

风力发电机之发电机及变频器

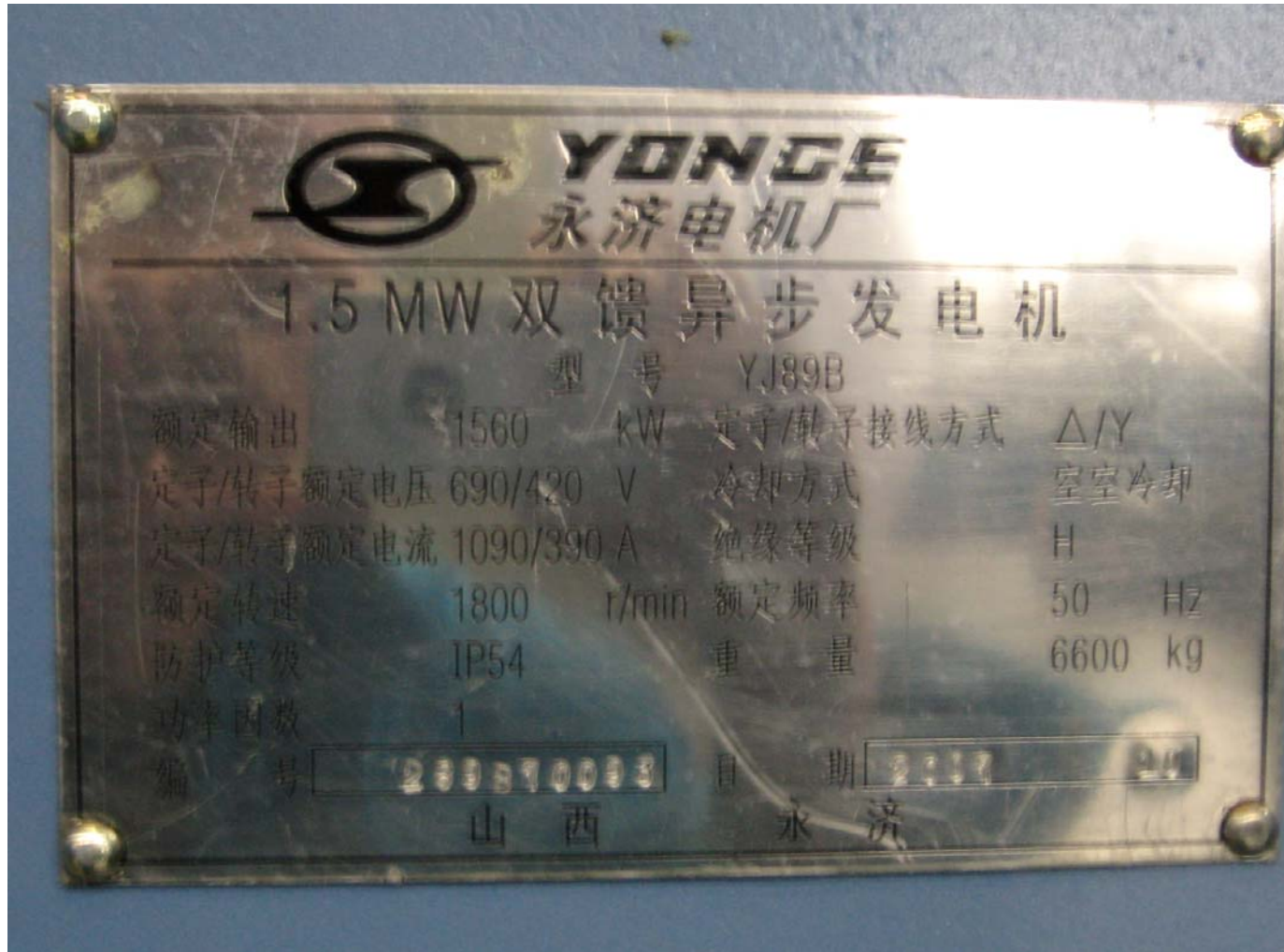


发电机—目录

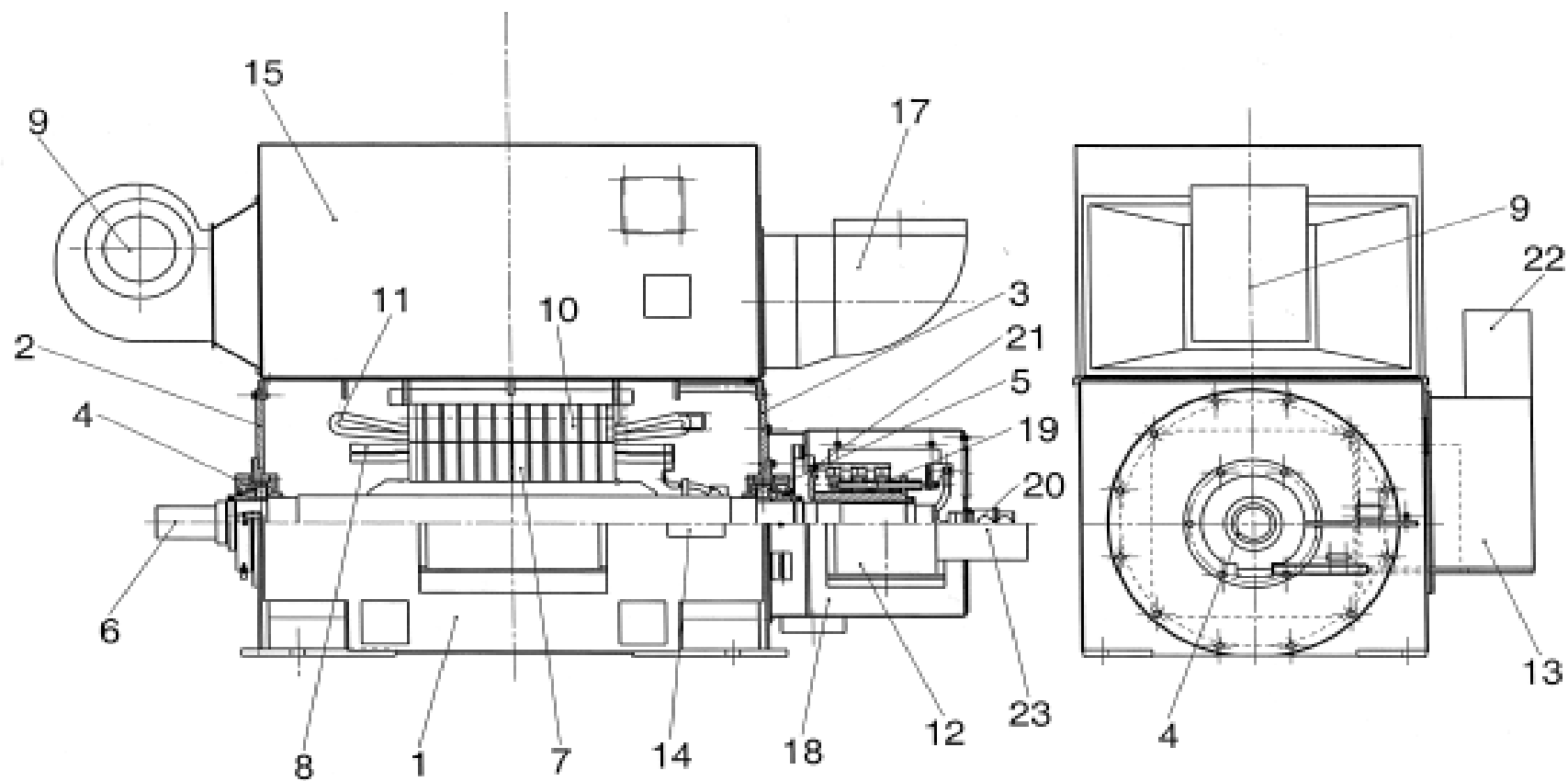
- 参数
- 结构
- 工作原理



发电机—参数



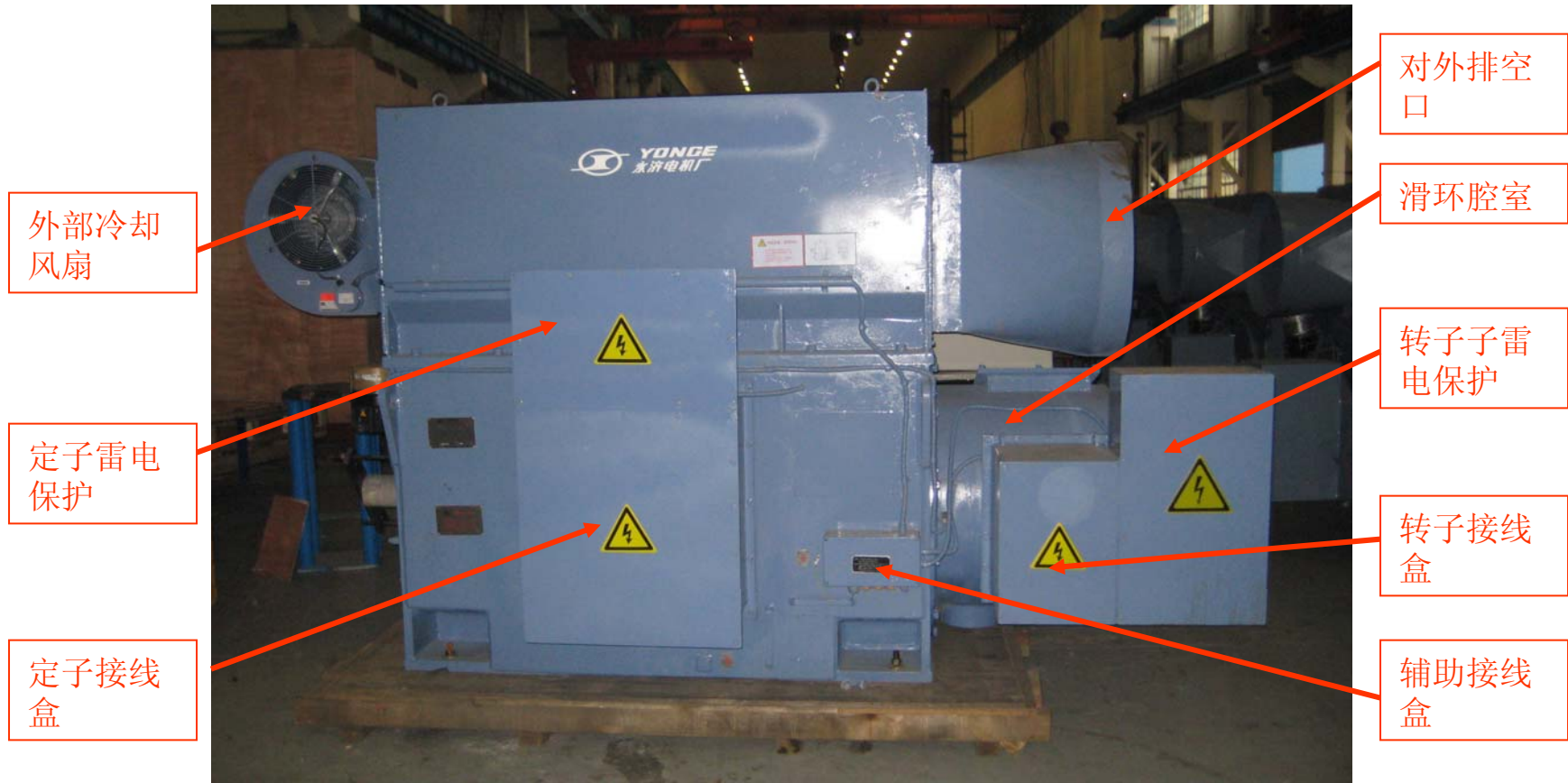
发电机—结构



发电机—结构

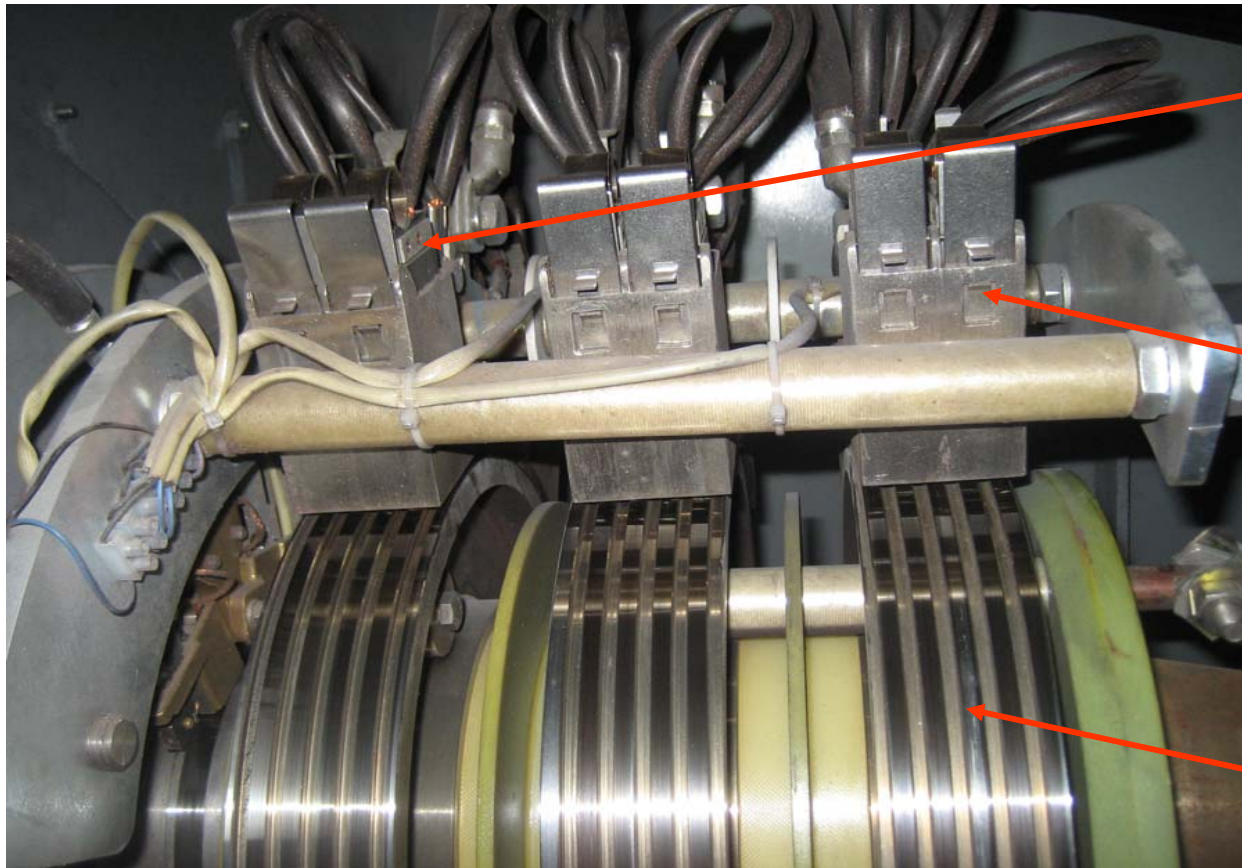
- 1 Housing 壳体
- 2 End shield D end 前端盖
- 3 End shield N end 后端盖
- 4 Bearing head N end with grooved ball bearing (locating bearing), insulated (refer to Chapter 2.2.4) 滚动球轴承及端盖, 绝缘隔离
- 5 Bearing head N end with grooved ball bearing (floating bearing), insulated and pre-tensioned (refer to Chapter 2.2.4) 滚动球轴承及端盖, 绝缘隔离及热套安装
- 6 Shaft 轴
- 7 Rotor core assembly 转子铁芯组件
- 8 Rotor winding 转子绕组线圈
- 9 External ventilator for outside air flow 用于导入外部空气流的外部通风风扇
- 10 Stator core assembly 定子铁芯组件
- 11 Stator winding 定子绕组线圈
- 12 Terminal box for rotor connections 转子接线盒
- 13 Terminal box for stator connection 定子接线盒
- 14 Auxiliary terminal box 辅助端子接线盒
- 15 Air/air heat-exchanger 空/空热交换器
- 17 Exhaust air blowing out opening 对外排空口
- 18 Slip ring cover 滑环腔室
- 19 Slip ring apparatus 滑环
- 20 Speed transmitter 编码器
- 21 Earthing brush 接地碳刷
- 22 Lightning protection box stator 定子雷电保护盒
- 23 Lightning protection box rotor 转子雷电保护盒

发电机—结构



发电机—结构

滑环腔室内部



碳刷

碳刷架

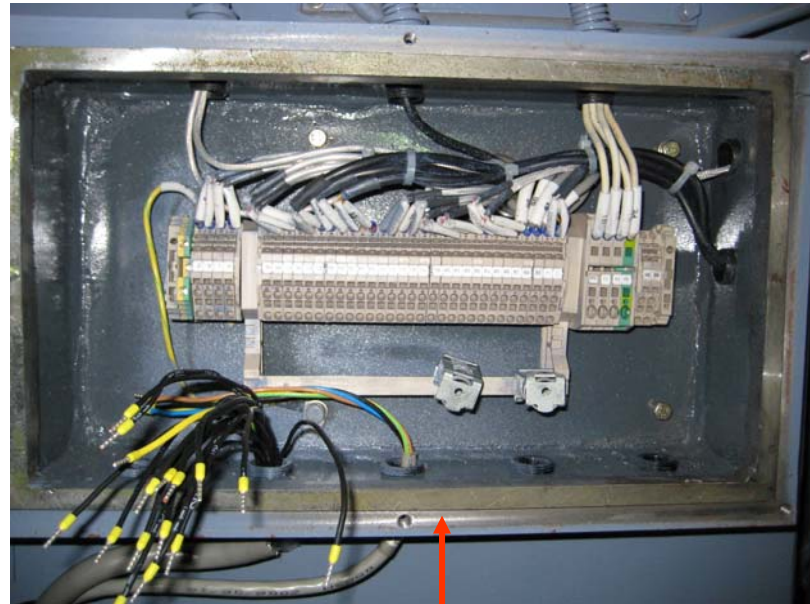
滑环

发电机—结构



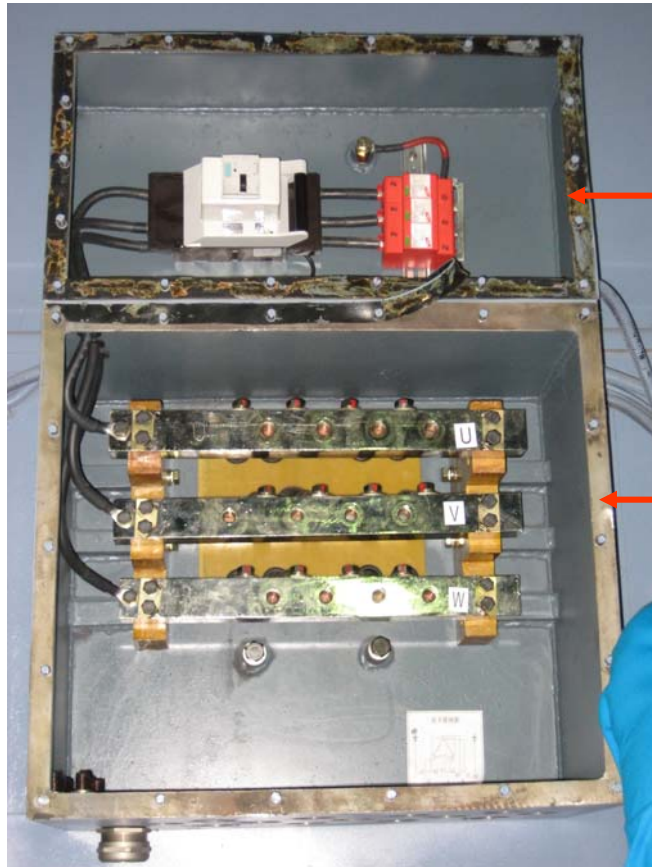
转子接线盒

转子雷电保护



辅助接线盒

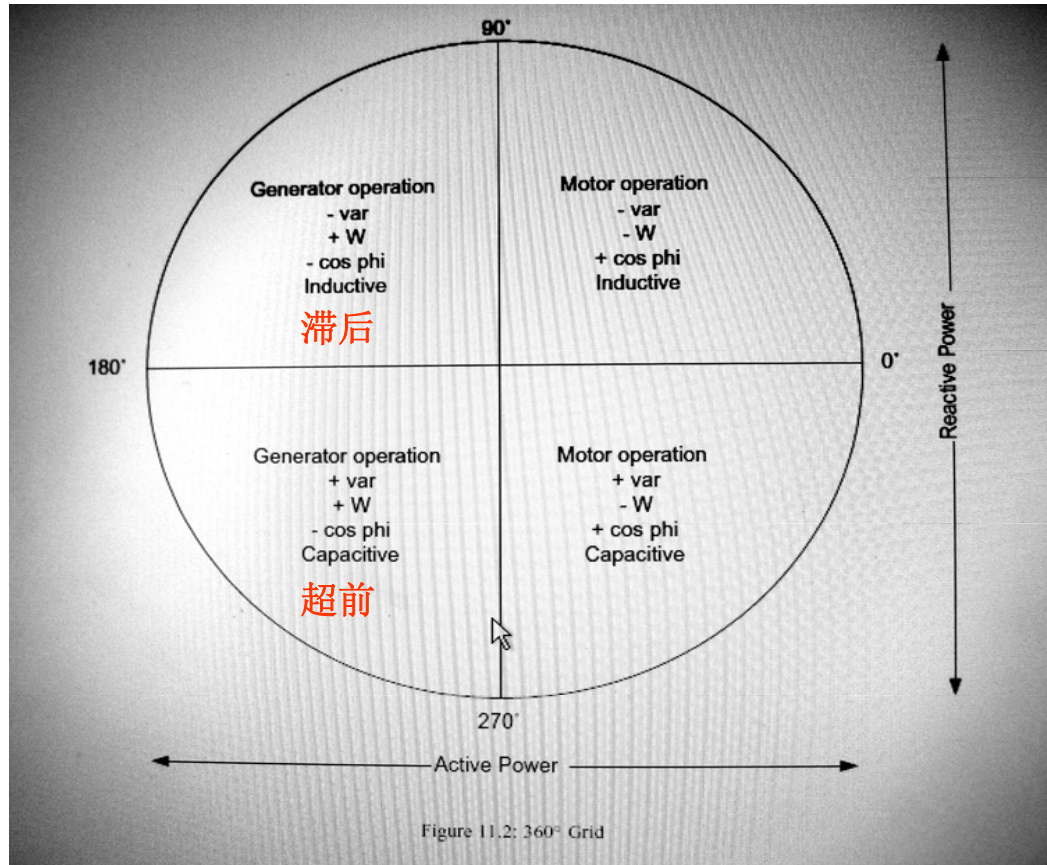
发电机—结构



定子雷电保护

定子接线盒

发电机—工作原理



双馈异步发电机；

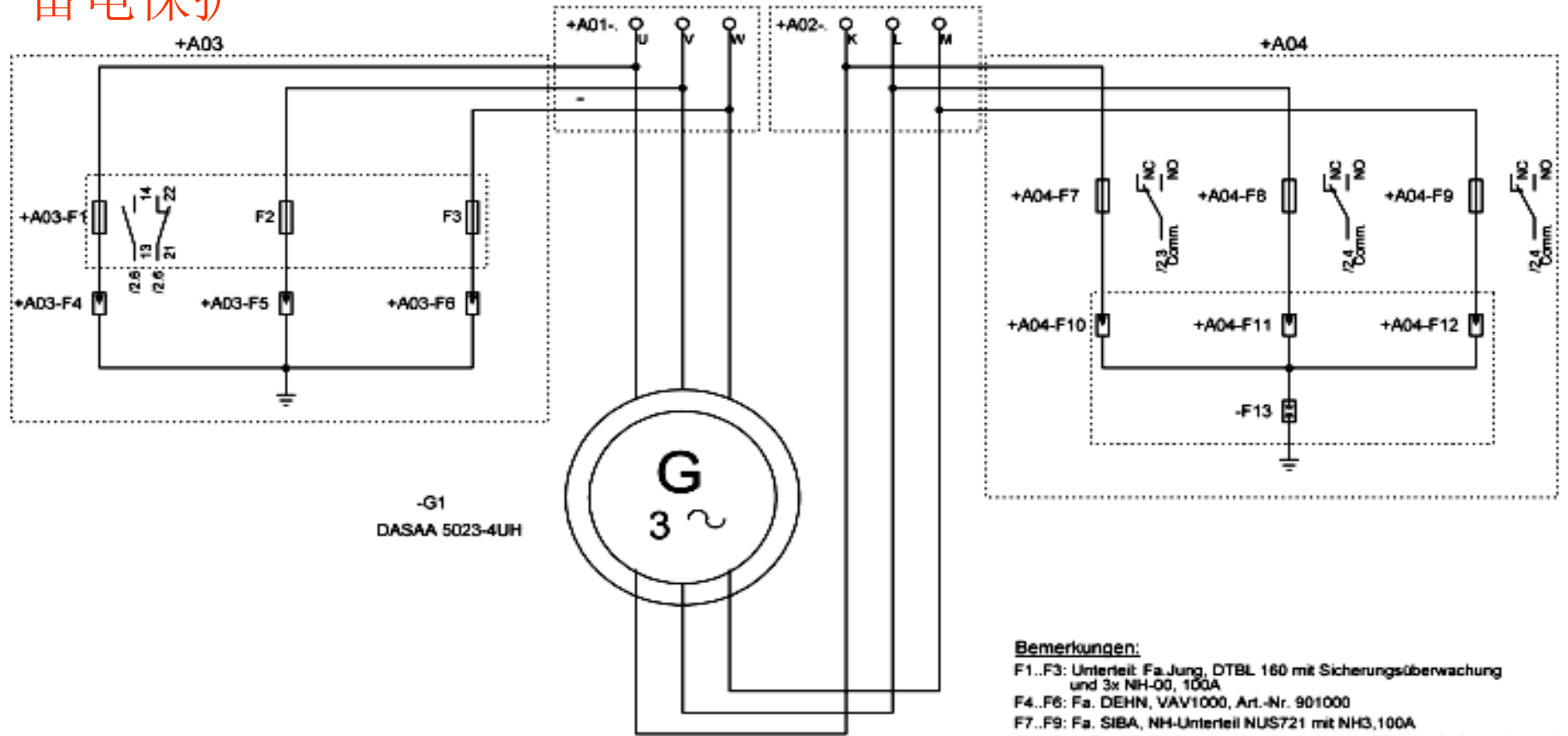
四象限运行；

4级，同步转速1500rpm；

同步转速以下，由转子提供励磁，仅定子发电；同步转速以上，由转子与定子间的转速差（滑差）维持磁场，定子、转子同时发电。

发电机—工作原理

雷电保护



Bemerkungen:

F1..F3: Unterteil: Fa. Jung, DTBL 160 mit Sicherungsüberwachung und 3x NH-00, 100A

F4..F6: Fa. DEHN, VAV1000, Art.-Nr. 901000

F7..F9: Fa. SIBA, NH-Unterteil NUS721 mit NH3,100A

F10..F13: Fa. DEHN, Netz-AK VAV3+1, Art.-Nr. 989 405/S, Serial-No. 4133

发电机—工作原理

辅助接线盒

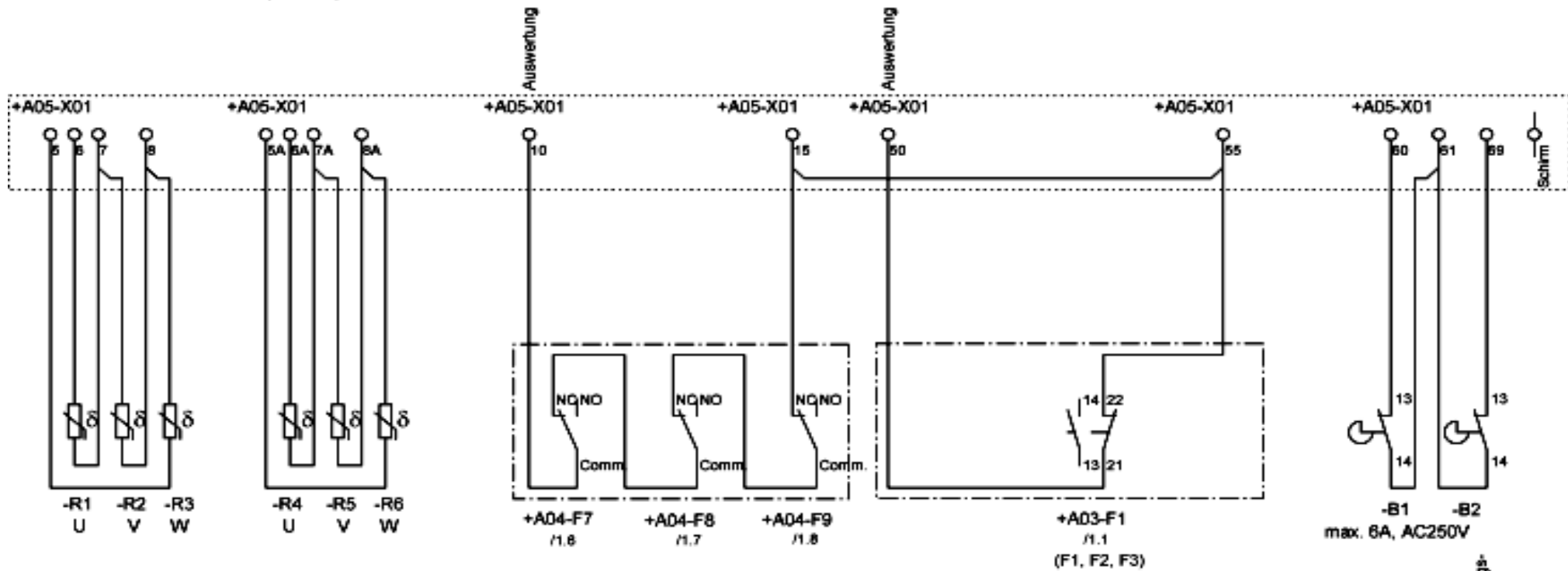
PTC in winding
Ständerwicklung

PTC in winding
(SPARE)
Ständerwicklung
(Reserve)

Blown-fuse indicating
Sicherungsüberwachung
Läufer

Blown-fuse indicating
Sicherungsüberwachung
Ständer

Brush wear
Bürstenverschleiß



Bemerkungen / Remarks:

PTC: Schalterpunkt 160°C

Switching point 160°C

Rotorstrom-
bürsten

Wellenendungs-
bürsten

发电机—工作原理

辅助接线盒

RTD in winding

Pt100
Ständerwicklung

RTD in bearing

Pt100 Wälzlager

Heater

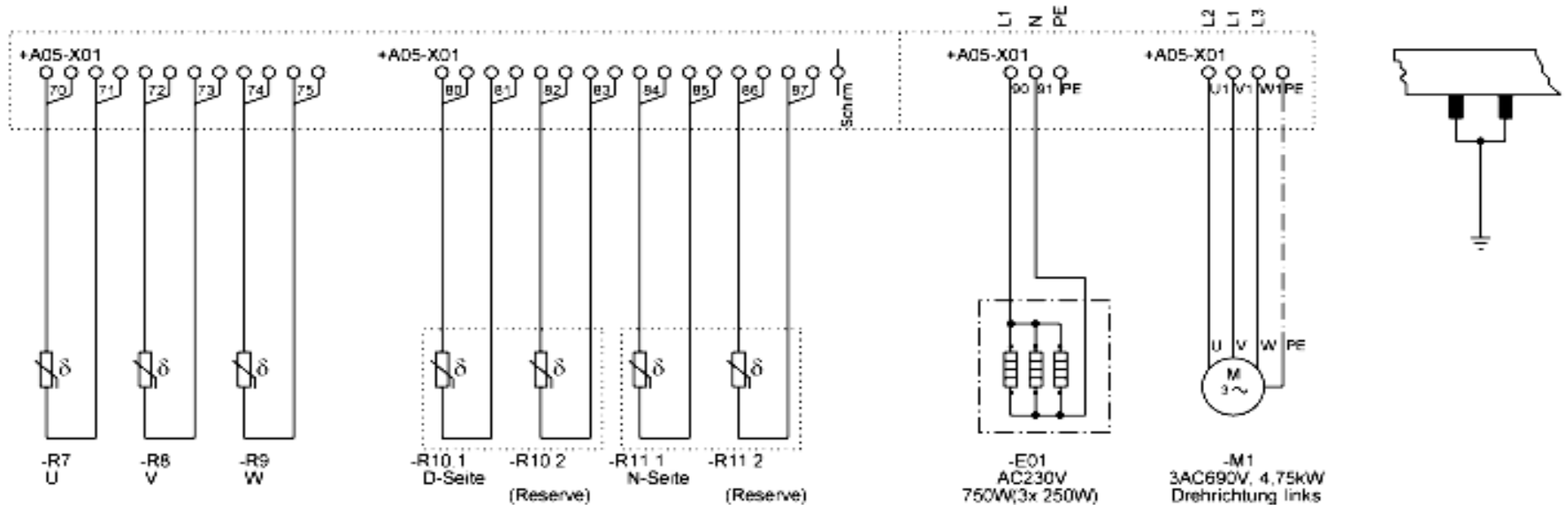
Heizung

External fan motor

Außenlüftermotor

Carbon brushes on shaft

Wellenbürsten



Bemerkungen / Remarks:

Pt100: Klemmen geeignet für 2-, 3- und 4-Leiteranschluß
Meßstrom <10mA

RTD: Terminals suitable for 2-, 3- or 4-wire connection
Measurement current <10mA

变频器—目录

- 接线
- 系统原理
- 硬件结构及功能
- 参数
- 调试

变频器—接线

与发电机的接线

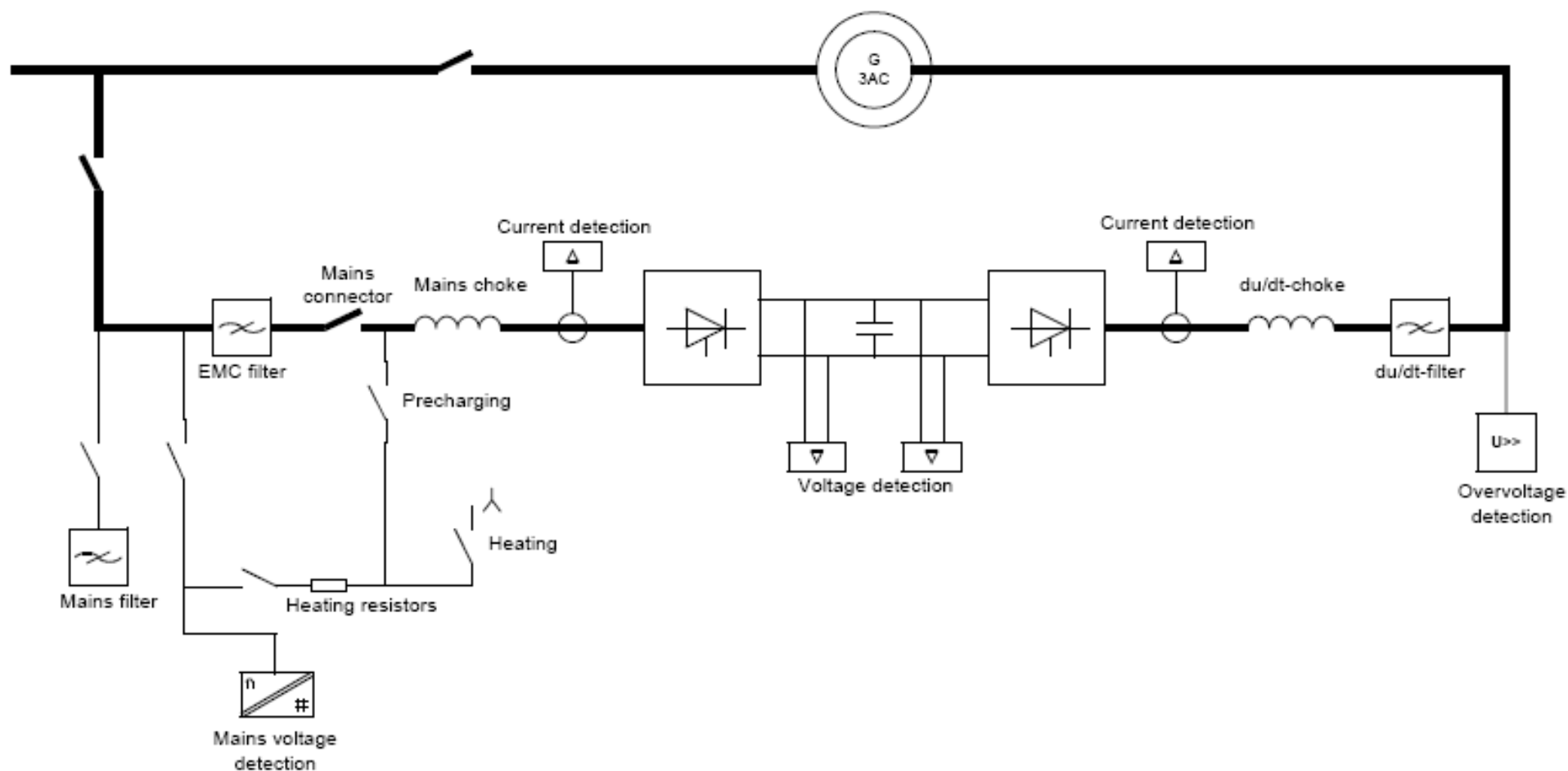


塔筒上部：发电机电
缆→BUS BAR

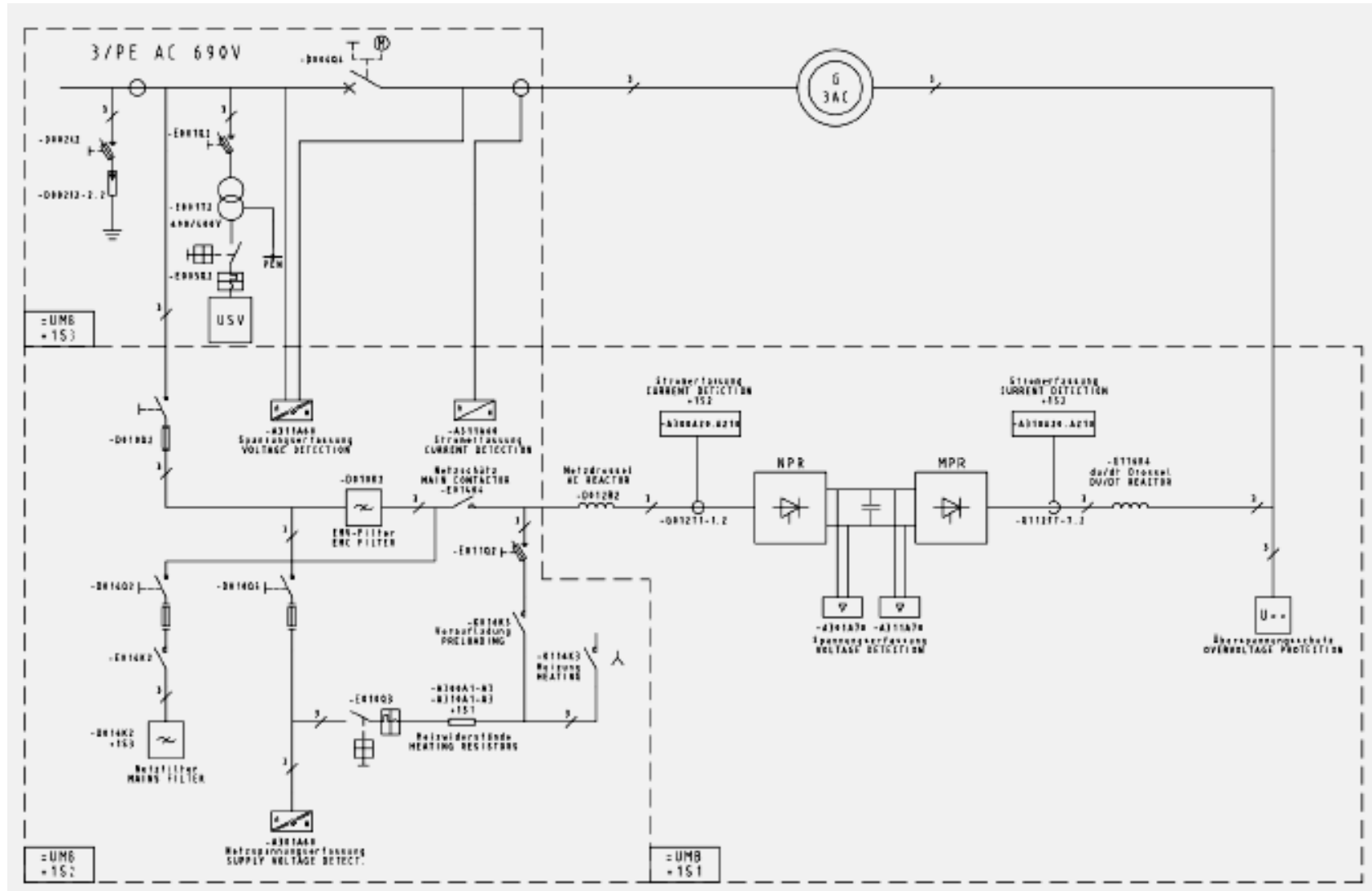


塔筒下部：BUS
BAR→变频器

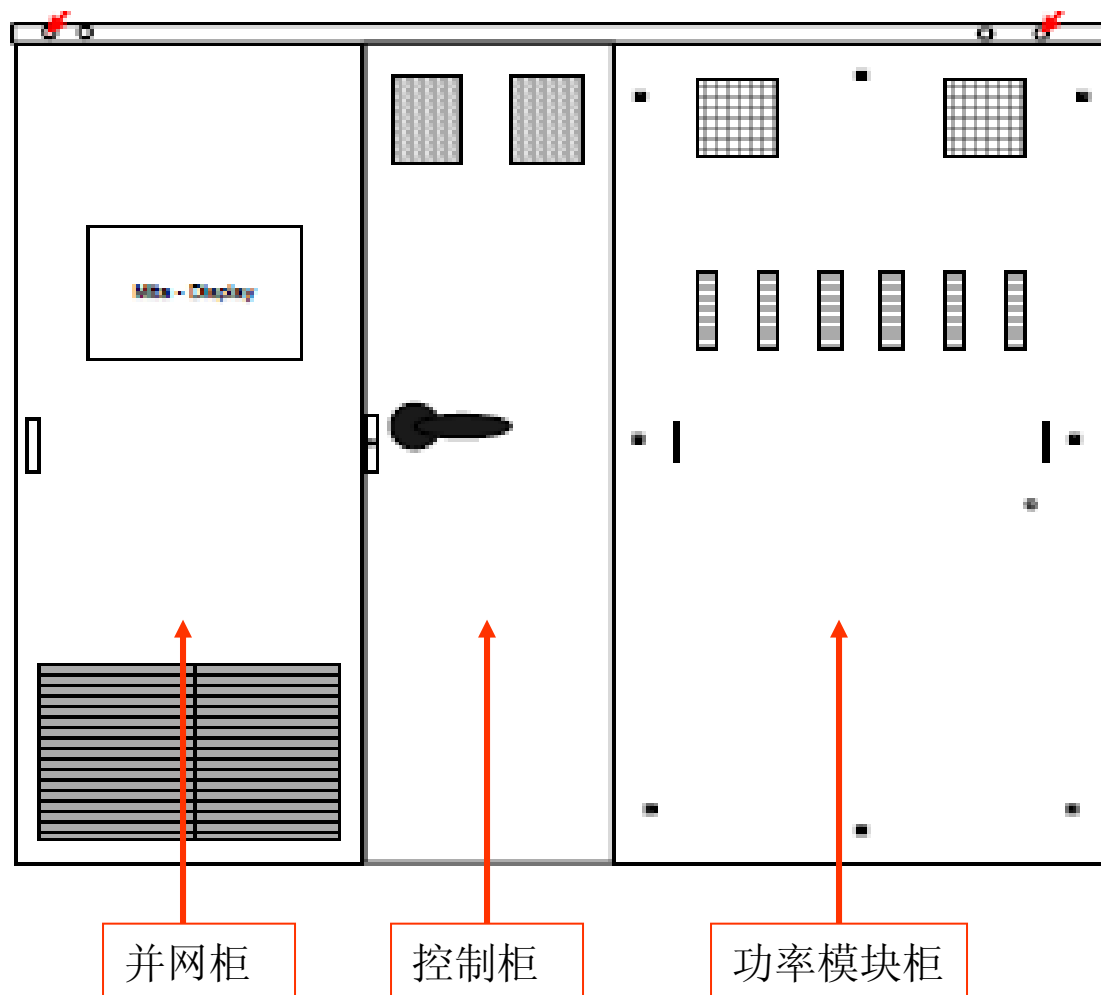
变频器—系统原理



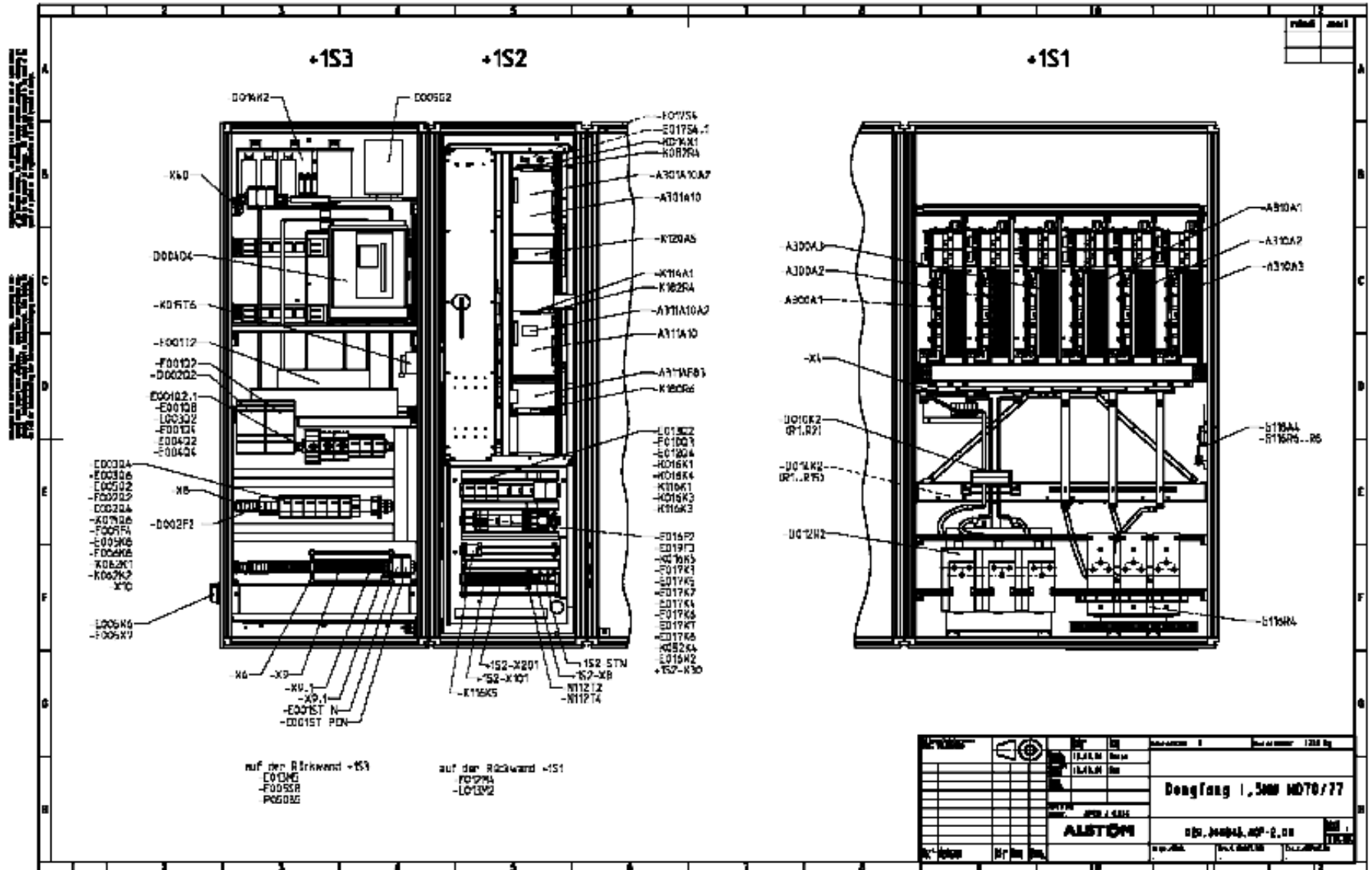
变频器—系统原理 (Converteam)



变频器——硬件结构及功能 (Converteam)



变频器——硬件结构及功能 (Converteam)



变频器——硬件结构及功能 (Converteam)

并网柜



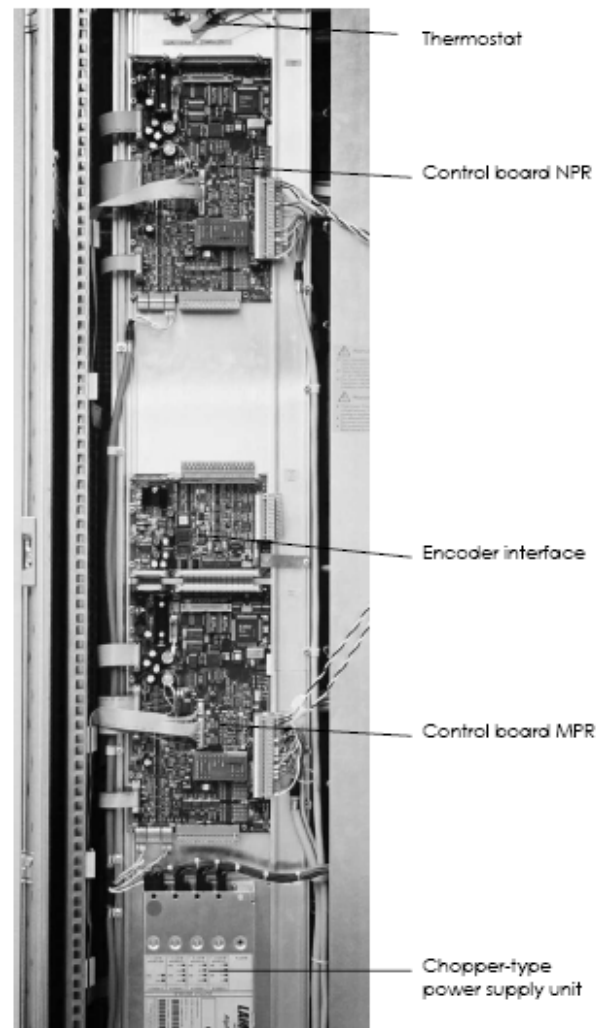
变频器——硬件结构及功能 (Converteam)

并网柜:

- 1 并网 (断路器)
- 2 保护 (断路器的过流保护)
- 3 系统电源分配
- 4 与机舱主控制器信号交换

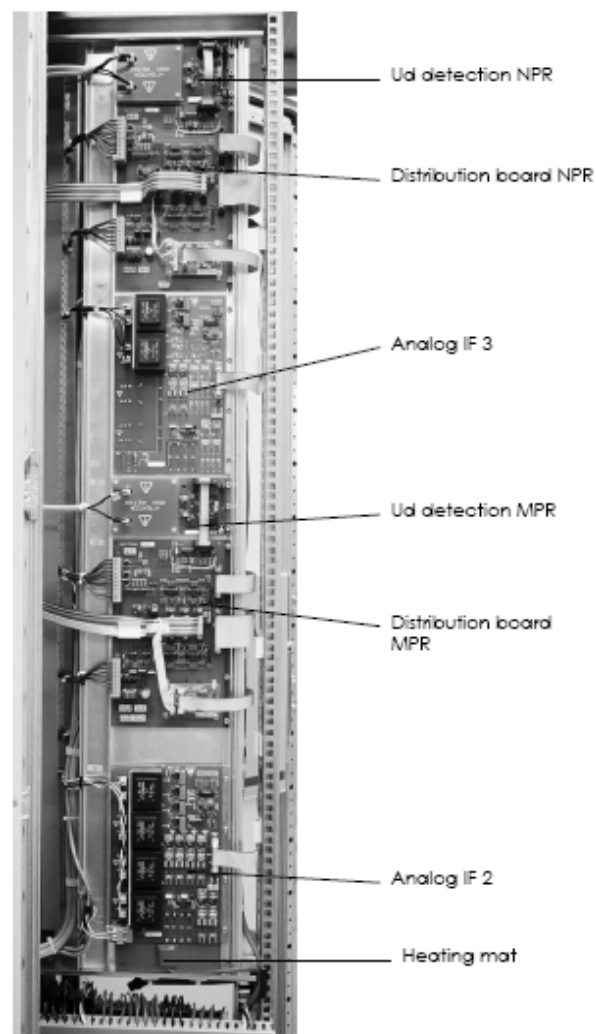
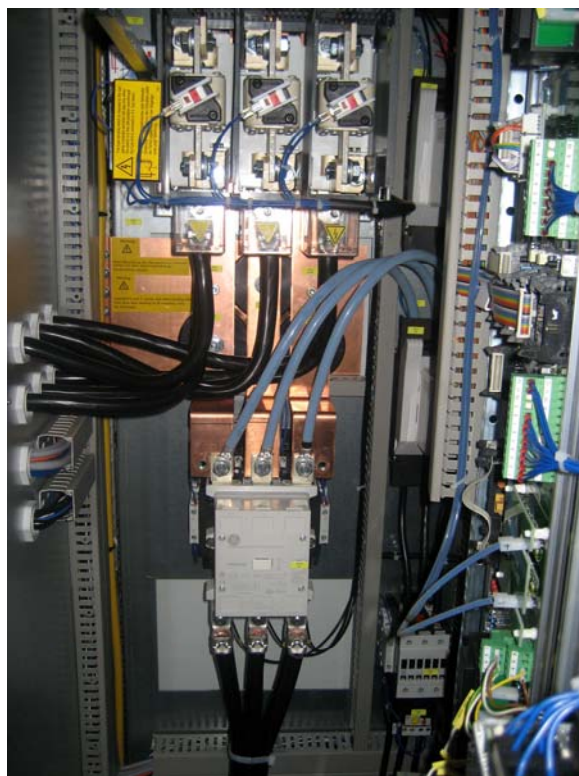
变频器——硬件结构及功能 (Converteam)

控制柜



变频器——硬件结构及功能 (Converteam)

控制柜内部



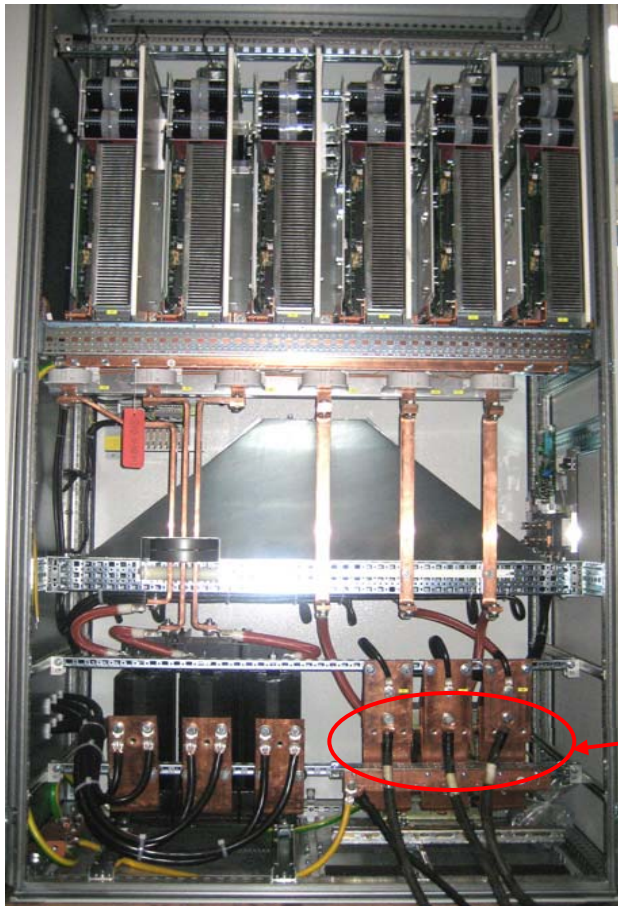
变频器——硬件结构及功能 (Converteam)

控制柜:

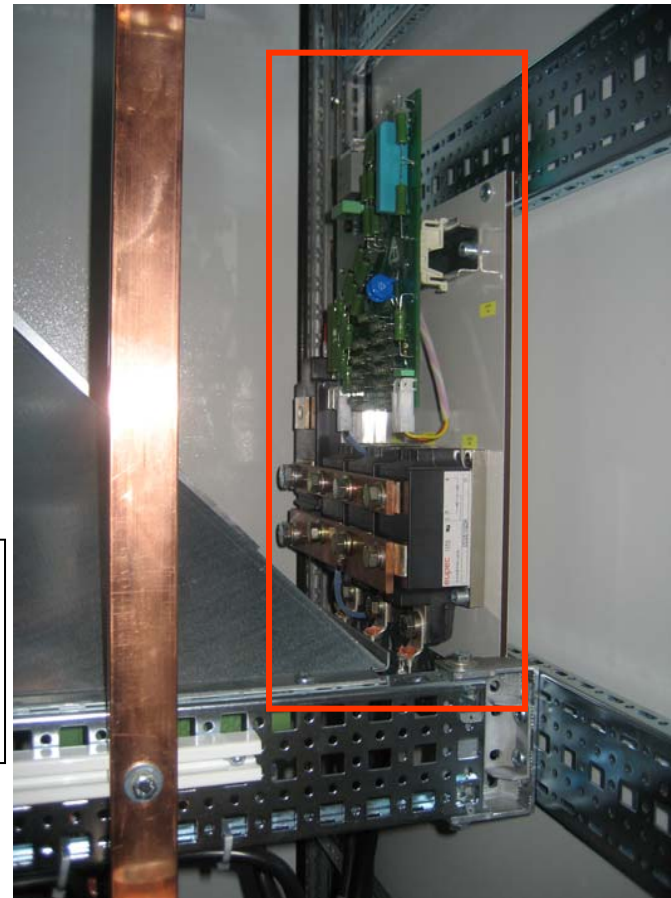
- 1 功率模块（变频模块）触发控制
- 2 励磁回路控制
- 3 自动同期控制
- 4 功率回路保护
- 5 信号采集及转换、分配
- 6 控制板件加热

变频器——硬件结构及功能 (Converteam)

功率模块柜



与转子的
连接的
电缆的
螺栓



变频器——硬件结构及功能 (Converteam)

功率模块柜:

1 变频

2 功率回路滤波

3 功率回路保护 (Crow-bar)

变频器—参数 (Converteam)

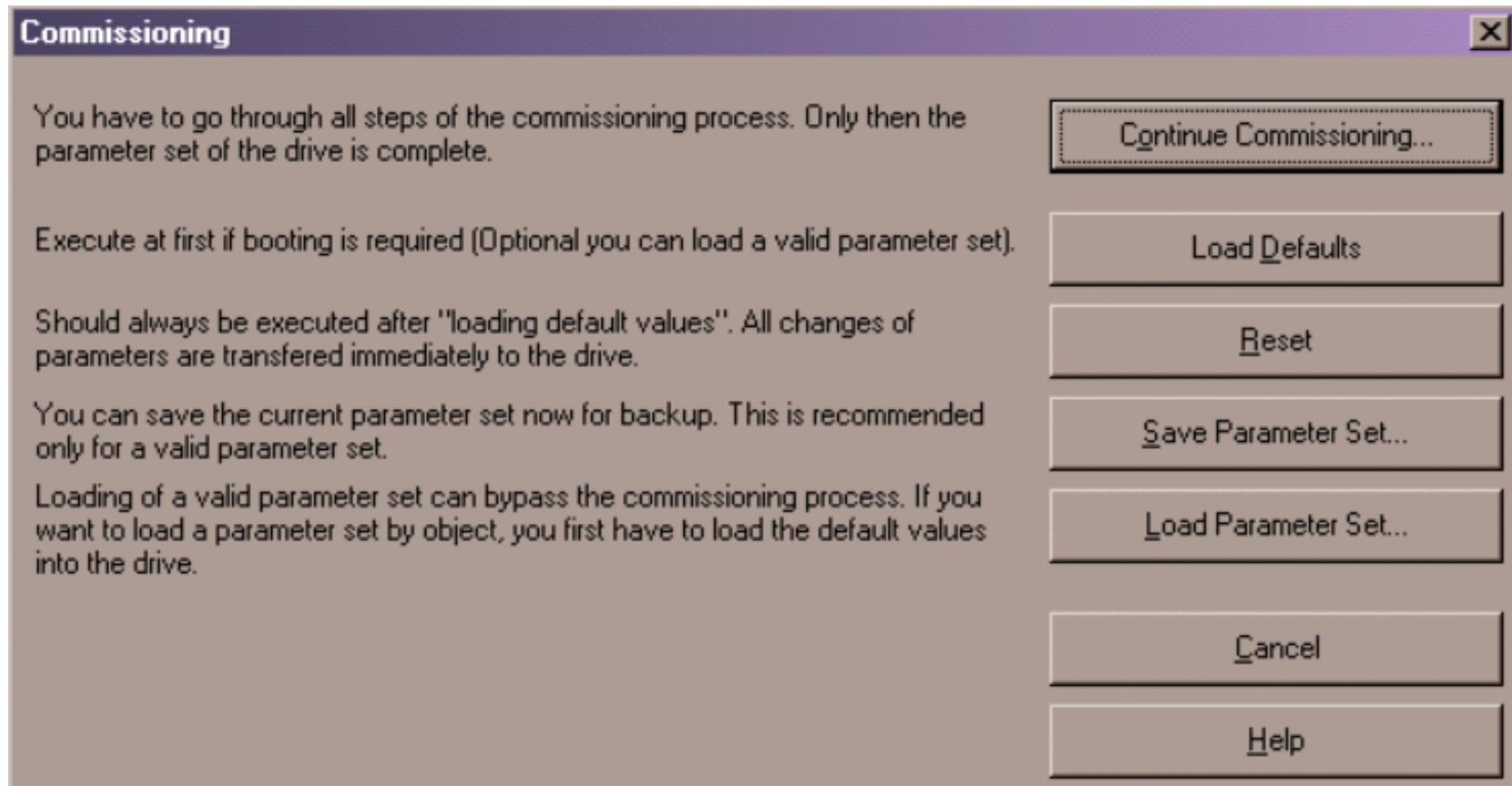
	1.5 MW	2.0 MW
Mains supply voltage	690 V +10%/-10%	
Mains frequency	50/60 Hz + 1 %/-1 %	
Vector frequency (can be parameterised)	6 kHz corresponding to a pulse frequency of 3 kHz	
Dimensions (L/D/H)	1800/900/2200 mm	
Approvals	prEN50179:1994/VDE0160 CE marking to Low Voltage Directive	
Efficiency at inverter rated power	> 0,97	
Rated current NPR	305 A	
Maximum current NPR	510 A (temperature-dependent)	
Rated current MPR	580 A	800 A
Maximum current MPR	640 A	880 A
	(temperature-dependent)	
Torque rise times for speed control with or without sensor	10 ms	

变频器—参数 (Converteam)

Noise	< 82db (A)	
Overtemperature shutdown	> 85 °C (heatsink temperature)	
Ambient temperature		
Operation	-15 °C ... +40 °C	
Storage	-25 °C ... +65 °C	
Environmental conditions		
Climatic	3K3	
Mechanical	3M3	
Mechanical, transport	2M1	
Cooling method	Air cooling	
Altitude	≤ 1000 m above sea level; up to max. 2200 m above sea level with power derating of 1.2 %/100 m	
Storage time	2 years without capacitors reforming, of which max. 5 months at temperatures above 40°C	
Degree of protection	Power electronics	IP21
	Controller	IP54

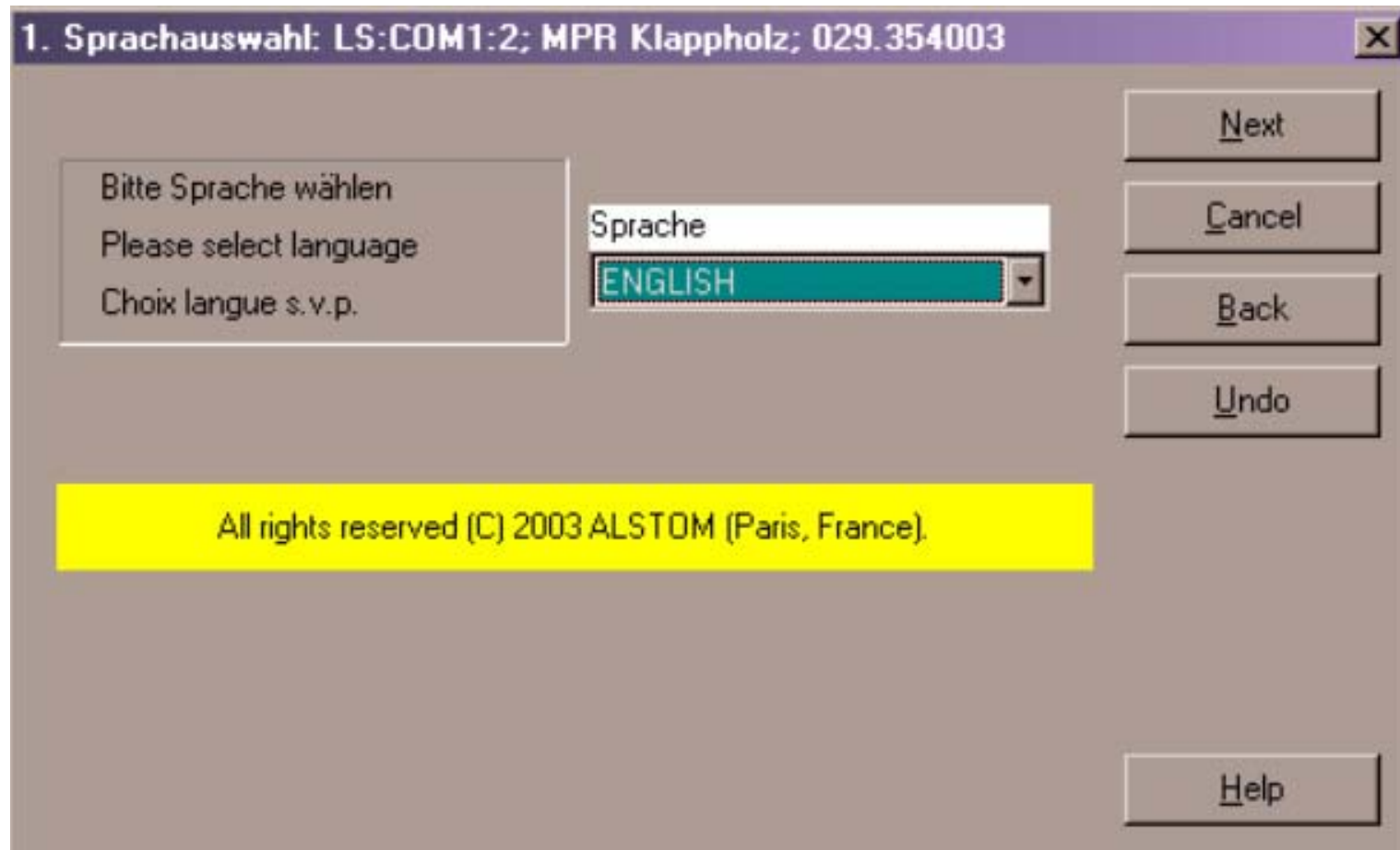
变频器——调试（Converteam）

进入调试画面



变频器——调试 (Converteam)

语言选择



变频器——调试 (Converteam)

时间设置

2. Set Drive name, Date and Time: LS:COM1:2; MPR Klappholz; 029....

Drive Name	MPR Klappholz
Date, Time	28-07-05 14:36:59

Next
Cancel
Back
Undo
Help

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变频器—调试 (Converteam)

系统参数设置

3. Data of inverter: LS:COM1:2; MPR Klappholz; 029.354003

**ZUR KONTROLLE
FOR CHECKING**

Invert. nom. voltage	690 V	
Inverter nom. power	770	KVA
vector frequency	6 kHz	
Inv. current nom	580	A

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Next
Cancel
Back
Undo
Help

变频器—调试 (Converteam)

发电机参数设置

4. Data of generator: LS:COM1:2; ; 029.354003

Rg	---	mOhm
Lsg	4,710	mH
Lh	0,244	mH
ue generator	4,732	
ppz	???	
Number of strokes	2	

Next
Cancel
Back
Undo
Help

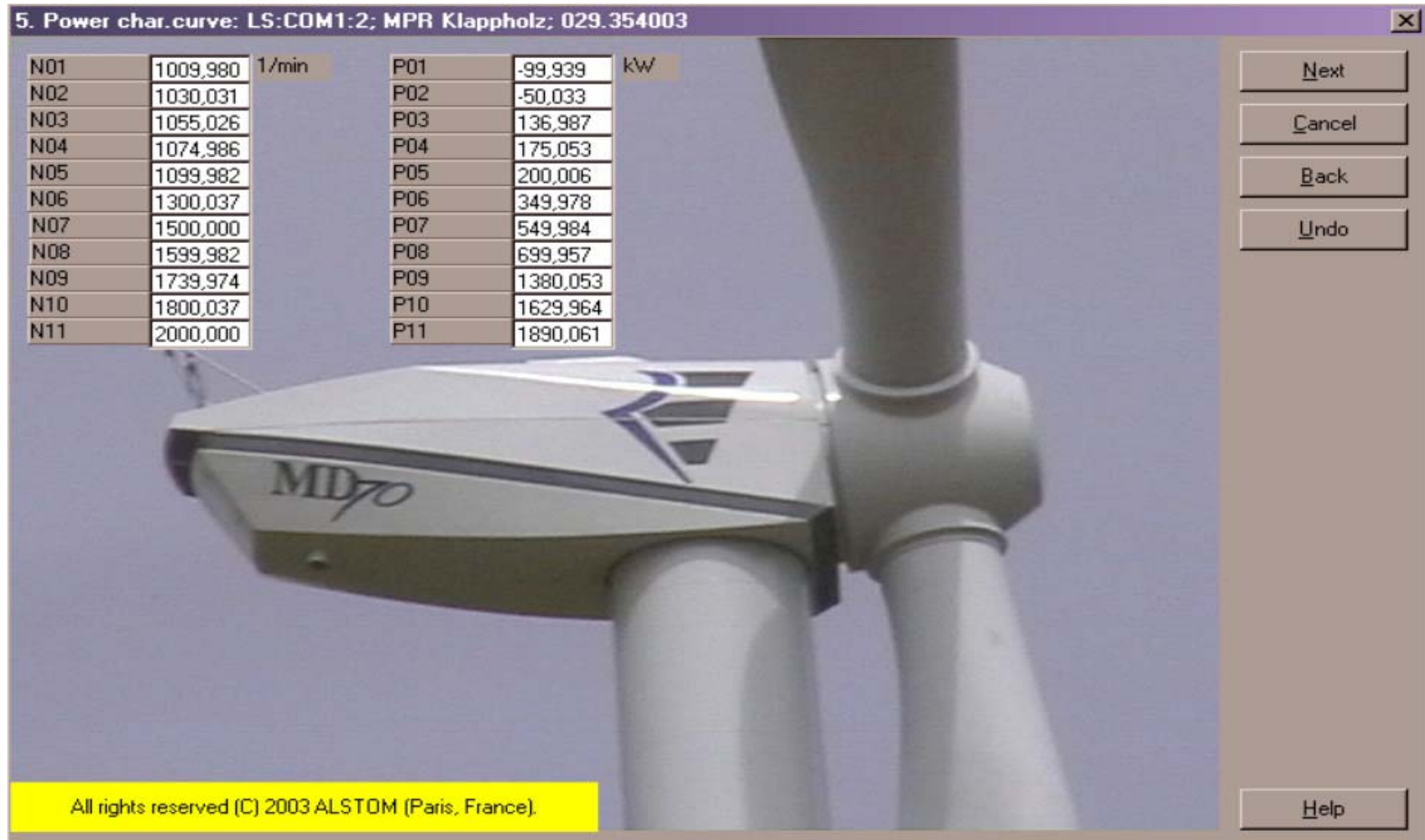
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变频器—调试 (Converteam)

功率曲线参数设置

5. Power char. curve: LS:COM1:2; MPR Klappholz; 029.354003

N01	1009,980	1/min	P01	-99,939	kW
N02	1030,031		P02	-50,033	
N03	1055,026		P03	136,987	
N04	1074,986		P04	175,053	
N05	1099,982		P05	200,006	
N06	1300,037		P06	349,978	
N07	1500,000		P07	549,984	
N08	1599,982		P08	699,957	
N09	1739,974		P09	1380,053	
N10	1800,037		P10	1629,964	
N11	2000,000		P11	1890,061	



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变频器——调试 (Converteam)

力矩与转速给定-反馈调整

6. Adaption demand: LS:COM1:2; MPR Klappholz; 029.354003

Analogeingänge 4...20mA > Analog inputs

Specification torque	9030	Nm	
X1 Wmd analog	19,239	%	A/D-channel5 26,857 %
X2 Wmd analog	97,272	%	
Y1 Wmd analog	-10,743	%	Drehmoment bei 4mA, bezogen auf "Normmoment" > Torque at 4mA, rel. to "Specification torque"
Y2 Wmd analog	100,000	%	Drehmoment bei 20mA, bezogen auf "Normmoment" > Torque at 20mA, rel. to "Specification torque"
Wmd 4-20 mA	0,055	%	Drehmomentsollwert, bezogen auf "Normmoment" > Torque reference, rel. to "Specification torque"

X1 WPhi	19,630	%	A/D-channel4 58,207 %
X2 WPhi	97,369	%	
WPhi max.(Ind.)	-28,713	%	Ind. Phasenwinkel 0...-30° (4mA), bezogen auf 90° > Ind. phase angle 0...-30° (4mA), rel. to 90°
WPhi max.(Kapaz.)	28,713	%	Kap. Phasenwinkel 0...30° (20mA), bezogen auf 90° > Cap. phase angle 0...30° (20mA), rel. to 90°
WPhi 4-20 mA	-0,13	*	Phasenwinkel-Sollwert, bezogen auf "Normmoment" > Phase angle reference, rel. to "Specification torque"

Analogausgänge 4...20mA > Analog outputs

< Torque outp. 319A - Actual value of torque

Test: Soll-Drehmomentausgabe = Adresse 3F5AH auswählen. (Drehmoment-Istwert = Adresse 319AH)
> Test: Reference torque output, select address 3F5AH, (torque Feedback signal = Address 319AH)

Outp. Xn max.	2200	1/min	
Outp. speed test	<input type="checkbox"/>		Test: Drehzahlausgabe, Vorgabe über Test-Parameter
Test outp. speed	2200	1/min	Test: Speed output, reference via test parameter

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Next
Cancel
Back
Undo
Help

变频器——调试 (Converteam)

励磁曲线及同期调整

7. Adaption: LS:COM1:2; MPR Klappholz: 029.354003

Schritt 1: Abgleichmodus aktivieren > Step 1: Set adjust. mode

Logiccontrol select Terminal Steuerung auf "RS422" setzen > Set logic control on

Test modus Testbetrieb aktivieren > Set test mode

Adapt. mag. curve Abgleichmodus Mag.Kennlinie aktivieren > Set mag. current

ON RS422 Umrichter einschalten > Switch on inverter

Next

Cancel

Back

Undo

Schritt 2: Magnetisierungskennlinie abgleichen > Step 2: Adjust. mag. curve

wUs mag. curve 100,000 % Output Rus 0,000 % Adapt.magn.curr. 115,999 %

U2	50,003 %	Wert von U in "wUS Mag. Kennl." eintragen und I so einstellen, bis "Ausg.Rus" etwa Null anzeigt > Set value from U to "wUS mag. curve" and adjust until "Output Rus" is zero	I2	33,999 %
U3	74,999 %		I3	54,001 %
U4	90,002 %		I4	73,497 %
U6	109,998 %		I6	142,001 %

Schritt 3: Rotorwinkel abgleichen > Step 3: Adjust. rotor angle

Limit Rw 9,00 °

Offs. enc. angle -170,50 °

Pha. Us-Un -34,627 %

Grenze Rw=0°, dann "Offs-Geb.-Winkel" so einstellen, bis "Pha. Us-Un" etwa Null anzeigt (<1.5%), abschließend Grenze Rw=9° > Limit Rw=0°, then set value "Offs. enc. angle" until "Pha. Us-Un" is zero (<1.5%), final Limit Rw=9°

变频器——调试 (Converteam)

控制设置

8. Testmode end: LS:COM1:2; MPR Klappholz; 029.354003

ON RS422 <input type="checkbox"/>	Umrichter ausschalten > Switch off inverter	Next
Logiccontrol select Terminal	Steuerung auf "Klemmleiste" setzen > Set logic control on	Cancel
Select demand WPhi 4-20 mA	Sollwert WPhi "4-20 mA" oder "Parameter" selektieren > Select demand WPhi "4-20 mA" or "Parameter"	Back
Select demand Wmd 4-20 mA	Sollwert Wmd "Lastkennlinie" oder "4-20 mA" selektieren > Select demand Wmd "Char.curve" or "4-20 mA"	Undo
WPhi Par. 0,00 *	Wsin(Phi) Par. auf "0" setzen > Set Wsin(Phi) Par. to "0"	
Wmd par. 0,000 %	Wmd Par. auf "0" setzen > Set Wmd Par. to "0"	
Adapt. mag. curve <input type="checkbox"/>	Abgleich mag.Kennlinie Modus auf "Inaktiv" setzen > Set mag.char.curve mode "inavtive"	
Test modus <input type="checkbox"/>	Testbetrieb auf "Inaktiv" setzen > Set testmode "inactive"	

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Help

变频器—调试 (Converteam)

通讯设置

9. Modem adjustment: LS:COM1:2; MPR Klappholz; 029.354003

Istwerte > Actual value		Sollwerte > Demand	
Baudrate	19200 Baud	Baudrate	19200 Baud
Length_Parity	8 Bit, no Parity	Length_Parity	8 Bit, even parity

Individual plant Wind park

19200 Baud 19200 Baud

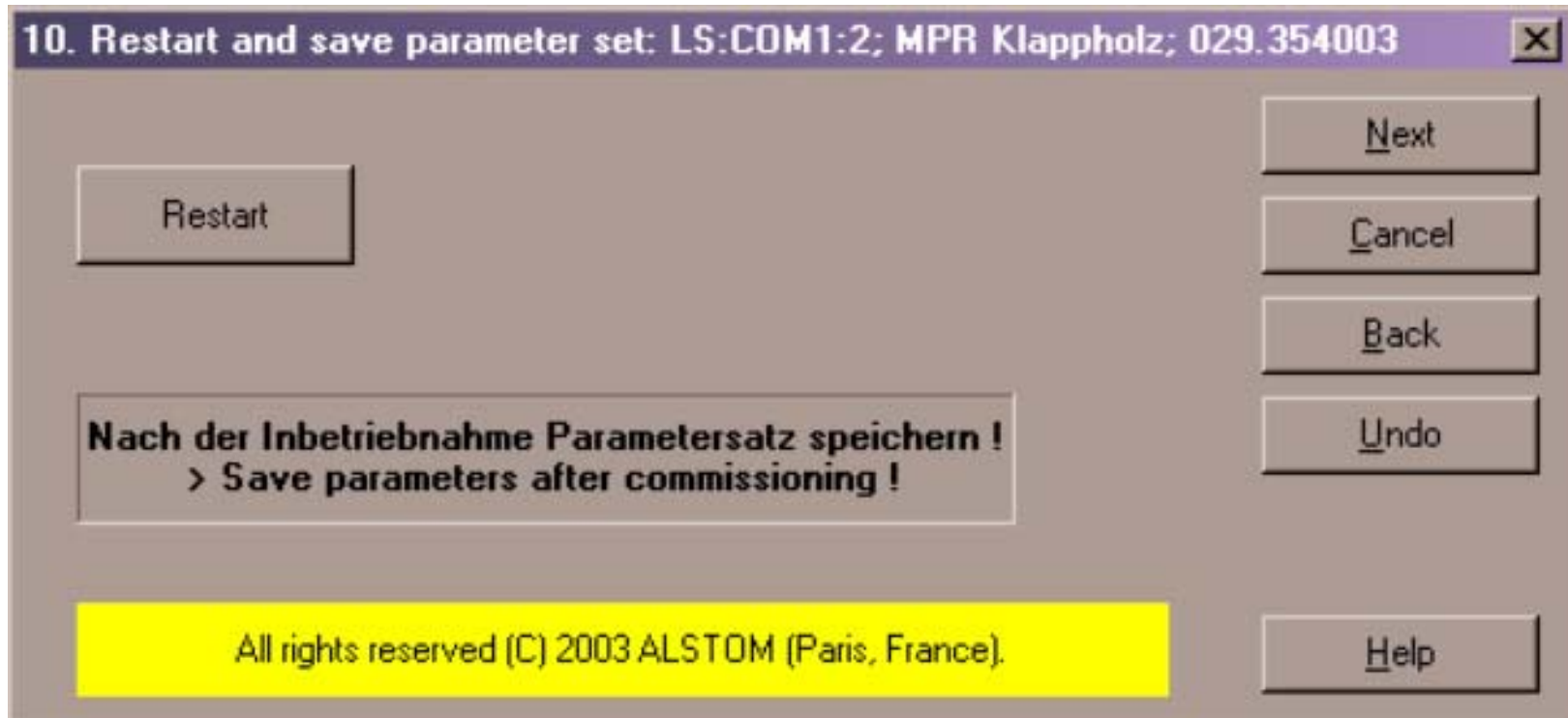
8 Bit, even parity 8 Bit, no parity

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Next
Cancel
Back
Undo
Help

变频器——调试 (Converteam)

复位



变频器—调试 (Converteam)

系统状态显示

11. System state: LS:COM1:2; MPR Klappholz; 029.354003

Ready RUN Fault QUIT RS422

Firstfault: Kein Eintrag

Next Cancel Back Undo

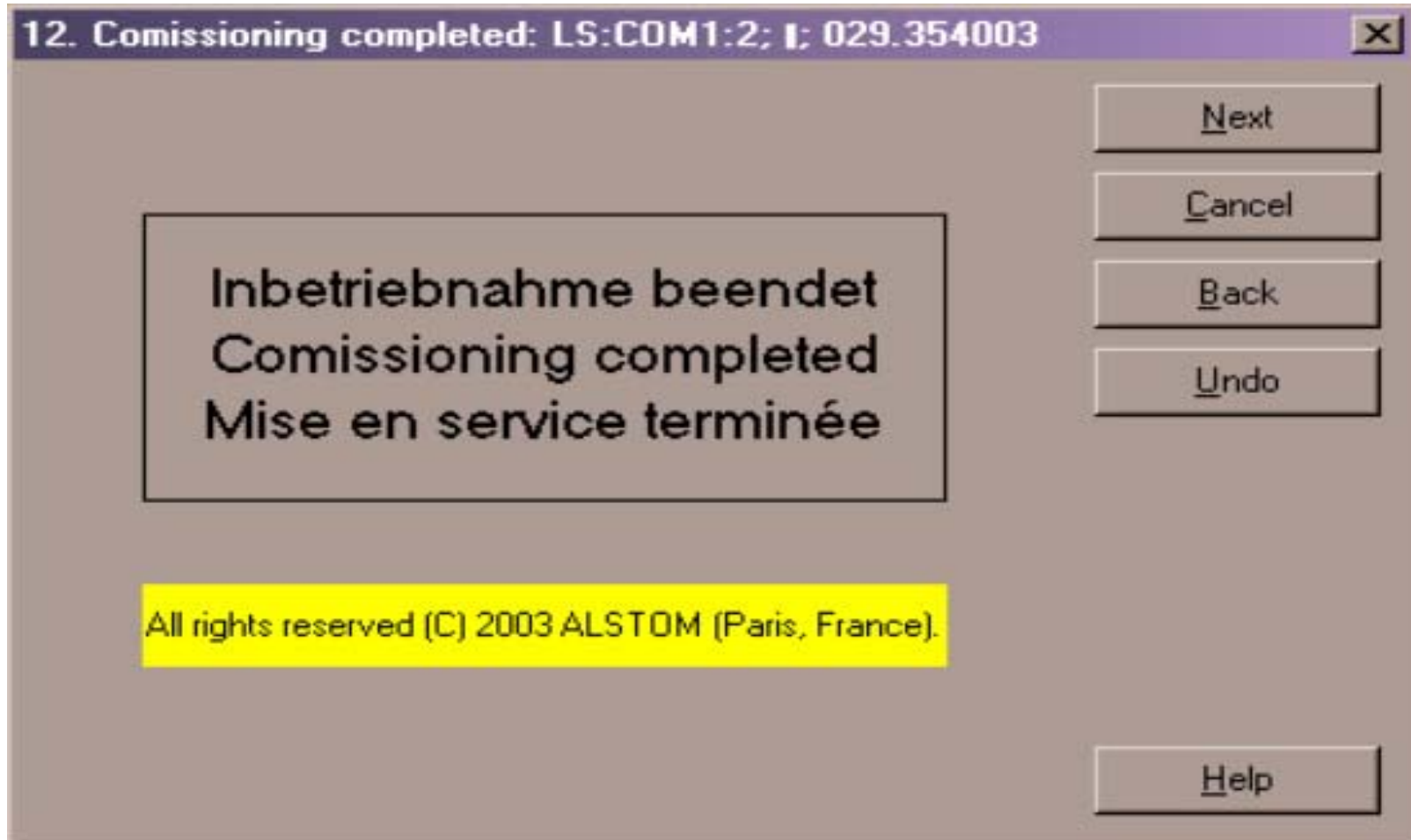
Input signals	System state	Error signals	Output signals
ON enable <input type="checkbox"/>	DN <input type="checkbox"/>	Over voltage <input type="checkbox"/>	NPR ON <input type="checkbox"/>
Synchronisation start <input type="checkbox"/>	EINV <input type="checkbox"/>	EXT. FAULT <input type="checkbox"/>	Enable AC-cnctr. <input type="checkbox"/>
RESET <input type="checkbox"/>	Patt. enable dem. <input type="checkbox"/>	Theta fault <input type="checkbox"/>	Heating ON <input type="checkbox"/>
MITA ready <input checked="" type="checkbox"/>	Pow.switch tens. <input type="checkbox"/>	BasicCAN fault <input type="checkbox"/>	Fans S <input type="checkbox"/>
	Synchronisation OK <input type="checkbox"/>	CAN-Bus fault <input type="checkbox"/>	Power reduction <input type="checkbox"/>
	PSW. ON <input type="checkbox"/>	Interrupt Wmd 4-20 <input type="checkbox"/>	Speed range limit <input type="checkbox"/>
	Ack. power switch <input type="checkbox"/>	Interrupt WPhi <input type="checkbox"/>	Shaft oscillation <input type="checkbox"/>
	Ref. release <input type="checkbox"/>		
	N area OK <input type="checkbox"/>		
	Discharge by PWM <input type="checkbox"/>		
	Phase intrpt <input type="checkbox"/>		
	Mians intrpt. <input type="checkbox"/>		

Demands		Feedback signals	
Wmd	0,037 %	Mains voltage	695,981 V
WPhi	-0,1 *	Speed	83 1/min
		xP mains	0 kW
		xQ mains	0 KVA

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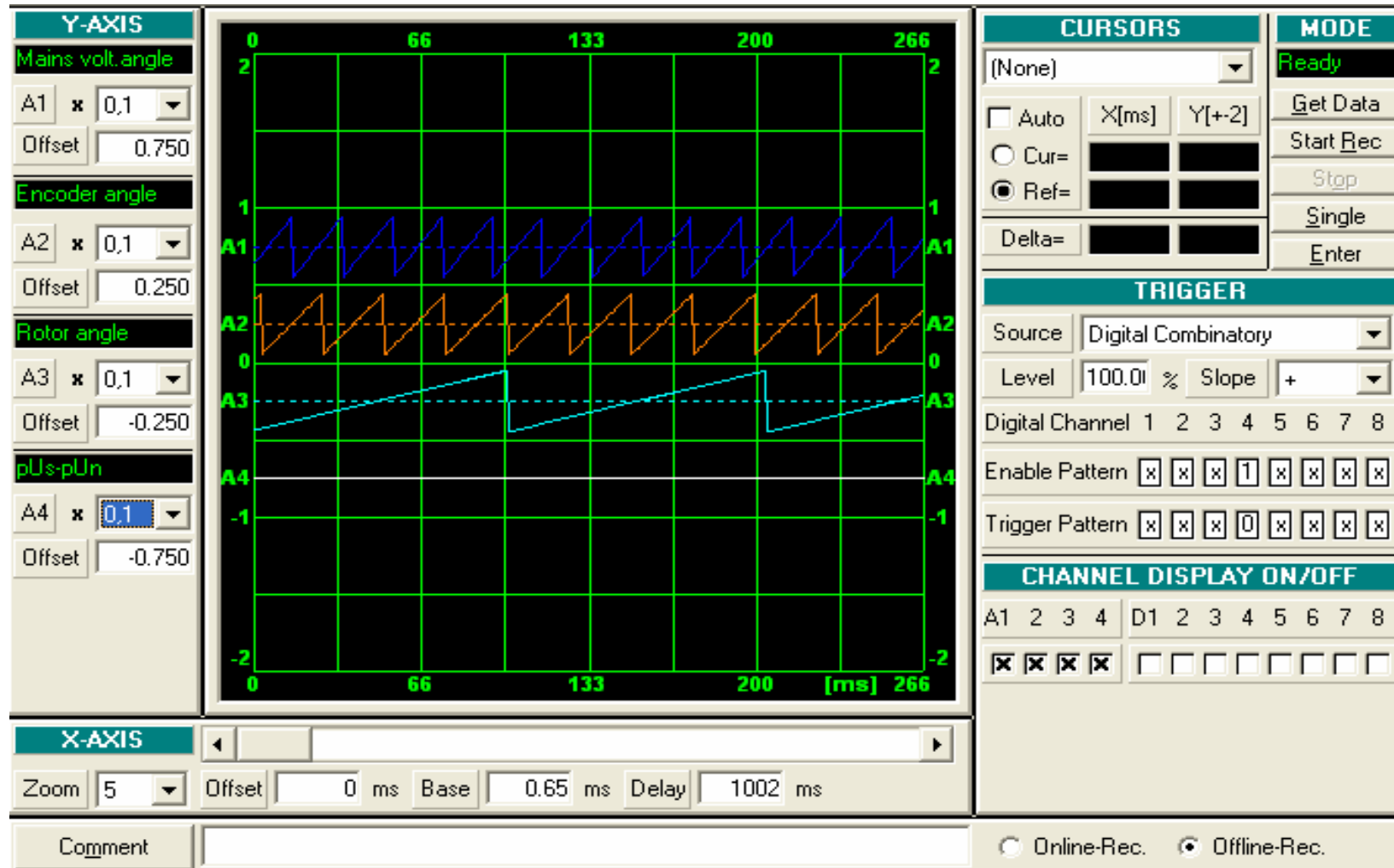
变频器—调试 (Converteam)

调试结束，准备并网



变频器——调试 (Converteam)

并网后录取的波形



谢 谢！