

APPLICATION OF TRN CONTROLLERS

TRN transformer controllers are intended for the switching and five-stage speed control of RP, RQ, RO and single-phase RF fans, including their modifications.

CONCEPT OF CONTROLLERS

Control and power parts of TRN controllers are separated and interconnected by the cable. Separated concept of controllers provides high variability, excellent layout planning and functional flexibility. It is advisable to place the output controller close to the fan, e.g. in a machine room, in the ceiling, etc. While the remote control can be conveniently situated within of the operator's reach. TRN controllers enable direct control from the control unit, respectively fully automated control using special control elements.

INTEGRATED BASIC FEATURES

As standard, TRN controllers (resp. in connection with remote controls) provide the following properties and features:

Start-up

Starting /stopping the fan using remote control.

Fan Output Control

Five-stage fan output (speed) control depending on the command coming from the controller.

Thermal Protection of Fans

Permanent monitoring of the motor temperature (state of thermo-contacts in the motor winding). Switching the fans automatically off if the maximum permissible temperature has been exceeded. The designer decides whether the protection will be active by selecting one of recommended ways of the wiring (refer to the Wiring Diagrams).

Safety Blocking after Activating the Protection

After the thermal protection has been activated the safety blocking function blocks the fan against spontaneous starting. After checking the fan the controller must be unblocked turning the selector to the "0" position.

External Start-up

Remote (external) starting and stopping of the fan other than using connected controller. This feature can be used to start or block the fan by an external switch (thermostat, pressostat, manostat, hygrostat, gas detector, any auxiliary contact, etc...). If the fan is started by the external switch the fans' operation and output will be controlled by the connected controller, and vice versa, if output stage 1-5 is preset on the controller the fan's operation will be controlled the external switch.

Blocking of Output Stages

Controllers and controls support electronic blocking of some output stages by simple settings performed on the controller and/or remote control device. One or any combination of stages can be blocked (applies for stages which can be blocked). For example, this feature can be used if the fan cannot be switched off by the controller but only by the external switch (i.e. function of external start-up is used). The blocking serves for the minimum air flow rate setting, i.e. to limit low outputs etc. The blocking of stages # 1, 2 and 3 can be performed directly in TRN controller. Blocking of stage "0" in an ORe5 controller, which can be operated independently or combined with a control unit, is performed in case of the controller switching by the contact, or if it is combined with a control unit (compulsory for electrical heating). For blocking settings of TRN controllers, refer to the section "Wiring". For blocking of the "0" stage in an ORe5 controller, refer to the documentation delivered with the controller.

Operation, Output and Failure Signalling

Controllers signal current operation state on an ORe 5:

- Operation or stop mode
- Active output stage
- Failure

Permanent Elimination of Some Functions

If TRN controllers are powered from the parent control system, e.g. REMAK control units, by no means the following functions may be used:

- Protection function
- Function of external start-up

The protection function can be permanently disabled by interconnecting the controller's TK, TK terminals.

If this is the case, the TK terminals in the fan's terminal box must be connected to corresponding terminals in a control unit.

The failure of the fan will be evaluated by the parent control system. External start-up function can be permanently disabled by interconnecting the controller's PT1, PT2 terminals. Both, protection and start-up functions can be disabled by interconnecting the controller's terminals PT2 and E48 - see the wiring diagram on page 262.

The wiring diagram of the controller in a parent control unit system is always included in the wiring diagram of the parent control unit.

OPERATING CONDITIONS, POSITION

These controllers are intended for indoor applications in a dry, dust and chemical free environment. They are designed for normal environmental conditions in accordance with ČSN 33 2000-1 ed.2 (IEC 60364-1).

- Degree of protection: IP 20
- Permissible ambient temperature: +5 °C to +40 °C
- Position: always vertical or horizontal.

The controllers can be situated on a wall, air-handling duct or ancillary construction. They can be mounted on A and B combustibility grade materials in accordance with the ČSN EN 13 501-1 standard.

The installation must be performed considering the weight of the controller, easy cable wiring, barrier-free service access, and free cooling openings. The controller casing is provided with ventilation openings – it must not be covered..

TABLE 3 – OUTPUT RANGE

Three-phase (3x 400 V)	Single-phase (1x 230 V)	Max. current (A)
TRN 2D	TRN 2E	2
TRN 4D	TRN 4E	4
TRN 7D	TRN 7E	7
TRN 9D	–	9

DIMENSIONAL AND OUTPUT RANGE

Totally seven types of TRN five-stage controllers are manufactured in accordance with table #3 and figure # 14, see below.

MATERIALS

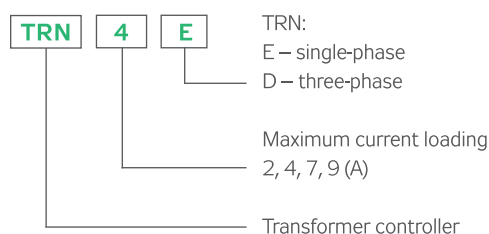
External casings of all types of controllers are made of steel sheet finished with RAL 9002 sprayed powder coating. Plastics, copper, aluminium, transformer steel and galvanized sheets are used in the internal structure

of the controller. Internal electronic components of the controller are situated on printed circuit boards provided with protecting coating. Switching and protection elements are used in both, power and control electronics.

DESIGNATION OF CONTROLLERS

Example: Designation TRN 4E specifies a single-phase fan controller designed for maximum current of 4 Amp.

FIGURE 14 – TYPE DESIGNATION



CONTROLS OF TRN CONTROLLERS

Several types of controls can be used to control TRN controllers. Each control enables one or two fan output controllers to be controlled.

The controllers can be specified according to their location and the way of control:

TABLE 4 – CONTROLLERS COMPARISON

Control	
according to location	stand-alone
	from the control unit (built-in)
according to use	manual
	automatic

Integrated controls (in terms of control unit functions available via the controller menu and in the time schedule) and description of the function plus wiring diagrams are part of configuration of the control unit and, if necessary, it must be consulted with the manufacturer.

The use of ORe5 remote controller with manual selection of output stage and light signalling of operation is essential if no control unit is used in the control system. However, its combination with a control unit can also be used in some cases. It is intended for separate interior installation (refer to page 270).

Automatic control without using the control unit can be solved by using OSX unit.

FIGURE 15 – DIMENSIONS AND WEIGHTS

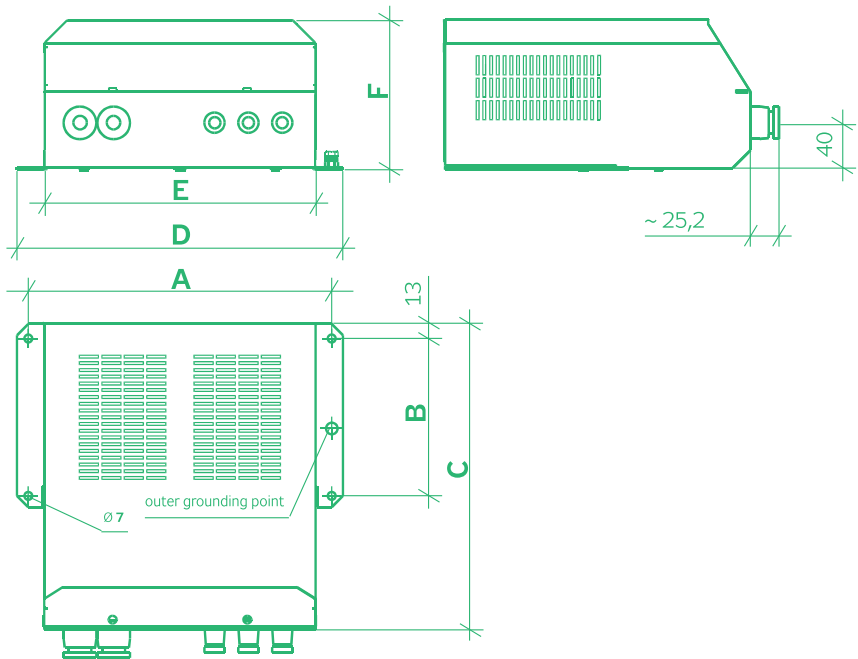
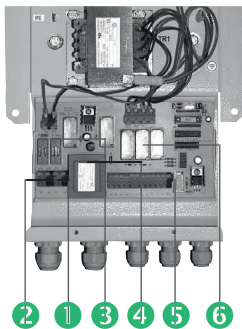


TABLE 5 – DIMENSIONS AND WEIGHTS

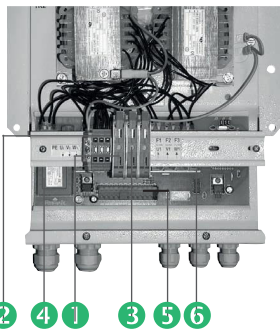
Controller Typ	Dimensions in mm						m
	A	B	C	D	E	F	kg
TRE 2E	185	120	253	205	157	134	5
TRE 4E	185	120	253	205	157	134	7
TRE 7E	185	120	253	205	157	134	8
TRD 2D	270	140	273	290	242	134	10
TRD 4D	270	140	273	290	242	134	14
TRD 7D	340	170	303	360	312	157	26
TRD 9D	340	170	303	360	312	157	32

FIGURE 16 – CONTROLLER CONNECTING POINTS

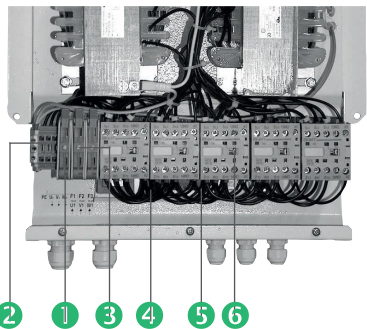
TRN 2E, TRN 4E, TRN 7E



TRN 2D, TRN 4D

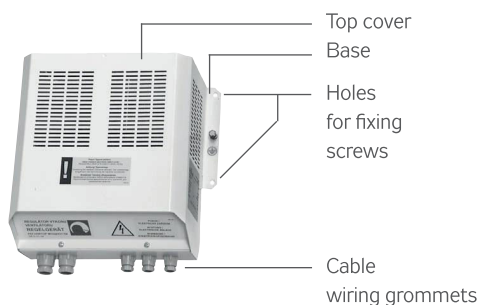


TRN 7D, TRN 9D



power supply terminals 1, fan motor connecting terminals 2, fuses 3, power supply 4, remote control connecting terminal box 5, assembly of switching relays (or contactors) 6.

FIGURE 17 – CONTROLLER DESCRIPTION



INSTALLATION

TRN controllers are not intended, due to their concept, for direct sale to end customers. Each installation must be performed in accordance with a professional project created by a qualified air-handling designer who is responsible for proper selection of the controller.

- The installation and commissioning can be performed only by an authorized company licensed in accordance with valid regulations.
- It is advisable to place the TRN output controller close to the fan, e.g. in a machine room, in the ceiling, etc. The controller can be placed on a wall, air-handling duct or ancillary construction.
- The installation must be performed considering the weight of the controller, easy wiring, barrier-free service access, and free cooling openings.
- The remote control can be situated at any distance from the controller, and mounted on a wall at the operator's location.

WIRING

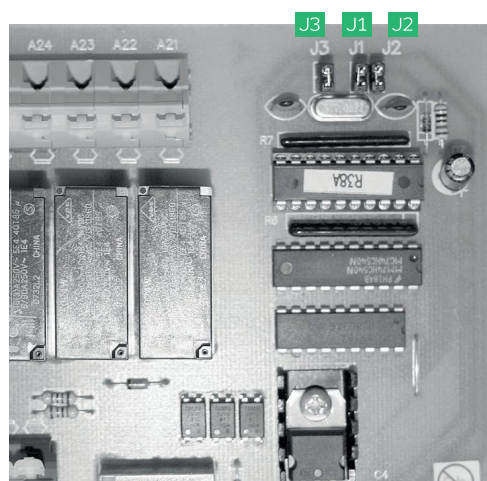
- Cables for the power supply, fan motors connection and control are led through plastic grommets, and connected to the WAGO terminals in the lower part of the controller casing. The controller's entry is provided with plastic grommets. An example of a layout of individual connection points for all controller sizes is shown in figure # 18.
- For controller wiring refer to figure # 19
- Each fan must be connected to a separate controller. If the same output stage for two fans (inlet, outlet) is needed, it is possible to control both controllers by one remote control. For more detailed information, refer to the operating instructions of individual controllers.

- As standard, the TRN controllers are equipped with integrated fan motor protection. The TK, TK terminals in the controller serve to interconnect the TK, TK terminals of the fan motor thermo-contacts.
- TRN controllers enable remote (external) start and stop of the fan independently of the controller. This function is controlled connecting and disconnecting the circuit between terminals PT1, PT2. This function can be used to start the fan by an external switch (thermostat, pressure switch, humidistat, auxiliary contact ...).
- Installation must be done on a project basis and in accordance with the catalogue and mounting instructions).
Before commissioning an electric installation must be revised.

BLOCKING OF OUTPUT STAGES

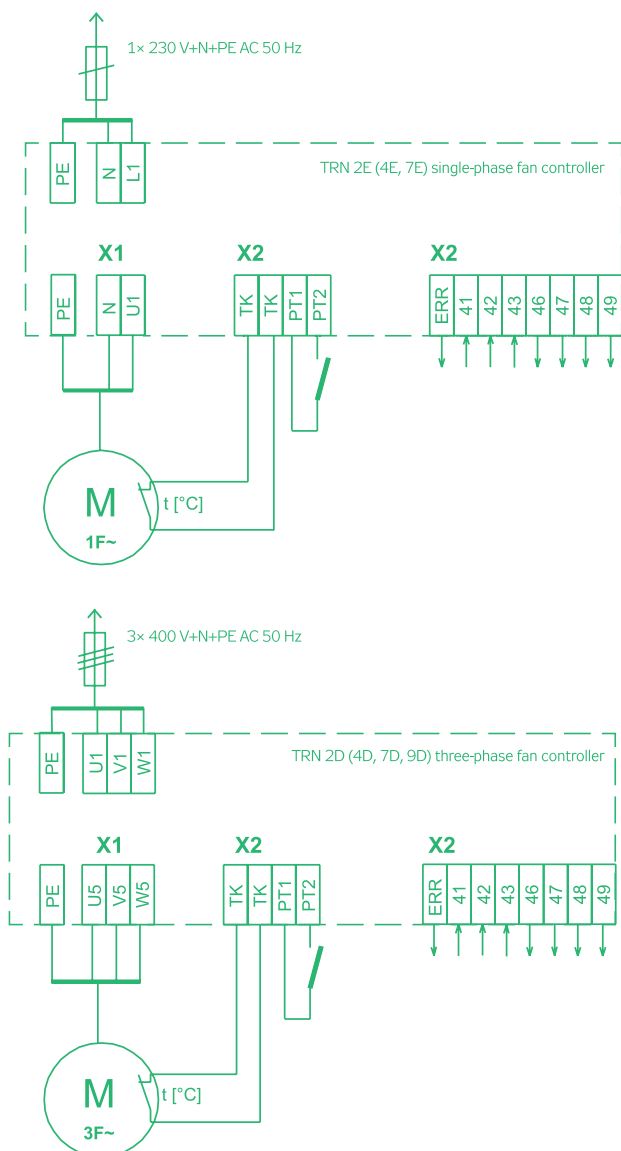
For each output stage which can be blocked (1, 2, 3) there serves one connection - "jumper". A combination of their states assigns blocked output stages. For more information refer to Instruction manual.

FIGURE 18 – JUMPER LOCATION



WIRING DIAGRAM

FIGURE 19 – TRN CONTROLLER TERMINAL DIAGRAM



L1, N, PE : 230 V supply
 U1, N, PE : motor controlled voltage
 U1, V1, W1, PE : 400 V supply
 U5, V5, W5 : controlled motor voltage
 48 : 0 V / DC
 49 : +24 V / DC, 80 mA
 TK, TK : thermo-contact terminals
 PT1, PT2 : external switching terminals (e.g. room thermostat)

TABLE 6 – CONTROLLER STATES ACCORDING TO STATE OF CONTROL INPUTS

Speed	49 41	49 42	49 43
Speed 1			
Speed 2			
Speed 3			
Speed 4			
Speed 5			
STOP (Sp. 0)			

Stop/Reset	
Start	

Dimensioning of contacts 24V/DC, 0,1A

CONTROL OF LKS, LKSF DAMPERS

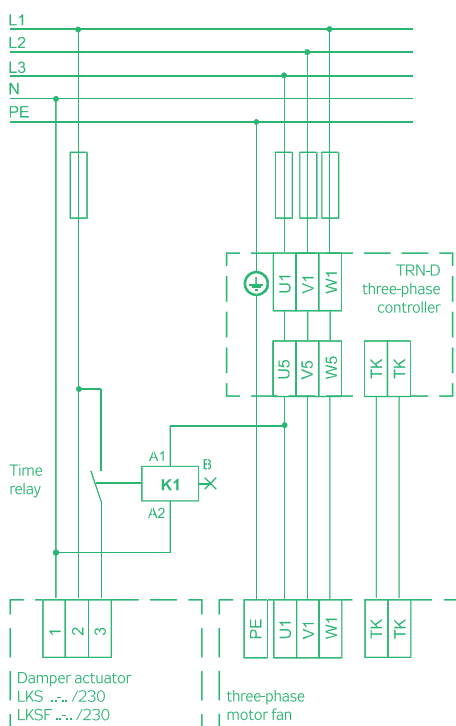
Simple air-handling systems equipped with a controlled fan sometimes require damper control to open the damper at the fan start-up. As the voltage on the controller's output terminals varies depending on the output stage selected this voltage cannot be used to control the damper actuator directly. Recommended solution is based on the power supply versatility of some time-relays, which can work at input voltage ranging from 24V to 240V AC/50Hz.

K1 relay provides one switching contact, which can be used to control LM230 or LF230 actuator. Alternatively, a pressure differential sensor can be used, e.g. P33V (suitably adjusted) situated on the fan, which ensures opening of the damper if the preset pressure difference has been indicated at the fan start-up.

CONTROL STAGES

RP, RQ, RO and single-phase RF fan motors, including their modifications, can be operated within the range approx. from 25 % to 110 % of the rated voltage. The table 1, page 250 shows the correlation between the input voltage and selected stage of the controller for single-phase and three-phase motors.

FIGURE 20 – LKS, LKSF DAMPERS WIRING SCHEME



On following pages you find illustrations of installations and wiring of TRN controllers; simple assemblies using only ORe 5 controllers are completed with their wiring diagrams.

Installations using ORe 5 controller

- A** One TRN controller featuring protection function equipped with an ORe5 controller
- B** Two TRN controllers featuring protection function equipped with a common ORe5 controller

Installations using controls installed directly into the control unit

- C** Control unit with two TRN controllers and common internal controls
- D** Two TRN controllers with protective functions and common OSX control box

The wiring diagrams with front-end elements (protective relays, controllers, control units) - see examples- are included in the installation manual, respectively in the AeroCAD project of these front-end elements.

Most of control system functions are set as soon as the system is connected. It is only necessary to set the blocking of control stages. For blocking procedure of TRN controllers, refer to the section "Wiring". The blocking of individual controllers is described in their accompanying documentation.

All non-standard connections must be consulted with the manufacturer in writing, respectively control of the controllers must be a part of the air-handling device configuration - i.e. an AeroCAD project or a letter of inquiry. The manufacturer's approval of the controller's wiring is essential for validity of the guaranty.

EXAMPLES, TRN CONTROLLERS

Controllers	...	Fans	EX	Fans	RPH	Fans	RF	Fans	RE	Fans	RO	Fans	RQ	Fans	RP
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EXAMPLE A

ONE TRN CONTROLLER FEATURING PROTECTION FUNCTION EQUIPPED WITH AN ORe5 CONTROLLER

An assembly of TRN controllers with individual ORe5 controller in a single venting system with one or more fans which must be controlled independently is shown in figure # 21 (a = single-phase, b = three-phase).

This connection of the speed controller ensures:

- The possibility of fan output selection within the stage range "1" to "5".
- Thermal protection of the fan
- Fan switching on/off manually, by the ORe5
- Fan switching on/off externally, by any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc.) on terminals PT1, PT2.

Upon selecting the required output stage using a selector on the ORe5 controller, the fan will start at corresponding speed. The closed switch connected to PT1, PT2 terminals and the thermo-contact circuit connected to TK, TK terminals are essential for the fan operation. The switch connected to PT1, PT2 terminals can externally stop the fan. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2.

If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the controller will disconnect the fan power supply, and the red control light on ORe5 controller will signal the failure. After cooling down, the motor is not automatically started. To restart the fan, it is necessary first to set the selector to the "STOP" position, and thus confirm failure removal, and then to set the required fan output. In this arrangement, the option "STOP" on ORe 5 controller must not be blocked.

EXAMPLE B

TWO TRN CONTROLLERS FEATURING PROTECTION FUNCTION EQUIPPED WITH A COMMON ORe5 CONTROLLER

An assembly of two TRN controllers with a common ORe5 controller in a single venting system is shown in figure # 22. The fans are always controlled together to the same output stage.

This connection of the speed controller ensures:

- The possibility of fan output selection within the stage range "1" to "5".
- Thermal protection of the fans
- Common fan switching on/off manually, from ORe 5
- Assembly switching on/off externally by any other switch (like room thermostat, gas detector, pressostat, hygrostat, etc.) on terminals PT1, PT2. External switching of the controller is independent; this example shows external starting of only one controller (TRN-E)

Upon selecting the required output stage using a selector on ORe5 controller the fan will start at corresponding speed. The closed switch connected to PT1, PT2 terminals and the thermo-contact circuit connected to corresponding controller TK, TK terminals are essential for the fan operation. The switch connected to PT1, PT2 terminals can externally stop the fan. If this possibility is not used, it will be necessary to interconnect terminals PT1 and PT2. If the fan is overloaded, the thermo-contact circuit will be disconnected due to overheating of the motor winding. As a reaction to this state, the controller will disconnect power supply to the overloaded fan. If this controller is the so-called reference controller, i.e. the controller's ERR terminal is connected to ERR terminal on ORe5 controller, the failure will be signalled by the red indicator on the ORe5 controller. If the thermo-contact circuit of the second fan is not simultaneously disconnected the second fan stay in operation. After cooling down, the fan is not automatically started. To restart the fan, it is necessary first to set the selector to the "STOP" position, and thus confirm failure removal, and then to set the required fan output. In this arrangement, the option "STOP" on ORe 5 controller must not be blocked.

FIGURE 21 – CONTROLLER CONNECTION

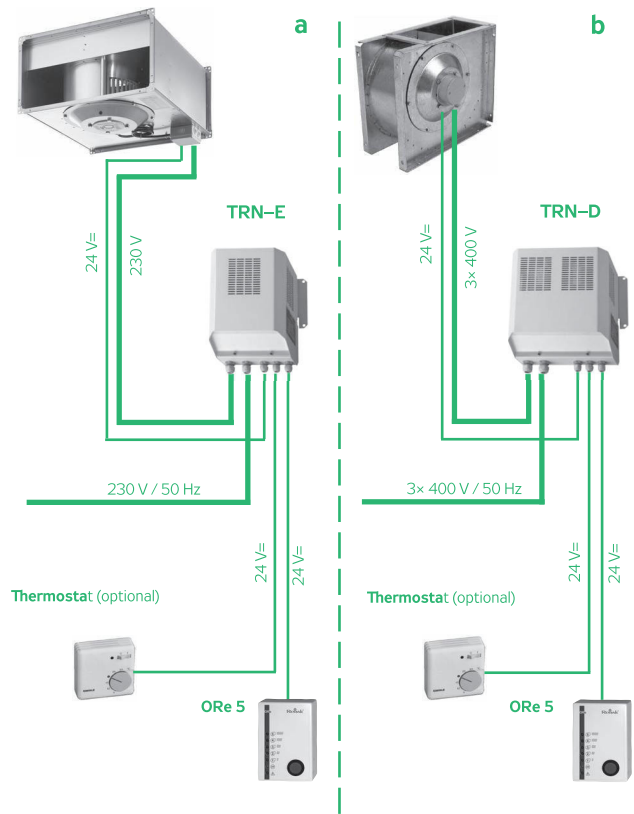
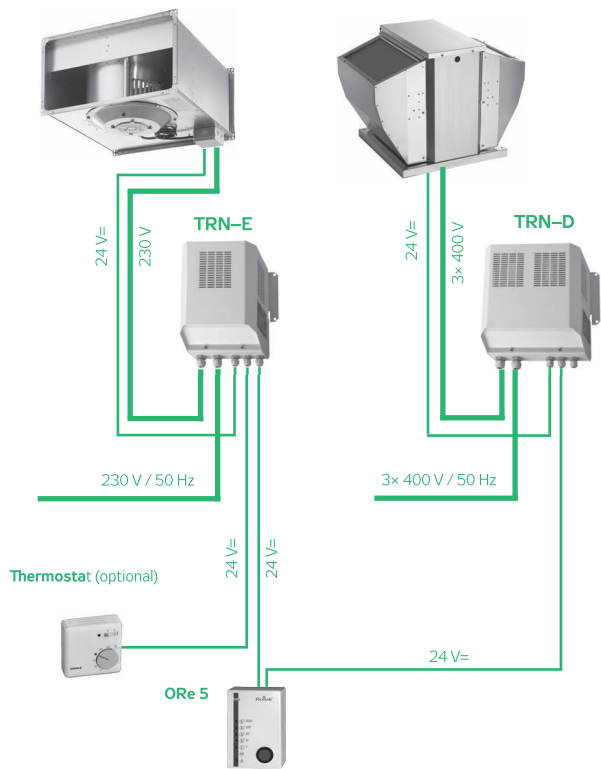


FIGURE 22 – CONTROLLER CONNECTION



Fans
RP

Fans
RQ

Fans
RO

Fans
RE

Fans
RF

Fans
RPH

Fans
EX

Controllers
...

EXAMPLE C

CONTROL UNIT WITH TWO CONTROLLERS AND INTERNAL CONTROL FOR BOTH CONTROLLERS

An assembly of the control unit with two TRN controllers and HMI controller in figure # 23. Among others, this connection ensures:

- Manual selection of the fan output within the stage range 1-5
- Thermal protection of the motor (by connecting the motor TK, TK thermo-contact terminals to 5a, 5a, 5b, 5b terminals in the control unit).
- Manual or programmable switching on/off of the entire device using the control unit.

In this installation, all additional functions of the controller must always be blocked by interconnecting the PT2 and E48 terminals in the controller.

EXAMPLE D

TWO TRN CONTROLLERS FEATURING PROTECTION FUNCTION EQUIPPED WITH A COMMON OSX UNIT.

An assembly of the control unit with TRN controllers and a common OSX unit is shown in figure # 24. The fans are controlled together to the same output stage. Among others, this assembly depending on its connection ensures the following:

- Automatic switching on/off of the fan at the selected value of input control voltage.
- Manual switching on/off of the fan from the OSX unit.
- Fan switching on/off, by external switching function.
- Automatic selection of the fan output stage ranging from "1" to "5" depending on a physical quantity, which is read by the sensor equipped with a unified analogue output (signal source of 0-10V).
- Manual start-up of the system at the MANUALLY preset (by the button) output stage. The factory default setting of the OSX controller enables MANUAL start of the assembly at the full output using this button.
- Thermal protection of the fans

The fans on the picture are started, controlled and protected by TRN controllers. OSX unit evaluates signal coming from a converter (signal source), and in five adjustable levels automatically switches stages "0" to "5" of the controller.

Thermal or pressure converters, converters for the measurement of relative or absolute humidity, concentration of gases, vapours or explosives in air, sensors of air quality and many other converters of different physical quantities can be used as sources of the control signal.

For detailed information about OSX (for explosion-proof fans OSX-Ex) units, refer to their accompanying documentation. For the wiring diagrams of OSX (for explosion-proof fans OSX-Ex) units, refer to their accompanying documentation.

FIGURE 23 – CONTROLLER CONNECTION

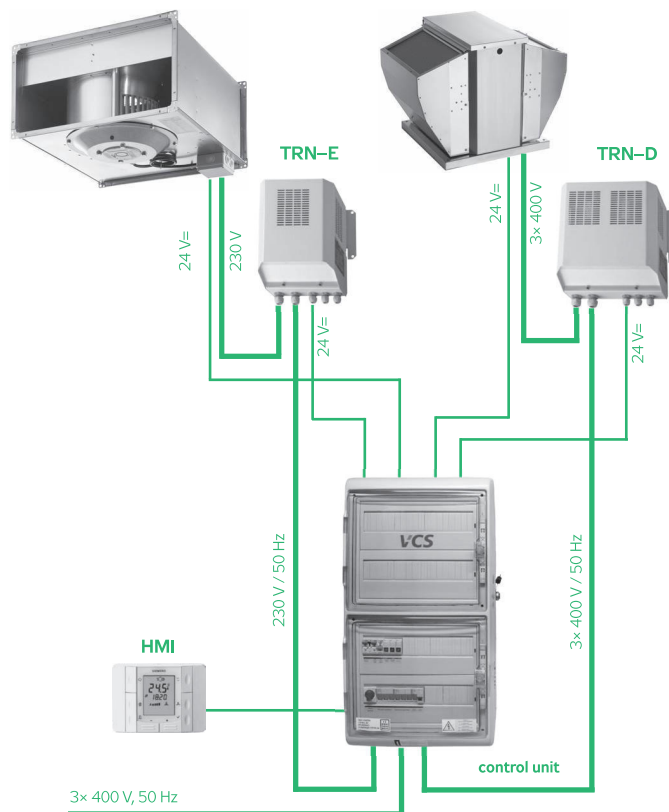


FIGURE 24 – CONTROLLER CONNECTION

