

HEATING AND VENTILATION UNITS CONTROL AND AUTOMATICS

A decorative graphic consisting of a series of overlapping squares and diamonds, arranged in a slightly curved line that tapers towards the right. The shapes are light gray and semi-transparent, creating a layered effect.

1. OVERVIEW OF AUTOMATIC CONTROL DEVICES

Automatic control of heating and ventilation equipment is responsible for the maintenance of the required air parameters and the reduction of facility maintenance costs. The purpose of automatic control is to minimise direct human intervention in the system and to reduce the operator's tasks only to the pre-selection of the required parameters. The rest of the functions should be performed by the automatic control system.

We offer the following automatic control solutions in the heating and ventilation units:

- 1.1 power supply/control box ZS
- 1.2 revolutions controller ARW or RTRD
- 1.3 actuators

1.1 ZS POWER SUPPLY/CONTROL BOX

Power Supply/Control Box are designed to supply and control the operation of the single speed, two speed and explosion-proof heating and ventilation units.

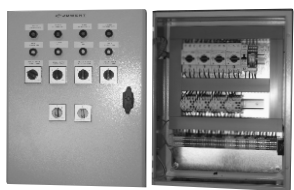
The box incorporates:

- main switch
- over-current breakers
- contactors and relays
- signal lamps (operation, alarms)

All switchgear components manufactured by leading suppliers of electrical equipment provide the highest reliability. They are incorporated in the box enclosures equipped with a front cover. The actuating levers, adjustment knobs and signaling elements are adjusted from the outside. Internal connections are completely covered and protected to guarantee safe maintenance and normal operation. Other benefits of the Power Supply/Control Box include: large space to accommodate cable and terminals, high safety level, easy operation, servicing and maintenance and operator-friendly design. The size of the box depends on the number of connected fans; up to four devices can be connected to a single box.

Fig. 1 Control box dimensions

Box type	ZS-1/1	ZS-2/1 ZS-1/2	ZS-3/1 ZS-2/2	ZS-4/1 ZS-3/2	ZS-4/2
Height [mm]	240	280	400	500	500
Width [mm]	160	200	300	400	500
Depth [mm]	125	125	150	200	200



For special requirements, the Power Supply/Control Box can be adapted to accommodate other controls and actuating components. Electrical connections should be made according to the enclosed start-up and regulation instruction. The box should be supplied from the main switchgear equipped with the main switch breaker and differential protection.

ZS-... [-1; -2; -3; -4]/1 power supply/control boxes are designed to control 230VAC single phase and three-phase (single speed) fans.

ZS-... [-1; -2; -3; -4]/2 Power Supply/Control Box is designed to control 3x400 VAC three-phase two-speed fan units.

DESIGNATIONS

Control box	ZS - 1 1
Number of connected units	1; 2; 3; 4;
Unit type	1 - single phase, three phase one speed 2 - three phase two speed

1.2. TRANSFORMER REVOLUTIONS CONTROLLERS

ARW-...[1.2; -3; -5] (1~230V/50Hz) five-speed transformer revolutions controllers or [-2;-4;-7] (3~400V/50Hz) are intended for air flow and thermal power control. Fan speeds are selected manually. Three sizes of the controller are available, differing in terms of power supply and rated current.

Fig. 2 Maximum rated current of ARW revolutions controller
Electrical diagram, see fig. 13

Type	ARW-1,2	ARW-3	ARW-5
Voltage [V]	230	230	230
IP	21	21	21
External dimensions	123x77x71	173x90x89	280x200x160





Fig. 3 Maximum rated current of RTRD revolutions controller
Electrical diagram, see fig. 15

Type	RTRD-2	RTRD-4	RTRD-7
Voltage [V]	400	400	400
IP	54	21	21
External dimensions	255X190X135	309X162X160	309X162X160



To avoid damage to the controller, only one device should be connected.

The controllers do not incorporate short-circuit protection.

The Power Supply/Control Box should be supplied from the main switchgear panel equipped with the main circuit switch and differential and short-circuit protection.

TYPES OF MONO-PHASE UNITS CONNECTED TO ONE ARW REVOLUTIONS CONTROLLER 1~230V/50Hz OR ZS-.../1 POWER SUPPLY/CONTROL BOX

Unit size	Type			Control box
	ARW-1,2	ARW-3	ARW-5	ZS-.../1
TERM-0÷1 TROPIC-1	●	—	—	●
TERM-2 TROPIC-2	—	●	—	●

● optional — not applicable

TYPES OF UNITS CONNECTED TO ONE RTRD REVOLUTIONS CONTROLLER 3~400V/50Hz OR ZS-.../1 | ZS-.../2 POWER SUPPLY/CONTROL BOX

Unit size	Type			Control box	
	RTRD-2	RTRD-4	RTRD-7	ZS-.../1	ZS-.../2
TERM-2	●	—	—	●	●
TERM-3	—	●	—	●	●
TERM-4	—	—	●	●	—

● optional — not applicable

1.3 ACTUATING COMPONENTS

The operation of individual components is constantly monitored to take immediate action if any malfunction occurs. The monitored parameters may be adjusted by the controller that is continuously updated with the value of critical parameters to adjust it when necessary. Therefore, the control processes is based on the operation of all necessary measuring, actuating and signalling devices that directly affect the quality of the control process, its accuracy, reliability, cost efficiency and energy consumption.

To provide the highest quality and long-term failure-free operation of the heating and ventilating units, the control and actuating systems are equipped with Siemens components.

This catalogue features the following options of automatic control of the heating and ventilating units:

- TPZ1/TPZ2 Freezing Protection Thermostats
- RD Overheating Protection Thermostat
- RT Temperature Controller
- TP Indoor Thermostat
- TPP Indoor Thermostat with timer
- V Valves
- MV Valve Actuators
- M Air Damper Actuator
- ZW Damper Position Presetting Unit

TPZ1/TPZ2 Freezing Protection Thermostat

TPZ1/TPZ2 Freezing Protection Thermostat is recommended for use in the heating and ventilating units with open air circulation water heaters to protect the heater from freezing.

The thermostat is equipped with a capillary tube arranged along the heater area. If the temperature drops below preset limit (5°C), the capillary tube sends a signal to the Power Supply/Control Box which, in turn, outputs "HEATER ALARM" message, switches on the fan, closes the open air circulation damper and fully opens the heating water valve of the air heater. The system returns to the normal operating mode automatically after the temperature of the heater has increased.

In the system with TP(PP) Indoor Thermostat, the TPZ1 Freezing Protection Thermostat is used and the TPZ2 Freezing Protection Thermostat is installed in the system with RT Temperature Controller.

Fig.4 TPZ1 Freezing Protection Thermostat
Electrical diagram, see fig. 16

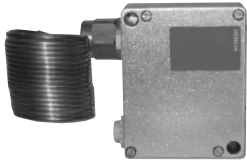

Supply voltage	24...230V AC	
Measurement range	-5...+15°C	
Factory settings	5°C	
Connector rated load	10(2)A	
Protection class	IP54	

Fig.5 TPZ2 Freezing Protection Thermostat
Electrical diagram, see fig. 17

Supply voltage	24...230V AC	
Measurement range	0...+15°C	
Factory settings	5°C	
Output signal	0...10V DC	
Protection class	IP42	


RD Overheating Protection Thermostat

In heating and ventilating units with electric heaters, double-step thermostats are used as a standard solution to protect the heater. If the heater temperature exceeds the safe level, the contact position is switched in the thermostat to change the corresponding response of the control system: the power is no longer supplied to the heater and the fan operates until the temperature decreases. Additionally, the heater will be restarted only if it detects the air flow. Electrical diagram, see fig. 18

RT Temperature Controller

The indoor Temperature Controller shown in is used to preset room temperature within range from 8°C up to 30°C. The controller compares the indoor temperature (measured by an integrated sensor) with the preset value. In case of irregularities, the Controller generates a controlling signal (constant: 0...10V DC) sent to the actuator of the heating valve.

Fig.6 RT Temperature Controller
Electrical diagram, see fig. 19

Supply voltage	24 AC	
Measurement range	8...+30°C	
Output signal	0...10V DC	
Protection class	IP42	

TP and TPP Indoor Thermostat

The on-off TP Indoor Thermostat allows setting of room temperature with an adjustment knob within the range 8°C-30°C; the on-off TPP thermostat with LCD display allows setting of the room temperature within the range from 8°C-35°C in a day/night mode.

If the room temperature drops below the preset value, the thermostat generates an output signal that opens the valve and switches the fan on. If the indoor temperature exceeds the preset value, the thermostat will switch over and generate a signal to close the valve and switch off the fan.

The thermostat can be used in both, closed loop and open air circulation.

Fig. 7a TP Thermostat
Electrical diagram, see fig. 20



Supply voltage	24..250V AC	24..250V AC	
Measurement range	8...+30°C	8...+35°C	
Connector rated load	6(2)A	10(1,5)A	
Protection class	IP30	IP65	

Fig. 7b TPP Indoor Thermostat with timer
Electrical diagram, see fig. 20

Supply voltage	2 x1,5V battery	
Measurement range	5...+35°C	
Connector rated load	5(2)A	
Protection class	IP30	

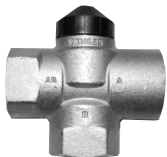
V Valves

Valves are generally applied to control the flow of the heating medium through heaters.

The three-way V valves may mix the media and are classified to the following groups:

- separating with inner thread connectors V20, V25(on/off). These valves should be installed on supply, medium flow is acceptable only in designated direction AB->A or AB->B.
- mixing with outer thread connectors V20, V25, V32, V40 and V50. These valves should be installed on return, medium flow is acceptable only in designated direction A->AB or B->AB.

Fig. 8a V valve (separating)

Designation	DN	k _{vs} , m ³ /h	t[°C]	PN	
V20	20	3,5	1..110	16	
V25	25	5	1..110	16	

FITTINGS:
 Z: cut-off valve manually operated
 P: circulation pump
 MV: 3-way control valve operated by valve actuator

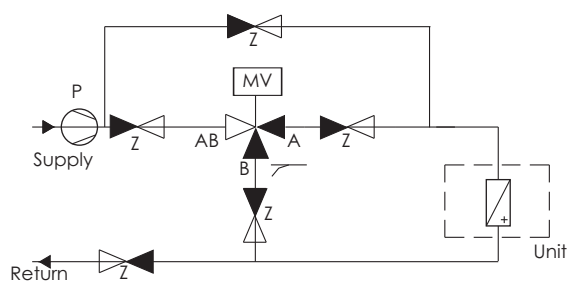

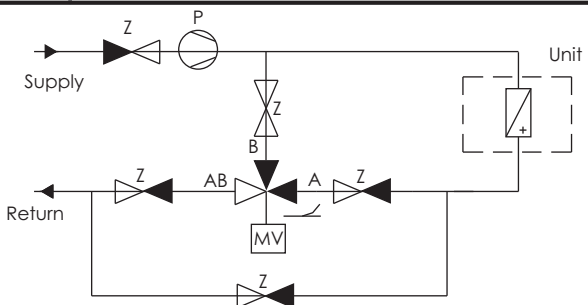


Fig. 8b Valve: V (mixing)

Designation	DN	k _{vs} , m ³ /h		t[°C]	PN	
		on/off	Constant signal			
V20	20	-	4	1..110	16	
V25	25	-	6,3			
V32	32	16	16			
V40	40	25	25			
V50	50	31	31			

FITTINGS:
 Z: cut-off valve manually operated
 P: circulation pump
 MV: 3-way control valve operated by valve actuator



MV Valve Actuators

Valve Actuators are designed for mounting directly on valves and, respectively, for constant or on/off control, using RT controller or TP/TPP thermostat. Movement of the valve stem is proportional to the control signal from the controller or thermostat.

MV Valve Actuators can also be adjusted manually and are intended for the following valves:

- DN15...40, rated force 400 N
- DN15...40, rated force 1000 N

Fig.10 MV Valve Actuator MV:

Electrical diagram on/off, see fig. 21A and 21B, constant signal see fig. 21C.

Actuator type	on/off		constant signal	
Supply voltage	230V AC		24V AC	
Opening/closing time	180 s		150 s	
Protection class	IP 43		IP 40	

ACTUATOR AND VALVE SELCTION TABLE

Unit size	Actuator and valve designation
TERM-0÷2, TROPIC 1 i 2	MV+V20
TERM-3	MV+V32
TERM-4	MV+V40


M Throttle actuators

Throttle Actuators are used to control throttles in the open air circulation system. The actuators are designed for placing the throttle in the required position and for protecting the water heaters against freezing. Depending on the throttle control system selected, the following actuators are available:

- open/close „on-off”
- continuous operation: 0..10V. In the latter type, the desired throttle position is obtained by applying control signal, ranging from 0 to 10 VDC, from the ZW Throttle Position Presetting Unit.

Fig. 11 M throttle actuator

Electrical diagram on/off, see fig. 22a, constant signal see fig. 22b.


Actuator type	on/off	constant signal	
Supply voltage	230V AC	24V AC	
Opening/closing time	150 s	150 s	
Protection class	IP 54	IP 54	

ZW Throttle Position Presetting Unit

ZW Throttle Position Presetting Unit enables presetting of the throttle in any desired position so that the exact required air flow from the outside is established. The ZW Throttle Position Presetting Unit is placed inside of or on the door of the control box.

Fig. 12 ZW Throttle Position Presetting Unit

Electrical diagram, see fig. 23


Supply voltage	24V AC	
Contol signal	0...10V DC	
Protection class	IP 42	

Service Switch

WS service switch is used to switch off the fan motor for service purposes. The WS service switch serves is a safety element that prevents the fan motor from unintended switch-on during service work.

Fig. 13 Service Switch

Electrical diagram, see for 3-poles see fig. 24A, 6-poles see fig. 24B

Type	WS-3	WS-6	
Main circuits: poles	3-poles	6-poles	
Supply circuits switch	single or three phase supply	three phase supply	
Constant current rate	25A	25A	
Protection class	IP 65	IP 65	

2. AUTOMATIC CONTROL HARDWARE CONNECTION CABLES

	Automatic components	Designation	Code and diameter of cable
1.	Throttle actuator	M	OMY 3x1 mm ²
2.	Water heater valve actuator	MV	OMY 3x1 mm ²
3.	Indoor thermostat	TP	OMY 2x1 mm ²
4.	Indoor thermostat with timer	TPP	OMY 2x1 mm ²
5.	Temperature controller	RT	OMY 3x1 mm ²
6.	Freezing protection thermostat	TPZ1	OMY 4x1 mm ²
7.	Freezing protection thermostat	TPZ2	OMY 5x1 mm ²
8.	Revolutions controller (5-step; 1~230V)	ARW-1,2; -3	OMY 3x1 mm ²
		ARW-5	OMY 3x1 mm ²
9.	Revolutions controller (5-step; 3~400V)	RTRD-2; - 7	OMY 4x1 mm ²

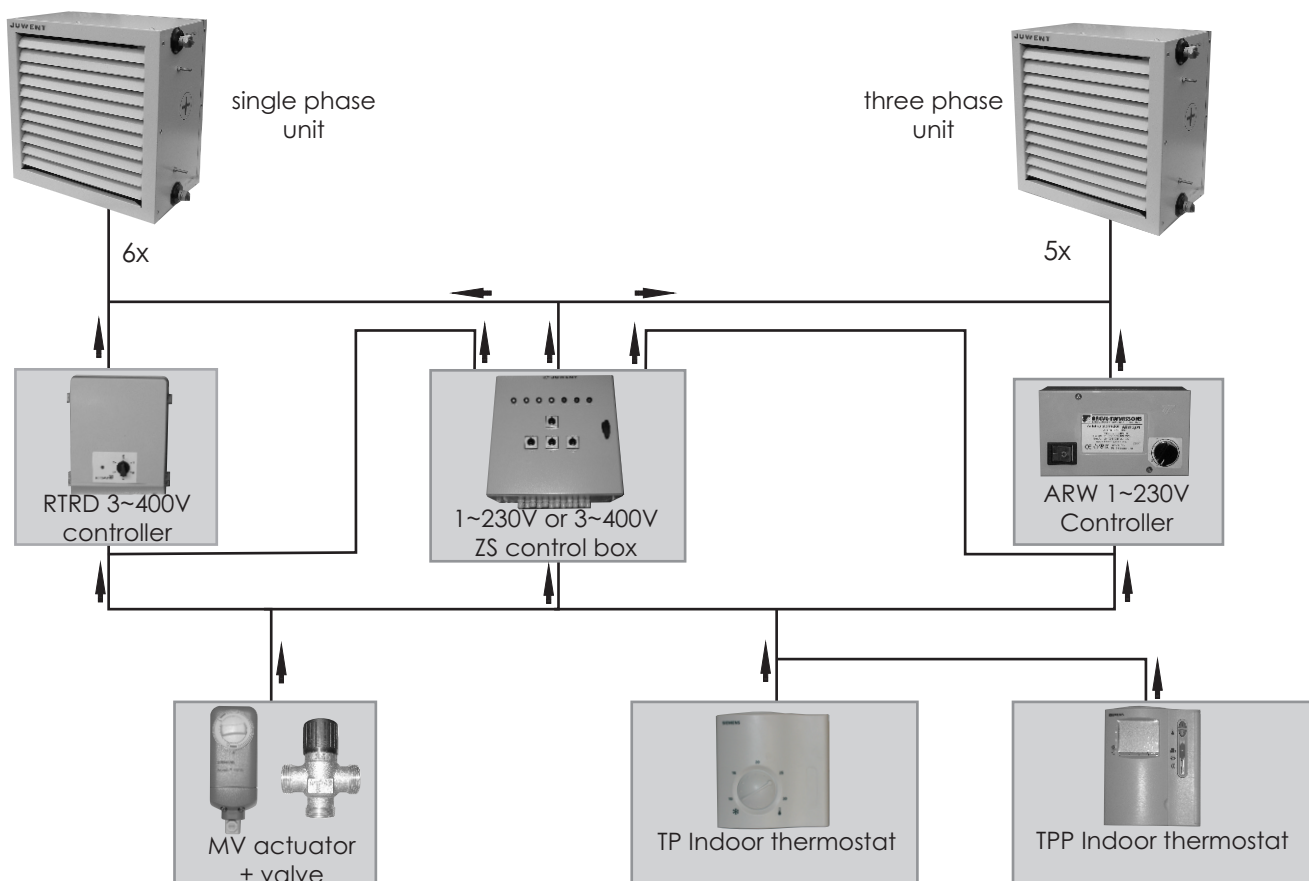
3. APPLICATIONS

3.1 AIR CIRCULATION SYSTEM (heating only)

DESCRIPTION

- room temperature control by means of TP on/off thermostat or TPP on/off thermostat with timer;
- on/off MV Valve Actuator for automatic valve operation
- capacity control by means of ARW(RTRD) controller or on/off control using ZS-...

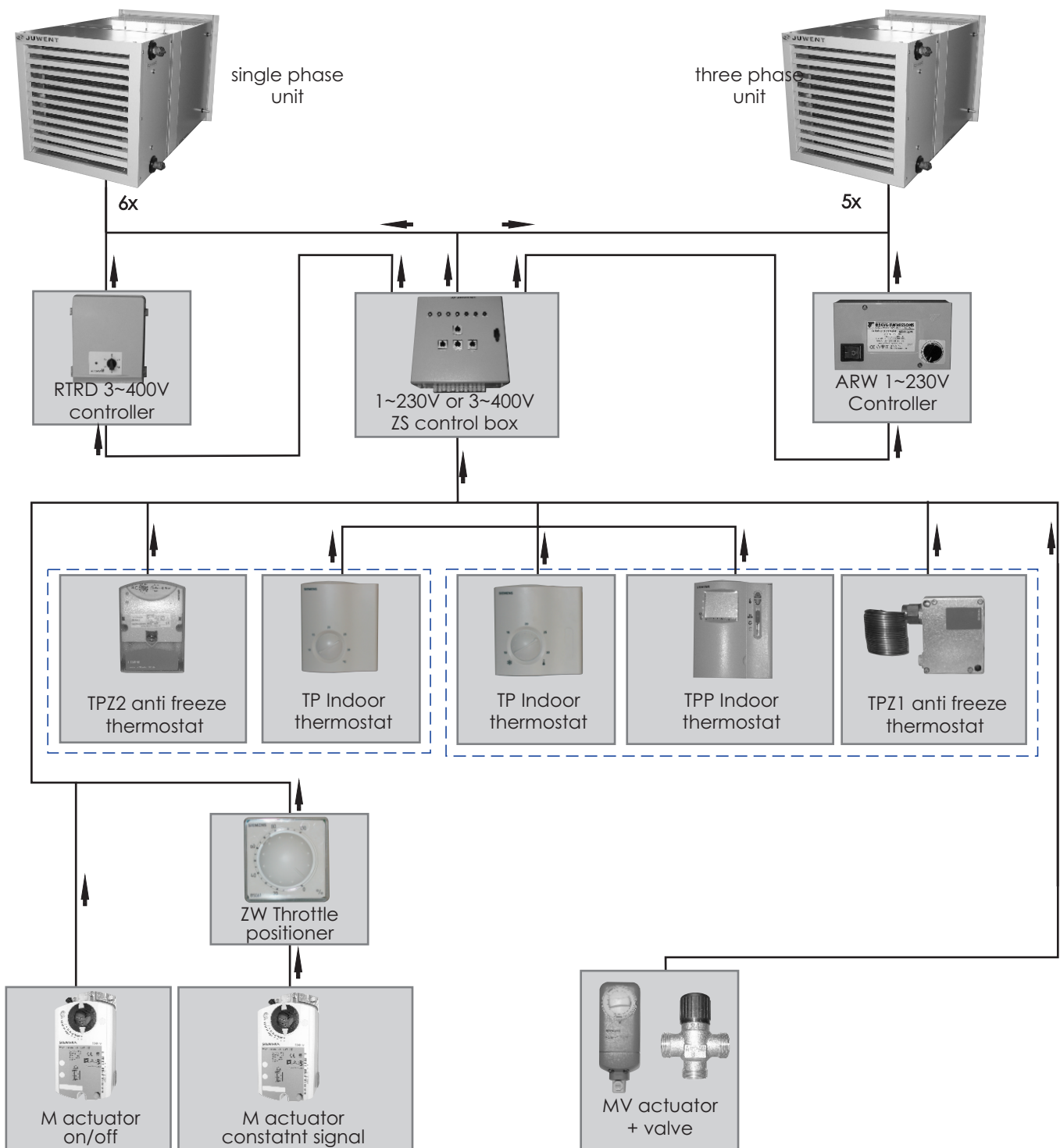
ZS-.../1 or ZS-.../2 Power Supply/Control Box with Indoor Thermostat is used to control a number of units until the maximum rated current is reached.



3.2 OPEN AND CLOSED LOOP AIR CIRCULATION SYSTEM (heating and ventilation)

DESCRIPTION

- room temperature control using TP/TPP on/off thermostat or RT stepless controller
- MV Valve Actuator for automatic valve operation
- Freezing Protection Thermostat protects heaters against freezing; TPZ1 Thermostat is used with TP(TPP) Thermostat while TPZ2 with RT Temperature Controller;
- opening of outside throttle M by on/off actuator or by the use of ZW Throttle Position Presetting Unit to move the actuator steplessly;
- ZW Throttle Position Presetting Unit installed in ZS-... Power Supply/Control Box matched with the outside stepless throttle actuator;
- capacity is adjusted by means of ARW(RTRD) Controller or on/off control using ZS-..
- a number of units may be controlled using one ZS-... Power Supply/Control Box with an indoor thermostat (controller).



4. REMARKS

As a standard, the units with electric heaters are equipped with:

- ZS Power Supply/Control Box (single-step fan, three-step manual heating power selection);
- RD - Overheating Protection Thermostat.

Optionally, the units with electric heaters can be equipped with two-step Temperature Controllers that cooperate with the sensor and the timer.

Because of various electric heaters power ranges, wiring diagrams and instructions for use are always enclosed to the ordered equipment.

5. WIRING DIAGRAMS

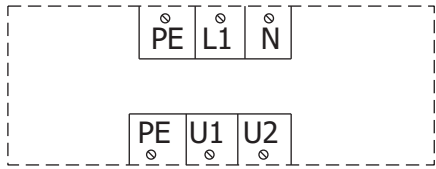
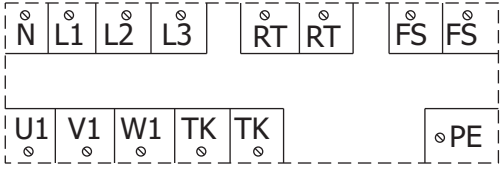
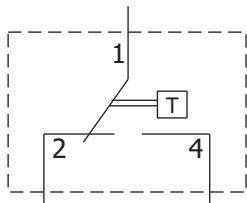
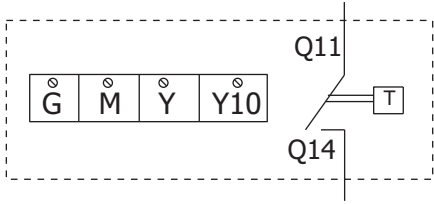
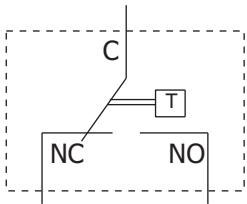
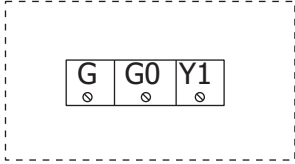
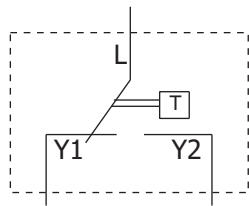
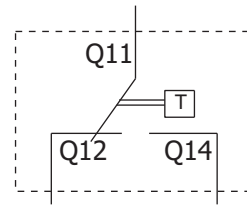
<p>Fig. 14 ARW CONTROLLER</p>  <p>PE-L1-N INPUT VOLTAGE PE,U1,U2 INPUT CONTROL VOLTAGE</p>	<p>Fig. 15 RTRD CONTROLLER</p>  <p>L1-L2-L3 INPUT VOLTAGE U1,V1,W1 INPUT CONTROL VOLTAGE TK-TK THERMAL PROTECTION CIRCUIT RT-RT REMOTE ON/OFF (TP/TPP THERMOSTAT) OFF (TP/TPP THERMOSTAT) FS-FS FREEZING PROTECTION THERMOSTAT</p>
<p>Fig. 16 TPZ1 THERMOSTAT</p>  <p>1-2 FREEZING ALARM 1-4 NORMAL OPERATION MODE</p>	<p>Fig.17 TPZ2 TERMOSTAT TPZ2</p>  <p>G SUPPLY VOLTAGE 24V AC M SUPPLY COMMON Y VALVE CONTROL SIGNAL INPUT FROM RT CONTROLLER RT, 0...10V DC Y10 VALVE CONTROL SIGNAL OUTPUT, 0...10V DC Q11-Q14 FAN ACTUATING CONTACT</p>
<p>Fig.18 RD CONTROLLER</p>  <p>C-NC DISCONNECTION AT TEMPERATURE INCREASE</p>	<p>Fig. 19 RT CONTROLLER</p>  <p>G-G0 SUPPLY VOLTAGE 24V AC Y1 VALVE CONTROL SIGNAL OUTPUT, 0...10V DC</p>

Fig.20 TP THERMOSTAT



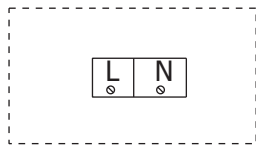
1-2 HEATING
1-4 COOLING

Fig.21 TPP THERMOSTAT



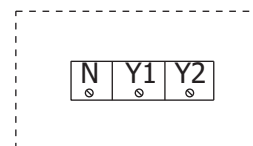
Q11-Q14 HEATING
Q11-Q12 COOLING

Fig.22A ON/OFF ACTUATOR, MV+V20; MV+V25



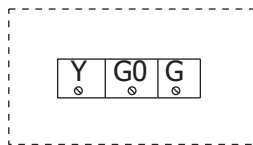
L-N SUPPLY VOLTAGE 230V AC

Fig.22B ON/OFF ACTUATOR, MV+V32; MV+V40



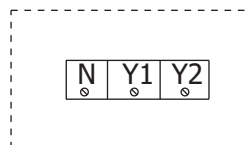
N NEUTRAL 230V AC
Y1 CONTROL SIGNAL: ENABLE 230V
Y2 CONTROL SIGNAL: DISABLE 230V

Fig.22C, M ACTUATOR (ANALOGUE SIGNAL)



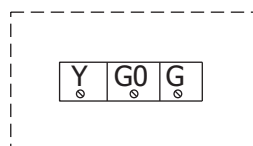
Y INPUT CONTROL SIGNAL 0...10V DC
G0 SYSTEM ZERO
G PHASE, 24V AC

Fig.23A M ACTUATOR (ON/OFF)



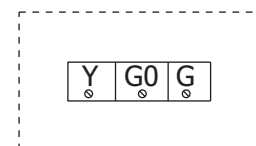
N NEUTRAL 230V AC
Y1 CONTROL SIGNAL: ENABLE 230V
Y2 CONTROL SIGNAL: DISABLE 230V

Fig.23B M+ZW STEPLESS THROTTLE ACTUATOR



Y INPUT CONTROL 0...10V DC
G0 SYSTEM ZERO
G PHASE, 24V AC

Fig.24 ZW THROTTLE POSITION PRESETTING UNIT



Y OUTPUT CONTROL SIGNAL 0...10V DC
G0 SYSTEM ZERO
G PHASE, 24V AC

Fig.25A SERVICE SWITCH WS 3 (3-POLES)

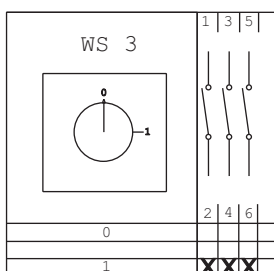
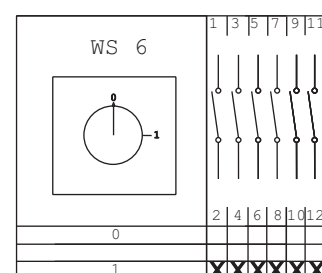
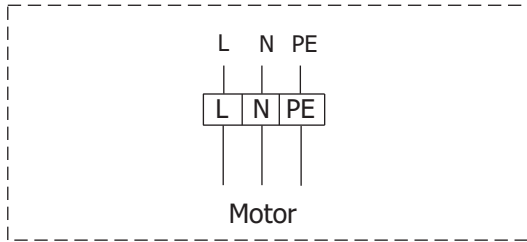


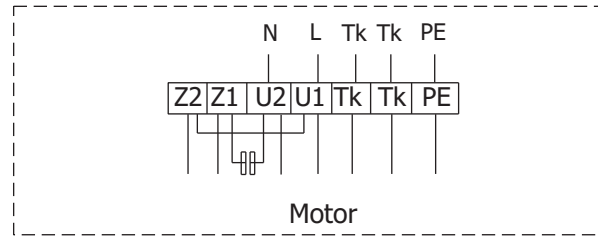
Fig.25B SERVICE SWITCH WS 6 (6-POLES)



Motor connection diagram:
TERM-0-J



Motor connection diagram:
TERM-1-J; TERM-2-J; TROPIC-1; TROPIC-2;



Motor connection diagram:
TERM-[2-3-4]-T;

