MOVITRAC® 3000
Frequency Inverter

Installation and Operating Instructions

Edition 07/96

08/101/91

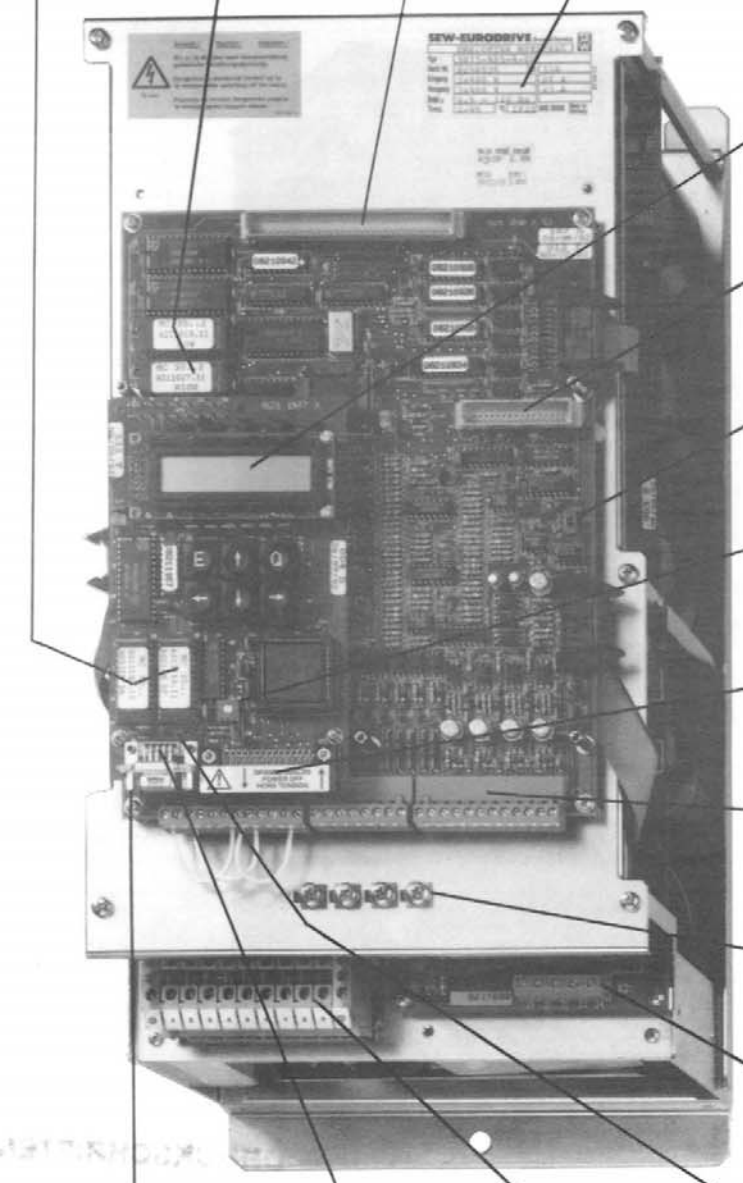
0921 1012 / 0796

TÜV CERT DIN EN ISO 9001

SEW EURODRIVE

Example: MOVITRAC 3011-403-4-00

Feature: 00 = Standard
Quadrants: 4 = 4Q (with chopper)
1 = 1Q (without brake chopper)
Type of connection 3 = 3-phase
Rated supply voltage 40 = 400 V_{AC}
50 = 500 V_{AC}
Useful motor power: e.g. 11 = 11 kW
Type series 3...



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Contents

⇒ Important sections for rapid commissioning ⇐

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General Notes

- Every inverter is manufactured and tested in accordance with the technical specifications which are valid for SEW-EURODRIVE .
- Check the equipment immediately for **packaging or transport damage**.
- The manufacturer **reserves the right** to make **alterations to the technical data and design** which serve the cause of progress.
- Compliance with these instructions and recommendations is a prerequisite for trouble-free operation and meeting possible warranty claims. Please read these instructions carefully before starting to work on or with the equipment.
- These instructions also contain important notes on servicing. They should therefore be kept in the vicinity of the inverter.
- The safety instructions must be followed!

Electrical hazard, e.g. when working on live equipment.

Mechanical hazard, e.g. when working on hoists.

Cross-references to other sections or publications are indicated by →.

Type designation

Example:

MOVITRAC 3 0 1 5 - 4 0 3 - 4 - 0 0

Version	00	= standard
Quadrant version	4	= 4-Q (with brake chopper) / 1 = 1Q
Type of supply connection	3	= 3-phase
Mains supply voltage	40	= 400 V_{AC} / 50 = 500 V_{AC}
Usable motor power	e.g 15	= 1.5 kW
Type number 30..		

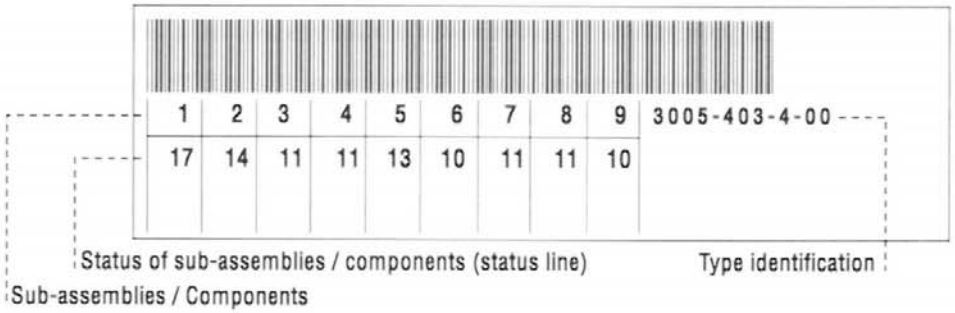
Note on the interference suppression symbol:

- **MOVITRAC ® 3000 variable frequency inverters from SEW, with the interference suppression symbol**, have been successfully tested by the VDE testing laboratory (in combination with a typical motor) for compliance with the level B limits of interference as per EN 55011 / EN 55014 (DIN VDE 0875 Part 11).

  The interference suppression symbol is only valid with:

  - **interference suppression wiring** → Sec. 2 – Electrical Installation
  - the appropriate **mains filter** → Sec. 8 – Accessory Equipment

Example:



If consulting with our customer service, please be sure to provide the status line data.

1 Mechanical Installation

The following points must be be observed during the installation of the inverter:

- Install in a switch cabinet with an appropriate enclosure suitable for the application to avoid dust accumulation and condensation.
- If necessary allowance should be made for installation of ventilation filters or anti-condensation heaters in the switch cabinet.
- **Note:** Ensure sufficient ventilation for the inverter!
  The space requirements for adequate cooling are:
  above and below the unit: at least 150 mm free space
  on the sides: at least 30 mm free space.

  Cable ducts in the free ventilation space do not impede the air flow.

  Max. permissible ambient temperature with full inverter utilisation: 45 °C
  with reduced utilisation: 60 °C
- Electronic signal relays (setpoint contacts, direction commands, etc.) and potentiometers should be placed as close as possible to the associated equipment, e.g. in the bottom 150 mm of free space.
- Line chokes, mains input filters or output chokes should likewise be mounted close to the associated inverter, taking account of the free space required for cooling.
- Mains input filter leads (= supply leads to the inverter input terminals 1 / 2 / 3) must be shortened to the minimum length necessary. The maximum length is 400 mm.
- For radio interference suppression, the mains input filter and inverter must be provided with earthing which is effective at (High frequency) HF: for instance, a widely spread metal-to-metal contact between the inverter housing and the sheet metal of the switch cabinet is a good prerequisite.
  Cable shielding must also be earthed by a wide-area contact. To achieve this, the entire cross-section of the shielding braid must be grounded to the PE (earth terminals) as directly as possible, i.e. without any extension.
- It is recommended that the motor is protected by using PTC thermistors, SEW type TF; a motor cut-out; (thermal overload trip or circuit breaker) is not sufficient.

2.1 Safety precautions to be observed during installation

- Equipment must only be installed by qualified electrical personnel in compliance with the valid regulations for installation and accident prevention.
  (e.g. EN 60204, DIN-VDE 0100 / 0113 / 0160)
- The appropriate instructions must be observed during the installation and commissioning of the motor and brake!
- When the inverter cover is open the unit has the enclosure IP 00. Dangerous voltages are present at some points, i.e. on all modules apart from the electronics control board. The unit must be closed during operation.
- Protective measures and equipment must be chosen according to the regulations which are valid (e.g. VDE 0100 T410 / VDE 0113 T1 or EN 60204 / VDE 0160)
  Necessary protective measure: protective earthing of the equipment.
  Further necessary protective eqipment: overcurrent protection (fuses)

2.2 Mains fuses and contactor, mains and motor leads

If more than four inverters are supplied by a single mains contactor (dimensioned for the total current), then a 3-phase mains choke (V_K = 4 %) wired in series, is recommended to limit the current surge when switching on.

Cross-sectional area for

- Mains supply leads: based on the input current at rated load. (Data: → Sec. 5)
- PE connection: protective earth cross-section of at least 10 mm² Cu or a second lead electrically parallel to the earth lead and with separate terminals, due to the potential presence of diverted current > 3.5 mA (DIN VDE sec. 6.5.2.1) (→ Table of input fuses and minimum lead cross-sections)
- Motor supply leads: based on the rated output current I_{outp}. (Data: → Sec. 5)
  The voltage drop on the motor leads is to be limited: to $\Delta V \leq 10$ V for single drives, to $\Delta V \leq 5$ V. for group drives and hoists

  The voltage drop can be determined from the following table: (with shorter leads the voltage drop can be calculated in proportion to the length):

Lead cross-section	Current load =											
	4 AAC	6 AAC	8 AAC	10 AAC	13 AAC	16 AAC	20 AAC	25 AAC	30 AAC	40 AAC	50 AAC	60 AAC
Copper	Voltage drop Δ V for a length = 100 m and Δ T = 50 K											
1.5 mm²	5.3 V	8.0 V	10.6 V	13.3 V	17.3 V	21.3 V	*)	*)	*)	*)	*)	*)
2.5 mm²	3.2 V	4.8 V	6.4 V	8.1 V	10.4 V	12.8 V	16.0 V	*)	*)	*)	*)	*)
4.0 mm²	1.9 V	2.8 V	3.8 V	4.7 V	6.5 V	8.0 V	10.0 V	12.5 V	*)	*)	*)	*)
6.0 mm²					4.4 V	5.3 V	6.4 V	8.3 V	9.9 V	*)	*)	*)
10 mm²						3.2 V	4.0 V	5.0 V	6.0 V	8.2 V	10.2 V	*)
16 mm²								3.3 V	3.9 V	5.2 V	6.5 V	7.8
25 mm²									2.5 V	3.3 V	4.1 V	4.9
35 mm²										2.3 V	2.9 V	3.5

*) Load not permissible in accordance with VDE 0100 Part 430.

- When operating two motors from one inverter and using the "Parameter change-over function", a switch- over contactor must be provided in each of the two motor leads. Switch-over contactors may only be operated when the inverter is disabled.
- The **input fuses** must be installed at the beginning of the mains supply leads, directly after the busbar junction (Wiring Diagram → Sec. 2.5: F11/F12/F13). Use fuse types as per VDE 0100 Part 430 (D, DO, low-voltage high-breaking-capacity (l.v. h.b.c.) or power circuit-breakers). The following **fuse current ratings** and **minimum wire cross-sections** are to be assigned to the various inverter types:

			Input fuses and minimum lead diameters									
MOVITRAC® Types	**for V_{mains} = 400 VAC**		**3001**	**3002**	**3003**	**3004**	**3005**	**3007**	**3011**	**3015**	**3022**	**3030**
	for V_{mains} = 500 VAC		**3001/3002**	**3003**	**3004**	**3005**		**3007**	**3011**	**3015**	**3022**	**3030**
Fuses F11 / F12 / F13	I_N	[A]	10	10	16	16	16	20	35	35	50	80
Mains supply leads, TL. 1 / 2 / 3		[mm²]	1.5	1.5	2.5	2.5	2.5	4	6	10	16	16
PE-Lead		[mm²] or	2 x 1.5 1 x 10	2 x 1.5 1 x 10	2 x 1.5 1 x 10	2 x 1.5 1 x 10	2 x 1.5 1 x 10	2 x 4 1 x 10	2 x 4 1 x 10	2 x 4 1 x 10	2 x 4 1 x 10	2 x 4 1 x 10
Motor supply leads, TL. 4 / 5 / 6		[mm²]	1.5	1.5	1.5	2.5	2.5	2.5	4	6	10	16
Inverter terminal cross-section		[mm²]	4	4	4	4	4	10	10	16	16	16

- For **radio-interference-suppressed wiring** (e.g. in residential areas) a shielded cable must be used for the motor lead. The shield must be earthed at **both ends** (a wide-area contact with the chassis is important). Furthermore, the use of mains input filters, type NF ... is required (→ Sec. 8).

- Only an **inductive/resistive** load may be driven from the output (motor or transformer), no capacitive load!
- For **jogging** the drive, use the clockwise/counterclockwise or enable (rapid stop) commands.
  The mains contactor K 11 must not be used for jogging, but only for switching the inverter on and off.
  There should be a time interval of at least 30 s between switching mains power off and switching on again!

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- Two MOVITRAC® **3000 of the same size series**(i.e. type series I, II or III, refer to Technical Data) and working **off the same supply** can be connected in parallel for the purpose of energy balance (one drive in the motor operating mode the other in the regenerative mode).
  Depending on the cumulative regenerative power (e.g. with emergency stop by the command "Rapid stop") it is also permissible, if necessary, to allocate only one MOVITRAC® 3000 as a 4-Q inverter with brake chopper.
  Example:

Connection	4 Quadrant 1st MOVITRAC® 3000-...-**4**-	1 Quadrant 2nd MOVITRAC® 3000-...-**1**-	**Remarks**
1. Connect the DC-link terminals	TL. 7 (–)	TL. 7 (–)	Permissible lead length l ≤ 1 m. Select short-circuit proof material ($V_{DC\text{-}link}$ to 750 V or 890 V). Cross-section as for the mains leads TL.1/2/3 (refer to previous table).
	TL. 8 (+)	TL. 8 (+)	
2. Connect the input terminals	TL. 1	TL. 1	**Caution:** do not mix up connections!
	TL. 2	TL. 2	
	TL. 3	TL. 3	
3. **Both** the mains contactors K11 **and** the mains fuses F11/F12/F13 (→ Sec. 2.5) must be dimensioned for the combined total power of both inverters. **Note:** Two mains contactors are only permissible if they are switched simultaneously, i.e. controlled in parallel!			

* The 2nd MOVITRAC® 3000 must also be programmed as a 1 Q unit on 4 Q (4 Quadrant operation P 890 = Yes).

2.3 Brake actuation

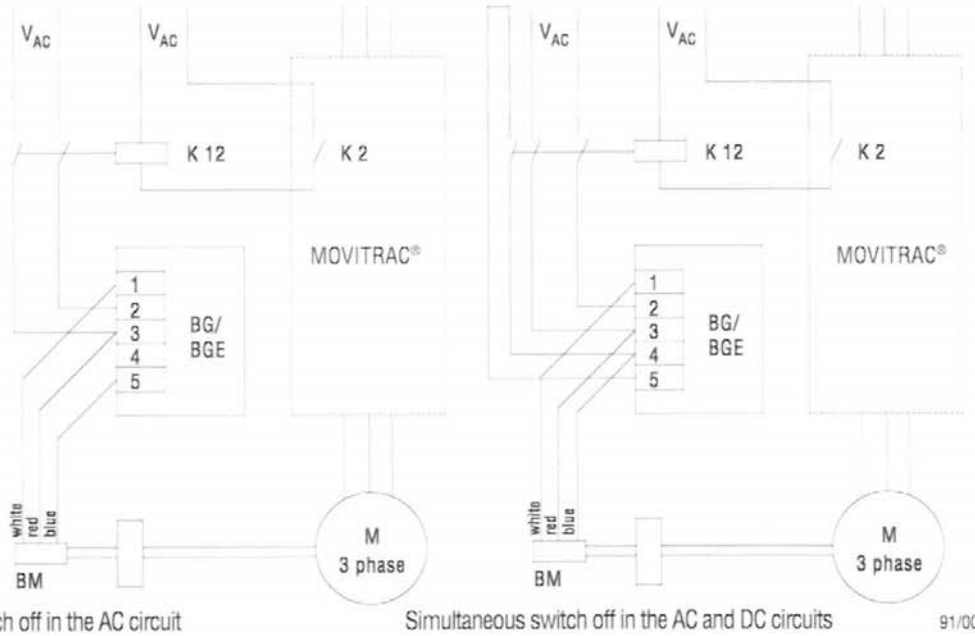
Comprehensive information about the SEW brake system can be found in the separate detailed instructions, as well as in the "Geared Motors" catalogue and in "Drive Engineering - Practical Implementation - Vol. 4" from SEW.

The SEW BM brake system a DC-excited disc brake, that is held off electro-magnetically and applied by spring force. A brake rectifier provides direct current for the brake. The standard rectifier for motor frame sizes DT63 ... DT100 is BG; from motor frame size DV112 it is BGE. **In inverter operation the brake must have its own mains supply leads; it is not permissible to feed the brake rectifier from the motor current supply!**

The switch-off of the brake rectifier, which applies the brake, can be implemented in two ways, by:
1. Switching off the AC circuit: Brake reaction time: t_{2I} = 20 ... 60 ms (depending on brake size)
2. Simultaneous switch-off in AC and DC circuits: Brake reaction time: t_{2II} = 5 ... 18 ms (depending on brake size)

Caution: On **hoists** the brakes must be applied by simultaneous switch-off in the AC and DC circuits (i.e. rapid brake reaction)!

Basic circuit of AC squirrel-cage brake motors with brake rectifiers BGE

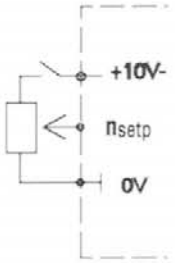


Switch off in the AC circuit — Simultaneous switch off in the AC and DC circuits — 91/008/91E

- Control the brake by using the output relay K2 "Brake", not by a PLC!
- The output relay of the inverter – K2 "Brake" – must be connected in series with the other interlocking contacts of the installation which control the K12 auxiliary contactor for brake actuation. **The K2 relay must not be used for direct switching of the brake coil power without using an auxiliary contactor!**
  The switching capacity of K2 must be taken into account (→ Sec. 5 - Technical Data)!

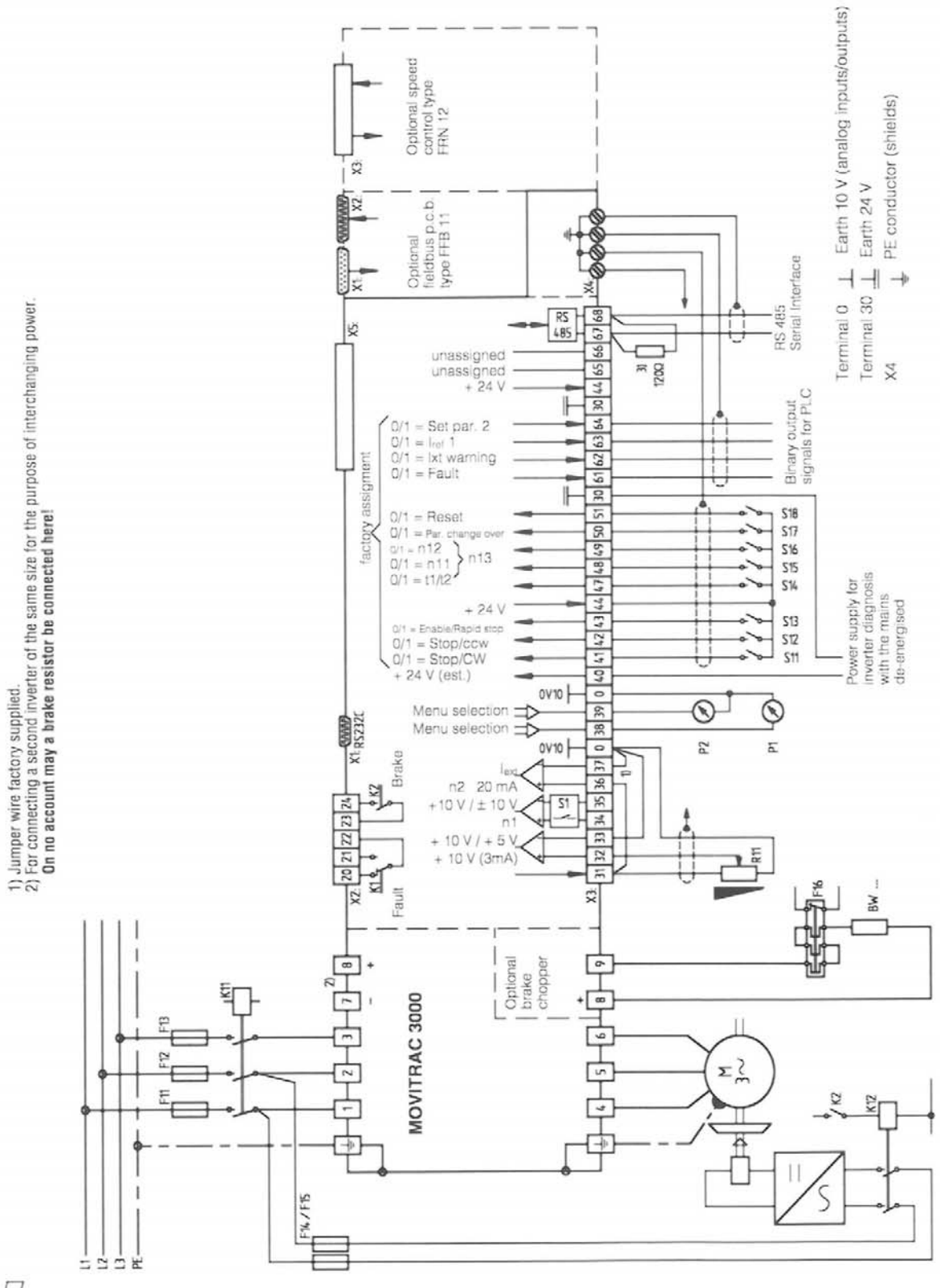
2.4 Electronics leads and signal generation

- The electronics terminals are suitable for wire cross-sections up to 1.5 mm.
- Interference-protected wiring is only possible with shielded leads (go-and-return leads in one shield). The shield should be earthed **at both ends.** However, earthing at one end may be advantageous for avoiding earth loops. It should be checked whether the open shield end needs to be earthed via a suppression capacitor, or whether a double shielded lead should be used – with the outer shield earthed on the inverter side and its inner shield at the other end.
- If **unshielded leads** are nevertheless to be used, then go-and-return lines must be twisted and run in separate cable ducts (i.e separately from power leads, contactor control leads and leads to braking resistors).
- Setpoints of potentiometers are switched via the + 10 V voltage, not the wiper lead (→ fig.).



- **0V leads must not to be switched** for signal generation.
- 0V leads of several interconnected inverters should not to be chained from unit to unit, but **wired in a STAR configuration**. That means:
  a) The inverters should not to be installed in widely dispersed switch cabinet sections but located in adjacent compartments
  b) The 0V leads are to be connected by 1.5 mm^2 wire and the shortest possible route, from one geometric central position to the individual units.
- If coupling relays are used, they must have encapsulated, **dust-tight electronic contacts**, that are suitable for switching low-level voltages (5 - 20 V) and currents (0.1 - 20 mA).
- Instead of using coupling relays, binary input commands can also be given directly as 0/1 commands from the PLC (signal level → Sec. 5 - "Technical Data"). For this purpose the reference potential (TL. 30) of the binary inputs TL. 41-43 / 47-51 is to be connected to the reference potential (0 V) of the PLC.
- The inverter starts a **self-test** (approx. 2.5 s), if the mains or the external 24 V supply (TL. 40) is switched on. During the self-test time the analogue output signals (TL. 38 / 39) have a "+10 V" level, the binary output signals (TL. 61-64) have a "1" level and the output relay K1 (TL. 20-22) is energised.
- When **connecting the inverter to a PC via RS 232,** use a serial interface cable (max. length = 5 m) with a 9 pole miniature D plug. The cable must be shielded (with the shield earthed at one end).
  Pin assignment: Earth = pin 5 RXD received data / TXD transmitted data = pin 2 / pin 3
  If the transmission and receiving leads are crossed within the interface cable, then the pin assignment can be switched over on the inverter with switch S7.

2.5 Wiring diagram



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2.6 Functional description of the terminals

Terminal = TL.	References to the function of inputs and signal outputs
1/2/3	Mains connection
4/5/6	Conductor leads to the motor
7	DC link voltage $-V_{DC\ link}$ **Caution**: These terminals are intended for interconnected operation (power interchange)
8	DC link voltage $+V_{DC\ link}$ of two inverters of the same size and V_{mains}. **Do not connect a braking resistor here!**
8/9	Brake resistor connection with 4-Q inverters (Tripping current of F16 → Sec. 8)
X1:	RS 232 serial interface, Submin.-D, 9-pole; max. cable length 5 m. Pin 5: earth; Pin 2 / Pin 3: RXD transmitted data / TXD received data (S7 = pin change-over)
X2:20-22	Relay K1 (functions as for binary outputs TL.61-64) Signal function: refer to menu (P 620)
23/24	Relay K2 (brake) opens - on STOP ..... after t11 / t21 (P 121 ff.) - RAPID STOP ..... after t31 / t32 (P 140 / 141) - Fault ..... immediately - in conditions according to P 730 "DC braking" after t set by P 731 / 734 - in conditions according to P 780 "Zero point stop function" - in conditions according to P 790 "Setpoint stop function"
X3:30	Chassis ground 24 V (2 reference terminals for TL. 40-64)
31	+10 V (3mA) for setpoint potentiometer
32/33	Setpoint input n1 (Differential input referred to TL.33) / Signal shape: refer to menu (P 100)
34/35	Setpoint input n2 (Differential input referred to TL.35) / Signal shape: refer to menu (P 110) as well as switch S7 (U/I)
36/37	External current limit I_{ext} - apparent current (Differential input referred to TL.37) / Signal shape: 0 ... 10 V ≙ 0 ... 100% I_{max} (menu P 320 / 340)
0	Ground for 10 V (2 reference terminals for analogue inputs/outputs TL. 32-39)
38	Analogue output 0 ... ±10 V (max. 3mA) f_{outp} / f_{outp}±slip / I_{active} / Σn_{setp} / V_{outp} / P_{active} / Ixt / $I_{apparent}$ refer to menu (P 630 / 631)
39	Analogue output 0 ... ±10 V (max. 3mA) f_{outp} / f_{outp}±slip / I_{active} / Σn_{setp} / V_{outp} / P_{active} / Ixt / $I_{apparent}$ refer to menu (P 632 / 633)
40	Ext. power supply + 24 V for inverter diagnosis with the mains off (LED V4) (approx. 0.6 A without power for options)
44	Auxiliary power supply output + 24 V (max. 250 mA) for external command switches S11 ... S18
41	Binary input for clockwise rotation S11 closed = clockwise rotation (looking at the end of the motor drive shaft)

Binary inputs (freely assignable); Selection: → menu (P 600-606)

	factory assignment:	additional selection possibilities:	assignment after commissioning:
42	- Anticlockwise/stop	- Motor pot. ramp up	TL.42:
43	- Enable/rapid stop	- Motor pot. ramp down	TL.43:
47	- Ramp change-over t2/t1	- Deceleration monitoring	TL.47:
48	- n 11 } n 13	- n/t program	TL.48:
49	- n 12 }	- Controller inhibit	TL.49:
50	- Parameter switch over	- External fault	TL.50:
51	- Reset	- Set to zero (FRS 11) - FRS 11 Master - Slave: free run	TL.51:
30	(see above)		

Binary outputs (freely assignable) Selection: → menu (P 610-613)

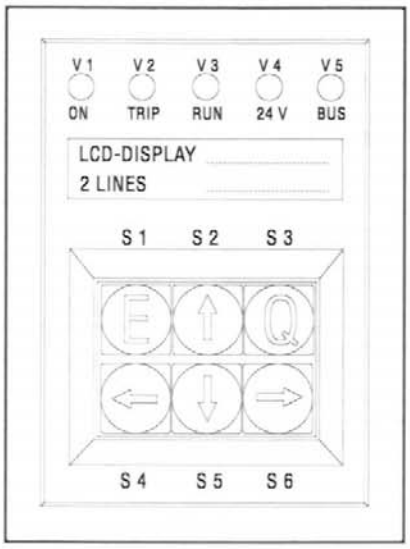
	Condition signals	Monitoring signals	Fault signals	Assign. factory / after commiss.
61	- MC ready	- f_{ref} 1	- Fault decel. mon.	TL.61: fault /
62	- Rotating field ON	- f_{ref} 2	- Collective fault sig.	TL.62: Ixt warning /
63	- Rotating field OFF	- $f_{ref1} < f < f_{ref2}$	- External fault	TL.63: $I_{ref}1$ /
64	- Brake ON	- $f = f_{setp}$	- Short circuit	TL.64: param. set /
	- Manual operation	- f_{min}	- $V_{DC\text{-}link}$ >>	
	- Parameter set 1/2	- f_{base}	- V_{Mains} >>	
	- I x t - Warning	- f_{max}	- V_{Mains} <<	
	- Fault temperature	- I_{ref} 1	- Overload Ixt	
	- Warning FRS11	- I_{ref} 2	- Overtemperature	
	- Slave in pos. FRS	- I_{max}	- Fault flying start	
		- f_{skip}	- Lag error FRS	
30	(see above)			
65/66	unassigned			
67 / 68	RS 485 serial interface ; max. cable length 200 m switchable via S2: Inverter → option board		For use as, e.g. master-slave operation: Provide terminals of the 1st and last inverter with 120Ω/0.25 W.	
X4:	Shield-end connections (PE-potential)			
X5:	Option: MELCARD (for saving up to 5 parameter sets)		Caution: plug in only in the de-energised state!	
X11	Optional board (→ Sec. 8 "Accessory equipment")			

3.1 Safety Precautions

- Commissioning and servicing of the inverter may only be carried out by qualified electrical personnel who have been properly trained in accident prevention and in compliance with the applicable regulation (e.g VBG 4, DIN-VDE 0100 / 113 / 160).
- Disconnect the inverter from the mains before removing the front plate. Dangerous voltages can still be present up to 10 minutes after switching off the mains.
- When the cover is removed the inverter has an IP 00 enclosure. Only the front board (with the electronics terminal strip) carries a low voltage. The rear inverter section carries dangerous voltages!
- In the power-on condition dangerous voltages are present on the output terminals and the connected cables and motor terminals. This is also the case, if the inverter is inhibited and the motor is at rest.
- If the operating LED V1 and other display elements go out, this is *not* an indication that the equipment is disconnected from the mains and de-energized.
- Internal safety functions or a mechanical blocking can result in a motor stoppage. Removal of the cause of the fault can lead to the drive restarting automatically. If this is not permissible with the driven machine, for safety reasons, then the inverter must be disconnected from the mains before clearing the fault.
  Furthermore, in these cases the activation of the "Auto-Reset" function (P 860) is prohibited.

3.2 Menu selection

The front of the inverter has the following operator's control panel:



Functions of the control panel:

Display: Plain text LCD-display with 2 lines of 16 characters each..
The contrast of the LCD-display can be altered by using the internal potentiometer R8.
(Location: underneath the pushbuttons S4/S5).
Operating displays → Sec. 4

LEDs: Indications → Sec. 4

Keys:

Arrows The cursor keys are used to move around the menu (→ Sec. 3.3).

[Q] In normal operation, this key results in a jump from any menu point back to the basic display (frequency and current).
In the "MANUAL OPERATION" mode" (P 870) the [Q] key produces a STOP command.

[E] In a fault condition the [E] key functions as a reset key. Pressing the [E] key results in the query (P862) "Pushbutton Reset Yes/No".
In the "MANUAL OPERATION" mode" (P 870) the [E] key is used to quit manual operation.

The **alteration of values in the display** changes the actual parameters for the inverter:

- when the arrow key is released: for most parameters
- directly, i.e. during the pressing of the arrow key: for boost and IxR (P 320 / P 321 / P 341 / P 342)
- after the completion of STOP or RAPID STOP: for f_{base} (P 201 / P 211 / P 221), parameter change-over (P 350), factory setting (P 830).

3.3 Parameter list

Menu structure

Parameter list

(Factory setting underlined)

For MOVITRAC® 3000 with processor p.c.b from Part No. 821 090 **X.12** and higher versions, i.e with systems EPROMs from version number ... (→ P 810 "Service Information")

MOVITRAC® Type		3001 / 3002	3003 / 3005	3007 / 3011	3015 / 3022 / 3030
System-EPROM	at Vmains = 400 V_{AC}	821 484 0.**17**	821 440 9.**17**	821 442 5.**17**	821 444 1.17
(LOW)	at V_{mains} = 500 V_{AC}	821 555 3.**13**	821 456 5.**13**	821 458 1.**13**	821 460 3.**13**

Basic display

Frequency.	5 ... 120 Hz
Current	0 ... 200 %

0 _ _ DISPLAY VALUES

0 0 _ Process values

0	Current	0 ... 200 %
	Frequency	0.5 ... 120 Hz
1	Temperature	20..+ 100 °C
2	Actual parameter set	#1 / #2
3	Ext. current limit TL. 36-37	0 ... 100 %
4	Speed	0 ... 7200 1/min

0 1 _ Voltages

0	V_{mains}	0 ... 1000 V
	$V_{DC\text{-}link}$	0 ... 1000 V
1	V_{motor}	0 ... 1000 V
	Frequency	0.5 ... 120 Hz

0 2 _ Currents/power

0	I_{active}	–200 ... +200 %
	$I_{apparent}$	0 ... 200 %
1	Power	–200 ... +200 %
	Utilization	0 ... 109 %

0 3 _ Status Binary inputs

0	41: ... 42: ... 43: ... 47: ... 0/1
1	48: ... 49: ... 50: ... 51: ... 0/1

0 4 _ Status Binary outputs

0	61: ... 62: ... 63: ... 64: ... 0/1	
1	Output relay	0/1
2	Brake relay	0/1

0 5 _ Options

0	Field bus	None / Interbus-S
1	Optional board	None / n-control

0 6 _ Fault memory

0	Error t-0:	.....
1	Error t-1:	.....
2	Error t-2:	.....
3	Error t-3:	.....
4	Error t-4:	.....
	Sub-menu to fault 0 ... 4:	
	Measured values at the fault instant:	
	$V_{DC\text{-}link}$ / V_{mains} / ϑ / f / I_{app} / Ixt / I_{active} /	
	terminals / parameter set	

0 7 _ INTERBUS *(only for option FFB11)*

0	Address / Drivecom-Index No.	
1	Copy Par. List from	MELCARD/MOVITRAC®
2	Copy	Yes/No

1 _ _ SETPOINT / RAMP GENERATORS

1 0 _ Setpoint n1 terminal 32 / 33

0	n1 Characteristic	gain / offset
1	n1 Gain factor	0.1 ... **1** ... 10.0
2	n1 Offset factor	0.1 ... **1** ... 9.0

1 0 _ Setpoint n2 terminal 34 / 35

0	n2 Signal TL. 34 / 35	**0 ... 10 V** / –10 ... +10 V
	(S1 to be noted)	0 ... 20 mA / 4 ... 20 mA

1 2 _ 1st ramp generator

0	t11 Ramp up	0.0 ... **1** ... 2000 s
1	t11 Ramp down	0.0 ... **1** ... 2000 s
2	t11 S-pattern	**0** / 1 / 2 / 3
3	t21 Ramp up	0.0 ... **1** ... 2000 s
4	t21 Ramp down	0.0 ... **1** ... 2000 s
5	t21 S-pattern	**0** / 1 / 2 / 3

1 3 _ 2nd ramp generator

0	t12 Ramp UP = DOWN	0.0 ... **5** ... 2000 s
1	t22 Ramp UP = DOWN	0.0 ... **5** ... 2000 s

1 4 _ Rapid stop ramp t3

0	t13 Ramp stop	0.0 ... **1.0** ... 9.9 s
1	t23 Ramp stop	0.0 ... **1.0** ... 9.9 s

1 5 _ Motor potentiometer

0	Motor pot.	Yes / **No**
1	t4 Ramp up	2 ... **10** ... 60 s
2	t4 Ramp down	2 ... **10** ... 60 s
3	Store last position	Yes / **No**
4	Motor pot. + n1	Yes / **No**

1 6 _ 1st set fixed setpoints

0	n 11	0.5 ... **5** ... 120 Hz
1	n 12	0.5 ... **25** ... 120 Hz
2	n 13	0.5 ... **50** ... 120 Hz
3	MIX 1st set + n1	Yes / **No**

1 7 _ 2nd set fixed setpoints

0	n 21	0.5 ... **5** ... 120 Hz
1	n 22	0.5 ... **25** ... 120 Hz
2	n 23	0.5 ... **50** ... 120 Hz
3	MIX 2nd set + n1	Yes / **No**

2 _ _ FREQUENCY CHARACTERISTICS

2 0 _ V/f pattern 1 (stepwise)

0	f_{min} 1	**0.5** ... 25 Hz
1	f_{base} 1 in steps	**50** / 60 / 87 / 104 / 120 Hz
2	f_{max} 1	40 ... **50** ... 120 Hz

2 1 _ V/f pattern 2 (stepwise)

0	f_{min} 2	**0.5** ... 25 Hz
1	f_{base} 2 in steps	**50** / 60 / 87 / 104 / 120 Hz
2	f_{max} 2	40 ... **50** ... 120 Hz

2 2 _ V/f pattern 3 (stepless)

0	f_{min} 3	**0.5** ... 25 Hz
1	f_{base} 3 stepless adjustment	5 ... **50** ... 120 Hz
2	f_{max} 3	40 ... **50** ... 120 Hz

2 3 _ 1. Frequency window skip

0	1. Frequency window skip	Yes / **No**
1	Window centre	5 ... **50** ... 87 Hz
2	Window width (half width)	±**2** ... ±9 Hz

2 4 _ 2. Frequency window skip

0	2. Frequency window skip	Yes / **No**
1	Window centre	5 ... **50** ... 87 Hz
2	Window width (half width)	±**2** ... ±9 Hz

2 5 _ V/f pattern selection

0	V/f pattern parameter set 1	**1** / 3
1	V/f pattern parameter set 2	**2** / 3

2 6 _ START / STOP frequency

0	Set 1 START / STOP frequency	0.5 ... **2.0** ... 5.0 Hz
1	Set 2 START / STOP frequency	0.5 ... **2.0** ... 5.0 Hz

SEW EURODRIVE

3 _ _ MOTOR PARAMETERS

3 0 _ Adjustment mode

0	Motor 1	Manually
1	Motor 2	Manually

3 1 _ Automatic adjustment 1

0	(without function)	

3 2 _ Manual adjustment 1

0	I_{max} 1	20 ... **150** %
1	BOOST 1	**0** ... 100 %
2	IxR 1	**0** ... 100 %
3	Slip 1	**0** ... 10 Hz
4	1st pole pair number	1 / **2** / 3 / 4 / 5 / 6

3 3 _ Automatic adjustment 2

0	(without function)	

3 4 _ Manual adjustment 2

0	I_{max} 2	20 ... **150** %
1	BOOST 2	**0** ... 100 %
2	IxR 2	**0** ... 100 %
3	Slip 2	**0** ... 10 Hz
4	2nd pole pair number	1 / **2** / 3 / 4 / 5 / 6

3 5 _ Parameter change-over

0	Release parameter change-over	Yes / **No**

4 _ _ REFERENCE SIGNALS

4 0 _ 1st frequency reference value

0	1st frequency reference	2 ... **50** ... 120 Hz
1	1st hysteresis	±1 ... **±2** ... ±9 Hz
2	1st delay	**0** ... 9 s
3	1st signal = 1 at	$f>f_{ref}1$ / **$f<f_{ref}1$**

4 1 _ 2nd frequency reference value

0	2nd frequency reference	2 ... **50** ... 120 Hz
1	2nd hysteresis	±1 ... **±2** ... ±9 Hz
2	2nd delay	**0** ... 9 s
3	2nd signal = 1 at	$f>f_{ref}2$ / **$f<f_{ref}2$**

4 2 _ Frequency window signal

0	Signal = 1 at f	inside/outside window

4 3 _ Setp.-actual value comparison

0	Hysteresis	±1.. **±2** ... ±9 Hz
1	Signal = 1 at *(concerns P 23_and P 24_)*	**$f=f_{setp}$** / $f<>f_{setp}$

4 4 _ f_{base} Signal

0	Signal = 1 at	**$f<f_{base}$** / $f>f_{base}$

4 5 _ 1st current reference value

0	1st current reference	10 ... **100** ... 150 %
1	1st hysteresis	**±1** ... ±9 %
2	1st delay	**0** ... 9 s
3	1st signal = 1 at	$I<I_{ref}$ 1 / **$I>I_{ref}$ 1**

4 6 _ 2nd current reference value

0	2nd current reference	10 ... **100** ... 150 %
1	2nd hysteresis	**±1** ... ±9 %
2	2nd delay	**0** ... 9 s
3	2nd signal = 1 at	$I<I_{ref}$ 2 / **$I\geq I_{ref}$ 2**

4 7 _ I_{max} signal

0	Signal = 1 at	**$I<I_{max}$** / $I = I_{max}$
1	Delay	**0** ... 9 s

5 _ _ MONITORING FUNCTIONS

5 0 _ Deceleration monitoring

0	Deceleration monitoring	Yes / **No**
1	f_{ref} 3	**10** ... 99 Hz

5 1 _ Speed Monitoring

0	Speed monitoring 1	Yes / **No**
1	Response time 1	0.1 ... **1** ... 9 s
2	Speed monitoring 2	Yes / **No**
3	Response time 2	0.1 ... **1** ... 9 s

5 2 _ Regenerative monitoring

0	Regen. monitoring 1	Yes / **No**
1	Regen. time 1	0.1 ... **1** ... 9 s
2	Regen. monitoring 2	Yes / **No**
3	Regen. time 2	0.1 ... **1** ... 9 s

5 3 _ Mains voltage monitoring

0	V_{mains} monitoring	Yes / **No**

5 4 _ Motor phases monitoring

0	Motor phases monitoring	**Yes** / No

5 5 _ Synchronous operation monitoring

		(only with FRS 11)
0	Warning FRS	**50** ... 65535
1	Regenerative fault	100 ... **4000** ... 65535
2	Window skip time	**1** ... 99 s
3	Fault reaction	**0/1** / control. inhibit / stop / rapid stop
4	Slave position tolerance	±10 ... **25** ... 32768
5	LED counter V11	±10 ... **100** ... 32768
6	Time const. for position mon.	1 ... **10** ... 2000 ms
7	Cable break mon. master / slave	**Yes** / No

6 _ _ TERMINAL ASSIGNMENT

6 0 _ Binary inputs 42-51 *17 types of command*

0	Terminal 42	**CCW / STOP**
1	Terminal 43	**Enable / RAPID STOP**
2	Terminal 47	**Ramp change-over t2 / t1**
3	Terminal 48	**n11 (n21)**
4	Terminal 49	**n12 (n22)**
5	Terminal 50	**Parameter change-over**
6	Terminal 51	**Reset**

6 1 Binary outputs 61-64 *32 signals*

0	Terminal 61	**Fault**
1	Terminal 62	**Ixt warning**
2	Terminal 63	**1. current reference I_{ref}**
3	Terminal 64	**Parameter set 2 / 1**

6 2 Output relay 20-22 *Selection → 6 1*

0	Relay K1 (TL.20-22)	**Fault**

6 3 Analogue outputs 38-39 *8 signal types*

0	Analogue output 1 (TL.38)	**Actual frequency f_{outp}**
1	Factor output 1	0.1 ... **1.0** ... 3.0
2	Analogue output 2 (TL.39)	**Apparent current Is**
3	Factor for output 2	0.1 ... **1.0** ... 3.0

7 _ _ CONTROL FUNCTIONS

7 0 _ Load distribution function

0	(not implemented)	

7 1 _ Hoist function

0	Hoist function 1	Yes / **No**
1	Premagn. time 1	40 ... **200** ms
2	Hoist function 2	Yes / **No**
3	Premagn. time 2	40 ... **200** ms

7 2 _ Rapid start function

0	Rapid start 1	Yes / **No**
1	Field current 1	10 ... **100** ... 110%
2	Duration 1	**3** ... 30 s
3	Rapid start 2	Yes / **No**
4	Field current 2	10 ... **100** ... 110%
5	Duration 2	**3** ...3 0 s

7	3	_	**DC braking**	
		0	DC braking 1	Yes / **No**
		1	DC braking time	**3** ... 30 s
		2	DC holding current	0 ... **20** ... 25%
		3	DC braking 2	Yes / **No**
		4	DC braking time	**3** ... 30 s
		5	DC holding current	0 ... **20** ... 25%
7	4	_	**Heating current**	
		0	DC heating current 1	Yes / **No**
		1	DC heating current 1	**0** ... 25 %
		2	DC heating current 2	Yes / **No**
		3	DC heating current 2	**0** ... 25 %
7	5	_	**Flying start function**	
		0	Flying start function 1	Yes / **No**
		1	Flying start CW / CCW 1	Yes / **No**
		2	Flying start function 2	Yes / **No**
		3	Flying start CW / CCW 2	Yes / **No**
7	6	_	**Synchronous operation**	*(only with option FRS11)*
		0	Synchronous operation	Yes / **No**
		1	MOVITRAC® is	**Master** / Slave
		2	Master gearing factor	**1** ... (3,999,999,999)
		3	Slave gearing factor	**1** ... (3,999,999,999)
		4	Mode selection TL.102/103-105	**1**/ 2/ 3/ 4/ 5/ 6
		5	Slave counter	±(**10** ... 99999999)
		6	Offset 1	±(**10** ... 32767)
		7	Offset 2	±(**10** ... 32767)
		8	Offset 3	±(**10** ... 32767)
		9	Control prop. amplification factor	1 ... **10** ... 200
7	7	_	**Speed control**	*(only with option FRN 12)*
		0	Speed control	Yes / **No**
		1	Proportional amplification	0.1 ... **5.0** ... 50.0
		2	Controller time constant	1 ... **10** ... 500 ms
		3	Encoder increments	128 / 256 / 512 / **1024** / 2048
		4	s x R	Yes / **No**
		5	Brake function	Yes / **No**
		6	Starting setpoint	±80 ... **200** ... ±500 mV
7	8	_	**Zero point stop function**	
		0	Zero point stop 1	Yes / **No**
		1	Zero point stop 2	Yes / **No**
7	9	_	**Setpoint Stop function**	
		0	Setpoint stop function 1	Yes / **No**
		1	Setpoint stop function 2	Yes / **No**

8 _ _ SPECIAL FUNCTIONS

8	0	_	**Parameter blocking**	
		0	Parameter blocking	Yes / **No**
		1	Save	**Yes** / No
8	1	_	**Service Information**	
		0	EPROM system	821 ___ _XX
		1	EPROM operator control	821 114 0.XX
		2	EPROM field bus	821 110 8.XX
		3	Service tel. no.	.....
8	2	_	**Parameter copying**	
		0	Copying from	**MOVITRAC®** / MELCARD
		1	MEMORY board	Set **1** ... 5
		2	Copy	Yes / No
8	3	_	**Factory setting**	
		0	Factory setting	Yes / No
8	4	_	**Mode interfaces**	
		0	RS 232 mode	**Local** / External
		1	Control mode	**Standard** / Remote setp. / Remote CTRL / Field bus
		2	Inverter address	**0** ... 63
8	5	_	**Language change-over**	
		0	Language	**D** / GB / F
8	6	_	**Reset mode**	
		0	Auto-Reset-Mode	Yes / **No**
		1	Restart time	3 ... **30** s
		2	Push-button reset	Yes / No
8	7	_	**Manual operation**	
		0	Manual operation	Yes / **No**
			Direction of rotation	CCW / CW
			Speed	↑ / ↓
8	8	_	**Master-Slave Operation**	
		0	Master slave	Yes / **No**
		1	MOVITRAC® is	Master / **Slave**
		2	Weighting factor	0.10 ... **1.00** ... 10.00
8	9	_	**4 quadrant operation**	
		0	4 quadrant 1	**Yes** / No
		1	4 quadrant 2	**Yes** / No

9 _ _ n/t PROGRAM

9	0	_	**Speed-time program**	
		0	Time program	Yes / **No**
		1	Stop after step 9	Yes / **No**
9	1	_	**Step 1**	
		0	Step time 1	0 ... **10** ... 9000 s
		1	Rotational direction 1	**CW** / CCW
		2	Ramp generator step 1	0.0 ... **1** ... 2000 s
		3	Frequency step 1	0.5 ... **5** ... 120 Hz
9	2	_	**Step 2**	
		0	Step time 2	0 ... **10** ... 9000 s
		1	Rotational direction 2	**CW** / CCW
		2	Ramp generator step 2	0.0 ... **1** ... 2000 s
		3	Frequency step 2	0.5 ... **5** ... 120 Hz
9	3	_	**Step 3**	
		0	Step time 3	0 ... **10** ... 9000 s
		1	Rotational direction 3	**CW** / CCW
		2	Ramp generator step 3	0.0 ... **1** ... 2000 s
		3	Frequency step 3	0.5 ... **5** ... 120 Hz
9	4	_	**Step 4**	
		0	Step time 4	0 ... **10** ... 9000 s
		1	Rotational direction 4	**CW** / CCW
		2	Ramp generator step 4	0.0 ... **1** ... 2000 s
		3	Frequency step 4	0.5 ... **5** ... 120 Hz
9	5	_	**Step 5**	
		0	Step time 4	0 ... **10** ... 9000 s
		1	Rotational direction 5	**CW** / CCW
		2	Ramp generator step 5	0.0 ... **1** ... 2000 s
		3	Frequency step 5	0.5 ... **5** ... 120 Hz
9	6	_	**Step 6**	
		0	Step time 6	0 ... **10** ... 9000 s
		1	Rotational direction 6	**CW** / CCW
		2	Ramp generator step 6	0.0 ... **1** ... 2000 s
		3	Frequency step 6	0.5 ... **5** ... 120 Hz
9	7	_	**Step 7**	
		0	Step time 7	0 ... **10** ... 9000 s
		1	Rotational direction 7	**CW** / CCW
		2	Ramp generator step 7	0.0 ... **1** ... 2000 s
		3	Frequency step 7	0.5 ... **5** ... 120 Hz
9	8	_	**Step 8**	
		0	Step time 8	0 ... **10** ... 9000 s
		1	Rotational direction 8	**CW** / CCW
		2	Ramp generator step 8	0.0 ... **1** ... 2000 s
		3	Frequency step 8	0.5 ... **5** ... 120 Hz
9	9	_	**Step pause**	
		0	Step pause time	0 ... **10** ... 9000 s
		1	Ramp gen. (towards n = 0)	0.0 ... **1** ... 2000 s

3.4 Explanatory comments on the parameters

Parameter group 000 DISPLAY VALUES

This menu section contains information on values measured inside the unit (currents, voltages, frequencies) as well as status conditions of the binary inputs and outputs.

P004 Speed

In V/f operation without speed control: the display is rounded up or down to a full number of revs. It is derived from the no. of pole pairs (P 324 / P 344) and the output frequency ($\Delta f \geq 0.05$ Hz).
With speed control (option FRN12): speed is derived from the encoder signals (= actual value) divided by the no. of motor pole pairs (P 324).
Accuracy: 2-pole motors ± 1 min^{-1} (RPM) / 4-pole motor ± 2 min^{-1} (RPM) (rounded from 1.5 min^{-1} (RPM)) / 6-pole motor ± 3 min^{-1} (RPM)

P 01_ Voltages

For the displayed voltages V_{mains} / $V_{DC\text{-}link}$ / V_{motor} : a tolerance range of $\pm 10\%$ applies.

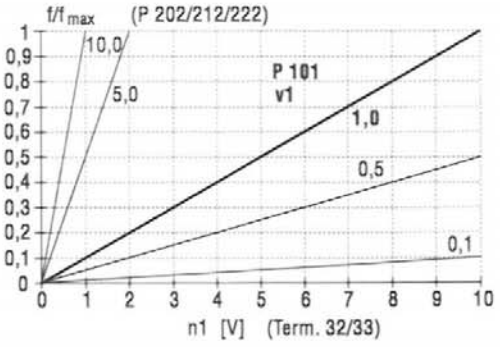
P 06_ Fault memory

Recall of the last 5 fault events (for possible fault display modes please refer to section 4.3)

Parameter group 100 SETPOINTS / RAMP GENERATORS

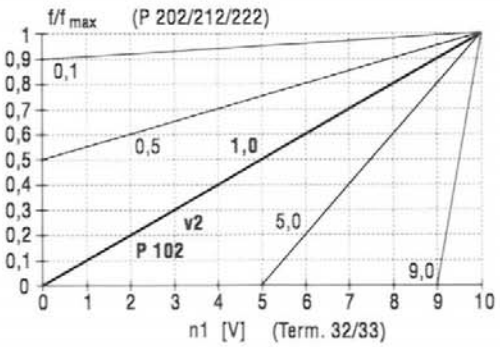
P 10_ Setpoint n1

The analogue setpoint n1 at TL. 32 (+) / TL. 33 (–/0V) is factory-set to 0 ... 10V ≙ 0 ... f_{max} (P 202 / 212 / 222). (Resolution: 10 bit). However, using P 101 and 102 it can also be referred to a part of the frequency range set in parameter group 200. Depending on the set f_{max}, the base frequency can be set alternatively to correspond to the setpoint "10 V" (by setpoint **gain**) or to the setpoint "0 V" (by setpoint **offset**) :



Setpoint gain P 101: (≙ override value 10 ... 100 ... 200%)
Setpoint 0 ... 10V ≙ 0 ... v1 · fmax
Factor v1:
0.1 ... 10.0 in steps Δv1 = 0.1

v1 = 10.0 → setpoint input n1 operates with 0 ... 1 V
v2 = 0.1 → setpoint input n1 operates with 0 ... 10 V → effects $\Delta f = 10\%$ f_{max} (e.g. used as correction setpoint)



Setpoint offset P 102: (≙ offset value of 0 ... 90%)
Setpoint 0 ... 10V ≙ (1 – v2) · f_{max}...f_{max}
Factor v2:
0.1 ... 9.0 in steps Δv2 = 0.1

If v2 > f_{min} the f_{min} value becomes ineffective.

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P 11_ Setpoint n2

The analogue setpoint n2 at TL.34(+) / TL.35(– / 0V) can be programmed for 4 signal forms (resolution: 9 bit).

Switch S1 in position	Selectable via P 110	Summing effect with setpoint n1	Explanatory notes
"U"	0 ... 10 V	yes	Standard setting for setpoint n2, same effect as with TL.32 / 33.
	–10 ... +10 V	no	The setpoint determines the output frequency and direction of rotation (+ ≙ CW/ – ≙ CCW). Effective from > ± 100 mV (without FRN12). The enable results via TL. 43 and TL. 41 or TL. 42. The binary commands CW / CCW (TL. 41 / 42) are ignored as rotational inputs. The internal fixed setpoints n11 / n12 / n13 resp. n21 / n22 / n23 (P 160 / P 170) cannot be activated. TL.43 effects "Rapid stop", TL. 41 / TL. 42 effects "STOP", i.e. stop via the deceleration ramp t11 / t21 resp. t12 / 22. → Zero Stop function P 780 / P 781 (with option FRN 12 → Sec. 8.)
"I"	0 ... 20 mA	yes	Input impedance R_i = 250 Ω
	4 ... 20 mA	yes	"Zero live"-signal; Input impedance R_i = 250 Ω

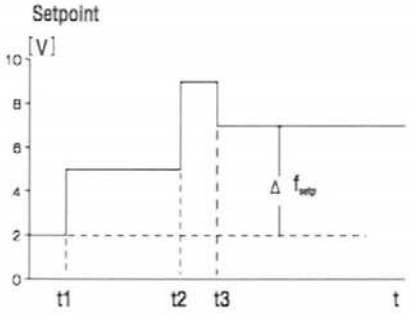
P 12_ 1st ramp generator (switchable)

Note: All ramp generators are influenced via an internal control circuit, depending on the current limit. A creep speed must therefore be provided for correct positioning.

The main ramp generator t11 / t21 enables separate setting of the acceleration time (ramp up) and the deceleration time (ramp down) for each parameter set. The adjustable time always refers to a frequency change of Δf=50 Hz; for larger frequency ranges the ramp time increases accordingly.

The S-pattern function can be activated in three stages (values 1/2/3). The S-pattern effects a jolt-free behaviour during setpoint changes, e.g. on start-up.

- Value = "0" the usual linear ramp, no rounding
- Value = "1" weak S-pattern
- Value = "2" medium S-pattern
- Value = "3" strong S-pattern



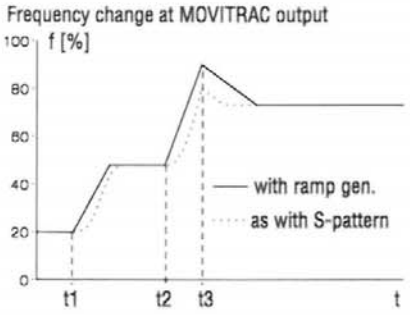
The S-pattern causes a lengthening of the acceleration or deceleration time. Compared with the usual time for linear ramps, the following values will result:

S-pattern = "1": + 24% of the set ramp generator time with setpoint jumps Δ f_{setp} > 12 Hz

S-pattern = "2": + 40% of the set ramp generator time with setpoint jumps Δ f_{setp} > 20 Hz

S-pattern = "3": + 58% of the set ramp generator time with setpoint jumps Δ f_{setp} > 29 Hz

Smaller setpoint jumps result in other time values.



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P 13_ 2nd ramp generator (switchable)

A "1" signal applied to TL. 47 (factory-assigned) effects a change-over from ramp generator t11 / t21 to the second ramp generator t12 / t22.

This ramp generator can be used to set equal acceleration and deceleration times: Ramp Up = Ramp Down.

P 14_ Rapid stop ramp (switchable)

The rapid stop ramp t13 / t23 becomes effective if the enable command (TL. 43 = "0") is removed.

P 15_ Motor potentiometer

The internal motor potentiometer function is activated with P 150 = "yes". Two of the 7 freely assignable binary input terminals 42-43 / 47-51 must be assigned to the functions "motor pot ramp up" and "motor pot ramp down" (P 60_).
The motor potentiometer setpoint which was last used can be stored (P 153 = "Yes") and thus remains effective even after STOP, rapid stop or switch-off.
With P 150 = "No" the motor potentiometer function is disabled; the motor potentiometer setpoints are reset to f_{min}.
For the frequency 0 ... f_{min} the actual effective ramp generator applies.
The internal fixed setpoints (P16_/17_) are dominant as opposed to the motorpoti-setpoint, meaning: if a fixed setpoint is activated via the terminals, this setpoint will be activated and the motorpoti-setpoint value remains inactive until the fixed setpoint is no longer active, at which time the previous motorpoti-setpoint is valid.
All other external setpoints and fixed setpoints are suppressed.
A combination with an external setpoint n1 is possible (P 154), e.g. serving as corrective value. In this case, for the corrective setpoint n1, the gain factor (P 101) is useful (e.g. n1 ≙ 20% of f_{max}: gain factor = 0.2)

P 16_ / P 17_ Internal fixed setpoints (switchable)

The freely assignable binary terminals are used to determine which setpoint is to be active.

Factory-assignment of terminals (P 60_):			
	TL. 48:	n11	(n21)
	TL. 49:	n12	(n22)
	TL. 48-49:	n13	(n23)

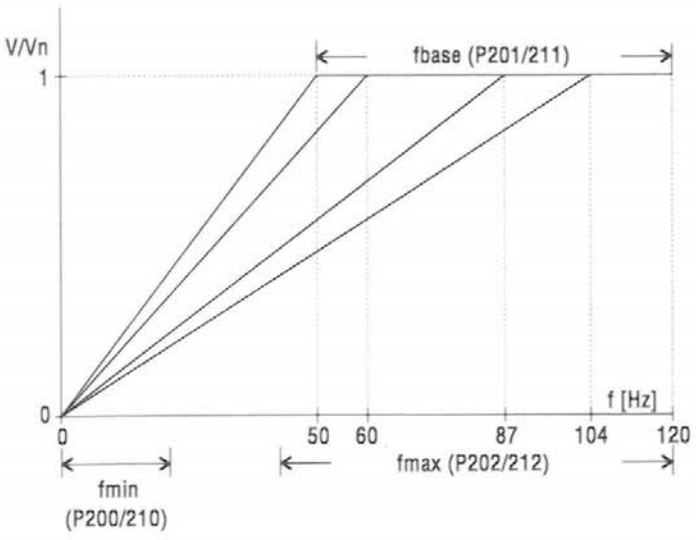
The parameter change-over provides two sets with 3 internal fixed setpoints each.
Each set can further be combined with the external setpoint n1.
If the setpoint n2 TL.34 / 35 is set as a bipolar setpoint ±10 V (P110), then the fixed setpoints cannot be activated.

Parameter group 200 FREQUENCY CHARACTERISTICS

P 20_ / P 21_ V/f patterns 1 and 2 (switchable)

Voltage / frequency patterns 1 and 2 (with adjustable f_{min}, f_{base} and f_{max}, f_{base}) can be selected in steps (50 / 60 / 87 / 104 / 120 Hz).
With the parameter change-over, a switch can be made between two V/f patterns (i.e. two frequency characteristics), selectable via P 250 / 251.

The range above the base frequency of a flattened off curve is the continuous field weakening range, in which the pull-out torque (M_K 2.4..3 x M_N) reduces quadratically with increasing frequency. This means that (with f_{base} = 50 Hz) there are no overload reserves available above about 90 Hz because of the danger of torque pull-out.



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The selection of the V/f pattern for the frequency inverter has a decisive importance on the torque and power characteristics of the motor. V/f patterns with base frequency (type point) generate, with increasing speed:

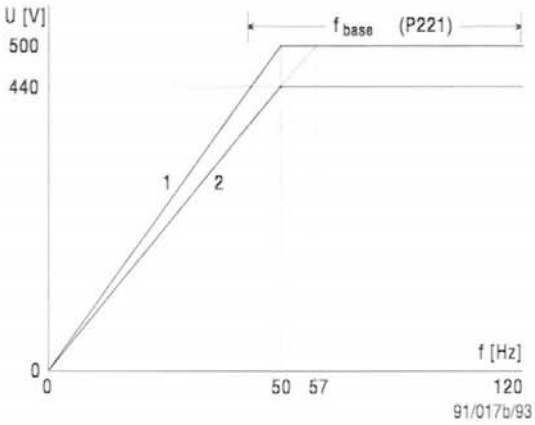
- up to the base frequency: constant torque with increasing power = normal setting range
- above the base frequency: constant power with reciprocally dropping torque = field-weakening range

MOVITRAC® 3000-503 can also be operated with a mains supply < rated supply voltage 3 x 500 V_{AC}.

With mains voltages < 500 V_{AC} (e.g. 440 V_{AC}) and f_{base} = 50 Hz the full output voltage will be reached some time before the preset base frequency, and the motor will be overexcited (characteristic 1).

It is advisable to adjust the V/f characteristic by setting a higher base frequency, so that the full voltage is reached at f_{base} (characteristic 2).

Example:
Optimized characteristic for MOVITRAC® 3...-**503** with mains suply 440 V / 50 Hz: set f_{base} = 57 Hz



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f_{min} (P 200 / 210 / 220) is ineffective
- when the analogue setpoint n2 = ± 10 V (P 110) is active
- when the Start /Stop frequency (P 260 / 261) is set > f_{min}

P 22_: Special characteristic 3

Special V/f pattern 3 with f_{min}, f_{max} and steplessly adjustable f_{base} = 5 ... 120 Hz.
The setting f_{base} < 50 Hz is only to be used for special applications, where the motor is matched to its permissible V/f pattern by using a special transformer (for f_N < 50 Hz).

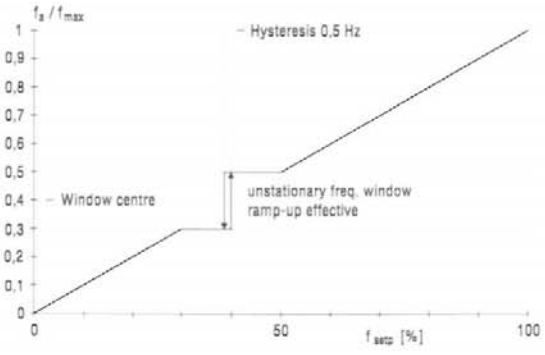
P 23_ / P 24_ Frequency window skip

The window skip is used to by pass undesired output frequencies (e.g. where there are resonant frequencies in the plant). The output frequency can run through the range which is set, but not remain stationary within it. As soon as the setpoint exceeds, or falls below, the centre of the window (with a fixed hysteresis of 0.5 Hz), the output frequency runs through the window with the effective integrator ramp time t11 / t21 or t12 / t22.

- With an increasing setpoint the output frequency stays set at the lower window value, until the setpoint reaches the centre of the window.
  ⇒ the output frequency rises with the ramp t11/t21 to the upper frequency window value.
- With the setpoint falling, the output frequency remains at the upper window value until the setpoint drops below the window centre value, and then drops to the lower window value.

A hysteresis of 0.5 Hz between these points prevents an unstable state.

The window skip can be programmed as a signal to one of the binary output terminals TL. 61-64 (P 61_) or the output relay K1 (P 620).



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P 25_ **Characteristics selection** (switchable)

The correspondingly applicable V/f pattern 1, 2 or 3 (P 200 / 210 / 220) can be selected for both parameter sets. For the first parameter set either V/f pattern 1 or 3 can be activated, for the second set V/f pattern 2 or 3.

P 26_ **Start / Stop frequency** (switchable)

All run-down ramps, i.e. STOP and Rapid Stop, are only effective down to the Start / Stop frequency. If the actual frequency falls below the set Start / Stop frequency value, the drive will be stopped immediately, i.e. the output voltage V_{outp} = "0" and the output relay "Brake" K2 = "0". This means that, below the Start/ Stop frequency, the rotating field stops immediately and the brake is applied. The inverter is enabled again above this frequency.

If the Start / Stop frequency is < f_{min} (P 200 / 210 / 220) then the active integrator ramp is effective between f_{min} and the Start / Stop frequency. If the start/stop frequency is > f_{min} (P 200 / 210 / 220) then f_{min} is ineffective.

Switch-off procedure → also P 790 / P 791 (setpoint stop function) and Sec. 4.2 "Switch-off".

When parameter change-over is used, a second Start/ Stop frequency can be assigned to the second V/f pattern.

Setting recommendations:

for travelling drives:	P 260 / P 261 = 0.5 ... 2 Hz
for hoists:	P 260 / P 261 = 2 ... 5 Hz

Parameter group 300 MOTOR PARAMETER

This parameter group is used to adjust the inverter to the motor it drives.

P 30_ **Adjustment mode** (switchable)

Manual or automatic adjustment can be selected. However, only "Manual" can be set at present. The adjustment can be made separately for each parameter set, after a parameter change- over.

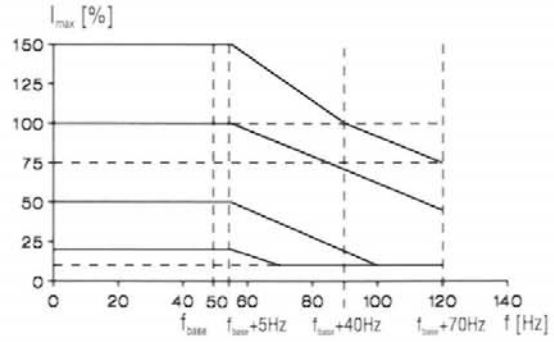
P 310 / P 330 **Automatic adjustment** *(cannot be activated yet)*

The automatic adjustment is not yet available.

P 320 / P 340 Current limit (switchable)

The internal current limit I_{max} is related to the apparent current. It takes precedence over the external current limit (TL. 36 / 37), i.e. it sets the limits, within which the external current limit can operate.
The value of the current limit is reduced linearly down to a minimum value in the field weakening range.

(current limit for hoists)
→ hoist function P 710-713)



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If **boost** (P 321/P 341) and **IxR** (P 322 /P 342) are **both set**, only the higher of the two values set will be effective.
I.e. normally: with no-load condition: boost / under load: IxR.
(Setting → Sec. 3.5)

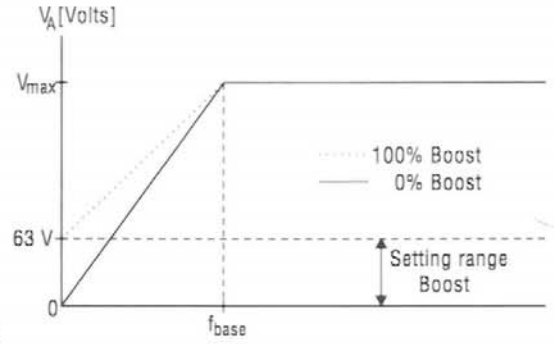
P 321 / P 341 Boost (switchable)

Increases the output voltage in the frequency range below the base frequency.

The setting range for Boost is 0 ... 100%, this corresponds to approx. 16 % of the maximum output voltage.

at 400 V_{AC} mains voltage: 100 % Boost ≈ 63 V

at 500 V_{AC} mains voltage: 100 % Boost ≈ 80 V



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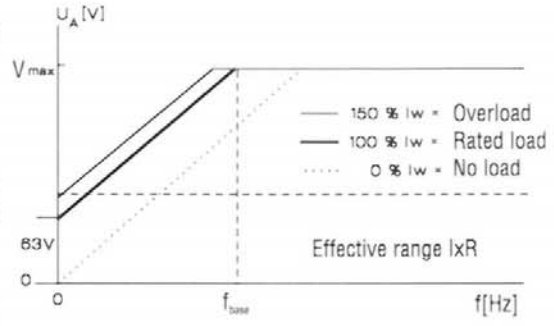
P 322 / P 342 IxR (switchable)

Load-dependent change of the V/f pattern. The increase of the output voltage - depending on the IxR setting - is proportional to the measured active current I_{active}.

Characteristic for 100% IxR for I_{active} = 0%, 100%, 150%

At the rated torque, i.e. at full load, the active current has the value 100 %.
At the rated frequency (= base frequency) the drive receives the maximum output voltage.
The voltage difference between the characteristics for 100% I_{active} and 0 % I_{active}, below the base frequency at 100 % IxR, is approx. 63 V (referred to 400 V output voltage).



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P 323 / P 343 Slip (switchable)

P 323 / 343 effects a load-dependent change of the output frequency. The output frequency is increased (motor operating mode) by the set value (0 ... 10 Hz at 100% I_{active}) or reduced (only for 4-Q inverters) in the regenerative mode).
Slip compensation reacts to changes in torque, and therefore adjusts to changing load conditions. This provides a speed which, to a large extent, is load-independent, i.e. the slip of the asynchronous motor is compensated.

The rated slip of the connected motor (matched to the inverter , $I_{N\ motor} = I_{N\ inverter}$) is entered here:

$$\text{slip setting} = \frac{\text{synchronous speed } n_{synch}\ [1/\text{min}] - \text{rated speed } n_N\ [1/\text{min}]}{\text{synchronous speed } n_{synch}\ [1/\text{min}]} \cdot \text{mains frequency } f_{synch}$$

No. of poles / pairs	Rated speed of the motor [1/min]									
	Rated frequency 50 Hz					Rated frequency 60 Hz				
2 pole / 1 pair	2700	2760	2820	2880	2940	3300	3360	3420	3480	3540
4-pole / 2 pairs	1350	1380	1410	1440	1470	1650	1680	1710	1740	1770
Slip setting	5 Hz	4 Hz	3 Hz	2 Hz	1 Hz	5 Hz	4 Hz	3 Hz	2 Hz	1 Hz

Different settings for:

- motors with a rated power P_N which is not fully used (e.g. if over dimensioned because of continuous duty at low speed). The slip which is to be set is reduced (compared with the motor's rated slip s_N) in the ratio of partial power to rated power.
- motors which are of a smaller class than the driving inverter (e.g. for parameter and motor change-over: $P_{inverter} = 4$ kW, $P_{motor} = 1.5$ kW. The value given in the table must be increased in the ratio $P_{inverter} / P_{motor}$

P 324 / P 344 Pole pair number (switchable)

The pole pair number of the connected motor (resp. connected motors) must be entered here (e.g.: 4-pole motor: "2"). It is used to calculate the speed in 1/min (RPM) for the display indication (P 004).

P 350 Parameter switch over (switchable)

With this function, 2 motors operated off one inverter can alternatively perform different drive functions.

If the parameter change-over (P 350 = "Yes") is activated and the inverter is disabled then the binary input TL. 50 (factory-assigned) can be used to switch over from set 1 to set 2.

The parameters covered by this function are listed in the table in section 3.6.

One of the programmable binary outputs TL. 61-64 should be assigned to the signal "Parameter set 1 / 2 " (factory assigned: TL. 64). Furthermore, it can be established which parameter set is currently active by using the operating display P 002.

Parameter group 400 REFERENCE VALUES

The following reference values are used to identify and signal certain operational conditions. All signals in the parameter group 400 can be provided at the binary outputs TL. 61-64 or the output relay K1 (→ parameter group 600).

P 40_ / P 41_ / P 420 Frequency reference values

Two frequency reference values can be set, which, if higher or lower frequency values are identified, generate a signal ("1" signal) at one of the freely assignable binary outputs (P 61_) or at the output relay K1 (P 620).

The signal is only made when the value exceeeds, alternatively falls below, a presettable tolerance range:

Hysteresis: Tolerance range = deviation from reference value [Hz]

Delay time: Permissible time for which the tolerance value may be exceeded [s]

Furthermore, both reference values applied together can be used for a window signal (P 420); the signal can be generated either within or outside (selection) the two reference values (not to be confused with P 230 ... P 242).

P 43_ Setpoint / Actual value comparison

The setpoint / actual value comparison is used to monitor and signal (P 61_, P 620) any deviations which are caused by acceleration conditions or overload.

P 440 f_{base} signal

A signal (P 61_, P 620) can be generated if the frequency is either more than, or less than (selection) the base frequency. This signal indicates the transition between constant torque and the field weakening range (= range of decreasing torque). The f_{base} value is set at P 201/211 or P 221. Only the f_{base} value of the currently selected V/f pattern is effective (can be determined by parameter change-over).

P 45_ / P 46_ Current reference values

Two current reference values can be set as % values of the rated current, which, if higher or lower current values are identified, generate a signal ("1" signal) at one of the freely assignable binary outputs (P 61_) or at the output relay K1 (P 620). They serve to signal load conditions.

The signal is only made if a presettable tolerance range is exceeded or not reached:

Hysteresis: Tolerance range = deviation from reference value [Hz]

Delay time: Permissible time the tolerance value may be exceeded [s]

P 47_ I_{max} signal

A signal (P 61_, P620) can be generated if the current is more than, or less than (selection) the set current I_{max} (P 320 / P 340) . For values > I_N this condition is only permissible for a short period of time , i.e. in practice this signal can be used to initiate a motor load reduction. This signal is not suitable for monitoring whether the motor frequency deviates from the setpoint; P 430 / 431 is used for this purpose .

Parameter group 500 CONTROL FUNCTIONS

The following control functions are used to monitor certain operational conditions, which may not be permissible in particular applications.

P 50_ Deceleration monitoring

In braking or deceleration phases this function monitors whether at the time of sampling (= "0" at a correspondingly assigned binary input P 60_) the output frequency f_{outp} has fallen below the set reference value $f_{ref}3$. If $f_{outp} > f_{ref}3$, the signal changes in accordance with the terminal assignment:

- from "1" to "0" (low active) at one of the binary outputs TL. 61-64 (P 61_)
- or the output relay K1 (P 620) is de-energised.

The signal change can further be used to activate the input "external fault" (P 600 ff.), i.e. trigger a fault signal.

A momentary comparison of f_{outp} and $f_{ref}3$ is performed:

- at a certain point of an unchanging braking distance (distance-controlled)
- or a certain time after the initiation of the braking operation (TI. 41 or TL. 42 = "0").

P 51_ Speed monitoring (switchable)

The speed monitoring function outputs the fault signal "MOT. OVERLOAD" if the output frequency $f_{outp} < f_{setp}$. In the motor mode this condition can be caused by operation at the current limit (as a result of acceleration or overload). Mains undervoltage at a higher speed is another possible reason.

Operation at the I_{max} limit can be tolerated for a short time by setting a response time of (0.1 ... 9 s).
The function can be activated separately for both parameter sets via parameter change-over.

P 52_ Regenerative monitoring (switchable)

The regenerative overload monitoring outputs the fault message "REGEN. OVERLOAD" if the output frequency $f_{outp} > f_{setp}$. In the regenerative mode this condition can be caused by overload, i.e. operation at the current limit.

Operation at the I_{max} limit can be tolerated for a short time by setting a response time of (0.1 ... 9 s).
The function can be activated separately for both parameter sets via parameter change-over.
(Note: this function was previously referred to as "lag monitoring")

P 530 Mains voltage monitoring

The mains voltage monitoring function is normally deactivated. It tolerates mains voltage fluctuations in the range of:

for MOVITRAC® 3000-**403**-:
- overvoltages up to 400 V_{AC} +10 % = 440 V_{AC} and
- undervoltages up to 400 V_{AC} –25 % = 300 V_{AC}.

for MOVITRAC® 3000-**503**-:
- overvoltages up to 500 V_{AC} +10 % = 550 V_{AC} and
- undervoltages up to 500 V_{AC} –25 % = 375 V_{AC}

If these values are exceeded or not reached, or if a phase failure is identified, a fault signal is triggered (No. 7 / 8 / 9 → Sec. 4).

However, normal operation of the inverter (without an additional load, such as starting) is guaranteed in the range of the undervoltage down to a minimum voltage of:

for MOVITRAC® 3000-**403**-:
- minimum voltage 200 V_{AC}

for MOVITRAC® 3000-**503**-:
- minimum voltage 300 V_{AC}

If the mains supply conditions are unstable the user can choose between:

- active mains voltage monitoring → fault signal at V_{mains} (400 V_{AC}) = 250 ... 300 V_{AC} or
  at V_{mains} (500 V_{AC}) = 300 ... 375 V_{AC}
- inactive mains voltage monitoring → uninterrupted operation
  (In this case the de-energising of contactor coils and brakes because of undervoltage must not impede the operation of the drive.)

Note: If the mains voltage monitoring function is switched off, the protection against overvoltage is limited to monitoring the DC link voltage $V_{DC\ link}$.

The mains voltage monitoring can be programmed as a signal at the freely assignable binary outputs TL. 61-64 (P 61_) or at the output relay K1 (P 620).

P 540 Motor-phase monitoring

With motor-phase monitoring activated P 540 = "Yes", a fault signal 14 "Output Open" will result if one, two or three motor phases fail.

When the hoist function is active (P 710 / 712 = "Yes") the motor-phase monitoring is activated automatically.

Caution:

- When using HF.. output filters a two or three phase failure may not always be recognised reliably!
- The single-phase monitoring will only function reliably if the current limit I_{MAX} (P 320 / 340) is set > 45 %.

P 55_ Synchronous Operation Signals *(only with FRS 11)*

This function can only be used with the option board FRS 11 "Synchronous Operation".
For further details on the function and installation → Sec. 8 - Option "Synchronous Operation" FRS 11

Parameter group 600 TERMINAL ASSIGNMENT

P 60_ Binary inputs TL. 42-43 / 47-51

The following types of signals can be programmed to the 7 binary inputs:

	Factory assigned:	Further options:
TL. 42:	- CCW / stop	- Motor pot. acceleration
TL. 43:	- Enable / rapid stop	- Motor pot. deceleration
TL. 47:	- Ramp generator change-over *)	- Deceleration monitoring *)
TL. 48:	- Speed n11	- Speed / time program *)
TL. 49:	- Speed n12 } n13	- Enable/controller inhibit
TL. 50:	- Parameter change-over *)	- External fault
TL. 51:	- Reset	- Zero point setting (FRS 11)
		- Master (FRS 11 CTRL)
		- Slave: free run (TL. 67 / 68)

The factory-set terminal assignments are activated as standard. If they are to be suppressed, then the terminal assignments must be changed.

*) For these signals the appropriate parameters must be activated.

- A reset is triggered if the signal on the assigned reset terminal changes from "0" to "1."

- Enable / controller inhibit:
  Removal of the enable signal at the binary input inhibits the controller, i.e. the inverter output is de-energized without any delay and the motor coasts to rest. The output relay K2 "Brake" remains energized, i.e. the brake is not applied. Controller inhibit does not mean an emergency stop, as the motor is not disconnected.
  (Note: Different to the Enable/Rapid Stop function. If evergency stop required then the Enable/Rapid Stop function is to be used).

- External fault:
  An external fault signal (e.g. from a PTC thermistor tripping relay) can be used to cause the inverter to behave as if a fault was signalled by one of the self-monitoring functions, i.e. to switch off with a fault signal (inverter output is de-energized; fault signal 27 "Ext. Terminal" appears in the display). The input responds to "low active", i.e. in the no-fault condition a "1" signal must be present at the terminal.The signal only becomes effective when the inverter is enabled.

P 61_ Binary outputs TL. 61-64

A choice can be made from the following signal functions for the 4 binary outputs TL. 61-64.
(logic level → Sec. 4).

	Factory assigned:	Status signals	Range signals	Fault signals
TL. 61:	Fault	- MC ready	- $f_{ref}1$	- Fault (collective indication)
TL. 62:	Ixt warning	- Rotating field ON	- $f_{ref}2$	- External fault
TL. 63:	$I_{ref}1$	- Rotating field OFF	- $f_{ref}1 < f < f_{ref}2$	- Short circuit
TL. 64:	Par.Set 1/2	- Brake ON	- $f = f_{setp}$	- $V_{DC\text{-}link}$ >>
		- Manual operation	- f_{min}	- V_{Mains} >> *)
		- Parameter set 1/2	- f_{base}	- V_{Mains} << *)
		- I x t - Warning	- f_{max}	- Overload Ixt
		- Temperature fault	- $I_{ref}1$	- Overtemperature
		- Warning FRS 11 *)	- $I_{ref}2$	- Flying start function *)
		- Slave in pos. (FRS11)	- I_{max}	- Deceleration monitoring *)
			- f window skip *)	- Regenerative fault FRS11 *)

*) If a binary output is assigned to this function, then the function must be activated with the corresponding parameter.

P 620 Output relay TL. 20-22

The programmable output relay K1 (TL. 20-22) can be assigned to the same signal types as the binary outputs (TL. 61-64, P 61_) (factory assignment: fault)

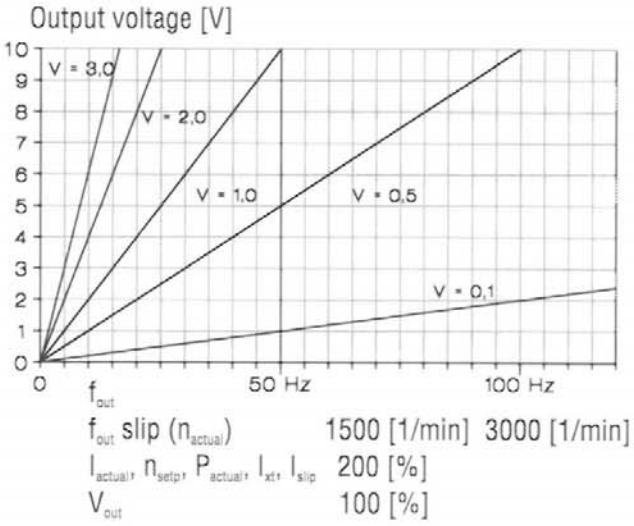
P 63_ Analogue outputs TL. 38-39

A selection can be made from the following 8 signal types for the two analogue outputs TL. 38 and TL. 39:

Display	Signal	Voltage level (Tolerance ±10%)	Explanatory notes	
Actual frequency	f_{outp}	±10 V ≙ 50 Hz	Output frequency	with sign: + = CW / − = CCW
Actual speed		±10 V ≙ 1500 1/min		with sign: + = CW / − = CCW
- without n-controller	$f_{outp} \pm s$		Output frequency	corrected by the slip, i.e. a speed-proportional display
- with n-controller (option FRN 12)	n_{actual}		The actual speed measured on the motor	
Active current	I_{act}	±10 V ≙ ±200 %	Active current	i.e. a torque-proportional display with sign: + = motor operating mode - = regenerative operating mode
Ramp generator	n_{setp}	±10 V ≙ 200 %	Overall effective setpoint after ramp generator, i.e. (n1 + n2) or (n11/12/13 + n1) or (n 21/22/23 + n1) or ($n_{motorpot}$ + n1)	
V motor	V_{outp}	+10 V ≙ 100 %	Output voltage	100 % ≙ V_{mains}
Power	P_{act}	±10 V ≙ 200 %	Active power	($P_{act} - V_{outp} \times I_{act}$)
Ixt value	Ixt	+10 V ≙ 200 %	Inverter utilisation	(Ixt = 100 % @ continuous rated load)
Apparent current	I_{app}	+10 V ≙ 200 %	Apparent current	

The maximum recommended lead length is 25 m.

The signal voltage is 0... 10 V. It can be weighted by a factor (V = 0.1 ... 3.0 in steps ΔV = 0.1).



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Note on P 61_ / P 62_ / P 63_:

The inverter starts a **self-test** (approx. 2.5 s), if the power supply or the 24 V supply on TL. 40 is switched on in the de-energized state. During the self-test period the analogue output signals have a "+10 V" level, the binary output signals have a "1" level and the output relay K1 is energized.

Parameter group 700 CONTROL FUNCTIONS

P 700 Load distribution *(cannot be activated yet)*

This function is intended to ensure proportional load distribution if several inverters are operated with a common load. The proportional load distribution takes into account both the number of inverters and their power in relation to the others.

P 71_ Hoist function (switchable)

The hoist function:

- Activates certain monitoring functions required for the hoist mode (→ fault signals no.13 / no.14 in Sec. 4.3).
- Injects a current to the motor, for an adjustable premagnetization time (P 711 or P 713), as soon as the starting command is given (= enable TL. 43 + directional command TL. 41 or TL. 42). This current builds up the motor torque before the brake is released.
- Controls the release of the brake, via the output relay K2 (brake), according to hoist mode requirements.
- Controls the BOOST and IxR depending on the direction of travel (hoisting/lowering).
- Applies a holding current to the motor, for a fixed postmagnetization time which corresponds to the set premagnetization time (P 711 or P 713).

Notes for proper hoist mode selection:

- Select the drive for f_{max} (P 202 / 212) = 70 Hz. This influences the choice of gear ratio i for the gearing.
- Select the motor power, one size rating higher than the calculated hoist power rating.
- The inverter power does not need to be overdimensioned.

- The controls must be implemented in such a way that a **change of drive direction** can **only** be made when the drive is **at rest**.
  Note: If this condition is not met, a fault shut-down will result, with the fault message "Output open".

Notes on commissioning:

- Set the current limit to I_{max} (P 320 / 340) = 150 %.
- The "hoisting" motion must be assigned to the command "CW OPERATION" / the positive setpoint (if required, interchange the phases at the motor).
- The BOOST and IxR values must be determined with the hoist in its lowest position and driving in the lifting direction with the command "HOIST" = "CW OPERATION".
  The setting is so as to produce an operating current < 100 % I_N
- Set f_{min} (P 200 / 210) ≥ 4 Hz, because of the motor's rated slip, to ensure a definite hoisting motion.
- Set f_{max} (P 202 / 212) = 70 Hz; f_{base} (P 201 / 211) = 50 Hz (with f_{mains} = 50 Hz and 50 Hz motor).

Note on speed control:

The hoist function P 710 does not have to be activated on hoists which have the speed control option FRN 12 .

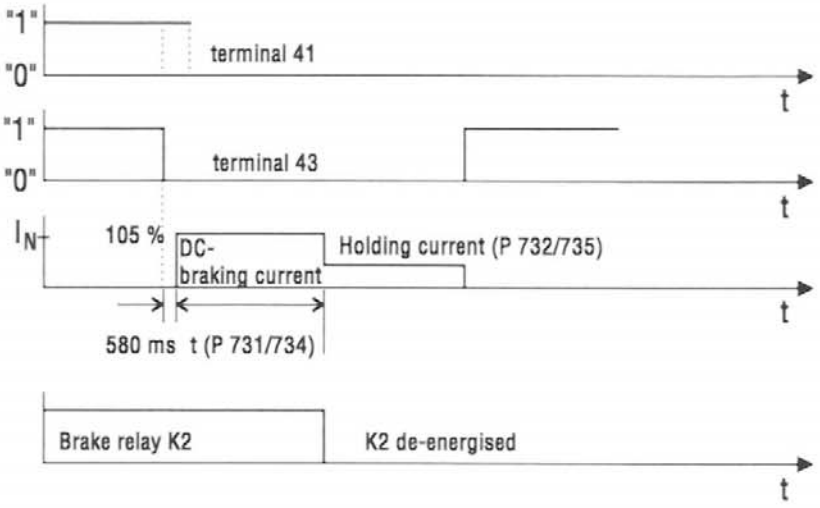
P 72_ Rapid start function (switchable)

The rapid start function keeps the motor excited over an adjustable standby time (P 722 or 725) with an adjustable current (10 ... 110 % I_N) so that when the starting command (= enable TL. 43 + directional command TL. 41 or TL. 42) is given within the standby time (3...30 s) the motor can start immediately without delay. If the starting command is not given within the standby time the rapid start capability is interrupted to protect the motor from overheating. A renewed rapid start capability is only possible after a restart and subsequent stop within the standby time.

P 73_ DC braking (switchable)

The DC-braking function can be activated (for 1-Q mode (P 890 / P 891) = "No") while the inverter is disabled. It enables the motor to be braked via **DC injection** (with 105 % I_N). The DC braking is initiated with the "RAPID STOP" command, i.e. removal of the enable command TL.43 = "0".

The braking time (P 731 or P 734) = 3 ... 30 s and should not be set any longer than necessary for the stopping operation. When the braking time has expired a **holding current excitation** follows, if the value P 732 or P. 735 is set > 0% (max. 25 % I_N). This holding current is only active with enable removed; the basic indication "HOLDING CURRENT" is displayed. It can therefore only be removed by an enable command TL. 43 = "1". A rotational direction command "CW" or "CCW" is only required if the drive should not start when the enable command is given. Otherwise, the directional commands have no influence on DC braking.



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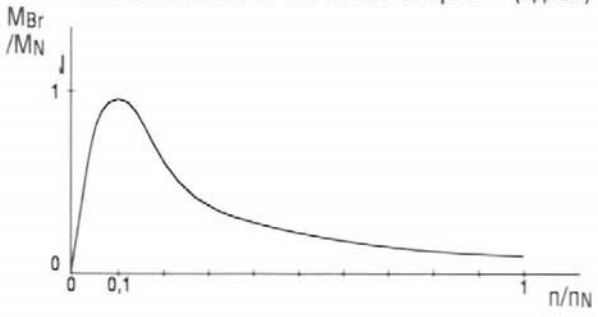
Characteristics of the brake torque (Approx.)



At rest, the DC-braking torque = 0. The braking torque is high at low speeds, and is reduced at higher speeds.

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Note: If the DC-braking is activated and the holding current is set > "0", then the heating current function (P 740) is inactive.

P 74_ Heating current (switchable)

The heating current function (I_{heat} = 0 ... 25 % I_N) is useful if low ambient temperatures prevail, to counteract the danger of water condensation inside the motor and thus the danger of freezing (in particular of the disc brake). When the current level is set, please ensure that the chosen setting does not result in overheating of the motor (condition: if the motor housing feels lukewarm the purpose is met). The heating current can be switched off by the controller inhibit (P 60_). For this purpose one of the binary inputs TL. 42-51 is assigned with the function Enable / Controller inhibit.

Note: If the DC-braking is activated and the holding current is set > "0", then the heating current function (P 740) is inactive.

P 75_ Flying start (switchable)

The flying start function is used to connect the inverter to a rotating motor (mechanically driven, e.g. fan). The flying start starts at f_{max} = 120 Hz in the rotational direction activated by the directional command. The output frequency is reduced continuously; the output current during the search phase is 20 % I_N.

If the motor rotates in the opposite direction, the flying start process will continue in the other rotational direction (provided: P 751 or P 753 "Flying start CW/CCW" = "Yes"). The flying start in one rotational direction lasts for about max. 3 s. If the flying start was successful, i.e. the inverter has caught the motor at a certain actual frequency, then the motor is guided along the preset ramp generator: t11/t21 or t12/t22 (P 120 / 121 or P 130) to the preselected setpoint frequency. If the motor speed is outside the search range, the fault signal "MOTOR FLYING START" will be triggered (→ P 61_, P 620).

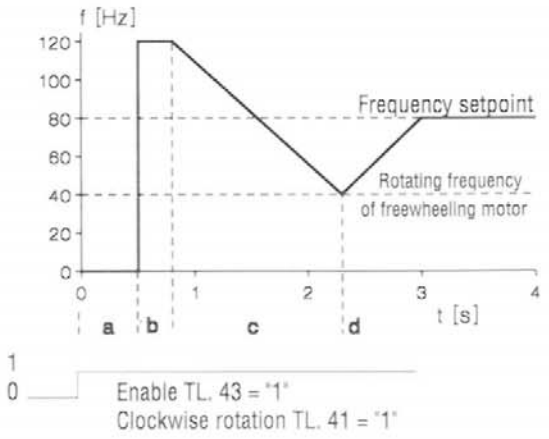
a = Waiting time, to ensure the demagnetization of the motor

b = Build-up time for the system of inverter and motor

c = Search phase; is carried out with a ramp = 50 Hz/s

d = Flying start completed successfully; motor is guided up the set ramp to the frequency setpoint.

Output frequency of the inverter



91/020/92 E

P 76_ Synchronous operation *(only with option FRS 11)*

This function can only be used with the option board FRS 11 "Synchronous operation".
For this purpose, the motor must be provided with an incremental encoder.
Further information about the function and commissioning is provided in section 8 and the separate publication: "System Description / Operating Instructions" for "Option FRS11 - Synchronization ".

P 77_ Speed control *(only with option FRN 12)*

This function can only be used with the option board "Speed control FRN 12" .
For this purpose, the motor must be provided with an incremental encoder.
Apart from the parameters P770 ff., some other parameters for the basic inverter (such as slip) will also have a different interpretation. For further information on function and commissioning → Sec. 8 - Option "Speed Control" FRN 12.

P 78_ Zero point stop function (switchable)

The zero point stop function P 780 / 781 = "Yes" is effective in combination with the setpoint n2 (TL. 34 / 35) if the signal form –10 ... +10 V is used. If the level drops below the setpoint **n2** ≤ ±**100 mV** (≙1 % n_{max}), the zero point stop function triggers an internal stop command (the inverter is disabled, on brake motors the brake is applied).

P 79_ Setpoint stop function (switchable)

When the setpoint stop function is activated, an instant stop will result if the frequency falls below f_{min} (P 200 / 210 / 220) or the stop frequency (P 260 / 261). A removal of the enable on the terminals is not necessary.
This means, that the output voltage goes to "0" and the brake is applied if the output frequency falls below the following limit frequencies:

- $f_{outp} < f_{min}$ (P 200 / 210 / 220) or
- f_{outp} < Start / Stop frequency (P 260 / 261) if this is > f_{min}

} V_{outp} = "0"
output relay K2 "Brake" is released

In this condition, the basic indication "SETPOINT STOP" appears.

In the other direction, starting without an enable command on the terminals, the inverter is only enabled when the setpoint is increased above the value of f_{min} (P 200 / 210 / 220), or the value of the Start / Stop frequency (P 260), plus a fixed hysteresis of 2 Hz.

Parameter Group 800 SPECIAL FUNCTIONS

P 800 Parameter block

If P 800 = "YES", the parameter blocking function blocks any change of adjustable parameters (Exception: P 862 "Pushbutton RESET"). Activation of this function is recommended after optimization of the inverter settings.

P 801 Save

With the parameter P 801 (Save) it can be decided whether parameter changes should be stored or not:

- ON = Parameter changes are stored immediately in the EEPROM, and are still effective after mains-off.
- OFF = Parameter changes are only effective as long as the inverter remains switched on.

The life expectancy of an EEPROM is limited by the number of storage operations. If the parameters are changed frequently via the serial interface (RS 232 / RS 485) or INTERBUS-S, the save function should be suppressed by P 801 = "OFF".

Exception: Fault signals continue to be stored via the function fault memory (P 060 ...).

P 81_ Service Information

With this function the EPROM number can be displayed. The 8th and 9th digit after the point indicate the version, i.e. the modification status:

P 810	EPROM "system"	(processor board)
P 811	EPROM "operator control"	(operator's keypad)
P 812	EPROM "field bus"	(option "Interbus-S" FFB 11)

P 813 shows the national service telephone number.

P 82_ Parameter copying

This function makes it possible to copy the complete menu, i.e. all the setting variables of the complete menu, including parameter change-over Set 1 / Set 2, from the inverter:

- to the plug-in MELCARD option
  provided that:
  - P 840 (interface RS 232) = "LOCAL"
  - if the parameters are to be copied on to another MOVITRAC® 3000 inverter, then the target inverter must have the system EPROMs with the same part no. version, or system EPROMs later than version .13 (→ P 810).

  Caution: Only plug in the MELCARD when the inverter is de-energised!
- to a PC connected via an RS 232 interface
  provided that:
  - P 840 (interface RS 232) = "EXTERNAL"
  - The SEW software "MC_SHELL" (from version 1.02) is installed on the PC.

  Further information on operator control via PC is to be found in the Software Documentation User Manual MC_SHELL.

The copying process begins with P 820, determiniing the direction to copy: from MOVITRAC to MELCARD or from MELCARD to MOVITRAC. The MELCARD can store different parameter menus; P 821 determines the set (1...5), to or from which to copy. The copy process is started with P 822 = "YES".

P 830 Factory setting

The factory settings of the inverter are stored as non-volatile data.

The factory setting can be reactivated by P 830 = "YES".
During the execution of the command the display indicates "SETUP ACTIVE". The fault memory P 060 ff. is erased during this process.

Note: For 1-Q inverters, set P 890 (4-quadrant operation) to "NO".

P 84_ Mode interfaces

The "mode interfaces" function enables selection of the type of operation and communication through different channels:

P 840 RS 232:	LOCAL:	Operation via integrated control panel and electronics terminal strip X3.
	EXTERNAL:	The inverter is controlled via RS 232 (X1:).
P 841 Control Mode	STANDARD:	The inverter is controlled via the electronics terminal strip X3; the parameters are set via RS 232, RS 485 or the integrated control panel
	REMOTE-SETP:	The setpoint is not entered via setpoint inputs TL. 32 / 33, TL. 34 / 35, TL. 36 / 37 but via PC (RS 232; X1:) or RS 485.
	REMOTE-CTRL:	Not only the setpoint, but also all other terminal functions are taken over by the PC (via RS 232; X1:) or RS 485.
	FIELD BUS:	The inverter is controlled via a field bus (Option "Interface for Interbus-S" FFB 11).
P 842 Inverter address:		If the inverter is connected via RS 485, it is given a certain address (0 ... 63), which must be entered here.

Further information on communications interfaces can be found in the publications "Software Documentation User Manual MC-SHELL" and "System Description with Interbus-S ".

P 850 Language change-over

The language change-over function is used to change the display text to GERMAN / ENGLISH / FRENCH.

"Operator Control" EPROMS are also available for the following language combinations:
ENGLISH / SPANISH / PORTUGUESE and
GERMAN / ENGLISH / ITALIAN
SWEDISH / ENGLISH / DANISH (not yet available)
Inverters which are supplied with these EPROMs have different part numbers (P 810).

P 86_ Reset mode

Apart from the standard fault-reset types:

- Power OFF and ON again, as well as
- External Reset command (factory-set at TL. 51, for alternatives → P 60_)

the reset mode function also provides for the following types of reset:

P 860 / 861 **Auto-Reset:** The auto-reset mode effects automatic restart after a fault , with an adjustable delay before restart of 3 ... 30 s. The auto-reset functions initiates a maximum of three restart attempts. After this it will remain in the fault condition. If the function "auto-reset" is turned off and on again, or after mains-off and mains-on, another three attempts will be made.

Caution: Do not use with drives where an automatic start-up would present a safety hazard to people or equipment!

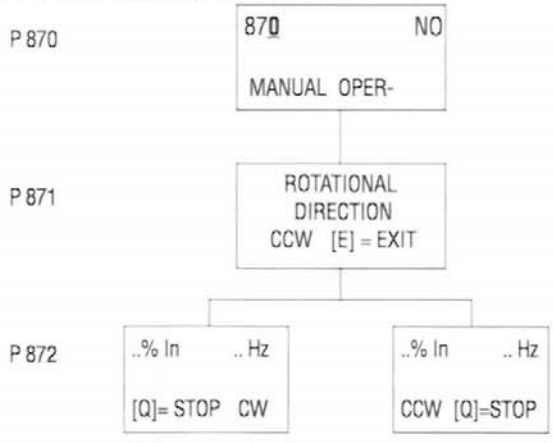
P 862 **Pushbutton reset:** The entry "yes" initiates a reset. In the case of a fault, **pushbutton [E]** effects this inquiry.

For further information on the reset function → Sec. 4.5 "Fault information".

P 87_ Manual operation

The function "Manual operation" enables manual operation of the inverter, via the pushbuttons on the control panel, without external commands. The external functions are ineffective during manual operation.
The only requirement is that the external current limit should not be "0" (jumper between TL. 31 and TL. 36).

Pushbutton control in manual operation:



with [→]	to "NO"
with [↑] [↓]	activate MANUAL OPERATION
with [←]	rotational direction CCW
with [→]	rotational direction CW
with [E]	exit to P 870
with [↑]	faster (by 5 Hz per s)
with [↓]	slower (by 5 Hz per s)
with [Q]	exit to ROTATIONAL DIRECTION
with[→][←]	direct rotational reverse

P 88_ Master-slave operation

This function enables frequency-proportional tracking of one or several (max. 31) slave inverters following one master inverter. The following settings are required for master-slave operation:

- P 880 = "YES" for all inverters in master-slave operation
- P 881 = "Master" for the master inverter
- P 881 = "Slave" for the slave inverter or inverters.

In order to be available in standby, the slaves must have a "1" signal assigned to TL. 41 and TL. 43.
The master passes the commands "Clockwise / CCW operation" and "Enable / Rapid Stop", as well its output frequency, on to the slaves as a setpoint input via the serial interface RS 485 (TL. 67 / 68) .

One binary input (P60_) on the slave can be assigned to "Slave: free run":
"1" signal: free-running slave
"0" signal slave follows master

The setpoint input of the master can be changed at the slave/slaves by a factor 0.10 ... 10.00 (P 882).

Examples:
P 882 = 1.00 → $f_{slave} = f_{master}$
P 882 = 0.10 → $f_{slave} = 0.1 \cdot f_{master}$
P 882 = 10.00 → $f_{slave} = 10.0 \cdot f_{master}$ (Caution: observe f_{max} limit for slave unit!)

Notes:

- Master and slave units can operate with different V/f patterns.
- External setpoints at the slave remain without effect.
- Switch S 2 must be set to "KL" (factory setting terminals)

Instructions for setting and wiring

- The RS 485 lead (2 wires twisted and shielded) must be terminated at both ends (master TL. 67/68 , also TL.67/68 on the last slave) with a load resistor each of 120 Ω/0.25 W.
- The 0 V leads from master and slave must be connected together.
- The slaves must be connedted to TL. 41 and TL. 43 with a level = "1" assigned (ready for operation)

Interaction with other MOVITRAC® 3000 options:

- If the master runs in normal **V/f operation**, then the **output frequency** from the master is passed to the slave as a setpoint via RS 485.
  If the master is under **speed control** ("Speed control" FRN12 option and activated speed control P 770) then the **actual speed** of the master is passed to the slave as a setpoint via RS 485.
- "Master-slave operation" P 880 cannot be activated with the **"Synchronous Operation"** FRS11 option.
  The master-slave function of the basic inverter is **not** a substitute for the option "Synchronous Operation".

P 89_ Four-quadrant operation (switchable)

The 4-quadrant operation is factory-set to "YES".

With 4-Q inverters, the 4-quadrant operation can be suppressed by setting P 890 or P 891 to "NO" and disconnecting the braking resistor.

With 1-Q inverters, after calling up the factory setting P 890, the 4-Q operation P 830 should again be set to "NO". However, with 1-Q inverters the fault signal 3 "Fault Brake Chopper", is suppressed independently by P 890.

PARAMETER GROUP 900 Speed / Time program

The Speed / Time program (n/t program) permits automatic operation of the inverter with 9 sequential steps.

Adjustable, for each of the **8 steps**:

- step time = step duration in seconds
- direction = CW or CCW operation
- ramp generator = acceleration time (individually for each step)
- frequency = setpoint

Step 9 is the **pause step**, for which only the step pause time is set, and the ramp generator time with which the setpoint of step 8 is guided to zero. Steps which are not required are set to a step time of zero.

The n/t program is started and stopped via TL. 41 and TL. 43. A further binary input (select, for example, TL. 47) must be assigned to the function "n/t program" (e.g. P 602). If this input changes to a "1" signal ($t \geq 1$ s), the step which is currently running is interrupted and the next step is started (with the ramp generator time of the following step).

P 901 is used to select whether the program is to be stopped after the 9th step, or continued cyclically.

When the n/t program is active, other setpoints are ineffective.

3.5 Advice on parameter setting for commissioning

3.5.1 General notes

An important precondition for commissioning is the testing of

- the wiring
- the terminal assignment
- the correct presetting of the parameters (e.g. factory setting)
- As the customer's drive functions are known, some of the parameters can be set in advance, without starting the motor.

The unintentional starting of the motor must be prevented by suitable measures:
  - by ensuring that the terminals TL. 41-43 cannot receive any input signals (e.g. by pulling off the terminal block)
  - or by disconnecting the motor terminals TL. 4-6.

- It is recommended that the settings are carried out with the motor in the **cold state**.
  If the **setting** is carried out with the motor at **operating temperature**, then the determined values for Boost (P 321) and IxR (P 322) must be reduced by approx. 20%, so as to avoid over-compensation later when the motor is in the cold state.
- The **basic display "CURRENT"** refers to the rated current of the inverter, not to the rated current of the motor. In the following examples it is assumed that the inverter is connected to a motor with the **recommended motor rating**. If a motor is used with rated power $P_{N\,motor} \neq$ to the recommended motor power rating, then the indicated inverter current must be converted to that of the motor current.
  Example: MOVITRAC® 3003: $P_{inverter} = 3$ kW $P_{motor} = 2.2$ kW
  $75\ \%\ I_{inverter\ rating} \cong 100\ \%\ I_{motor\ rating}$

After the commissioning is finished, the set parameter values should be saved.

- by activating the parameter blocking (P 800).
- by documenting the parameter settings:
  - in tabular form (parameter table in Sec. 3.6),
  - by copying the whole parameter set on to the optional MELCARD (→ Sec. 8.5)
  - or by saving as a parameter file on a PC with the software MC_SHELL (→ Sec. 8.9).

3.5.2 Presetting for all the following examples

Note: The following commissioning examples refer to

- the terminal designations and functions per the wiring diagram MOVITRAC® 3000 and the factory assignments.
- the parameter settings as per the factory setting and parameter set 1.
- the motor ratings for a motor with matched rated power ($P_{N\ motor}$ = recommended motor power of the inverter MOVITRAC® 3...-403-).

- **Setpoint signal type (P 100 ... 110):**
  If a signal type other than 0 ... +10 V is to be selected:
  – –10 ... +10 V
  – or 0/4 ... 20 mA (switch S1 in position "I")

- **External setpoints TL. 32 / 33 and TL. 34 / 35** are disconnected or set = "0" for the duration of the parameterization .

- Prevent the **activation of the setpoints via TL. 48 / 49**, i.e. set to = "0".

- **Set to parameter set 1** (TL. 50 = "0").

- **Ramp generator time** (P 120 / 121):
  Set $t11_{UP}$ and $t11_{DOWN}$ according to the application requirements.
  As a guide value, without specified requirements: 1 s.

- Set I_{max} **(P 320)** = 150% (with adapted motor).

- **Preliminary match to the motor used:**
  Set the pole pair number (P 324) of the motor which is connected; this serves to indicate the correct speed in 1/min (P 004).

3.5.3 Notes for controlling the operating behaviour

After concluding the basic commissioning (examples → Sec. 3.5.4) the correct operating behaviour should be tested.

The correct Boost setting is checked with the motor in the cold state:

For this purpose, select a low frequency < 5 Hz and observe the CURRENT display:
If the current is too high or too low alter the Boost (P 321) so that < 80 % $I_{N\ motor}$ flows.
Stop the drive again.

If the drive does not start under load, and the current is << 150 % $I_{N\ inverter}$:
Increase Boost enough for the drive to accelerate to the desired speed.
Then check the CURRENT display (< 80 % $I_{N\ motor}$) again, so that the motor is not thermally overloaded at creep speed.

If the settings / checks are carried out with the motor at operating temperature, it is possible that the drive will not start when switched on later, in the cold state, and the current shown will be 140 ... 150%.
In this case, reduce the Boost (P 321) enough for the drive to start.
Check again, at operating temperature, whether the current < 80 % $I_{N\ motor}$, so that the motor is not thermally overloaded at creep speed.

3.5.4 Commissioning examples

Example 1 — Single drive

- **Travelling drive**
- **Group drive with common mechanical load**
- **Hoist with counterweight**
- **Pump or fan drive**

The following basic settings can be carried out **without a load**.
First carry out the presettings (section 3.5.2.)!

1. Set f_{min} (P 200) 15 Hz
   Set f_{base} (P 201) and f_{max} (P 202) as per application requirements

2. Set Boost (P 321) = 100 %
   Set I x R (P 322) = 0 %
   Set slip (P 323) = 0
   Select Boost (P 321)

3. Enable the drive, i.e. enable TL. 43 and rotational direction TL. 41 or TL. 42 = "1" signal
   (**Note:** If the rotational direction is incorrect → immediately switch off the mains and interchange the phases!)
   → the inverter operates at the current limit (display CURRENT I 140...150 %).

4. Continuously reduce Boost (P 321), until the drive accelerates to f_{min} (15 Hz).
   For the time being, leave the Boost set at this determined value.

   Remove the enable, i.e. TL. 43 = "0"

5. Set the Boost (P 321) to half of the determined Boost value.
   Set IxR (P 322) to 1.5 times the final Boost value.
   Example: determined Boost value = 30 % →Boost = 15 % / IxR = 23 %

6. Set f_{min} (P 200) as per the application requirements.
   Exception: project plan f_{min} > 7 Hz: set f_{min} (P 200) = 7 Hz

7. Enable the drive again, i.e. TL. 43 = "1"

8. Check current: The operating current should be < 80 % $I_{N\ motor}$ (refer to CURRENT display).
   Also observe the operating behaviour notes (→ Sec. 3.5.3).

9. Remove the enable again, i.e. TL. 43 = "0"

10. If f_{min} is set = 7 Hz: Set f_{min} (P 200) to the application requirements value.
    Set slip (P 323) to the rated slip s_N of the motor.

11. Reconnect or reactivate the external setpoints TL. 32 / 33 or TL. 34 / 35.

The drive now has an operational basic setting. Now – depending on the application – the parameters P 400 to P 900 can be set.

Example 2 — Single drive (Alternative to example 1)

- **Travelling drive**
- **Group drive with common mechanical load**
- **Pump or fan drive**

The following basic settings can be carried out **without a load**.

First carry out the presettings (section 3.5.2.)!

1. Set f_{min} (P 200) ≈ 5 Hz
   Set f_{base} (P 201) and f_{max} (P 202) as per application requirements.

2. Set Boost (P 321) = 0 %
   Set I x R (P 322) = 0 %
   Set slip (P 323) = 0
   Select Boost

3. Enable the drive, i.e. enable TL. 43 and rotational direction TL. 41 or TL. 42 = "1" signal.
   (**Note:** If the rotational direction is incorrect → immediately switch off the mains and interchange the phases!)
   → the inverter produces f_{min}: the drive remains at rest or rotates very slowly.

4. Continuously increase Boost (P 321), until the drive accelerates to f_{min} and a motor current ≈ 70 % $I_{N\ motor}$ starts to flow.
   For the time being, leave the Boost set at this determined value.

   Remove the enable, i.e. TL. 43 = "0"

5. Set IxR (P 322) to 1.5 times the final Boost value.
   Example: determined Boost value = 15 % →IxR = 23 %

6. Enable the drive again, i.e. TL. 43 = "1"

7. Check current: The operating current should be < 80 % $I_{N\ motor}$ (refer to CURRENT display).
   Also observe the operating behaviour notes (→ Sec. 3.5.3).

8. Remove the enable again, i.e. TL. 43 = "0"

9. Set f_{min} (P 200) to the application requirements value.

   Set slip (P 323) to the rated slip s_N of the motor.

10. Reconnect or reactivate external setpoint TL. 32 / 33 or TL. 34 / 35.

The drive now has an operational basic setting. Now – depending on the application – the parameters P 400 to P 900 can be set.

Example 3 — Group drive without mechanical coupling

The following basic settings can be carried out **without a load**.

First carry out the presettings (section 3.5.2.)!

Note: The sum of the rated motor currents must be adapted to the rated inverter current. $I_{N\ motor}$ means the sum of the rated motor currents.

1. Set f_{min} (P 200) ≈ 5 Hz
   Set f_{base} (P 201) and f_{max} (P 202) per the application requirements.
2. Set Boost (P 321) = 0 %
   Set I x R (P 322) = 0 %
   Set slip (P 323) = 0
   Select Boost (P 321)
3. Enable the drive, i.e. enable TL. 43 and rotational direction TL. 41 or TL. 42 = "1" signal
   (**Note:** If the rotational direction is incorrect → immediately switch off the mains and interchange the phases!)
4. Continuously increase Boost (P 321), until the drive accelerates to f_{min} = 5 Hz and the current is about 50 ... 80 % of the sum of the motor currents (refer to CURRENT display).
   Leave the Boost set at this determined value.
   Note: IxR (P 322) and slip (P 323) remain set to "0".

   Remove the enable, i.e. TL. 43 = "0".
5. Set f_{min} (P 200) as per application requirements.
   Exception: application requirements f_{min} > 7 Hz: set f_{min} (P 200) ≈ 7 Hz.
6. Enable the drive again, i.e. TL. 43 = "1"
7. Check current: The operating current should amount to < 80 % $I_{N\ motor}$ (refer to CURRENT display).
   Also observe the operating behaviour notes (→ Sec. 3.5.3).
   With f_{min} or f ≈ 5 ... 8 Hz the current per motor should be < 80 % $I_{N\ motor}$, so that the motor is not thermally overloaded at low speeds. The sum of the individual motor currents matches the output current of the inverter.
8. Remove the enable again, i.e. TL. 43 = "0"
9. If f_{min} is set to ≈ 7 Hz: Set f_{min} (P 200) to the application requirements value.
10. Reconnect or reactivate external setpoint TL. 32 / 33 or TL. 34 / 35.

The drive now has an operational basic setting. Now – depending on the application – the parameters P 400 to P 900 can be set.

Example 4 — Hoist without counterweight

Note — Configuration recommendation for hoists: (refer to catalogue MOVITRAC® 3000)
$f_{min} \geq 6$ Hz (Series 1) or ≥ 4 Hz (Series 2 and 3) / $f_{base} = 50$ Hz / $f_{max} = 70$ Hz

Caution: Observe the notes on hoisting function (P 710 ff) in Sec. 3.4!

First carry out the presettings (section 3.5.2)!

1. Correlation: Clockwise rotation TL. 41 ≅ hoisting movement "UP". The hoist should be in the lowest position.
2. Activate the hoisting function (P 710 = "YES").
   Set the premagnetization time (P 711) = 200 ms (≅ factory setting) or to the application requirements value.
   Caution: If the premagnetization time is too short the drive could droop down during starting.
3. Set f_{min} (P 200) ≈ 15 Hz
   f_{base} (P 201) = 50 Hz; f_{max} (P 202) = 70 Hz or to application requirements values.
4. Set the Start / Stop frequency (P 260) to the rated slip s_N of the motor.
5. Set Boost (P 321) = 100 %
   set I x R (P 322) = 0 %
   Set slip (P 323) = 0
   Select Boost (P 321)
6. Enable the drive, i.e. enable TL. 43 and input rotational direction TL. 41 = "1" signal.
   (**Note:** If the rotational direction is incorrect → switch off the mains immediately and interchange the phases!)
   → the inverter operates at the current limit (display CURRENT = 140 ... 150 %); motor does not turn.
7. Continuously reduce Boost (P 321), until the drive accelerates to f_{min}.
   For the time being, leave the Boost set at this determined value.
   Remove the enable, i.e. TL. 43 = "0"
8. Set the Boost (P 321) to half of the determined Boost value.
   Set IxR (P 322) to 1.5 times the final Boost value.
   Example: determined Boost value = 30 % → Boost = 15 % / IxR = 23 %
9. Set f_{min} (P 200) as per application requirements.
   Exception: project plan $f_{min} > 7$ Hz: set f_{min} (P 200) ≈ 7 Hz.
10. Enable the drive again, i.e. TL. 43 = "1"
11. Check current: The operating current should amount to < 80 % $I_{N\ motor}$ (refer to CURRENT display).
    Also observe the operating behaviour notes (→ Sec. 3.5.3).
12. Remove the enable again, i.e. TL. 43 = "0".
13. If f_{min} is set to ≈ 7 Hz: Set f_{min} (P 200) to the project application requirements value.
    Set slip (P 323) to the rated slip s_N of the motor.
14. Set the lowering operation at f_{min}. For this, select enable TL. 43 and rotational direction TL. 42 = "1" signal.
    If the drive does not come up to speed (current I = 140 ... 150 %), reduce the Boost a bit.
15. Reconnect or reactivate external setpoint TL. 32 / 33 or TL. 34 / 35.
16. Activate the speed monitoring (P 510) and regenerative monitoring (P 520).

3.6 Parameter table for values after commissioning

Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning	Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning
	Selectable parameters Parameter set 1				Parameter set 2		
100	n1 pattern (TL_32/33)	**gain** / offset					
101	Gain factor	0.1 ... **1** ... 10.0					
102	Offset factor	0.1 ... **1** ... 9.0					
110	n2 signal form (TL_34 / 35) *(Note switch S1)*	**0 ... 10 V** 0 ... 20 mA 4 ... 20 mA –10 ... +10 V					
120	1. ramp gen. t11-UP	0.0 ... **1** ... 2000 s		123	1.ramp gen. t21-UP	0.0 ... **1** ... 2000 s	
121	1. ramp gen. t11-DOWN	0.0 ... **1** ... 2000 s		124	1.ramp gen. t21-DOWN	0.0 ... **1** ... 2000 s	
122	t11 S-pattern	0 ... 3		125	t21 S-pattern	**0** ... 3	
130	2. ramp t12 UP/DOWN	0.0 ... **5** ... 2000 s		131	2.ramp t22 UP/DOWN	0.0 ... **5** ... 2000 s	
140	t13 Rapid stop ramp	0.0 ... **1.0** ... 9.9 s		141	t23 Rapid stop ramp	0.0 ... **1.0** ... 9.9 s	
150	Motor pot.	Yes / **No**					
151	t4 UP	2 ... **10** ... 60 s					
152	t4 DOWN	2 ... **10** ... 60 s					
153	Store last position	Yes / **No**					
154	Motor pot. + n1	Yes / **No**					
160	Set 1: n11	0.5 ... **5** ... 120 Hz		170	Set 2: n21	0.5 ... **5** ... 120 Hz	
161	Set 1: n12	0.5 ... **25** ... 120 Hz		171	Set 2: n22	0.5 ... **25** ... 120 Hz	
162	Set 1: n13	0.5 ... **50** ... 120 Hz		172	Set 2: n23	0.5 ... **50** ... 120 Hz	
163	MIX: Set 1 + n1	Yes / **No**		173	MIX: Set 2 + n1	Yes / No	
200	V/f pattern 1: f_{min} 1	**0.5** ... 25 Hz		210	V/f pattern 2: f_{min} 2	**0.5** ... 25 Hz	
201	f_{base} 1	**50** / 60 / 87 / 104 / 120 Hz		211	f_{base} 2	**50** / 60 / 87 / 104 / 120 Hz	
202	f_{max} 1	40 ... **50** ... 120 Hz		212	f_{max} 2	40 ... **50** ... 120 Hz	
				220	V/f pattern 3: f_{min} 3	**0.5** ... 25 Hz	
				221	(stepless) f_{base} 3	5 ... **50** ... 120 Hz	
				222	f_{max} 3	40 ... **50** ... 120 Hz	
230	1st freq. window skip	Yes / **No**					
231	Window centre	5 ... **50** ... 87 Hz					
232	Window width	±**2** ... ±9 Hz					
240	1st freq. window skip	Yes / **No**					
241	Window centre	5 ... **50** ... 87 Hz					
242	Window width	±**2** ... ±9 Hz					
250	V/f pattern param. set 1	**1** / 3		251	V/f pattern param.set 2	**2** / 3	
260	Start/Stop frequency 1	0.5 ... **2.0** ... 5.0 Hz		261	Start/Stop frequency 2	0.5 ... **2.0** ... 5.0 Hz	
300	Adjust. mode motor 1	Manual		301	Adjustm. mode motor 2	Manual	
320	I_{max} 1	20 ... **150** %		340	I_{max} 2	20 ... **150** %	
321	Boost 1	**0** ... 100 %		341	BOOST 2	**0** ...100 %	
322	IxR 1	**0** ... 100 %		342	IxR 2	**0** ...100 %	
323	Slip 1	**0** ... 10 Hz		343	Slip 2	**0** ...10 Hz	
324	Pole pair no. 1	1..**2**..6		344	Pole pair no. 2	1 ... **2** ... 6	
350	Param. change-over	Yes / **No**					
400	1. Frequency reference	2 ... **50** ... 120 Hz					
401	1. Hysteresis	±1 ... **2** ... ±9 Hz					
402	1. Delay	**0** ... 9 s					

Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning	Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning
	Selectable parameters Parameter set 1				Parameter set 2		
403	1. Signal = 1 at	f > f_{ref} 1 / **f < f_{ref} 1**					
410	2. Frequency reference	2 ... **50** ... 120 Hz					
411	2. Hysteresis	±1 ... **2** ... ±9 Hz					
412	2. Delay	**0** ... 9 s					
413	2. Signal = 1 at	f > f_{ref} 2 / **f < f_{ref} 2**					
420	$f_{window\ skip}$ signal at	**within** / outside					
430	Hysteresis	±1 ... **2** ... ±9 Hz					
431	Signal = 1 at	**f = f_{setp}** / f <> f_{setp}					
440	f_{base} signal at	**f < f_{base}** / f > f_{base}					
450	1. Current reference	10 ... **100** ... 150 %					
451	1. Hysteresis	**±1** ... ±9 %					
452	1. Delay	**0** ... 9 s					
453	1. Signal = 1 at	**I > I_{ref} 1** / I < I_{ref} 1					
460	2. Current reference	10 ... **100** ... 150 %					
461	2. Hysteresis	**±1** ... ±9 %					
462	2. Delay	**0** ... 9 s					
463	2. Signal = 1 at	**I > I_{ref} 2** / I < I_{ref} 2					
470	Signal = 1 at	**I < I_{max}** / I = I_{max}					
471	Delay	**0** ... 9 s					
500	Deceleration monitoring	Yes / **No**					
501	3. Frequency reference	**10** ... 99 Hz					
510	Speed monitoring 1	Yes / **No**		512	Speed monitoring 2	Yes / **No**	
511	Response time 1	0.0 ... **1** ... 9 s		513	Response time 2	0.1 ... **1** ... 9 s	
520	Regen. monitoring 1	Yes / **No**		522	Regen. monitoring 2	Yes / **No**	
521	Regen. time 1	0.0 ... **1** ... 9 s		523	Regen. time 2	0.1 ... **1** ... 9 s	
530	V_{mains} monitoring	Yes / **No**					
540	Motor-phase mon.	**Yes** / No					
550	Synch. operation sigs. *(only with option FRS 11)* Warning FRS 11	**50** ... 65535					
551	Regenerative fault	100 ... **4000** ... 65535					
552	Window skip time	**1** ... 99 s					
553	Fault response	**0/1 signal** / inhibit controller / STOP / rapid stop					
554	Slave position tolerance	10 ... **25** ... 32768					
555	LED counter V11	10 ... **100** ... 32768					
556	Time constant for position signal	1 ... **10** ... 2000 ms					
557	Cable break master-slave	**Yes** / No					
600	Binary inputs TL. 42	**CCW / Stop**					
601	TL. 43	**Enable / Stop**					
602	TL. 47	**Ramp change t2 / t1**					
603	TL. 48	**n11 (n21)**					
604	TL. 49	**n12 (n22)**					
605	TL. 50	**Param. change-over**					
606	TL. 51	**Reset**					

Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning	Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning
	Selectable parameters Parameter set 1				Parameter set 2		
610	Binary outputs TL. 61	**Fault**					
611	TL. 62	**Ixt warning**					
612	TL. 63	**1.Current ref.**					
613	TL. 64	**Parameter set**					
620	Output relay TL. 20-22	**Fault**					
630	Analogue out 1 TL. 38	**Actual frequency f_{act}**					
631	Factor output 1	0.1 ... **1.0** ... 3.0					
632	Analogue out 2 TL. 39	**Apparent current I_{app}**					
633	Factor output 2	0.1 ... **1.0** ... 3.0					
700	Load distribution						
710	Hoist function 1	Yes / **No**		712	Hoist function 2	Yes / **No**	
711	Premagnetization time	40 ... **200** ms		713	Premagnetization time	40 ... **200** ms	
720	Rapid start 1	Yes / **No**		723	Rapid start 2	Yes / **No**	
721	Field current 1	10 ... **100** ... 110 %		724	Field current 2	10 ... **100** ... 110 %	
722	Duration 1	**3** ... 30 s		725	Duration 2	**3** ... 30 s	
730	DC braking 1	Yes / **No**		733	DC braking 2	Yes / **No**	
731	DC braking time 1	**3** ... 30 s		734	DC braking time 2	**3** ... 30 s	
732	DC holding current 1	0 ... **20** ... 25 %		735	DC holding current 2	0 ... **20** ... 25 %	
740	DC heating current 1	Yes / **No**		742	DC heating current 2	Yes / **No**	
741	DC heating current 1	**0** ... 25 %		743	DC heating current 2	**0** ... 25 %	
750	Flying start function 1	Yes / **No**		752	Flying start function 2	Yes / **No**	
751	Flying st. CW/CCW 1	Yes / **No**		753	Flying st. CW/CCW 2	Yes / **No**	
760	Synchron. operation *(only with option FRS 11)*	Yes / **No**					
761	MOVITRAC is	**MASTER** / SLAVE					
762	Master gearing factor	**1** ... (3,999,999,999)					
763	Slave gearing factor	**1** ... (3,999,999,999)					
764	Mode selection	**1** / 2 / 3 / 4 / 5 / 6					
765	Slave counter	±(**10** ... 99999999)					
766	Offset 1	±(**10** ... 32767)					
767	Offset 2	±(**10** ... 32767)					
768	Offset 3	±(**10** ... 32767)					
769	Controller P-factor	1 ... **10** ... 200					
770	Speed control *(only with option FRN 12)*	Yes / **No**					
771	P-amplification	0.1 ... **5.0** ... 50.0					
772	Controller time const.	1 ... **10** ... 500 ms					
773	Encoder increments	128/256/512/**1024**/2048					
774	S x R	Yes / **No**					
775	Brake function	Yes / **No**					
776	Start setpoint	80 ... **200** ... 500 mV					
780	Zero point stop 1	Yes / **No**		781	Zero point stop 2	Yes / **No**	
790	Setp. stop function 1	Yes / **No**		791	Setp. stop function 2	Yes / **No**	
800	Parameter blocking	Yes / **No**					
801	Save	**ON** / OFF					
820	Param. copying from	**MOVITRAC**/ MELCARD					
821	MELCARD	Set **1** ... 5					

Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning	Par. Add.	Function	Setting range **Factory setting**	Setting after commissioning
	Selectable parameters Parameter set 1				Parameter set 2		
840	RS 232 mode switch S7	**local** / external					
841	Control mode	**Standard** / Remote setpoint / Rem. control / field bus					
842	Inverter address	**0** ... 63					
850	Language change-over	**German** / English / French					
860	Auto-Reset	Yes / **No**					
861	Restart time *(for p 860)*	3 ... **30** s					
862	Pushbutton reset [E]	Yes / **No**					
880	Master-slave-operation	Yes / **No**					
881	MOVITRAC is	Master / **Slave**					
882	Weighting factor	0.10 ... **1.00** ... 10.00					
890	4-quadrant 1	**Yes** / No		891	4-quadrant 2	**Yes** / No	
900	n / t program	Yes / **No**					
901	Stop after step 9	Yes / **No**					
910	Step 1 time 1	0 ... **10** ... 9000 s					
911	Direction 1	**CW** / CCW					
912	Ramp 1	0.0 ... **1** ... 2000 s					
913	Frequency 1	0.5 ... **5** ... 120 Hz					
920	Step 2 time 2	0 ... **10** ... 9000 s					
921	Direction 2	**CW** / CCW					
922	Ramp 2	0.0 ... **1** ... 2000 s					
923	Frequency 2	0.5 ... **5** ... 120 Hz					
930	Step 3 time 3	0 ... **10** ... 9000 s					
931	Direction 3	**CW** / CCW					
932	Ramp 3	0.0 ... **1** ... 2000 s					
933	Frequency 3	0.5 ... **5** ... 120 Hz					
940	Step 4 time 4	0 ... **10** ... 9000 s					
941	Direction 4	**CW** / CCW					
942	Ramp 4	0.0 ... **1** ... 2000 s					
943	Frequency 4	0.5 ... **5** ... 120 Hz					
950	Step 5 time 5	0 ... **10** ... 9000 s					
951	Direction 5	**CW** / CCW					
952	Ramp 5	0.0 ... **1** ... 2000 s					
953	Frequency 5	0.5 ... **5** ... 120 Hz					
960	Step 6 time 6	0 ... **10** ... 9000 s					
961	Direction 6	**CW** / CCW					
962	Ramp 6	0.0 ... **1** ... 2000 s					
963	Frequency 6	0.5 ... **5** ... 120 Hz					
970	Step 7 time 7	0 ... **10** ... 9000 s					
971	Direction 7	**CW** / CCW					
972	Ramp 7	0.0 ... **1** ... 2000 s					
973	Frequency 7	0.5 ... **5** ... 120 Hz					
980	Step 8 time 8	0 ... **10** ... 9000 s					
981	Direction 8	**CW** / CCW					
982	Ramp 8	0.0 ... **1** ... 2000 s					
983	Frequency 8	0.5 ... **5** ... 120 Hz					
990	Step pause time	0 ... **10** ... 9000 s					
991	Ramp time (→ n = 0)	0.0 ... **1** ... 2000 s					

4.1 Operating displays (display and LEDs)

Display

automatic

Display with enabled inverter output:

FREQ.	xxx.xx Hz
CURRENT	xxx %

0.5 ... 120 Hz
0 ... 200 % I_N

Display with inhibited inverter output:

NO ENABLE

Display with the use of the n/t program
(Parameter group P 900)

FREQ.	xxx.xx Hz
CURR. xxx%	STEP x

0.5 ... 120 Hz
0 ... 200 % I_N
STEP 0 ... 9

Display with inverter having a fault signal:

FAULT	xx
xxxxxxxxxxxxxxx	

(→ sec. 4.4)

selectable via menu

000 DISPLAY VALUES [↓] [↑]

- 000 PROCESS VALUES
- 010 VOLTAGES
- 020 CURRENTS / POWER
- 030 STATUS BINARY INPUTS
- 040 STATUS BINARY OUTPUTS
- 050 OPTIONS
- 060 FAULT MEMORY

LEDs

LED			Normal condition	Comment / interpretation
V1	"ON"	(green)	"On"	Processor unit ready for operation
V2	"TRIP"	(red)	"Off"	If "On": Collective fault indication (relay K1 is de energised)
V3	"RUN"	(green)	"On" "Off"	Inverter in operation, i.e. rotating field running Inverter ready for service (standby), but electronically inhibited
V4	"24 V"	(green)	"On"	External power supply + 24 V (TL. 40) applied
V5	"BUS"	(green)	"On"	Inverter control via field bus board

4.2 Operating conditions and Switch-off

Operating condition	Command	Drive behaviour	
Enable	TL. 43 = "1"	Inverter is ready for operation. Drive is not rotating	
Enable + CW / CCW command	TL. 43 and TL. 41 / 42 = "1"	Drive runs up with ramp K11 / K12 in the chosen rotational direction. Output relay K2 "Brake" is energized ≙ Brake is off The drive can be stopped by STOP or RAPID STOP	
Enable + CW / CCW command + Enable / controller inhibit	TL. 43 and TL. 41/42 = "1" TL. XX = "1"	Drive runs up with ramp K11 / K12 in the chosen rotational direction. Output relay K2 "Brake" is energized ≙ Brake is off The drive can be stopped by STOP or RAPID STOP or CONTROLLER INHIBIT	
CW / CCW rotation (if TL. 43 ≠ enable)	TL. 41 / 42 = "1"	Drive runs up with ramp t11 / t12 in the chosen rotational direction. Output relay K2 "Brake" is energized ≙ Brake is off The drive can be stopped by STOP.	
CW / CCW rotation + Enable / controller inhibit	TL. 41 / 42 = "1" TL. XX = "1"	Drive runs up with ramp t11 / t12 in the chosen rotational direction. Output relay K2 "Brake" is energized ≙ Brake is off The drive can be stopped by STOP or CONTROLLER INHIBIT.	
Switch-off behaviour			
Halt	TL. 41 / 42 = "0"	Drive stops with ramp K11 / K12 Output relay K2 "Brake" is released → Brake is applied	
Rapid stop	TL. 43 = "0" or fault signal	Drive stops with ramp K13 Output relay K2 "Brake" is released → Brake is applied See Sec. 4.5 for reaction to fault signals	
Controller inhibit	TL. XX = "0"	Triggered by binary input comand	Inverter stops, sets the output voltage V_{outp} = "0", without using a ramp. Output relay K2 "Brake" remains energised → Brake is not applied
Immediate switch-off	Fault signal	Reaction to a fault (→ Sec. 4.5)	Inverter stops immediately, setting the output voltage without ramp V_A = "0"; Output relay K2 "Brake" becomes de-energized → Brake is applied.
Standstill function	$f_{outp} < f_{min}$ or $f_{outp} < f_{St}$	Instant stop without a terminal command or the run-down ramp (P 79_)	
Start / stop frequency f_{St}	$f_{outp} < f_{St}$	All run-down ramps function only down to the Start / Stop frequency f_{St} (P 26_)	
Emergency stop	Switch off mains	A time of at least 30s should elapse between mains-off and mains-on	

*) The terminal numbers refer to the factory setting.

Note:
The inverter starts a **self-test** (approx. 2.5 s), if the mains or 24 V supply TL. 40 is switched on in the de-energized state. During the self-test time the **analogue output signals** have a "+10 V" level, the **binary output signals** have a "1" level and the **output relay K1** is energized.

4.3 Measurement functions of the analogue outputs

A selection can be made from the following types of signal for the analogue outputs TL. 38 and TL. 39:
actual frequency / actual speed / effective current / ramp integrator / V-motor / power / Ixt value / apparent current

For detailed information and levels → Sec. 3 (P 630)

4.4 Signal functions of the binary outputs and the output relay K1

The programmable binary outputs TL. 61 / 62 / 63 / 64 (P 610-614) and the programmable output relay K1 (TL. 20 / 21 / 22) (P 620) can be assigned with the following signals:

Type	Signal	"1" signal	"0" signal	Refer also to
Condition signals	MC ready	Inverter in standby	Fault	
	Rotaring field ON	Rotary field: rotating	Rotary field: stationary	
	Rotaring field OFF	Stationary rotary field, final stage disabled		
	Brake ON	Motor brake applied	Brake is released	
	Manual operation *)	Manual operation ON	Manual operation OFF	
	Parameter set 1 / 2 *)	Parameter set 2	Parameter set 1	
	I x t warning	Normal operation	Ixt > 100 %	
	Temperature fault (heat sink)	Normal operation	Series I: ϑ > 75 °C Series II: ϑ > 85 °C Series III: ϑ > 95 °C	
	FRS11 warning	Normal operation	Set master-slave deviation exceeded	P 550
	FRS11 slave in position	Slave synchronous with master	Set master-slave deviation exceeded	P 554 P 556
Range signals	$f_{ref}1$	$f < f_{ref}1$ $f > f_{ref}1$	$f > f_{ref}1$ $f < f_{ref}1$	P 403
	$f_{ref}2$	$f < f_{ref}2$ $f > f_{ref}2$	$f > f_{ref}2$ $f < f_{ref}2$	P 413
	$f_{ref}1 < f < f_{ref}2$	inside: $f_{ref}1 < f < f_{ref}2$ outside: $f < f_{ref}1$ or $f > f_{ref}2$	$f < f_{ref}1$ or $f > f_{ref}2$ $f_{ref}1 < f < f_{ref}2$	P 420
	$f = f_{setp}$	$f = f_{setp}$ $f <> f_{setp}$	$f <> f_{setp}$ $f = f_{setp}$	P 431
	f_{min}	$f = f_{min}$	$f > f_{min}$	
	f_{base}	$f < f_{base}$ $f > f_{base}$	$f > f_{base}$ $f < f_{base}$	P 440
	f_{max}	$f = f_{max}$	$f < f_{max}$	
	I_{ref} 1	$I < I_{ref}1$ $I > I_{ref}1$	$I > I_{ref}1$ $I < I_{ref}1$	P 453
	I_{ref} 2	$I < I_{ref}2$ $I > I_{ref}2$	$I > I_{ref}2$ $I < I_{ref}2$	P 463
	I_{max}	$I < I_{max}$ $I = I_{max}$	$I = I_{max}$ $I < I_{max}$	P 470
	$f_{window\ skip}$	$f <> f_{window\ skip}$	$f = f_{window\ skip}$	P 230 / P 240
Fault signals	Fault deceleration mon.	Normal operation	Fault decel. monitoring	P 500 f.
	Collective fault signal	Normal operation	Fault	
	External fault	Normal operation i.e. input "Ext.Fault" = "1"	External fault,i.e. input "Ext.Fault" = "0"	P 600 ... 606 Binary inputs
	Short circuit	Normal operation	Overcurrent	
	$V_{DC\text{-}link}$ >>	Normal operation	$V_{DC\text{-}link\ 400\ VAC}$ >> 750 V_{DC} $V_{DC\text{-}link\ 500\ VAC}$ >> 880 V_{DC}	
	V_{mains} >> *)	Normal operation	V_{mains} >> 120 % V_N	P 530
	V_{mains} << *)	Normal operation	V_{mains} <><> 70 % V_N	P 530
	Overload Ixt	Normal operation	I x t ≥ 110 %	
	Overtemperature (heat sink)	Normal operation	Series I: ϑ > 75 °C Series II: ϑ > 85 °C Series III: ϑ > 95 °C	
	Flying start function	Normal operation	Fault: motor flying start	P 750 ff
	Regen. fault FRS *)	Normal operation	Set master-slave deviation exceeded	P 551 P 553 (= further Fault reactions)

*) If a binary output is assigned to this function, then the function must be activated in the corresponding parameter.

4.5 Fault Information / reset / fault signals

When a fault occurs, the display switches automatically to one of the **Fault indications**.

A further switch to the operating information and to the parameter menu is possible as follows:

1. Depress the pushbutton [E]. →The query appears: "Pushbutton reset YES / NO " (P 862).
2. Leave the parameter "Pushbutton reset" with the left arrow pushbutton [←], without initiating a reset.

After this entry into the menu, the menu functions can be used as usual, i.e. the operating displays, such as the fault memory, can be viewed or incorrectly set parameters can be corrected.
Afterwards, a pushbutton reset can be initiated via the appropriate menu function P 862.

The **fault memory** (P 060 ... P 064) stores the last five fault signals. The following operating information is stored in non-volatile memory for each of these five events, at the time of the fault:

- DC-link voltage
- Mains voltage
- Temperature of the heat sink
- Frequency
- Apparent current
- Ixt (utilization)
- Active current
- Terminal conditions (of the binary inputs)
- Parameter set

Depending on the type of fault, two consequences are possible:

a) Switch off mode "Immediate switch off"
This action follows if the inverter can no longer brake the drive.
The inverter inhibits, i.e.
- it immediately sets the output voltage V_{outp} = "0"
- the output relay K 2 "Brake" is released.

b) Switch off mode "Rapid stop"
The drive is guided down along the rapid stop ramp t3 (P 140). When it reaches the set Start /Stop frequency (P 260) the brake is applied; the inverter now remains inhibited in the fault condition.

If the output relay K 1 is programmed for "fault" (P 620), it also is released in the event of a fault.
If the fault is already present when switching on, output relay K 1 (programmed for "fault") will be energized briefly during the self-test period (about 2.5 s) and then be released again, within this period, when the fault is recognized.

RESET: a fault can be reset by

- auto-reset (P 860) with an adjustable restart time (P 861) of 3 ... 30 s and a maximum of 3 restart attempts
  Caution: do not use with drives where an automatic start could endanger persons or equipment!
- pushbutton reset with the query "Pushbutton reset YES / NO" (P 862).
  using pushbutton [E] (only effective as a reset pushbutton as a direct reaction to a fault)
  or the selection of the menu function "pushbutton reset (P 862).
- reset via input terminals (factory assignment: TL. 51).
- switching the mains off and on again
  (After mains-off, a pause of a 30 s is recommended – until LED V1 goes out – before switching on again.)
- some faults are self-resetting.
- a PC (software MC_SHELL)
- Interbus-S

Notes on **RESET**: The fault memory stores each new fault and simultaneously deletes the oldest fault in the memory. If the last fault reoccurs again and again, then, with repeated switching off and on, all five memory positions will be taken up by this fault signal.

- If a fault cannot be reset, please contact SEW Electronic Service (refer to addresses in "Service and Spare Parts Manuals").

  If a unit is returned for repair, please include the following information:
  - fault description
  - circumstances
  - presumable cause of fault
  - unusual occurances, etc.

List of fault signals

Display indication	Switch off mode	Reset	Cause *)
Fault 1 **OVERCURRENT**	Immediate switch-off	●	Earth fault at the output
		–	- Short circuit at the output - Defective final stage - Motor too large (low-resistance)
Fault 2 **DC-LINK**	Immediate switch-off	●	DC link voltage $V_{DC\ link}$ (TL. 7 / 8+): > 790 V_{DC} *(950 V_{DC})* (display P 010 or P 060 ff.)
Fault 3 **BRAKE CHOPPER**	Immediate switch-off	–	- Braking resistor circuit TL.8+ / 9– interrupted - Short circuit in the braking resistor circuit TL.8+/9 - Brake chopper transistor defective - Mains switched on again too quickly
Fault 4 **CONTINUOUS OVERLOAD**	Immediate switch-off	●	Ixt value (utilization) > 109 % (display P 021 resp. P 060 ff.)
Fault 5 **REGEN. OVERLOAD**	Immediate switch-off	●	Only with active regenerative monitoring: (P 520 ff.) $f_{outp} > f_{setp}$ in regenerative operation (description → P520 ff.)
Fault 6 **OVERTEMPERATURE**	Rapid stop	●	Inverter heat sink too hot; inadequate cooling conditions (display P 001 or P 060 ff.)
Fault 7 **PHASE FAILURE**	Immediate switch-off	●	Only with active mains voltage monitoring (P 530): a phase is missing at the terminals 1 / 2 / 3
Fault 8 **MAINS OVERVOLTAGE**	Rapid stop	●	Only with active mains voltage monitoring (P 530): Input voltage at TL. 1 / 2 / 3 V_{mains}> approx. 480V_{AC} *(600V_{AC})*
Fault 9 **MAINS UNDERVOLTAGE**	Rapid stop	●	Only with active mains voltage monitoring (P 530): Input voltage at TL. 1 / 2 / 3 V_{mains}< approx. 280V_{AC} *(350V_{AC})*
Fault 10 **ROTATIONAL DIRECTION**	Immediate switch-off	●	Only with option FRN 12 and active speed control (P770 ff.): - Encoder tracks A/A and B/B are interchanged in pairs - If the motor rotates in the opposite direction to the input,then two motor lead phases are interchanged. - If the motor is intended to rotate in the opposite direction to the input (e.g. on command "clockwise" the motor should rotate counterclockwise): 1. Connect the motor lead phases accordingly. 2. Interchange the encoder tracks A/A and B/B in pairs. - Regenerative overload (e.g. with hoist drooping down) due to load being too large or Boost set too low (P 321).
Fault 11 **N-MEASUREMENT**	Immediate switch-off	●	Only with option FRN 12 and active speed control (P 770 ff.) - Option board FRN 12 missing - Incorrect option board - Broken lead cores from TL. 94 or TL. 97 to the encoder.
Fault 12 **MOT. OVERLOAD**	Immediate switch-off	●	Only with active speed monitoring (P 510 ff.): - $f_{outp} < f_{setp}$ in motor operation mode (→ P 510 ff.) Only with option FRN 12 and active speed control (P770 ff.): - faulty encoder signals
Fault 13 **START CONDITIONS**	Immediate switch-off	●	Only with active hoist function (P 710 ff.): Current cannot build up fully in the premagnetization time (possibly motor too small, i.e. motor resistance too high)
Fault 14 **OUTPUT OPEN**	Immediate switch-off	●	Only with active hoist function (P 710 ff.) or active motor phase monitoring (P 540 ff.): - One or more output phases interrupted - $P_{motor} << P_{inverter}$ (i.e. motor resistance too high) - Change of direction with rotating motor
Fault 15			Not assigned

*) Several fault signals can also be produced by **jogging the drive with the mains contactor.**
Jogging the mains contactor on and off is not permitted under any circumstances.

(details bracketed in italics): valid for Vmains = 500 VAC

Display indication	Switch off mode	Reset	Cause *)
Fault 16 **MOT. FLYING START**	Immediate switch-off	●	Only with active flying-start function (P 750 ff.): Motor driven with a speed beyond the search range.
Fault 17 **STACK OVERFLOW**	Immediate switch-off	●	Inverter electronics faulty. Possible cause: EMC effect (electronic wiring / earthing Reoccurrence of the fault requires an analysis by SEW service.
Fault 18 **STACK UNDERFLOW**	Immediate switch-off	●	
Fault 19 **NMI TRAP**	Immediate switch-off	●	
Fault 20 **UNDEFINED OPCODE**	Immediate switch-off	●	
Fault 21 **PROTECTED INSTR.**	Immediate switch-off	●	
Fault 22 **WORD OP. ACCESS**	Immediate switch-off	●	
Fault 23 **INSTRUCT. ACCESS**	Immediate switch off	●	
Fault 24 **EXT. BUS ACCESS**	Immediate switch-off	●	
Fault 25 **EEPROM**	Immediate switch-off	● **) P830	
Fault 26 **NO CONNECTION**	Rapid stop	●	
Fault 27 **EXT. TERMINAL**		●	Only with active "External Fault" function (P 600 ff.): Input signal = "0" (Display P 030 / 031 or P 060 ff.)
Fault 28 **FAULT INTERBUS**	Rapid stop	●	Only with active "Interbus" board (P 841): Faulty monitoring signals
Fault 29 **15V SUPPLY**	Immediate switch-off	●	Probably an overload on TL. 44 (+24 V)
Fault 30 **DC LINK GEN. CIRC.**	Immediate switch-off	●	V_{mains} > 50 V_{AC} *(60 V_{AC})* and $V_{DC\ link}$ < 150 V_{DC} *(190V_{DC})* Fault can only be recognised when switching on the mains.
Fault 31 **MAINS MEASUREMENT**	Immediate switch-off	●	Only with active mains voltage monitoring (P 530): V_{mains} < 50 V_{AC} *(60 V_{AC})* and $V_{DC\ link}$ > 150 V_{DC} *(190V_{DC})* Fault can only be recognised when switching on the mains.
Fault 32 **MELCARD**	No switch-off	auto-reset	Only when using a MELCARD and copying the parameters (P 820): - card incorrectly inserted - card defect
Fault 33 **MASTER-SLAVE**	Rapid stop	auto-reset	- Connection master-slave interrupted - Switch S2 not switched over to Terminal - Master or slave defined incorrectly in P 880
Fault 34 **INTERBUS**			

*) Several fault signals can also be produced by **jogging the dirve with the mains contactor.**
Jogging the mains contactor on and off is not permitted under any circumstances.

(details bracketed in italics): valid for Vmains = 500 VAC

) 1. P 830 "Factory setting" means that **all the set values are put back to the basic factory-set values.
2. The adapted values must be set again.
3. Perform a "Reset" (→ Sec. 4.5)
If a fault cannot be resolved, then refer to:
SEW Electronics Service: refer to addresses "Service and spare parts"
If the unit is sent for test or repair, please provide the following:
- Type of fault
- Circumstances
- Suspicions of the faut cause
- Especially abnormal occurrauces, etc.

Supply voltage 3 x 400 V_{AC}

MOVITRAC® - Type (Size I)		3001-403-	3002-403-	3003-403-	3004-403-	3005-403-
Inverter Part No.	1-Q	825 632 2	825 633 0	825 634 9	825 635 7	825 643 8
with brake chopper	4-Q	825 646 2	825 647 0	825 648 9	825 649 7	825 657 8
Output rated power (@ V_N = 3 x 400 V_{AC})	P_N	2.6 kVA	3.8 kVA	5.0 kVA	6.6 kVA	8.0 kVA
Rated supply voltage Permissible range	V_{mains}	3 x 400 V_{AC} V_{mains} = 400 V – 25 % ... 400 V + 10 %				
Mains frequency	f_{mains}	50 Hz ... 60 Hz ± 5%				
Mains rated current	I_{mains}	5.0 A_{AC}	7.2 A_{AC}	9.4 AAC	12.2 A_{AC}	15.3 A_{AC}
Output voltage	V_{outp}	Continuously up to 3 x 400 V_{AC} (max. V_{mains})				
Output frequency	f_{outp}	0.5 ... 120 Hz		f_{min} = 0.5 ...25 Hz	f_{max} = 40 ...120 Hz	
Resolution	Δf_{outp}	0.05 Hz		over the entire range		
Field weakening range	f_{base}	in steps: 50 / 60 / 87 / 104 / 120 Hz as well as continuously: 5 ... 120 Hz				
Useful motor power	P_{mot}	1.5 kW	2.2 kW	3.0 kW	4.0 kW	5.5 kW
Output rated current	I_N	3.8 A_{AC}	5.4 A_{AC}	7.3 A_{AC}	9.6 A_{AC}	12.0 A_{AC}
Dynamic current limit with brake chopper	I_{max}	Motor operating mode: 150 % I_N for 60 s Regenerative mode: 150 % I_N for 60 s				
Braking resistor with 4-Q inverters TL. 8 / 9		$R_{BW} \geq 39\,\Omega - 10\,\%$				
Internal current limit		I_{max} = 20 ...150 % adjustable via the menu				
Interference voltage level with EMC-measures (mains input filters NF and shielded leads)		B (to EN 55011); with interference suppression symbol				
Interference immunity static electricity (ESD) to IEC 801-2		discharge through air 8 kV discharge on contact 6 KV				
electromagnetic fields test field strength (to IEC 801-3)		3 V/m		(ISM-frequencies 10 V/m)		
bursts to IEC 801-4				unshielded	shielded	
		mains lead		4 kV	4 kV	
		motor lead		2 kV	4 kV	
		braking resistor lead	2 kV	4 kV		
		output relay leads		4 kV	4 kV	
		electronics leads		2 kV	4 kV	
Ambient temperature	ϑ_A	0 ° ... +45 °C (P_N reduction: 3% I_N per K up to max. 60 °C)				
Enclosure		IP 20 (DIN 40 050)				
Duty type		Continuous duty (DIN 57 558 Part 1)				
Power loss @ P_N	P_{loss} max	105 W	130 W	170 W	220 W	250 W
Type of cooling (DIN 41 751)		Convection cooling		Forced cooling		
Forced cooling: air flow				58 m^3/h		
Altitude above sea level		h ≤ 1000m (P_N reduction: 1% per 100m from 1000m to 2000m)				
Weight		10.5 kg	10.5 kg	11 kg	11 kg	11 kg
Dimensions B x H x D		243 x 386 x 222 mm				

Supply voltage 3 x 400 V_{AC}

MOVITRAC® - Type (Size II and III)		3007-403-	3011-403-	3015-403-	3022-403-	3030-403-
Inverter Part No.	1-Q	825 637 3	825 639 X	825 640 3	825 641 1	825 642 X
with brake chopper	4-Q	825 651 9	825 653 5	825 654 3	825 655 1	825 656 X
Output rated power (@ V_N = 3 x 400 V_{AC})	P_N	11 kVA	16 kVA	23 kVA	33 kVA	42 kVA
Rated supply voltage Permissible range	V_{mains}	3 x 400 V_{AC} V_{mains} = 400 V – 25 % ... 400 V + 10 %				
Mains frequency	f_{mains}	50 Hz ... 60 Hz ± 5%				
Mains rated current	I_{mains}	20 A_{AC}	27 A_{AC}	35 AAC	50 A_{AC}	65 A_{AC}
Output voltage	V_{outp}	Continuously up to 3 x 400 V_{AC} (max. V_{mains})				
Output frequency	f_{outp}	0.5 ... 120 Hz		f_{min} = 0.5 ...25 Hz	f_{max} = 40 ...120 Hz	
Resolution	Δf_{outp}	0.05 Hz		over the entire range		
Field weakening range	f_{base}	in steps: 50 / 60 / 87 / 104 / 120 Hz as well as continuously: 5 ... 120 Hz				
Useful motor power	P_{mot}	7.5 kW	11 kW	15 kW	22 kW	30 kW
Output rated current	I_N	16 A_{AC}	23 A_{AC}	33 A_{AC}	47 A_{AC}	61 A_{AC}
Dynamic current limit with brake chopper	I_{max}	Motor operating mode: 150 % I_N for 60 s Regenerative mode: 150 % I_N for 60 s				
Braking resistor with 4-Q inverters TL. 8 / 9		R_{BW} ≥ 39 Ω – 10 %	R_{BW} ≥ 15 Ω – 10 %	R_{BW} ≥ 12 Ω – 10 %		
Internal current limit		I_{max} = 20 ...150 % adjustable via the menu				
Interference voltage level with EMC-measures (mains input filters NF and shielded leads)		B (to EN 55011); with interference suppression symbol				
Interference immunity						
static electricity to IEC 801-2 (ESD)		discharge through air 8 kV discharge on contact 6 KV				
electromagnetic fields test field strength (to IEC 801-3)		3 V/m		(ISM-frequencies 10 V/m)		
bursts to IEC 801-4				unshielded	shielded	
		mains lead		4 kV	4 kV	
		motor lead		2 kV	4 kV	
		braking resistor lead	2 kV	4 kV		
		output relay leads		4 kV	4 kV	
		electronics leads		2 kV	4 kV	
Ambient temperature	ϑ_A	0 ° ... +45 °C (P_N reduction: 3% I_N per K up to max. 60 °C)				
Enclosure		IP 20 (DIN 40 050)				
Duty type		Continuous duty (DIN 57 558 Part 1)				
Power loss @ P_N	P_{loss} max	330 W	400 W	500 W	750 W	1000 W
Type of cooling (DIN 41 751)		Forced cooling				
Forced cooling: air flow		120 m^3/h		140 m^3/h		
Altitude above sea level		h ≤ 1000m (P_N reduction: 1% per 100m from 1000m to 2000m)				
Weight		17.5 kg	18 kg	29 kg	30 kg	
Dimensions B x H x D		243 x 488 x 277 mm		243 x 668 x 311		

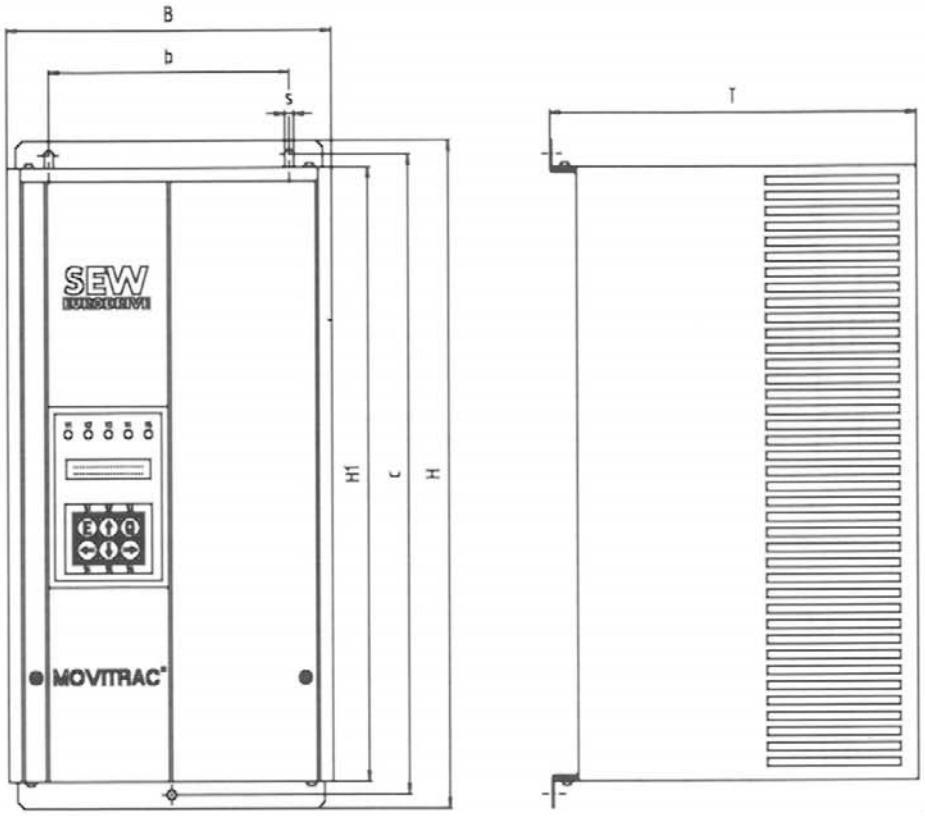
Supply voltage 3 x 500 V_{AC}

MOVITRAC® - Type (Size I)		3001-503-	3002-503-	3003-503-	3004-503-	3005-503-
Inverter Part No.	1-Q	825 724 8	825 725 6	825 726 4	825 727 2	825 728 0
with brake chopper	4-Q	825 733 7	825 734 5	825 735 3	825 736 1	825 737 X
Output rated power (@ V_N = 3 x 500 V_{AC})	P_N	2.7 kVA	3.8 kVA	5.0 kVA	6.7 kVA	8.4 kVA
Rated supply voltage Permissible range	V_{mains}	3 x 500 V_{AC} V_{mains} = 500 V – 25 % / + 10 %				
Mains frequency	f_{mains}	50 Hz ... 60 Hz ± 5%				
Mains rated current	I_{mains}	4.0 A_{AC}	5.8 A_{AC}	7.4 AAC	9.8 A_{AC}	12.1 A_{AC}
Output voltage	V_{outp}	Continuously up to 3 x 500 V_{AC} (max. V_{mains})				
Output frequency	f_{outp}	0.5 ... 120 Hz		f_{min} = 0.5 ...25 Hz	f_{max} = 40 ...120 Hz	
Resolution	Δf_{outp}	0.05 Hz		over the entire range		
Field weakening range	f_{base}	in steps: 50 / 60 / 87 / 104 / 120 Hz as well as continuously: 5 ... 120 Hz				
Useful motor power	P_{mot}	1.5 kW	2.2 kW	3.0 kW	4.0 kW	5.5 kW
Output rated current	I_N	3.1 A_{AC}	4.4 A_{AC}	5.8 A_{AC}	7.7 A_{AC}	9.7 A_{AC}
Dynamic current limit with brake chopper	I_{max}	Motor operating mode: 150 % I_N for 60 s Regenerative mode: 150 % I_N for 60 s				
Braking resistor with 4-Q inverters TL. 8 / 9		$R_{BW} \geq 39\,\Omega$ – 10 %				
Internal current limit		I_{max} = 20 ...1 50 % adjustable via the menu				
Interference immunity static electricity (ESD) to IEC 801-2		discharge through air 8 kV discharge on contact 6 kV				
electromagnetic fields test field strength (to IEC 801-3)		3 V/m (ISM-frequencies 10 V/m)				
bursts to IEC 801-4				unshielded	shielded	
		mains lead		4 kV	4 kV	
		motor lead		2 kV	4 kV	
		braking resistor lead	2 kV	4 kV		
		output relay leads		4 kV	4 kV	
		electronics leads		2 kV	4 kV	
Ambient temperature	ϑ_A	0 ° ... +45 °C (P_N reduction: 3% I_N per K up to max. 60 °C)				
Enclosure		IP 20 (DIN 40 050)				
Duty type		Continuous duty (DIN 57 558 Part 1)				
Power loss @ P_N	P_{loss} max	105 W	130 W	170 W	220 W	250 W
Type of cooling (DIN 41 751)		Convection cooling		Forced cooling		
Forced cooling: air flow				58 m^3/h		
Altitude above sea level		h ≤ 1000m (P_N reduction: 1% per 100m from 1000m to 2000m)				
Weight		10.5 kg	10.5 kg	11 kg	11 kg	11 kg
Dimensions B x H x D		243 x 386 x 222 mm				

Supply voltage 3 x 500 V_{AC}

MOVITRAC® - Type (Size II and III)		3007-503-	3011-503-	3015-503-	3022-503-	3030-503-
Inverter Part No.	1-Q	825 729 9	825 730 2	825 731 0	825 732 9	826 009 5
with brake chopper	4-Q	825 738 8	825 739 6	825 740 X	825 741 8	826 010 9
Output rated power (@ V_N = 3 x 500 V_{AC})	P_N	11 kVA	16 kVA	23 kVA	33 kVA	42 kVA
Rated supply voltage Permissible range	V_{mains}	3 x 500 V_{AC} V_{mains} = 500 V – 25 % / + 10 %				
Mains frequency	f_{mains}	50 Hz ... 60 Hz ± 5%				
Mains rated current	I_{mains}	15.9 A_{AC}	21.3 A_{AC}	28.5 A_{AC}	40.2 A_{AC}	52 A_{AC}
Output voltage	V_{outp}	Continuously up to 3 x 500 V_{AC} (max. V_{mains})				
Output frequency	f_{outp}	0.5 ... 120 Hz		f_{min} = 0.5 ...25 Hz	f_{max} = 40 ...120 Hz	
Resolution	Δf_{outp}	0.05 Hz		over the entire range		
Field weakening range	f_{base}	in steps: 50 / 60 / 87 / 104 / 120 Hz as well as continuously: 5 ... 120 Hz				
Useful motor power	P_{mot}	7.5 kW	11 kW	15 kW	22 kW	30 kW
Output rated current	I_N	13 A_{AC}	18.4 A_{AC}	26 A_{AC}	37.5 A_{AC}	49 A_{AC}
Dynamic current limit with brake chopper	I_{max}	Motor operating mode: Regenerative mode:		150 % I_N for 60 s 150 % I_N for 60 s		
Braking resistor with 4-Q inverters TL. 8 / 9		R_{BW} ≥ 39 Ω – 10 %	R_{BW} ≥ 18 Ω – 10 %	R_{BW} ≥ 12 Ω – 10 %		
Internal current limit		I_{max} = 20 ...1 50 % adjustable via the menu				
Interference immunity static electricity to IEC 801-2 (ESD)		discharge through air discharge on contact		8 kV 6 KV		
electromagnetic fields test field strength (to IEC 801-3)		3 V/m		(ISM-frequencies 10 V/m)		
bursts to IEC 801-4				unshielded	shielded	
		mains lead		4 kV	4 kV	
		motor lead		2 kV	4 kV	
		braking resistor lead	2 kV	4 kV		
		output relay leads		4 kV	4 kV	
		electronics leads		2 kV	4 kV	
Ambient temperature	ϑ_A	0 ° ... +45 °C (P_N reduction: 3% I_N per K up to max. 60 °C)				
Enclosure		IP 20 (DIN 40 050)				
Duty type		Continuous duty (DIN 57 558 Part 1)				
Power loss @ P_N	P_{loss} max	330 W	400 W	500 W	750 W	1000 W
Type of cooling (DIN 41 751)		Forced cooling				
Forced cooling: air flow		120 m^3/h		140 m^3/h		190 m^3/h
Altitude above sea level		h ≤ 1000m (P_N reduction: 1% per 100m from 1000m to 2000m)				
Weight		17.5 kg	18 kg	29 kg	30 kg	
Dimensions B x H x D		243 x 488 x 277 mm		243 x 668 x 311		

MOVITRAC® - Type Series 3000		General electronic data
External current limit	TL. 36 / 37	I_{max} = 0 ... 100 % of the internal current limiting value 100% ≙ 10 V R_i = 20 kΩ TL. 36 / 37 is implemented as a differential input. Ground TL. 37 to 0 V if required.
Speed setpoints	TL. 31	Reference voltage for the setpoint potentiometer: +10 V = 0 / +5 % Drift ≤ +0.1% at Δ ϑ = 10 K I_{max} = 3mA
External selection	TL. 32 / 33 TL. 34 / 35	n1= (0 ... 10 V) x (V= 0.1 ... 2.0) R_i = 20 kΩ Δn: 10 Bit ≙10 mV n2= 0 ... +10 V / 0 ... ±10 V R_i = 40 kΩ Δn: 9 Bit ≙ 20 mV n2= 0 ... 20 mA / 4 ... 20 mA R_i = 250 Ω Δn: 8 Bit ≙ 0.08 mA Sampling time 4 ms
Internal setpoints		n11 / n12 / n13 = 0.5 ... 120 Hz via parameter change-over: n21 / n22 / n23 = 0.5 ... 120 Hz
Motor potentiometer		Up / Down: 2 ... 60 s (separately adjustable) valid for Δ f_{outp} = 50 Hz
Frequency ramp generator time range		t11 / t21 Up: 0.0 ... 2000 s valid for Δ f_{outp} = 50 Hz t11 / t21 Down: 0.0 ... 2000 s via time switch: t12 / t22 Up = Down: 0.0 ... 2000 s
Analogue outputs		Sampling rate: ≤ 10 ms max. cable length: 25 m
Signal form	TL. 38+39	(0 ... ±10 V) x (V = 0.1 ... 3.0) I_{max} = 3 mA
Signal type	TL. 38+39	Selectable via menu: foutp / foutp / aeslip / Iactive / S nsetp / Voutp / Pactive / Ixt / Iapparent (P 630-632)
Binary inputs		Isolated via optocoupler Ri 1.8 kΩ Sampling time ≤ 10 ms
Signal form		(+13 ... +33) V ≙ "1" = contact closed (DIN 19240) (3 ... +7) V ≙ "0" = contact open
Control functions	TL. 41 TL. 42/43/47/48/49/50/51	Clockwise/stop assignable via menu (P 600-606) with the signal types: CCW/stop / Enable/rapid stop / Ramp gen. change-over / n11 / n12 / n13 / Parameter change-over / Reset / Motor pot Up / Motor pot Down / Deceleration monitoring / n/t program / Controller inhibit / Ext. fault / Set to zero (FRS 11) / Slave position (FRS 11) / Slave: free run
Aux. power source output Ext. electronic supply in	TL.44 TL.40	V = + 24 V_{DC} Current carrying capacity: I_{max} = 250 mA V = + 24 V_{DC} ±25 % I_{inp} = 0.6 A (without power supply for options)
Binary outputs		Isolated via optocoupler (open collector) R_i 400 Ω Response time ≤ 10 ms
Signal form (24 V feed)		"0" = 0 V "1" = 24 V Load rating: 20 mA
Signal functions K1	TL.61-64	Assignable via menu (P610-613) with 32 signal types: 10 condition signals 11 range signals 11 fault signals
Serial interfaces	TL.67 / 68 X1	RS 485 (to EIA Standard) max. cable length: 200 m Baudrate: 9600 RS 232 C (to EIA Standard) max. cable length: 5 m Baudrate: 9600 Sub D connector, 9 poles (to MIL C-24308) RS 232: Pin switch-over via S7
Output relays Contact data		Response time ≤ 20 ms 250 V_{AC} / 0.25 A_{AC} / AC 11 or 24 V_{DC} / 0.6 A_{DC} / DC 11 to IEC 337-1
Signal functions K1	TL. 20-22	Change-over contact assignable via menu with: 10 condition / 11 range / 11 fault signals (P 620)
Brake K2	TL. 23/24	Normally open contact for brake control (switches at f = 0.5 ... 5 Hz; P 260 / 261)



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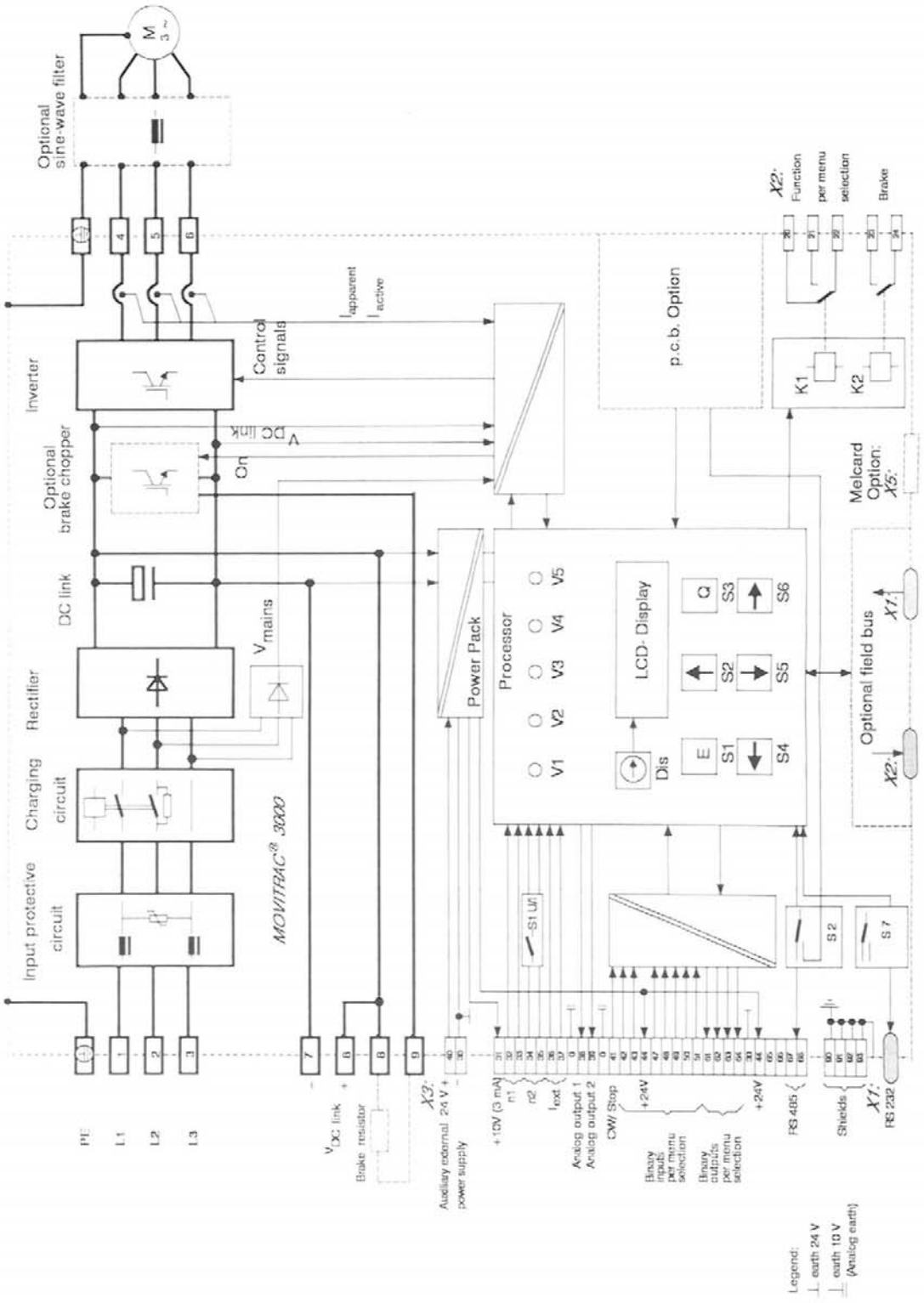
For adequate cooling, provide at least 150 mm clearance above and below the unit and 30 mm clearance on the sides of the unit .

MOVITRAC® Type	Size	recommended Motor power [kW]	Dimensions [mm] B	H	T (=D) depth	H1	b	c	s [1] for	Weight [kg]
3001-...-00	I	1.5	243	386	222	346	180	365	M6	10.5
3002-...-00		2.2	243	386	222	346	180	365	M6	10.5
3003-...-00		3.0	243	386	222	346	180	365	M6	11.0
3004-...-00		4.0	243	386	222	346	180	365	M6	11.0
3005-...-00		5.5	243	386	222	346	180	365	M6	11.0
3007-...-00	II	7.5	243	488	277	442	180	468	M8	17.5
3011-...-00		11.0	243	488	277	442	180	468	M8	18.0
3015-...-00	III	15.0	243	668	311	622	180	648	M8	29.0
3022-...-00		22.0	243	668	311	622	180	648	M8	30.0
3030-...-00		30.0	243	668	311	622	180	648	M8	30.0

[1] s = Keyhole opening for M.. screws


Optional sine-wave filter
Inverter
Optional brake chopper
DC link
Rectifier
Charging circuit
Input protective circuit
MOVITRAC® 3000
Control signals
$I_{apparent}$
I_{active}
$V_{DC\ link}$
On
V_{mains}
p.c.b. Option
Power Pack
Processor
V1
V2
V3
V4
V5
LCD- Display
Dis
E
S1
S2
S3
S4
S5
S6
Q
K1
K2
X2: Function per menu selection
Brake
Melcard Option: X5:
Optional field bus
X1:
X2:
X3:
S1 UP
S2
S7
PE
L1
L2
L3
$V_{DC\ link}$ -
$V_{DC\ link}$ +
Brake resistor
Auxiliary external 24 V power supply
+10V (3 mA)
n1
n2
Iext
Analog output 1
Analog output 2
CW/ Stop
+24V
Binary inputs: per menu selection
Binary outputs: per menu selection
+24V
RS 485
Shields
RS 232
Legend:
earth 24 V
earth 10 V (Analog earth)

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8.1 Braking Resistors BW.. for 4-quadrant operation

When connecting the braking resistor, the following must be observed:

- Connect to TL. 8 and 9 of the MOVITRAC®.
  Caution: do not connect to TL. 7.
- Maximum lead length = 100 m.
  Use two close lying conductors (e.g. twisted) or 2-core power cable.
  Proper EMC-wiring requires a shielded cable.
- Protect with a bimetallic relay F16; this should protect the braking resistor against excessive ON periods in ED (intermittent) operation and must therefore be set to the tripping current of the braking resistor (refer to table).
  The bimetallic relay F16 contact should be arranged in the control ciruitry to act:
  - on the mains contact K11
  - as well as on a binary input with function "External fault".
- The conductor cross-section must be selected in accordance with the rated current of the inverter. (→ Sec. 5 - Technical Data).
- **CAUTION:** The conductor leads to the braking resistor carry a high level DC during rated operation! (for MOVITRAC® 3...-403 up to about 750 V_{DC} / for MOVITRAC® 3...-503 up to about 890 V_{DC})
- The resistor surface reaches a high temperature when operating under load at rated power. The location must therefore take this into account. The braking resistors are therefore normally mounted on top of the switch cabinet.

Regenerative power limits

In the following tables the **load capability of the braking resistors** is shown as a function of the cyclic duration factor (ED of the braking resistor referring to an operating time ≤ 120 s).

The actual **upper power limit** depends on the **regenerative power limit** for the inverter type = 150 % of the recommended motor power rating (→ Sec. 5 - Technical Data).

MOVITRAC® 3...-403-

Braking resistor type Part number	**BW 039-003** 821 687 8	**BW 039-006** 821 688 6	**BW 039-012** 821 689 4	**BW 039-026** 821 690 8	**BW 039-050** 821 691 6
Load capability at 100% ED [1] 50% ED 25% ED 12% ED 6% ED	0.3 kW 0.5 kW 1.0 kW 1.7 kW 2.8 kW	0.6 kW 1.1 kW 1.9 kW 3.5 kW 5.7 kW	1.2 kW 2.1 kW 3.8 kW 7.0 kW 11.4 kW	2.6 kW 4.6 kW 8.3 kW - -	5.0 kW 8.5 kW - - -
Resistance value	39 Ω ± 10 %				
Tripping current	1.2 A_{AC}	2.4 A_{AC}	4.2 A_{AC}	7.8 A_{AC}	11 A_{AC}
Design	Wire resistor on ceramic tube				Steel-grid resistor
Electrical connections	Ceramic terminals for 2.5 mm²				
Enclosure	IP 20 (in the mounted condition)				
Ambient operating temperature	–20 ... + 45 °C				
Cooling	Natural convection				
Peak load capability $P_{brake(pk)} = V^2_{DC\ link\ max} / R_{BW}$	for MOVITRAC® 3...-403- with $V_{DC\ link\ max}$ = 750 V_{DC}: 14 kW				
For use with MOVITRAC® type	3001 / 3002 / 3003 / 3004 / 3005 / 3007-**403**-				

Braking resistor type Part number	**BW 715** 821 258 9	**BW 815** 821 259 7	**BW 915** 821 260 0
Load capability at 100% ED [1] 50% ED 25% ED 12% ED 6% ED	3.0 kW 5.2 kW 9.0 kW 13.5 kW 22.8 kW	6.0 kW 10 kW 18 kW 27 kW -	16 kW 27 kW - - -
Resistance value	15 Ω ± 10 %		
Tripping current	8 A_{AC}	15 A_{AC}	31 A_{AC}
Design	Steel-grid resistor		
Electrical connections	Stud bolts M8		
Enclosure	IP 20 (in the mounted condition)		
Ambient operating temperature	–20 ... + 45 °C		
Cooling	Natural convection		
Peak load capability $P_{brake(pk)} = V^2_{DC\ link\ max} / R_{BW}$	for MOVITRAC® 3...-403- with $V_{DC\ link\ max}$ = 750 V_{DC}: 37 kW		
For use with MOVITRAC® type	3011-**403**-		

Braking resistor type Part number	**BW 012-015** 821 679 7	**BW 012-025** 821 680 0	**BW 012-050** 821 681 9	**BW 012-100** 821 682 7
Load capability at 100% ED [1] 50% ED 25% ED 12% ED 6% ED	1.5 kW 2.5 kW 4.5 kW 6.7 kW 11.4 kW	2.5 kW 4.2 kW 7.5 kW 11.2 kW 19 kW	5.0 kW 8.5 kW 15 kW 22.5 kW 38 kW	10 kW 17 kW 30 kW 45 kW -
Resistance value	12 Ω ±10 %			
Tripping current	4.0 A_{AC}	7.0 A_{AC}	14 A_{AC}	22 A_{AC}
Design	Laminar resistor	Steel-grid resistor		
Electrical connections	Ceramic terminals for 2.5 mm²			
Enclosure	IP 20 (in the mounted condition)			
Ambient operating temperature	–20 ... + 45 °C			
Cooling	Natural convection			
Peak load capability $P_{brake(pk)} = V^2_{DC\ link\ max} / R_{BW}$	for MOVITRAC® 3...-403- with $V_{DC\ link\ max}$ = 750 V_{DC}: 46 kW			
For use with MOVITRAC® type	3015 / 3022 / 3030-**403**-			

1) ED = cyclic duration factor of the braking resistor

MOVITRAC® 3...-503-

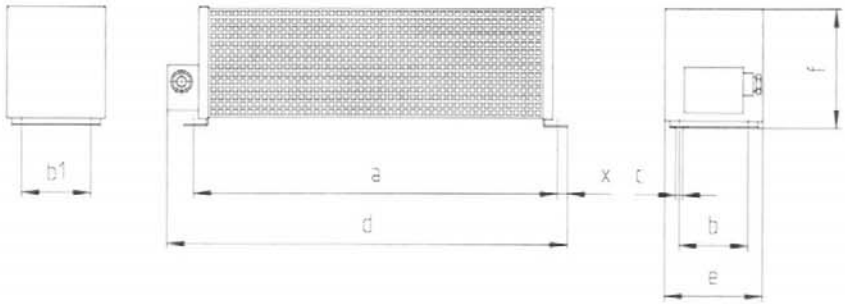
Braking resistor type Part number	**BW 039-006** 821 688 6	**BW 039-012** 821 689 4	**BW 039-026** 821 690 8	**BW 039-050** 821 691 6
Load capability at 100% ED [1] 50% ED 25% ED 12% c.d.f 6% ED	0.6 kW 1.1 kW 1.9 kW 3.5 kW 5.7 kW	1.2 kW 2.1 kW 3.8 kW 7.0 kW 11.4 kW	2.6 kW 4.6 kW 8.3 kW 15.3 kW -	5.0 kW 8.5 kW 15 kW - -
Resistance value	39 Ω ± 10 %			
Tripping current	2.1 A_{AC}	3.7 A_{AC}	6.7 A_{AC}	9.6 A_{AC}
Design	Wire resistor on ceramic tube			Steel-grid resistor
Electrical connections	Ceramic terminals for 2.5 mm²			
Enclosure	IP 20 (in the mounted condition)			
Ambient operating temperature	–20 ... + 45 °C			
Cooling	Natural convection			
Peak load capability $P_{brake(pk)} = V^2_{DC\ link\ max} / R_{BW}$	for MOVITRAC® 3...-503- with $V_{DC\ link\ max}$ = 890 V_{DC}: 20 kW			
For use with MOVITRAC® type	3001 / 3002 / 3003 / 3004 / 3005 / 3007-**503**-			

Braking resistor type Part number	**BW 018-015** 821 684 3	**BW 018-035** 821 685 1	**BW 018-075** 821 686 X
Load capability at 100% c.d.f[1] 50% ED 25% ED 12% ED 6% ED	1.5 kW 2.5 kW 4.5 kW 6.7 kW 11.4 kW	3.5 kW 5.9 kW 10.5 kW 15.7 kW 26.6 kW	7.5 kW 12.7 kW 22.5 kW 33.7 kW -
Resistance value	18 Ω ± 10 %		
Tripping current	4.0 A_{AC}	8.1 A_{AC}	14 A_{AC}
Design	Laminar resistor	Steel-grid resistor	
Electrical connections	Ceramic terminals for 2.5 mm²		
Enclosure	IP 20 (in the mounted condition)		
Ambient operating temperature	–20 ... + 45 °C		
Cooling	Natural convection		
Peak load capability $P_{brake(pk)} = V^2_{DC\ link\ max} / R_{BW}$	for MOVITRAC® 3...-503- with $V_{DC\ link\ max}$ = 890 V_{DC}: 44 kW		
For use with MOVITRAC® type	3011-**503**-		

Braking resistor type Part number	**BW 012-025** 821 680 0	**BW 012-050** 821 681 9	**BW 012-100** 821 682 7
Load capability at 100% ED [1] 50% ED 25% ED 12% c.d.f 6% c.d.f	2.5 kW 4.2 kW 7.5 kW 11.2 kW 19 kW	5.0 kW 8.5 kW 15 kW 22.5 kW 38 kW	10 kW 17 kW 30 kW 45 kW -
Reistance value	12 Ω ± 10 %		
Tripping current	6.1 A_{AC}	12 A_{AC}	22 A_{AC}
Design	Steel-grid resistor		
Electrical connections	Ceramic terminals for 2.5 mm²		
Enclosure	IP 20 (in the mounted condition)		
Ambient operating temperature	–20 ... + 45 °C		
Cooling	Natural convection		
Peak load capability $P_{brake(pk)} = V^2_{DC\ link\ max} / R_{BW}$	for MOVITRAC® 3...-503- with $V_{DC\ link\ max}$ = 890 V_{DC}: 66 kW		
For use with MOVITRAC® type	3015 / 3022 / 3030-**503**-		

1) ED = Cyclic duration factor of the braking resisto

Dimension of braking resistors BW..



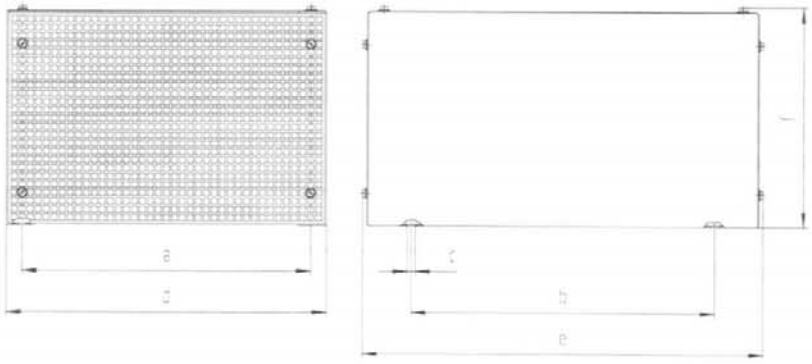
Laminar resistors

80 050 65

Braking resistor type	Dimensions [mm] a	b	c	d(Breadth)	e (Depth)	f (Height)	x	Weight [kg]
BW 012-015	540	64	5.8	600	92	120	10	4
BW 018-009	485	64	5.8	545	92	120	10	3
BW 018-015	540	64	5.8	600	92	120	10	4

Wire wound resistors on ceramic tubes

Braking resistor type	Dimensions [mm] a	b	c	d (Breadth)	e (Depth)	f (Height)	x	Weight [kg]
BW 039-003	226	64	5.8	286	92	120	10	1.5
BW 039-006	426	64	5.8	486	92	120	10	2.2
BW 039-012	426	150	5.8	486	185	120	10	4.3
BW 039-026	530	240	5.8	586	275	120	10	7.5



Steel-grid resistors

80 050 65

Braking resistor type	Dimensions [mm] a	b	c	d (Breadth)	e (Depth)	f (Height)	Weight [kg]
BW 012-025	270	380	10.5	295	490	260	9
BW 012-050	370	380	10.5	395	490	260	12
BW 012-100	570	380	10.5	595	490	260	21
BW 018-035	270	380	10.5	295	490	260	9
BW 018-075	570	380	10.5	595	490	260	21
BW 039-050	370	380	10.5	395	490	260	12
BW 715	270	380	10.5	295	490	260	10
BW 815	370	380	10.5	395	490	260	14
BW 915	770	380	10.5	795	490	260	26

8.2 Mains Input Filters NF...--... (3-phase)

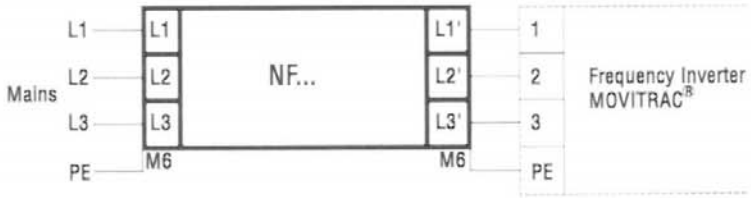
For radio interference suppression of the inverter to radio interference level B (per EN 55011)

The interference suppression symbol has been granted for all MOVITRAC® 3000-403- variable frequency inverters with mains input filters NF... and the appropriate wiring (Radio interference level B per EN 55011).

To maintain the radio interference level B it is necessary to observe the following:

- The leads (twisted, unshielded) between the mains input filter and inverter (input TL. 1 / 2 / 3) must be shortened to the necessary length, the maximum permissible length is 400 mm.
  Install the mains input filter in the vicinity of the inverter, taking into account the free space for ventilation.
- The mains input filter and the inverter must be properly HF-earthed for radio interference suppression. A good prerequisite is a wide-area metal-to-metal surface contact of the inverter chassis with for example, the sheet metal of the switch cabinet.
- Use shielded cable for the motor leads. The shield must be earthed at **both** ends (a wide-area metal-to-metal surface contact with the earth is important).
- Interference-free wiring is only possible with shielded leads (go and return lead in one shield). The shield must be earthed at **both** ends (→ Sec. 2.3).

Connections for NF...



Mains input filters NF...-443 for MOVITRAC® 3...-403-

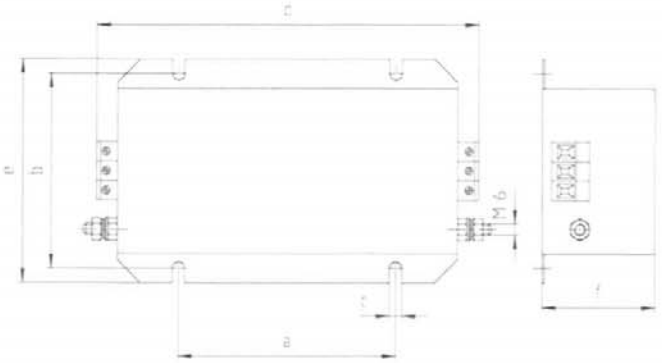
Mains input filter type		NF 008-443	NF 015-443	NF 020-443	NF 035-443	NF 050-443	NF 080-443
Part number		825 721 3	825 719 1	825 718 3	825 717 5	825 716 7	825 830 9
Rated current	I_N	8 A_{AC}	15 A_{AC}	20 A_{AC}	35 A_{AC}	50 A_{AC}	80 A_{AC}
Rated voltage	V_N	3 x 400 V (max. operating voltage = 440 V_{AC})					
Mains frequency	f_{mains}	50 / 60 Hz					
Leakage current at V_N (f_{mains} = 60 Hz) determined under worst-case-conditions		≤ 2 mA	≤ 2 mA	≤ 15 mA	≤ 15 mA	≤ 20 mA	≤ 25 mA
Power loss P_{loss} at I_N		8 W	9 W	9 W	10.5 W	13 W	
Ambient temperature	ϑ_{amb}	–25...+45 °C					
Enclosure		IP 20 (DIN 40 050)					
Connection terminals cross-section		4 mm^2		10 mm^2			
For use with MOVITRAC® 3...-403-.-		3001 / 3002 *)	3003 / 3004 / 3005 *)	3007 *)	3011 / 3015 *)	3022 *)	3030

*) The interference suppression symbol has been granted for these inverters with the appropriate mains filters .

Mains input filters NF...-503 for MOVITRAC® 3...-503-

Mains input filter type Part number		NF 008-503 825 831 7	NF 016-503 825 832 5	NF 025-503 825 833 3	NF036-503 825 834 1	NF 050-503 825 835 X
Rated current	I_N	8 A_{AC}	16 A_{AC}	25 A_{AC}	36 A_{AC}	50 AAC
Rated voltage	V_N	3 x 500 V (max. operating voltage = 550 V_{AC})				
Mains frequency	f_{mains}	50 / 60 Hz				
Leakage current at V_N (f_{mains} = 60 Hz) determined under worst-case conditions		≤ 2 mA	≤ 2 mA	≤ 15 mA	≤ 15 mA	≤ 15 mA
Ambient temperature	ϑ_{amb}	–25 ... +45 °C				
Enclosure		IP 20 (DIN 40 050)				
Connection terminals cross-section		4 mm^2		10 mm^2		
For use with MOVITRAC® 3...-503-.-		3001 / 3002	3003/3004/3005	3007	3011 / 3015	3022 / 3030

Dimensions of mains input filters NF ...-...



80 080 02

Mains input filter type	Dimensions [mm] a	b	c	d	e	f	Earthing stud	Weight [kg]
NF 008-443	115	100	6.5	202	115	60	M6	1.7
NF 016-443	115	135	6.4	222	150	65	M6	3.0
NF 020-443	115	135	6.4	250	150	65	M6	3.0
NF 035-443	115	135	6.4	250	150	65	M6	3.2
NF 050-443	115	135	6.4	250	150	65	M6	3.2
NF 080-443	375	130	15	427	170	90	M10	9.5

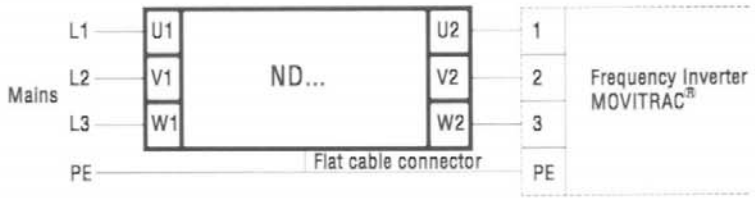
Mains input filter type	Dimensions [mm] a	b	c	d	e	f	Earthing stud	Weight [kg]
NF 008-503	115	100	6.5	202	115	60	M6	1.7
NF 016-503	115	135	6.4	222	150	65	M6	3.0
NF 025-503	115	135	6.4	250	150	65	M6	3.0
NF 036-503	115	135	6.4	250	150	65	M6	3.2
NF 050-503	115	135	6.4	250	150	65	M6	3.2

8.3 Line chokes ND ...-... (3-phase)

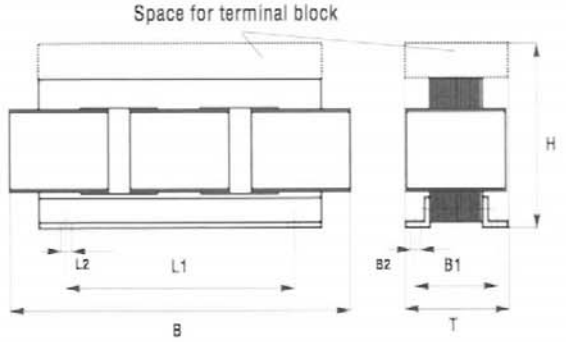
- for limiting mains harmonic pollution
- to increase the overvoltage protection

Line choke types		ND 006-453	ND 010-323	ND 015-203	ND 027-123	ND 035-073	ND 050-053	ND 085-033
Part number		825 768 X	825 769 8	825 770 1	825 771 X	825 772 8	825 787 6	825 799 X
Rated current	I_N	5.5 A_{AC}	10 A_{AC}	15 A_{AC}	27 A_{AC}	35 A_{AC}	50 A_{AC}	85 A_{AC}
Inductance	L_N	4.5 mH	3.2 mH	2.0 mH	1.2 mH	0.7 mH	0.5 mH	0.3 mH
Rated voltage	V_N	3 x 400 V_{AC} / 500 V_{AC} (max. operating voltage = 550 V_{AC})						
Mains freq.	f_{mains}	50 / 60 Hz						
Ambient temp.	ϑ_{amb}	–25 ... + 45 °C						
Enclosure		IP 00 (DIN 40 050)						
Impedance volt.	V_{Imp}	4 % V_N at V_{mains} = 400 V_{AC} / 3 % V_N at V_{mains} = 500 V_{AC}						
For use with MOVITRAC® 3...-...		3001	3002 / 3003	3004 / 3005	3007 / 3011	3015	3022	3030

Connections for ND...



Dimensions of line chokes ND ...-...



Line chokes types	B x H x T (depth) [mm]	L1 x B1 [mm]	Threaded for screws	Weight [kg]
ND 005-453	125 x 85 x 155	81 x 46	M 5	2.5
ND 010-323	125 x 95 x 155	81 x 57	M 5	4.5
ND 015-203	150 x 105 x 190	136 x 67	M 6	5.0
ND 027-123	185 x 140 x 200	136 x 87	M 6	6.0
ND 035-073	185 x 120 x 225	136 x 87	M 6	11
ND 050-053	235 x 130x 260	136 x 87	M 6	12
ND 085-033	235 x 155 x 235	136 x 112	M 6	18

8.4 Output filters HF ...-...

- for reducing the motor noises
- with a number of parallel motor feed cables with group drives for compensation of the cable capacitances
- to reduce EMC interferences caused by the inverter output cable (e.g when lying in parallel with sensitive control leads or with nonshielded motor feed cables).

When using output filters HF...-... the following is to be observed:

- The output filter HF are matched to MOVITRAC® 3000-403- with PWM frequency = 5...16 kHz.
- The leads between inverter (output terminals 4/5/6) and the output filter are to be restricted to the absolute necessary length; the maximum permissible is 500 mm.
  Install the output filter in the vicinity of the appropriate inverter taking into account the free space required for ventilation.

Output filter type	HF004-403	HF006-403	HF008-403	HF010-403	HF012-403	HF016-403	HF023-403	HF033-403	HF047-403
Part number	825 778 7	825 779 5	825 780 9	825 781 7	825 782 5	825 783 3	825 784 1	825 785 X	825 786 8
Rated voltage V_N	3 x 400 V_{AC} / 3 x 500 V_{AC} (max. operating voltage = 550 V_{AC})								
Rated current $I_{N\ 400\ V}$ (at V = 3 x 400 V)	4 A_{AC}	6 A_{AC}	8 A_{AC}	10 A_{AC}	12 A_{AC}	16 A_{AC}	23 A_{AC}	33 A_{AC}	47 A_{AC}
Rated current $I_{N\ 500\ V}$ (at V = 3 x 500 V)	3 A_{AC}	5 A_{AC}	6 A_{AC}	8 A_{AC}	10 A_{AC}	13 A_{AC}	19 A_{AC}	26 A_{AC}	38 A_{AC}
Rated frequency f_N	50 / 60 Hz								
Leakage curr. @ V_N	0 mA								
Power loss P_{loss} (at P_N)	15 W	40 W	43 W	45 W	50 W	65 W	90 W	120 W	200 W
Ambient ϑ_{amb} temperature	–25 ... + 45 °C (reduction: 3 % of I_N per K to max. 60 °C)								
Enclosure	IP 20 (DIN 40 050)								
Terminal cross-section	4 mm^2	10 mm^2					25 mm^2		
For use with MOVITRAC® type	3001 3108/3122	3002 3122	3003 3130	3004	3005	3007	3011	3015/ 3030 *)	3022

Output filter for MOVITRAC® 3...-504-.- on request.

Dimensions of output filter HF ...-...

Output filter	Fig.	Dimensions [mm]						Weight	Ventilation space [mm]		
type	no.	B	H	T (depth)	a	b	c	[kg]	each side	above	below
HF 004-403	1	85	180	290	164	–	6.5	3.7	7.5	100	50
HF 006-403	1	115	260	320	244	70	6.5	9.2	10	120	70
HF 008-403	1	115	260	320	244	70	6.5	9.6	10	120	70
HF 010-403	1	115	260	320	244	70	6.5	9.8	10	120	70
HF 012-403	1	145	290	320	274	100	6.5	10.6	10	150	100
HF 016-403	1	145	290	320	274	100	6.5	12.1	10	150	100
HF 023-403	2	145	284	365	268	60	6.5	15.9	30	150	150
HF 033-403	2	145	284	365	268	60	6.5	16.5	30	150	150
HF 047-403	3	190	300	385	284	80	6.5	23	30	150	150

Dimensions of output filters HF ...-...

Fig. 1

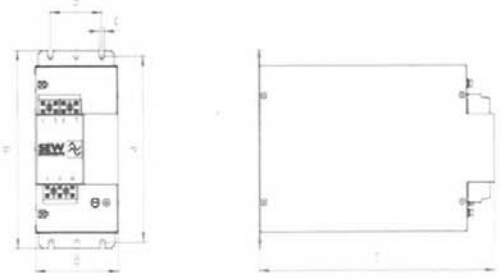


Fig. 2

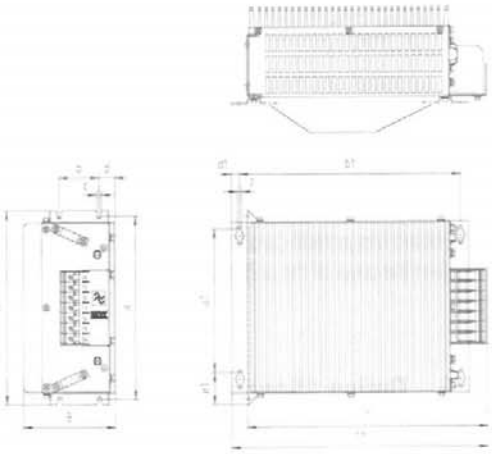
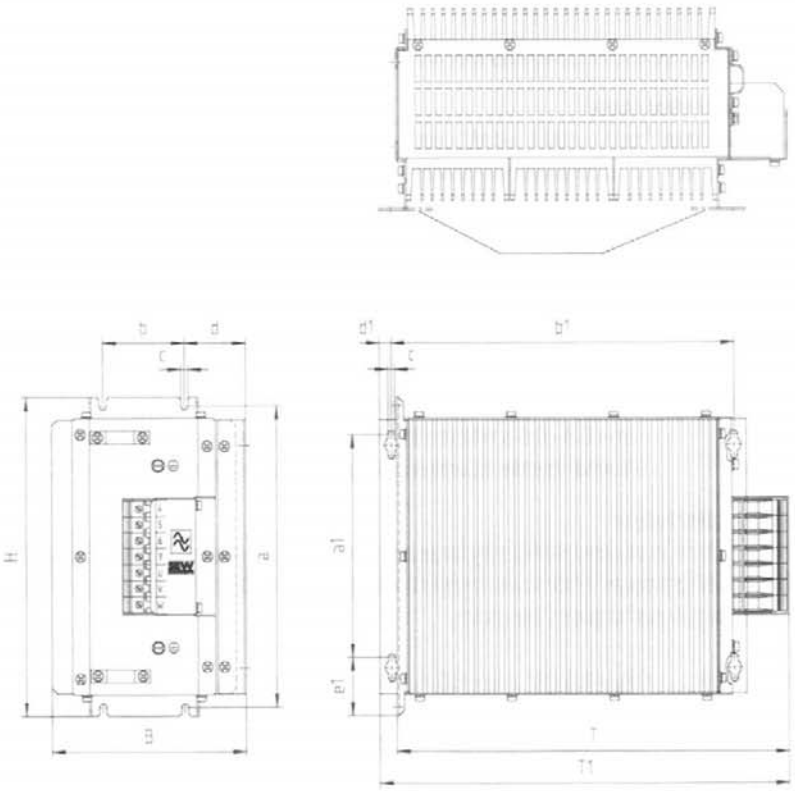


Fig. 3



8.5 Option MELCARD

(Part Number 821 285 6)

The MELCARD option is an EEPROM memory board with a storage capacity of 8 kbyte.
It can store 5 complete parameter sets.
With the "Copy Parameter" function (P 820) it is possible

- to document the parameter settings
- to load the parameter settings into a number of inverters.
  In order to transfer parameters between a number of inverters, the inverter system EPROMs (up to version .13) must have the same part no. and version no. All EPROMS are compatible above version .13 (→ P 820).

The board has a credit-card format, and can be plugged into a socket provided at the expansion slot X5 on the MOVITRAC® 3000 – when the cover of the unit has been removed with the mains off.

8.6 Option "Speed Control" type FRN 12

(Part no. for kit: 821 897 8)

The preconditions for the speed control are:

- The "Speed Controller" FRN 12 option board must be fitted to the inverter
- MOVITRAC® 3000 with the activated function "Speed Control" (P 770-776)
- an incremental encoder (no. of increments 128 / 256 / 512 / 1024 / 2048 – TTL levels) on the motor.

The drive has the following expanded capabilities with the "Speed Control" option:

- **Expanded speed control range**
  - with n_{max} = 1460 min^{-1} to R ≈ 100:1 ≙1460 min^{-1} : 15 min^{-1} (with 1024 encoder increments)
  - with n_{max} > 1460 min^{-1} a correspondingly greater control range.
  Comparison: Inverter drive without closed loop speed control: R 15:1 to 20:1

- **Increased static control accuracy**
  to Δn ≈ 0.3 % referred to n_N and load steps ΔM = 80% M_N
  Comparison: Normal inverter operation with slip compensation: Δn 1 - 3%
  depending on the power, number of poles and operating speed of the motor.

- **Inproved control dynamics**, i.e. settling time with load changes.
  Typical values: Δt ≈ 0.3 - 0.6 s referred to ΔM ≈ 80% M_N also dependent on the drive inertia.
  In comparison: Normal inverter operation with slip compensation: Δt ≈ 0.5 - 2 s.

- **Considerably greater torque**
  With an inverter which is selected sufficiently large and adequatey set slip setting, e.g. 2 x s_N (P 323), the motor can develop operating torques in the lower frequency range, which – if operated directly off the mains, would have exceeded the pull out torque of the motor.

  Example: DT 90 L4 P_N = 1.5 kW I_N = 3.5 A M_N = 10.1 Nm $M_{pull-out}$ = 2.7 · M_N
  Connected to a MOVITRAC® 3003 with speed control, the result is:
  at I = 9.5 A ≙ 2.7 · I_N → M = 37 Nm ≙ 3.7 · M_N

The torque developed, depending on the current of the asynchronous motor, is thereby considerably increased.

The "Speed Controller" FRN 12 option provides:

- 3 input channels for connection of an encoder to measure the speed:
  Channel A and $\overline{A}$; B and $\overline{B}$ = 2 tracks for determining the speed and rotational direction,
  Channel C and $\overline{C}$ = as a "1" signal for complete turns.
  Channel C and $\overline{C}$ are not evaluated by the inverter for the speed control.
- 3 output channels A and $\overline{A}$; B and $\overline{B}$; C and $\overline{C}$ for external control.

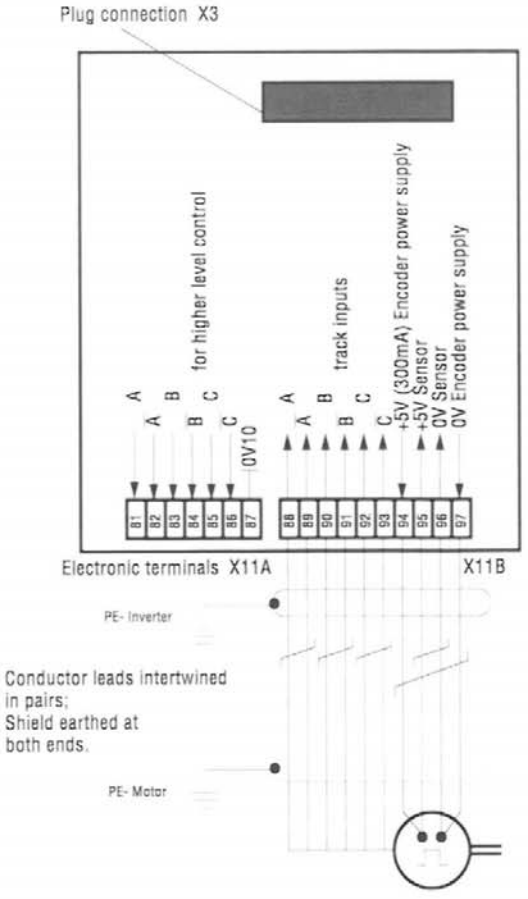
The FRN 12 option board is normally already incorporated in the MOVITRAC® 3000 inverter at the factory. This is indicated by a label next to the nameplate on the inverter.

It is also possible to install the FRN 12 option at a later date. If the inverter menu contains the parameter "Speed Control" P 770 ... 776, then the insatllation can be carried out by the customer, using a kit. In all other cases it will be necessary to consult SEW Electronics Service.

Connection diagram and function assignments of the terminals

When connecting the encoder the following are to be observed:

- The motor must be provided with a suitable encoder (5 V– TTL):
  Incremental encoder with pulse number 128 / 256 / 512 / 1024 / 2048; i.e. exclusively with 2^n increments.
- Shielded leads with twisted cores and with a connection cross-section of at least 0.25 mm^2 are to be used.
- The lead shielding must be earthed at both ends (at the inverter and at the incremental encoder).

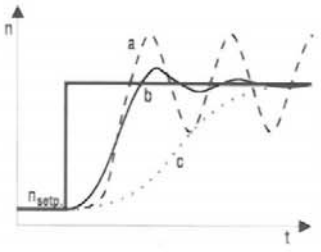


X11:	Option board "Speed controller" FRN 12	
81	Output: channel A	For connection of external controls (5V - TTL, RS 422)
82	Output: channel $\overline{A}$	
83	Output: channel B	
84	Output: channel $\overline{B}$	
85	Output: channel C	
86	Output: channel $\overline{C}$	
87	Reference potential for TL. 81 - 86	
88	Input: channel A	Connection of the encoder: The track sequence A → B means: motor rotates CW (looking at the drive end of the motor shaft, i.e. A leads B when the fan rotates CCW
89	Input: channel $\overline{A}$	
90	Input: channel B	
91	Input: channel $\overline{B}$	
92	Input: channel C	
93	Input: channel $\overline{C}$	
94	Encoder power supply (+5 ... 8 V))	
95	Sensor lead (+5 V)	for voltage sensing at the encoder
96	Ref. potential for TL. 95	
97	Earth reference potential for TL. 94	

80 303 12

Commissioning / Setting of the parameters for MOVITRAC® 3000 with the "Speed Control" function

It is advisable to document the settings which are carried out. The parameter settings can be documented in writing in the parameter list in section 3. The parameters can also be saved from the MOVITRAC® 3000 to the MELCARD option, or stored in a PC by using MC_SHELL software.

Param. Addr.	Menu point	Setting range (factory setting)	Setting and function
770	Speed control	Yes / **No**	"Yes" only effective for parameter set 1
771	P amplification	0.1 ... **0.5** ... 50.0 Δ= 0.1 *usual range of values:* 0.5 ... 4	PI controller for setting of the speed control dependent on the inertia: If the factory setting or the setting in the usual range of values does not result in satisfactory operating behaviour, then proceed as follows: 1. Set ramp generator t11 to the minimum permissible value. 2. Enable = "1", i.e. the drive rotates. 3. Set P 772 "time constant" ≥ 200 ms. 4. Slowly increase P 771 "P amplification", until the drive speed starts to oscillate. 5. Reduce P 771 again, until the drive speed just stops oscillating. Run through the speed range to test the stability of the drive. 6. P 772 reduce again in steps. Enter a setpoint step-change and check that the speed does not start to oscillate again. With the correct setting, the speed levels off to $n_{setpoint}$ after only 1-2 overshoots. a) P 771 too large / P 772 too small b) Setting correct c) P771 too small / P772 too large 
772	Controller time constant	1 ... **10** ... 500 msΔ = 1 ms *usual range of values:* 5 ... 20 ms	
773	Encoder increments	128 / 256 / 512 / **1024** / 2048	Encoder increment per track and rotation
774	s x R - preselection	Yes / **No**	The speed control uses P 322 "I x R" as "s x R". The automatic adjustment of P 322 is triggered by P 774 = "Yes" while with the inverter is inhibited. If P 774 is not used, then P 322 must be set manually.
775	Brake function	Yes / **No**	Replaces P 780 "Zero point stop function". Can be activated with bipolar setpoint n2 (10 ... +10 V): effects brake application at setpoint ≤ +40 mV or ≤ -40 mV.
776	Starting setpoint	80 ... **200** ... 500 mV Δ = 10 mV	Only effective if P 775 "Brake function" = "Yes". Indicates the setpoint threshold at which the brake releases. The brake is applied without delay at ± 40 mV.
004	Speed display		Derived from the encoder signals (= actual value) divided by the no. of motor pole-pairs (P324 / 344). Accuracy: 2-pole motor: ± 1 min^{-1} 4-pole motor: ± 2min^{-1} (rounded up from 1.5) 6-pole motor: ± 3min^{-1}
260	Start / Stop frequency	0.5 ... **2.0** ... 5.0 Hz *usual range of values:* 0.5 ... 1.5 Hz	Only effective,if P 775 "Brake function" = "No"
321	Boost 1	**0** ... 100 % Δ = 1%	100 % = 1.5 times weighting of the value of P 322 "s x R" in the range f_{outp} = 0 ... 10 Hz (i.e. ineffective above f_{outp} = 10 Hz)

Param. Addr.	Menu point	Setting range (factory setting)		Setting and function
322	I x R 1	**0** ... 100 %	Δ = 1%	Acts with the speed control as "s x R" (slip controlled instead of current controlled) With P 774 = "Yes" automatic adjustment follows. The value can, however, also be changed manually after the automatic adjustment. V_{outp} increase with s_N: 100 % ≡ 63 V
323	Slip 1	**0** ... 10 Hz	Δ = 0.05 Hz	At least the rated slip of the connected motor, as described in P 323.
324	Pole pair number 1	1 ... **2** ... 6	Δ = 1	Pole pair number of connected motor: 2-pole = "1" / 4-pole = "2"
510	Speed monitoring 1	Yes / **No**		**Setting "Yes"** → for encoder increment monitoring, → for recognizing motor overload
511	Response time 1	**0.1** ... 9 s	Δ = 1	Combined with P 510 **Note:** The acceleration and overload time must also be considered here.
520	Regen. monitoring 1	Yes/**No**	Δ = 0.1 s	**Setting "Yes"** → for recognizing regenerative overload
521	Regenerative time 1	**0.1** ... 9 s	Δ = 0.1 s	Combined with P 520
710	Hoist function			The hoist function does **not** have to be activated for hoists which have a speed control, however, the notes on commissioning must be observed.

Note:

If the number of encoder increments is set too low (P 773) or the no. of pole pairs is set too large (P 324), then the drive will run up uncontrolled to f_{max} after activating the enable!

The faults no. 5 "REGEN.OVERLOAD" or no. 12 "MOT.OVERLOAD", which lead to immediate switch-off, will only be recognized if the speed monitoring 1 (P 510) and regenerative monitoring 1 (P 520) are switched on. If P 510 and P 520 are not activated, then the drive can only be switched off by using the emergency stop!

Exception: If one of the programmable binary inputs (P 600-606 / TL.42-51) has been assigned to "controller inhibit", then the drive can also be switched off by a "0" signal = Controller inhibit.

Technical Data

Option board type		**Speed controller FRN 12**
Part number		821 272 4
Power supply for encoder	TL. 94+ / 97 (0V)	+ 5 V (up to max. V_{max} = 8 V) / I_{max} = 300 mA
Sensor control	TL.95+ / 96 (0V)	For voltage sensing and readjustment of the 5 V at the encoder input
Increment inputs A/$\overline{A}$, B/$\overline{B}$, C/$\overline{C}$	TL. 88-93	+ 5 V, TTL level (RS 422)
Increment outputs A/$\overline{A}$, B/$\overline{B}$, C/$\overline{C}$	TL. 81-86	+ 5 V, TTL level (RS 422)
Encoder increments per track and revolution		128 / 256 / 512 / 1024 / 2048 (preferred no. of increments 1024)
Limit frequency of the inputs		f_{limit} = 200 kHz
Limit speed,with reference to f_{limit}		with 2048 increments: 6000 1/min , with 1024 increments: 12000 1/min
Control range referred to f_{max} (with encoder increments 1024)		f_{max} = 53 Hz (50 Hz + 3 Hz slip reserve) R = 100 : 1 f_{max} = 90 Hz (87 Hz + 3 Hz slip reserve) R = 170 : 1 f_{max} = 120 Hz R = 240 : 1
Dimensions B x H x D		100 x 160 x 20 mm

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8.7 Option "Synchronous Operation" FRS 11

(Part number FRS 11: 821 646 0)

MOVITRAC® 3000 inverters which have a built-in "Synchronous Operation" option FRS 11 are labelled as MOVITRAC® 3000-...-4-**06**

With the "Synchronous Operation" function a group of asynchronous motors (master and slaves) can be operated in angular synchronization to one another or in an adjustable proportional relationship.

The following applications can be solved:

- **Synchronous start, operation and stop** of a master and 2 to 10 slave drives
- **Proportional operation** (= adjustable synchronous relationship) of 2 drives or a train of drives in a settable relationship other than 1 : 1 (electronic gearing)
- **Intermittent synchronous operation** of a continuously operating and an intermittently operating drive
- **Synchronous operation with an adjustable angular displacement** of the slave - effective either continuously or for a short duration
- **Temporary free-running**, without differential counting during the free-running operation, for the optional type of operation "No Synchronous Operation" (e.g. during set-up of master and slave).

The basis for the synchronous operation function is the angular position comparison of the master and slave motors using an encoder. The reaction of the slave to the input from the master can be adjusted to suit the application by means of the parameter menu .

The prerequisites for the synchronous operation are:

- A master drive with the FRS 11 "Synchronous Operation" option or the FRN 12 "Speed Controller" option
- One or more slave drives with the option FRS 11 "Synchronous Operation"
- Active function: "Synchronous Operation" (P 550 ff, P 760 ff) on the slave MOVITRAC® 3000
- Master and slave motors with incremental encoders with the same no. of pulses/turn (128 / 256 / 1024 / 2048 / TTL technology).

The FRS 12 option board contains all the terminals required for synchronous operation:

- For the encoder connection,
- For the logic connection of the master and slave inverters
- And for the free-run / synchronous commands.

The board measures 160 mm x 100 mm and is integrated into the inverter, next to the operating panel.
The "Interface for Interbus-S", type FFB 11 option board, cannot be used at the same time as the "Synchronous Operation" function.

Further information may be found in the publication "System Description / Operating Instructions" for the option "Synchronous Operation" FRS 11.

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8.8 Option "Interface for Interbus-S " FFB 11

Part Number:
Kit for size I: 821 435 2
Kit for size II: 821 436 0
Kit for size III: 821 437 9
(The kits contain various front plates for the individual inverter sizes)

The option board FFB 11 provides the MOVITRAC® 3000 series with field bus capability by serving as an interface to Interbus-S. The communication between the higher level controller (e.g. PLC) and the inverter (= "actuator") as well as further actuators and sensors is carried out via an universal field bus, the Interbus-S which is not proprietary to any manufacturer.

The communication includes:

- Binary commands for the inverter (e.g. clockwise; counterclockwise; ramp generator change- over)
- Real-time binary signal capability from the inverter (e.g: signals / diagnosis)
- Setpoint signals to the inverter
- Analogue signals from the inverter
- Setting of the inverter parameters

8.9 Software MC_SHELL

(Order number 09212000)

MOVITRAC® 3000 can be connected to a PC via the RS 232 or RS 485 interfaces.
A special software package – MC_SHELL – is available for setting the parameters or operating the MOVITRAC® 3000 via a PC.
This can be obtained as a 3 1/2" diskette, free of charge, as an accessory to the MOVITRAC® 3000.

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