VTS

EN

Control gear for Supply and Supply-Exhaust Air Handling Units

Operation and Maintenance Manual

ventus

DTR - CG UPC - ver.2.6 (06.2019)

EN

The control gear complies with European Standard

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

www.vtsgroup.com

Table of Content

EN

EN

I. USER'S MANUAL

1. DESCRIPTION OF CONTROLS

1.1. INTRODUCTION

Application:

Protection and control of supply and exhaust AHUs equipped with up to:

- two fan sets (up to 8 fans in total) and two air dampers
- cooler, heater, heat recovery system
- optional pre-heater (in specified units)
- three filtration sections

Range of operation:

VS 10-75 CG UPC
VS 40-150 CG UPC SUP
VS 40-150 CG UPC SUP-EXH
VS 180-300 CG UPC
VS 400-650 CG UPC

Systems equipped with frequency converters and motors with up to 11kW power output

EN

1.2. MAINS SWITCH

Function:
Swithing the control gear On / Off

1.3. COMMUNICATION PORT

RJ11 socket, is placed In front of the control gear housing
Function:
Connecting the HMI Advanced UPC control panel to the controller

1.4. SIGNALLING CONTROLLER STATUS

In the bottom left side of the controller, there are two LED indicators

Orange LED indicates the condition of the power supply. LED off means no power supplied to the terminals or malfunction of internal power supply circuitry. LED on means correct parameters of the power supply.

Green LED indicates the condition of controller's BIOS. LED off means that the firmware is not running correctly. LED on means that BIOS runs OK and the controller is ready for operation.

!

1. All control gears of the VS…CG UPC typeline need to be powered from the main switchgear equipped with appropriate protection of wires powering the control box.
2. Assembly, wiring and start-up of the control gear should by done by qualified staff only.
3. 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.
4. The entire length of the input/output connections must be less than 30 m, according to EN 61000-6-2.
5. Installation must be performed according to the standards and legislation in force in the country where the appliance is used.
6. 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. The X0:3,N clamps are designed to power that module. (ratings: 230V AC, 6A)

EN

1.5. ADVANCED CONTROL PANEL VS 00 HMI ADVANCED UPC

LCD Display
Displaying available parameters, settings and current values

BELL Button

Jump to alarm handling pages

PRG Button
1. Quick jump to the Calendar main page
2. In Calendar pages - quick clear of the settings

ESC Button
Jump to the main page or leaving the parameter change

UP Arrow
1. Moving up accross the menu screens (when the cursor stays in upper left corner)
2. Increasing the parameter value

<table>
<tr>
<td> 
</td>
<td>ENTER Button
1. Moving the cursor across the screen - cursor jumps to the next parameter available for changing. Read-Only parameters are not marked with the cursor.
2. Confirming entered values
3. Entering sub-menus from the main menu level:
Parameters
Calendar
Alarms
Settings
Service
DOWN Arrow
1. Moving down accross the menu screens (when the cursor stays in upper left corner)
2. Decreasing the parameter value</td>
</tr>
<tr>
<td colspan="2">Navigation example:
1. In the main menu level use UP/DOWN arrows to find the desired sub-menu
2. Press ENTER to go to the sub-menu level
3. Use UP/DOWN arrows to move accross the sub-menu screens
4. In the desired screen, use the ENTER button to switch between the changeable parameters - the ursor starts from the upper left corner (which is the base positnion) and jumps on and on until going back to the upper left corner - then the loop can be started again
5. To change the parameter marked with the cursor, use the UP/DOWN arrows
6. Press ENTER to go confirm the change and to jump further</td>
</tr>
<tr>
<td colspan="2">Functions:
▪ Air handling unit operation, parameterization and maintenance
▪ Selection of control application
▪ Time zones setting
▪ Displaying and canceling alarm statuses, viewing alarm history</td>
</tr>
<tr>
<td>!</td>
<td>Parameters available in the LCD window depends on a AHU type and the control application. Hence in AHUs not equipped with heater, options related to the heating module will not be visible.
HMI Advanced UPC can’t serve as a room temperature sensor.</td>
</tr>
<tr>
<td>☝</td>
<td>Optional element</td>
</tr>
</table>

EN

1.6. SIMPLIFIED CONTROL PANEL - HMI BASIC UPC

1. LCD Display
Indicates actual room temperature or temperature on the main control sensor as well as a chosen seting, operation mode, fan speed, time and day of the week.

2. ON/OFF button
Switching between On/Off state (forcing the unit to stop or enabling operating mode selection)

3. Fan button
Button for mode setting: Auto / Low / Econo / Comfort

4. Clock buttonn
Entering Auto mode. Controller will operate according to the time schedule stored in Calendar settings.

Note: *There are two options for time schedule operation. For details, follow chapters related to Calendar and to Service Menu.*

Note: *If the Calendar is also in Auto mode, the AHU operation will rely only on protective and energy saving functions like Standby and Night Cooling. This is possible for the main Calendar of the controller. The built-in Calendar of the HMI Basic doesn't support that functionality.*

5. Push & Roll knob
Quick, intuitive and easy entering values, changing setpoints, accepting new values.

Note: *To change the temperature setpoint, just turn the knob.*

Display of the room sensor temperature or the value of the temperature setpoint offset ***Note!*** *Setting is limited to 16..26°C*
Icons for active recirculation, cooling or heating
Time indication
Display of the fan speed setting or the indication of automatic fan mode
Indications of the weekdays
Icon for active recovery unit
Icon for alarm event
Icon for Off mode

EN

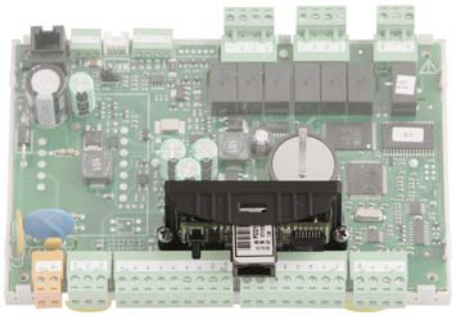
Functions:

- Room temperature measurement and display
- Change and display of temperature setpoint
- Change and display of fan setpoint
- Display temperature of the main control sensor
- Change of AHU operation mode
- Info on alarm status

☝	*Optional element* *Connects to the controller via the Modbus line, common with the frequency converters.*

WEB-SERVER OPTION – AVAILABLE AS EXPANSION CARD

MODBUS TCP/IP – AVAILABLE AS EXPANSION CARD



Gives extended access to read / write parameters like measurement readouts, setpoints, settings, output values, selected calendar settings, alarms. Total count of available parameters exceeds 200 datapoints.

SEE SPECIAL MANUAL FOR DETAILS OF EXPANSION CARD OPERATION

EN

2. SYSTEM START-UP

!	*Operation of the AHU is strictly arrested by the fire-protection alarm, activation of the thermal protection of fans' motors, threefold activation of the protection of electric heater and threefold activation of the anti-frost thermostat. Each of these events requires removing the cause of the alarm and then canceling it ((see more details in Advanced Manual).*

2.1. SWITCHING ON POWER SUPPLY

Switching on power supply of the control gear with the mains switch (Q1M). Correct power supply and good BIOS operation is indicated by yellow and green LED lamps on the controller's PCB.

The system is ready for operation after about half minute from switching on.

☝	*If the system did not start, check the F1 protection status* *Correct device operation depends on the application settings. Choosing and setting up the application should be done by qualified service provider, according to recommendations of part II "Advanced manual"*

2.2. HMI ADVANCED UPC

Main menu structure

1. Main default screen with most important statuses and setpoints.

Set mode HMI – is used to set the main operating mode from the HMI.

Current mode – indicates current AHU mode resulting from HMI setting, alarms, external control signals etc.

Set temp HMI – is used to enter the main temperature setpoint from the HMI.

Current temp – temperature readout from the main sensor.

2. Second main status screen

Fans – indicates the current state and rate of the fans

Dampers – indicates the current state and opening rate of the dampers

Regulator – indicates the state and the output of the main controller for heating / cooling function

Recovery – indicates the state and rate of the heat recovery unit

EN/PL/RU – language selection

PASSWORD – is used to enter to special settings and hidden parameters

3. Sub-menu link screen

PARAMETERS → link to main statuses and readouts from the control system

4. Sub-menu link screen

CALENDAR → link to calendar settings and time schedule programming

5. Sub-menu link screen

ALARMS → link to alarm pages

6. Sub-menu link screen

SETTINGS → link to set and adjust the control system, regulators, timers

7. Sub-menu link screen

SERVICE MENU → link to main configuration parameters, application codes, AHU startup settings

☝ *All the menus are dynamically changed, as they depend on the application settings and the password level*

2.3. LANGUAGE SELECTION

HMI Advanced supports the following languages:

EN English
PL Polish
RU Russian

English is set as a default language.

2.4. ENTERING THE PASSWORD

Many parameters are protected with a password, to avoid unintentional change, that could be dangerous for the unit or for the user. To access that parts of the menu, a password must be entered.

Default password is: 1357

2.5. SELECTION OF OPERATING MODE

The AHU can operate in one of the following operating modes.

Auto – AHU operates depending on – the calendar programming

HMI Basic

external control signals (binary inputs)

critical temperatures, e.g. too low temperature causes AHU start and immediate heat-up of the room

Off - AHU switched off – fans stopped,

dampers and control valves closed

all sensors and gauges are activated – in order to protect the unit from damage, e.g. fire alarm, frost protections

Low – Lower economy mode – The fan speed and the deadzone for temperature regulation are adjustable

The temperature control algorhitm can use broad deadzone and the fans can be set to low speed in order to reduce energy consumption

Econo – Upper economy mode – The fan speed and the deadzone for temperature regulation are adjustable

The temperature control algorhitm can use narrower deadzone and the fans can be set to higher speed in order to optimize energy consumption

HMI ADVANCED

Selection path: Main menu / Set mode HMI / Auto..Off..Low..Econo..Comfort

Set mode HMI	Comfort
Current mode	InitHtg
Set temp HMI	21,0°C
Current temp	19,4°C
Mon 28.02.2011 10:09	

Comfort – Comfort mode – The fan speed and the deadzone for temperature regulation are adjustable

The temperature control algorhitm can use most accurate deadzone and the fans can be set to highest speed in order to give maximum comfort

Note! *The temperature setpoint is common for all operating modes, the deadzone settings are individual for each mode.*

HMI BASIC

1. On/Off button - press to switch between Off and Low mode.
2. Fan button - press to switch operating mode between Low - Econo - Comfort
3. Clock button - press shortly to switch to Auto mode. In Auto mode Calendar will be capable of taking over the control.

EN

2.6. INDICATION OF OPERATING MODE

The following modes can be displayed in Current mode field in the main menu: Auto..Off..Low.. Econo..Comfort as described above

Fire – operating mode enabled by fire alarm input. All the devices switched off, the fans stop or run with selected setpoint (see chapter Service Menu)

OverRun – AHU switches off, but the fans keep running on the idle speed until the heater is cooled down (see chapter Service Menu)

NightClg – Night Cooling – a mode for energy saving by cooling down the room using cold air from the outside in the night. Available only in the units with external temperature sensor.

Standby – protection mode for min/max room temperature – if the temperature exceeds specified setpoints, AHU is switched on, to heat up or cool down to desired range. Then switches off again.

NightKick – testing mode, that forces fans to run in order to exchange the air in the ventilation system.

Note! *Night cooling and Standby functions rely on room temperature. If there's no measurement in the room, the exhaust duct sensor is taken into account and gives the readout. This requires turning on the fans to have appropriate room temperature value on that sensor.*

InitHtg - Initial Heating - a mode for startup of water heating units in winter conditions, heats up the coil before starting the fans in order to prevent activation of frost alarms.

Startup - temporary mode when dampers are opening, fans speed up and the heating / cooling devices are enabled and start operation.

FastHtg / FastClg - Fast Heating or Cooling - special mode for units with PCR or RRG recovery, that allows operation with closed intake/outlet dampers and full recirculation. That improves heating up the building.

Heating - mode when heaters can be enabled

Cooling - mode when coolers can be enabled

Vent - Ventilation - energy saving mode, when neither heaters nor coolers are enabled and the unit operates only with ventilation and optional recovery unit.

EmgStop - Emargency Stop - unit forced to stop immediately, according to signal from optional digital input.

AlrStop - Alarm Stop - unit forced to stop because of an alarm

CrtStop - Critical Stop - unit forced to stop because of a critical alarm

Config - unit forced to stop because the controller is in Config mode. Conatoller must be configured first and switched to Running mode

The unit can be controlled from several sources. Mind the priorities between them.

1. HMI Advanced (highest priority)
2. The BMS over Modbus TCP/IP connection
3. External control inputs
4. HMI Basic
5. The calendar mode

Note! *To enable another sources than the HMI Advanced, the Operating mode HMI must be set to Auto*

3. SYSTEM OPERATION

3.1. PARAMETERS → OPERATING MODE

Actual – indicates current AHU mode resulting from HMI setting, alarms, external control signals etc.
From HMI – indication of the operating mode from the HMI
From BMS – indication of the operating mode requested from BMS link over the Modbus TCP/IP connection
Note! *Control over Modbus TCP/IP is available only in controllers equipped with expansion board*
External ctrl – indication of the operating mode resulting from the digital inputs
HMI Basic - indication of the operating mode resulting from the HMI Basic UPC device
From Calendar – indication of the operating mode from the calendar

HMI ADVANCED

OPERATING MODE		
HMI Advanced		Comfort
BMS		Auto
Digital inputs		Auto
HMI Basic		Auto
Calendar		Auto
	DI Sum	HMI Wint

Actual season – selection of the current working mode for universal heating/cooling coil. If “Winter” selected – the coil works as a water heater. If “Summer” selected – the coil works as a water cooler.
Selection HMI – Winter/Summer
Binary input – Winter/Summer – universal binary input can be configured as a season selector
From BMS – indication of the operating mode requested from BMS link over the Modbus TCP/IP connection
Sum/Wint – season selection switch – used in combi-coil applications, where one coil can be switched to heating in winter (fed from boiler) or to cooling in summer (fed from chiller). The selected season must correspond to the actual setup of the hydraulic valves.
Note! *The pipeline has to be switched manually between supplying from chiller or from boiler. The season selection must be done according to the actual state of the piping.*
Note! *The Summer mode has got lower priority than the Winter mode, regardless to the control source – HMI or binary input or BMS command over Modbus TC/IP connection.*

HMI ADVANCED

OPERATING MODE	
Actual season	Winter
Selection HMI	Winter
Binary input	Summer
From BMS	Winter

3.2. CALENDAR → MAIN PAGE

CHECK FOR ERRORS! - indicates misordered settings. That text is displayed in the top line only if errors were found in the calendar settings.
Calendar mode – indicates current mode from calendar: Auto.. Off..Low..Econo..Comfort
Temp setpoint – indicates current temperature setpoint from calendar
Exceptions – indicates if the special time zones were activated or not: Disabled..Enabled
Date – indicates the current date and weekday, allows for change
Time – indicates current time, allows for change

HMI ADVANCED

CALENDAR	
CHECK FOR ERRORS!	
Calendar mode	Standby
Temp.setpoint	21,0°C
Exceptions	Disabled
Date	Mon 28.02.2011
Time	10:09

EN

3.2.1. CALENDAR → MONDAY

HMI ADVANCED

Clr – quick erase of all the daily settings – press PRG button to activate, ESC to quit or ENTER to go to further settings

! / OK – indicates the right order of time zones, zone 1 is the earliest, zone 6 is the latest, and all zones should be in ascending order

Lines 1..6 – six time zones for daily settings

Time – starting point for the zone, range 00:00..23:59, first zone start fixed at 00:00, last zone end fixed at 23:59

Operating mode – Auto..Off..Low..Econo..Comfort

Temperature setpoint – individual temperature setpoint for each time zone

The same range of settings applies to all days of the week. Each day has own page in the Calendar.

CALENDAR MONDAY			
Clear			OK
1	00:00	Off	21,0°C
2	05:20	Stby	21,0°C
3	06:00	Low	22,5°C
4	12:30	Econo	22,5°C
5	14:00	Comfort	22,5°C
6	19:00	Stby	19,0°C

3.2.2. CALENDAR → SPECIAL

HMI ADVANCED

Copy Mon – Fri – copy the settings from Monday to all working days

Copy Mon – Sun – copy the settings from Monday to all days of the week

Select desired option with ENTER key and press PRG to activate.

CALENDAR Special		
Copy Mon-Fri		Copy
Copy Mon-Sun		Copy

3.2.3. CALENDAR → EXCEPTIONS

HMI ADVANCED

There are six exception settings for specific periods like holidays.

Activate – No..Yes – activates the exception settings

From – starting point for the period (month, day, time)

To – end point for the period (month, day, time)

Mode / Setpoint – set desired operating mode and temperature setpoint

EXCEPTIONS		
Activate		Yes
From	01.03	00:00
To	06:03	12:00
Mode		Off
Setpoint		21,0°C

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3.3. CALENDAR MODE IN HMI BASIC

HMI Basic can operate with time schedules in two ways. Selection is done in Service Menu of the µPC controller and is available only via HMI Advanced interface.

1. HMI Basic can use the calendar in the controller – all settings are done via HMI Advanced or via BMS connection and HMI Basic can only activate / deactivate operation according to time schedule stored in the controller.

Note! *HMI Basic cannot change any settings in the controller's calendar.*

2. HMI Basic can use own local time scheduler – all the settings are done and stored in HMI Basic.

Note! *Mind the limitations of the HMI's calendar – only On/ Off and temperature settings can be adjusted in the HMI Basic. Low / Econo / Comfort modes must be pre-set in the controller settings via HMI Advanced.*

Setting the program for selected days:

1. Clock button - long-press to enter settings mode

2. Turn the knob to select "Time band" and press to enter

3. In "Sel days" turn the knob to select days - whole week, working days, weekend, or any day separately. Then press to enter.

4. Observe the house icon - it indicates which time zone is edited at the moment. Turn the knob to select specific time zone from 1 to 6. Press to enter.

5. Turn the knob to set hour and press to confirm.

Note! *Between 23 and 00 there's blank setting --:-- which means, that current time zone is skipped.*

6. Turn the knob to set minutes and press to confirm.

7. Turn the knob to set the temperature adn press to confirm.

Note! *Below min. setpoint there's OFF setting. Use that to turn off the unit in selected time zone.*

To leave from any level of calendar programming, select ESC and press to confirm.

To set clock, long-press the Clock button to enter settings mode, turn the knob to select Cloc, press to enter and set proper hour, minutes and weekday.

Note! *Setting the weekday properly is necessary for correct operation of the Calendar mode.*

HMI BASIC

EN

3.4. PARAMETERS → AIR TEMPERATURES

HMI ADVANCED

Readout of actual temperature inputs. If the sensor is not activated in the application, indicates "-".

AIR TEMPERATURES	
Supply	21,0°C
Room	21,0°C
Exhaust	21,0°C
External	21,0°C
After recovery	21,0°C
Pre-heater	21,0°C

3.4.1. PARAMETERS → HUMIDITY

HMI ADVANCED

Humidity – actual value of air humidity

AIR HUMIDITY	
Humidity	050,0%

3.4.2. PARAMETERS → HUMIDITY CONTROL

HMI ADVANCED

Humidification rate - actual rate of humidification

Dehumidification rate - actual rate of dehumidification

■ **-** active □ **-** inactive

HUMIDITY CONTROL	
Humidification rate ■	050,0%
Dehumidification rate □	050,0%

3.4.3. PARAMETERS → SUP FAN & DAMPER

3.4.4. PARAMETERS → EXH FAN & DAMPER

HMI ADVANCED

SUP FAN & DAMPER		
Sup fan setpoint		
Low: 30%	Eco: 60%	Comf: 90%
Sup fan rate		60%
Alarm status		OK
Damper opening		100%

Sup fan setpoint / Exh fan setpoint – setting for fan rate given in % for Low / Econo / Comfort separately

Sup fan rate / Exh fan rate – indicate the current fan state by showing the percentage of control signal. 0% = fans stopped, >0% = fans running

Status - combined information for communication problems and for motor alarms

OK - no malfunctions

Comm - communication to the frequency converter not stable or lost

Alarm - communication OK, but frequency converter reported an error, e.g. overload

Damper opening - indicates current position of the intake and outlet dampers: 0% = fully closed, 100% = fully opened

Note! *The fan rate settings cannot exceed Freq. low / high limit settings. If so, they are corrected automatically.*

3.4.5. PARAMETERS → HEATING

HMI ADVANCED

HEATING	
Main temp	18,0°C
Setpoint	21,0°C
Heating rate	40%
Pump status	On
Alarm status	OK
Back-water	50,0°C

Main temp – current readout from the main temperature sensor

Setpoing – current setpoint for the regulator, read only

Heating rate – indicates current heating capacity

0% – no heating, 100% – full heating

Pump status – indicates current state of the circulation pump

On - turned on

Off - switched off

Alarm status – indicate the state of frost protection input or overheating protection (for water coil or electrical heater, respectively)

Back water – current readout of the back-water temperature measured on outlet pipe of the heating coil.

EN

3.4.6. PARAMETERS → RECOVERY

Recovery mode - selecting the operation mode for the recirculation chamber

• **MECH** – Maximum Energy Changeover – control from the PID controller, recirculation plays the role of the first heating / cooling section in order to take full advantage of energy recovery, the scope of possible changes concerning recirculation is defined by fixed setting of minimum fresh air.

• **Manual** - fixed manual recirculation settings

• **Univ.AI** – control from the universal analog input; the range of possible changes is limited by the setting of minimum fresh air

Recovery rate – indicates current recovery capacity, gives a link to output detail screen (password protected link – see Advanced Manual)

0% – no recovery, 100% – full recovery

Note! *The controller signal can differ from the actual recovery rate due to protective functions that could affect it.*

Frost prot. rate – indicates the rate of frost protection, that is subtracted from controller signal in order to protect the recovery unit from freezing

Note! *Frost protection can be managed in two stages - first step can be reduction of supply fan speed, second step is reducing the recovery rate*

Glycol pump – indicates current state of the pump, gives a link to pump detail screen (see Advanced manual)

Status - combined information for communication problems and for motor alarms

OK - no malfunctions

Comm - communication to the frequency converter not stable or lost

Alarm - communication OK, but frequency converter reported an error, e.g. overload

CO2 value - value of CO2 concentration

HMI ADVANCED

RECOVERY	
Recov. mode	MECH
Recovery rate	50%
Frost prot.rate	o%
Glycol pump	On
Alarm status	OK
CO2 value	500 ppm

3.4.7. PARAMETERS → COOLING

Main temp – current readout from the main temperature sensor

Setpoint – current setpoint for the regulator, read only

Cooling rate – indicates current cooling capacity

0% – no cooling, 100% – full cooling

Pump status – indicates the current state of the pump or chiller

Alarm status – indicates the state of the cooling device

OK – no malfunctions

Fault – alarm input has been activated

HMI ADVANCED

COOLING	
Main temp	27,0°C
Setpoint	21,0°C
Cooling rate	65%
Pump status	On
Alarm status	OK

3.4.8. PARAMETERS → PRE-HEATING

Temperature – current readout from sensor dedicated for pre-heating coil

Setpoint – current setpoint for the regulator, read only

Heating rate – indicates current heating capacity

0% – no heating, 100% – full heating

Pump status – indicates current state of the circulation pump

Alarm status – indicate the state of frost protection input

Note! *The pre-heating coil works out of the standard cooling/heating sequence. It is intended just to keep the constant temperature in specified place, e.g. to heat up outside air before entering the heat recovery unit.*

HMI ADVANCED

PRE-HEATING	
Temperature	-10,0°C
Setpoint	-11,0°C
Heating rate	40%
Pump status	On
Alarm status	OK
Back-water	20,0°C

3.4.9. PARAMETERS → SUP MOTORS

3.4.10. PARAMETERS → EXH MOTORS

Freq - actual output frequency

Current - actual current consumption

Status - combined information for communication problems and for motor alarms

OK - no malfunctions

Comm - communication to the frequency converter not stable or lost

Alarm - communication OK, but frequency converter reported an error, e.g. overload

Note! *Ventus AHU can have up to 4 frequency converters in one fan set (MultiFan configuration). All FCs in the fan set have common settings for frequency, ramp-up, ramp-down and the main limits – as they must work synchronously.*

Note! *FC details visible only if frequency converters were enabled during unit configuration*

HMI ADVANCED

SUP MOTORS		
Freq	Current	Status
1: 40,0Hz	4,1A	OK
2: 40,0Hz	4,3A	OK
3: 40,0Hz	4,2A	OK
4: 40,0Hz	4,2A	OK

3.4.11. PARAMETERS → SUPPLY PRESSURE TRANSDUCER

Pressure - actual value of air pressure

Set Point - actual setting value of air pressure

HMI ADVANCED

SUPPLY AIR PRESSURE		
Pressure	800	Pa
SetPoint	799	Pa

3.4.12. PARAMETERS → EXHAUST PRESSURE TRANSDUCER

Pressure - actual value of air pressure

Set Point - actual setting value of air pressure

HMI ADVANCED

EXHAUST AIR PRESSURE		
Pressure	800	Pa
SetPoint	800	Pa

3.4.13. PARAMETERS → SUPPLY PRESSURE TRANSDUCER

Pressure - actual value of air pressure
Air flow - calculated air volum flow
Set Point - actual seting value of air volum flow

HMI ADVANCED

SUPPLY AIR FLOW	
Pressure	800 Pa
Air flow	11240 m3/h
SetPoint	12003 m3/h

3.4.14. PARAMETERS → EXHAUST PRESSURE TRANSDUCER

Pressure - actual value of air pressure
Air flow - calculated air volum flow
Set Point - actual seting value of air volum flow

HMI ADVANCED

EXHAUST AIR FLOW	
Pressure	800 Pa
Air flow	11240 m3/h
SetPoint	12003 m3/h

3.4.15. PARAMETERS → REDUNDAN

Working time – information on hours worked fans
1st set – a first set of fans
2nd set – a second set of fans
Active set of fans - the currently running a set of fans
1st set – a first set of fans
2nd set – a second set of fans
• \/□ - stop/start

HMI ADVANCED

REDUNDANT		
Working time		
1st set	123	h
2nd set	200	h
Active fans		
1st set	□	
2nd set	□	

3.5. SETTINGS → TIMERS

On-delay - setting for startup delay, from start command to the actual startup of the unit
Idle - setting for startup procedure, in idle state the fans run at lowest speed, dampers are opening and all the heating/ cooling/recovery and protective regulators enter normal operation mode
Off-delay - setting for delayed stopping of the fans, can be used to cool down electric heater or to run down the DX cooling system

HMI ADVANCED

TIMERS		
	Sup	Exh
On-delay	20s	10s
Idle	20s	30s
Off-delay	10s	10s

3.5.1. SETTINGS → STANDBY

Enable – activate the standby functionality
No – function disabled
Yes – function enabled
Start Htg – temperature at which the heating is activated
Setpoint Htg – temperature at which the heating is turned off
Start Clg – temperature at which the cooling is activated
Setpoint Clg – temperature at which the cooling is turned off
Min work time – min. running time in standby mode
Min delay – min. resting time after working in standby mode

HMI ADVANCED

STANDBY	
Enable	Yes
Start Htg	16,0°C
Setpoing Htg	22,0°C
Start Clg	27,0°C
Setpoing Clg	18,0°C
Min work time	60s
Min delay	600s

3.5.2. SETTINGS → NIGHT COOLING

Enable – activate the night cooling functionality

No – function disabled

Yes – function enabled

Min ext temp – night cooling function is disabled below that limit of external temperature

Min work time – min. working time for the nigh cooling

Min delay - min. time when the function cannot be enabled again

HMI ADVANCED

NIGHT COOLING	
Enable	Yes
Min ext temp	18,0°C
Min work time	60s
Min delay	60s

3.5.3. SETTINGS → NIGHT TEST

Night cooling and Standby functions rely on room temperature. If there's no temperature measurement in the room, the exhaust duct sensor is taken into account and gives the readout. This requires turning on the fans to refresh the air and have appropriate room temperature value on that sensor.

Enable – activate the night test functionality

No – function disabled

Yes – function enabled

Test hour – setting the time, when the night test function will be triggered. The night test operates in a daily manner.

Test duration – specifies how long the night test will be executed

Note! *If during the Night Test operation, conditions for Night Cooling or Standby will be detected, the unit will automatically switch to another relevant mode.*

Note! *Night Test functionality will not be triggered if external temperature is lower than Min Ext Temp for Night Cooling.*

HMI ADVANCED

NIGHT TEST	
Enable	Yes
Test hour	05:15
Test duration	60s

3.5.4. SETTINGS → FAST HEATING

Enable – activate the fast heating functionality

No – function disabled

Yes – function enabled

Temp deviation – the fast heating algorithm will be executed until the main temperature is lower than the setpoint by the value of Temp deviation

HMI ADVANCED

FAST HEATING	
Enable	Yes
Temp deviation	5,0°C

3.5.5. SETTINGS → TEMPERATURES

Setpoint Hi – setting for upper boundary of temperature setpoint

Range: 20..40

Default: 26

Setpoint Lo – setting for lower boundary of temperature setpoint

Range: 0..20
Default: 16

Deadzone LOW – settings for the allowed non-sensitive range in Low mode

Range: 0..10
Default: 4.0

HMI ADVANCED

TEMPERATURES	
Setpoint Hi	26,0°C
Setpoint Lo	16,0°C
Deadzone LOW	4,0°C
Deadzone ECO	2,0°C
Deadzone COMF	1,0°C
Min Clg temp	16,0°C

EN

Deadzone ECO – settings for the allowed non-sensitive range in Econo mode

Range: 0..10
Default: 2.0

Deadzone COMF – settings for the allowed non-sensitive range in Comfort mode

Range: 0..10
Default: 1.0

Min Clg temp – setting for the temperature limit. If external temperature falls below that value, the cooling functionality is disabled.

Range: 0..20
Default: 16

3.5.6. SETTINGS → HUMIDITY CONTROL

LOW, ECO, Comf., Standby, Auto - value of setpoint humidity for selected mode

HMI ADVANCED

HUMIDITY		
Humidity setpoints		
LOW	ECO	Comf
050,0%	050,0%	050,0%
Standby	Auto	
050,0%	050,0%	

PI regulator - main regulator of de-/humidification
- **KP -** proportional gain
- **Ti -** integrational time

Deadzone - non-sensitive range

Start signal
- **ON -** humidifier on threshold
- **OFF -** humidifier off threshold

HMI ADVANCED

HUMIDITY CONTROL		
PI regulator		
Kp	050,0 Ti	120s
Deadzone		05,0%
Start signal		
ON	50,0%	
OFF	1,0%	

3.5.7. SETTINGS → FANS

Supply freq limits Min / Max
Exhaust freq limits Min / Max
Limits in Hz for allowed range of operation

Ramp up / Ramp down – settings for acceleration and deleceleration times

Range: 30..120s
Default: 45s

Note! *The fan rate settings cannot exceed Freq. low / high limit settings. If so, they are corrected automatically.*

HMI ADVANCED

FANS	
Supply freq limits	
Min: 20Hz	Max: 80Hz
Exhaust freq limits	
Min: 20Hz	Max: 80Hz
Ramp up	45s
Ramp down	45s

3.5.8. SETTINGS → WATER HEATER

HMI ADVANCED

WATER HEATER	
Pump start temp	5,0°C
Pump kick	Day
Back-water setp	40,0°C

Pump start temp – setting for the temperature limit, that forces the pump to continuous operation for initial freezing protection

Range: -10..20

Default: 5

Pump kick – timer that forces the circulation pump to run for short period of time (30s) in specified intervals. That prevents the mechanical sealings from sticking and damage.

Range:

No - function disabled

Day - function activated daily

Week - weekly

Month - monthly

Back water setp – setpoint for back water temperature regulator. Special PI regulator works in two operating modes. First is normal heating mode, when the AHU is working. Regulator prevents the back water from dropping below the temperature limit.

Note! *Main temperature has got lower priority than back-water control!*

Second mode is anti-freezing protection, when the AHU is stopped in Off mode. The regulator maintains the back water temperature equal to the setpoint value, in order to prevent returning too hot water to the boiler system.

Note! *Back-water control functionality is optional and must be enabled in Configuration mode of the controller.*

3.5.9. SETTINGS → INIT HEATING

HMI ADVANCED

INIT HEATING HW		
Y2 75%		
Y1 25%	T1 -25°C	T2 5°C
t_a 30s	t_b 60s	

T_1 – lower scaling external temperature

T_2 – upper scaling external temperature

Y_1 – heating rate at T1 temperature

Y_2 – heating rate at T2 temperature

t_a - time to force the valve to 100% opening, regardless to the external temperature, in order to fill the pipeline with the hot water

t_b – time the unit stays with calculated heating rate

Note! *Total time is t_a + t_b . These settings are common for initial heating of pre-heater and secondary heater, if both are present in the AHU.*

3.5.10. SETTINGS → RECOVERY UNIT

After reco setp - setpoint for minimal allowed temperature after the recovery units PCR, RRG or glycol turnaround coils

Range: -64..64
Default: 3.0

Min. fresh air – setting for min. opening of intake / outlet dampers to provide fresh air in the ventilated room

Range: 0..100%
Default: 30%

Manual mode - setting fixed values of recirculation for Hand and Hand.Multi modes

Range: 0 ….. 100%
Default: 30%

HMI ADVANCED

RECOVERY UNIT		
After reco setp		
Min fresh air		
Low: 30%	Eco: 30%	Comf: 30%
Manual setting		
Low: 30%	Eco: 30%	Comf: 30%

After reco setp - setpoint for minimal allowed temperature after the raecovery units PCR, RRG or glycol turnaround coils

Range: -64..64

Default: 3,0

Start recovery - RRG total exchanger ON threshold

HMI ADVANCED

RECOVERY UNIT		
After reco setp		05,0
Start recovery		50,0%

Min. Fresh air - setting for min. Opening of intake / outlet dampers to provide fresh air in the ventilated room

Range: 0..100%

Default: 30%

Manual setting - setting fixed values of intake / outlet dampers

HMI ADVANCED

RECOVERY UNIT		
Min.fresh air		
Low:	Eco: 30%	Comf: 30%
Manual setting		
Low:	Eco: 30%	Comf: 30%

CO2 Setpoint - CO2 concentration setpoint for each mode

- **Low • Eco • Comf**

CO2 PI Regulator - The PI controller maintaining a constant value of CO2 concentration in the air

- **KP** - proportional gain
- **Ti** - integrational time

CO2 value - actual value of CO2 concentration in the air

HMI ADVANCED

MIXING CHAMBER		
CO2 Setpoint [ppm]		
Low	Eco	Comf
700	600	550
CO2 PI Regulatora		
Kp	000.2 Ti	030.0 s
CO2 value		500 ppm

3.5.11. SETTINGS → DX COOLER

On / Off for stage I and for stage II - settings for the relation between coolind regulator and DX unit stages

Min work – setting for the min. working time for each stage

Range: 10..600s
Default: 30s

Min rest – setting for the min. resting time for each stage

Range: 10..600s
Default: 30s

HMI ADVANCED

DX COOLER		
	st.I	st.II
On	30%	60%
Off	10%	40%
Min work	25s	25s
Min rest	60s	60s

EN

3.5.12. SETTINGS → WATER PRE-HEATER

Pump start temp – setting for the temperature limit, that forces the pump to continuous operation for initial freezing protection

Range: -10..20
Default: 5

Pump kick – timer that forces the circulation pump to run for short period of time (30s) in specified intervals.

That prevents the mechanical sealings from sticking and damage.

HMI ADVANCED

WATER PRE-HEATER	
Pump start temp	5,0°C
Pump kick	Day
Back-water setp	40,0°C

Range:
No - function disabled
Day - function activated daily
Week - weekly
Month - monthly

Back water setp – setpoint for back water temperature regulator. Special PI regulator works in two operating modes. First is normal heating mode, when the AHU is working. Regulator prevents the back water from dropping below the temperature limit.

Note! *Main temperature has got lower priority than back-water control!*

Second mode is anti-freezing protection, when the AHU is stopped in Off mode. The regulator maintains the back water temperature equal to the setpoint value, in order to prevent returning too hot water to the boiler system.

Note! *Back-water control functionality is optional and must be enabled in Configuration mode of the controller.*

Note! *The pre-heating coil works out of the standard cooling/ heating sequence. It is intended just to keep the constant temperature in specified place, e.g. to heat up outside air before entering the heat recovery unit.*

3.5.13. SETTINGS → INIT HEATING

$\mathbf{T_1}$ – lower scaling external temperature
$\mathbf{T_2}$ – upper scaling external temperature
$\mathbf{Y_1}$ – heating rate at T1 temperature
$\mathbf{Y_2}$ – heating rate at T2 temperature
t_a - time to force the valve to 100% opening, regardless to the external temperature, in order to fill the pipeline with the hot water
t_b – time the unit stays with calculated heating rate
Note! *Total time is t_a + t_b . These settings are common for initial heating of pre-heater and secondary heater, if both are present in the AHU.*

HMI ADVANCED

INIT HEATING PRE-HW		
Y2 50%		
Y1 20%	T1 -40°C	T2 -10°C
t_a 30s	t_b 60s	

3.5.14. SETTINGS → FAN PI REGULATOR

Recovery frost protect - special PI regulator to manage supply fan speed reduction in case of freezing conditions. If the limit temperature is reached, the regulator reduces the frequency converter output by specified max. value in Hz
$\mathbf{K_p}$ - proportional gain
$\mathbf{T_i}$ - integrational time

HMI ADVANCED

FAN PI REGULATORS	
Recovery frost protect	
K_p	T_i
Y_{min}	Y_{max}

EN

Y_{min} - min. value of subtracted frequency (no frost protecting action) - fixed at 0Hz

Y_{max} - max. value of subtracted frequency (max. frost protecting action)

Range: 0..50Hz
Default: 5Hz

Parametric volume control – special regulator for automatic adjustment of the fan speed according to external measurement of flow or pressure. The input

K_p - proportional gain

T_i - integrational time

Ymin - min. value – fixed at min fan rate setting

Ymax - max. value – limited by fan rate setpoint for current mode Low / Econo / Comfort

Setpoints Low / Econo / Comfort – setpoints for each mode

HMI ADVANCED

FAN PI REGULATORS		
Parametric volume control		
K_p		T_i
Y_{min}		Y_{max}
Setpoints		
Low	Eco	Comf

3.5.15. SETTINGS → PRESSURE PI REGULATORS

Air flow - automatic adjustment of the fan speed according to measurement of pressure

- **KP** - proportional gain
- **Ti** - integrational time

□ - work information

HMI ADVANCED

FAN PI REGULATORS			
supply fan		□	054.2 %
Kp	000.2	Ti	030.0 s
exhaust fan		□	054.2 %
Kp	000.2	Ti	030.0 s

3.5.16. SETTINGS → TEMP PI REGULATORS

There are alltogether 9 regulators for temperature control. Mostly all of them allow for the same adjustments:

K_p - proportional gain

T_i - integrational time

Y_{min} - min. value ofr the output

Y_{max} - max. value of the output

The regulators are:

Min sup temp – regulator of min. supply temperature limit

Max sup temp – regulator of max. supply temperature limit

HMI ADVANCED

TEMP PI REGULATORS	
Min sup temp	
Kp	T_i
Ymin	Y_{max}
Max sup temp	
K_p	T_i
Y_{min}	Y_{max}

Heating – regulator for main heater

Back water – regulator for limiting return water temperature in heater protective mode in stopped AHU

HMI ADVANCED

TEMP PI REGULATORS	
Heating	
K_p	T_i
Y_{min}	Y_{max}
Back-water	
K_p	T_i
Y_{min}	Y_{max}

Pre-heating + Back water – regulators for pre-heater, identical to those for standard heater

HMI ADVANCED

TEMP PI REGULATORS	
Pre-Heating	
K_p	T_i
Y_{min}	Y_{max}
Back-water	
K_p	T_i
Y_{min}	Y_{max}

Recovery – regulator for recovery unit

Frost protection – regulator for recovery unit protection in winter conditions

HMI ADVANCED

TEMP PI REGULATORS	
Recovery	
K_p	T_i
Y_{min}	Y_{max}
Frost protection	
K_p	T_i
Y_{min}	Y_{max}

Cooling – regulator for cooler

HMI ADVANCED

TEMP PI REGULATORS	
Cooling	
K_p	T_i
Y_{min}	Y_{max}

3.5.17. SETTINGS → MANUAL MODE

Manual operation – override the inputs and output

Auto – cancel override

other states – select to force the inputs or outputs, values depend on the output type

DI1..DI7 - digital inputs - select Auto / On / Off

Note! *For states different from NULL, an alarm is triggered, the HMI operating mode is forced to Off and AHU cannot be started. Manual mode is intended only for testing purposes.*

Note! *For any overridden states, an alarm is triggered, the HMI operating mode is forced to Off and AHU cannot be started. Manual mode is intended only for testing purposes.*

Always observe the unit for unintended unsafe operation when using manual mode!

HMI ADVANCED

MANUAL MODE		
DI1	DI2	DI3
Auto	On	Off
DI4	DI5	DI6
Auto	Auto	Auto
DI7		
Auto		

EN

B1..B7 - temperature probe inputs - select Auto / -20 / -10 / 0 / 10 / 20 / 30

HMI ADVANCED

MANUAL MODE		
B1	B2	B3
Auto	-20	-10
B4	B5	B6
Auto	Auto	Auto
B7		
Auto		

NO1..NO7 - *digital outputs - select Auto / On / Off*

HMI ADVANCED

MANUAL MODE		
NO1	NO2	NO3
Auto	On	Off
NO4	NO5	NO6
Auto	Auto	Auto
NO7/NC7		
Auto		

Y1..Y3 - analog outputs - select Auto / 0 / 20 / 40 / 60 / 80 / 100

HMI ADVANCED

MANUAL MODE		
Y1	Y2	Y3
Auto	0%	20%

3.5.18. SETTINGS → INPUT OFFSET

Offset to correct the stable additive error, e.g. from very long sensor cable

HMI ADVANCED

INPUT OFFSET		
B1	B2	B3
B4	B5	B6
B7		

3.5.19. SETTINGS → FREQ CONV RRG

Freq - actual output frequency

Current - actual current consumption

Status - combined information for communication problems and for motor alarms

OK - no malfunctions

Comm - communication to the frequency converter not stable or lost

Alarm - communication OK, but frequency converter reported an error, e.g. overload

Freq. low limit – lower boundary of the frequency

Range: 10..25Hz
Default: 15Hz

HMI ADVANCED

RRG DRIVE		
Freq	Current	Status
45Hz	0,6A	OK
Min frequency		15Hz
Max frequency		55Hz

Freq. high limit – upper boundary of the frequency

Range: 35..65Hz
Default: 55Hz

3.5.20. SETTINGS → FANS FIRE MODE

Settings for the fan behavior when there's a fire alarm signal

Sup fire setp - 0..100% - setpoint for fan rate in fire conditions, 0% = fan stopped

Exh fire setp - 0..100% - setpoint for fan rate in fire conditions, 0% = fan stopped

Fire temp limit - setpoint for the supply and exhaust duct temperature that triggers the alarm signal

Range: 60..99
Default: 99

HMI ADVANCED

FANS FIRE MODE	
Sup fire setp	
Exh fire setp	
Fire temp limit	

3.5.21. SETTINGS → UNIVERSAL REGULATOR

The universal controller allows the use to implement some specific functionalities, that are not supported by original Ventus applications.

The structure of the universal controller contains of two main blocks:

comparator – to check the relation between two signals (can be selected from the program variables or from universal analog input)

HMI ADVANCED

logic block – the output from the comparator can be processed by a logic function with another binary value (from the program or from the binary input)

the binary output – can do simple on/off control to external actuators via universal relay 1 or 2

44 < 50 AND Off = Off – current status line, shows all Input values, all functions and resulting output

Signal source – select signal source to be compared with a reference in comparator block

AI7 – user configurable analog input
SupplyTmp – supply temperature [°C]
RoomTmp – room temperature [°C]
ExhustTmp – exhaust temperature [°C]
RecovrTmp – temperature after the heat recovery unit [°C]
ExternTmp – external temperature [°C]
HeatgRate – heating rate [%]
CoolgRate – cooling rate [%]
RecovRate – heat recovery rate [%]
SupFnRate – supply fan rate [%]
ExhFanRate – exhaust fan rate [%]
Compare function – type of compare action
Less – check if the source signal is less than the reference
Greater

UNIV REGULATOR		
44 < 50 AND Off = Off		
Signal src		AI7
Compare func		Less
Setpoint src		AI7
Const:	Hyst:	
Logic block		AND
Logic source		DI6

EN

Equal
True – forces constant logical TRUE on comparator's output
False – forces constant logical FALSE on comparator's output

Setpoint source – select the reference for comparator
AI7 – user configurable analog input
Constant – constant value set in following line

Setpoint constant
Range: -100..100
Default: 20

Hysteresis – set the hysteresis for comparator
Range:0..100
Default: 1.0

Logic Block – select type of logical operation
AND
NAND
OR
NOR
XOR
Logic source – select logic signal source
DI6 – user configurable digital input 2
DI7 – user configurable digital input 1
StartConf – start confirmation
HeatgConf – heating confirmation
CoolgConf – cooling confirmation
RecovConf – heat recovery confirmation
InAlarm – AHU in alarm
True – constant TRUE
False – constant FALSE

EXAMPLE 1 – Additional roof exhaust fan

Requested functionality: if supply fans run at more than 70% setpoint, turn on additional fan
Additional condition: additional fan's thermal protection is OK – multi-function digital input 1 is HIGH
Settings for universal controller:
Signal source
- **SupFnRate**

Compare function
- **Greater**

Setpoint source
- **Constant**

Setpoint constant
- **70%**

Hysteresis
- **1**

Logic Block
- **AND**

Logic source
- **DI7**

HMI ADVANCED

UNIV REGULATOR		
59 < 70 AND On = Off		
Signal src		SupFnRate
Compare func		Greater
Setpoint src		Constant
Const: 70	Hyst: 1	
Logic block		AND
Logic source		DI7

Note! *The universal relay REL3 or REL6 must be set to UniReg or NOTUniReg – to let the resulting signal out of the controller.*

3.6. ALARM MENU

ALARM MENU →

Alarm menu can be accessed via dedicated button on the HMI Advanced

NAME – description of the feature or function that was in alarm state, e.g. Modbus comm

STATUS – current condition of the alarm, OK – inactive, ALARM – active

TYPE – defines the group of alarm events – Normal – these are mostly non-remanent alarms of lower priority; Critical – these are mostly remanent alarms of higher priority, that could even stop and block the unit from further operating.

DATE / TIME – time stamp when the alarm occured

Note! To acknowledge the alarm currently displayed on the HMI, press PRG button.

Another way of cancelling the alarms is turning the power Off and On again. At startup all alarms are cleared, except of those, that are stiil activated by input signals.

Note! *Alarms can be remanent – they are locked until fixed and acknowledged, e.g. the fire alarm. Or can be non-remanent – they unlock, when the alarm signal is fixed and don't need to be acknowledged to go to the history records, e.g. the filter alarm.*

HMI ADVANCED

ALARMS		
NAME	Fire alarm	
STATUS		ALARM
TYPE		Critical
DATE		05.07.11
TIME		10:11

ALARMING IN HMI BASIC

Alarm in HMI Basic are displayed instead of time indication in a form of a letter and number, like AL15. The number is given to identify what is the source of alarm.

Note! *HMI Basic cannot acknowledge alarms. All non-remanent events will disappear automatically. All remanent events need to be reset by means of HMI Advanced, or by switching off / on the power supply.*

List of alarm codes:

AL01. Fire alarm

AL02. HW thermostat

AL03. HW back-water

AL04. Pre-HW thermost

AL05. Pre-HW back-wtr

AL06. HE overheat

AL07. Supply sensor

AL08. Exhaust sensor

AL09. Room sensor

HMI BASIC

EN

AL10. Aft.Reco sensor **AL11**. External sensor **AL12**. HW water sensor **AL13**. Pre-HW sensor **AL14**. Pre-HW wtr.sens **AL15**. SupFan1 comm **AL16**. SupFan2 comm **AL17**. SupFan3 comm **AL18**. SupFan4 comm **AL19**. SupFan1 ovrload **AL20**. SupFan2 ovrload **AL21**. SupFan3 ovrload **AL22**. SupFan4 ovrload **AL23**. ExhFan1 comm **AL24**. ExhFan2 comm **AL25**. ExhFan3 comm **AL26**. ExhFan4 comm **AL27**. ExhFan1 ovrload **AL28**. ExhFan2 ovrload **AL29**. ExhFan3 ovrload **AL30**. ExhFan4 ovrload **AL31**. Manual mode **AL32**. HMI Basic init **AL33**. HMI Basic comm **AL34**. HMI Adv.init **AL35**. HMI Adv.comm **AL36**. Modbus init **AL37**. Modbus comm **AL38**. BMS init **AL39**. BMS comm **AL40**. Chiller **AL41**. Sup filters **AL42**. Exh filters **AL43**. RRG communication **AL44**. RRG drive overload **AL45**. supply pressure communication **AL46**. exhaust pressure communication	

II. ADVANCED MANUAL

4. SERVICE MENU

Service menu is intended for service use, mainly at general startup of the AHU.

The whole menu is password protected and cannot be even viewed without logging-in.

Configuration of the controller is the most important startup action, that influences the whole behavior of the controlled air handling unit. All the functionalities, like specific heaters or frequency converter types, are selected here. If not done properly, the controller will apply control algorithms not efficient and in worst case dangerous to the equipment.

4.1. SERVICE MENU → CONFIG PAGES

APPLICATION CODE ERROR – is a warning displayed in the top line of the page, if the application code data is bad. If the code is OK, nothing is displayed.

Program mode – setting whether the controller is in configuration or in normal working mode

- **Config** (default factory state)
- **Running**

Note! *The controller mode must be switched from Config to Running after completing all the settings in unit configuration and in frequency converters configuration pages.*

Unit size – setting for small units with reduced application set or for fully featured units

- **VS10-15** – for VS10-15 units
- **VS21-650** – for VS21-650 units

Application – setting for the application code, done in two parts – the letter code, defining base features of the unit and the number code, defining detailed configuration of the AHU

- **AD** – for supply-exhaust units (default)
- **AG** – for S-E units with glycol heat recovery
- **AP** – for S-E units with plate cross-flow recuperator
- **AR** – for S-E units with rotary regenerator

The number code – range 0..1024

- Default: 0

Main sensor – setting for the temperature controllers. The signal from chosen sensor is compared to the reference for heating / cooling / recovery actions

- **Supply (default)**
- **Room**
- **Exhaust**

HMI Basic – setting for enabling the HMI Basic communication

- **NO** - control system without HMI Basic
- **ITS** - control system with HMI Basic, the interface screen indicates the real room temperature measured with its own sensor (Internal Temperature Sensor mode).

HMI ADVANCED

CONFIG 1/5		
APPLICATION CODE ERROR		
Program mode		Config
Unit size		VS10-15
Application	AD	0000
Main sensor		Supply
HMI Basic		NO
Units		Metric

EN

<table>
<tr>
<td>• MTS - control sstem with HMI Basic, the interface screen indicates the temperature value measured by the main sensor (Main Temperature Sensor mode).
• ITS+Cal - Internal Temperature Sensor mode + calendar operation according to internal scheduler of the HMI Basic
• MTS+Cal – Main Temperature Sensor mode + calendar operation according to internal scheduler of the HMI Basic
Units - change from metric units to imperial units</td>
<td></td>
</tr>
<tr>
<td>Modbus bps - Modbus communication speed
Supply FC – selection of the frequency converter type for supply side
Exhaust FC – selection for the exhaust side
• No FC – no frequency converters, the Modbus communication is disabled and don't trigger "communication lost" alarm message
• LS iC5 – smaller FC from LG / LS Industrial Systems
• LS iG5A – larger FC from LG / LS Industrial Systems
• CFW500 – FC from WEG Electric Corp.
Supply multi – selection for the quantity of FC on the supply side
Exhaust multi – selection for the exhaust side
• No – only one FC on the side
• Twin – two FCs on the side
• Tripple – three FCs on the side
• Quadr – four FCs on the side
• Redun. – redundant function</td>
<td>HMI ADVANCED
<table><tr><td>CONFIG 2/5</td><td></td></tr><tr><td>Modbus bps</td><td>9600</td></tr><tr><td>Supply FC</td><td>LSiC5</td></tr><tr><td>Exhaust FC</td><td>LSiC5</td></tr><tr><td>Recovery FC</td><td>LSiC5</td></tr><tr><td>Supply Multi</td><td>None</td></tr><tr><td>Exhaust Multi</td><td>None</td></tr></table></td>
</tr>
<tr>
<td>Redundant connection scheme: Redundant_R - in CD, Control application sections.</td>
<td>HMI ADVANCED
<table><tr><td colspan="2">Converter's address in Modbus Network</td></tr><tr><td>2</td><td>Air-supply fan</td></tr><tr><td>3</td><td>Air-exhaust fan</td></tr><tr><td>5</td><td>Air-supply fan No.2 / redundant</td></tr><tr><td>7</td><td>Air-supply fan No.3</td></tr><tr><td>9</td><td>Air-supply fan No.4</td></tr><tr><td>6</td><td>Air-exhaust fan No.2 / redundant</td></tr><tr><td>8</td><td>Air-exhaust fan No.3</td></tr><tr><td>10</td><td>Air-exhaust fan No.4</td></tr></table></td>
</tr>
<tr>
<td>DI6 function – setting for universal binary input
Possible functions:
System – input occupied by the application
LockUnit – the input blocks start of the AHU, must be closed to allow unit operation
Extern.2 – external control input 2 – for remote control of AHU operating mode. The functionality depends on combination of the inputs. See the details in the chapter “External control”
Sum/wint – season selection switch – used in combi-coil applications, where one coil can be switched to heating in winter (fed from boiler) or to cooling in summer (fed from</td>
<td>HMI ADVANCED
<table><tr><td>CONFIG 3/5</td><td></td></tr><tr><td>DI6 function</td><td>System</td></tr><tr><td>DI7 function</td><td>NoFunc.</td></tr><tr><td>AI7 function</td><td>System</td></tr><tr><td>DI6 external</td><td>Off</td></tr><tr><td>DI7 external</td><td>Eco</td></tr><tr><td>DI6&7 external</td><td>Comfort</td></tr></table></td>
</tr>
</table>

chiller). The selected season must correspond to the actual setup of the hydraulic valves. **Emergncy** – emergency stop – to force immediate stop of the AHU	

AlarmAck – alarm acknowledge – to cancel currently displayed alarms

Note! *No need to enter the password*

Uni.Reg. – the input can enter the logic block of the Universal Regulator, see the relevant chapter for details

Availability:

all applicatios without glycol pre-heating coil

DI7 function – setting for universal binary input

Possible functions:

No func. – no function, input disabled

System – input occupied by the application

LockUnit – the input blocks start of the AHU, must be closed to allow unit operation

Extern.1 – external control input 2 – for remote control of AHU operating mode. The functionality depends on combination of the inputs. See the details in the chapter “External control”

Sum/Wint – season selection switch – used in combi-coil applications, where one coil can be switched to heating in winter (fed from boiler) or to cooling in summer (fed from chiller). The selected season must correspond to the actual setup of the hydraulic valves.

Emergncy – emergency stop – to force immediate stop of the AHU

AlarmAck – alarm acknowledge – to cancel currently displayed alarms

Note! *No need to enter the password*

Uni.Reg. – the input can enter the logic block of the Universal Regulator, see the relevant chapter for details

Note! *If both inputs carry the same function at a time, the logical sum OR will be calculated and applied to the control algorhitms*

Availability:

all applications

AI7 function – setting for universal analog input

Possible functions:

System – input occupied by the application

FreqSup – frequency scaling for supply fans, 0..1V low voltage input – 0V = 0%, 1V = 100%

FreqExh – frequency scaling for exhaust fans, low voltage input

FrequS+E – frequency scaling for supply and exhaust, low voltage input

Note! *The frequency scaling signal affects the current valid setpoint from the program. Example: current AHU mode: Econo → original fan setpoint for Econo 55% → frequency scaling: 80% → final setpoint with scaling: 55% x 80% = 44%*

The final setpoint can never fall below the min. frequency configured for the frequency converter.

TempSet - temperature setpoint, low voltage input – 0V = -3°C,
1V = +3°C

Note! *Value from the input is an offset to the original setpoint from the program. Example: Original setpoint: 21°C, offset from the input +2°C, final setpoint: 21+2 = 23°C*

External temperature setpoint is ignored, when HMI Basic is activated in the system.

Recircul - mixing chamber control, low voltage input – 0V = 0%,
1V = 100%

ATTENTION! *The level of recirculation is limited by the setting of minimum fresh air*

UniReg – input value for the universal regulator, low voltage input – 0V = 0%, 1V = 100%

Parametric – input signal of flow or pressure measurement to the fan speed PI regulator; low voltage input 0..1V – 0V = 0%,
1V = 100%

ParamInv – input signal as described above, but for reversed operation of the regulator. In that mode the error "e" value for the PI calculation is taken with reverse sign.

Note! *Adjust regulator settings in SETTINGS → FAN PI REGULATOR for parametric volume control.*

In Parametric mode, AI7 input increases → regulator output decreases

In ParamInv mode, regulator operates in reversed manner: AI7 input increases → regulator output increases

Availability:

all applications without glycol pre-heating coil

DI6 external / DI7 external / DI6&7 extern - setting for DI6 and DI7 configured as external control of the unit. Available options are the same like for other control sources: Auto / Off / Low / Econo / Comfort

Example:

Settings:

- DI6 external set to Low
- DI7 external set to Econo
- DI6&7 extern set to Comfort

Operation:

- DI6=0 DI7=0 → external control = Auto
- DI6=1 DI7=0 → external control = Low
- DI6=0 DI7=1 → external control = Econo
- DI6=1 DI7=1 → external control = Comfort

EN

REL3 function – settings for user configurable relay

Possible function:

- **System** – output occupied by the application
- **Start** – start confirmation – unit set to any running mode including startup
- **Heating** – heating rate >0
- **Cooling** – cooling rate >0
- **Recovery** – recovery rate >0
- **Filters** – filter alarms triggered
- **UniReg** – universal controller output
- **NOTUniReg** – negated universal controller output

Availability:

all applications without glycol heat recovery (application code AG)

REL6 function – settings for optional user configurable relay

Possible functions:

other options same as described above

Note! *Both relays can carry the same function at a time*

Availability:

all applications without glycol pre-heating coil

HMI ADVANCED

CONFIG 4/5	
REL5 function	Start
REL6 function	Heating

Exhaust fan - exhaust fan mode

Fixed rate - fan efficiency depends on the individual settings

Follow Sup - fan performance equals supply fan performance

Fan control - adjust the fan efficiency as a function of the variable resistance

WARNING! - Depend of chosen functionality the pressure transducer must be mounted properly.

- **Disable** - function is disabled and the fans work with speed assigned to the current mode.
- **CAV** - constant air volume of AHU (Compensation internal resistance of AHU)
- **CPress**. - constant air pressure in the ductwork (Compensate of ventilation installation resistances)

CO2 control - controlling function of CO2 concentration

- **Disable** - function disabled
- **Enable** - function is activated

Back-wate HW - controlling function of back water temperature from the heater

HMI ADVANCED

CONFIG 5/5	
Exh. Fan	Fixed rate
Fan control	CAV
CO2 control	Disable
Back-water HW	Disable
B-water PreHW	Disable

B-water PreHW - controlling function of back water temperature from the pre-heater

- **Disable**
- **Enable**

Supply/Exhaust fan

k-factor - nozzle coefficient depends on the model of the fan

Air flow - maximum air flow rate of AHU

HMI ADVANCED

CONFIG CAV		
Supply fan		
Supply fan	VS-315	/105
DI4	006000	m3/h
Exhaust fan		
k-factor	VS-315	/105
max flow	006000	m3/h

Fan type	k-factor	Fan type	k-factor
VS-225	046	VS-450	205
VS-250	056	VS-500	258
VS-315	105	VS-560	334
VS-355	132	VS-630	402
VS-400	154		

Transducer type - mounted differential pressure sensor

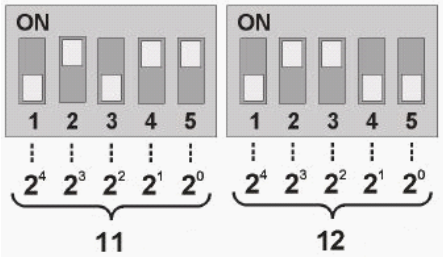
- **SPS** - sensor from Sentera Controls
- **DPT** - sensor from CATIC-I
- **OTHER** - manual settings
- **MB** - main board
- **DPC** - OEM VTS

(**Holding Register** - Modbus function **0000** - pressure index in modbus)

Change address - option to change address of modbus device 11>12 (example: from 11 to 12)

□ Save changes

OEM VTS DPC DIP



Transducer online - information about connected devices on modbus line

HMI ADVANCED

Pressure transducer		
Transducer type	SPS	
Holding Register	0000	
Change adrress	11>12	□
Transducer online		
sup	exh	□

Rotate time - maximum working time of one set.

Reset working time – reset working time counter(first and second sets).

HMI ADVANCED

REDUNDANT CONFIG	
Rotate time	168h
Reset working time	NO

EN

VTS reserves the right to implement changes without prior notice

Actual input values are available here to check the hardware functionality. All symbols refer to the hardware descriptions on µPC controller and not to VTS electrical diagrams and meaning of the signal to the controller. Note! These symbols are not AHU function-related but µPC controller related!

Temperatures

Readout of actual temperature inputs. If the sensor is not activated in the application, indicates -

- **Terminal B1** - Supply temperature
- **Terminal B2** - Room temperature
- **Terminal B3** Outside temperature
- **Terminal B4** After recovery temperature

HMI ADVANCED

INPUTS		
DI1	DI2	DI3
Off	Off	Off
DI4	DI5	DI6
On	On	On
DI7		
Off		

- **Terminal B5** - water heater return
- **Terminal B6** Pre-heater temperature
- **Terminal B7** - water pre-heater return or user configurable analog input

Binary inputs

- **Terminal DI1** - fire alarm
- **Terminal DI2** - heater alarm (frost or overheating)
- **Terminal DI3** - cooler alarm (chiller or DX unit)
- **Terminal DI4** - supply filter
- **Terminal DI5** - exhaust filter
- **Terminal DI6** - pre-heater frost alarm or user configurable binary input No.2
- **Terminal DI7** - user configurable binary input No.1

INPUTS		
B1	B2	B3
25,0°C	25,0°C	25,0°C
B4	B5	B6
15,0°C	15,0°C	15,0°C
B7		
5,0°C		

Note! Before choosing Send make sure that HMI Basic is disconnected

Active probes - present probes in actual configuration

- **Supply**
- **Exhaust/Room**
- **HMI Basic**

Humidification - disable option

Dehumidification - disable option

HMI ADVANCED

HUMIDITY TRANSDUCER	
Active probes	
Supply	
Humidification	On
Dehumidification	Off

Transducer type - mounted sensor

- **SENT -** sensor from Sentera Controls
- **CATI -** sensor from CATIC-I
- **OTHER -** manual settings
- **HCRH -** OEM VTS

(Holding Register - Modbus function **0000 -** the humidity value index)

Transducer online - information about connected device on Modbus line

sup - supply **exh -** exhaust

HMI ADVANCED

HUMIDITY TRANSDUCER	
Transducer type	SENT
Holding Register	0000
Transducer online	
sup	■ ,exh ■

Transducer type - mounted sensor

- **DSC** - sensor from Sentera Controls
- **CDD** - sensor from CATIC-I
- **OTHER** - manual settings
- **HTC** - OEM VTS

(**Holding Register** - Modbus function **0000** - CO2 value index in modbus)

Transducer online - information about connected device on Modbus line

HMI ADVANCED

CO2 transducer	
Transducer type	DSC
Holding Register	0000
Transducer online	■

4.2. SERVICE MENU → OUTPUTS

Actual output values are available here to check the hardware functionality.

Digital outputs

- **Terminal NO1** - water heater pump start
- **Terminal NO2** - damper open
- **Terminal NO3** - glycol recovery pump start or user configurable relay 1
- **Terminal NO4** - cooling start (DX stage 1 or chiller)
- **Terminal NO5** - cooling start (DX stage 2)
- **Terminal NO6** - pre-water heater pump start or user configurable relay 2
- **Terminal NO7** - alarm signal

Analog outputs

- **Terminal Y1** - heating rate
- **Terminal Y2** - cooling rate or pre-heating rate
- **Terminal Y3** - recovery rate

Note! *The percentage values refer to 0..10V hardware output.*

HMI ADVANCED

OUTPUTS		
NO1	NO2	NO3
Off	Off	Off
NO4	NO5	NO6
On	On	On
NO7/NC7		
Off		

OUTPUTS		
Y1	Y2	Y3
25%	0%	100%

FRQ CONVERTERS CONFIGURATION

Device function – setting for the place in the AHU, that the actual FC has got.

- **Supply 1** – 1st supply fan (Modbus address 2)
- **Supply 2** – 2nd (5)
- **Supply 3** – 3rd (7)
- **Supply 4** – 4th (9)
- **Exhaust 1** – 1st exhaust fan (3)
- **Exhaust 2** – 2nd (6)
- **Exhaust 3** – 3rd (8)
- **Exhaust 4** – 4th (10)
- **RRG** – rotary regenerator (4)

Note! *Bad selection will cause bad parameter setting and bad addressing in Modbus communication.*

HMI ADVANCED

FC CONFIG	
Device function	Supply1
Freq.conv.type	LSiC5
Motor power	0,55kW
Motor poles	2p
Selection OK	Yes
FCConfig state	Ready

EN

Freq. conv. type – selection for the FC type
- **LG iC5**
- **LG iG5A**

Motor power – selection of motor type
- **0.09 kW**
- **0.18 kW**
- **0.37 kW**
- **0.55 kW**
- **0.75 kW**
- **1.1 kW**
- **1.5 kW**
- **2.2 kW**
- **3.0 kW**
- **4.0 kW**
- **5.5 kW**
- **7.5 kW**
- **11.0 kW**

Motor poles – selection of motor type
- **2p** – motors with rated approx. 2900 rpm
- **4p** – motors with rated approx. 1450 rpm

Selection OK – indicates, if the settings match each other and the configuration is possible to be implemented.

FCConfig state – setting and indication of current state of the FCConfig
- **Ready** – function in idle state, no errors
- **Send** – select that to start sending the parameters to the frequency converter.

4.4. SYSTEM INFO

Program info – indicates the version of the program and the HMI templates, specifies the oldest compatible operating system

Controller – shows the operating system version and other controller and application related details – only for special service purposes.

HMI ADVANCED

SYSTEM INFO	
Program info	
Controller	

5. CONTROL ALGORITHMS

OPERATING MODE

The unit can be controlled from several sources and the priorities between them has got significant influence on the behavior of the AHU.

Note! *The "zero priority" is reserved for important protective functions like fire alarm. Events of that kind disable all other controls to protect life and property.*

HMI Advanced UPC – the main and the most capable interface has got the highest priority. Choosing any mode other than Auto causes blocking all the other control sources. The unit will work continuously in selected mode.

Note! *Selecting Off in the HMI Advanced blocks the unit. Only protective functions like frost protection are activated.*

To enable any control source of lower priority, the HMI operating mode must be set to Auto.

BMS – second highest interface capable of AHU mode change. For the details, refer to special Web Module Manual.

External control inputs – those are configurable binary inputs available for the user depending on the complexity of the control application. Most applications allow for two binary inputs DI6 and DI7. DI6 however, can be occupied by the additional pre-heating coil frost protection.

The control mode resulting from external inputs overrides all the settings from the Calendar and HMI Basic UPC.

HMI Basic UPC – it is a device with lower priority. HMI Basic can overwrite any operation mode from the calendar (time schedule).

Calendar – lowest priority control source available for the user. If HMI Advanced is set to Auto and no other control sources are activated, the unit will work according to specified time schedule.

Economy and protection functions – those the least prioritized automatic functions, activated when the HMI Advanced is set to Auto and all other control sources are Auto. Those functions are Night Nooling and Standby.

Night cooling checks the external temperature readout and if the air outside the building is colder than the room setpoint, the fans are turned on in order to cool down the building, the walls and equipment inside. That allows for energy saving by not using the cooler in the morning time.

Standby checks the deviation of controlled temperature and if it goes too much away from desired value, the unit is turned on to cool down or heat up the room – to stay within the specified range. That functionality protects the building and the appliances inside from too big temperature amplitudes across the day.

Note! *To enable any control source, all other sources of higher priority must be set to Auto.*

STARTUP SEQUENCE

The startup sequence ensures proper order of enabled functions. The main startup operations are:

1. **Power up delay** – fixed 20s - the timer that delays the startup of the unit after switching on the power. That delay gives time for all devices for reaching stable initial state (e.g. frequency converters and communication)
2. **Initial heating** – function of initial heat-up of the water coils in wintertime, according to specified timers and valve opening rate. The preheating disables the fans and dampers until finished. The valve opening rate of initial heating stage, is copied as a starting point for the regulator of normal heating mode. This minimizes the risk of accidental frost protection alarms between the stages of unit startup.
3. **Idle operation** – dampers are opening, regulators are enabled and controlling the outputs, while fans are running at the minimum speed and the supply air upper temperature limit is forced to 40°C to allow smooth ventilation and heating start after initial heating stage.
4. **Fans ramp-up time** – specifies the rate of acceleration for the fans.
5. **Idle at stop** – allows for cooling down the electrical heater or smooth stop of the DX cooling appliance.

Note! *Some alarm events can block the startup of the unit.*

COOLING / RECOVERY / HEATING

Applied signals:

1. Temperature measurements
2. Alarm signals
3. Outputs for actuators

The purpose:
Heat exchangers in the AHU cooperate to keep the temperature in specified range. Three separate ranges can be defined for Low, Economy and Comfort mode – with common setpoint, but with separate deadzone for each. The range is defined as the setpoint ± ½ deadzone.

Example:

- setpoint: 21°C, comfort deadzone: 2°C → resulting range: 20..22°C
- setpoint: 21°C, economy deadzone: 6°C → resulting range: 18..24°C
- setpoint: 21°C, low deadzone: 8°C → resulting range: 17..25°C

The ranges are selected depending on the current operating mode of the controller. If the actual temperature is within the range – the unit will remain in current state – so the cooling / recovery / heating signals will stay in equilibrium. If the actual temperature is above the range – the unit will increase in cooling. If it's below the range – the unit will increase in heating. What should be noted, the first sequence of cooling / heating is performed by the heat recovery unit to maximize the utilization of the energy generated in the building. If the recovery capacity is not enough, then the cooler or heater starts to operate to supply more energy to the unit.

Note! *The recovery can be active together with cooling or with heating sequence. However, the cooling and heating cannot be active at a time under any circumstances.*

The recovery for heating is active by default. For cooling this must be activated by specific application code number.

Protective functions:

1. Min/max supply air temperature
   If the main temperature sensor is selected room or exhaust, the supply temperature is controlled against over-heating or over-cooling. This could seriously affect the comfort of the people in the room. The min/max controller has higher priority than main temperature control loop.
2. Cooling sequence is protected with Chiller / DX Unit binary alarm input. If activated: the AHU remains working, but the cooling demand relays and analog signal for the valve are turned off Doesn't need to be acknowledged, the alarm is of non-remanent type
3. Recovery sequence is protected against freezing
   If the temperature measurement in the exhaust duct after the recovery unit, fall below the specified protection setpoint, the rate of the recovery is being reduced. The reduction is controlled by PI controller, so it is always the least necessary value to protect the recovery unit, but without excessive degrading the recovery efficiency.
   The first stage of recovery anti-freezing protection is reducing the fan speed for the supply (or supply and exhaust synchronously). After the maximum allowed fan slowing down, the recovery unit can apply own protective functions (bypassing of the plate cross-flow heat exchanger, reducing the RPM of rotary recuperator, closing the intake damper for non-bypass plate cross-flow exhangers in VS10-15 units).
   The recovery protection does not affect the AHU operation. All other devices continue to work even if the recovery rate is reduced to 0% by protective functions.
4. Heating sequence
   a. Initial heating – is a start-up feature enabled in winter, to avoid passing cold air to the room and to avoid activating the water heater frost protection at start-up. The specified time and valve opening characteristic is applied in order to properly heat-up the coil and the coil compartment before starting the fans.
      The startup of the AHU is blocked until the preheating is finished.
      During initial heating, the heat recovery unit is automatically forced to 100% efficiency.
   b. Frost protection on the air side – uses a digital alarm input to connect the frost detector. If activated, the fans are stopped, dampers closed and the valve is forced to open at full 100% heating rate. After the detector switches back to normal mode, the startup of the AHU is performed again.

Note! *The automatic release of the frost protection on the air side can be done max. 3 times per hour. If that happens more often the controller is locked in stop mode and the AHU cannot be started until fixing the malfunction and acknowledge the alarm.*

Note! *The counter is disabled if the AHU is in Off mode, e.g. stopped for the night. The frost protection will work continuously just to protect the coil and ensure proper temperature in coil's compartment.*

c. Frost protection on the water return side – uses an analog NTC probe input. If the back-water temperature falls below the specified limit, the alarm is activated, the fans are stopped, dampers closed and the valve is forced to open at full 100% heating rate. After the temperature goes +10°C above the safety limit, the startup of the AHU is performed again.

Note! *This alarm is always automatic - release.*

d. Pump kick – is a timer to turn on the pump for the very short period of time, to prevent it from sticking and damaging the sealing.

e. Pump min. out temperature – turns on the pump for constant working if the external temperature falls below the specified limit – regardless of heating rate.

f. Overheating protection for the electrical heater

Note! *The automatic release of the overheating protection can be done max. 3 times per hour. If that happens more often the controller is locked in stop mode and the AHU cannot be started until fixing the malfunction and acknowledge the alarm.*

6. TECHNICAL DATA

EN

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 µPC "Small board" controller

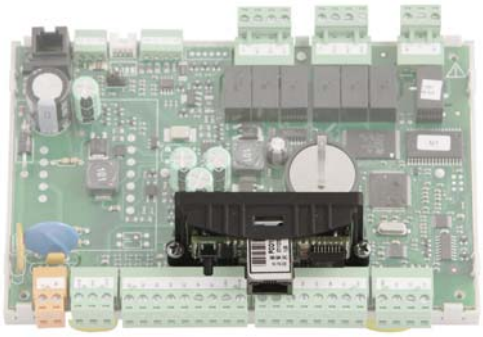
Weight	**VS 10-75 CG UPC**	**VS 40-150 CG UPC SUP** **VS 40-150 CG UPC SUP-EXH** **VS 180-300 CG UPC**	**VS 400-650 CG UPC**
	10kg	10kg	10kg
Dimensions (w x h x d)	319 x 400 x 153	319 x 400 x 153	448 x 625 x 160
		319 x 400 x 153	
		319 x 400 x 153	

OPERATION PARAMETERS			
Parameter	**VS 10-75 CG UPC**	**VS 40-150 CG UPC SUP:** **VS 40-150 CG UPC SUP-EXH:** **VS 180-300 CG UPC:**	**VS 400-650 CG UPC**
system	TN		
U3 rated power supply voltage	~230V	3N~400V	3N~400V
In control box rated current	VS 10-75 CG UPC: 31A	VS 40-150 CG UPC SUP: 28A VS 40-150 CG UPC SUP-EXH: 49A VS 180-300 CG UPC: 91A	VS 400-650 CG UPC: 175A
Ui rated insulation voltage	400 V		
Uimp rated impulse withstand voltage	2.5 Kv		

rated short-time withstand current Icw for respective circuits - effective value of alternating currentcomponent withstood during 1 second, i.e.: short-circuit current expected at rated connecting voltage	6 kA
rated peak withstand current (ipk) at cosφ= 0.5	10.2 kA
rated short-circuit current	6 kA
coincidence factor	0.9
rated frequency	50 Hz ± 1Hz
protection class	IP54
acceptable operating temperature	0 ÷ 40 °C
supply voltage of control circuits	24 V AC
EMC environment	1

PARAMETERS OF PROTECTION UNITS	
F1 (B6)	Protection of lighting circuit
F1M (C16)	Protection of power supply circuit of water heater pump and rotary exchanger (for VS 10-75 CG UPC, VS 40-150 CG UPC SUP-EXH, VS 180-300 CG UPC and VS 400-650 CG UPC)
F1M (C10)	Protection of supply circuits of water heater pump (for VS 40-150 CG UPC SUP)
F2	Glass or ceramic fuse element of size 5x20mm, type T 0,63A

CAREL µPC „SMALL BOARD" CONTROLLER	
RESOURCES	
Relay outputs Q1..Q7	
Analog inputs B1..B7	Reference potential GND;
Outputs, DC 0-10V (1mA)	Reference potential GND;
Binary inputs DI1..DI7	Voltage free contacts
	Reference potential GND;
Analog outputs Y1..Y3	0...10V, max 5mA
	Reference potential GND;
RS485 communication port (J10)	Modbus protocol, 1200m
Optional expansion card for Ethernet communication	RJ45 socket
	10/100 MBit (IEEE 802.3U)
	Capable of:
	Parameter overview via Internet browser
	Modbus TCP/IP Server functionality via port 502 (datapoints specified by the end of that manual)
HMI Advanced comm. port (J7 or J8)	Serial link over RS485 connection
	Standard connection – factory supplied flat cable, 3m long



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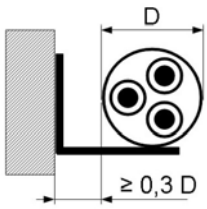
7. CABLING



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.

Wire type	Wire picture	Wire 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 / connection point	all control gears VS10-75 CG UPC VS40-150 CG UPC … VS180-300 CG UPC VS400-650 CG UPC	Wire type	Section [mm²]
controller	N1	-	-
fire alarm switch	S1F	[2]	2x0,75
multi-function switch	S6	[2]	2x0,75
optional multi-function switch	S7	[2]	2x0,75
supply air temperature sensor	B1	[1]	2x0,75
room/ exhaust air temperature sensor	B2	[1]	2x0,75
external air temperature sensor	B3	[1]	2x0,75
after recovery air temperature sensor	B4	[1]	2x0,75
multi-function analog reference	B5	[1]	2x0,75
air temperature after glycol pre-heater	B6	[1]	2x0,75
HW back-water temperature sensor	B7	[1]	2x0,75
glycol pre-heater back-water temperature sensor	B8	[1]	2x0,75

EN

Name of element / connection point	all control gears VS10-75 CG UPC VS40-150 CG UPC … VS180-300 CG UPC VS400-650 CG UPC	Wire type	Section [mm²]
HE alarm switch	VTS-E-0005 ter. 22:23	[2]	2x0,75
HW anti-frost air side thermostat	S2F	[2]	2x0,75
glycol pre-heater anti-frost thermostat	S6F	[2]	2x0,75
HW analog controlled valve	Y1	[1]	3x0,75
HE power rate control input	VTS-E-0005 ter. 15:21	[1]	3x0,75
HW circulating pump contactor	M1		3x1,5
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
CW analog controlled valve	Y2	[1]	3x0,75
RHE frequency converter	U1	[1] [2]	3x1,5 / 4x1,5
RHE alarm switch	via Modbus comm.	[3]	UTP 2x2
RHE start input	via Modbus comm.		
RHE speed reference input	via Modbus comm.		
recirculation damper actuator	Y3	[1]	3x0,75
cross-flow bypass actuator	Y4, Y41	[1]	3x0,75
CWHW analog controlled valve	Y5	[1]	3x0,75
glycol pre-heater analog valve	Y6	[1]	3x0,75
glycol heat recovery analog valve	Y7	[1]	3x0,75
CWHW “cooling” command	E3.1	[2]	2x0,75
CWHW “heating” command	E3.2	[2]	2x0,75
AHU alarm	E4	[2]	2x0,75
AHU start confirmation (configurable)	E5	[2]	2x0,75
start signal for the circulation pump of the glycol pre-heater	E6	[2]	2x0,75
start signal for the circulation pump of the glycol heat recovery	E7	[2]	2x0,75
AHU start confirmation (configurable)	E8	[2]	2x0,75
Humidifier - start signal	E9	[2]	2x0,75
RRG Total - start signal	E10	[2]	2x0,75

Name of element / connection point	all control gears VS10-75 CG UPC VS40-150 CG UPC … VS180-300 CG UPC VS400-650 CG UPC	Wire type	Section [mm²]
HMI Basic UPC – reduced function interface	N2	[3]	UTP 1x2
HMI Advanced UPC – full function interface	N3	[4]	8x0,1
supply elements			
pressure control - primary filter, supply	1S1H	[2]	2x0,75
pressure control - primary filter, supply	1S2H	[2]	2x0,75
pressure control - compression monitoring for HE-Module	1S3H	[2]	2x0,75
supply frequency converter	1U1	[1] [2] [3]	TAB A UTP 2x2
second supply fan frequency converter	1U2	[1] [2] [3]	TAB A UTP 2x2
frequency converter of the third supply fan	1U3	[1] [2] [3]	TAB A UTP 2x2
frequency converter of the fourth supply fan	1U4	[1] [2] [3]	TAB A UTP 2x2
intake damper actuator	1Y1	[2]	2x0,75 / 3x0,75
Redundant damper actuator - supply	1Y8	[2]	3x0,75
exhaust elements			
pressure control - primary filter, exhaust	2S1H	[2]	2x0,75
exhaust frequency converter	2U1	[1] [2] [3]	TAB A UTP 2x2
second exhaust fan frequency converter	2U2	[1] [2] [3]	TAB A UTP 2x2
frequency converter of the third exhaust fan	2U3	[1] [2] [3]	TAB A UTP 2x2
frequency converter of the fourth exhaust fan	2U4	[1] [2] [3]	TAB A UTP 2x2
Redundant damper actuator - exhaust	2Y8	[2]	3x0,75

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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]		[mm²]	[mm²]	[mm²]		[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	

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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																								

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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

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

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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)

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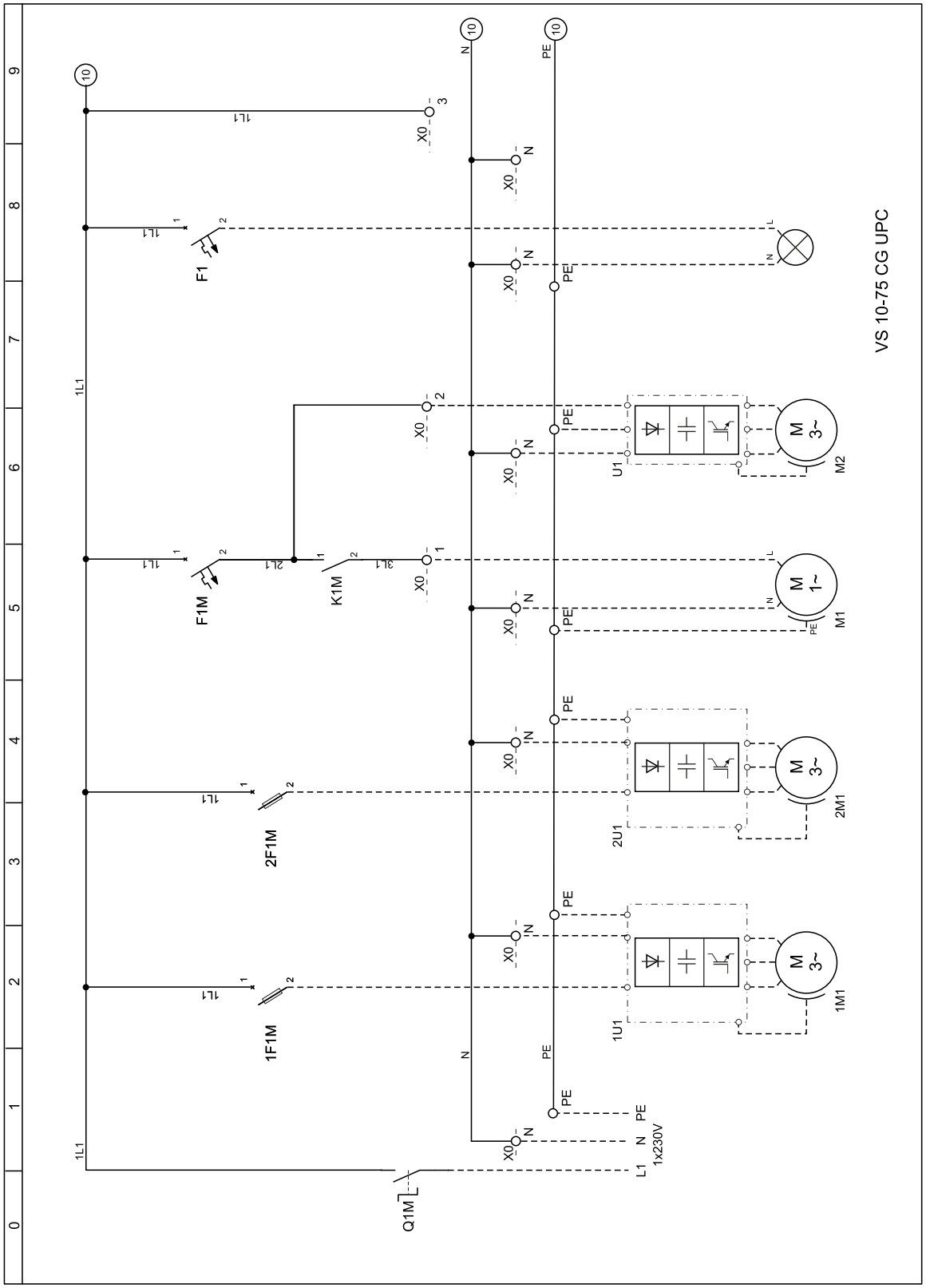
Appendix 1 Circuit diagram of VS 10-75 CG UPC control gear 1/2



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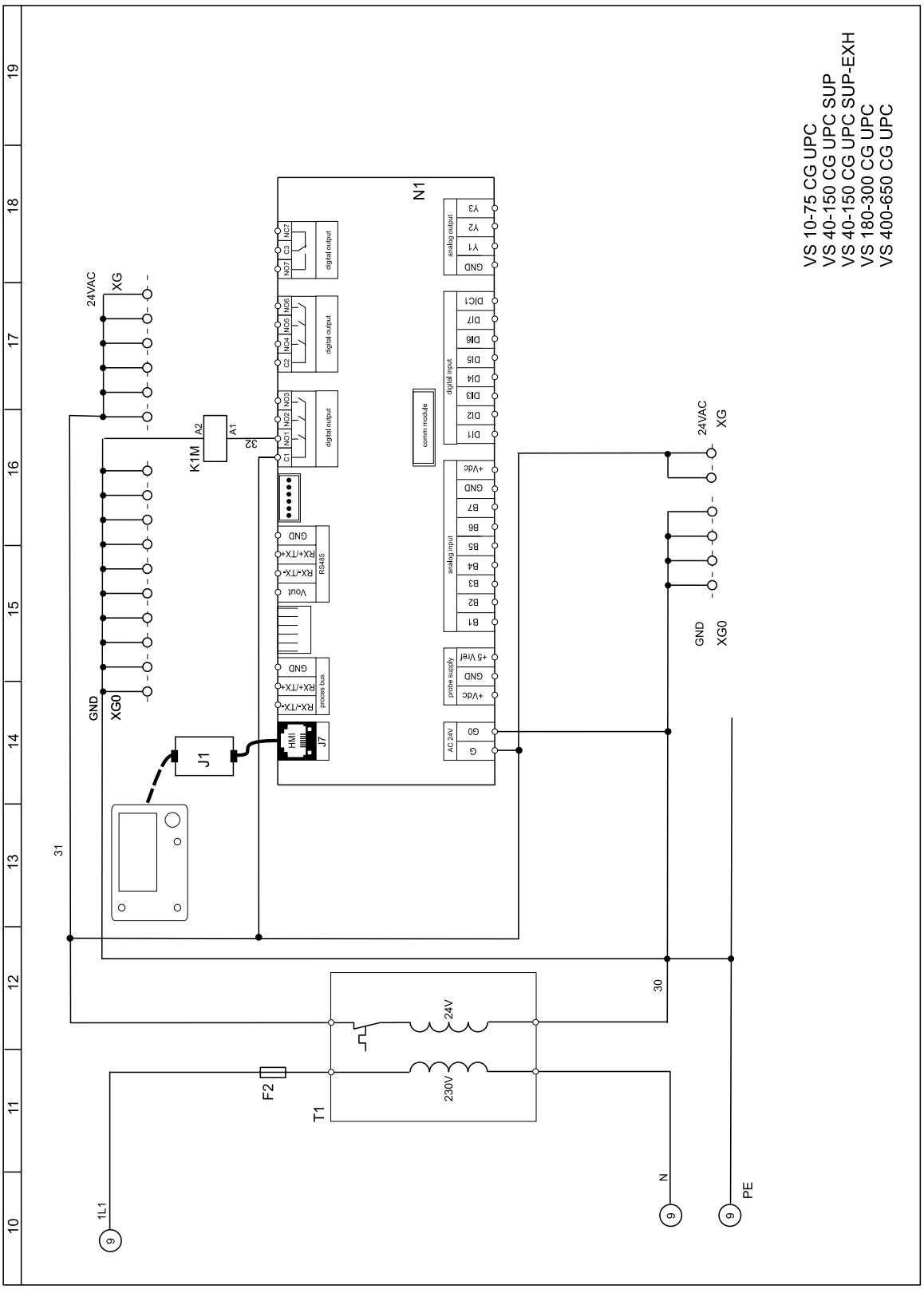
Appendix 1 Circuit diagram of VS 10-75 CG UPC control gear 2/2



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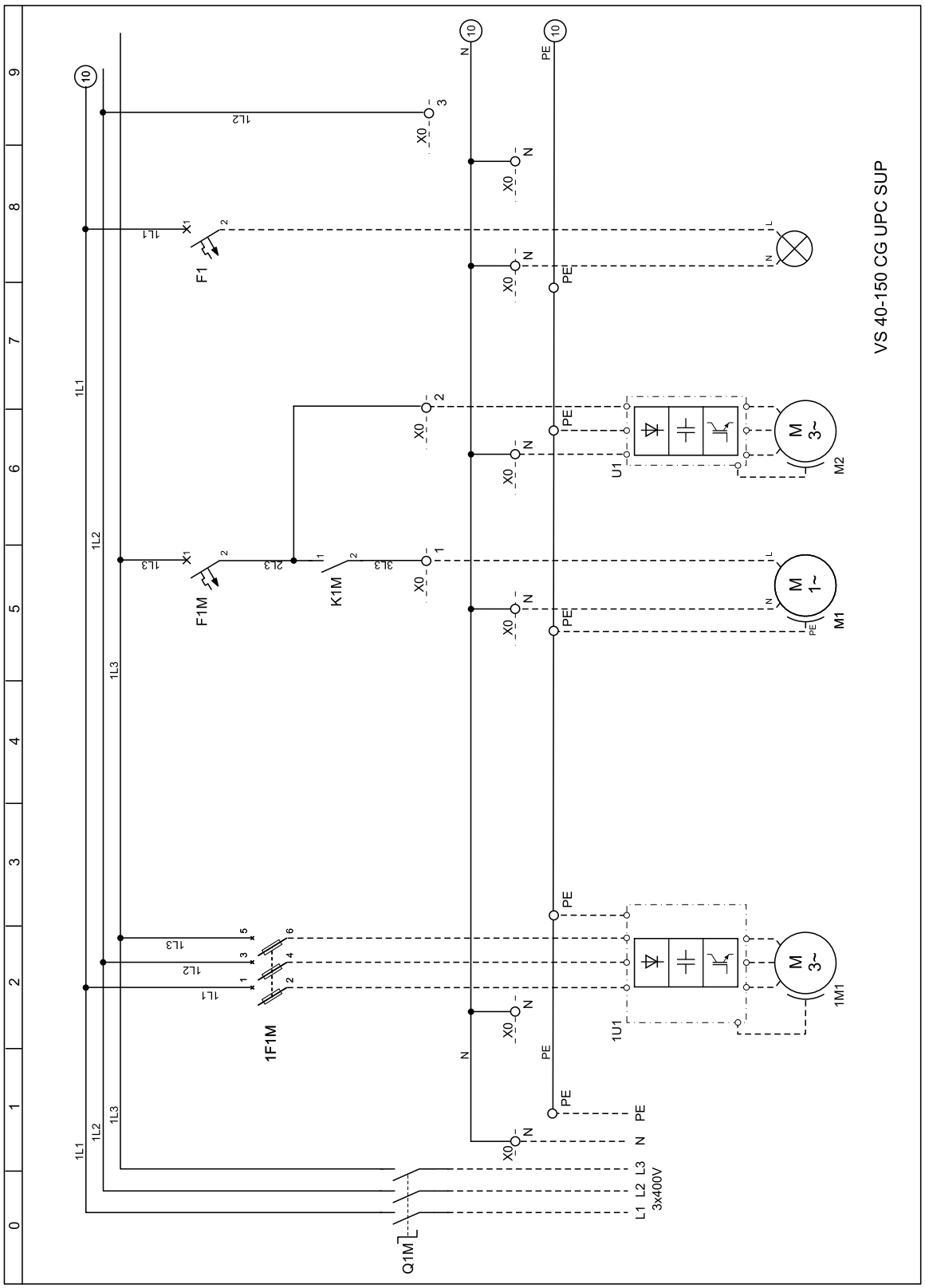
Appendix 2 Circuit diagram of VS 40-150 CG UPC SUP control gear 1/2



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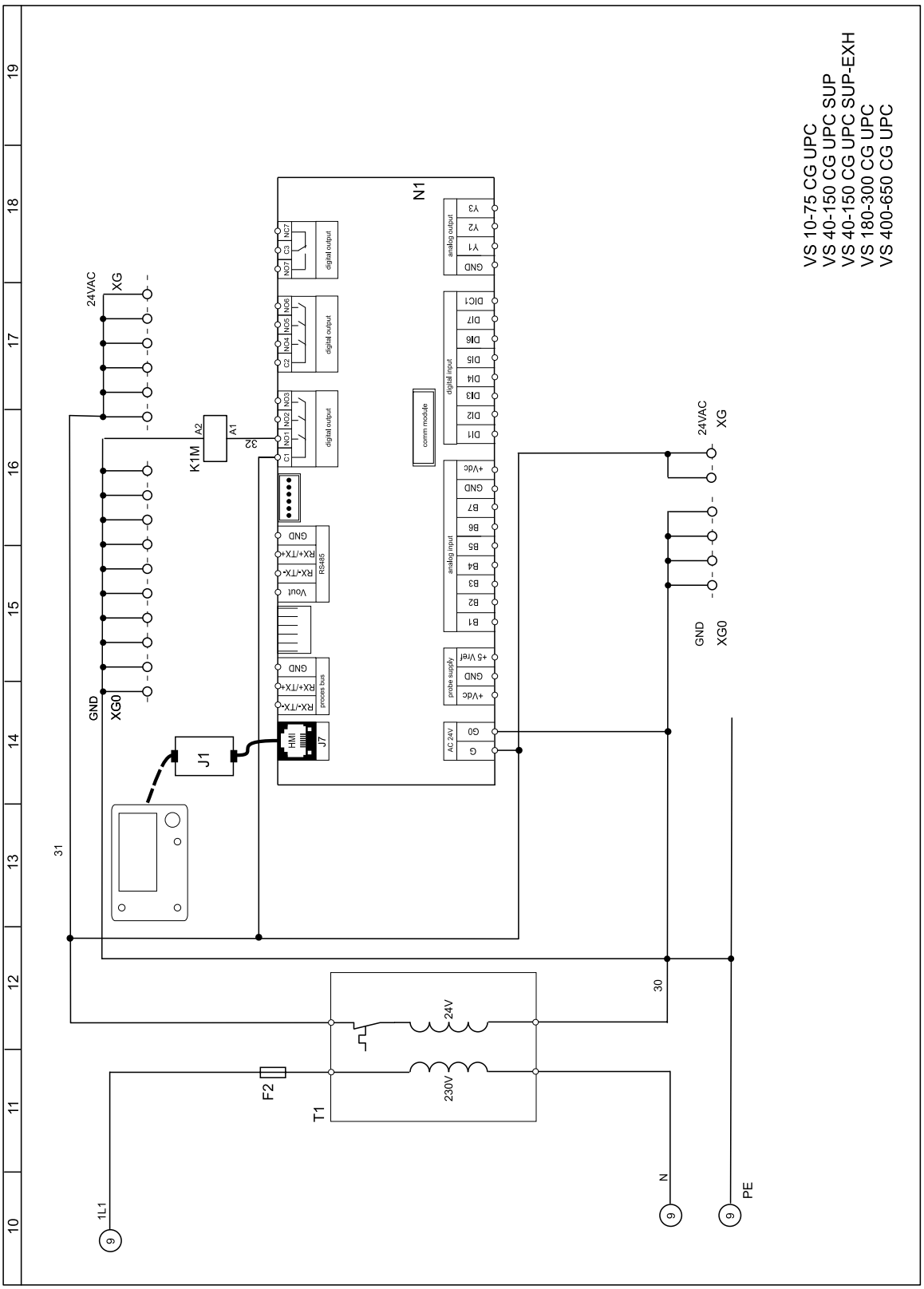
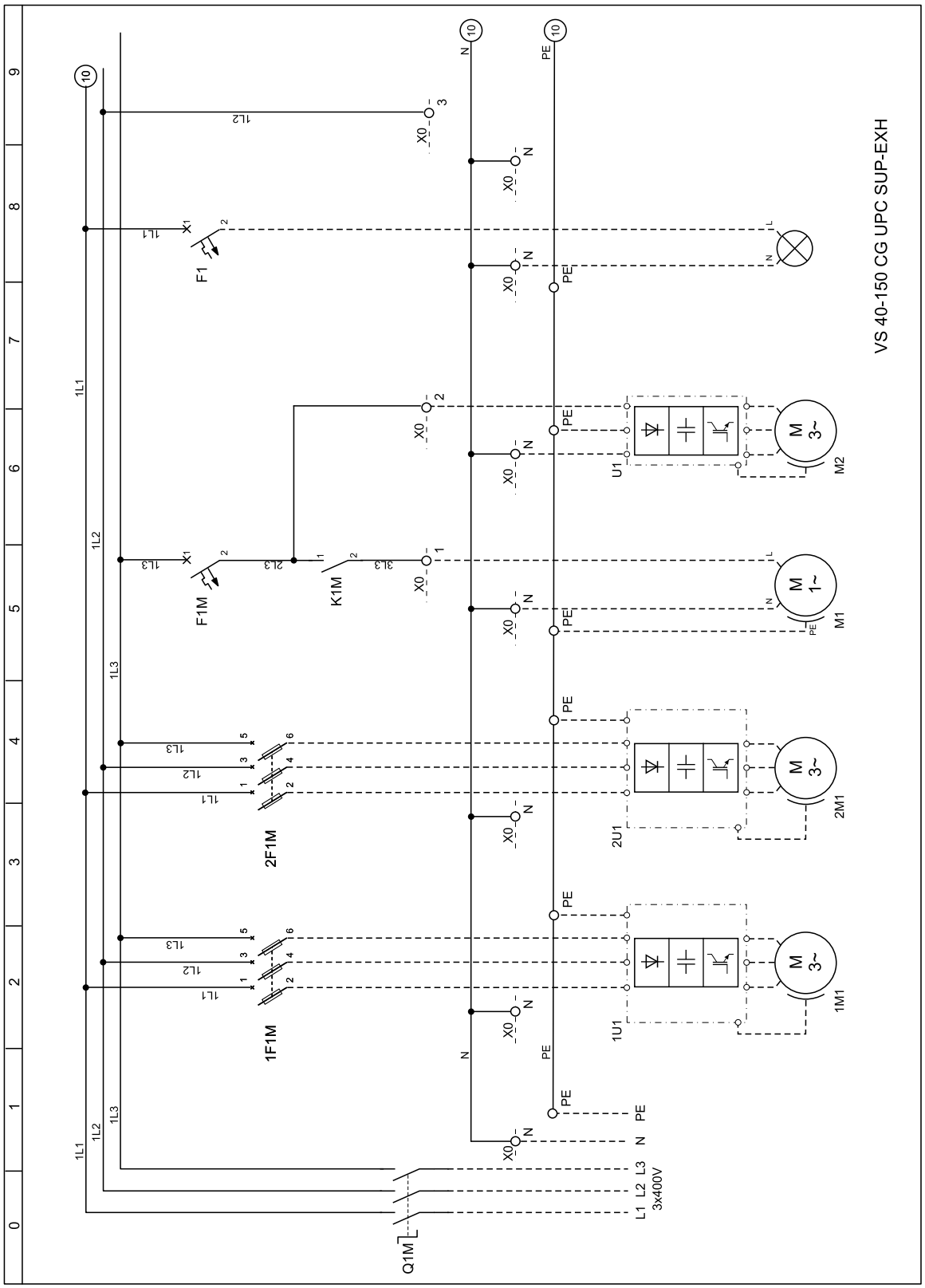
Appendix 2 Circuit diagram of VS 40-150 CG UPC SUP control gear 2/2



Appendix 3 Circuit diagram of VS 40-150 CG UPC SUP-EXH control gear 1/2



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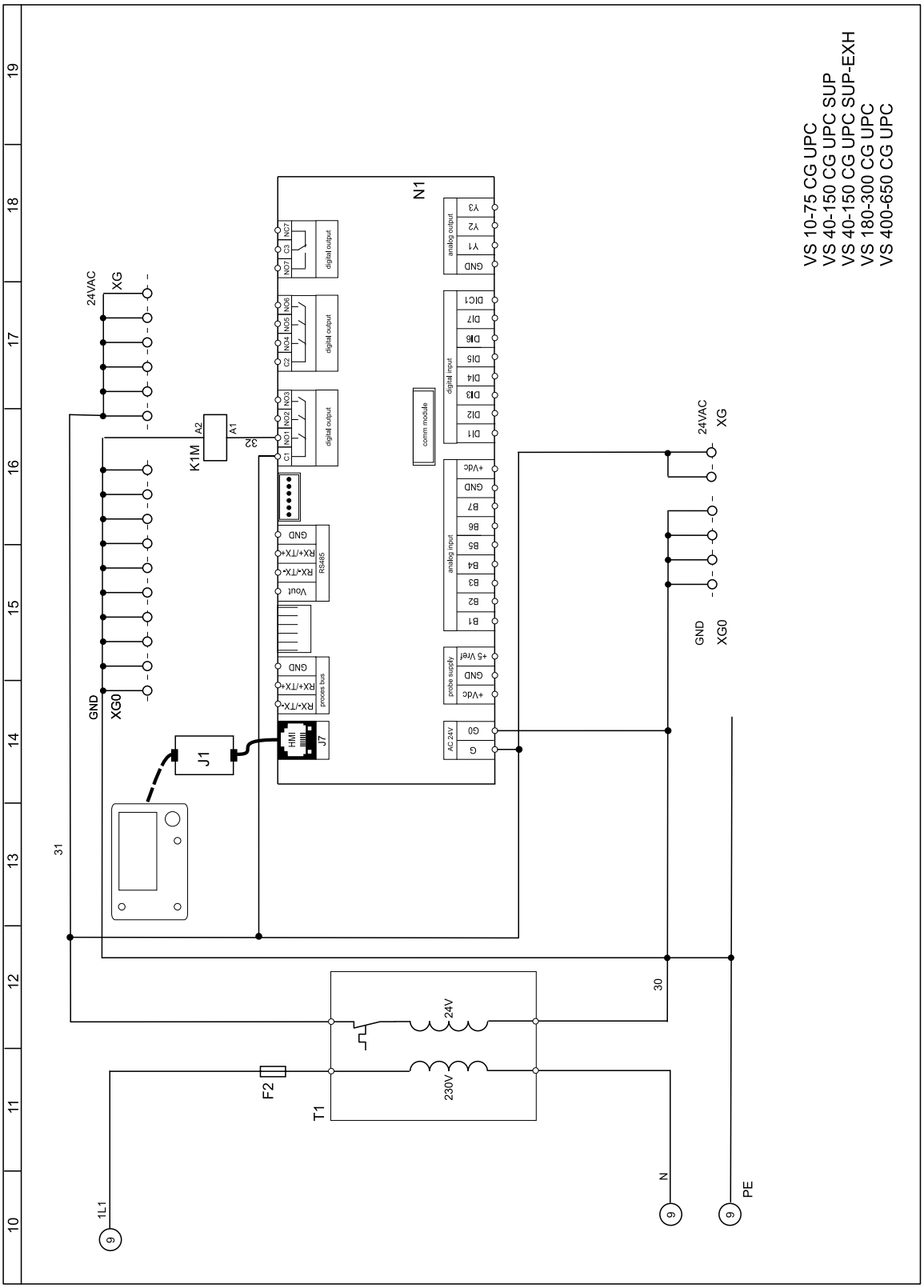
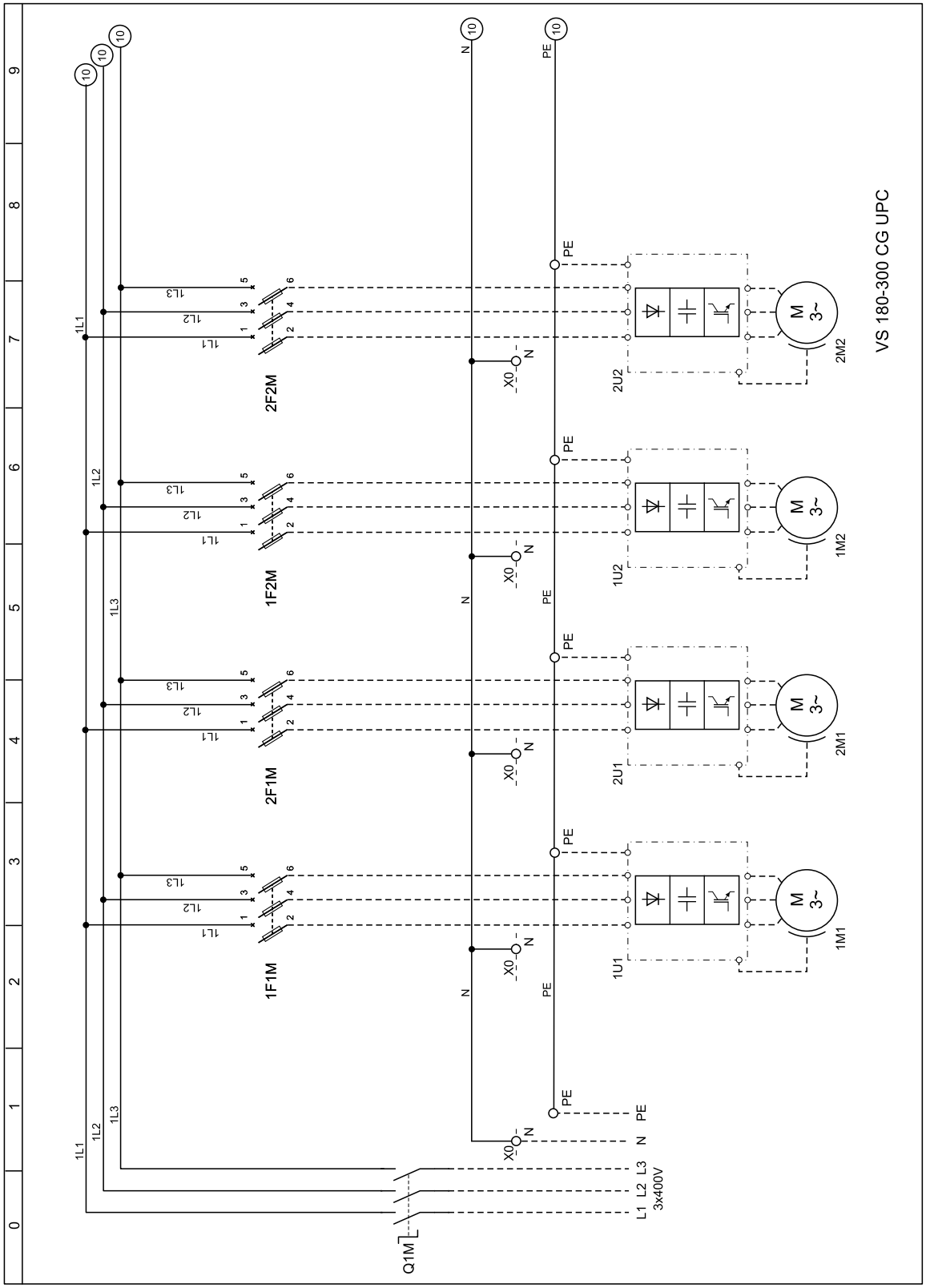
Appendix 3 Circuit diagram of VS 40-150 CG UPC SUP-EXH control gear 2/2



Appendix 4 Circuit diagram of VS 180-300 CG UPC control gear 1/3



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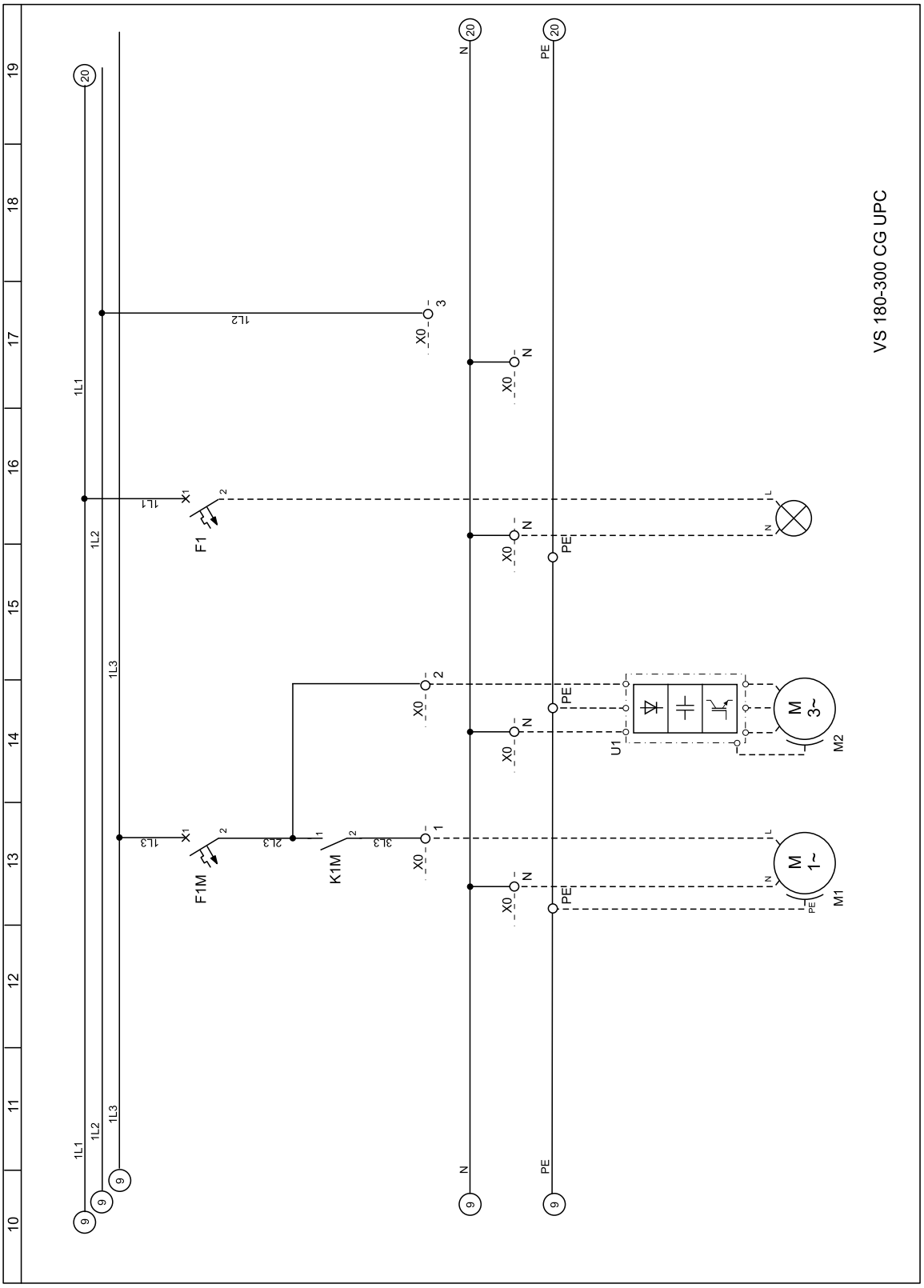
Appendix 4 Circuit diagram of VS 180-300 CG UPC control gear 2/3



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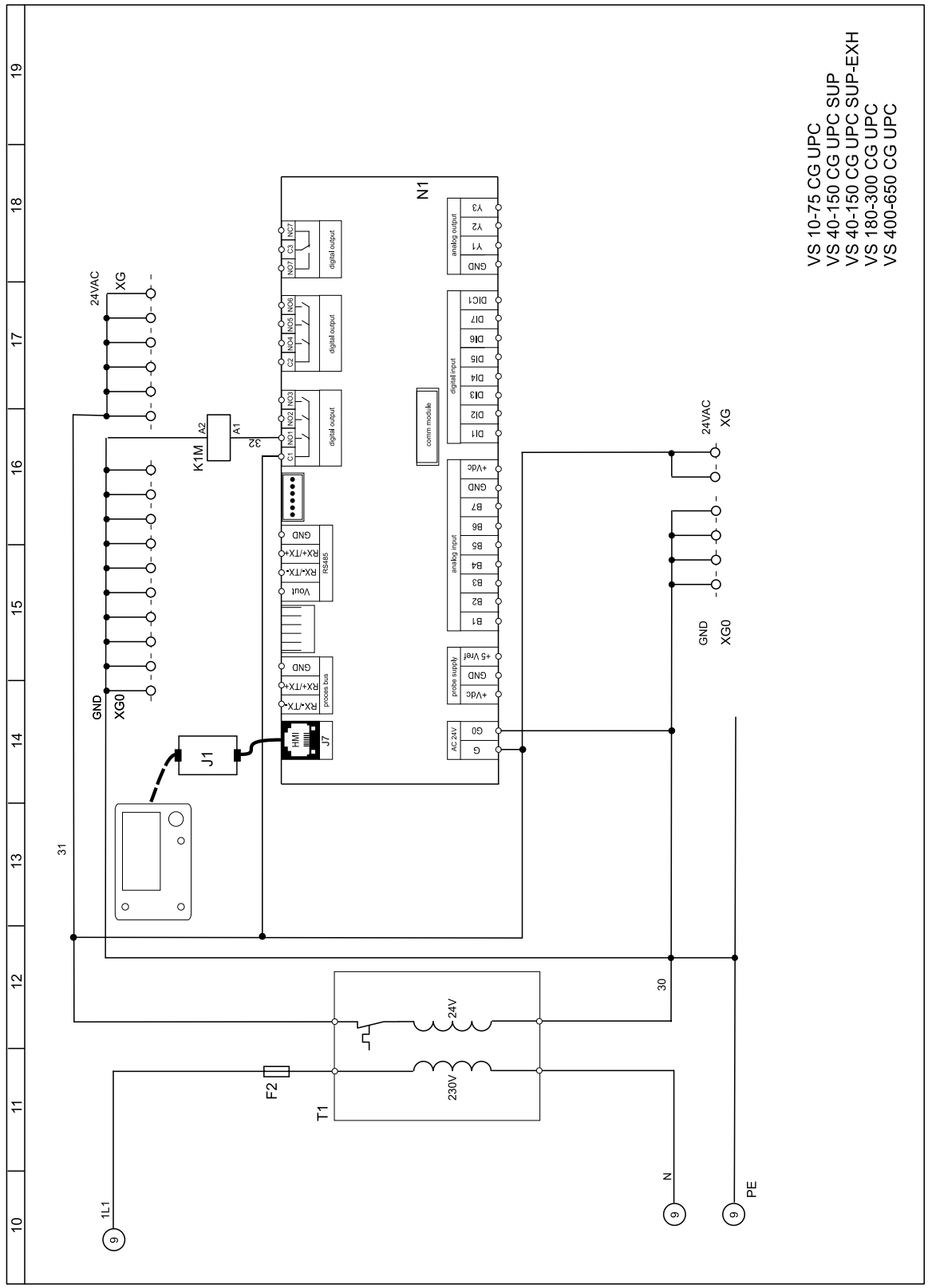
Appendix 4 Circuit diagram of VS 180-300 CG UPC control gear 3/3



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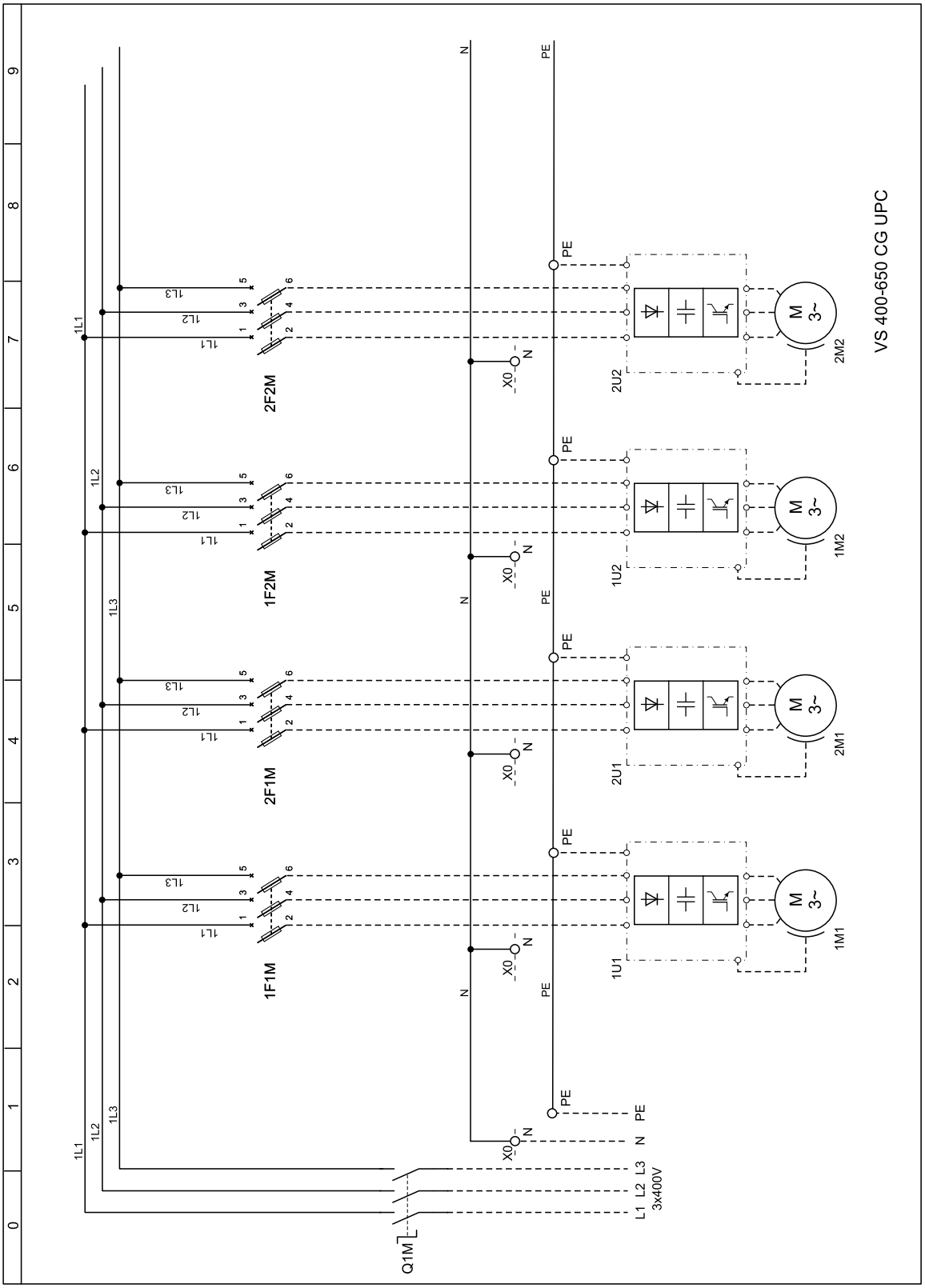
Appendix 5 Circuit diagram of VS 400-650 CG UPC control gear 1/4



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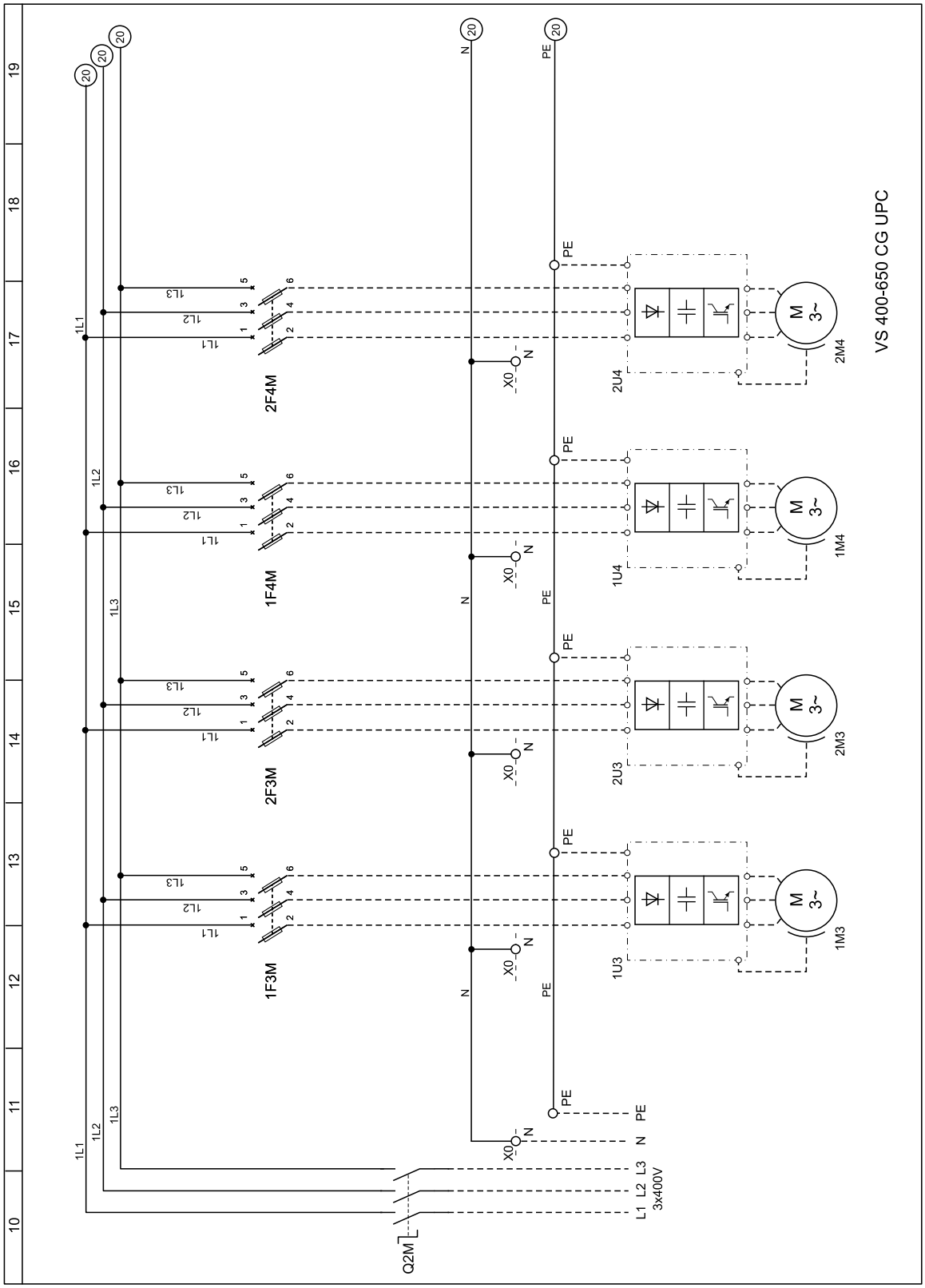
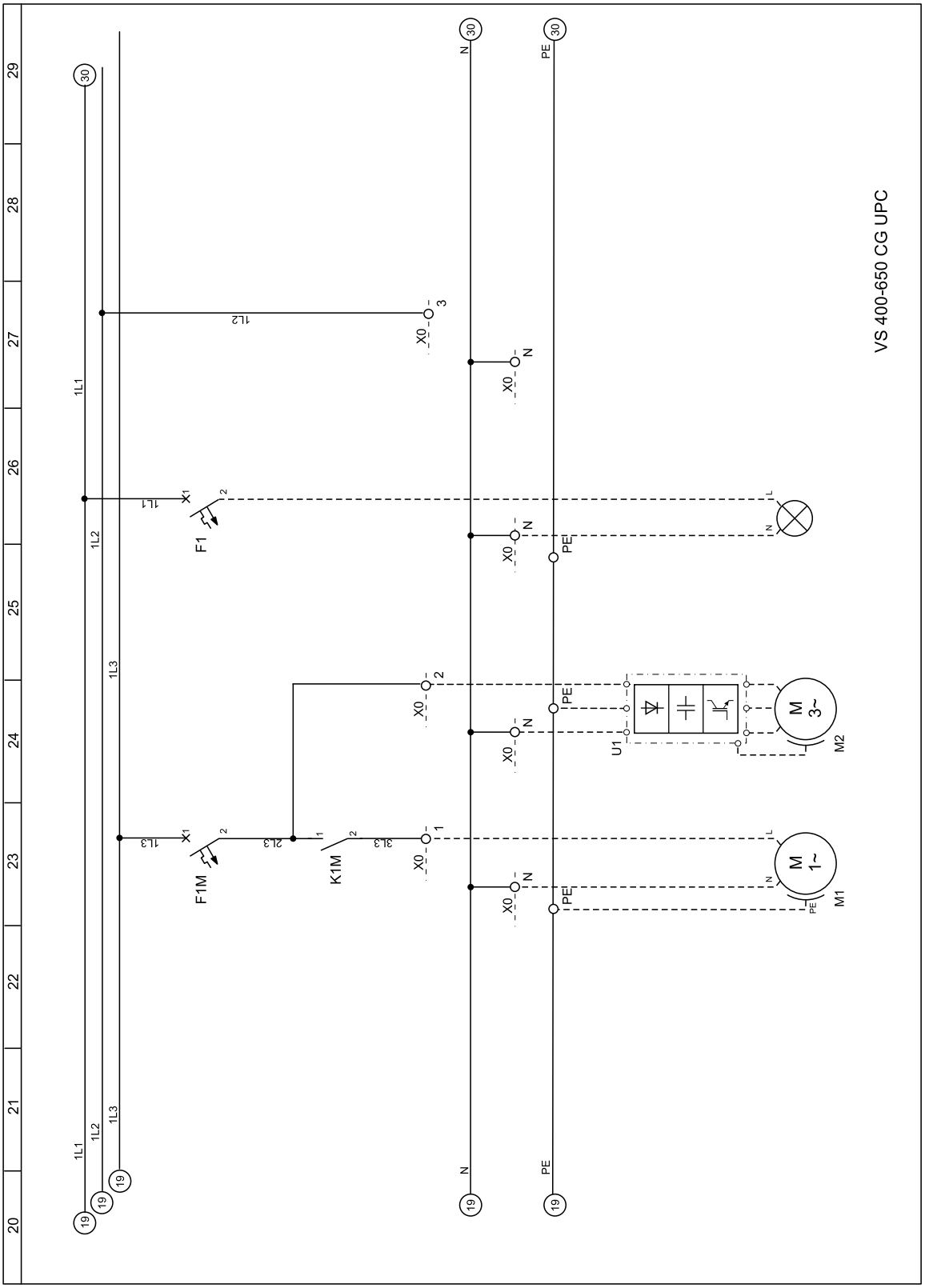
Appendix 5 Circuit diagram of VS 400-650 CG UPC control gear 2/4



Appendix 5 Circuit diagram of VS 400-650 CG UPC control gear 3/4



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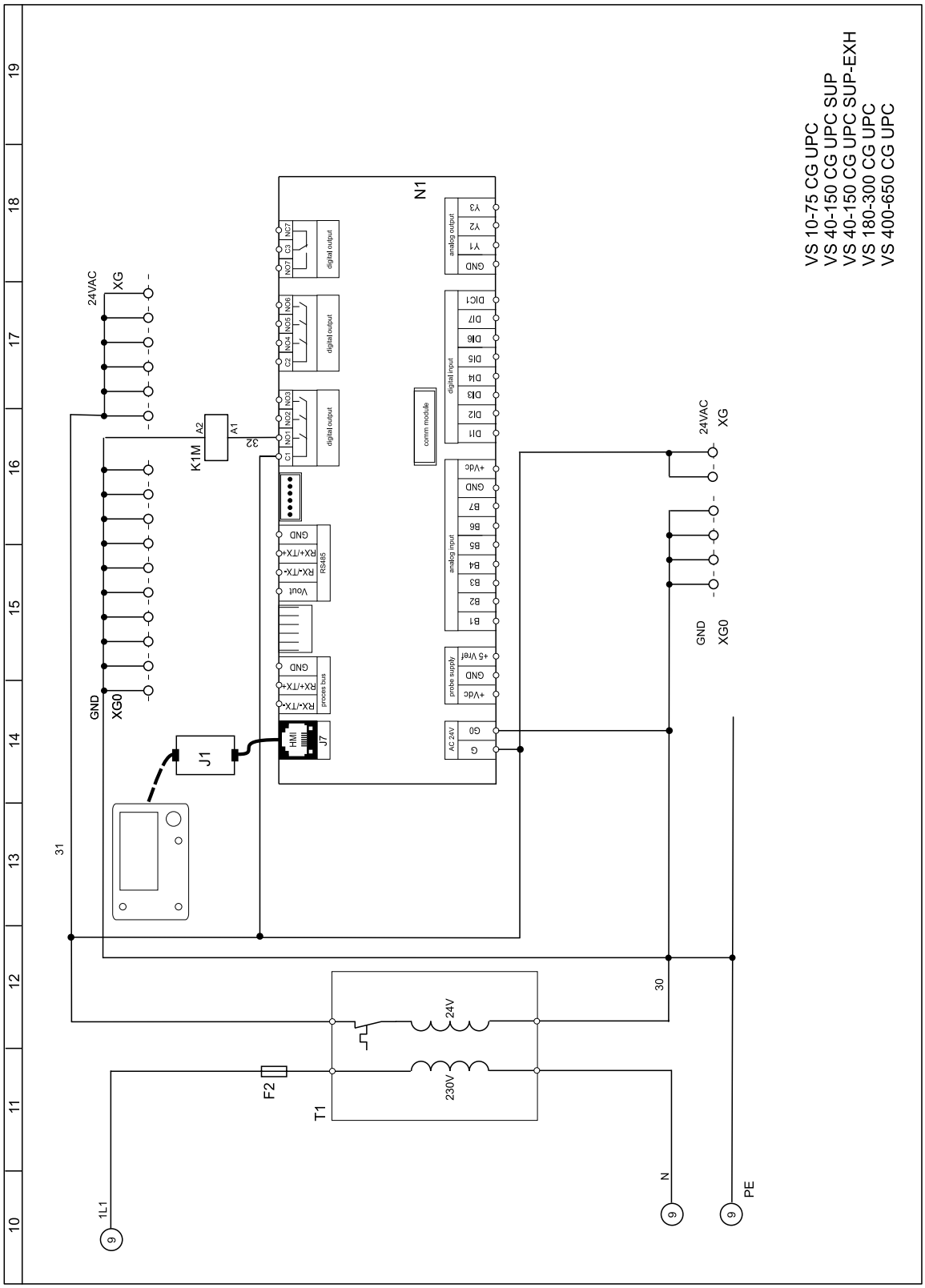
Appendix 5 Circuit diagram of VS 400-650 CG UPC control gear 4/4



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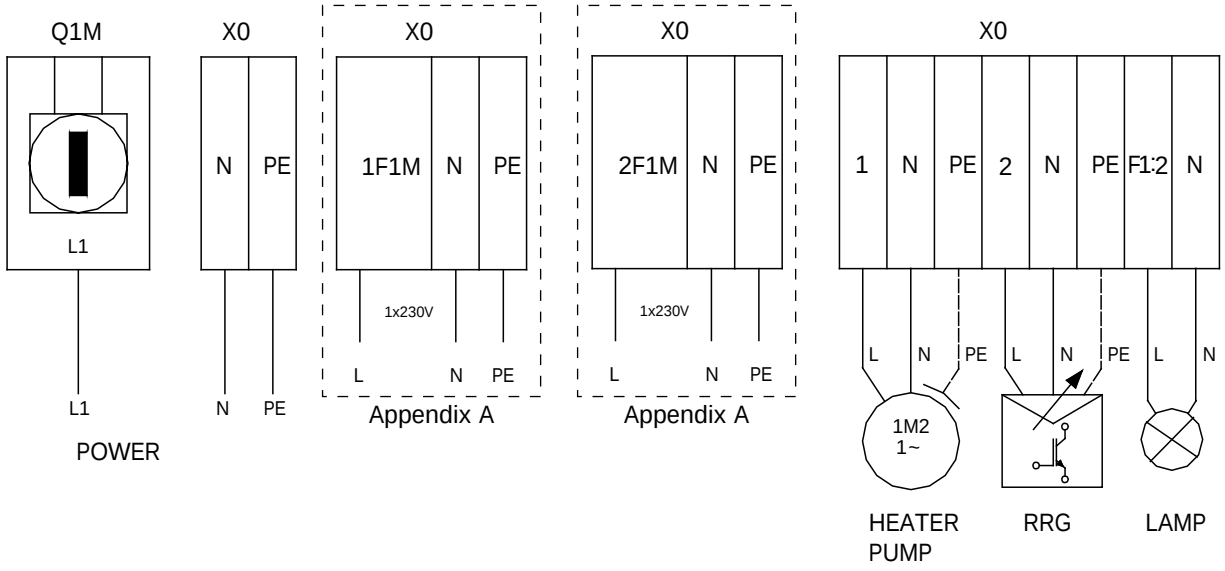
Appendix 6 Circuit diagram of power and motor connection VS 10-75 CG UPC control gears

1x230V power supply, frequency converter with 1x230V suply



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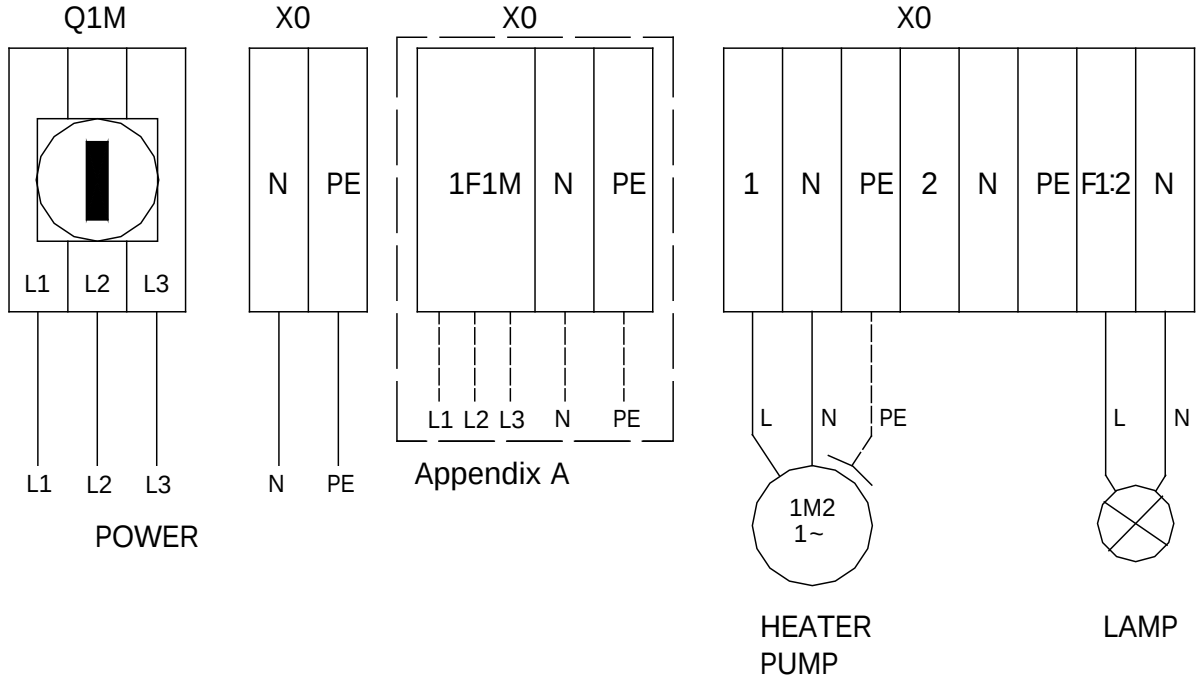
Appendix 7 Circuit diagram of power and motor connection for VS 40-150 CG UPC SUP control gear

3x400V power supply, frequency converter with 1×230V or 3x400V supply



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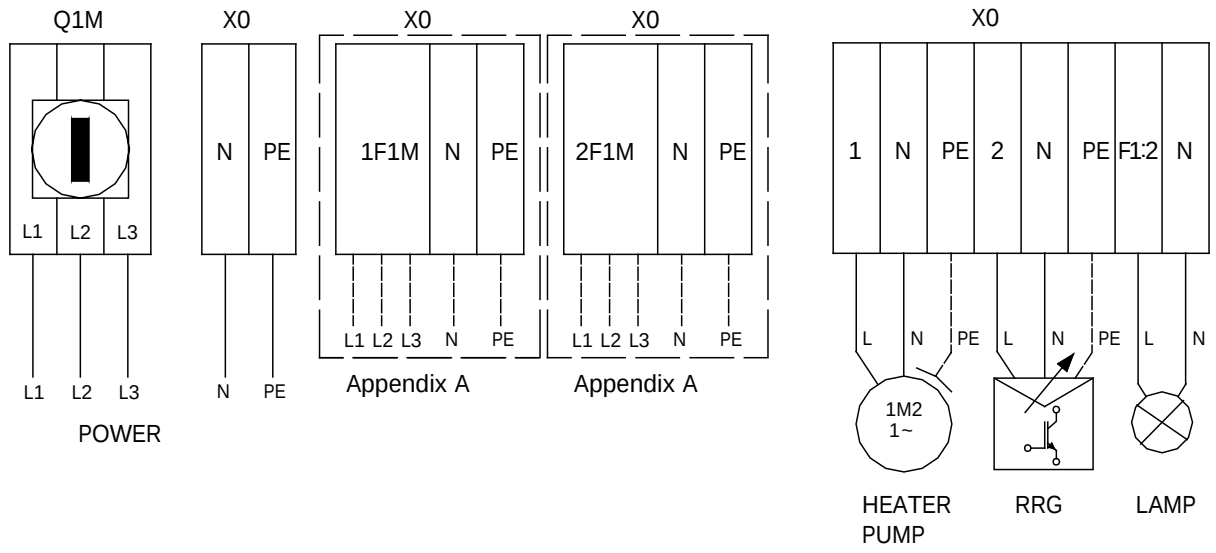
Appendix 8 Circuit diagram of power and motor connection VS 40-150 CG UPC SUP-EXH control gear (used also for VS 180-300 supply)

3x400V power supply, frequency converter with 1×230V or 3x400V supply



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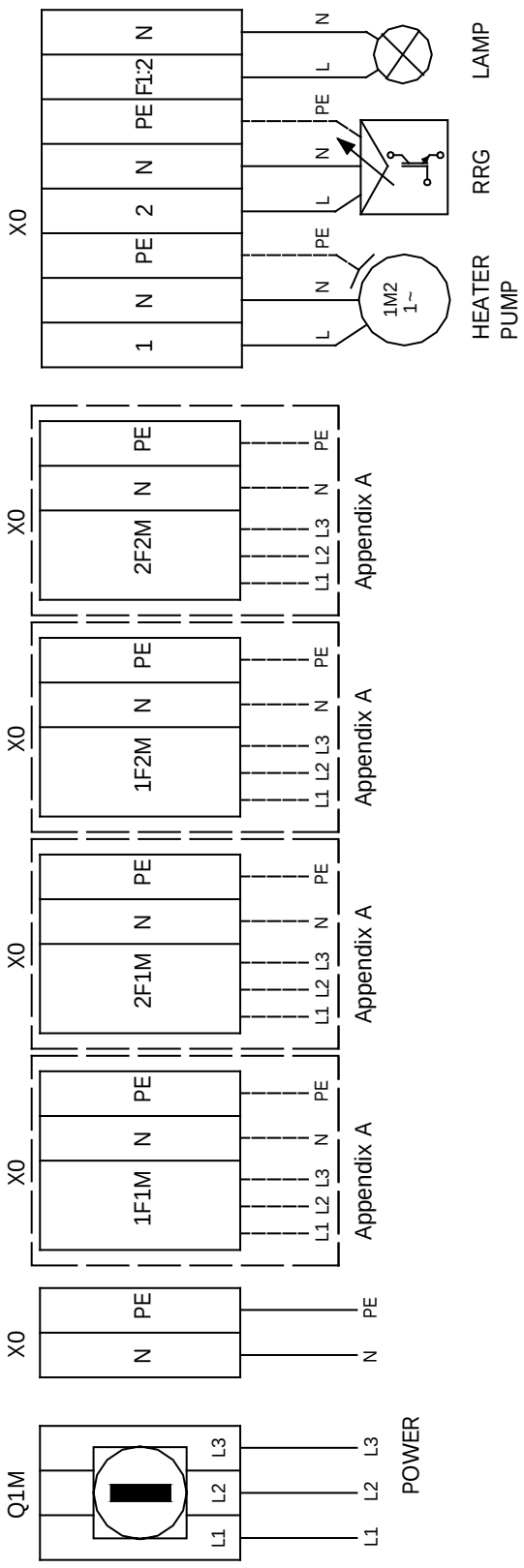
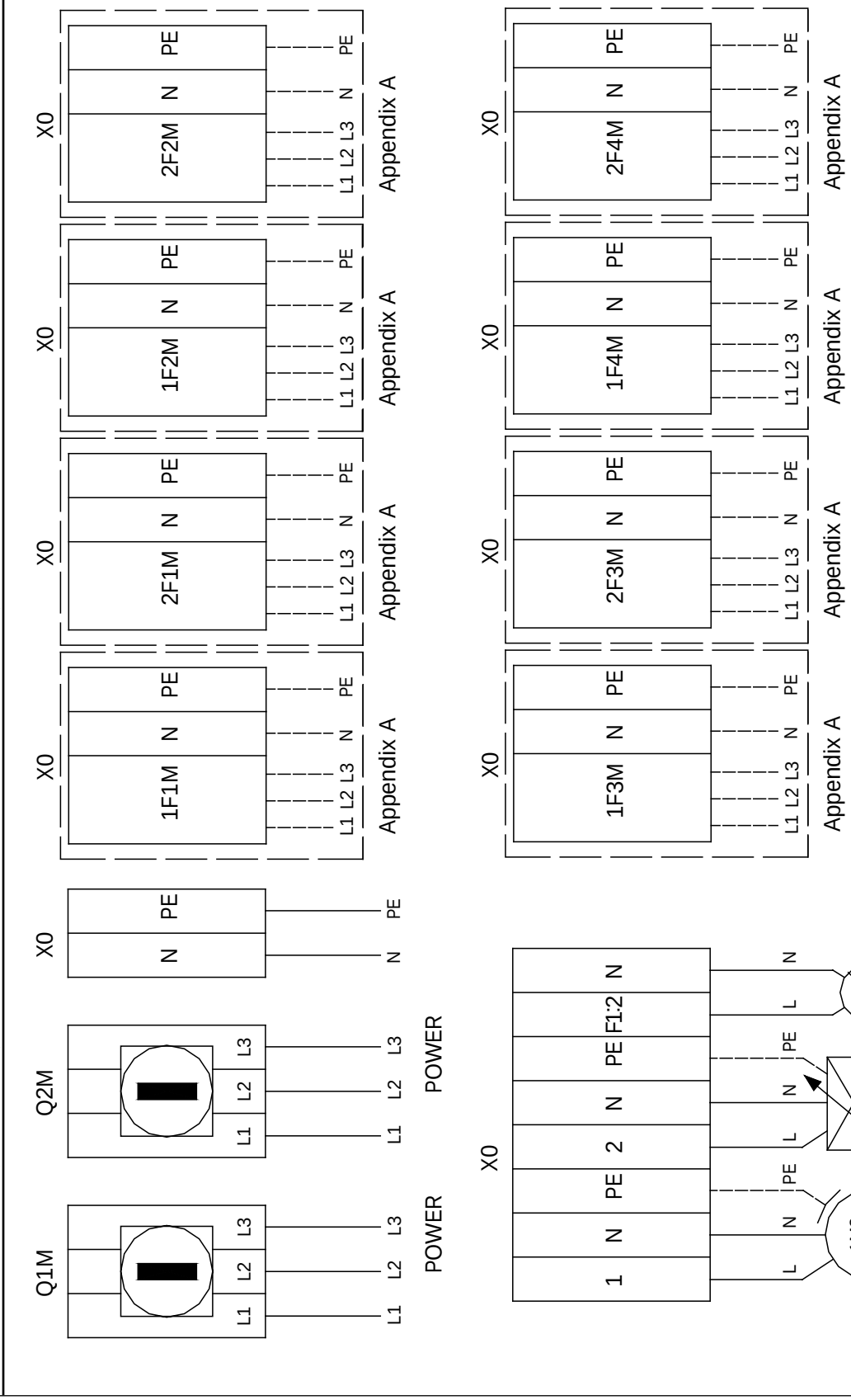
Appendix 9 Circuit diagram of power and motor connection for VS 180-300 CG UPC control gear (used also for VS 400-650 supply)

3x400V power supply, frequency converter with 1×230V or 3x400V supply



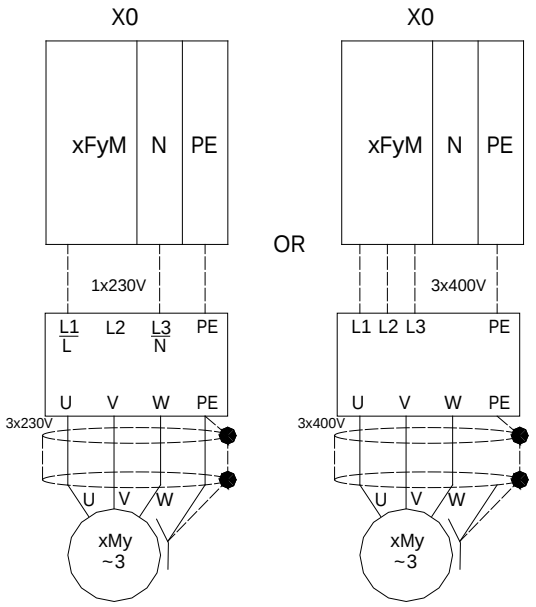
Appendix 10 Circuit diagram of power and motor connection VS 400-650 CG UPC control gear

3x400V power supply, frequency converter with 1×230V or 3x400V supply



Appendix A Circuit diagram of motor connection depending on the type of the frequency co-nverter

Frequency converters with 1×230V supply or with 3x400 supply



y = 1 or 2; 1 - for supply, 2 – for exhaust (according to the table D)

x = 1…4 - the next noumber of motor in AHU(according to the table D)

TABLE D

	1F1M	2F1M	1F2M	2F2M	1F3M	2F3M	1F4M	2F4M
VS 10-70 CG UPC	1M1	2M1						
"VS 10-70 CG UPC (sup with RDT function)"	1M1	1M2						
VS 40-150 CG UPC SUP	1M1							
VS 40-150 CG UPC SUP-EXH	1M1	2M1						
"VS 40-150 CG UPC SUP-EXH (sup for VS 180-300)"	1M1	1M2						
"VS 40-150 CG UPC SUP-EXH (sup with RDT function for VS 40-150)"	1M1	1M2						
VS 180-300 CG UPC	1M1	2M1	1M2	2M2				
"VS 180-300 CG UPC (sup for VS 400-650)"	1M1	1M3	1M2	1M4				
"VS 180-300 CG UPC (RDT function for VS 40-150)"	1M1	2M1	1M2	2M2				
VS 400-650 CG UPC	1M1	2M1	1M2	2M2	1M3	2M3	1M4	2M4

Appendix 11 The application control schemes

The control schemes for separate application are on the CD plate delivered with AHUs. In order to print the proper application scheme as the first one should find the application code on the AHU's technical data, next select „Control Aplication" from menu „AUTOMATICS" of CD plate and next choose suitable code and leading sensor.