

## 1. DESCRIPTION

The digital temperature relay TR42 has been created as an accessory of main importance for resin or air insulated three-phase MT transformers, as protection against dangerous over temperatures on the insulating coil, on the winding and to manage the intervention of cooling fans. The temperature is detected by 3 or 4 thermal detectors PT 100, three of them located in the transformer coils, the fourth on the core.

### Features

- Display of the actual temperature of the 4 PT sensors.
- Display & storage of the highest temperature of each PT sensor.
- 3 programmable output contacts from 0° to 220°C level 1, level 2 and FAN control.
- Automatic and "Always ON" fan mode.
- Alarm of device failure or PT 100 disconnection or short circuit.
- Automatic fan start every week (bearing protections).
- Insulated RS-485 communication port.
- Insulated 4-20mA output (*Optional: see ORDER CODE*).

## 2. INSTALLATION

Install the equipment according to the characteristics of humidity and temperature that has been designed to work in. To avoid noise pickup and interference the relay should be placed away from high current conductors or sources of strong magnetic fields. The device has been designed for the installation on a panel board with a cutout of 92x92mm using the fixing accessories that come with the relay. Before proceeding with the installation that must be carried out by a qualified technician, it is recommended to disconnect the power supply on the working area. Orion Italia urges that security procedures be followed during this installation.

## 3. WIRING CONNECTION

For the connection, follow the diagram on page 4. Herein after the description of the different electric connections:

### 3.1 POWER SUPPLY

The power supply range is: 24-240 Vcc/Vca (50 – 60Hz), -15%, +10% and power must be connected between the terminals 40 and 42. **Note:** The device does not have internal fuses. This is to allow the selection of the desired external protection.

**IMPORTANT:** before doing the dielectric strength test of panel board, where the device is installed, it is necessary to disconnect it from the power line voltage.

### 3.2 SENSORS CONNECTION

Each PT sensor has one white wire and two red ones according to the UNI 7937 regulation.

- Sensor cables should be made with shielded twisted pairs and the shield should be connected to the system's ground.
- To compensate the resistance of the wire, it is necessary to connect each sensor with three (3) wires of the same section (at least 1 mm<sup>2</sup>).
- The probes wiring should be placed away from high current conductors, high tension and from inductive elements such as remote-control switch, etc. If the wires travel on the same route as the power lines, separate the wires with suitable elements.

### 3.3 OUTPUT CONTACTS CONNECTION

In the back side of the device, it is possible to see the output contacts (in absence of power supply). The ALARM relay (L1), TRIP relay (L2) and fan control (FAN) activate when temperature reaches the setpoint. The FAULT relay (FAULT) opens when power supply is connected and it will be closed when internal failure occurs, failure of the PT sensors or failure of the power supply. The FAN contact can be used as a control of the cooling system. **Note:** When using the contacts for control of inductive loads in Vac (coils of relays, contactors, solenoids), it is essential to limit the overcurrent, or place a R/C group in parallel to the inductor. If it works in DC, a diode in anti-parallel should be connected.

### 3.4 SERIAL COMMUNICATION CONNECTION

Communication capabilities are available in the device connecting the RS-485 port in a network (up to 32 devices) controlled by a supervisor device (PC). The protocol used is Modbus RTU. The connections must be made with shielded twisted wires.

## 4. FUNCTIONS AND SIGNALS

**Display:** on the display °C (3 digits) you can observe the value of the temperature and program the settings; through the display PT (1 digit) you can see the corresponding Pt Channel.

**SET LED:** if on, it indicates that the user is in the SET mode.

**°C MAX LED:** if on, it indicates that the user is in the °C MAX mode.

**L1, L2 LED:** if on, the temperature of one PT sensor reached the corresponding L1 or L2 programmed threshold and the corresponding relay is active.

**FAN LED:** if on, the "always ON" mode is active and the FAN relay will always be active. If flashing, the temperature of one PT sensor reached the corresponding FAN programmed threshold or the weekly fan activation function is active and the FAN relay is active.

**PT1, PT2, PT3, PT4 LEDs:** if on, the temperature of one of the corresponding PT sensors reached the L1 or L2 programmed threshold and the corresponding relay is active. If flashing, the respective PT sensor is in fault.

**FAULT LED:** if flashing, it indicates that the flashing PT1, PT2, PT3, PT4, is in fault. The fault cause will be showed through the °C display when positioned with the arrow buttons on the faulty sensor: Fcc in case of short circuit and Fco for open circuit. Dropout condition for Fcc:  $T \geq -7$  °C. Dropout condition for Fco:  $T \leq 239$  °C.

**AUTO LED:** if on, it means the user is in the AUTO SCAN mode.

**HMI Test:** depending on which menu the user is in, by pressing the SET, °C MAX, AUTO button and then keeping the DOWN button pressed, all LEDs and seven segment LEDs will turn on.

**SCAN, AUTO SCAN:** in AUTO SCAN mode, the device will automatically scan between each PT sensor temperature showing it on the display every 5sec allowing the user to see all the temperatures. To exit from the AUTO SCAN function, press any arrow button. The user will still be able to manually scan by using the UP/DOWN buttons. By pressing the SET, °C MAX, AUTO button until the AUTO LED turns on, the AUTO SCAN function will reactivate. To activate the AUTO SCAN function in °C MAX, select the °C MAX mode with the same button and keep the UP button pressed for more than 2sec.

**FAN:** the FAN button allows to switch between "always ON" or Automatic Fan Operation. In "always ON" mode, the fan will always be ON and the FAN LED will be ON. In automatic mode, the fan will be ON and the FAN LED will blink when one PT sensor reaches the corresponding FAN programmed threshold. If the setpoint *FAN ACTIVATION = OFF*, the manual fan will still allow the user to close/open the fan output contact.



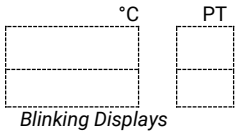
### 5. 4-20mA OUTPUT (Optional: see ORDER CODE)

An indicator can be connected to the 4-20mA output (polarity must be respected). The maximum load impedance is 500 Ω. The loop is isolated to ensure maximum immunity from disturbances.

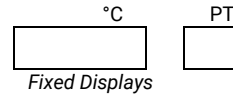
Ratio between output current and temperature:  $I_{out} = (T/15) + 4$  [mA] where T = °C temperature

**Note:** It is recommended a shielded and twisted cable, avoiding bends or ring windings, placed away from power cables.

#### Symbols used in the text:



Two blinking displays alternate between the options on the first row and the second row.



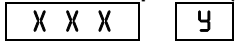
#### Example:

**RANGE: 2; 4; 5** → select 2, or 4, or 5 (select among the elements on the list).  
**RANGE: 2 ÷ 4** → select 2, or 3, or 4 (select any value within the indicated parameters).

### 6. ACTUAL VALUES

Each time the device is powered on, it turns on all LEDs and displays for about 2sec. Once this operation is over, the device begins to function automatically in Current Temperature (AUTO) mode.

#### Current Temperature (AUTO)



XXX: Temperature; Y: PT channel

Y: 1; 2; 3 if PT SENSORS CONNECTED = 3

Y: 1; 2; 3; 4 if PT SENSORS CONNECTED = 4

Press the SET, °C MAX, AUTO button until the °C MAX LED and the SET LED are off.

The user will see the actual temperature on the °C display and the relative PT sensor input on the PT display. To manually scroll through the PT channels, press the UP/DOWN buttons. The SET and °C MAX LEDs are off.

### 7. SETPOINTS

Press the SET, °C MAX, AUTO button until the SET LED is on.

#### PROGRAMMING MODE (SET mode)

By pressing SCAN (UP/DOWN buttons), the user can navigate the setpoints and visualize them.

If the user wants to modify the setpoints, follow the steps below:

STEP 1: keep the ENTER button pressed for at least 2sec.

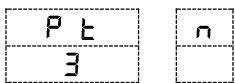
STEP 2: insert the password (three digits) with UP/DOWN and ENTER buttons. If the password is correct, the value to be modified will blink. Otherwise, the display will show Err P for a few seconds.

STEP 3: use the direction buttons to set the new value.

STEP 4: press ENTER to confirm.

**Note:** If the password is disabled or has been previously inserted, STEP 2 will be skipped.

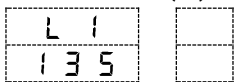
#### PT SENSORS CONNECTED



3; 4

Select the number of PT sensors connected.

#### ALARM RELAY (L1)



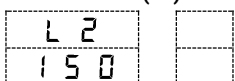
0÷219 Step: 1

Set the value at which the L1 contact will operate.

The dropout (reset) value is 2°C less than the setpoint.

**Note:** L1 must be < L2.

#### TRIP RELAY (L2)



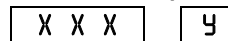
0÷220 Step: 1

Set the value at which the L2 contact will close.

The dropout (reset) value is 2°C less than the setpoint.

**Note:** L2 must be > L1.

#### Maximum Temperature (°C MAX mode)



XXX: Temperature; Y: PT channel

Y: 1; 2; 3 if PT SENSORS CONNECTED = 3

Y: 1; 2; 3; 4 if PT SENSORS CONNECTED = 4

Press the SET, °C MAX, AUTO button until the °C MAX LED is on. The user will see the maximum temperature reached on the °C display and the relative PT sensor input on the PT display. To manually scroll through the PT channels, press the UP/DOWN buttons.

By pressing ENTER for 2sec, the last maximum temperature of the visualized PT sensor is cleared and the next °C reading will be considered the maximum. During this operation, the SET LED is off.

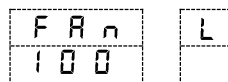
#### FAN ACTIVATION



0n; OFF

If a fan is connected to the FAN contact, select ON.

#### FAN OFF LEVEL

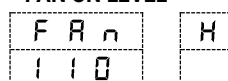


0÷219 Step: 1

FAN will be turned OFF at this temperature.

Based on the thermal inertia of the system, choose an appropriate temperature delta between FAN L and FAN H.

#### FAN ON LEVEL



0÷220 Step: 1

FAN will be turned ON at this temperature.

Visible only if FAN ACTIVATION = ON

Visible only if FAN\_ACTIVATION = ON

**PT SENSORS ENABLED FOR FAN**

Pt	F
3	

3; 4

Select 4 if the temperature of the PT4 sensor will be considered for the control of the FAN contact. If 3 is chosen, PT4 will NOT be considered.

**WEEKLY FAN**

FAN	A
OFF	

On; OFF

If ON, the FAN contact will be closed for 5min each week. This function is useful in case the fans connected have not been used for a long time, causing mechanical parts (bearings) to deteriorate, increasing reliability.

**BUZZER (Optional: see ORDER CODE)**

bU2	
OFF	

OFF; L1; L2

A high-pitched tone will sound when temperature reaches the L1 or L2 threshold. This buzzer is installed inside the product.

**COMMUNICATION BAUD RATE**

BAU	d
9	6

96 (9600); 192 (19200); 384 (38400); 576 (57600); 1152 (115200)

Baud rate.

**ADDRESS**

AdD	
1	

1-247

Modbus address.

**PARITY**

SEr	
BN1	

BN1; BN2; BE1; BE2; BD1; BD2

Parity and stop bit.

**LOCAL/REMOTE CONTROL**

L-r	
Loc	

rE; Loc

Loc: No setpoint modifications via RS-485, except °C MAX reset.  
rE: Setpoint modifications via RS-485 are allowed.

**4-20mA OUTPUT CHANNEL (Optional: see ORDER CODE)**

420	C
SCA	

SCA; HQE; 1; 2; 3; 4

Select how the temperatures will be transmitted through the 4-20mA output.

1, 2, 3 or 4: only the selected PT will be transmitted.

SCA: this option will scan each PT sensor every 5sec.

HQE: hottest PT sensor among the ones connected.

**4-20mA OUTPUT LOAD (Optional: see ORDER CODE)**

420	L
100	

100; 200; 300; 400; 500

Select the resistive load [Ω].

**PASSWORD MANAGEMENT**

PAS	5
On	

OFF; On; CHRP (change password)

OFF: password not requested to modify the setpoints.

On: password requested to modify the setpoints.

CHRP: the user can change the password only if: password previously inserted and USER LOGIN STATUS = ON.

STEP 1: the display will show --- n (new password).

STEP 2: insert the three new digits.

To abort press the SET, °C MAX, AUTO button or wait 20sec without pressing any key.

STEP 3: to confirm the new password inserted, press ENTER. The display will show done.

**Forgot password? Reset to factory default password (1111).**

STEP 1: disconnect all PT sensors.

STEP 2: keep simultaneously pressed the UP and DOWN buttons for 2sec.

The display will show r25 P. The password is now reset.

Visible only if PSM MANAG. = ON

**USER LOGIN STATUS**

USE	r
OFF	

On; OFF

If the password was previously inserted, the user will remain logged in for 5min from the last button pressed.

Visible only if USER LOGIN STATUS = ON

**TEST**

LES	L
- - -	

---: L1; L2; FAN; FAU; bU2; 420

The L1; L2; FAN; FAU (fault) relay tests work only if the relays are not already excited. It lasts approximately 5sec.

The 420 Test will simulate the following temperatures for 5sec each: 60°C, 180°C, 60°C and 180°C.

bU2 (buzzer) Test.

**4-20mA INDICATOR CALIBRATION ENABLING MENU**

(Optional: see ORDER CODE)

CAL	
OFF	

On; OFF

Select ON to enable the 4mA and the 20mA indicator calibration correction.

Visible only if 4-20mA CALIBRATION ENABLING MENU = ON

**CALIBRATION CORRECTION AT 4mA (Optional: see ORDER CODE)**

CA	4
1.00	0

0.800+1.200 Step: 0.001

4mA will be applied to the output and it will be possible to correct the calibration value.

Visible only if  
4-20mA CALIBRATION  
ENABLING MENU = ON

**CALIBRATION CORRECTION AT 20mA** (Optional: see ORDER CODE)

C	A	2	0
1	0	0	0

0.800+/-0.200 Step: 0.001

20mA will be applied to the output and it will be possible to correct the calibration value.

Visible only if  
USER LOGIN STATUS = ON

**FIRMWARE UPGRADE**

U	P	d	
0	F	F	

OFF; rdy

Note: for manufacturer's use only.

## 8. MAINTENANCE

The device has been constructed principally with solid state technology, so it needs a simple maintenance. The operations of maintenance are simplified as follows: keep the relay dry and clean, verify that all terminal blocks are well connected, periodically check the display test by which all LEDs will be on, periodically control the right function of the output relays.

## 9. WARRANTY

The purchased product is covered by the manufacturer's or seller's warranty within the terms set out in the General Conditions of Sale, which can be consulted on the website [www.orionitalia.com](http://www.orionitalia.com) and/or in the purchase contract stipulated. Orion Italia, S.r.l. warrants this product to be free from defects in material and workmanship. To exercise this warranty, write or call your local Orion Italia representative, or contact Orion Italia in Piacenza, Italy. You will be given prompt assistance.

## 10. ORDER CODE

Model	Description
TR42CM	Communication Port RS485
TR42AD	Communication Port RS485 + 4-20mA output + Buzzer

## 11. SPECIFICATIONS

**Scale:** -10 ÷ +240 °C  
**Accuracy:** ±1% F.S. ± 1 digit  
**Settings:** L1, L2, FAN: 0 ÷ 220 °C  
**Supply voltage:** 24-240 Vcc/Vca (50-60Hz), -15%, +10%  
**Maximum power consumption:** 4VA or 4W  
**Inputs:** 4 platinum sensors PT100 with 3 wires. 500 Ohm max wire impedance.  
**Outputs:** FAN: normally open, I<sub>max</sub> 16A 240Vac/24Vdc resistive load (7A continuous) /1HP 240 Vac. L1, L2: change-over 5A(n.o) res. load 250 Vac. FAULT: 5A (n.c)  
**Operational Temperature:** 0 ÷ 50 °C  
**Storage Temperature:** -20 ÷ 70 °C  
**Relative Humidity:** 90% (non-condensing)  
**Test Run in:** 48 hours  
**Dielectric Withstand Voltage:** 2 kVac, 60s  
**Terminal block:** draw-out terminals for 4 mm<sup>2</sup> cables (12 AWG).  
**Frame:** In ABS self-extinguish with frontal protection (IP54).  
**Assembly:** to be fixed in the structure through stirrups and screws.  
**Dimensions:** 96x96x114 mm **Cutout:** 91mm (-0,5mm) x 91mm (-0,5 mm)  
**Weight:** 500 grams

**Communication port:** Insulated RS-485, insulation 1500 Vdc.  
**Communication protocol:** MODBUS RTU, function: 03h, 04h, 05h, 06h, 10h.  
**4-20 mA output:** Internal power supply 15 Vdc, max. Voltage drop 10 V, insulation voltage 1500 Vdc. Range: 0 °C÷240 °C. Accuracy: ±1% F.S. **No external power supply needed.**

**Emissions Tests:**  
 Radiated emissions: EN 55011; Port: enclosure.  
 Conducted emissions: EN 55011; Port: AC mains.

**Immunity Tests:**

- Conducted disturbances induced by RF field: EN 61000-4-6; Port: AC mains and signal lines.
- Radiated electromagnetic field: EN 61000-4-3; Port: enclosure.
- Electrostatic discharge: EN 61000-4-2; Port: enclosure.
- Fast transients (burst): EN 61000-4-4; Port: AC mains and signal lines.
- Surge: EN 61000-4-5; Port: AC mains.
- Voltage dips and short interruptions: EN 61000-4-11; Port: AC mains.

