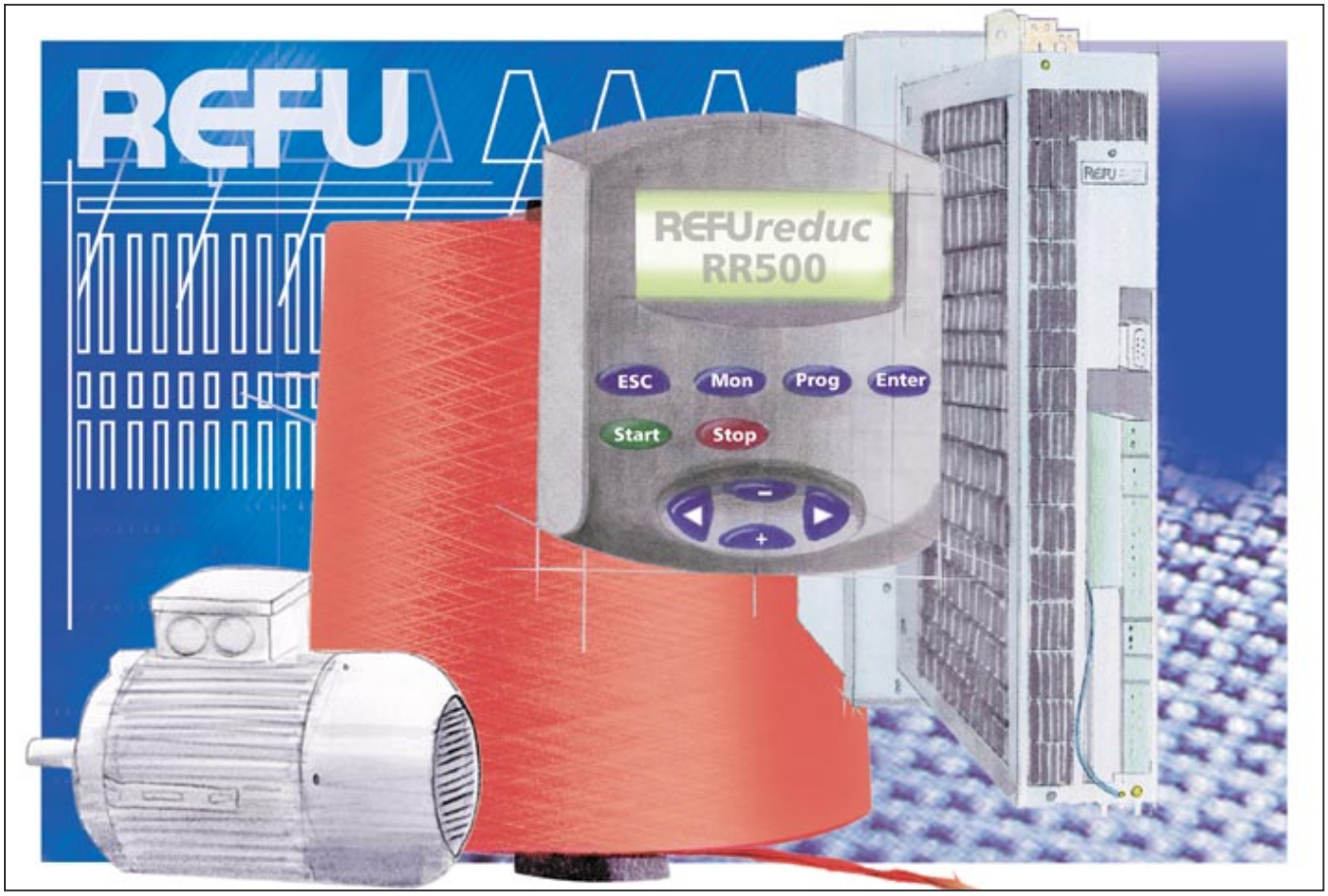

REFUreduc RR52
Drive control devices for textile engineering

Operating Instructions

REFU*drive 500*

DOK-RD500*-RR52*******-IB01-EN-P

Rexroth
Indramat

Title
REFUreduc RR52
Drive control devices for textile engineering

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Operating Instructions

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Purpose of Documentation
This documentation explains the frequency converters and inverters of the drive series REFU*reduc* RR52. It provides information...
- for planning the mechanical control cabinet construction
- for planning the electrical control cabinet construction
- for commissioning the drive controls
- for basic parameterization of the drive controls
- to fault messages and notes to cause and remedy

Record of Revisions

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List of contents

0 Safety

0.1 Safety information and instructions in the technical documentation for REFUdrive500

The safety information and instructions provided in this section are valid for all documents, electronic documents, or other publications associated with the REFU*drive 500* drive converter series subsequently known as "Technical Documentation REFU*drive 500*". Please observe the safety- and application information for drive converters in the Manual provided, "Safety information and EC Certificates".

0.2 Definition of the terminology used

Qualified personnel

In the sense of the REFU*drive 500* technical documentation and the warning information on the products themselves, are electrical specialists or personnel with electrical training in accordance with EN 600204 Part 1, 3.55 or 3.30. They are knowledgeable about the installation, mounting, connecting-up, commissioning and operation of the product, and have the appropriate qualifications for their job.

WARNING

Warning

For the purpose of the REFU*drive 500* documentation and the warning information on the products themselves, warning means that death, severe personal injury or significant property damage can result if proper precautions are not taken.

CAUTION

Caution

For the purpose of the REFU*drive 500* Technical Documentation and the warning information on the products themselves, caution indicates that minor personal injury or material damage can result if proper precautions are not taken.

Caution - Components which can be destroyed by electrostatic discharge (EGB)

For the purpose of the REFU*drive 500* technical documentation and the warning information on the products themselves, indicate boards and modules which can be destroyed by electrostatic discharge. Please observe the measures specified below.

Note:

For the purpose of the REFU*drive 500* Technical Documentation, "Note" indicates information about the product or the respective part of the Instruction Manual that is essential to highlight.

0.3 Definition of the symbols used

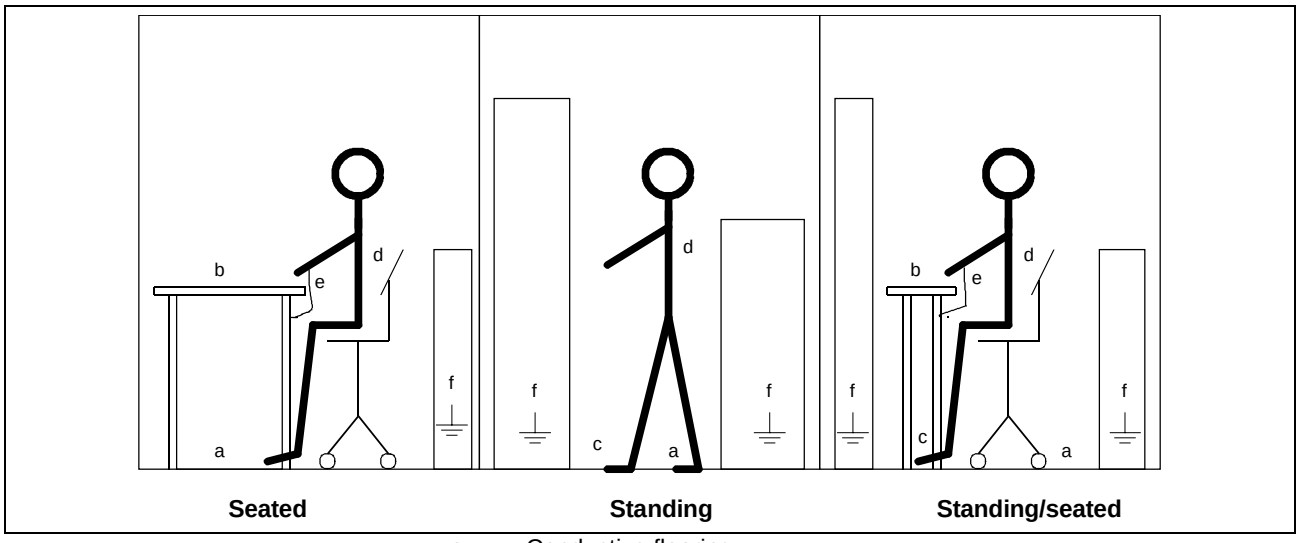
Symbol	Significance and application
	Caution! General potential source of danger. Used in conjunction with the terms "Warning" and "Caution".
	Caution! Danger due to electric current. Used in conjunction with the terms "Warning" and "Caution".
	Caution! Components which can be destroyed by electrostatic discharge This is used in conjunction with the term Caution - ESD‘.
	Important Information! Used in conjunction with the term "Note"

0.4 Precautionary measures when handling components which can be destroyed by electrostatic discharge (ESD)

The units contain electrostatically sensitive devices that can easily be destroyed if they are incorrectly handled. However, if your work does involve the handling of such devices, please observe the following information:

- Electronic modules should not be touched unless work has to be carried-out on them.
- If it is essential for you to touch and handle an electronics module, make sure that your body is electrostatically discharged beforehand .
- Modules may not be allowed to come into contact with electrically insulating materials -such as plastic foil, insulated table tops or clothing made of synthetic fibers-.
- Modules may only be placed on electrically conducting surfaces.
- When carrying-out soldering work on the modules, the soldering iron tip must be grounded.
- Modules and electronic components must always be packed in electrically conducting containers (e.g. such as metalized plastic boxes or metal canisters) before being stored or shipped.
- If packing containers are used which are not conductive, modules and boards must first be wrapped in a conducting material. Examples of such materials including electrically conducting foam rubber or household aluminum foil.

The necessary ESD protective measures are illustrated in the diagram below:



a: Conductive flooring
b: ESD table
c: ESD shoes/footwear
d: ESD overall
e: ESD bracelet/chain
f: Grounding connection of the cabinets

Fig. 0-1: ESD protective measures

1 Description

1.1 The REFU*drive 500* drive converters

REFU*drive 500* is a state-of-the-art three-phase drive system for various types of synchronous- and induction motors which can be universally used. The drive converters can be flexibly adapted to the particular drive task as a result of the modular hardware and software design.

The system includes various versions of AC drive converters (with/without braking chopper, line contactor etc.) inverters for DC rectification as well as rectifier- and regenerative feedback converters. The modules can either be used individually or combined in groups, completely connected-up in cabinets.

The power sections are designed for rear cooling. This allows forced air cooling to be implemented outside the cabinet for higher degrees of protection (where the heat sink extends through the rear panel or heat transfer plates). Versions are also available with liquid cooling, with integrated or external heat exchanger.

Handling

Special importance was placed on simple handling:

- Automatic motor adaptation using parameter identification routines
- Simple commissioning via Quick-Setup
- Prompted start-up using the operator panel with graphics display
- Highest level of user-friendliness using a PC with the high performance REFUwin software package

1.2 REFU*reduc*

REF*Ureduc* is a member of the REF*Udrive 500* series. Functionality, flexibility, and the performance characteristics have been taken from the larger series line. However, we have focused on the specific requirements of textile engineering, which have been consistently integrated into the product line:

- Optimally designed for the textile industry, with space-saving NEMA 12 construction to avoid heat build-up in your machines
- Textile-suitable heat sink
- Flexible components for solutions with several motors
- VFC (voltage-frequency-control) can be used up to high-quality, dynamic servo drive systems
- Operator panel – if required – is optionally available either as plug-in or as (NEMA 12) membrane display and keypad
- No line filter or input throttle – offered as a group solution for machines

Technical features

- AC or DC power supply
- Either forced air cooling, heat transfer plates or integrated cooling circuits
- Removable 4-line graphic display with copy function
- Various interfaces for operating observing, and parameterizing (“download” parameterization) the drive system:

- Profibus DP, Interbus S, CANopen
- Peer-to-peer coupling with fiber-optic cables
- SynchroLink for fast communication between several drives
- RS 232 / RS 485

- Expanded, freely combinable technological functions:
  PID, PI controller, AND, OR, XOR, RS flip-flop, D latch and Sample & Hold module
  - Mathematical function elements
  - Timers, counters, comparators, ramp-function generators
  - Free programmable characteristic
- Additional signal processor (32-bit floating point) for high-dynamic applications and servo applications:
  - Torque rise time of 0.3 ms
  - Current cycle times of 0.1 ms
- Double overload for 0.5 sec
- High-performance software tool: REF*Uwin*

Fig. 1-1: Device of the REFU*reduc* series

1.3 Rating plate

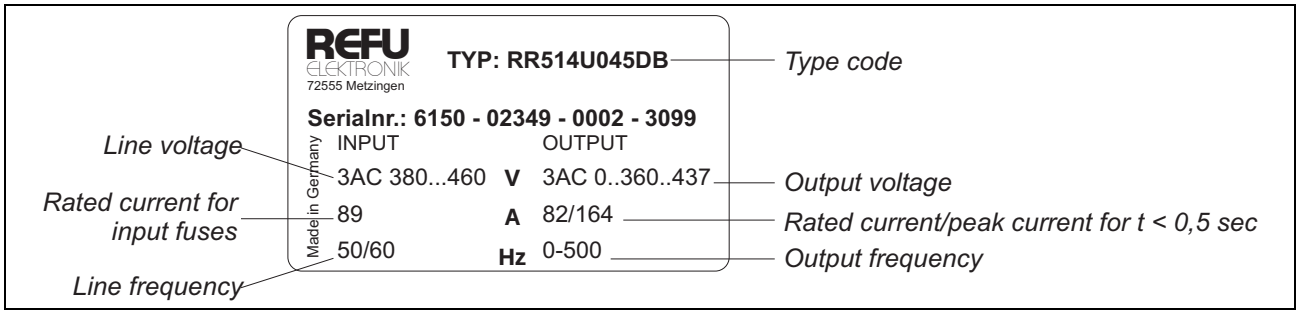


Fig. 1-2: Rating plate

1.4 Technical Data

Technical Data for pulse frequency f_p = 4 kHz

RR52			001	003	004	005	007	011	015
Motor output [1]		[kW]	1,5	3,0	4,0	5,5	7,5	11	15
Line supply voltage: Converter 3-ph. 400 V AC (±15%) / Inverter 560 V DC (±15%)									
Output frequency		[Hz]	0 -250 Hz						
Rated current		[A]	4,0	7,5	10	13	18	25	30
Peak current for	t=60 s	[A]	5,2	9,8	13	17	23	33	39
	t=1 s	[A]	6,8	13	17	22	31	43	51
	t=0,5 s	[A]	8,0	15	20	26	36	50	60
Rated output S_N		[kVA]	2,6	4,9	6,6	8,6	12	16	20
Peak output for	t=60s	[kVA]	3,4	6,5	8,6	11	15	22	26
Line supply voltage: Converter 3-ph. 460 V AC (±15%) / Inverter 650 V DC (±15%)									
Output frequency		[Hz]	0 -250 Hz						
Rated current		[A]	3,5	6,5	9	12	16	21	27
Peak current for	t=60 s	[A]	5,2	9,8	13	17	23	33	39
	t=1 s	[A]	6,8	13	17	22	31	43	51
	t=0,5 s	[A]	8,0	15	20	26	36	50	60
Rated output S_N		[kVA]	2,6	4,9	6,6	8,6	12	16	20
Peak output for	t=60s	[kVA]	3,4	6,5	8,6	11	15	22	26
Line supply voltage: Converter 3-ph. 500 V AC (±10%) / Inverter 710 V DC (±10%)									
Output frequency		[Hz]	0 - 250 Hz						
Rated current		[A]	3	6	8	10	14	20	24
Peak current for	t=60 s	[A]	3,9	7,8	10	13	18	26	31
	t=1 s	[A]	5,1	10	14	17	24	34	41
	t=0,5 s	[A]	6,0	12	16	20	28	40	48
Rated output S_N		[kVA]	2,5	4,9	6,6	8,2	12	16	20
Peak output for	t=60s	[kVA]	3,2	6,4	8,2	11	15	21	26
Ambient conditions, losses, radio interference suppression level, noise immunity									
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0-40 °C)						
Losses at rated output		[W]	45	90	120	165	225	330	450
Radio interference suppression level / noise immunity			A 1 according to EN 55011 / EN 61800-3						
Mechanical design									
Size classes			A	A	A	A	A	B	B
Degree of protection			IP 20 according to EN 60529					IP 20 acc. to EN 60529 (without terminal connections)	
Weight of the drive converter for cooling type									
Forced ventilation		[kg]	15	15	15	15	15	18	18
Liquid cooling		[kg]	10	10	10	10	10	12	12
Heat conducting plate		[kg]	10	10	10	10	10	12	12

[1] Maximum permissible motor output referred to a 4-pole standard induction motor.

Technical Data for pulse frequency f_p = 4 kHz

RR52			018	022	030	037	045	055	075
Motor output [2]		[kW]	18,5	22	30	37	45	55	75
Line supply voltage: Converter 3-ph. 400 V AC (±15%) / Inverter 560 V DC (±15%)									
Output frequency		[Hz]	0 -250 Hz						
Rated current		[A]	35	43	56	68	82	99	135
Peak current for	t=60 s	[A]	46	55	73	88	107	129	176
	t=1 s	[A]	60	72	95	116	139	168	230
	t=0,5 s	[A]	70	85	112	136	164	198	270
Rated output S_N		[kVA]	23	28	37	45	54	65	89
Peak output for	t=60s	[kVA]	30	36	48	58	70	85	116
Line supply voltage: Converter 3-ph. 460 V AC (±15%) / Inverter 650 V DC (±15%)									
Output frequency		[Hz]	0 -250 Hz						
Rated current		[A]	3,5	6,5	9	12	72	86	120
Peak current for	t=60 s	[A]	5,2	9,8	13	17	107	129	176
	t=1 s	[A]	6,8	13	17	22	139	168	230
	t=0,5 s	[A]	8,0	15	20	26	164	198	270
Rated output S_N		[kVA]	2,6	4,9	6,6	8,6	54	65	89
Peak output for	t=60s	[kVA]	3,4	6,5	8,6	11	70	85	116
Line supply voltage: Converter 3-ph. 500 V AC (±10%) / Inverter 710 V DC (±10%)									
Output frequency		[Hz]	0 - 250 Hz						
Rated current		[A]	31	38	49	60	66	80	108
Peak current for	t=60 s	[A]	46	55	73	88	86	104	140
	t=1 s	[A]	60	72	95	116	112	136	184
	t=0,5 s	[A]	70	85	112	136	132	160	216
Rated output S_N		[kVA]	23	28	37	45	54	66	89
Peak output for	t=60s	[kVA]	30	36	48	58	71	86	115
Ambient conditions, losses, radio interference suppression level, noise immunity									
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0-40 °C)						
Losses at rated output		[kW]	0,56	0,66	0,90	1,11	1,35	1,65	2,25
Radio interference suppression level / noise immunity			A 1 according to EN 55011 / EN 61800-3						
Mechanical design									
Size classes			B	C	C	C	C	D	D
Degree of protection			IP 20 according to EN 60529 (without terminal connections)						
Weight of the drive converter for cooling type									
Forced ventilation		[kg]	18	33	33	33	33	50	50
Liquid cooling		[kg]	12	25	25	25	25	37	37
Heat conducting plate		[kg]	12	--	--	--	--	--	--

[2] Maximum permissible motor output referred to a 4-pole standard induction motor.

Technical Data for pulse frequency f_p = 8 kHz

RR52			001	003	004	005	007	011	015
Motor output [3]		[kW]	1,1	2,2	3,0	4,0	5,5	7,5	11
Line supply voltage: Converter 3-ph. 400 V AC (±15%) / Inverter 560 V DC (±15%)									
Output frequency		[Hz]	0 -500 Hz						
Rated current		[A]	3,0	5,8	7,5	10	13	18	25
Peak current for	t=60 s	[A]	3,9	7,5	9,8	13	17	23	33
	t=1 s	[A]	51	9,9	13	17	22	31	43
	t=0,5 s	[A]	6,0	12	15	20	26	36	50
Rated output S_N		[kVA]	2,0	3,8	4,9	6,6	8,6	12	16
Peak output for	t=60s	[kVA]	2,6	4,9	6,5	8,6	11	15	22
Line supply voltage: Converter 3-ph. 460 V AC (±15%) / Inverter 650 V DC (±15%)									
Output frequency		[Hz]	0 -500 Hz						
Rated current		[A]	2,6	5,0	6,5	8,7	12	16	21
Peak current for	t=60 s	[A]	3,9	7,5	9,8	13	17	23	33
	t=1 s	[A]	51	9,9	13	17	22	31	43
	t=0,5 s	[A]	6,0	12	15	20	26	36	50
Rated output S_N		[kVA]	2,0	3,8	4,9	6,6	8,6	12	16
Peak output for	t=60s	[kVA]	2,6	4,9	6,5	8,6	11	15	22
Line supply voltage: Converter 3-ph. 500 V AC (±10%) / Inverter 710 V DC (±10%)									
Output frequency		[Hz]	0 - 500 Hz						
Rated current		[A]	2,4	4,5	6	8	10	14	20
Peak current for	t=60 s	[A]	3,1	5,9	7,8	10	13	18	26
	t=1 s	[A]	4,1	7,7	10	14	17	24	34
	t=0,5 s	[A]	4,8	9,0	12	16	20	28	40
Rated output S_N		[kVA]	2,0	3,7	4,9	6,6	8,2	12	16
Peak output for	t=60s	[kVA]	2,6	4,9	6,4	8,2	11	15	21
Ambient conditions, losses, radio interference suppression level, noise immunity									
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0-40 °C)						
Losses at rated output		[W]	45	90	120	165	225	330	450
Radio interference suppression level / noise immunity			A 1 according to EN 55011 / EN 61800-3						
Mechanical design									
Size classes			A	A	A	A	A	B	B
Degree of protection			IP 20 acording to EN 60529					IP 20 acc. to EN 60529 (without terminal connections)	
Weight of the drive converter for cooling type									
Forced ventilation		[kg]	15	15	15	15	15	18	18
Liquid cooling		[kg]	10	10	10	10	10	12	12
Heat conducting plate		[kg]	10	10	10	10	10	12	12

[3] Maximum permissible motor output referred to a 4-pole standard induction motor.

Technical Data for pulse frequency f_p = 8 kHz

RR52			018	022	030	037	045	055	075
Motor output [4]		[kW]	15	18,5	22	30	37	45	55
Line supply voltage: Converter 3-ph. 400 V AC (±15%) / Inverter 560 V DC (±15%)									
Output frequency		[Hz]	0 -500 Hz						
Rated current		[A]	30	35	43	56	68	82	99
Peak current for	t=60 s	[A]	39	46	55	73	88	107	129
	t=1 s	[A]	51	60	72	95	116	139	168
	t=0,5 s	[A]	60	70	85	112	136	164	198
Rated output S_N		[kVA]	20	23	28	37	45	54	65
Peak output for	t=60s	[kVA]	26	30	36	48	58	70	85
Line supply voltage: Converter 3-ph. 460 V AC (±15%) / Inverter 650 V DC (±15%)									
Output frequency		[Hz]	0 -500 Hz						
Rated current		[A]	27	31	38	49	60	72	86
Peak current for	t=60 s	[A]	39	46	55	73	88	107	129
	t=1 s	[A]	51	60	72	95	116	139	168
	t=0,5 s	[A]	60	70	85	112	136	164	198
Rated output S_N		[kVA]	20	23	28	37	45	54	65
Peak output for	t=60s	[kVA]	26	30	36	48	58	70	85
Line supply voltage: Converter 3-ph. 500 V AC (±10%) / Inverter 710 V DC (±10%)									
Output frequency		[Hz]	0 - 500 Hz						
Rated current		[A]	24	28	34	45	55	66	80
Peak current for	t=60 s	[A]	31	36	44	59	72	86	104
	t=1 s	[A]	41	48	58	77	94	112	136
	t=0,5 s	[A]	48	56	68	90	110	132	160
Rated output S_N		[kVA]	20	23	28	37	45	54	66
Peak output for	t=60s	[kVA]	26	30	36	49	59	71	86
Ambient conditions, losses, radio interference suppression level, noise immunity									
Environmental class			3K3 according to DIN IEC 721-3-3 (ambient temperature 0-40 °C)						
Losses at rated output		[kW]	0,56	0,66	0,90	1,11	1,35	1,65	2,25
Radio interference suppression level / noise immunity			A 1 according to EN 55011 / EN 61800-3						
Mechanical design									
Size classes			B	C	C	C	C	D	D
Degree of protection			IP 20 according to EN 60529 (without terminal connections)						
Weight of the drive converter for cooling type									
Forced ventilation		[kg]	18	33	33	33	33	50	50
Liquid cooling		[kg]	12	25	25	25	25	37	37
Heat conducting plate		[kg]	12	--	--	--	--	--	--

[4] Maximum permissible motor output referred to a 4-pole standard induction motor.

Technical Data for pulse frequency f_p = 10 and 12 kHz

RR52		001	003	004	005	007	011	015
Data for pulse frequency f_p = 10 kHz								
Rated current for 3-ph. 400 V AC (±15%)	[A]	2,6	4,9	6,5	8,5	11,5	15,5	21,5
Rated current for 3-ph. 460 V AC (±15%)	[A]	2,2	4,2	5,6	7,3	10,3	13,5	18,5
Data for pulse frequency f_p = 12 kHz								
Rated current for 3-ph. 400 V AC (±15%)	[A]	2,2	4	5,5	7	10	13	18
Rated current for 3-ph. 460 V AC (±15%)	[A]	1,9	3,5	4,8	6	8,7	11	15,5

RR52		018	022	030	037	045	055	075
Data for pulse frequency f_p = 10 kHz								
Rated current for 3-ph. 400 V AC (±15%)	[A]	26	32,5	39	48	60	75	89,5
Rated current for 3-ph. 460 V AC (±15%)	[A]	23	28,5	34,5	42	53	65,5	78
Data for pulse frequency f_p = 12 kHz								
Rated current for 3-ph. 400 V AC (±15%)	[A]	22	30	35	40	52	68	80
Rated current for 3-ph. 460 V AC (±15%)	[A]	19	26	30,5	35	45,5	59	69,5

Power losses

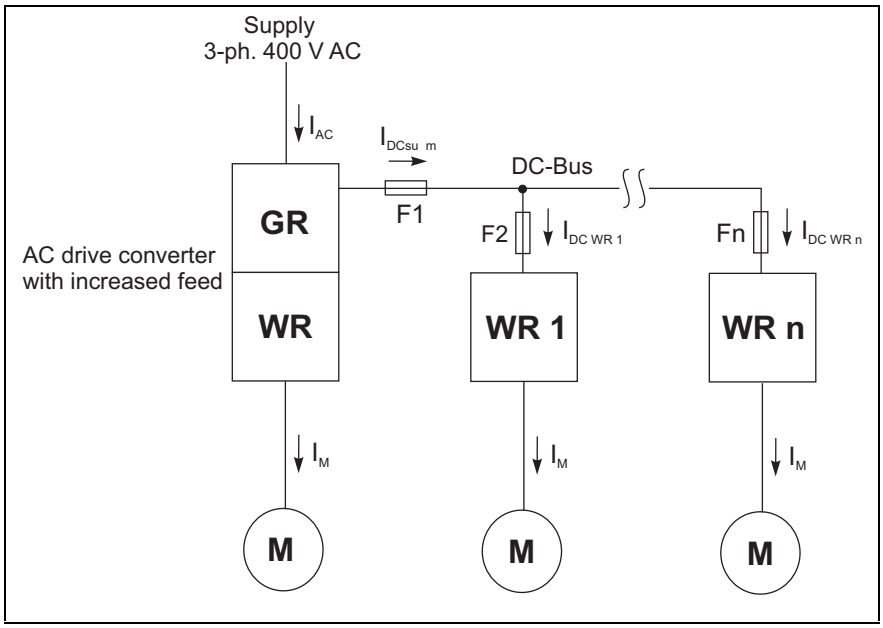
The power loss in the unit at rated output is 3 %, refer to the previous tables, "losses at rated output". The total power loss is sub-divided into 15% convection and an output-independent component of 60 W which is dissipated via the unit housing, and 85% which must be dissipated at the rear to the cooling system via the heat transfer plate.

Power loss via the heat transfer plate 85 % of the total power loss

Power loss through the housing 15 % of the total power loss + 60 W from the control electronics

1.5 DC supply with AC converters

For AC converters with higher rating feed, the rectifier has a higher rating than the inverter. The power difference is available at terminals C and D as feed power for the DC bus. The DC link output must be fused in the AC converter. The DC link cross-section and its fusing (cable protection) is dependent on the sum of the inverter currents, and therefore must be determined on a project-for-project basis. The maximum values for the DC link fuses can be taken from the table below. The sum of the powers of all the inverters connected to the DC bus, may not exceed the rectification power of the AC converter. If the DC bus is a busbar, from which the individual connecting cables to the inverters are connected, with a lower cross-section, then these connecting cables, depending on the cross-section, must be individually fused to provide cable protection



GR: Rectifier
WR: Inverter
M: Motor
F1: Fusing at the AC drive converter
F2-Fn: Fuses for the feeder cables

Fig. 1-3: Circuit principle, AC converter with increased feed power

AC drive converter with increased feed 1)	**Code**	**011**	**015**	**018**	**022**	**030**	**045**	**055**
Rated motor output f_p = 4kHz	[kW]	11	15	18.5	22	30	45	55
Rectifier power	[kW]	26.5	26.5	26.5	75	75	75	75
DC link power for the DC bus	[kW]	15.5	11.5	8.5	53	43	30	20
Max. possible DC-bus fuses	[A]	Not necessary	Not necessary	Not necessary	125 2)	125 2)	50 3)	50 3)
Size class		B	B	B	D 2)	D 2)	D	D

1): The motor output is valid as code
2): External fuse holder
3): Internal fuse

Fig. 1-4: Dimensioning multi-motor drives with DC bus

Note: The rated current, the peak currents, the rated- and peak power at the various supply voltages and pulse frequencies should be taken from the tables with the drive converter technical data.

1.6 Circuit principle

Electronic section

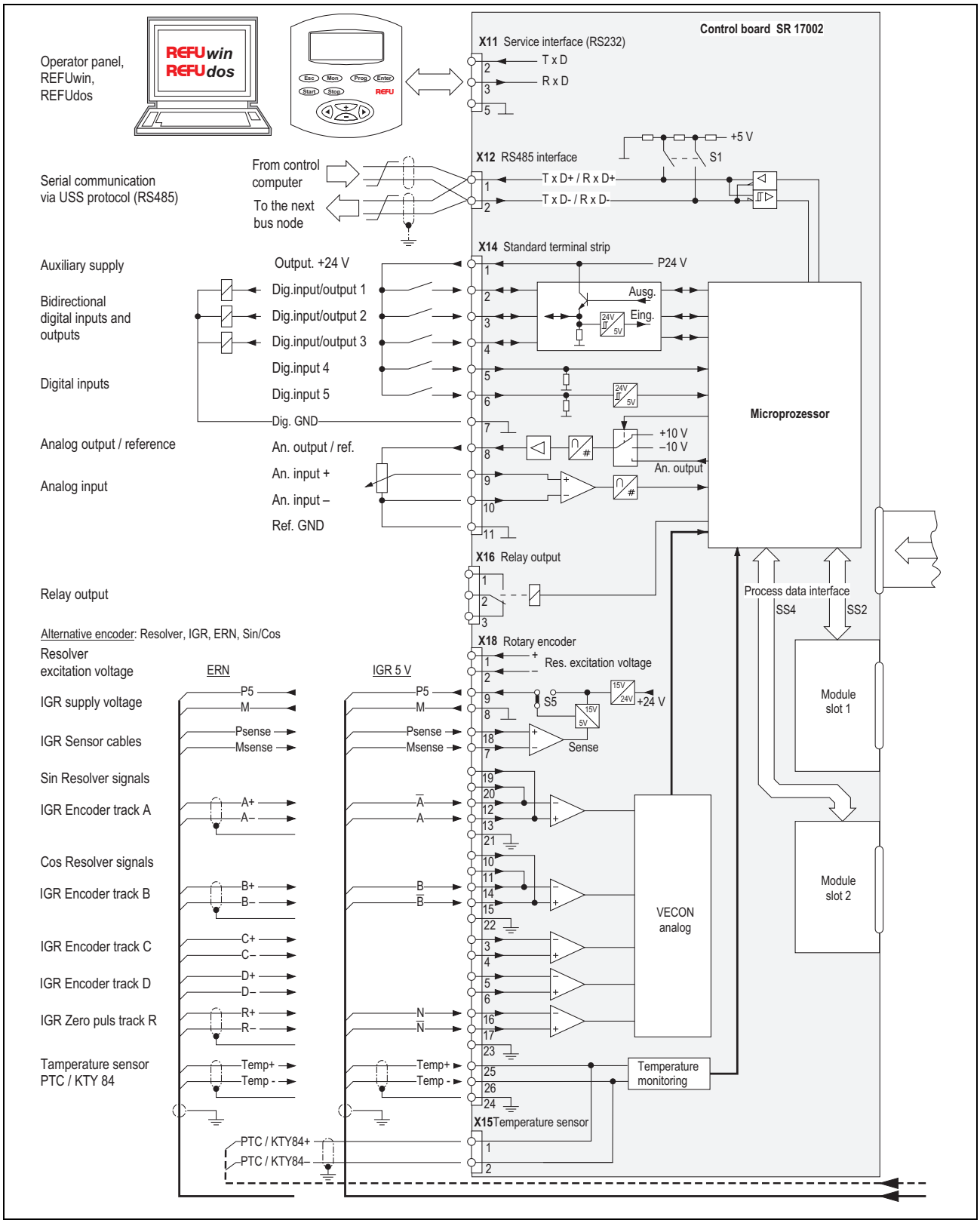


Fig. 1-5: Circuit principle of converter electronic section

Converter power section

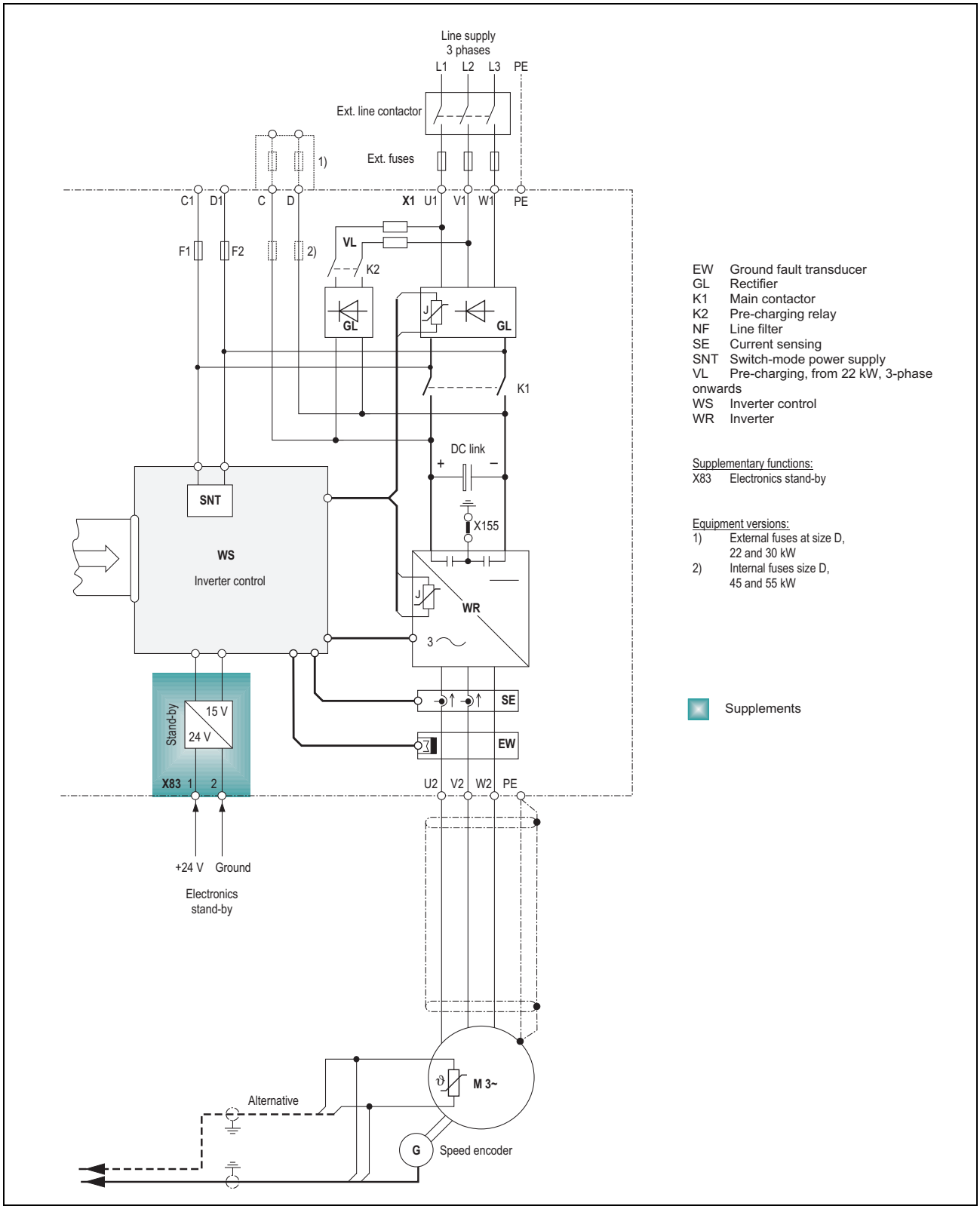


Fig. 1-6: Circuit principle of converter power section

Inverter power section

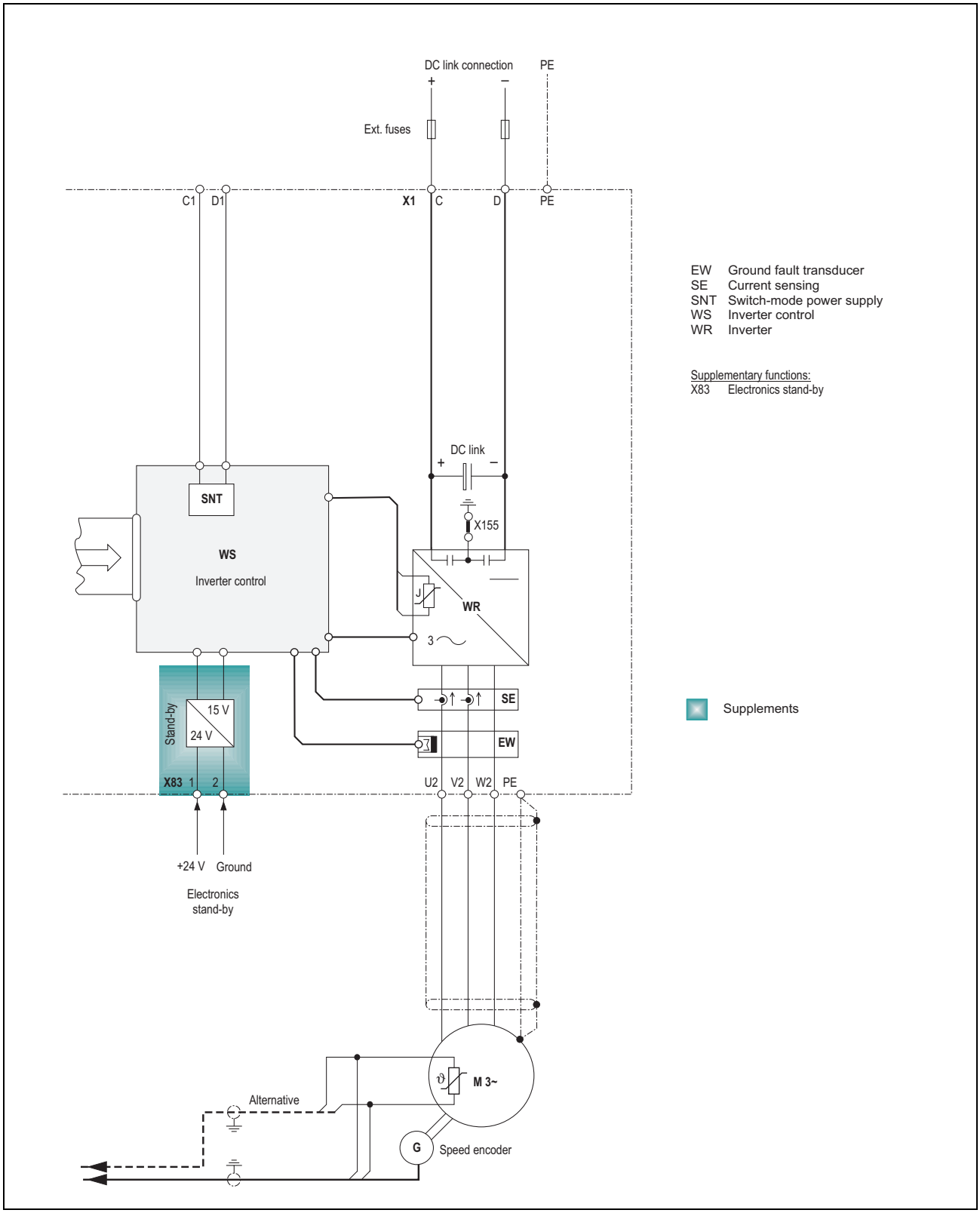


Fig. 1-7: Circuit principle of inverter power section

1.7 Type code

In preparation

Fig. 1-8: Type code

2 Mechanically installation

2.1 Storage and installation location

Storage

The units must be stored in clean, dry rooms. The storage temperature must be between -25° C (-13° F) and +70° C (+158° F). Temperature fluctuations exceeding 20 K per hour are not permissible.

Note: AC drive converters and rectifier units include aluminum-Elko DC link capacitors. They can be stored for a maximum of 2 years in a no-voltage condition, for a storage temperature of 40 °C. If they are stored for longer than two years, these DC link capacitors must be re-formed before the unit is commissioned.

Minimum requirements regarding the installation location

- The rooms in which the drive converters are to be installed should be dust-free. Dust-laden air must be filtered (3K3 according to DIN IEC 721-3-3).
- The ambient temperature must be within the range 0...45° C (23° F ... 113 ° F), optionally 0...55° C.
- The relative air humidity may not exceed 90 %; moisture condensation is not permissible.
- It should be ensured that the ventilation is adequate. The air drawn in may not contain any aggressive or electrically conductive gases which could have a negative impact on the functioning of the equipment.
- The unit dissipates heat and increases the temperature of the ambient air. Thus, sufficient clearance must be maintained to heat-sensitive equipment.

Installation altitudes exceeding 1000 meter above sea level:

For installation altitudes exceeding 1000 meters above sea level, the drive converter or inverter must be de-rated corresponding to the adjacent diagram.

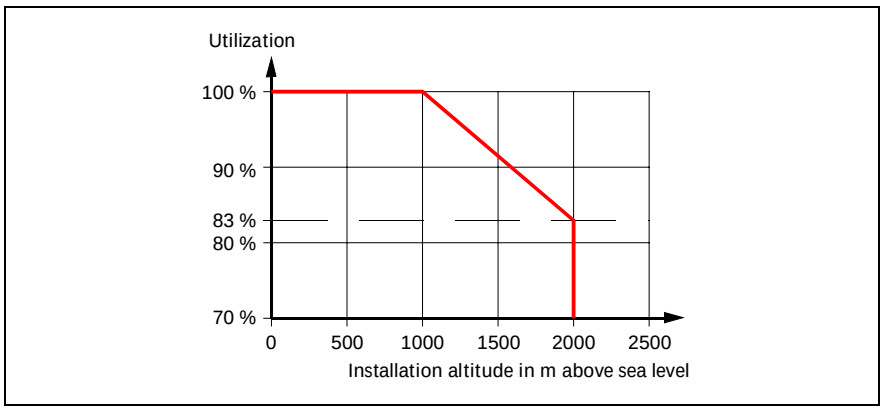


Fig. 2-1: Derating as a function of the installation altitude

2.2 Mounting units sizes A to D

- The REFU*drive 500* drive converters, sizes A to D are modular, and are designed for mounting in cabinets.
- For cabinet mounting, the cooling air requirements of the mounted units must be calculated and the cabinet cooling appropriately dimensioned. The power loss of the units is sub-divided into 15 % + 60 W (from the electronics) dissipated from the unit, and 85 % which is dissipated at the rear of the unit through the heat transfer plate. If the power loss is dissipated to the external environments via the heat transfer plate, or using liquid cooling, the cabinet cooling only has to be dimensioned to dissipate the remaining power loss.
- The units are mounted by flanging the heat transfer plate of the units on heatsinks. As a result of the holding assembly, the minimum clearance when mounting units in-line is 20 mm.

Application-related engineering

For projects involving the REFU*reduc* drive series, a complete quotation is always specifically generated for the particular drive application. The application-related engineering is offered as service and includes the following items:

- Dimensioning the drive systems
- Software and firmware
- Hardware
- Mounted and integrated components
- Cooling systems

In addition to general technical documentation, project-specific documentation is always supplied:

- System description
- Circuit diagrams of the total project
- Mounting and installation diagrams
- Dimension drawings

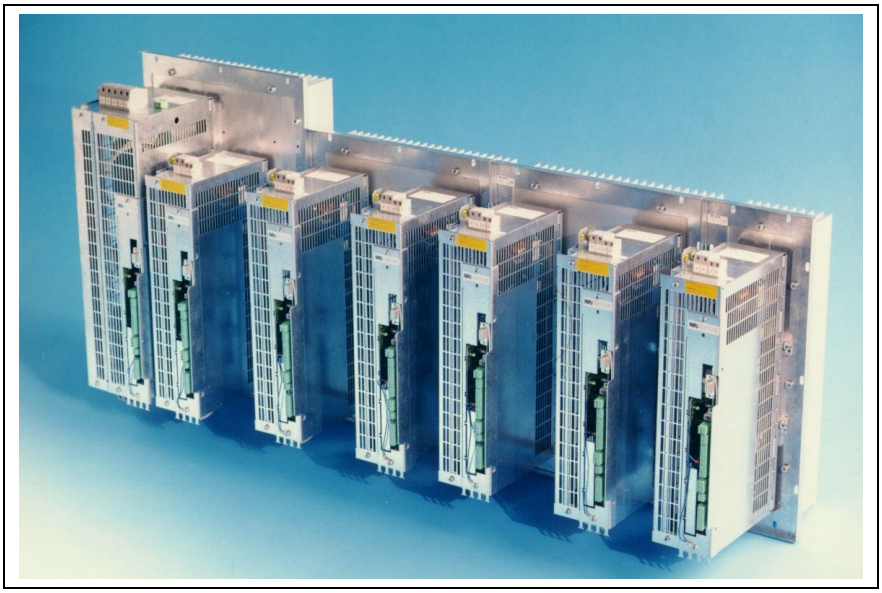


Fig. 2-2: Project with units from the REFU*reduc* series: Multi-motor drive with degree of protection IP 54 (NEMA 12) through connection mounting with textile heatsinks and mounting frames

Project example

Fig. 2-3: Project example; AC drive converter with higher rating feed (rectifier) and inverter

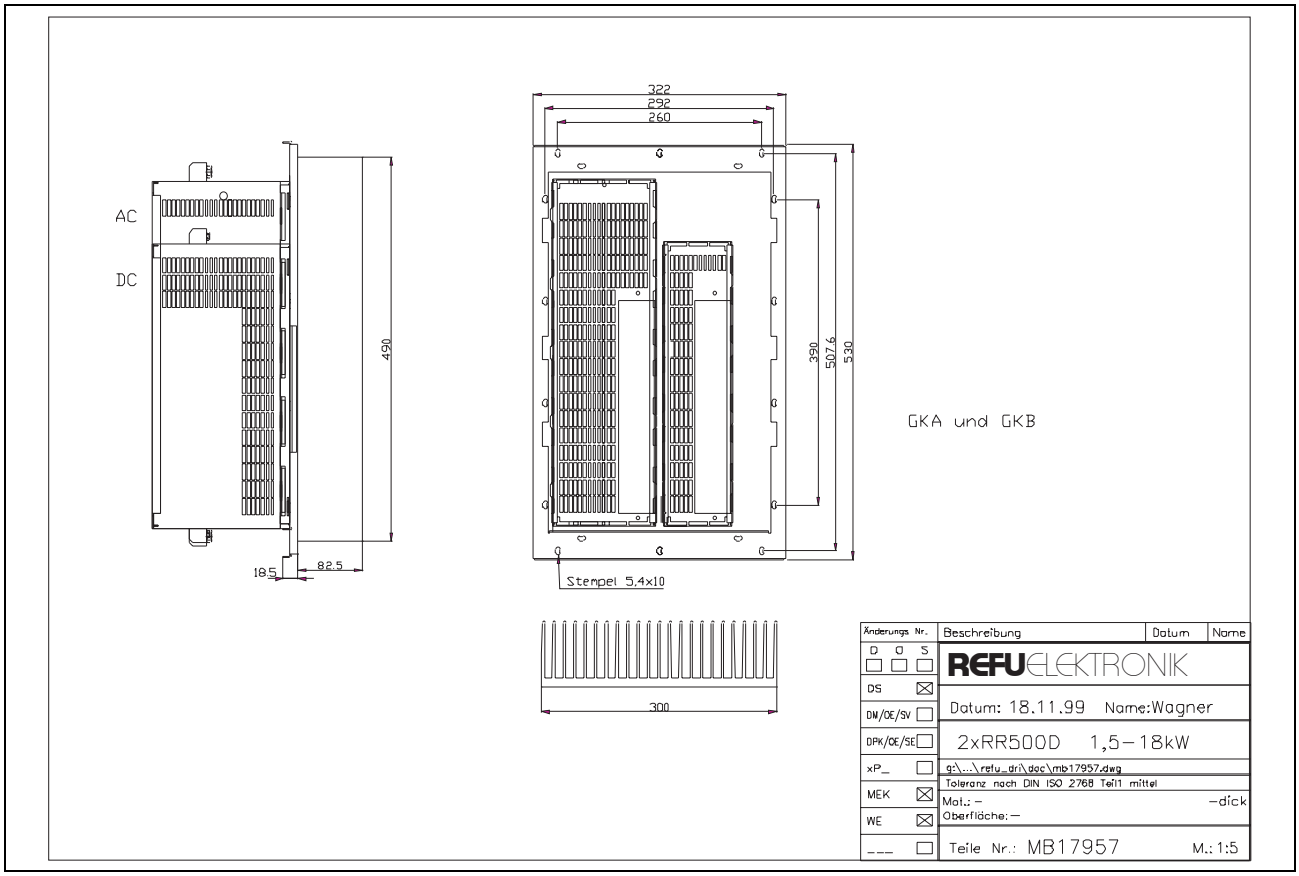


Fig. 2-4: Project documentation; Dimension drawing with overall dimensions and mounting holes

Dimension drawings

Note:

In the dimension sheets shown below, only the housing dimensions of each size class are specified without the cooling system. Every REFU*reduc* series unit with cooling system which is shipped has the project-related dimension drawings with the complete dimensions including the cooling system and mounting holes.

Drive inverter

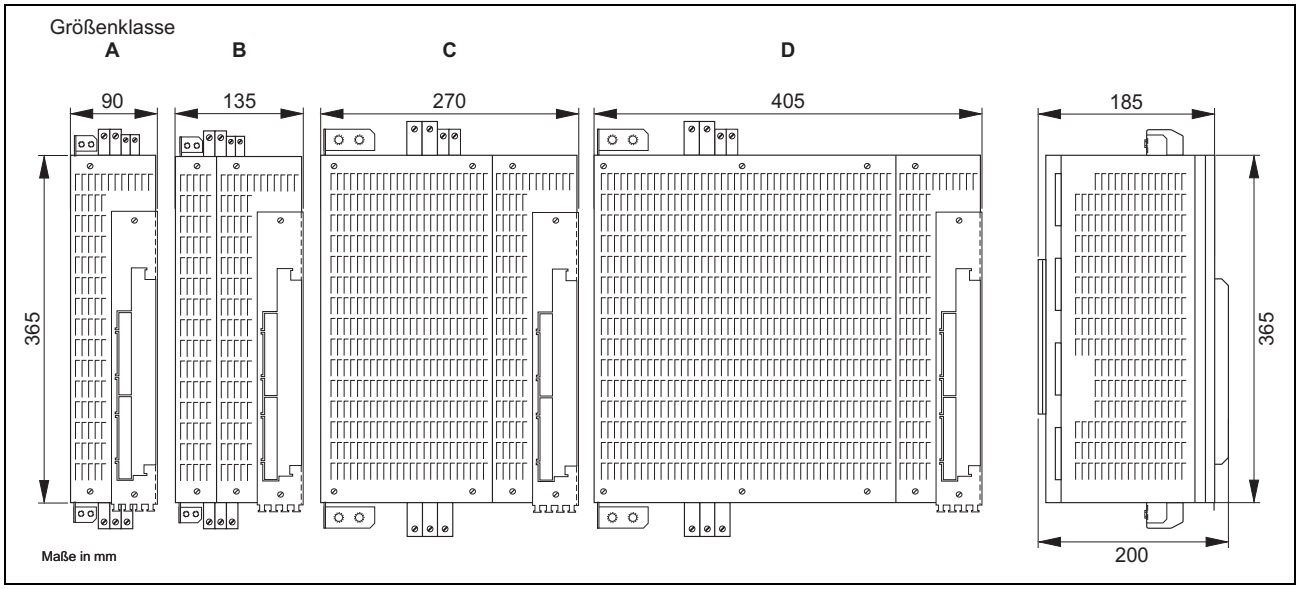


Fig. 2-5: Dimension drawing, inverter without cooler

AC drive converter (size A – D) and AC drive converter with increased feed (size B and D)

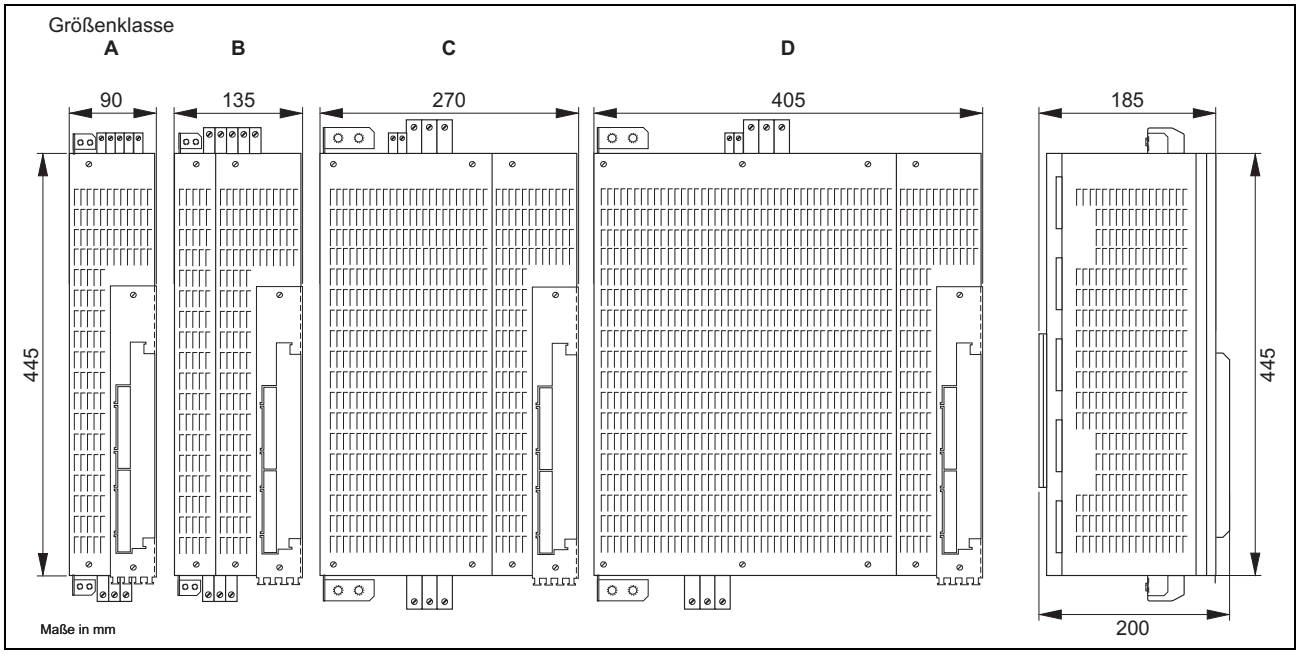


Fig. 2-6: Dimension drawing, converter without cooler

AC drive converters with higher rating rectifier (size D) and external fuse load disconnector

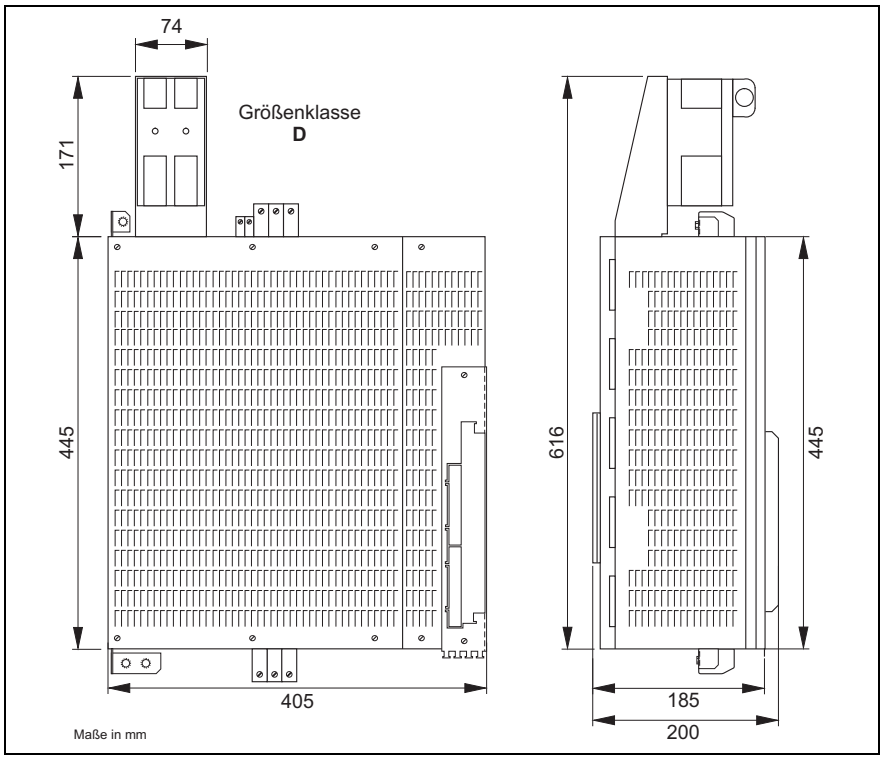


Fig. 2-7: Dimension drawing AC drive converter with higher output rectifier (size D) with external fuse load disconnector without cooler

2.3 Cooling systems

The power sections of AC drive converters and inverters from the *REFUreduc* series are designed for rear cooling. With the heat conduction plate and push-through mounting with special textile heatsinks, forced air cooling can also be implemented outside the cabinet for higher degrees of protection. Versions are also available with liquid cooling with external heat exchangers.

Size class	Heat transition plate	Push-through cooler	Liquid cooling
A and B	yes	yes	yes
C and D	no	yes	yes

Fig. 2-8: Cooling systems for the REFU*reduc*

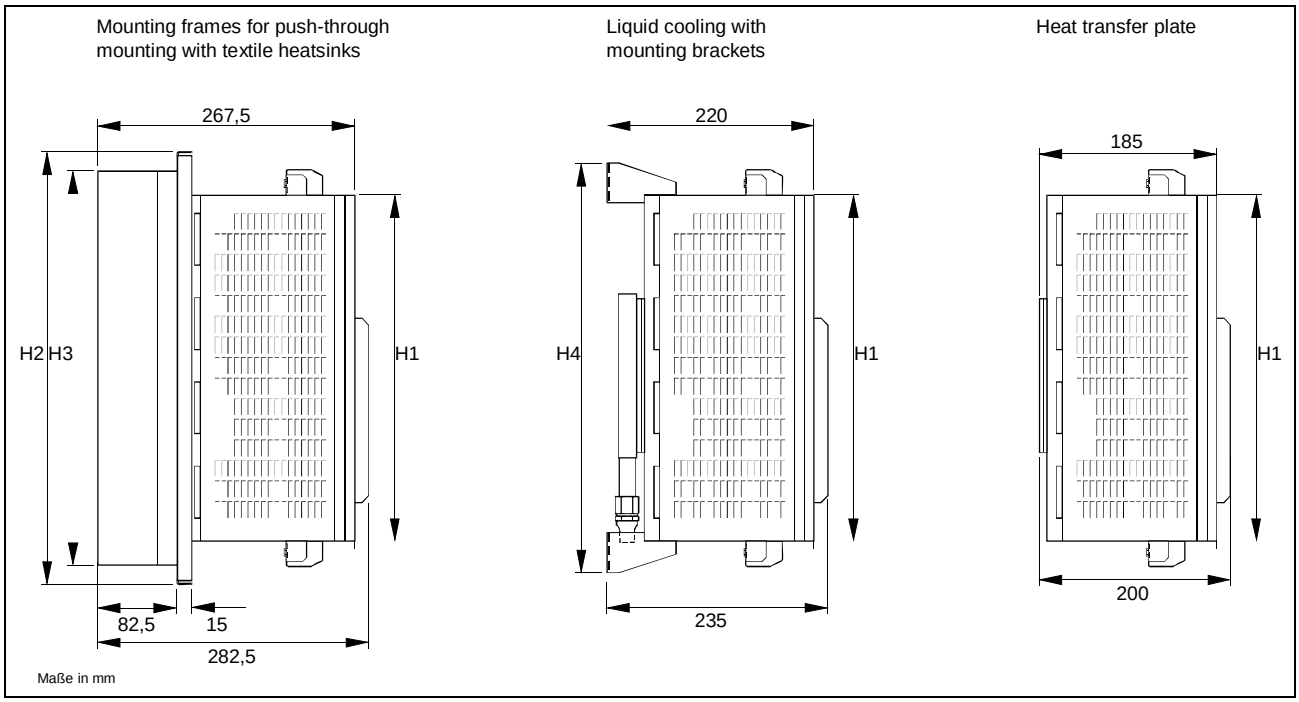


Fig. 2-9: Dimension drawing cooling systems

High	Inverter	Converter
H1	365	445
H2	410	490
H3	450	530
H4	425	505

Fig. 2-10: Height specifications for Fig. 2-9: Dimension drawing cooling systems

Heat transfer plate

Units with heat transfer plate can be directly mounted on a heatsink, or for units with small outputs, on the rear panel of a cabinet or machine housing. The required brackets and mounting rails to flange-mount the heat transfer plate are supplied. In order to calculate the power loss at the heat transfer plate, refer to the Technical data. Heat transfer paste is not required for the heat transfer from the heat transfer plate to the heatsink.

CAUTION

Incorrectly applied heat transfer paste has a negative impact on the heat transfer capability!

The heat transfer plate has been dimensioned so that no heat transfer paste is required. Heat transfer foil can be used without any problems.

Mounting frames for push-through mounting with textile heatsinks

Special textile heatsinks have been used for this cooling system. They have extremely smooth ribs and an optimum cooling rib distance. This means that no fibers or other particles from the cooling air stick to the ribs. This means that cooling air filters are not required. The heatsinks can be easily cleaned.

An air flow of 6 to 10 m/sec is expected for forced cooling with textile heatsinks.

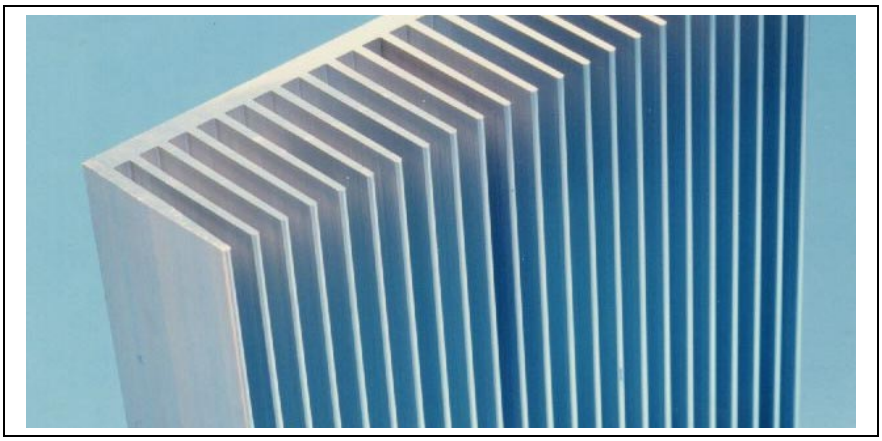


Fig. 2-11: Special textile heatsink

The push-through mounting is especially suitable for cabinets with degree of protection IP54. As a result of the special unit and cabinet mechanical design, the power loss to be dissipated in the cabinet is only 15 %. 85 % of the power loss is directly dissipated through the external heatsink. The textile heatsinks allow cooling with non-filtered ambient air.

For multi-motor drives, the units with heat transfer plate can be mounted on a common heatsink in-line with several other units. The width of the heatsink depends on the size and number of the units and the required heat dissipation. The units with textile heatsinks and mounting frames are always configured on a customer-for-customer basis and supplied as coupled units, refer to Fig. 2-2: . Every REFU*reduc* series unit with cooling system which is shipped has the project-related dimension drawings with the complete dimensions including the cooling system and mounting holes.

Liquid cooling

REFU*reduc* units with liquid cooling are supplied with special mounting brackets. When customers request it, heatsinks for several drive units can be configured and also alternative mounting methods, e.g. where the heatsink is directly bolted to the mounting surface.

REFU*reduc* units with liquid cooling can be integrated in an existing cooling system, e.g. for motors. A dedicated cooling system with heat exchangers can also be configured. It is possible to connect several units in series. The cooling system must be engineered with reference to the flow rates, power loss and connected units and heat exchangers. The liquid discharge temperature at the last drive unit of the cooling system should not be above 50°C. The heatsinks of Indramat Refu are adapted to the power loss of the units so that at rated output, the cooling liquid, depending on the output class of the unit, temperature rises between 3°C and 5°C. An external circulating pump is required to circulate the cooling water. A number of frequency converters can be connected to an Indramat Refu heat exchanger until the sum of all of the individual losses reaches the cooling power of the heat exchanger.

Heat exchanger for liquid cooling systems

Heat exchangers for mounting on the cabinet roof assembly and at the panel are available with two different ratings.

Mounting type	Order code	Size	Cooling power (kW)
Cabinet	LE12305.5	A	4
Cabinet	LE12405.5	B	5
Panel	LE12366.5	C	4
Panel	LE12466.5	D	5

Fig. 2-12: Heat exchanger for liquid cooling systems

Heat exchanger for cabinet mounting

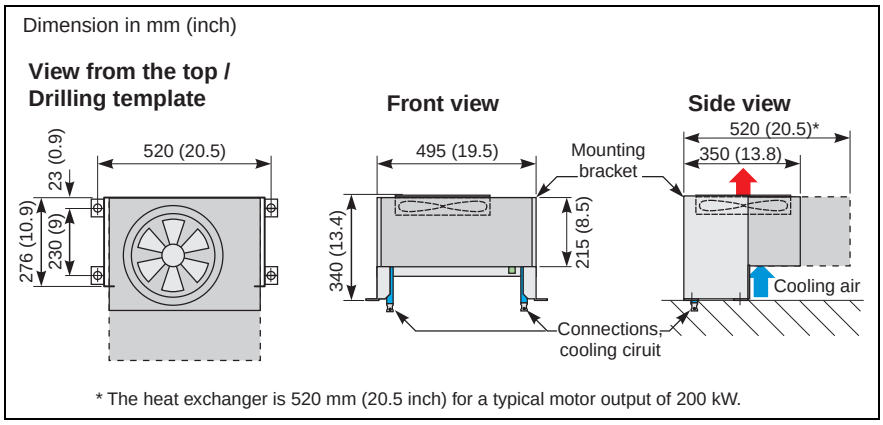


Fig. 2-13: Dimension drawing heat exchanger for cabinet mounting, size class A and B

Heat exchanger for wall mounting

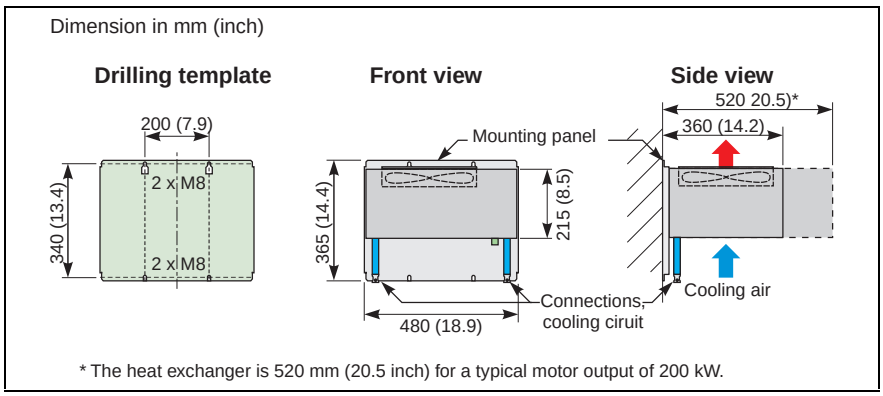


Fig. 2-14: Dimension drawing heat exchanger for wall mounting, size class C and D

Recommended cooling medium for liquid cooling systems

Liquid cooling systems produced by Indramat Refu are filled with a cooling medium comprising tap water and anti-freeze , type Antifrogen N (Clariant) in a ratio of 1.5 : 1. This guarantees corrosion protection and antifreeze protection down to –30° C.

For liquid cooling systems, which customers manufacture themselves using accessories from Indramat Refu (heat exchangers, heatsinks, hoses, connecting elements), a cooling agent must be used with the

same composition as specified above. The anti-freeze is available from Indramat Refu under Order No.: 0015343.

CAUTION

Anti-freeze agents is poisonous!

⇒ If accidentally swallowed, immediately contact a doctor and show him/her the packing or label on the anti-freeze container.

WARNING

If other anti-freeze agents are mixed, this can result in deposits which could accumulate and destroy the cooling system!

⇒ Do not mix the cooling medium with other anti-freeze agents!

3 Electrical installation

3.1 EMC-compatible drive design

The following 10 rules are the basics for designing drive systems which are EMC-compatible. You'll find details in the Instruction Manuals supplied with the equipment.

You can obtain a detailed description "EMC-compatible drive design" from Indramat Refu, or from the Internet under http://www.refu.com.

Rules 1 to 7 are generally valid. Rules 8 to 10 are especially important to limit noise emission.

Rule 1 All metal parts of the cabinet should be connected with one another through the longest possible surface so that the best electrical connection is established. (Not paint on paint!) If required, use serrated washers which cut through the paint surface. The cabinet door should be connected to the cabinet using the shortest possible grounding straps.

Rule 2 Signal-, line supply-, motor- and power cables should be routed away from another (this eliminates mutual interference!). The minimum clearance is: 20 cm. Barriers should be provided between power- and signal cables. These barriers should be grounded at several locations.

Rule 3 Contactors, relays, solenoid valves, electromechanical operating hours counters etc. in the cabinet must be provided with noise suppression devices, e.g. using RC elements, diodes, varistors. These devices must be connected directly at the coil.

Rule 4 Unscreened cables of the same circuit (feeder and return cables) should be twisted with the smallest possible distance between them. Cores which are not used must be grounded at both ends.

Rule 5 Generally, noise which is coupled-in can be reduced by routing cables as close as possible to grounded sheet steel panels. For this reason, cables and wires should not be routed freely in the cabinet, but as close as possible to the cabinet itself and the mounting panels. This is also true for reserve cables.

Rule 6 Incremental encoders must be connected using a shielded cable. The shield must be connected at the incremental encoder and at the AC drive converter through the largest possible surface area. The shield may not be interrupted, e.g. using intermediate terminals.

Rule 7 The screens of signal cables must be connected to ground at both ends through the largest possible surface area to establish a good electrical connection (transmitter and receiver). If the potential bonding between the screen connections is poor, to reduce the screen current, an additional potential bonding conductor with a cross section of at least 10 mm² should be connected in parallel with the screen. The screen can be connected to ground (=cabinet housing) at several locations. This is also true outside the cabinet. Foil screens are not recommended. Braided screens provide a better screening (factor of 5). If the potential bonding is poor, analog signal cables may only be connected at one end to the drive converter in order to prevent low-frequency noise being injected into the screen (50 Hz).

Rule 8 Always locate a radio interference suppression filter close to the noise source. The filter should be connected through the largest possible surface area with the cabinet housing, mounting panel etc. The best solution is a bare metal mounting panel (e.g. manufactured from stainless steel, galvanized steel), as the complete mounting surface can be used to establish good electrical contact.

The incoming and outgoing cables of the radio interference suppression filter should be separated.

Rule 9 All variable-speed motors should be connected using screened cables, whereby the screen is connected at both ends to the housings through the largest possible surface area to minimize the inductance. The motor cables should also be screened outside the cabinet, or at least screened using barriers. Suitable motor cables, e.g. Siemens PROTOFLEX-EMV-CY (4x1.5 mm^2... 4x120 mm^2) with copper screen.

Steel-screened cables are not suitable.

To connect the screen at the motor, a suitable PG gland with screen connection can be used (e.g. „SKINDICHT SHV/SRE/E“ from the Lapp Company, Stuttgart). It should be ensured that the connection between the motor terminal box and the motor housing has a low impedance. Otherwise, use an additional grounding strap between them.

Never use plastic motor terminal boxes!

Rule 10 The screen between the motor and AC drive converter may not be interrupted by installing components such as output reactors, sinusoidal filters, motor filters, fuses, contactors. The components must be mounted on mounting panels which also simultaneously serve as screen connection for the incoming and outgoing motor cables. If required, metal barriers may be required to screen the components.

3.2 Warning notes and informations

DANGER

High electrical voltage! Danger to life, severe electrical shock and severe bodily injury!

⇒ REFUdrive 500 drive converters are operated at high voltages. Work on the equipment may only be carried-out when the equipment is in a no-voltage condition!

⇒ Only qualified personnel may carry out work on the equipment!

⇒ Death, severe bodily injury and significant material damage could result if this warning information is not observed.

⇒ The drive converter can still be at hazardous voltage levels up to 5 minutes after the equipment has been disconnected, due to the DC link capacitors. Thus, work may only start on the drive converters or the DC link terminals after an appropriate delay time has expired.

⇒ Even when the motor is at a standstill, the power- and control terminals could still be under volt-age.

⇒ If the DC link voltage is centrally supplied, it should be ensured that the inverter is safely isolated from the DC link voltage!

⇒ When working on a unit which has been opened, it should be observed that live components are exposed.

⇒ The user is responsible in ensuring that all of the drive converters are mounted and connected according to the recognized technical regulations in the country of installation as well as any other regionally valid regulations. Cable dimensions, fusing/protection, grounding, shutdown, isolation and overcurrent protection must be especially taken into account.

CAUTION

Observe the supply voltage!

⇒ The REFU*drive 500* units are designed and manufactured for various line supply voltages! Thus, line supply voltages are not specified in the drawings and tables for the terminal strips.

⇒ When connecting-up the equipment, please observe the line supply voltage specified on the rating plate and in the Technical Data.

Information regarding protective grounding

As a result of the equipment discharge currents (>3.5mA) through the protective conductor (PE), according to DIN VDE0160, the cross-section of the protective conductor to the cabinet must be at least 10mm^2 Cu, or a second protective conductor must be connected in parallel. (VDE 0160, Section 6.5.2). The equipment discharge currents can be up to 100 mA.

For higher ratings, the minimum cross-section of the protective conductor must have the appropriate relationship to the cross-section of the phase conductor. Refer to DIN 57100 Part 540 / VDE 0100 Part 540 Table 2. The line-side circuit of the drive converter corresponds to circuit 7 (DIN VDE 0160-5.5.3.4.2 Fig. 8).

In this case, it is not permissible to use e.l.c.b.'s as protective device.

3.3 Conductor cross-section

The conductor cross-sections refer to the rated drive converter current.

The associated protective conductor cross-section must be a minimum of 10 mm^2 (if cables have cable cross-sections > 10 mm^2, the protective conductor must have the same cross-section).

For line supply cables / DC link cables (feeder cables), the following assumptions are made:

- The cross-sections are valid for one phase for multi-core cables and was defined in accordance with VDE0298.
- Up to 35 mm^2, individual cores in the cable duct.
- Above 50 mm^2, free routing in the cabinet without coming into contact with other cables or equipment (as an alternative, busbars are recommended).

For motor feeder cables, the following assumptions are made:

- The cross-sections are valid for shielded four-conductor cables, and were defined according to VDE0298.
- Up to 35 mm^2, routing in cable ducts without cable clumping
- From 50 mm^2, free, routing in the cabinet without coming into contact with other cables or equipment.

Frequency converters without DC link and inverters

Equipment output for 400/480 V	Supply connection				Motor connection	
	Recommended min. cross-section		Cable cross-section range 1)	Maximum fusing Type gL	Recommended min. cross-section	Cable cross-section range 1)
	converters 2)	inverters 3)				
[kW]	[mm^2]	[mm^2]	[mm^2]	[A]	[mm^2]	[mm^2]
1,5	2,5	2,5	0,2 - 4	5	2,5	0,5 - 10
3,0	2,5	2,5	0,2 - 4	10	2,5	0,5 - 10
4,0	2,5	2,5	0,2 - 4	16	2,5	0,5 - 10
5,5	2,5	4	0,2 - 4	16	2,5	0,5 - 10
7,5	4	4	0,2 - 4	20	4	0,5 - 10
11	10	10	0,5 - 25	35	6	0,5 - 16
15	10	16	6 - 25	35	10	0,5 - 16
18,5	16	16	6 - 25	50	10	0,5 - 16
22	16	25	16 - 50	50	16	25 - 50
30	25	35	16 - 50	63	25	25 - 50
37	35	35	25 - 50	80	35	25 - 50
45	50	50	25 - 50	100	50	25 - 50
55	50	50	35 - 95	125	50	35 - 95
75	50	95	35 - 95	160	50	35 - 95

1): As a result of the terminal size
2): Frequency converters; feeder cables at U1, V1, W1
3): Inverters; feeder cables at C, D

Fig. 3-1: Cable cross section for mains-, DC bus- and motor connection

Frequency converters to feed a DC bus

Equipment output for 400/480/500 V	Supply connection		
	Recommended min. cross-section	Cable cross-section range 1)	Maximum fusing Type gL
[kW]	[mm^2]	[mm^2]	[A]
11	16	10 - 16	63
15	16	10 - 16	63
18,5	16	10 - 16	63
22	70	35 - 95	160
30	70	35 - 95	160
45	70	35 - 95	160
55	70	35 - 95	160

1): As a result of the terminal size

Fig. 3-2: Cable cross-sections for mains connection, frequency converter with DC bus

3.4 Power terminals RR52, size class A-D

Only a drive converter of one size is illustrated in the terminal layout diagram. The terminal position is the same for narrower or wider units. Line supply- and DC connections are always at the top and the motor and P24V electronics standby connections at the bottom in the housing.

Note: The P24V electronics standby power supply (terminal X83) is only installed if this was specified when ordering. It may only be retrofitted by our service department.

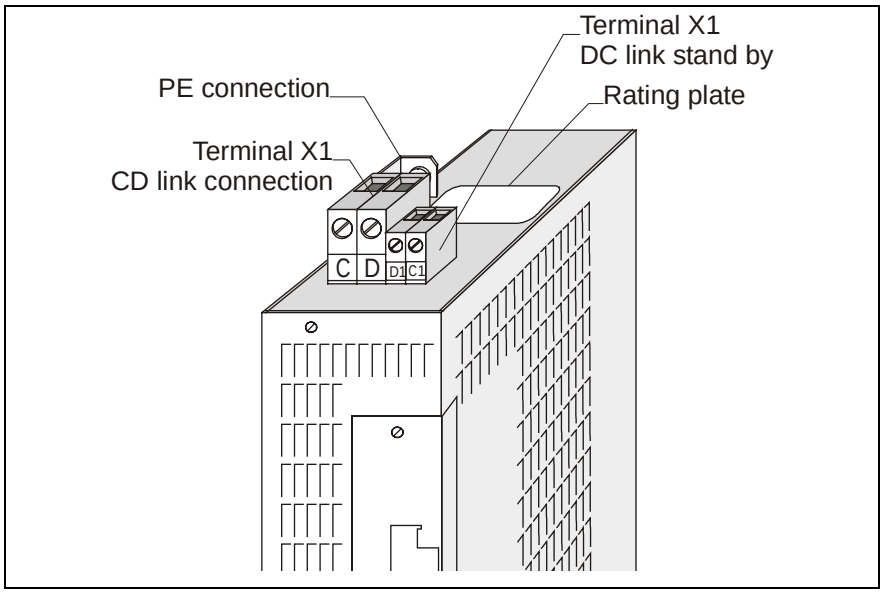
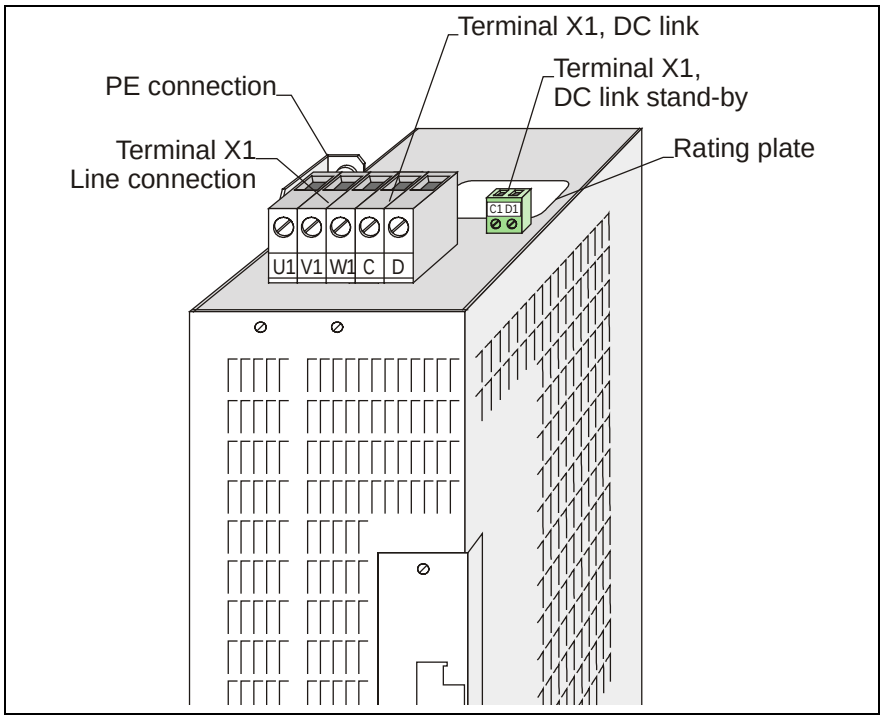


Fig. 3-3: Top side of inverters, size A



C1/D1:At size A, this terminals are missing

Fig. 3-4: Top side of frequency converters, size B

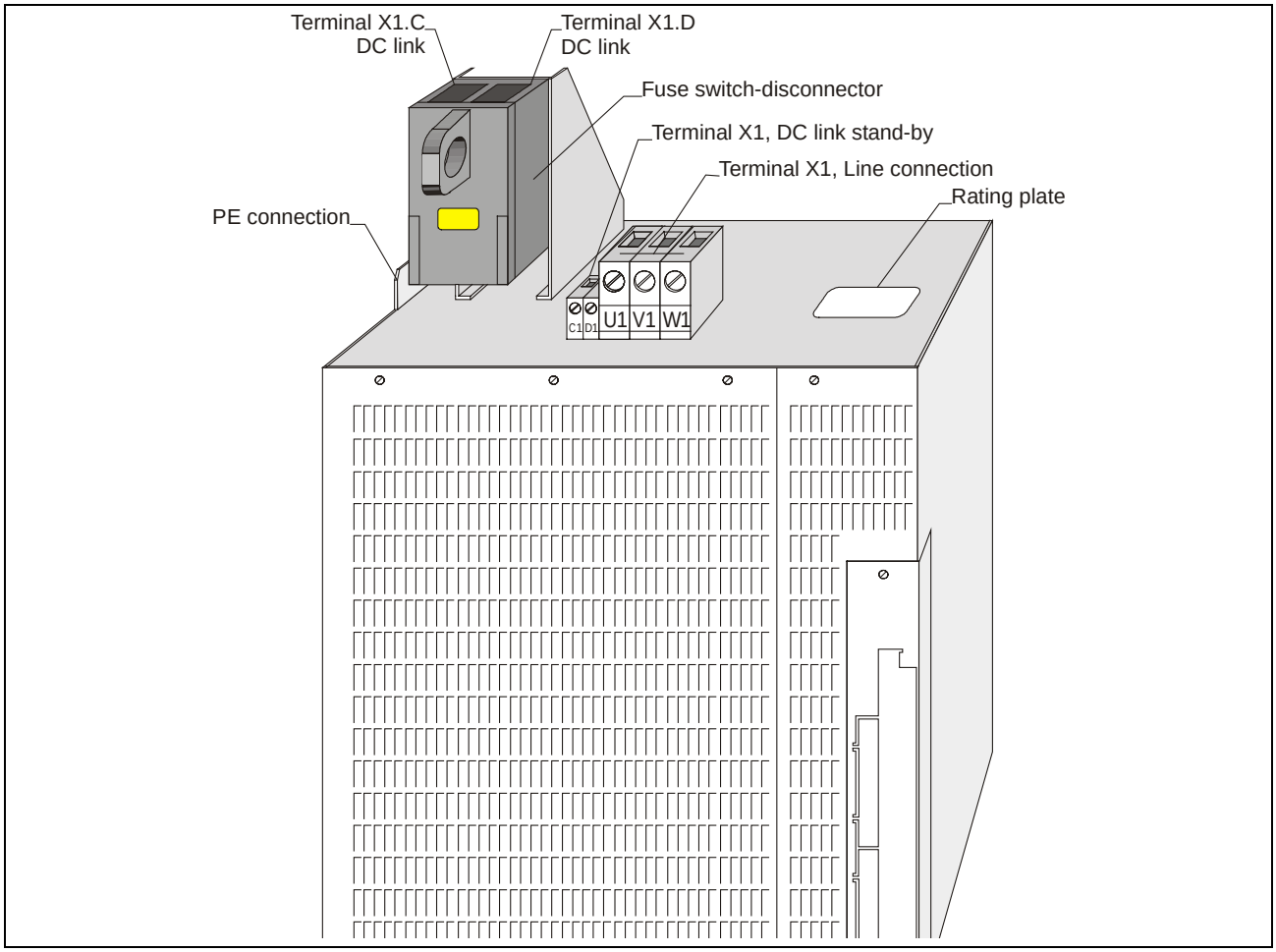


Fig. 3-5: Top side of frequency converters, size D, with external fuse switch-disconnector

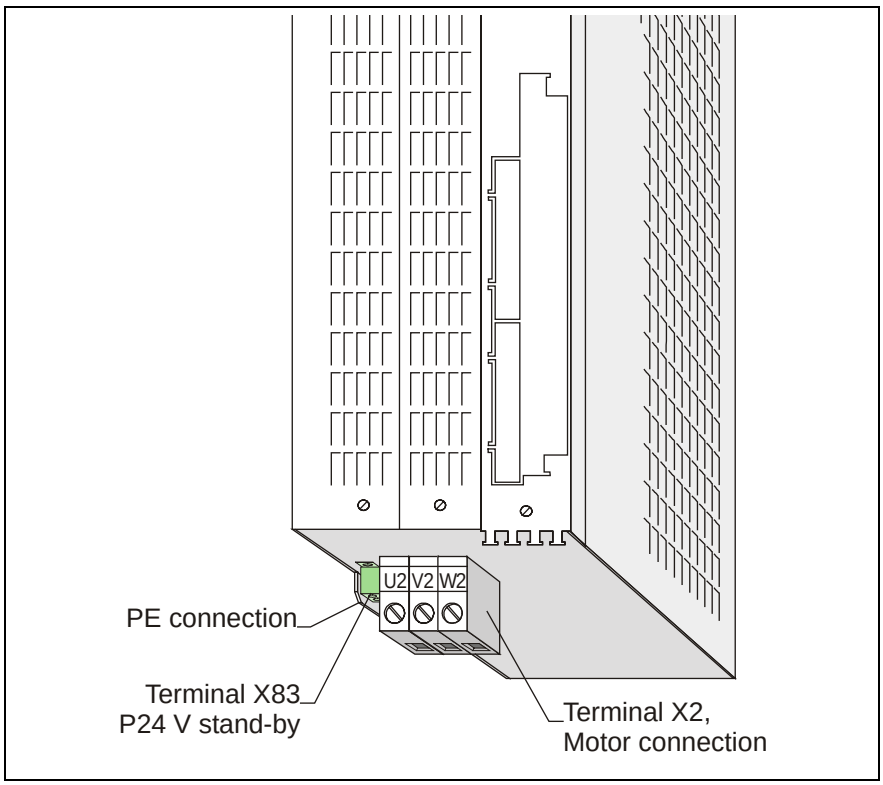


Fig. 3-6: Bottom side, size B

Description of the power terminals

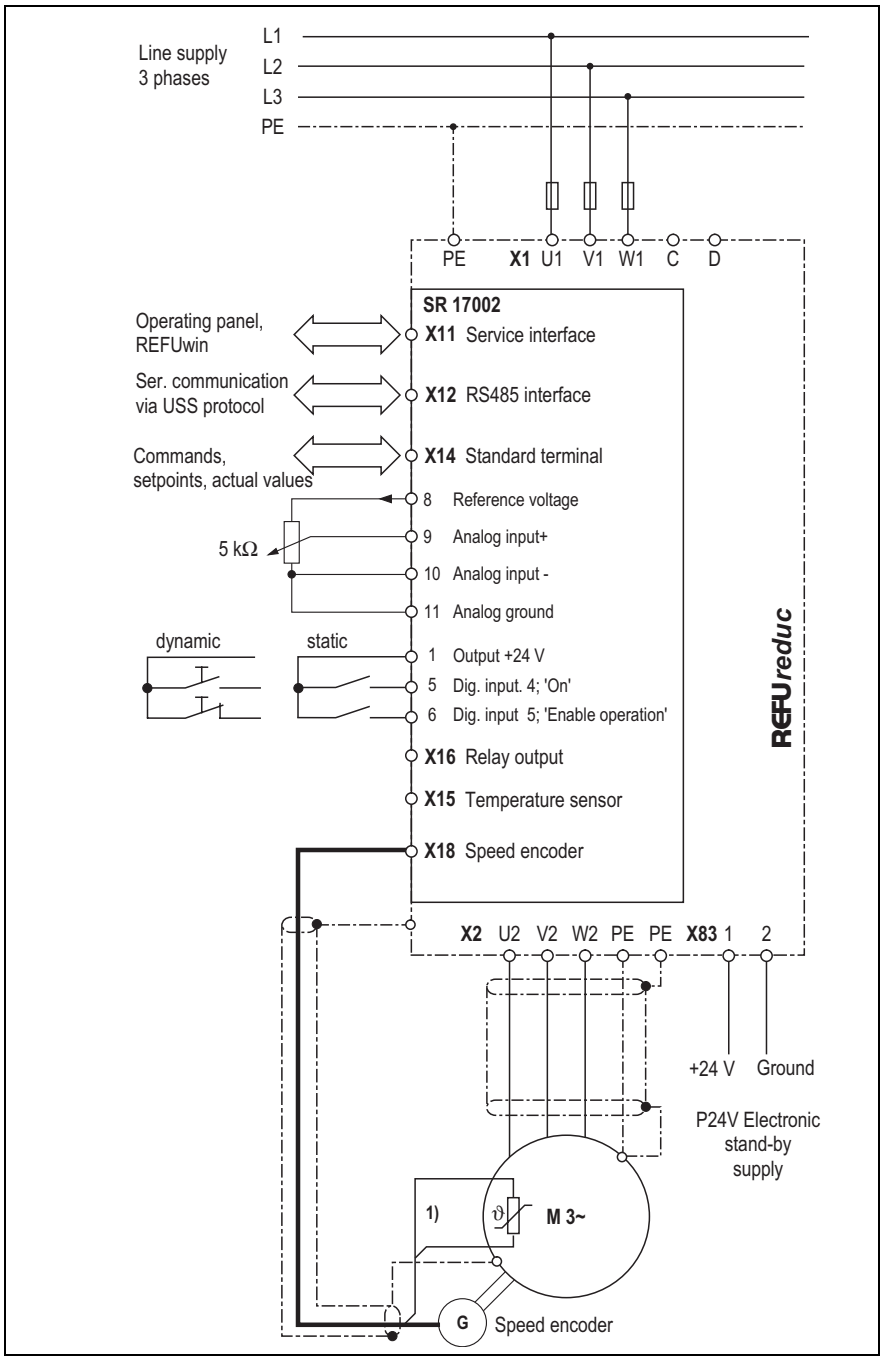
Terminal	Comment
X1	**Line-, DC link-, brake resistor connection**
PE	Protective conductor connection; sheet steel lug on the housing with captive nut, for sizes A and B = M5, for sizes C to E = M6
L1 / U1	Supply connection, 3 phases L1, L2, L3 Permissible line supply voltage, refer to the rating plate on the upper section of the equipment.
L2 / V1	
L3 / W1	
L+ / C	DC link connection L+
L- / D	DC link connection L-
L+ / C1	DC link stand-by to connect the switched-mode power supplies. At the frequncy converters, C1/D1 are output terminals, internal fused with 4 A.
L- / D1	

X2	Motor terminal
U2	Motor connection U, V, W
V2	
W2	
PE	Protective conductor connection, motor and screen connection for the motor cable; Sheet steel lug with captive nut on the housing, for sizes A and B = M5, for sizes C and D = M6

X83	OPTION P24V stand-by supply for the electronic (the terminal is only mounted for equipment with the integrated OPTION)
1	+24 V uncontrolled (18 V ... 30 V), power drain approx. 40 W
2	Ground

3.5 Connection diagrams

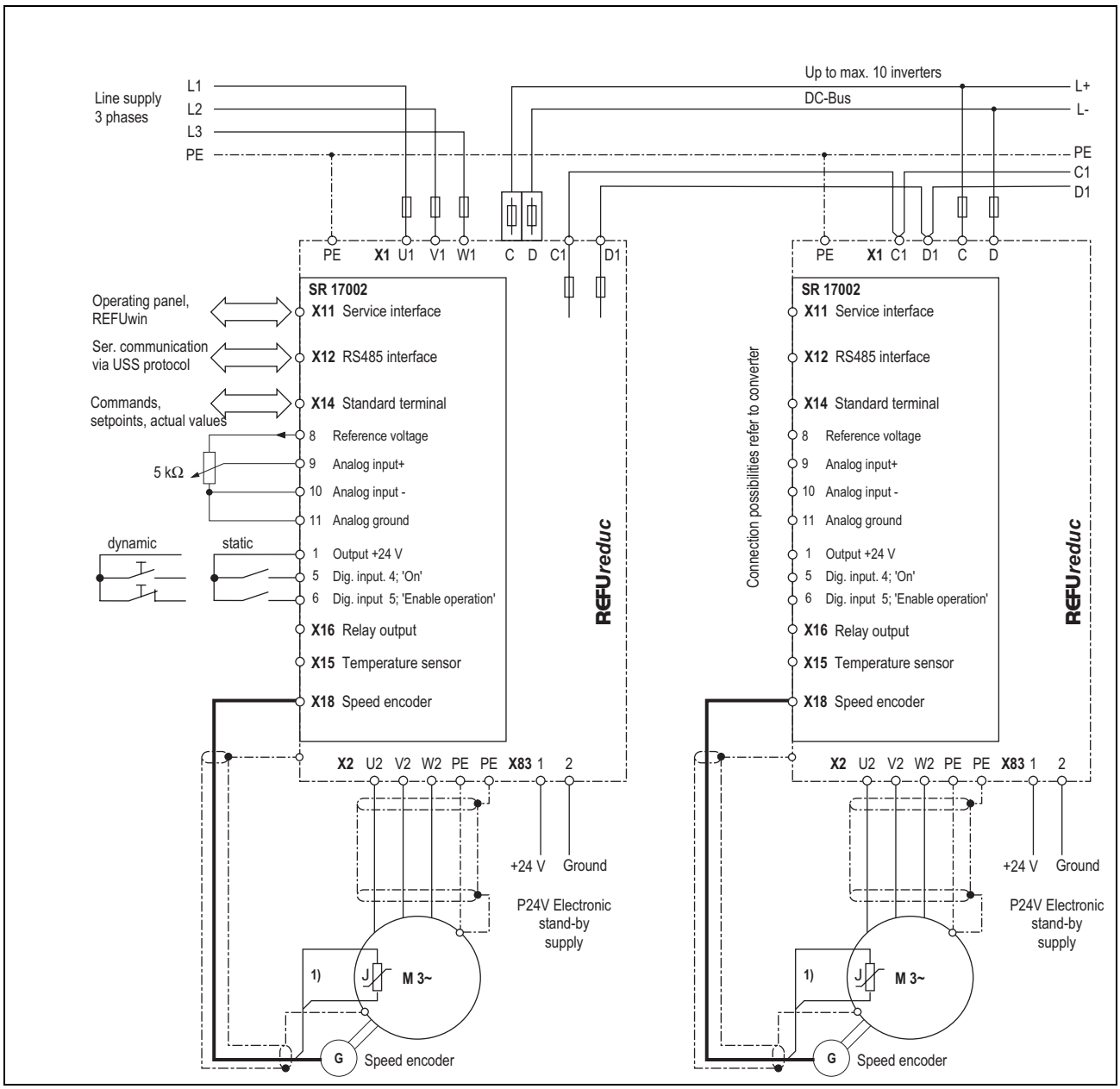
Frequency converter



1): Depending on the encoder used, the conductors for the temperature sensor are routed in the encoder cable or are connected to X15 using a separate cable.

Fig. 3-7: Connection diagram for frequency converter

Frequency converter with DC bus and inverters



1): Depending on the encoder used, the conductors for the temperature sensor are routed in the encoder cable or are connected to X15 using a separate cable.

Fig. 3-8: Connection diagram for frequency converter with DC bus and inverters

3.6 Control terminals

Terminal layout diagram SR17002

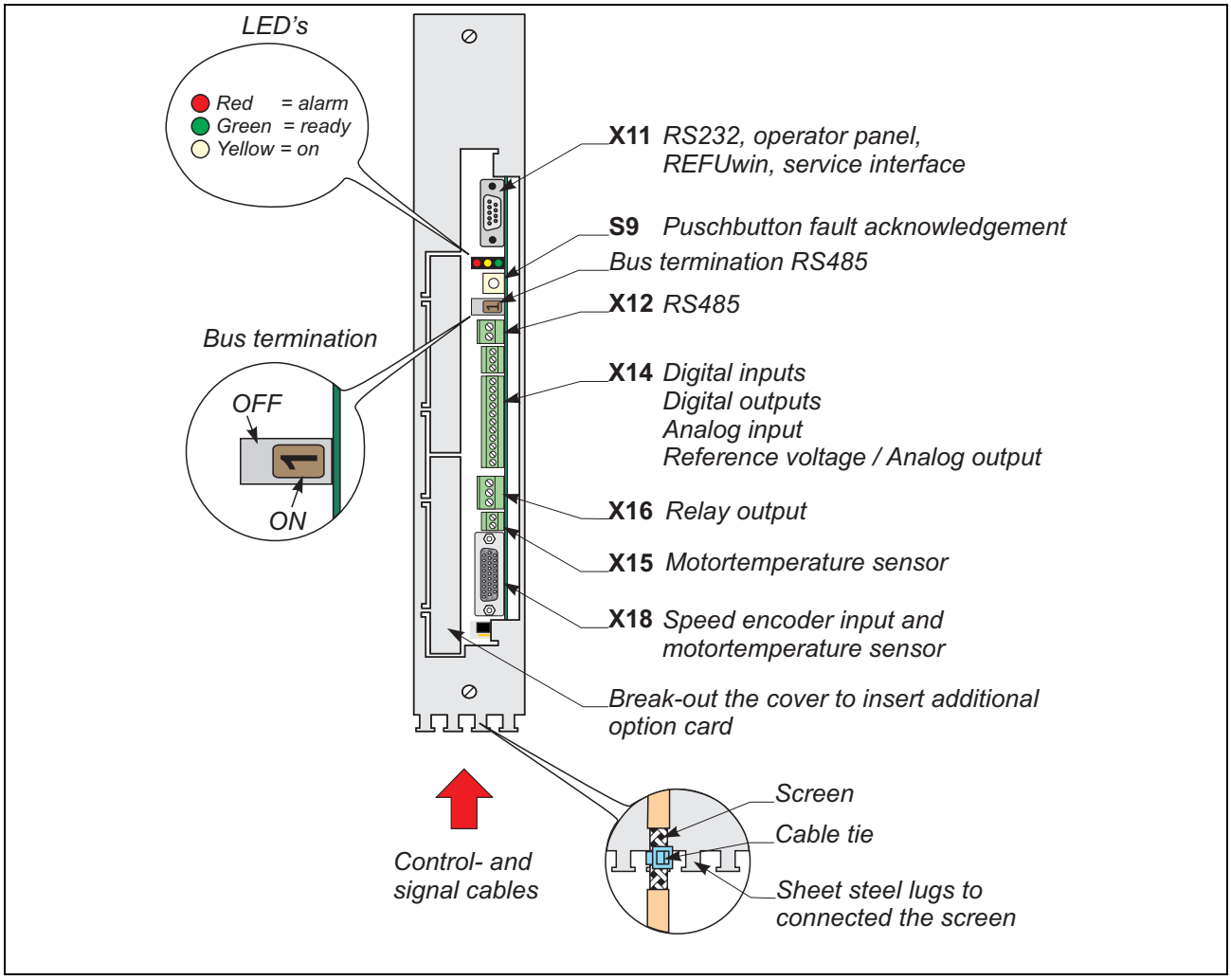


Fig. 3-9: Control terminals on the control board SR17002

Description of the control terminals

Terminal	Designation	Comment
X11	**Service interface**	
3	R x D	RS232 service interface; ➢ to insert the operator panel ➢ to connect a PC with the REFU*win* HMI
2	T x D	
5	Ground	
X12	**RS485 interface**	
1	R x D+ / T x D+	RS485 interface; communications with the USS protocol
2	R x D- / T x D-	
X14	**Standard terminal strip**	
1	P24V output	Load capability, max. 50 mA
2	Dig. input 1 Dig. output 1	Digital inputs without electrical isolation: Input current for 24 V: 8.6 mA H signal: +13 V ... +33 V L signal: –3 V ... +5V or open-circuit terminal Digital outputs H signal: +21 V, max. 20 mA L signal: 0 V
3	Dig. input 2 Dig. output 2	
4	Dig. input 3 Dig. output 3	
5	Dig. input 4	
6	Dig. input 5	
7	Digital Ground	Reference ground +24 V (X14.1)
8	±10 V reference Analog output	Optional function, can be switched-over with P0436: ➢ reference voltage +10 V ➢ reference voltage –10 V ➢ analog output 0 ... ±10 V Load capability, max. 5 mA, short-circuit proof
9	Analog input+	Differential input, can be optionally set: ➢ ±10 V; A/D converter ±11 Bit; resolution 5 mV R_e = 40 kΩ ➢ 0 ... 20 mA; A/D converter 11 Bit; resolution 0,01 mA R_e = 150 Ω ➢ 4 ... 20 mA; A/D converter 11 Bit; resolution 0,01 mA R_e = 150 Ω
10	Analog input -	
11	Analog Ground	Reference ground, reference voltage / analog output (X14.8)
X15	**Motor temperature sensor**	
1	PTC / KTY+	Motor temperature sensor connection (PTC or KTY84). Observe the polarity when connecting a KTY84!
2	PTC / KTY -	
X16	**Relay output**	
1	NO contact	Relay output Load capability: 250 V AC, 7 A 30 V DC, 7 A
2	Common contact	
3	NC contact	

Fig. 3-10: Description of the control terminals on the control board SR17002

3.7 Encoder connection

The following encoder types can be connected to the REFU*drive 500* RD52 series:

- TTL incremental encoders, V_B = 5 V, with inverted tracks according to RS422
- TTL incremental encoders (type R), V_B = 9 to 30 V, with inverted tracks according to RS422
- HTL incremental encoders, V_B = 9 to 30 V, with / without inverted tracks
- Sine/cosine encoders, V_B = 5 V, signal voltage 1 V_{PP}
- Sine/cosine encoders, V_B = 5 V, with rotor position sensing, e.g. ERN 1387
- Resolvers
- Magneto-resistive transducers

The encoder is connected to the control card at X18 (26-pin sub-D socket connector) (refer to Section 3.6, Terminal layout diagram SR17002). The 26-pin sub-D connector for the encoder is included in the scope of supply of the RD52 units. Pre-assembled encoder cables are available for all of the encoder types.

General information/instructions for engineering and configuring

All of the above mentioned encoders can be used for induction motors.

An ERN1387 or a resolver can be used as encoder for synchronous motors.

The maximum encoder cable length which can be connected essentially depends on the signal frequency, the cable capacitance and the signal voltage, and is specified by the encoder manufacturer. Typical values lie between approximately 100 to 300 m.

Encoder cable cores, which are not used, must be connected to the housing ground at the encoder- and at the drive converter sides.

The motor temperature sensor can either be routed in the encoder cable, or in a separate cable to connector X15 of the control card refer to Section 3.6, Terminal layout diagram SR17002).

Parameterizing the encoder

Parameter No.:	Name	Description /explanation Selectable options	Factory setting Min ... Max values	Pass word
0130	**Encoder selection**		**1**	**2**
		0 = Resolver 1 = Incremental Encoder 2 = ERN Encoder 3 = Sine/cosine Encoder 4 = No speed sensor	0 ... 4	
0131	**Resolver pole-no**		**2**	**2**
		The pole number can be freely set between 2 and 64 poles.	2 ... 64	
0132	**Encoder increments**		**1024**	**2**
		The pulse number can be freely set between 64 and 10000 pulses.	64 ... 10000	
0133	**Resolver delta-phi**		**0°**	**3**
		Electrical encoder adjustment	-180 ... 180°	

Changing-over the encoder power supply voltage

The power supply voltage is changed-over using jumper S5 on the control card. When the equipment is supplied, the jumper is inserted for 5 V. Proceed as follows to change-over the jumper:

Hinweis: Please observe the warning information and instructions in Section 3.2.

- Disconnect the equipment so that it is in a no-voltage condition.
- Remove the front cover of the unit.
- When connecting encoders with a 15 V supply, carefully change-over the jumper from + 5 V (factory setting) to +15 V.

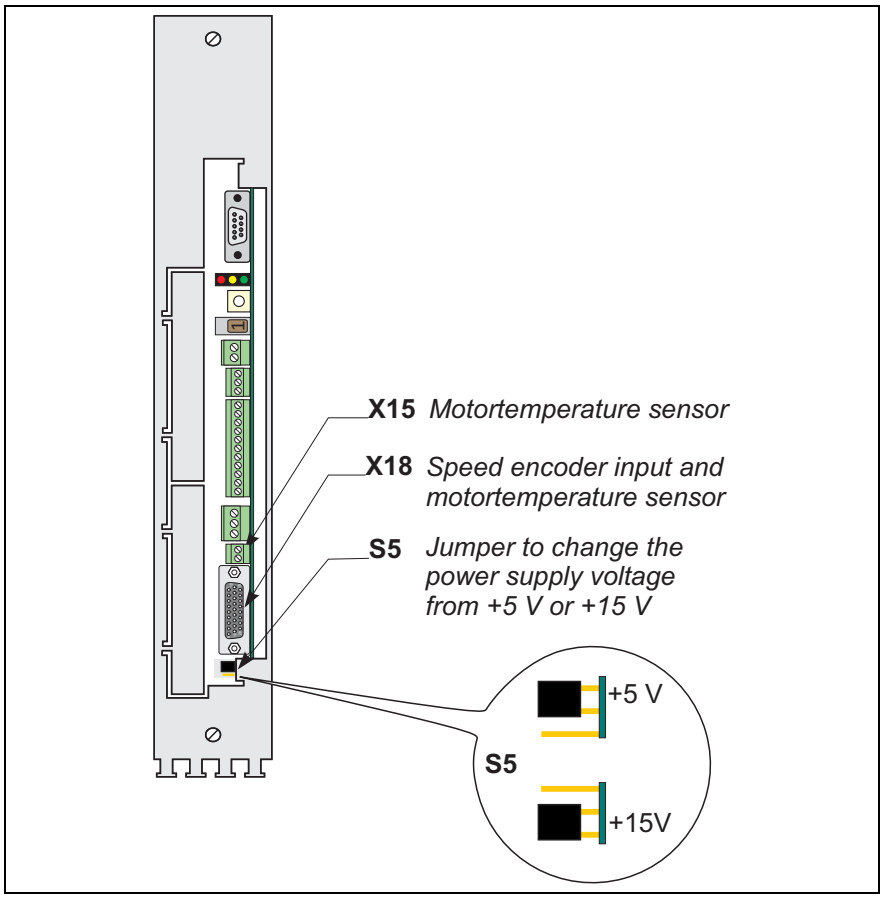


Fig. 3-11: Set the encoder supply voltage

HTL and TTL incremental encoders (for operation with induction motors)

Signal characteristics for clockwise rotation when viewing the drive end of the motor shaft

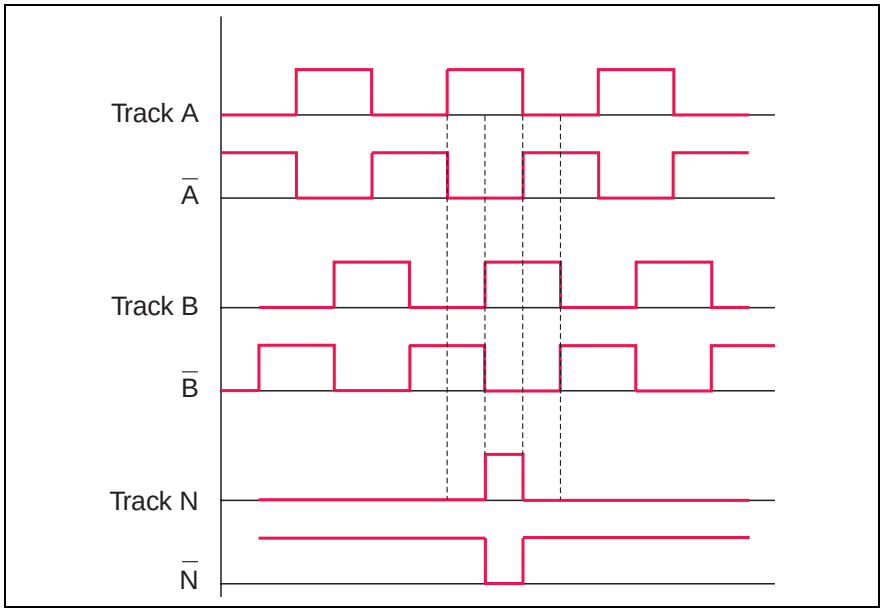


Fig. 3-12: Signal characteristics for HTL and TTL incremental encoders

Connecting the HTL encoder

X18	Speed encoder	
3	N	Zero pulse
4	$\overline{N}$	Zero pulse, inverted
8	M	0 V (ground)
9	P 15V	+15 V power supply voltage (insert jumper S5 to the +15 V setting) (refer to 3.8.3, Changing-over the power supply voltage).
10	B	Pulse track B
11	$\overline{B}$	Pulse track B inverted
19	A	Pulse track A
20	$\overline{A}$	Pulse track A inverted

Fig. 3-13: X18 connector assignment for HTL encoder

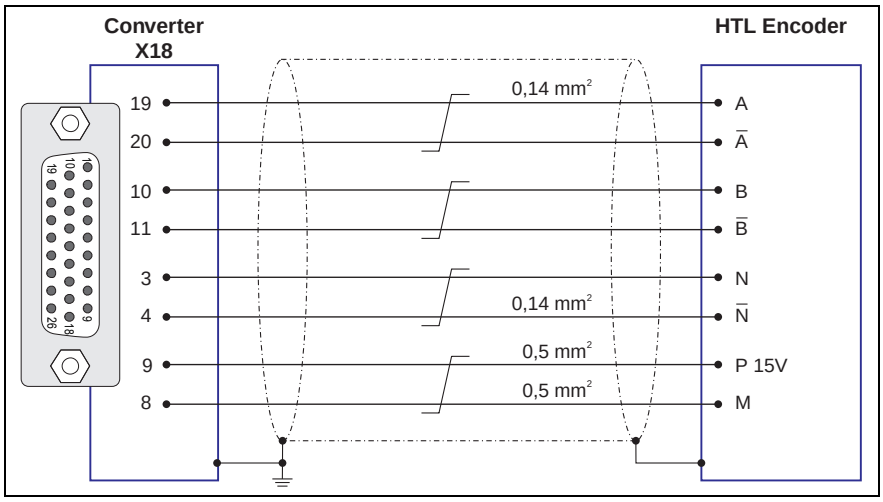


Fig. 3-14: Connecting the HTL encoder with inverted tracks

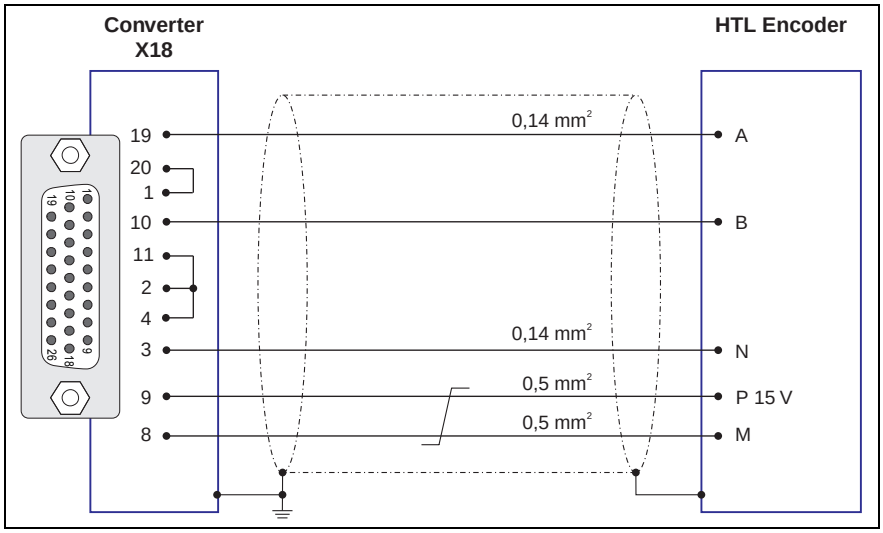


Fig. 3-15: Connecting the HTL encoder without inverted tracks

Technical data of the HTL encoder evaluation

Power supply voltage V_B (DC)	15 V (jumper S5, refer to page 3-14)
Max. output current	I_{max} = 175 mA
Limiting frequency	150 kHz without inverted tracks 300 kHz with inverted tracks
Parameterization	P0130: Incremental encoder P0132: Pulse number

Connecting the TTL encoder

X18	Speed encoder	
7	M sense	Sensor line 0 V
8	M	0 V (ground)
9	P 5V	+5V power supply voltage (jumper S5, refer to Section 3.8.3)
12	$\overline{A}$	Pulse track A inverted
13	A	Pulse track A
14	B	Pulse track B
15	$\overline{B}$	Pulse track B inverted
16	N	Zero pulse N
17	$\overline{N}$	Zero pulse N inverted
18	P sense	Sensor line +5V

Fig. 3-16: X18 connector assignment for TTL encoder

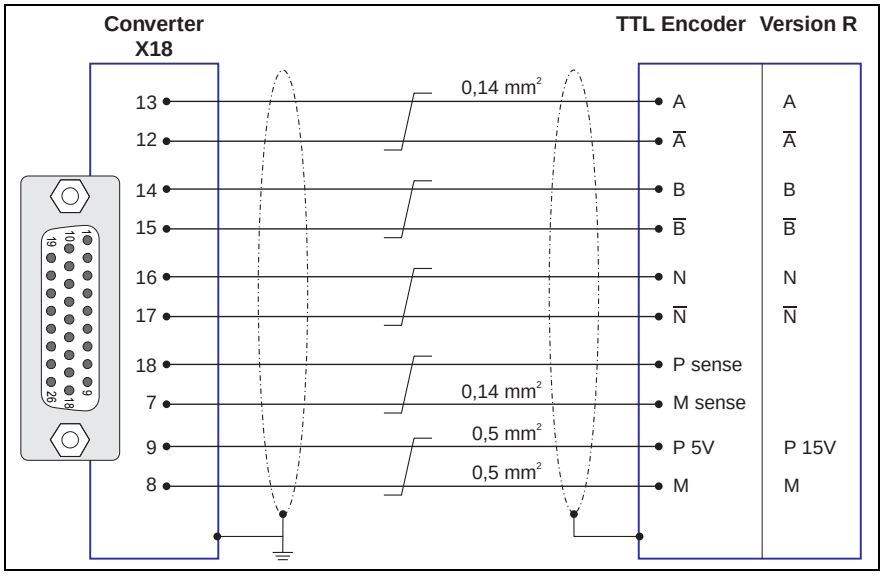


Fig. 3-17: Connecting the TTL encoder

Technical data of the TTL encoder evaluation

Power supply voltage V_B (DC) 5 V ± 2,5% (jumper S5, refer to page 3-14)

Max. output current I_{max} = 200 mA

Limiting frequency 300 kHz

Input resistance 120 Ω

Parameterization P0130: Incremental encoder
P0132: Pulse number

Sine/cosine encoder 1V_{PP} and magneto-resistive transducer (for operation with induction motors)

Signal characteristics for clockwise rotation when viewing the drive end of the motor shaft

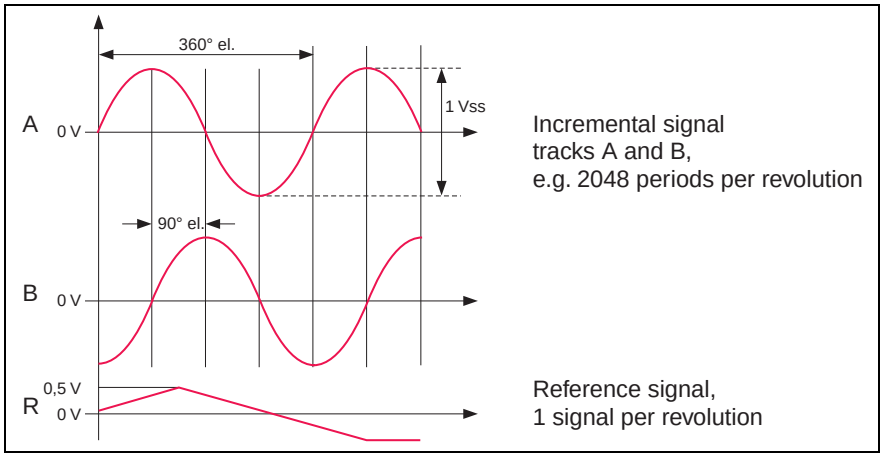


Fig. 3-18: Signal characteristics for sine/cosine encoder 1V_{PP} and magneto-resistive transducer

Sine/cosine encoder connection

X18	Speed encoder and temperature sensor	
7	M sense	Sensor line 0 V
8	M	0 V (ground)
9	P 5V	+5 V power supply voltage (jumper S5, refer to Section 3.8.3)
12	A-	Incremental signal A
13	A+	
14	B+	Incremental signal B
15	B-	
16	R+	Incremental signal R
17	R-	
18	P sense	Sensor line +5 V
25	Motor temp.+	Connecting a motor temperature sensor (PTC or KTY84) When connecting a KTY84, ensure that the polarity is correct!
26	Motor temp. -	

Fig. 3-19: X18 connector assignment for sine/cosine encoder 1V_{PP} and magneto-resistive transducer

We recommend that encoder cable No. 266-306-01 from the Heidenhain company is used to connect this encoder to the drive converter. The following diagram is only valid when this cable is used.

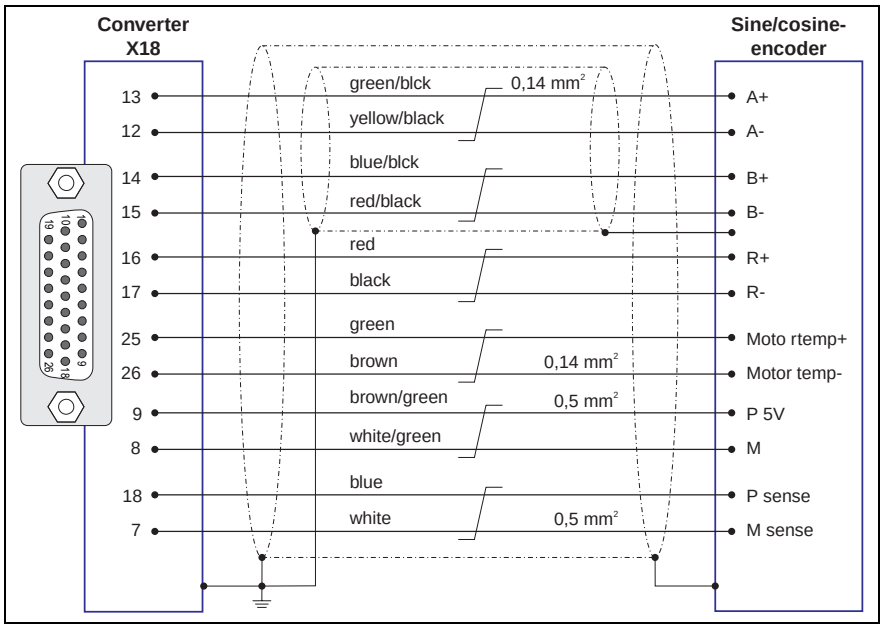


Fig. 3-20: Connecting the sine/cosine encoder $1V_{PP}$ and magneto-resistive transducer

Technical data of the sine/cosine encoder evaluation

Power supply voltage V_B (DC):	5 V ± 2,5% (jumper S5, refer to page 3-14)
Max. output current	I_{max} =200 mA
Limiting frequency	300 kHz
Terminating resistor, input	120 Ω
Parameterization	P0130: Sine/cosine encoder P0132: Pulse number

Sine/cosine encoder 1 V_{PP} with rotor position sensing, e. g. ERN 1387 (for operation with induction- and synchronous motors)

Signal characteristics for clockwise rotation viewing the drive end of the motor shaft

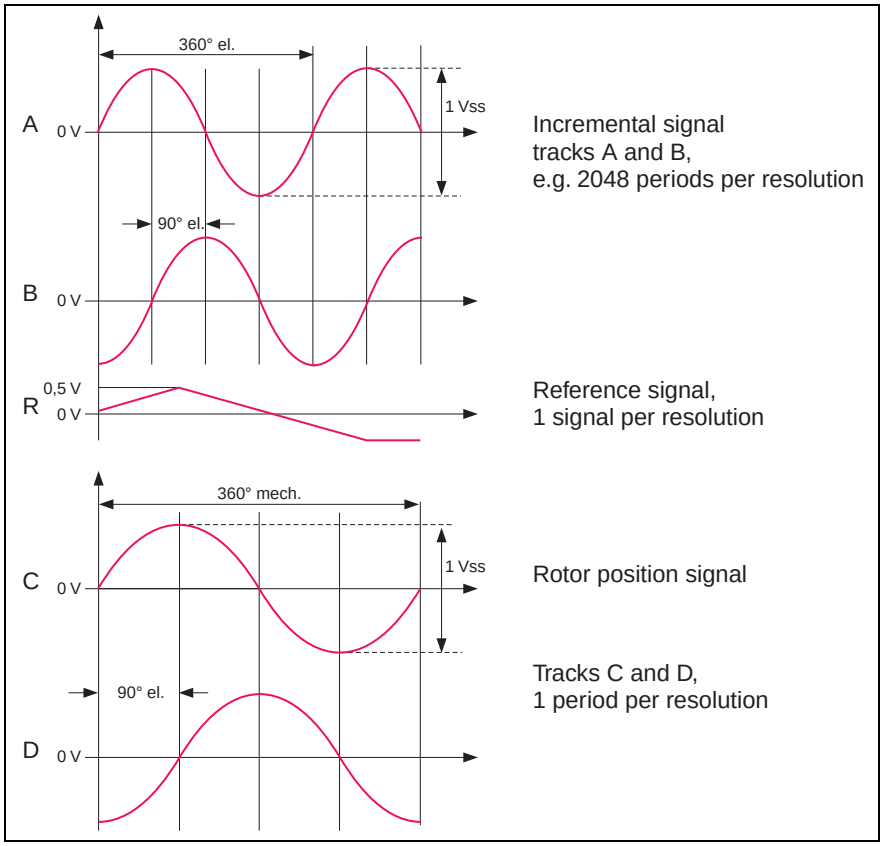


Fig. 3-21: Signal characteristics for sine/cosine encoder 1 V_{PP} with rotor position sensing

ERN encoder connection

X18	Speed encoder and temperature sensor	
3	C+	Signal track C, rotor position
4	C-	
5	D+	Signal track D, rotor position
6	D-	
7	M sense	Sensor line 0 V
8	M	0 V (ground)
9	P 5V	+ 5 V power supply voltage
12	A+	Incremental signal A
13	A-	
14	B+	Incremental signal B
15	B-	
16	R+	Incremental signal R
17	R-	
18	P sense	Sensor line +5 V

X18	Speed encoder and temperature sensor	
25	Motor temp.+	Connecting a motor temperature sensor (PTC or KTY84) When connecting a KTY84, the correct polarity must be ensured!
26	Motor temp. -	

Fig. 3-22: X18 connector assignment for for sine/cosine encoder $1V_{PP}$ with rotor position sensing

We recommend that encoder cable No. 266-306-01 from the Heidenhain company is used to connect this encoder to the drive converter. The following diagram is only valid when this cable is used.

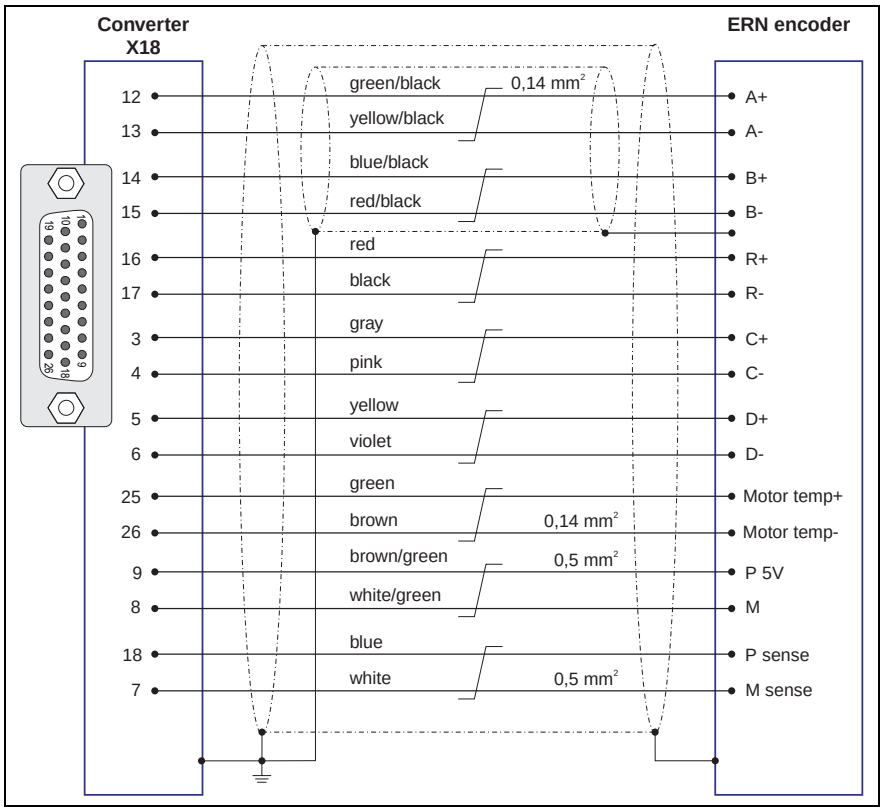


Fig. 3-23: Connecting the sine/cosine encoder $1V_{PP}$ with rotor position sensing

Technical data of the ERN encoder evaluation

Power supply voltage V_B (DC) 5 V ± 2,5% (jumper S5, refer to page 3-14)

Max. output current I_{max} = 200 mA

Limiting frequency 300 kHz

Terminating resistor, input 120 Ω

Parameterization P0130: ERN encoder
P0132: Pulse number

When using a Siemens encoder or an encoder with a round connector with a Siemens-compatible pin assignment, a pre-assembled cable can be ordered from REFU.

Resolver (for operating induction- and synchronous motors)

Signal characteristics for clockwise rotation when viewing the drive end of the motor shaft

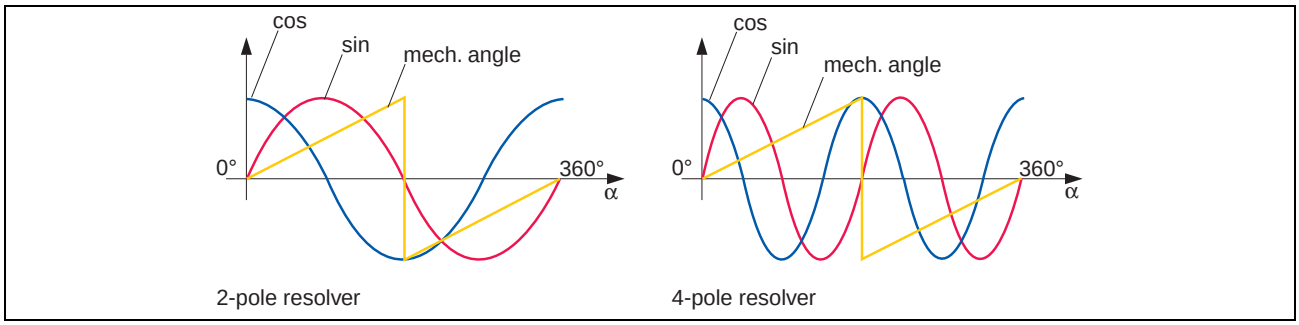


Fig. 3-24: Signal characteristics for resolver

The signals can be displayed using the REFU*win* oscilloscope function.

- Sine: D1086
- Cosine: D1087
- Mechanical angle: D1890

Connecting the resolver

X18	Speed encoder and temperature sensor	
1	R1	Excitation voltage +
2	R2 (R3)	Excitation voltage -
10	S1	cos +
11	S3	cos -
19	S2	sin +
20	S4	sin -
25	Motor temp.+	Connecting a motor temperature sensor (PTC or KTY84) When connecting a KTY84, the correct polarity must be ensured!
26	Motor temp. -	

Fig. 3-25: X18 connector assignment for resolver

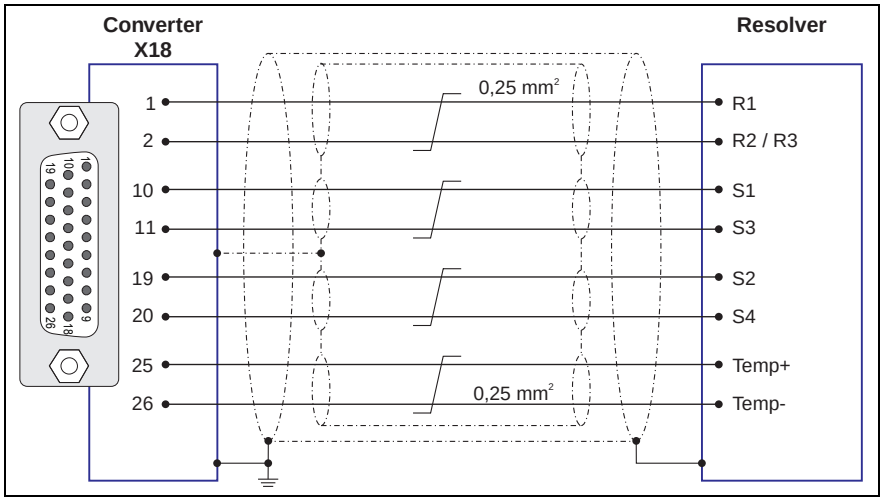


Fig. 3-26: Connecting the resolver

We recommend that you use an 8-core, twisted pair cable with additional outer shield to connect the resolver to the drive converter. The cable cross-section should be a minimum of 0.25 mm^2 (e.g. LIYCY-CY 4 x 2 x 0,25 or DUE4504-4P24-7091).

The resolver cable should be kept as short as possible and may not exceed 150 m.

Technical data of the resolver evaluation

Power supply voltage V_B (AC): 7 V_{RMS}, 8 kHz

Max. output current I_{max} = 100 mA

Parameterization P0130: Resolver
P0131: Pole number

Recommended resolver characteristic data

Transformation ratio 0.4 ... 0.6

Max. phase shift ±15°

Max. electrical error ±10 angular minutes

Max. output impedance Z_{PP} (180 + j500) Ω

Zero voltage < 30 mV

Mounting the resolver

Center offset between the rotor and stator max. 0,05 mm

Axial offset between the rotor and stator max. ±0,25 mm

Assignment, motor pole number – resolver pole number

The ratio between the pole number of the motor and the resolver must always be an integer number!

Pole number = pole pair number ∗ 2.

Pole No., resolver	Pole No., motor				Manufacturer	
	2	4	6	8	Siemens	Tamagawa
2	X	X	X	X	V23401-H2009-B202	TS2018 N 431 E41
4		X		X	V23401-H2012-B201	TS2018 N 532 E41
6			X		V23401-H2002-B209	TS2018 N 543 E41
8				X	V23401-H2003-B209	

Fig. 3-27: Assignment, motor pole number – resolver pole number

When using a Siemens resolver or a resolver with a pin assignment of a round connector, which is compatible to that of a Siemens resolver (20°-coded), a pre-assembled encoder cable can be ordered from REFU.

3.8 First testing the encoder

Connect the motor with the encoder connected to the drive converter. The drive converter may not be enabled (must be inhibited) and then manually rotate the motor shaft clockwise (when viewing the drive end). A positive speed must be displayed in the operator panel. A negative speed must be displayed when rotating the motor shaft counter-clockwise.

3.9 Service interface RS232 (X11)

This interface is used to connect the operator panel or a PC with REFU-win. To connect the devices, a pre-assembled standard extension cable can be obtained from REFU (Order No. 0013456, length 5 m).

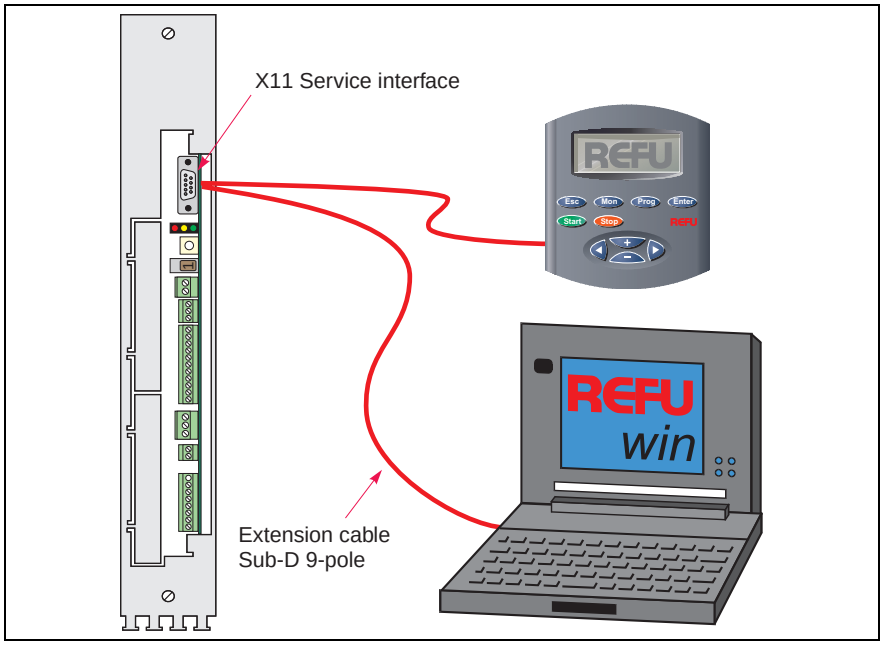


Fig. 3-28: Connection possibilities service interface

Connecting the operator panel

The operator panel can either be inserted directly at connector X11 or using the above mentioned cable.

Connecting a PC

The cable to connect a PC must have the following configuration:

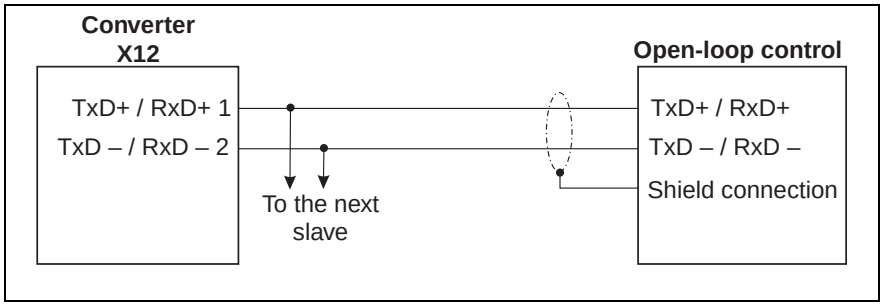


Fig. 3-29: Connecting cable to the PC

Alternatively, the operator panel cable can be used.

The following settings must be observed:

Baud rate	can be set using P 0499: 1200, 2400, 4800, **9600** (factory setting), 19200, 38400, 57600, 76800 baud
Data bits	8
Parity	Even
Stop bits	1
Protocol	USS protocol, 4/6 words

3.10 Standard interfaces RS485 (X12)

The RS485 interface supports the USS protocol, which is used to control the drive converter via a PLC. The USS protocol (Universal Serial Interface Protocol) defines an access technique according to the master-slave principle for communications via a serial bus. You can obtain a detailed description of the USS protocol from REFU, or from the Internet under http://www.refu.com.

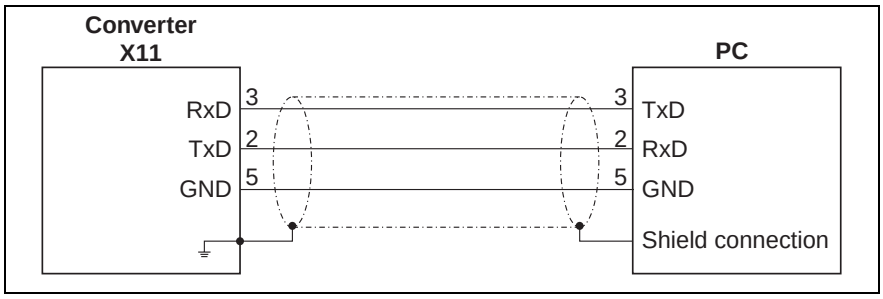


Fig. 3-30: Connecting the standard interface

When using this interface, it should be observed, that each bus node (station) should have the same interface configuration.

Exception: "SS1 slave address", in this case, each bus node (station) has its own address.

The interface **parameterization** is provided in this Instruction Manual in Section 5.4.5 Serial Communications.

Bus termination

The last node of a bus system must terminate the bus to protect the system against the effects of noise and disturbances. The bus terminating resistor is switched-in using a switch on the control board (refer to Section 3.7.1 Terminal layout diagram SR 17000).

4 Operator control and parameterization

4.1 Operating possibilities

he operator panel (option), the REFUwin PC and several interfaces are available to operate, visualize and parameterize REFUdrive 500 drive converters.

The serial RS232 and RS485 interfaces are standard on the control card. In addition, there are the optional interface cards Profibus DP, CAN bus, Interbus S, Peer-to-peer coupling and SynchroLink.

Fig. 4-1: Operator panel with graphic display (option)

4.2 Using the operator panel

Monitoring using the operator panel (monitor)

Button	Menu level
Esc	Return to the previous menu item
Mon	Change into the monitor.
Prog	Change into the parameterization.
Enter	Accept the selected menu item.
+	To the previous menu item.
-	To the next menu item.

Fig. 4-2: Key functions when monitoring

Parameterizing using the operator panel

The basic parameterization is described in detail in Section 5.

Button	Menu level	Parameterization level
Esc	Return the previous menu item	Reject the changed value.
Mon	Change into the monitor.	
Prog	Change into the param-eterization.	The value is temporarily accepted. All of the values are only accepted after the “Enter“ button has been pressed.
Enter	Accept the selected menu item.	Accepts the changed value.
+	To the previous menu item.	Increases the value.
–	To the next menu item.	Reduces the value.
▶	Jumps to the end of the list.	Cursor is positioned to the right.
◀	Jumps to the beginning of the list.	Cursor is positioned to the left.

Fig. 4-3: Key function when parameterizing

Fast parameterization using various key combinations

Taste	Response
+ + –	When these keys are pressed at the same time: – all of the parameter numbers are set to 0 (numerical list). – the complete parameter value is set to 0 (for numerical parameters). – the text selection is continued in steps of 10 (practical, e.g. for parameter P0875 with almost 100 selection texts). – sets the standard value.
◀ + ▶	When these keys are pressed at the same time, the active value is set to the factory setting.
Mon + Prog	When these keys are pressed at the same time, changes from the mon- or prog range into the temporary actual value display. By pressing the ESC again, the display goes back to the selected menu. In order that the operator can differentiate between the normal operating display and the temporary actual value display, the temporary actual value display has a flashing frame.

Fig. 4-4: Key combinations

Error messages when parameterizing

Error message	Cause	Solution
Parameter inhibited.	Unit is operational.	Inhibit the inverter and then change the parameter.
Data conflict (general)	Several parameter settings are dependent on one another. If a parameter value is changed and confirmed with Enter, data conflict can occur.	
Data conflict e.g. P0109 with P0026	The current limiting set in D0109 is too high for this drive converter at the selected pulse frequency (P0026).	Temporarily accept the value of the first parameter change with Prog, after the second parameter change, confirm that both values are saved using Enter.

Fig. 4-5: Error messages when parameterizing

Copy function

A copy function is integrated into the operator panel. This allows a parameter set to be saved in the operator panel and to be quickly transferred to another unit. Only those parameters are saved, which are accessible using the selected password level. (Refer to the equipment setting, parameters 0732 and 0733).

Note: After the drive has been successfully commissioned and optimized, the parameter set can be saved in the operator panel. This means that when the AC drive is replaced, it can be quickly re-commissioned.

Fault acknowledgment

After a fault/error occurs, “fault” is indicated in the operating display with the fault cause and the number of operating hours. The fault can be acknowledged using the Esc button on the operator panel after the fault cause has been removed.

4.3 Monitoring

Monitor stucture

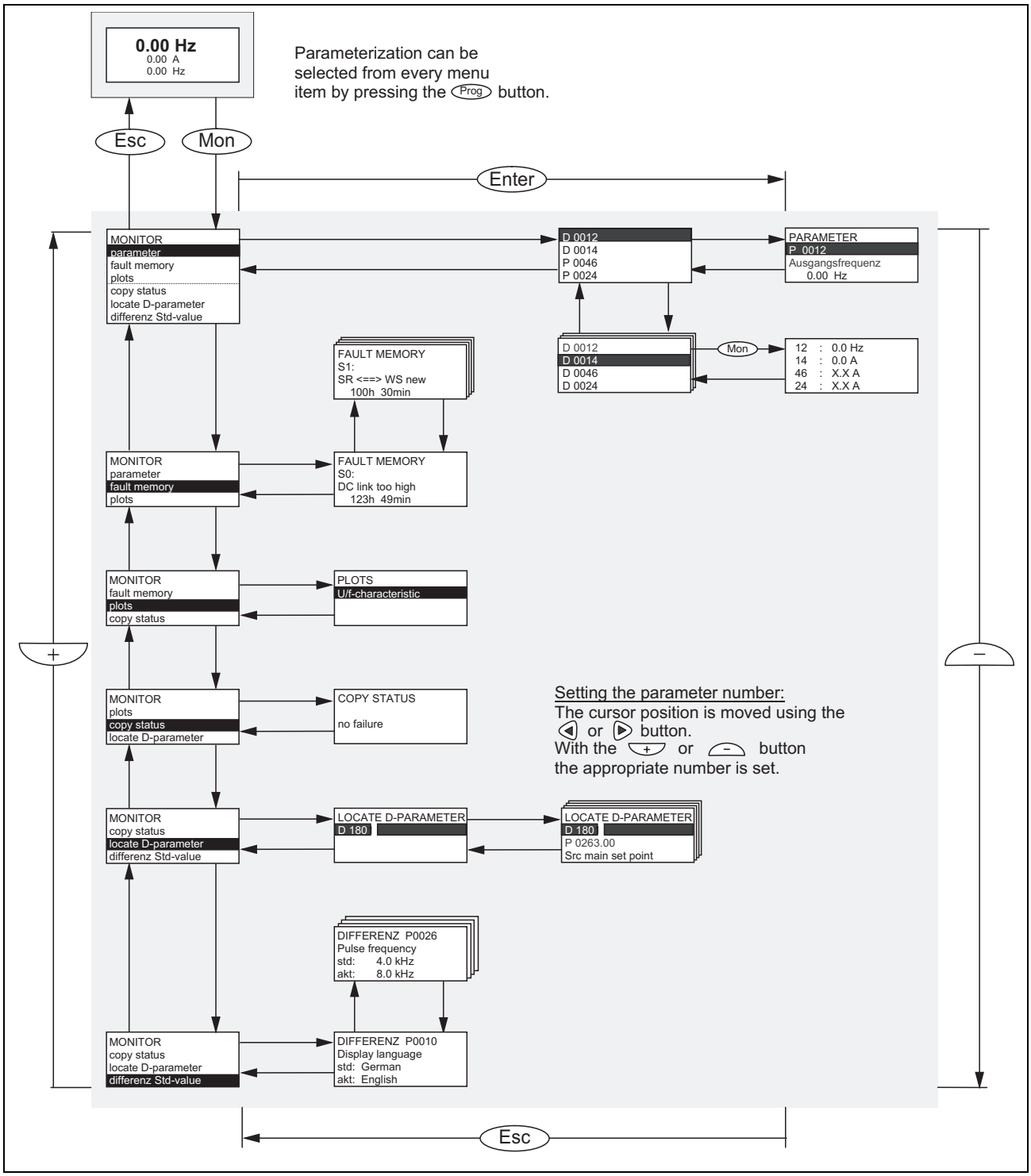


Fig. 4-6: Structure of the monitor programm

Monitor functions

Parameter Four selected parameters can be simultaneously displayed. The parameter monitor can be helpful at start-up, e.g. for the setpoint generation. The actual values of the setpoint change at various points in the setpoint cascade. In this case use the D parameters[1)] in the function diagrams.

Fault memory The last 10 faults are saved in the fault memory. The last fault in the memory is S0 and the oldest is S9. A new fault is always saved in memory location S0. All of the older faults are shifted upwards in the memory by one position. This means that the fault at memory location S9 is lost.

Copy status Errors and irregularities which occur when copying a data set from the operator panel into the drive converter, are displayed in the menu. The copy status is lost when the drive converter is electrically shutdown.

Locate D-parameter With the search “D parameter”, a list of the variables, parameter sources is displayed, in which the selected D parameter is interconnected. You can scroll through the list using the Enter key. If the selected D parameter is not linked with a “variable, parameter source”, the following is displayed: “Is not linked”. Refer to the function diagrams with legend for a more detailed explanation.

Operating display

From ten displayed values, three can be selected to be displayed in the operating display; refer to P0037.0x in the equipment setting.

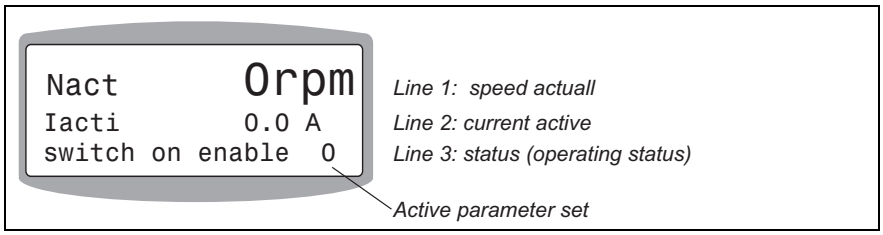


Fig. 4-7: Operating display

Alarm display

If a critical operating status occurs, the alarm message and the operating display are alternately displayed until the critical status has been resolved.

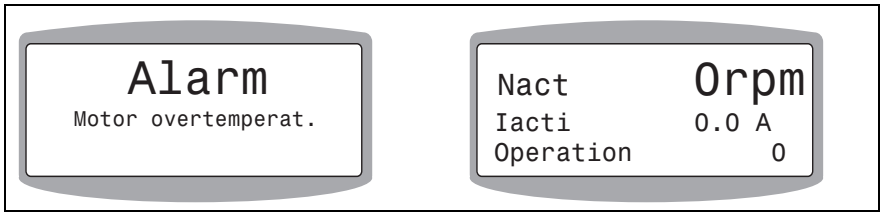
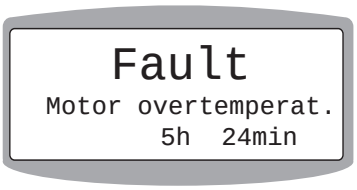


Fig. 4-8: Alarm display

[1)] The terms “D parameter” and “Variable, parameter source” are explained in the legend for the function diagrams, refer to “Function diagram and parameter list.

Fault display

If an operating status occurs, which initiates a fault/error, the operating display is replaced by a fault display.



Line 1: fault message
Line 2: fault cause
Line 3: fault time (operating hours)

Fig. 4-9:Fault display

LED display

LED display		Significance	
○ ○ ○	All LEDs dark	Operating status:	Power-on inhibit Not ready to power-up, alarm present!
●	Green LED bright	Operating status:	Ready to power-up
● ●	Green and yellow LEDs bright	Operating status:	Ready
●	Yellow LED bright	Operating status:	Run
●	Red LED bright	Operating status:	Fault

Fig. 4-10: LED display

5 Parameterization

5.1 Menu description in preparation

Menu description in preparation!

6 Start-up

6.1 Preparatory steps for start-up

The power terminals should be connected-up, as specified in Section 3.4, and the control terminals, as specified in Section 3.7 .

Check whether the star/delta jumpes have been correctly connected at the motor terminal board.

Observe the “Hazardous voltage warning information” in Section 3.2!

It should also be ensured, that signal-, line supply- and motor feeder cables have been separately routed with a minimum clearance between them. The setpoint cables must be shielded. Please refer to Section 3.1 “EMC-correct design of drives”.

Before first commissioning the electrical system, the qualified electrician or engineer should first check whether the equipment corresponds, both electrically and mechanically to the safety requirements

(5 Paragraph 1 No. 1 VBG 4), specified by

- - the accident prevention regulations, and
- - the general electrical regulations.

Check whether a rotating motor could cause human injury or material damage!

After all of the control-, setpoint- and line cables have been correctly connected, the line supply- and control voltages can be switched-in. After approximately 3.5 sec, the operator panel displays “Ready to power-up”.

6.2 Procedure when first commissioning

In this “Start-up” Section, as far as the parameterization is concerned, it is assumed that the drive still has the standard values set as set in the factory.

The following diagrams will guide you through the first start-up.

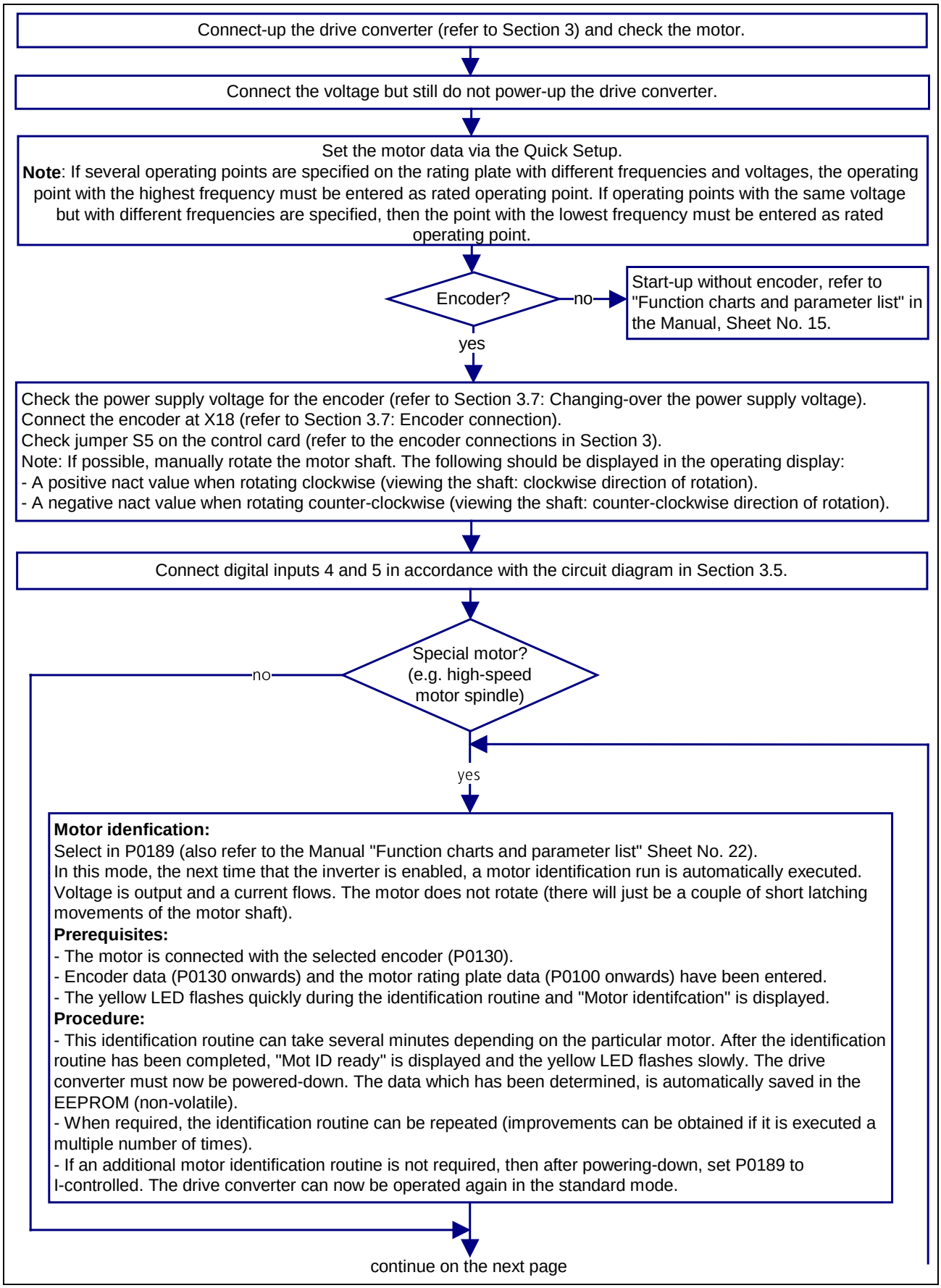


Fig. 6-1: Commissioning flow charter 1

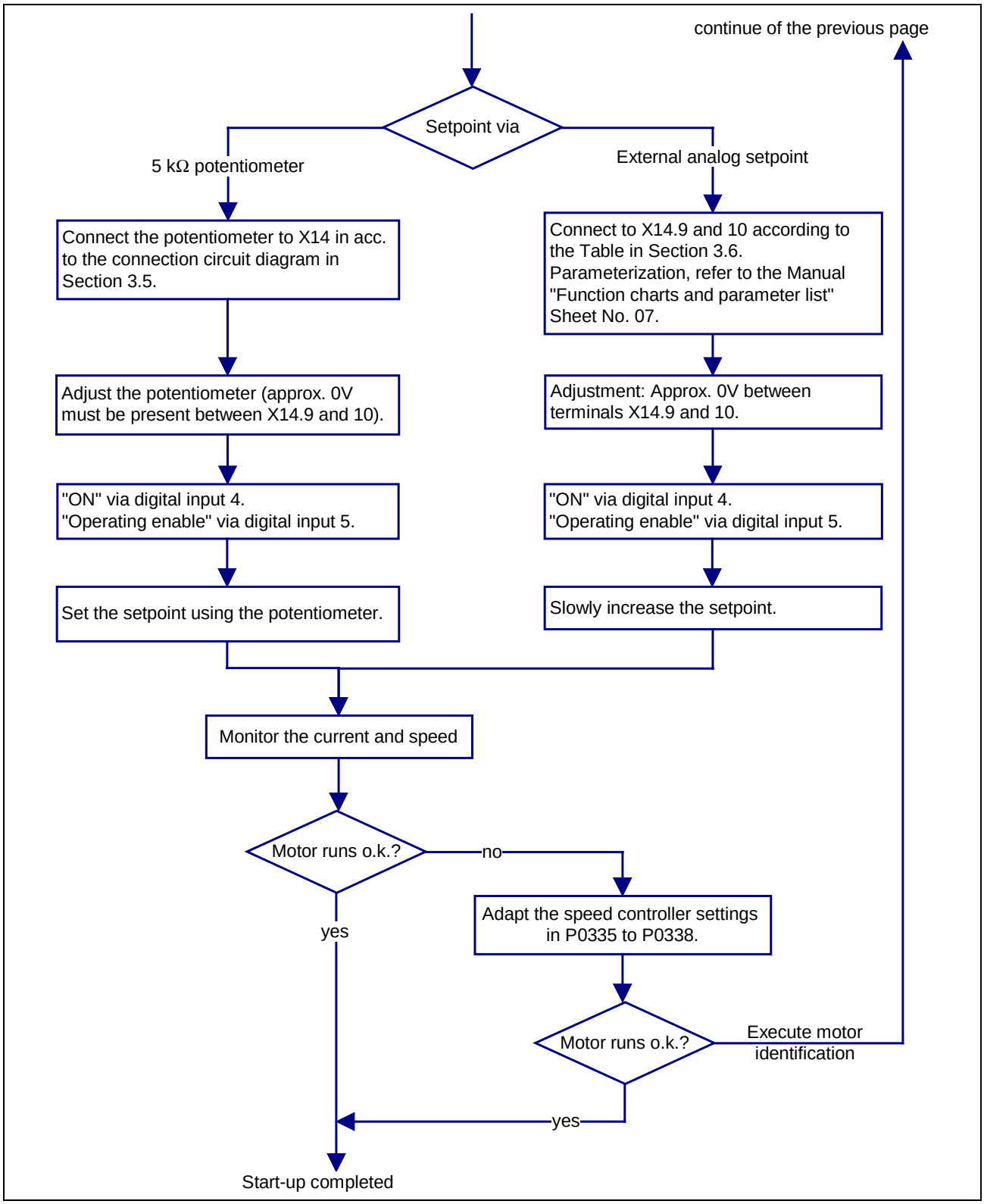


Abb. 6-2: Commissioning flow charter 2

6.3 General information/instructions

You can quickly start-up (commission) several drive converters using the copy function (refer to Section).

If you wish to reset all of the parameters due to incorrect programming, then use the “Set standard values” function using parameter P0071.

Fault acknowledgement

There are three ways to acknowledge a fault:

1. Use the “Esc” button on the operator panel.
2. Press the “RESET” button S9 on the control card (the cover must beremoved).
3. Energize a digital input configured with the “Fault acknowledgement” function.

Note: If a fault occurs during operation, and the fault is acknowledged, then the “Power-on inhibit” message is displayed. This means that the drive converter has latched itself out. A “Stop” command must be issued to go into the “Ready to power-up” status.

7 Troubleshooting

7.1 Self test - error messages

After the initialization routine, the system executes a self test. The individual components of the microcomputer system are tested, e.g. the EEPROM, and the data from the power control board is read-in.

7.2 Alarms

If an alarm is output, the alarm message is displayed, alternating with the programmed operating display.

Note: The alarm bit (D1737) is set and can be logically combined in a digital output or also in the drive converter, e. g. to prevent power-up.

7.3 Faults

During operation, permanently-programmed and parameterizable limit values are continuously monitored. In order to protect the power module against damage, when a limit value is exceeded, the drive converter is always powered-down and the appropriate fault message is displayed.

For REFU*drive 500* drive converters with three-phase supply, when a fault occurs, the main contactor is de-energized, and the power module goes into a no-voltage condition. The appropriate fault message is displayed.

The fault is displayed using the red LED "alarm" on the front panel of the drive.

Fault messages are saved in the fault memory so that they are not lost when the power fails. The fault memory is called-up in the monitor (operator control, refer to Section 4). The last faults are saved in the fault memory. The last fault is S0 in the memory location, the oldest, in S9. A new fault is always saved in memory location S0. All of the older faults in the memory are shifted one position upwards. This means the fault at memory location S9 is lost.

Fault acknowledgment

After a fault trip, the drive converter cannot be powered-up again until the fault has been acknowledged. The fault cannot be acknowledged as long as the fault still exists. If the cause of the fault has been removed, the fault can be acknowledged after a timer has expired (P0093, factory setting 1 sec.).

There are several ways of acknowledging a fault message:

- Pressing the Esc -button on the operator panel.
- Pressing the button S9 "Fault acknowledgment" on the control card.
- Using a digital input: Connect an H signal at the digital input, interconnect non-inverted D parameters of the selected digital inputs to P0050.07.
- Via the serial RS485 interface; transfer control word with bit 7 set to "high".

7.4 List of the alarm- and fault messages

No.	Messages	Alarm	Fault
1	External	x	x
3	DC link voltage too high		x
4	DC link voltage too low	x	x
7	Device overtemperature	x	x
8	Brake resistor		x
9	Main contactor		x
10	Pre-charging		x
11	New EEPROM		x
13	Power section		x
14	Inverter		x
15	Power supply		x
16	Intern DSP comm. (communication)		x
17	Overspeed	x	x
18	Ground fault		x
19	EEPROM data	x	x
20	Intern DSP ack. (acknowlegement)		
21	Internal WS comm.		x
22	NTC power section		x
23	Resolver		
24	SI1 timeout	x	x
25	SI2 function	x	x
26	SI2 timeout	x	x
28	Motor oertemperature	x	x
30	SR-Release		x
39	start protection On		x
40	Switched power supply		x
41	SR <==> WS new		x
44	SI4 function	x	x
45	SI4 timeout	x	x
47	Start protection On	x	

Fig. 7-1: Fault messages

7.5 Alarm- and fault messages - cause and remedy/comments

No.	Designation	Message
	Cause	Remedy / Comment
1	**External**	**Alarm / fault**
	If a digital input has been assigned the "no external fault" function, and there is no 24 V signal at the digital input, then the drive converter shuts down with the "External" fault (this is the version which is immune to wire breakage – i.e. fail-safe).	Define the cause of the signal loss in the plant/system and remove.
3	**DC link voltage too high**	**Fault**
	The motor regenerates into the DC link. Limit value: $U_{DC\ link\ max}$ (P0095) was exceeded. The ramp down time has been set too short.	If the fault occurs when braking, set the ramp-function generator down ramp slower (P0280). Brake resistor (if option W is used) using an ohmmeter, use a higher-rating external brake resistor. Check whether the brake resistor is selected (P0036).
4	**DC link voltage too low**	**Alarm / fault**
	During operation, the DC link voltage falls below limit value $V_{DC\ link\ min}$ (P0094). • Line supply dips or power failure. • Main contactor interrupted. • Defective line rectifier.	Check the line supply voltage using an oscilloscope.
7	**Device overtemperature**	**Alarm / fault**
	The measured heatsink temperature of the power section or the rectifier is too high. An alarm is displayed if the heatsink temperature is greater than 65 °C. The drive converter is shutdown if the temperature exceeds 70 °C. The temperature difference between the alarm and the fault trip can be changed in parameter P0086. The actual heatsink temperatures can be displayed using the monitor (power section = D1870 and rectifier = D2029). • Ambient temperature > 40 °C • Defective fan • Air filter blocked • NTC (temperature sensor) defective • Incorrectly set fan control	Example of an incorrectly set fan control in P0034: The function is set to "Automatic" and the threshold in P0035 is set too high. Reduce the threshold
9	**Main contactor**	**Fault**
	Main contactor does not pull-in during operation, or a checkback signal is not received from it.	• Check the control voltage for the main contactor. • Check the auxiliary contact for the checkback signal.
10	**Pre-charging**	**Fault**
	After the drive unit has been powered-up, the DC link voltage charging over time is monitored. If illegal deviations occur, pre-charging is stopped. • Short-circuit between terminals C and D (DC link voltage) or C-PE or D-PE. • Only with the optional W brake resistor: Short-circuit between F and C. • Only for option V, electronics standby: The "ON"	Check the following, • whether the line supply voltage is available • whether there is a short-circuit between terminals C and D or C-PE and D-PE. **Comment:** After the "pre-charging" fault has been acknowledged, it is only permissible to power-on again after 30 seconds. This protects the pre-charging

No.	Designation	Message
	Cause	**Remedy / Comment**
	command was connected, while the standby supply is active, but there is no line supply voltage.	resistors against overheating.
11	**New EEPROM**	**Fault**
	The processor control did not recognized the bit pattern, factory-loaded in the EEPROM	Please contact customer service
13	**Power section**	**Fault**
	Power section fault, which cannot be described in any detail.	Please contact customer service.
14	**Inverter**	**Fault**
	This fault is initiated when the overcurrent threshold is exceeded; it protects the power section transistors. **Causes outside the drive converter:** • Defective motor; stalled (blocked) motor or a motor which cannot move freely; defective motor cable • Setpoint step which is too fast	• Disconnect the motor cable, enable the inverter. If the fault no longer occurs, then the cause is the motor. Replace the motor • Measuring with REFUwin "Oscilloscope function“: Parameter D1981“f-act from normalization“.
	Parameterization: • The incorrect motor data were parameterized. • Only for option S sinusoidal filter: The pulse frequency (P0026) is set to less than 8 kHz; thus, the sinusoidal filter can oscillate and conduct high currents. **With the drive converter:** • Defective power section transistor.	• Check the motor data in the Quick-setup. • Set the pulse frequency in Quick-setup (P0026) to 8 kHz or greater.
	Troubleshooting: In many cases, a defective power transistor in the inverter can be simply found using a conventional multimeter. Proceed as follows: 1. Disconnect and isolate the drive converter from the line supply. 2. Disconnect the motor. 3. Measuring the diode let-through voltage between the output terminals and the DC link terminals, using the multimeter. If the inverter is intact: from U2 to C: Diode let-through voltage; from C to U2: Blocking voltage from U2 to D: Blocking voltage; from D to U2: Diode let-through voltage from V2 to C: Diode let-through voltage; from C to V2: Blocking voltage from V2 to D: Blocking voltage; from D to V2: Diode let-through voltage from W2 to C: Diode let-through voltage; from C to W2: Blocking voltage from W2 to D: Blocking voltage; from D to W2: Diode let-through voltage When the power transistors are inhibited, they are in a high-ohmic state in both directions. The multimeter indicates the diode let-through voltage if the free-wheeling diode, connected in parallel, is measured in the let-through direction.	
15	**Power supply**	**Fault**
	The switched-mode power section voltages lie outside the limit values: Limit value for +15 V = +13.5 V - 15 V = - 13.5 V	The switched-mode power section is defective or the load is too high as a result of a defective module (also refer to the comment on Fault 40, switched-mode power supply).

No.	Designation	Message
	Cause	Remedy / Comment
16	intern DSP comm. (communication)	Fault
	Communications with the digital signal processor on the control card is faulted.	Please contact customer service.
17	Overspeed	Alarm / Fault
	• This fault is output if the speed encoder signal exceeds the selected threshold. **Cause external to the drive converter:** • Encoder system fault. • The driven load drives the motor exceeding the speed threshold. • Only for synchronous motors: - motor phase assignment is incorrect - incorrect resolver angle setting **Cause due to the parameterization:** • Incorrect speed normalization. • Incorrect speed threshold setting • Incorrect speed controller setting (this can result in speed overshoot).	• Measure the encoder signal using an oscilloscope or the “Oscilloscope” function from REFU*win* (D1897 and D1873). • Check P0390 (frequency normalization) that it has the correct value and if required, change. • Check the speed threshold in P0395. • Check the speed controller settings in quick-setup or using the “Oscilloscope” function from REFU*win*.
18	Ground fault	Fault
	Ground fault at the inverter output terminals (U2, V2, W2) or excessive capacitance to ground due to long motor cables.	
19	EEPROM data	Alarm / Fault
	Parameterization: • The control card was replaced and, after initialization, detects a new power section, which, for example, cannot supply the parameterized current. This means, that one or several parameters lie outside the tolerance range. When the fault is acknowledged, the associated parameters are reset to the standard drive converter values. **In the drive converter:** • This fault can occur, if the power fails during operation. In this case, the power section could send incorrect data to the control card.	• Using P0061.XX, the appropriate parameter numbers can be viewed, and with P0062.XX, the erroneous parameter values. • The fault can be removed by special acknowledgment using P0060 (password level 3 [Esc], [Mon], [Prog] and [+]). Finally, it must be checked whether the modified parameters fit the particular application. When parameterization is exited, the values are transferred into the EEPROM. • The fault may be able to be removed by powering-up and powering-down the line supply voltage or the standby supply. If this is not successful, then please call customer service.
20	Intern DSP ack.	Fault
	Internal processor coupling is faulted.	Fault acknowledgement; if the fault occurs after the fault has been acknowledged several times, then a component is faulted; if required replace the control card.
21	Internal WS comm.	Fault
	Communications between the process PC board and the power section is faulted. If the fault occurs after power-up during the self-test, it cannot be acknowledged.	Check the plug connection between the PC boards or replace the modules.
22	NTC power section	Fault
	Wire broken/interrupted to the NTC on the heatsink in the power section or rectifier; NTC defective; excessive resistance or the contactor has no contact.	Check the plug connection; replace the connector, cable or NTC.

No.	Designation	Message
	Cause	**Remedy / Comment**
23	**Resolver**	**Fault**
	• Incorrect encoder data parameterized. • The resolver cable is interrupted. • Resolver is defective.	• Check that the encoder data in P0130 and P0131 are correct. • Check that the resolver cable is not interrupted. • Replace the resolver.
24	**SI1 timeout**	**Alarm / Fault**
	The control computer does not send data within the parameterized response time (P0506).	Check the plug connection SS1 (RS485), extend the response time (P0506), select another response type (P0505).
25	**SI2 function**	**Alarm / Fault**
	Only for option interface cards at option slot 1. The drive converter detects a physical fault on the interface cable from the higher-level control computer. Erroneous data transfer along the fieldbus.	Check that the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If a bus error occurs in the form of an alarm or fault, then the alarm or the fault or both messages can be suppressed using parameter P0509; this means that the system can continue to operate!
		Only for the CAN bus option: The protocols sent on the CAN bus interface are monitored. If a bus error occurs more than 127x, an alarm is output. If a bus error occurs more than 255x, a fault is signaled. The alarm or fault, or both messages can be masked in parameter P0509; this means that the system can continue to operate. **Only for the Profibus option:** Either "no action" and "fault" when receiving clear data can be selected in parameter P0524. Caution: In this case, P0509 should be set to the "all active" function! i.e. Clear Data is sent from the control computer, if there is an invalid protocol or a bus error. **Only for Interbus S option:** The response type can be set in parameter P0518 and the monitoring time when a bus error occurs, in P0519. Index 0 = process data, index 1 = PKW range.
26	**SI2 timeout**	**Alarm / Fault**
	Only for option interface cards at option slot 1. • Within the parameterized response time (P0527), the higher-level control computer does not send any data.	• Check plug connection SS2 • Extend response time (P0527), select another response type (P0526).
28	**Motor overtemperature**	**Alarm / Fault**
	The drive converter detects an excessive resistance at terminals X15.1 and 2. • The motor temperature is too high, temperature sensor defective, sensor cable defective. • Erroneous parameterization.	• Replace the sensor or sensor cable. • Check the temperature evaluation parameters (P0385 – P0389) are correct. When the KTY84 has been selected, the actual motor temperature °C, or for PTC selection, the actual ohmic value can be displayed with D1872 or D1871 respectively.
30	**SR-Release?**	**Fault**
	The control card and the firmware (Flash EPROM) do not match.	Please contact your customer service
39	**Start protection On**	**Fault**
	This message only occurs when the start inhibit	

No.	Designation	Message
	Cause	**Remedy / Comment**
	option is being used. Sizes A to E: Contacts X80.1 and 2 were opened during operation, or an on command was output with the terminal open. Sizes G and H: Contacts X80.170 and 171 were opened during operation, or an on command was issued with the terminals open-circuit.	
40	**Switched power supply**	**Fault**
	The switched-mode power supply for the electronic supply does not output a checkback signal.	Replace the defective switched-mode power supply. Depending on the drive converter version, the switched-mode power section is on the PC board: LT (power section), WS (inverter control) or SV (power supply).
41	**SR <==> WS new**	
	If the control card is replaced in another drive converter with a higher or lower output- or drive converter index, this entry is made in the fault memory (the drive converter does not go into a fault condition!). A fault is issued if the parameters lie outside the limit values (refer to Fault 19).	
44	**SI4 function**	**Alarm / Fault**
	Only for option interface cards at option slot 2. The drive converter detects a physical fault on the interface cable from the higher-level control computer. Erroneous data transfer along the fieldbus	Check that the PPO type (protocol type), baud rate, parity, stop bit and slave address are correct. If a bus error occurs in the form of an alarm or fault, then the alarm or the fault or both messages can be suppressed using parameter P0745; this means that the system can continue to operate! **Only for the CAN bus option:** The protocols sent on the CAN bus interface are monitored. If a bus error occurs more than 127x, an alarm is output. If a bus error occurs more than 255x, a fault is signaled. The alarm or fault, or both messages can be masked in parameter P0745; this means that the system can continue to operate. **Only for the Profibus option:** Either "no action" and "fault" when receiving clear data can be selected in parameter P0524. Caution: In this case, P0745 should be set to the "all active" function! i.e. Clear Data is sent from the control computer, if there is an invalid protocol or a bus error. **Only for Interbus S option:** The response type can be set in parameter P0518 and the monitoring time when a bus error occurs, in P0519. Index 0 = process data, index 1 = PKW range.
45	**SI4 timeout**	**Alarm / Fault**
	Only for option interface cards at option slot 2. • Within the parameterized response time, the higher-level control computer does not send any data.	• Check plug connection SS4 • Extend response time (P0747), select another response type (P0746).
47	**Start protection On (active)**	**Alarm**
	Only for the start inhibit option: Start inhibit was activated, while the drive converter was not in the operational status.	

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Canada ☒ SALES ☒ Service

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