### English

Original instructions



# **INSTALLATION INSTRUCTION**

DMCS007 Upgrade Kit: STD

012451en / Revision A

2012-05-30





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### 1 INTRODUCTION

### 1.1 About this manual

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This manual offers guidance to the installation and start-up tasks of DMCS007 frequency converter replacement.

As a maintenance technician, taking the time to read this manual will help you easily adopt the replacement procedures. Note that this manual is not intended as a substitute for proper training.



Please read through these instructions and make yourself familiar with all the steps before proceeding.

### 1.2 About the DMCS007 upgrade kit usage

This upgrade package is designed only for DMCS007 frequency converters mounted on a wire rope hoist crane. It is not designed for chain hoist applications or the TMU. There is a different replacement kit available for the chain hoist application.



Parameters for the new TMK003 frequency converter have NOT BEEN SET UP at the factory. Please make sure that you SET UP the DIP switches according the following instructions before start-up.

### 1.3 Waste treatment and recycling of removed material 012457

The removed parts and packaging material shall be recycled according to local regulations. We recommend recycling the frequency converter's aluminum heat sink separately.



## 2 SAFETY

## 2.1 Before starting to work at the site

Before starting any work on the crane:

- Familiarize yourself with the equipment and its user instructions.
- Find out the location of the main switch and the emergency stop buttons.
- Evaluate the risks of the site and try to minimize them.
- Inform the site responsible that you will be working on the crane.
- Restrict access to the working area, if possible.
- Prevent unintentional use of the crane.
- Ensure that you have all the appropriate personal protection equipment. Use them as required.
- Follow the fall protection procedures. Konecranes rules require that fall protection be used at all times when working at heights, even if not required by local regulations.

### 2.2 Main switch and emergency stop buttons

Lock and tag the main switch when you need to switch it off during your work.

## **A WARNING**

Be aware of the main isolation switch functionality. Even though one switch is turned off, there may still be voltage in some

parts of the product.

### 2.3 After working at the site

Ensure that you leave the site in a safe condition:

- Ensure that the work area is clean.
- · Remove any locks/tags from switches.
- Ensure that the crane functions normally.
- Inform the site responsible that you have finished the work.

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#### 3 **DESCRIPTION OF THE UPGRADE KIT**

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#### 3.1 Parts included in the kit



Part	Name	Qty.	Image
Part 1	Frequency converter	1 pcs	
Part 2	Mounting rack	1 pcs	
Part 3	Terminal block	1 pcs	
Part 4	Wire harness	1 pcs	
Part 5	Installation accessory	1 pcs	5



### WIRE HARNESS



### INSTALLATION ACCESSORY





### FIXING SET

Part	Name	Qty.	Note	Image
Part 20	Allen key 2.5 mm	1 pcs		(21) (23) (24)
Part 21	Wire end ferrule	5 pcs		
Part 22	Vibration damper	5 pcs		20 (25)
Part 23	Self-locking hexagon nut	5 pcs	1 pcs for spare	26 
Part 24	Screw M5x6	1 pcs	for mounting rail screw change	
Part 25	Thick washer M5	1 pcs	for mounting rail screw change	22 29 28
Part 26	Sesco washer M5	1 pcs	for mounting rail screw change	•
Part 27	Allen screw M4x10	1 pcs	for spare	
Part 28	Allen screw M4x6	1 pcs	for spare	
Part 29	Lock washer M4	1 pcs	for spare	

### 3.2 Required tools

#### Item Name Image No Screwdriver, flathead 5.5 x 1.0 mm 1 5 2 Screwdriver, flathead 3.5 x 0.6 mm 3 Screwdriver, Phillips No. 2 (PH2) 4 Socket wrench, 8 mm 5 Wire cutters 6 Wire strippers 7 Crimping tool for wire end ferrules 3 6



## 3.3 Terminal connections

The following table describes the differences between the terminals of DMCS007 and TMK003.

Description of Terminal	DMCS007 Terminal X1	TMK003 Power terminals
Protective earth	1	PE
Power supply, phase 1	2	L1
Power supply, phase 2	3	L2
Power supply, phase 3	4	L3
Motor supply, phase 1	5	U
Motor supply, phase 2	6	V
Motor supply, phase 3	7	W
		Control board terminals
Drive command, direction 1	8	1
Drive command, direction 2	9	2
Speed 2 / Acceleration command	10	3
Control voltage, common	11	7



Terminals 4, 5 and 6 in TMK003 control board are not used.

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## 3.4 DIP switches

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DMCS007 has 4 groups of DIP switches (S1-S4), whereas TMK003 has 10 groups of DIP switches (S1-S10).

The correct DIP switch settings for TMK003 can be found in Chapter 5: "Commissioning".

	DMCS007	ТМК003		
Switch Description		Description	Switch	
	$ \begin{array}{c} \hline \\ \hline $	$\begin{array}{c ccccccccccccccccccccccccccccccccccc$		
S1	Maximum driving frequency	Maximum driving frequency	S1	
S2	Minimum driving frequency	Minimum driving frequency	S2	
S3	Acceleration and deceleration ramp times	Acceleration and deceleration ramp times	S3	
S4	Control mode and motor type	Control method and slowdown mode	S4	
		Limit operations	S5	
		Voltage at low frequencies (U/f curve)	S6	
		Current limit	S7	
		Start and stop current	S8	
		Motor nominal frequency	S9	
		Terminal DI6 operation	S10	



## 3.5 EMC

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DMCS007 has an external EMC filter package (KC310 / KC330), whereas TMK003 has an internal EMC filter in the power supply. By default, the EMC level of the frequency converter is set to N by the manufacturer.

If the mains network is non-grounded (IT-network), the TMK003 frequency converter's EMC level must be changed to 0 by removing the filter capacitor disconnection screw.

### CHECK the original electrical drawings to find out the type of the supply network.





## 4 INSTALLATION

4.1 Preparations

Before you start, be sure to take into account the following matters:

- If the crane is drivable, check the trolley/bridge driving directions before switching the main power off.
- Check that the main power switch is off (lock and tag procedure).
- Always follow all local safety regulations and instructions.

## A WARNING

### High voltage inside the device. Wait for at least five minutes after the voltage supply has been switched of before taking any service actions.

### 4.2 Old frequency converter removal



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3	Disconnect and mark the motor supply wires (U, V, W) and control wires (8, 9, 10, 11). If there is glue from the old wire marks left on the wires, use the attached cleaning pad (Part 18) for cleaning.	
4	Loosen and remove the nuts (2 pcs) holding the DMCS007. Remove the old frequency converter and EMC filter from the enclosure. If the frequency converter is installed on the enclosure back plate with screws, put the screws aside for further installation. Be careful not to loose the wire marks while removing the old frequency converter.	
5	Strip all the wires up to 10 mm. If the wires have thin strands, use wire end ferrules (Part 21) as shown in the picture.	

## 4.3 Control voltage front resistors

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To by-pass the front resistors, remove the control signal wires from the top of the terminals on and connect them to the bottom side of the same terminals, as shown in the picture. Do not mix the order of the wires.

- Voltage used to control the digital inputs in the DMCS007 frequency converter may be either 48 V or 115 V.
- If the control voltage of the crane is 230 V, front resistors are used to decrease the control voltage to 115 V for digital inputs.
- In the TMK003 frequency converter, the acceptable digital input voltage is 42–230 V. Therefore, **you must remove or by-pass** the possible front resistors when replacing a DMCS007 with a TMK003.









If the front resistors are not removed or by-passed, the control inputs on the TMK003 frequency converter will not be activated, even though voltage can be measured with a multimeter.

## 4.4 New frequency converter installation methods

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### 4.4.1 Selection of the installation method

There are three different ways to install the new frequency converter, which are dependent on the enclosure type and layout.







2	If the enclosure has two layers and the old frequency converter is located behind the tray, follow the installation instruction described in Double layer enclosure (page 22).	<image/>
3	If the enclosure has more room around the old frequency converter as shown in the pictures, follow the installation instruction described in DIN-rail installation (page 32).	<image/>



### 4.4.2 Single layer enclosure

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1	If the upper mounting rail is full of components, remove the cable clamp and move it to the left end of the mounting rail.	
2	Loosen the grounding terminals and move all the terminals as far to the left as possible. Tighten the grounding terminals.	



3	Remove current transformer A-T20 from the mounting rail. Remove the rail clamp and replace it with the support arm (Part 13). Use the Allen key (Part 20) for installation.	
4	Place the current transformer back on the mounting rail as near to the terminals as possible. Make sure that the wire loops on the transformer are still OK.	
5	Slide hoist brake rectifier A-G7 next to current transformer A-T20.	
6	Slide hoist contactors A-K1, A-K2 and A-K4 next to A-G7. Now you should have approximately 22 mm of free space between contactor A-K4 and the enclosure wall. This space is needed for the new frequency converter mounting rack.	



7	Loosen terminal A1 on contactor A-K4 and take off the wires.	
8	Push contactor A-K4 downwards to get it off the mounting rail. Turn the contactor sideways on top of contactors A-K1 and A-K2. Help the wires by hand to get the contactor turned.	
9	Take the frequency converter mounting rack (Part 2) and place it on the fixing bolts located on right-hand wall of the the enclosure.	
10	Use self-locking nuts (Part 23) to fix the mounting rack. Use a socket to place the nuts on the bolt ends.	



11	Place contactor A-K4 back on the mounting rail and connect the wires to terminal A1.	
12	Take the terminal block (Part 3) and place it on the bolts at the bottom of the enclosure (fixing of the DMCS007). Make sure that the free end of the mounting rail is pointing to the left. Use self-locking nuts (Part 23) to fix the terminal block.	
13	Connect grounding, power supply, motor supply and control wires to the bottom side of the terminal block.	
14	Take the new frequency converter (Part 1) and the wire harness (Part 4) out of the upgrade kit box. First connect the grounding wire (Part 6) to the left grounding terminal of the frequency converter. Then connect the power supply wires (Part 7) and motor supply wires (Part 8). The heat shrink side of the wire harness comes to the frequency converter side.	



15	Open the cover of the frequency converter by pulling it up with your fingers. Be aware that the edges of the terminal are quite sharp. Connect the control wires to terminals 1, 2, 3 and 7. Terminals 4 , 5 and 6 stay free. Close the cover.
16	Make sure that the fixing screws (3 pcs) are in place at the frequency converter mounting plate, as shown in the picture.
17	Turn the screws so that the screw ends are flush with the back side of the mounting plate (makes frequency converter installation easier).



18	Place the frequency converter on top of the fixing screws and slide it down. Tighten the screws carefully with the Allen key (Part 20).
19	Lift all the wires upwards and fix the control wires to the power supply wires using a small cable tie (Part 16).



20	Fix all the wires to the cable tie anchor with the bigger cable tie (Part 15), as shown in the picture. Make sure that the wires do not touch the bottom of the enclosure. Fix the wires also between the anchor and the frequency converter with a small cable tie (Part 16).	
21	Connect all the wires to terminal block X1, starting from the control wires. Use additional small cable ties (Part 16) to fix the wires together as shown in the picture.	
22	Take the frequency converter support arm (Part 12) and place it on the mounting rail to the left side of the terminal block. The height adjustment plate should point to the right.	



23	Adjust the support arm height by using the Allen key (Part 20). The height is right if the frequency converter touches the arm when turned to locking position.	
24	Lock the frequency converter sideways on top of the support arm by turning and tightening the screw of the locking mechanism. Make sure that the frequency converter does not vibrate when you knock it with your finger. If the frequency converter vibrates, add height to the support arm. Leave the frequency converter mounting rack to the unlocked position for parameterization.	<image/> <image/>



### 4.4.3 Double layer enclosure

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2	Remove the mounting rail fixing screw (under the CID) and replace it with a short screw (Part 24) and two washers (Parts 25 & 26). The screw end should be flush with the backside of the tray when fully tightened.
3	Install the CID back to the mounting rail and connect the terminal connectors.
4	Open the tray. Remove the nuts and the tray locking bracket on the enclosure wall.



5	Remove control wires 8, 9 and 10 from the socket base and replace them with the new longer wires (Part 10), as shown in the picture.	
6	Take the terminal block (Part 3) and remove the label "X1". Loosen the end clamp and the grounding terminal. Slide all the terminals off from the mounting rail.	
7	Check if there is room for new terminals on the lower mounting rail of the enclosure. If there is no mounting rail installed, take the additional mounting rail (Part 14) and fix it with the self-locking nuts (Part 23).	
8	Install the removed terminals on the mounting rail as near to the right end as possible. Tighten the grounding terminal and the end clamp. Attach the label "X1" back to the end clamp. Connect all the loose wires to the terminals bottom side, starting from the grounding wire. Cut and replace the cable ties holding the wires, if needed.	



9	Take the frequency converter mounting rack (Part 2) and remove the cable tie anchor and the locking mechanism (barrel nut and screw).	
10	Flip the mounting rack over and use the Allen key (Part 20) to remove the screws (4 pcs) shown in the picture.	
11	Flip the fixing plate over so that you can read the letters "B". Turn the frequency converter mounting plate 180 degrees and place the hinges over the letters "B". The arrows on the both plates should point towards each other. Install and tighten the removed screws.	



12	Remove the screws (3 pcs) from the frequency converter mounting plate and install them to the holes on the opposite side of the plate, as shown in the picture. Screw ends should be flush with the back side of the mounting plate (makes frequency converter installation easier).	
13	Take the new frequency converter (Part 1) and the wire harness (Part 4) out of the upgrade kit box. First connect the grounding wire (Part 6) to the right-hand grounding terminal of the frequency converter. Then connect the power supply wires (Part 7) and the motor supply wires (Part 8). The heat shrink side of the wire harness comes to the frequency converter side.	
14	Open the cover of the frequency converter by pulling it up with your fingers. Be aware that the edges of the terminal are quite sharp. Connect the control wires to terminals 1, 2, 3 and 7. Terminals 4, 5 and 6 stay free. Close the cover.	



15	Place the frequency converter on top of the fixing screws on the mounting plate and slide it down. Tighten the screws carefully with the Allen key (Part 20).	
16	Take a small cable tie (Part 16) and fix the control wires on top of the motor supply wires, as shown in the picture.	
17	Bend all the wires to the back side of the mounting plate. Lay the motor supply wires at the bottom. Then lay the power supply wires and control wires on top. Fix the wires with small cable ties (Part 16) to the plate, but do not tighten the cable ties completely.	



18	Place the ground wire behind all other wires, as shown in the picture.	
19	Tighten the cable ties and cut the tails as short as possible.	



**20** Make sure that the cable tie locks do not prevent the hinged plate from turning to its lowest position, as shown in the picture.







The curve on the wires must be as tight as possible on the lowest edge of the mounting plate to avoid contact with the socket body on the enclosure. The purpose of the heat shrink tube on top of the wires is to protect the wires while the frequency converter is bend to its lowest position.



21 Install the mounting rack with the frequency converter to the bolts on the enclosure wall (fixing of the tray locking bracket) and fix it with the self-locking nuts (Part 23). Make sure that the wires do not touch the socket body when you bend the frequency converter to the bottom of the enclosure. 22 Connect all the wires to the terminals, starting from the control wires.



23	Use additional cable ties (Part 16) to fix the wires together. Make sure that the frequency converter bends freely to the open position.
24	Take the cleaning pad (Part 18) and carefully clean the bottom of the enclosure (area under the frequency converter) and the back side of the tray (area on top of the frequency converter). Take the vibration dampers (Part 22) and install 2 pcs to the bottom of the enclosure and 2 pcs to the back side of the tray. The vibration dampers should be located so that they prevent the frequency converter from touching the bottom of the enclosure and the tray.
25	Leave the tray open for frequency converter parameterization.  Check the right parameter settings from DMCS007 old parameter settings (page 35).



### 4.4.4 DIN-rail installation

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1	Take the "X1". Loc terminal. S rail.	terminal block (Part 3) and remove the labe osen the end clamp and the grounding Slide all the terminals off from the mounting	
2	Loosen an rail. Place the the mount	nd take off the screws holding the mounting mounting rail on top of the lowest holes or ting plate and fasten the screws.	Acrimenter 3
3	Turn the the location plate with nuts (Part	mounting plate 180 degrees and install it to on of the DMCS007. Fasten the mounting the removed screws or use the self-locking 23). There are 8 possible height positions fo turning the mounting plate 180 degree mounting rail.	The mounting rail. They can be reached by thes and changing the fixing point of the



4	Take the new frequency converter (Part 1) and install it on the mounting rail as shown in the picture. If the height of the mounting rail is not correct and the new frequency converter will not fit, change the position of the mounting rail.	
5	If control wires 8, 9, 10 and 11 look too short, remove them from the terminal block and replace with the attached wire harness (Part 11), as shown in the picture. If the wires can reach up to the new frequency converter control terminals, replace the wire marks with numbers 1, 2, 3 and 7 (Part 17).	
6	Connect the grounding wire, power supply wires (L1, L2, L3) and the motor supply wires (U, V, W). Make sure that the wires have been inserted deep enough inside the terminals. After tightening the terminal screws, pull the wires slightly to make sure they hold in place.	d if the frequency converter has been taken






#### 5 COMMISSIONING

Before powering up the frequency converter, the DIP switches must be set up according to the following instructions.

#### 5.1 DMCS007 old parameter settings

Check the old parameter settings from the DMCS007 frequency converter and note down the readings in the table below.

	Table 1: DMCS007 parameter settings														
Switch S1 Switch S2								Swite	h S3		Switch S4				
-1	-2	-3	-4	-1	-2	-3	-4	-1	-2	-3	-4	-1	-2	-3	-4

#### 5.2 Setting up the DIP switches of the TMK003

Compare the DIP switch settings of the DMCS007 with the following tables and find the correct settings for the TMK003 DIP switches.

#### Driving frequency table selection 5.2.1

The maximum and minimum driving frequencies depend on the nominal frequency of the motor. Use the following table to determine which table should be used to set the maximum driving frequency and the minimum driving frequency:

Table 2. Driving Frequency table selection										
D S	MCS00 witch S	)7 4	Maximum Driving	Minimum Driving						
-2	-3	-4	Frequency Table	Frequency Table						
0	0	0								
0	1	0	3	5						
0	0	1								
1	0	0	Λ	6						
1	1	0	+	6						

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### 5.2.2 S1 Maximum driving frequency

Set the maximum driving frequency according to the following tables:

Table 3: Maximum Driving Frequency Motor nominal frequency = 100/120 Hz									
	DMC Swite	S007 ch S1		TMK003 Switch S1					
-1	-2	-3	-4	-1 -2 -3					
0	0	0	0	0	0	0			
0	0	0	1	1	1	1			
0	0	1	0	1	1	0			
0	0	1	1	1	1	1			
0	1	0	0	1	0	0			
0	1	0	1	1	1	0			
0	1	1	0	1	0	1			
0	1	1	1	I	0				
1	0	0	0	0	0	1			
1	0	0	1	1	0	1			
1	0	1	0	1	0	0			
1	0	1	1	0	1	0			
1	1	0	0	0		0			
1	1	0	1	0	1	1			
1	1	1	0	0		-			
1	1	1	1	0	0	1			

Table 4: Maximum driving frequency Motor nominal frequency = 80 Hz										
	DMC Swite	S007 ch S1	TMK003 Switch S1							
-1	-2	-3	-4	-1	-2	-3				
0	0	0	0	0	1	0				
0	0	0	1	0	1	1				
0	0	1	0	0	0	1				
0	0	1	1	0	1	1				
0	1	0	0	1	1	0				
0	1	0	1	0	1	1				
0	1	1	0	U	1	1				
0	1	1	1	0	0	1				
1	0	0	0	0	0	0				
1	0	0	1	1	1	1				
1	0	1	0		1					
1	0	1	1	1	1	0				
1	1	0	0	1	0	1				
1	1	0	1	1	0	0				
1	1	1	0	1	0	0				
1	1	1	1	0	1	0				

#### 5.2.3 S2 Minimum driving frequency

Set the minimum driving frequency according to the following tables:

۲ M	Table 5: Minimum driving frequency           Motor nominal frequency = 100/120 Hz									
	DMC Swite	S007 ch S2	TMK003 Switch S2							
-1	-2	-3	-4	-1	-2	-3				
0	0	0	0	1	1	0				
0	0	0	1	0	0	0				
0	0	1	0	1	0	0				
0	0	1	1	0	0	0				
0	1	0	0	1	1	1				
0	1	0	1	0	0 0					
0	1	1	0	0	0	1				
0	1	1	1	1	0	1				
1	0	0	0	1	1	1				
1	0	0	1	1	0	1				
1	0	1	0	0	1	0				
1	0	1	1							
1	1	0	0							
1	1	0	1	1	1	1				
1	1	1	0							
1	1	1	1							

Table 6: Minimum driving frequency Motor nominal frequency = 80 Hz										
	DMC	S007		TMK00	3					
	Swite	ch S2		S	witch S	2				
-1	-2	-3	-4	-1	-2	-3				
0	0	0	0	1	1	1				
0	0	0	1	1	0	1				
0	0	1	0	0	1	0				
0	0	1	1	0	0	0				
0	1	0	0	0	1	1				
0	1	0	1	0	0	1				
0	1	1	0	1	1	0				
0	1	1	1	1	0	0				
1	0	0	0							
1	0	0	1							
1	0	1	0							
1	0	1	1	0	1	1				
1	1	0	0	5	l '					
1	1	0	1							
1	1	1	0							
1	1	1	1							

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### 5.2.4 S3 Acceleration and deceleration ramp time

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Set the acceleration and deceleration ramp time according to the table below.

It is not possible to separately set the acceleration and deceleration time.

For TMK003, 1.5 s is the shortest possible ramp time.



Do not set the ramp time to be shorter than the original; this would shorten the lifetime of the frequency converter. Increasing of the ramp time is allowed if the customer accepts it.

٦	Table 7: Acceleration and deceleration ramp time										
Ramp Time		DMC Swite	S007 ch S3		S	Ramp Time					
(s)	-1	-2	-3	-4	-1	-2	-3	(s)			
0,5	1	1	1	1							
1	0	1	1	0	1	1	0	1,5			
1,5	1	0	0	0							
2	0	1	0	0	0	1	1	2			
2,5	0	0	0	0	0	1	0	2,5			
3	0	0	1	0	1	0	1	3			
3,5	0	0	0	1	0	0	0	3,5			
4	1	0	0	1	1	0	0	4			
4,5	1	1	0	0	0	0	1	4,5			
5	0	0	1	1							
5,5	1	1	1	0							
6	1	1	0	1							
6,5	1	0	1	1	1	1	1	5,5			
7	1	0	1	0							
7,5	0	1	1	1							
8	0	1	0	1							



### 5.2.5 S4 Control mode and slowdown mode (TMK003)

Set the control mode (EP or MS control) and slowdown mode according to the following table:

Table 8: Control mode						
DMCS007 Switch S4	TMK003 Switch S4					
-1	-1	-2				
0	1	0				
1	0	0				

#### 5.2.6 S5–S10 Motor parameters

Set the motor parameters according to the following table:

	Table 9: Motor Parameters																	
	D	MCS00	7								TMK00	3						
Motor type	S	witch S	4	Swite	ch S5	S	witch S	6	s	witch S	57	s	witch S	68	Swite	ch S9	Switc	h S10
	-2	-3	-4	-1	-2	-1	-2	-3	-1	-2	-3	-1	-2	-3	-1	-2	-1	-2
MF06MA200	0	0	0	1	1	0	0	1	0	1	0	0	0	0	0	0	1	0
MF06MA100	1	0	0	1	1	0	1	1	0	1	0	0	0	0	0	1	1	0
MF06LA200	0	1	0	1	1	1	1	0	0	1	0	0	0	0	0	0	1	0
MF06LA100	1	1	0	1	1	1	0	1	0	1	0	0	0	0	0	1	1	0
2 x MF06MA200	0	0	1	1	1	0	0	1	0	1	0	0	0	1	0	0	1	0

### 5.3 Testing

#### 012484

If any problems or malfunctions occur during the commissioning, refer to Chapter "Troubleshooting" to find out the reason. The source of any problems with the product must be solved before continuing with the commissioning procedure.



**A WARNING** 

To avoid electrical shock, ensure that the main isolation switch is turned to the off position before connecting the frequency converter to the mains supply.

To avoid injuries and damage to the equipment, ensure proper mounting of the motor before starting. Also, make sure that the machinery connected to the motor allows the motor to run.

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# 5.4 Filling in the commissioning sticker

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After setting up the DIP switches, fill in the commissioning sticker and place it inside the enclosure at a visible place, as shown in the pictures.







# 6 TROUBLESHOOTING

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### 6.1 **Purpose of troubleshooting**

The purpose of troubleshooting is primarily to determine whether problems are caused by the frequency converter or external devices. It is also possible that a faulty external device has caused damage to the frequency converter. In that case it is very important to repair or change any faulty devices to prevent recurring problems.



When replacing a frequency converter with a new one, the parameter list of the old frequency converter is needed for copying the parameter settings to the new frequency converter.

Reducing of the ramp time from the value of the original delivery is not allowed.

# 6.2 **Problems and solutions**

Sr. no.	Product	Suggested solution
1	The green LED is continuously ON but motor does not run or just jerks but control voltage can be measured from the terminals.	Make sure that the front resistors on the control voltage circuit have been removed or by-passed according to the instructions in <u>Control voltage front resistors (page 11)</u> .
2	The frequency converter does not start (green LED stays off) when it is started.	<ul> <li>Check the main voltage between terminals L1, L2 and L3.</li> <li>Check that there are no devices causing disturbance connected to the same voltage supply as the crane. These are for example devices that require high currents, such as big motors or welding devices.</li> </ul>
		When the EMC screw is connected, the frequency converter has RC filters connected to the power supply side to reduce disturbance to the network. The capacitors of these filters may cause the RCD (Residual Current Device) to trip. Therefore, using RCD with frequency converter controlled cranes is not recommended.
3	The green LED is continuously on or flashing (after previous fault) and the red LED is off, but motor does not run.	<ul> <li>Check the motor cable connection.</li> <li>Check the limit switches.</li> <li>Check the voltage in direction command terminal 1 (DI1) and terminal 2 (DI2) against the common (terminal 7).</li> </ul>
4	The motor runs poorly: trolley/bridge does not move as it supposed to move.	<ul> <li>Check that the load is not over nominal.</li> <li>Check that all cables are correctly connected and not loose.</li> <li>Check that all motor parameters are correctly set.</li> <li>Check that the U/f-curve parameters (switch group S6) are correctly set.</li> <li>Check that the switch group S4 switch -2 is set to 1 and group S5 switches are set to 11.</li> <li>Check that the switch group S7 switches are set to 010.</li> <li>Check that the motor's brake opens completely.</li> </ul>

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# 7 ELECTRICAL DRAWING

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# 7.1 Frequency converter TMK003



English

**Original instructions** 



# SERVICE MANUAL FOR FREQUENCY CONTROL SYSTEM

ControlMaster NXT

- - - -

092137 12.2011

SUPDOC\_SM\_TM040-0.ORD 27.7.2012





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# **1 GENERAL INTRODUCTION**

# 1.1 Foreword: About This Manual

This manual offers guidance to enable safe and efficient operation of the crane.

As a **crane operator**, taking the time to read this manual will help you to prevent damage to the crane and load, and, most importantly, personnel situated close to the crane. The crane is designed to be safe when used correctly. However, there are many potential hazards associated with incorrect operation and these can be avoided when you know how to recognize and anticipate them.

This manual is not intended as a substitute for proper training but provides recommendations and methods for safe and efficient operation. The crane owner must ensure that operators are properly trained prior to crane operation and, at all times, comply with all of the applicable and prevailing safety and other standards, rules and regulations.

# 1.2 Symbols Used In This Manual

Readers should familiarize themselves with the following symbols which are used in this manual.

- COB250	Indicates that the crane is slowing down or is moving at its slowest speed.
I THERE	Indicates that the crane is accelerating or moving at its highest speed.
F 50 859	NOTE: Indicates items which require special attention by the reader. There is no obvious risk of injury associated with notes.

# 1.3 Safety Alert Symbols and Signal Words

The following symbols are used in this manual to indicate potential safety hazards.

	Obey all safety messages that follow this symbol to avoid possible injury for death.
CAUTION	Indicates a potentially hazardous situation, which if not avoided, MAY result in minor or moderate injury. It may also be used to alert against unsafe practices.
WARNING	Indicates a potentially hazardous situation, which if not avoided, COULD result in death or serious injury.

	DANGER	INDICATES AN IMMINENTLY HAZARDOUS SITUATION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.
--	--------	---



NOTICE	Addresses situations not related to personal injury, such as likely or possible damage to equipment.

Shall	Indicates that a rule is mandatory and must be followed.

Should Indicates that a rule is a recommendation, the advisability of which depends on the facts in each situation.
---

### **1.4 Questions And Comments**

Any questions or comments relating to the content of this manual and/or the operation, maintenance and/or service of manufacturer products should be directed to: **www.rmhoist.com** 

# 1.5 Exclusion Of Warranty

THE MANUFACTURER MAKES ABSOLUTELY NO WARRANTY WHATSOEVER WITH REGARD TO THE CONTENTS OF THIS MANUAL, EXPRESS OR IMPLIED, WHETHER ARISING BY OPERATION OF LAW OR OTHERWISE, INCLUDING, BUT NOT LIMITED TO, ANY IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

### 1.6 Manual Use

Every person exposed to the manufacturer's products must, prior to OPERATING, SERVICING AND/OR MAINTAINING SUCH PRODUCTS, read and understand the contents of this manual and strictly adhere AND CONFORM THEIR CONDUCT WITH AND TO THE INFORMATION, RECOMMENDATIONS AND warnings provided herein.



**Note:** Keep these instructions in a safe, accessible location for future reference by personnel operating the crane or exposed to crane operation.

A	Read and understand the contents of this manual prior to operating, servicing, and or/maintaining the crane. Failure to do so can result in serious injury or death.
---	--

Manufacturer shall not be liable for and owner and READER shall release, and hold manufacturer, harmless from any and all claims, demands, AND damages, regardless of their nature or type losses and expenses, whether known or unknown, present or future, any and all liability, of and from any and all manner of actions, cause[s] of actions, all suits in law, in equity, or under statute, State or Federal, of whatever kind or nature, third party actions, including suits for contribution and/or indemnity on account of or in any way arising out of acts or omissions of the Owner or READER and relating in any way to this MANUAL or THE PRODUCTS referenced herein, including, but not limited to the Owner's or READER'S use thereof or any other cause identified herein or that may be reasonably inferred HEREFROM.



# 1.7 Terminology

The following terms and definitions may have been used in this manual:

ANSI	American National Standards Institute	
Authorized personnel	Persons who are authorized by the owner and who have the necessary training to carry out operation or service actions.	
CE marking	The product's CE-marking indicates that the product complies with the appropriate CE regulations.	
Check	A visual and functional assessment (not a test) of the product without dismantling.	
Current rating	The maximum flow of current through a frequency converter.	
Bridge	The bridge (main girder) moves along the runway.	
Main girder	The main girder (bridge) is connected to the bridge end carriages.	
Main isolation switch	The main isolation switch is the power switch which the operator should normally use to turn off the power.	
Hoist	Drive mechanism for lifting and lowering the load.	
Power supply	Power is supplied to the components via the power supply.	
Controller	The pendant or other type of controller is used by the operator to give commands to the crane.	
Qualified personnel	One with necessary qualification based on theoretical and practical knowledge of hoists or/and cranes. The person must be in a position to assess the safety of the installation in conjunction with the application. Persons with the authority to undertake certain maintenance work on products of manufacturers include manufacturers' service engineers and trained fitters with corresponding certification.	
QR Code™	A two dimensional bar code that can include, for example, a product's serial number in an optically readable form. Note: The term "QR Code" is a registered trademark of Denso Wave Incorporated in Japan and other	
	countries.	



# 1.8 Directives and standards

### 1.8.1 CE/CSA/UL/CCC

This product complies with one or more of the following requirements and directives described in this section. For more detailed information about which requirements the product meets, see the main sticker attached to the device.

CE	The CE marking certifies that a product has met EU health, safety, and environmental requirements, which ensure consumer safety.
CSA	The CSA marking means that a product has been tested and meets applicable standards for safety and/or performance, including the applicable standards written or administered by the American National Standards Institute (ANSI), Underwriters Laboratories (UL), Canadian Standards Association (CSA), National Sanitation Foundation (NSF), and others.
UL	The UL marking means that Underwriters Laboratories (UL) has tested representative samples of the product and determined that they meet UL's requirements. These requirements are based primarily on UL's published and nationally recognized Standards for Safety.
ccc	The China Compulsory Certificate mark, commonly known as the CCC Mark, is a compulsory safety mark for a variety of products sold on the Chinese market. The CCC mark is required for both domestically manufactured products and products imported into China.
RoHS	The RoHS marking means that a product complies with the directive for the restriction of the use of certain hazardous substances in electrical and electronic equipment.
WEEE	The WEEE indicates that the product should be disposed of according to the WEEE directive regulations.

The frequency converters carry the CE label as a proof of compliance with the Low Voltage Directive (LVD) and the Electro Magnetic Compatibility (EMC). The company SGS Fimko has acted as the Competent Body.

### 1.8.2 EMC

The abbreviation "EMC" stands for Electromagnetic Compatibility. According to the European EMC directive, "the apparatus shall be so constructed that:

- The electromagnetic disturbance it generates does not exceed a level allowing other apparatus to operate as intended
- The apparatus has an adequate level of intrinsic immunity of electromagnetic disturbance to enable it to
  operate as intended".

Declaration of conformity	With the declaration of conformity the manufacturer informs that a device is manufactured to fulfil required EMC standards.	
Environments	Immunity and emission requirements are divided in tw the environments.	vo levels in the product standard according to
	First environment is an environment that includes domestic premises and other establishments directly connected to a low-voltage power supply network.	



Second environment is an environment that includes all the establishments other than those directly connected a low-voltage power supply network.	

#### **EMC** levels

There are three EMC levels: S, N and 0.

- S-level: No manufacturer's EMC solution is adopted and products will be used in other market areas than European Union (EU) when local power supply system is the grounded network.
- N-level: Manufacturer's EMC solution is adopted to fit for Second Environment and products will be used in EU
  when local power supply system is the grounded network.
- 0-level: No manufacturer's EMC solution is adopted, products can be used in either EU or other market areas when local power supply system is the non grounded network.

#### **Fulfilled EMC-standards**

- Immunity: All products fulfil the immunity requirements defined in the EN61000-6-2 and the EN 61800-3 Amendment 11 (2000) for the second environment.
- Emissions: N level products fulfil the emission requirements (lower than specification) of the EN 61800-3 A11 (2000) for the second environment.0 level products fulfil the emission requirements (they might exceed the limit of N level products) of the EN 61800-3 A11 (2000) for the second environment.



**Note:** The involved products are designed for Second Environment (Industrial Environment) only. The disturbances emitting from the basic products are not filtered to the required level of residential, commercial and light industrial (e.g. offices, gasoline station, retailer shops etc.) environment (First Environment). In this sense, these products should not be used in First environments. If you still want to use them in First environments, additional requirements are needed, please contact product supplier.



Note: EMC filters in N level products might cause disturbances on residual current device (RCD).



# 2 IDENTIFICATION

# 2.1 Product identification data

This manual covers the installation and use of the switch based frequency converter model.

Converter can be used on traveling movement application and chain hoist lifting application. Application type is selected with switch S10-2. Switch settings are explained on section Parameters.





Application type selection done with switch S10-2 changes the basic functionality of converter. Pay special attention that apllication is selected correctly with switch S10-2. Wrong switching will cause potentially hazardous situation.

Front panels of frequency converter models:





#### 2.1.1 Main sticker

The main sticker shows, for example, the model and serial number of the frequency converter, as well as the rated voltage.



1	Product model number	Indicates the exact model of the product.
2	Identification number	A unique string that identifies the unit.
3	Input	Indicates the acceptable mains voltage range, current and frequency that the product can be connected to.
4	Output	Indicates the voltage range, current and frequency range the product is able to provide at a specified output capacity.
5	Control	Indicates the acceptable voltage range and frequency of control signals that the product can be connected to.
6	Serial number	The serial number of the unit in an alphanumerical format.
7	IP classification	Indicates the ingress protection classification of the product.
8	EMC level modified	Indicates whether the EMC level has been changed from the default level. By default, the EMC level is set as N.
9	Option board	Indicates whether the product is fitted with an optional board providing additional features. Option boards can be used only with a frequency converter featuring a display.
10	Approvals and standards	Indicates the directives and approvals the product complies to. See the section "Directives and standards for more information.
11	Batch identification number	Indicates the batch from which the unit originates. The first four digits indicate the year and week of manufacture, respectively. The last digit (1 through 5) indicate the weekday, 1 being Monday, 2 Tuesday, number 5 indicating Friday.
12	Code	Identification and feature information provided by the manufacturer.
13	QR Code™	A two dimensional bar code in an optically readable form. Note: The term "QR Code" is a registered trademark of Denso Wave Incorporated in Japan and other countries.



# **3 SAFETY RELATED INSTRUCTIONS**

# 3.1 Intended use of the frequency converter

#### **Travelling movements**

These frequency converters are designed for industrial crane usage for controlling the speed of travelling motors.

#### **Hoisting movements**

These frequency converters are designed for industrial crane usage for controlling lifting speed in chain hoist applications.

# 3.2 Limitations of use



Note: The frequency converter shall be used only in fixed installations.



Note: Only the product's manufacturer shall perform any voltage withstand tests.



Any alterations and/or modifications to the product not authorized by the manufacturer are strictly prohibited. Opening the product's cover voids its warranty.



The parameters and settings of the frequency converter shall not be changed. Changing the parameters or settings could lead to dangerous situations, serious injury or death.



# **4** PREPARING THE PRODUCT FOR USE

# 4.1 Transport and storage

The product shall be stored in an environment meeting the following conditions:

- storing temperature between -40 and +70 degrees Celsius
- relative humidity below 95%, no condensation

After unpacking the component, ensure that there are no visible signs of transport damage.

# 4.2 Safety precautions before installation

Before installing, check that there are no signs of damage on the frequency converter.

	DANGER	THE ELECTRICAL INSTALLATION SHALL BE PERFORMED ONLY BY PERSONNEL AUTHORIZED BY THE MANUFACTURER. IT IS POSSIBLE THAT INSTALLATIONS MADE BY UNAUTHORISED PERSONNEL ARE INCORRECT, AND CARRY AN INCREASED RISK OF AN ELECTRICAL SHOCK.
	DANGER	TO REDUCE THE RISK OF ELECTRICAL SHOCK, THE FREQUENCY CONVERTER SHALL ALWAYS BE GROUNDED WITH A GROUNDING CONDUCTOR CONNECTED TO THE GROUNDING TERMINAL.
	DANGER	THE FREQUENCY CONVERTER'S POWER UNIT COMPONENTS ARE LIVE WHEN THE CONVERTER IS CONNECTED TO MAINS. THE VOLTAGE IS DANGEROUS, AND DIRECT CONTACT WITH IT MAY CAUSE DEATH OR SERIOUS INJURY.
	WARNING	The frequency converter remains live while running a motor energized by a process. The motor acts as a generator that feeds energy to the frequency converter, creating a risk of an electrical shock.
A	CAUTION	The cover of the frequency converter shall not be opened. The converter's components may be damaged by a static voltage discharge from, for example, fingers.



# 4.3 Mounting and installation

### 4.3.1 Dimensions

The main dimensions of the two models of the product are described in the following illustrations.



003 dimensions (mm)							
H1	H2	H3	W1	W2	W3	D1	D2
157	147	137	66	38	4.5	99	7

<u>u</u>		0	-
	н	0	0
	НЗ	•	o
			<u></u>

006 dimensions (mm)							
H1	H2	H3	W1	W2	W3	D1	D2
195	183	170	122	102	6	122	20

#### 4.3.2 Mounting

There are two possible ways to mount a frequency converter to the panel: screw or DIN rail mounting (model 003 only). The measurements for placing the holes and the screw size to be used are marked on the back of the frequency converter.

The frequency converter has forced airflow cooling so the device can be mounted at any angle without affecting its operation.

#### Screw mounting without integrated braking resistor

1	Initially tighten the screws so that they can be fitted in the holes in the upper part of the frequency converter. Model 003 screw size: M4 Model 006 screw size: M5 Model 012 screw size: M5 Use screw locking liquid.	
2	Once the device is held up by the screws, tighten the upper screws and then secure the lower part with a screw.	

R&M Materials Handling, Inc.

4501 Gateway Boulevard

Springfield, Ohio 45502

P.: (937) 328-5100

FAX: (937) 325-5319

#### Screw mounting with integrated braking resistor



#### **DIN rail mounting**

MATERIALS

1	Incline the device and insert the upper edge of the rail into the rail groove on the device.	a se st
2	Press the lower part until it locks into the rail.	a a a a a a a a a a a a a a a a a a a



#### Unmounting from the DIN rail

1	Removal of the frequency converter from the DIN rail is done by pressing the releasing latch of the device with a screwdriver.	
2	Lift the lower part of the device and remove it from the DIN rail.	a de la

#### 4.3.3 Terminals



The frequency converter power module has terminals for 3-phase power supply and 3-phase motor supply. Frequency converters of the higher current rating also have terminals for an external braking resistor.

Both models (003 and 006) have 6 digital inputs.

The control voltage for digital inputs can be 42 – 240VAC. All digital inputs must be connected to same control voltage transformer.

The transformer shall have galvanically separated windings and the neutral phase of the secondary circuit must be connected to protective earth.

The frequency converter has protection against earth faults in the motor or in the motor cables. Since the frequency converter has a plastic cover, it does not ground via the DIN rail.

Digital inputs DI1 and DI2 are always used for direction commands. The functions of inputs DI3 – DI6 vary depending on parameter settings. DI6 is an ES (External Stop) input that is connected to the motor's thermal protection as standard. All terminals are listed in the table below.

Power supply terminal (L1, L2/N, L3)	The mains power cable shall be connected to this terminal.
Motor cable terminal (U/T1, V/T2, W/T3)	The motor cable shall be connected to this terminal.
Braking resistor terminal (R+, R-)	The braking resistor wires shall be connected to this terminal (model 006 only).
Grounding wire terminals	The protective grounding conductor shall be connected to these terminals.

Terminal / Name Function Cable size	
-------------------------------------	--



				mm2	AWG
	L	.1			
	L2		3-phase input		
	L3				
	U/	T1			16 – 12
Dever	V/	T2	Motor output		
module	W /	' T3		1.5 – 4.0	
	R+ R-		External braking resistor (no in model 003)		
	PE		Protective earth		
	1	DI1	Drive command forward		
	2	DI2	Drive command reverse		
Control board	3 DI3 4 DI4 5 DI5		Function depends on parameter settings	unction depends on parameter settings 1.0 – 2.5 20	
	6	DI6	Motor temperature protection / External stop		
	7	COM	Common DI1-DI6		





The connection terminals of the 003 model

The connection terminals of the 006 model



The digital input terminals on both models



		THE MOTOR TERMINALS (U, V, W / T1, T2, T3) AND BRAKING RESISTOR TERMINALS (R+ AND R- WHEN APPLICABLE) ARE LIVE WHEN THE FREQUENCY CONVERTER IS CONNECTED TO A MAINS SUPPLY, EVEN WHEN THE MOTOR IS NOT RUNNING. THE CONTROL BOARD'S RELAY OUTPUT
<u>.</u>	DANGER	TERMINALS (WHEN APPLICABLE) MAY HAVE A DANGEROUS CONTROL VOLTAGE, EVEN WHEN THE FREQUENCY CONVERTER IS DISCONNECTED FROM THE MAINS SUPPLY. THESE CONDITIONS MAKE A RISK OF ELECTRICAL SHOCK POSSIBLE.

### 4.3.4 Conductor diameter and stripping lengths

Use cables with heat resistance of at least 70℃.



### 4.3.5 Recommended tightening torques

The screw tightening torques of the power module terminals are 0.5 - 0.6 Nm and for control board's digital input terminals 0.5 Nm.



**Note:** Do not over tighten the terminal screws. Over tightening can cause the terminal block to break. If the terminal block breaks, the entire frequency converter must be replaced.



#### 4.3.6 EMC

The frequency converter has an internal EMC filter in the power supply. By default, the EMC level of the frequency converter is set to N by the manufacturer.

If the mains network is non-grounded (IT-network), the frequency converter's EMC level shall be changed to 0 by removing the filter capacitor disconnection screw.



Note: The filter capacitor disconnection screw cannot be replaced after it has been removed.





When the EMC-screw is connected, the frequency converter has RC-filters connected to the power supply side to reduce disturbances to the network. The capacitors of these filters may cause the RCD (Residual Current Device) to trip. Therefore, the use of RCD with the frequency converter controlled cranes is not recommended.

#### Motor cable length

To fulfill the European EMC regulations, cable lengths shall not exceed following values:

Longer cable	≤ 40 m
Shorter cable	≤ 7 m.





MI	The bridge travelling motor installed at the opposite end from the bridge panel.
M2	The bridge travelling motor installed at the bridge panel end of the main girder.
	The frequency converter.

If the European regulations for EMC are not adhered to, both motor cables can be 40 m long.

#### Exception: 003 with two motors (MF06MA200)

Model 003 with two motors shall be connected as illustrated in the following picture. The grounding cables of the motors shall be connected to the grounding terminals of the converter. The ferrite component shall be placed on the wires between the frequency converter and the terminal blocks, near the converter. The phase and grounding wires shall go through the ferrite component twice.





# **5 PARAMETERS**

# 5.1 Switch settings

Settings of the switch model frequency converter are selected with 26 dip switches, which are located at the top of the frequency converter. The switches are divided into groups of 2 or 3 switches. Each switch-group is labelled with positions S1 through S10.

An individual switch is given a number. For example, S1-1 denotes the first switch of switch group S1. The state of each switch is either 0 (Off) or 1 (On) as shown in the image below. The switch interface is designed so that the switches need to be altered from 0 as little as possible.

The switch group S9 shall be set first, because the functionality of the switch groups S1 and S2 depend on the settings of the group S9.

#### The switch groups are:

- S1 Maximum driving frequency
- S2 Minimum driving frequency
- S3 Acceleration and deceleration ramp times
- S4 Control method and slowdown mode
- S5 Limit operations
- S6 Voltage at low frequencies (U/f curve)
- S7 Current limit
- S8 Start and stop current
- **S9** Motor nominal frequency
- S10 Terminal DI6 operation



Note: Changes in the switch settings come into effect only after powering down and restarting the frequency converter.











Note: The switch setting description sections are arranged in the same order as the settings shall be selected.

The switch should be turned gently with small screwdriver, moving screwdriver only sideways.



**NOTICE** The switch will be damaged if it is twisted or turned using too much force.



# 5.2 Switch settings in traveling movement application

Converter's default application is traveling movement application. Application can be changed with switch group S10-2.



Switch S10- 2	Chain hoist lifting application
0	The chain hoist lifting application is not active.
1	The chain hoist lifting application is active.

In traveling movement application ie. when chain hoist lifting application is not active the switches must be set according to the descriptions in the following sections.

### 5.2.1 S9 Motor nominal frequency in traveling movement application

The motor's nominal frequency and voltage are selected according to the values presented in the following table. If the first alternative is selected and the mains voltage is 400 V, the maximum frequency (switch S1) must not exceed 100 Hz.



Switch S9		Motor nominal fragmanay	Motor nominal valtage	
- 1	- 2	wotor nominal requency	wotor nominar vortage	
0	0	100Hz / 120Hz	400 V / 460 V	
0	1	80Hz	400 V	
1	0	35Hz	400 V	
1	1	Parameter fault	Parameter fault	



#### 5.2.2 S1 Maximum driving frequency in traveling movement application

This switch group adjusts the maximum driving frequency of the motor. The switch settings are shown in the following table. The selected motor nominal frequency (switch group S9) defines which column of the table is used. The maximum driving frequency shall not be set higher than the nominal frequency of the motor.



Note: The 100 Hz nominal frequency may be exceeded only if the line voltage is at least 460V.



Switch S1			Maximum driving frequency			
-1	-2	-3	Maximum frequency for 100/120 Hz motor	Maximum frequency for 80 Hz motor	Maximum frequency for 35 Hz motor	
1	1	1	50	55	26	
1	1	0	60	60	28	
1	0	1	70	65	30	
1	0	0	85	70	33	
0	1	0	95	75	35	
0	0	0	100	80	19	
0	1	1	110(*)	45	21	
0	0	1	120(*)	50	24	

(\*) May only be used if the line voltage is at least 460V.



### 5.2.3 S2 Minimum driving frequency in traveling movement application

This switch group adjusts the minimum driving frequency of the motor. The switch settings are shown in the following table. The selected motor nominal frequency defines which part of the table is used.



Switch S2			Minimum driving frequency			
-1	-2	-3	Minimum frequency for 100/120 Hz motor	Minimum frequency for 80 Hz motor	Minimum frequency for 35 Hz motor	
0	1	1	12	24	4	
0	0	0	14	10	5	
0	0	1	16	12	6	
1	0	1	20	14	7	
1	0	0	23	20	8	
0	1	0	26	18	9	
1	1	0	28	16	10	
1	1	1	30	22	3	



#### 5.2.4 S6 U/f curve settings in traveling movement application

The effect of stator resistance at low frequencies is compensated for by increasing the U/f-ratio. The U/f curve settings for the different motors are shown in the following table.



Note:

• Zero Freq Volt[%] = output voltage at 0 Hz given as a percentage of the voltage at the motor's nominal frequency.

• U/f Mid Volt[%] = output voltage at U/f-curve's intermediate point, fixed to 10 % of motor nominal frequency, given as a percentage of the voltage at the motor's nominal frequency.



Switch S6			U/f curve settings			
-1	-2	-3	Zero Freq Volt [%]	U/f Mid Volt [%]	Motor Type	
0	1	0	6	12	MF06LA100	
1	0	1	6.5	12	MF06LA100(*)	
0	0	0	8	12	MF06LA200	
1	1	0	8.5	12	MF06LA200(*)	
0	1	1	9	16	MF06MA100	
0	0	1	10	14	MF06MA200, MF06MK200 (100/120Hz)	
1	0	0	21	24	MF06MK200 (35Hz)	
1	1	1	Used in a chain hoist liftir	ng application. See section "I	Parameters for chain hoist lifting".	

(\*) Denotes a boost function that provides extra torque for specific motors driven at low frequencies. The function can be used when motors cannot otherwise move at low speeds. When the curve number 3 or 6 is selected, the current limit shall be increased to 150% which is set at factory as standard.



**Note:** Authorized service personnel are allowed to change the curve number 1 to the curve number 3, and the curve number 4 to the curve number 6.



**Note:** Before activating the torque boost function, drive a few times on the runway at high speed to flatten the runway. If this does not help, the boost function can be activated.



### 5.2.5 S7 Current Limit in traveling movement application

The frequency converter limits the maximum current. The limit settings for different currents are shown in the following table. The limit is a percentage of the device's nominal current.

Frequency converter model	Nominal current [A]
003	2.4
006	5.6



Switch S7		Current	002 [4]	006	Motor Example		
-1	-2	-3	Limit [%]	003 [A]	[A]	003	006
0	1	0	150 % (*)	3.6	7.7	2 x MF06MA200	2 x MF06LA200, 2 x MF06LA100, 4 x MF06MA200
1	1	1	130 %	3.1	6.6		
1	1	0	120 %	2.9	6.1		
0	0	0	110 %	2.6	5.6	MF06LA200	
1	0	1	100 %	2.4	5.1		
0	0	1	90 %	2.2	4.6	MF06MA200	2 x MF06MA200, MF06LA200, MF06LA100
1	0	0	80 %	1.9	4.1		
0	1	1	70 %	1.7	3.6	MF06MK200 35Hz	MF06MA200

(\*) Factory default setting.



### 5.2.6 S8 Number of motors in traveling movement application

The model is only used with compact brake motors, which need DC (direct current) to open the brake at the start and to keep the brake open during electrical braking. Depending on the nominal current of the frequency converter, up to four motors can be connected to it. Thus start and stop DC must be adjusted to the right level with switch group S8.



Switch S8			Number of Motors			
-1	- 2	- 3	Number of Motors	003 Current [A <sub>rms</sub> ]	006 Current [A <sub>rms</sub> ]	
0	0	0	1	3	3	
0	0	1	2	4.8	6	
0	1	0	3	-	9	
0	1	1	4	-	12	



Note: Other settings will cause parameter fault.



#### 5.2.7 S3 Acceleration and deceleration ramp times in traveling movement application

This switch group adjusts the ramp time for motor acceleration and deceleration. The ramp time is defined as from zero to the set maximum frequency. The acceleration and deceleration times are the same.

Contact the product's manufacturer, if it is necessary to recalculate the ramp time.



**Note:** The ramp time must be set according to the wiring diagrams and parameter lists and it shall not be shortened. Decreasing the ramp time may damage the motor brakes or the frequency converter. The ramp time can be increased, if necessary.



	Switch S3	Acceleration and	
-1	-2	-3	deceleration ramp time
1	1	0	1.5
0	1	1	2
0	1	0	2.5
1	0	1	3
0	0	0	3.5
1	0	0	4
0	0	1	4.5
1	1	1	5.5


#### 5.2.8 S4 Control method and slowdown mode in traveling movement application

The frequency converter can be parametrised for two different control methods. The control method options are listed in the following table. The descriptions of the control methods are given in the section "Control methods".

#### Digital inputs and the control method:

Terminal	Name	MS2	EP2
1	DI1	S1	S1
2	DI2	\$2	S2
3	DI3	MS2	AP
4	DI4	S11/S21	S11/S21
5	DI5 *)	S12/S22	S12/S22
6	DI6	ES	ES

\*) Note: As factory default DI5 is not in use. The stop limit signal shall be connected in series to direction signals respectively.

#### **Control signals:**

S1	Drive command forward
S2	Drive command reverse
MS2	Multistep 2 frequency
AP	Acceleration command
S11	Slowdown limit forward
S12	Stop limit forward
S21	Slowdown limit reverse
S22	Stop limit reverse
ES	External stop, used for thermal protection of the motor



Switch S4 - 1	Control method
0	EP2
1	MS2

The switch model has one slowdown input DI4. There are two ways to handle the slowdown command and the selection is made with switch S4-2. Alternatives are shown in the following table. As the slowdown limit switch contact opens during running, the maximum speed is limited in the running direction.





Switch S4 - 2	Slowdown mode		
	Operation	Description	
0	Direction memory on	When the power is turned off, the limit switch status is saved. When power is turned back on and limit switch circuit is opened, driving is allowed with maximum speed in the opposite direction.	
1	Direction memory off	When the limit switch circuit is opened, the maximum speed is limited in both directions until the limit switch circuit is closed.	

	WARNING	Do not turn the direction memory on when a limit switch can be activated without running the equipment, for example, by an anti collision device or a tandem drive application.
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#### 5.2.9 S5 Limit operations in traveling movement application

The functions of the slowdown limit input DI4, stop limit input DI5 and slowdown limit frequency are adjusted with this switch group. Value of the slowdown speed is given as a percentage of the set maximum frequency (see section "S1 Maximum driving frequency"). If slowdown frequency is set lower than the minimum frequency (switch S2), the set value is equal to the minimum frequency.



Note: As factory default DI5 is not in use. The stop limit signal shall be connected in series to direction signals respectively.



Note: There are two possibilities to make limit circuits:1-step limit (slow down)2-step limit (slow down and stop)

CAUTION

Wrong parameter setting may accidentally deactivate the slowdown function as well as the slowdown and stop limits, possibly causing hazardous situations.



Switch S5		Limit operations			
- 1	- 2	Input DI4 (Slowdown)	Input DI5 (Stop)	Slowdown frequency [%]	
0	0	In use	In use	20 *)	
0	1	In use	Not in use	20	
1	0	In use	In use	35	
1	1	Not in use	Not in use	-	

\*) Default.



## 5.2.10 S10 Terminal DI6 operation in traveling movement application

Input DI6 is used for external faults as motor thermal protection. The function of the DI6 input can be changed according to the following table. The NTC thermistor can be used with external thermistor relay.

<b>CAUTION</b> Wrong parameter setting may accidentally deactivate the DI6 in causing hazardous situations.	out, possibly
---	---------------



Switch S10- 1	Terminal DI6 operation		
	DI6 Function Description		
0	In use	Normally a voltage is present at the input. When the voltage drops: Starting the motor is not possible During running the motor current is cut off immediately External stop fault code is shown with LED.	
1	Not in use	When the input is deactivated, it does not have any effect in the operation of the device.	



# 5.3 Switch settings on chain hoist lifting application

The chain hoist lifting application is activated with switch group S10. The switches must be set according to the descriptions in the following section.

#### 5.3.1 S10 -2 Chain hoist lifting application

The switch S10 – 2 activates the chain hoist lifting application.



Switch S10- 2	0- 2 Chain hoist lifting application	
0	The chain hoist lifting application is not active.	
1	The chain hoist lifting application is active.	



Note: The setting shall be used for lifting applications only.

#### 5.3.2 S6 U/f curve settings on chain hoist lifting application



Switch S6			U/f curve settings	
-1	-2	-3	Zero Freq Volt [%]	U/f Mid Volt [%]
1	1	1	8.5	16

The intermediate point is 5.5 % of the motor's nominal frequency.



#### 5.3.3 S7 Current limit on chain hoist lifting application

The frequency converter limits the maximum current. The limit settings for different currents are shown in the following table. The settings are applicable to the model 003 only.



Switch S7			Current Limit	
-1	-2	-3	Current Limit [%]	003 [A]
0	0	0	200	4.8
0	0	1	190	4.6
0	1	0	180	4.3
0	1	1	170	4.1
1	0	0	155	3.7
1	0	1	140	3.4
1	1	0	125	3.0
1	1	1	110	2.6



#### 5.3.4 S3 Acceleration and deceleration ramp times on chain hoist lifting application

Switch group S3 adjusts the ramp time as described in chapter "S3 Acceleration and deceleration ramp times", but values for acceleration and deceleration differ from normal (travelling application) use. Values for chain hoist lifting are shown in the table below.



Note: The setting shall be used in chain hoist lifting applications only.



Switch S3			Acceleration and deceleration ramp
-1	-2	-3	time
0	0	1	0.5
0	0	0	1.0
0	1	0	1.5
0	1	1	2.0
1	0	0	2.5
1	0	1	3.0
1	1	0	3.5
1	1	1	4.0

#### 5.3.5 Other switch groups on chain hoist lifting application



Note: Switch group S8 (start and stop direct current) has no effect when a chain hoist lifting application is in use.



Note: The maximum frequency (switch group S1) is limited to 100 Hz in a chain hoist lifting application.



**Note:** Switch groups S2, S4, S5, S9 and S10 are similar to normal (travelling application) use and can be set as described in the "Parameters" section.



# 6 COMMISSIONING

If any problems or malfunctions occur during the commissioning, refer to the chapter "Troubleshooting" to find out the reason. The source of any problems with the product must be solved before continuing with the commissioning procedure.

WARNING	To avoid electrical shock, ensure that the main isolation switch is turned to the off position before connecting the frequency converter to the mains supply.
	To avoid damage to the equipment or persons, ensure the proper mounting of

WARNING	To avoid damage to the equipment or persons, ensure the proper mounting of the motor before starting. Also, make sure that the machinery connected to the motor allows the motor to run

# 6.1 Visual checks

1	Check that the main power is switched off.	runna (
2	Check that the serial number of the drive is the same as in the delivery documents.	
3	Check the connections and condition of cabling to motor, braking resistor (not in 003), grounding, and thermistors.	
4	Check the motor type, nominal voltage, nominal current and nominal frequency.	



# 6.2 Checks before the first run

1	Check that the main power is switched off.	rand
2	When installing a new unit, disconnect the motor (U / T1, V / T2, W / T3) cables to prevent damage to the frequency converter. Measure the insulation resistance of the motor windings (each phase to ground). Insulation resistance requirement for new motor: Cold motor (1040 °C): $\geq$ 5 MΩ Warm motor (40 °C or more): $\geq$ 1 MΩ If insulation resistance is less that requirement the motor shall be dried.	
3	Reconnect the motor cables and check the thightness of the other cables.	
4	Check that the external connections and selected control parameters (switches) are set according to the application.	S1 52 53 54 55 15 S2 53 54 55 15 S5 57 53 59 510 OR OO DANGER 100 00000000000000000000000000000000



5	Make sure that the control devices are at the neutral position.	
6	Turn the power on (main and control voltage).	
7	Measure the power supply voltage. The main voltage shall be between 380-480VAC.	▲
8	Measure the control voltage. The control voltage shall be between 42 and 240 VAC.	1 2 3 4 5 6 7 8 9 42 - 240 V

#### 6.2.1 Power up procedure

1	Make sure that the main power isolation switch is ON. The product only becomes operational (energized) after the necessary steps have been followed to established communication between the product and controller.	P C C C C C C C C C C C C C C C C C C C
2	If applicable, use the key switch to turn on the controller.	- Ceesed
3	To prepare the controller for operation, release the emergency stop button by turning it clockwise (or, if it is a push-pull button, by lifting it up) so that it is in the raised position.	First



	FAA. (937) 323-3319	
4	Energize the product by pressing the start pushbutton.	r Tanad
5	The frequency converter goes into a ready-to-run state after the power supply is connected. The frequency converter verifies that both direction signals are switched off.	
6	After start up, if a green LED is lit the frequency converter will accept driving commands.	31 52 51 54 55 31 52 51 50 510 31 52 57 52 59 510 31 52 50 510 31 52 50 510 50 50 000 1 0000000000000000000000000000000
7	A red LED indicates a fault, and the frequency converter does not accept drive commands until the cause of the fault is eliminated. The green LED blinks, indicating the fault code number. See the section "Troubleshooting" for more detailed information about the fault.	OK C

# 6.3 Test run without load

1 Ensure that movement of the equipment will not cause any danger to the environment or to the crane itself. Avoid driving close to the limit areas.



2	Check limit switches manually, if possible, by measuring their state when they are turned into different positions. After check turn the limit switches back to neutral position.	
3	<ol> <li>Drive in free direction at minimum speed for 5 to 10 seconds.</li> <li>Accelerate to full speed</li> <li>Run for 5 to 10 seconds with full speed</li> <li>Stop</li> <li>Repeat for the opposite direction.</li> </ol>	5-10 sec 5-10 sec
4	<ul> <li>Check the motor operation (acceleration, deceleration and braking):</li> <li>1. Accelerate to full speed in one direction</li> <li>2. Change to full speed in the opposite direction</li> <li>3. Again, change to full speed in the opposite direction</li> <li>4. Stop.</li> </ul>	
5	<ul> <li>Check the limit switch functions:</li> <li>1. Drive slowly in one direction and check the limit switch operations</li> <li>2. Re-check using full speed</li> <li>3. Repeat for the opposite direction.</li> </ul>	

# 6.4 Test run with load

**CAUTION** Ensure that crane movements will not cause any danger to the environment or to the crane itself.





2	Check the deceleration ramp time. Ensure that the motor brake closes <b>after</b> the movement has stopped. If the movements stops suddenly during the deceleration, check the frequency converter fault code. If it is fault 2, increse the ramp time with switch group S3.	
3	Check the limit switch functions with full load.	
	If one step slow down limit switch is used:	
	<ol> <li>Drive slowly in one direction and check the limit switch operation.</li> <li>Repeat for the opposite direction.</li> <li>If two step limit switch is used:</li> <li>Drive full enced in one direction and sheek the limit switch.</li> </ol>	
	<ol> <li>Drive full speed in one direction and check the limit switch operation.</li> <li>Repeat for the opposite direction.</li> </ol>	



Note: One step slow down limit switch do not stop the motion.



### 6.5 After the test run

Record the parameter value changes in a parameter list. Changed values are needed if the frequency converter will be replaced with a new one.

#### Upon completing the test:

Ensure that all of the remarks and parameter values are sent to the manufacturer. Up to date parameter list ensure correct parameter settings in spare part deliveries. See the section "Manufacturer" for contact information.





# 7 OPERATING INSTRUCTIONS

# 7.1 Normal function

#### 7.1.1 Control methods





# CAUTION

When a pushbutton is pressed or released, the movement will accelerate or decelerate smoothly. The operator SHALL account for the starting and stopping distances before making crane movements.



The motor stops moving after ramp time when the pushbutton is released.

	When a pushbutton is pressed or released, the movement will accelerate or
<b>NOTICE</b> When a pushbutton is pressed or released, the move decelerate smoothly. The operator SHALL account for distances before making crane movements.	decelerate smoothly. The operator SHALL account for the starting and stopping distances before making crane movements.

#### 7.1.2 Slowdown-limit

The slowdown limit reduces the speed of the crane or trolley at both ends of the runway. The slowdown signal input is connected to terminal DI4. In a normal state the limit switch contact is closed and control voltage connected to the input. When the limit switch contact is opened, the slowdown function is activated.

The slowdown function limits the output frequency. If the driving frequency is higher than the set slowdown frequency, the frequency converter decelerates to the slowdown frequency. Movement is possible between the slowdown frequency and minimum frequency. The movement speed is reduced in the running direction or both directions, depending on the setting of switch S4-2.

#### 7.1.3 Stop-limit

The stop limit stops the crane or trolley before the free runway ends. The stop limits are connected in series to direction input S1 and S2. In a normal state the limit switch contact is closed. When the limit switch contact is opened the motion stops with ramp.Movement is possible only in the opposite direction when the stop limit function is active.



#### 8 MAINTENANCE



**Note:** Mechanical and electrical maintenance work requires special skills and tools to ensure safe and reliable operation of the product. Maintenance work shall be carried out only by authorized service personnel or an experienced service technician authorized by the product's manufacturer or manufacturer's representative.

Ensure proper air flow and cooling of the frequency converter. Remove dust from cubicle and frequency converter during regular maintenace.

NOTICE	Do not use aerosol dust remover. Compressed air may damage the frequency converter.
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Inspect the frequency converter and it's environment during regular maintenance of application:

- Check fault codes.
- Check fastening of frequency converter.
- Check condition of wiring and terminal connections.
- Check condition of cable bushings and door sealings on cubicle.
- Check operation and cleanliness of cooling fan of frequency converter.
- Check operation and cleanliness of cooling fan and filters of cubicle.





# 9 TROUBLESHOOTING

The purpose of troubleshooting is primarily to determine whether problems are caused by the frequency converter or external devices. It is also possible that a faulty external device has caused damage to the frequency converter. In that case it is very important to repair or change any faulty devices to prevent recurring problems.



**Note:** When replacing a frequency converter with a new one, the parameter list of the old frequency converter is needed for copying parameter settings to the new frequency converter.



Note: Reducing of the ramp time from the value of the original delivery is not allowed.

# 9.1 **Problems and solutions**

Problem	Suggested solution
The frequency converter does not start (green LED stays off) when it is started.	Check the main voltage between terminals L1, L2 and L3. Check that there are no devices causing disturbances connected in the same voltage supply as the crane. These are e.g. devices that require large currents: big motors, welding devices etc.
	<b>NOTE:</b> When the EMC-screw is connected, the frequency converter has RC-filters connected to the power supply side to reduce disturbances to the network. The capacitors of these filters may cause the RCD (Residual Current Device) to trip. Therefore, the use of RCD with the frequency converter controlled cranes is not recommended.
The green LED is continuously on or flashing (after previous fault) and the red LED is off, but motor does not run.	Check the motor cable connection. Check the limit switches. Check the voltage in direction command terminal 1 (DI1) and terminal 2 (DI2). Also common (terminal 7).
The motor runs poorly: trolley/bridge doesn't move as it supposed to move.	Check that the load is not over nominal. Check that all cables are correctly connected and not loose. Check that all motor parameters are correctly set. Check that the U/f-curve parameters (switch group S6) are correctly set. Check the voltage of the slowdown limit switch input (DI4) and limit operation parameters (switch groups S4-2 and S5). Check that the motor's brake opens completely. Check that the minimum speed parameter value (switch group S2) has not been set too low. Drive with the device a couple of times the trolley/crane track from end to end to flatten the runway(s). Check the parameter settings for current limit (S7).



# 9.2 Exceptional situations

#### 9.2.1 Determining movement direction

The frequency converter needs to know in which direction the motor is running to execute the limit functions properly, because it has only one input for the slowdown limit and one input for the stop limit.

If the slowdown limit signal is deactivated when the motor is not running, the frequency converter cannot determine which direction is safe. Therefore, the maximum speed is limited in both directions until the slowdown limit signal is activated. Same applies if the slowdown limit signal is deactivated during a power shortage.

If the stop limit signal is deactivated when the motor is not running, the frequency converter cannot determine which direction is blocked. In this situation it is possible to run in both directions with minimum speed. The normal operating speeds are restored when the stop limit signal is activated.



Note: Driving to a stop limit will immediately cut off power to the motor.

# 9.3 Warning and Fault codes

When the frequency converter detects an unacceptable situation it stops the current movement and indicates a warning or fault code. After the unacceptable situation is removed or warning has been reset, the red LED switches off and the green LED continues to blink to inform about the latest active fault code. Green LED ends blinking the latest active fault code after second power off.

Some of the faults are reset automatically by the software, while others may require the frequency converter to be powered down. The causes of the fault(s) must be resolved and both drive commands have to be at the OFF position for 0.5s before the motor can be started again. In a case of over current fault the supply voltage must be switched off and back on before it is possible to resume operation.

Red LED			Green LE	D	Denoting code number
OFF, Blink or ON	Warning	Fault	OFF, Blin	k or ON	
			ON		Normal operation
		x	Blink Once	•	1
		x	Blink Twice	●☆●☆●●●●●●●●	2
		x	Blink Three times	● <del>☆●☆●☆</del> ●●●●●●●● <del>☆</del> ●☆●☆●	3
		x	Blink Four times	● <del>☆●☆●☆●☆</del> ●●●●●●● <del>☆</del> ●☆●	4
	x		Blink Five times	● <del>☆</del> ●☆●☆●☆●☆●	5
		x	Blink Six times	● <del>☆●☆●☆●☆●☆</del> ●	6



	x	Blink Seven times	● <del>☆●☆●☆●☆●☆●</del> ☆●	7
	х	OFF		Other fault



**Note:** There is a pause after each time the green LED has finished blinking the error code sequence. After the pause, the green LED starts blinking again.

The warning and fault code numbers and corresponding warnings and faults, possible causes and suggested solutions are listed in the following table.

Code	Warning or Fault	Possible cause	Solution
1	Over current / current limit (stall)	<ul> <li>A sudden and significant load increase has occurred</li> <li>There is a short circuit in the motor cable</li> <li>The motor is inadequate for the application</li> <li>The motor parameters have been set wrong</li> <li>Current limit activates</li> <li>Ramp time is too short</li> </ul>	<ul> <li>Check the load of the motor</li> <li>Check the motor brake operation</li> <li>Check the connection of the motor cable</li> <li>Check the motor insulation</li> <li>Verify the correct parameters</li> <li>Check crane/trolley runway clearness</li> <li>To reset: Power off and restart after 1 min.</li> </ul>
2	Power supply under- or over voltage, over voltage at start	<ul> <li>The supply voltage is below 240VAC</li> <li>The supply voltage is unbalanced</li> <li>The deceleration time is too short</li> <li>The supply voltage is over 528 VAC (480V+10%), has over voltage spikes or not sinusoidal wave form</li> </ul>	<ul> <li>Check that the supply voltage is not unbalanced</li> <li>Check that the supply voltage level is above 380VAC-15%. Use, for example, autotransformer to boost the voltage</li> <li>Set a longer deceleration time</li> <li>Measure the supply voltage level and wave form, use an autotransformer to lower the voltage</li> <li>Check the braking resistor cable (model 006, not 003)</li> <li>Check the braking resistor type and resistance (internal 120Ω, external 90Ω)</li> <li>To reset: voltage must increase above the limit OR power off and restart after 1 min. Main voltage must be under 528 V<sub>AC</sub></li> </ul>
3	Frequency converter Under / over temperature	<ul> <li>The crane is operated in a temperature that is too low/high</li> <li>The cubicle/panel heating is not working</li> <li>The cubicle/panel isolation is broken or the door is open</li> <li>The cubicle/panel cooling is not working</li> <li>Dust inside the frequency converter</li> <li>Broken cooling fan</li> </ul>	<ul> <li>Check that the environment temperature meets the crane's requirements</li> <li>Check the cubicle/panel heating/cooling systems and air flow. If cooling fan is not working replace the frequency converter.</li> <li>To reset: when the ambient temperature rises above -10°C OR drops below +40°C.</li> </ul>
4	Earth fault in motor output	<ul> <li>The motor load is not symmetric</li> <li>There is an insulation failure in the motor winding or motor cable</li> </ul>	<ul> <li>Check the motor/motor cable insulation (phase-ground, phase-phase)</li> <li>To reset: power off and restart after 1 min</li> </ul>
5	External stop / limit warning	<ul> <li>Limit switch is activated</li> <li>The motor has overheated</li> <li>Loose or missing wire in DI6</li> <li>Parameter S5 setting</li> </ul>	<ul> <li>Drive back from limit switch</li> <li>Wait until the motor is cooled down</li> <li>To reset: Power off and restart after 1 min.</li> </ul>
6	DC bus over voltage	<ul> <li>DC bus voltage has been too high because of too short slowdown ramp time</li> <li>The tailwind load is too high or, in tandem use, the other crane is pushing</li> <li>Check the braking resistor connection</li> </ul>	<ul> <li>Increase the deceleration ramp time (Switch group S3)</li> <li>To reset: leave the controls at a neutral position at least 0.5 second</li> </ul>



Code	Warning or Fault	Possible cause	Solution
7	Both drive commands on / parameter fault	<ul> <li>Both drive commands are in the "on" position</li> <li>There is a short circuit in the pendant or pendant cable</li> <li>Parameters have been set wrong</li> </ul>	<ul> <li>Check the digital I/O cabling</li> <li>Check the parameter settings (Switch group S8 and S9)</li> <li>To reset: set both drive commands to OFF OR set correct values for the parameters, turn the supply voltage off and restart after 1 min</li> </ul>
other fault	Other fault	Several reasons	Replace the device



# **10 TAKING PRODUCT OUT OF OPERATION**

# 10.1 Disposal of waste materials

Waste material from installation, maintenance or dismantling shall be disposed of according to local regulations.





# **11 TECHNICAL DATA**

Mains connection	Supply voltage Uin	380 - 480V, -15%+10% 3-phase	
	Supply voltage frequency	4566 Hz	
	Connection to mains	Once per minute or less (normal case)	
Motor connection	Output voltage	0 — 0,95*U <sub>in</sub>	
	Nominal output current	003: I <sub>N</sub> 2.4A (max 3.6A), 006: I <sub>N</sub> 5.6A (max 7.7A)	
	Continuous output current	Ambient temperature max. +50°C, overload 1.5 x I <sub>N</sub> (1min/10min)	
	Starting current	$2 \ x \ I_N \ 2 \ sec$ every 20 sec, if output frequency <30Hz and temperature of heatsink <+60°C	
	Output frequency	5120 Hz (limited options)	
Braking resistor (only 006 model)     Resistance     Internal resistor: 12 External resistor: 90       Digital inputs     Control voltage     42 – 240 V., current		Internal resistor: 120 $\Omega$ (45 W continuous, 2000 W peak power) External resistor: 90 $\Omega$ (550W continuous power)	
Digital inputs	Control voltage	42 – 240 V <sub>ac</sub> , current consumption 15 ± 5 mA	
Terminals	Tightening torque	0,5 – 0,6 Nm	
	Conductor diameter	Mains, motor, braking resistor and grounding terminals: 1.5 – 4.0 mm	
	Conductor diameter	Digital input terminals: 1.0 – 1.5 mm	
Control features	Control method	Frequency Control U/f	
		Open Loop Vector Control	
	Switching frequency	3,6 kHz	
	Field weakening point	Fixed values	
	Acceleration time	1,55,5s (0,5s steps)	
	Deceleration time	1,55,5s (0,5s steps)	
Ambient conditions	Ambient operating temperature	-10°C (no frost)+50°C (outside the cubicle + 40°C)	
	Storage temperature	-40°C+70°C	
	Relative humidity	095% RH, non-condensing, non-corrosive, no dripping water	
	Air quality:		
	- Chemical vapors	IEC 721-3-3, unit in operation, class 3C2	
	- Mechanical particles	IEC 721-3-3, unit in operation, class 3S2	
	Altitude	100% load capacity (no derating) up to 1000m. 1% derating for each 100m above 1000m; max. 2000m	
	Vibration:	5150 Hz Displacement emplitude 1 (neek) mm et 5 - 15 9 Hz	
	EN50178/EN60068-2-6	Displacement amplitude 1 (peak) mm at 515.8 Hz	
	Shock	IIPS Drop Test (for applicable LIPS weights)	
	EN50178. IEC 68-2-27	Storage and shipping: max 15 G. 11 ms (in package)	
	Enclosure class	IP20	
	Weight	003 model: 0.6 kg, 006 model: 1.4 kg (including braking resistor)	
EMC	Immunity	Complies with EN61000-6-2, EMC: EN61800-3: 2004	
		EMC-level N: with the internal EMC filter connected	
	Emissions	EMC level 0: with the internal EMC filter disconnected	
		Complies with EN61800-3 A11 (2004) for second environment	
Safety		61800-5-1, EN60204-1, CE, UL, cUL, FI, GOST R, IEC (see the unit's main sticker for more detailed approvals), RoHS	
Protections	Over voltage protection	875V <sub>DC</sub> trip level	
	Under voltage protection	333V <sub>DC</sub> trip level	
	Earth-fault protection	Earth fault is tested before every start. In case of earth fault in motor or motor cable, only the frequency converter Is protected.	
	Unit over temperature	Yes	
	Motor stall	Yes	
	Overcurrent protection	Trip limit 4,0*I <sub>N</sub> instantaneously	
	Motor overtemperature supervision	Yes	



# **12 QUICK GUIDE FOR THE SWITCH INTERFACE**

#### Start with these:

#### Then proceed with the following:

Swite	:h S9	Motor	Nominal II
- 1	- 2	Nominal f	Nominal O
0	0	100Hz/120Hz	400 V / 460 V
0	1	80Hz	400 V
1	0	35Hz	400 V

Switch S1			Max driving frequency			
-1	-2	-3	Motor 100/120 Hz	Motor 80 Hz	Motor 35 Hz	
1	1	1	50	55	26	
1	1	0	60	60	28	
1	0	1	70	65	30	
1	0	0	85	70	33	
0	1	0	95	75	35	
0	0	0	100	80	19	
0	1	1	110	45	21	
0	0	1	120	50	24	

Switch S2			Min driving frequency				
-1	-2	ېم-	Motor 100/120 Hz	Motor 80 Hz	Motor f 35 Hz		
0	1	1	-	24	-		
0	0	0	14	10	5		
0	0	1	16	12	6		
1	0	1	20	14	7		
1	0	0	23	20	8		
0	1	0	26	18	9		
1	1	0	28	16	10		
1	1	1	30	22	-		

#### Switch S6 Zero f V U/f Mid V Motor Type -1 -2 -3 [%] [%] 0 1 0 6 12 MF06LA100 0 MF06LA100(\*) 1 1 6.5 12 0 12 MF06LA200 0 0 8 1 1 0 8.5 12 MF06LA200(\*) 0 1 1 MF06MA100 9 16 MF06MA200, MF06MK200 0 0 1 10 14 (100/120 Hz) MF06MK200 (35Hz) 1 0 0 21 24 1 1 1 Chain hoist (\*) Boost function

 
 Switch S7
 Current limit [%]
 K003 [A]
 K006 [A]

 -1
 -2
 -3
 [%]
 K003 [A]
 K006 [A]

 0
 1
 0
 150 %
 3.6
 7.7

Switch S8			Number of	K003 Current	KOOG Current [A ]
-1	- 2	- 3	Motors	[A <sub>rms</sub> ]	Kobo Current [Arms]
0	0	0	1	3	3
0	0	1	2	4.8	6
0	1	0	3	-	9
0	1	1	4	-	12

#### Finally, set these:

Switch S4-1	Switch S4-2	Method	Operation	Description
0		EP2		
1		MS2		
	0		Direction memory ON	Limit switch status saved.
	1		Direction memory OFF	Max. speed limited in both directions until the circuit is closed.

Switch S10-1	DI6 (external stop) Function	Description	
0	In use	Voltage present in input.	
1	Not in use	No effect in operation.	

S	Switch S5		Slowdown &St		
-	1	I - 2 Input DI4 (Slowdown) Input		Input DI5 (Stop)	Slowdown f [%]
(	0	0	In use	In use	20
(	0	1	In use	Not in use	20
	1	0	In use	In use	35
	1	1	Not in use	Not in use	-

S3			Acceleration
-1	-2	-3	and deceleration Time
1	1	0	1.5
0	1	1	2
0	1	0	2.5
1	0	1	3
0	0	0	3.5
1	0	0	4
0	0	1	4.5
1	1	1	5.5

1	0
ON	OFF
· • · · · · · ·	1 (C 1)
	•

Input	MS2	EP2	
DI1	S1	S1	
DI2	S2	S2	
DI3	MS2	AP	
DI4	S11/S21	S11/S21	
DI5	SS12/S22	S12/S22	
DI6	ES	ES	
COM	Common DI1-DI6		





# **13 APPENDIX 1, ELECTRICAL CONNECTIONS**

Sample electrical drawing for limit switch connections.



DI2 Direction 2 DI3 – DI6 Digital input DCOM Control voltage, neutral STOP Stop limit switch SLOW Slowdown limit switch BI-METAL SWITCH Thermal limit switch

NOTICE

All electrical connections shall do according to valid project specific electrical drawings.