TAKEDO®- 3VF TKN

USER MANUAL

0	17.11.2023	E. Castagnini
REV.	DATE	Verification and approval R.T.

INDEX

1 – INTRODUCTION

TAKEDO-3VF TKN is a new inverter model **with built-in EMC filter**, compliant with Directives 2014/30/EU (Electromagnetic Compatibility) and 2014/35/EU (Low Voltage).

The inverter can only operate in open loop.

This manual contains **essential information** concerning the connections in the control panel and the operation of the inverter (keyboard operation, parameter list, alarm messages).

Complete application information can be found in the original Nidec TECHNICAL INSTALLATION AND MAINTENANCE MANUALS (**M400** series inverter) available at **https://acim.nidec.com.**

2 – WARNINGS AND CAUTIONS

For all **personal safety** warnings and **to avoid accidental damage to the product or the equipment** connected to it, please refer to the **"SAFETY"** chapter of the original Nidec INSTALLATION AND MAINTENANCE MANUALS (M400 series inverter) available at **https://acim.nidec.com**, where the "Declaration of Conformity" is also available.

Read this manual completely before powering up the equipment.

With regard to the specific application on lifts, please also carefully consider the following points:

1- **The leakage current of the inverter to earth is higher than 30mA**, therefore a residual current circuit breaker with **I_d not less than 300mA, type B or type A**, must be provided. The standard prescribes a cable with a minimum cross-section of 10 mm² for the earth connection. **If, when closing the main switch, the residual current circuit breaker trips, do not repeat the manoeuvre several times in succession because the inverter could be permanently damaged**. Check that the residual current circuit breaker is at least 300mA.

2- **Network connection:** once a minute or less

3- In order to prevent damage to the inverter in the event of prolonged standstill without power, it is necessary to:
   - **If the inverter has been idle for several months, power it for at least 1 hour in order to regenerate the bus capacitors.**
   - **If the inverter has been idle for more than 1 year, power it for 1 hour at a voltage 50% below the rated voltage, then for 1 hour at the rated voltage.**

4- It is advisable to balance the system 50/50. If the balance is 40%, the rising current at full load is higher and it may be necessary to use a larger inverter.

3 – TECHNICAL DATA

TKN 400 VOLT series INVERTER (380 – 480V +/- 10%)

RATED CURRENT In (A)	OVERLOAD CURRENT Ia (A)	MAXIMUM CURRENT Is (A)	CODE	DIMENSIONS WxHxD (mm)	FUSES gG/gL (A)
13	19.5	23.4	TKN00135	115x286.6x175	20
16	24	28.8	TKN00165	115x286.6x175	25

In = Continuous rated current
Ia = Overload current (150%) for 1 minute every 10'
Is = Maximum current (180%) for 3 seconds every 20''

Device operating temperature = -10°C…+70°C
Stand-by consumption = 10W

IMPORTANT!

Current values are based on a temperature of 40°C, and a maximum switching frequency of 8kHz.

For use in different conditions, please refer to the manufacturer's manual.

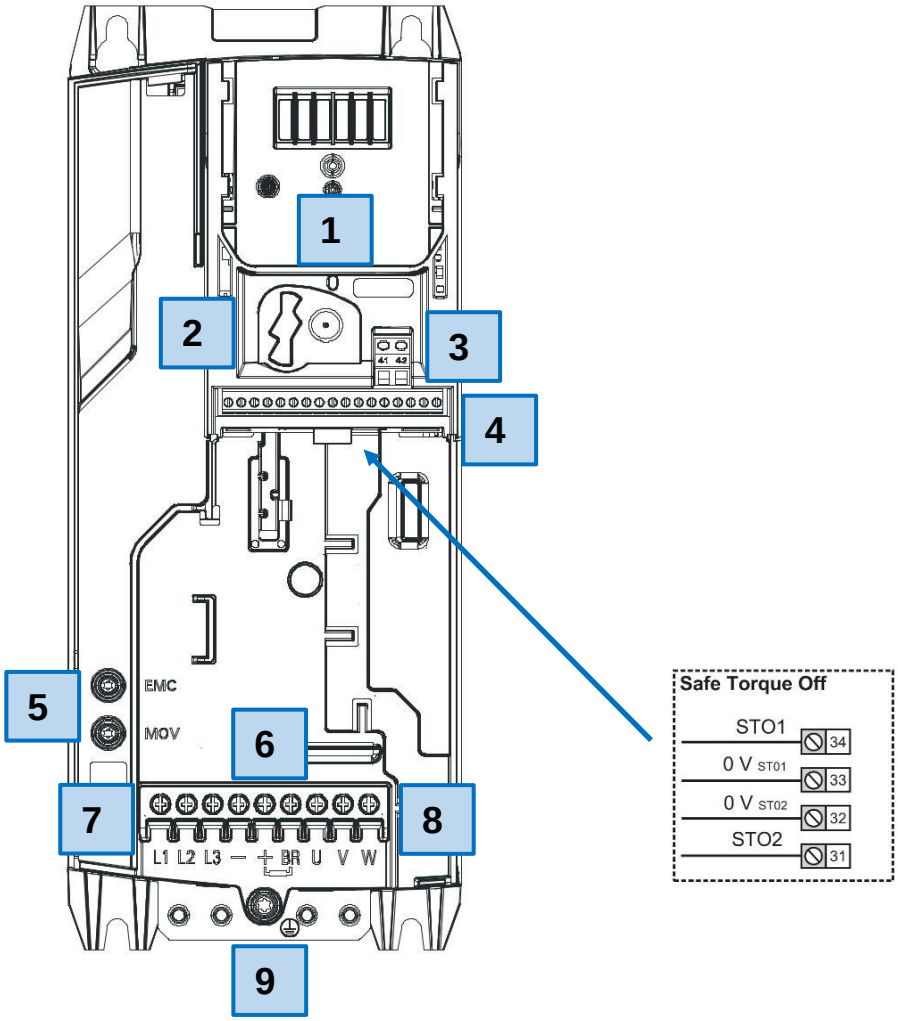
CODE	BRAKING RESISTORS		
	PROVIDED BY SMS (Ω) - (W)	MINIMUM VALUE RECOMMENDED (Ω)	DIMENSIONS WxDxH (mm)
TKN00135	65Ω – 500W (004.16.W0065)	50	260x36x27
TKN00165	No. 2 x 33Ω - 500 W in series (004.16.W0033 x 2)	50	260x36x27

4 – POWER CIRCUIT CONNECTION

L1; L2; L3	Mains power input	Connect the three mains input phases, irrespective of cyclic direction.
U; V; W	Inverter output	Connect the three output phases to the contactors and then to the motor
+; BR	External braking resistor	Connect the external braking resistor
⏚	Earth	Connect to the earth of the electrical system

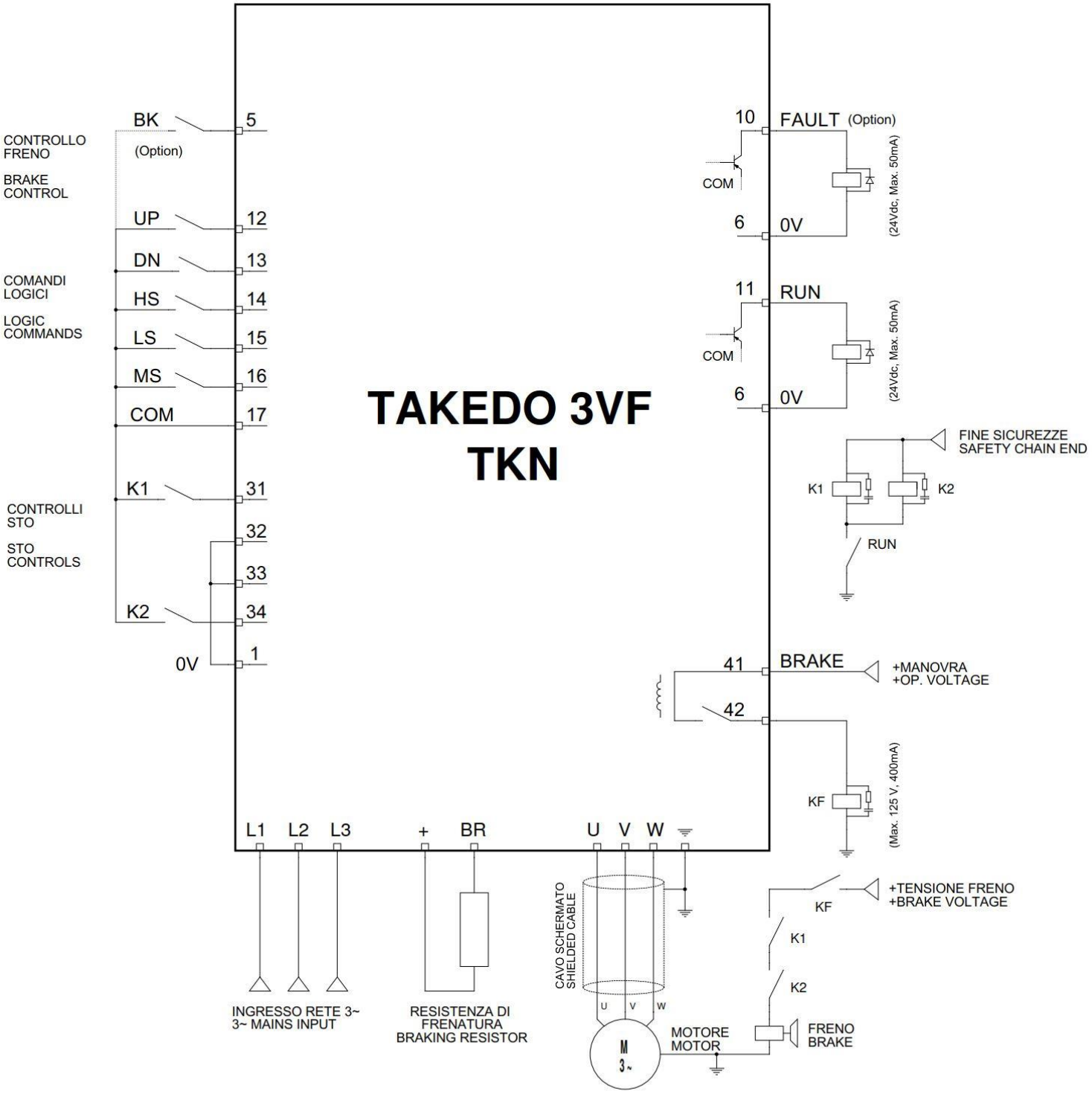
For cable sizing and terminal locations, please refer to the chapter "POWER CONNECTIONS" in the original Nidec TECHNICAL INSTALLATION AND MAINTENANCE MANUAL (**M400** series inverter) available at **https://acim.nidec.com.**

5 – LAYOUT



Number	Description
1	Removable keypad
2	Release opening (STO terminals below)
3	Relay output terminals
4	Control I/O terminals
5	EMC filter screws and internal MOV varistor
6	Braking resistor terminals +, BR
7	Mains input terminals L1, L2, L3
8	Motor output terminals U, V, W
9	Earth screw

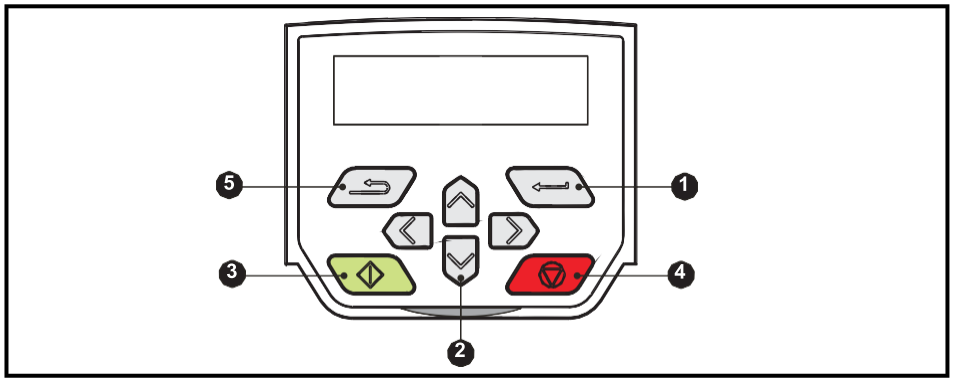
6 – APPLICATION DIAGRAM



7 – KEYBOARD AND PROGRAMMING

The keyboard and display provide information on the drive's operating status, alarms and alarm codes, and allow parameters to be changed and the drive to be reset in the event of an alarm.

Detail of the TKN drive keyboard



(1) The *Enter* key is used to access parameter display or editing mode, or to confirm a change made to a parameter.

(2) The *Navigation* keys are used to select individual parameters or to change parameter values. In keyboard mode, the '*Up*' and '*Down*' keys are also used to increase or decrease the motor speed.

(3) The *Start* button (green) not used.

(4) The *Stop / Reset* button (red) is used to reset any alarms and to confirm the saving of parameters. Continuous pressure for 5 seconds clears the alarm history.

(5) The Exit key is used to exit parameter edit/display mode or to ignore a parameter change.

NOTES : The keyboard is supplied only on request.

On the multi-line LCD display, it is possible, in addition to displaying parameters, to monitor inverter operation

7.1 Status indications

String top line	Description	Drive output stage
Inhibition	The drive is inhibited from operation because the STO inputs are not enabled	Disabled
Ready	The drive is ready to be started. STO inputs are present but the run command is missing (input 12 or 13)	Disabled
Run	The drive is up and running.	Enabled
Loss of power supply	A power loss condition was detected.	Enabled
Deceleration	The drive is stopping the motor.	Enabled
Alarm	The drive has gone into alarm and is no longer controlling the motor. The alarm code is shown in the lower display.	Disabled
Undervoltage	The drive is in an undervoltage state, in low voltage or high voltage mode.	Disabled

8 – PARAMETERS MENU

Parameter	Description	Default value	Installation value
00.000	Takedo TKN		
00.001	Current limit	180,0 %	
00.002	Motor rated voltage	400 V	
00.003	Motor rated frequency	50.00 Hz	
00.004	Motor rated speed	1440.0 rpm	
00.005	Motor rated current	13,50 A	
00.006	Motor rated power factor	0,85	
00.007	Self-calibration	0	
00.008	Stator resistor	0,0000 Ω	
00.009	Trans. induct.	0.000 mH	
00.010	Maximum frequency	50.00 Hz	
00.012	V1 - Input frequency 14	50.00 Hz	
00.013	V2 - Input frequency 15	5.00 Hz	
00.014	V3 - Input frequency 14+15	30.00 Hz	
00.015	V4 - Input frequency 16	25.00 Hz	
00.016	V5 - Input frequency 14+16	0.00 Hz	
00.017	V6 - Input frequency 14+15	0.00 Hz	
00.018	V7 - Input frequency 14+15+16	0.00 Hz	
00.020	Acceleration time	2,0 s	
00.021	Deceleration time	2,0 s	
00.022	Deceleration stop time	4,0 s	
00.023	Acceleration start rounding	3.0 s²/100Hz	
00.024	Acceleration end rounding	3.0 s²/100Hz	
00.025	Deceleration start rounding	3.0 s²/100Hz	
00.026	Deceleration end rounding	6.0 s²/100Hz	
00.029	Initial torque level	50,00%	
00.030	Time 0Hz departure	0,8 s	
00.031	Initial rounding	1.5 s²/100Hz	
00.032	Brake opening delay	0,1 s	
00.033	Activation frequency 0Hz	0.10 %	
00.034	Brake closing delay	0,1 s	
00.035	Time 0Hz arrival	0,5 s	
00.036	Torque 0Hz	100,0 %	
00.050	Max switching freq	8 kHz	
00.051	Boost voltage	2,0 %	
00.052	Boost frequency	2,0 %	
00.060	2-speed sequence	Off	
00.061	Brake control enabling	Off	
00.062	Contact type ON=NC / OFF=NO	Off	
00.063	Logical input polarity	Positive logic	

Parameter	Description	Default value	Installation value
00.070	Alarm 0	None	
00.071	Alarm 1	None	
00.072	Alarm 2	None	
00.073	Alarm 3	None	
00.074	Alarm 4	None	
00.075	Alarm 5	None	
00.076	Alarm 6	None	
00.077	Alarm 7	None	
00.078	Alarm 8	None	
00.079	Alarm 9	None	

9 – MONITOR MENU

Parameter	Description	Example value	Measured value
00.080	Stack temperature	33 °C	
00.081	Reference selected	50.00 Hz	
00.082	Pre-ramp reference	5.00 Hz	
00.083	Final request reference	2.00 Hz	
00.084	c.c. Bus voltage	536 V	
00.085	Output frequency	40.00 Hz	
00.086	Output voltage	320 V	
00.087	Motor rpm	1400 rpm	
00.088	Current absolute value	10,00 A	
00.089	Torque production current	08,00 A	
00.090	Digital I/O read word	0x000110010100	
00.091	Active reference	Off	
00.092	Reverse selection	Off	
00.093	Jog selection	Off	
00.094	Analogue input 1	0,00%	
00.095	Analogue input 2	100,00%	

10 - Saving parameters

Saving the parameters is not automatic but must be done manually using the following procedure:

- Select "*Save parameters*" in parameter 00.000 Takedo TKN and confirm with the enter key 
- Confirm saving by pressing the Stop key 

11 – DIAGNOSTICS

If a drive has a fault, users should not attempt to repair it, nor should they carry out any troubleshooting other than the diagnostic functions described in this chapter.

11.1 Fault indications

Alarm code	Condition	Description
Self-calibration	The measured inertia exceeded the set parameter range	The drive went into alarm during self-calibration with a rotating motor, or during a mechanical load measurement test.
Self-calibration interrupted	The self-calibration test was interrupted before completion	The drive could not complete the self-calibration test because the drive enable signal or the drive start signal was removed.
Braking resistor overheat	Braking resistor overload timeout (I^2t)	A timeout occurred due to an overload of the braking resistor.
Current offset	Current feedback offset error	The current offset is too much to compensate.
Modification of data	Drive parameters are being changed	A user intervention or write operation is in progress in the file system that is changing the drive parameters and the drive enable has been set.
Derivative ID	Error in the derivative file	Contact the drive supplier.
Image of the derivative	Image error of the product derivative	Contact the drive supplier.
Destination	Two or more parameters are writing to the same destination parameter.	The *dest* alarm indicates that the destination output parameters of two or more logic functions (Menu 7 and 8) within the drive are writing to the same parameter.
Drive configuration	Drive configuration	Contact the drive supplier.
EEPROM error	Default parameters have been loaded	The cause of the alarm can be identified by checking the sub-alarm number displayed after the alarm string.
External alarm	Mechanical brake status feedback	The comparison of the status of the brake output (41-42) with the control input (input 5) was negative for at least 3 continuous seconds.
Fan failure	Fan failure	Indicates a fault in the fan or its circuits.
Modified file	Modified file	A file has been modified, switch off and on again to clear the alarm.
Incompatible FW	Firmware incompatibility	User firmware is incompatible with power firmware.
HFxx trip	Hardware faults	Internal drive hardware fault (see the *User's Control Guide*).
Hot brake/rectifier	Hot brake/rectifier	Over-temperature detected on the input rectifier or braking IGBT.
Cal. range I	Current calibration range	Current calibration range error.
I/O overload	Digital output overload	The total current drawn by the 24 V AI-Adaptor or the digital output has exceeded the limit.
Watchdog	Watchdog timeout (surveillance system) control word	The *Watchdog* alarm indicates that the control word has been enabled and a timeout has occurred.

Alarm code	Condition	Description
Motor overheating	Output current overload timeout (I^2t)	The alarm indicates a thermal overload of the motor based on the output current and the thermal time constant of the motor. The drive generates the *Motor overheating* alarm when the accumulator reaches 100%. This can happen: In the presence of excessive mechanical load Ensure that the load is not blocked/glued Check that the load on the motor has not changed Ensure that the rated motor current is not set to zero
No power board	No power board	No communication between control and power boards.
Brake OHt	Braking IGBT overtemperature	Braking IGBT overtemperature.
Control OHt	Control stage overtemperature	Control stage overtemperature.
DC bus OHt	DC Bus overtemperature	Overheating of a DC Bus component based on a thermal protection software model.
Inverter OHt	Inverter overtemperature depending on thermal protection model	An overtemperature was detected in the IGBT connection based on a thermal protection software model.
Power supply OHt	Power stage overtemperature	This alarm indicates that an overtemperature has been detected in the power stage.
Rectifier OHt	Rectifier overtemperature	The *rectifier OHt* alarm indicates that an overtemperature has been detected in the rectifier.
AC OI	Detection of an instantaneous output current overload	The instantaneous output current of the drive has exceeded the set limit. Possible solutions: Increase acceleration/deceleration time If the problem is detected during self-calibration, reduce the voltage boost Check if there is a short circuit in the output wiring Check whether the motor insulation is intact, using an insulation tester The length of the motor cable is within the limits for this size Reduce values in current loop gain parameters
OI brake	Detection of a current overload in the braking IGBT: short-circuit protection for braking IGBT activated	A current overload was detected in the braking IGBT or the protection of this IGBT was activated. Possible cause: Check the wiring of the braking resistor Check that the braking resistor value is greater than or equal to the minimum resistor value Check the insulation of the braking resistor
Disabling options	The option module does not provide confirmation when changing the drive mode	The option module did not provide confirmation by notifying the drive that communication with the drive was interrupted during the drive mode change within the allotted available time.

Alarm code	Condition	Description
Loss of a motor phase	Loss of a motor phase detected	The loss of a phase at the drive output was detected.
Output phase short circuit	Output phase short circuit	Current overload detected at drive output when enabled.
Overspeed	The motor frequency has exceeded the maximum frequency threshold	Excessive motor speed (normally caused by the mechanical load driving the motor).
Overvoltage	DC bus voltage has exceeded the peak or maximum level in continuous operation for 15 seconds	The *Overvoltage* alarm indicates that the DC bus voltage has exceeded the maximum limit. Possible solutions: Increase *Deceleration Time 1* (Pr 00.004) Decrease the braking resistor value (but keep it above the minimum value). Check the level of the rated AC power supply voltage. Check if there are any power supply disturbances that can cause the DC bus voltage to rise. Check the motor insulation using an insulation tester.
Loss of a phase	Loss of a power phase	The drive detected the loss of an input phase or a strong imbalance in the power supply.
HF power board	HF power board	Hardware anomaly in the power processor.
Serial line power supply	Communication has been lost / errors were detected between the power and control stage	No communication between power and control stage.
Power supply data	Power supply system configuration data error	Error in the configuration data stored in the power supply system.
Save at shutdown	Save error at shutdown	An error was detected in the shutdown parameters saved in non-volatile memory.
PSU	Internal power supply fault	One or more internal power supply rails are out of limits or overloaded.
Resistance	The measured resistance exceeded the set parameter range	The stator resistance measured during a self-calibration test exceeded the maximum possible value of the *Stator Resistance* parameter. See the *User's Control Guide*.
Different slot 1	The option module inserted in slot 1 has changed	The option module in slot 1 on the drive is different in type to the one installed when the parameters were last saved on the drive.
Error slot 1	The option module in option module slot 1 detected a fault	The option module in slot 1 on the drive has detected an error.
HF slot 1	Hardware failure of option module 1	The option module in slot 1 on the drive has detected a hardware fault.
Slot 1 not installed	The option module inserted in slot 1 was removed	The option module in slot 1 on the drive has been removed since the last power-up.
Watchdog slot 1	Optional module watchdog function assistance error	The option module installed in slot 1 started the watchdog function option, but failed to assist the surveillance system correctly.
Soft Start	Soft start relay did not close, soft start monitoring fault	The soft start relay in the drive did not close or the soft start monitoring circuit did not function.
STO error	Safe Torque Off board not installed	STO boar not installed.

Alarm code	Condition	Description
HF saved	A hardware alarm occurred during the last shutdown	The hardware alarm (HF01 -HF19) occurred and the drive was switched off and on again. Contact SMS.
Subarray RAM	RAM memory allocation error	The *Subarray RAM* alarm indicates that the derivative image of an option module required more parameter RAM than allowed.
Temp. feedback	Internal thermistor fault	Internal thermistor fault.
Braking res. temp.	Braking resistor overtemperature	The *Braking res. temp* alarm is generated if hardware-based thermal monitoring of the braking resistor is connected and the resistor overheats.
Thermistor short-circuit	Short circuit in motor thermistor	The Thermistor *short-circuit* alarm indicates that the motor thermistor connected to terminal 14 (digital input 5) on the control terminal connections is short-circuited or has a low impedance (< 50 Ω).
Thermistor	Motor thermistor overtemperature	The *Thermistor* alarm indicates that the motor thermistor connected to terminal 14 (digital input 5) on the control terminal connections has indicated an over-temperature in the motor.
User AC OI	User AC OI	The *User AC OI* alarm is generated if the output current of the drive exceeds the alarm level set by Pr *User alarm level for current overload*. See the *User's Control Guide*.
User programme alarm	Alarm generated by integrated user programme	This alarm can be activated from within an integrated user programme.
User programme	Integrated user programme error	An error was detected in the image of the onboard user programme.
Saving users	Error saving user / not completed	The *User Save* alarm indicates that an error has been detected in the user save parameters in the non-volatile memory.

11.2 Alarm indications

In any mode, an alarm is an indication shown on the display alternating between the alarm string and the drive status string. If no action is taken to eliminate any alarm, with the exception of the “Self-calibration” or “24V auxiliary power supply loss” alarm, the drive may eventually go into alarm. Alarms are not displayed when changing parameters.

Alarm string	Description
Braking resistor	Braking resistor overload. The parameter *Braking resistor thermal accumulator* in the drive has reached 75.0% of the value at which the drive goes into alarm. Refer to the *Electrical Connection Guide*.
Motor overload	The *Motor protection accumulator* parameter has reached 75.0% of the value at which the drive goes into alarm, and the load on the drive is > 100%, reduce the motor current (load). See the *Parameter Reference Guide*.
Drive overload	Drive over-temperature. The parameter *Drive thermal alarm level percentage* in the drive is above 90%. See the *Parameter Reference Guide*.
Self-calibration	The self-calibration procedure has been initialised and a self-calibration is in progress.
Low AC	Low voltage mode. See *Low AC Alarm* in the *User's Control Guide*.
Current limit	Active current limit. See *Active Current Limit* in the *User's Control Guide*.
Loss of 24V auxiliary power supply	No 24V auxiliary power supply. See *Enabling leakage for 24V alarm* in the *User's Control Guide.*

12 – ADJUSTMENTS

Before starting the system, the motor data must be set and the self-calibration must be carried out

12.1 Motor data setting

Parameter 00.002 Motor rated voltage: Power supply voltage data read on plate
Parameter 00.003 Motor rated frequency: Rated frequency data read on plate
Parameter 00.004 Motor rated speed (rpm): Motor load rpm data

- In case the rpm is not known, or 1500 rpm is indicated on the plate:
  - if the motor is 1 or 2 Speed or for conventional ACVV, set 1350/1380 rpm.
  - if it is for VVVF, set 1440 rpm.

Parameter 00.005 Motor rated current : Current consumption data read on the plate
Parameter 00.006 Motor rated power factor : Cos phi data read on the plate

- In case you do not know the value of cos phi:
  - if the motor is 1 or 2 Speed or for conventional ACVV, set 0.76 rpm.
  - if it is for VVVF, set 0.80.

12.2 Self-calibration

After entering the correct values for the motor, **it is essential to carry out the SELF-CALIBRATION**:

- Set parameter **00.007** to 1, and make a call within 10 seconds.
- the inverter controls the contactor attraction but does not open the mechanical brake. Wait for parameter 00.007 to return to value 0 automatically.
- Cancel the call (e.g. by opening the control valve).
- Verify successful self-calibration by checking that the following parameters have changed from the default ones

Parameter	Description	Default	Value
00.008	Stator resistor	0,0000 Ω	
00.009	Trans. induct.	0.000 mH	

If you change any value of the motor characteristics, you have to repeat the SELF-CALIBRATION.

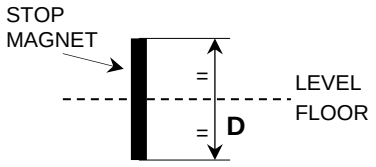
12.3 Deceleration and stopping spaces

Position the deceleration controls at a distance from the floor as in the table

DECELERATION SPACES TABLE			
Rated system speed (m/s)	**0.7**	**1.0**	**1.2**
Required deceleration space (mm)	**1000**	**1400**	**1700**

With larger spaces comes greater comfort.

Position the stop switch in a central position in relation to the floor, observing the distances according to the following table



STOPPING SPACES TABLE			
Rated system speed (m/s)	**0.7**	**1.0**	**1.2**
Total stopping distance (D) (mm)	**60**	**80**	**100**

The stop setting is done via the inverter parameters (see next point **12.7**).

12.4 Speed settings

Parameter 00.010 Maximum frequency: Set the frequency to which the rated cabin speed corresponds

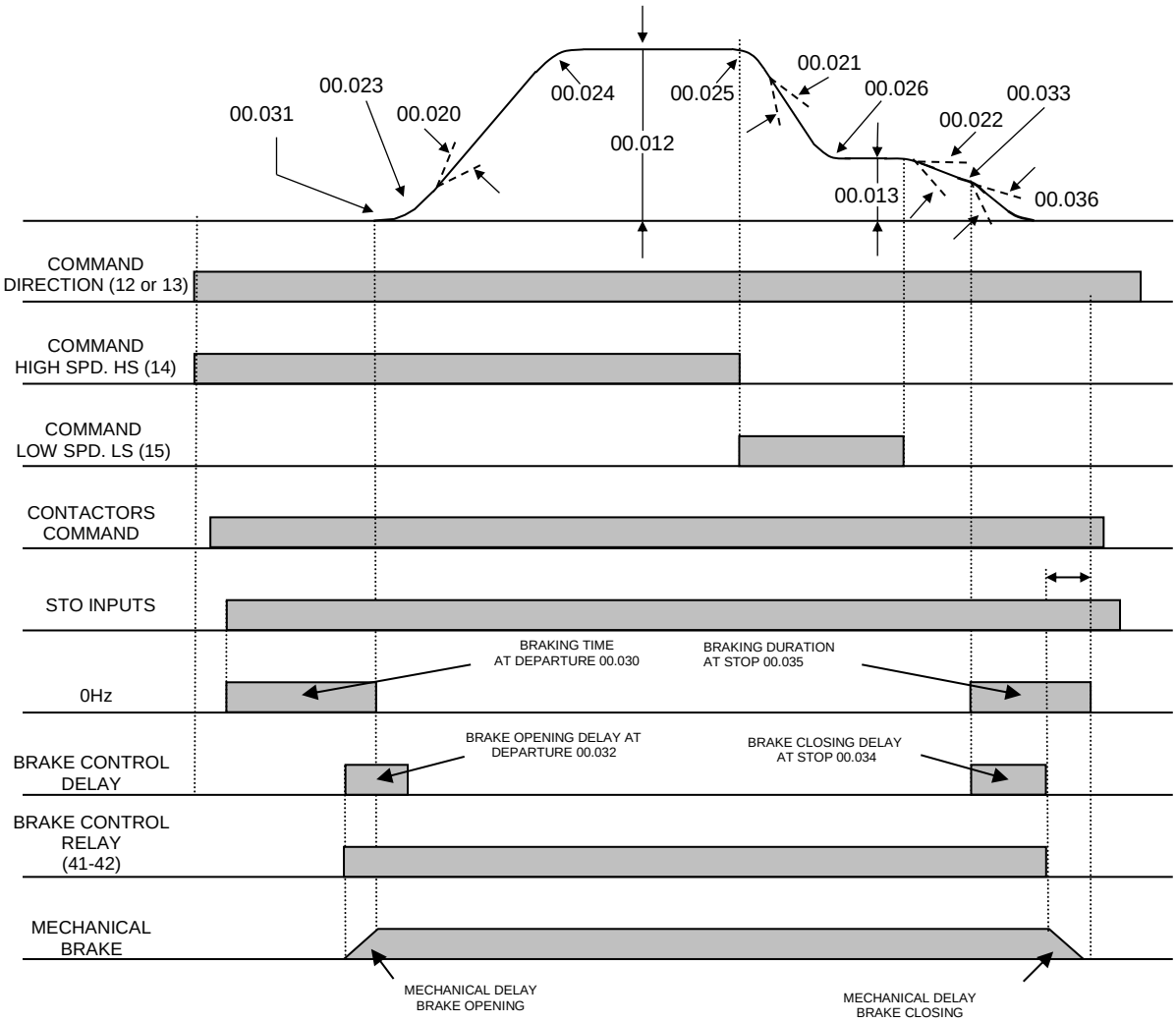
Parameter 00.012 V1 Input Frequency 14: Set the frequency to which the rated cabin speed corresponds

Parameter 00.013 V1 Input frequency 15: Set the frequency to which the speed of approach to the floor corresponds (normally 1/10 of the rated speed)

Parameter 00.015 V1 Input frequency 16: Set the frequency to which the maintenance speed corresponds (Speed less than 0.63 m/sec)

Check that parameters 00.010 to 00.018 are programmed with values compatible with the motor's rated frequency.

12.5 Speed profile



12.6 Input status monitor

In parameter **00.090 Digital I/O read word**, the status of the inverter inputs can be monitored.

Bit	11	10	9	8	7	6	5	4	3	2	1	0
I/O	--	--	Brake	STO2	STO1	MS	LS	HS	DN	UP	--	--
Example	0	0	1	1	1	0	0	1	1	0	0	0

12.7 Final adjustments

After carrying out the above points, test the system and make the following checks and adjustments if necessary:

IMPORTANT: Parameters must ALWAYS be changed ONE AT A TIME

1 - Adjust the **departure** via the parameters:

		JERK	COUNTER-WHEEL
00.029	Initial Torque level	▲ ▼	▲
00.031	Initial rounding ▲	▼	
00.032	Brake opening delay	▲	▼

The departure must be “soft”, without jerks or counter-rotations.

2 - Check that at **high speed** the motor has the required rpm and the speed is constant.
If it is not constant (pendulum), adjust parameter **00.004**. (motor rated speed) by decreasing or increasing the speed.

3 - Check the **deceleration phase**, the system must arrive at the floor by travelling a small distance at a constant speed (approx. 10cm) without pendulum, vibrations and maintaining the same speed both uphill and downhill, both empty and loaded.
Adjust the distance travelled at low speed with parameter **00.021** (Deceleration Time).

4 - If, during **low speed,** the motor stops or “struggles” to reach the floor, the parameters to be adjusted are:

00.004	Motor rated speed	▼
00.013	Low speed	▲

5 - If **on arrival at the floor** there is not a perfect alignment between the floor and the cabin:
the parameters to be adjusted are:

		It stops BEFORE	It stops AFTER
00.022	Final deceleration time	▲	▼
00.013	Low speed	▲	▼

6 - If, when loading the cabin, **the floor alignment** changes
the parameters to be adjusted are:

		it stops BEFORE	it stops AFTER
00.004	Motor rated speed	▼	▲

7 - If **stopping at the floor** is not comfortable
the parameters to be adjusted are:

00.033	Activation frequency 0Hz	▲ ▼
00.034	Brake closing delay	▲ ▼
00.036	Torque 0Hz	▲ ▼

IMPORTANT

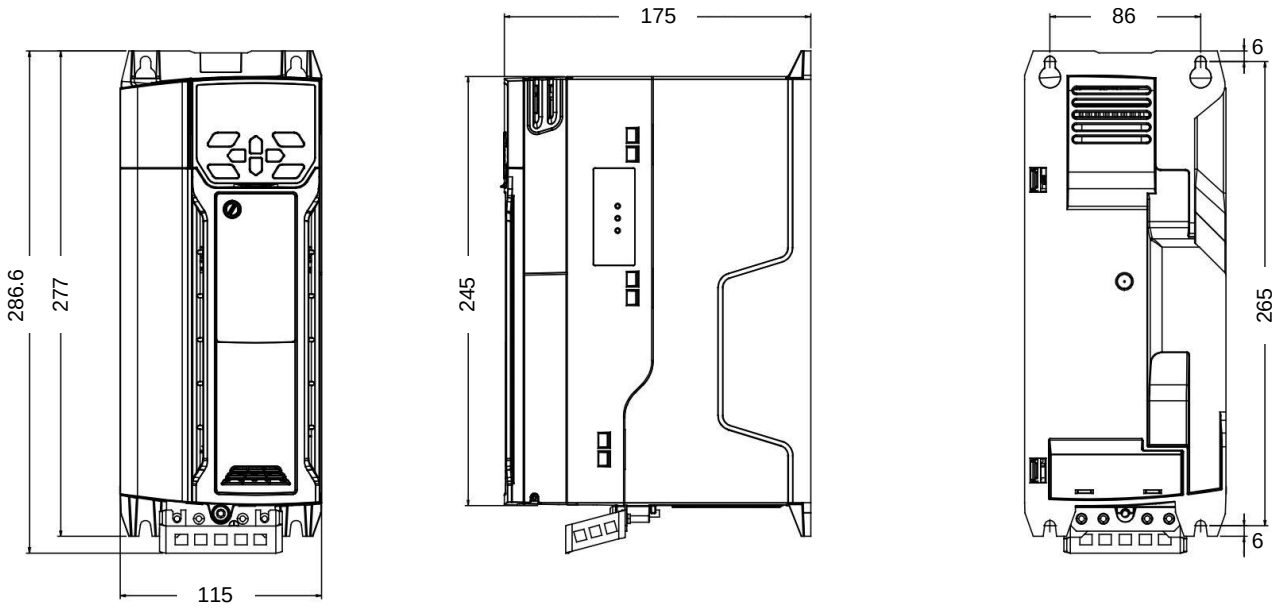
It is recommended to set the **low speed frequency 00.013 to a value of about 1/10 of the rated frequency** (example : Set 5Hz on 50Hz rated frequency motors)

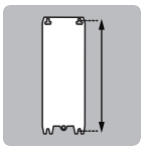
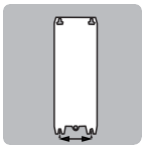
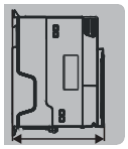
12.8 Mechanical brake micro control

By means of parameter 00.061, it is possible to enable control of the correct operation of the mechanical brake. Parameter 00.062 defines the type of contact used (NC/NO)

The fault state occurs if there is an inconsistency between the command to open or close the mechanical brake (terminals 41 and 42) and the corresponding control input (terminal 5) for 3 continuous seconds. If it occurs during running, operation is only blocked at the end of running. It can be reset by pressing the reset button 

13 - DIMENSIONS, WEIGHT AND FIXINGS



 H		 W		 D	 Ø	**Weight**
Assembly	Width	**Assembly**	Width	Width	Diameter	
265 mm	277 mm	**86 mm**	115 mm	175 mm	6 mm	3.13 kg

SMS S.R.L. (Gruppo SASSI HOLDING)

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