EAC/AFV

ET System electronic GmbH

Hauptstraße 119-121
68804 Altlußheim

ETSYSTEM®

Telefon 06205 3948-0
Fax 06205 37560
info@et-system.de
www.et-system.de

Software version:
January 2015

Table of Contents

Info & Contact Addresses **1**
Technical Specifications **1**
Ambient Conditions 1
Display 2
Input Specifications 2
Output Specifications 2
Total Power 2
Technical Drawing 3
Important Safety Instructions **4**
Initial Operation 4
Unpacking 4
Setting Up 4
Visual Inspection 4
Mains Operation 4
Functional Description **5**
Block Diagram 5
Structure of the Main Control Unit 6
Description of cable connections 6
Cable Wiring 6
General Settings **7**
Initial State & Splash Screen 7
Main Menu **7**
Application 7
System 7
Event 7
Menu “APP“ 8
Mode “General“ 8
Mode “Step“ 9
Mode “Gradual“ 10
Mode “Meas.“ 11
Error Message 12
Menu “SYSTEM“ 12
Date & Time 13
System Setting 13
Language Setting 13
Menu ”EVENT“ 13
RS 485 Interface **14**
Command Format 14
Commands of Functions 14
Answer Commands 14
Protocol Examples 15
CRC Check Sum 18
Error Messages **19**
Maintenance **19**
Notes **20**

INFO & CONTACT ADDRESSES

ET System electronic GmbH was founded in 1986 in the heart of the Rhine-Neckar-Triangle. As a subsidiary of a leading electricity utility group, the company quickly took on a leading role in the area of laboratory power electronics and associated electrical measurement. The existing know-how in power technologies in the 90s gave rise to the "Power Solutions" product division as a strong extension of the historical "Test & Measurement" range.

Since 1997, we have been working successfully as an independent, privately held company with customers in all lines of business from industry, medical care, railway technology and automotive electronics.

By means of our high vertical range of manufacture and our ever expanding development division we can fast and flexibly adjust to our customers' requirements. Necessary approvals such as CSA, UL, VDE, TÜV etc. are flexibly carried out by qualified personnel. The approval procedures are performed within the scope of development planning and thus do not negatively impact the start of manufacturing. Permanent manufacturing control through accredited laboratories and an ISO 9001 compliant quality management system guarantee a constant high-level series-production quality.

We offer repairs and adjustment for units outside of our warranty period. Please contact your local distributor for further information:

Germany
ET System electronic GmbH
Hauptstraße 119-121
68804 Altlußheim

Germany
Phone: +49 (0) 6205 39480
Fax: +49 (0) 6205 37560
em@il: info@et-system.de

web: www.et-system.de

Place of Business: Altlußheim, Germany
VAT Identification Number: DE 144 285 482
Register Court: Mannheim, Germany
Register Number: HRB 421186
Managing Director: Dipl.-Ing. Eric Keim
Sales Manager: Roland Kosmowski
Development Leader: Hermann Amtsberg

TECHNICAL SPECIFICATIONS

AMBIENT CONDITIONS

Operating Temperature	0 - 45 °C
Operating Height	< 1.500 m
Insulation Resistance	≥ 500 V DC 10 MΩ
Insulation Test Voltage	AC 1.800 V 10 mA/1 min
Cooling	Fan
Humidity	< 90 %

DISPLAY

Display	Touch screen
Voltage	Display: 0 - 300 V, Resolution: 0.1 V, Accuracy: 0.5 % FS + 4COUNT
Current	Display: 0 - 999,9 A, Resolution: 0.1 A, Accuracy: 0.5 % FS + 4COUNT
Frequency	Display: 0 - 999,9 Hz, Resolution: 0.1 Hz, Accuracy: ± 0.1 Hz

INPUT SPECIFICATIONS

Number of Phases	3
Voltage	230/400 V
Voltage Fluctuation	230/400 V ± 15 %
Frequency Fluctuation	50/60 Hz ± 3 Hz
Power Factor	0.9
Max. permitted current under full load	140.3 A

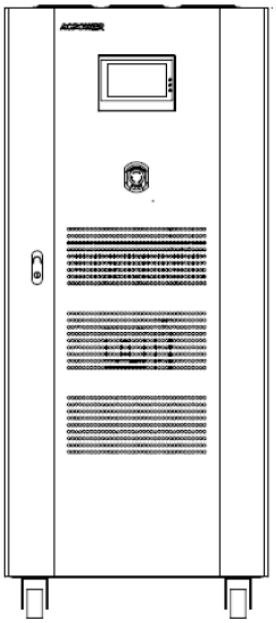
OUTPUT SPECIFICATIONS

Number of Phases	3
Wave Form	Sine
Low Voltage	0 - 150 V (L - N)
High Voltage	150.1 - 300 V (L - N)
Frequency	45 - 500 Hz
Frequency Stability	±≤ 0.01 %
Max. high voltage current	LO: 83.3 A
Max. low voltage current	HI: 41.7 A

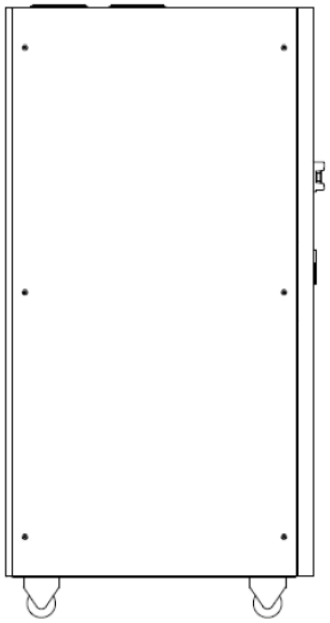
TOTAL POWER

Output Power (kVA)	75
Circuit Mode	IGBT/PWM (pulse width modulation)
Voltage Control	≤ 1 %
Load Control	± 1 %
Wave Form Distortion (THD)	≤ 2 %
Efficiency	≥ 90 %
Reaction Time	≤ 2 ms
Crest Factor	3:1
Protective Devices	Input: fuse switch, Output: overvoltage/undervoltage, overcurrent, overload Input: overvoltage/undervoltage, countercurrent protection, overtemperature, short circuit protection, conduct fast protection and lock fault protection , error display

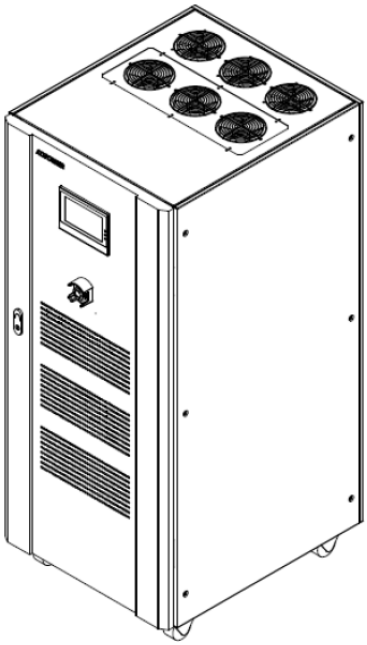
TECHNICAL DRAWING

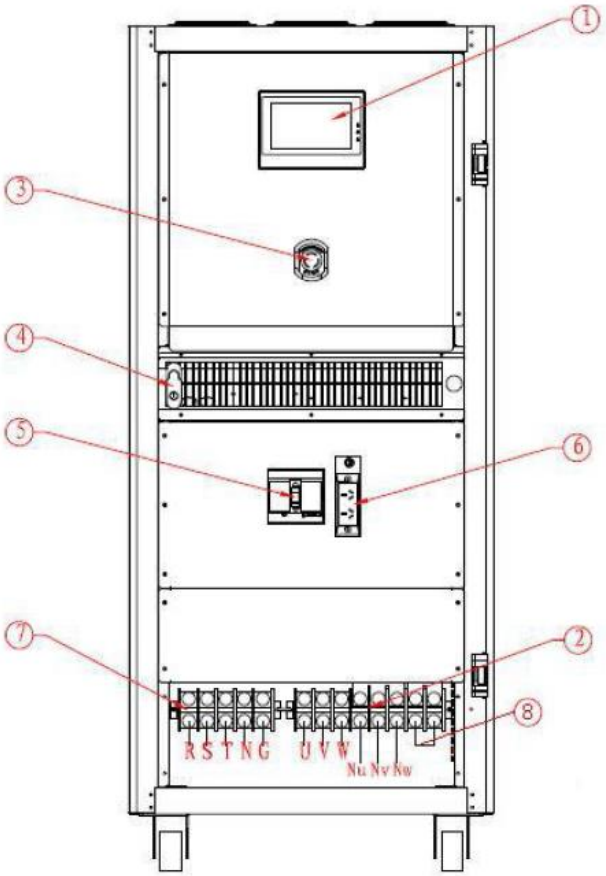


Vorderansicht



Rückansicht





1	Touchscreen
2	AC Output terminal row: U, V, W, N_u, N_v, N_w
3	Emergency stop button
4	Door handle
5	Input air switch
6	Maintenance socket
7	AC input terminal row: R, S, T, N, G
8	Parallel operation

IMPORTANT SAFETY INSTRUCTIONS

Please read this manual thoroughly before putting the device into operation. Pay regard to the following safety instructions and keep this manual nearby for future purpose.

This operating manual is based on the state of technology at the time of printing. However, it is possible that despite regular control and correction, the present document contains printing errors or deficiencies. ET System electronic GmbH assumes no liability for any technical, printing or translational errors within this manual.

INITIAL OPERATION

UNPACKING

Please make sure that the shipping carton and the packaging is free of damage. If external damage is found, it is important to record the type of damage. Please keep the original packaging to ensure the device is adequately protected in case it needs to be transported in the future or claims for compensation need to be asserted.

SETTING UP

To avoid electric shocks and product failure, the device should be installed in a temperature and humidity controlled indoor environment. The ambient temperature must not exceed 50 °C. The device must never be exposed to liquids or extreme humidity.

VISUAL INSPECTION

The unit must be examined immediately for defects or damages in transit. Damages caused during transport may be loose or broken control knobs and bent or broken connectors. Do not use the device if any physical damage is apparent. Please inform the carriers and a representative of ET System electronic immediately.

MAINS OPERATION

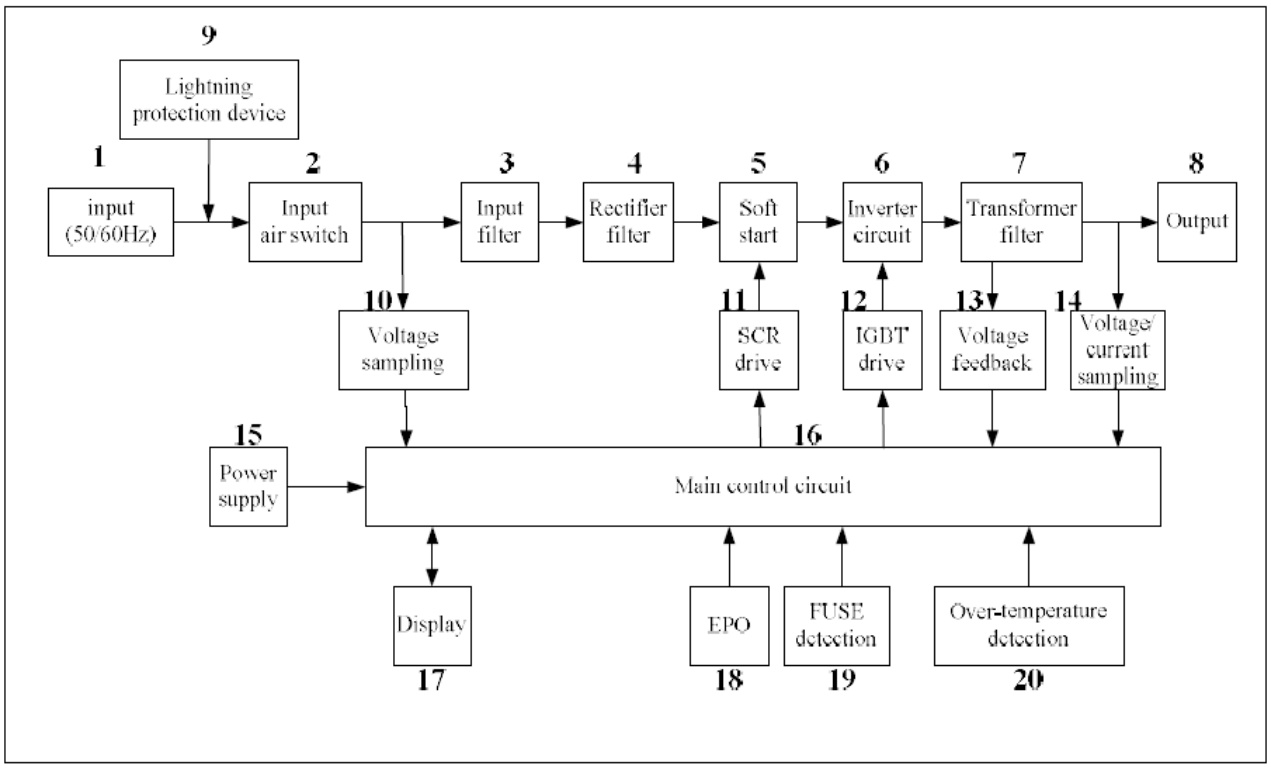
Make sure to verify the model number and voltage stated on the nameplate. Damages due to wrong power feed are not covered by guarantee conditions.

The unit must only be operated when connected directly to the mains. To avoid damage, do not connect the unit to isolating transformers, auto-transformers, magnetic current limiters or similar devices.

FUNCTIONAL DESCRIPTION

BLOCK DIAGRAM

The following block diagram gives information about the various adjustment options.



Description:

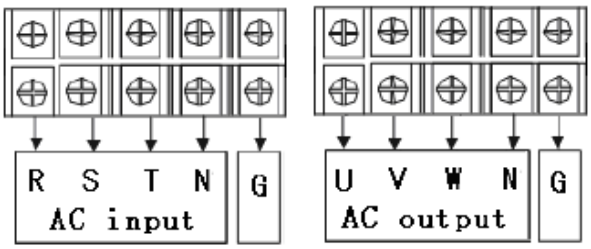
1 Input	connection between power supply endpoint and input terminal disk
2 Input Air Switch	power input control
3 Input Filter	input inductor and capacitor filter
4 Rectifier Filter	converts input alternating current into direct current
5 Soft Start	D.C. capacitor is charged slowly to reduce impulse current
6 Inverter Circuit	converts direct current into PWM waveform
7 Transformer Filter	boosts the output voltage of IGBT and outputs the voltage after LC filter
8 Output	output voltage is transferred to the output terminal disk through the contactor
9 Lightning Protection Device	overvoltage protection, lightning protection, restraining surge current, absorbing spike pulse, etc.
10 Voltage Sampling	input voltage sampling conditioning circuit
11 SCR Drive	drives the control circuit of soft start SCR
12 IGBT Drive	amplifies PWM signals to drive IGBT power components
13 Voltage Feedback	steady output voltage amplitude
14 Voltage/Current Sampling Circuit	samples conditioning circuit of output voltage and current
15 Power Supply	power supply of all PCB
16 Main Control Circuit	processes all input and output signals
17 Display	touch screen display
18 EPO	emergency stop signal
19 Fuse Detection	transmits the fuse power-off signal to the control circuit for trip protection
20 Over-temperature Detection	transmits the over-temperature signal to the control circuit for trip protection

Structure of the Main Control Unit

The main control unit is divided into three modules: protection sampling, main control, display control.

Description of cable connections

The following picture gives an overview about the cable connections of the main circuit:



Before installing the equipment, all switches need to be disconnected. The circuit cables must be connected according to the diagram above.

Cable Wiring

Use the voltmeter to confirm whether there is no voltage output in the distribution lines. Confirm whether all switches of the variable frequency power supply are in the position “OFF”. The input and output cables can be selected according to the cables recommended in the following tables.

Input distribution cables:

Input Current (A)	Input live wire (mm²)			Input zero line (mm²)	Input ground wire (mm²)
	A	B	C		
70.8 A	25 mm²	25 mm²	25 mm²	16 mm²	16 mm²

Output distribution cables:

Output Current (A)	Output live wire (mm²)			Output zero line (mm²)	Output ground wire (mm²)
	U	V	W		
LO: 83.3 A - HI: 41.7 A	25 mm²	25 mm²	25 mm²	25 mm²	16 mm²

The above recommended reference cables are multi-core flexible copper cables which can be selected by the user according to the present input and output current situation. If the length of the input or output lines exceeds 20 meters, it is recommended that the wire diameter of the cable should be doubled. Successively connect the input distribution lines to the corresponding wiring terminals at the input and the output distribution lines to the corresponding wiring terminals at the output.

GENERAL SETTINGS

INITIAL STATE & SPLASH SCREEN

The input and output wirings should be connected properly. If the system is started, the main engine fan will start to operate, the display screen is on and the main interface is entered, indicating that the start-up is normal and the parameter settings can be entered.

If an external load is connected, the load switch must be disconnected and the input switch connected. Before, the user should ensure, that no electrical current is flowing at the input terminal row.

When switching on the unit, the splash screen and the initialization graphic will appear on the display.

MAIN MENU

Application

The menu ***APP*** displays voltage, current and frequency for each phase of the output terminal. For detailed information, see chapter → Menu APP.

System

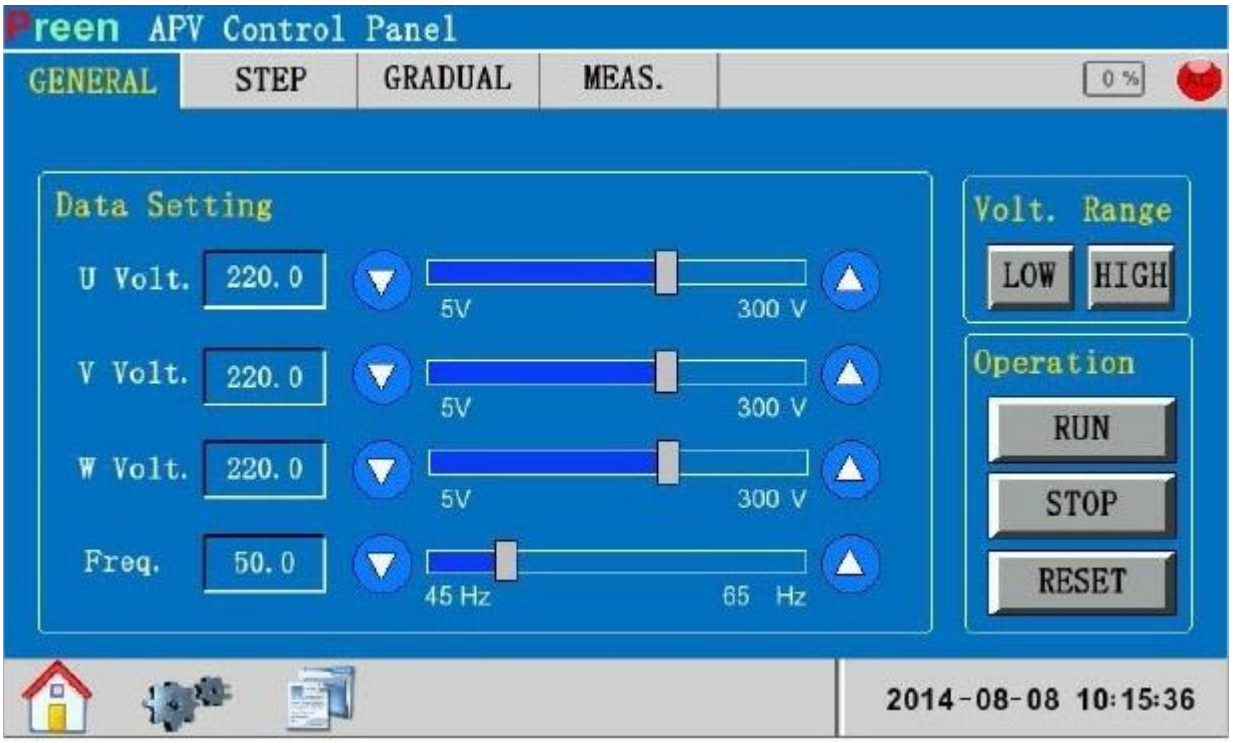
The menu ***System*** enables the user to adjust time and other system settings. For detailed information, see chapter → Menu SYSTEM.

Event

The menu ***Event*** records event protocols and information. For detailed information, see chapter → Menu EVENT.

MENU "APP"

Mode "General"



Data Setting

The adjustment of the values for U Volt., V Volt., W Volt. and Freq. (Frequency) can be adjusted in three ways. A click on the input field opens the dialog box where the desired value can be entered via keyboard. Alternatively, the value may be adjusted via slide control and mouse. A third option for entering the values are the arrow buttons besides the slide control. By clicking these buttons, the value changes by 0.1 interval.

Volt. Range

After clicking the button ***LOW,*** the unit is on low voltage. After clicking the button ***HIGH***, the unit is on high voltage.

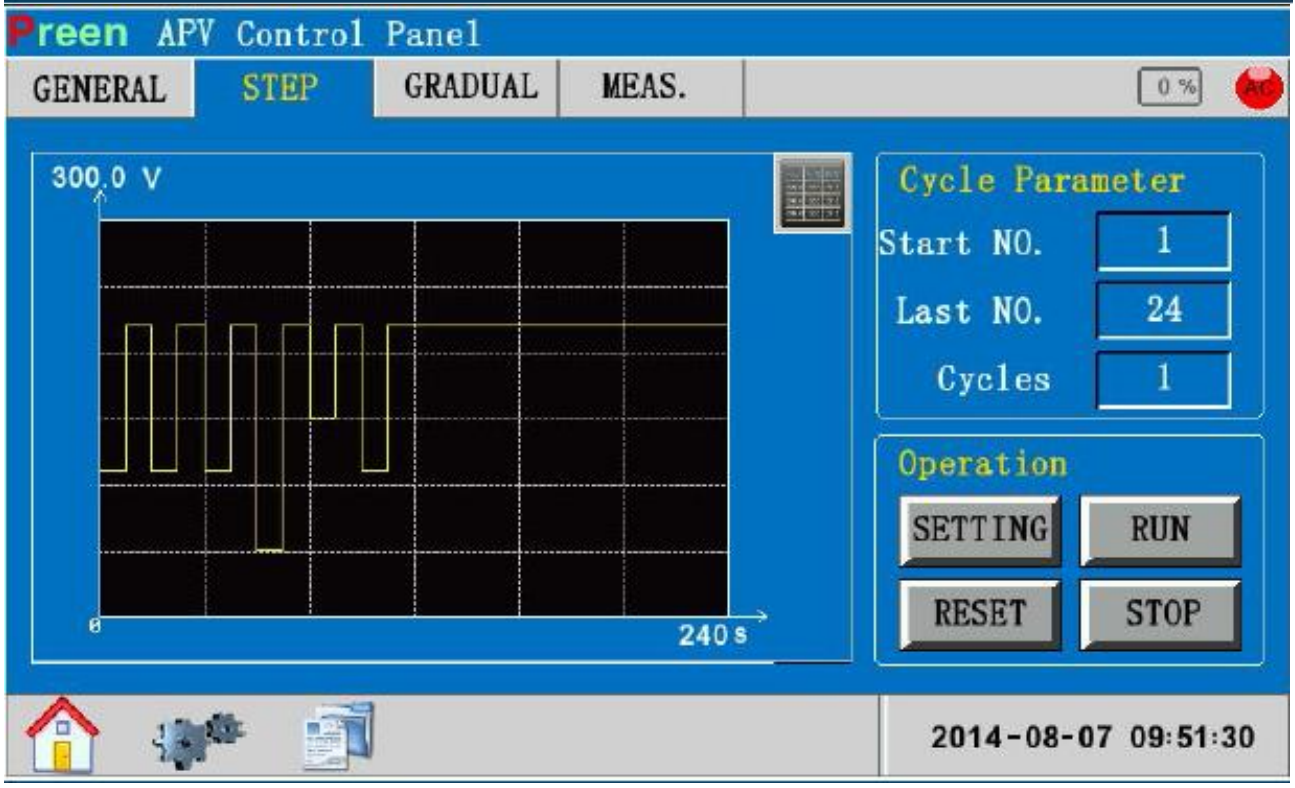
Operation

The output of the unit is activated when the button ***RUN*** is clicked. Deactivate the output by clicking the button ***STOP***.

AC Symbol

The AC symbol in the upper right corner of the display shows the status of the unit output. A red symbol means the output is inactive, while a green symbol means the output is active.

Mode “Step“



Download Parameter

Starts the download of the adjusted parameters.

Operation

Mode ”Step“ is activated after button ***RUN*** was clicked, and deactivated after button ***STOP*** was clicked. ***RESET*** sets the unit back to its initial state.

The button in the upper right field of the display switches between adjustment function and graphical display of the mode “Step”.

Mode “Gradual“

Download Parameter

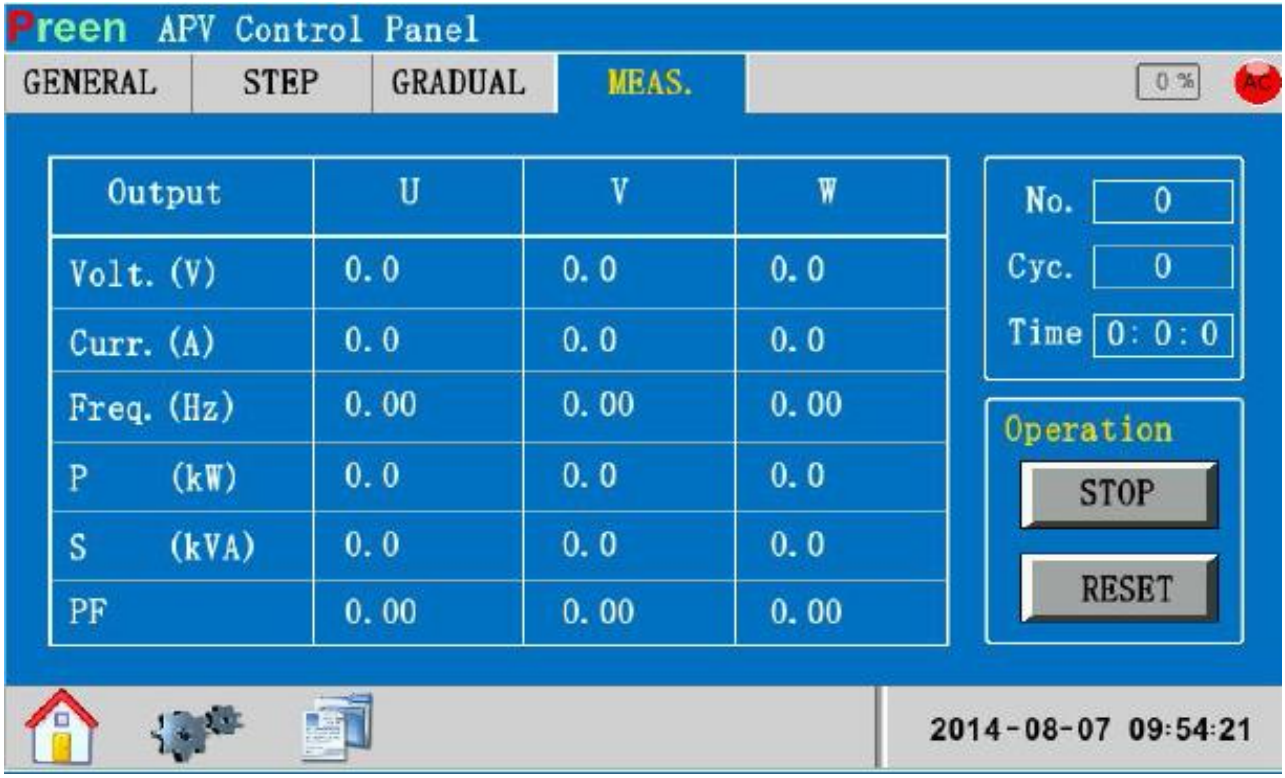
Starts the download of the adjusted parameters.

Operation

Mode ”Gradual“ is activated after button ***RUN*** was clicked, and deactivated after button ***STOP*** was clicked. ***RESET*** sets the unit back to its initial state.

The button in the upper right field of the display switches between adjustment function and graphical display of the mode “Gradual”.

Mode “Meas.“



Operation

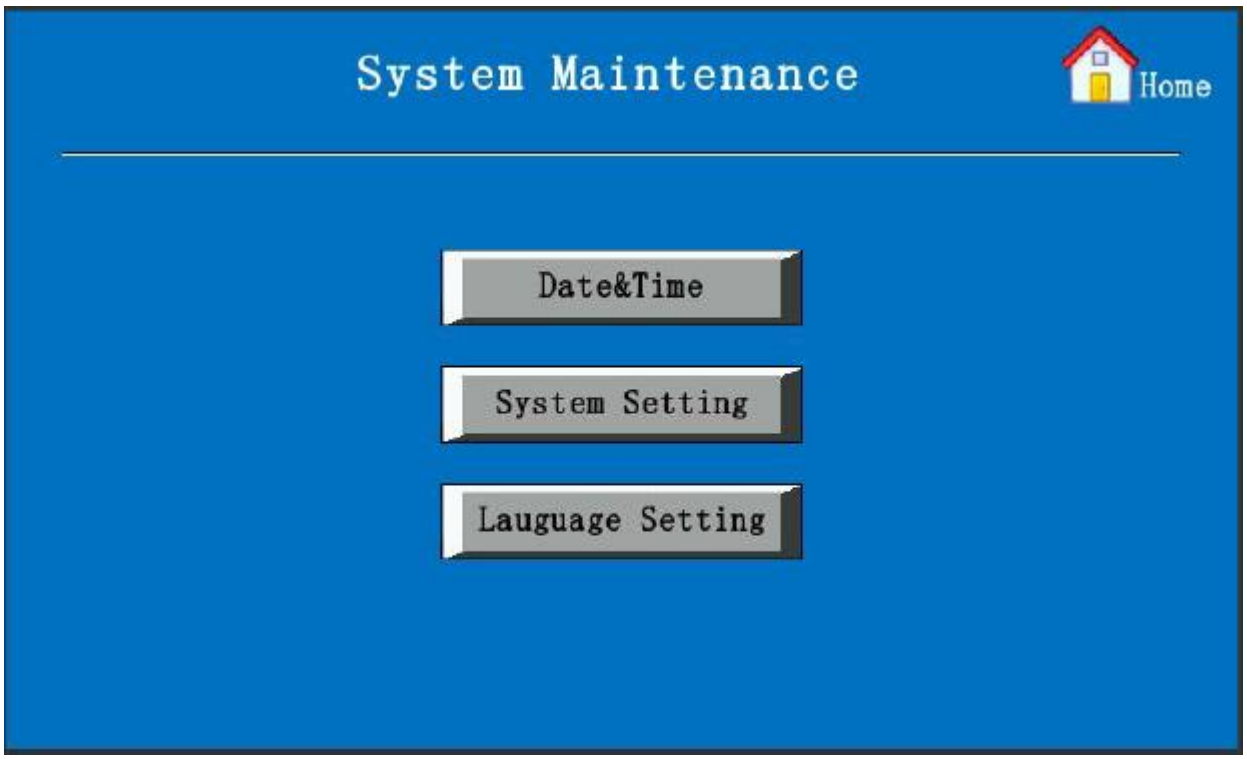
The mode “Meas.“ (realtime sampling) is paused after the button ***STOP*** was clicked. A click on the button ***RESET*** sets the unit back to its initial state.

Error Message

Operation

A click on the button ***RESET*** resets the error meassage. Clicking ***OK*** switches to the previous display.

MENU "SYSTEM"



Date & Time

Date and time can be entered via keyboard. The button ***Back*** saves these settings and switches to the previous menu.

System Setting

System settings may be read but cannot be changed by the user. In case, that adjustments shall be made, please contact our service.

Language Setting

Adjusts the menu language. The button ***Back*** saves these settings and switches to the previous menu.

MENU ”EVENT“

Operation

Clicking on the button ***Previous/Next*** browses the unit log. The button ***Clear*** deletes all saved protocols. The button ***Back*** saves settings and opens the previous menu.

RS 485 INTERFACE

COMMAND FORMAT

Address	Function	Length	Data Range	CRC Check	
Addr	Func	Len	{data}	CRC_H	CRC_L

COMMANDS OF FUNCTIONS

Control	0x00~0x0F
Adjustment	0x10~0x1F
Adjustment Data Functions	0x20~0x2F
Data Enquiry	0x30/0x31
Application parameter	0x16~0x17
Command for standard address	0x02

ANSWER COMMANDS

0 x 02	Address
0 x 50	Function
0 x 01	Command length
0 x 00	Status: 00 – Communication on 01 - Timeout Error 02 - Parity Error
0 x 00	CRC Checksumme high byte
0 x 1D	CRC Checksumme low byte

PROTOCOL EXAMPLES

Command	Function	Command example
Control examples		
Operation	0x01	**Send command:** 0x02 address 0x01 function code 0x02 command length 0x00 0x01 Operation type: 0x01—general mode function operation 0x02—step mode function operation 0x03—gradual mode function operation 0x04—Three-phase voltage independent setting function 0x05/0x06—reserved 0x07—Voltage disturbances run 0x08—Frequency disturbances run 0x09—Voltage and Frequency disturbances run 0x3C CRC Checksum high byte 0x3C CRC Checksum low byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Stop	0x02	**Send command:** 0x02 address 0x02 function code 0x00 command length 0xD1 CRC Checksum high byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Reset	0x03	**Send command:** 0x02 address 0x03 function code 0x00 command length 0xD0 CRC Checksum high byte 0xF0 CRC Checksum low byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Remote Control	0x04	**Send command:** 0x02 address 0x04 function code 0x04 command length 0x00 0x01 Remote control connection: 0-disconnect, 1-connect 0x00 0x01 reserved 0x58 CRC Checksum high byte 0x84 CRC Checksum low byte **Answer from unit:** 0x02 address 0x04 function code 0x0A command length 0x00 0x01 operation status: 0-stop, 1-run 0x08 0x98 current output voltage 0x01 0xF4 current output frequency
Output voltage	0x07	**Send command:** 0x02 address 0x07 function code 0x02 command length 0x00 0x00 Output voltage in high or low segment 0x00—Output voltage in low segment 0x01—Output voltage in high segment 0x3C CRC Checksum high byte 0xB4 CRC Checksum low byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D

Command	Function	Command example
Application Settings		
General information (AC)	0x20	**Send command:** 0x02 address 0x20 function code 0x04 command length 0x08 0x98 current output voltage (220 V x 10) 0x01 0xF4 current output frequency (50 Hz x 10) 0x40 CRC Checksum high byte 0xb9 CRC Checksum low byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D **Note:** The command RUN has to be send again if voltage or current were adjusted before.
Adjustment mode “STEP“	0x21	**Send command:** 0x02 address 0x21 function code 0x0A command length 0x00 0x01 Group number（1-24） 0x08 0x98 output voltage of this group（220V×10） 0x01 0xF4 output frequency of this group（50Hz×10） 0x00 0x00 0x00 0x0A execution time of this group（10second） 0x7C CRC Checksum high byte 0xF1 CRC Checksum low byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Adjustment mode “GRADUAL“	0x22	**Send command:** 0x02 address 0x22 function code 0x0E command length 0x00 0x01 Group number (1-12) 0x04 0x4C output voltage of this group (110 V x 10) 0x01 0xF4 output frequency of this group (50 Hz x 10) 0x08 0x98 output voltage of this group (220 V x 10) 0x02 0x58 output frequency of this group (60 Hz x 10) 0x00 0x00 0x00 0x0A execution time of this group (10 Sekunden) **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Voltage adjustment 3phase (AC)	0x23	**Send command:** 0x02 address 0x23 function code 0x08 command length 0x08 0x98 current R-phase output voltage (220 V x 10) 0x08 0x98 current S-phase output voltage (220 V x 10) 0x04 0x4C current T-phase output voltage (110 V x 10) 0x01 0xF4 current output frequency (50 Hz x 10) 0x63 CRC Checksum high byte 0xF2 CRC Checks **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Adjustment of application parameters		
Mode “STEP“ Loop adjustment	0x16	**Send command:** 0x02 address 0x16 function code 0x06 command length 0x00 0x01 starting group number of step-mode loop 0x00 0x18 ending group number of step-mode loop 0x00 0xFF loop number 0x09 CRC Checksum high byte 0x31 CRC Checksum low byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Mode “GRADUAL“ Loop adjustment	0x17	**Send command:** 0x02 address 0x17 function code 0x06 command length 0x00 0x01 starting group number of Gradual-mode loop

Command	Function	Command example
		0x00 0x0C ending group number of Gradual-mode loop 0x00 0xFF loop number 0x88 CRC Checksum high byte 0xF9 CRC Checksum low byte **Answer from unit:** 0x02 0x50 0x01 0x00 0x00 0x1D
Data collection		
Data collection	0x30/31	**Send command:** 0x02 address 0x30 function code 0x00 command length 0xc4 CRC Checksum high byte 0x00 CRC Checksum low byte **Answer from unit (touch screen):** 0x02 address 0x31 function code 0x2C command length 0x01 current operating loop number 0x01 current operating group number 0x08 0x98 current U-phase output voltage (220 V x 10) 0x08 0x98 current V-phase output voltage (220 V x 100) 0x08 0x98 current W-phase output voltage (220 V x 10) 0x01 0xFC current U-phase output current (50 A x 10) 0x01 0xFC current V-phase output current (50 A x 10) 0x01 0xFC current W-phase output current (50 A x 10) 0x13 0x88 current output frequency (50 Hz x 100) 0x03 0xDE U-phase active power (99 kW x 10) 0x03 0xDE V-phase active power (99 kW x 10) 0x03 0xDE W-phase active power (99 kW x 10) 0x03 0xE8 U-phase Apparent power (100 kVA x 10) 0x03 0xE8 V-phase Apparent power (100 kVA x 10) 0x03 0xE8 W-phase Apparent power(100 kVA x 10) 0x00 0x63 U-phase Power Factor (0,99 x 100) 0x00 0x63 V-phase Power Factor (0,99 x 100) 0x00 0x63 W-phase Power Factor (0,99 x 100) 0x00 0x00 0x00 0x00 current system failure 0x00 0x00 0x00 0x0A Current execution time（10 second） 0x00 0x01 Status Symbol zur Anzeige der Vollständigkeit von „STEP“-od. „GRADUAL“ Modus: 0 - unvollständig, 1 - vollständig 0x02 CRC Checksum high byte 0x4C CRC Checksum low byte **Answer from unit (VFD):** 0x02 address 0x31 function code 0x1E command length 0x08 0x98 current U-phase output voltage (220 V x 10) 0x08 0x98 current V-phase output voltage (220 V x 10) 0x08 0x98 current W-phase output voltage (220 V x 10) 0x01 0x98 current U-phase output current（40.8A×10） 0x01 0x98 current V-phase output current（40.8A×10） 0x01 0x98 current U-phase output current（40.8A×10） 0x08 0x98 current R-phase input voltage (220 V x 10) 0x08 0x98 current S-phase input voltage (220 V x 10) 0x08 0x98 current T-phase input voltage (220 V x 10) 0x14 0x50 Bus voltage (250 V x 10) 0x01 0xF4 current output frequency (50 Hz x 10) 0x00 0x00 reserved for optional feature 0x00 0x00 0x00 0x00 current system failure 0x00 0x00 reserved for optional feature 0x07 CRC Checksum high byte 0x34 CRC Checksum low byte

CRC CHECK SUM

```
/*****************************************************************************
** Task Name: CRC Verification
** Description: CRC checksum calculation
*****************************************************************************/
static unsigned char auchCRCHi[]={
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,10/12
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01,
0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0,
0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01,
0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81, 0x40, 0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41,
0x00, 0xC1, 0x81, 0x40, 0x01, 0xC0, 0x80, 0x41, 0x01, 0xC0, 0x80, 0x41, 0x00, 0xC1, 0x81,
0x40
};
static unsigned char auchCRCLo[256] = {
0x00, 0xC0, 0xC1, 0x01, 0xC3, 0x03, 0x02, 0xC2, 0xC6, 0x06, 0x07, 0xC7, 0x05, 0xC5, 0xC4,
0x04, 0xCC, 0x0C, 0x0D, 0xCD, 0x0F, 0xCF, 0xCE, 0x0E, 0x0A, 0xCA, 0xCB, 0x0B, 0xC9, 0x09,0x08, 0xC8, 0xD8, 0x18, 0x19, 0xD9,
0x1B, 0xDB, 0xDA, 0x1A, 0x1E, 0xDE, 0xDF, 0x1F, 0xDD,0x1D, 0x1C, 0xDC, 0x14, 0xD4, 0xD5, 0x15, 0xD7, 0x17, 0x16, 0xD6, 0xD2,
0x12, 0x13, 0xD3,0x11, 0xD1, 0xD0, 0x10, 0xF0, 0x30, 0x31, 0xF1, 0x33, 0xF3, 0xF2, 0x32, 0x36, 0xF6, 0xF7,0x37, 0xF5, 0x35, 0x34,
0xF4, 0x3C, 0xFC, 0xFD, 0x3D, 0xFF, 0x3F, 0x3E, 0xFE, 0xFA, 0x3A,0x3B, 0xFB, 0x39, 0xF9, 0xF8, 0x38, 0x28, 0xE8, 0xE9, 0x29,
0xEB, 0x2B, 0x2A, 0xEA, 0xEE,0x2E, 0x2F, 0xEF, 0x2D, 0xED, 0xEC, 0x2C, 0xE4, 0x24, 0x25, 0xE5, 0x27, 0xE7, 0xE6, 0x26,0x22,
0xE2, 0xE3, 0x23, 0xE1, 0x21, 0x20, 0xE0, 0xA0, 0x60, 0x61, 0xA1, 0x63, 0xA3, 0xA2,0x62, 0x66, 0xA6, 0xA7, 0x67, 0xA5, 0x65, 0x64,
0xA4, 0x6C, 0xAC, 0xAD, 0x6D, 0xAF, 0x6F,0x6E, 0xAE, 0xAA, 0x6A, 0x6B, 0xAB, 0x69, 0xA9, 0xA8, 0x68, 0x78, 0xB8, 0xB9, 0x79,
0xBB,0x7B, 0x7A, 0xBA, 0xBE, 0x7E, 0x7F, 0xBF, 0x7D, 0xBD, 0xBC, 0x7C, 0xB4, 0x74, 0x75, 0xB5,0x77, 0xB7, 0xB6, 0x76, 0x72,
0xB2, 0xB3, 0x73, 0xB1, 0x71, 0x70, 0xB0, 0x50, 0x90, 0x91,0x51, 0x93, 0x53, 0x52, 0x92, 0x96, 0x56, 0x57, 0x97, 0x55, 0x95, 0x94,
0x54, 0x9C, 0x5C,0x5D, 0x9D, 0x5F, 0x9F, 0x9E, 0x5E, 0x5A, 0x9A, 0x9B, 0x5B, 0x99, 0x59, 0x58, 0x98, 0x88,0x48, 0x49, 0x89, 0x4B,
0x8B, 0x8A, 0x4A, 0x4E, 0x8E, 0x8F, 0x4F, 0x8D, 0x4D, 0x4C, 0x8C,0x44, 0x84, 0x85, 0x45, 0x87, 0x47, 0x46, 0x86, 0x82, 0x42, 0x43,
0x83, 0x41, 0x81, 0x80,0x40
};
unsigned short CRCVerify(unsigned char *pMsg,unsigned short usDataLen)
{
unsigned char ucCRCHi = 0xff;
unsigned char ucCRCLo = 0xff;
unsigned short uIndex = 0;11/12
while(usDataLen--)
{
uIndex = ucCRCHi ^ *pMsg++;
ucCRCHi = ucCRCLo ^ auchCRCHi[uIndex];
ucCRCLo = auchCRCLo[uIndex];
}
return (ucCRCHi << 8 | ucCRCLo);
}
```

ERROR MESSAGES

The following table shows solutions for common error messages in case of disorder.

Error	Description	Possible Cause	Solution
Err-01	U-Phase IGBT1 overcurrent fault	IGBT Phase U is damaged	Check and replace IGBT
Err-02	U-Phase IGBT2 overcurrent fault	IGBT Phase U is damaged	Check and replace IGBT
Err-03	U-Phase IGBT3 overcurrent fault	IGBT Phase U is damaged	Check and replace IGBT
Err-04	U-Phase IGBT4 overcurrent fault	IGBT Phase U is damaged	Check and replace IGBT
Err-05	V-Phase IGBT1 overcurrent fault	IGBT Phase V is damaged	Check and replace IGBT
Err-06	V-Phase IGBT2 overcurrent fault	IGBT Phase V is damaged	Check and replace IGBT
Err-07	V-Phase IGBT3 overcurrent fault	IGBT Phase V is damaged	Check and replace IGBT
Err-08	V-Phase IGBT4 overcurrent fault	IGBT Phase V is damaged	Check and replace IGBT
Err-09	Overcurrent fault W-Phase IGBT1	IGBT Phase V is damaged	Check and replace IGBT
Err-10	Overcurrent fault W-Phase IGBT2	IGBT Phase V is damaged	Check and replace IGBT
Err-11	Overcurrent fault W-Phase IGBT3	IGBT Phase W is damaged	Check and replace IGBT
Err-12	Overcurrent fault W-Phase IGBT4	IGBT Phase W is damaged	Check and replace IGBT
Err-13	Radiator over-temperature	Fan malfunction	Check fan
Err-14	Transformer over-temperature	Fan malfunction	Check fan
Err-15	Emergency stop button	Emergency stop button is pushed	Check emergency stop button
Err-16	Fuse 1 is defect	Fuse 1 is damaged	Check and replace fuse
Err-17	Fuse 2 is defect	Fuse 2 is damaged	Check and replace fuse
Err-18	Fuse 3 is defect	Fuse 3 is damaged	Check and replace fuse
Err-19	IGBT over-temperature 1	Fan malfunction	Check fan
Err-20	IGBT over-temperature 2	Fan malfunction	Check fan
Err-21	Input undervoltage error	Input voltage is too low	Check input voltage
Err-22	Input overvoltage error	Output voltage is too high	Check input voltage
Err-23	DC-Spannung zu gering	Input voltage is too low	Check input voltage
Err-24	DC-Spannung zu hoch	Output voltage is too high	Check input voltage
Err-25	Overload U	U phase overload	Check load
Err-26	Overload V	V phase overload	Check load
Err-27	Overload W	W phase overload	Check load
Err-28	Output undervoltage error	Output voltage too low	Check output voltage
Err-29	Output overvoltage error	Output voltage too high	Check output voltage

MAINTENANCE

The fan should be examined for its functionality and cleaned from contamination at regular intervals. For this purpose, the ventilation duct must be removed and the fan can easily be taken out.

NOTES