



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

ver.1.4 (07.2020)

VTS reserves the right to implement changes without prior notice

Table of contents

Table of contents	2
SAFETY INSTRUCTIONS AND ALARMS!	3
Technical data	4
Control gear construction	4
Main internal elements:	4
Operation parameters	4
Short-circuit and overload protection	5
Relay pump	5
Control circuit	5
Table I/O (for application ver. to 1.0.004)	5
Table I/O (for application ver. to 1.0.005)	6
Connection controller diagram	7
Dimensions and weight	8
Cabling	9
Table A - electrical parameters of switchboards	10
Table B - nominal currents of switchboards	11
Table B - nominal currents of switchboards	12
Table B - nominal currents of switchboards	13
Table C - power supply cables of switchboards	14
Table D - electrical parameters of switchboards (EC motors)	15
Table E - nominal currents of switchboards (EC motors)	15
Appendix 1 Circuit diagram of "CBX uPC3 3x400V 2x1VFD <2,2kW" control gear	16
Appendix 2 Circuit diagram of "CBX uPC3 3x400V 2x1VFD <11kW" control gear	18
Appendix 3 Circuit diagram of "CBX uPC3 3x400V 2x2VFD <11kW" control gear	20
Appendix 4 Circuit diagram of "CBX uPC3 3x400V 2x3VFD <11kW" control gear	22
Appendix 5 Circuit diagram of "CBX uPC3 3x400V 2x4VFD <11kW, 2x5VFD <7,5kW" control gear	24
Appendix 6 Circuit diagram of "CBX uPC3 3x400V 1x1VFD <11kW" control gear	26
Appendix 7 Circuit diagram of "CBX uPC3 3x400V 2x1EC" control gear	27
Appendix 8 Circuit diagram of "CBX uPC3 3x400V 2x2EC" control gear	29
Appendix 9 Circuit diagram of "CBX uPC3 3x400V 1x1EC" control gear	31
Appendix 10 Circuit diagram of control circuit	32

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 be 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 μ PC 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 μ PC3 XS controller

Operation parameters

- | | |
|--|----------------------------|
| • System | TN |
| • U3 rated power supply voltage: | $\sim 230V / 3N \sim 400V$ |
| • 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 $\cos\phi = 0.5$: | 10,2kA |
| • rated short-circuit current: | 6kA |
| • coincidence factor 0.9: | 0,9 |
| • rated frequency: | 50..60Hz $\pm 1Hz$ |
| • 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 (2A)*

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

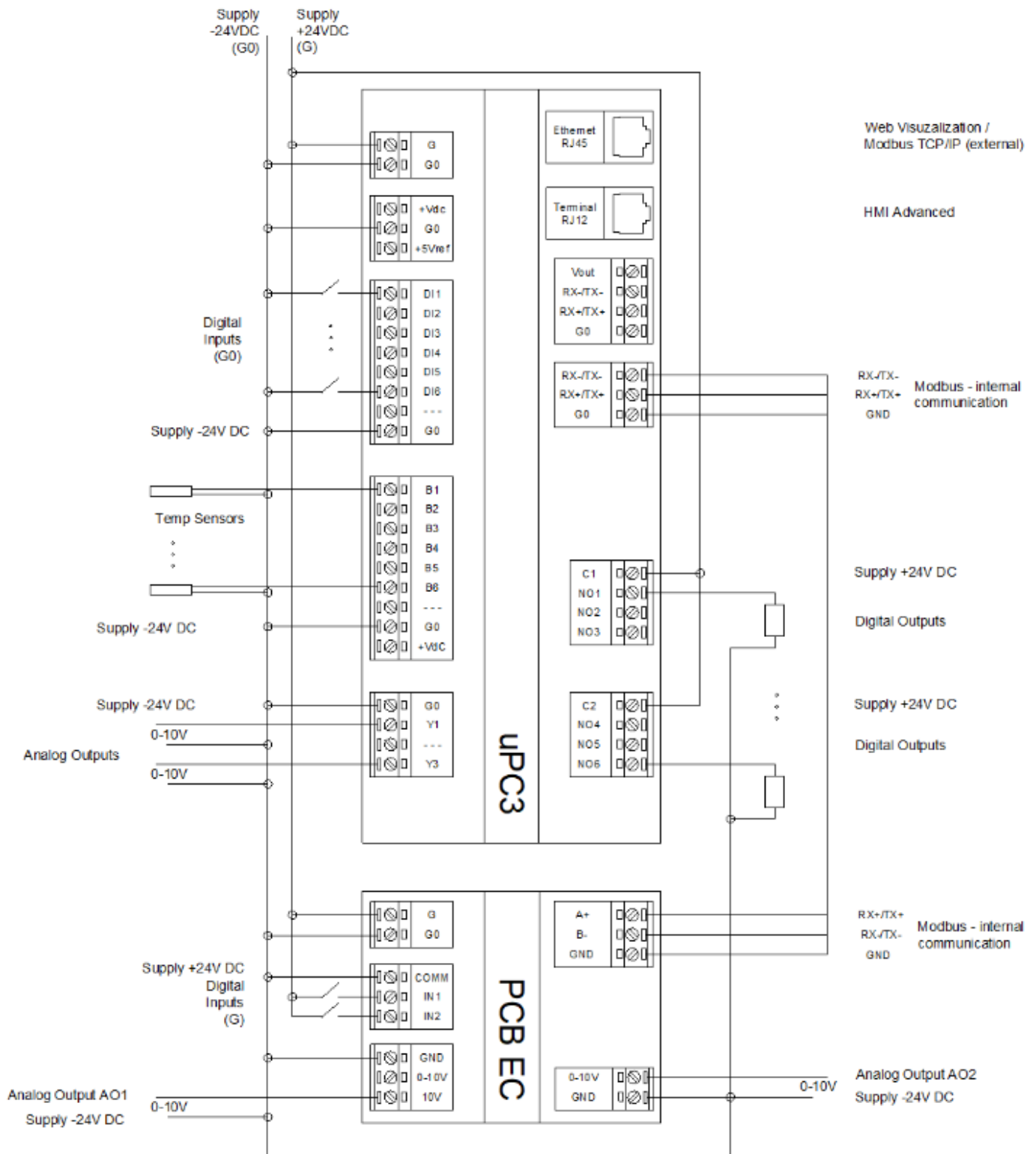
Table I/O (for application ver. to 1.0.004)

UPC3		UPC3	
Supply		Analog Inputs	
G	+24V DC	B1	Temp. Supply
G0	-24V DC	B2	Temp. Return (Room) / PreHeater (for Compact AHU)
Digital Inputs		B3	Temp. External
DI1	Fire Alarm	B4	Temp. Exhaust
DI2	Heater Alarm / DXH Alarm	B5	Temp. Water Heater
DI3	Cooler Alarm	B6	Temp. Recovery on Supply / PreHeater (for Ventus AHU)
DI4	Humidity Alarm / Filter supply alarm	Analog Outputs	
DI5	Summer – Winter / Filter return alarm	Y1	Heater / DXH
DI6	Remote STOP	Y3	Recovery / Mixing damper / Cooler
Relay Outputs		Communication	
NO1	Heater / DXH 1st.	Ethernet RJ-45	Web Visualization / Modbus TCP/IP (external)
NO2	Dampers	RS-485	Modbus RTU Master (internal)
NO3	Global Alarm / ReHeater / PreHeater	pLan	HMI Advanced – pGD1
NO4	Cooler		
NO5	Cooler 2 / DXH Reverse / Humidity / Glycol pump / Redundant		
NO6	Heater 2 / DXH 2 st.		
PCB EC		PCB EC	
Supply		Digital Inputs	
24V	+24V DC	IN1	Supply Filter
24V	-24V DC	IN2	Return Filter
Analog Outputs		Communication	
AO1 - AIN 10V	Recovery	RS-485	Modbus RTU Slave (internal)
AO2- AOOUT 0-10V	Mixing		

Table I/O (for application ver. to 1.0.005)

UPC3		UPC3	
Supply		Analog Inputs	
G	+24V DC	B1	Temp. Supply
G0	-24V DC	B2	Temp. Return (Room) / PreHeater (for Compact AHU)
Digital Inputs		B3	Temp. External
DI1	Fire Alarm	B4	Temp. Exhaust
DI2	Heater Alarm / DXH Alarm	B5	Temp. Water Heater
DI3	Cooler Alarm / DXH Alarm	B6	Temp. Recovery on Supply / PreHeater (for Ventus AHU)
DI4	Humidity Alarm / Filter supply alarm	Analog Outputs	
DI5	DX_H reverse / Filter return alarm	Y1	Recovery / Mixing damper / Heater / Re-Heater for DX_H
DI6	Remote STOP	Y3	Recovery / Mixing damper / Cooler / DX_H
Relay Outputs		Communication	
NO1	Heater / Re-Heater for DX_H	Ethernet RJ-45	Web Visualization / Modbus TCP/IP (external)
NO2	Dampers	RS-485	Modbus RTU Master (internal)
NO3	Global Alarm / ReHeater / PreHeater	pLan	HMI Advanced – pGD1
NO4	Cooler / DX_H		
NO5	Cooler 2 / Humidifier / Glycol / Redundant / DX_H reverse		
NO6	Heater 2 / DX_H st. 2 / Humidifier		
PCB EC		PCB EC	
Supply		Digital Inputs	
24V	+24V DC	IN1	Supply Filter alarm
24V	-24V DC	IN2	Return Filter alarm
Analog Outputs		Communication	
AO1 - AIN 10V	Recovery / Humidifier	RS-485	Modbus RTU Slave (internal)
AO2- AOOUT 0-10V	Recovery / Mixing dampers / Re-Heater / Pre-Heater		

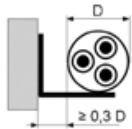
Connection controller diagram



Dimensions and weight

CBX NAME	Weight [kg]	Dimensions (w x h x d)
uPC3 3x400V 2x1VFD <2,2kW	3,85	390x317x150
uPC3 3x400V 2x1VFD <11kW	4,1	390x317x150
uPC3 3x400V 2x2VFD <11kW	5,0	540x317x150
uPC3 3x400V 2x3VFD <11kW	8,4	657x455x160
uPC3 3x400V 2x4VFD <11kW, 2x5VFD <7,5kW	9,1	693x455x160
3x400V 1x1VFD <11kW	3,95	390x317x150

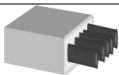
Cabling



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	Description	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
Analog Inputs	B1-B6	[1]	2x0,5
Analog Outputs	Y1,Y3, Ain10V, Aout0-10V	[1]	3x0,5
Digital Inputs	DI1-DI6, IN1,IN2	[2]	2x0,5
Relay Outputs	NO2-NO6	[2]	2x0,5
HMI Basic UPC – reduced function interface	RS-485	[3]	UTP 1x2
HMI Advanced UPC – full function interface	N3	[4]	8x0,1
HW circulating pump contactor	K1	[2]	3x1,5

Table A - electrical parameters of switchboards

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	
7,5	15,0	gG20	4x2,5	4x2,5	5x2,5		17 / 16,5 / 22	
11,0	21,0	gG25	4x4	4x4	5x4		23 / 22,5 / 28	

Table B - nominal currents of switchboards

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 - nominal currents of switchboards

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 - nominal currents of switchboards

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 - power supply cables of switchboards

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)

Table D - electrical parameters of switchboards (EC motors)

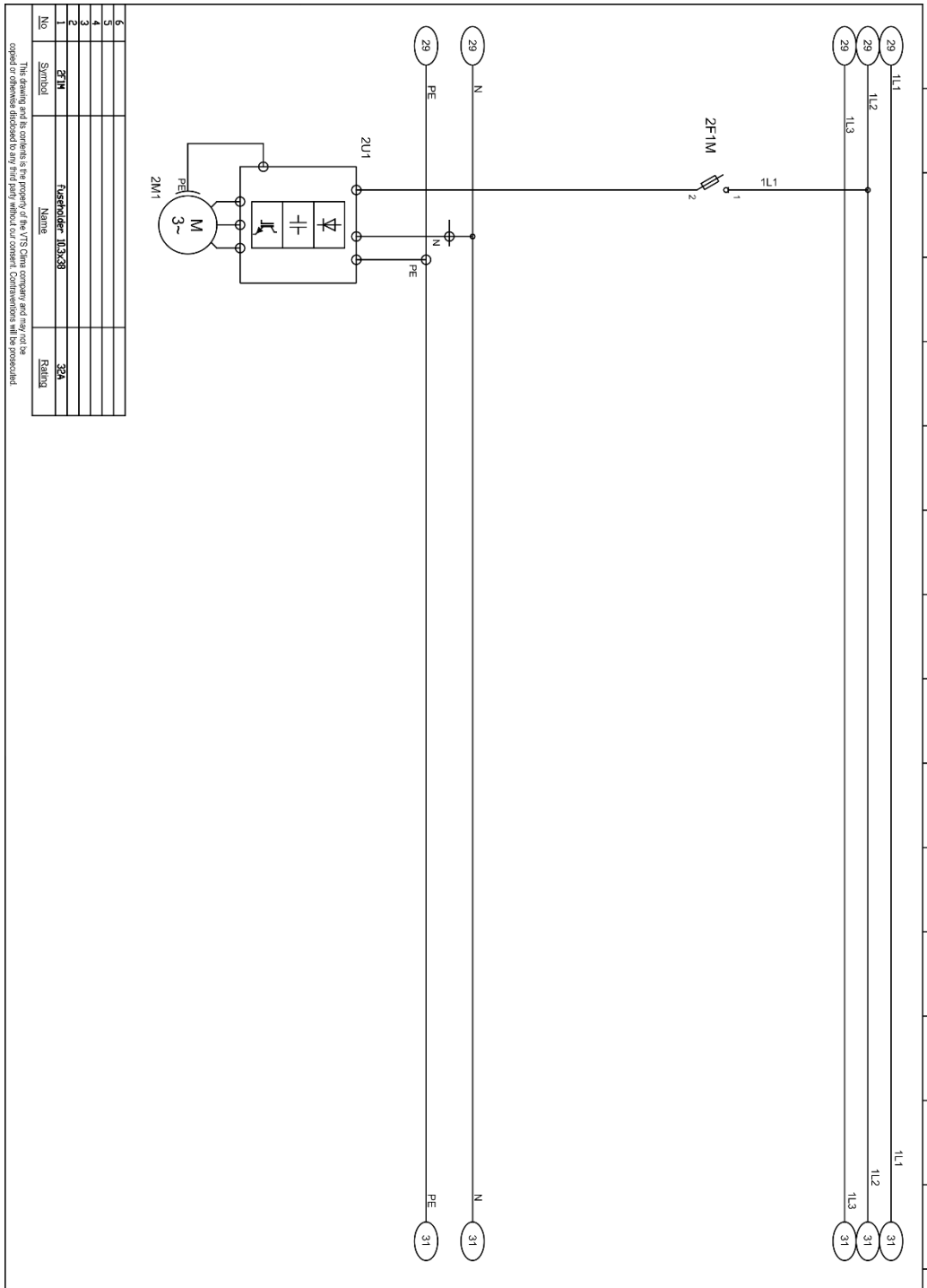
EC motor rated power [kW]	EC motor rated current [A]	Protection	Power supply motor cable [mm ²]	Control gear power supply cable [mm ²]		Control gear rated current [A]	
1~230V/50Hz	1~230V / 50Hz			supply AHU	supply – exhaust AHU	supply AHU L1	supply – exhaust AHU L1
EC 0,35	2,1	gG10	3x1,5	5x2,5	5x2,5	Tabela E	
EC 0,75	5,4	gG10	3x1,5	5x2,5	5x2,5		

Table E - nominal currents of switchboards (EC motors)

Motor power [kW]	0,35kW			2x0,35kW			0,7kW			2x0,7kW		
phase	L1	L2	L3	L1	L2	L3	L1	L2	L3	L1	L2	L3
supply only	3,1	4,0	0,0	3,1	6,1	0,0	6,4	4,0	0,0	6,4	9,4	0,0
0,35kW	3,1	6,1	0,0	5,2	6,1	0,0	6,4	6,1	0,0	8,5	9,4	0,0
2x0,35kW	5,2	6,1	0,0	5,2	8,2	0,0	8,5	6,1	0,0	8,5	11,5	0,0
0,7kW	3,1	9,4	0,0	8,5	6,1	0,0	6,4	9,4	0,0	11,8	9,4	0,0
2x0,7kW	8,5	9,4	0,0	8,5	11,5	0,0	11,8	9,4	0,0	11,8	14,8	0,0

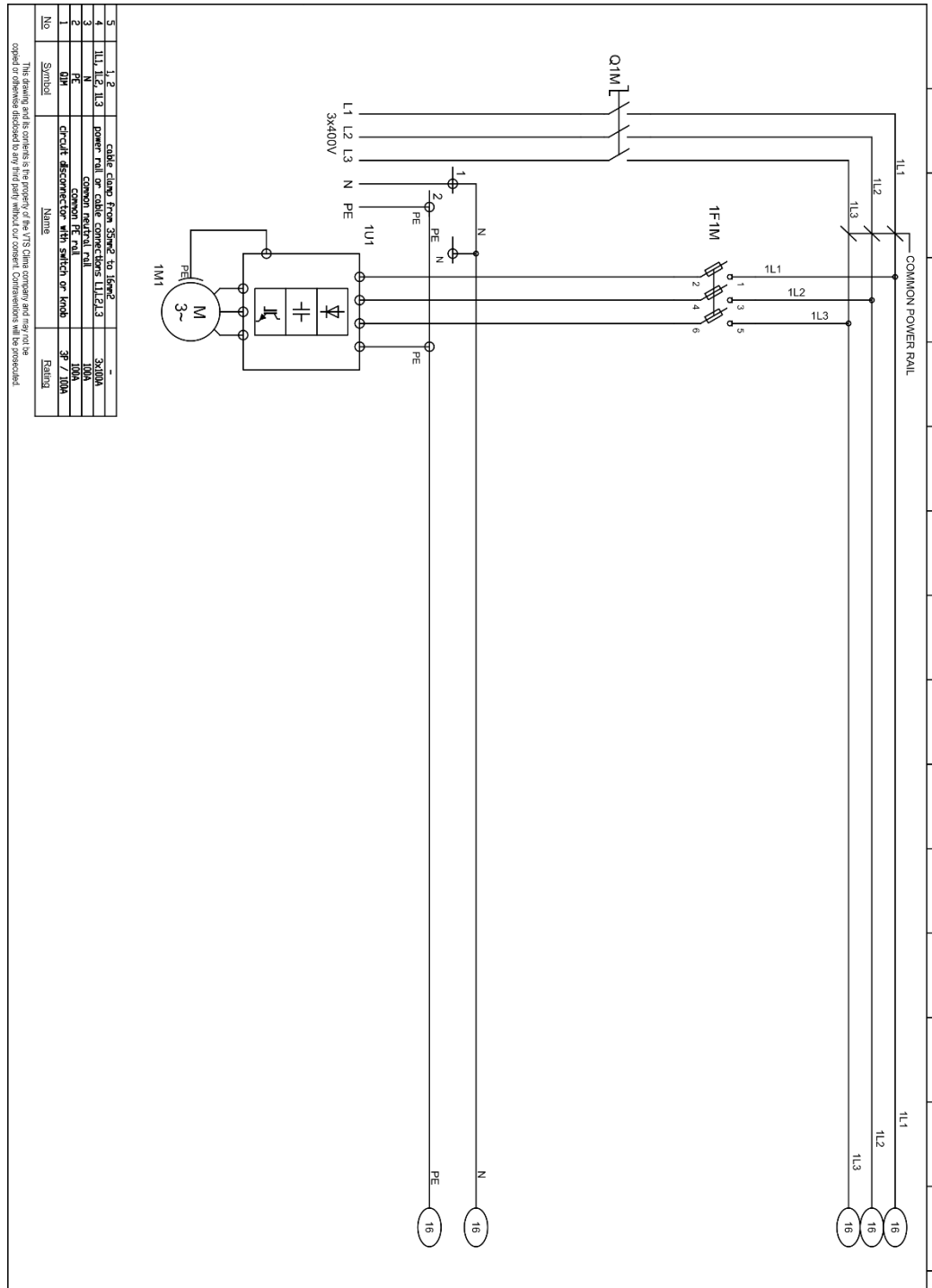
2x1 motors 1x230V / 3x400V from 0,75kW to 2,2kW

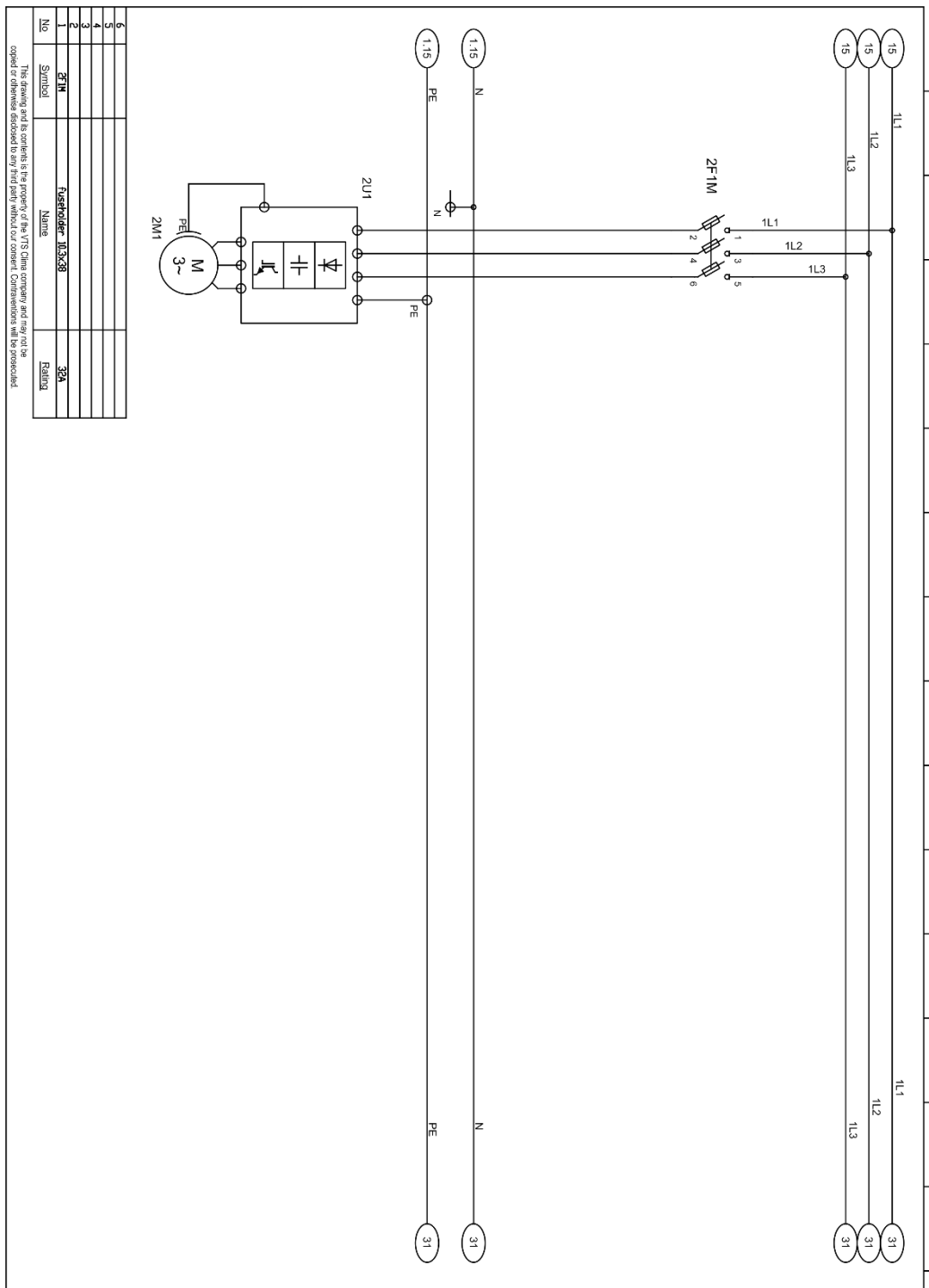




Appendix 2 Circuit diagram of “CBX uPC3 3x400V 2x1VFD <11kW” control gear

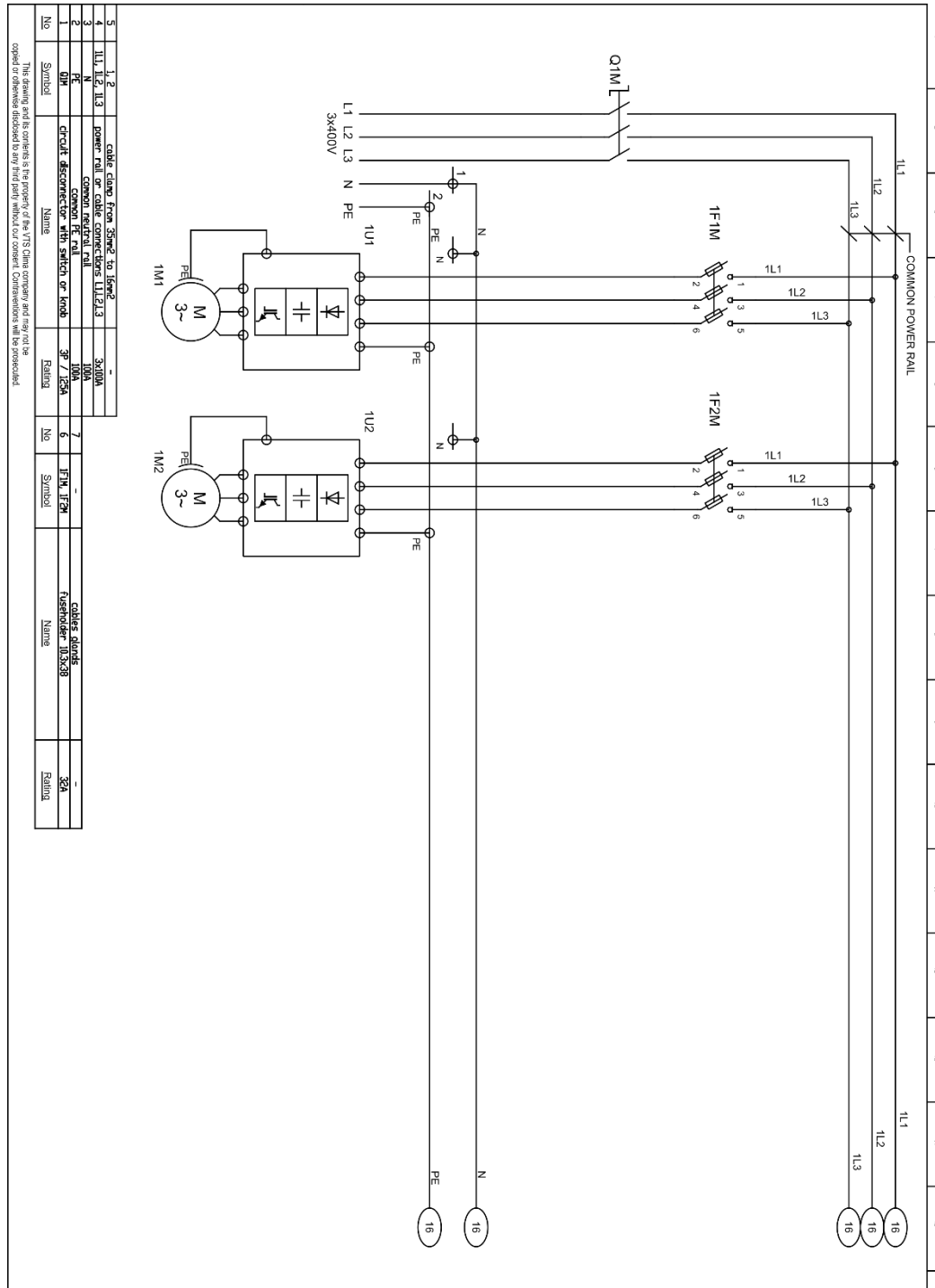
2x1 3x400V from 0,75kW to 11kW

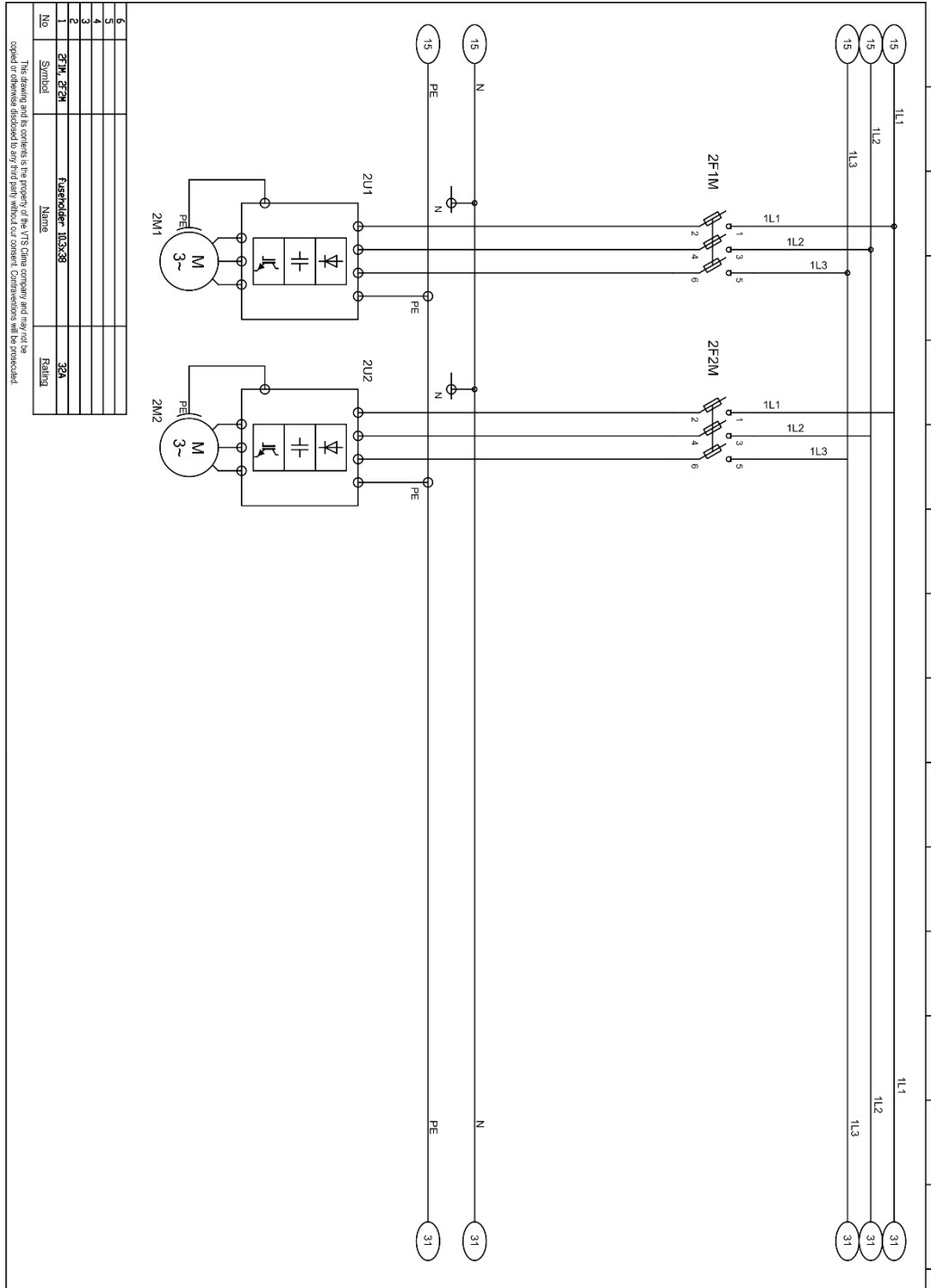




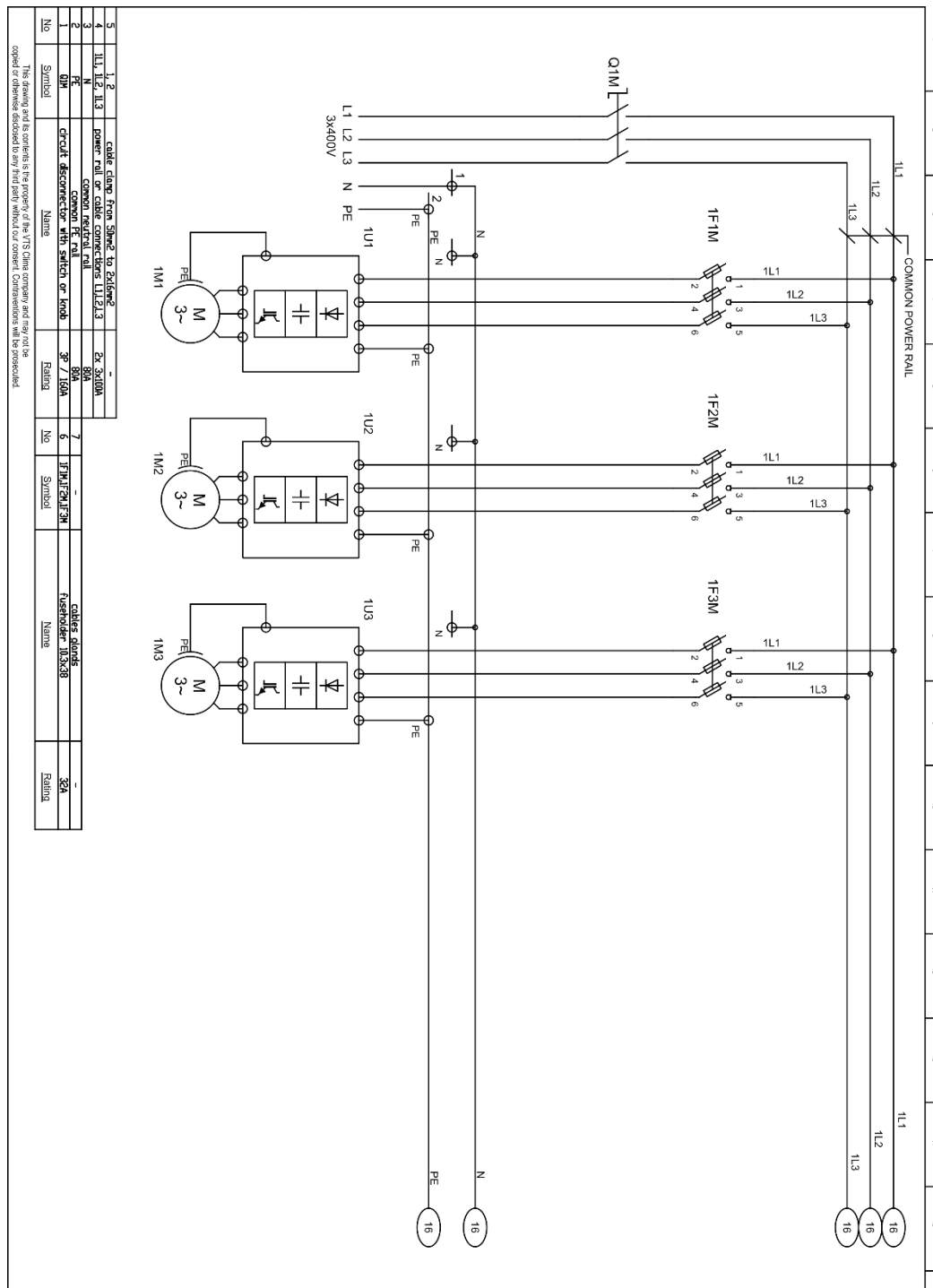
Appendix 3 Circuit diagram of “CBX uPC3 3x400V 2x2VFD <11kW” control gear

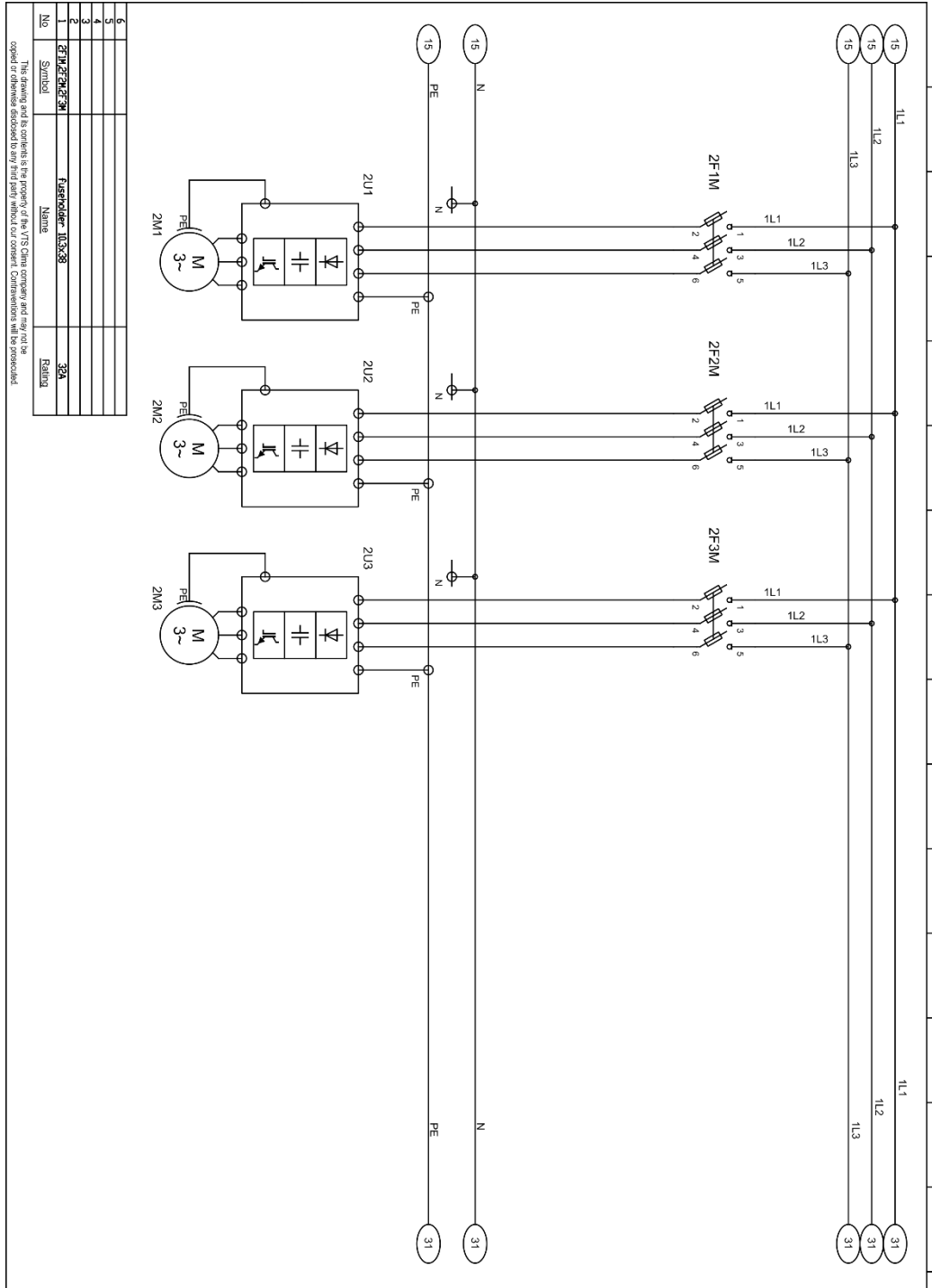
2x2 motors 3x400V from 0,75kW to 11kW





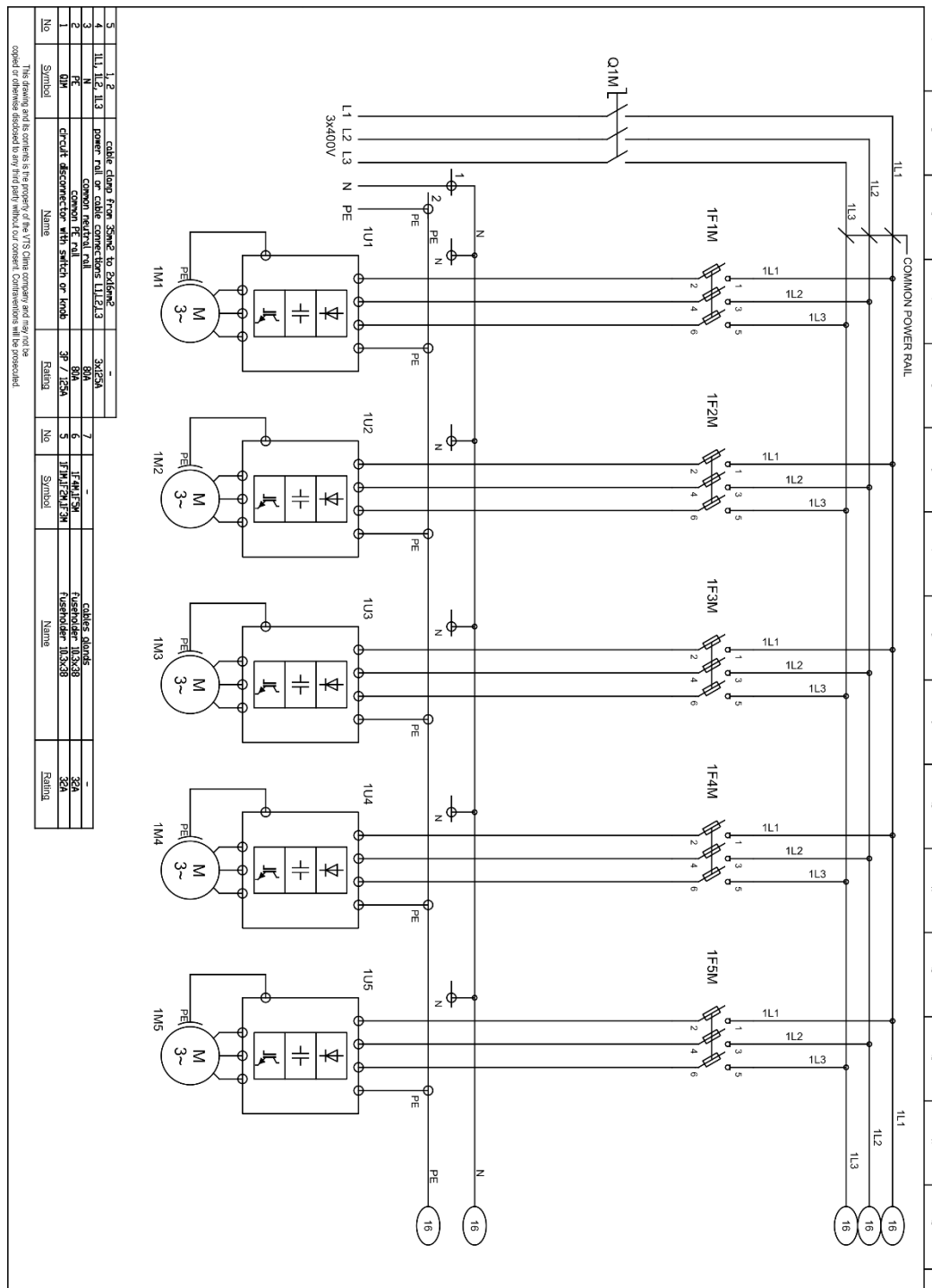
2x3 motors 3x400V from 0,75kW to 11kW

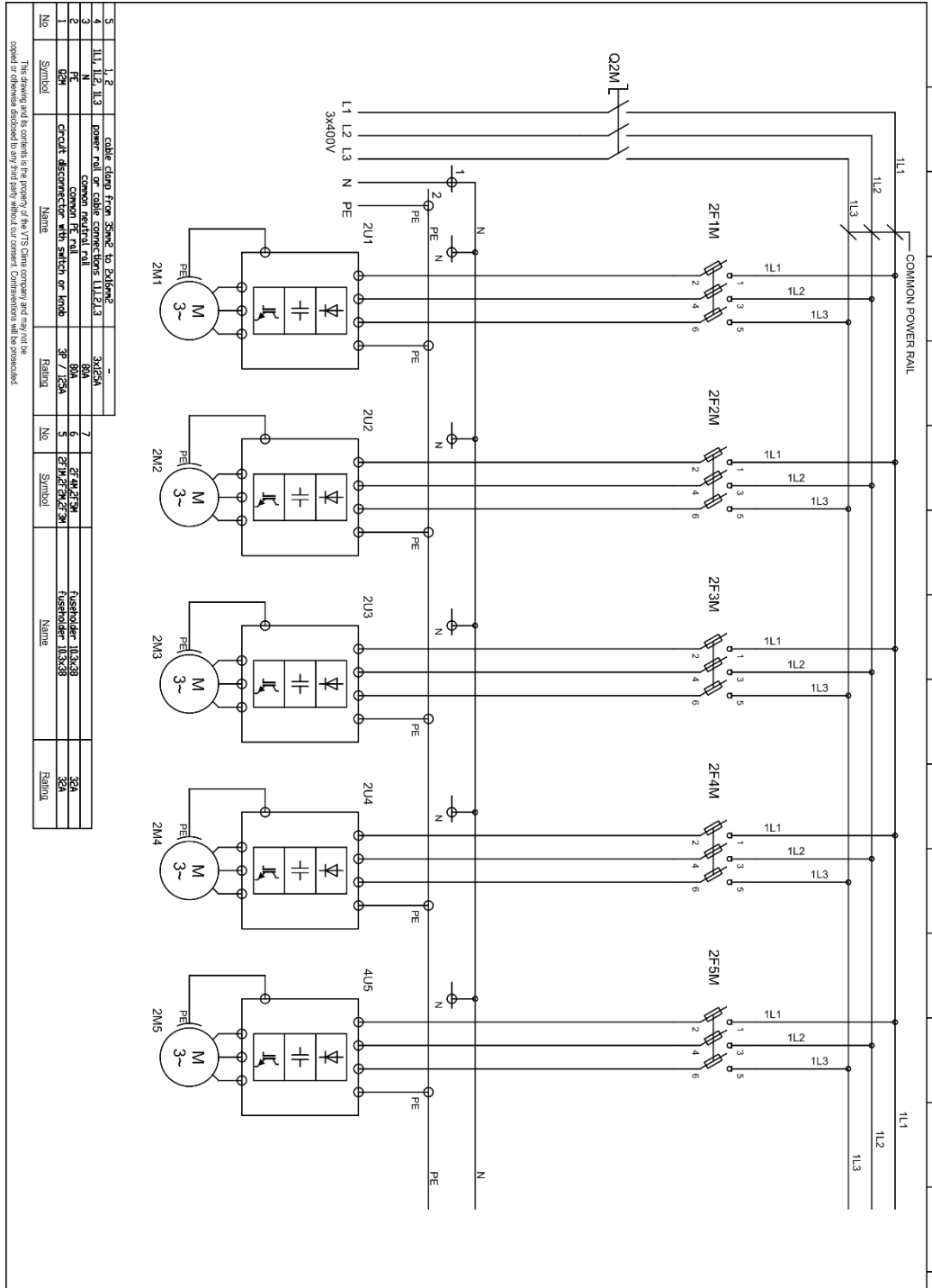




Appendix 5 Circuit diagram of “CBX uPC3 3x400V 2x4VFD <11kW, 2x5VFD <7,5kW” control gear

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

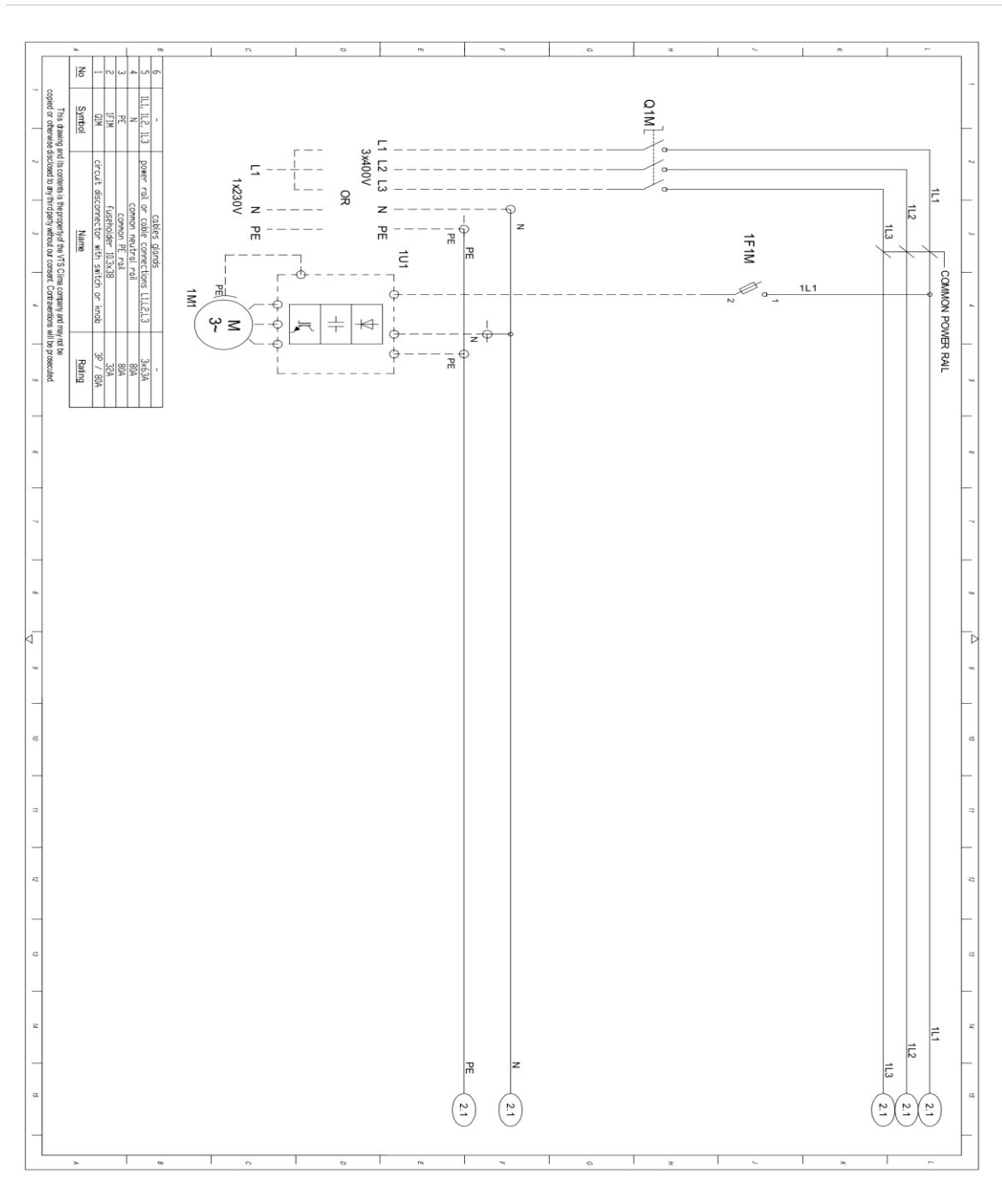


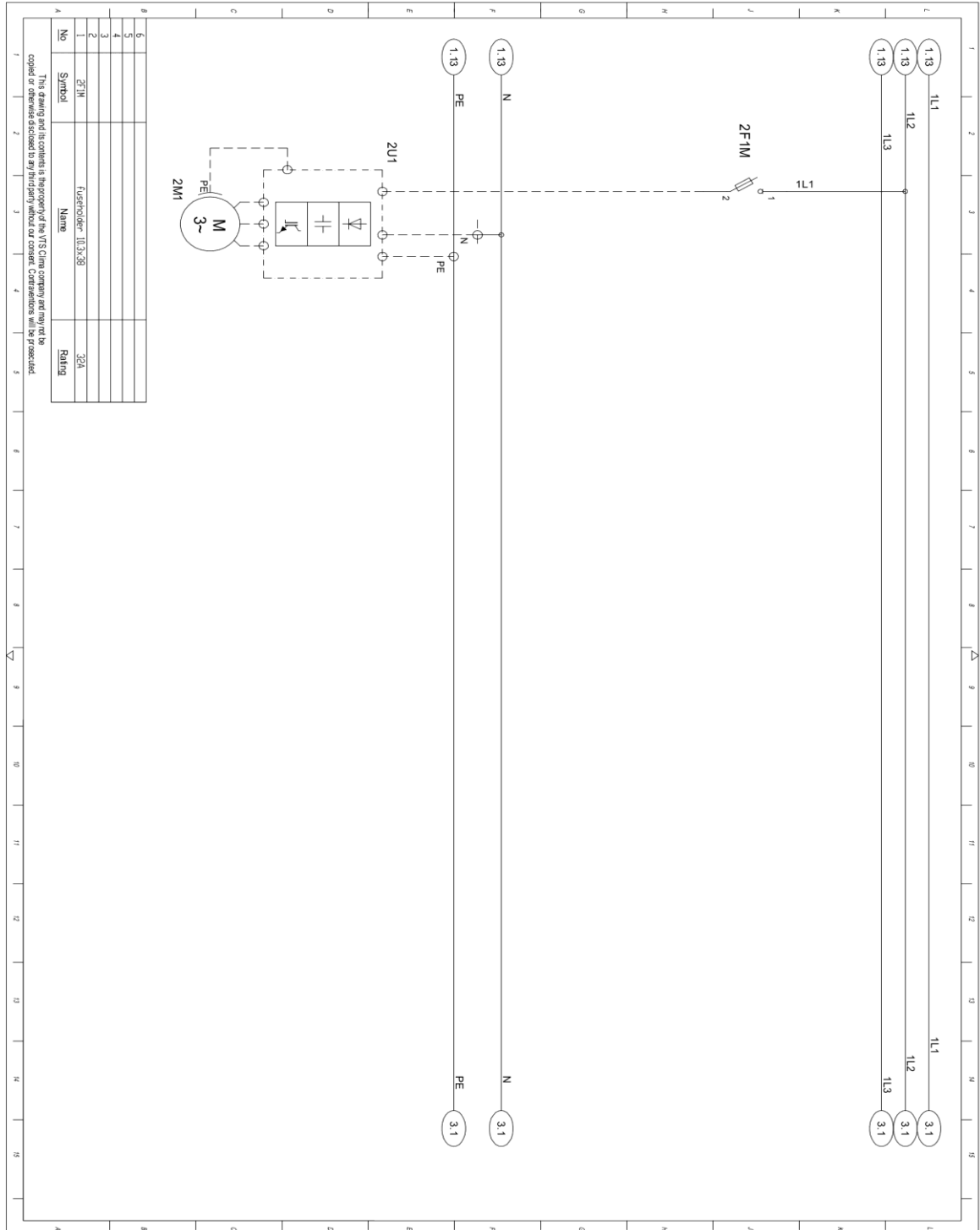


1x1 motors 3x400V from 0,75kW to 11kW

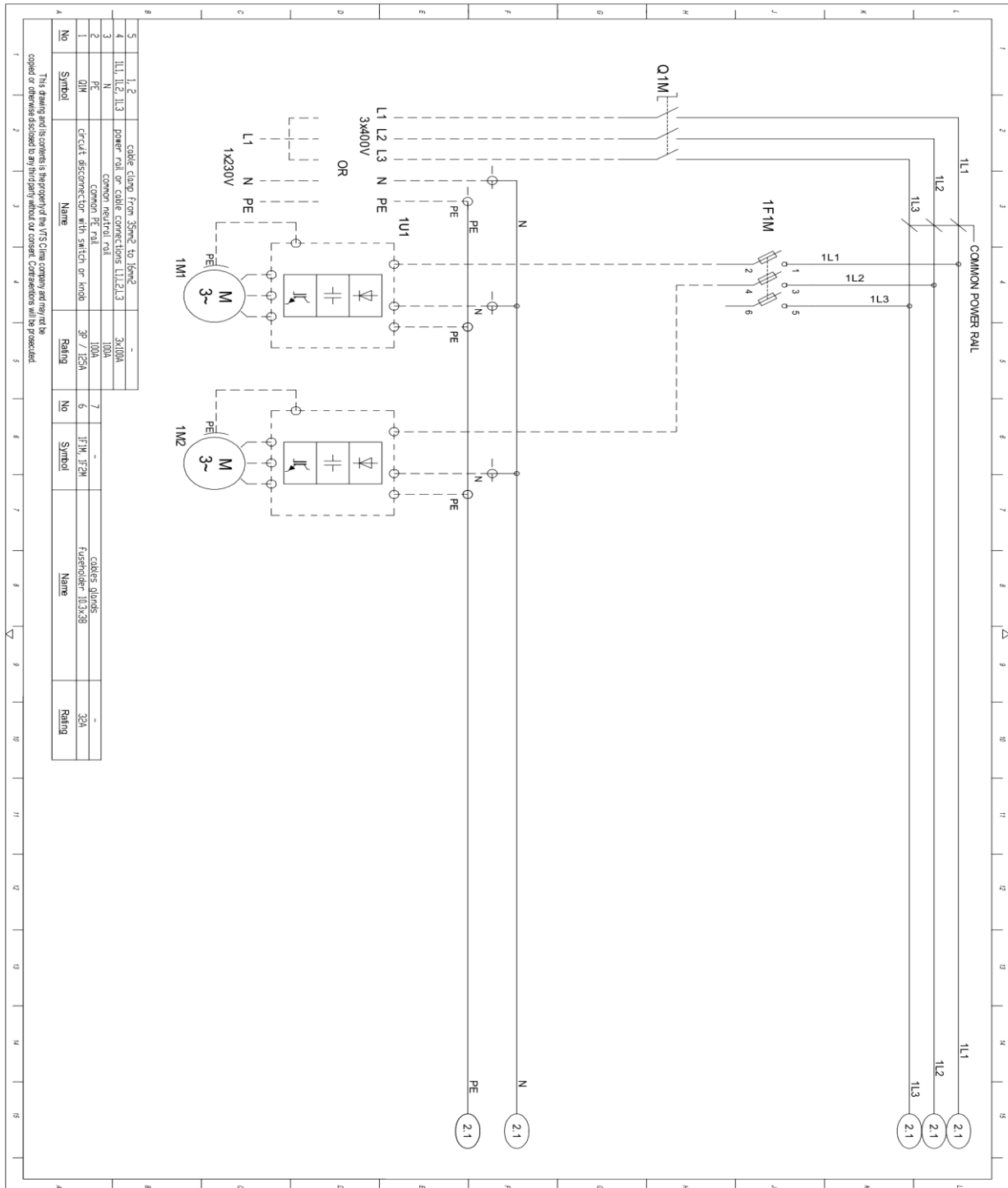


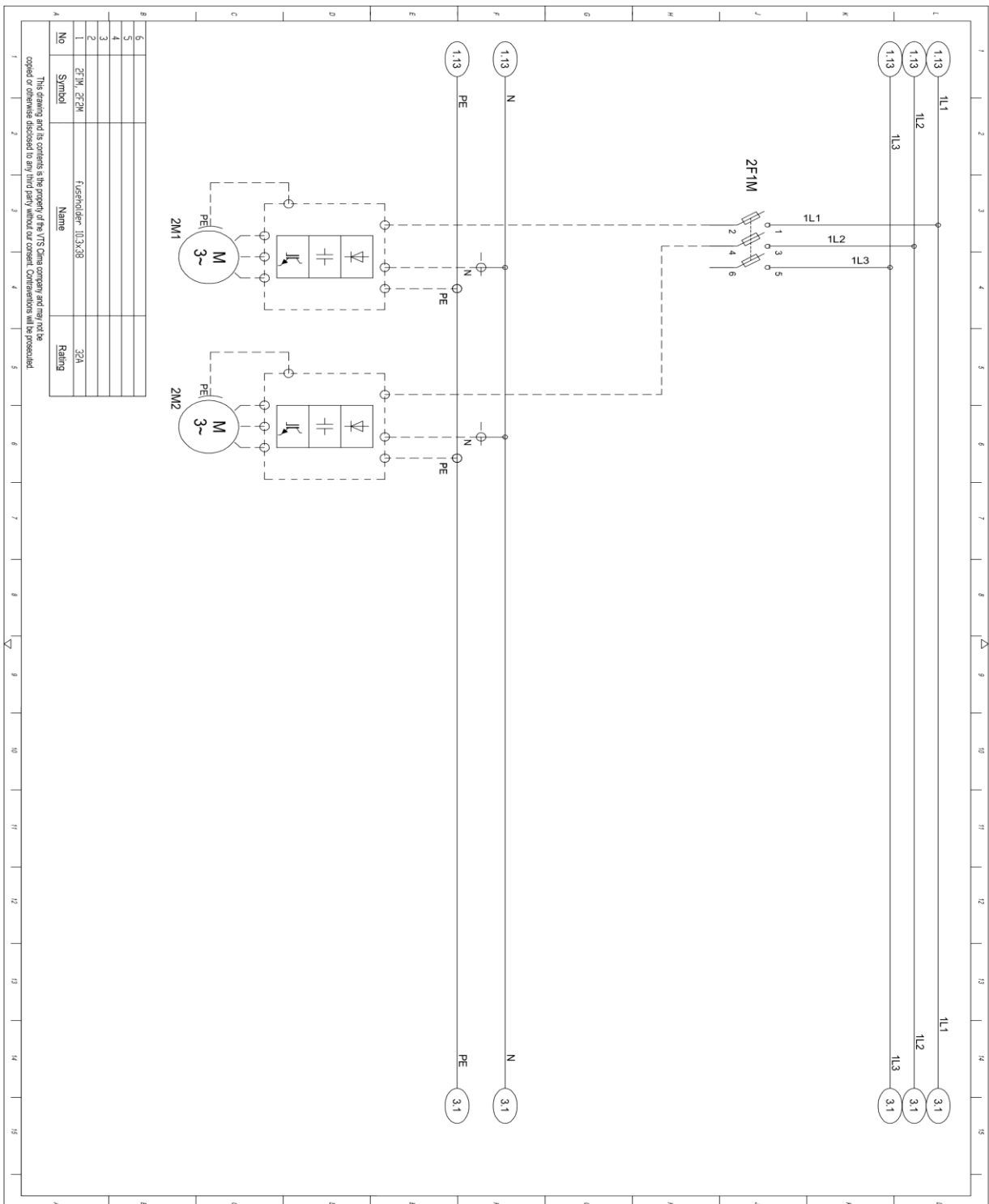
Appendix 7 Circuit diagram of “CBX uPC3 3x400V 2x1EC” control gear





29





31



Appendix 10 Circuit diagram of control circuit

Suitable for all type of control gears

