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Operating manual

Motor driven AC source

MV 3P 4016 DS / MV 3P 2416 DS
MV 3P 4032 DS / MV 3P 2432 DS
MV 3P 4063 DS / MV 3P 2463 DS
MV 3P 40100 DS
MV 3P 4832 DS / MV 3P 69100 DS

EN/IEC 61000-4-11
EN 61000-6-1
EN 61000-6-2

The motorized AC variacs of the series MV are suitable for voltage dips and voltage variation test.

The Motorvariac is suitable for testing 3-phase EUT in delta and star connection as per IEC 61000-4-11 Ed 2 : 2004-03

The the internal voltage control compensate automatically voltage variations on the mains supply for the tapped output voltage.

emc test equipment

Version: 2.11 / 30.05.2017
Replaces: 2.10 / 21.03.2016
Filename: UserManual-MV3P40xxDS-E-V2.11
Printdate: 30.05.17

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Contents

1. Standards for testing with MV3P40xx

The AC sources of the series MV26xx and MV3P40xx are used for the following standard tests:

- IEC 61000-4-11 Testing and measurement techniques - Voltage dips, short interruptions and voltage variations immunity tests

1.1. Models and options

This manual is written for the following devices and options:

3 phase equipments:

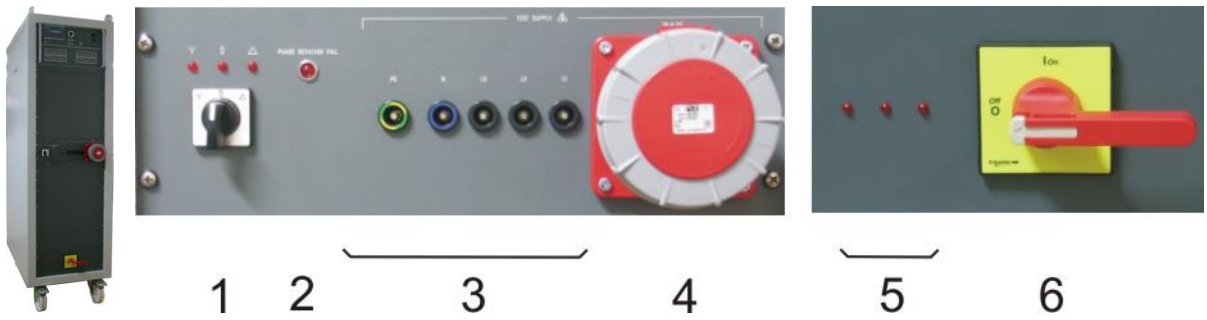
MV 3P4016DS	3- phase Motorized Variac with Star and Delta connection	3x 0 - 400V (L-L) / 16A ac	50 / 60 Hz
MV 3P4032DS	3- phase Motorized Variac with Star and Delta connection	3x 0 - 400V (L-L) / 32A ac	50 / 60 Hz
MV 3P40100DS	3- phase Motorized Variac with Star and Delta connection	3x 0 - 400V (L-L) / 100A ac	50 / 60 Hz
MV 3P2632YDS	3- phase Motorized Variac with Star and Delta connection	3x 0 - 400V (L-L) / 32A ac	50 / 60 Hz

3 phase equipments with variable voltage input:

MV 3P2416DS	3- phase Motorized Variac Input Range with Star and Delta connection	3x 0 - 400V (L-L) / 16A ac 3x 170V – 240V	50 / 60 Hz
MV 3P2463DS	3- phase Motorized Variac Input Range with Star and Delta connection	3x 0 - 400V (L-L) / 63A ac 3x 170V – 240V	50 / 60 Hz
MV 3P4016DS	3- phase Motorized Variac Input Range with Star and Delta connection	3x 0 - 400V (L-L) / 16A ac 3x 380V – 440V	50 / 60 Hz
MV 3P 4832DS	3- phase Motorized Variac Input Range with Star and Delta connection	3x 0 - 480V (L-L) / 32A ac 3x 480V ±10%	50 / 60 Hz
MV 3P 69100DS	3- phase Motorized Variac Input Range with Star and Delta connection	3x 0 - 690V (L-L) / 100A ac 3x 690V ±10%	50 / 60 Hz

2. Operating Functions

2.1. Operating elements on front and rear side



1 Mode selector STAR - DELTA
2 Phase rotation indicator
3 EUT output bananaplugs L1, L2, L3, N, PE
4 EUT output CEE connector
5 Voltage indicator EUT
6 Mains power switch rack

1 Mode selector STAR - DELTA
Selecgion of the operating mode. The inidication red lamp shows the feedback of the setting. For change the mode, the variac must first go to the zero position.
Y : **Star** connection 0-270V
O : **Zero postition** the lamp indicate the zero position
Δ : **Delta** connection of the

2 Phase Rotation Fail
This signal will indicate if the phase rotation of the power supply is invers or when the supply voltage is too low. In case of wrong phase rotation the user has to change two of the three input mains lines L1, L2, L2.

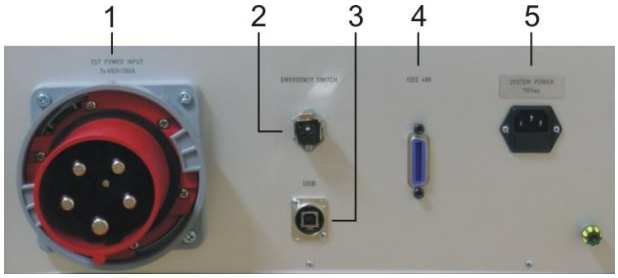
3 EUT Output bananaplugs
Banana output plugs L1, L2, L3, N, PE to the EUT. The output voltage (PF1 or PF2) is selected by the PFS 503 setting. The rated current of each plug is 32A

4 EUT Output CEE connector
32A CEE connector output to the EUT. The output voltage (PF1 or PF2) is selected by the PFS 503 setting.

5 EUT supply indicator
Each phase of the EUT voltage supply is indicated with a red lamp.

7 Power supply switch
Main power switch ON/OFF for the EUT and control power.

2.2. Operating elements on front and rear side



1 EUT supply input 3-phase 3x400V / 32A
2 Emergency Switch
3 USB interface
4 Parallel interface GPIB / IEEE 488
5 System Power Mains input PFS 503

1 EUT supply input 3-phase 3x400V

2 Emergency Switch
Short circuit this loop for interrupt 250V 1A

3 USB Interface (PFS 503)

4 Parallel interface GPIB / IEEE 488
IEEE 488 interface with IEEE connector

5 System Power mains input PFS 503
Mains input for PFS 503 control with a built in fuse. (230V / 2A)

3. Putting into Operation

Prior to unpack completely the equipment please check if the packing materials do show visible damages. In this case do not remove the equipment from packing.

3.1. Inspection

Check if the equipment shows visible transportation damages.

3.2. Supply voltage

Prior to turning on the equipment check if the selected supply voltage corresponds with the actual power supply mains in your laboratory. Damages which may arise from wrong supply voltage are not covered by warrantee.

Check the **phase rotation** by connecting the 3-phase power supply.

The system will not operate if the phase rotation is not in the correct direction

3.3. Main socket and plug

Main socket, power-on switch and fuses are located at the rear part of the equipment.

3.4. Safety aspects

This description contains the necessary information for the correct application of the product described below. It is intended for use by technically qualified personal only. Please read carefully the the Safety manual

Qualified personnel are persons who, because of their training, experience and position as well as their knowledge of appropriate standards, regulations, health and safety requirements and working conditions, are authorised to be responsible for the safety of the equipment, at all times, while carrying out their normal duties and are therefore aware of, and can report, possible hazards (Definition of qualified employees according to IEC 364).

Safety instructions

The following instructions are provided for the personal safety of operators and also for the protection of the described product and connected equipment.

Warning !

Hazardous Voltage. Missing attention can lead to death, cause serious injury or damage.

- Disconnect from power mains supply before installation or dismantling work, as well as for fuse changes or post installation modifications.
- Observe the prescribed accident prevention and safety rules for the specific application.
- Before putting into operation check if the rated voltage for the unit conforms with the local supply voltage.
- Emergency stop devices must be provided for all applications. Operation of the emergency stop must inhibit any further uncontrolled operation.
- **The electric connections must be covered!**
- **Earth connection must be checked for safe function after assembly!**

Use According to Designation

The units described herein are electrical equipment for the use in industrial plants. They are **not** determined for private households.
Units with open electric connections are determined for installation only.

4. Switch-on condition

After switching ON the equipment is set into the following condition:

- Output voltage is returning to the latest (previous) adjusted value (Level).
- Remote voltage control input 0-10V DC is activated.

5. Remote control voltage

The output voltage level is controlled by an external DC-voltage signal
(0-10V DC). The output voltage is directly proportional to the input signal. The input voltage signal is connected at the BNC-plug available at the rear panel of the equipment.

 **WARNING**	**The reference voltage setting between Star and Delta connection is different.** **Wrong connection mode setting can damage the EUT**

6. Output

The AC source has tree different power supply outputs at the frontpanel of the equipment.
- CEE connector 32A
- 3 x Schuko output one for each phase
- 5 x Banana plugs 32A (L1, L2, L3, N, PE)

The access to the direct output of the variac is availlable on the PFS 503 input plugs at the rearside.
- Channel PF1 (100%)
- Channel PF2 (variable tap).

7. Variac

7.1. General

The equipment consists of a 3-phase variable transformer with motor drive. The transformer can be switched in **Star- connection** and **Delta – connection**. (figure 7.1) For change the connection mode the variac must be in the zero position. The red light indicates the actual connection mode.

Figure 7.1

A main switch is provided at the input; 35A fuses are mounted in the output to PF1 and PF2 for protection of the unit.

The regulation is realised by using saturating servo-mechanism regulator (NLR 500). The regulator is fed over the control transformer (BV 16-149 with tapping at 115V). The Motor is driven by a frequency conferter FR-S 520

The equipment is protected against short-circuit by fuses.

7.2. Function description

After installation of the connections the 3-phase variable transformer can be put into operation.

The supply voltage for the regulator is adapted to the mains voltage fed by using the change-over switch S2. Before switching on the main switch S1 it must be assured that the supply voltage at the regulator corresponds to the prescribed value of 32 V-36 V.

If the supply voltage for the regulator is too low or too high, either the function of the regulator is not assured, or the regulator may be destroyed by over voltage.

The output voltage of Star (0...260V) or Delta (0-400V line to line over one tap) is adjusted with a set point of 0...10V, DC over a BNC-socket.

WARNING	**Voltage lost in the EUT power supply will move the variac position to the max. position as long the control is not switched out.** The reason is cause the feedback of the voltage to the regulator is zero. The regulator will move the tap to higher voltage position. = > Star connection : 100% of the variac position = **approx. 460V L-N (very dangerous)** **For return in a safe position the variac must changed in delta connection and set to zero position.** = > Delta connection: 100% position = 400V L-L (not dangerous)

7.3. Star connection

The 100% input from the 3-phase is approx in the middle of the variac transformer. At the bottom is the neutral located. The variable voltage (line-neutral) is variable in the range of 0..270V. The setting from in the PFS 503 is possible up to 250V

Star connection is the general connection for perform all single phase tests.

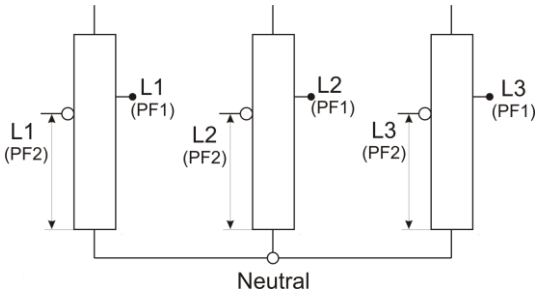


Figure 7.1. Star connection

WARNING

Hazardous Voltages can occur on the PF 2 output when the power setting of the PFS 503 is not correct.

7.4. Delta connection

In Delta connection the variac moves with all phases accross the collnum. This connection is the preffered connection for Dips as per IEC 61000-4-11.

Figure 7.2

For the voltage dip tests of three-phase systems without neutral, each phase to phase voltage shall be tested at a time as showed in figure 7.2

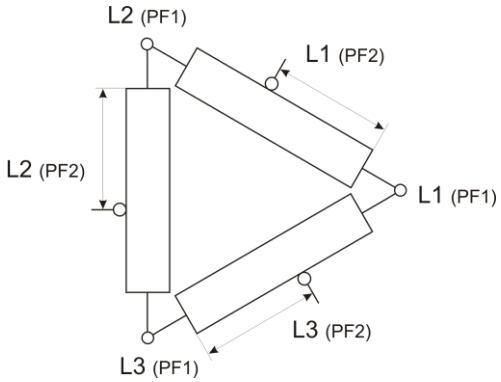


Figure 7.3. Star connection

Attention

Other tests than **dips on a single phase** make no sense in the 3-phase connection with the variac. Operating with in PF2 mode generate the vector added voltages between the taps .

A regulation as 0...100% between the phases is not possible. For such application the Star connection is necessary.

7.4.1. Vector diagram for dips in Delta connection

Figure 7.4 shows the vector diagram of a delta connection transformer with dips with on phase L1.in a 3-phase system.

The voltage L2-L3 keeps at 100%. The voltages between the phases L1'-L2 and L1'-L3 are vectoriel added voltages depends of the tap position.

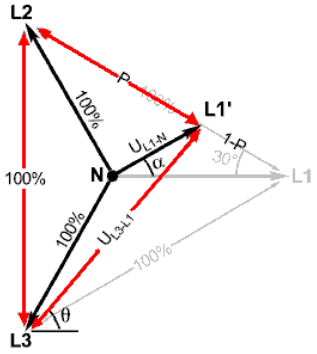


Figure 7.4 Vector diagram of a delta dip on a single phase

8. Control

The control is located at the rear side of the rack. Figure 8,1 shows the control main elements.

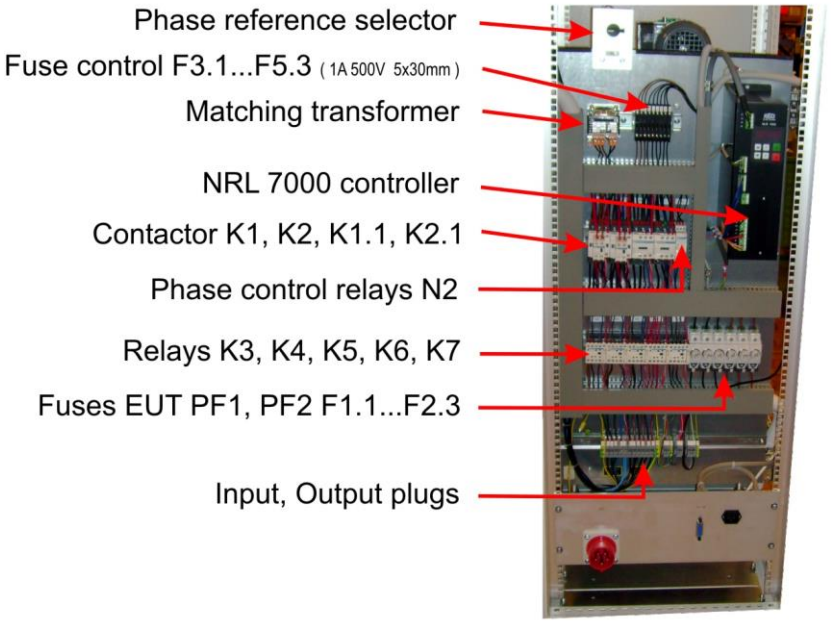


Figure 8.1

8.1. Phase reference selector

Figure 8.2

Depending upon the output rating of the complete system which is to be controlled, the feedback signal can be derived in various ways. The standard unit has three possible feedback channels with an input from each of the 3-phases.
With the switch **phase reference** on the frontpanel (figure 8.2), the user select one of the three phases U - V – W.
The zero position is used for get a time delay between the position.
1 = phase U
2 = phase V
3 = phase W

WARNING

Phase referenze in zero position has no feedback to the control

The control will move to higher output voltage > 270V.

Should there be other feedback voltage values, there is a bank of switches available for feedback selection. An externally adjusted trimmer "ISTWERT" provides fine control of the system.
The feedback range from Star- and Delta-mode is adapted by the matching transformer in figure 8.3 for adapt the input range to the controller module NLR 500

Mode	**Range**
Star	0-270V
Delta	0-400V

Figure 8.3

8.2. Controller type NLR 7000

The NLR 7000 is a combined comparator and 3-phase servo-motor drive unit designed specifically for use with motorised variabletransformers in voltage regulating or stabilising systems. The required voltage level can be set internally through the digital control-panel or by using an external set-point source which can be a potentiometer or an analogue voltage or current signal. Motor voltage, frequency and response characteristics are set by using the digital control-panel.
The controller normally operates in automatic mode but it can be switched to manual for setting up purposes. It also has a zero-volts homing function for putting the system into a safe position, when required. Limit-switch inputs are also provided to ensure that the variable-transformer cannot be driven into ist end-stops. There are analogue outputs available, which provide signals for measuring the actual output voltage current

8.2.1. General

Control Unit for Motorised Variable Transformers

Variable power supplies for mains and medium voltage ranges, are often fitted with variable transformers. In general, in addition to controlling the voltage these are often required hold the output voltage constant. For this purpose, the variable transformer is driven by a motor which is controlled by a suitable electronic regulator. The unit described below, is such an electronic regulator for controlling three-phase AC motors.

8.2.2. Function description NLR 7000

The unit is set up from a control panel mounted in the front of the unit (using keys and an LED-display). All settings can be made through the control panel, using a menu system. The various parameters are accessed by entering a user code. The function of the menu control will be explained in detail in the section on “Parameter Adjustment“. Alternatively, output voltage, output current or power may also be adjusted from external potentiometers, an external control voltage 0...10 V,DC or a control current 0(4)...20 mA (must be selected in menu 003) A potential-free relay contact is provided for fault indication and connections to this are brought out to terminals. The “run” LED is illuminated during normal operation. In the programming mode the various settings are to be used in the manner described in these instructions. Setting adjustments are automatically saved upon leaving the programming mode or if no button is pressed for a period of 100 seconds.

There are two possible operating modes:

Voltage Stabiliser
This mode does not require external set points. The settings are made through touch panel and LEDdisplay.

Current /Voltage Regulation
In this operating mode the regulator requires current and voltage set point values, which can be provided through the touch-panel or externally.

8.2.3. Technical data NLR 7000

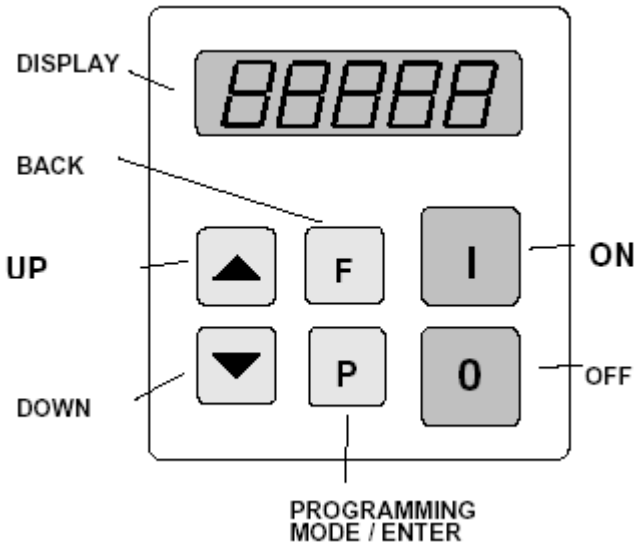
Unit Type	NLR 7000
Input voltage with neutral wire connected	Single-phase, 230V +/- 20%
Three-Phase, 3x 400V +/-20%	
Input Frequency	50 / 60 Hz
Motor Power	370W
Motor Capacity	Adjustable 0...100 %
Current Set-point	10k Potentiometer / 0...10VDC / 0(4)...20mADC
Voltage Set-point	10k Potentiometer / 0...10VDC / 0(4)...20mADC
Actual Current	3 x 0...4,5VAC or 0...5VDC
Actual Voltage	3 x 0...440VAC (3x 254VAC against N) or 0...5VDC
Protection	IP 20
Operating Temperature	0...+45 °C
Storage Temperature	-10...+80 °C
Relative Humidity	80% without dew
Degree of Pollution	2
Mounting Altitude	1000 m with 0,5 % current derating for each additional 100m
Mounting Orientation	Horizontal, Vertical

8.2.4. Settings

The six buttons and a LED display found in the front-panel, are used for operating and setting up the unit. All operating methods and adjustable parameters can be set up through this panel.

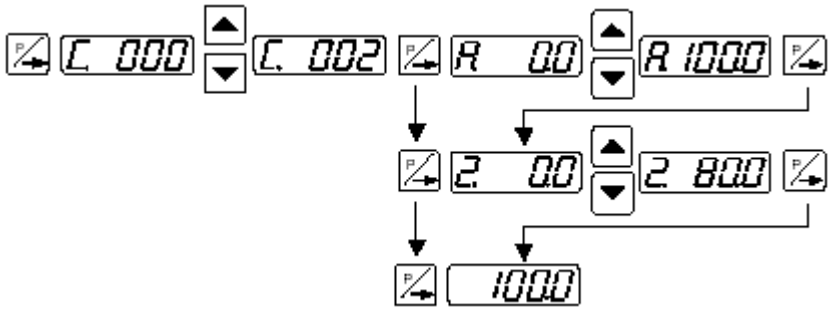
The “I” and “O” buttons are used for switching the unit ON and OFF, however, **these do not provide mains isolation,** they simply inhibit the controller. The “P”, “F” and “Cursor Buttons” are used for parameter adjustment. Parameters are set by using menu controls which are called up by entering operator codes. A capital letter is used to indicate the selected function.

The display value can be increased or decreased by units, or tens of units, by a short press of the cursor buttons. Holding the buttons down will cause the display to change in units of ten.



The user menus are protected against accidental or unauthorized adjustment of parameters; a code must be entered to open the user menus and there are different pass codes for each function group. **Setting adjustments are automatically saved upon leaving the programming mode if no button is pressed for a period of 100 seconds.**

All settings routines are initiated by pressing the programming button “P“. The following diagram should clarify the sequence in which the keys are pressed.:-



1. Press the “P“ key.
2. Select the code number with the cursor keys.
3. Press the “P“ key. This displays the first menu point. The required menu point can be found by repeatedly pressing the “P” key (scrolling).
4. The value in the menu point can be changed with the cursor keys.
5. Scroll to the next menu point or to the end of the menu, which returns the display to the set point value, by pressing the “P” key. To exit the menu and return back to the normal display. Quickly, depress the “P” key for 5 seconds.
6. To return back to the previous position in the menu, press the “F“ key.

8.2.5. Adjustment parameters

Parameters:		Code	Factory settings:	Pass code:
Set points, with internal set points selected!				
• Voltage set point	0...100 %	U.	0 %	002
• Current set point	0...100 %	I.	0 %	002
• Power set point	0...100 %	P.	100 %	002
Change-Over				
• External set point OFF	0 / I	E.S.P.	0	003
• 4...20 mA (only if E.S.P. = I)	0 / I	4.20	0	003
• Actual External Voltage	0 / I	E.F.U.	0	003
• Actual External Current	0 / I	E.F.I.	0	003
Parameters				
• Minimum output voltage (without set point)	0...100 %	U.	0 %	020
• Minimum output current (without set point)	0...100 %	I.	0 %	020
• Minimum output power (without set point)	0...100 %	P.	100 %	020
• Maximum output power (limitation)	25...100 %	u	100 %	020
• Maximum output voltage(limitation)	25...100 %	i	100 %	020
• Maximum output current (limitation)	12,5... 100%	p	100 %	020
• Voltage regulation P- characteristic	1...100	P.U.	20	020
• Current regulation P- characteristic	1...100	P.I.	15	020
• Power regulation P- characteristic	1...100	P.P.	15	020
• Soft start	0...10 Sec.	/.	0,1	020
• Soft stop	0...10 Sec.	\	0,1	020
Service				
• Display actual motor current		i.		40
• Display actual motor frequency		F.		40
•				
• Save user parameter		PUSH		143
• Restore factory settings		FAC.		210
• Display software version number				001

8.2.6. Adjustment Voltage Stabilizer

This regulation mode does not require an external set point. All adjustments are made from the display.
For voltage regulation the set points for current and power are set at 100 %.
The voltage set point is set to 90 % to enable later correction of the output voltage (+/- 10 %).
The desired output voltage is adjusted with the adjustment of voltage limitation.
Upon locking the regulating parameters the output voltage (parameter “U“ under Code C 020) can still be adjusted.

Parameter settings

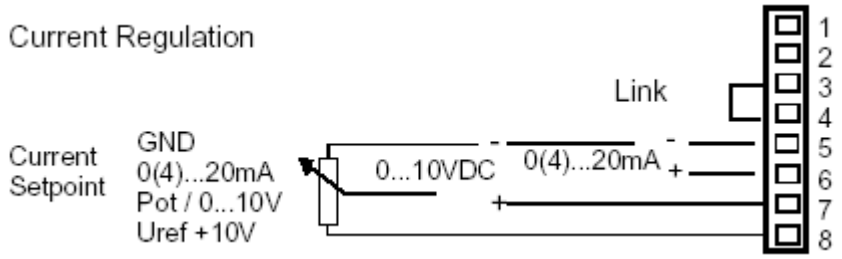
Parameters	Code	Adjustment from display
Output Power „P”	C 020	100%
Output current „I“	C 020	100%
Output Voltage „U.“	C 020	90%,
Maximum Output Voltage „u“	C 020	Output current adjustment

8.2.7. Setting Current/Voltage Regulation

Two set points, one for current and the other for voltage are required by the regulator for this regulating method.

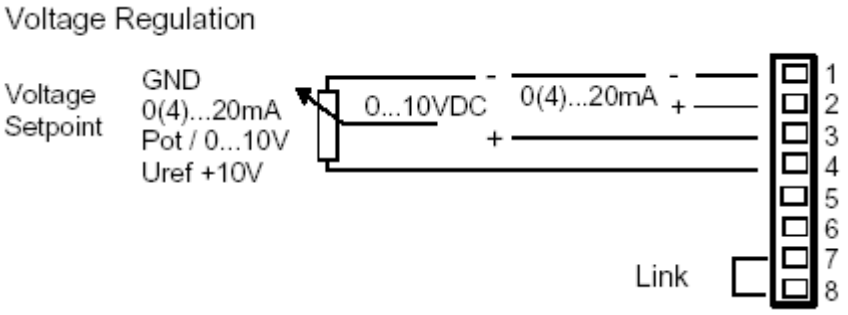
Current regulation

The voltage set point must be set to 100% either by using the display (E.S.P. = 0) or terminals 3 and 4 (E.S.P. = 1).
The output current can now be set by using display code 002 (I) or terminals 5-6 (E.S.P = 1)



Voltage Regulation

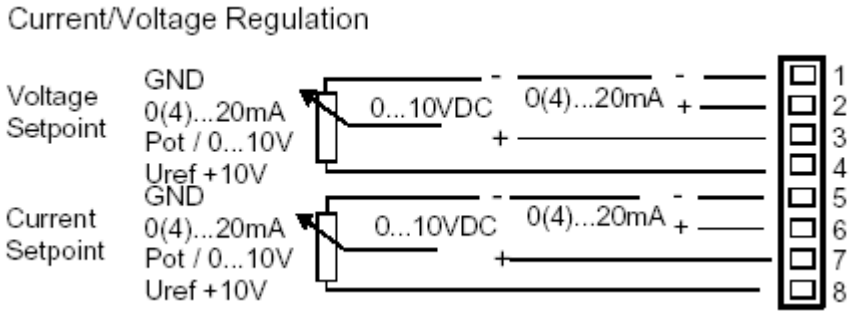
The current set point must be set to 100% either by using the display (E.S.P. = 0) or terminals 7 and 8 (E.S.P. = 1).
The output voltage can now be set by using display code 002 (U) or terminals 1-4 (E.S.P. = 1).



Current/Voltage Regulation

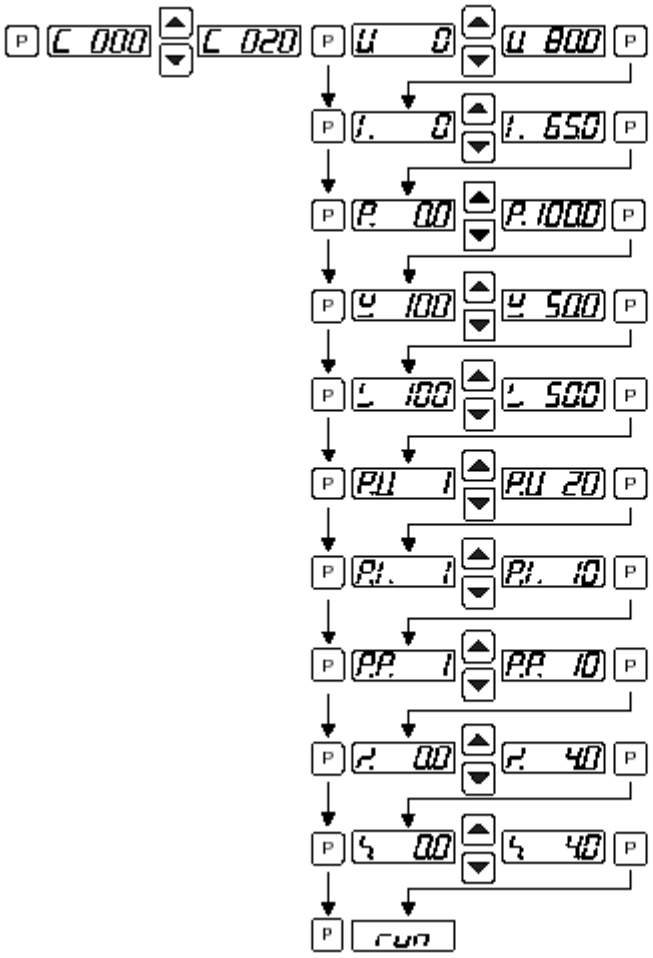
The current and voltage set points can be provided separately. The regulator switches automatically between current and voltage regulation depending on which actual value matches the set point.

Parameter ESP under code C002 must be set to "1" for external set point source.



8.2.8. Settings

Code 020



Minimum output voltage [%]
(without set point)

Minimum output current [%]
(without set point)

Maximum output power [%]
Pmax

Output voltage limitation [%]
Umax

Output current limitation [%]
Imax

Control parameter voltage regulation
P-Part

Control parameter current regulation
P-Part

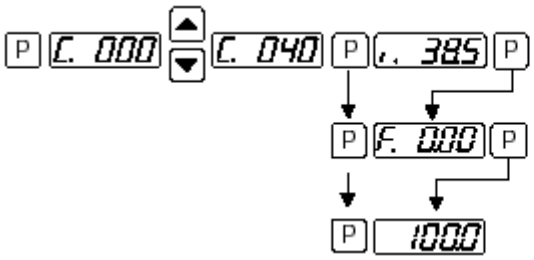
Control parameter power regulation
P-Part

Run-up ramp [Secs]
Soft Start

Return ramp [Secs]
Soft stop

Run mode

Display Motor Voltage and Frequency
Code 040

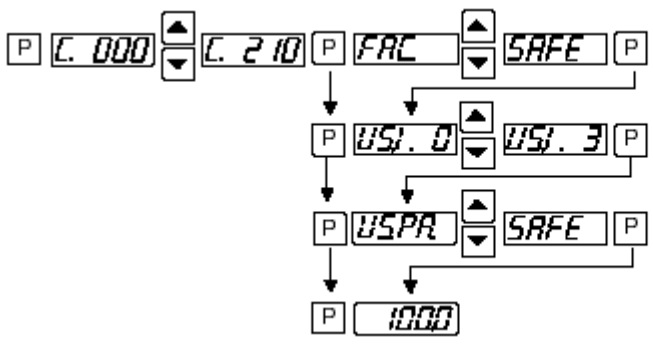


Actual Motor Current (Only Display)

Actual Motor Frequency (Only Display)

Run Mode

Recalling Factory Or User Settings
Code C. 210



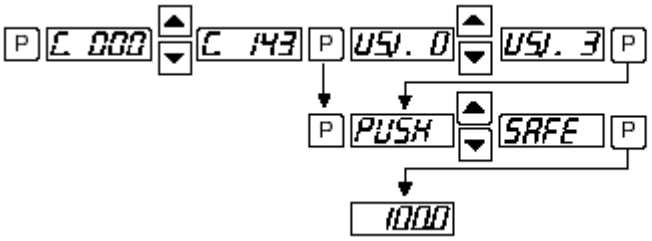
Restore factory settings

Select parameter number 0...3

Reinstate user settings

Run Mode

Saving User Settings
Code C. 143

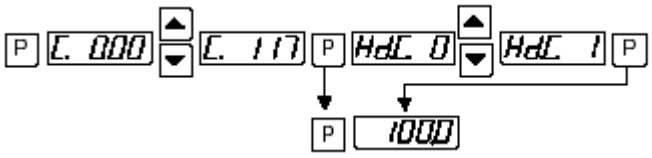


Select parameter number

Store parameter settings

Run Mode

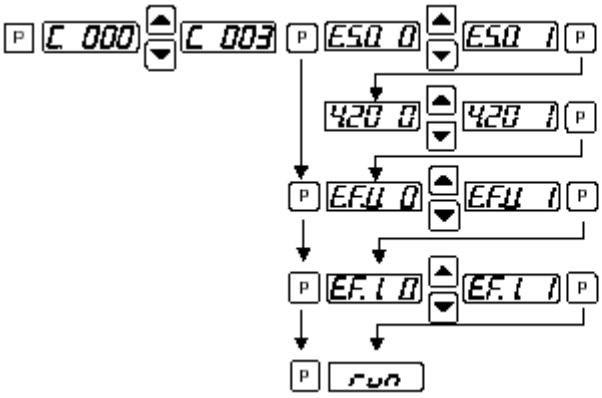
Protect From Unauthorized Adjustment Of Settings
Code C. 117



I= Hide Menus

Run Mode

Set Point And Actual Value Sources
Code 003



E.S.O. = 0 = External set point source
E.S.O. = I = Internal set point source (keypad)

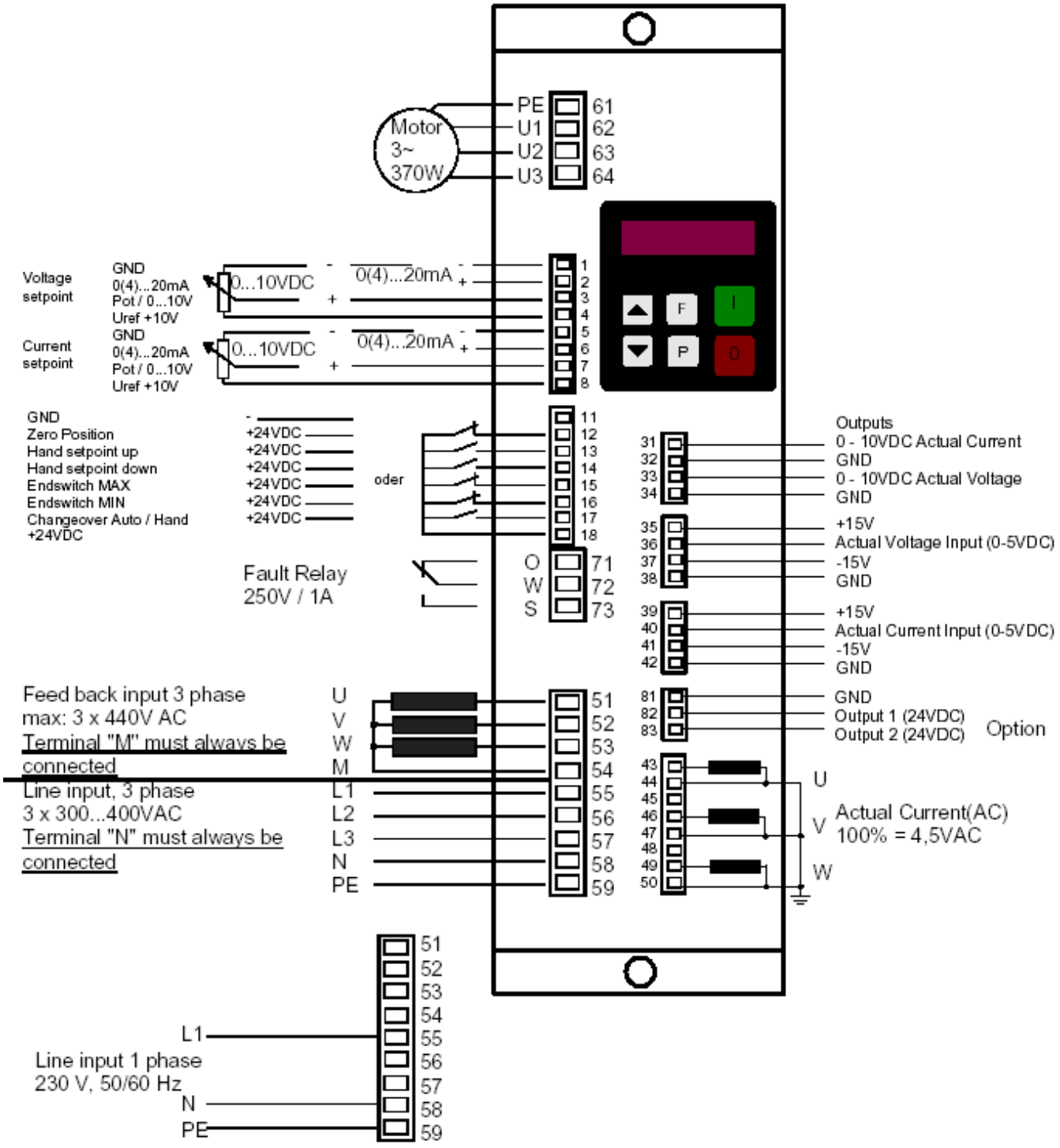
4.20 = 0 = External set point 0...20 mA / 0...10V
4.20 = I = External setpoint 4...20 mA

E.F.U. = 0 = Actual Value 3 x 0...440VAC (3 x 254VAC against N)
E.F.U. = 1 = Actual Value 0...5VDC

E.F.I. = 0 = Actual Value 3 x 0...4,5VAC
E.F.I. = 1 = Actual Value 0...5VDC

Run Mode

8.2.9. Connection NLR 7000



Return signal for control at different positions

Plug	min	max	middle
12 : zero position	0V	24V	24V
15 : Endswitch max	24V	0V	24V
16 : Endswitch min	0V	24V	24V
17 : Changeover Auto/Hand	24V	0V	0V
18 : + 24V DC	24V	24V	24V

9. Application and setup

The motor variac can be used with the equipment listed below:

- PFS 503

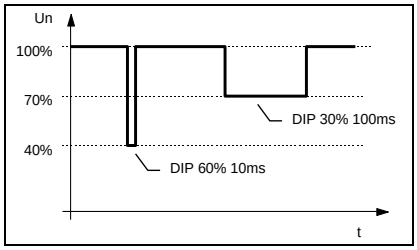
9.1. Application

The motor variac can be used to simulate power supply failures as undervoltages, voltage interruptions and voltage variations. The Basic Standard IEC 61000-4-11 and the Generic Standard EN 61000-6-1 / 2 are specifying these phenomenas.

Voltage interruptions (DIPS)

Voltage interruptions will cause a reduction of the power supply voltage for a certain period of time. see fig. 9.1. Three different test levels are required:

The change between U_T and the changed voltage is abrupt. Unless otherwise specified by the responsible product committee, the start and stop phase angle for the voltage dips and interruptions shall be 0° (i.e. the positive-going voltage zero-crossing on the dipped phase).



The following test voltage levels (in % U_T) are used, corresponding to voltage dips or interruptions with residual voltages of:

Level in in % U_T
0%
40%
70%
80%

Figure 9.1 Dips application

fig 9.1: Voltage dips

9.2. Test setup

The setup in the PFS 503 must be adapted to the switching mode of the transformer. The setting must be done in the PFS 503 menu Service / Setup / set voltage. **For star and delta connection are different settings**.

The following settings are approx. values and must be verified during the put in service.

The regulating time for the dip voltage is max. 15s The PFS 503 is designed for a variac with 2s regulating time for 0...100%. Therefore it is necessary to set the Voltage U nom to the estimated dip voltage

9.2.1. PFS setting for Star connection

The max. voltage in Star connection is approx. 270V L-N. Higher voltages are in general possible with the transformer. The 270V is limitted by the overvoltage protection in tne switch of the PFS 503.

Attention

Umax : **275**V
Unom : Depends on the dip voltage 184V (80%); 161V (70%) and 92V (40%)
Default Channel : PF1

Umax : **275**V
Unom : Depends on the dip voltage 184V (80%); 161V (70%) and 92V (40%)
Default Channel : PF1

9.2.2. PFS setting for Delta connection

In delta connection the setted voltage must be verified at the input plugs of the PFS 503. (L2 PF1 - L1 PF2) PFS 503 works in the Star system. Therefore the max input voltage is 280V. For using the correct values, all inputs are multiplied with the factor √3 =1.73

Attention

Umax :	**230V**
Unom :	Depends on the dip voltage 184V (80%); 161V (70%) and 92V (40%)
Default Channel :	PF1

Table for voltage reference

Level	Setting in PFS503 Display voltage for dU	Output voltage on EUT for dips in Delta connection
100%	230 V	400 V
80%	184 V	318 V
70%	161 V	279 V
40%	92 V	159 V

Where are the dip voltages.

For verify and measuring the dip-voltages please refer the followinng table:

Line	Dip voltage between lines
L1	L1 – L2
L2	L2 – L3
L3	L3 – L1

9.2.3. Setting in Software ISMIEC

ISMIEC software offers for star and delta a separate supply voltage setupshown in figure 9.3. For application the standard dips as per IEC 61000-4-11 the menü offers separate pulses for star- and deltaconnections tests. Star and delta means the setting of the Motorvariag.

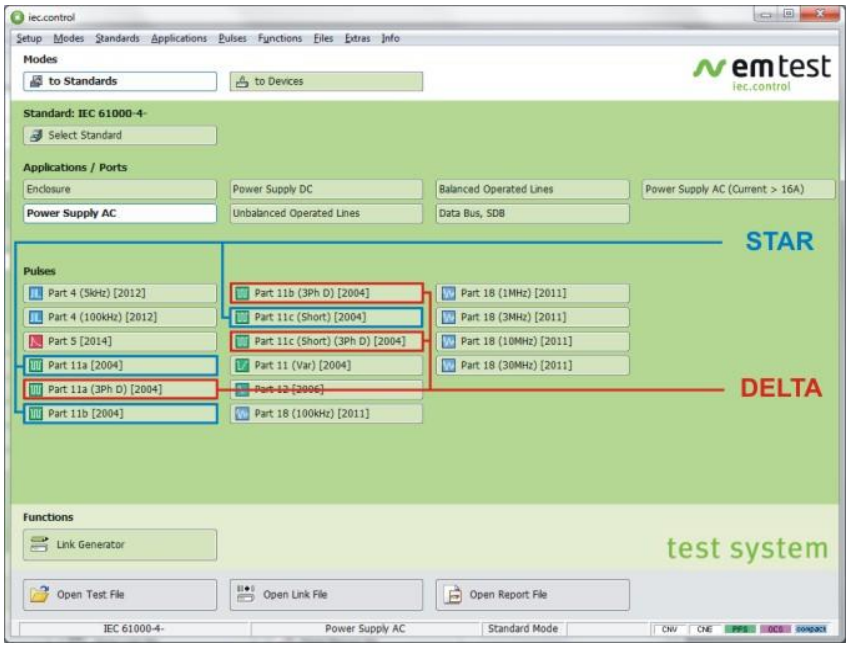


Figure 9.2 : Application menu for star and delta connection

Figure 9.3: Supply voltage setup

9.3. Voltage dips in 3-phase system

For short interruptions, the starting angle shall be defined by the product committee as the worst case. In the absence of definition, it is recommended to use 0° for one of the phases.
For **short interruptions** test of three-phase systems, all the three phases shall be simultaneously tested.

For voltage dips test of **three-phase systems with neutral**, each individual voltage (phase-toneutral and phase-to-phase) shall be tested, one at a time. This implies six different series of tests. See Fig 9.1 and 9.2 below.

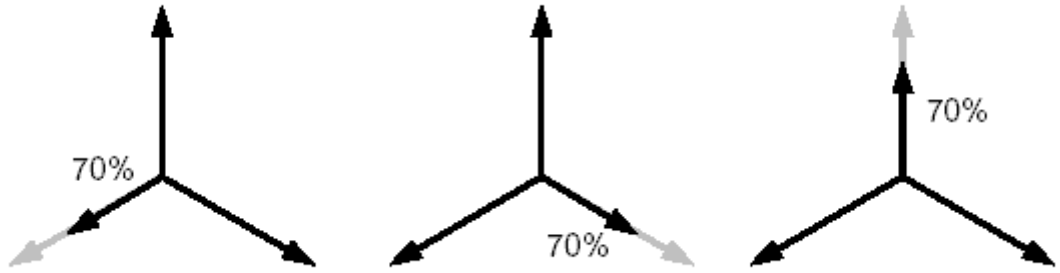


Fig 9.1 :Phase-to-neutral testing on three-phase systems

Fig 9.4 :Phase-to-phase testing on three-phase systems – preferred phase shift

For voltage dips test of **three-phase systems without neutral**, each phase-to-phase voltage shall be tested, one at a time. This implies three different series of tests. See figure 9.3 below

Fig 9.5 Phase-to-phase testing on three-phase systems – preferred phase shift

9.3.1. Acceptable and not acceptable dips in 3-phase System

For phase-to-phase testing on three-phase systems, the vectors of Figure 9.3. are preferred, but the vectors of Figure 9.4 are acceptable. The preferred vectors shown in Figure 9.3 may be easier for test labs to generate. The acceptable vectors shown in Figure 9.4 may be more representative of real-world dips. There may be significant differences between results when comparing the vectors of Figure 9.3 to the vectors of Figure 9.4.

Fig 9.4. :Phase-to-phase testing on three-phase systems – acceptable phase shift

Fig 9.5 : Not acceptable – phase-to-phase testing without phase shift

10. Technical data

10.1. Technical data MV 3P4016DS, MV 3P4032DS, MV 3P40100DS

Input:

Voltage EUT	Uin: 3x 400V ±10%
Voltage Control	230V single phase
Frequency	50/60Hz

For other mains supply voltages like 200V/115V system special designed transformer are necessary.

Output:	**MV 3P4016DS**	**MV 3P4032DS**	**MV 3P40100DS**
Output voltage channel PF1	3x 400V	3x 400V	3x 400V
Output voltage channel PF2 Y	0 - 270V	0 - 270V	0 - 270V
Current I max :	3x 16A	3x 32A	3x 100A
Power	0 – 11.4 kVA	0-22.8 kVA	0-69 kVA
Fuses channel PF1	20AT,	32A	100A
channel PF2	16AT	32A	100A

Connection:

Star	Star autotransformer with separated neutral
Delta	Delta autotransformer with separated neutral

Control:

Main switch	On/Off for the output voltages
Control voltage	0 - 10V DC for 0-270V output voltage for Y connection for 0-400V output voltage for delta connection
Time 0..100%	< 20s 0-100% delta connection < 13s 0-100% star connection
Voltage accuracy	approx. 1% of full range

Dimensions and weight

Model	**MV 3P4016DS**	**MV 3P4032DS**	**MV 3P40100DS**
Weight	app. 400 kg	app. 450 kg	app. 500 kg

Dimensions	19" 600x800x1950mm (BxTxH)
Environment Tmax	10 °C to 40°C
Humidity rel.	Max. 95% non condensing
Operation	Max. 1000m over sea level

10.2. Technical data MV 3P 4832 DS

Input:

Voltage EUT	Uin: 3x 480V ±10%
Voltage Control	115V single phase
Frequency	50/60Hz

For other mains supply voltages like 208V system special designed transformer are necessary.

Output:	**MV 3P 4832 DS**
Output voltage channel PF1	3x 480V
Output voltage channel PF2 Y	0 - 300V
Current I max :	3x 32A
Power	0-26.57 kVA
Fuses channel PF1	32A
channel PF2	32A

Connection:

Star	Star autotransformer with separated neutral
Delta	Delta autotransformer with separated neutral

Control:

Main switch	On/Off for the output voltages
Control voltage	0 - 10V DC for 0-300V output voltage for Y connection for 0-480V output voltage for delta connection
Time 0..100%	< 19s 0-100% delta connection < 12s 0-100% star connection
Voltage accuracy	approx. 1% of full range

Dimensions and weight	
Weight	app. 540 kg
Dimensions	600x1150x2030mm (BxTxH)
Environment	
Environment Tmax	10 °C to 40 °C
Humidity rel.	Max. 95% non condensing
Operation	Max. 1000m over sea level
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1 060 mbar)

10.3. Technical data MV 3P69100DS

Input:

Voltage EUT	Uin: 3x 690V ±10%
Voltage Control	230V single phase
Frequency	50/60Hz

Output:	**MV 3P69100DS**
Output voltage channel PF1	3x -- 690 V
Output voltage channel PF2 Y	0 – 465 V
Current I max :	3x 100 A
Power	3x 0 – 39.79 kVA = 119.37 kVA
Fuses channel PF1	100 AT,
channel PF2	100 AT

Connection:

Star	Star autotransformer with separated neutral
Delta	Delta autotransformer with separated neutral

Control:

Main switch	On/Off for the output voltages
Control voltage	0 - 10V DC for 0-465 V output voltage for Y connection for 0-690 V output voltage for delta connection
Time 0..100%	< 19s 0-100% delta connection
Voltage accuracy	approx. 1% of full range

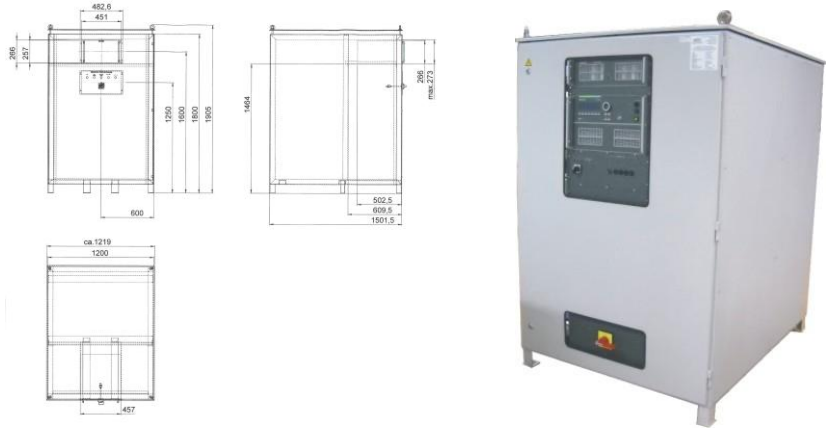
Dimensions and weight	
Weight	app. 600 kg
Dimensions	19" 1219x 1501x1905mm (BxTxH)
Dimensions	

Figure 10.1

Environment	
Environment Tmax	10 °C to 40 °C
Humidity rel.	Max. 80% non condensing
Operation	Max. 1000m over sea level
Atmospheric pressure	86 kPa (860 mbar) to 106 kPa (1 060 mbar)

=> All parameters that are not relevant for the standard can be changed by manufacturer <=

10.4. Overload

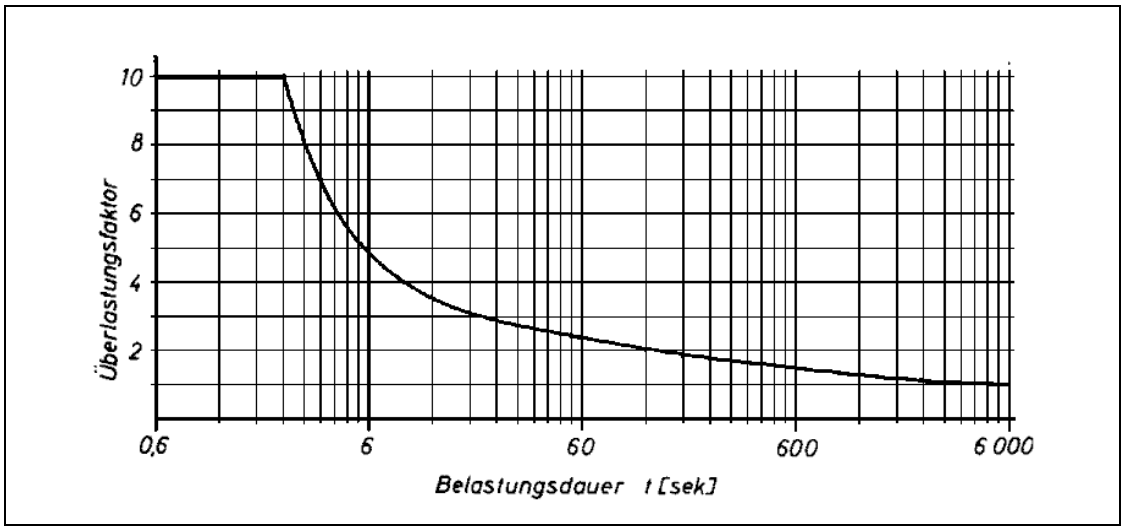


Figure 10.2: Overload curve of MV 3P series (16A to 100A)

11. Maintenance

11.1. Maintenance

The system is maintenance free.

11.2. Calibration and Verification

11.2.1. Factory calibration

Every EM TEST generator is entirely checked and calibrated as per international standard regulations before delivery. A calibration certificate is issued and delivered along with a list of the equipment used for the calibration proving the traceability of the measuring equipment. All auxiliary equipment and accessories are checked to our internal manufacturer guidelines.

The calibration certificate and the certificate of compliance (if available) show the date of calibration.

The EM Test equipment are calibrated in the factory and marked with a calibration mark. The used measuring instruments are traceable to the Swiss Federal Office of Metrology.
The calibration date is marked. The validity of the calibration is to the responsibility of the user's quality system. Neither the certificate of calibration nor the corresponding label mark any due date for re-calibration.

Example: Calibration mark

11.2.2. Guideline to determine the calibration period of EM Test instrumentation

Our International Service Departments and our QA Manager are frequently asked about the calibration interval of EM TEST equipment.

EM TEST doesn't know each customer's Quality Assurance Policy nor do we know how often the equipment is used and what kind of tests are performed during the life cycle of a test equipment. Only the customer knows all the details and therefore the customer needs to specify the calibration interval for his test equipment.

In reply to all these questions we like to approach this issue as follows :
EM TEST make use of a solid state semiconductor switch technique to generate high voltage transients. A precious advantage of this technique is the absolute lack of periodical maintenance effort. In consequence thereof a useful calibration period has to be defined based on two criteria :

- The first one is the customer's Quality Assurance Policy. Any existent internal regulation has to be applied at highest priority. In the absence of such internal regulation the utilization rate of the test equipment has to be taken into consideration.

- Based on the experience and observation collected over the years **EM TEST recommend a calibration interval of 1 year** for frequently used equipment. A 2-years calibration interval is considered sufficient for rarely used test generators in order to assure proper performance and compliance to the standard specifications.

11.2.3. Calibration of Accessories made by passive components only:

Passive components do not change their technical specification during storage. Consequently the measured values and the plots stay valid throughout the storage time. The date of shipment shall be considered as the date of calibration.

11.2.4. Periodically In-house verification

Please refer to the corresponding standard before carrying out a calibration or verification. The standard describes the procedure, the tolerances and the the necessary auxiliary means. Suitable calibration adapters are needed. To compare the verification results, EM Test suggests to refer to the waveshape and values of the original calibration certificate.

All calibrations and verifications are always done without mains supply voltage connected to the coupling network input.


Danger

Before starting the calibration or verification

remove the EUT Mains Supply

from the generator and from the coupling network

12. Delivery Groups

Identical accessory parts are delivered only once if several devices are ordered. The delivered packing list is in each case valid for the delivery.

12.1. Basic equipment

- Motor variac type MV3P40xxx DS
- BNC connection cable 0-10V
- Banana cables
- Manual on USB memory card
- Calibration certificate

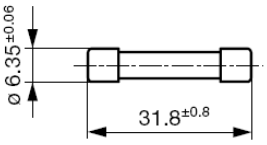
12.2. Auxilliary equipment

Fuses

Fuse	16 A	32 A
Voltage	500 V	500 V
Model	DIAZED / 5SB2 61	DIAZED / 5SB4 010
Manufacturer	Siemens	

Fuse	80 A	100 A
Voltage	500V	690V
Model	3NA3 824-7	3NA7 830-6
Manufacturer	Siemens	

Other fuses :	
Rating :	6.3A
Rating :	0.5A
Voltage :	500V ac
Dimension:	6.3mm x 31.8mm

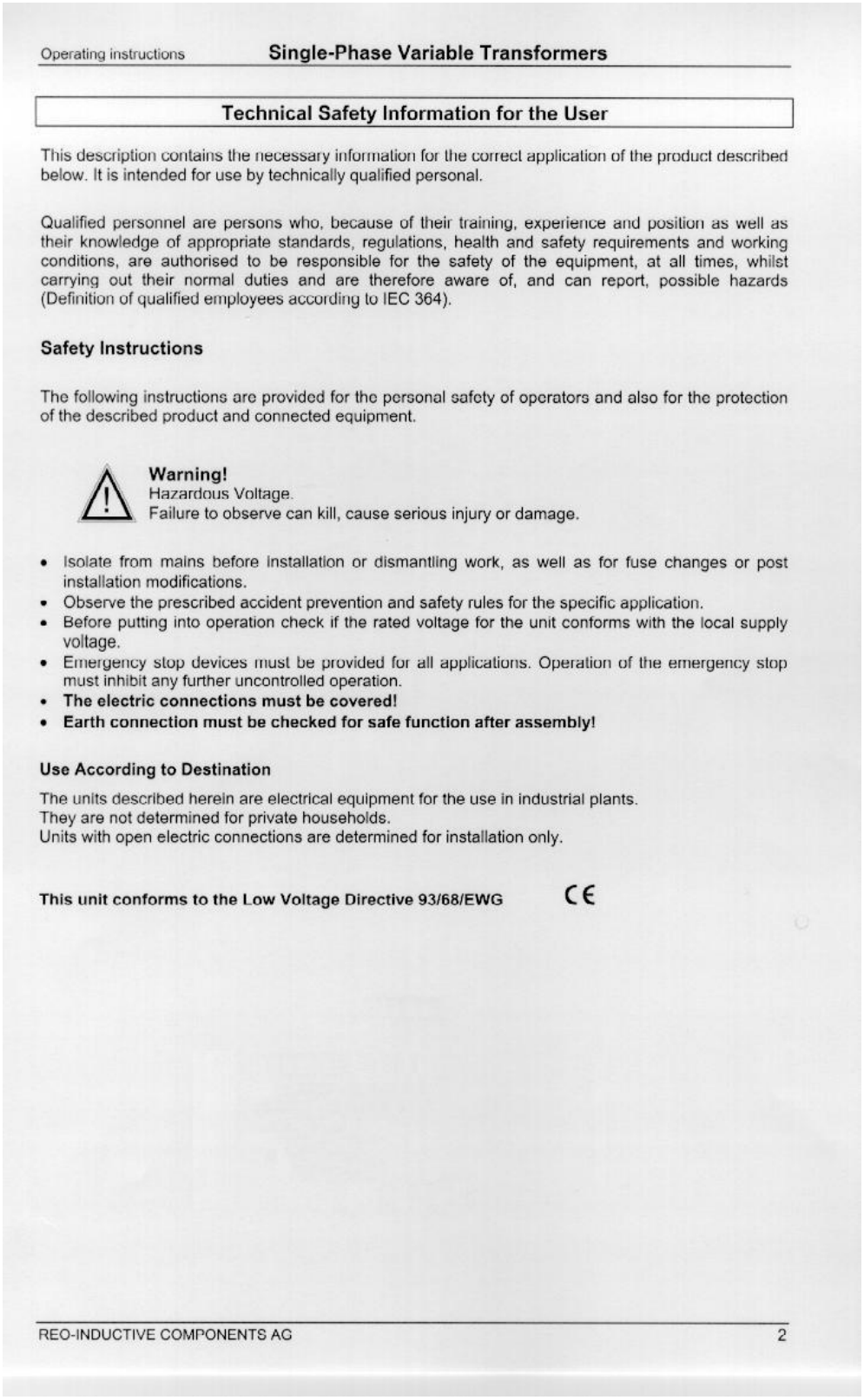


- **User software " iec.control "**
  - Test, analysis and documentation with windows
  - License version for testing according the most industrial standards
  - Report generator with export function to word-processing software

13. Appendix

13.1. Declaration of conformity

The MV 26XX and MV 3P40XX are exclusive manufactured for EM Test from REO. Please refer to the declaration of conformity of the manufacturer:



Operating instructions **Single-Phase Variable Transformers**

Technical Safety Information for the User

This description contains the necessary information for the correct application of the product described below. It is intended for use by technically qualified personal.

Qualified personnel are persons who, because of their training, experience and position as well as their knowledge of appropriate standards, regulations, health and safety requirements and working conditions, are authorised to be responsible for the safety of the equipment, at all times, whilst carrying out their normal duties and are therefore aware of, and can report, possible hazards (Definition of qualified employees according to IEC 364).

Safety Instructions

The following instructions are provided for the personal safety of operators and also for the protection of the described product and connected equipment.

Warning!
Hazardous Voltage.
Failure to observe can kill, cause serious injury or damage.

- Isolate from mains before installation or dismantling work, as well as for fuse changes or post installation modifications.
- Observe the prescribed accident prevention and safety rules for the specific application.
- Before putting into operation check if the rated voltage for the unit conforms with the local supply voltage.
- Emergency stop devices must be provided for all applications. Operation of the emergency stop must inhibit any further uncontrolled operation.
- **The electric connections must be covered!**
- **Earth connection must be checked for safe function after assembly!**

Use According to Destination

The units described herein are electrical equipment for the use in industrial plants.
They are not determined for private households.
Units with open electric connections are determined for installation only.

This unit conforms to the Low Voltage Directive 93/68/EWG CE

REO-INDUCTIVE COMPONENTS AG 2

13.1.1. Declaration of Conformity MV 3P4016DS

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Motor Variac with built in Power Fail generator PFS 503Nxx
Model Number(s)	MV 3P4016DS

Remark: The declatation of Conformance of the built in PFS503Nxx PowerFail generator is in the UserManual of the PFS 503 Geneator.

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	N. Holub General manager	A. Burger Design and Research
Place	Kamen, Germany	Reinach BL , Switzerland
Date	25. February 2016	25. February 2016

13.1.2. Declaration of Conformity MV 3P2416DS

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Motor Variac with built in Power Fail generator PFS 503Nxx
Model Number(s)	MV 3P2416DS

Remark: The declatation of Conformance of the built in PFS503Nxx PowerFail generator is in the UserManual of the PFS 503 Geneator.

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	N. Holub General manager	A. Burger Design and Research
Place	Kamen, Germany	Reinach BL , Switzerland
Date	25. February 2016	25. February 2016

13.1.3. Declaration of Conformity MV 3P4032DS

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Motor Variac with built in Power Fail generator PFS 503Nxx
Model Number(s)	MV 3P4032DS

Remark: The declatation of Conformance of the built in PFS503Nxx PowerFail generator is in the UserManual of the PFS 503 Geneator.

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	N. Holub General manager	A. Burger Design and Research
Place	Kamen, Germany	Reinach BL , Switzerland
Date	25. February 2016	25. February 2016

13.1.4. Declaration of Conformity MV 3P2463DS

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Motor Variac with built in Power Fail generator PFS 503Nxx
Model Number(s)	MV 3P2463DS

Remark: The declatation of Conformance of the built in PFS503Nxx PowerFail generator is in the UserManual of the PFS 503 Geneator.

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	N. Holub General manager	A. Burger Design and Research
Place	Kamen, Germany	Reinach BL , Switzerland
Date	25. February 2016	25. February 2016

13.1.5. Declaration of Conformity MV 3P4832DS

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Motor Variac with built in Power Fail generator PFS 503Nxx
Model Number(s)	MV 3P4832DS

Remark: The declatation of Conformance of the built in PFS503Nxx PowerFail generator is in the UserManual of the PFS 503 Geneator.

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	N. Holub General manager	A. Burger Design and Research
Place	Kamen, Germany	Reinach BL , Switzerland
Date	25. February 2016	25. February 2016

13.1.6. Declaration of Conformity MV 3P40100DS

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Motor Variac with built in Power Fail generator PFS 503Nxx
Model Number(s)	MV 3P40100DS

Remark: The declatation of Conformance of the built in PFS503Nxx PowerFail generator is in the UserManual of the PFS 503 Geneator.

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	A. Gerstner General manager	A. Burger Business Manager Conducted EMC
Place	Kamen, Germany	Reinach BL, Switzerland
Date	20. December 2016	25. February 2016

13.1.7. Declaration of Conformity MV 3P69100DS

Manufacturer :	**EM TEST (Switzerland) GmbH**
Address:	Sternenhofstr. 15 CH 4153 Reinach BL1 Switzerland

declares, that under is sole responsibility, the product's listed below, including all their options, are conformity with the applicable CE directives listed below using the relevant section of the following EC standards and other normative documents.

Product's name:	Motor Variac with built in Power Fail generator PFS 503Nxx
Model Number(s)	MV 3P69100DS

Remark: The declatation of Conformance of the built in PFS503Nxx PowerFail generator is in the UserManual of the PFS 503 Geneator.

Low Voltage Directive 2014/35/EU

Standard to which conformity is declared:

EN 61010-1:2011	Safety requirements for electrical equipment for measurement, control, and laboratory use.

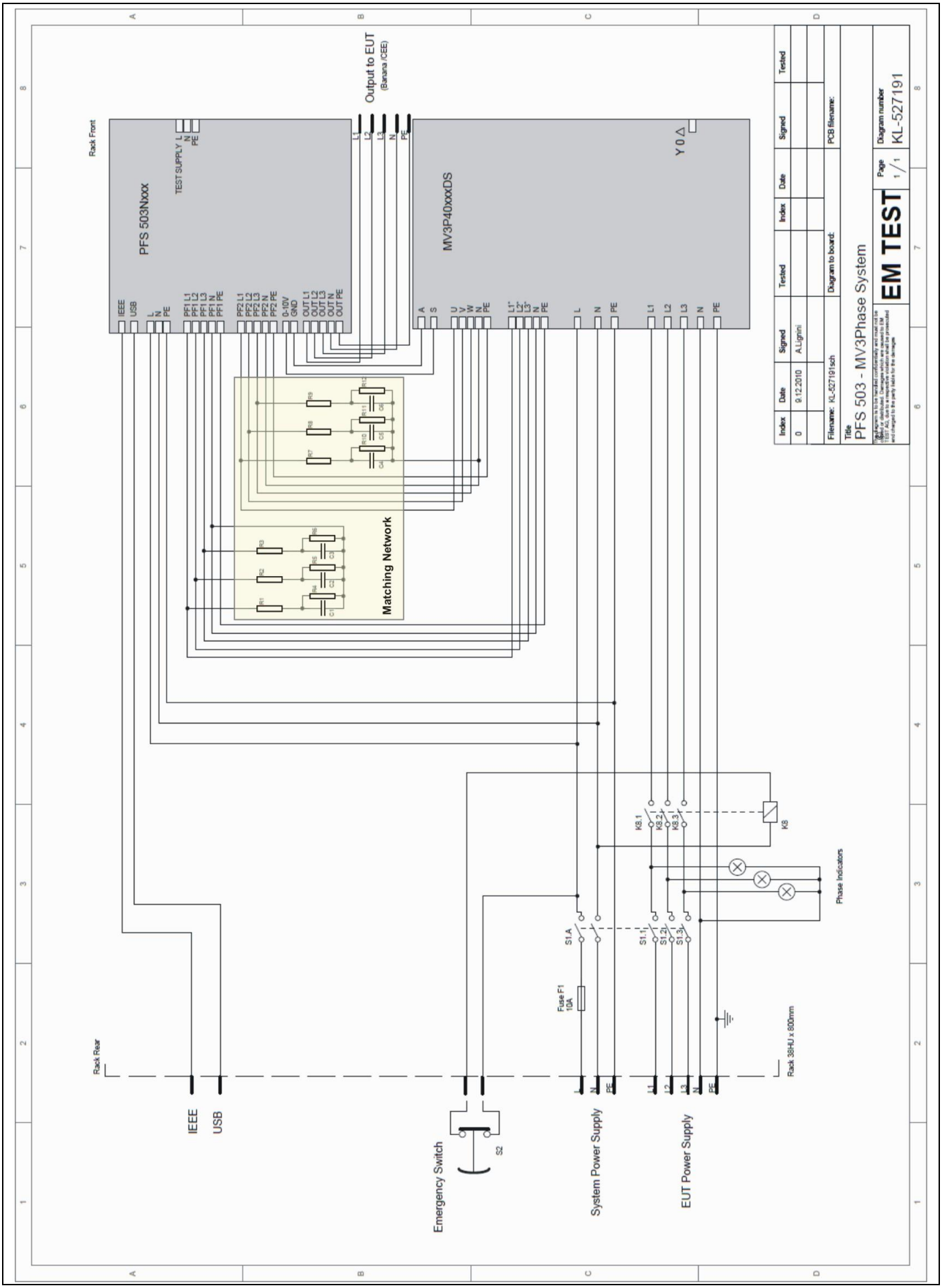
EMC Directive 2014/30/EU

Standard(s) to which conformity is declared:

EN 61326-1:2013	Electrical equipment for measurement, control and laboratory use (Requirements for devices to use in industrial area.)
EN 61000-3-2:2014	Limits for harmonic current emissions
EN 61000-3-3:2013	Limitation of voltage changes, voltage fluctuations and flicker in public low-voltage supply systems.

	European representative	Manufacturer
	AMETEK CTS Germany GmbH Lünenerstr. 211 D 59174 Kamen Tel: +49 (0) 2307 / 26070-0 Fax: +49 (0)2307 / 17050	EM TEST (Switzerland) GmbH Sternenhofstr. 15 CH 4153 Reinach Tel: +41 61-7179191 Fax: +41 61-7179199
By	N. Holub General manager	A. Burger Design and Research
Place	Kamen, Germany	Reinach BL , Switzerland
Date	25. February 2016	25. February 2016

13.2. Schematic overview PFS 503 - MV 3P40xxxDS System



13.3. Diagram MV 3P40xx DS

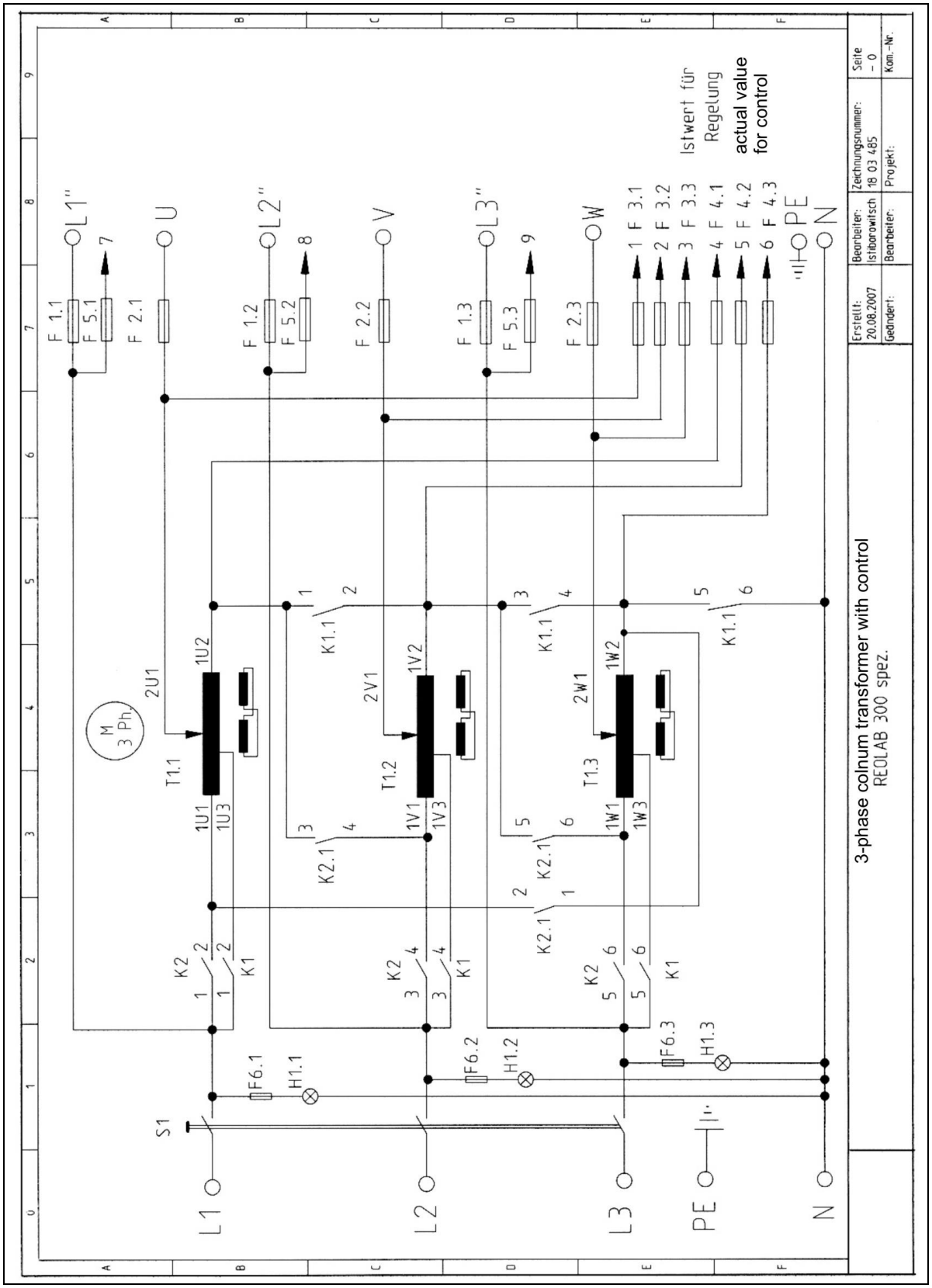


Figure 13.1: Wiring Variac transformer

13.4. Diagram Control MV 3P40xx DS

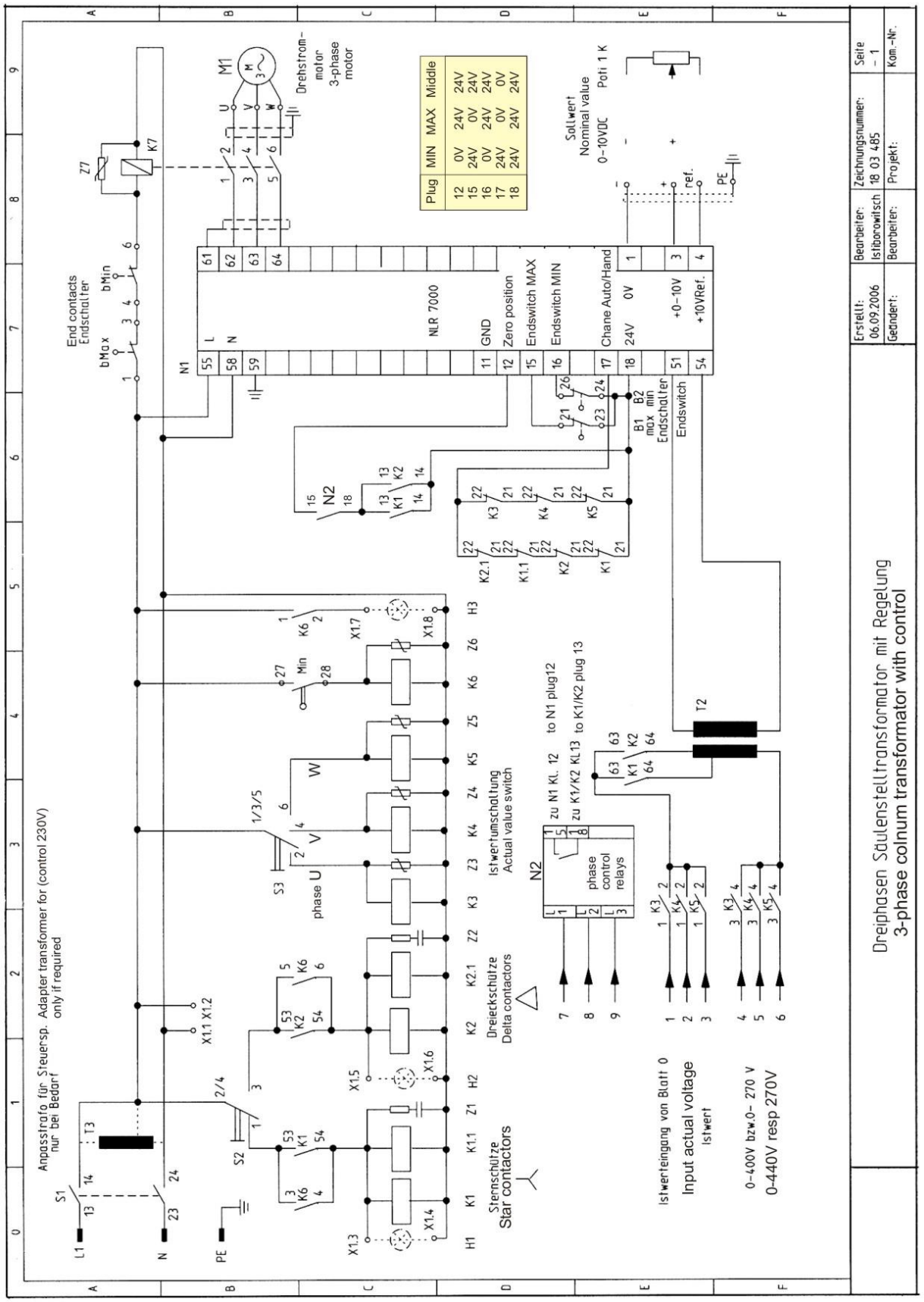


Figure 13.2: Diagram control variac

13.5. Matching Network

The Matching network matches the Motor variac transformer to the switching elements of the Power Fail generator withgthe following functions:

- Recuction of the under and overshoot during switching
- Stabilize the voltage during switchine
- Reduce the effect of transformer demagnetization

The matching network is located on the top of the rack near the PFS 503N power fail generator. Max power at 230V (L-N) approx.. 80W

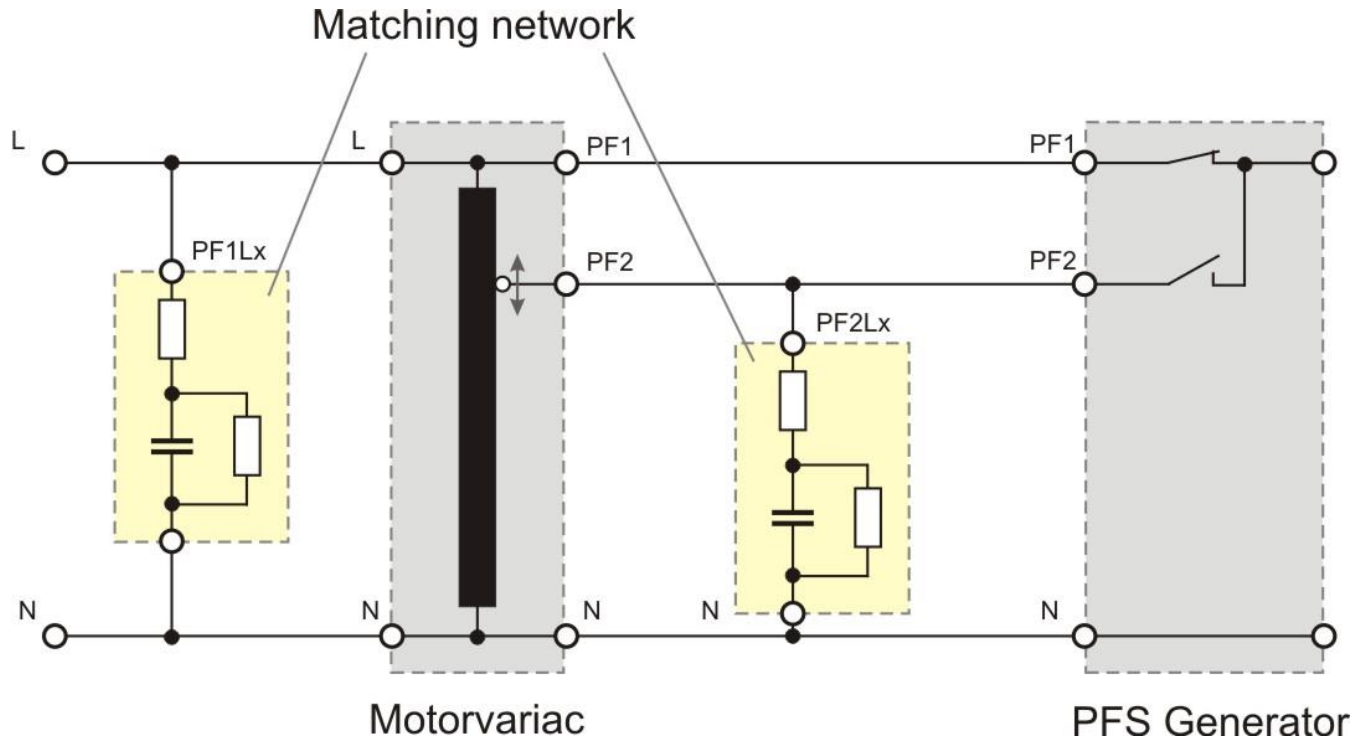


Figure 13.3: Schematic diagram of a single phase of the matching network

Figure 13.4: Matching network at the top of the rack

Figure 13.5: Air grid for cooling output of the matching network (example)

13.5.1. Technical data matching network

Voltage	230 V Line to Neutral
Power dissipation	80W max.
Connection	Star connection
Number of networks	6 (3 x PF1, 3 x PF2)

13.6. Application with transformer V4070 or V4780

For single phase application with reduced mains voltage a tapped autotransformer can be used.
Figure 12.3 shows the wiring for such test.

For single phase application with reduced mains voltage a tapped autotransformer can be used.
Figure 12.3 shows the wiring for such test.

1. Set the Variac in Y- modus.
2. Selegt in the power setup the desired voltage.
3. Disconnect the banana plug PF1 L1 at the PF1 input at the rear side of the PFS 503.
4. Disconnect the banana plug PF2 L1 at the PF2 input at the rear side of the PFS 503 and connect it as new 100% value to the Line input of the V4070 / V4780 transformer.
5. Connect the Neutral and PE of the V4070 / V4780 transformer to the PFS 503.
6. Connect the 100% output of V4070 / V4780 transformer to L1 PF1 input.
7. Connect the 40% / 70% output of V4070 / V4780 transformer to L1 PF2 input.
8. Connect the EUT at the front side of the PFS 503 or the banana plugs at the front panel.

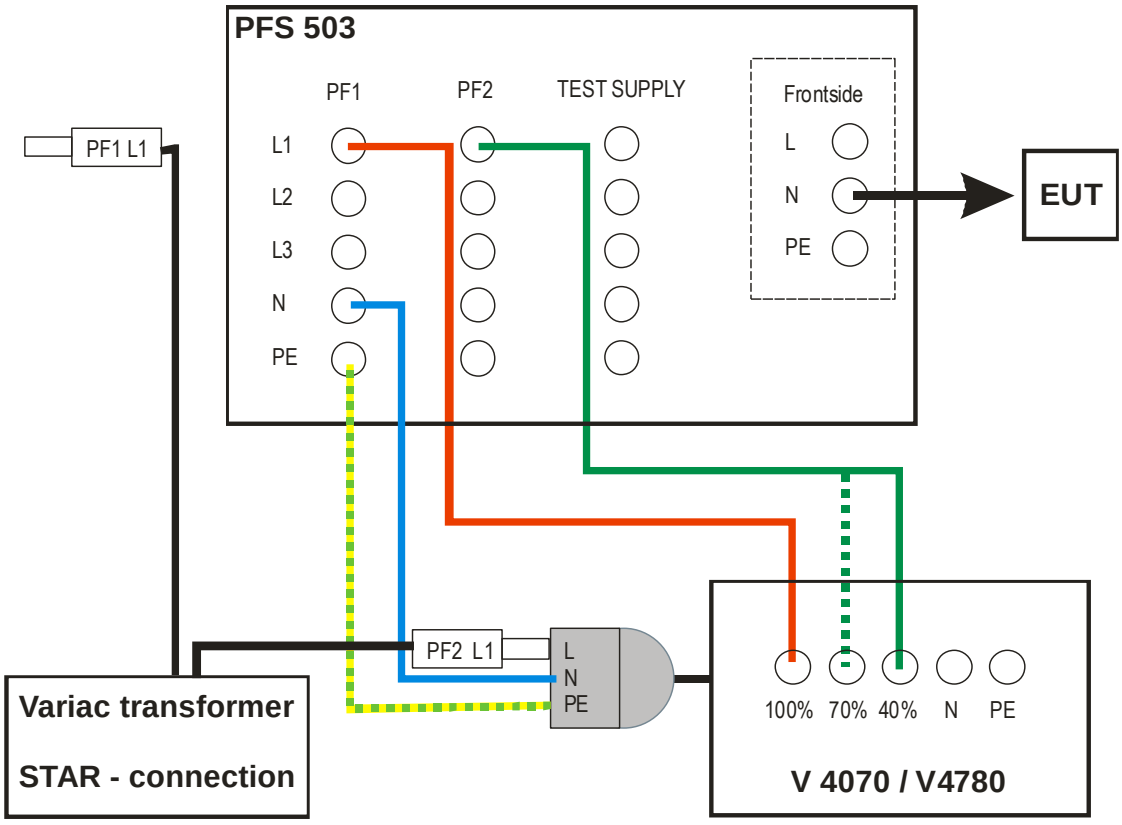


Figure 12.6: Application V4070 / V4780

13.7. 16A System application with variable input power (170V -240V and 380V – 440V)

For application with variable system voltage it necessary to have an electronic 3-phase voltage source for simulate the mains power. Cause of the magnetic flux the physics does limit the input range of Variac transformer. Therefore for wide voltage input the 3.phase testing is splitted in the following system voltages (line – line).

Voltage range	Motorvariac model
170V – 240V :	MV 3P 2416 DS
380V – 440V :	MV 3P 4016 DS

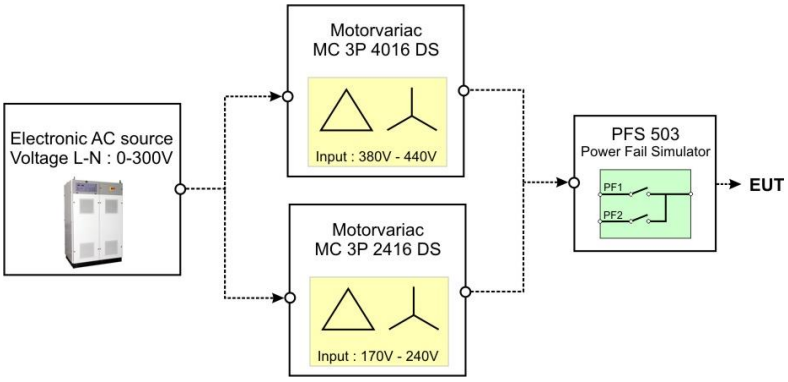


Figure 12.7: Blockdiagram for a system with two voltage ranges

For safe the costs of the power fail simulator, only one PFS 503 simulator is used in the system. The PFS 503 is located into the Rack of the 380V to 440V system.

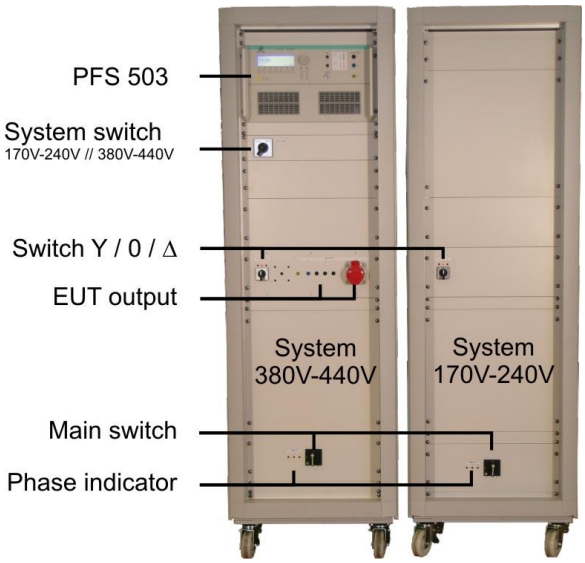


Figure 13.8: Frontside

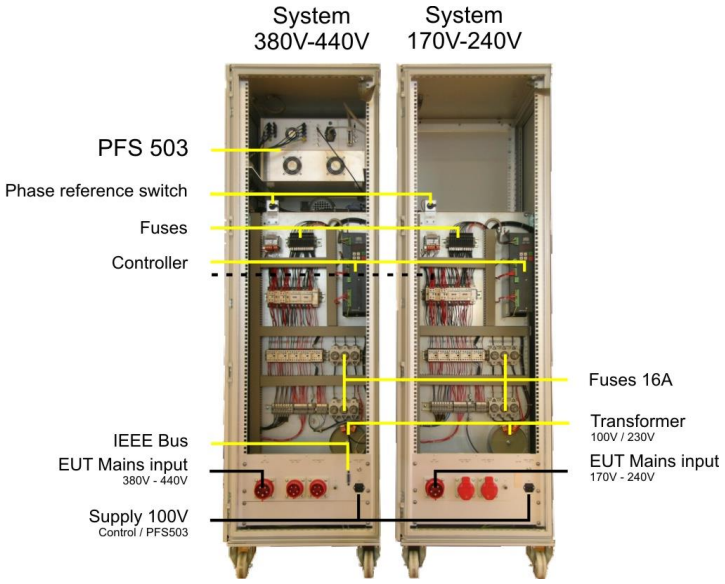


Figure 13.9: rearside

13.7.1. Technical data for Motorvariac V3PXX16DS with variable input

Technical data for
Input:

Voltage EUT	Uin: max. 3x 400V
Voltage Control	230V single phase
Frequency	50/60Hz

Output:	**MV 3P 2416 DS**	**MV 3P 4016 DS**
Input voltage	3x 170V - 240V	3x 380V - 440V
Output voltage channel PF1	3x 170V - 240V	3x 380V - 440V
Output voltage channel PF2 Y	0 – (170V – 240V)	0 – (380V - 440V)
Current I max :	3x 16A	3x 16A
Power	0 – 6.67 kVA	0-12.19 kVA
Fuses channel PF1	16AT,	16AT,
channel PF2	16AT	16AT

13.7.2.Settings of PFS503S1 with MV3P4016DS (System 380 – 440V)

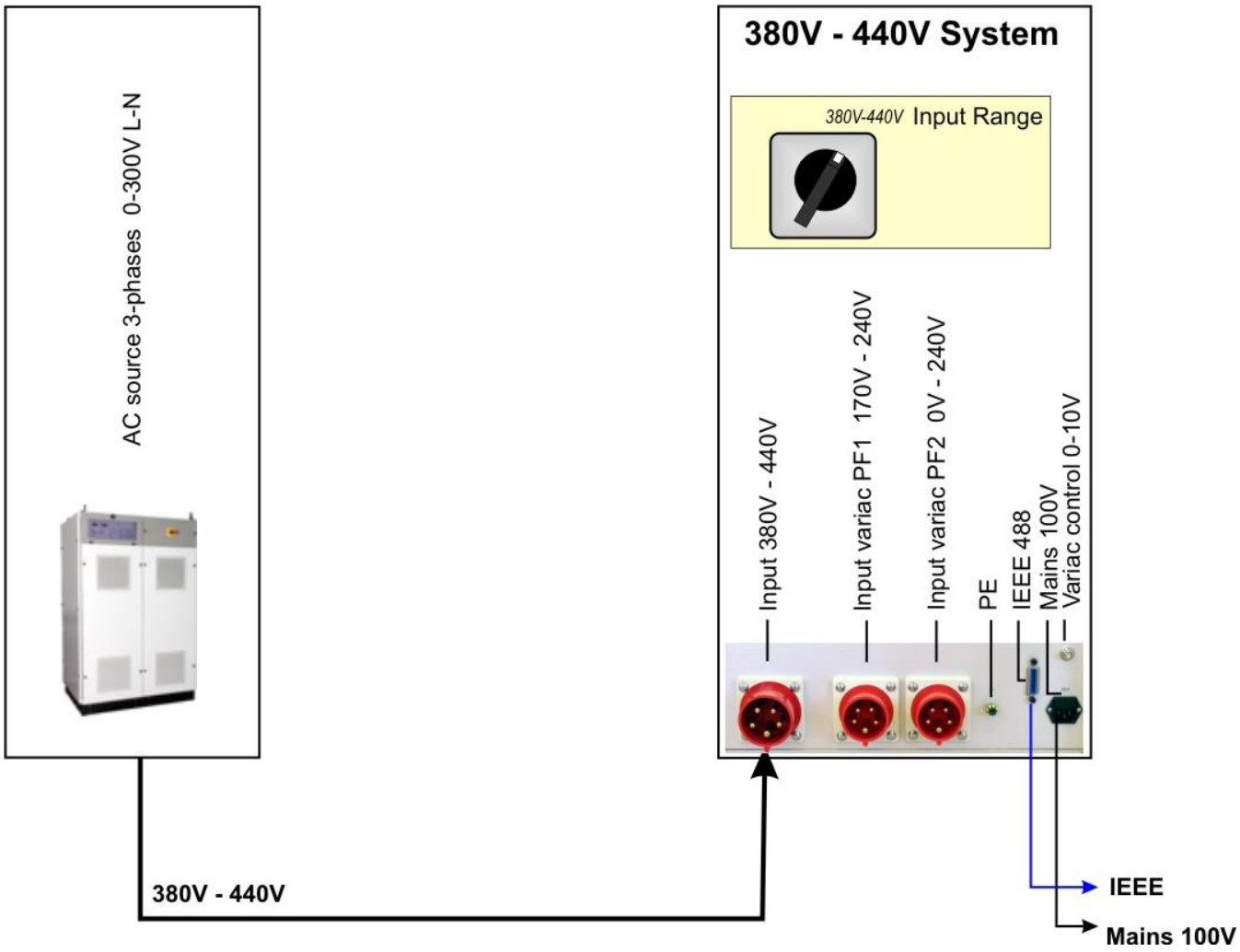


Figure 13.10: :Wiring diagram for 380 –440V system

UIn (PF1)	PFS Settings					
	Star (Ph – N PF2)			Delta (Ph PF2 – Ph PF1)		
	U Set max. variac voltage	Un Set nominal voltage	UOut Max Line to Neutral	U Set max. variac voltage	Un Set nominal voltage	UOut Max Line to Line
380V	**254V**	**220V**	254V	**254V**	**220V**	380V
390V	**254V**	**225V**	254V	**254V**	**225V**	390V
400V	**254V**	**230V**	254V	**254V**	**230V**	400V
410V	**254V**	**237V**	254V	**254V**	**237V**	410V
420V	**254V**	**242V**	254V	**254V**	**242V**	420V
430V	**254V**	**248V**	254V	**254V**	**248V**	430V
440V	**254V**	**254V**	254V	**254V**	**254V**	440V

Calculation of Deltamode setting: Un Set = UIn / √3 , => U Set = 254V

PFS 503 Setting for manual operation

Menu : Service / Set voltage

Example for 400V L-L input power

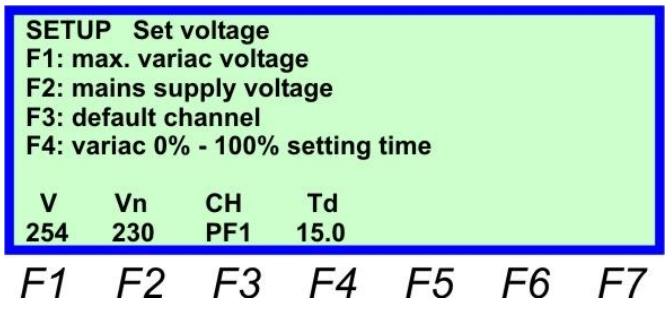


Figure 13.11 : Setup for PFS 503 manual testing

13.7.3.Settings of PFS503S1 with MV3P2416DS (System 170 – 240V)

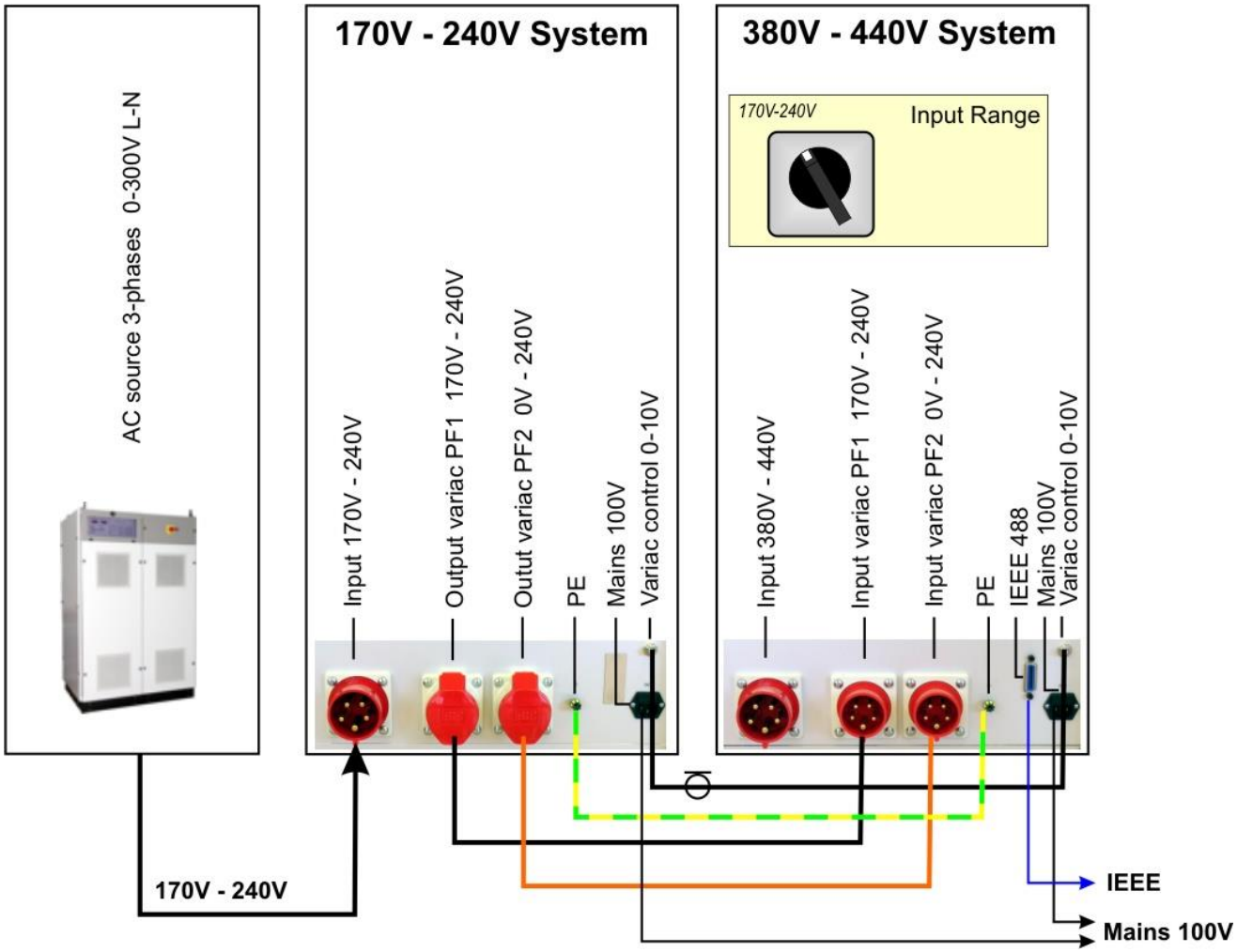


Figure 13.12 :Wiring diagram for 170 – 240V system

UIn (PF1)	PFS Settings					
	Star (Ph – N PF2)			Delta (Ph PF2 – Ph PF1)		
	U Set max. variac voltage	Un Set nominal voltage	UOut Max Line to Neutral	U Set max. variac voltage	Un Set nominal voltage	UOut Max Line to Line
170V	**138V**	**100V**	138V	**138V**	**100V**	170V
180V	**138V**	**104V**	138V	**138V**	**104V**	180V
190V	**138V**	**110V**	138V	**138V**	**110V**	190V
200V	**138V**	**115V**	138V	**138V**	**115V**	200V
210V	**138V**	**121V**	138V	**138V**	**121V**	210V
220V	**138V**	**127V**	138V	**138V**	**127V**	220V
230V	**138V**	**133V**	138V	**138V**	**133V**	230V
240V	**138V**	**138V**	138V	**138V**	**138V**	240V

Calculation of Deltamode setting: Un Set = UIn / √3 , => U Set = 138V

PFS 503 Setting for manual operation

Menu : Service / Set voltage

Example for 200V L-L input power

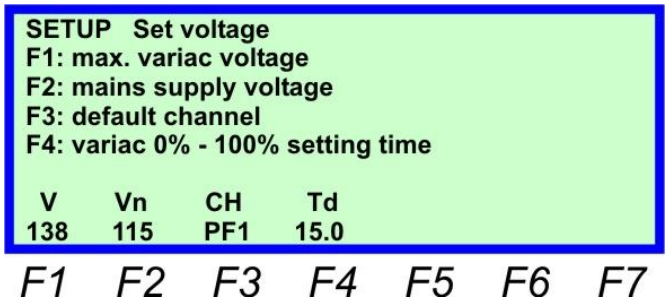


Figure 13.13 : Setup for PFS 503 manual testing

13.7.4.Software setup for iec.Control software

For the software setup it is necessary to enter the correct values for **STAR** and **DELTA** connection for the following parameters:

- Max. variac voltage [V]
- Mains Supply voltage [V]

Wait times [s]

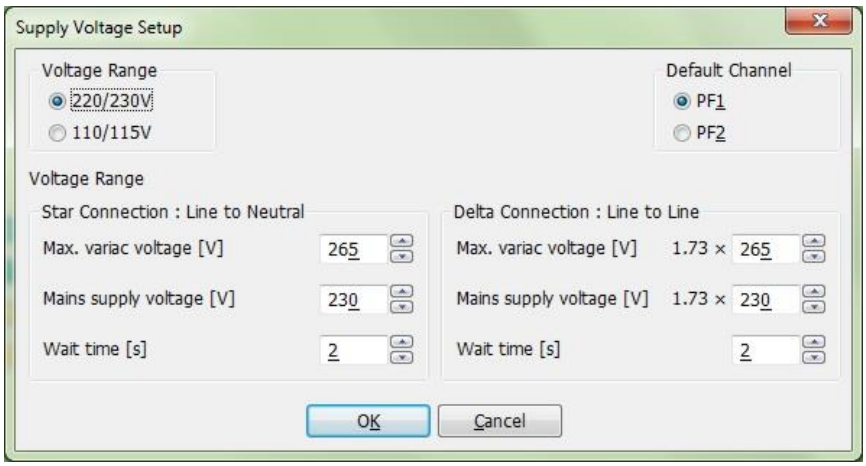


Figure 13.14 : Software setup 380V-440V System for 400V

In case of a system with two voltage ranges the 110/115V low voltage range can be set by change the radio button **Voltage Range** (Figure 12.11).

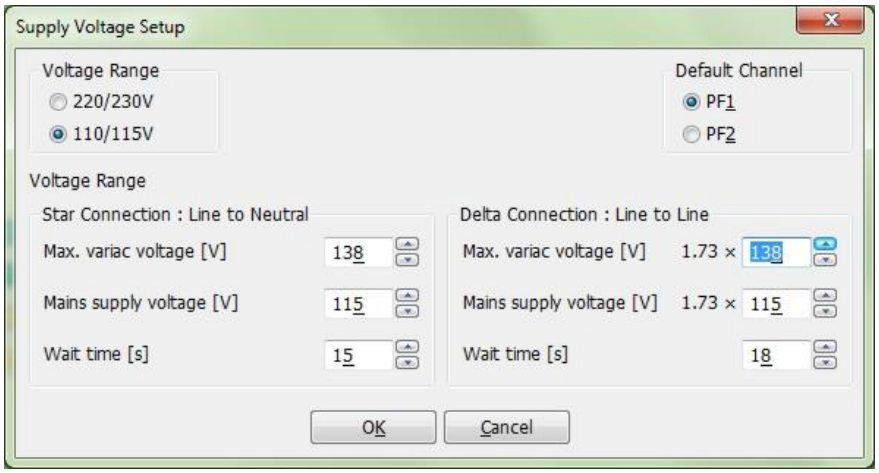


Figure 13.15 : Software setup 170V-240V System for 208V line - line

13.8. System 16A / 32A with subsequently extended voltage range to (170V -240V)

For application with variable system voltage it necessary to have an electronic 3-phase voltage source for simulate the mains power.
Cause of the magnetic flux the physics does limit the input range of Variac transformer. Therefore for wide voltage input the 3.phase testing is splitted in the following system voltages (line – line).

Voltage range	Motorvariac model
170V – 240V :	MV 3P2416DS / MV 3P2432DS
380V – 440V :	MV 3P4016DS / MV 3P4032DS

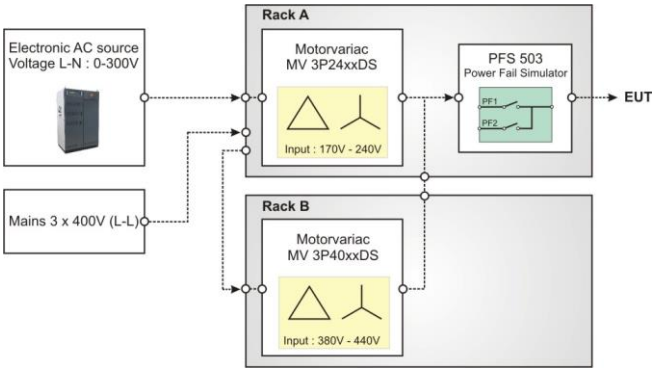


Figure 13.16 : Blockdiagram for a system with two voltage ranges

For reduce the onsite wiring the power fail simulator PFS 503 simulator must be moved into the new system. The PFS 503 is located into the Rack of the 170V to 240V system.

System wiring

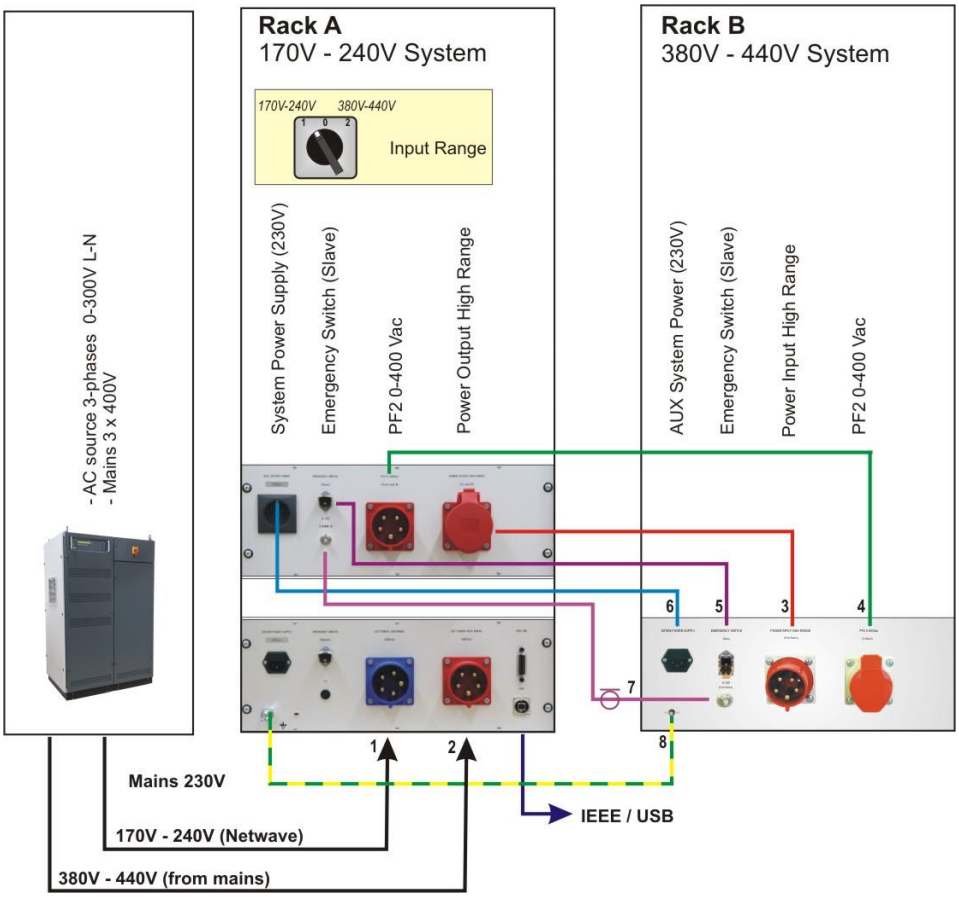


Figure 13.17 : External cabling of a subsequently extended system to 170V – 240V

Cable list:

Cable	Connection		Length	Remark
1	Mains	– Rack A (existing)	5 m	EUT Supply 3-ph 400V
2	Netwave	– Rack A:	5 m	EUT Supply 3-ph 170V – 240V
3	Rack A (Power Output High Range)	– Rack B (Power Input High Range)	2 m	400V High range
4	Rack A (PF2 0-400 Vac)	– Rack B (PF2 0-400 Vac)	3 m	0-400V High range
5	Rack A (Emergency Switch Master)	– Rack B (Emergency Switch Slave)	2 m	Emergency stop
6	Rack A (Aux. Power Supply)	– Rack B (System Power Supply)	2 m	System Supply 230V
7	Rack A (0-10V to RackB)	– Rack B (0-10V from Rack A)	2 m	BNC Cable
8	Rack A (Earth)	– Rack B (Earth)	2 m	Cable green-yellow; 25mm2

Low volage range 170 V to 240 V (L-L)

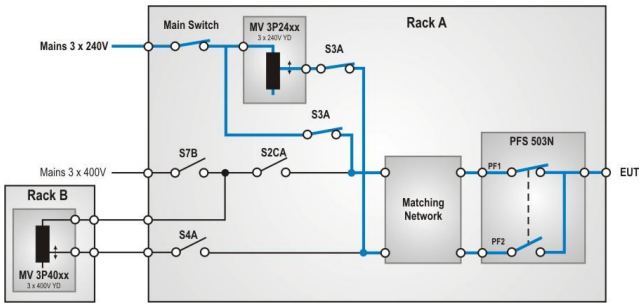


Figure 13.18 : Supply path for range 170V to 240V

High volage range 380 V to 440 V (L-L)

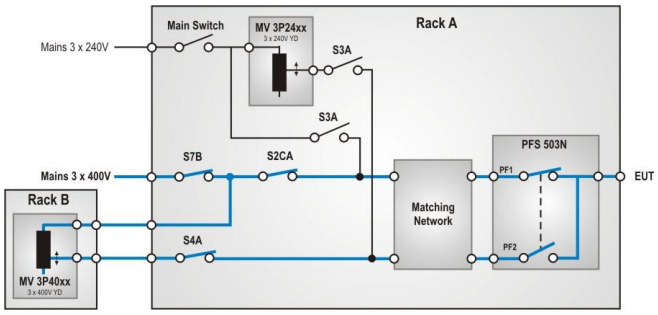


Figure 13.19 : Supply path for range 380V to 440V

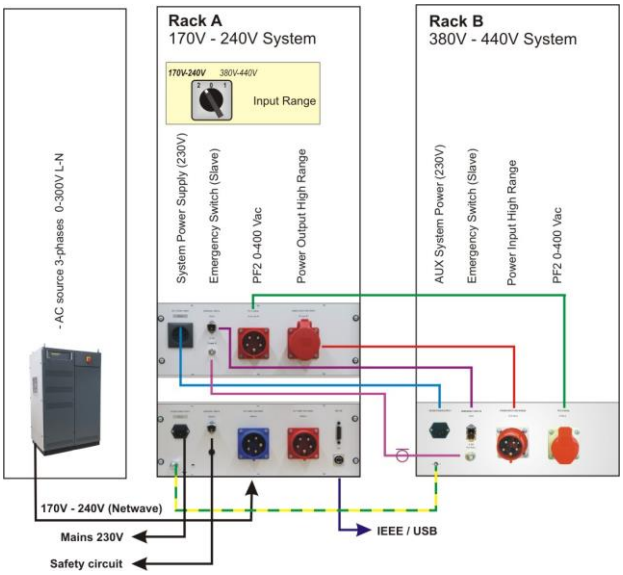


Figure 13.20 : Configuration for low range 170V to 240V

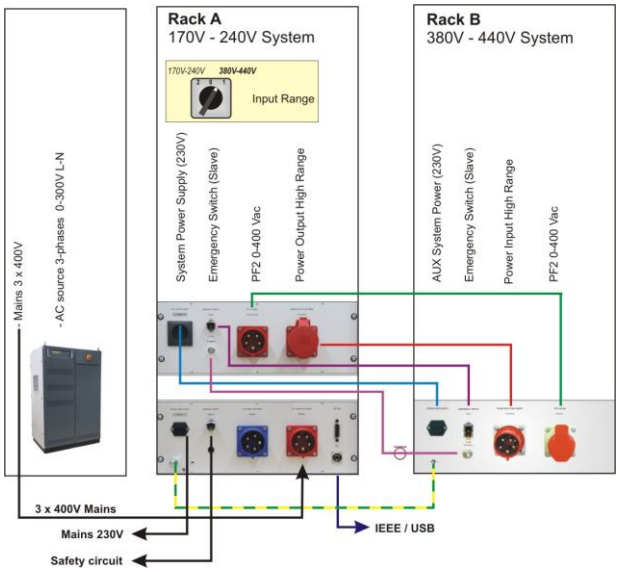


Figure 13.21 : Configuration for low range 380V to 440V

13.8.1. Rack view front / rear

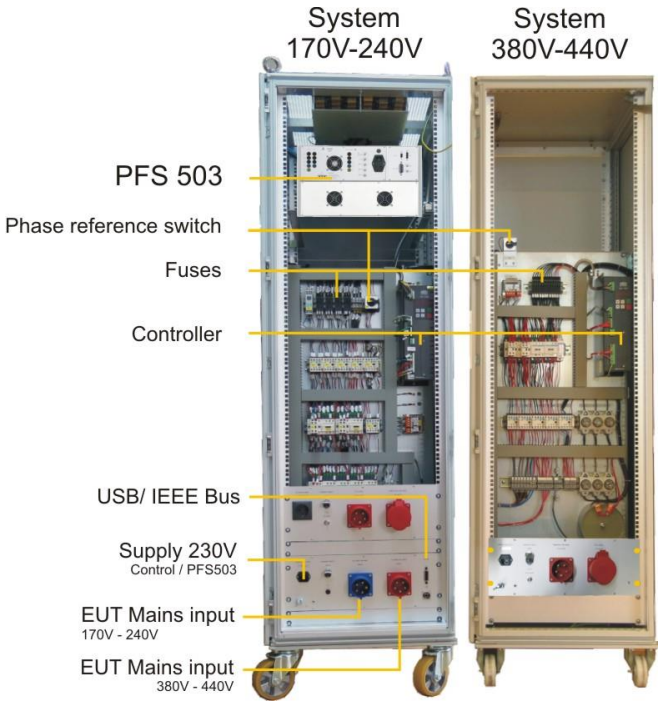


Figure 13.21: Rearside

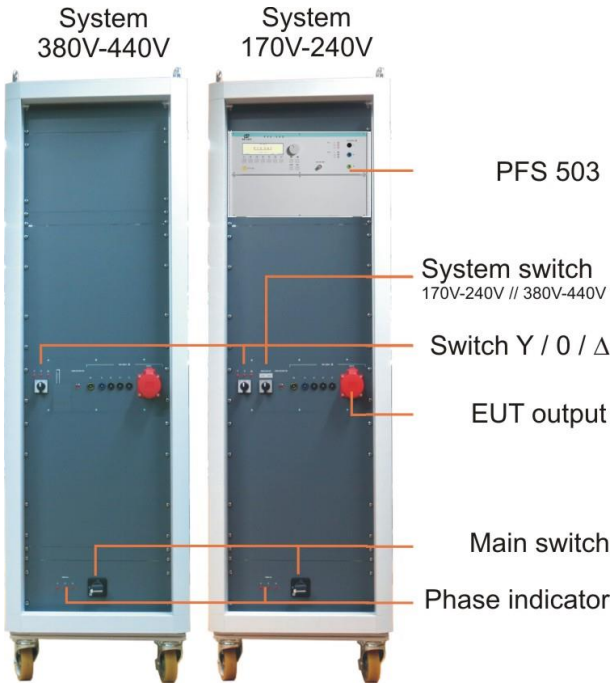


Figure 13.22: Frontside

13.8.2. Technical data for Motorvariac System with variable input (170V -240V and 380V – 440V)

16 A System with MV 3P 2416 DS and MV 3P 4016 DS

Technical data for
Input:

Voltage EUT	Uin: max. 3x 400V
Voltage Control	230V single phase
Frequency	50/60Hz

Output:	**MV 3P 2416 DS**	**MV 3P 4016 DS**
Input voltage [line-line]	3x 170V - 240V	3x 380V - 440V
Output voltage channel PF1	3x 170V - 240V	3x 380V - 440V
Output voltage channel PF2 Y	0 – (170V – 240V)	0 – (380V - 440V)
Current I max :	3x 16A	3x 16A
Power	0 – 6.67 kVA	0-12.19 kVA
Fuses channel PF1	16AT,	16AT,
channel PF2	16AT	16AT

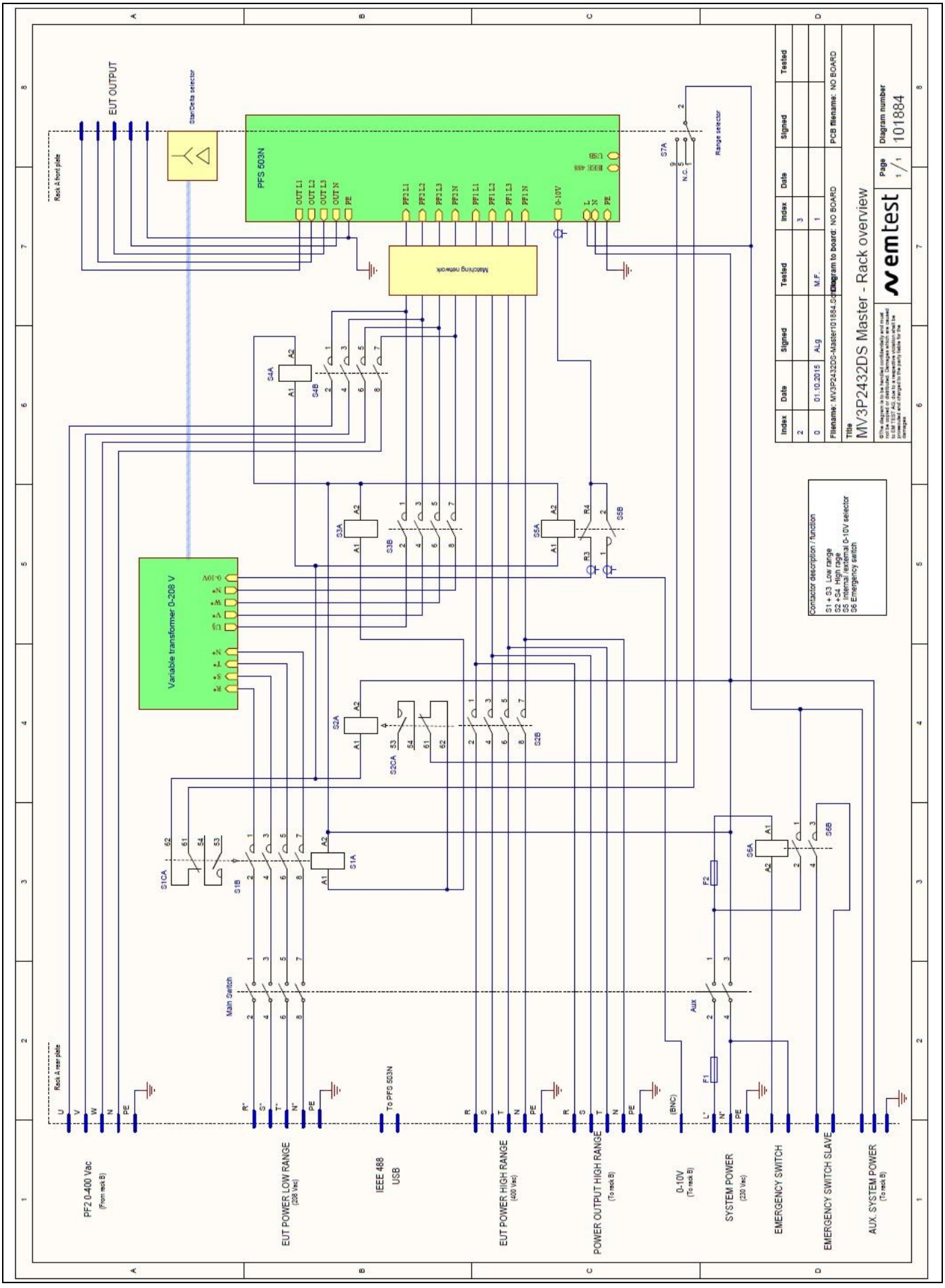
32 A System with MV 3P 2432 DS and MV 3P 4032 DS

Technical data for
Input:

Voltage EUT	Uin: max. 3x 400V
Voltage Control	230V single phase
Frequency	50/60Hz

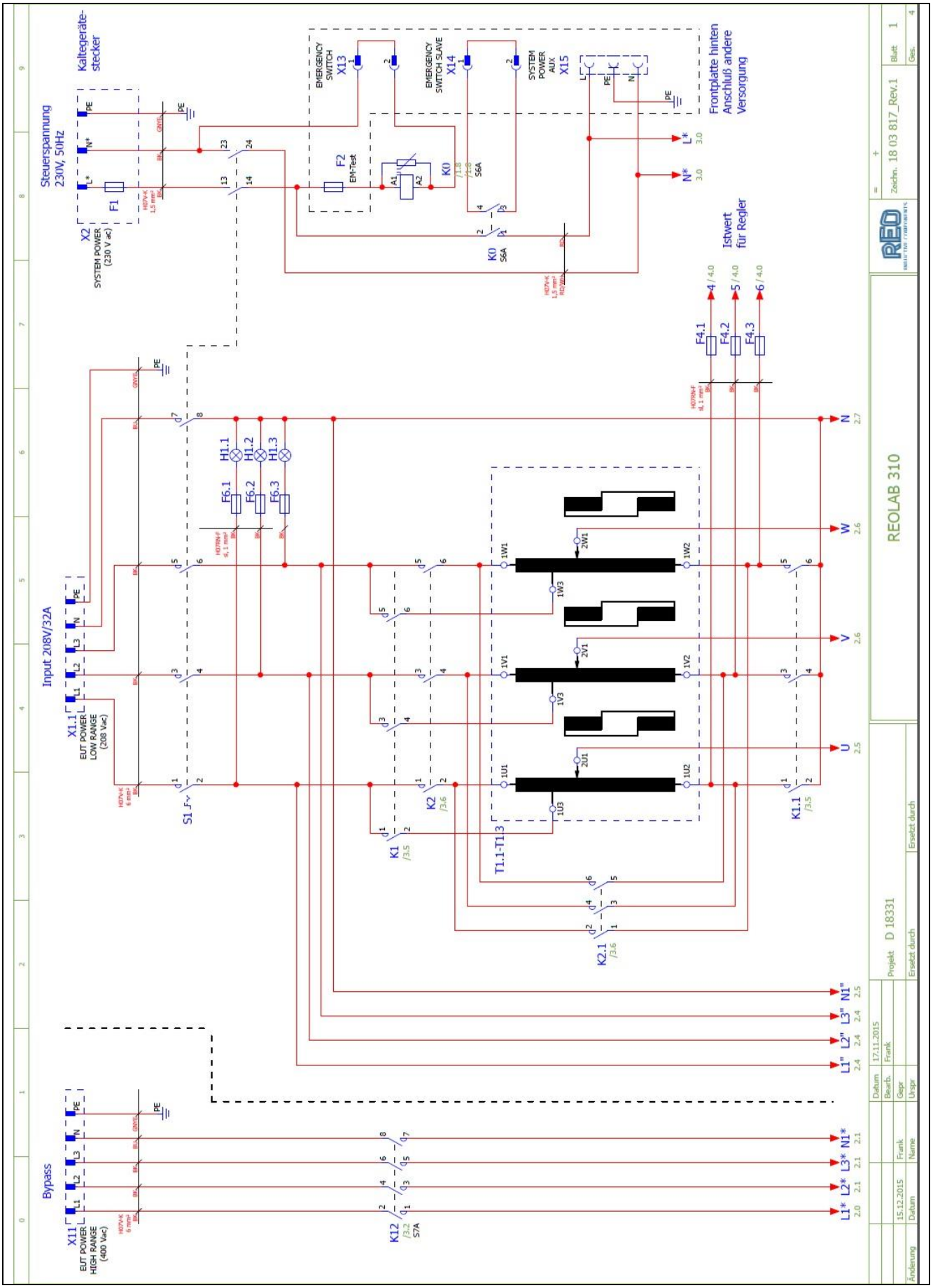
Output:	**MV 3P 2432 DS**	**MV 3P 4032 DS**
Input voltage [line-line]	3x 170V - 240V	3x 380V - 440V
Output voltage channel PF1	3x 170V - 240V	3x 380V - 440V
Output voltage channel PF2 Y	0 – (170V – 240V)	0 – (380V - 440V)
Current I max :	3x 32A	3x 32A
Power	0 – 13.34 kVA	0-24.38 kVA
Fuses channel PF1	32AT,	32AT,
channel PF2	32AT	32AT

13.8.3. Schematic system MV 3P2432DS Rack System overview

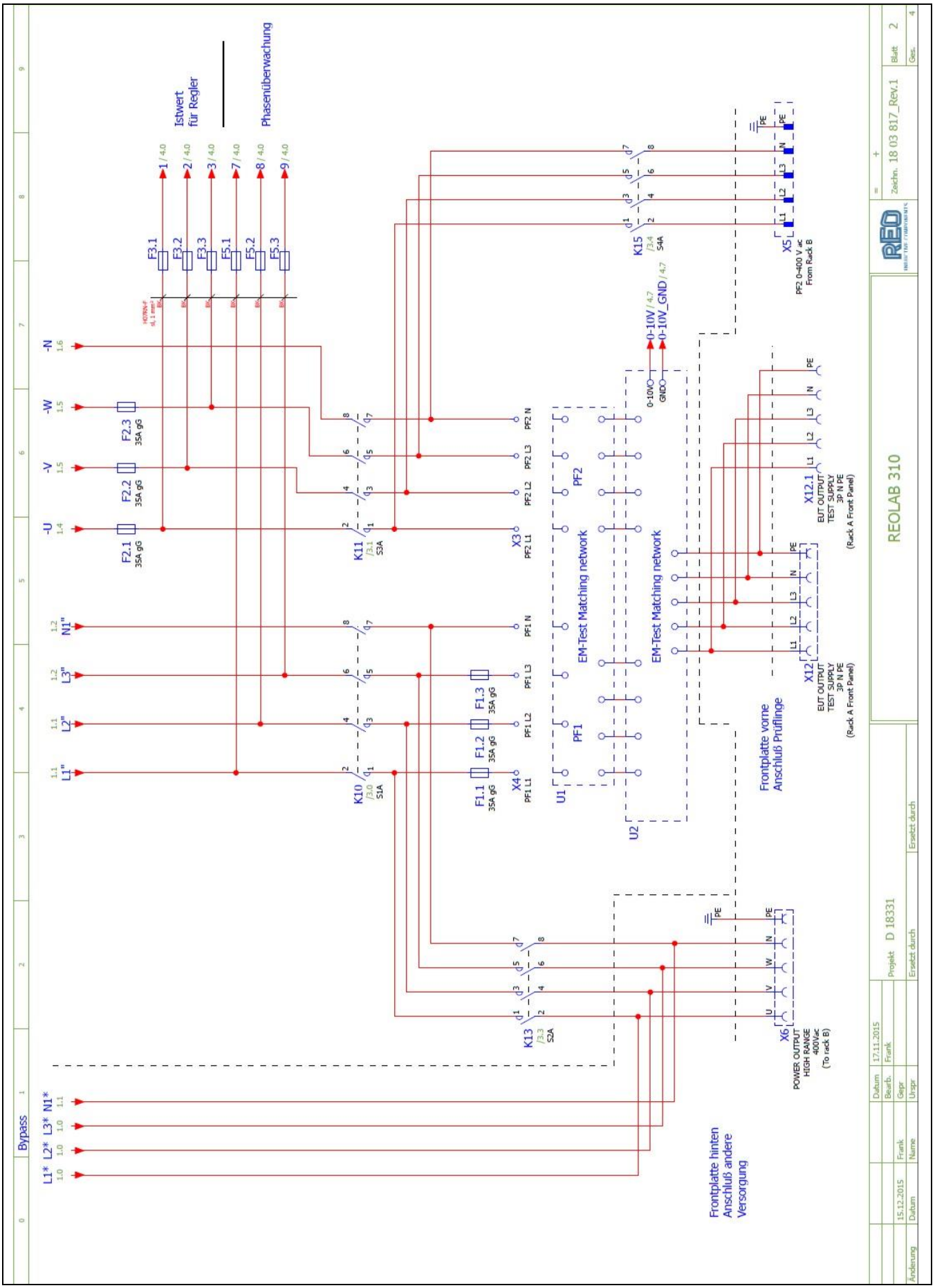


13.8.4. **Schematic system Variable Transformer MV 3P2432DS** (extension to 400V System)

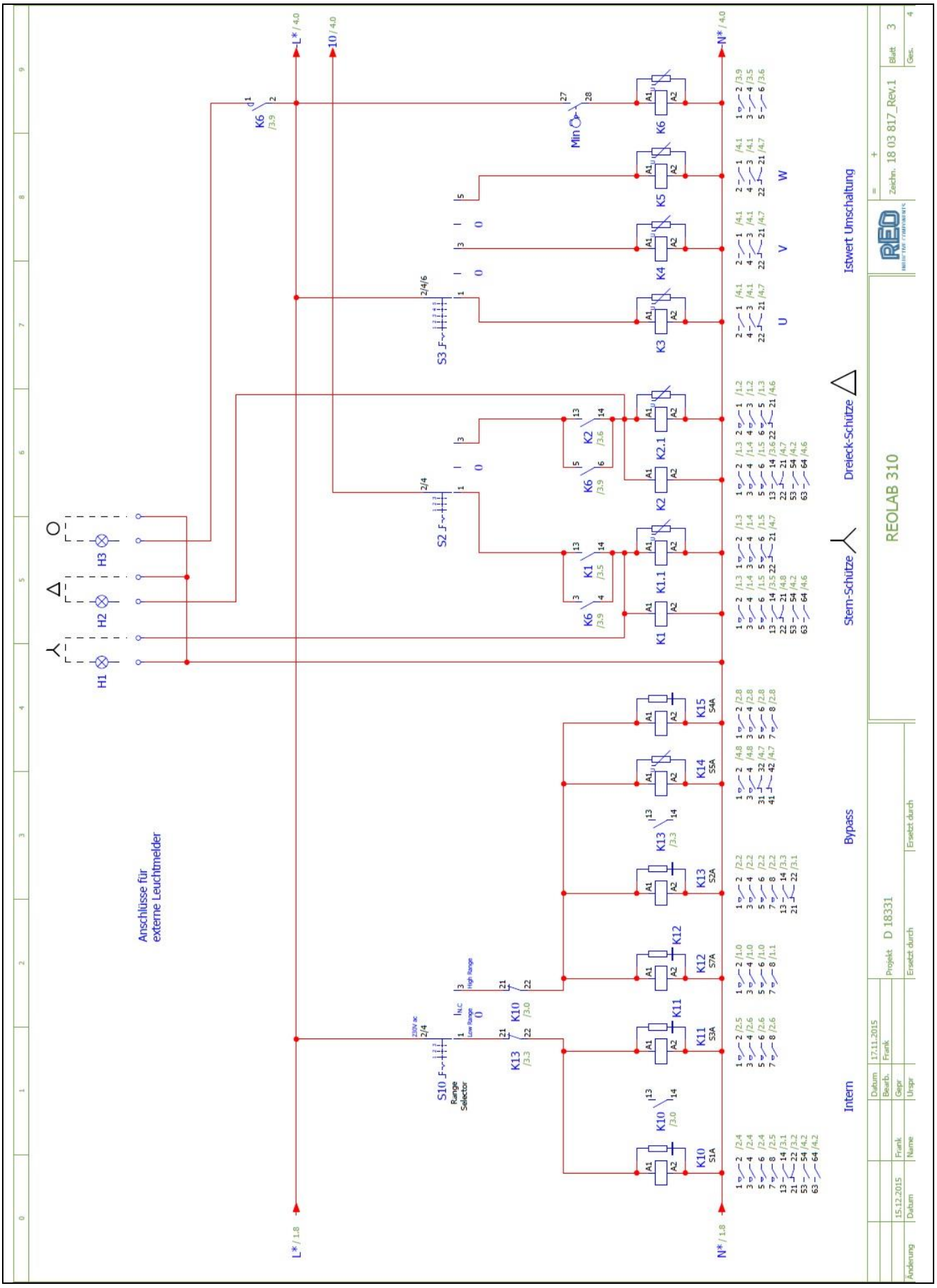
REOLAB 310 System 1/4



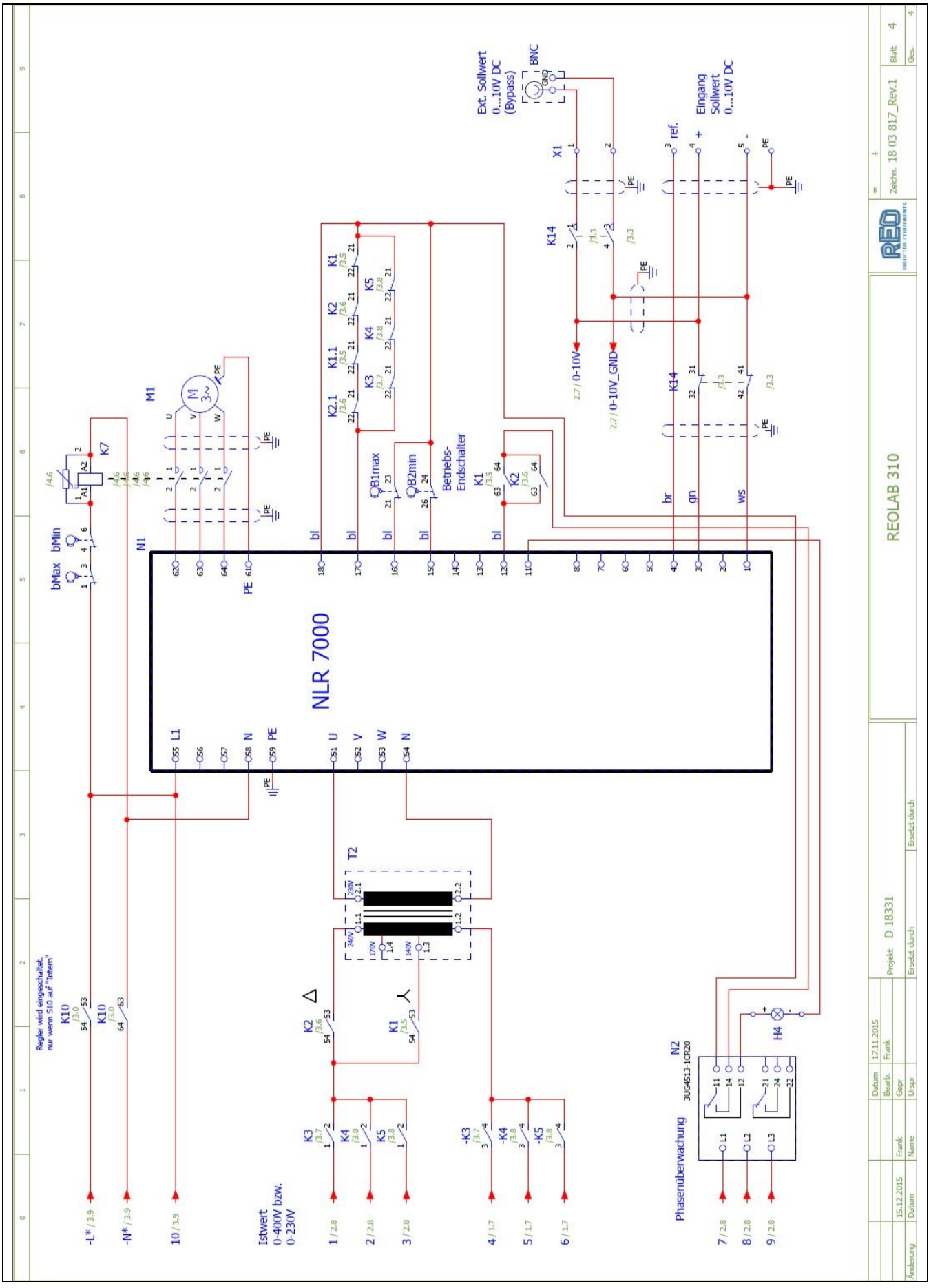
REOLAB 310 System 2/4



REOLAB 310 System 3/4



REOLAB 310 System 4/4



13.9. 63A System application with variable input power (170V -240V and 380V – 440V)

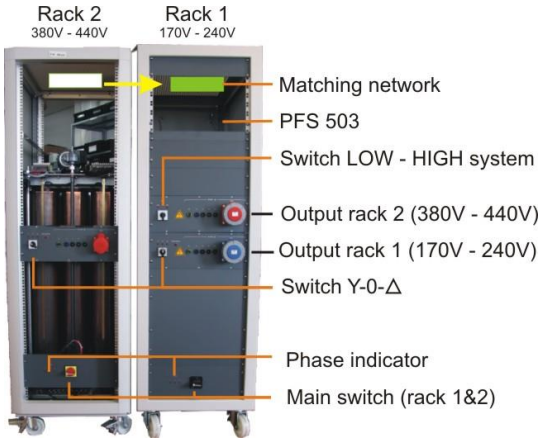


Figure 13.23: System frontside

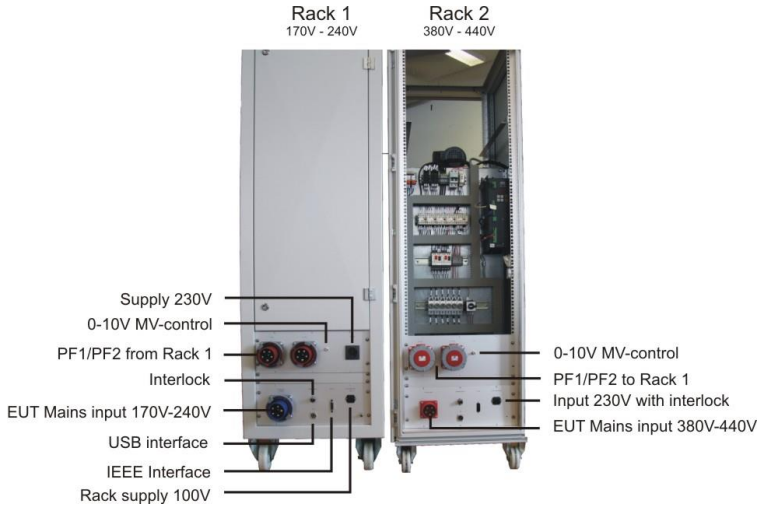


Figure 13.24: System rearside

Principal schematics

An external AC source or transformer delivers the mains voltage to one of the two motorvariacs who covers the two operating ranges :

Range 1: 170V to 240V = Rack (1) 63A
Range 2: 380V to 440V = Rack (2) 63A

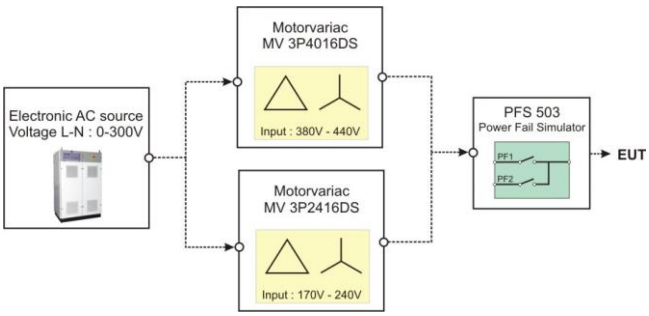


Figure 13.25: Principle scematic of power supply to the rack with a 16A system. The 63A system works similar.

The PFS 503 is located into the low voltage 240V system (rack 1). The high voltage (rack 2 400V system) delivers the system voltage to rack 1. The voltage selector switch, connect voltages PF1 and PF2 from rack 2 to the PFS 503. Additionally the 0-10Vdc for motorvariac control changes to the selected rack.

13.9.1. System cabling and settings

Settings for 380V to 440V operating

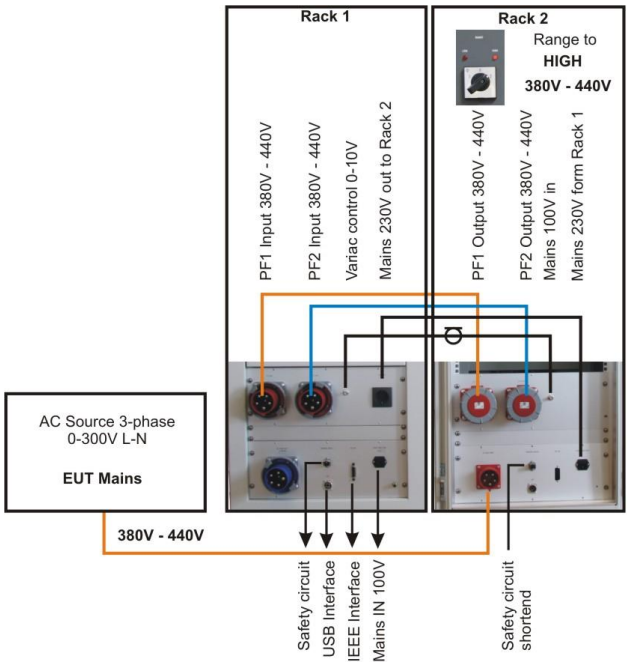


Figure 13.26: Settings for 380V to 440V operating

Settings for 170V to 240V operating

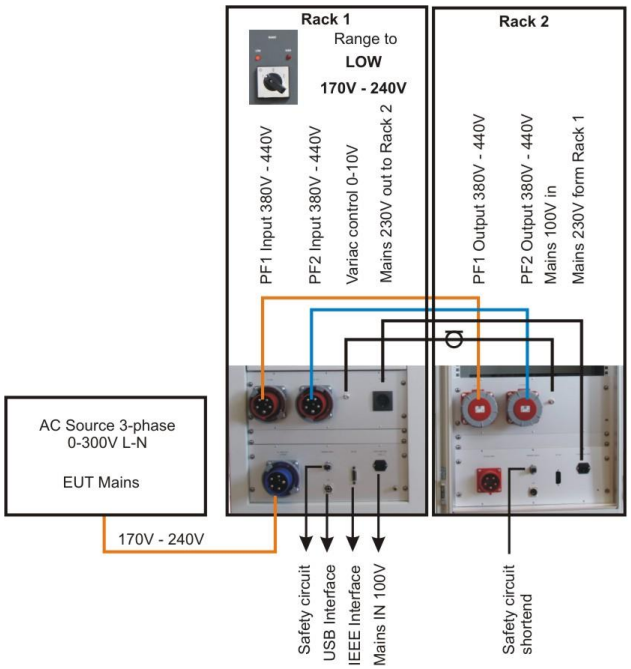


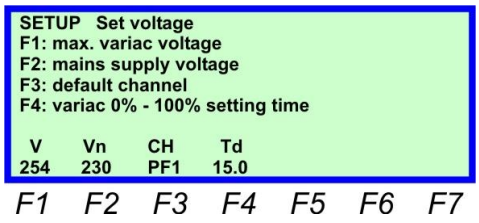
Figure 13.27: Settings for 170V to 240V operating

PFS305 settings

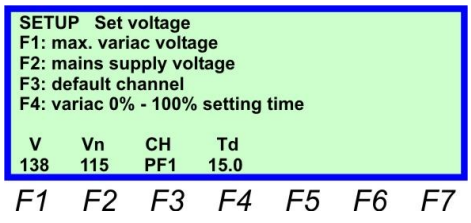
UIn (PF1)	PFS Settings					
L-N	Star (Ph – N PF2)			Delta (Ph PF2 – Ph PF1)		
	U Set max. variac voltage	Un Set nominal voltage	UOut Max Line to Neutral	U Set max. variac voltage	Un Set nominal voltage	UOut Max Line to Line
100V	**141V**	**135V**	135V	**135V**	**115V**	173V
105V	**141V**	**135V**	135V	**135V**	**115V**	182V
110V	**141V**	**135V**	135V	**135V**	**115V**	190V
115V	**141V**	**135V**	135V	**135V**	**115V**	200V
120V	**141V**	**135V**	135V	**135V**	**115V**	208V
125V	**141V**	**135V**	135V	**135V**	**115V**	217V
130V	**141V**	**135V**	135V	**135V**	**115V**	225V
135V	**141V**	**135V**	135V	**135V**	**115V**	234V

Calculation of Deltamode setting: Un Set = UIn / √3 , => U Set = 200V
Vn set is the value which has to be set to get an output voltage “Vout Max” of 135V 0r 200V respectively

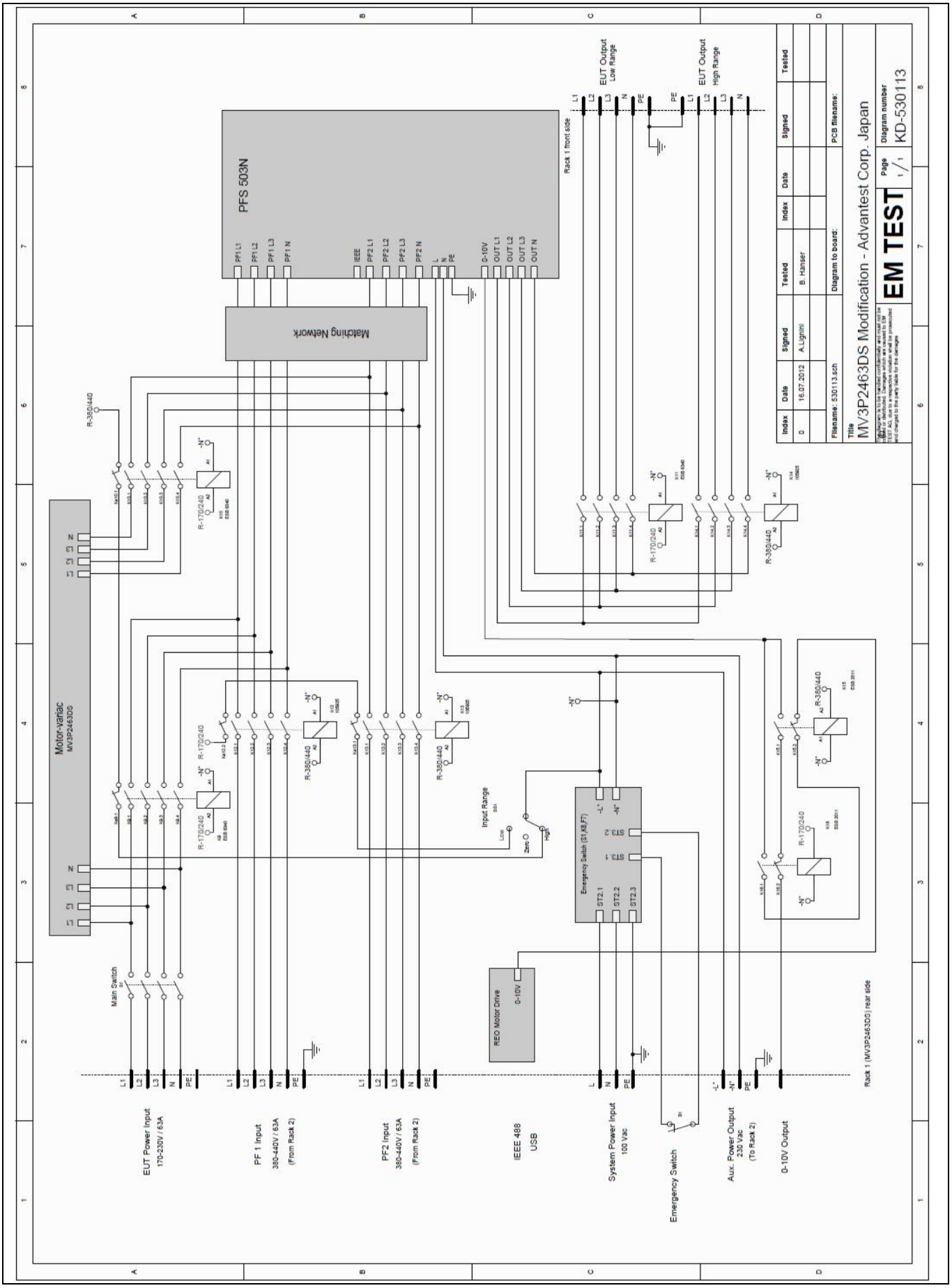
Example for PFS 503 settings **400V System**



Example for PFS 503 settings **200V System**



13.9.2. Scematics MV3P2463DS system rack 1



13.10. MV 3P69100DS System for 100 A and 690 V input power

Figure 13.27: Front side

Figure 13.28: Rear side

Reference: Fertigungsnummer: D 17570.01 (November 2013)