Control gear for Supply and Supply-Exhaust Air Handling Units

The control gear complies with European Standard

IEC 61439-2: Power switchgear and control gear assemblies

Table of contents

SAFETY INSTRUCTIONS AND ALARMS!

Prior to installation and use of the unit, please read this Manual carefully. Installation, connection and maintenance shall be executed by a qualified specialist considering the local rules, normative acts and practice. Prior to connecting peripherals to the board, please read the Manual. The Company shall not assume any liability for personal injuries or damage to property in case of failure to observe these safety requirements, if the product is modified without manufacturer's consent

Electrical power switching and unit maintenance shall be performed only by qualified employee following the manufacturer manual and applicable safety instructions.

- To reduce a potential risk during maintenance or installation works appropriate safety clothes shall be worn.
- Electrical power to power mains must be connected via appropriate rating circuit-breaker.
- All control gears need to be powered from the main switchgear equipped with appropriate protection of wires powering the control box.
- Assembly, wiring and start-up of the control gear should by done by qualified staff only.
- For applications subject to strong vibrations (1.5 mm pk-pk 10/55 Hz), secure the cables connected to the µPC using clamps placed around 3 cm from the connectors.
- The entire length of the input/output connections must be less than 30 m, according to EN 61000-6-2.
- Installation must be performed according to the standards and legislation in force in the country where the appliance is used.
- In the event of malfunctions do not attempt to repair the controller, but rather contact the service.

Without additional elements the control gears can work inside a building. Assembly outside in a moderate climate is permissible if an additional heating module is assembled.

Technical data

Control gear construction

- Casing with external mains switch and RJ11 port for connecting the HMI Advanced control panel

Main internal elements:

- short-circuit and overload protection assemblies
- connection units
- CAREL µPC3 XS controller

Operation parameters

• System	TN
• U3 rated power supply voltage:	~230V / 3N~400V
• Ui rated insulation voltage :	400V
• Uimp rated impulse withstand voltage:	2,5kV
• Rated short-time withstand current Icw for respective circuits - effective value of alternating current component withstood during 1 second, i.e.: short-circuit current expected at rated connecting voltage:	6kA
• Rated peak withstand current (ipk) at cosϕ= 0.5:	10,2kA
• rated short-circuit current:	6kA
• coincidence factor 0.9:	0,9
• rated frequency:	50..60Hz ±1Hz
• protection class:	IP54
• acceptable operating temperature:	0÷40°C
• supply voltage of control circuits:	24V DC
• EMC environment:	1

Short-circuit and overload protection

- Supply VFD, EC motors *1F1M – 1F5M (gG32A)*
- Exhaust VFD, EC motors *2F1M – 2F5M (gG32A)*
- Water pump, rotary wheel drive *F1 (B6)*
- Lighting circuit *F2 (B6)*
- Control signal protection 230Vac *F3 (2,5A)*
- Control signal protection 24Vdc *F4 (2,5A)*

Relay pump

- Pump *K1*

Control circuit

- Relay outputs
  (NO1, NO2, NO3) – C1; (NO4, NO5, NO6)-C2; NO7-C7
- Analog inputs
  (B1, B2, B3, B4, B5, B6) – GND
- Analog outputs
  (Y1, Y3) - GND; (AO1, AO2) -GND
- Digital inputs
  (DI1, DI2, DI3, DI4, DI5, DI6) – GND
- Communication protocol
  RS485 (ModBus Master); Modbus TCP/IP

Table I/O

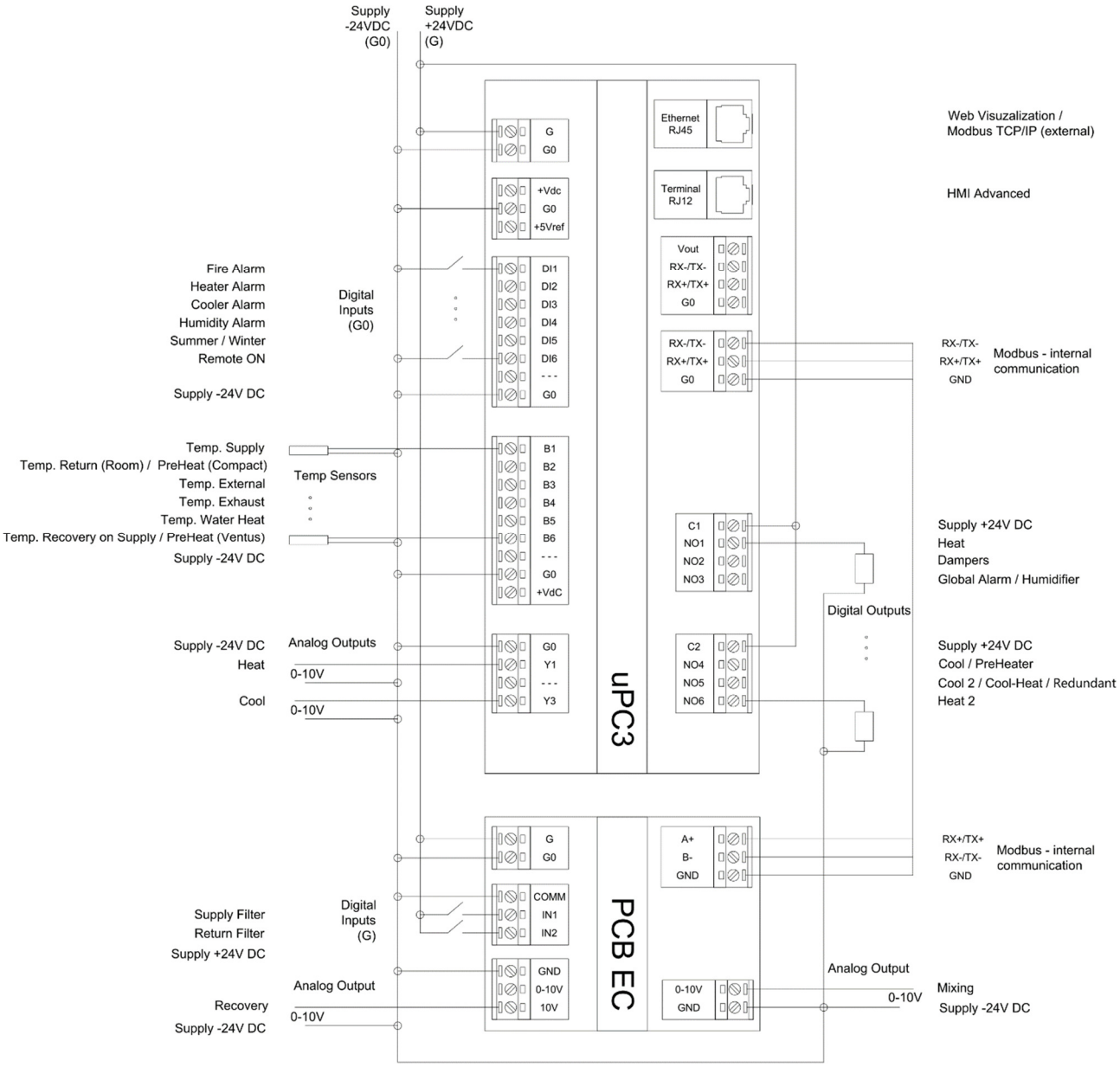
UPC3	
Supply	
G	+24V DC
G0	-24V DC
Digital Inputs	
DI1	Fire Alarm
DI2	Heater Alarm
DI3	Cooler Alarm
DI4	Humidity Alarm
DI5	Summer / Winter
DI6	Remote ON
Relay Outputs	
NO1	Heat
NO2	Dampers
NO3	Global Alarm / Humidifier
NO4	Cool / PreHeater
NO5	Cool 2 / Cool-Heat / Redundant
NO6	Heat 2

UPC3	
Analog Inputs	
B1	Temp. Supply
B2	Temp. Return (Room) / PreHeat (for Compact AHU)
B3	Temp. External
B4	Temp. Exhaust
B5	Temp. Water Heat
B6	Temp. Recovery on Supply / PreHeat (for Ventus AHU)
Analog Outputs	
Y1	Heating
Y2	Cooling
Communication	
Ethernet RJ-45	Web Visualization / Modbus TCP/IP (external)
RS-485	Modbus RTU Master (internal)
pLan	HMI Advanced – pGD1

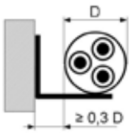
PCB EC	
Supply	
24V	+24V DC
24V	-24V DC
Analog Outputs	
AIN 10V	Recovery
AOUT 0-10V	Mixing

PCB EC	
Digital Inputs	
IN1	Supply Filter
IN2	Return Filter
Communication	
RS-485	Modbus RTU Slave (internal)

Connection controller diagram



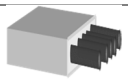
Cabling



Connect power leads of the control gear and frequency converter of the fan drive according to the Electric diagram.

The wire cross-sections have been selected for long term current capacity for cables arranged in the air (supported on brackets, cable racks, in perforated trays) with spacing from the wall of min. 0.3 cable diameter, insulated with PVC, for 3-conductors loaded.

Due to the protection selectivity, length, cable placement method and short-circuit currents, revise the feeders' cross-sections in the table below.

Type	Picture	Ddescription	Parameters
[1]		Control wires with copper cores with a shield. PVC isolation.	Nominal voltage: 300/500 V Ambient temperature: –30 to 80°C
[2]		Copper cores. PVC isolation.	Nominal voltage: 450/750V Ambient temperature: from –40 to 70°C
[3]		Copper cores. PVC isolation.	Nominal voltage: 150 V Ambient temperature: –20…60°C
[4]		Flat communication cable without shield.	Nominal voltage: 150V Ambient temperature: –20…60°C

Name of element	Symbol	Type	Name of element
Controller	N1	–	–
Fire alarm switch	S1F	[2]	2x0,5
Multi–function switch	S6	[2]	2x0,5
Optional multi–function switch	S7	[2]	2x0,5
Supply air temperature sensor	B1	[1]	2x0,5
Room/ Return air temperature sensor	B2	[1]	2x0,5
External air temperature sensor	B3	[1]	2x0,5
HW back–water temperature sensor	B7	[1]	2x0,5
HE alarm switch	VTS–E–005 ter. 22:23	[2]	2x0,5
HW anti–frost air side thermostat	S2F	[2]	2x0,5
HW analog controlled valve	Y1	[1]	3x0,5
CW analog controlled valve	Y2	[1]	3x0,5
HE power rate control input	VTS–E–005 ter. 15:21	[1]	3x0,5
HW circulating pump contactor	M1		3x1,5
CW analog controlled valve	Y2	[1]	3x0,5
Chiller / refrigerating unit / heat pump alarm switch	S5F	[2]	2x0,75
Chiller start input	E1	[2]	2x0,75
Refrigerating unit start input – I stage	E2.1	[2]	2x0,75
Refrigerating unit start input – II stage	E2.2	[2]	2x0,75
Recirculation damper actuator	Y3	[1]	3x0,75
Cross–flow bypass actuator	Y4	[1]	3x0,75
AHU alarm	E4	[2]	2x0,75
HMI Basic UPC – reduced function interface	N2	[3]	UTP 1x2
HMI Advanced UPC – full function interface	N3	[4]	8x0,1
Supply elements			
Intake damper actuator	1Y1	[2]	2x0,75 / 3x0,75
Exhaust elements			
Redundant damper actuator – exhaust	2Y1	[2]	3x0,75

Table A

Motor rated power	Motor rated current	FC protection	FC supply cable	Motor cable	Control gear power supply cable		Control gear rated current	
[kW]	[A]		[mm^2]	[mm^2]	[mm^2]		[A]	
3~230V / 50Hz		1~230V / 50Hz			supply AHU 1~230V	supply- exhaust 1~230V	supply AHU L1	supply- exhaust L1
0,55	2,5	gG10	3x1,5	4x1	3x1,5	3 x TABLE C	14,5	TABLE B
0,75	3,0	gG10	3x1,5	4x1,5	3x1,5		15,5	
1,1	4,5	gG10	3x1,5	4x1,5	3x1,5		17,5	
1,5	6,0	gG20	3x2,5	4x1,5	3x2,5		18,5	
2,2	8,0	gG20	3x2,5	4x1,5	3x2,5		21,5	
3x400V / 50Hz		3x400V / 50Hz			supply AHU 3~400V	supply- exhaust 3~400V	supply AHU L1 / L2 / L3	supply- exhaust L1 / L2 / L3
3,0	6,0	gG16	4x2,5	4x2,5	5x1,5	5 x TABLE C	8 / 7,5 / 13	TABLE B
4,0	8,0	gG16	4x2,5	4x2,5	5x1,5		10 / 9,5 / 15	
5,5	11,0	gG20	4x2,5	4x2,5	5x2,5		13 / 12,5 / 18	

Table B

Motor power [kW]	0,55kW			0,75kW			1,1kW			1,5kW			2,2kW			3kW			4kW			5,5kW		
	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
only supply	14,5			15,5			17,5			18,5			21,5			8,0	7,5	13,0	10,0	9,5	15,0	13,0	12,5	18,0
0,55kW	19,0																							
0,75kW	20,0			21,0																				
1,1kW	22,0			23,0			25,0																	
1,5kW	23,0			24,0			26,0			27,0														
2,2kW	26,0			27,0			29,0			30,0			33,0											
3kW				12,5	10,0	13,0	14,0	10,0	13,0	15,5	10,0	13,0	17,5	10,0	13,0	14,0	13,5	19,0						
4kW				14,5	12,0	15,0	16,0	12,0	15,0	18,5	12,0	15,0	19,5	12,0	15,0	16,0	15,5	21,0	18,0	17,5	23,0			
5,5kW				17,5	15,0	18,0	18,0	15,0	18,0	20,2	15,0	18,0	22,5	15,0	18,0	19,0	18,5	24,0	21,0	20,5	26,0	24,0	23,5	29,0
7,5kW				21,5	19,0	22,0	23,0	19,0	22,0	24,5	19,0	22,0	26,5	19,0	22,0	23,0	22,5	28,0	25,0	24,5	30,0	28,0	27,5	33,0
11kW				27,5	25,0	28,0	29,0	25,0	28,0	30,5	25,0	28,0	32,5	25,0	28,0	29,0	28,5	34,0	31,0	30,5	36,0	34,0	33,5	39,0
2x4kW																24,0	23,5	29,0	26,0	25,5	31,0	29,0	28,5	34,0
2x5,5kW																30,0	29,5	35,0	32,0	31,5	37,0	35,0	34,5	40,0
2x7,5kW																38,0	37,5	43,0	40,0	39,5	45,0	43,0	42,5	48,0
2x11kW																50,0	49,5	55,0	52,0	51,5	57,0	55,0	54,5	60,0
3x4kW																								
3x5,5kW																								
3x7,5kW																								
3x11kW																								
4x4kW																								
4x5,5kW																								
4x7,5kW																								
4x11kW																								

Table B

Motor power [kW]	7,5kW			11kW			2x4kW			2x5,5kW			2x7,5kW			2x11kW			3x4kW			3x5,5kW		
	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
only supply	17,0	16,5	22,0	23,0	22,5	28,0	18,0	17,5	23,0	24,0	23,5	29,0	32,0	31,5	37,0	44,0	43,5	49,0	26,0	25,5	31,0	35,0	34,5	40,0
0,55kW																								
0,75kW																								
1,1kW																								
1,5kW																								
2,2kW																								
3kW																								
4kW																								
5,5kW																								
7,5kW	32,0	31,5	37,0																					
11kW	38,0	37,5	43,0	44,0	43,5	49,0																		
2x4kW	33,0	32,5	38,0	39,0	38,5	44,0	34,0	33,5	39,0															
2x5,5kW	39,0	38,5	44,0	45,0	44,5	50,0	40,0	39,5	45,0	46,0	45,5	51,0												
2x7,5kW	47,0	46,5	52,0	53,0	52,5	58,0	48,0	47,5	53,0	54,0	53,5	59,0	62,0	61,5	67,0									
2x11kW	59,0	58,5	64,0	65,0	64,5	70,0	60,0	59,5	65,0	66,0	65,5	71,0	74,0	73,5	79,0	86,0	85,5	91,0						
3x4kW							42,0	41,5	47,0	48,0	47,5	53,0	56,0	55,5	61,0	68,0	67,5	73,0	50,0	49,5	55,0			
3x5,5kW							51,0	50,5	56,0	57,0	56,5	62,0	65,0	64,5	70,0	77,0	76,5	82,0	59,0	58,5	64,0	68,0	67,5	73,0
3x7,5kW							63,0	62,5	68,0	69,0	68,5	74,0	77,0	76,5	82,0	89,0	88,5	94,0	71,0	70,5	76,0	80,0	79,5	85,0
3x11kW							81,0	80,5	86,0	87,0	86,5	92,0	95,0	94,5	100,0	107,0	106,5	112,0	89,0	88,5	94,0	98,0	97,5	103,0
4x4kW																			58,0	57,5	63,0	67,0	66,5	72,0
4x5,5kW																			70,0	69,5	75,0	79,0	78,5	84,0
4x7,5kW																			86,0	85,5	91,0	95,0	94,5	100,0
4x11kW																			110,0	109,5	115,0	119,0	118,5	124,0

Table B

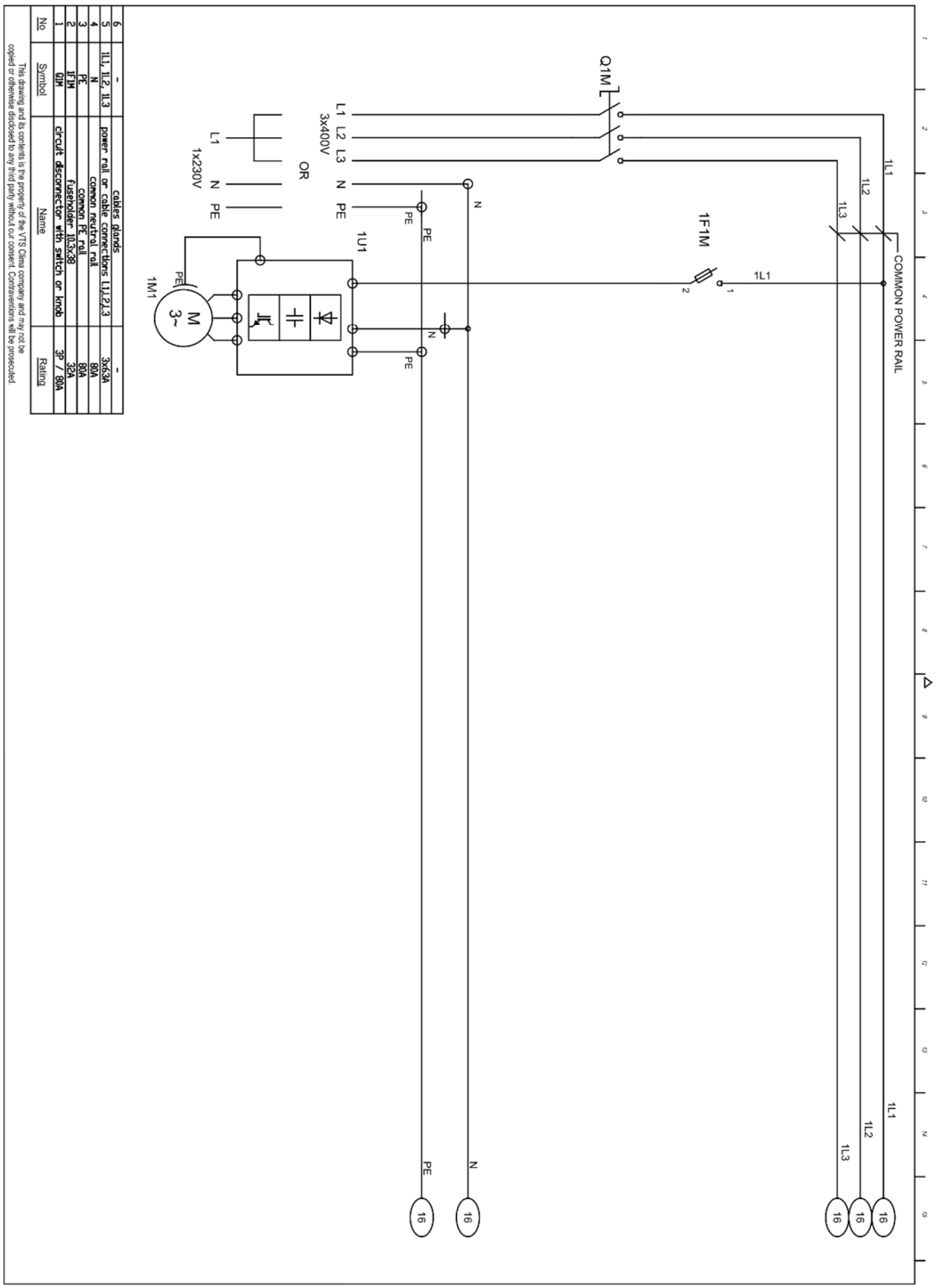
Motor power [kW]	3x7,5kW			3x11kW			4x4kW			4x5,5kW			4x7,5kW			4x11kW		
	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
only supply	47,0	46,5	52,0	65,0	64,5	70,0	34,0	33,5	39,0	46,0	45,5	51,0	62,0	61,5	67,0	86,0	85,5	91,0
0,55kW																		
0,75kW																		
1,1kW																		
1,5kW																		
2,2kW																		
3kW																		
4kW																		
5,5kW																		
7,5kW																		
11kW																		
2x4kW																		
2x5,5kW																		
2x7,5kW																		
2x11kW																		
3x4kW																		
3x5,5kW																		
3x7,5kW	92,0	91,5	97,0															
3x11kW	110,0	109,5	115,0	128,0	127,5	133,0												
4x4kW	79,0	78,5	84,0	97,0	96,5	102,0	66,0	65,5	71,0									
4x5,5kW	91,0	90,5	96,0	109,0	108,5	114,0	78,0	77,5	83,0	90,0	89,5	95,0						
4x7,5kW	107,0	106,5	112,0	125,0	124,5	130,0	94,0	93,5	99,0	106,0	105,5	111,0	122,0	121,5	127,0			
4x11kW	131,0	130,5	136,0	149,0	148,5	154,0	118,0	117,5	123,0	130,0	129,5	135,0	146,0	145,5	151,0	170,0	169,5	175,0

Table C

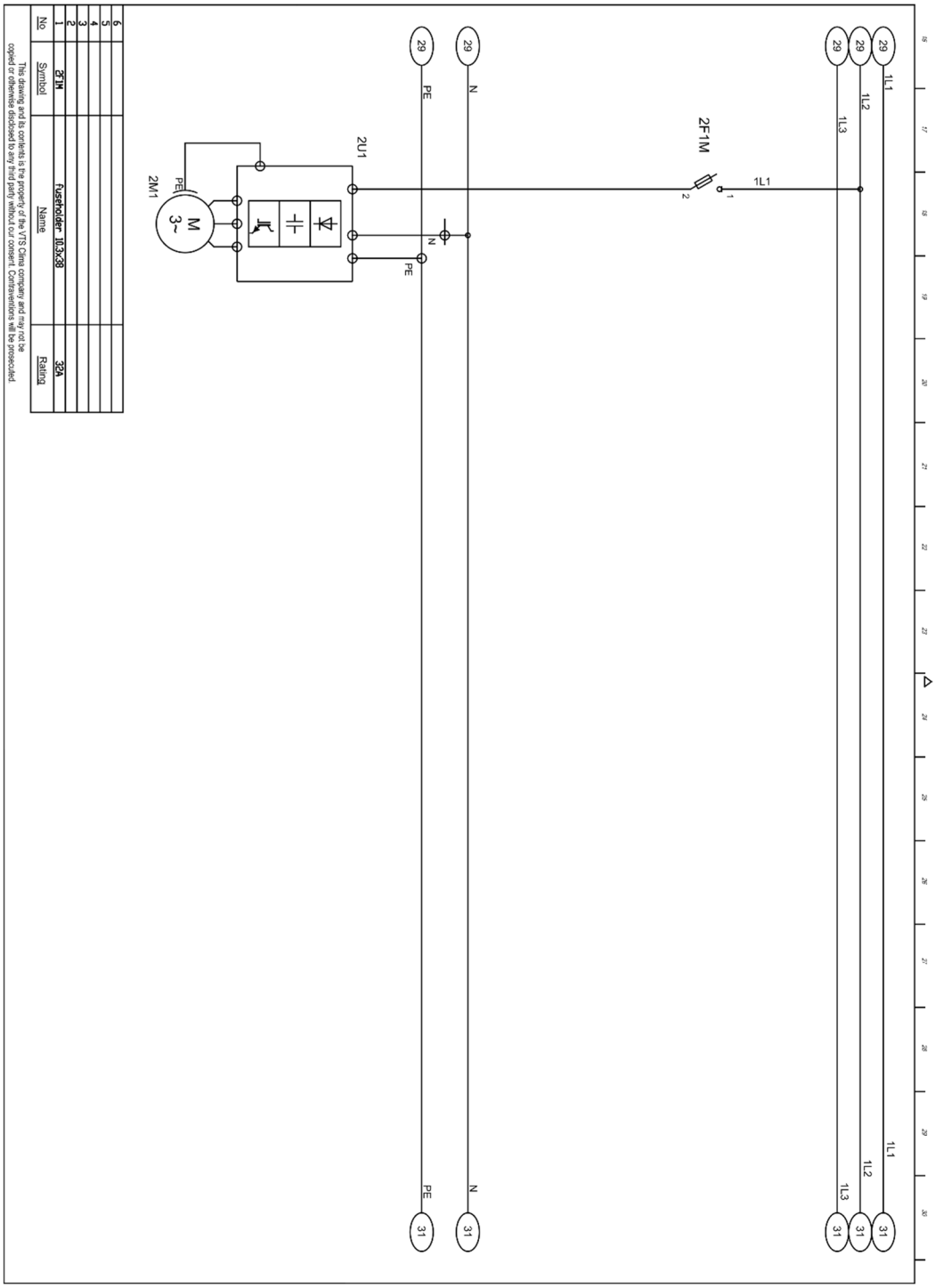
Motor power [kW]	0,55kW	0,75kW	1,1kW	1,5kW	2,2kW	3kW	4kW	5,5kW	7,5kW	11kW	2x4kW	2x5,5kW	2x7,5kW	2x11kW	3x4kW	3x5,5kW	3x7,5kW	3x11kW	4x4kW	4x5,5kW	4x7,5kW	4x11kW
	1,5	1,5	1,5	2,5	2,5	1,5	1,5	2,5	2,5	4	2,5	4	6	10	4	6	10	16	6	10	16	25
0,55kW	2,5																					
0,75kW	2,5	2,5																				
1,1kW	2,5	2,5	2,5																			
1,5kW	2,5	2,5	4	4																		
2,2kW	4	4	4	4	4																	
3kW		1,5	1,5	2,5	2,5	2,5																
4kW		1,5	2,5	2,5	2,5	2,5	2,5															
5,5kW		2,5	2,5	2,5	2,5	2,5	4	4														
7,5kW		2,5	2,5	4	4	4	4	4	6													
11kW		4	4	4	6	6	6	6	10	10												
2x4kW						4	4	6	6	10	6											
2x5,5kW						6	6	6	10	10	10	10										
2x7,5kW						10	10	10	10	10	10	10	16									
2x11kW						10	10	16	16	16	16	16	16	25								
3x4kW											10	10	16	16	10							
3x5,5kW											10	16	16	25	16	16						
3x7,5kW											16	16	25	25	16	25	25					
3x11kW											25	25	25	16 (2x)	25	16 (2x)	16 (2x)	25 (2x)				
4x4kW															16	16	25	16 (2x)	16			
4x5,5kW															16	25	25	16 (2x)	25	25		
4x7,5kW															25	25	16 (2x)	25 (2x)	25	16 (2x)	25 (2x)	
4x11kW															25 (1x) 10 (1x)	25 (1x) 10 (1x)	25 (2x)	35 (2x)	25 (1x) 10 (1x)	25 (2x)	25 (2x)	35 (2x)

Appendix 1 Circuit diagram of TYPE 1 control gear

2x1 motors 1x230V from 0,75kW to 2,2kW



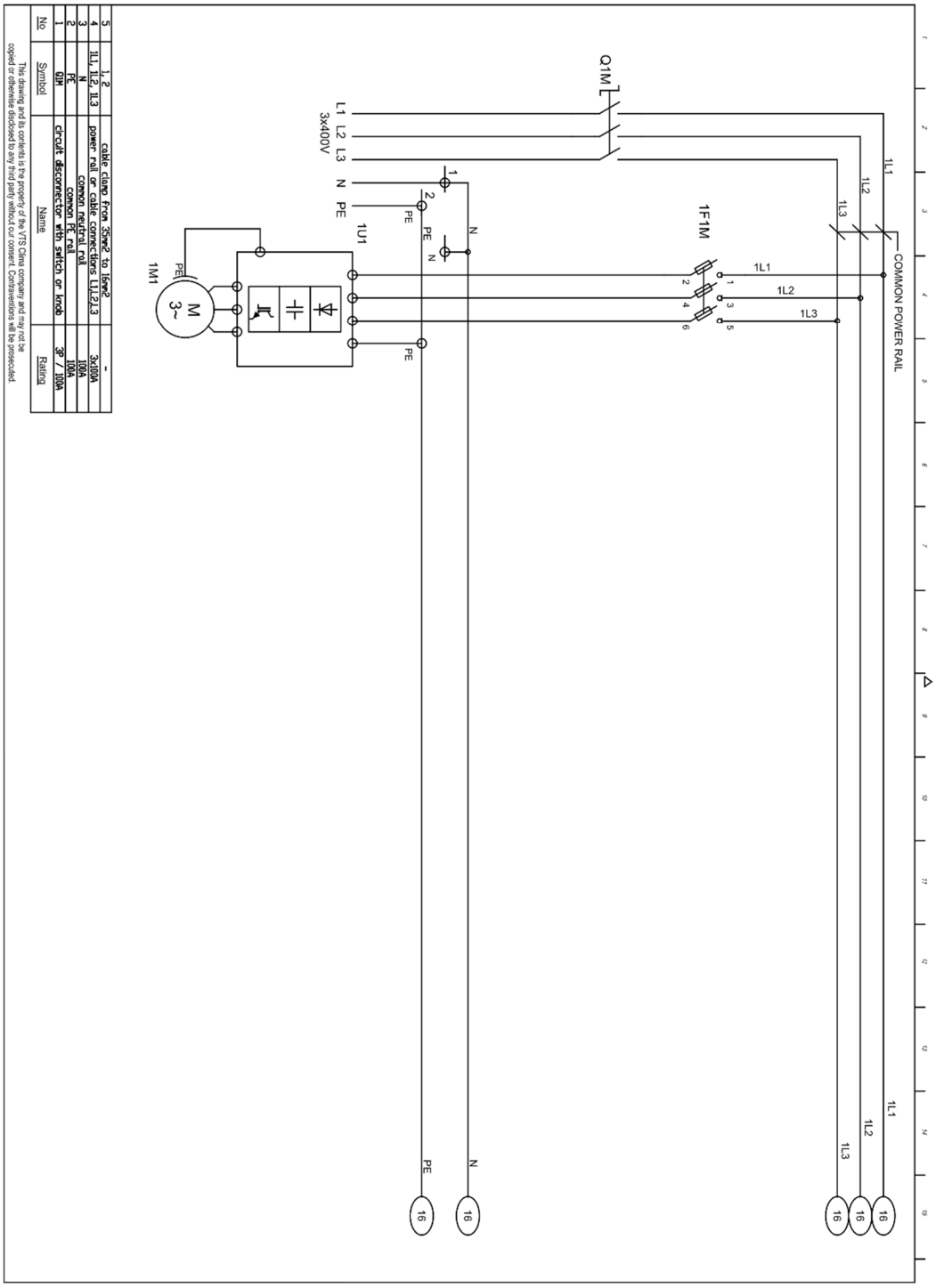
No	Symbol	Name	Rating
6	-	cables glands	-
5	1L1, 1L2, 1L3	power rail or cable connections L1,L2,L3	3x63A
4	N	common neutral rail	80A
3	PE	common PE rail	80A
2	1F1M	fuseholder 10,3x38	32A
1	Q1M	circuit disconnector with switch or knob	3P / 80A



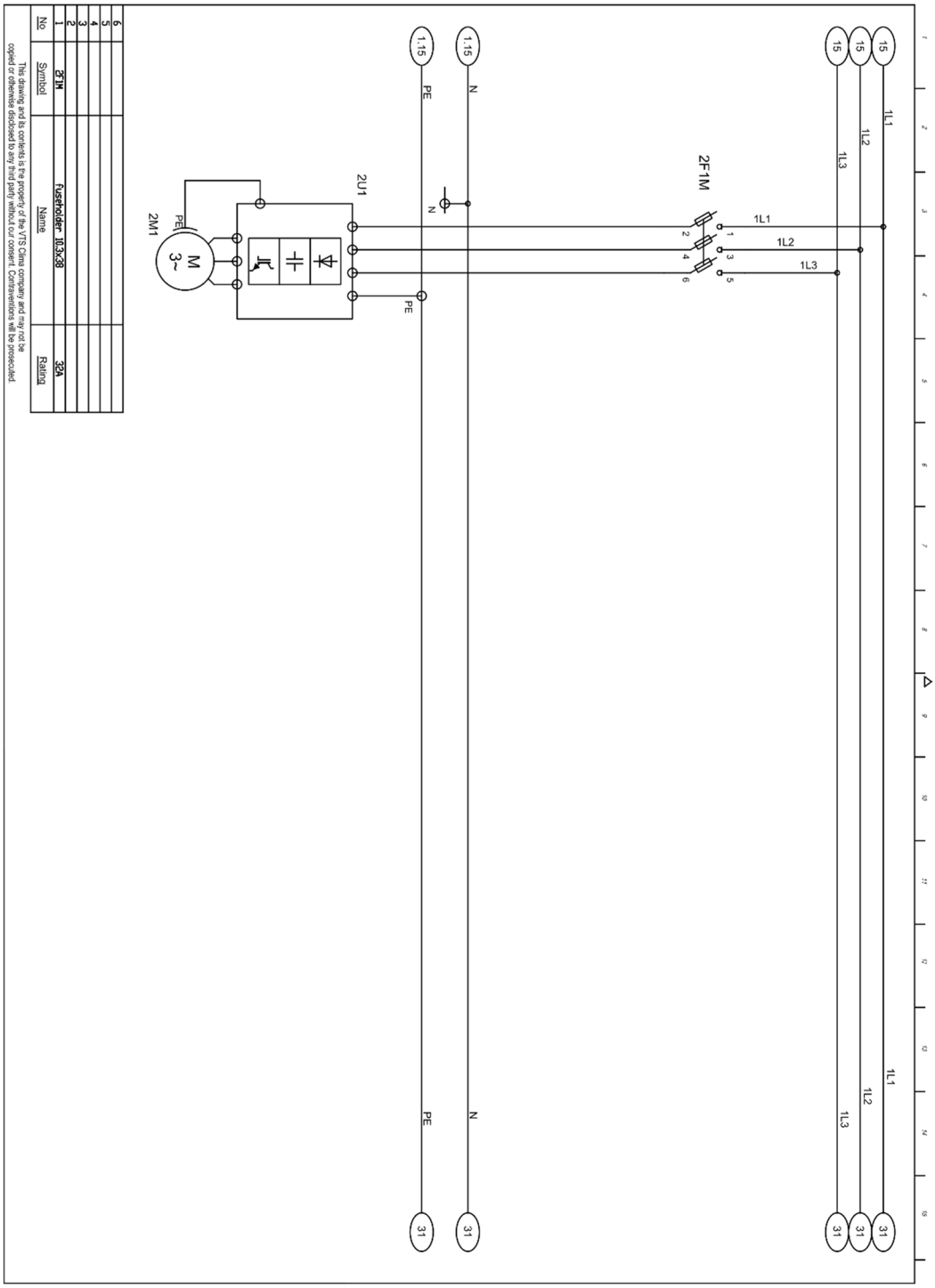
No	Symbol	Name	Rating
1	2F1M	Fuseholder 10.3x38	32A
2			
3			
4			
5			
6			

Appendix 2 Circuit diagram of TYPE 2 control gear

2x1 3x400V from 0,75kW to 11kW



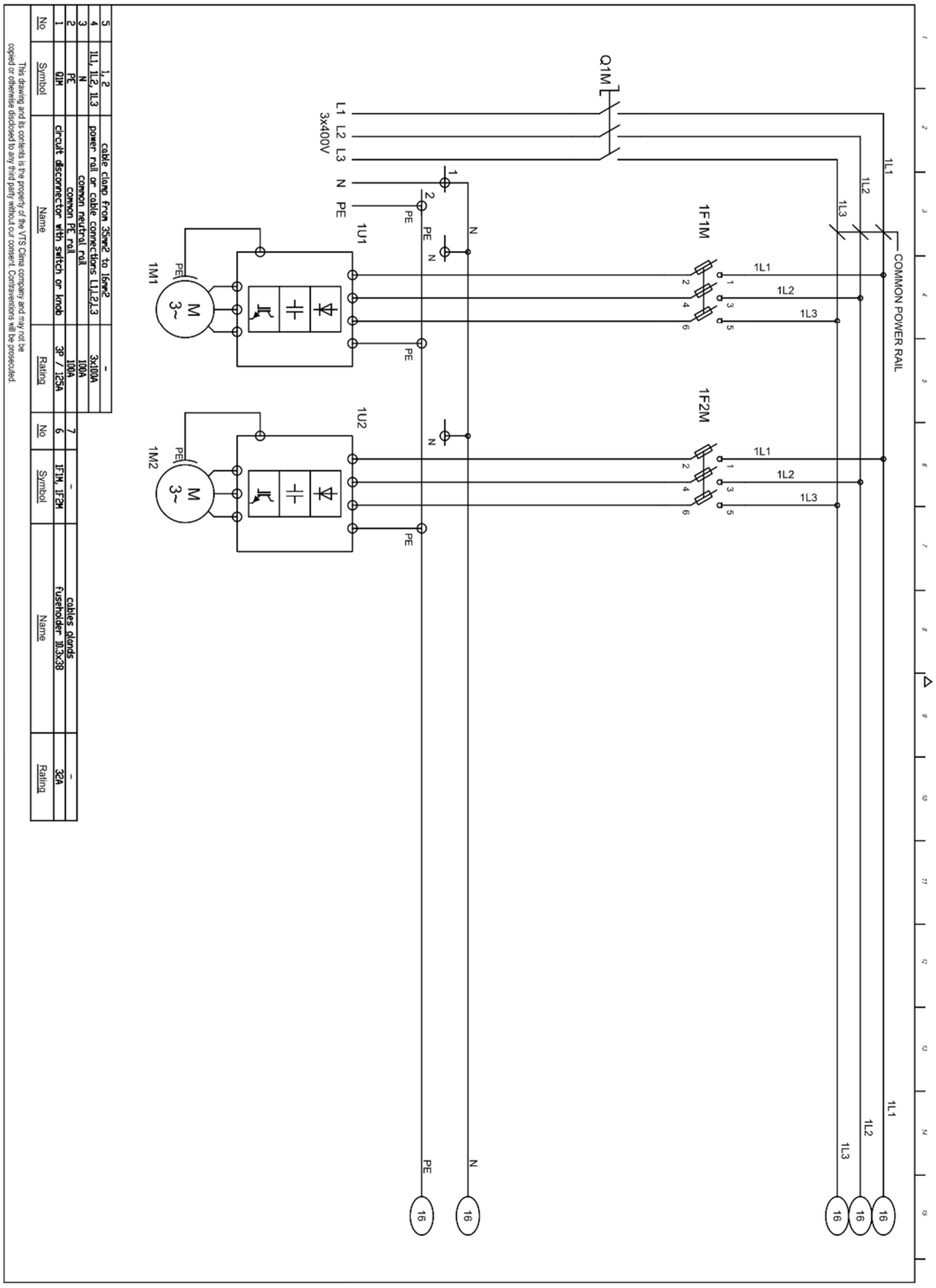
No	Symbol	Name	Rating
5	1, 2	cable clamp from 35mm2 to 16mm2	-
4	1L1, 1L2, 1L3	power rail or cable connections L1,L2,L3	3x100A
3	N	common neutral rail	100A
2	PE	common PE rail	100A
1	Q1M	circuit disconnector with switch or knob	3P / 100A

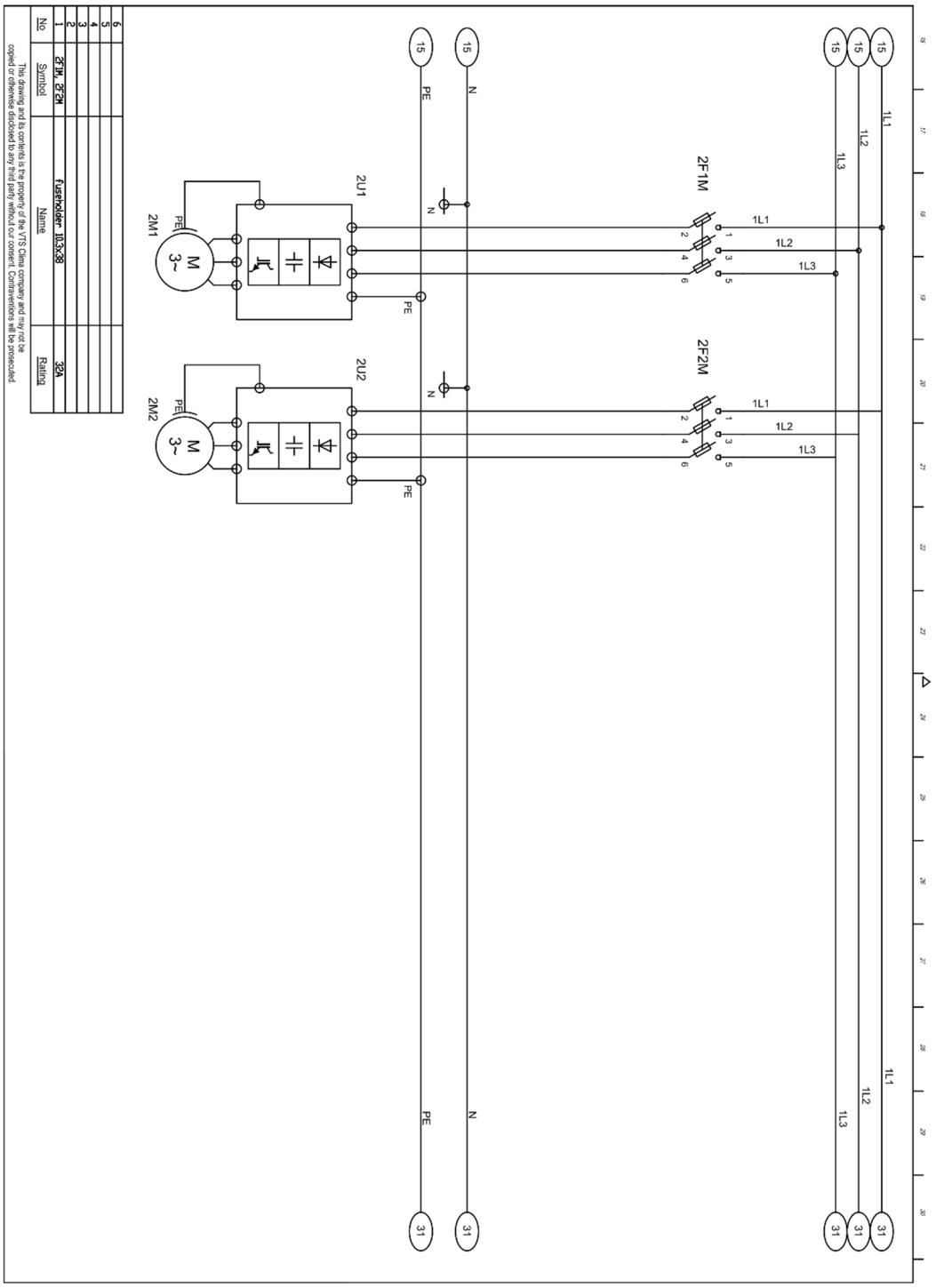


No	Symbol	Name	Rating
1	2F1M	Fuseholder 10.3x38	32A

Appendix 3 Circuit diagram of TYPE 3 control gear

2x2 motors 3x400V from 0,75kW to 11kW

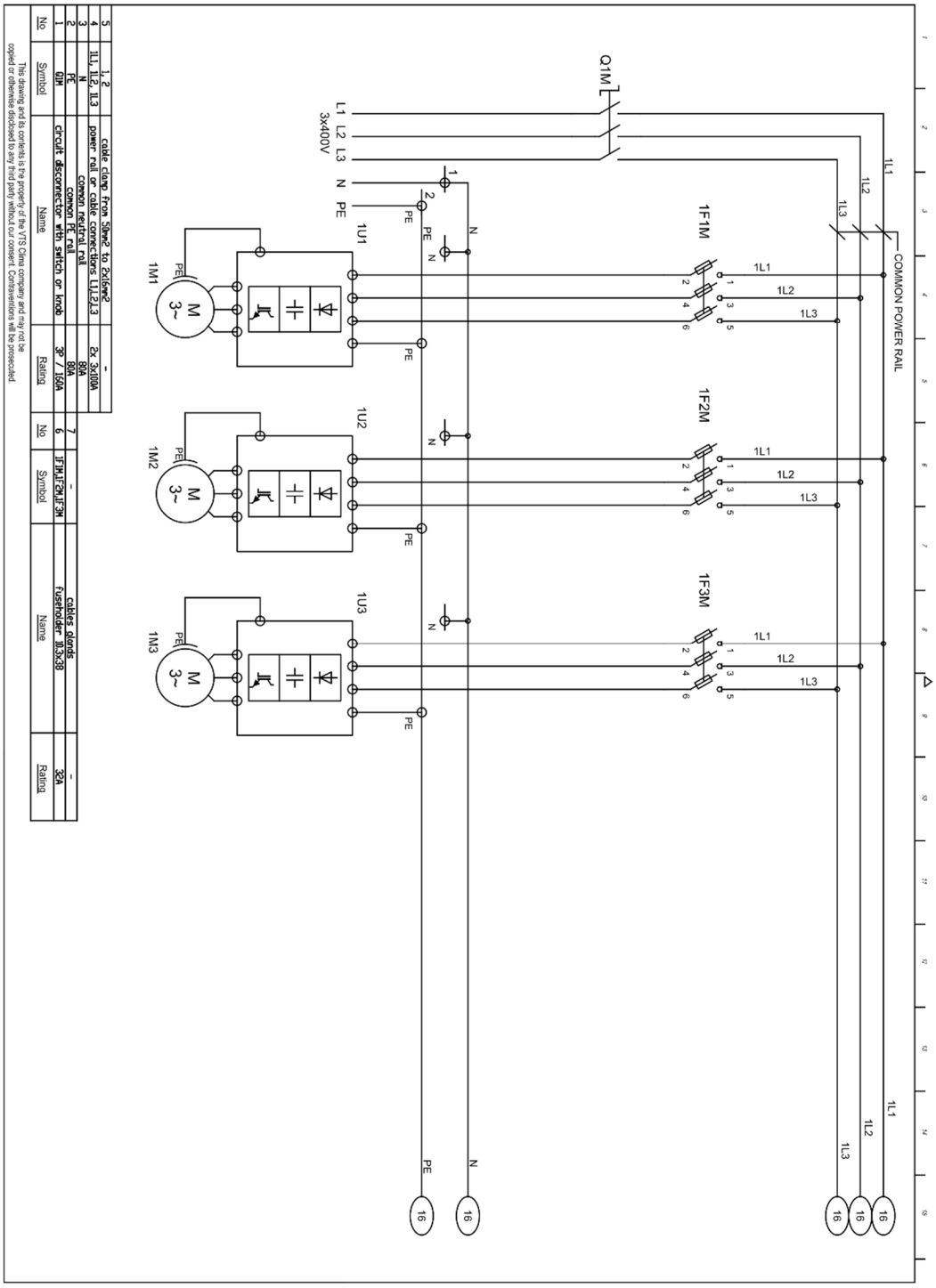




No	Symbol	Name	Rating
1	2F1M, 2F2M	Fuseholder- 10.3x38	32A
2			
3			
4			
5			
6			

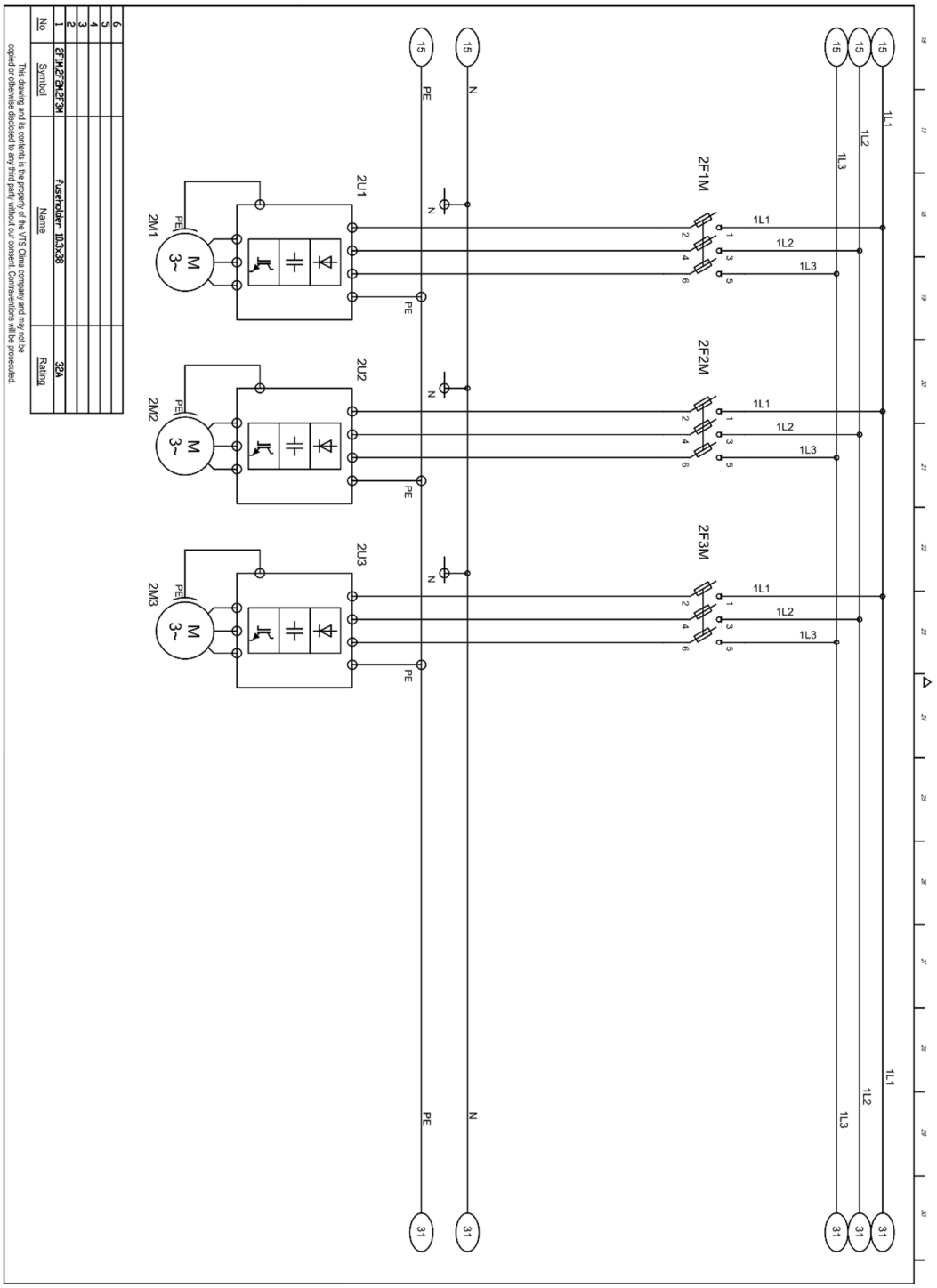
Appendix 4 Circuit diagram of TYPE 4 control gear

2x3 motors 3x400V from 0,75kW to 11kW



No	Symbol	Name	Rating
5	1, 2	cable clamp from 50mm2 to 2x16mm2	-
4	1L1, 1L2, 1L3	power rail or cable connections L1/L2/L3	2x 3x100A
3	N	common neutral rail	80A
2	PE	common PE rail	
1	Q1M	circuit disconnector with switch or knob	3P / 160A

No	Symbol	Name	Rating
7	-	cables glands	-
6	1F1M,1F2M,1F3M	fuseholder JM3x38	32A


No
Symbol
Name
Rating
1
2F1M,2F2M,2F3M
Fuseholder 10.3x38
32A
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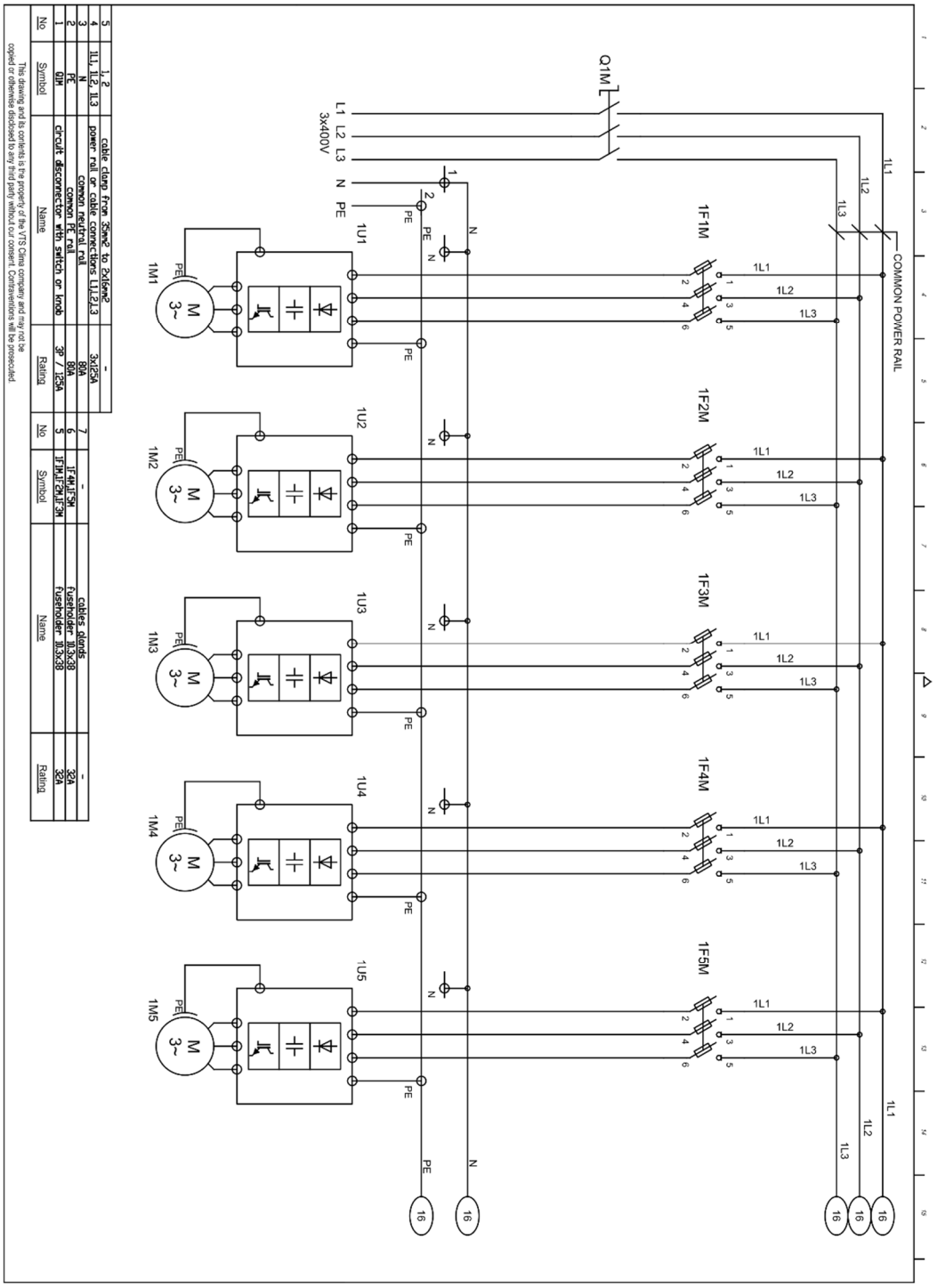
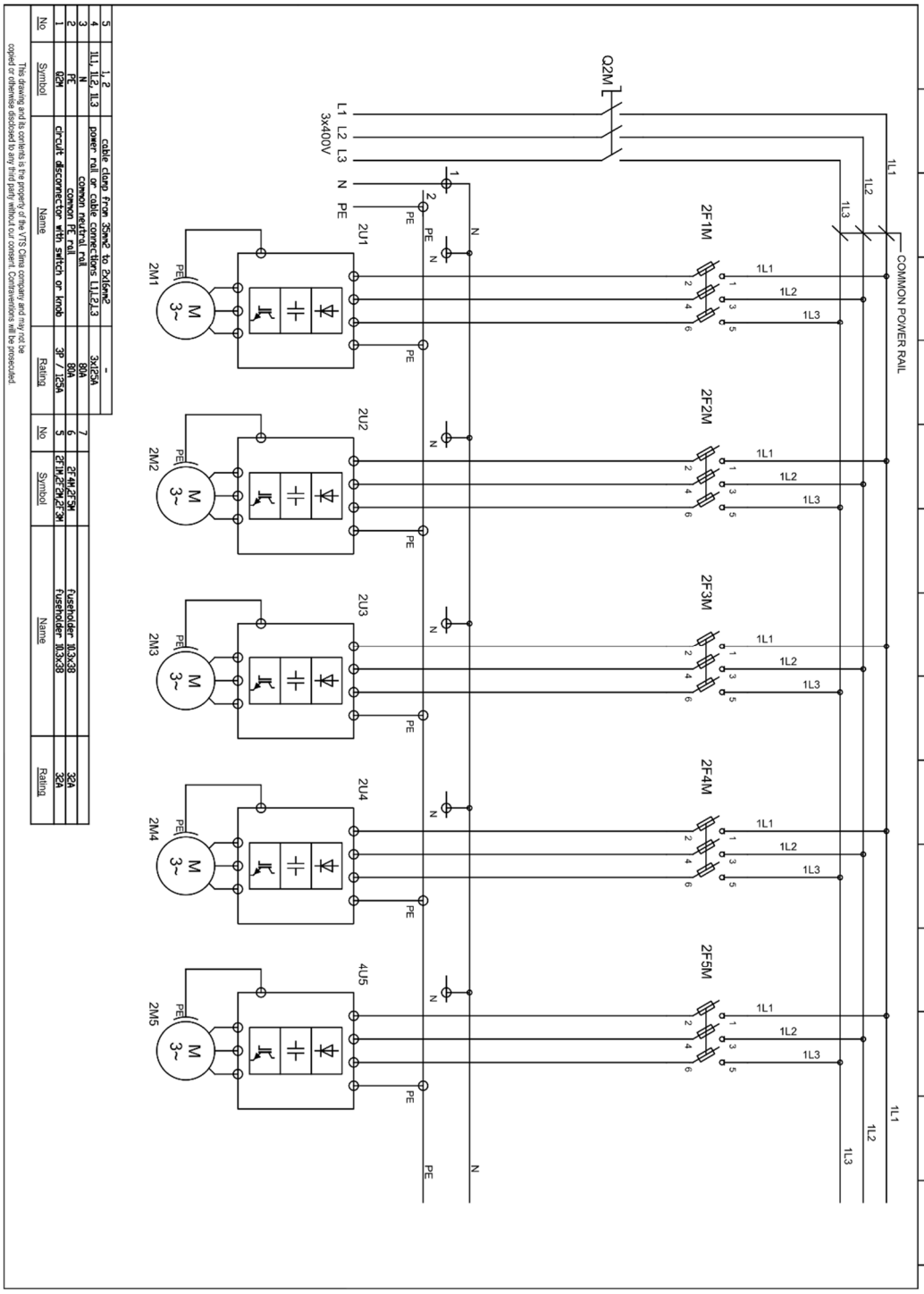
2F1M
2F2M
2F3M
2U1
2U2
2U3
2M1
2M2
2M3
1L1
1L2
1L3
PE
N
15
31

Appendix 5 Circuit diagram of TYPE 5 control gear

2x5 motors 3x400V from 0,75kW to 11kW



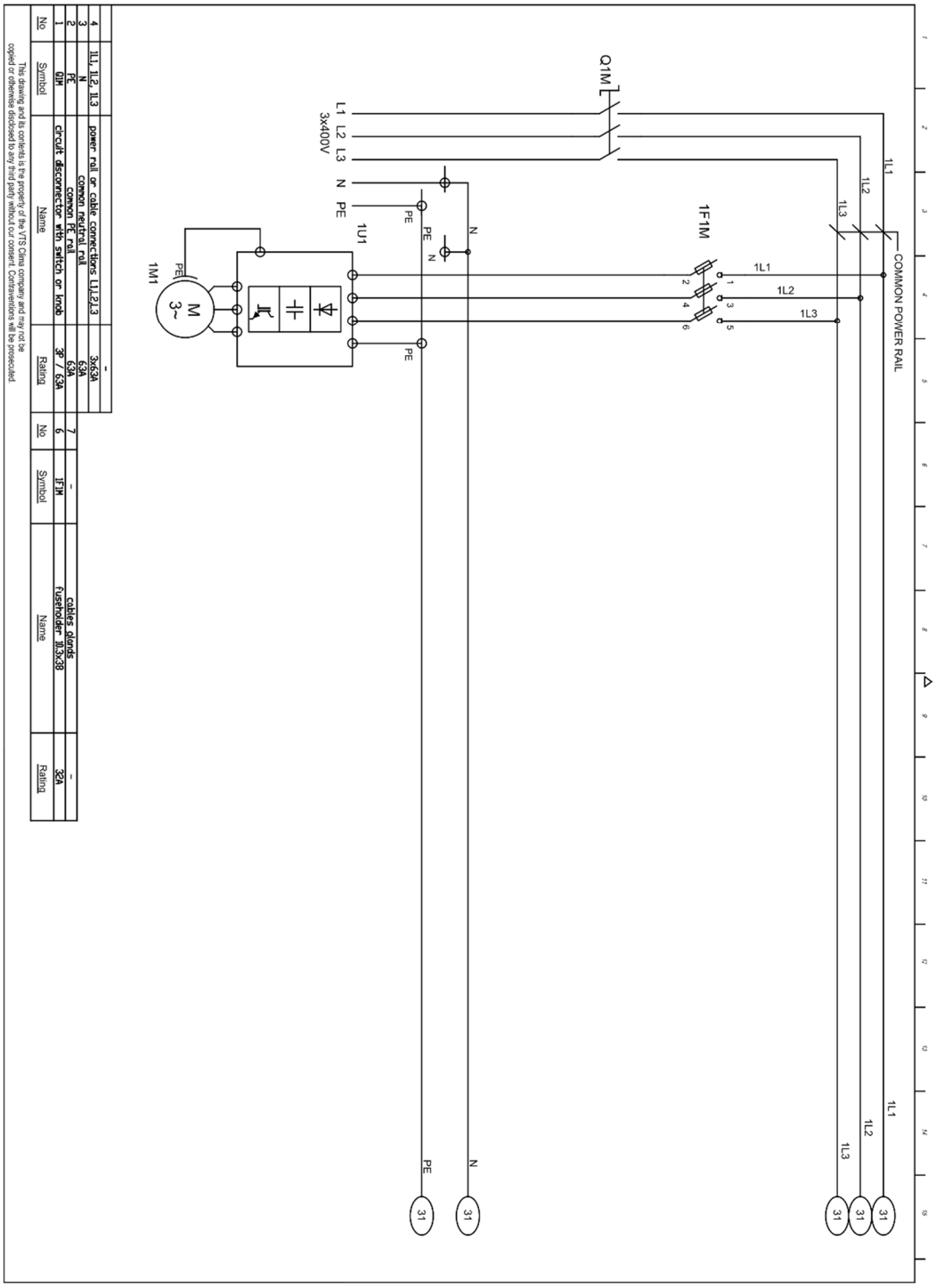


No	Symbol	Name	Rating
5			
4	1, 2	cable clamp from 35mm2 to 2x16mm2	-
3	1L1, 1L2, 1L3	power rail or cable connections L1/L2/L3	3x125A
2	N	common neutral rail	80A
1	PE	common PE rail	80A
	Q2M	circuit disconnector with switch or knob	3P / 125A

No	Symbol	Name	Rating
7			
5	2F1M,2F2M,2F3M,2F4M,2F5M	fuseholder 10.3x38	32A
		fuseholder 10.3x38	32A

Appendix 6 Circuit diagram of TYPE 6 control gear

1x1 motors 3x400V from 0,75kW to 11kW

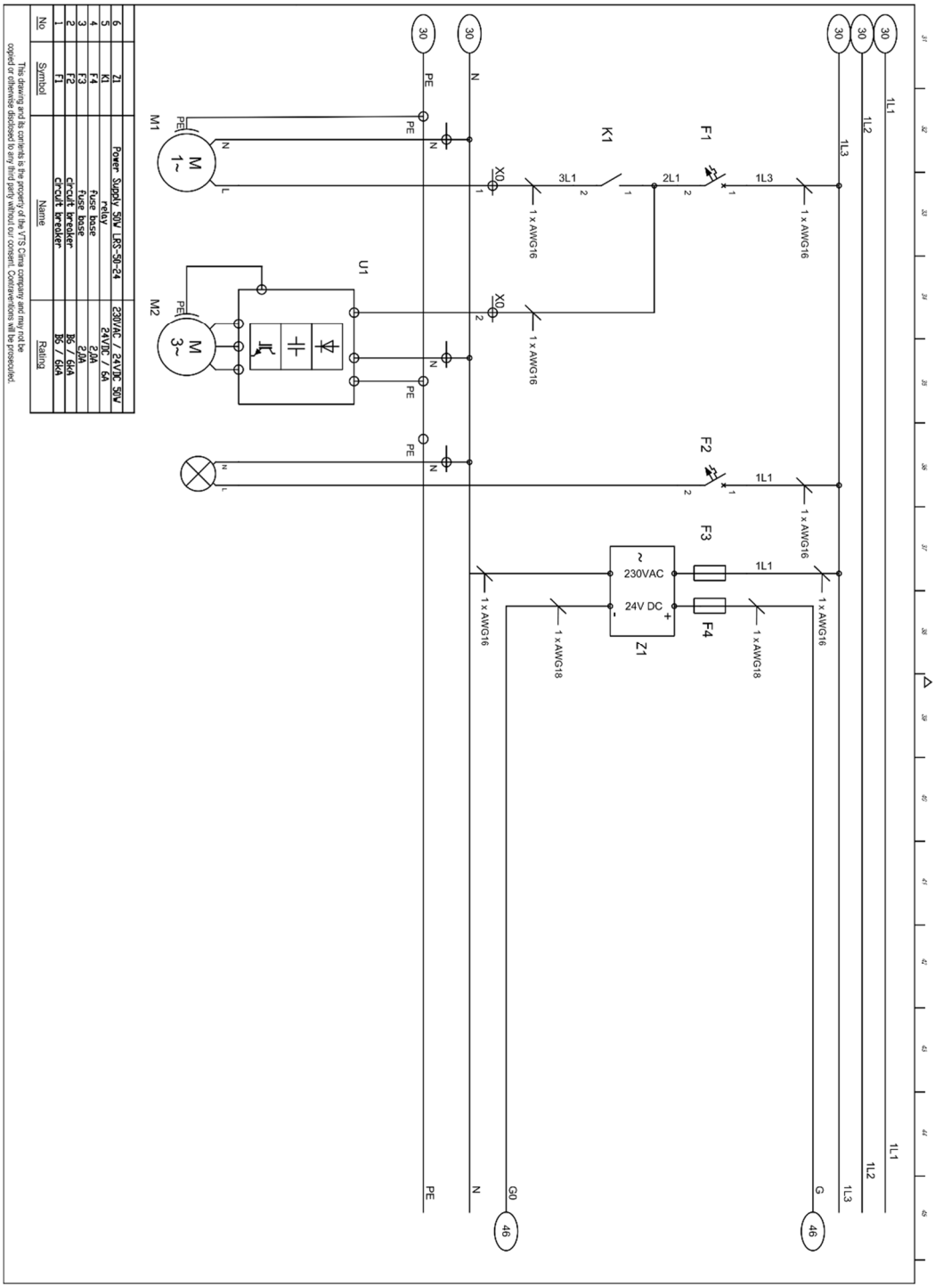


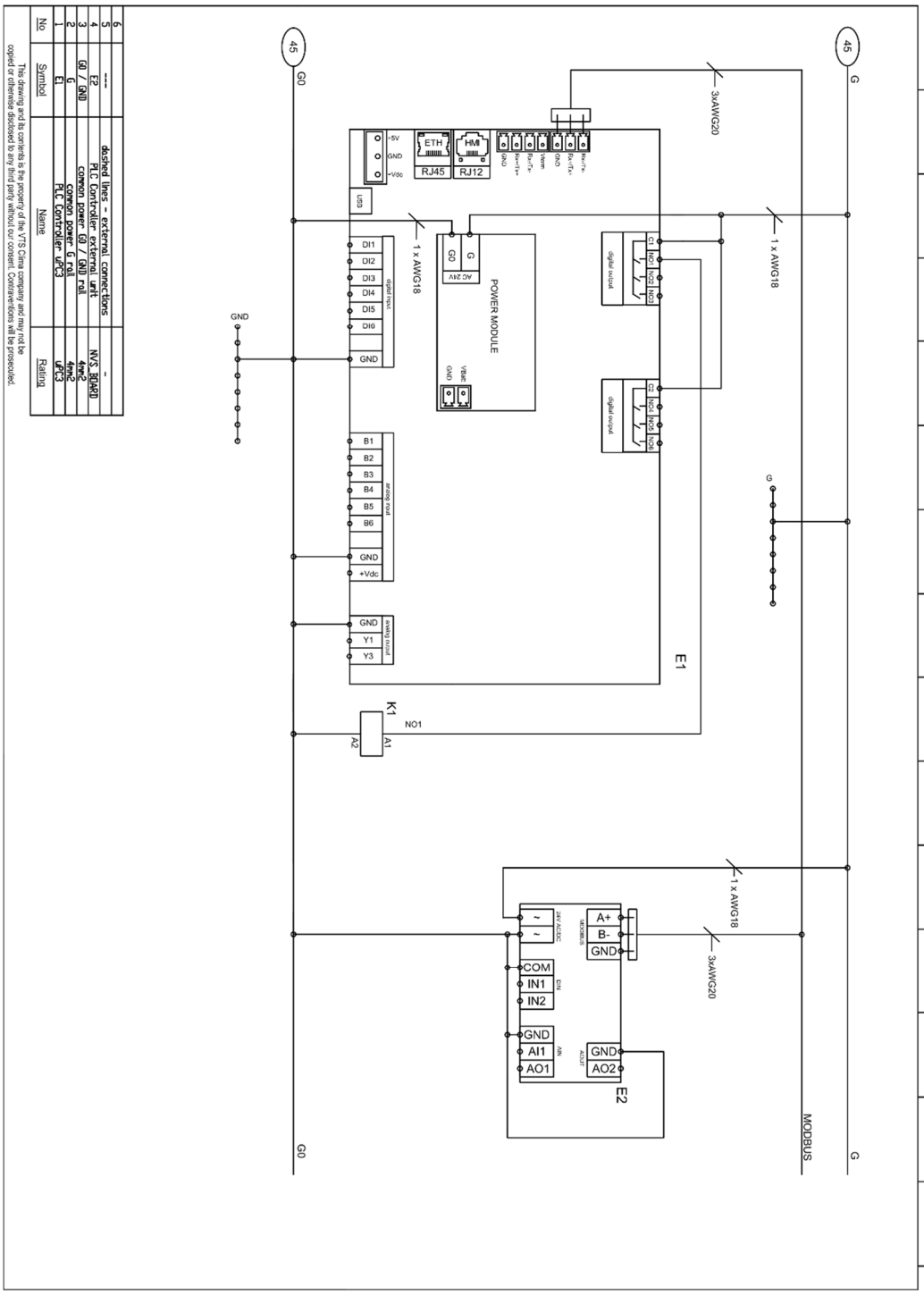
No	Symbol	Name	Rating
4	1L1, 1L2, 1L3	power rail or cable connections L1/L2/L3	-
3	N	common neutral rail	63A
2	PE	common PE rail	63A
1	Q1M	circuit disconnector with switch or knob	38 / 63A

No	Symbol	Name	Rating
7	-	cables glands fuseholder M30x38	-
6	1F1M		32A

Appendix 7 Circuit diagram of control circuit

Suitable for all type of control gears





No	Symbol	Name	Rating	
6				
5	---	dashed lines - external connections		
4	E2	PLC Controller external unit	NVS_BOARD	-
3	G0 / GND	common power G0 / GND rail	4mm2	
2	G	common power G rail	4mm2	
1	E1	PLC Controller uPC3	uPC3	