



Control units

VCB

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Application, working conditions, construction

Application

Control units VCB are compact control and power switchboards for decentral control of air handling devices. They are intended for control of basic air treatment, that means heating, cooling and heat recovery. They provide high stability, safety of device and provide easy operating including indication of working states.

Project

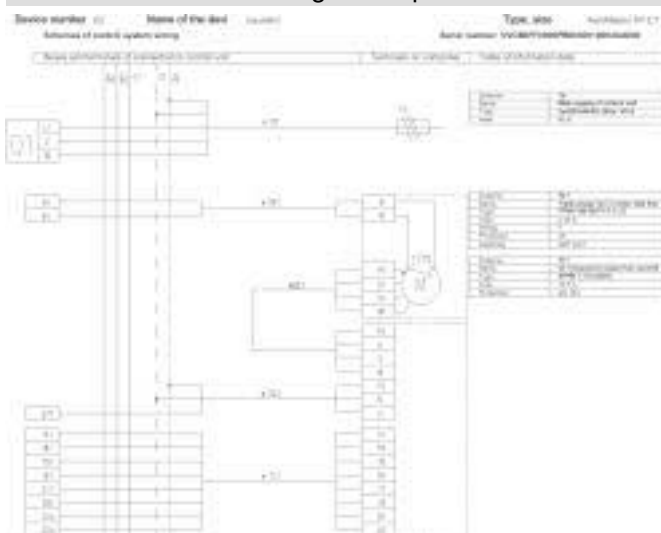
Project of control unit consists of selection of needed functions and configuration of inside composition. Project is done automatically using algorithm built in computer program by which the air handling unit is projected as well. Project output is exact production specification of control unit and these individualized lists for particular device:

1. list of connected components
2. schemes of electric wiring of all components
3. list of cables for wiring of all components

Picture 1 – list of connected components

Component name	Type	Value
Control unit	VCB	VCB01
Control unit	VCB	VCB02
Control unit	VCB	VCB03
Control unit	VCB	VCB04
Control unit	VCB	VCB05
Control unit	VCB	VCB06
Control unit	VCB	VCB07
Control unit	VCB	VCB08
Control unit	VCB	VCB09
Control unit	VCB	VCB10
Control unit	VCB	VCB11
Control unit	VCB	VCB12
Control unit	VCB	VCB13
Control unit	VCB	VCB14
Control unit	VCB	VCB15
Control unit	VCB	VCB16
Control unit	VCB	VCB17
Control unit	VCB	VCB18
Control unit	VCB	VCB19
Control unit	VCB	VCB20
Control unit	VCB	VCB21
Control unit	VCB	VCB22
Control unit	VCB	VCB23
Control unit	VCB	VCB24
Control unit	VCB	VCB25
Control unit	VCB	VCB26
Control unit	VCB	VCB27
Control unit	VCB	VCB28
Control unit	VCB	VCB29
Control unit	VCB	VCB30
Control unit	VCB	VCB31
Control unit	VCB	VCB32
Control unit	VCB	VCB33
Control unit	VCB	VCB34
Control unit	VCB	VCB35
Control unit	VCB	VCB36
Control unit	VCB	VCB37
Control unit	VCB	VCB38
Control unit	VCB	VCB39
Control unit	VCB	VCB40
Control unit	VCB	VCB41
Control unit	VCB	VCB42
Control unit	VCB	VCB43
Control unit	VCB	VCB44
Control unit	VCB	VCB45
Control unit	VCB	VCB46
Control unit	VCB	VCB47
Control unit	VCB	VCB48
Control unit	VCB	VCB49
Control unit	VCB	VCB50

Picture 2 – electric wiring of components



Picture 3 – list of cables for components wiring

Cable number	Cable type (cross-section)	Cable length (m)	Comments
1	VCB01	1.0	
2	VCB02	1.0	
3	VCB03	1.0	
4	VCB04	1.0	
5	VCB05	1.0	
6	VCB06	1.0	
7	VCB07	1.0	
8	VCB08	1.0	
9	VCB09	1.0	
10	VCB10	1.0	
11	VCB11	1.0	
12	VCB12	1.0	
13	VCB13	1.0	
14	VCB14	1.0	
15	VCB15	1.0	
16	VCB16	1.0	
17	VCB17	1.0	
18	VCB18	1.0	
19	VCB19	1.0	
20	VCB20	1.0	
21	VCB21	1.0	
22	VCB22	1.0	
23	VCB23	1.0	
24	VCB24	1.0	
25	VCB25	1.0	
26	VCB26	1.0	
27	VCB27	1.0	
28	VCB28	1.0	
29	VCB29	1.0	
30	VCB30	1.0	
31	VCB31	1.0	
32	VCB32	1.0	
33	VCB33	1.0	
34	VCB34	1.0	
35	VCB35	1.0	
36	VCB36	1.0	
37	VCB37	1.0	
38	VCB38	1.0	
39	VCB39	1.0	
40	VCB40	1.0	
41	VCB41	1.0	
42	VCB42	1.0	
43	VCB43	1.0	
44	VCB44	1.0	
45	VCB45	1.0	
46	VCB46	1.0	
47	VCB47	1.0	
48	VCB48	1.0	
49	VCB49	1.0	
50	VCB50	1.0	

Documentation

Units can be installed and used only according to provided documentation. Documentation must be available to service attendance and placed preferably close to unit. List of documentation provided with control unit:

Name	Use/specification
Installation and service instructions	Unit description and use (operation), installation, attendance, service
Record of functional and single part check performance	Unit installation, operation, service ¹⁾
Device service book	Starting procedure, service inspections and their evidence Control system configuration, Unit installation, operation (List of connected elements), ¹⁾

After installation, the documentation must be completed with initial revision of electric device, which is provided by company performing installation of VCB unit. Revision must be performed by specialist with appropriate competence.

Unit operation must be according to operation regulations (page 17).

Working conditions

Control units VCB can be used in dry environment without dust, chemical substances and explosion risk.

Electric protection of plastic box corresponds with IP 65 when the door is closed and with IP 40 when the door is opened. Electric protection of sheet metal box is IP 66 when the door is closed and IP 20 when the door is opened. Electric protection of sheet metal box with additional venting is IP 54 when the door is closed and IP 20 when the door is opened.

Control units VCB can be mounted directly to surfaces of combustibility grade A and B according to EN 13501-1. Acceptable operating temperature of environment is from 0 °C up to +40°C.

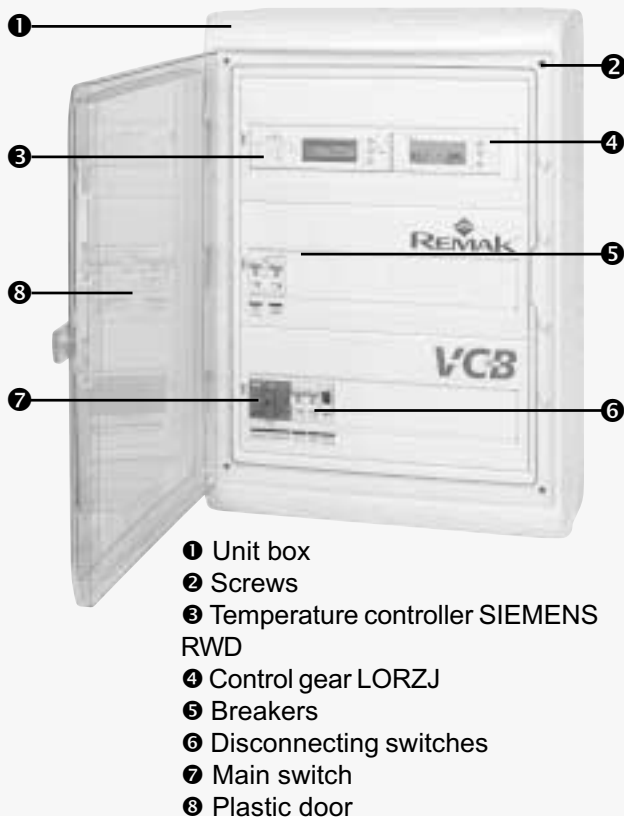
Unit construction

Control and power parts of unit are placed in one box. Separate components, control and operating elements are placed inside of unit on DIN rails.

(1) Bound together as Accompanying technical documentation

Application, working conditions, construction

Picture 4 – VCB unit construction



Control units VCB are built-in plastic or sheet metal boxes with front transparent door, with control elements placed behind it.

Regulating and control part

Control and regulating functions are provided by two interconnected components:

- temperature controller Siemens RWD
 - component for logical and time actions control LORZJ
- Particular configuration (there are many options) is determined by required function of control unit (controlled components).

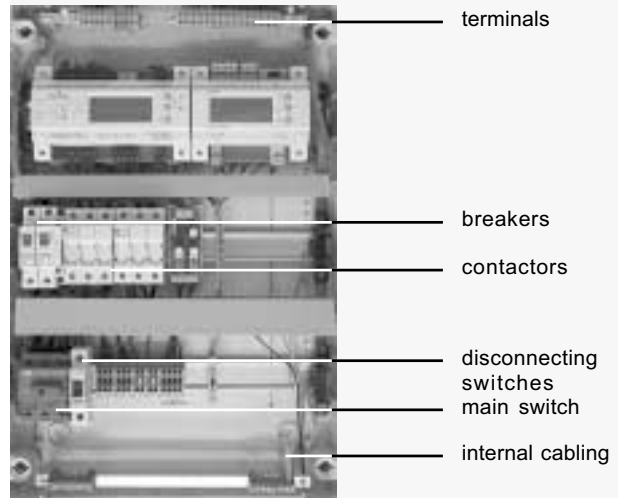
Picture 5 – VCB unit construction



There are three types of gears: RWD 62, RWD 82, RWD 68

Control component LORZJ is intended for control of air handling unit operation. It contains input circuits which scan states of separate parts of air handling unit and also output circuits which control air handling unit according to evaluated input states. Unit is equipped with real time gear which provides air handling unit control according to week time program.

Picture 6 – power part of VCB unit



Power part

Power part is just like control part always made to measure of particular air handling unit.

Boxes

Control units VCB are built-in plastic (units Vento and AeroMaster FP) or sheet metal (AeroMaster XP units) boxes with front transparent door with control elements

Table 1 – box dimensions in mm

Type	Height	Width	Depth	Usual use
Plastic	610	448	160	Vento, FP, small XP (single speed)
Plastic	842	448	160	Vento, FP, small XP (single speed)
Sheet metal	800	550	250	XP, demanding Vento devices
Sheet metal	1200	750	300	XP
Sheet metal	1600	750	300	XP
Sheet metal	2000	800	400	XP
Sheet metal	2000	1000	400	XP

Boxes 2000 x 800 x 400 mm and 2000 x 1000 x 400 mm can be also equipped with ventilation system - fan and screen in opposite corners of box.

Marking of control units

Control unit is always marked by original code (generated by "Design program for calculation and project of control unit AeroCAD" and is set only in Accompanying technical documentation, not on control unit) and by serial number (for communication with producer)

Temperature controller Siemens RWD provides temperature control by controlling operational devices (water heaters, cooling, heat exchanger). Controller guarantees high accuracy of control action with tolerance of $\pm 1^\circ\text{C}$. Controller enables to set comfortable and attenuation temperature which provides economical operation of whole device.

Application, working conditions, construction

Summary of functions				Control method			Control range	
Options				on / off	step	stepless	production	user
	symbol	Controlled component						
Control functions								
inlet air temperature	Control functions							
	Comfortable temperature			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	23 °C	-50 °C to +150 °C ²⁾
	Attenuation temperature			<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	18 °C	-50 °C to +150 °C
		water heating control	+	water heater			<input type="radio"/>	
		electric heating control	+	electric heater	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	
		condensing unit control	-	direct evaporator	<input type="radio"/>	<input type="radio"/>		1 to 2 no
	mixing set	-	water cooler			<input type="radio"/>		
	speed control RR	⊕	rotary heat exchanger	<input type="radio"/>		<input type="radio"/>		
Speed control								
air flow	control of double speed motors		motor		<input type="radio"/>		higher/lower	higher/lower
	control of voltage controllers		controller		<input type="radio"/>		1 - 5	1 - 5
	control of frequency convertors		frequency convertor		<input type="radio"/>		1 - 5	1 - 5
Safety functions								
Heaters protection								
anti-freeze protection	anti-freeze protection of water heater on side of air		+	water heater	<input type="radio"/>		5,5 °C	no
	anti-freeze protection of water heater on water side		+	water heater	<input type="radio"/>		+8 °C (1-19)	no
	fore-heating of water heater during system operation		+	water heater	<input type="radio"/>			
	fore-heating of ohřivače		+	water heater			<input type="radio"/>	+30 °C (18-45) no
	delayed start of fan operation		+	water heater			<input type="radio"/>	120 + T(0-300)s no
	opening and closure of dampers		⊕		<input type="radio"/>			
	delayed shutdown of fan operation		+	electric heater			<input type="radio"/>	0 to 300 s no
	maximal temperature check		+		<input type="radio"/>			80 °C no
	heat exchangers protection		⊗					
	control of plate heat exchanger bypass damper		⊗	plate heat exchanger	<input type="radio"/>			
Fan protection								
	fan protection		⊕	fan	<input type="radio"/>			
	thermocontact switching		⊕	fan	<input type="radio"/>			
	shutdown of motor starter		⊕	fan	<input type="radio"/>			
	motor overcurrent at frequency convertor scanning		⊕	fan	<input type="radio"/>			
Programs								
	real time			<input type="radio"/>				
	week program with option of eight changes daily						0 to 8 changes	0 to 8 changes
Control								
	control from unit			<input type="radio"/>				
	remote starting of unit		ORe 1	<input type="radio"/>				
	remote temperature setting		QAA 25			<input type="radio"/>	+5 °C - +35 °C	
	remote air flow setting		ORe 2		<input type="radio"/>		higher/lower	

Control unit VCB enables to take advantage of one or two control sequences (heating + cooling, heating + heat recovery). Further it is possible to connect components with independent control (for example rotary heat exchanger with regulated efficiency). Units are supplied in individual application design and are provided with functions which are necessary for operation control of particular device.

Standard VCB unit doesn't provide cascade temperature control, mixing control, communication, humidification control, gas heating control, heating pump switching according to outdoor temperature, summer and winter temperature compensation.

(1) VCB controls 1- 2(3) outputs - can be combinations of two kinds (heating - continuous cooling - ON/OFF)
 (2) Maximal acceptable setting for air handling unit is generally to 40 °C

Control, protective functions

Algorithm of control

Temperature controller Siemens RWD automatically performs selection of one out of four basic actions according to required (set) temperature and actual measured temperature:

- ventilation (doesn't require heating or cooling)
- heat recovery (by rotary heat exchanger)
- heating (controller controls heater operation)
- cooling (controller controls cooler operation)

Heating and cooling can work together with heat recovery, or heating and cooling together (without heat recovery).

Control of heating

Water heating is controlled by SUMX mixing set actuator LM 24 SR with continuous control signal (0-10 V).

Electric heating can be controlled by:

- full output power switching – heaters EO, EOS
- separate sections switching – heaters series EOSX, big EO (sectional);
- control using current valve PV - heaters EOS (to 45 kW).

Control of cooling

Water cooling is controlled in the same way as water heating.

Direct cooling is controlled by output power of condensing unit switching. If the condensing unit is double-circuit (or if two single-circuit units are used), the control is double step. VCB provides optimal frequency of condensing unit switching.

Correction of requested value

This function is added at customer request.

Set value of inlet air temperature is adjusted according to outdoor temperature scanned by a sensor (set required temperature on controller is adjusted ("recalculated") according to temperature measured outside).

The purpose of this function is lowering temperature difference (shock) at the entrance to the building from outdoor environment and in other way, too (in certain situation also energy saving).

Rotary heat exchanger output power control

Rotary heat exchanger control can be done:

- by continuous speed control - heat recovery efficiency control:
 - directly by controller (if the controller is not equipped with heating and cooling control) - by frequency convertor;
 - by independent control system - with frequency convertor with built-in control procedure.
- by ON/OFF control – by controller (if the controller is not equipped with heating and cooling control) - without using frequency convertor (lower quality of device but saving costs for convertor).
- continuous operation (with fans) with possibility of manual shutdown (for example in summer), that means without control.

Fan speed control

Speed control can be common for inlet and exhaust or independent for every branch.

For program mode and for manual mode with external VCB control it provides selection of two step fan output power setting. In this way, following device can be controlled:

- double-speed motors
- five-step voltage controllers
- frequency convertors

Higher and lower speed can be set on VCB unit. Setting is performed by producer or user according to draftsmen setting for required air flow rate.

Example for voltage five-step controllers and frequency convertors:

Higher speed is set for full unit operation –

5. level on speed controller. Lower speed is set for lowered output power (for example 3. level of output power on controller). For week program it means that always when higher speed is requested, the unit will be operated in 5. level and always when lower speed is requested, the unit will be operated in 3. level of controller. For manual mode with internal device, five output power levels can be set for voltage controllers and frequency convertors.

Fans output power controllers

Only controllers of second generation TRN - E and TRN - D and frequency convertors VLT can be standardly connected to VCB control units.

When making project of VCB to air handling unit in program AeroCAD, the right selection and compatibility of components is secured. When ordering control units without project worked in AeroCAD it is necessary to use right controllers.

Protective and safety functions

VCB provides package of protective functions which protect separate parts of controlled air handling unit.

Fan electromotors protection

Control unit VCB provides according to configuration protection of all types of fan motors mounted to air handling devices REMAK. That means:

- motors with external rotor, thermocontacts in winding
- standard asynchronous motors with thermocontacts in winding (single or double-speed);
- motors with external rotor with thermistors in winding or motors without thermocontacts of other than REMAK devices can be connected.

Motors with thermocontacts or thermistors with trigger in control unit or with serial thermocontacts in winding is basic protection against winding overheating owing to overloading or increased temperature of flowing air provided by continuous evaluating of thermocontacts state (they must be wired!).

Standard asynchronous motors or if the motors are not equipped with thermocontacts have protection against overloading provided by motor starters or temperature relay. In this case protection against overheating owing to high air temperature is not provided.

Control, protective functions

Motors wired through frequency convertor are protected by this convertor (its parameters must be set correctly). In case the motors are also equipped with thermocontacts is this second motor protection active as well. In this case protection against overheating owing to high air temperature is not provided as well.

Short-circuit protection (electric safety) is provided by breakers with motor characteristics (for voltage controllable motors with external rotor) or motor starters sometimes in connection with a fuse (for standard asynchronous motors) or fuses (used with frequency convertors).

Anti-freeze protection of water heater

Is framed as two-step - for water and air.

The protection is activated when the temperature:

- of outlet air from exchanger drops under $+8\text{ }^{\circ}\text{C}$ (the user can order special setting in production in range $+1\text{ }^{\circ}\text{C} - 19\text{ }^{\circ}\text{C}$).
- of inlet air after water heater drops down to $+5\text{ }^{\circ}\text{C}$ (can not be changed).

In "STOP" mode, the temperature of water heater is maintained at temperature c. $+30\text{ }^{\circ}\text{C}$. This temperature is preset by producer and can not be changed by user (the user can order special setting in production in range from $18\text{ }^{\circ}\text{C}$ to $+45\text{ }^{\circ}\text{C}$).

If the water or air temperatures drop under limits, the unit alerts failure and shuts down the fan, closes all dampers and opens water mixing valve to 100%. Part of anti-freeze protection is fore-heating which provides full power water heating in the heater for two minutes and after this time the fans are started.

Electric heater protection

- protective thermostat shuts down the unit if the temperature in the heater exceeds $+80\text{ }^{\circ}\text{C}$.
- the unit provides function of delayed fan shutdown - after-running. Safe cooling of electric heater section is provided by this. After-running time is set according to specification in range from 60 to 300 s.

Heat exchanger protection

Is provided by pressure difference sensor. If the value of pressure loss exceeds set value, the actuator of bypass damper is activated and the damper stays open during frost melting from the exchanger. Even capillary sensor CAP JM can be alternatively used.

Direct evaporator protection

Is provided by capillary thermostat CAP 3M, which disconnects cooling when the evaporator starts to get frost-bitten.

Failure alarm

VCB unit provides well-arranged signalling of failure states. These states are divided into two groups:

Failures with A priority are such states which influence operation of air handling unit in great way. Examples: anti-freeze protection, fan protection, electric heater protection.

The air handling unit is stopped when these failures originate. Water version is stopped immediately after failure

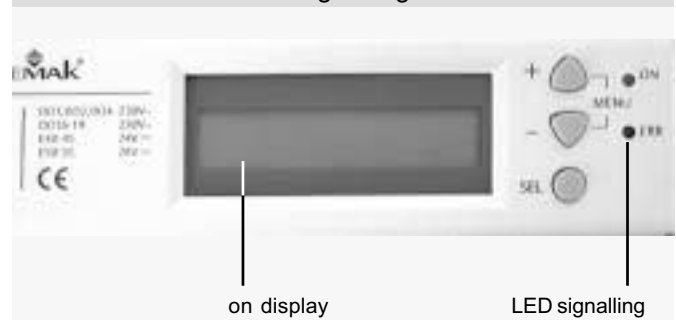
has originated. But according to type of originated failure there are different changeovers to emergency mode (immediate or standard use of AFP of water heating system). Devices with electric heating are according to type of failure either stopped right away - without fan after running (fan failure, external failure of for example fire-stopping damper) or with fan after-running (for cooling of el. heater, for example el. heater failure, cooling failure).

Failures with B priority are such states when set parameters are exceeded but this excess doesn't endanger any part of air handling unit. Example: filter clogging signalling. The control unit signals the failure but it doesn't stop operation of air handling unit.

Failures are signalled

- lighting red diode failure on LORZJ gear;
- on display with failure specification
- acoustic signal

Picture 7 – unit failure signalling



Remote control of VCB unit

Way of starting and control is set by user by option in control unit settings. External remote control can be chosen instead of internal control on keyboard of control unit. Remote control provides unit starting and air flow control, or air temperature control without communication with control unit, directly from ventilated (air conditioned) room.

Controllers types for remote control of VCB:

Operation and output power of device:

ORe1 – for VCB they control air handling unit with fans without output power control - the controller can stop and start the device and switch it to time program

ORe2 – for VCB they control air handling unit with fans equipped with output power control – the controller can stop the device or start it in two preset output power levels and switch it to time program.

Both controllers also signal operation modes and device failures. For needs of control from superior system or technology it is possible to replace controllers ORe2 and ORe1 by two non-voltage contacts; for specific functions (narrowed to switching 2 modes) even with one thermocontact (after consultation with producer).

Installation

ORe5 – for direct operating of fan output power controllers without use of internal driver and for device (control unit) starting and shutdown.

Use with VCB is limited because it is not possible to use output power control according to time program (stopping and starting is possible using program).

Air temperature

QAA25 – for remote correction of set temperature. Comfortable remote controller SIEMENS for setting required temperature in room is intended for mounting to the wall. It is operated by turning a selector in range from +5°C to +35°C. Use of controller must be set in configuration for the auxiliary function of remote temperature setting to be activated in production.

Automatic starting after blackout

User can set automatic starting of unit after a blackout. Independently from selected way of control, the unit is during automatic restart set to the same state as before the blackout.

Remote signalling

VCB control unit can be optionally equipped with one or two outputs for remote signalling.

According to configuration, signalled can be:

- only failure (voltage output 24 V / 0,1 A)
- failure and operation (2 non-voltage contacts, max. 230 V / 10 A).

Transport and storage

Control units VCB are packed in cardboard boxes. Considering that it is a electrotechnic product, it is necessary to follow policy for handling of fragile goods.

Storing

Units must be stored in rooms where:

- maximal relative humidity doesn't exceed 85% without moisture condensation
- surrounding temperature ranges from -25°C to +60°C
- no dust, gases and caustic vapours or other chemical adulterants causing corrosion of construction parts and device equipment are present.

Placing

Placing must be done considering good access of attendance and easy cable wiring. Place on the wall for unit installation must be flat.

Securing service accesses

When placing the unit it is necessary to have sufficient room on service side for maintenance and service attendance.

Unit installation

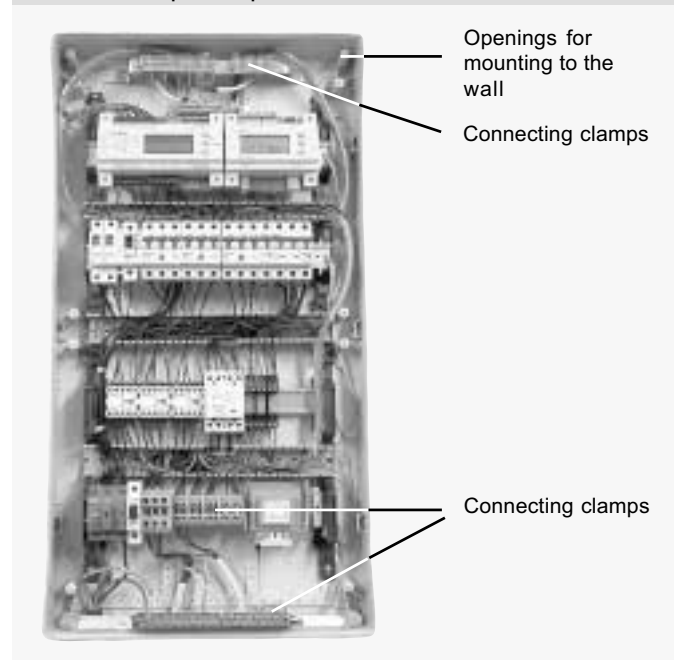
Before actual installation check entireness of delivery according to bill of delivery

Unit installation

- VCB control units are installed in vertical position either directly to wall or embed 50 mm under plaster.

Cables can be brought to the unit through plastic gutters or beneath the plaster. Units can be mounted directly to bases with combustibility grade of A and B according to EN 13501-1.

Picture 8 – power part of VCB unit



- power cables (motors, electric heating, main supply) are connected from below.
- control and communication cables (sensors, actuator control, etc.) are connected from above.
- we recommend to mount the unit to the wall using 4 pieces of plugs and screws considering structure of wall.
- control units 2000 mm high are placed on the floor

Unit connection

Safety instructions

Electric wiring can only be done according to general regulations by authorized worker. Revision of the whole electric wiring must be done before starting operation.

■ VCB control units get connected (according to type) either to TNS system (1x 230 V +N +PE) or TNS system (3x 400 V +N +PE). At the inlet to the unit there are separately clamps PE and N taken out. Values of output breakers are given by particular group of used motors and in some cases by electric heater. But we always recommend to check breaking ability of safety elements while paying attention to required time of disconnection, short-circuit resistivity and overcharging of appropriate cable.

■ control units are connected to air handling unit by cable system according to project documentation of electric wiring and project of measuring and control. Main supply is connected directly to main switch. Other power cables (fans motors, electric heater and pump of heating substance) are connected in bottom part of control unit to labelled clamps.

Installation

■ sensors, actuators and other components connected to voltage 24 V / AC are connected from above to labeled clamps.

Considering requirements for electromagnetic compatibility we recommend to run control and signal cables separately from power cables with minimal parallel-run and main supply provide with proper protection against over-voltage. To reach high operation reliability and service life of all components it is necessary to make sure that overvoltage does not exceed standardized values.

■ protection against dangerous contact of not live elements is framed as protection with automatic supply disconnection combined with supplementary connection of not live elements of separate device components.

■ during installation, all conducting parts of air handling device must be equipped with fan (castle) washer in place of screw connection on side of nut and screw as well.

■ all non-conducting parts, for example elastic connections must be bridged over with yellow and green wire (or with copper braid) of cross-section of 4 mm², at the ends equipped with cable loops with castle washers

■ the whole air handling unit must be interconnected with control unit by independent yellow and green wire with cross-section corresponding with cross-section of the supply cable or bigger. This conductor is connected in the control unit to the PE clamp.

■ when mounting control unit to the wall, when starting its operation even during regular operation it is necessary to make sure that the inside of unit doesn't get filthy. Control unit contains sensitive electromechanical elements whose foulness could effect safe operation of the whole air handling device.

All elements with electric connection are connected according to individual scheme of connection supplied with every produced control unit.

Temperature sensors

For temperature measuring there are for VCB units standardly used nickel temperature sensors Ni 1000 with temperature factor 5000 ppm/°C. The basic elements are metal nickel-based sensors which are made by technology of sputtering of thin metal layers on ceramic substrate and further processed by common procedures for integrated circuit production. They are characterized by great reliability and high stability if its parameters. The sensors are trimmed by laser beam so that the value of resistance at 0 °C was 1000 Ω.

Types of sensors

These types of sensors are recommended for VCB:

NS 120 - for temperature measuring in air handling duct

NS 130 R - for temperature measuring of outlet water in the collector of water heater

Sensor NS 120 must always be in inlet (after heater or cooler) and connected to the unit, and units controlling water heating must always have sensor NS130R connected in return water.

Also an auxiliary sensor of outside air temperature NS120 or remote controller for setting required temperature can be connected to the unit.

These optional elements (mutually alternative) must be set when configuring control unit (not all of a sudden).

Inlet air temperature sensor (type NS 120)

Placing: to the straight stage of air handling duct in distance of 1 to 5 m from heater to measure temperature of heated air before its exhaust to the room.

Protection stage according to EN 60 529 is IP 65. Sensors are delivered with plastic mounting clip. All metal elements are made of stainless steel grade 17 241 or 17 248. Range of working temperatures is -30 °C to 100 °C. Installation is done so that first using enclosed drilling template mount the plastic clip. After removing sensor cover connect through bushing the cable to the terminal. Then close the cover and insert the sensor to the clip. Conductors with cross-section of 0,35 mm² to 2 mm² are suitable for connection. External diameter of cable from 4 mm to 8 mm.

Note: sensor is used for control but it also works as an element of anti-freeze protection on side of air.

Sensor of return water in heater (type NS 130R)

Placing: They are installed to thread G1/2" in outlet collector on bottom side of the heater so that it was run-around by water coming out of the heater.

They are developed especially for use in REMAK units as an element of anti-freeze protection. They have short time constant $\tau < 8$ s and $\tau < 15$ s. The actual sensing unit is placed in thin-walled tube 70 mm long on cover with thread G 1/2". The cover and tube are made of stainless steel of grade 17 241 or 17 248. The terminal is connected to the cover by cable 1m long. Protection is IP 65, measuring current max. 1 mA. Range of working temperatures for cover is -30 °C to 100 °C and for actual measuring unit -30 °C to +150°C. Cover mounting is done to thread G 1/2" on bottom side of outlet collector of water heater. The cover is sealed by flat packing on finished surface of collector. During installation of the cable to sensor terminal, the cable must not be twisted. The terminal is placed to suitable place where the connecting cable can reach.

Warning! Perfect sensor installation is condition for functional anti-freeze protection.

Pressure difference sensor (type P33 N)

Placing: on filter, heat exchanger or fan section. Generally it is mounted directly to the housing and measures pressure loss of given section. The sensor doesn't have power supply and when exceeding preset pressure difference the break-make sensor switches over. Switching pressure is set according to filter type on scale of gear wheel after removing the cover.

Parameters setting and control

Starting device operation

Check before first start-up:

- whether air handling device contains all elements necessary for safe operation. Above all check presence, placing and connection of temperature sensors, fan and heater thermocontacts, thermistors, safety thermostats;
- whether fans and electric heaters are correctly mounted (arrow indicates air flow direction);
- conductive connection of all parts of air handling duct and related devices;
- circuits connected to emergency accesses. Circuits can not be shorten out neither disconnected;
- reaction of control unit to separate failure states
- power supply and correct phase sequence

Service book

Service book determines extent and time periods of service checks, revisions and inspections including maintenance.

Service book and its recording enclosure are indivisible part of operation documentation of air handling device. Record performed to service book enclosure must be done in time, intelligible and indelible. Entireness and credibility of record have fundamental signification when analyzing air handling unit operation and deciding about possible claim.

Parameter setting

Setting of all parameters is done using two gears.

Control – LORZJ for setting parameters of control.

Regulating – RWD/OEM SIEMENS for temperature setting.

Picture 9 – operating



Both gears are operated in the same way. Operating is done using three-button keyboard which is separate for LORZJ gear and separate for RWD gear.

Functions of buttons: **(+)** and **(-)**

- function or parameter setting
- motion in the main menu and submenu (up-down)

SEL

- entry to selected mode from the main menu
- confirmation of function or parameter selection
- motion of cursor
- exit from main menu or submenu

Setting required temperatures values

Setting of required temperatures is done on Siemens controller RWD.

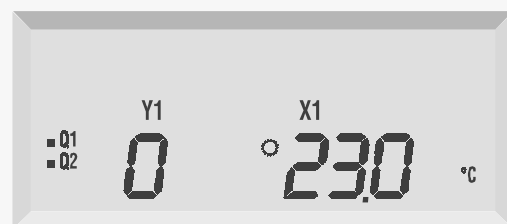
Picture 10 – control



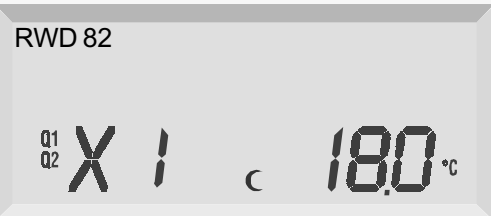
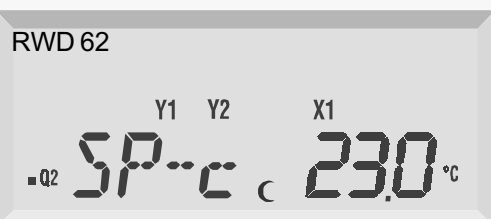
First switch-on

After power supply connection (main switch switch-on) the control unit runs initialization and display check (lighting of all segments). Actual state of device is displayed after the starting actions have been performed.

Picture 11 – example of control for RWD 68



For gears of series RWD 62 and RWD 82, the basic display is different.



Note: In the user menu there are another displays where only informative data are displayed. These displays are not intended for user parameters setting.

Presetting

The attendance doesn't have to do any primary setting of RWD controller. Presetting is done in production according to configuration of air handling unit. Inlet air temperature (comfortable is set to +23 °C, attenuating temperature is set to +18 °C). The user can change preset temperature according own needs.

Parameters setting and control

Unit program setting

Is done using LORZJ gear

Picture 12 – operating



Functions

For communication with attendance, the control gear LORZJ is equipped with three-button keyboard and double-row alphanumeric display. Control and unit setting is done via item selection in the menu.

The control unit is equipped with real-time unit which enables to control the air handling device according to week time program.

Signalling of working states is provided by two LEDs and by crystal loudspeaker. The speaker signals press of any button and in case of failure it also signals failure state.

After switching control unit on by main switch and initialization running the unit is ready for starting. After first starting – connection of control unit to voltage the unit skips to the state preset in production.

The display will show state (for water version):



- first three symbols in top row to the left IIIII mean unit STOP
- message „STOP“ signals mode that the unit is in
- message „INT“ signals that the control is internal from LORZJ
- message „Po“ displays weekday
- indication „08:00“ shows real time
- indication „038“ – (for water version) shows temperature of heating water at the outlet from water heater in STOP mode

Setting of input and output circuits is following:

- fans stop
- dampers closed
- night attenuation none
- contactor of electric heater is disconnected - for electric version
- anti-freeze control active, controlled from LORZJ gear - for water version
- digital failure inputs in closed state, there is no failure
- inputs for connection of remote controller - according to set state
- controllers

Production setting of LORZJ

Basic parameters:

Selection of control	internal
New start	prohibited
External failure – priority	B
External failure – priority	B
Restart parameter	off

Presetting of time program for units with speed control

Day and week program: The unit enables to set eight time intervals for each weekday where the user can set required modes and values. Within one time interval can be set:

- required temperature (comfortable / attenuating)
- required air flow (higher / lower speed of fan)

Example of week program setting for one weekday (moday):

Point of change	Speed	Time of change	Temperature
Program Po 1	Higher (operation)	05:00	Comfort
Program Po 2	-----	06:00	
Program Po 3	-----	07:00	
Program Po 4	Lower	15:00	Attenuation
Program Po 5	-----	16:00	
Program Po 6	-----	17:00	
Program Po 7	STOP	18:00	
Program Po 8	-----	19:00	

Symbols „-----“ mark inactive points of change. That means that in given time interval is the operation state same as in the previous one.

Setting description

The air handling unit is started at 5:00 to the state of higher fan speed and comfortable temperature, time intervals 2 and 3 have the same program as interval 1. At 15:00 the air handling unit is switched to mode with lower fan speed and attenuating temperature. Following time intervals 5 and 6 have the same program as interval 4. The unit is stopped at 18:00. Program for next weekdays can be freely changed.

The change is always determined by time and not by number of time interval. Therefore it is possible to order functional sections.

Point of change	Speed	Time of change	Temperature
Program Po 1	Higher (operation)	05:00	Comfort
Program Po 2	Lower	15:00	Attenuation
Program Po 3	STOP	18:00	
Program Po 4	-----	20:00	
Program Po 5	-----	21:00	
Program Po 6	-----	22:00	
Program Po 7	-----	23:00	
Program Po 8	-----	24:00	

Parameters setting and control

Basic indications on display

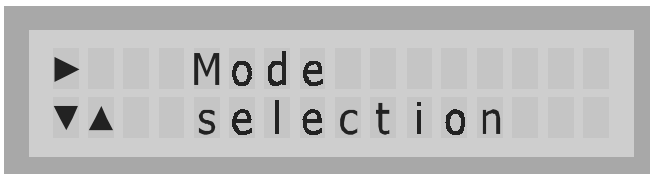


User setting

After simultaneous pressing buttons for entering the "MENU" (+) and (-) for about 2 seconds, menu "Mode selection" will be displayed as basic menu in main menu.

Main menu

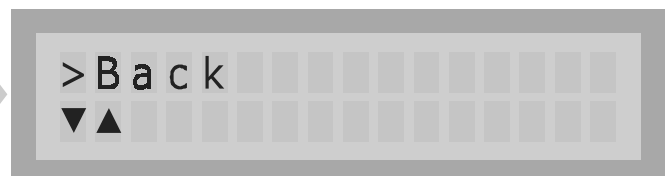
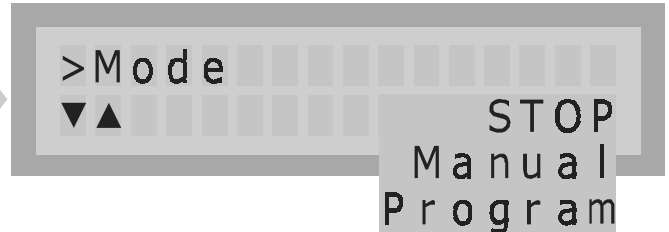
Movement in menu: (+) or (-)
Selection confirmation: **SEL**



Purpose: provides selection of mode which the unit will be operated in.
Manual – manual unit starting (according to requirements set in manual menu).
Program – unit operation according to set program. Program is set in program menu.
Stop - unit shutdown

Submenu

Movement in menu: (+) or (-)
Selection confirmation: **SEL**

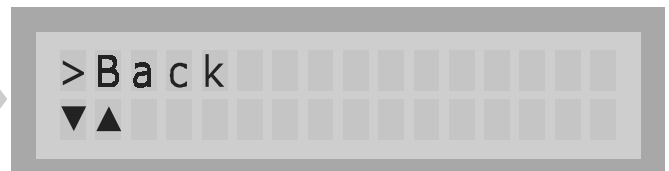
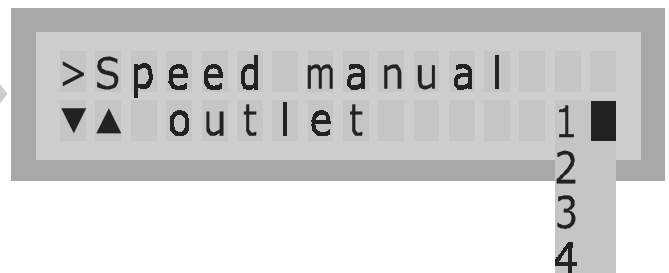
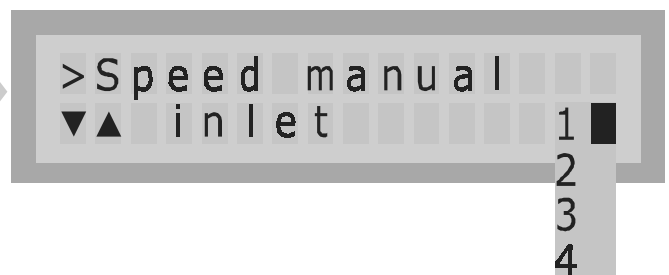
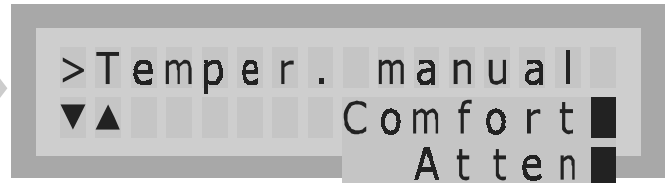


Purpose: provides setting parameters for mode manual - that means manual unit starting.

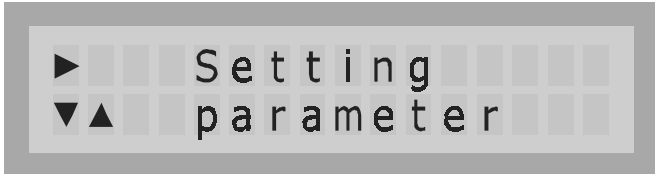
Set is: attenuating and comfortable temperature
If speed control is required, it is also possible to set fan speed in this menu.

According to customer specification the unit is either equipped with gear for common or separate control of inlet and outlet fan.

Units without speed control don not display submenu "Speed manual".

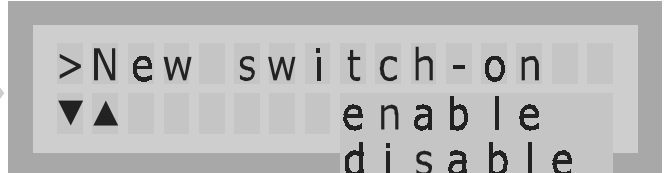
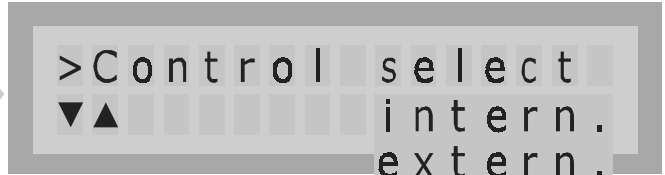


Parameters setting and control

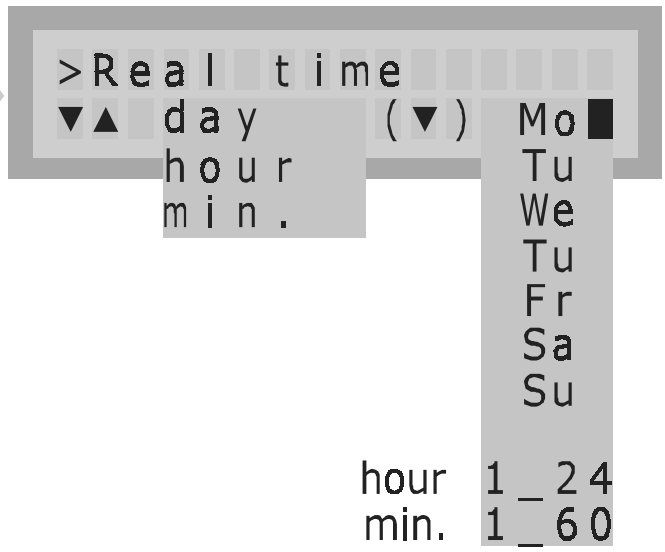


Purpose: provides control unit parameters setting:

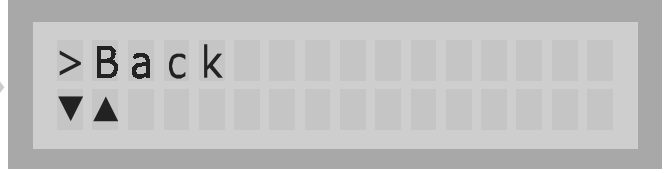
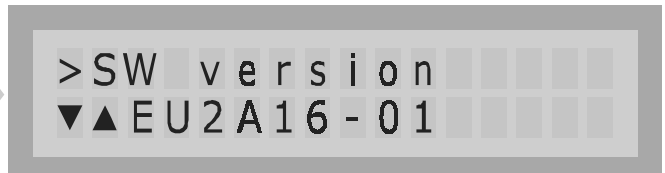
- selection of control from unit or by remote controller
- restart option after blackout without deblocking (restart option enabled) or with deblocking (restart option forbidden);
- priority setting of external failure (example: failure of hot water supply to the heater). When option A selected and a failure occurs, the unit will be shutdown and the alarm will started. When option B selected and a failure occurs, the unit only signals a failure state: by flashing red diod, by sound signal and displaying failure on the display.
- cooling failure setting



Example of real time setting:
Actual time can be set by standard movement in the menu.



Only information about operating software version.



Parameters setting and control



Purpose: it is used for program changes setting during day and week. It is possible to set eight time intervals for each day.

Actual setting:

Weekday setting: by **SEL** button place the cursor behind the weekday and by arrows choose required day.

Time interval setting: by **SEL** button place the cursor behind time interval number and by arrows choose selected time interval.

Operation selection setting (or speed):

place the cursor behind speed selection and choose the state by arrows.

Time beginning of given state setting:

place the cursor behind time indicator (before colon) and by arrows choose the time. Minute setting is analogical.

SEL => arrows (+) and (-) = shift to "Program temperature".

Assignment of temperature mode (comfort x attenuation) to time interval:

by selecting comfortable or attenuating temperature using arrows, assign to given time interval required temperature mode.

SEL => arrows (+) and (-) = shift to "Program speed higher inlet".

Assignment of speed to time interval:

by selecting higher speed for inlet using arrows, assign to given time interval required speed level.

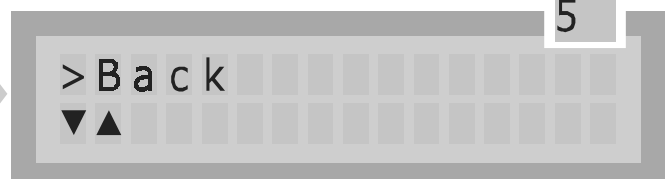
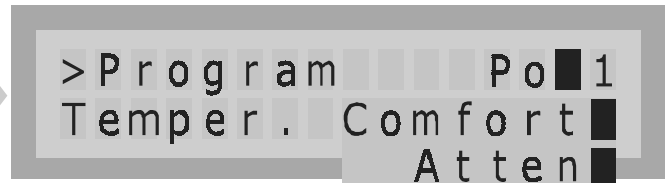
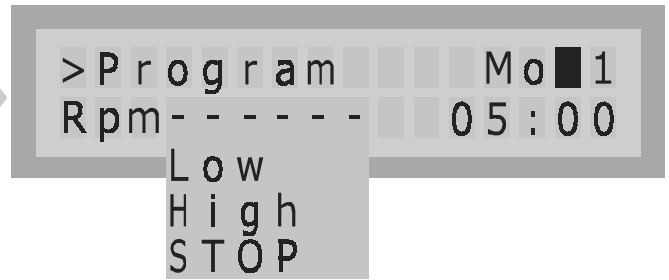
SEL => arrows (+) and (-) = shift to "Program speed higher outlet".

Assignment of speed to time interval:

by selecting higher speed for outlet using arrows, assign to given time interval required speed level.

Repeat this procedure for setting lower speeds.

And also repeat this procedure for setting all selected time intervals.



Working states

LORZJ gear can be in different working states which are listed in following overview (basic specifications only)

1 - unit WITHOUT POWER SUPPLY

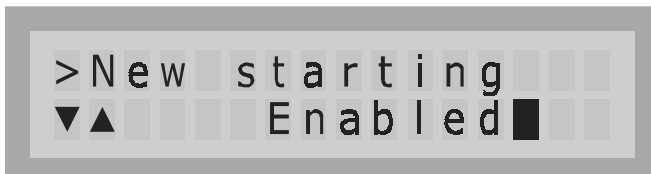
The unit is entirely out of operation. Only the real time unit works because it's provided with internal battery. The unit can come in to this state - especially in winter and water version of control unit - only for limited time during service etc., because no protective functions are in operation, especially anti-freeze protection of water heaters. In case of power supply disconnection, all possible actions to prevent water exchanger breakdown must be done.

No diode on display is on.

2 - unit in state of INICIALIZING

This unit state occurs only for a limited time after the unit has been connected to power supply. During this time the control microcomputer is inicialized and the data in control gear memory is checked. During this time all inputs and outputs are blocked to prevent origination of random states. Time of inicialization is 4-5 sec. After it is over, the unit can end up in following states:

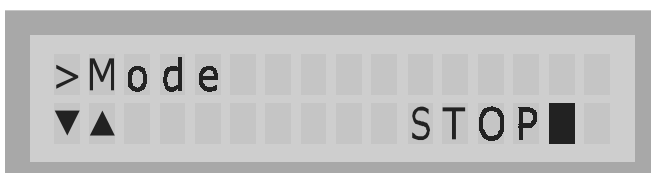
- new start – the unit is waiting for new start confirmation by attendance. Confirmation is done by pressing SEL button and the unit subsequently starts operation in state before power supply disconnection.
- If function of automatic switch-on after blackout is on, the unit starts operation in state before shutdown without the attendance having to confirm new start. (for example STOP, PROGRAM, MANUAL).



3 - unit in STOP mode

unit comes to stop mode when:

- a) blackout
- b) manual or program switch-off
- c) failure



The unit provides anti-freeze protection (AFP). Fans are stopped and air dampers are closed. VCB LORZJ watches failures besides fan operation failures. Failures are signalled, or function of anti-freeze protection is active, but no stopping (nor starting) sequences are activated. For right function of anti-freeze protection, supply of heating substance must be provided!

4 - unit in MANUAL state

"Manual" is working state when the dampers are opened, fans are running, control is on according to setting (comfort x attenuation).

On top row of the display the arrows are flashing, state "Manual" and return water temperature of water exchna-ger are displayed. VCB controls water freezing, sensor failure and all other failures.



5 - unit in PROGRAM state

The unit is controlled according to preset week program. Program enables to change unit state, for example "STOP", or switching fan speed (using speed gears) or changing temperature states "Comfort" and "Attenuation" according to preset time in the program. VCB controls water freezing, sensor failure and all other failures.



6 - unit in COMFORT state

Temperature controller RWD is set to the state of comfort temperature control (symbol of day is displayed). The unit can be either in state "manual" or "program". In "stop" state is this state only displayed. LORZJ controls water freezing, sensor failure and all other failures.

7 - unit in ATTENUATION state

Temperature controller RWD is set to the state of attenuating temperature control (symbol of day is displayed). The unit can be either in state "manual" or "program". In "stop" state is this state only displayed. LORZJ controls water freezing, sensor failure and all other failures.



8 - Device START UP

There is either "Program" or "Manual" indicated on the display. It is only transition state when the dampers are being opened, mixing set valve is being fully opened (for water version), the fans are being stopped. After two minutes the water exchanger is heated up and control valve is controlled by VCB unit so, that the set temperature

Operation, maintenance and service

was reached (comfort, attenuation). In case fans delay is not set, fans are started and symbols of arrows flash. During start up, the symbols of arrows representing fans operation (air flow) in top left corner are changeless. Start of VCB can be initiated in two ways according to set control method in parameters setting:

- using keyboard (if the internal control is selected) by pressing simultaneously (+) and (-), following selection of item "MODE" and next by selecting "MANUAL" or "PROGRAM";
- using external controller (if the external control is selected);
- can be caused by reconnection of power supply after a blackout (if the automatic restart is enabled) or by confirming new start (if the automatic restart is not enabled).

9 - Device (air handling unit) AFTER-RUNNING

this state is indicated by three pairs of flashing vertical lines (in top left corner on basic display) and state "STOP" is displayed. It is transition state when the dampers are being closed, mixing set valves are adjusted so that they were ready for another operation (for water version), the fans are after-running. After the after-running period has expired, the three pairs of vertical lines are constantly lighted.

10 - FAILURE (Alarm ON)

The unit signalling of failure is visual and acoustic. Control system responds to the failure according to failure priority.

Return to basic display is performed by buttons (+) and (-), or automatically in 20 s, if there's no attendance interference.

The user is only allowed to change temperature parameters, other settings may only be performed by service technician.

Operation, maintenance, service

Unit operation - operation regulations

Before putting device in permanent operation the supplier of device (mounting company) must issue operation regulations according to draftsman and corresponding with valid regulations. Following structure is recommended:

- composition, specification and description of air handling device operation in all modes and working states;
- description of all safety and protective elements and device functions;
- principles of health protection and rules of safety operation and attendance of air handling device;
- requirements for eligibility and training of attendant personnel, list of workers who are authorized to operate the device;
- detailed instructions for attendance, attendance actions during emergency and failure states;
- list of operation specialties in different climatic areas (summer and winter operation);
- schedule of revisions, checks and maintenance, including list of checks and method of recording.

Air handling unit can only be operated according to operation regulations. Service staff must satisfy all requirements provided by operation regulations or requirements provided by producer (authorization of some service actions).

Service inspections must be performed at least twice a year (during transition to season operation - summer/ winter). Preventive checks and check procedures including record of recognized and measured parameters are described in service book.

On top of it also extra checks are performed for example after device failure or after natural disaster and after emergency situations.

Maintenance is only tied down to regular cleaning. System parts placed inside of switch box must be in given dates cleaned of dust and other impurities.

In case of need, clean the front side of the box with soft, humid (not wet) rag. Standard cleaners or neutral cleaners can be used.

During transition to summer operation and heating shutdown, the attendance must switch-off disconnection of mixing set pump. Switch-off is performed by switching the switch to position "Off". During transition to winter operation the pump must be switched to active state by reversed advance.

Content of regular inspection

Check of overall state

Cleaning all dirty parts of unit.

Safety policy

Condition of error-free and safety operation of control unit is right mounting, installation and putting in operation as well as right operating.

Devices with water heater must be equipped with control and anti-freeze sensor on side of air NS120 placed after the heater - for inlet air temperature measuring. May not be placed in the room.

Sensor of anti-freeze protection on side of water NS 130R must be placed in return water from the water heater so that it was runaround by water. Heating water circuit must provide all required functions for control and safety of water heater (providing hot water and water passage or filling with anti-freeze mixture).

The device can only be put in operation by qualified staff which is well trained by producer or authorized producer representative.

- Control unit VCB may only be operated by persons, who have been (by operator, producer or authorized representative) demonstrably trained according to valid operation regulations of air handling unit and who have been noticed about possible risks and danger.
- Removing, bridging or disconnection of safety devices, safety functions and protective devices is prohibited.
- Only error-free air handling components can be used. Failures which can affect safety of device must be immediately removed.

Failures and their removing

- It is necessary to closely respect all precautions concerning accidents with electric current, and avoid all manipulations causing (even temporarily) function restrictions of safety and protective precautions.
 - Under any circumstances, it is not permitted to remove covers, boxes or other safety devices or to operate the device or its components if the safety devices are not efficient or if their efficiency is limited.
 - It is necessary to avoid actions which could cause restriction of specified safe low voltage separation.
 - When changing fuses, secure non-voltage state of control unit, only use specified fuses and protective elements.
 - Secure limitation of damaging effect of electromagnetic interference and overvoltage interaction with signal, control and power cables, which could cause starting of safety endangering actions and functions or eventually lead to destruction of electronic elements in separate parts.
 - Never work on connected device supplied with electric power !!! Before You start working on air handling unit switch off the power supply by main switch and lock its off position. Use protective and working instruments according to operation regulations and standards valid in country of installation.
 - If the separate technical groups of air handling unit are equipped with service switch and operation regulations, state and installation characteristics provide this option, then switch-on and off by appropriate service switch (for example electric switch, fan etc.) is sufficient.
 - Abrasive powdered cleaners or cleaners which dissolve plastics or acid and alkali solutions may not be used for cleaning in any case.
 - It is necessary to prevent water, stroke, impact and shock actions!
 - Separate components of air handling devices must be mounted and installed only according to appropriate installation instructions.
- The producer recommends to pay attention to error free state and functions of all protective elements and precautions; after failure has been removed always check functionality of automatic protective and safety elements, examine the state of main and supplementary connection and earthing.

Possible causes of failures

Water freezing:

low water temperature in water exchanger circuit

- check source of heating water supply
- check (clean) the filter of SUMX mixing set
- check switch-on and operation of circulatory pump
- check functionality of three-way valve actuator
- check temperature sensor NS 130 in the piping

Heater failure:

low temperature of inlet air

- check water temperature in water exchanger circuit
- check (clean) filter of SUMX mixing set

- check operation of circulatory pump
- check functionality of three-way valve actuator
- check temperature sensor NS 120 in the duct
- check exchanger fouling
- check thermocontacts of electric heater
- check switching of electric heater

Fan failure:

- check connection of thermocontacts
- check state of motor breaker
- check the V-belt
- check free running of fan
- check connection and function of P33N pressure difference sensor
- check electric current of motor

Air flow failure:

- check state of V-belt
- check free running of fan
- check connection and function of pressure difference sensor
- check running and rotation direction of fan

External failure (fire dampers etc.):

- check state of connected external device

Clogged filters:

- check filter clogging, eventually change the filter
- check setting of P33N pressure sensor

Cooling failure:

- check state of connected cooling unit (with failure notification by VCB)

Functionless cooling - without failure notification:

- check switch-on and operation of circulatory pump of water cooler (when active signal of cooling is over 20% = 2 V)

Anti-freeze protection sensor failure:

- check temperature of heating water
- check connection of sensor NS 130R
- change the sensor

Directions for removing failures

During any manipulations with air handling device and when removing failures it is necessary to switch-off (using main switch) the power supply of the whole switchboard. During checks especially pay attention to places providing right function of protections (function of SUMX mixing set, motor thermocontacts, electric heater thermocontact). Check right function of evaluating, protecting and switching elements. Perform check of control signal. Check tightening of clamps on side of connected elements and on side of control unit.

Spare parts

Spare parts are not delivered with the unit. In case of need they can be ordered at REMAK a.s. or at a regional distributor.

Spare parts, service , disposal and recycling**Service**

Guarantee and after guarantee actions can be ordered either at REMAK a.s. or at a regional distributor. The producer can authorize with service trained service companies. Their list can be found at www.remak.cz.

Disposal and recycling

Control unit is composed of electronic parts and plastic box. After the service life of control unit is over it should be disposed and recycled according to national regulations of country of installation.

Abbreviations in text

AFP anti-freeze protection

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REMAK a.s.
Zuberská 2601, 756 61 Rožnov pod Radhoštěm,
tel.: +420 571 877 878, fax: +420 571 877 877,
email: remak@remak.cz, internet: www.remak.cz