Abridged Manual

Frequency Inverter ST500 Series

Introduction

This abridged manual briefly describes the external wiring, the terminals, the keypad, the quick start steps, as well as some essential function parameter settings and the most commonly occurring errors and their solutions for Sourcetronic ST500 series frequency inverters.

Visit www.sourcetronic.com for more information or refer to the detailed full version of the e-manual.

| Warning! |
|---|
| This guide only contains the most basic information on installation and commissioning. Failure to observe the safety instructions and the installation and commissioning instructions in the corresponding documentation can lead to accidents, including damage to the appliance, injuries or even death.

Only trained and qualified specialists may carry out the relevant work! |
| **Danger!** |
| Ensure that the frequency inverter is **switched off** while you are working on the inverter! Wait until the condensers have **discharged** before working on the DC link! There is an LED on the supply board that indicates the charge in the DC link. If in doubt, measure the terminals to ensure that there is no voltage. There is a risk of injury from electric shock!

Work on the frequency inverter may only be carried out by trained specialist personnel! Also ensure that the frequency inverter is properly earthed! Do not remove the earthing until the capacitors have completely discharged their charge. |

1 Wiring and Terminals

1.1 Wiring Diagram
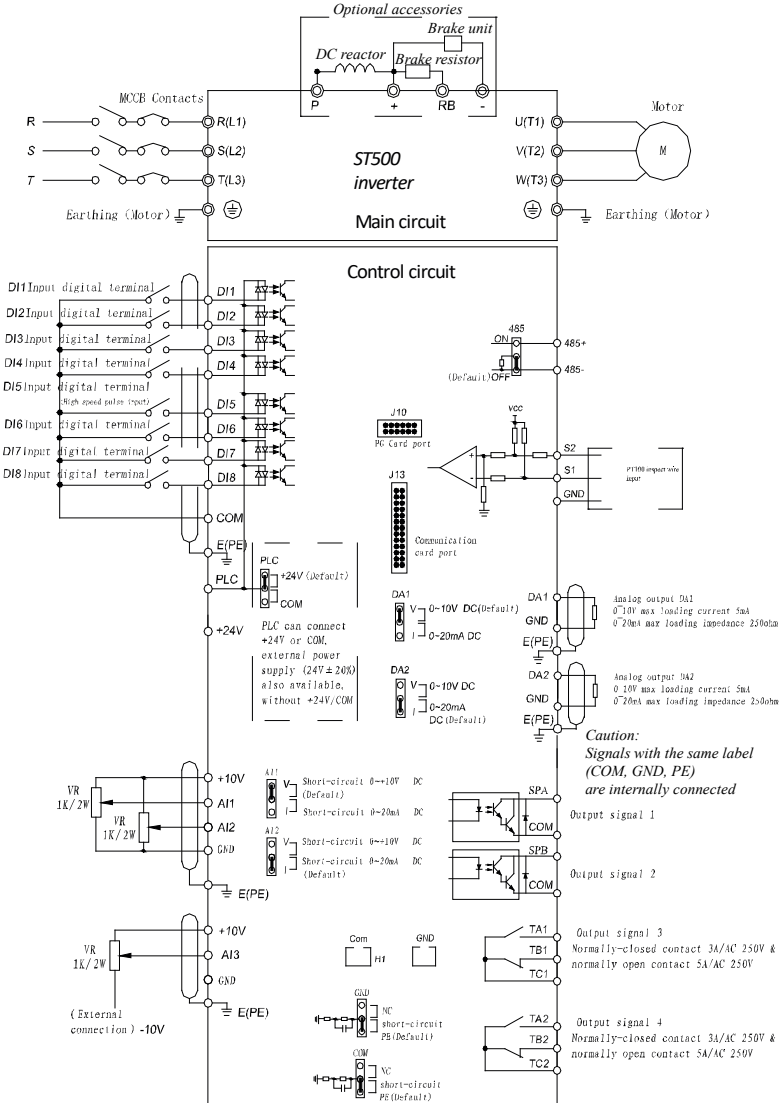
Figure 1-1 Wiring Diagram for Main Circuit and Control Circuit

1.2 Main Circuit Terminals

Terminal	Name	Description
R/L1/P	Input Terminals	Terminals for connecting the power supply of the frequency inverter. For single-phase models, the screw of terminal S remains unassembled; the two remaining terminals R and T must be used for phase and neutral. Due to the symmetry of the input rectifier, it is irrelevant which of the two or three supply lines is connected to which terminal.
S/L2		
T/L3/N		
P +	DC Reactor Terminals (from 4kW G1/5.5kW G3)	To install a DC link reactor, the bridge between P and + must be removed.
+ RB	Braking Resistor Terminals (up to 22kW G3)	For installing a braking resistor.
+ -	DC Link Terminals	For connecting a brake unit.
U/T1	Output Terminals	Output terminals for connecting a three-phase motor. ⚠ **Single-phase motors must not be connected!**
V/T2		
W/T3		
E	PE Terminal	PE connection terminals (protective conductor).

1.3 Control Circuit Terminals

Category	Terminal	Name	Description
Power Supply	+10V GND	+10V DC Voltage Source Jumper GND: Interference Suppressor Against Protective Earth PE	+10V voltage source with a maximum output current of 10mA. Usually used as a source for a potentiometer. The total resistance range should be between 1kΩ and 5kΩ.
	+24V COM	+24V DC Voltage Source, Galvanically Isolated Jumper COM: Interference Suppressor Against Protective Earth PE	+24V voltage source with a maximum output current of 200mA. Can be used to supply external sensors (connect COM and GND, galvanic isolation not required) or the digital input terminals.
	PLC	Input Terminal for External Voltage Source 9-30V for the Digital Inputs	When using an external voltage source, the PLC jumper must be removed. The pole of the source from/to which current is to flow via the optocouplers in the active state must be connected to terminal PLC; accordingly, the inputs must be connected to the other pole of the source in the active state.

Analog Input	AI1 GND	Analog Input AI1	Input voltage range: 0V to 10V DC or 0mA to 20mA DC. Can be switched via jumper AI1 or AI2 on the control board.
	AI2 GND	Analog Input AI2	Input impedance: 22kΩ (0-10V), 500Ω (0-20mA).
	AI3 GND	Analog Input AI3	Input voltage range: -10V to +10V DC.
Digital Input	DI1	Digital Input DI1	Contacts as optocouplers compatible with bipolar input (i.e. can be operated in both current directions). Input impedance: >1.65kΩ (DI5) / >3.3kΩ (all other DI), anti-parallel Zener diode. Voltage range: 19.2V to 28.8V DC. DI1 to DI8 voltage setting by jumper PLC, remove jumper for external source.
	DI2	Digital Input DI2	
	DI3	Digital Input DI3	
	DI4	Digital Input DI4	
	DI5	Digital Input DI5	
	DI6	Digital Input DI6	
	DI7	Digital Input DI7	
	DI8	Digital Input DI8	
	DI5	Digital Pulse Input	DI5 can also be used as a pulse input. Max. Input frequency: 100kHz.
Analog Output	DA1 GND	Analog Output DA1	Selection of the output signal between **0V to 10V** or 0mA to 20mA via jumper DA1.
	DA2 GND	Analog Output DA2	Selection of the output signal between 0V to 10V or **0mA to 20mA** via jumper DA2.
Digital Output	SPA COM	Digital Output 1	Opto-coupler isolation, bipolar open collector output; Output voltage range: 0V to 24V; Output current range: 0mA to 50mA
	SPB COM	Digital Output 2	
	SPB COM	Pulse Output	Using function parameter F2.00, SPB can also be configured as a pulse output. The maximum output frequency is 100 kHz.
Relay Output	TA1/2 TC1/2	Normally Open Contact	Maximum switchable power: 250V AC NC contact 3A, NO contact 5A, cosφ = 0.4 30V DC 1A NC contact relay 2 only available up to V1.05
	TB1/2 TC1/2	Normally Closed Contact	
Motor Temperature Sensor	S1 S2 GND	PT100/PT1000/PTC	Connection for a motor temperature sensor.
Interfaces	J13	Interface Card	26-pin connection for interface card: CANbus or Profibus-DP
	J10	PG Interface	12-pin connection for position encoder
	485+ 485-	RS485 Interface	RS485/Modbus interface; not potential-free to GND

2 Keypad

Figure 2-1 Keypad

2.1 LED Indicators

LED		Name / Description
Status LED	RUN	• Motor operating status display • ON: the frequency inverter is in operation. • OFF: the frequency inverter is in standby mode.
	LOCAL/ REMOTE	• Display of the control source • ON: the frequency inverter is controlled via the terminals. • OFF: the frequency inverter is controlled via the control panel. • FLASHING: the frequency inverter is controlled remotely (RS485, CAN etc.)
	FWD/REV	• Direction of rotation display • ON: Direction of rotation is forwards. • OFF: Direction of rotation is backwards.
	TUNE/TC	• Auto detection / error display • ON: Torque control active • Slow FLASHING: Auto-detection mode active • Fast FLASHING: Inverter is in error state
Units Combination Indicator	HzAV	<table><tr><td>Hz</td><td>Frequency Unit</td></tr><tr><td>A</td><td>Current Unit</td></tr><tr><td>V</td><td>Voltage Unit</td></tr><tr><td>RPM</td><td>Speed Unit</td></tr><tr><td>%</td><td>Percentage</td></tr></table>

2.2 Keypad Buttons

Sign	Name	Function
PRG	Parameter Setting/ ESC Key	• Call up parameterization menu • Close parameterization menu • Cancel parameter input without saving
>> SHIFT	Shift Key	• Select special functions during operation • Switch through the displayed status parameters • Select the decimal point when selecting function parameters or entering function parameters
▲	UP Key	Increase parameter or function number, defined by parameter F6.18.
▼	DOWN Key	Decrease parameter or function number, defined by parameter F6.19.
RUN	RUN Key	Start running (if the device is in keypad control mode)
STOP RST	Stop/Reset Key	Stops the motor during operation and resets the error status. If the keypad control is not active, the function depends on the setting in F6.00.
ENTER	Enter Key	• Confirm settings • Navigate in parameter menus
QUICK	QUICK Multifunction Key	This key's function is determined by the setting of the function code F6.21.
	Keypad Rotary Encoder	Enables parameter values to be selected and changed in parameterization mode and can be used for frequency control during operation.

3 Quickstart

⚠	Ensure that all terminals have been securely connected.
	Ensure that the motor power matches that of the VFD.

3.1 Commissioning Flowchart
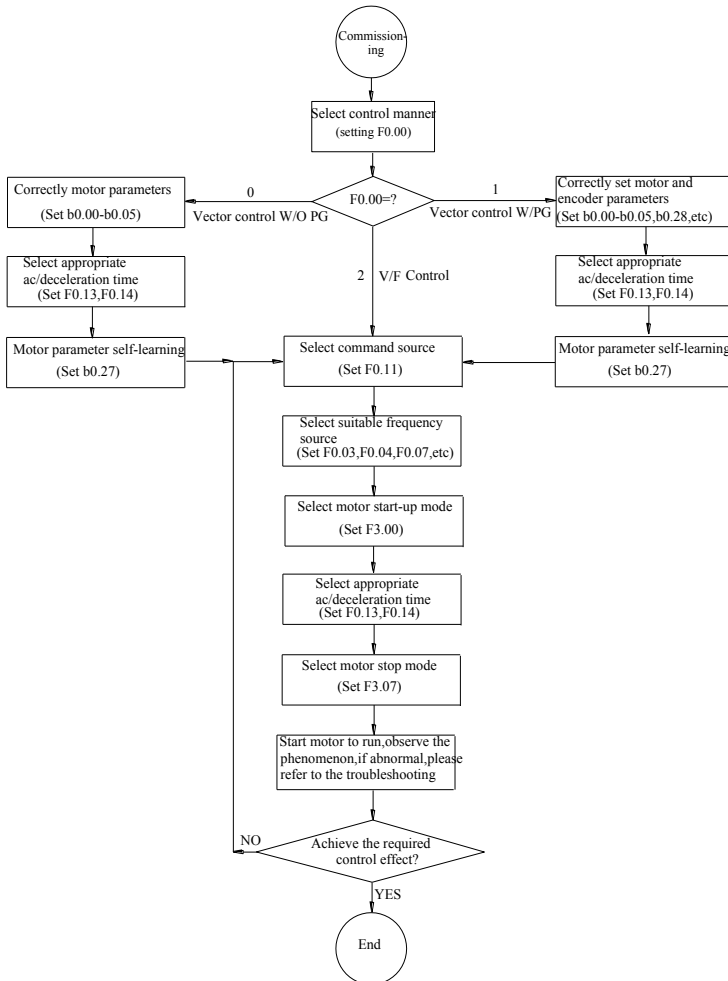
Figure 3-1 Commissioning Flowchart

4 Function Parameters

Only a few of the most common function parameters and typical values are briefly described below. **For the complete list of function parameters, please see the full user manual.**

The column labelled "Mod." refers to whether or not the parameters are modifiable, i.e. can be manually adjusted by the user.

The following symbols will be used:

★　　　This parameter cannot be modified during operation

●　　　This parameter is part of the actual testing data and thus cannot be modified

☆　　　This parameter can be modified both during operation and in standby mode;

▲　　　Factory parameter, not modifiable

_　　　This is a factory parameter related to power or model. Please check the details in the involved parameter introduction.

Code	Designation	Setting Range	Default	Mod.
F0.00	Motor Control	0: Vector control without PG 1: Vector control using the pulse generator / rotary encoder 2: V/f control	2	★
F0.01	Target Frequency	0.00Hz to F0.19 (max frequency)	50.00Hz	☆
F0.03	Frequency Control Source	0: Keypad (F0.01) without saving after power-off 1: Keypad (F0.01), saving after power-off 2: AI1 3: AI2 4: Control panel rotary encoder 5: High-frequency pulse 6: Multi-speed operation 7: Simple PLC program 8: PID control 9: Specification via remote control 10: AI3	1	★
F0.11	Command Source	0: Keypad (LED off) 1: Terminals (LED on) 2: Communication interface (LED flashes) 3: Keypad + communication interface 4: Keypad + terminals + communication interface	0	☆

F0.13	Acceleration Time 1	0.00s to 6500s	Depends on Model	☆
F0.14	Braking Time 1	0.00s to 6500s Default settings depend on output	Depends on Model	☆
F0.19	Maximum Output Frequency	50.00Hz to 3200.0Hz	50.00Hz	★
F0.21	Upper Limit Frequency	F0.23 to F0.19	50.00Hz	☆
F0.23	Lower Limit Frequency	0.00Hz to F0.21	0.00Hz	☆
F0.24	Direction of Motor Rotation	0: Default (Forward) 1: Reverse (Backward)	0	☆
F1.00	DI1 Function	0 to 51 (for the complete list, please see the full user manual; the following are examples.) 0: No Function 1: Forward Operation 2: Reverse Operation 3: Three-Wire Operation Control 4: Forward Jog (FJOG) 5: Reverse Jog (RJOG) 6: Increase Frequency (UP) 7: Decrease Frequency (DOWN) 8: Free Stop 9: Reset Error State (RESET) 10: Pause Operation	1	★
F1.01	DI2 Function		2	★
F1.02	DI3 Function		8	★
F1.03	DI4 Function		9	★
F1.04	DI5 Function		12	★
F1.05	DI6 Function		13	★
F1.06	DI7 Function		14	★
F1.07	DI8 Function		15	★
F2.00	SPB Output Function	0: Pulse output (F2.06) 1: Switching output (F2.01)	0	☆
F2.01	SPB Output Function (If F2.00=1)	0 to 40 (for the complete list, please see the full user manual; the following are examples.) 0: No function 1: Inverter in operation 2: Error signal 3: Frequency limit FDT1 reached 4: Target frequency reached 5: Inverter in operation with frequency 0Hz, but not stopped	0	☆
F2.02	Relay Output 1 Function (TA1, TB1, TC1)		2	☆
F2.04	SPA Output Function		1	☆
F2.05	Relay Output 2 Function (TA2, TC2)		1	☆
F2.06	SPB Pulse Output Function (If F2.00=0)	0 to 17 (for the complete list, please see the full user manual; the following are examples.)	0	☆

F2.07	DA1 Output Function	0: Actual frequency 1: Target frequency 2: Output current	2	☆
F2.08	DA2 Output Function	3: Torque 4: Output power 5: Output voltage	13	☆
F3.00	Start-Up Mode	0: Direct start-up 1: Rotation-monitored start-up, speed equalization 2: Asynchronous motor pre-excited start	0	☆
F3.02	Value for Speed Equalization	1 to 100	20	☆
F3.07	Stop Mode	0: Active stop 1: Free stop	0	☆
F3.08	DC Braking Frequency	0.00Hz to F0.19	0.00Hz	☆
F3.09	Waiting Time for DC Brake	0.0s to 100.0s	0.0s	☆
F3.10	Output Current with DC Braking Function	0% to 100%	0%	☆
F3.11	Duration of DC Braking Function to Stop	0.0s to 100.0s	0.0s	☆
F4.01	Torque Boost	0.0% (Automatic) 0.1 to 30% (manual)	0.0%	☆
F4.09	Slip Compensation	0% to 200.0%	0.0%	☆
F4.11	Oscillation Suppression	0 to 100	0	☆
F5.00	Lower Proportional Component G1	1 to 100	30	☆
F5.01	Lower Integral Time T1	0.01s to 10.00s	0.50s	☆
F5.02	Lower Switching Frequency 1	0.00 to F5.05	5.00Hz	☆
F5.03	Upper Proportional Component G2	0 to 100	20	☆
F5.04	Upper Integral Time T2	0.01s to 10.00s	1.00s	☆
F5.05	Upper Switching Frequency 2	F5.02 to F0.19	10.00Hz	☆

F5.06	Integral Component	0: Active 1: Inactive	0	☆
F5.09	Differential Gain	50% to 200%	150%	☆
F6.06	IGBT Temperature	0°C to 100°C	-	●
F6.07	Total Operation Time	0h to 65535h	-	●
F6.08	Total Power-On Time	0h to 65535h	-	●
F6.09	Total Power Consumption	0 to 65535 kWh	-	●
F9.00	Baud Rate	Ones Digit: MODBUS Tens Digit: Profibus-DP Hundreds Digit: Reserved Thousands Digit: CANlink 0 to 9, i.e. 300BPS to 115200BPS	6005	☆
F9.01	Data Format	0: (8-N-2) 1: (8-E-1) 2: (8-O-1) 3: (8-N-1)	0	☆
F9.02	Address of the Inverter	1 to 247, 0 for master	1	☆
FA.00	Control Mode	0: Speed control 1: Torque control	0	★
FA.01	Source for Torque Setting	0: Keypad (FA.02) 1: AI1 2: AI2 3: Control panel rotary encoder 4: Pulse 5: Communication interface 6: MIN (AI1, AI2) 7: MAX (AI1, AI2) 8: AI3	0	★
FA.02	Torque Value Setting	-200.0% to 200.0%	150%	☆
FA.03	Torque Control Acceleration Time	0.00s to 650.00s	0.00s	☆
FA.04	Torque Control Braking Time	0.00s to 650.00s	0.00s	☆
FA.07	Torque Filter Time	0.00s to 10.00s	0.00s	☆

b0.00	Motor Type	0: All common three-phase asynchronous motors 1: Three-phase asynchronous motor especially for frequency inverters 2: Permanently excited synchronous motor (b0.27 to b0.28 required)	0	★
b0.01	Motor Rated Power	0.1 to 1000.0kW	Depends on Model	★
b0.02	Motor Rated Voltage	1 to 2000V	Depends on Model	★
b0.03	Motor Rated Current	0.01 to 655.35A / 6553.5A	Depends on Model	★
b0.04	Motor Rated Frequency	0.01Hz to F0.19	Depends on Model	★
b0.05	Motor Rated Speed	1 to 36000rpm	Depends on Model	★
y0.00	Parameter Initialization	0: No function 1: Reset to factory settings (not including motor parameters) 2: Delete runtime data 3: Reset to factory settings (including motor parameters) 4: Save current parameter set 501: Restore user backup parameters 10: Delete the control panel memory 11: Upload current parameter set to control panel memory location 1 12: Upload current parameter set to control panel memory location 2 21: Download parameter set from control panel memory location 1 22: Download parameter set from control panel memory location 2	0	★
y0.01	User Password	0 to 65535	0	☆

5 Troubleshooting

No.	Error ID	Error Type	Possible Causes	Solutions
1	Err.01	Inverter Unit Protection	Short circuit at the output	Check the wiring.
			Cables too long	Install a motor filter or motor reactor.
			Overheating	Check the fan of the inverter and observe the installation dimensions.
			Wiring error	Check the wiring.
			Control unit faulty	Contact the technical support team.
			Faulty control display	
			IGBT module faulty	
2	Err.02	Overcurrent During Acceleration	Launch ramp too short	Increase the launch ramp time.
			Manual torque increase or V/f not suitable	Reduce the torque increase and adjust the V/f characteristic curve.
			Motor voltage too low	Adapt the motor voltage parameters to the motor.
			Short circuit on the motor	Check the wiring.
			Motor parameters missing in vector control	Input and calibrate the motor parameters.
			Engine in motion even before the start	Activate speed measurement or stop the motor.
			Sudden increase in motor load	Avoid sudden load changes.
			Rated power of the inverter too low	Choose a larger inverter.
			Automatic torque boost attempts to force the engineinto motion, but the frequency is too low for the motor	• Deactivate the torque boost (F4.01). • Increase the starting frequency. • Calibrate the motor and operate in vector mode.
3	Err.03	Overcurrent During Braking	Short circuit at the output of the inverter	Check the motor supply cable.

			Motor parameters missing in vector control	Input and calibrate the motor parameters.
			Braking time too short	Increase the braking time.
			DC braking frequency too high	Reduce F3.08.
			Motor voltage too low	Adapt the motor voltage parameters to the motor.
			Sudden increase in motor load	Avoid sudden load changes.
			No brake unit / brake resistor	Install a brake unit / brake resistor.
4	Err.04	Overcurrent at Constant Speed	Short circuit at the output of the inverter	Check the motor supply cable.
			Motor parameters missing in vector control	Input and calibrate the motor parameters
			Motor voltage too low	Adapt the motor voltage parameters to the motor
			Sudden increase in motor load	Avoid sudden load changes.
			Rated power of the inverter too low	Choose a larger inverter.
5	Err.05	Overvoltage During Acceleration	Input voltage too high	Check the mains voltage.
			External torque accelerates motor	Remove the external torque.
			Launch ramp too short	Increase the ramp time.
6	Err.06	Overvoltage During Braking	Input voltage too high	Check the mains voltage.
			External torque accelerates motor	Remove the external torque or install a brake unit / brake resistor.
			Stop ramp too short	Increase the stop ramp time.
			No brake unit / brake resistor	Install a brake unit / brake resistor.
7	Err.07	Overvoltage at Constant Speed	External torque accelerates motor	Remove the external torque or install a brake unit / brake resistor.
			Input voltage too high	Check the mains voltage.

8	Err.08	Control Voltage Error	Input voltage at the terminals is not within the specified range	Adapt the input voltage to the specified range.
9	Err.09	Undervoltage	Temporary loss of input voltage	Acknowledge the error (e.g. in the case of external power-off)
			Input voltage not in the range of the inverter	Check the mains voltage.
			DC link voltage incorrect	Contact the technical support team.
			Rectifier not working correctly	
			Output circuit not working correctly	
			Control circuit not working correctly	
10	Err.10	Inverter Overload	Inverter power too low	Choose a larger inverter.
			Load on motor too high or motor blocked	Reduce the load and check the motor for mechanical defects.
11	Err.11	Motor Overload	Mains voltage too low, resulting in grid weakness	Check the mains voltage.
			Motor protection parameter (F8.03) incorrect	Check parameter F8.03.
			Load on motor too high or motor blocked	Reduce the load and check the motor for mechanical defects.
12	Err.12	Phase Loss / Phase Asymmetry at the Input (only possible for 18kW and above models)	Mains voltage collapses	Reduce the load on the grid.
			Input circuit not working correctly	Contact the technical support team.
			Control circuit not working correctly	
			Mains voltage quality too low	Install a line reactor.
13	Err.13	Phase Loss at the Output	Motor supply cable not in order	Check the motor supply cable and the connection to the motor terminal board.
			There is no symmetrical load at the output	Check the insulation of the motor windings.
			Output circuit not working correctly	Contact the technical support team.
			IGBT module not working correctly	

14	Err.14	Overheating of the IGBT Module (above 80°C)	Ventilation covered	Ensure sufficient air supply.
			Cooling fan damaged	Replace the cooling fan.
			Ambient temperature too high	Lower the temperature.
			Thermistor damaged	Contact the technical support team.
			IGBT module damaged	
15	Err.15	Error due to External Accessories	External error signal active at DI terminals (function 11 or 33)	Acknowledge (reset) the error signal.
16	Err.16	Communication Error	Communication line disrupted	Check the cable.
			Parameter F9.07 not correct	Correctly select the communication card type.
			Other parameters from F9 for communication configuration not correct	Check the parameters.
			Connected PC sends incorrectly	Check the settings and wiring of the PC.
17	Err.17	Error at the Power Switch	Phase loss / phase asymmetry at the input	Contact the technical support team.
			Contacts in input or output circuit faulty	
18	Err.18	Error in Current Measurement	Current sensor faulty	Contact the technical support team.
19	Err.19	Error when Calibrating Motor Parameters	Motor parameters entered do not match nameplate	• Correct the parameters. • Check the comma position.
			Measurement timeout	Check the connection to the motor.
20	Err.20	Encoder Card Error (Encoder Signal longer than b0.34)	Encoder damaged	Contact the technical support team.
			Encoder card damaged	Replace the encoder card.
			Encoder card not compatible with encoder	Order a compatible card.
			Encoder parameters not correct	Check the parameter settings.

			Connection between encoder card and encoder faulty	Check the connection.
21	Err.21	EEPROM Read / Write Error	EEPROM damaged	Contact the technical support team.
22	Err.22	Hardware Error	Overvoltage	Eliminate the overvoltage.
			Overcurrent	Eliminate the overcurrent.
23	Err.23	Short-Circuit to Earth	Short circuit on the motor	Replace the cable or the motor.
26	Err.26	Operating Time Limit (F7.21) Reached	Configured operating time limit has been reached (monitoring active)	• Increase the time limit. • Reset the operating times with y0.00.
27	Err.27	Custom Error 1	Digital input terminal with function 44 active	Acknowledge (reset) the error signal.
28	Err.28	Custom Error 2	Digital input terminal with function 45 active	Acknowledge (reset) the error signal.
29	Err.29	Power-On Time Limit (F7.20) Reached	Configured power-on time limit has been reached (monitoring active)	• Increase the time limit. • Reset the operating times with y0.00.
30	Err.30	Load Loss	Current drops below the value of F8.31 for the duration set in F8.32	Check parameters F8.31 and F8.32.
31	Err.31	PID Feedback Signal Loss During Operation	PID feedback signal does not exceed E2.11 without interruption for longer than the detection time configured in E2.12	Check the PID feedback signal and wiring or adjust E2.11/E2.12.
40	Err.40	Current Limit Exceeded	Load on motor too high or motor blocked	Reduce the load and check the motor for mechanical damage.
			Inverter power too low	Choose a larger inverter.
41	Err.41	Motor Switchover During Operation	Switched to another motor during operation	Stop the motor and repeat the switchover.
42	Err.42	Speed Deviation Too High	Settings of parameters F8.15/F8.16 incorrect	Adjust the parameters.
			Settings for encoder card incorrect	

			Motor parameter calibration was not successful	Repeat the calibration.
43	Err.43	Motor Speed Too High	Motor parameter calibration was not successful	Repeat the calibration.
			Settings for encoder card incorrect	Adjust the parameters.
			Settings of parameters F8.13/F8.14 not correct	
45	Err.45	Motor Overheating (above F8.34)	Connection to temperature sensor not correct	Check the sensor and the cable.
			Motor temperature too high	Adjust the carrier frequency (parameter F0.18) or improve motor cooling.
51	Err.51	Error During Position Initialization	Deviation between the actual and the entered motor parameters is too high	Check the motor parameters.
–	CoF	Communication Error	Poor connection between inverter and control unit	Check the cable and the control unit.
–	LoC	N/A, see y0.01	Inverter is password-protected	• Enter the password. • Remove the password.

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