



EN

Control gear for Exhaust Air-Handling Units (EAHU)

VS 21-150 CG 0-1

VS 180-300 CG 0-1

VS 400-650 CG 0-1

Operation and Maintenance Manual

ventus

DTR-CG-ver. 1.6 (06.2020)



EN

The control gear complies with European Standard

IEC/EN 60439-1 + AC Standard Switchboards and low-voltage control gears

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I. USER'S MANUAL

1. DESCRIPTION OF CONTROLS

1.1. VS 21-150 CG-0-1, VS 180-300 CG 0-1 and VS 400-650 CG 0-1 control gears



Application:

EAHU Operation Control in Ventilation Systems.

Range of operation:

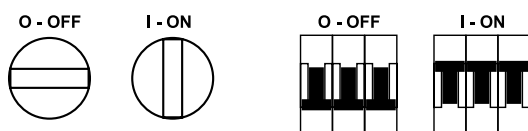
The control gear works with exhaust systems equipped with -frequency converters for VS 30-150 CG 0-1 , VS180-300 CG 0-1 and VS400-650 CG 0-1

VS180-300 CG 0-1 oraz VS400-650 CG 0-1

- EC motors for VS ... CG 0-1

which comply with standard VTS Clima control applications.

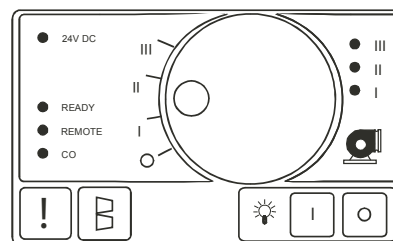
1.2. Main Power Switch



Function:

Switching-on Power of the Control Gear.

1.3. Control Panel














Element	Function
24V DC	Control circuits supply LED +24V
READY	Ext. start permission LED
REMOTE	Remote control LED
CO	Control LED indicating control from the CO detection module
	Local fan speed adjuster
	<i>Fan speed may vary from the set speed, depending on signals from CO detection module and remote control signal (see: Chapter 2).</i>
	LEDs indicating fan speed

1.4. Detailed description of signal lamps






	<p>Blinking of the control determines the detector's alarm status. Control module sets the EAHU at speed III.</p> <p>When the alarm is reset, the control gear returns to the normal mode.</p>
	<p>The LED lighting-up indicates a fire alarm or a converter failure. The control module stops the unit.</p> <p>After troubleshooting clear the alarm by turning off the power and switch on again using the Q1 mains switch of the control gear.</p>

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1.4. Detailed description of signal lamps

  	  	  	<p>The EAHU operation at a given speed is indicated by the number of LEDs placed at the fan symbol.</p>
speed I	speed II	speed III	
 REMOTE	Signal confirmation of speed I, II or III at the remote control terminal.		
 CO	Signal confirmation of speed I, II or III or alarm confirmation at the CO detector module terminal.		

1.3. Control Panel

	Alarm LED
	Filters contamination warning LED
	Control gear lighting status LED
	Light switch
	Light switch

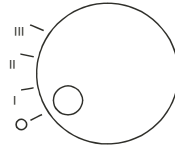

2. OPERATION

CAUTION!



Operation of the exhaust unit is stopped by a fire alarm or failure of the fan motor converter for AC motors. For EC motors there is no such alarm, therefore a connection loop is required for alarm X3.27 and X3.28 - please see connection diagrams

Each of this event requires fixing the cause of the alarm and resetting the memory of the electronic module by turning off and switching on again the Q1 mains switch of the control gear.

Function	Condition	Operation
EAHU Start-up	Local fan speed adjuster  setting I, II or III	Each of the three control signals: - local - remote - from the CO detector may, independently from the others, have value of I, II or III speed. The VS 21-150 CG-0-1 electronic module of the control gear chooses the highest value and sends it to the output controlling the fan speed.
	Remote control signal at speed I, II or III	 <p>1. Signals of local and remote controlling may be blocked if the external start permission signal ESP is not set active. In such a case the EAHU is controlled only by a signal of the CO detection module.</p> <p>2. If connecting external control signal ESP is not intended, move both slider connectors S1, located on the VTS-E-0006 electronic module PWB, to the ON or 1 position in order to enable local and remote control function.</p>
	CO detector signal about exceeding threshold I, II or III of gas concentration	
	CO detector failure signal	For safety regulations concerning people staying in the building, the CO detector failure results in functioning of the EAHU at the maximum speed. This way quick air exchange is enforced, which minimizes the risk of influence of the harmful gas.

II. ADVANCED INSTRUCTIONS

CAUTION!



All works related to the inner elements of the control gear should be carried out with the power of external control circuits turned off by means of the X3 strip. Even if the mains switch Q1 of the control gear is turned off, some external circuits control voltage may be present at the X3 strip.

3. DETAILED DESCRIPTION OF THE CONTROL GEAR

3.1. EAHU Output Control

The **VTS-E-0006** electronic module of **VS...CG-0-1** control gears enables gradual adjustment of exhaust AHUs' air capacity by means of selecting one of three, previously programmed, reference frequencies of **2U1 to 2U4** inverters (two inverters can appear in AHUs over VS150, four inverters can appear in AHUs over VS 300).

Converter control output **X3:1 ÷ X3:5** consists of four voltage-free operating contacts with a joint **COM** terminal. Number of output circuit contacts shorted with **COM** terminal decides about functioning of the converter as well as speed selection.



Stimulation of converter inputs is carried out by its internal charger.

Status of control output	Converter operation														
<table><tr><td>X3:2</td><td>START</td><td>-</td></tr><tr><td>X3:3</td><td>FC I</td><td>-</td></tr><tr><td>X3:4</td><td>FC II</td><td>-</td></tr><tr><td>X3:5</td><td>FC III</td><td>-</td></tr></table>	X3:2	START	-	X3:3	FC I	-	X3:4	FC II	-	X3:5	FC III	-	Converter stopped		
X3:2	START	-													
X3:3	FC I	-													
X3:4	FC II	-													
X3:5	FC III	-													
<table><tr><td>X3:2</td><td>START</td><td>x</td></tr><tr><td>X3:3</td><td>FC I</td><td>x</td></tr><tr><td>X3:4</td><td>FC II</td><td>-</td></tr><tr><td>X3:5</td><td>FC III</td><td>-</td></tr></table>	X3:2	START	x	X3:3	FC I	x	X3:4	FC II	-	X3:5	FC III	-	Converter started, speed I		
X3:2	START	x													
X3:3	FC I	x													
X3:4	FC II	-													
X3:5	FC III	-													
<table><tr><td>X3:2</td><td>START</td><td>x</td></tr><tr><td>X3:3</td><td>FC I</td><td>x</td></tr><tr><td>X3:4</td><td>FC II</td><td>x</td></tr><tr><td>X3:5</td><td>FC III</td><td>-</td></tr></table>	X3:2	START	x	X3:3	FC I	x	X3:4	FC II	x	X3:5	FC III	-	Converter started, speed II		
X3:2	START	x													
X3:3	FC I	x													
X3:4	FC II	x													
X3:5	FC III	-													
<table><tr><td>X3:2</td><td>START</td><td>x</td></tr><tr><td>X3:3</td><td>FC I</td><td>x</td></tr><tr><td>X3:4</td><td>FC II</td><td>x</td></tr><tr><td>X3:5</td><td>FC III</td><td>x</td></tr></table>	X3:2	START	x	X3:3	FC I	x	X3:4	FC II	x	X3:5	FC III	x	Converter started, speed III		
X3:2	START	x													
X3:3	FC I	x													
X3:4	FC II	x													
X3:5	FC III	x													

Control of converter's speed depends on the signals coming from three requesting channels, which may be disconnected from the module.

Source of control	Control channel; Connection place	Function
Local control	LOC - channel 1 connection J12	Exhaust fan speed can be controlled from the front of the control gear.
Remote control	RC - channel 2 X3:13 ÷ X3:16	Exhaust fan speed can be controlled through remote control signal coming from e.g.: switch, supply unit controller, master control system.
	CO - channel 3 X3:6 ÷ X3:10	Exhaust fan speed can be controlled through CO detection module, depending on CO concentration in a room. Processing of alarm signal from the CO detection module is an additional function of this channel. In case of the CO detector alarm, the EAHU will operate at maximum, speed.



*Signal of set frequency for the **2U1 to 2U4** converters equals the highest input set signal **LOC, RC and CO**.*

EC MOTORS

EC motors require the use of a module to convert the switched signal - binary to 0-10V analog signal. Speed setting for gears I and II is done using the potentiometers on the module. Gear III is always set to the maximum engine speed - 10V control signal. Direct voltage + 10VDC is applied to terminal X3.1. The voltage is switched and fed to the inputs module. A 0-10V signal appears at the output according to the running gear. The module detects the situation setting by means of potentiometers smaller signals for gear II in relation to I. In such a situation the red LED flashes (state of error) and the output will show a 0V signal (engine stop).

The control rules for the switchgear are identical to those for an AC motor with a frequency converter.

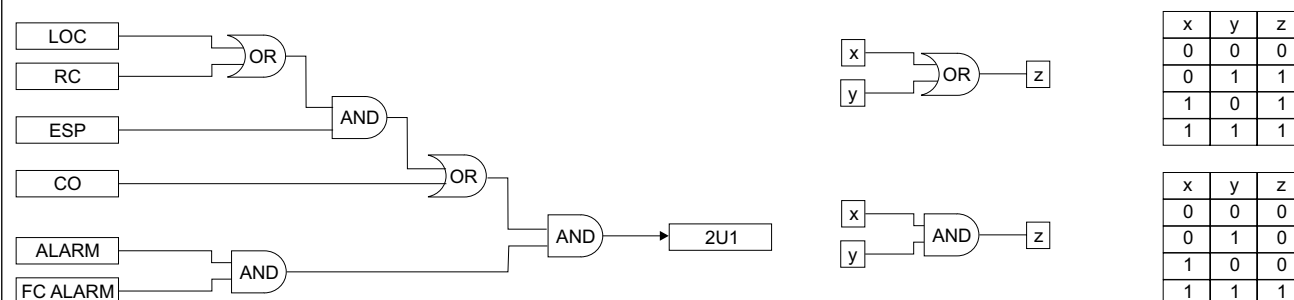
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3.2. EAHU Start Control Signals

VTS-E-0006 module is equipped with three special terminals monitoring start-up of the EAHU.

Source of control	Control channel; Connection place	Function
Remote control	ESP – channel 4 X3:25 ÷ X3:26	External start permission – lack of the permission, blocks the control signals coming from channel no 1 (LOC) and no 2 (RC). Starting-up and output control of the EAHU is only accessible through the CO channel (the CO detection module input). <div> <div>!</div> <div>In case when connecting an external ESP control signal is not intended, move both slider connectors S1, located on the VTS-E-0006 PWB, to the ON position.</div> </div>
	ALARM – channel 5 X3:11 ÷ X3:12	Fire sensor signal - the highest priority – interruption of sensor circuit blocks all remaining control channels and stops the EAHU. <div> <div>!</div> <div>The input is equipped with memory module. Operation of the exhaust unit after a fire alarm requires fixing the cause of the alarm by turning off and switching on again the Q1 mains switch of the control gear.</div> </div>
	FC ALARM – channel 6 X3:27 ÷ X3:28	Failure signal of frequency converter. Priority of this channel is the same as the input of fire sensor - interruption of FC ALARM circuit blocks all control channels and stops the exhaust unit. <div> <div>!</div> <div>1. List of events which triggers the alarm to stop the exhaust unit depends on properties and configuration of the converter. 2. The input is equipped with memory module. The exhaust unit start-up after converter alarm event requires fixing the cause of the alarm and turning off and switching on again the Q1 mains switch of the control gear.</div> </div>

3.3. Order of Control Channels



3.4. Damper Control

M2 damper opening request is set at the same time as the **2U1 to 2U4** converters start signal. Operating contact controlling the damper provides the **X3:20** terminal with **24V AC** in relation to the **X3:21** terminal.

3.5. EAHU Start Confirmation for Remote Equipment

Activation of a single voltage-free switching contact marked **START CONFIRMATION** is done in parallel with setting the **2U1 to 2U4** converters start signal. The contact is provided to the **X3:22 ÷ X3:24** terminals.

- !

1. The EAHU operation confirmation signal indicates that the control system is working properly but it does not control and guarantee the performance of the air exhaust system. The VS...CG-0-1 control gears do not control the air flow in the exhaust system and do not detect e.g.: blockage of the air damper.
2. Rated parameters of the **START CONFIRMATION** contact: 24V AC/DC, current 2A

3.6. Filter Check

Terminals **X3:29 ÷ X3:32** are designed for connecting pressure control units: **2S1H** and **2S2H**. A contact shorting of any pressure control unit activates the filter contamination warning LED located at the control gear front panel.

- !

Contamination of filter does not influence controlling of the EAHU. The pressure control inputs are used exclusively for indicating filter contamination status and prompting their replacement.

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4. TECHNICAL SPECIFICATION

4.1. Construction

casing with control panel and mains switch	
main internal elements	- short-circuit protection assembly - connection units - VTS-E-0006 electronic module
weight	5,3 kg
dimensions	460x340x170

4.2. Operation parameters

system	TN
rated power supply voltage U_3	3×400 V or 1 x 230 V
rated insulation voltage U_i	400 V
rated impulse withstand voltage U_{imp}	2,5 kV
rated short-time withstand current I_{cw} for respective circuits - effective value of alternating-current component withstood during 1 s i.e.: short-circuit current expected at connecting voltage of	6 kA
rated peak withstand current (i_{pk}) at $\cos\phi = 0,5$	10,2 kA
rated short-circuit current	6 kA
coincidence factor	0,9
rated frequency	50 Hz \pm 1Hz
protection class	IP54
acceptable operating temperature	0 ÷ 50°C
supply voltage of control circuits	24 V AC
EMC environment	1

4.3. Parameters of protection elements of the VTS-E-0006 electric module

F11 Protection module of power supply circuit of the CO detection module. Parameters: ceramic fuse-element, size 5×20mm T 1.25A.



The CO detector circuit is designed for 230V AC power supply!

F12 Protection module of the EAHU lighting. Parameters: ceramic fuse-element, size 5×20mm T 1.25A.

F13 Protection of main module circuits, i.e.: electronic elements and modules, inputs and outputs and control panel. Parameters: ceramic fuse-element, size 5×20mm F 800mA

4.4 Parameters of the 230/24V transformer protection modules

F1 ceramic fuse-elements size 5x20 mm T 1,25A

CAUTION!



1. Power supply requirement of the control gear depends on applied frequency converter. The control gear requires 3x400V/ 50Hz or 1x230V/50Hz power supply from the main switchgear equipped with the mains switch and appropriate protection of the control gear feeders.
2. Connection and start-up of the control gear should be done by qualified personnel only.
3. The control gear is designed for indoor use.

5. DESCRIPTION OF EAHU AUTOMATICS

5.1. Interaction of EAHU with CO Detection Modules

The CO detection modules should be connected in parallel from the power supply side and alarm contacts side. If a detector detects concentration of CO exceeding a threshold, then EAHU will start operating.



Rated parameters of the protection unit mounted on the VTS-E-0006 electric module PWB have to be taken into account (see page 3.3).


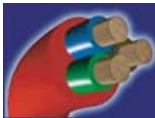
5.2. Connecting control components



Control components should be connected as shown on the Electric Diagram

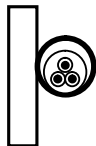
No	Location of cable connection	Unit (group)	Diagram ref no.	Conductor type	Cross-section [mm ²]
1.	Joint terminal of converter control	[2] converter	[2] / COM	[2]	1×1
2.	Initiating signal for frequency converter		[2] / START		1×1
3.	Speed I signal for frequency converter		[2] / FC I		1×1
4.	Speed II signal for frequency converter		[2] / FC II		1×1
5.	Speed III signal for frequency converter		[2] / FC III		1×1
6.	Frequency converter alarm contact		FC ALARM		2×1
7.	Joint terminal for CO detector	CO detector	N1F / 24V DC		1×1
8.	CO detector contact indicating exceeding of the first threshold of CO concentration		N1F / CO I		1×1
9.	CO detector contact indicating exceeding of the second threshold of CO concentration		N1F / CO II		1×1
10.	CO detector contact indicating exceeding of the third threshold of CO concentration		N1F / CO III		1×1
11.	CO detector contact indicating unit's failure		N1F / CO ALARM		1×1
12.	Joint terminal for remote control	Remote control adjuster	Q2 / 24V DC		1×1
13.	Remote control contact – speed I		Q2 / RC I		1×1
14.	Remote control contact – speed II		Q2 / RC II		1×1
15.	Remote control contact – speed III		Q2 / RC III		1×1
16.	Alarm contact of fire protection control		ALARM		2×1
17.	EAHU lighting		E1		2×1
18.	Damper actuator		2Y1		3×1
19.	Operation confirmation voltage-free contact NO type		X3:23 – X3:22		2×1
20.	Operation confirmation voltage-free contact NC type		X3:23 – X3:22		2×1
21.	External initiating signal		ESP		2×1
22.	Pressure control contact of initial filter		2S1H		2×1
23.	Pressure control contact of secondary filter		2S2H		2×1

5.3. Required Conductors

Conductor type	Figure	Description	Parameters
[1]		Control cables with copper conductors, shielded with copper wires, PCV insulated.	Rated voltage: 300/500 V Operating temperature: -40 up to 70°C
[2]		Multi-conductor cables, single- or multi-wire copper conductors, PCV insulated.	Rated voltage: 450/750V Operating temperature: -40 up to 70°C

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5.4. Connecting Power Supply to Control gear and Converters



Connect power leads of the control gear and frequency converter of the fan drive according to the **Electric diagram**. The wire cross-sections has been selected for long-term current capacity according to the Picture, for three load conductors. Due to the protection selectivity, length, cable placement method and short-circuit currents, revise the feeders' cross-sections in the table below.

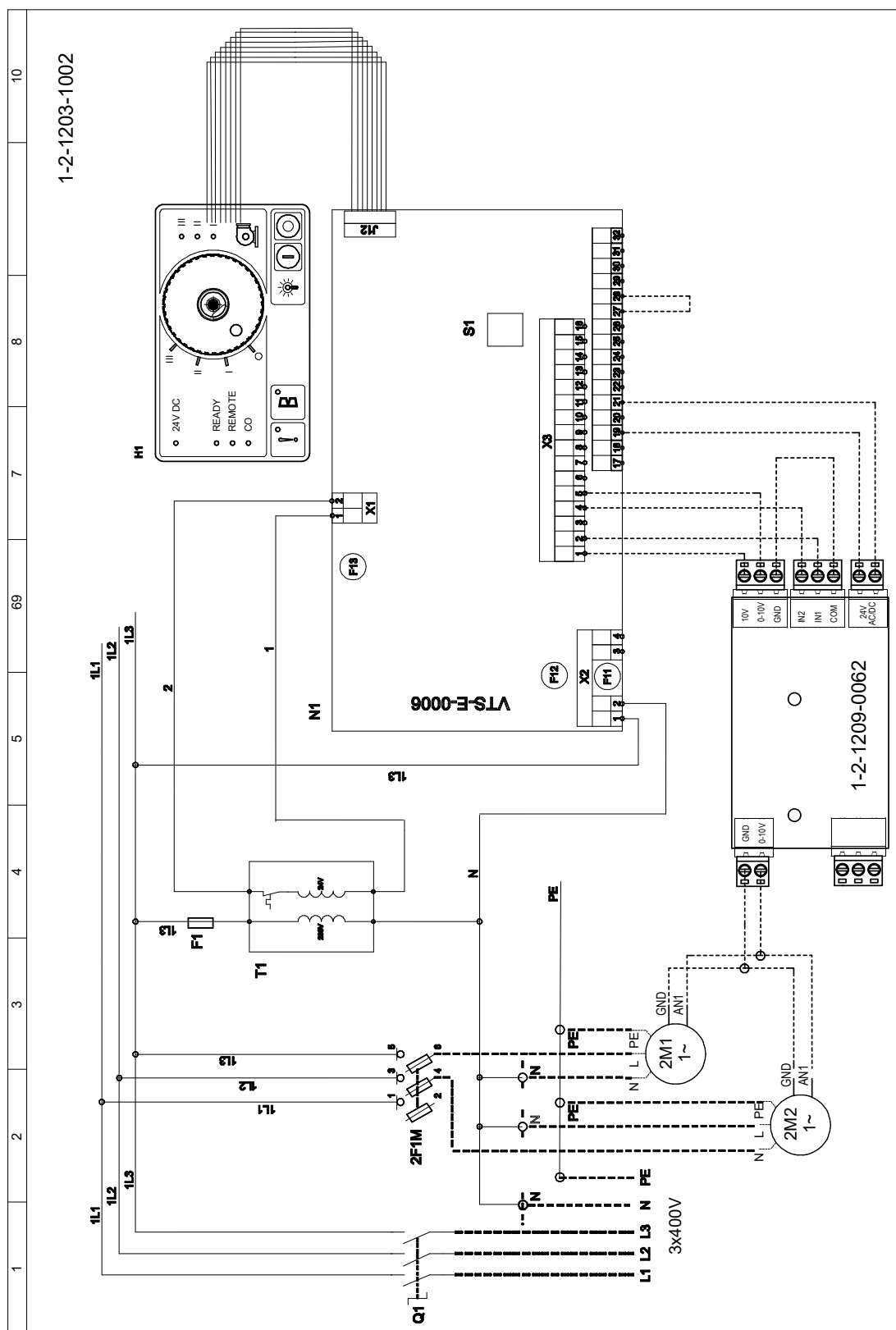
Motor power/ frequency converter	Motor rated current	Protection of frequency converter		Converter feeder [2]	Motor feeder [1]	Control gear feeder [2]	Control gear rated current
[kW]	[A]	1x230V/50Hz		[mm ²]	[mm ²]	[mm ²]	[A]
Δ - 3x230V/50Hz		MicroDrv	VLT				
0,75	3	gG16/1		3x1,5	4x1,5	3x2,5	4,5
1,1	4,5	gG16/1		3x1,5	4x1,5	3x2,5	6
1,5	6	gG25/1		3x2,5	4x1,5	3x4	7,5
2,2	8	gG25/1		3x2,5	4x1,5	3x4	10
Δ - 3x400V/50Hz		3x400V/50Hz					
3,0	6	gG16/3		4x2,5	4x2,5	5x4	6 / 6 / 7,5
4,0	8	gG16/3		4x2,5	4x2,5	5x4	8 / 8 / 9,5
5,5	11	gG20/3		4x2,5	4x2,5	5x4	11 / 11 / 12,5
7,5	15	gG25/3		4x2,5	4x2,5	5x6	15 / 15 / 16,5
11,0	21		gG35/3	4x4	4x4	5x6	21 / 21 / 22,5
2x 7,5	15	gG25/3		4x2,5	4x2,5	5x10	34 / 34 / 35,5
2x 11,0	21		gG35/3	4x4	4x4	5x16	46 / 46 / 47,5
4x 7,5	15	gG25/3		4x2,5	4x2,5	5x25	64 / 64 / 65,5
4x 11,0	21		gG35/3	4x4	4x4	5x35	88 / 88 / 89,5
1x230V/50HZ		EC motor					
0,37	2,37	gG16/1		-	3x1,5	3x2,5	0/ 0/4,5
0,75	3,88	gG16/1		-	3x1,5	3x2,5	0/ 0/6,5
2x0,37	2x2,37	gG16/2		-	3x1,5	3x2,5	0/2,5/4,5
2x0,75	2x3,88	gG16/2		-	3x1,5	3x2,5	0/ 4/6,5

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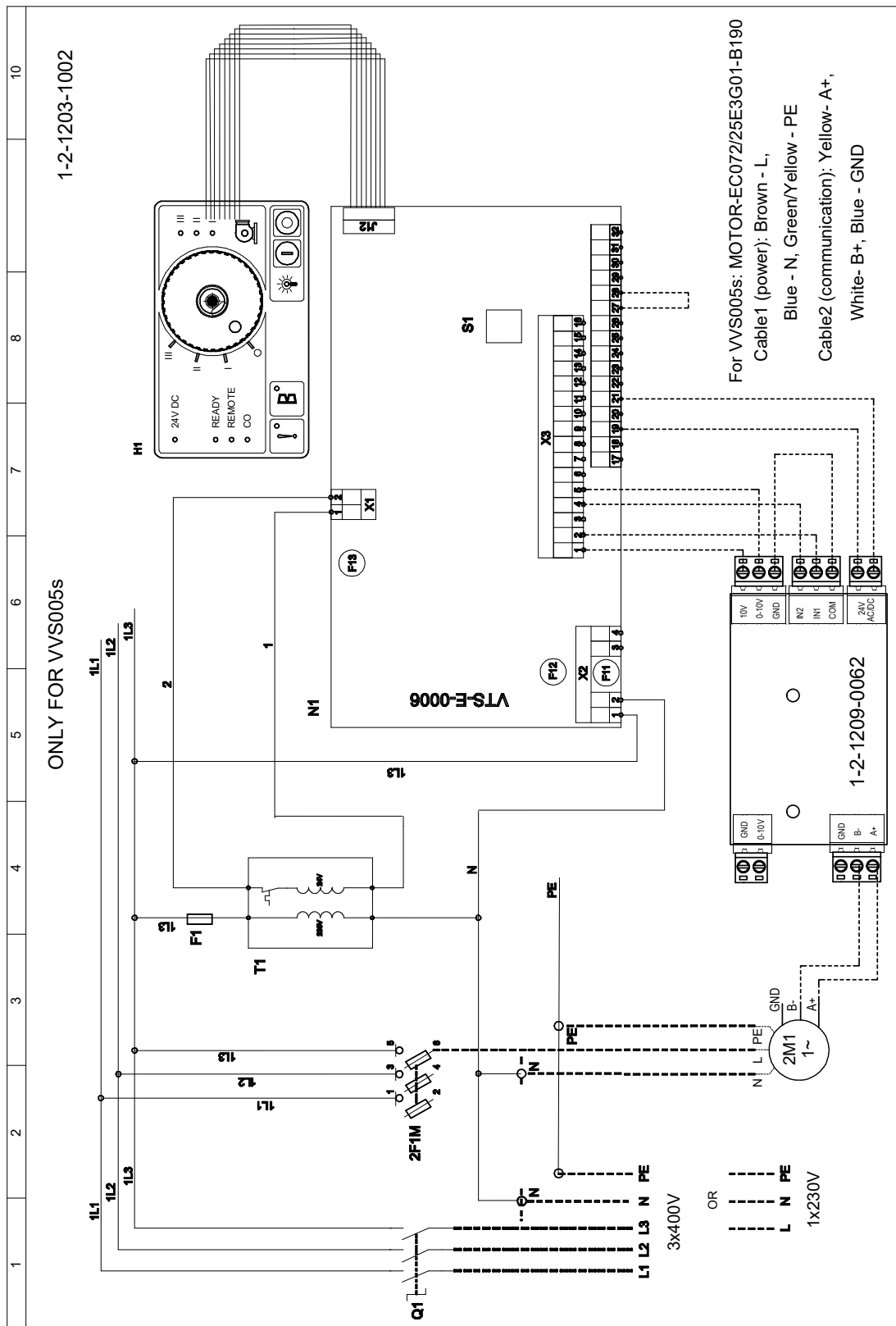
Advanced instructions



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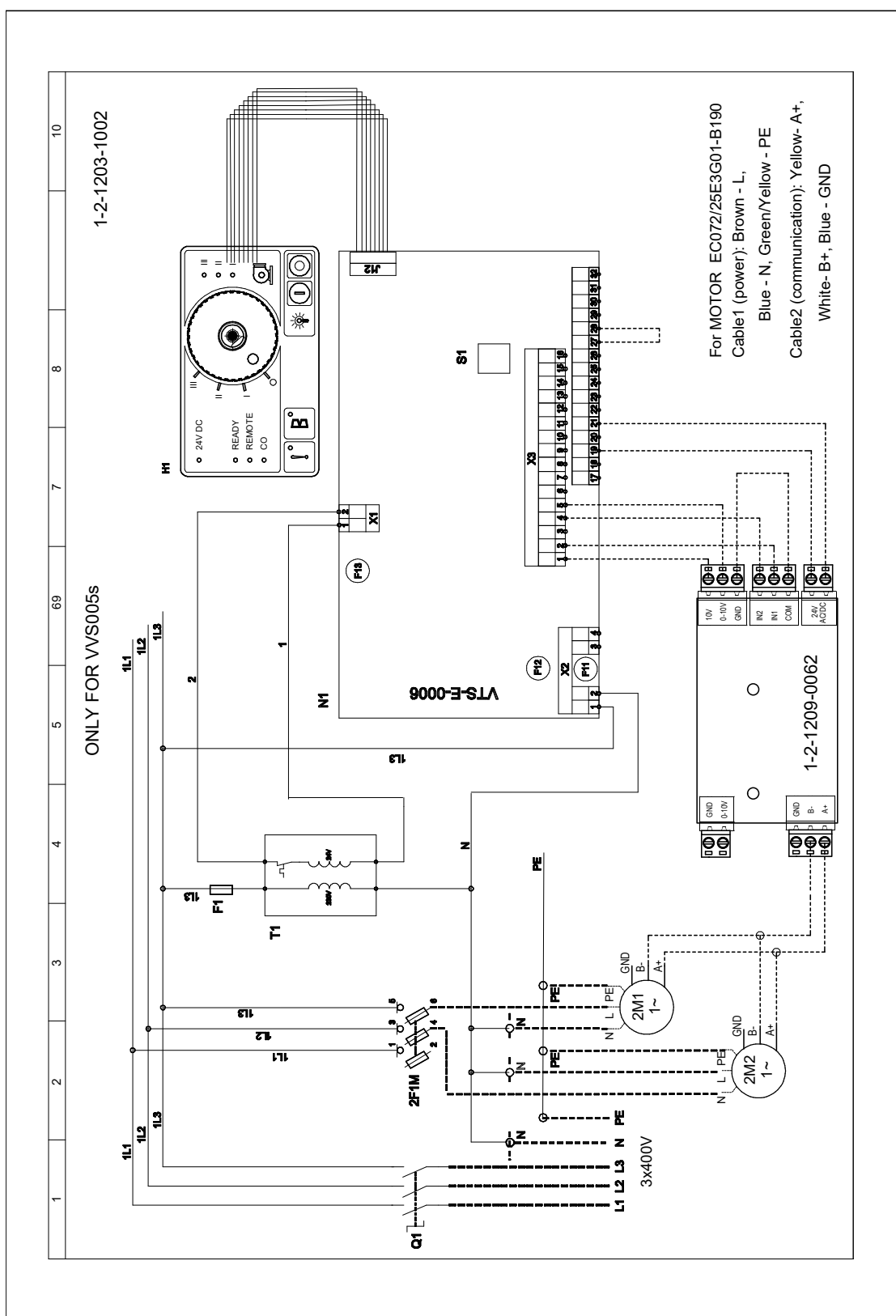


Electrical diagram of the VS ... CG 0-1 control gear with x 1 EC motor for VVS005s



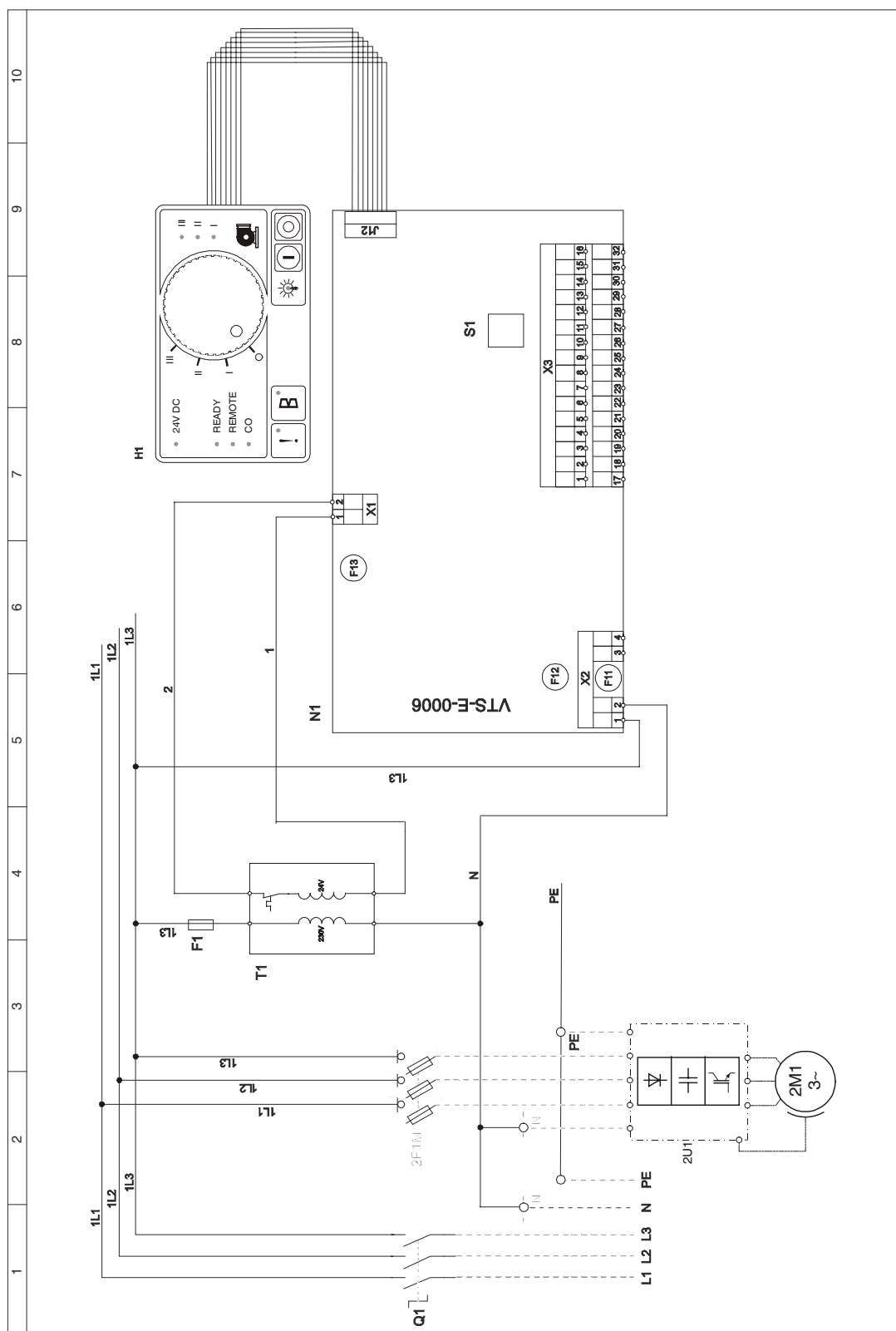
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Electrical diagram of the VS ... CG 0-1 control gear with x 2 EC motors



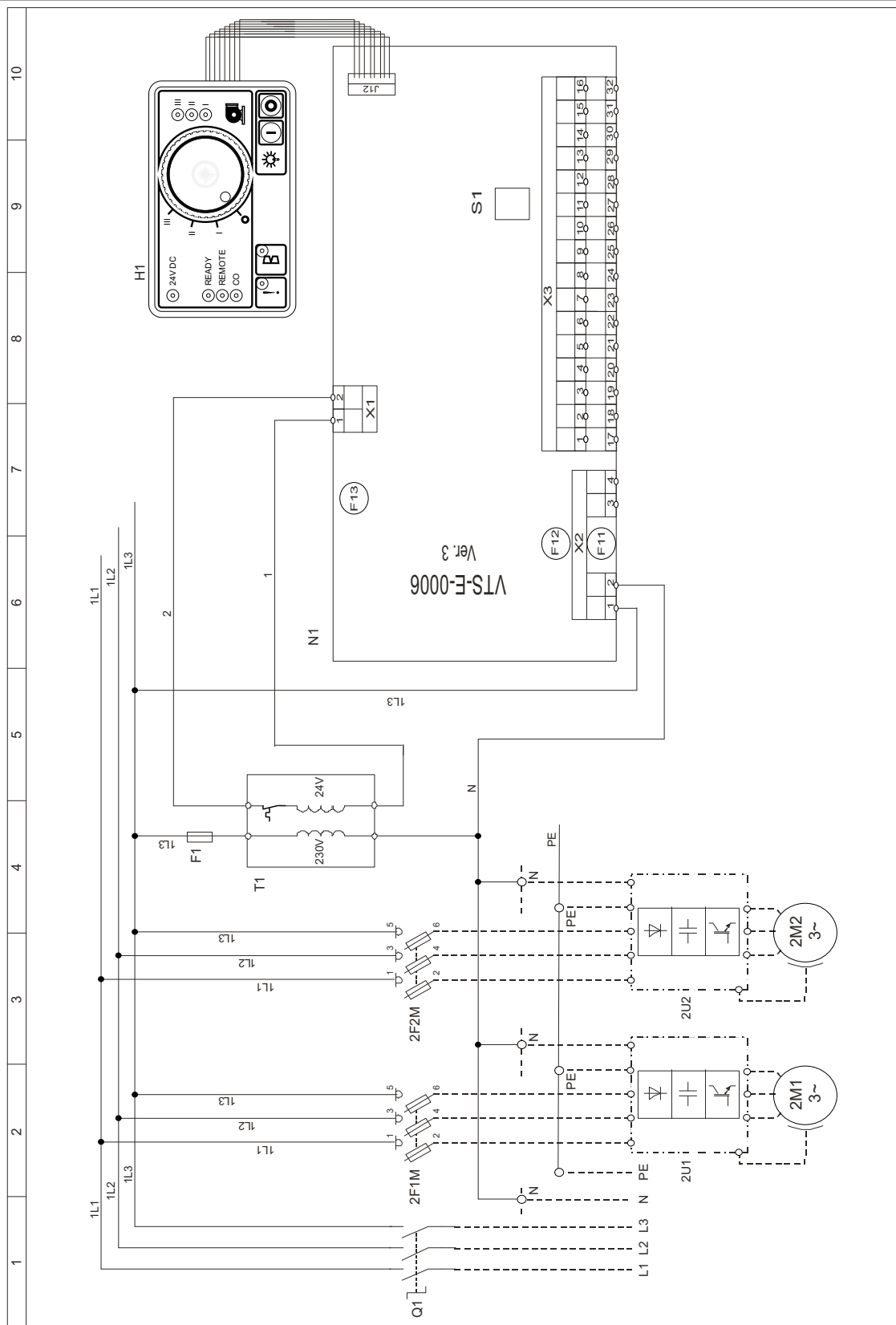
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Electric scheme of VS 21-150 CG 0-1 control gear



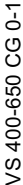
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Electric scheme of VS 180-300 CG 0-1 control gear



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Electric scheme of VS 400-650 CG 0-1 control gear



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