English

Original instructions

SERVICE MANUAL FOR TRAVELING INVERTER

Service Manual for DMCS 022F

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R&M MATERIALS HANDLING INC.

SUPDOC_SM_DMCS0550100-0 PS02379 25.3.2010

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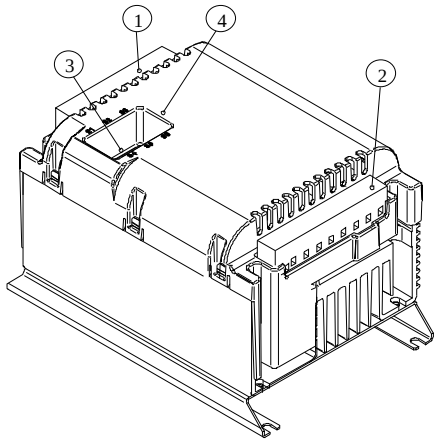
1 DESCRIPTION OF THE INVERTER

There are high voltages inside the inverter (including the programming switches). Wait for at least three minutes after the supply voltage has been switched off before any service actions.

1.Control terminal X1
2.Power terminal X2
3.Programming switches
4.Leds



1.1 Connections

Control signals are connected to terminal block X1 as follows:

Nbr	Name	Description
1	S1	Drive command. Direction 1. 48 or 115V 50/60Hz
2	S2	Drive command. Direction 2. 48 or 115V 50/60Hz
3	DI3	Digital input. 48 or 115V 50/60Hz.
4	DI4	Digital input. 48 or 115V 50/60Hz.
5	DI5	Digital input. 48 or 115V 50/60Hz.
6	ONE	Control voltage, neutral.
7	R01	Relay output
8	R02	Relay output
9		Empty
10	T1	Motor thermistor
11	T2	Motor thermistor

Power cabling is connected to terminal block X2 as follows:

Crane power supply conductor rail must have double collectors.

Nbr	Name	Description
1	L1	Mains, phase 1. 380-480V 50/60Hz.
2	L2	Mains, phase 2. 380-480V 50/60Hz.
3	L3	Mains, phase 3. 380-480V 50/60Hz.
4	U	Motor, phase 1.
5	V	Motor, phase 2.
6	W	Motor, phase 3.
7	R+	Braking resistor, positive, see note
8	R-	Braking resistor, negative, see note
9	PE	Protective earth

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Standard duty resistor must be disconnected when heavy duty resistor DMHR01F90 is connected to terminals R+ and R–.

1.2 Technical characteristics

Technical data	
Power range	2.2 kW
Supply voltage	380 - 480 VAC +/-10%
Nominal supply frequency	48 – 62 Hz
Nominal current	5.1A
Digital control	S1, S2, DI3, DI4, DI5
Max output voltage	Equal to supply voltage
Control voltage range	48 VAC/115 +/- 10%. If control voltage is 230VAC, front resistors (15k,2W) have to be connected to digital inputs
Output	Relay output for brake contactor
Ambient temperature	-10°C to 50°C
Humidity	95% N.C. (without dripping)
Degree of protection	Frequency converter + cover (IP20)
Dimensions (WxHxD)	134x195x123mm
Altitude	Output current must be reduced 1 % for every 100 m over 1000 m. For altitudes over 3000 m, manufacturer must be consulted.
Pollution degree	Pollution degree 2 according to NEMA ICS-1, IEC664 and UL840
Vibration	IEC68-2-6
Shock	IEC68-2-27

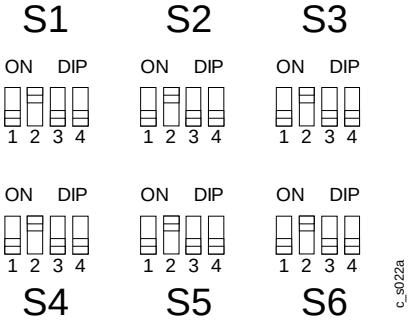
1.3 Normal operation

The inverter goes into the ready-to-run state within one second after the power supply is connected. During running the inverter follows the operator's speed reference according to the set acceleration/deceleration ramp. During direction change the brake is kept open all the time. When drive command is switched off the inverter decelerates to zero according to the set ramp and closes the mechanical brake.

1.4 Status indication leds (green and red)

The inverter indicates its operating state by two leds. Red led indicates "fault state" (driving is inhibited). Green led indicates "ok-state". Blinking of green led indicates that fault state has been active, but it has been recovered. Normal driving is however possible also when green led is blinking (in other words, blinking of green led does not indicate "warning-state").

1.5 Programming switches



The programming of the inverter is performed by dip-switches. The state of each switch is either OFF (0) or ON (1). It is possible to set he following parameters by the switches S1-S6.

- S1 = Maximum speed
- S2 = Minimimum speed
- S3 = Acceleration / deceleration time

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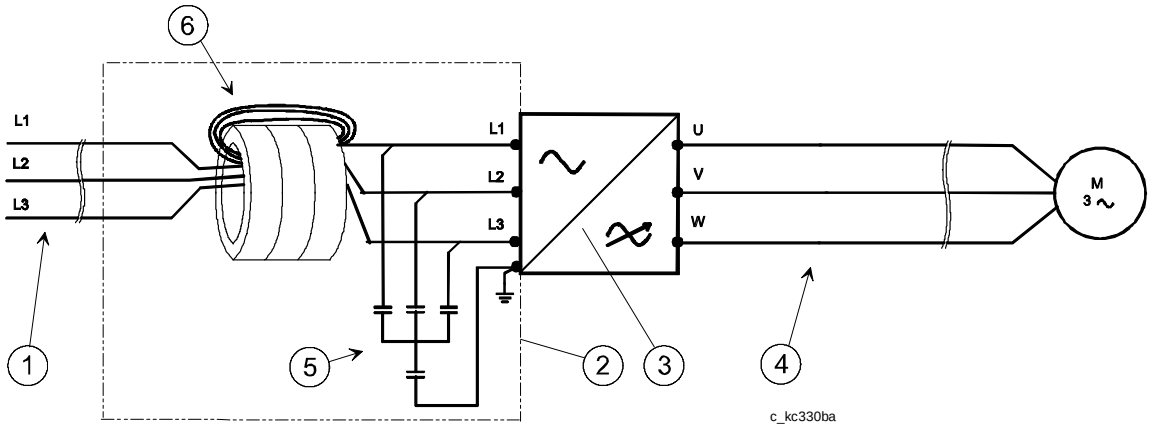
- S4 = Motor frequency and IR-compensation
- S5 = Motor current, fast deceleration, stopping method
- S6 = Control mode, slowdown speed, speed2, speed3

1.6 The EMC requirements (Not in use for deliveries in USA/Canada)

The device complies with the requirements of EN61800-3:2004 (IEC61800-3) for second environment, category C3, when a dedicated external EMC filter is applied.

1.6.1 EMC filter connection to inverter for trolley travelling.

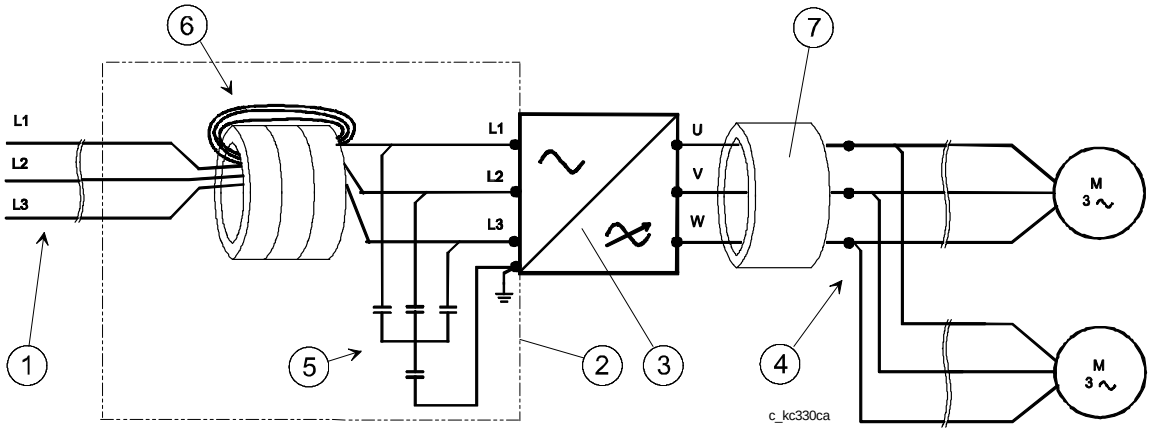


1. Supply
2. EMC filter KC-330-00
3. Inverter
4. Motor cable length max 3 m
5. 4 x 1 µF
6. Input wires two times through input ferrite rings.

KC-330-00 includes capacitors (4*1µF) and input ferrite rings (3 x EF 32008).

☞ Ferrite rings and capacitors must be placed as near the inverter as possible.

1.6.2 EMC filter connection to inverter for bridge travelling.



1. Supply
2. EMC filter KC-330-00
3. Inverter
4. Motor cable length max 1 m + 25 m
5. 4 x 1 µF
6. Input wires two times through input ferrite rings.
7. Output ferrite ring RH175285107

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KC-330-00 includes capacitors (4*1µF) and input ferrite rings (3 x EF 32008).

☞ Ferrite rings and capacitors must be placed as near the inverter as possible.

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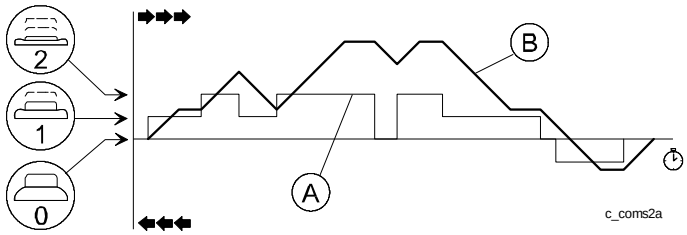
2 DESCRIPTION OF CONTROL MODES

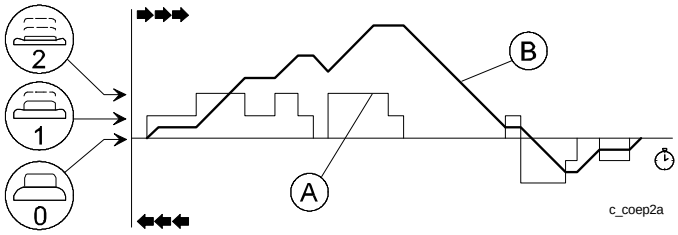
2.1 MS2-control (S6-1=OFF & S6-2=OFF)



A. Pushbutton position
B. Speed

- S1 means “drive minimum speed forward”
- S2 means “drive minimum speed reverse”
- HSP means “maximum speed”
- When S1 and S2 or are not active the inverter decelerates to zero

2.2 EP2-control (S6-1=ON & S6-2=OFF)



0. Decelerate
1. Maintain speed
2. Accelerate
A. Pushbutton position
B. Speed

- S1 means “drive forward”
- S2 means “drive reverse”
- AP means “accelerate”
- When starting, S1 and S2 mean “accelerate to minimum speed”
- When S1 and S2 are not active the inverter decelerates to zero
- During running S1 and S2 mean “hold speed”
- At maximum speed AP means “hold speed”

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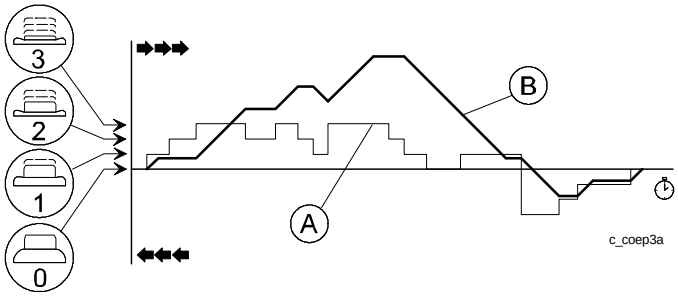
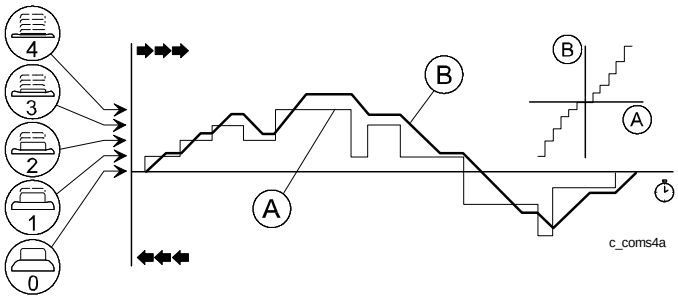
2.3 EP3-control (S6-1=OFF & S6-2=ON)



0. Decelerate
1. Minimum speed
2. Maintain speed
3. Accelerate
A. Pushbutton position
B. Speed

- S1 means “drive minimum speed forward”
- S2 means “drive minimum speed reverse”
- AP means “accelerate”
- HOLD means “hold speed”
- When S1 and S2 are not active the inverter decelerates to zero
- At maximum speed AP means “hold speed”

2.4 MS4-control (S6-1=ON & S6-2=ON)



A. Pushbutton position
B. Speed

- S1 means “drive minimum speed forward”
- S2 means “drive minimum speed reverse”
- SP2 means “drive speed2”
- SP3 means “drive speed3”
- HSP means “drive maximum speed”
- When S1 and S2 are not active the inverter decelerates to zero
- The “highest” active input sets the speed reference (i.e. if HSP is active SP2 and SP3 are ignored. If SP3 is active SP2 is ignored)

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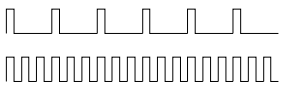
3 FAULT CODES, TROUBLESHOOTING

There are high voltages inside the inverter (including the programming switches). Wait for at least three minutes after the supply voltage has been switched off before any service actions.

When the inverter detects a fault situation it stops running and starts signalling the fault code by blinking the indication leds (green and red). The blinking of the code is carried on until a new fault occurs or until power is switched off. The fault codes are explained in the table below.

Fault code, color		Fault. Possible cause. Checkings.
Green		**Overvoltage.** Mains voltage is too high or deceleration ramp time is too short. Check the voltage of all supply phases at the terminal X2. If they are ok, set a longer ramp by switch S3 (and S5-3).
Green		**Stall supervision / overcurrent.** Brake does not open properly or there is an obstackle on the track. Check also the motor dependent parameters.
Green		**Deceleration ramp supervision.** Deceleration ramp has not been followed. If the fault occurs again set longer ramp time by switch S3. Check also the setting of the motor nominal current (switch S5).
Green		**Motor overtemperature.** Check the type and the loading of the motor. If there is no sensor in the motor the inverter terminals X1:10-11 must be short circuited.
Green		**Inverter overtemperature.** Motor current is too high (bearing problem, obstacle on the track, brake does not open properly,…) or the ambient temperature is too high.
Green		**Undervoltage.** Check the voltage of all supply phases at the terminal X2.
Red		**Short circuit.** Switch the power off. Check the insulation of the motor cables and the motor windings.
Red		**Microprosessor fault.** Switch the power off for 10 seconds. Then power-up the inverter.

The latest active fault is removed from the memory always when power is switched off.

If inverter is not in a fault state, but driving is not possible:

- Motor will not start if dc-bus voltage too high (above 745V), this occurs if any of line-to-line voltages exceeds 480V+10% = 528V
  If line voltage cannot be reduced, install drop-down transformer
- Check the supply voltage phases at terminal X2.
- Check the drive command signal at terminal X1.
- Check the limit-switch signals at terminal X1.
- Check that the control voltage level is correct. Rating plate is located on the left side of the inverter.
- Check all parameters, especially the motor dependent parameters.
- Check that the motor(s) corresponds the selected motor parameters.
- Check that the brake opens and closes properly. Check the brake airgap if necessary.

Inverter starts and opens the brake, but motor does not rotate. Check motor current parameter.

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1 PROGRAMMING OF THE APPLICATION PARAMETERS

⚠ Check that he wiring and the mechanical performance of the machinery is suitable for the selected application parameters.

3.1 Minimum speed, maximum speed and ramp time

The adjustment ranges of maximum and minimum speed depend on the selected motor nominal frequency. Table A is for 100 and 120Hz motors, Table B for 80Hz motors and Table C for 50 and 60Hz motors. Maximum speed is set by the four switches of the switch-package **S1** and minimum frequency by the four switches of the switch-package **S2**.

Switch S1 / S2				**Table A (100/120Hz motors)**		**Table B (80Hz motors)**		**Table C (50/60Hz motors)**	
-1	**-2**	**-3**	**-4**	**Max speed (Hz)**	**Min speed (Hz)**	**Max speed (Hz)**	**Min speed (Hz)**	**Max speed (Hz)**	**Min speed (Hz)**
0	0	0	1	50	14	42	14	25	7
0	0	1	1	54	10	40	10	27	5
0	1	0	1	58	12	44	12	29	6
0	0	1	0	62	23	50	18	31	12
0	1	1	0	66	16	46	16	33	8
0	1	1	1	70	18	48	20	35	9
1	0	0	1	75	20	53	24	38	10
0	1	0	0	80	32	62	30	40	16
1	0	1	0	85	26	56	26	43	13
1	0	1	1	90	35	59	28	45	18
1	1	0	0	95	38	65	32	48	19
0	0	0	0	100	29	77	22	50	15
1	1	0	1	105 [1)]	41	68	34	53 [2)]	21
1	1	1	0	110 [1)]	44	71	36	55 [2)]	22
1	0	0	0	115 [1)]	50	80	40	58 [2)]	25
1	1	1	1	120 [1)]	47	74	38	60 [2)]	24

1) 100Hz may be exceeded only if line voltage is 440-480V mains.
2) 50Hz may be exceeded only if line voltage is 440-480V mains.

3.1.1 Example of parameter setting

80Hz motor is connected to the inverter and 62Hz maximum speed is desired. That speed is located on the 5th row in the speed table B. The corresponding setting for S1 swithces is in the same row in the leftmost columns of the table: 0-1-0-0 (off-on-off-off).

S1

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3.1.2 Acceleration and deceleration ramp

Acceleration and deceleration ramps are set by switch S3 as follows:

Switch S3				Ramp time (sec)
-1	-2	-3	-4	
1	0	0	0	1.5
0	1	0	0	2.0
0	0	0	0	2.5
0	0	1	0	3.0
0	0	0	1	3.5
1	0	0	1	4.0
1	1	0	0	4.5
0	0	1	1	5.0
1	1	1	0	5.5
1	1	0	1	6.0
1	0	1	1	6.5
1	0	1	0	7.0
0	1	1	1	7.5
0	1	0	1	8.0

It is possible to reduce the deceleration ramp time by 30% if necessary. The fast deceleration ramp is activated by switching S5-3 ON (1).

3.1.3 Example of parameter setting:

Acceleration/deceleration time of 3 seconds is selected by setting switch S3=0-0-1-0.
Fast deceleration (3sec is reduced to 2.1sec) is activated by switch S5-3=1.

3.2 Stopping method

The motor can be stopped either by dynamic braking (=by a ramp) or by mechanical brake. When stopping by mechanical brake is selected and drive command is switched off the inverter immediately cuts off the motor current and opens the relay contact. The stopping method is selected by switch S5-4 as follows:

- S5-4 = 0 Stopping by a ramp
- S5-4 = 1 Immediate stopping by mechanical brake

3.3 Control mode

There are four different control modes available. The inverter operation in different control modes is explained in section 4. The control mode is selected by switches S6-1 and S6-2 according to the table below.

Control mode	S6-1	S6-2
MS2	0	0
EP2	1	0
EP3	0	1
MS4	1	1

The functions of all five digital inputs is assigned automatically according to the selected control mode:

	MS2	EP2	EP3	MS4
DI1	S1	S1	S1	S1

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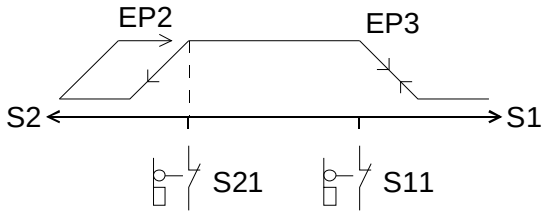
	MS2	EP2	EP3	MS4
DI2	S2	S2	S2	S2
DI3	HSP	AP	HOLD	SP2
DI4	S12	S11	AP	SP3
DI5	S22	S21	S11/S21	HSP

Description of the control signals:

S1	Drive command forward
AP	Acceleration command
S11	Slowdown limit forward
S12	Stop-limit forward
SP2	Speed2
HSP	High speed
S2	Drive command reverse
HOLD	Hold speed command
S21	Slowdown limit reverse
S22	Stop-limit reverse
SP3	Speed3

3.4 Slowdown speed



Slowdown frequency is activated in EP2 and EP3 control modes when the slowdown limit circuit is opened. In EP2 there are separate inputs for both limit switch, therefore it is possible to drive high speed in the slowdown area in the safe direction. In EP3 there is only one input and therefore the speed is limited in both directions in the slowdown area. There are two alternatives for the level of slowdown speed which are selected by switch S6-3 as follows:

- S6-3 = 0 Slowdown speed is 20% of the maximum speed (set by switch S1)
- S6-3 = 1 Slowdown speed is 35% of the maximum speed (set by switch S1)

3.5 Speed2 and Speed3

In MS4-control mode the lowest speed level is set by switch S2 and the highest level by switch S1. There are two alternative settings for the speed2 and speed3, which are set as a percentage of the maximum speed by switch S6-3 as follows:

- S6-3 = 0 Speed2 is 20% of maximum speed and speed3 is 40% of maximum
- S6-3 = 1 Speed2 is 30% of maximum speed and speed3 is 50% of maximum

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2 PROGRAMMING OF THE MOTOR PARAMETERS

The motor parameters are set by switches S4 and S5 according to the following table. Only the most common motor types are shown in the table. Settings for other motors can be defined when motor nominal frequency, voltage, current and the IR-rate are known.

Motor type	Nominal voltage and frequency	S4 settings	S5 settings		
			Number of motors		
			1	2	4
MF06MA200	400V 100Hz 460V 120Hz	0	00xx	10xx	11xx
MF06MA100	400V 80Hz	1010	10xx	11xx	-
MF06LA200	400V 100Hz 460V 120Hz	10	10xx	11xx	-
MF06LA100	400V 80Hz	1001	10xx	11xx	-
MF06LB200	400V 100Hz 460V 120Hz	10	01xx	-	-
MF06LB100	400V 80Hz	1011	01xx	-	-
MF07LA200	380-415V 50Hz 460-480V 60Hz	100	00xx	10xx	11xx
MF07LA100	380-415V 50Hz 460-480V 60Hz	101	00xx	10xx	11xx
MF07LB200	380-415V 50Hz 460-480V 60Hz	100	00xx	01xx	-
MF07LB100	380-415V 50Hz 460-480V 60Hz	101	00xx	10xx	11xx
MF07ZC200	380-415V 50Hz 460-480V 60Hz	110	10xx	11xx	-
MF07ZC100	380-415V 50Hz 460-480V 60Hz	111	10xx	11xx	-
MF09LA200	380-415V 50Hz 460-480V 60Hz	110	11xx	-	-
MF09LA100	380-415V 50Hz 460-480V 60Hz	111	01xx	11xx	-
MF09LB200	380-415V 50Hz 460-480V 60Hz	101	11xx	-	-
MF09LB100	380-415V 50Hz 460-480V 60Hz	111	11xx	-	-

3.6 Defining the motor parameters

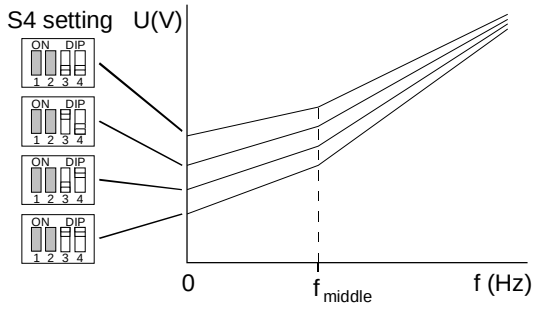
3.6.1 Motor nominal voltage and frequency

Motor nominal voltage and frequency are selected by switches S4-1 and S4-2 according to the following table:

Motor nominal		S4-1	S4-2	Speedtable
Voltage	Frequency			
400V 460V	100Hz 120Hz	0	0	A
400V	80Hz	1	0	B
380-415V 440-480V	50Hz 60Hz	0	1	C

3.6.2 IR-compensation

By the IR-compensation the effect of the stator resistance at low frequencies is compensated by increasing the U/f-ratio. Typically the necessary amount of compensation (added voltage) is higher for small motors. The IR-compensation is set by switches S4-3 and S4-4. Estimation of the correct setting of IR-compensation is made by calculating the IR-rate of the motor.



Calculation of the IR-rate:

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$$\text{IR-rate} = I_{NOM} * R_S * p * n$$

I_{NOM}	Nominal current of the motor (one motor)
R_S	Stator resistance, measured between inverter terminals X2:4-5
P	Number of polepairs
N	Number of motors connected to inverter

Settings:

IR-rate	Setting of S4
90 -	S4-3 = 0 ; S4-4 = 0
60 - 89	S4-3 = 1 ; S4-4 = 0
40 - 59	S4-3 = 0 ; S4-4 = 1
- 37	S4-3 = 1 ; S4-4 = 1

For conical brake motors it is recommended to set the IR-compensation one step higher than the IR-rate indicates. The reliable operation of the brake must be verified during start-up.

3.6.3 Motor nominal current

Motor nominal current is set by switches S5-1 and S5-2 as follows:

- Check the nominal current of the motor from the rating plate
- Calculate the total current by multiplying the current by the number of the motors
- Select the settings according to the table below

$I_{NOM,TOTAL}$	S5-1	S5-2
0…1.8A	0	0
1.9A…2.7A	1	0
2.8A…3.5A	0	1
>3.5A	1	1

For example: there are two 1.5A motors ⇒ Setting is S5-1=0 and S5-2=1.